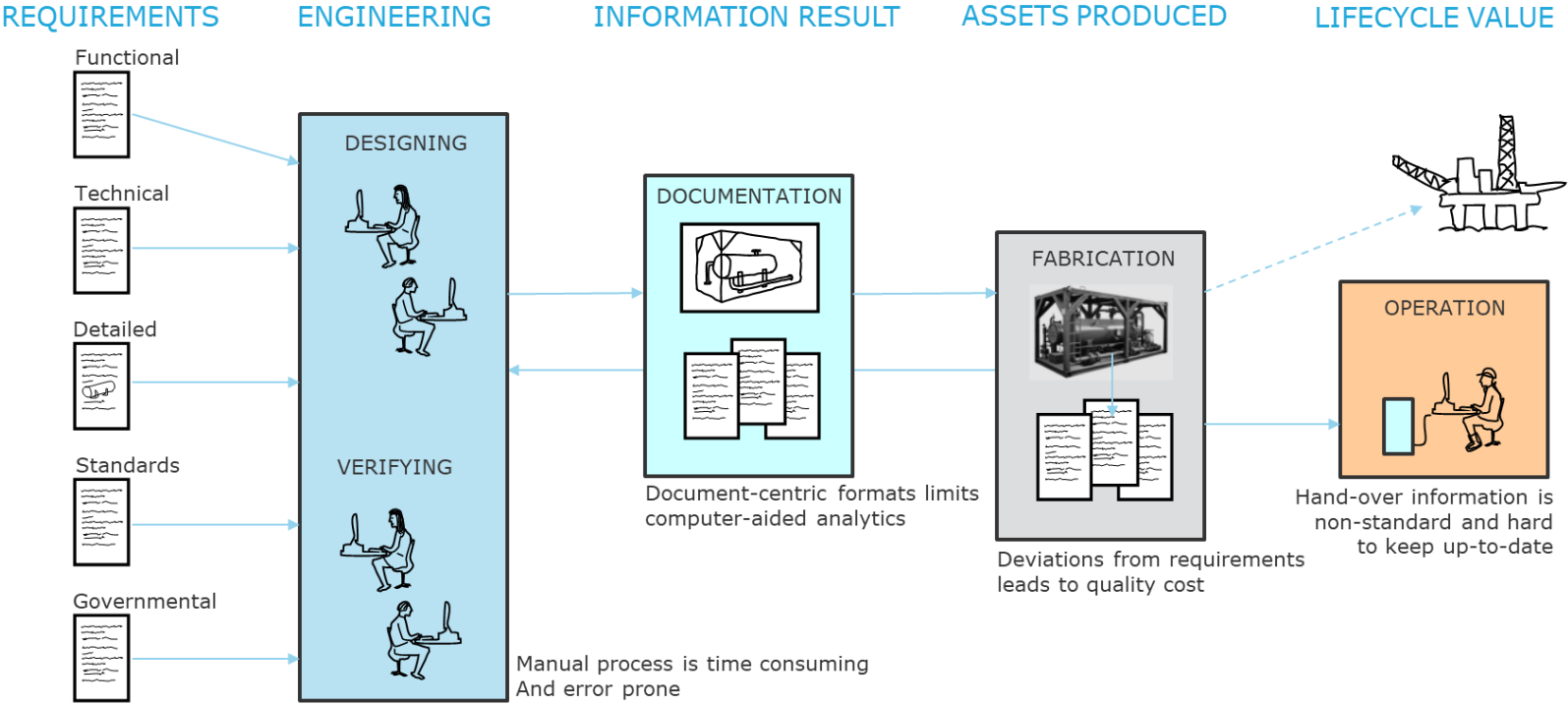




## Shaping The Future Of Digital Requirements And Information Flow In The Oil And Gas Value Chain

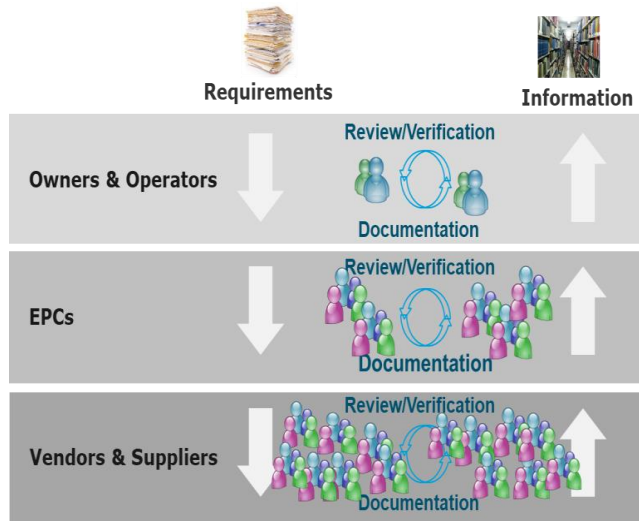
READI – Requirement Asset Digital lifecycle Information

# In a world where READI never was...

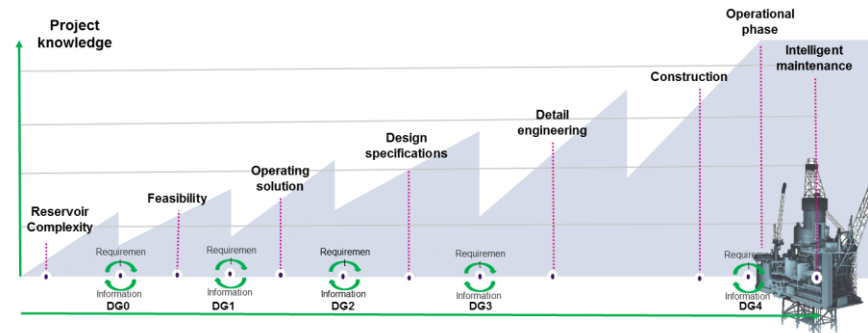


Human language format is imprecise and inconsistent, allowing for contradictory information, preventing automated verification

