Updated and latest news from international standardization

Runar Østebø, Advisor (Equinor) and ISO/TC67/WG4 Convenor

5th ISO Seminar on International Standardization in the Reliability Technology and Cost Area

Hosted by TotalEnergies, Paris, France - 1 December 2022

Content

- Background and introduction
  - Standards communication – Recent seminar and conferences involving ISO/TC67/WG4
  - Standards in the energy industries framework – global business focus
- ISO/TC67 framework and ISO/TC67/WG4 standards portfolio
- Executive overview of standards and status
- Concluding remarks

Last 4th ISO seminar in Houston, 4 May 2018

Statoil | Reliability Dynamics | International Association of Oil & Gas Producers | ISO

Presentations from the ISO Seminar on International Standardization in the Reliability Technology and Cost Area

ISO and with Statoil as a host organized the successful seminar entitled "International Standardization in the Reliability Technology and Cost Area" on Friday 4 May 2018. This was the 4th ISO seminar on this topic and was held at the Statoil offices in Houston.

Welcome address by Helge Hove Haldorsen, Vice President, Investor Relations, Statoil

Presentations from these recent ISO seminars can be found below:

- 4th ISO seminar – 4 May 2018, Houston, USA (hosted by Statoil)

The photo of ISO seminar from 4 May 2018 was shown at the closing of OTC panel session 4 May 2022, and was "precursor" for the OTC standardization session series 4 years afterwards ☺.

OTC 2022 – Panel

"How Unified International Standards Enable Efficiency in the Energy Transition"

OTC 2022 – Technical session

"Standardization Throughout the Project Life Cycle"

ONS 2022 – Technical session with panel

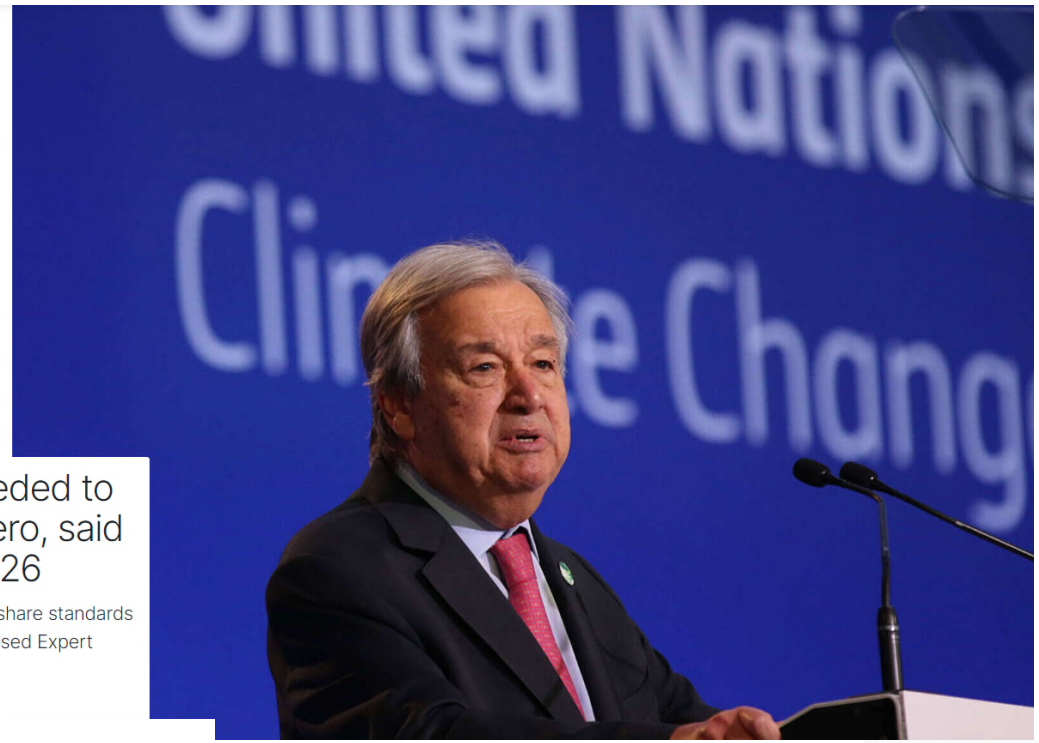
"Standardization accelerates value creation in the Oil and Gas Sector - Energy transition"

[LINK to ONS Aug 2022 session at ISO/TC67 committee website (and presentations)]

[6 min video with ONS 2022 interviews)]

[LINK to OTC May 2022 sessions at ISO/TC67 committee website (and papers)]

Standards needed to achieve net Zero (*)



Standards needed to achieve net zero, said UNSG at COP26

IEC, ISO and ITU ready to share standards and knowledge with proposed Expert Group.

3 minutes to read

[COP26 reference]

With ISO standards, we can contribute to making the 2030 Agenda a reality, so no one is left behind.

Sergio Mujica, ISO Secretary-General

[IWA 42 published at COP27]
(*Net Zero Guidelines)

COP27 (11 Nov 2022):
«Energy efficiency» depends on **«Operational efficiency»** which depends on **«Cost-efficiency».**

