



The use of international standards in technology development, project execution and operations

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Standards Roadshow

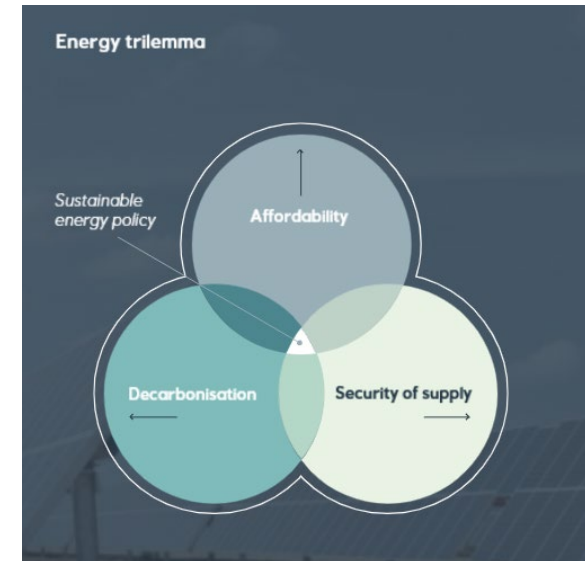
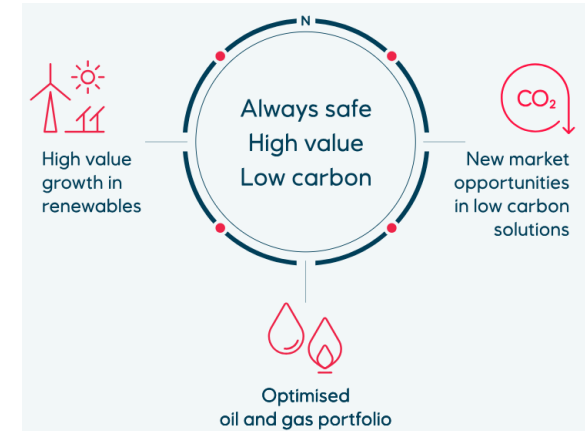
Challenges in Standardisation for the Oil & Gas Industry in the Eastern Mediterranean

15 October 2024, Lemon Park, Nicosia - CYPRUS



Content

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 - Equinor governance and relationship to standards
2. ISO/TC67 framework and standards usage
 - Safety & sustainability
 - Reliability & cost
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 - Technology development
 - Project execution
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WE ARE EQUINOR

A broad energy company, searching for better solutions

We are a Norwegian energy company, determined to use our competence, skills and innovation, continuously searching for the solutions that will drive the energy transition.

23,000

EMPLOYEES

Across the world

30

COUNTRIES

Presence and business operations

8,000

SUPPLIERS

Working together with us

170

MILLION PEOPLE

Get access to our energy – everyday





EQUINOR STANDARDIZATION PHILOSOPHY

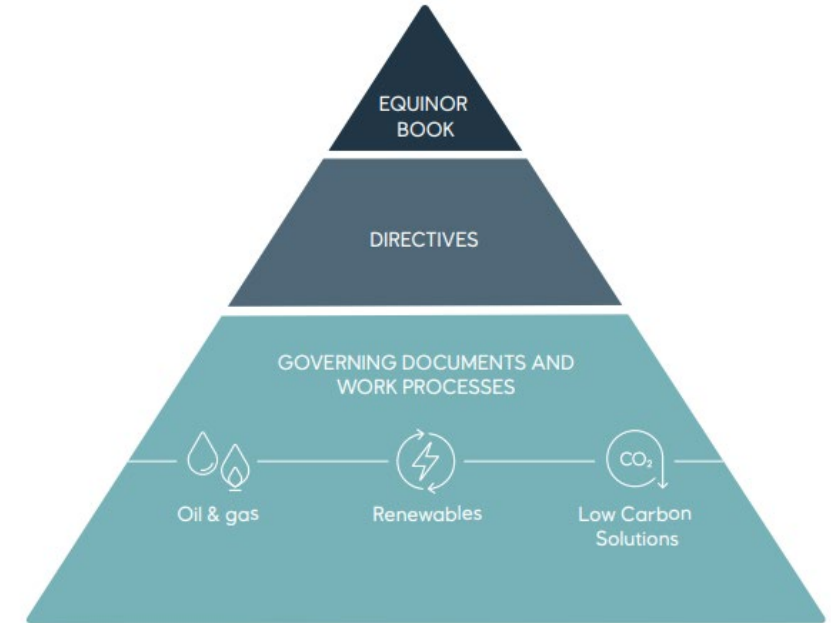
- REDUCE COMPANY SPECIFIC REQUIREMENTS
- USE GLOBAL STANDARDS WITH INDUSTRY ALIGNED SPECIFICATIONS