# Management of requirements and information is lost along the asset's life cycle



Resource intensive review and verification of requirement in the supply chain

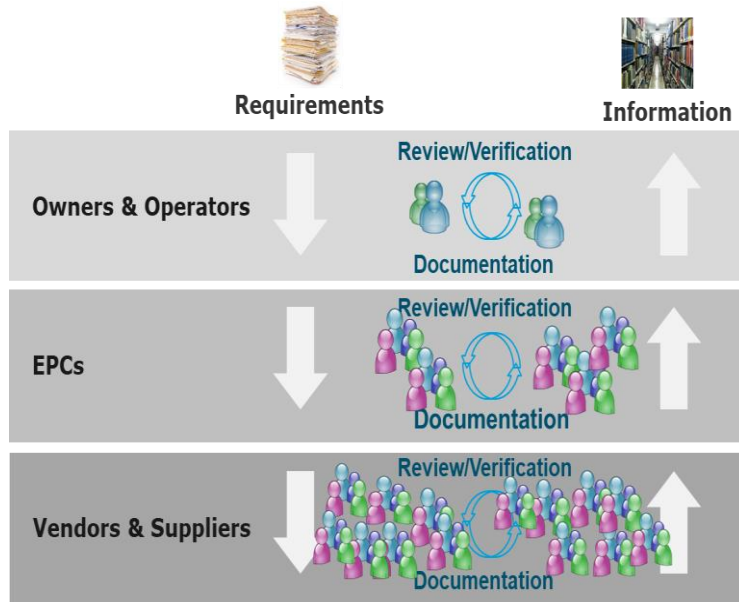


Source: Marianne Kalvenes, Equinor

Information is lost through life cycle due to:

- Lack of precision
- High complexity
- Lack of automation
- Lack of interoperability
- Standardization is time consuming

# Management of requirements and information is lost along the asset's life cycle



- **Lack of precision**

- Requirements are to a large extent *unprecise* and give room for different interpretations resulting in higher prices to compensate for increased delivery risks

- **High complexity**

- Difficult to understand for which *context* the requirements are relevant and applicable
- There are lots of examples of *contradictory and irrelevant* requirements in projects
- To a large extent there exist divergent *company specific* requirement
- *Relations* between requirements *are complex*, and hard for human beings to understand

- **Lack of automation**

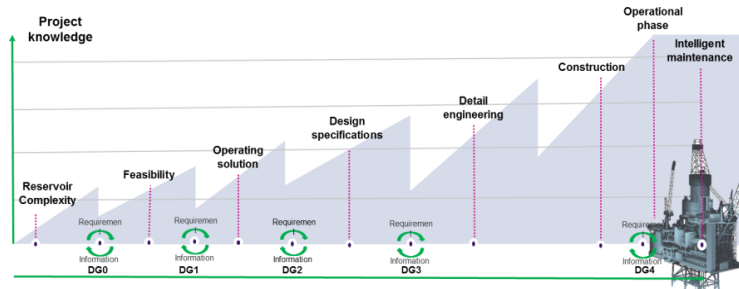
- Standards/requirements are analogue and *not accessible by computers*
- *Verification* of requirements is mainly done *manually*

- **Lack of interoperability**

- Software solutions supporting requirements- and information management processes are *proprietary*
- Information *sharing* and exchange between different systems are *costly*

- **Standardization is time consuming**

- Updating of standards requires update of entire standard documents. This is time-consuming resulting in outdated requirements.



# Strategy for the Oil and Gas industry – realization of Konkraft recommendations

Digital **transformation of business processes** for field development and operation

We need a **common digital language and framework** enabling efficient flow of information between disciplines and work processes



# Business cases points to significant benefits with digitalised requirements and documentation in E&P projects.

## High level estimate for Norwegian Continental Shelf <sup>1)</sup>

### – broad implementation:

- Annual spending <sup>2)</sup>: NOK 72 billion
- Annual savings from <sup>3)</sup>: up to 5 %
- **Annual savings from : NOK 4 billion**

### Cost savings and enhanced safety due to:

- Precise requirements and digital control of documentation
- Re-use of concepts and products
- More effective and improved quality in engineering and procurement work processes
- Reduction of variants and avoiding duplication

