



Maersk Drilling – Innovation and Energy Storage

28th of September 2015, CTO Mr. Frederik Smidth

Agenda

Maersk Drilling - Facts

Value chain and cost drivers

Innovation Process in Maersk Drilling

Energy storage/ Flywheel:
Deep Water Drilling
Energy storage

Project Description

Questions

Maersk Drilling - part of the A.P.Moller – Maersk Group



Maersk Line



Maersk Oil



APM Terminals

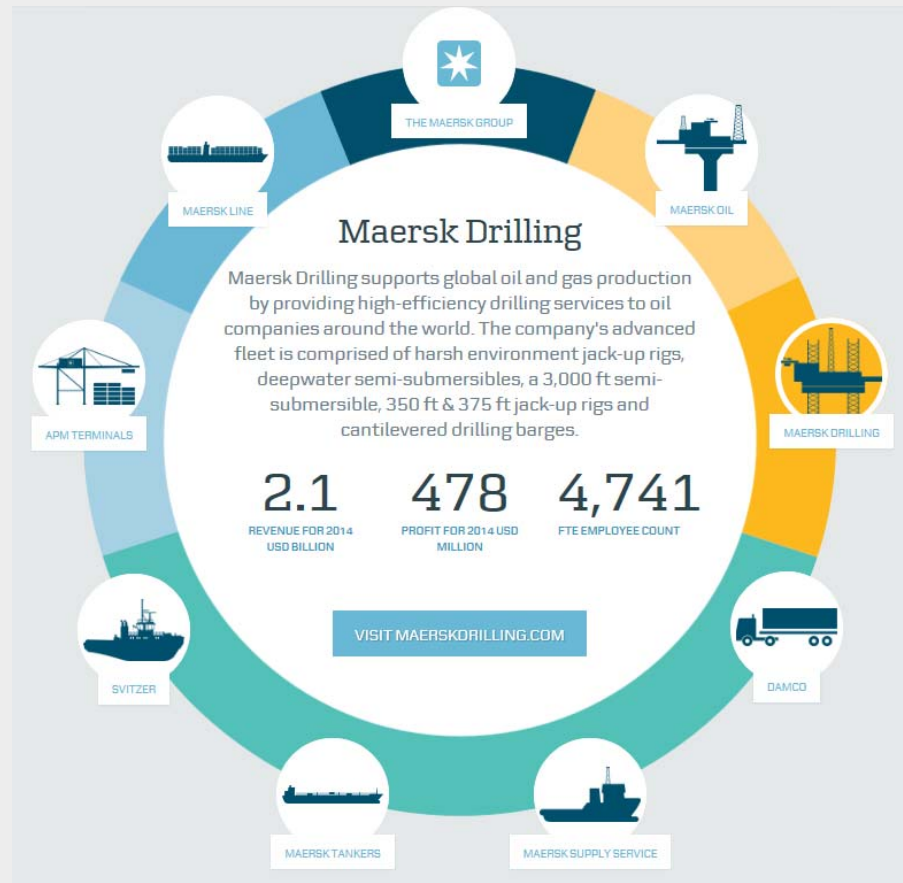
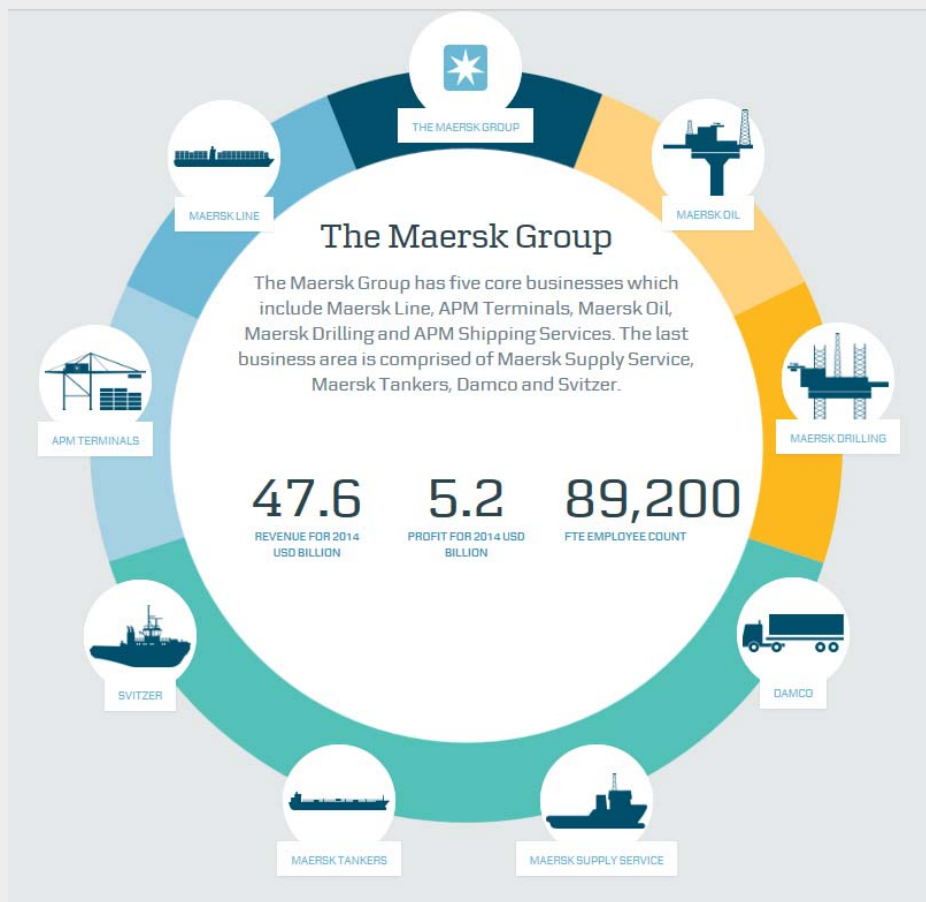