Example of SDG for ISO/TC67

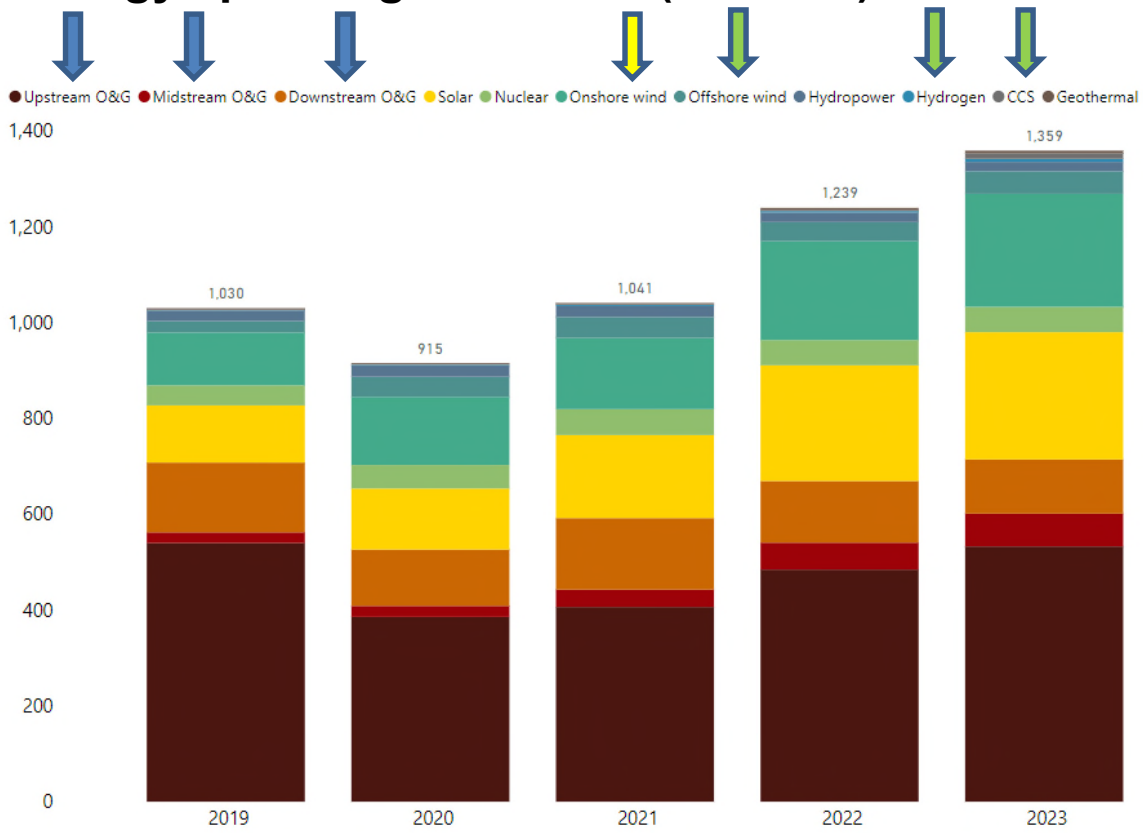
← Sustainable Development Goals

Goal 9: Industry, Innovation and Infrastructure

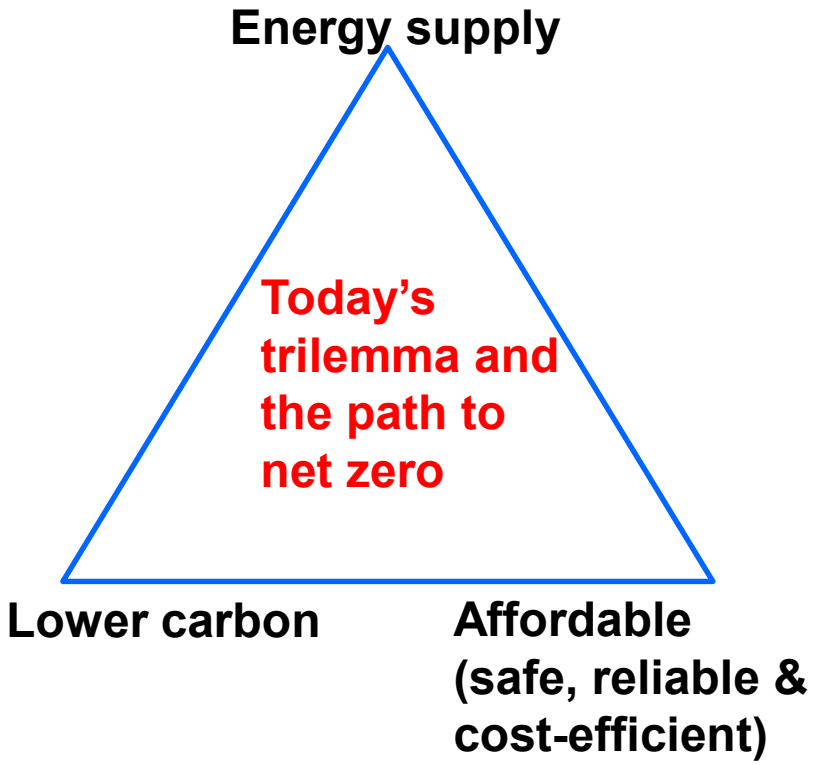
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Energy supply trilemma - Global energy industries

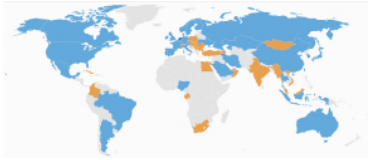
Energy spending - $ billion (nominal)



Source: Rystad, Energy Spending Analysis Dashboard – 10 Nov 2022



Scoping in ISO/TC67



Scope of ISO/TC 67

- *Standardization in the field of the oil and gas industry, including petrochemical and lower carbon energy activities*

ISO/TC67 Vision

See ISO/TC67 Standards Committee website (35 countries)

ISO courses: Register interest for ISO/TC67/WG4 standard courses at this link

Working Group 4 “Reliability engineering and technology” *ISO/TC67/WG responsible for reliability and cost related ISO/TC 67 standardization activities in the field of the oil and gas industry, including petrochemical and lower carbon energy.*