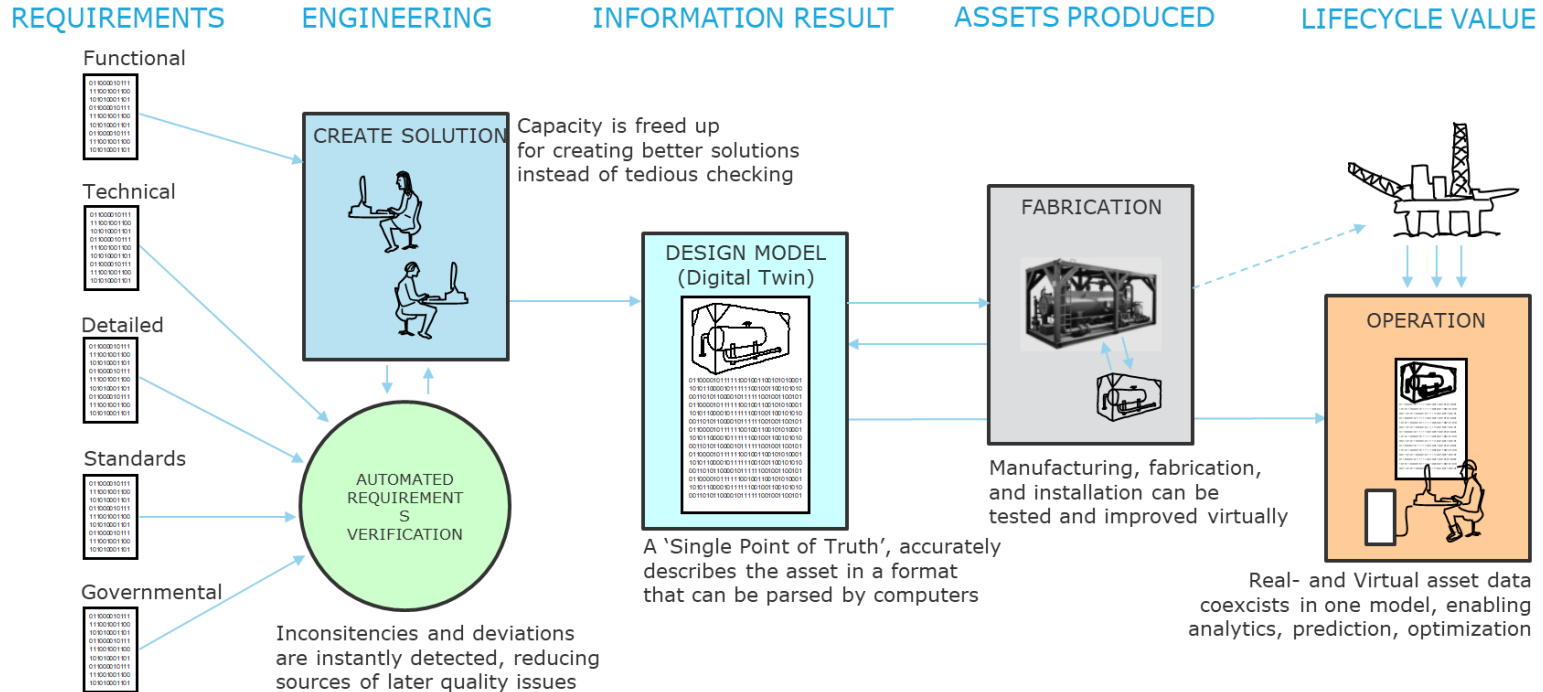
**AIBEL MMD<sup>3</sup>: 5% cost reduction  
for bulk material ordered  
amounts to > NOK 150 mill for  
a large project**

1) Work lead by Equinor

2) Input from Rystad Energy

3) Input from Aibel

# The vision READI is pointing towards



We need a common digital language and framework enabling efficient flow of information between disciplines and work processes

# READI value proposition - from paper to machine readable

## READI – governance of digital requirements in the oil and gas industry

The **open industry platform** READI translates **diverse company practises** into **shared digital LCI and technical requirements**, and helps the industry to improve safety, cut costs and increase efficiency in **business critical processes** through automation.



Paper based standards



Company specific requirements



Updated and common requirements in a digital format



READI – Common industry vocabulary and digitalization method for machine readable requirements



Application for business process improvements

READI JIP

Industry applications



# READI scope and main deliverables

## Scope:

### Technical information requirements

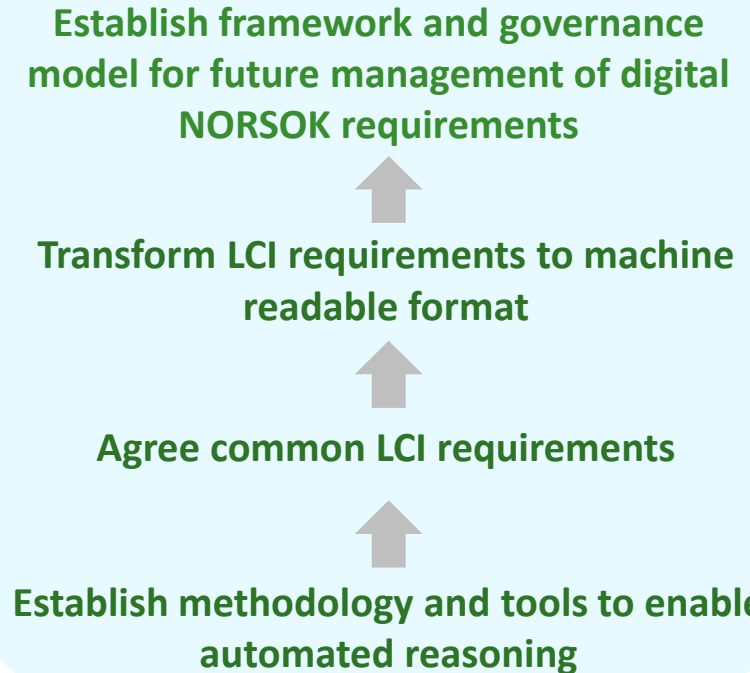
- Z-018: Supplier's documentation of equipment
- Z-001: Documentation for Operation (DFO)

### Information modelling framework

- Z-CR-002: Component Identification System
- Z-DP-002: Coding System
- Z-003: Technical Information Flow Requirements

CR = Common Requirements

DP= Design Principles



# Conceptual information model - main building blocks

**READI Vision**

- Automated digital verification of requirements and design in the oil and gas industry
- Used globally, based on international standards and open source technology
- Standardized breakdown of assets and identification of components for all projects and operation