Management System in Equinor



- Equinor management system covers a wide set of disciplines that meet our different business needs.
- Integrated approach builds on ISO management system standards, e.g.:
 - ISO 9001 Quality management
 - ISO 14001 Environmental management
 - ISO 31000 Risk Management
 - ISO 50001 Energy management
 - ISO 55000 Asset management
- Equinor committed to standards development for operating and quality management systems for our business sector through our participation in ISO/TC67/WG2.



International standards used to ensure safety

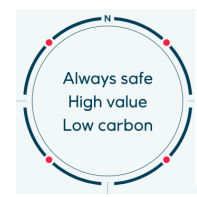


Photo 1: Gjøa platform - 2010

Commissioning test of fire water systems according to ISO 13702.

«Prior to start-up, commissioning tests should be performed under as realistic operating conditions as possible. The fire water system should be subject to full scale dimensioning fire water demand scenario test.»



Photo 2: Martin Linge (heli deck) – 2024

Test of “Deck integrated fire fighting system” according to ISO 13702.

Equinor has convened for ISO/TC67/SC6/WG1. This standards portfolio is actively used in Equinor.

Examples of standards imbedded into governing documents:

ISO 10418:2019. “Basic surface process safety systems”

ISO 13702:2024. “Control and mitigation of fires and explosions on offshore installations”

ISO 15544:2024. “Emergency response on offshore installations”

ISO 17776:2016. “Guidelines on tools and techniques for identification and assessment of hazardous events”

IEC 61511:2016 (all parts). “*Functional safety – Safety instrumented systems for the process industry sector*”

International standards used to ensure sustainability



• ISO 14001 Environmental management systems

- Equinor's Fundamental Requirements for Sustainability (FR11) says: *Integration of sustainability into business processes is essential to shape and safeguard the company, avoid infringing on human rights, and deliver on the energy transition plan. The requirement is to ensure:*
 - Regulatory compliance and preparedness
 - Integration of the principles of ISO 14001 into the management system
 - License to operate

• ISO 50001 Energy management systems

- Equinor's energy management system is based on this standard. There is also a requirement in our discharge permits from Norwegian Environmental Agency (NEA), that the assets shall have an energy management system in place.

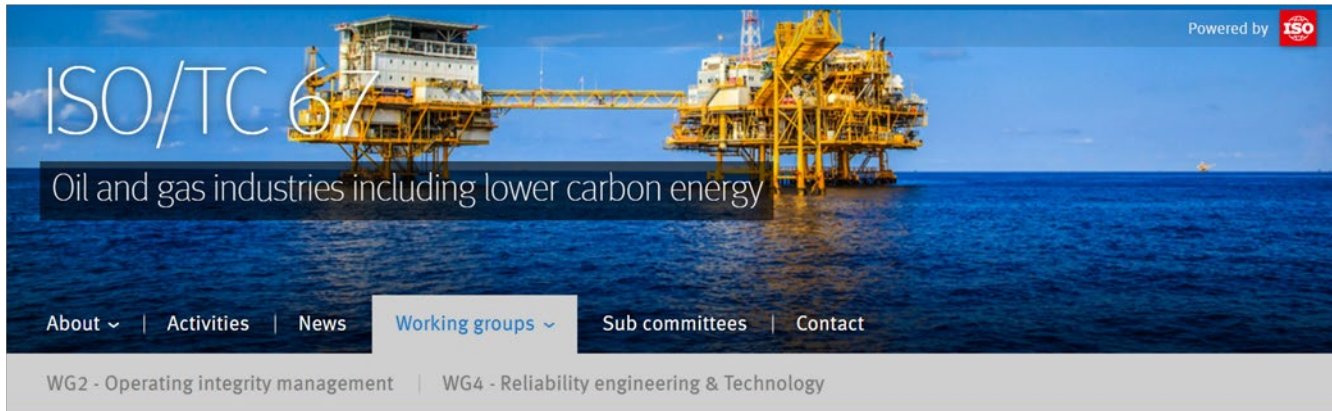
• New standard under development

- ISO 19870 – *"Methodology for Determining the Greenhouse Gas Emissions Associated with the Production, Conditioning and Transport of Hydrogen to Consumption Gate"*.
- Equinor is active in the standard development.

