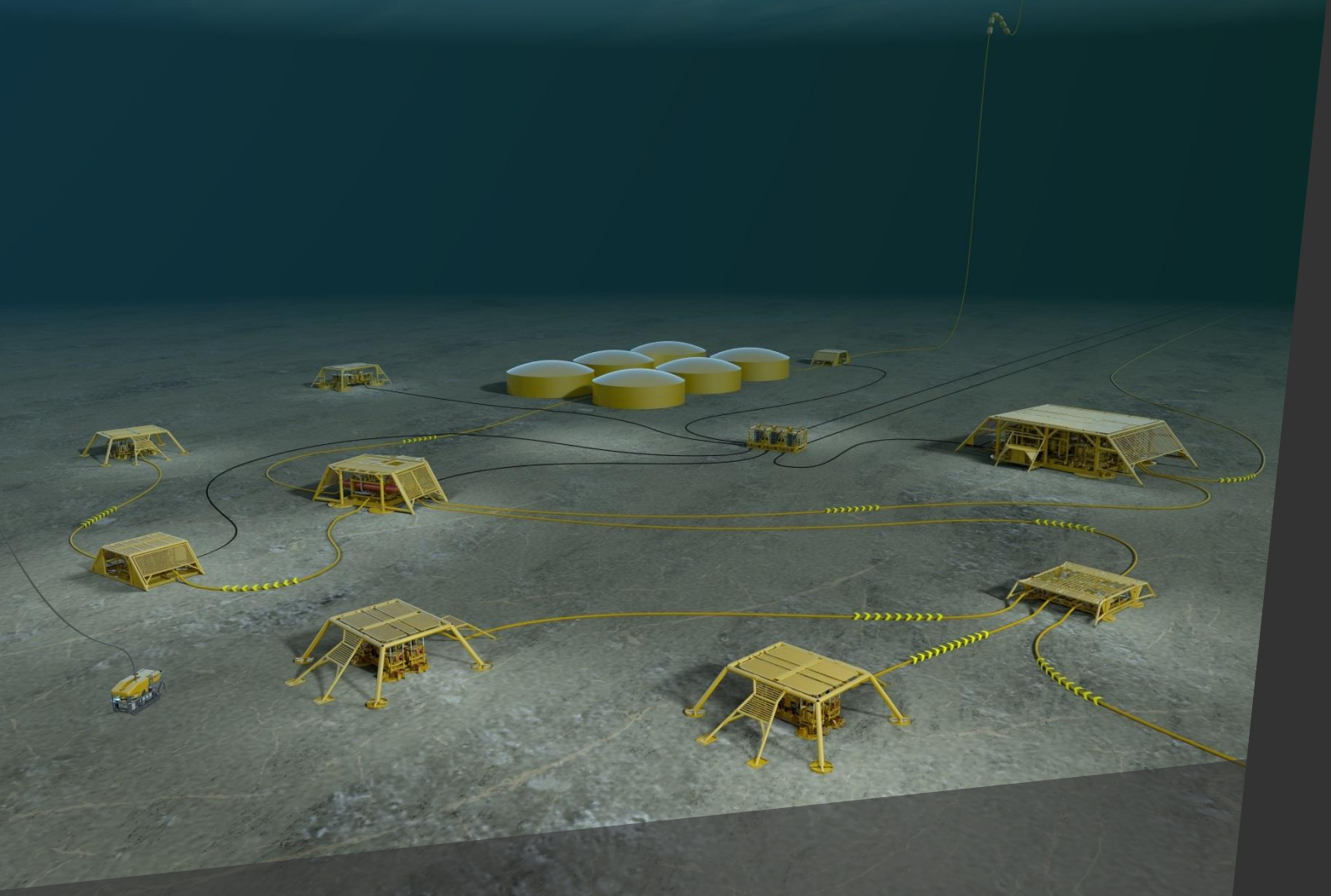
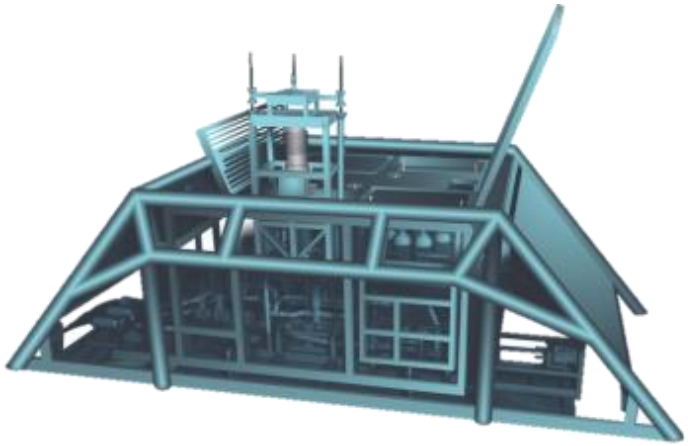