## READI framework

Governance

W3C standards

Digitalization methodology and tools

### Information model

Upper ontology  
ISO 15926

ISO/IEC 81346

Standard RDLs and vocabularies

## Applications and use cases

Norsok Z-Ti harmonization and digitalization

Current scope

Digital design basis

Ongoing dialogue

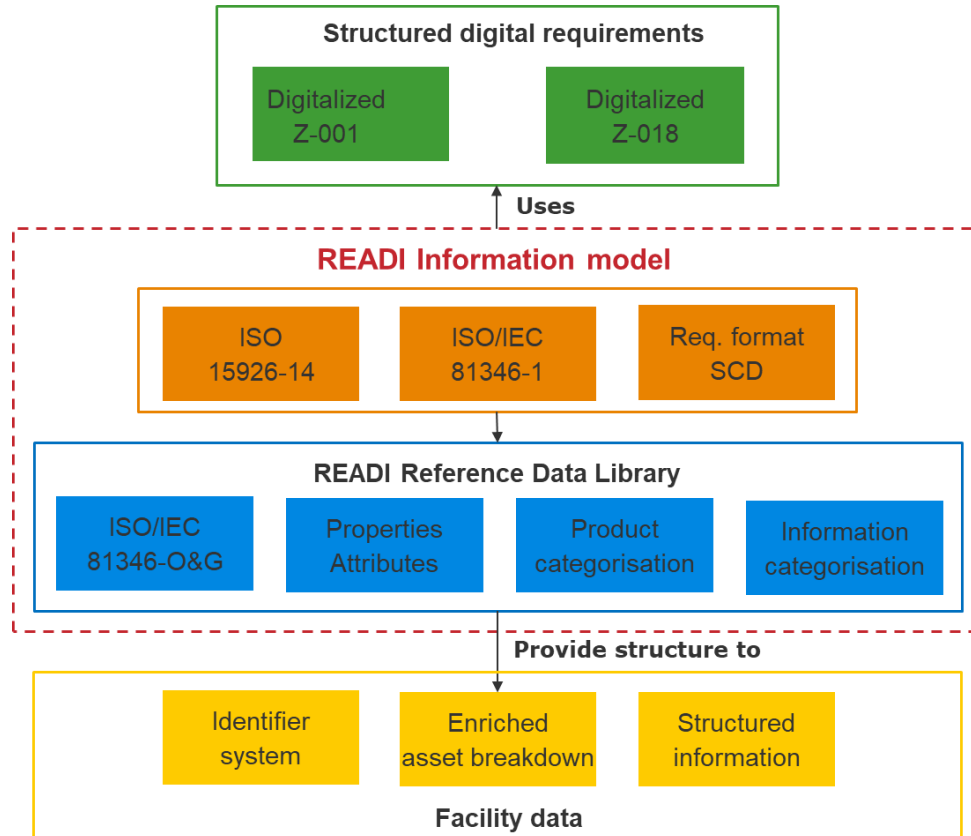
Piping commodity codes

IOGP JIP 33/36

READI ambition

Other

# READI Information model (draft)

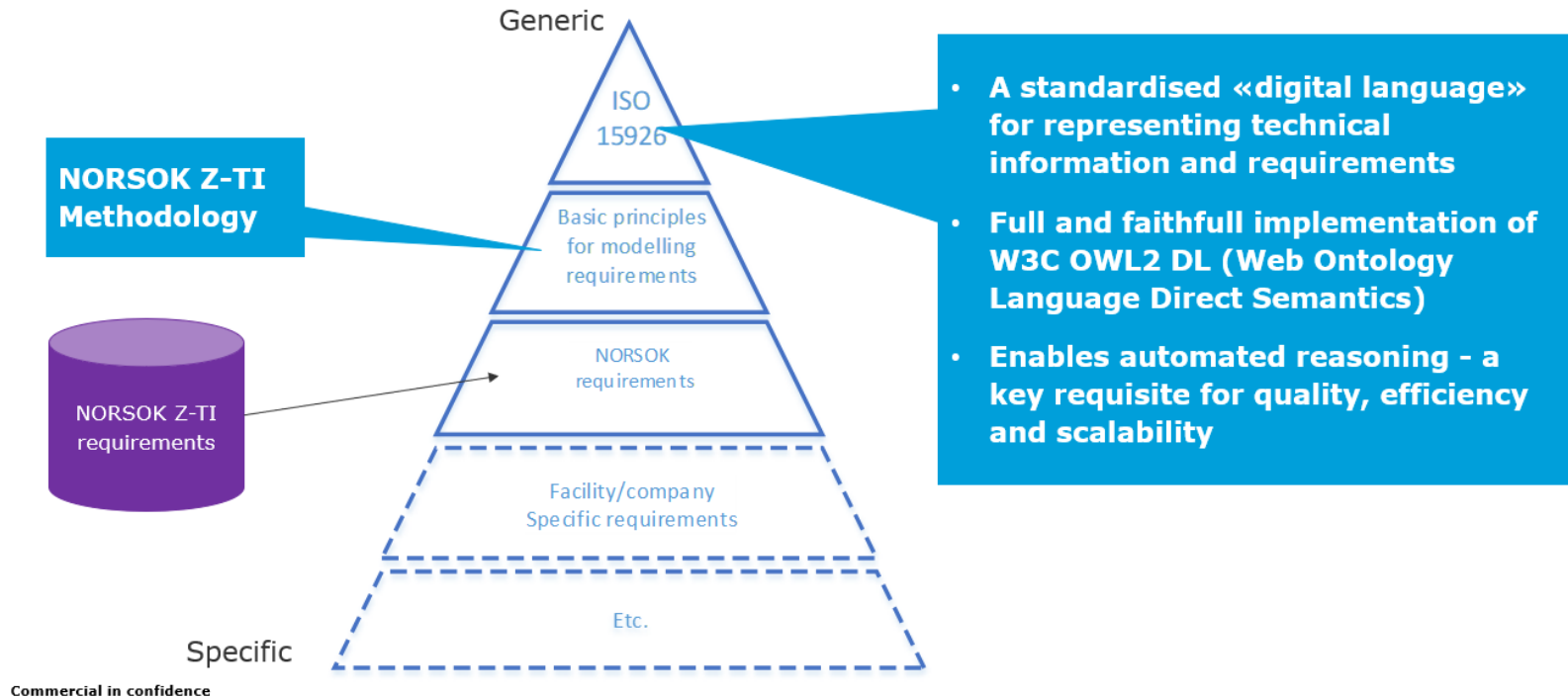


## Comments:

- ISO 15926-14 gives upper vocabulary to READI Reference Data Library (RDL)
- ISO/IEC 81346-1 provides concepts for READI RDL
- The SCD format give precise requirements
- ISO/IEC 81346 O&G provides a flexible asset breakdown structures
- READI RDL provides standard vocabularies
- The READI RDL provides structure to organisation of facility data which enable automated data flow and extended automation of data processing