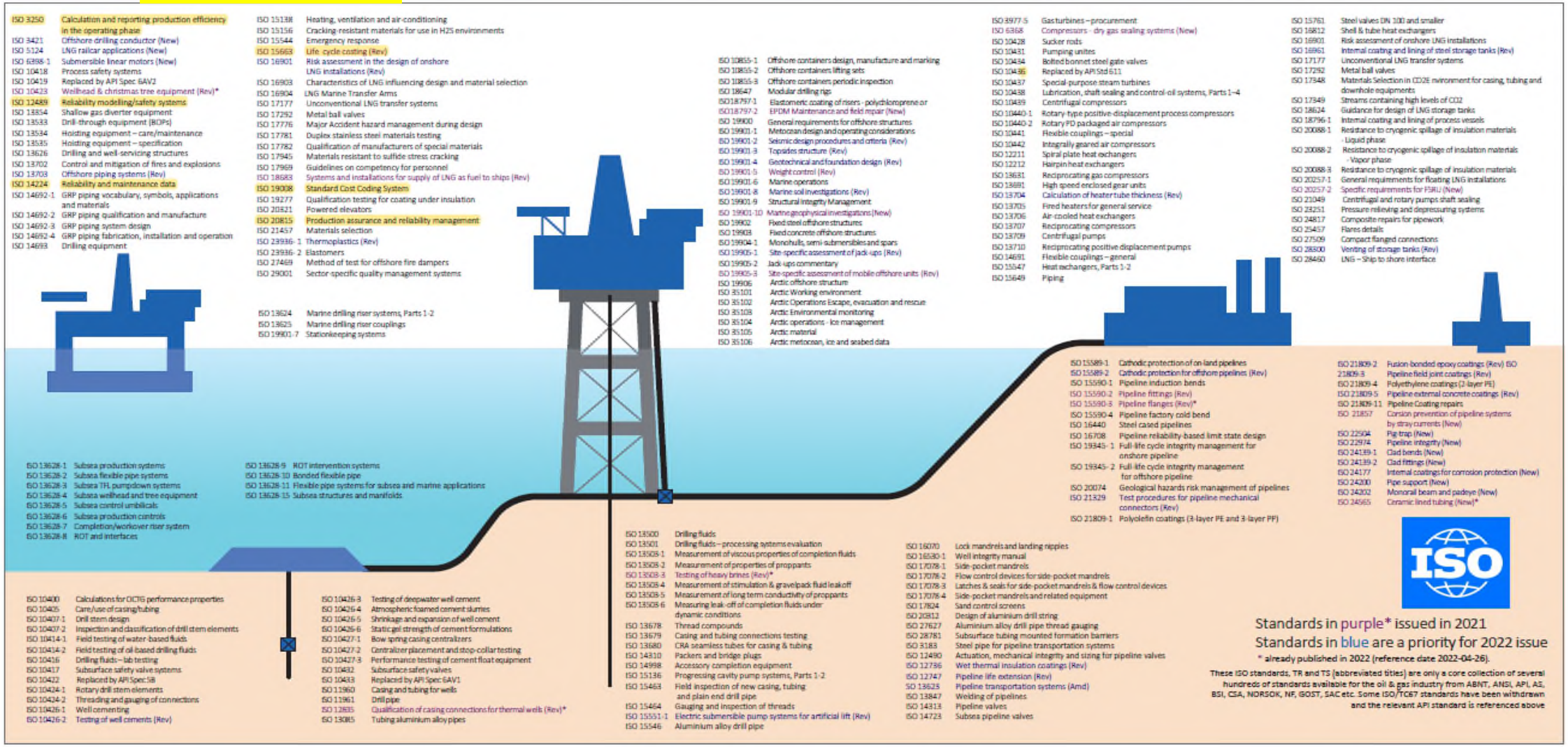
ISO/TC67/WG4 standardization member countries

- 51 experts from 13 countries (per Nov 2022)

Previously also («partly»):
- Belgia
- China
- Denmark
- Nigeria
- (Ukraine)

ISO Standards for use in the oil & gas industry

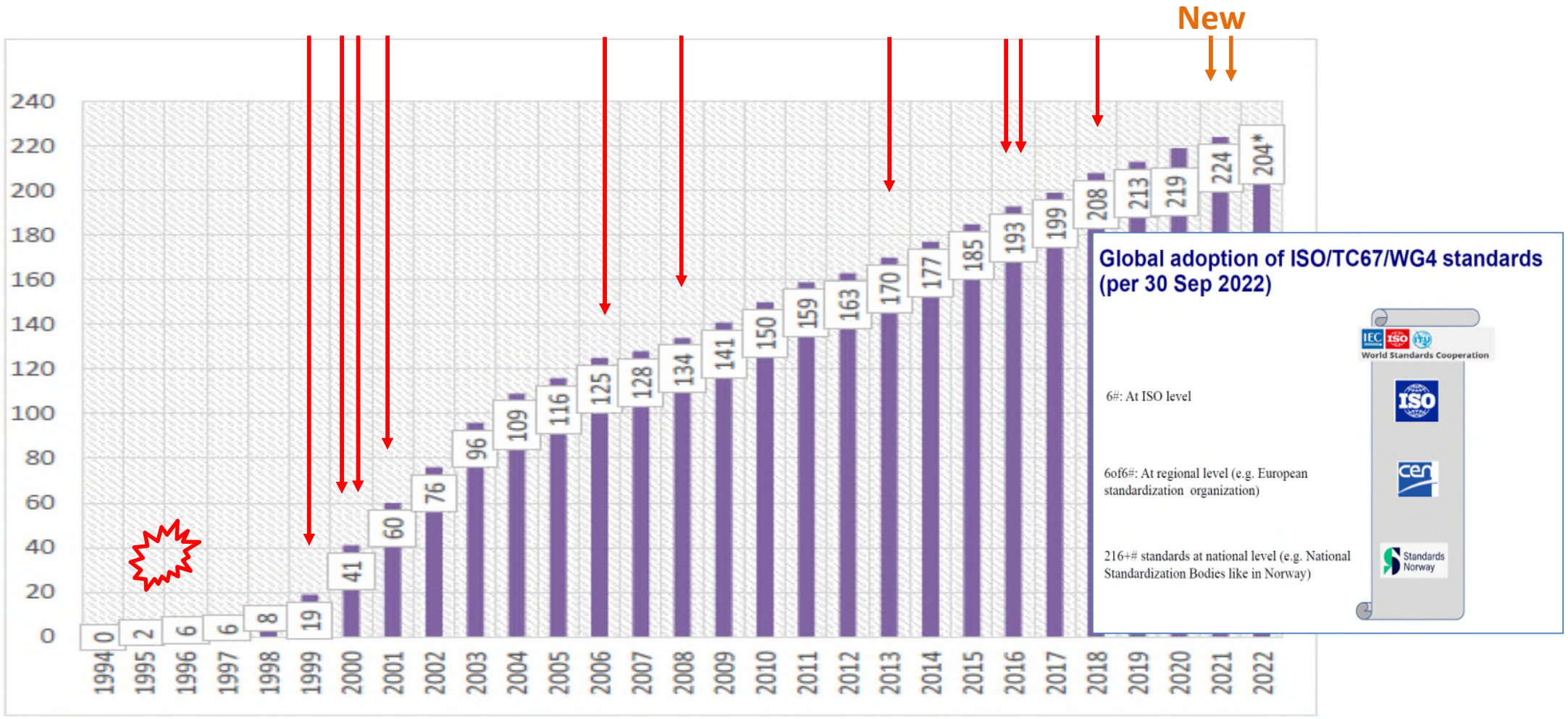
ISO/TC67/WG4 standards



[ISO Standards for use in the oil & gas industry - A3 poster (ISO/TC67 Standards Committee website - April 2022)]