Next Generation Subsea Technology: Key Challenges and Technology Trends

André Mærli, Statoil Research Centre Rio

Contents

- Introduction
- Subsea in Statoil
- The Statoil Subsea Factory™
- Shaping the future of Subsea
- The next generation of Subsea



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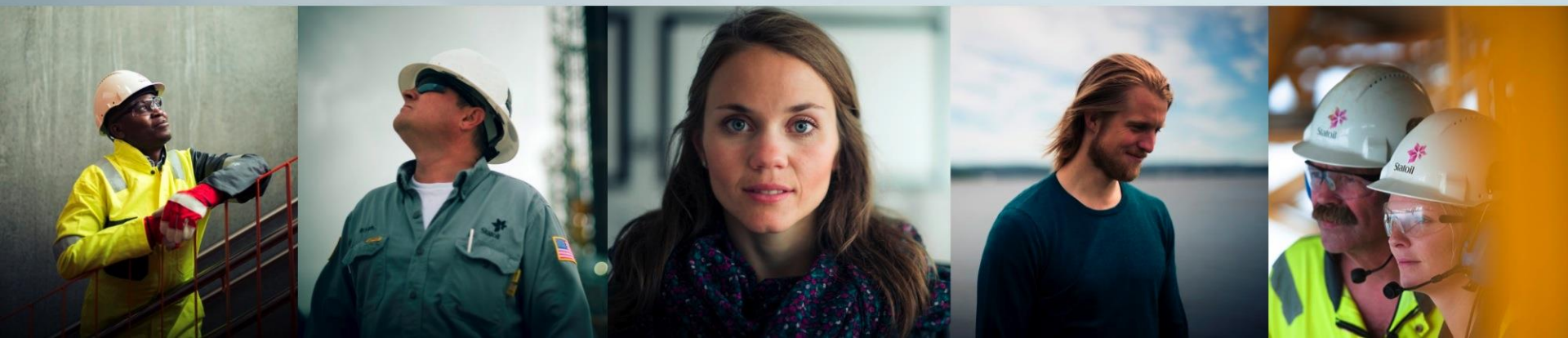
Shaping the future of energy

Competitive at all times

Transforming the oil and gas industry

Providing energy for a low carbon future



The world's first subsea compression: x2!

Åsgard Subsea Compression

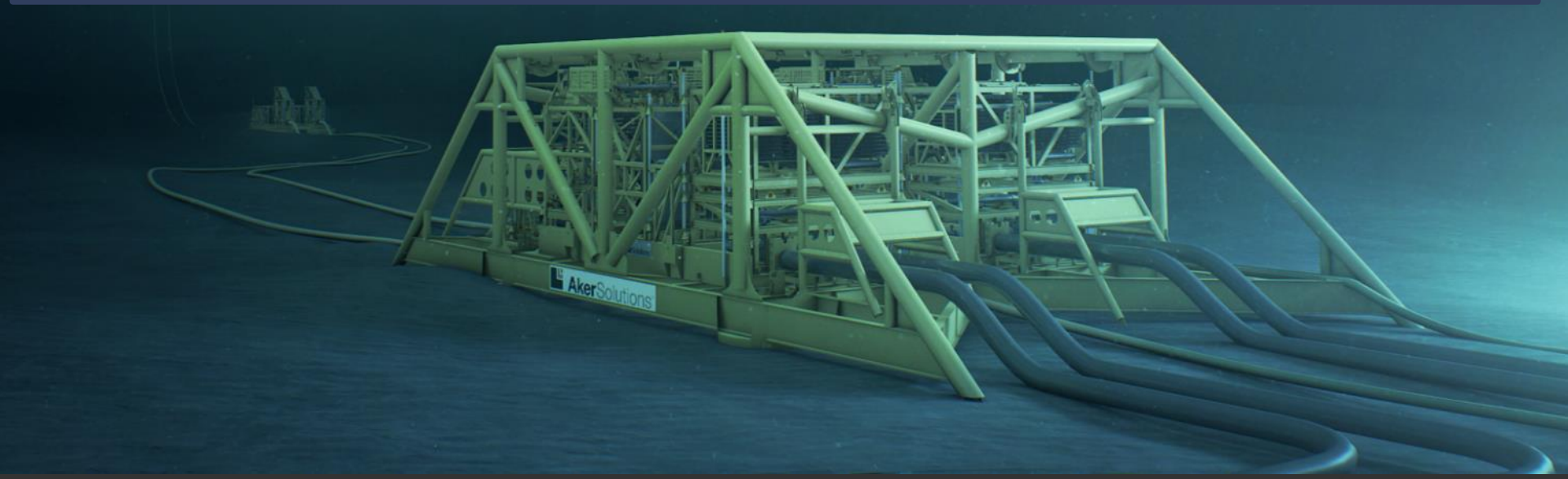
Increased recovery from Midgard and Mikkel estimated to **306 million boe**