Maersk Drilling

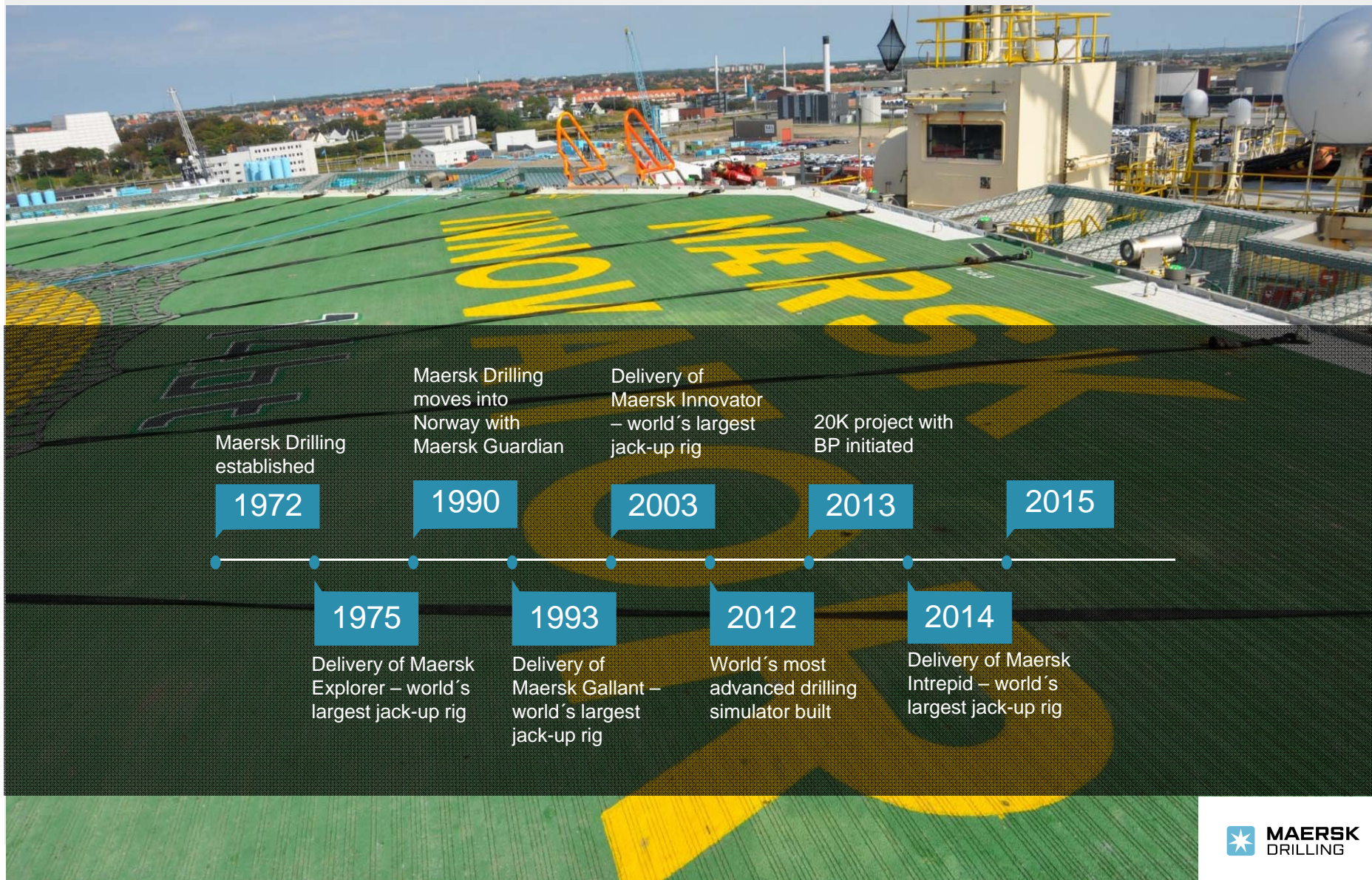


**Services &
Other Shipping**

Maersk Drilling – The numbers



Highlights from Maersk Drilling's history



Maersk Drilling established

1972

1975

Delivery of Maersk Explorer – world's largest jack-up rig

1990

Maersk Drilling moves into Norway with Maersk Guardian

1993

Delivery of Maersk Gallant – world's largest jack-up rig

2003

Delivery of Maersk Innovator – world's largest jack-up rig

2012

World's most advanced drilling simulator built


2013

20K project with BP initiated

2014

Delivery of Maersk Intrepid – world's largest jack-up rig

2015



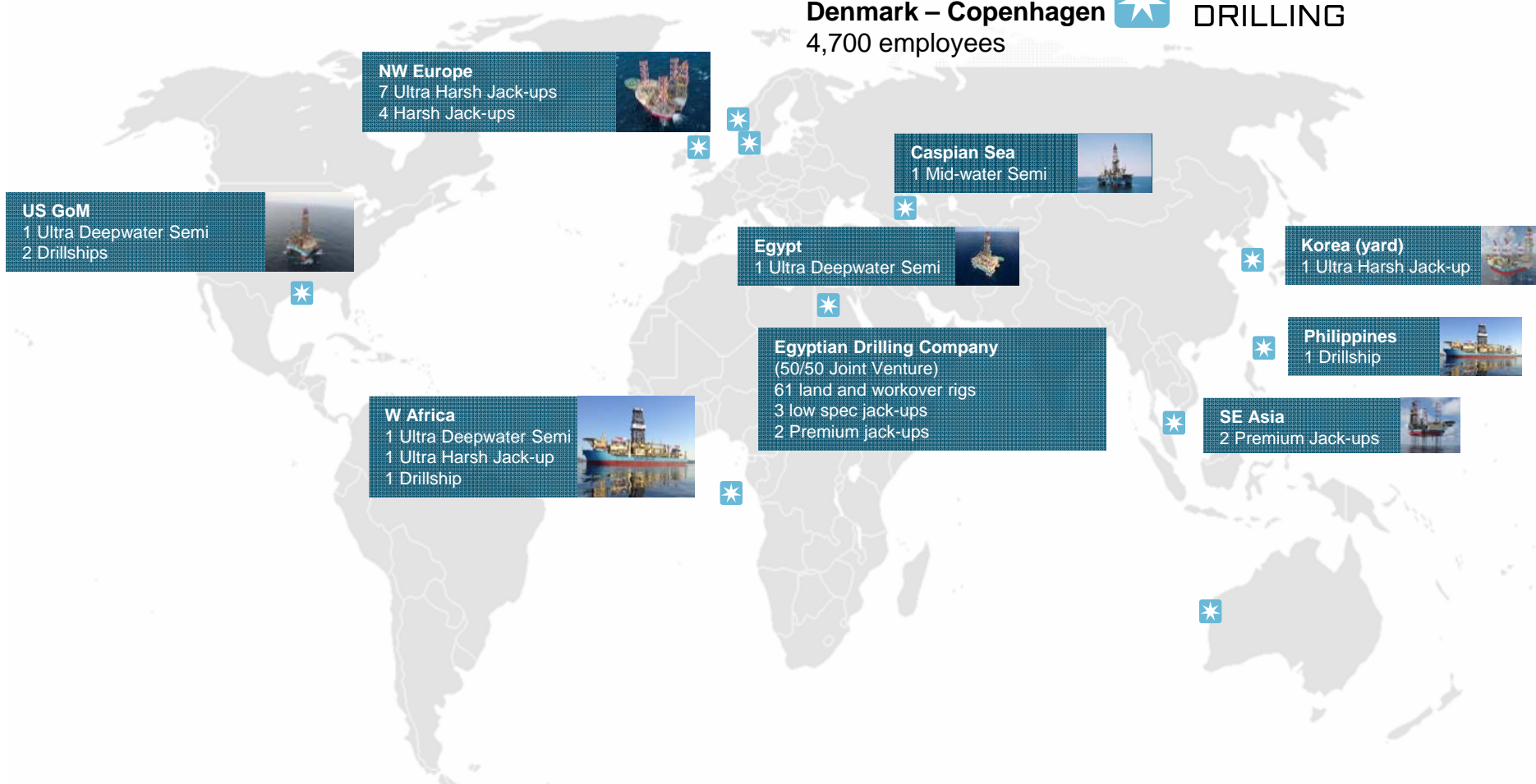
Maersk Drilling is a worldwide operator

Headquarter:
Denmark – Copenhagen

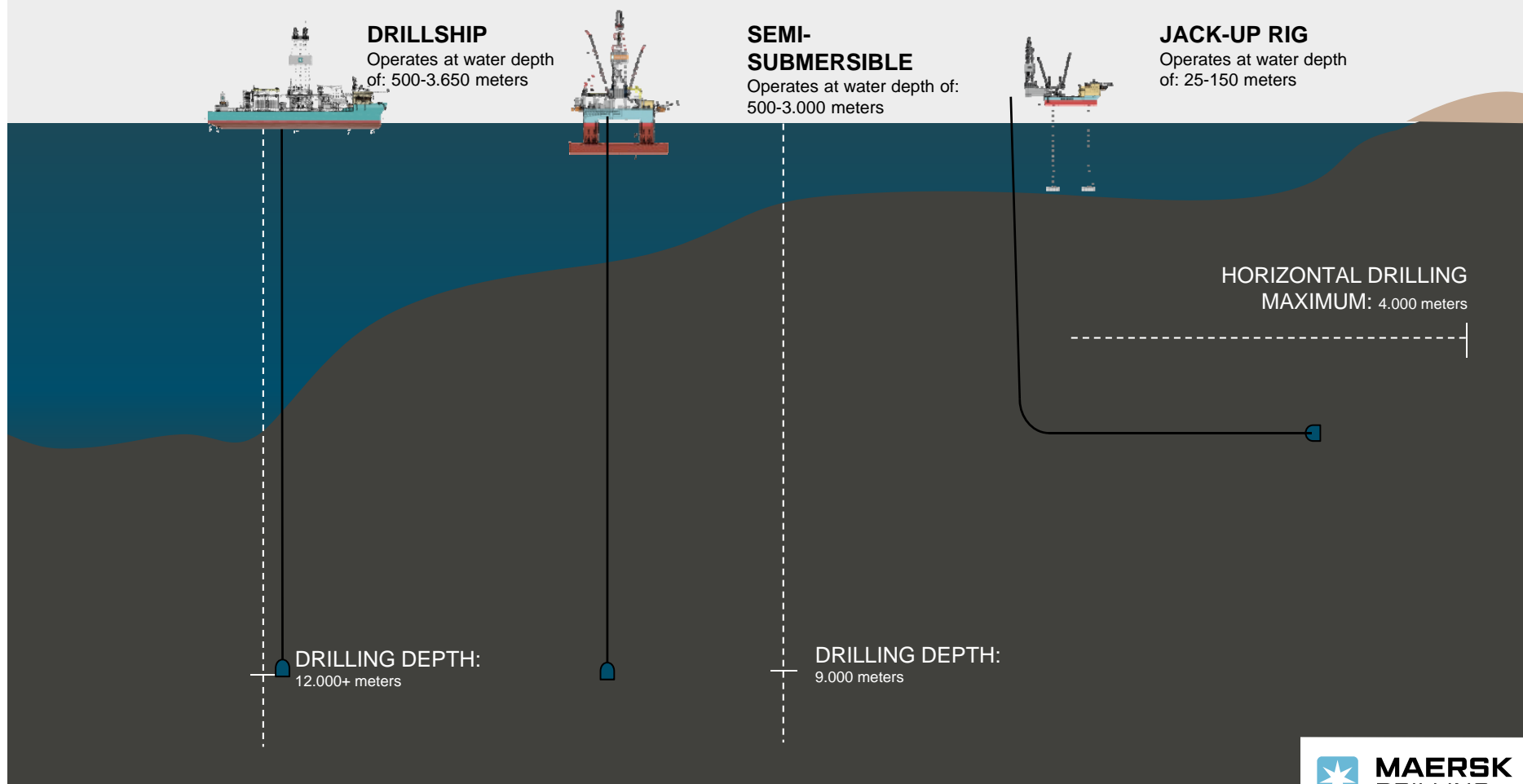


MAERSK
DRILLING