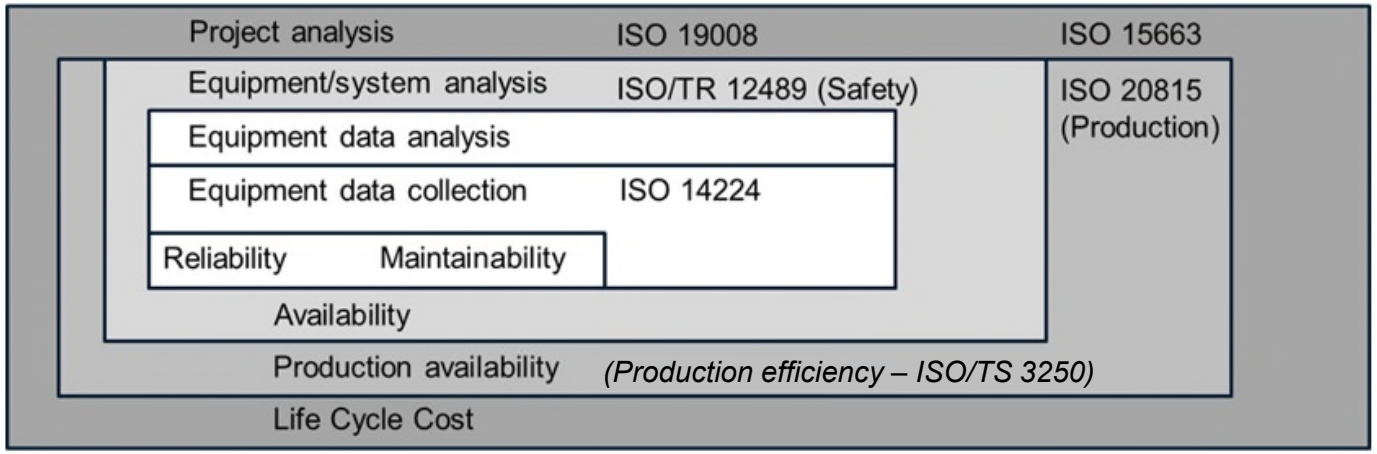
ISO/TC67 standards published

ISO standards development by ISO/TC67/WG4
(20+ years industry applications and integrated portfolio)



ISO/TC67/WG4 Standards portfolio

– Reliability and cost related standards



Source: ISO 20815:2018, Figure D.2. Adjusted to also reflect new ISO/TS 3250:2021

- ISO 14224:2016 "Collection and exchange of reliability and maintenance data for equipment"
- ISO 20815:2018 "Production assurance and reliability management"
- ISO/TR 12489:2013 "Reliability modelling and calculation of safety systems"

New in 2021

- ISO 15663:2021 "Life cycle costing"
- ISO 19008:2016 "Standard Cost Coding System for oil and gas production and processing facilities"

New in 2021

- ISO/TS 3250:2021 "Calculation and reporting production efficiency in the operating phase"

ISO Guide 84:2020
Also applied when developing ISO 15663 and ISO/TS 3250

Translation memo of 63 reliability terms in ISO 14224, ISO 20815 and ISO/TR 12489

- See ISO/TC67 N1714 (April 2019)