# READI information model

## WP4 - ISO Standardisation: ISO 15926 – 14 TR (Technical Report)

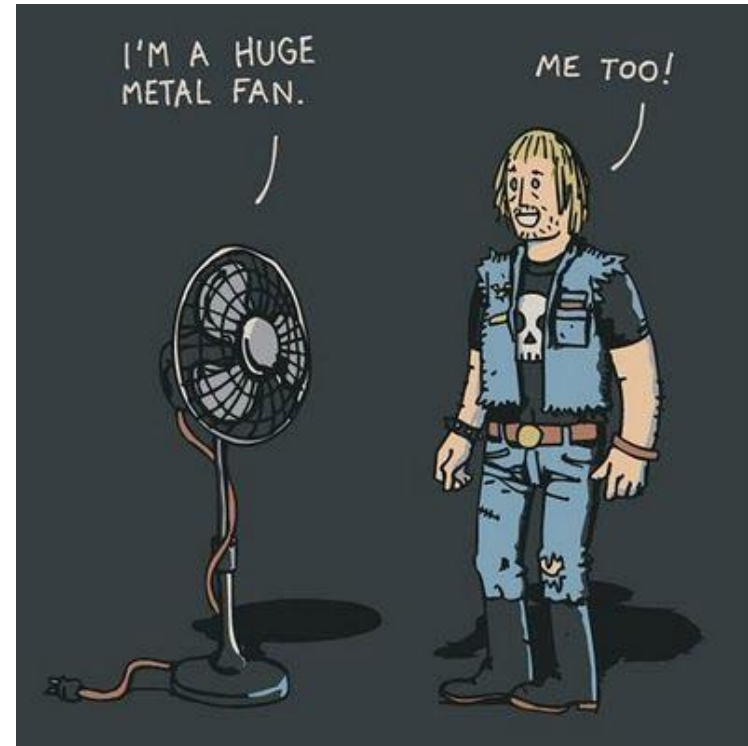


# The solution

**Why is semantic technology the solution?**



**We need a common vocabular and unambiguous requirements understood by humans and computers!**



# Why do we talk about common digital language?

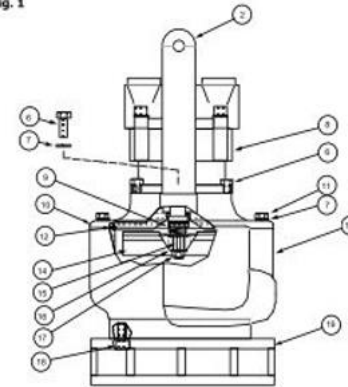
## 1. What's the common name for the document for spare parts?

- Spare part list
- Spar part interchangeable record
- Spare Parts Recommendations and Price List
- List of recommended spare parts
- Recommended spare parts
- Consolidated Spare Parts List

## 2. Are these the same documents or not?

Submersible Pump HWP 2" spare parts list  
From Serial No. 0100

Fig. 1



Pos.	Part No.	Description	Pcs.
2	9901500	Handle	1
6	9901509	Bob	6
7	9901510	Lock washer	6
8	9901511	Hydraulic motor 2" pump	1
9	9901512	Mechanical seal assembly	1
10	9901513	Top cover aluminum	1
11	9901514	Bob	4
12	9901515	O-ring top cover	1
13	9901516	Volute aluminum	1
14	9901517	Impeller	1
15	9901518	Shaft key	1
16	9901519	Washer	1
17	9901520	Lock nut	1
18	9901521	Screw	4
19	9901522	Sprayer	1
-	7431167	Elbow fitting	2
-	7431168	Straight fitting	2
-	7521072	Seal ring 1/2"	2
-	7401141	O.R. coupling 1/2" BSP male	1
-	7401142	O.R. coupling 1/2" BSP female	1
-	9901523	Seal kit motor w/bearings	1
-	9001562	Seal kit motor	1

## PCA linked data

- We have one unique term and definition for part list:  
<http://data.posccaesar.org/rdl/RDS16236529>
- Term: Part list
- Definition: A document listing all components or parts the described artefact or item consist of
- One stable, unique and trustworthy source for information

# Writing unambiguous requirements: It's all about 3 letters

**S C D**  
scope condition demand



# SCD – Scope, Condition and Demand

## Traditional method - Textual requirement

Equipment with a transport dry weight above 1000 kg shall be weighed by the manufacturer and a weight certificate shall be issued

## SCD method - Digital requirement

Requirement 1

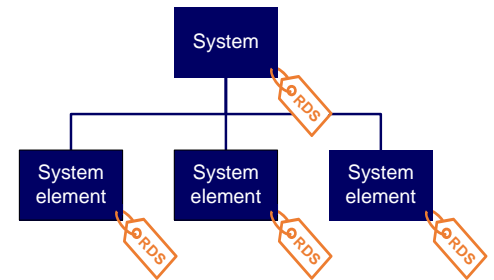
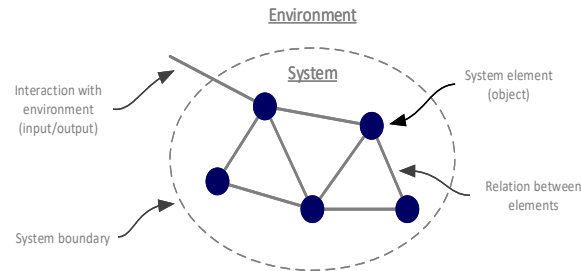
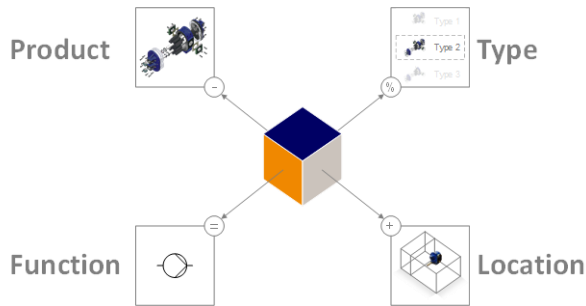
Scope  
Equipment