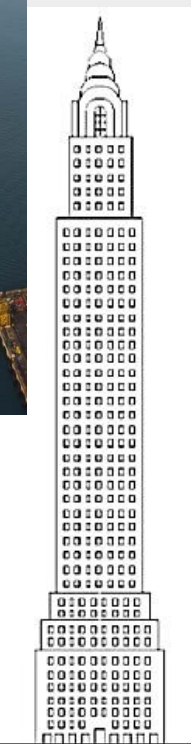
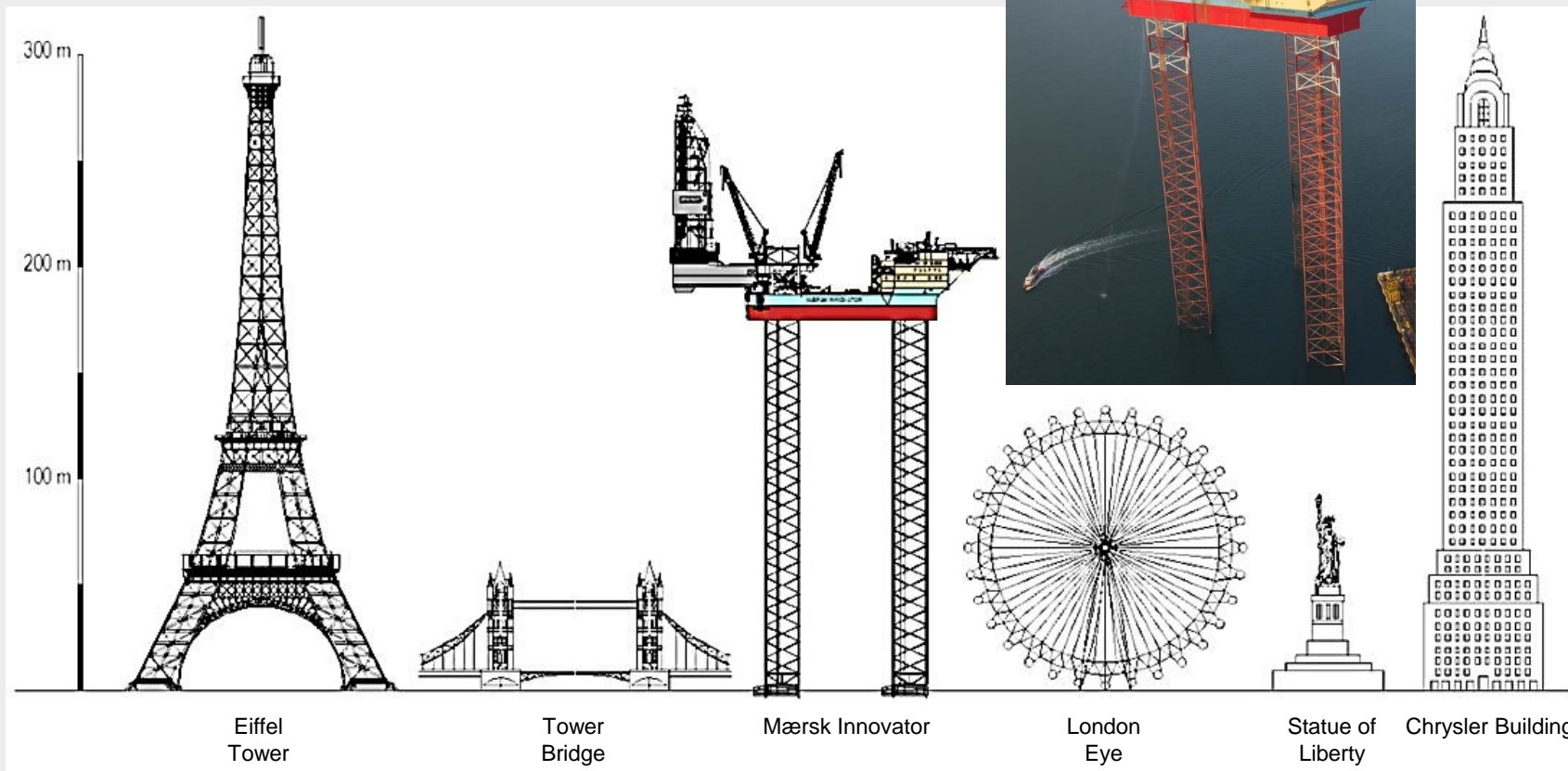
4,700 employees



The Fleet - Exploration and development drilling



The Fleet: It's Big!

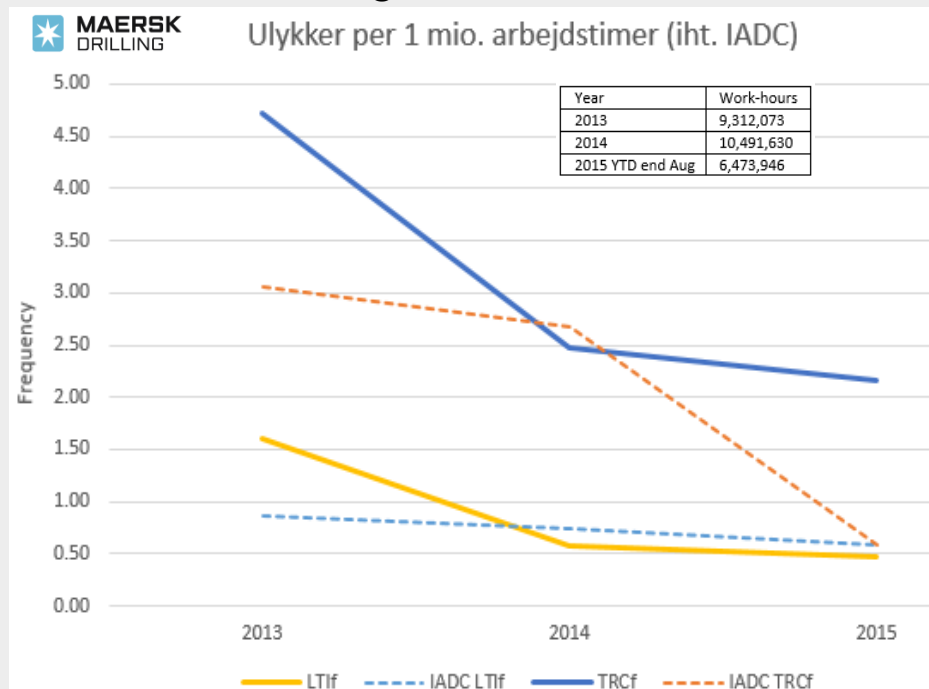


Maersk Drilling Safety Performance

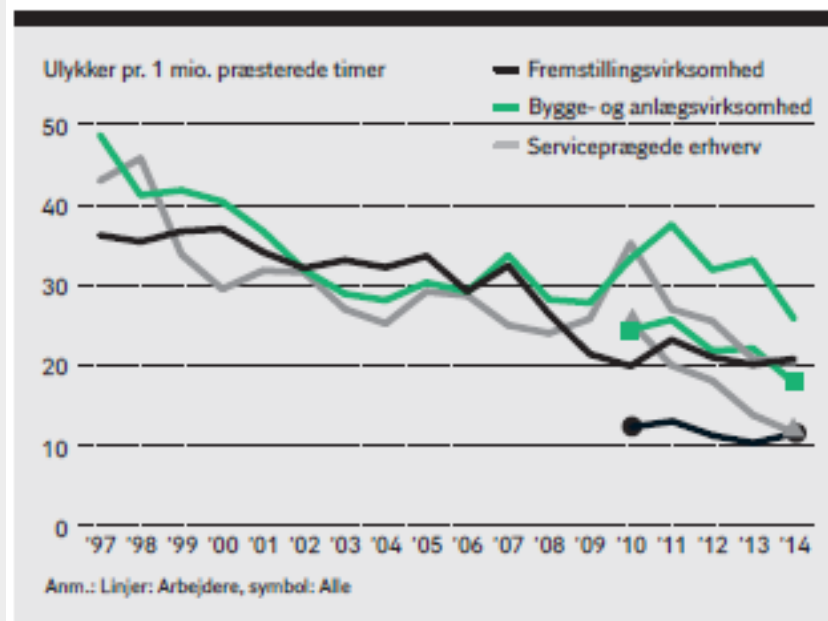
Safety has the highest priority within the Oil & Gas industry

Maersk Drilling Onshore & Offshore

Danish Industry



Figur 3: Ulykkesfrekvens – hovedbrancher



Maersk Drilling consolidated numbers 2013 → YTD Aug. 2015

Source: DI Stat – Arbejdsulykker 2015

LTI – Lost Time Injuries

Maersk Drilling	Danish Industry
~ 0.5	~ 10

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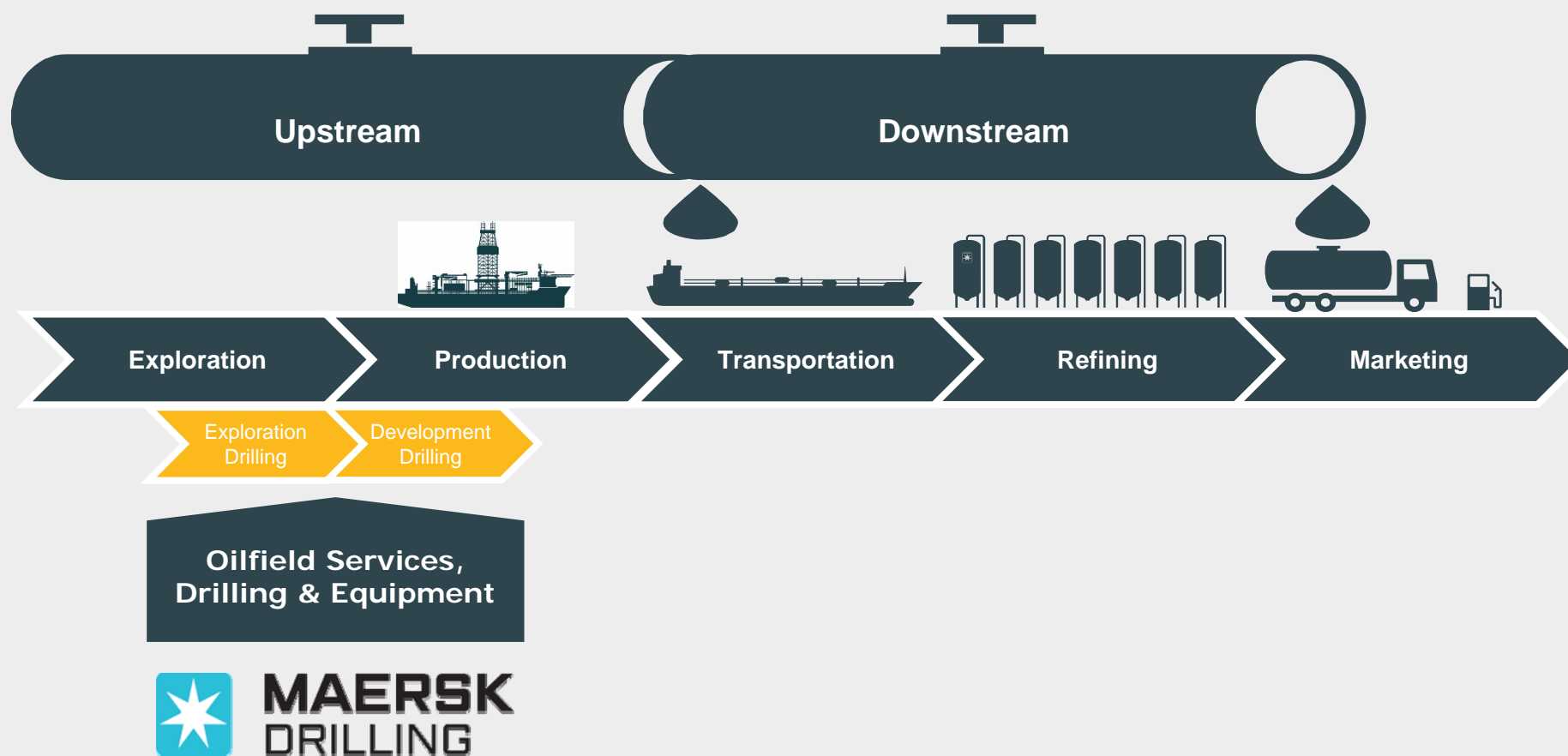
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The Oil & Gas Industry Value Chain