Gullfaks Subsea Compression

Increased recovery from Gullfaks south estimated to **22 million boe**

Start-up: September and October 2015

Technology step: **Substantial recovery and lifetime increase**



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ÅSC Commissioning Control Centre at Stjørdal

Full control system access from onshore

Åsgard A on video conference call

- Control room personnel brought onshore
- Independent of offshore cabin capacity
- Short mobilization time for vendor personnel
- No offshore certificates needed
- No undesired event caused by working remote
- Close communication with Åsgard technical staff
- Utilized test personnel from previous testing.
- **Efficient execution of commissioning with high quality**

Onshore team performing controls testing during installation, complete control system check and operation of train with nitrogen and MEG.

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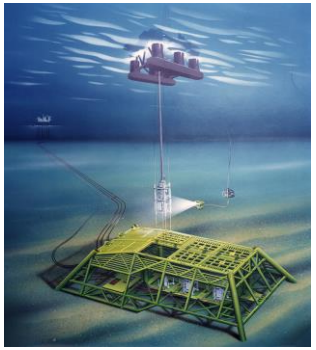
Marine Operations

- Training in Simulator
- 3D Online Visualization

Subsea in Statoil

Using history to create history

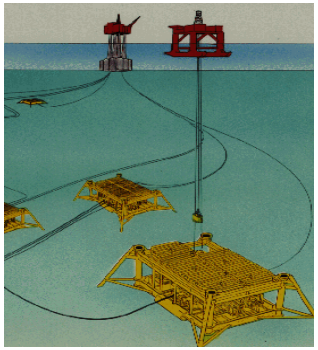
Pioneering
1985 -1990



1. generation

Gullfaks
Tommeliten

Standardization
1991-2000

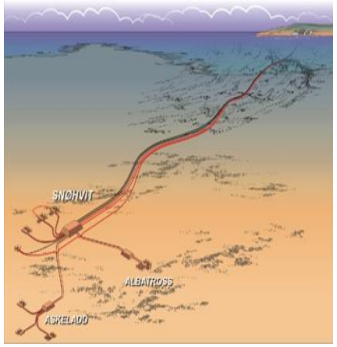


2. & 3. generation

Sleipner og Statfjord sat.
Heidrun, Norne

Yme, Lufeng, Åsgard,
Gullfaks sat2, Sygna,
Sigyn, Troll

Pushing Limits
2004-2012



3.& 4. generation

Kristin, Morvin,
Snøhvit, Ormen Lange

Vega, Gjøa

Fast Track & IOR
2007-2015

Subsea catalogue and Subsea processing

Fast track I, II and III
Aasta Hansteen

Tordis SSBI, Tyrihans RSWI

ÅSC, GSC
Pazflor, Marlim; Rosa;Clov, J&SM, Julia, OL Pilot.

Industrialization
2015-2025

BROWNFIELD Solutions
Njord, Visund , Snorre, +

SUBSEA-TO-HOST

Extended Reach

DEEP WATER

Cost reduction through;
- **Simplification**
- **Standardization**
- **Industrialization**
- **Innovation**

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Shaping the future of Subsea

Work Differently

- Radically new ways of working and collaborating
- Collaboration: DNV-GL JIP on subsea boosting and IOGP JIP 33 on Subsea Trees
- *Transform our way of working and the way the industry work*

Simplify Standardize Industrialize

- Simplify and standardize to stay competitive at all times
- Design to Cost (DtC) approach, with step-wise cost-benefit analysis
- Re-use solutions, concepts and processes

Innovate and Implement

- Technologies for lower cost and a low carbon future
- Radical and innovative solutions to transform the industry
- Develop new value chains

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Standardisation – key to succeed

Deliver year 2000 cost-level again - more than 50% reduction!