International standards used for reliability & cost



[See ISO/TC67 Standards Committee website](#)



Equinor applications in project and operations :

- Technology development
- Project execution
- Operations

- Standards implemented in governing documents
- Topics:
 - Production Assurance Programme (PAP)
 - Reliability management
 - Production efficiency (PE)
 - Life cycle costing
 - Cost management

- [ISO 14224:2016](#): “Collection and exchange of reliability and maintenance data for equipment”
- [ISO 20815:2018](#): “Production assurance and reliability management”
- [ISO/TR12489:2013](#): “Reliability modelling and calculation of safety systems”
- [ISO 15663:2021](#): “Life cycle costing”
- [ISO 19008:2016](#): “Standard Cost Coding System for oil and gas production and processing facilities”
- [ISO/TS 3250:2021](#): “Calculation and reporting production efficiency in the operating phase”

INTERNATIONAL STANDARD **ISO 20815**

Second edition
2018-10

Petroleum, petrochemical and natural gas industries — Production assurance and reliability management

Industries du pétrole, de la pétrochimie et du gaz naturel — Assurance de la production et management de la fiabilité

NOTE: New revision in progress to prepare ISO 20815:2018, ed. 3
“Oil and gas industries including lower carbon energy - Production assurance and reliability management”

INTERNATIONAL STANDARD **ISO 14224**

Third edition
2016-09-15
Corrected version
2016-10-01

Petroleum, petrochemical and natural gas industries — Collection and exchange of reliability and maintenance data for equipment

INTERNATIONAL STANDARD **ISO 19008**

First edition
2016-08-15

Standard cost coding system for oil and gas production and processing facilities

Système de codage du coût standard pour la production de gaz et d'huile, et des installations de traitement

NOTE: New revision in progress to prepare ISO 19008, ed. 2:
“Oil and gas industries including lower carbon energy - Standard cost coding system”

INTERNATIONAL STANDARD **ISO 15663**

First edition
2021-02

Petroleum, petrochemical and natural gas industries — Life cycle costing

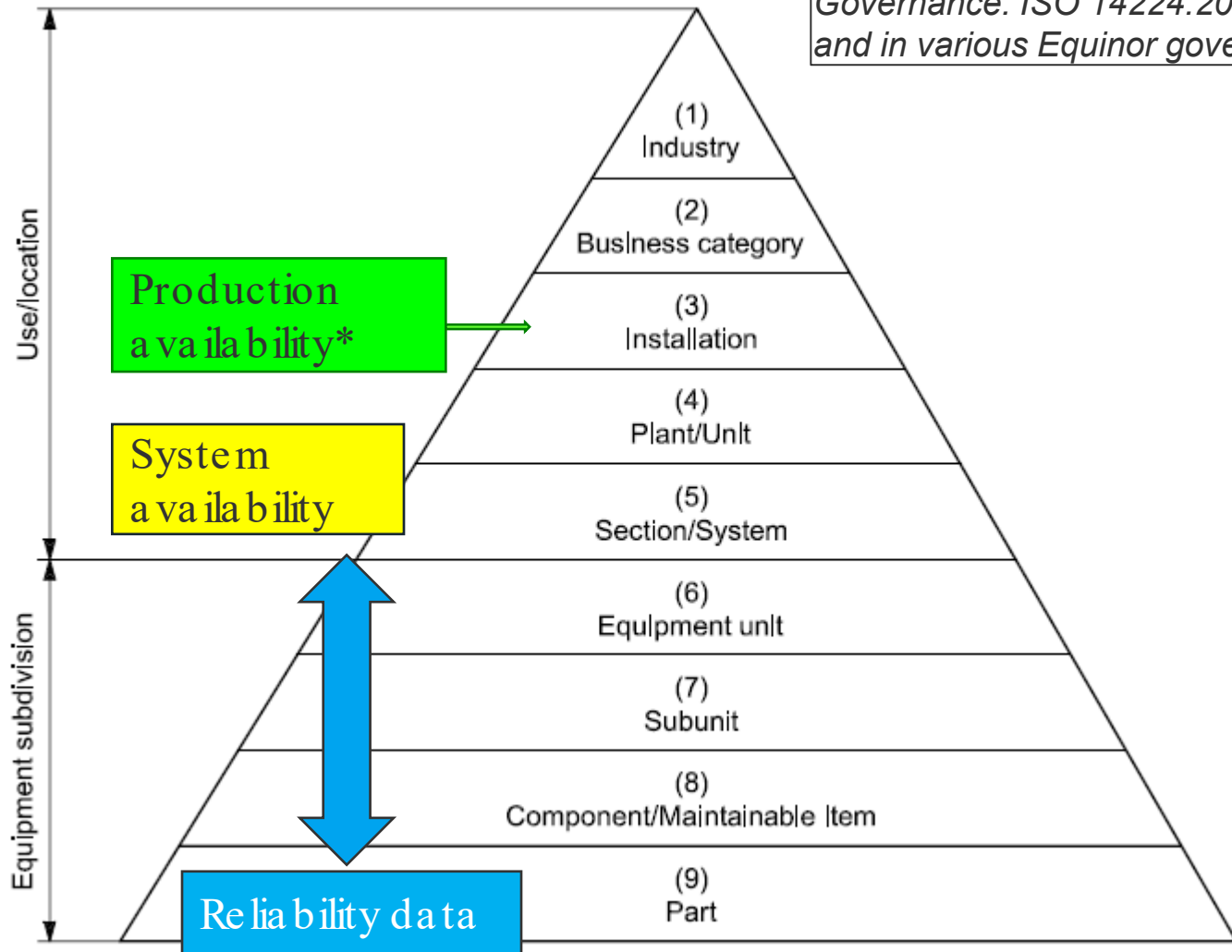
Industries du pétrole et du gaz naturel — Estimation des coûts globaux de production et de traitement