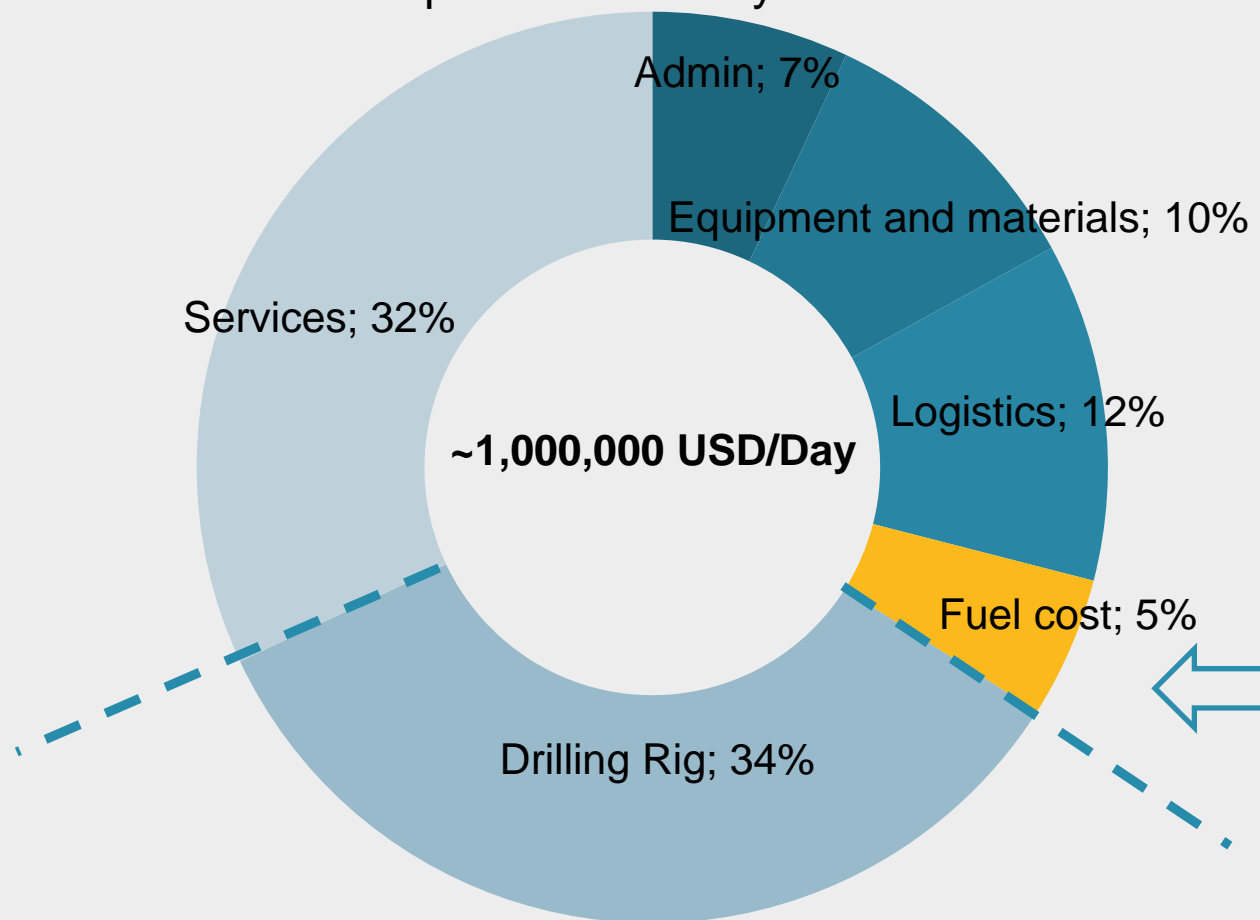


Maersk Drilling provides offshore drilling services to the upstream part of the oil and gas industry



Total well cost – not just the cost of the drilling rig

Example of Total Daily Well Cost for an Oil Company

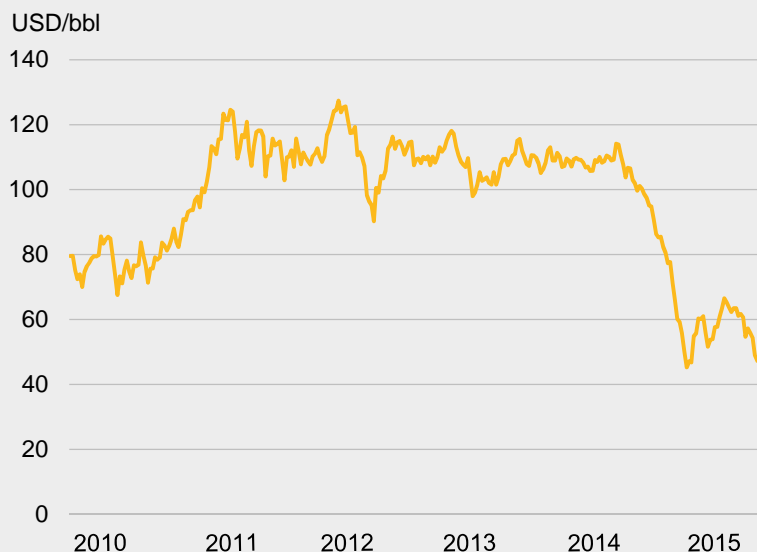


Challenge: Fuel savings will in the current setup only benefit the Oil Company

Maersk Drilling scope - only a part of the total well cost

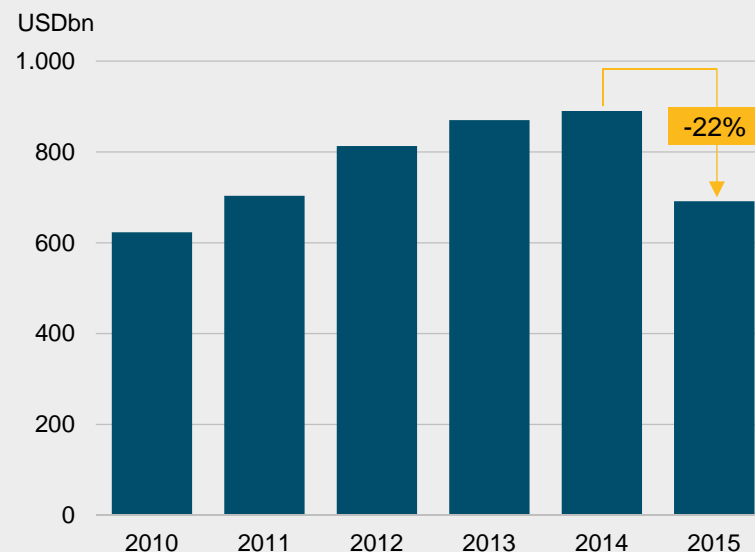
Significant declines in oil prices have resulted in decreased upstream spending

Oil prices have steadily deteriorated over the past year (Brent Crude daily oil price)



Note: Capital expenditures include all exploration, development, drilling and operational costs
Source: Thomson Reuters Datastream, Rystad Energy, Maersk Drilling

Oil companies reducing capital expenditures by USD 200 billion in 2015



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Our Business Objectives

*“Maersk Drilling's overall business objective is to become a significant and stable contributor to the APMM Group profit by developing and growing our **business within the ultra deepwater and ultra harsh environment segments.***

*We create value with our customers through a unique service delivery concept where we customize **safe and efficient drilling services.** We build our service around our highly skilled and committed work force, our **state-of-the-art offshore drilling rigs and our 40 years of experience of operating in the most challenging environments.**”*

“Moving boundaries within offshore drilling”