Simplify

- ✓ Design-to-cost - always minimum solution as starting point
- ✓ Drive for significant efficiency improvements in all cost elements

Standardise on the simplified solution

- ✓ Standardise on cost effective design and limit variations
- ✓ Extensive effort to remove company's specific requirements

Industrialise

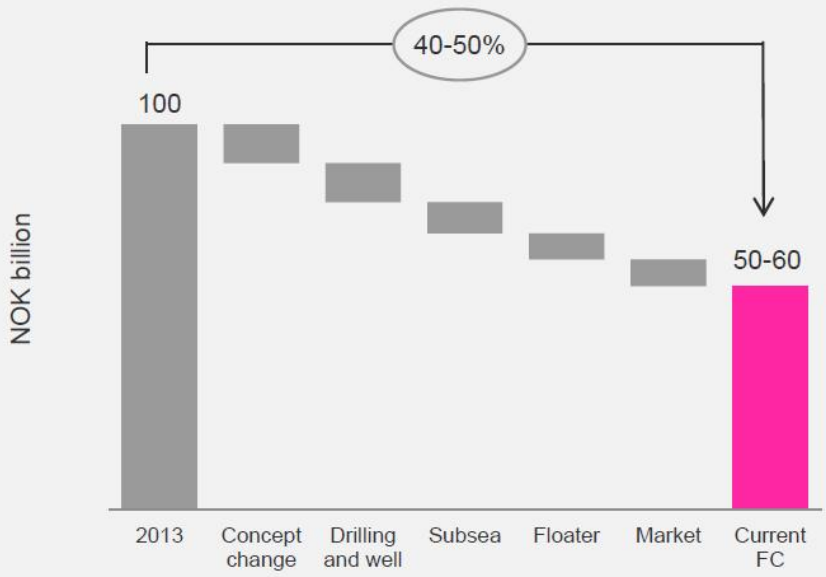
- ✓ Systematically strive for re-use and repeatability
- ✓ Maximise use of industry standards and supplier solutions

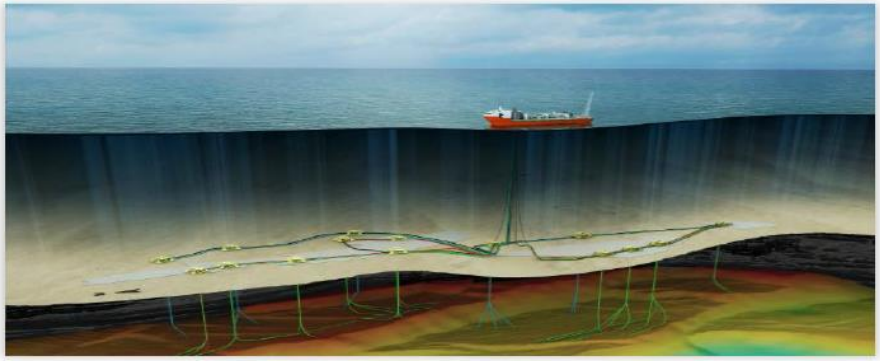
Drive cost down

Johan Castberg

Simplification, Standardization and Innovation

Capex reductions [1)]