ISO 14224 used for failure reporting and various analyses

- Taxonomy classification applies for all disciplines



Governance: ISO 14224:2016 is quoted by Havtil (Norwegian Ocean Industry Authority) and in various Equinor governing documents (e.g. technology and maintenance).



Source: ISO 14224:2016

*In operation often called Production efficiency (PE)

ISO 14224 equipment classes are reflected in Equinor SAP when recording failure characteristics, see example from OTC-28705-MS paper from 2018:



Example of ISO 20815 for reliability management

- Reliability Business Case example from Subsea All-Electric JIP

Reference All-Electric (AE) subsea field to enable reliability management during technology development.

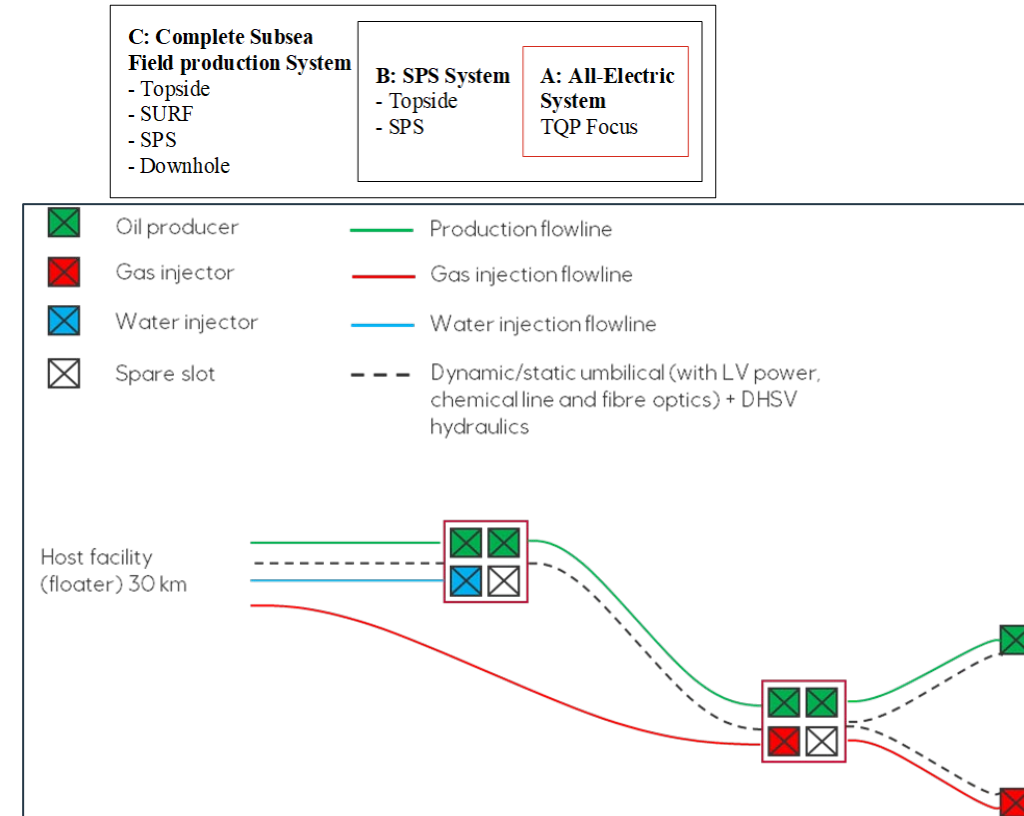
Basis for framing the performance objectives and performance requirements, i.e. system availability estimation:

- Technical availability (main target)
- Operational availability
- *Key terms as defined in ISO 14224 and ISO 20815 were used.*

Basis for system availability estimation and comparison between alternatives:

- All-Electric vs. Electro-Hydraulic subsea production control

See OTC 2024 paper : [OTC-35350-MS](#),
 “Reliability and Quality Management for Technology Qualification of Subsea All-Electric Xmas Tree”





ISO 20815 used for optimizing production availability and equipment reliability – at asset level and component level

Equinor has applied PAP with production availability analyses for numerous projects last decades in line with ISO 20815.

Specify related requirements. Prioritize and organize activities to support reliable and safe solution.

- Production assurance: Activities implemented to achieve and maintain a performance that is at its optimum in terms of the overall economy and at the same time consistent with applicable framework conditions. (Source: ISO 20815:2018, 3.1.45)

PAP By Operator

- Reliability management: Activities undertaken to achieve reliability related performance objectives and performance requirements. (Source: ISO 20815:2018, 3.1.52)

RMP By Supplier

Specific Subsea All-Electric RMP was made and is being used in the JIP.

See more info in OTC 2024 paper : [OTC-35350-MS](#)

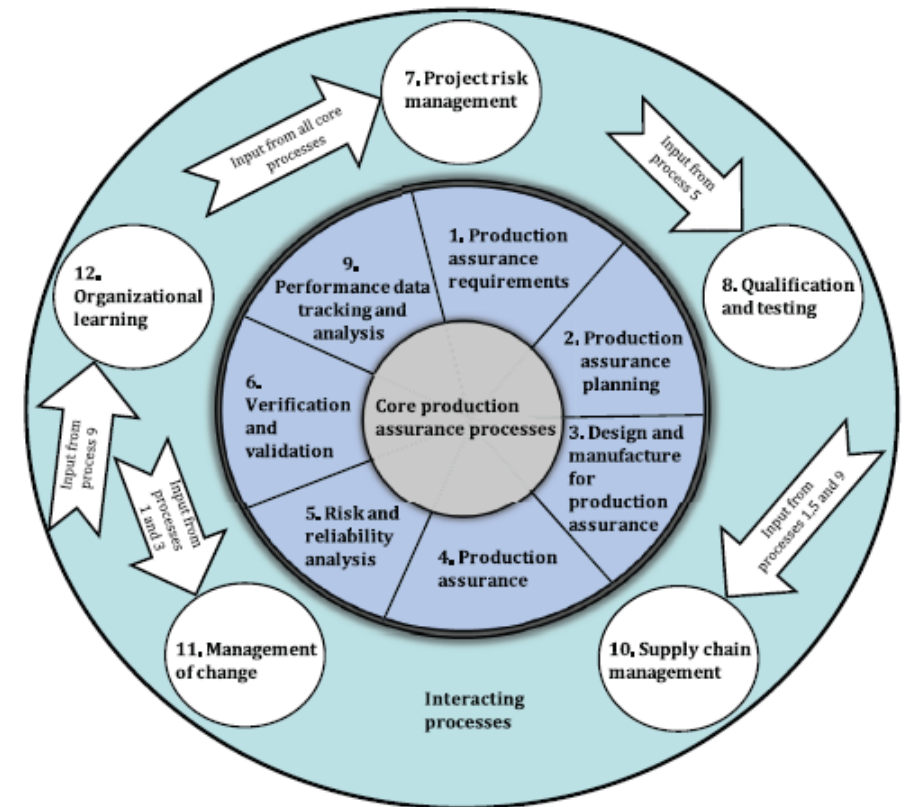
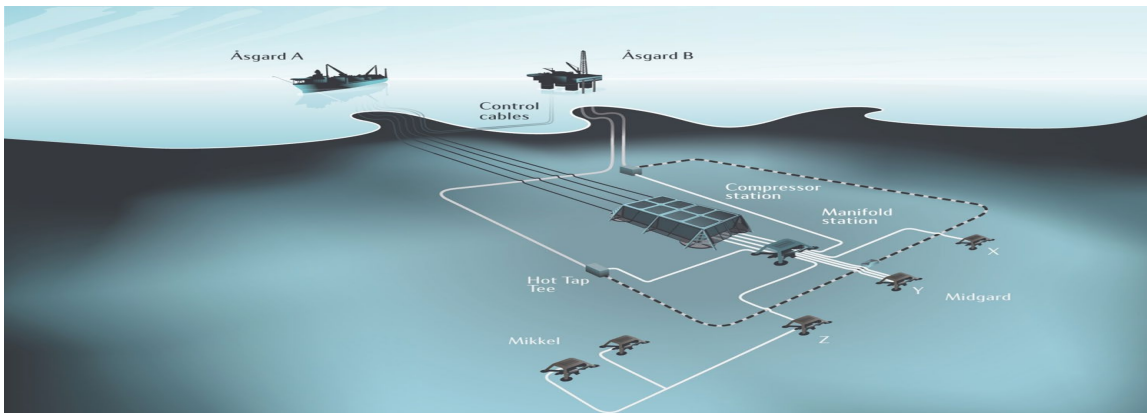