Four innovation priorities To support of MD's vision of moving boundaries

MAERSK DRILLING VISION

MOVING BOUNDARIES
WITHIN OFF-SHORE
DRILLING



CLOSER
ANCHORING MD
IN VALUE CHAIN
OF OIL MAJORS



DEEPER
BUILDING A UNIQUE
POSITION IN THE
UDW SEGMENT



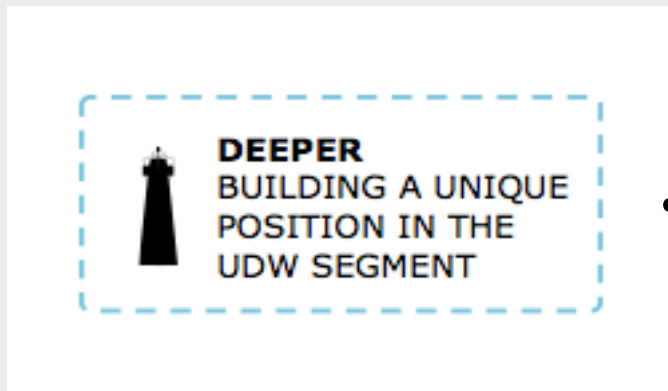
LEANER
DRIVING EFFICIENCIES
ACROSS THE VALUE
CHAIN



SMARTER
HARNESSING
OUR INNOVATION
POTENTIAL

Online system for capturing innovative ideas from all employees

Maersk Drilling idea campaign: Ideas for the next generation ultra deep water rig



MAERSK DRILLING About Innovation Challenge 2014 SPI Groups Log out Admin

ACTIVITY IDEAS CREATE IDEA

New Popular Advanced Set status: NEW

Alarm activated cameras ★ 81
Have cameras connected to fire alarm system to allow the immediate visual confirmation of a space that is indicating a fire.
By Charles Velle about a year ago

Well control, return mud measuring ★ 47
Install a dual coriolis flow meter on mud return flow line. By implementing this type of accurate meter we can improve well control...
By Aleksandr Rudenia about a year ago

use LED lights instead of bulbs ★ 46
Use LED lights wherever possible on navigation, positioning, status lights as well as applicable lighting all over the rig.
By Alexander Heil about a year ago

Mud pits design ★ 45
Build circular type of mud pits, similar to bulk tanks, with hydraulic agitation system, integrated tank clearing system, level and...
By Aleksandr Rudenia about a year ago

Enhanced semisubmersible hullform for improved transit speed and station keeping performance ★ 39
Most modern semisubmersibles are designed and optimised for motion characteristics, stability, load carrying capacity, structural...
By Jesper Holck about a year ago

Pipe handling equipment design ★ 37
The drill pipes set back area shall be on the drill floor level.

Well control, return mud measuring ★ 47
★ ★ ★ ★ ★ 47 Edit Send to a friend Follow Idea More

Idea summary:
Install a dual coriolis flow meter on mud return flow line. By implementing this type of accurate meter we can improve well control, instead of relying on the level measurements in the mud pits.

Description:
The coriolis type flow meter is very accurate providing driller with exact readings of the return mud, allowing identifying well control issues instantly, instead waiting for mud return to active pits (conventional system design). The flow meter must be installed after diverter before shaker valve.

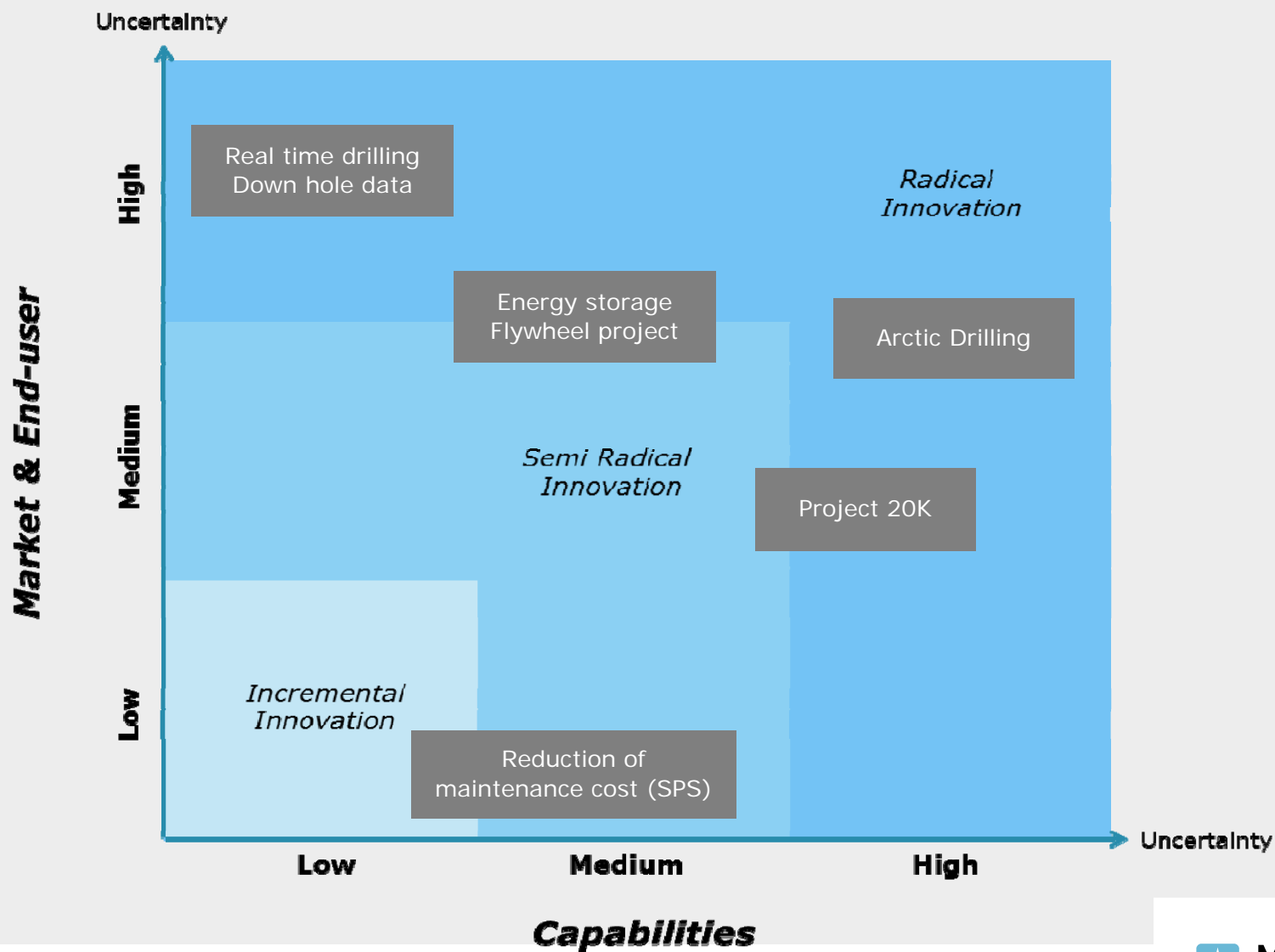
By installing coriolis flow meter we can simplify mud pits level measuring system. The mud return system can be changed to pressurised instead of gravity return system.

Benefits:

- improved well control
- simplified mud pits level measuring system, cost saving on installation and maintenance of level sensors in pits.
- any mud pit can be used as active, since we are not depended on the level in the pit. Reduced potential for downtime, by being more flexible in mud pits management.

549 ideas and 204 comments

Balanced Innovation Portfolio



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**Energy storage/ Flywheel:
Deep Water Drilling
Energy storage**

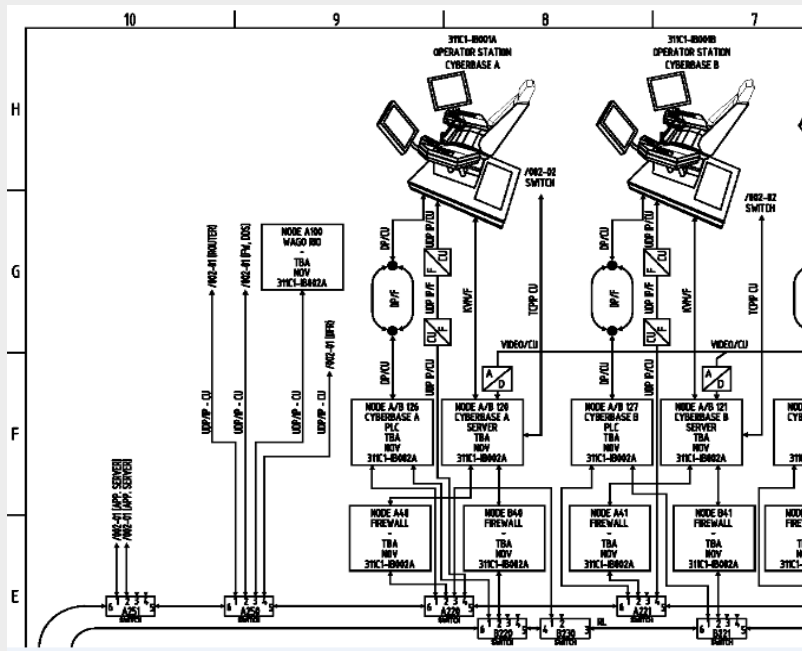
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Offshore drilling – The basics