N 1714

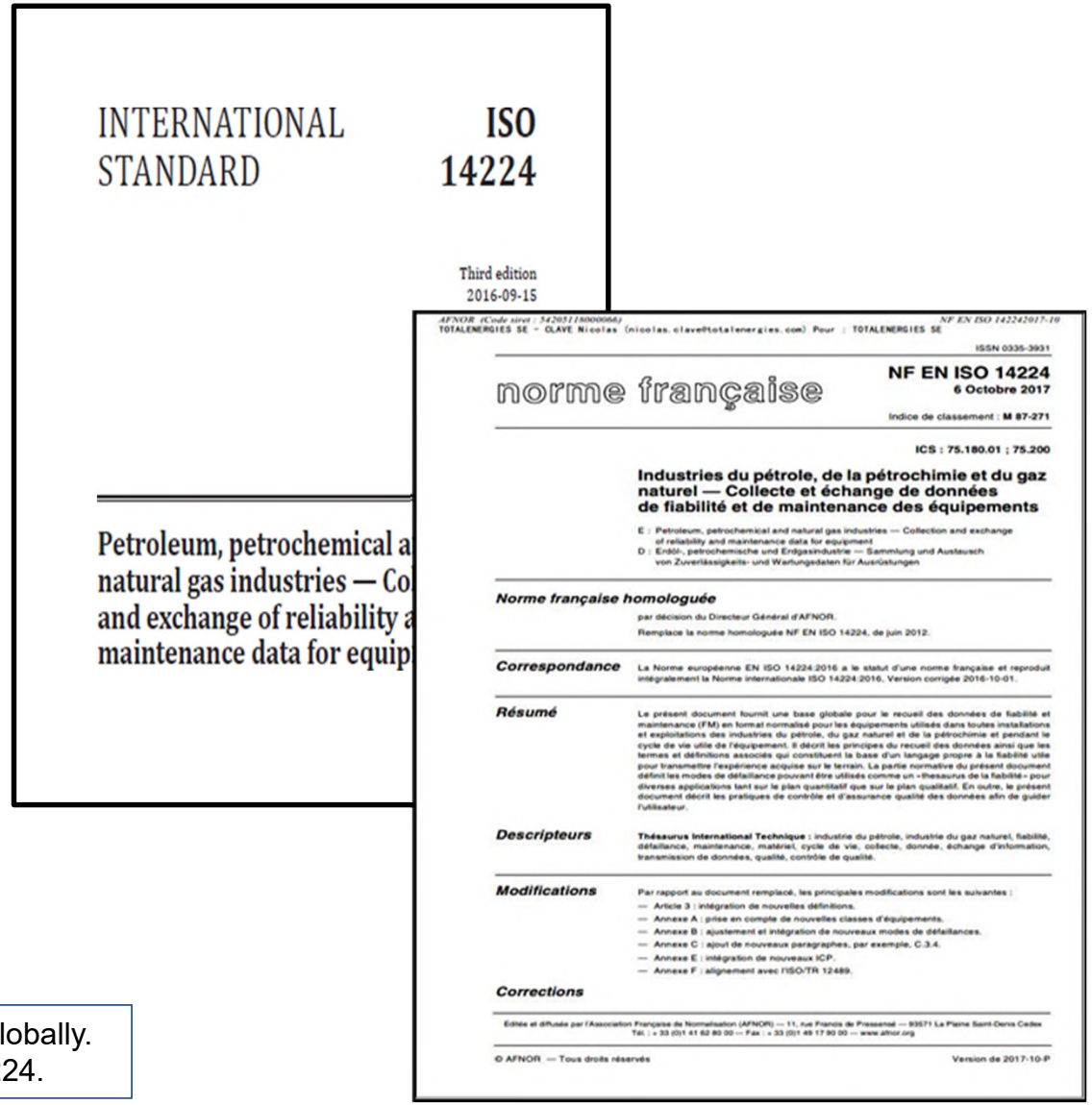
Annex A - Translation of selected terms in ISO 14224:2016 and ISO 20815:2018 and ISO/TR 12489:2013							
English Term (Abbreviation)	References	Finnish	French	Italian	Norwegian	Portuguese	Spanish
1. availability	ISO 14224:2016, 3.3 ISO 20815:2018, 3.1.2 IEC 60050-192:2015, 192-01-23	käytettävyys	disponibilité	disponibilità	tilgjengelighet	disponibilidade	disponibilidad
2. technical availability	ISO 14224:2016, Annex C.2.3.2 + Table E.3 IEC 60050-192:2015, 192-08-02	tekninen käytettävyys	disponibilité technique	disponibilità tecnica	teknisk tilgjenglighet	disponibilidade técnica	disponibilidad técnica
3. operational availability	ISO 14224:2016, Annex C.2.3.2 + Table E.3 IEC 60050-192:2015, 192-08-03	toiminnallinen käytettävyys	disponibilité opérationnelle	disponibilità operativa	operasjonell tilgjengelighet	disponibilidade operacional	disponibilidad operacional
4. production availability	ISO 20815:2018, 3.1.46	tuotannon määrään perustuva käytettävyys	disponibilité de production	disponibilità di produzione	produksjonstilgjengelighet	disponibilidade de produção	disponibilidad de producción
5. deliverability	ISO 20815:2018, 3.1.8	toimituskyky	productibilité	erogabilità	leveransetilgjengelighet	capacidade de entrega	capacidad de entrega

Likewise, see ISO/TC67 N1952 (July 2021) regarding translation of 21 cost terms in ISO 19008:2016 and ISO 15663:2021

ISO 14224:2016 – Scope and key content

Scope

- Specifies requirements and gives guidance for collection, analysis and exchange of Reliability and Maintenance (RM) data
- Provides key definitions of key terms used by data analytics methods
- Enables communicating equipment experience: «**reliability esperanto**»
- Contains normative terminology, e.g.
  - **Failure modes (per equipment class)**
    See ISO Standards Maintenance Portal:
    http://standards.iso.org/iso/14224
  - **Failure mechanism and failure cause (generic across all equipment classes)**
- Provides a list of **Key Performance Indicators (KPI)**
- **Equipment class library** in Annex A - for all types of facilities and operations in upstream, midstream, downstream and petrochemical business categories



The ISO 14224 Systematic Review per Feb 2022 shows 45 countries has adopted ed. 3 globally.
Per 28 Nov 2022: 46+ countries have adopted and approx.50 countries are using ISO 14224.

ISO 14224:2016 - Taxonomy for all oil & gas business categories

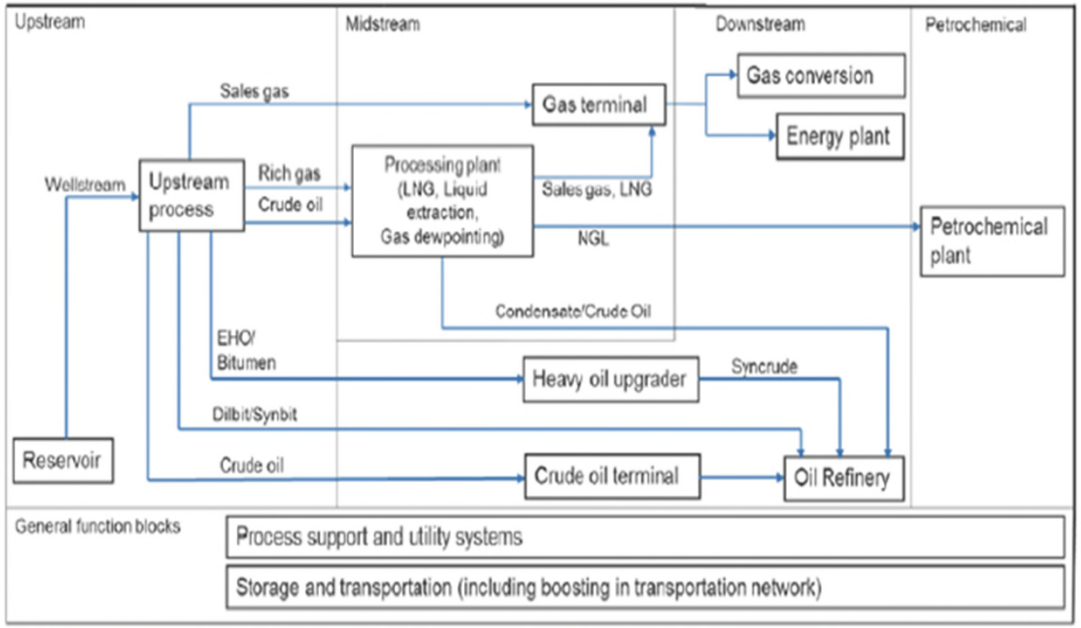


Figure A.1 — Process technology function blocks in the oil and gas value chain — Level 3