Figure 4 — Core and interacting production assurance processes

International standards used in technology development - Åsgard Subsea Compression



- Production Assurance Programme as per ISO 20815 defined «ASC Production Availability» target as 96% in first year.
- Historic production unavailability was less than 4% and ASC Technology Qualification Programme approved at TRL7 in Jan 2017.

Source: OTC 2018 paper [OTC-28705-MS](#)



Equinor use of standards for Technology Qualification

- Technology Readiness Level (TRL) as per ISO 20815:2018



Table I.8 — Technology readiness levels for technology development and qualification

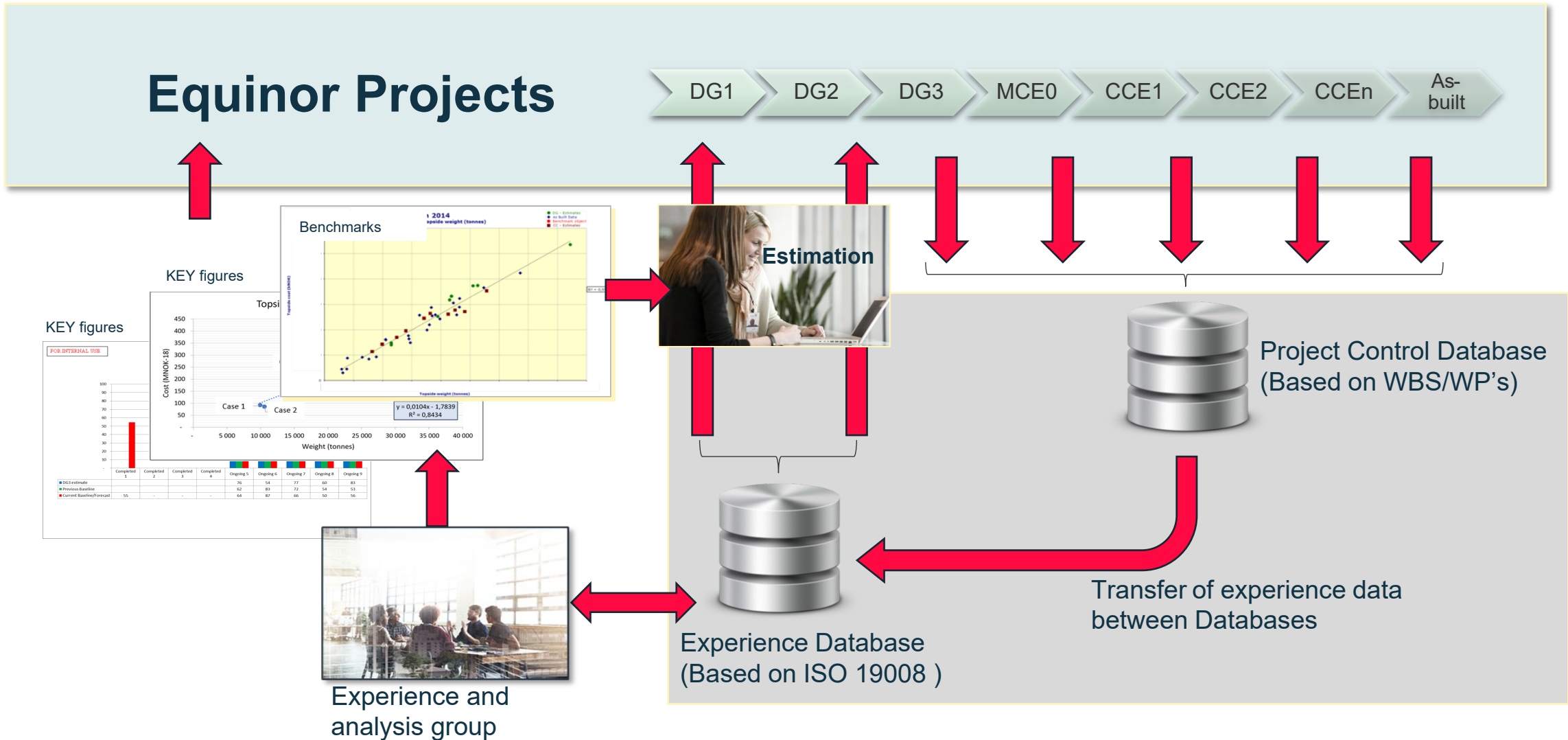
Level	Development stage	TRL description
TRL 0	Unproven idea/proposal	Paper concept. No analysis or testing has been performed.
TRL 1	Concept demonstrated	Basic functionality demonstrated by analysis, reference to features shared with existing technology or through testing on individual subcomponents/ subsystems. Should show that the technology is likely to meet specified objectives with additional testing.
TRL 2	Concept validated	Concept design or novel features of design validated through model or small scale testing in laboratory environment. Should show that the technology can meet specified acceptance criteria with additional testing.
TRL 3	New technology tested	First version of technology built, and functionality demonstrated through testing over a limited range of operating conditions. These tests may be done on a scaled version, if scalable. If the technology is tested as a small-scale version, it is important that the scale effects compared to a large-scale version are sufficiently well understood and predicted.