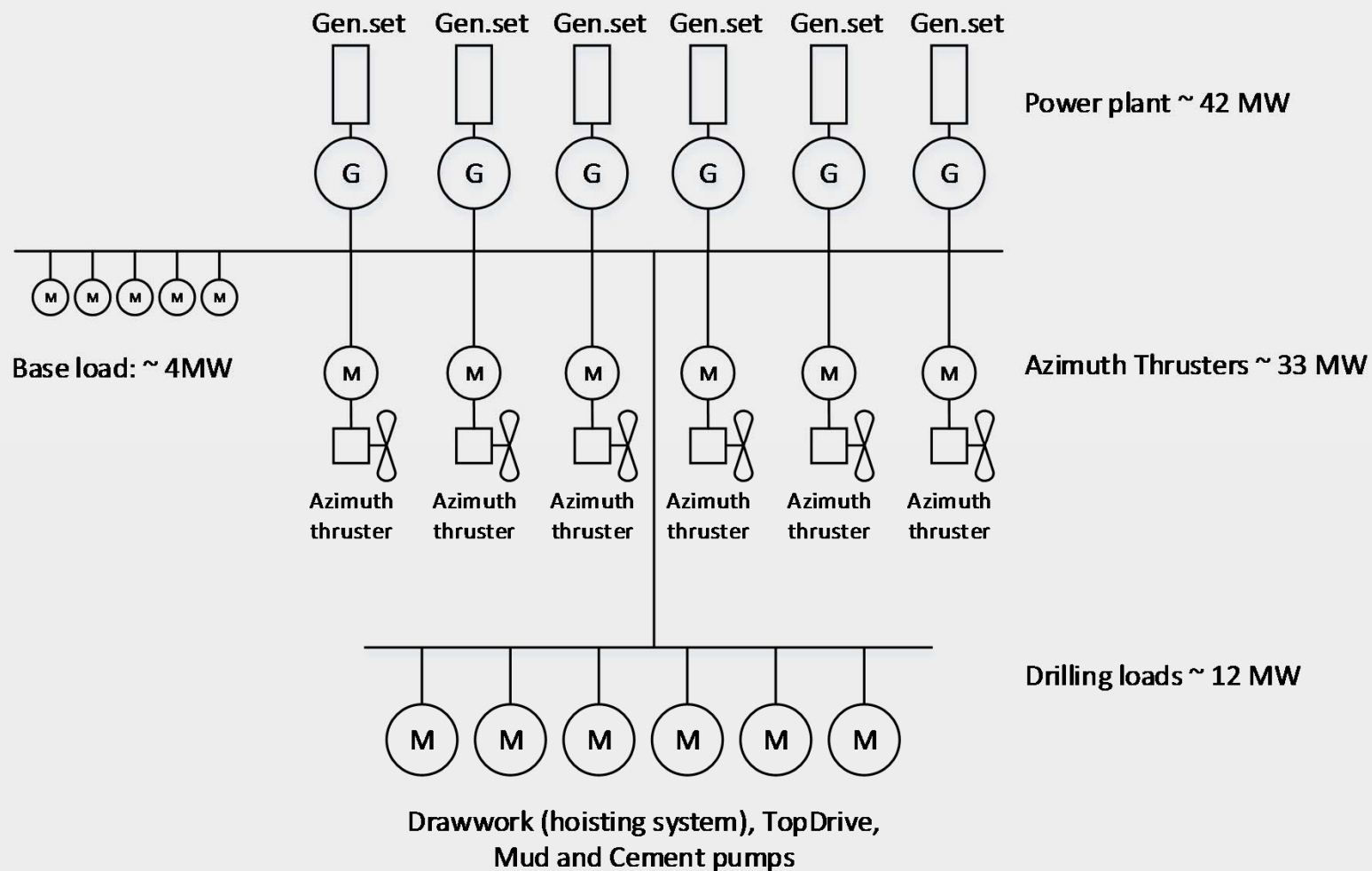
<https://www.youtube.com/watch?v=YQtDiX2Dbr0>

Very complex technology and systems



- Power plant: ~42 MW (same size as medium sized city in Denmark)
- Control system: ~80,000 I/O's
- DP (Dynamic Positioning), satellite DGPS and acoustic ref. system
- Thruster capacity for station keeping: 33 MW
- Vessel speed (transit): 12.5 knots (23 km/t)

Power distribution system - simplified



Energy Storage - perspectives

- Saving fuel cost and emissions
- Safer operation
- Supporting increased drilling efficiency
- Saving maintenance cost
- Long term goal: Reducing Total Cost of Ownership



“Moving boundaries within offshore drilling”

Offshore challenges.

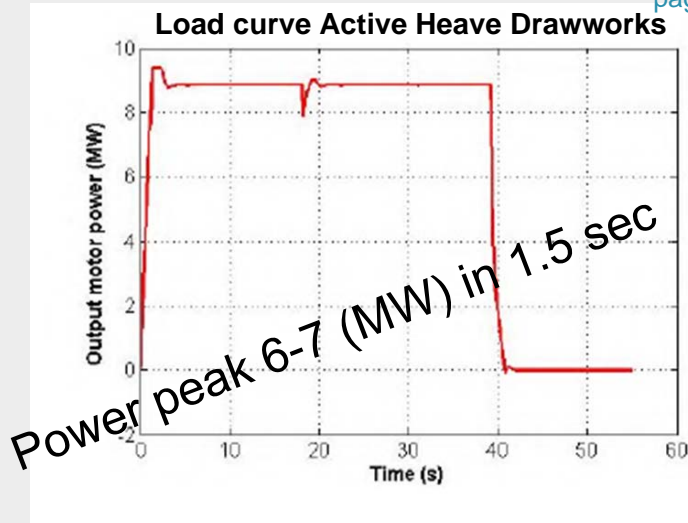
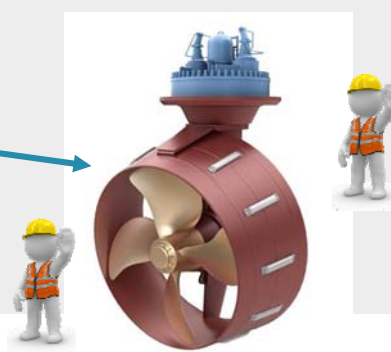
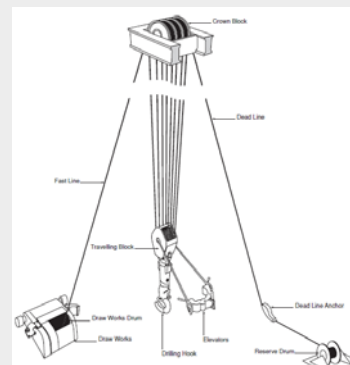
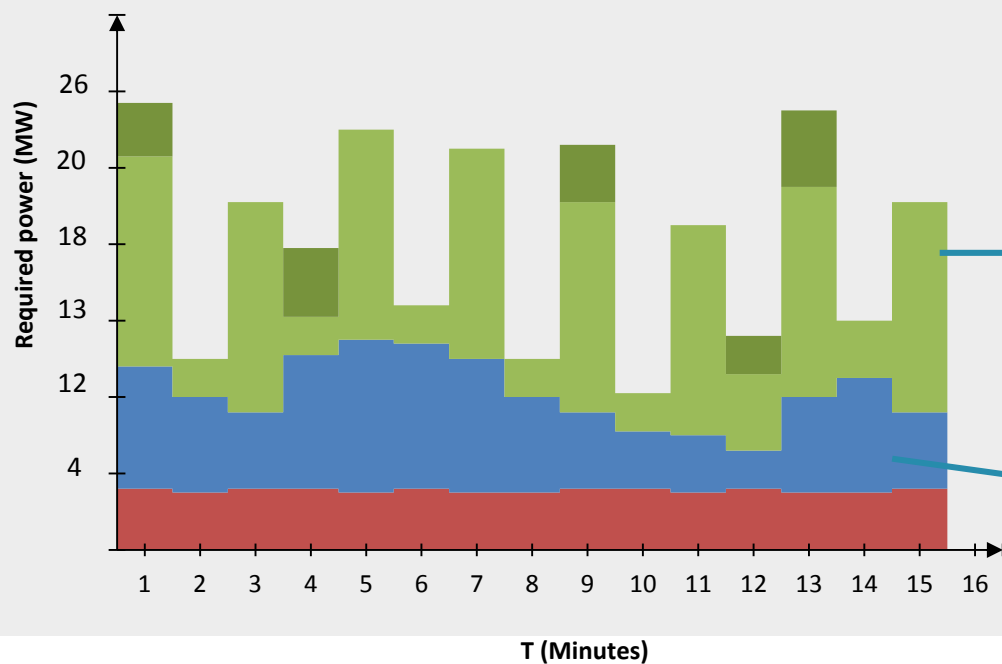