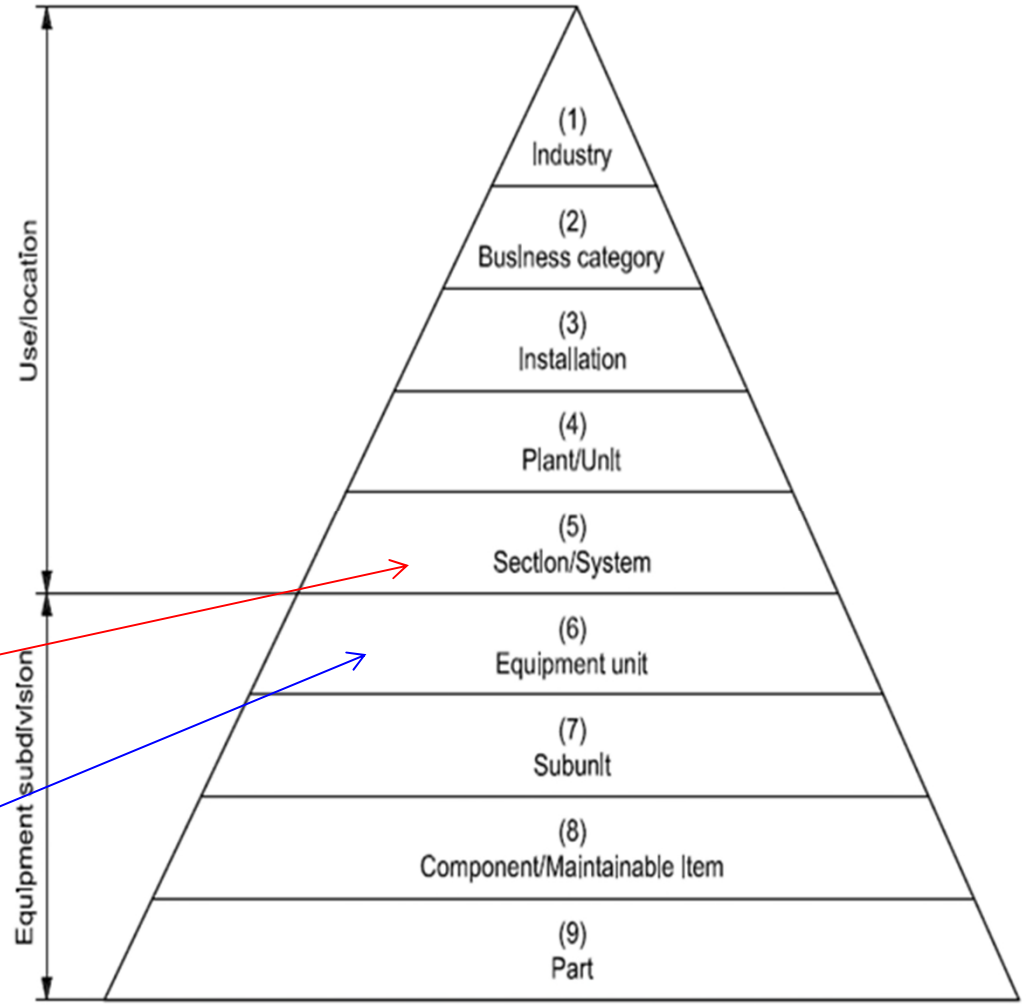


Figure 3 — Taxonomy classification with taxonomic levels

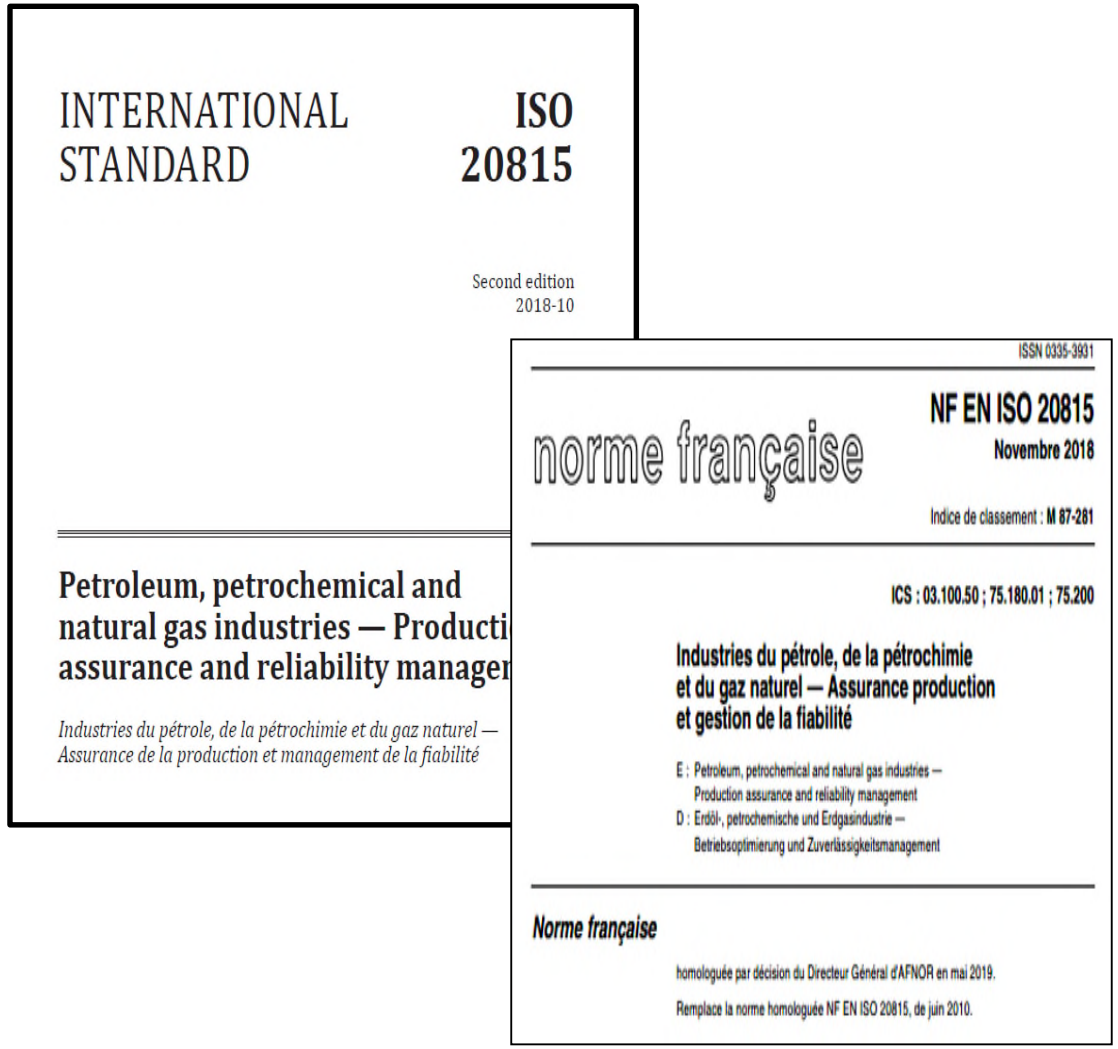
- 97 systems (Level 5)
  («ISO engineering numbering system»)
- 108 equipment classes (Level 6)
  - 46 addressed on level 6-8.
  - 60 failure modes for all equipment