TRL 4	Technology qualified for first use	Large scale version of technology built, and technology qualified for use within specified operating conditions/limits, through testing in intended environment, simulated or actual. The new technology is now ready for first use. If the technology is qualified as a large-scale version, it is important that the scale effects compared to a full-scale version are sufficiently well understood and predicted.
TRL 5	Technology integration tested	Full-scale technology built and integrated into the environment where it is intended to operate, with full interface and functionality tests.
TRL 6	Technology in operation	Full-scale technology built and integrated into the environment where it is intended to operate, with full interface and functionality tests. The technology has operated in accordance with predefined performance criteria over a limited period of time.
TRL 7	Proven technology	The technology has operated in accordance with predefined performance and reliability criteria, over a period of time sufficient to reveal time-related effects. Required duration of operation is one of the pre-defined criteria. The technology is now proven for use within specified operating conditions/limits.

The technology qualification shall be based on the following standards:

- **DNV-RP-A203:2021** *Qualification of new technology*
 - Qualification basis & Qualification principles
- **ISO 20815:2018** *Production assurance and reliability management*
 - Technology Readiness Level (TRL) and Technology Novelty Categorization (TNC)
 - Performance objectives (reliability targets) and analysis techniques
- **ISO 14224:2016** *Collection and exchange of reliability and maintenance data for equipment*
 - Reliability data and associated reliability terminology

Each project must make project specific TRL4 and TRL7 acceptance criteria.