Condition  
Dry weight > 1000 kg

Demand  
Weight certificate

# We need a richer asset breakdown system: **ISO/IEC 81346** Reference Designation System for Oil and Gas

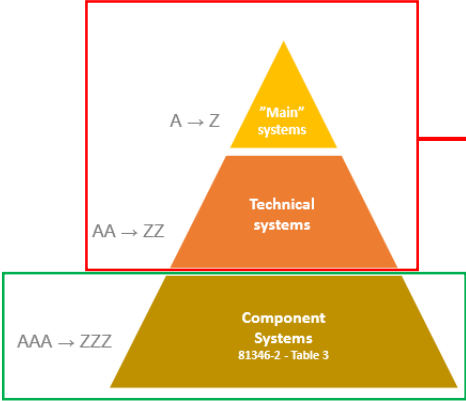
- Existing identification system is not rich enough.
- Existing identification system has a limited form of hierarchy breakdown structure
- Existing identification system does not separate between functions, products, locations, type
- Existing identification system requires a master database from early project phase to avoid duplicates.
- Existing identification system is Norwegian oil and gas industry based with company and project specific adjustment.



# IEC/ISO 81346 RDS for O&G

## Scope and deliverables

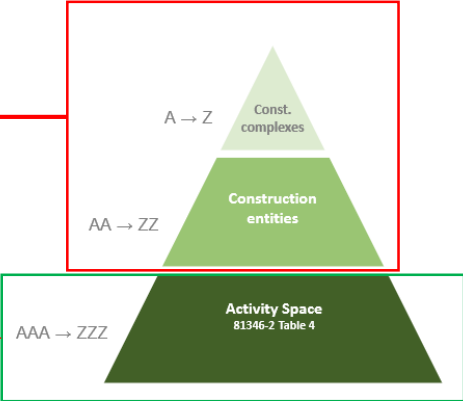
RDS-O&G System Library



O&G Library of Systems and Location

Class code	Class Abbrev	Class name	IEC/ISO 81346-2 example	IEC/ISO 81346-2 example
U	U	Uplift	Uplift	Uplift
AA	AA	AA-object for something specific	AA-object	AA-object
AAA	AAA	AAA-object for something even more specific	AAA-object	Example 1, Example 2, Example 3, Example 4, Example 5, Example 6

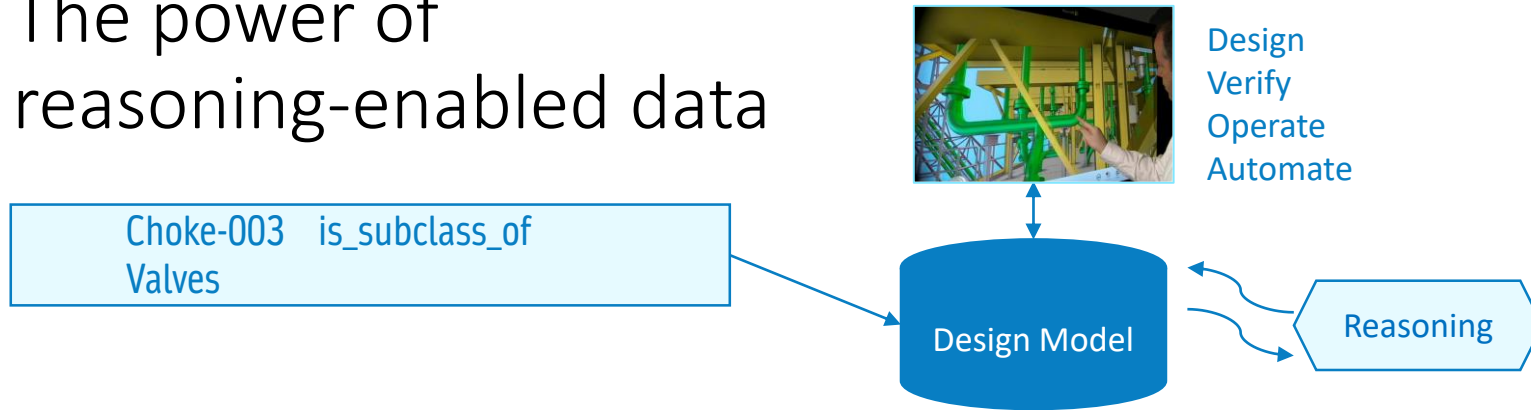
RDS-O&G Location Library



Oil and Gas Terms

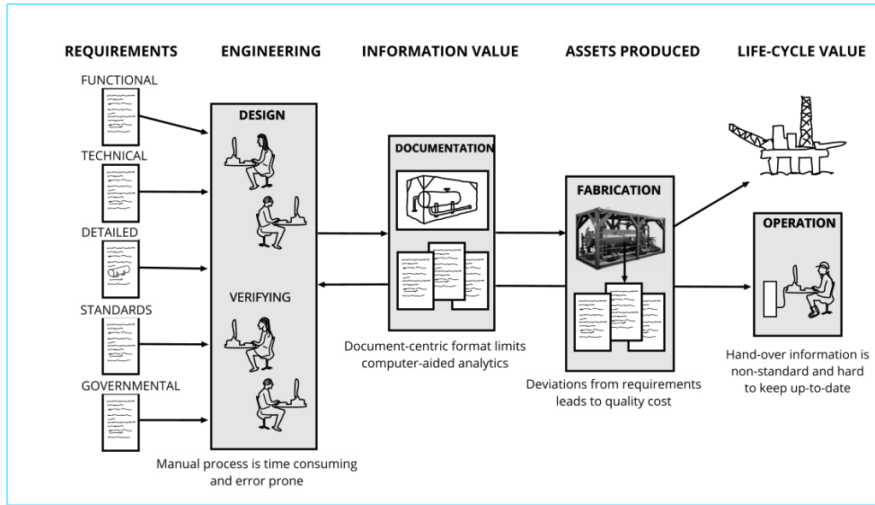
RDS-O&G Manual  
(user guide)