ISO 20815:2018

"Production assurance and reliability management"

Scope

- Production assurance and reliability management
  - **Production Assurance Programme (PAP)** (operating companies)
  - **Reliability Management Programme (RMP)** (equipment suppliers)
- Definitions including
  - **Technology Readiness Level (TRL)**
  - **Production and Time loss categorization** - interacting with ISO 14224 (now supplemented by ISO/TS 3250:2021)
- Guidance on **performance objectives and performance requirements**, for use in for example contractual reliability framing (targeting).
- Outline of **analysis techniques (Annex I)** and Guidance on **reliability data qualification (Annex E)**



Regulatory example: NS-EN ISO 20815 quoted also in PSA (e.g. Maintenance programme in Activity Regulations - § 47).

ISO 20815:2018 - Production assurance terms

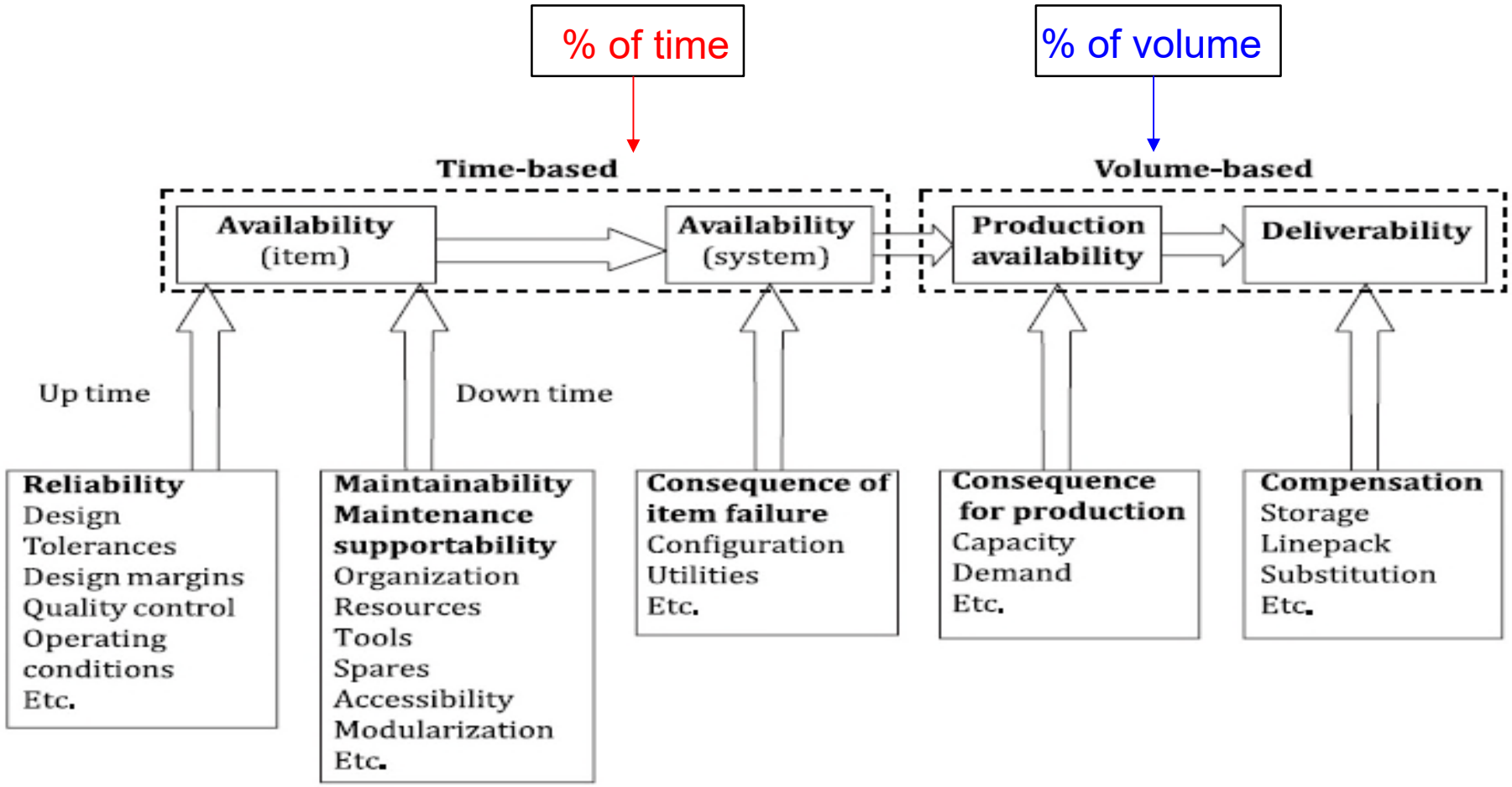


Figure G.1 — Illustration of the relationship between some time-based and volume-based production assurance terms