Changes in break-even price

2013 above	Current below
80 USD/bbl	45 USD/bbl

[1)] **Capex numbers in real term NOK 2016**

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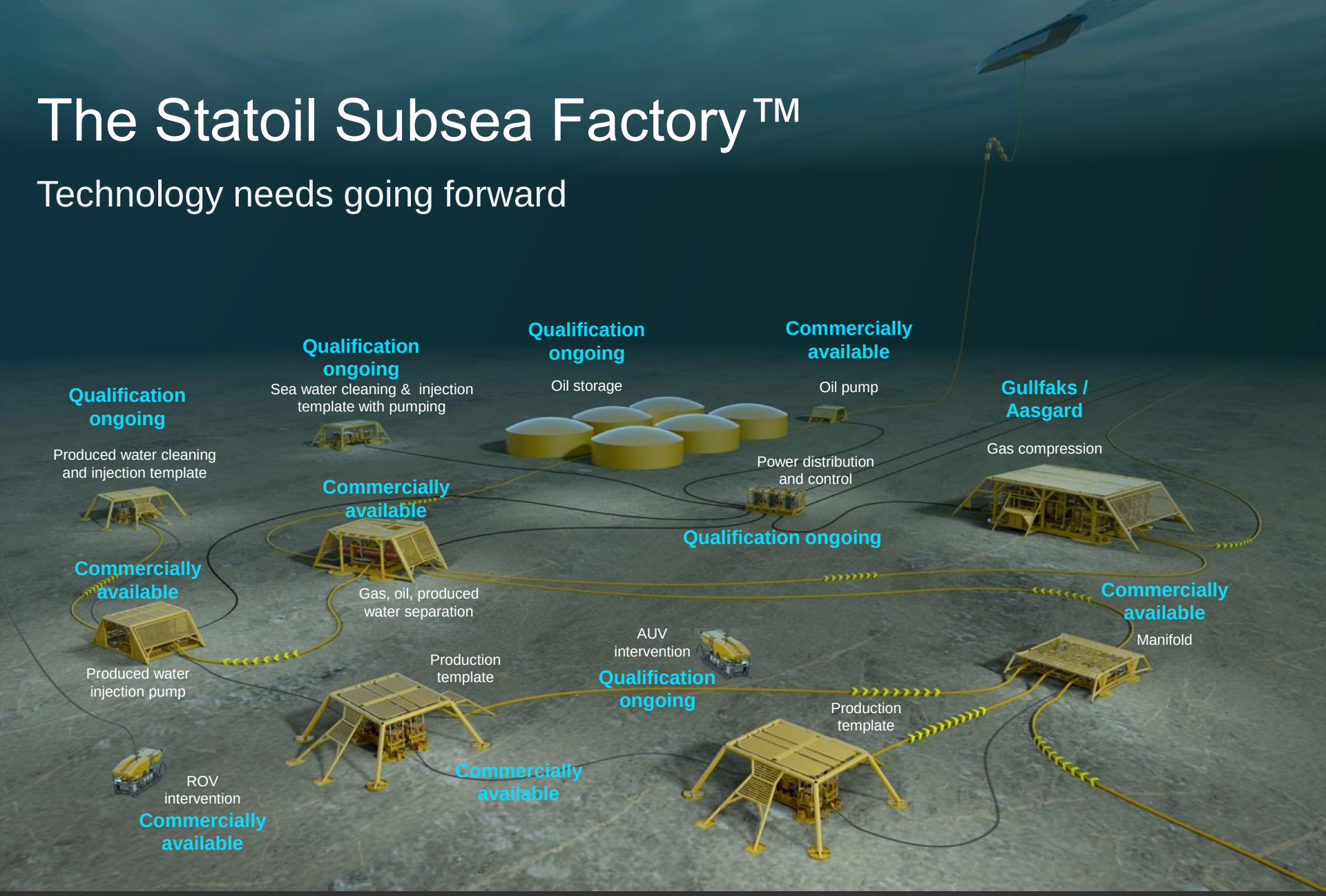
The Statoil Subsea Factory™

Technology needs going forward



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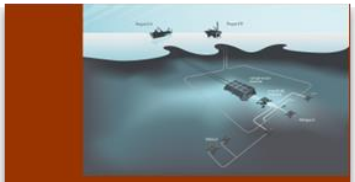
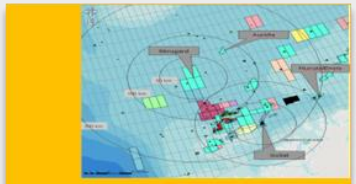
The Subsea and UPP*) Factory
'Cleaner- Leaner-Smarter'

COST <40 $/bbl Technology Solutions
COMMERCIAL MINDSET First/Multiuse Focus
Industry Collaboration to reduce cost
CARBON EFFICIENCY Reduced Carbon Footprint