ISO 19008 – Enables systematic cost data feedback across project phases

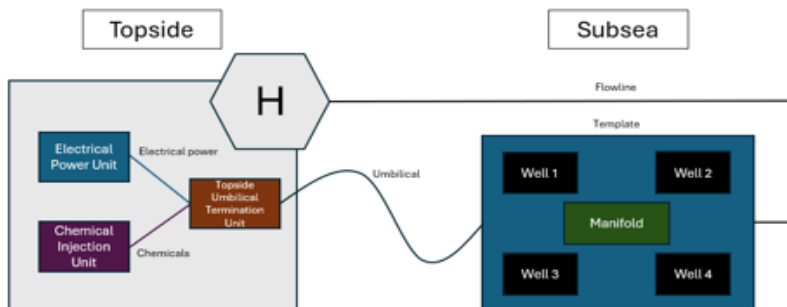


Study case: Subsea Chemical Storage & Injection

Subject matter – Competing options

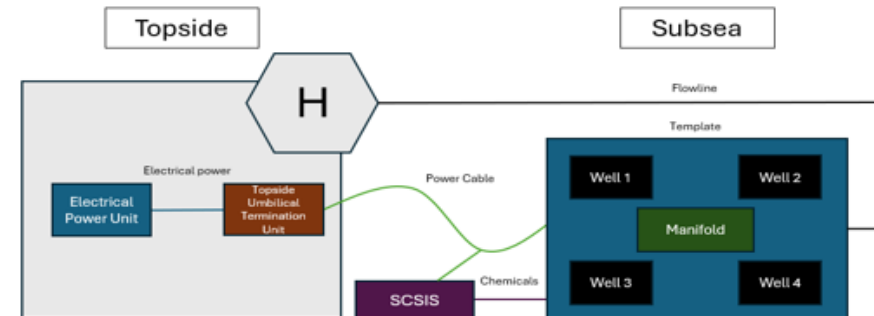
- Subject matter
 - Chemical Storage and Injection for subsea wells
- Competing options:

Option A: Topside Chemical Storage and Injection System



See OTC 2024 paper : [OTC-35368-MS](#),
“Life Cycle Costing Applications in the Energy Sector – Technology Applications”.

Option B: Subsea Chemical Storage and Injection System (SCSIS)



Governing documents specify various projects usage, also interacting with production assurance & reliability management:

- Life cycle costing management plan - LCCMP (Based on ISO 15663) as input to selection of concept, systems and equipment
- Establish scope for: Reliability, availability, maintainability (RAM) and life cycle cost analyses within the scope of the PAP and the LCCMP

Equinor ISO standards usage for reliability & cost

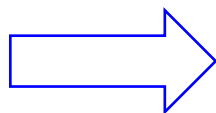
- Across value chain – Corporate framework



ISO standard	Technology development	Project execution	Operations
ISO 14224	<ul style="list-style-type: none"> - Technology qualification (e.g. failure modes and failure mechanisms) - Reliability management for new technology 	<ul style="list-style-type: none"> - Reliability data for analyses - Performance requirements (equipment reliability targets) 	<ul style="list-style-type: none"> - Failure reporting (ISO failure codes in SAP) - Maintenance planning - Accident investigation
ISO 20815	<ul style="list-style-type: none"> - Technology qualification (TRL:Technology Readiness Level) - Reliability management/ RMP in technology projects 	<ul style="list-style-type: none"> - Production Assurance Programme (PAP) as field development operator - Reliability Management Programme (RMP) towards suppliers 	<ul style="list-style-type: none"> - Production Efficiency (PE) reporting (ISO/TS 3250) - Reliability management
ISO 15663	<ul style="list-style-type: none"> - Life cycle costing of technology options 	<ul style="list-style-type: none"> - Life cycle costing of e.g. equipment configuration alternatives 	<ul style="list-style-type: none"> - Life cycle costing for e.g. modifications
ISO 19008	<ul style="list-style-type: none"> - Cost estimation of new technology 	<ul style="list-style-type: none"> - Cost estimation, benchmarking, forecasting and data collection 	<ul style="list-style-type: none"> - Cost and quantity data collection
General	<ul style="list-style-type: none"> • Terms & definitions in ISO standards are used in various governing documents • Standards reduces subject company specifications towards external suppliers • ISO/TR 12489 also applied in functional safety and in reliability management (support SIL calculations) 		

Concluding remarks

ISO/TC67 Vision



Equinor as a broad energy company

- International standards actively used and integrated in governing documents to:
 - Reduce risk (safety and environment) and optimize production assurance
 - Ensure cost-efficiency and operational excellence
 - Minimize company own specifications
- Application provides value creation
 - Technology development, project execution and operations
- Actively engaged in international standards development and joint collaborations



The use of international standards in technology development, project execution and operations

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Standards Roadshow, Challenges in Standardisation for the Oil & Gas Industry in the Eastern Mediterranean

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