Illustration of fluctuating loads during tripping operating in DP mode

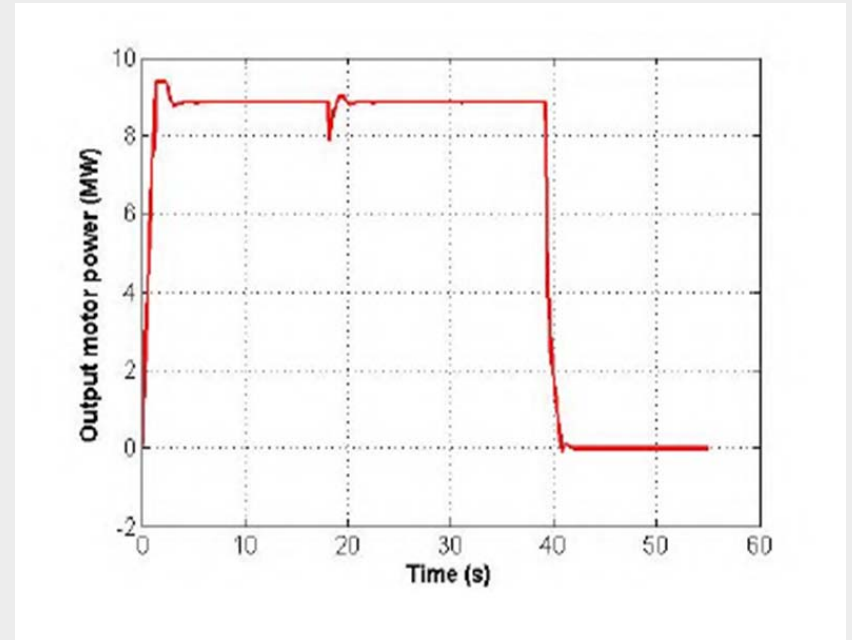


Azimuth thrusters



Drawwork

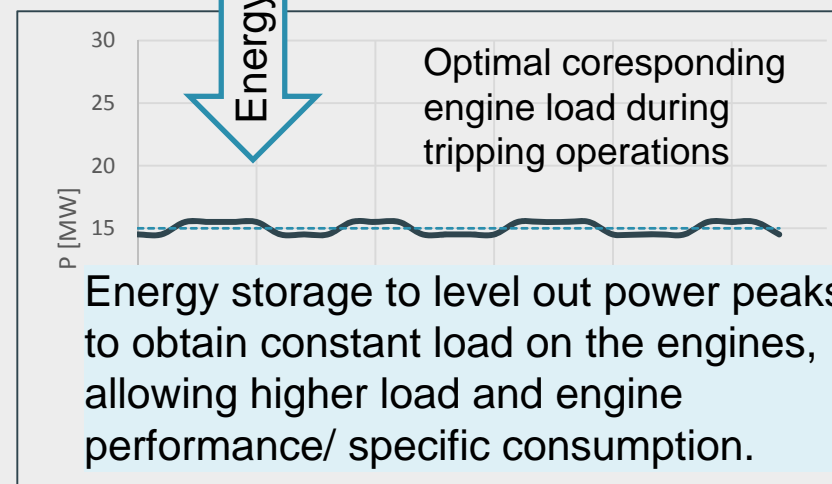
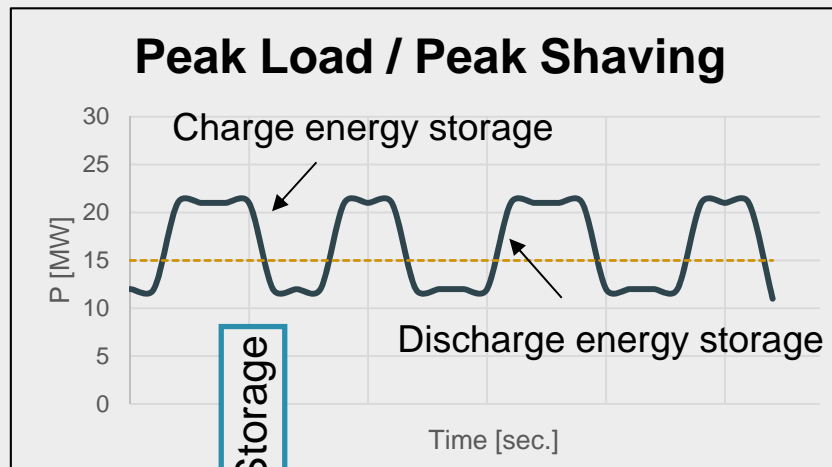
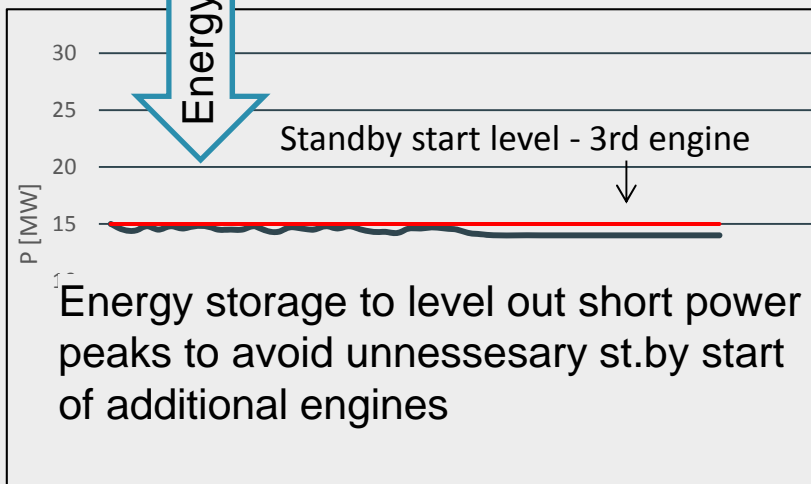
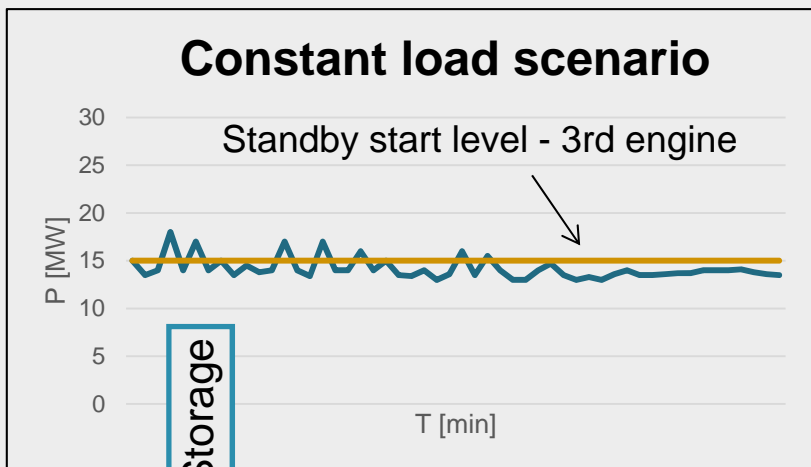
Drilling process – Tripping sequence



Huge power peaks from drawwork

Improvements in tripping speed equals time and cost savings for our Clients.

Energy storage – Common scenarios



Energy storage – Stable power plant

A stable power plant is an important parameter for:

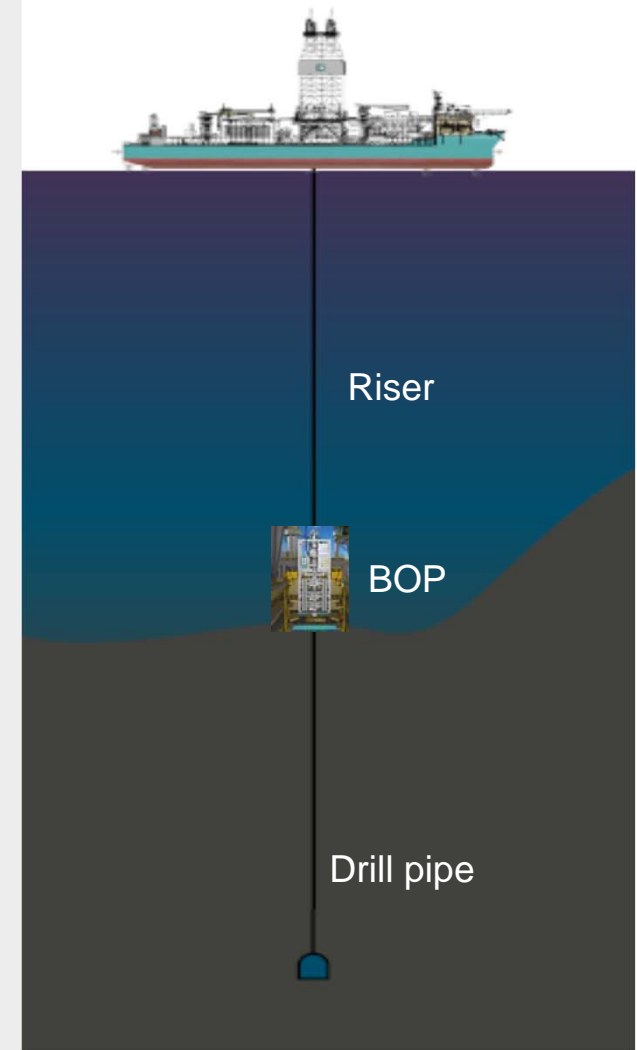
- 1) Maintaining vessel position (operating envelope)
- 2) Maintaining power to drilling equipment.

Risk associated with loss of power:

- Unable to maintain position (drift off)
- Not sufficient time to close well (safety)
- Damage/ loss of equipment (high CAPEX)