PRODUCT LINE	BUSINESS NEED	CONCEPT/FOCUS	KEY CUSTOMERS
 BROWNFIELD FACTORY	50 % reduced facility CAPEX 60 % recovery from existing fields	Simplification & Standardization Simplified Subsea Compression & Boosting	ASSETS
 SUBSEA-TO-HOST FACTORY	Reducing CAPEX/OPEX through less topside modifications Increase tie-back optionality by de-bottlenecking	Subsea Power & Controls CO2 measures Gas-2-Pipe™ System	
 EXTENDED REACH FACTORY	Allow subsea production and transport to remote host up to 250 km for gas up to 100 km for oil	Lean Extended Reach System Subsea Produced Water Treatment	
 DEEP WATER FACTORY	Enable production from new fields to existing host /new facility down to 3000m water	Deep Water Portfolio	

Carbon Efficiency

*) UPP = Unmanned Processing Platform

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The next generation(s) of subsea

Subsea processing roadmap

Reference Cases

Activities

Achievements

2015 Åsgard & Gullfaks Subsea compression

2012 WGC 4000

2010 - Next Gen subsea Compression - Ormen Lange Pilot

2019 Asset water inj. Boosting, separation

2017 Seawater treatment

2016 SSP Standard Interfaces

2021 Asset Boosting

2016 Subsea pump portfolio

2015: Standard Pump Station

2023 Asset Compression

2016 Subsea compression portfolio

2016: Simplified subsea compression

2025+ NCS 23. round Boosting/SWI

2017 CAP'X

Subsea Smart Manifold

2025 Asset Gas-2-Pipe™

2020 Gas-2-Pipe™ Gas dehydration

Subsea Fiscal Metering

2015 Subsea separation systems

2027 Snøhvit Long distance compression

2017/18 Pressure tolerance, VSD, SWG, long distance transmit

2027 Asset Ultra deep water processing

2020 Deep water SURF Solutions

1997	2000	2007	2012	2013	2014	2015
Lufeng Subsea pump	**Troll pilot** Subsea separation and Injection	**Tordis** subsea sep, boosting and injection	**Pazflor** Subsea sep	**Tyrihans** RSWI	**Jack / St Malo** HP pumps	**ÅSC & GSC** subsea compression

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There's never been a better time for **good ideas**

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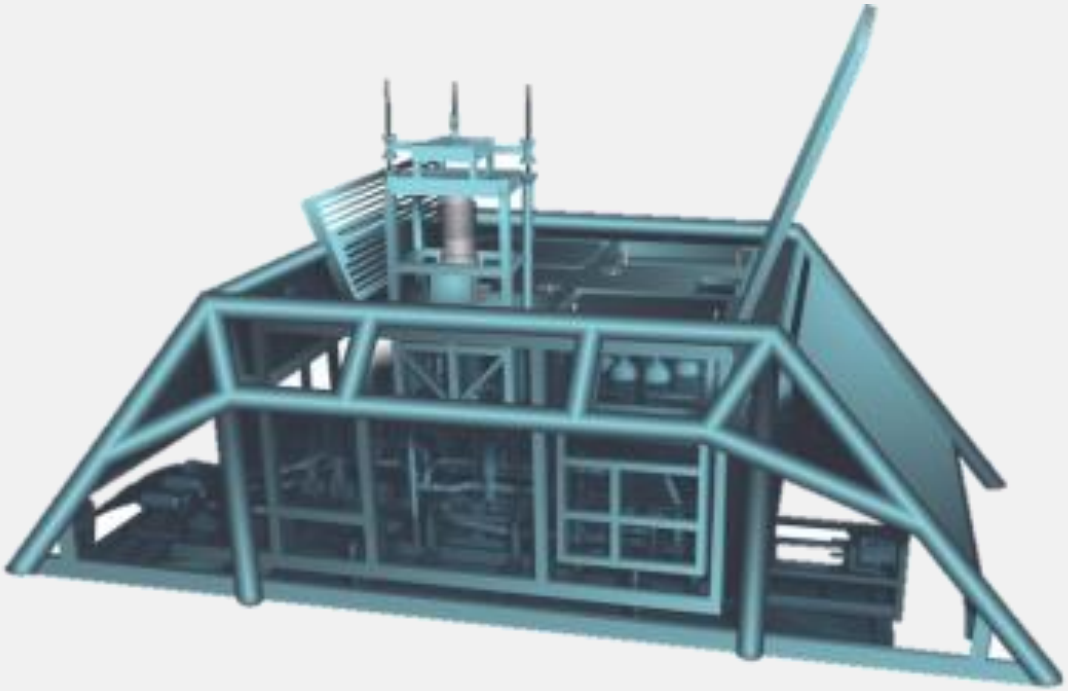
Forward-looking Statements