# The power of reasoning-enabled data



- To achieve a scalable, reasoning-enabled format, the context of the data is included as an inherent part of the data element
- This allows *any* computer to traverse the data and perform reasoning, needing no proprietary database structures – it is implementation independent
- A Digital Twin formulated such will enable full interoperability across platforms
- AI/ML will not be limited by having to build on context hidden in volumes of raw data; reasoning-enabled data dramatically increases its power

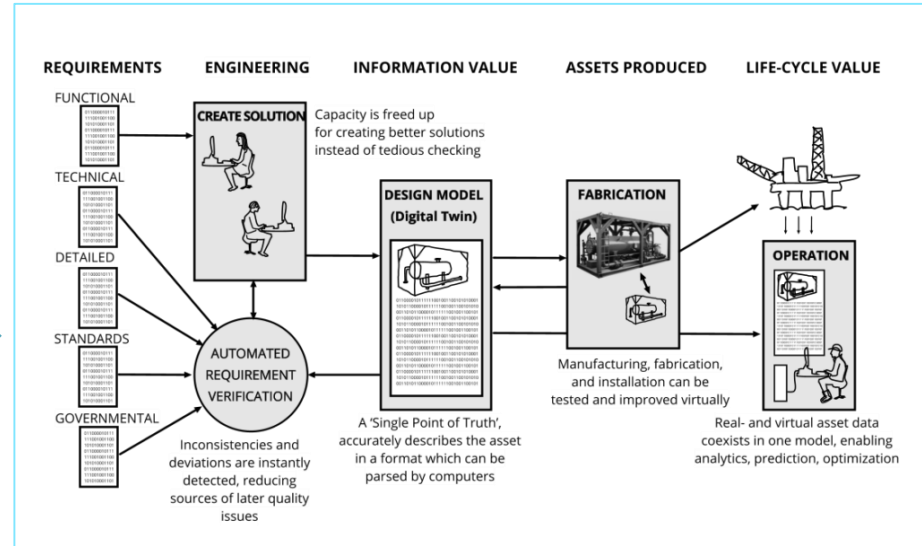
# Automated reasoning can dramatically reduce cost & time



Document-centric regime



Semantic data-centric regime



# The READI JIP is executed in phases

June 2018

October 2020

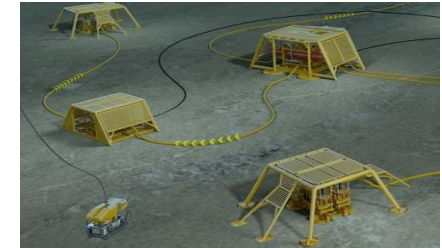
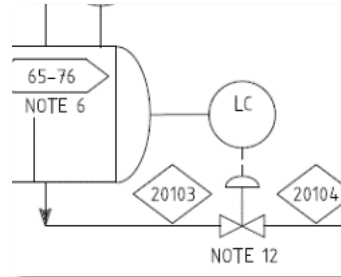
2021

Initiation

Phase 1

Phase 2

Phase 3



## Phase 1:

Building the platform for digitalisation at a larger scale – Proof of Concept based on concrete pilots; valves (general) and subsea system

## Phase 2:

Common DFO\* requirements  
Complete methodology and platform for digitalisation of requirements  
International collaboration

## Phase 3:

Digitalisation of DFO and Supplier documentation requirements  
Extensive use case for practical application of shared digital requirements

*\*Documents For Operation*

# Some achievements Phase 1



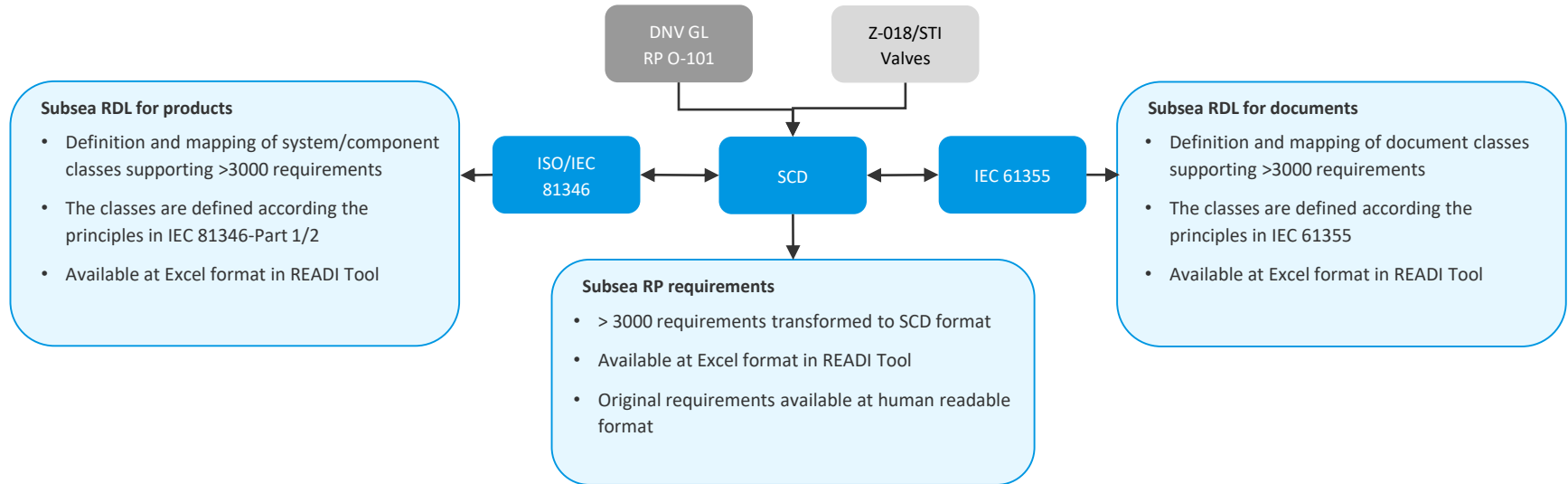
Captured and structured more than 3100 documentation requirements for subsea and valves according to READI methodology.

Demonstrated that a >50% reduction in number of documentation requirements in DNV GL RP-O101 is achievable by application of the READI methodology .