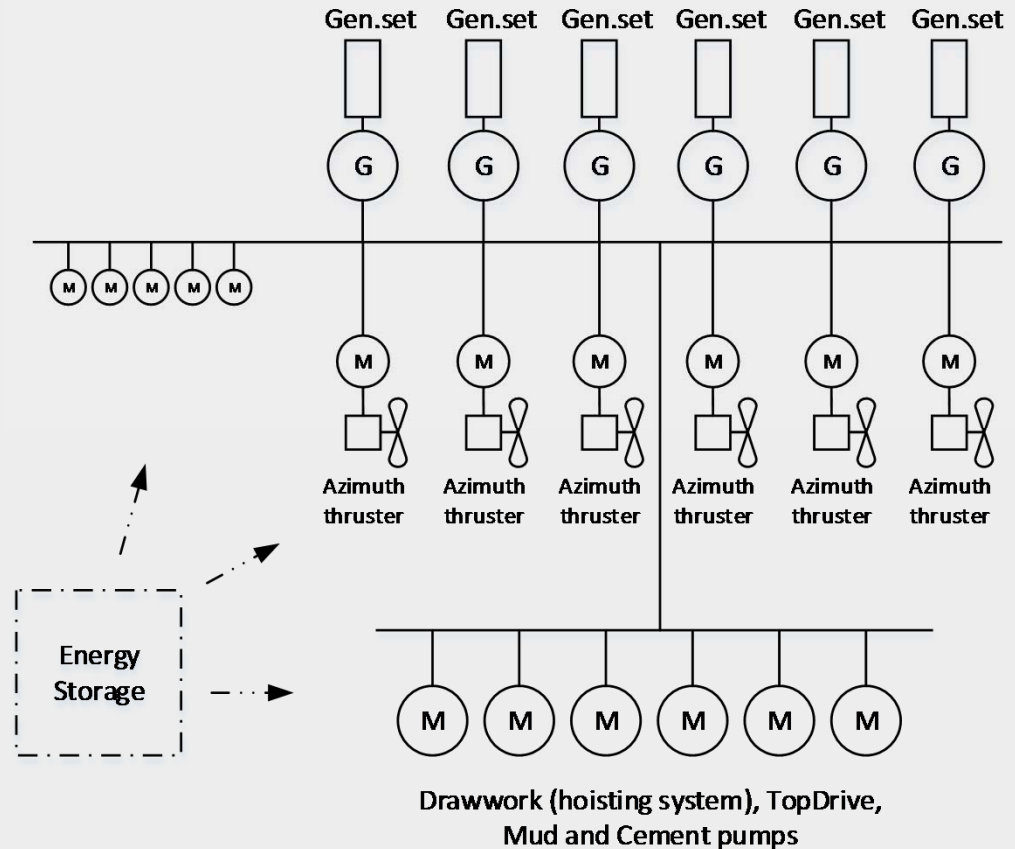
DRILLSHIP

Operates at water depth of:
500-3.650 meters



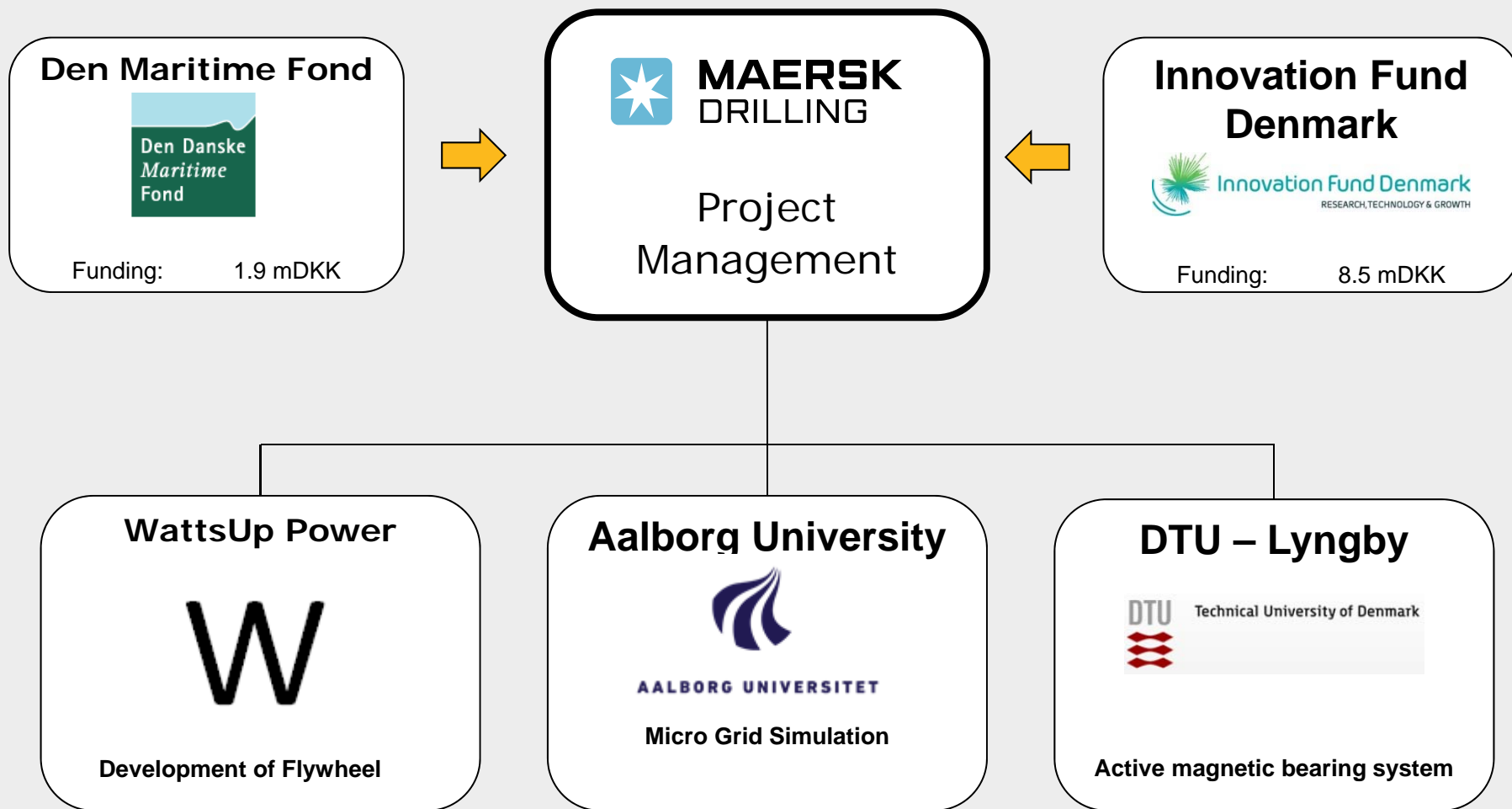
Energy Storage – Part of the solution

- To pursue and maintain our leading position in providing safe and efficient drilling services by state-of-the-art-drilling rigs, we need continuous close co-operation and innovation with key partners in the industries.
- We see the capabilities of energy storage as a possible part of a total system solution for further improving the stability and efficiency of offshore power plants.
- In addition to our close cooperation with key partners, the cooperation with Universities is new to Maersk Drilling.



Flywheel Energy Storage System

Development of flywheels for Offshore/Marine use



Maersk Drilling expectations to the project



Development of the flywheel technology for:

- Offshore application.
- High Efficiency
- Long life time (20 years)

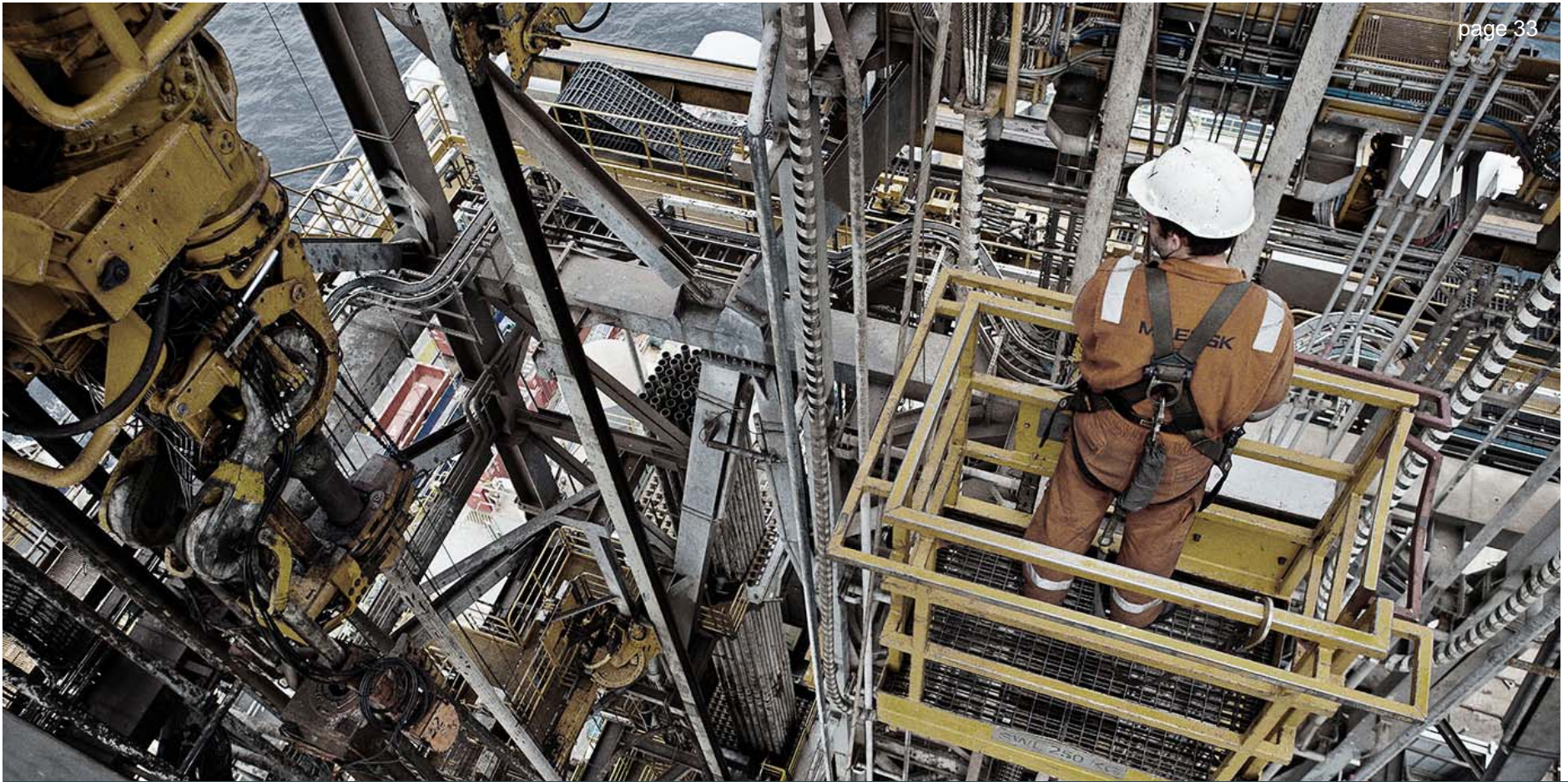
Total project budget: 20mDKK

Timeline:

- Project start: March 2015
- Onshore test: Autumn 2015
- Offshore test: Spring 2017->

“Moving boundaries within offshore drilling”

Questions ?



Maersk Drilling – Moving boundaries within offshore drilling