This presentation contains certain forward-looking statements that involve risks and uncertainties. In some cases, we use words such as "ambition", "continue", "could", "estimate", "expect", "focus", "likely", "may", "outlook", "plan", "strategy", "will", "guidance" and similar expressions to identify forward-looking statements. All statements other than statements of historical fact, including, among others, statements regarding future financial position, results of operations and cash flows; changes in the fair value of derivatives; future financial ratios and information; future financial or operational portfolio or performance; future market position and conditions; business strategy; growth strategy; future impact of accounting policy judgments; sales, trading and market strategies; research and development initiatives and strategy; projections and future impact related to efficiency programs, market outlook and future economic projections and assumptions; competitive position; projected regularity and performance levels; expectations related to our recent transactions and projects, completion and results of acquisitions, disposals and other contractual arrangements; reserve information; future margins; projected returns; future levels, timing or development of capacity, reserves or resources; future decline of mature fields; planned maintenance (and the effects thereof); oil and gas production forecasts and reporting; domestic and international growth, expectations and development of production, projects, pipelines or resources; estimates related to production and development levels and dates; operational expectations, estimates, schedules and costs; exploration and development activities, plans and expectations; projections and expectations for upstream and downstream activities; oil, gas, alternative fuel and energy prices; oil, gas, alternative fuel and energy supply and demand; natural gas contract prices; timing of gas off-take; technological innovation, implementation, position and expectations; projected operational costs or savings; projected unit of production cost; our ability to create or improve value; future sources of financing; exploration and project development expenditure; effectiveness of our internal policies and plans; our ability to manage our risk exposure; our liquidity levels and management; estimated or future liabilities, obligations or expenses and how such liabilities, obligations and expenses are structured; expected impact of currency and interest rate fluctuations; expectations related to contractual or financial counterparties; capital expenditure estimates and expectations; projected outcome, objectives of management for future operations; impact of PSA effects; projected impact or timing of administrative or governmental rules, standards, decisions, standards or laws (including taxation laws); estimated costs of removal and abandonment; estimated lease payments, gas transport commitments and future impact of legal proceedings are forward-looking statements. You should not place undue reliance on these forward-looking statements. Our actual results could differ materially from those anticipated in the forward-looking statements for many reasons.

These forward-looking statements reflect current views about future events and are, by their nature, subject to significant risks and uncertainties because they relate to events and depend on circumstances that will occur in the future. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied by these forward-looking statements, including levels of industry product supply, demand and pricing; price and availability of alternative fuels; currency exchange rate and interest rate fluctuations; the political and economic policies of Norway and other oil-producing countries; EU directives; general economic conditions; political and social stability and economic growth in relevant areas of the world; the sovereign debt situation in Europe; global political events and actions, including war, terrorism and sanctions; security breaches; situation in Ukraine; changes or uncertainty in or noncompliance with laws and governmental regulations; the timing of bringing new fields on stream; an inability to exploit growth or investment opportunities; material differences from reserves estimates; unsuccessful drilling; an inability to find and develop reserves; ineffectiveness of crisis management systems; adverse changes in tax regimes; the development and use of new technology; geological or technical difficulties; operational problems; operator error; inadequate insurance coverage; the lack of necessary transportation infrastructure when a field is in a remote location and other transportation problems; the actions of competitors; the actions of field partners; the actions of governments (including the Norwegian state as majority shareholder); counterparty defaults; natural disasters and adverse weather conditions, climate change, and other changes to business conditions; an inability to attract and retain personnel; relevant governmental approvals; industrial actions by workers and other factors discussed elsewhere in this report. Additional information, including information on factors that may affect Statoil's business, is contained in Statoil's Annual Report on Form 20-F for the year ended December 31, 2014, filed with the U.S. Securities and Exchange Commission, which can be found on Statoil's website at www.statoil.com.

Although we believe that the expectations reflected in the forward-looking statements are reasonable, we cannot assure you that our future results, level of activity, performance or achievements will meet these expectations. Moreover, neither we nor any other person assumes responsibility for the accuracy and completeness of the forward-looking statements. Unless we are required by law to update these statements, we will not necessarily update any of these statements after the date of this report, either to make them conform to actual results or changes in our expectations.

There's never been a better time for good ideas



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