Established core methodology and working tool enabling creation and automatic processing of digital requirements..

Demonstrated automatic consistency checks of requirements by use of the READI methodology and tools. The tool also recommends how to resolve inconsistencies.

# Subsea use case: Digitalisation of DNV GL RP O-101 and STI (valves)



- Transformation of RP O-101 to digital format completed, including of building the ontologies (triplets) – *only quality check remains*
- Decided to use RP O-101 as pilot case for demonstration of “proof of concept”
- The decision to use IEC 81346 as reference standard for system/component classification delayed the process, but important in order to meet overall ambitions related to automation and improved interoperability between current management/enterprise systems used by the industry.



# Development of READI TIRC for hosting of digital requirements

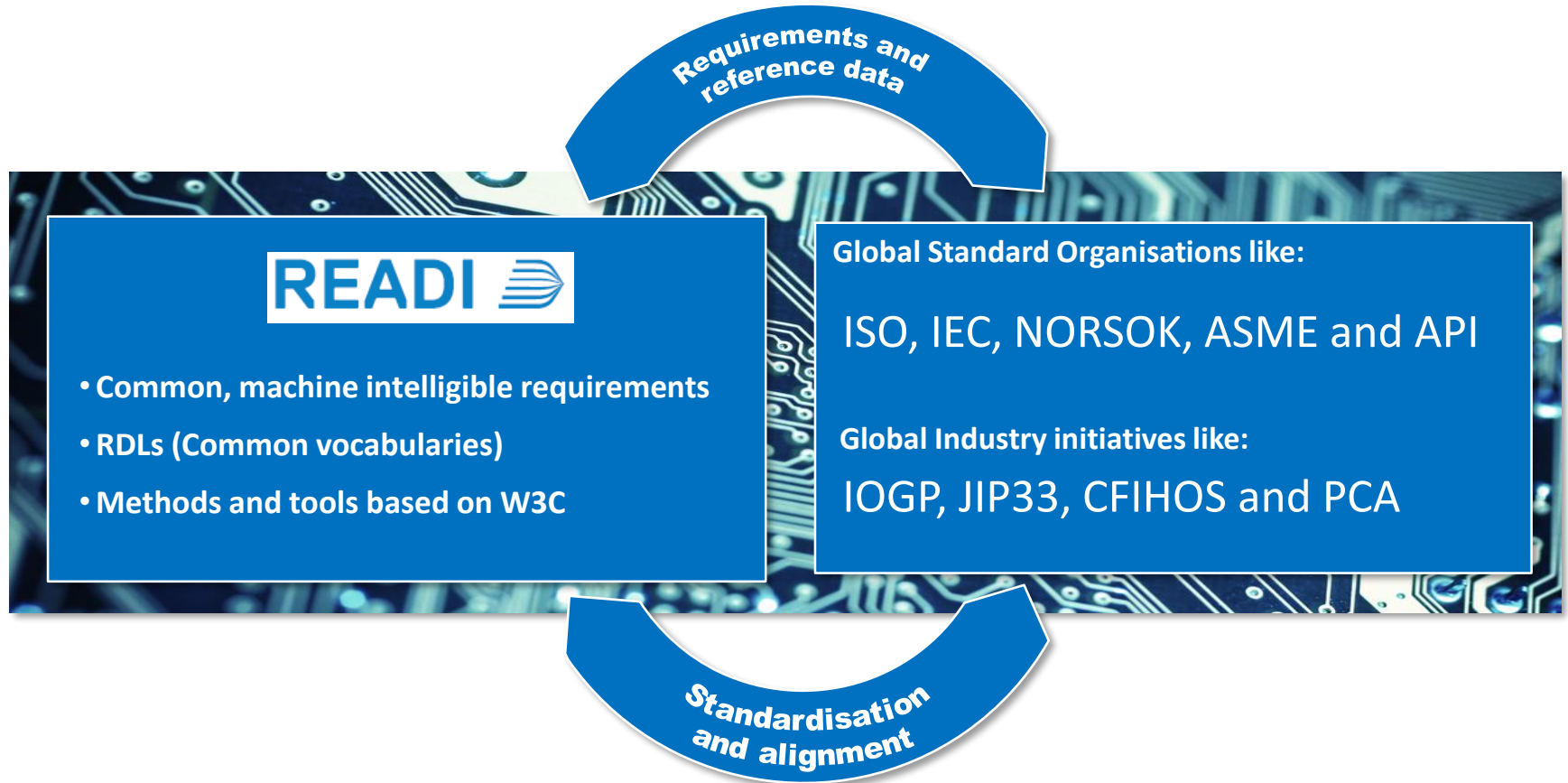
Live demo every 2<sup>nd</sup> week

Last demo:

- We have made content to buttons in READI TIRC
- We have chosen three products:
  - Absolute pressure transmitter
  - Pump
  - Electrical motor-LV
- From this, we will make a machine readable technical information requirement file



# READI has global ambitions – bringing the digital platform to the O&G community



# Current Participants

Category	Company
Operators	Equinor
	ConocoPhillips
	Aker BP
	Lundin
	Shell
	Vår Energi (Eni)
EPC Contractors	TechnipFMC
	Aibel
	Aker Solution

Category	Company
Equipment and system vendors	ABB
	Computas
	Proenco
Authorities	Petroleum Safety Authority
	Ministry of Petr. and Energy
	Standard Norge
Others	DNV GL
	Sector Board Petroleum
	NOROG
Observers	POSC Caesar Association
	Norsk Industri

# READI



Bringing the  
oil and gas  
industry together



Share practises and requirements  
for improved cost efficiency  
and safety



Reducing complexity and risk  
for errors in work processes and  
information exchange



Enabling the automation  
of critical business  
processes and design

## READI contact information

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Mobile: +47 906 74 106

<https://readi-jip.org/>

Steering Committee Chair: Steinar Mollan, Equinor

E-mail: [stem@equinor.no](mailto:stem@equinor.no)

Mobile: +47 974 19 251