ISO 20815:2018 - Life cycle costing perspectives

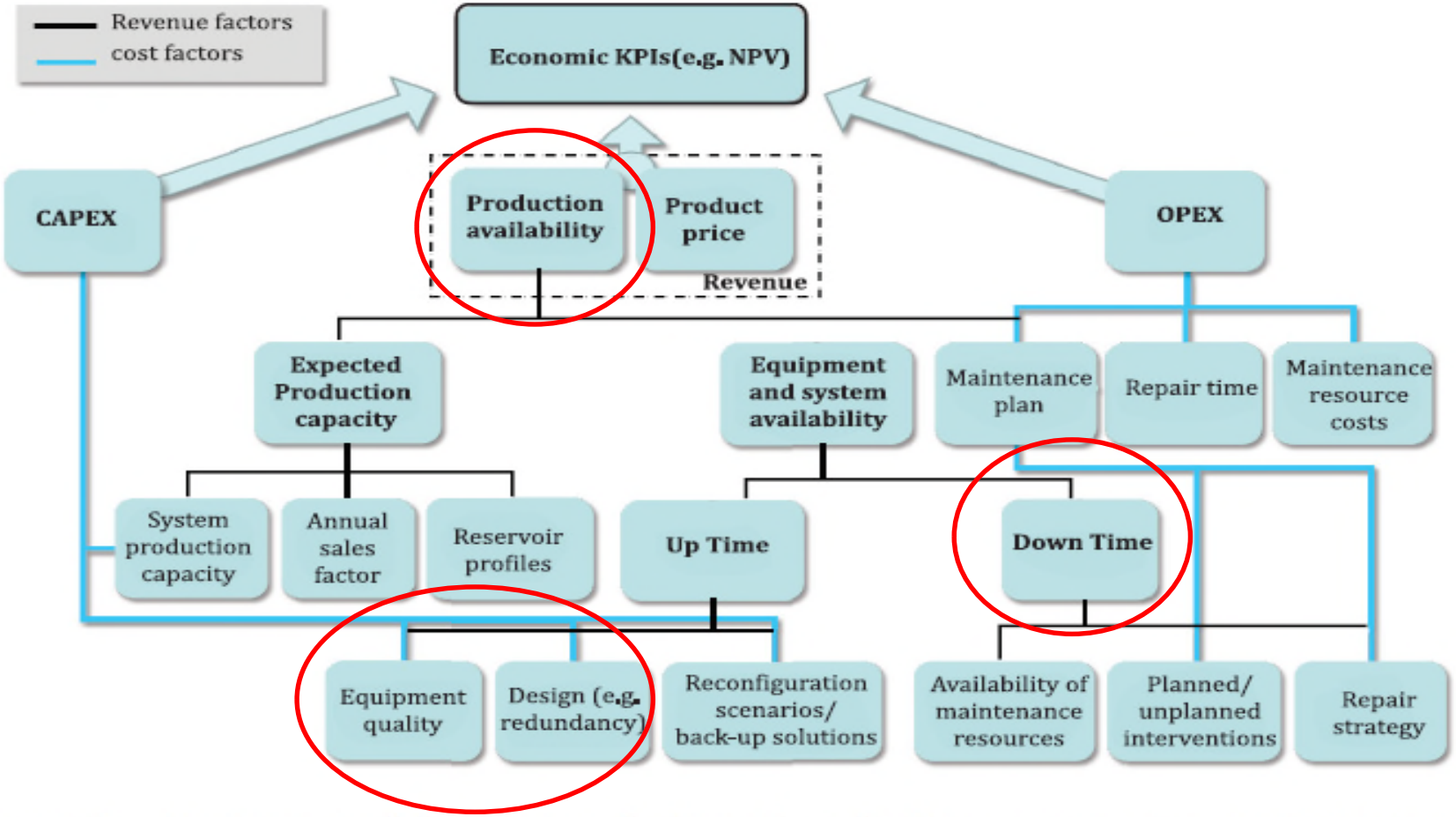


Figure 2 — Business model: Influence factors of production assurance on project economy

Production availability analysis techniques are described in ISO 20815:2018, Annex I. See also ISO 15663:2021, C.4.3.
For **production loss categories** for upstream business categories, see ISO/TS 3250:2021.

Technology maturity assessment and technology qualification

- Technology Novelty Categorization (TNC) and Technology Readiness Level (TRL)

ISO 20815:2018

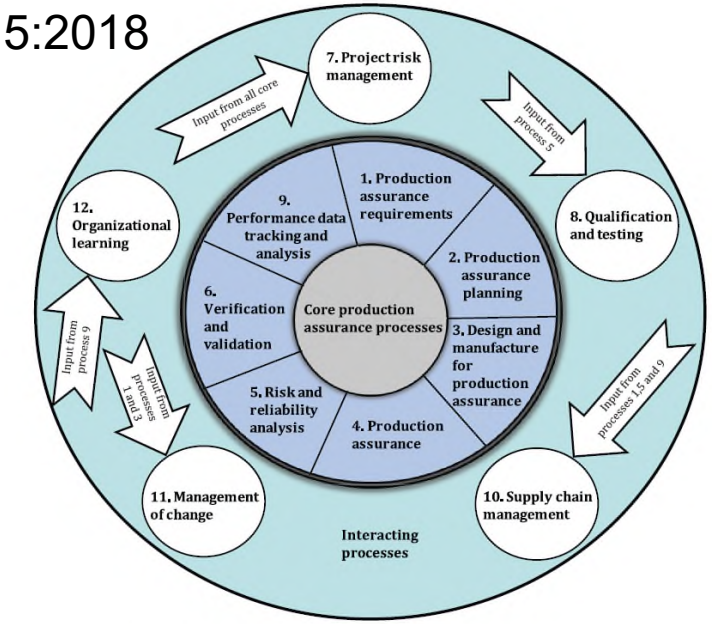


Figure 4 — Core and interacting production assurance processes

Table I.9 — Technology novelty categorization

Application area	Degree of technology novelty[a]		
	No new technical elements	Technical elements with limited industry history	New technical elements with no industry history
Known	1 or 2a	2c	3
New	2b or 2c	3	4

[a] Table I.9 provides an explanation of different technology novelty categories.

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.

ISO Technical Report 12489:2013
”Reliability modelling and calculation of safety systems”

Scope

- Provide guidelines with to ensure correct modelling & calculations.
- ISO/TR 12489 is an important supplement of IEC 61508-part 6 (functional safety).

See: ISO/TR 12489 – Information sheet, 26 Aug 2022

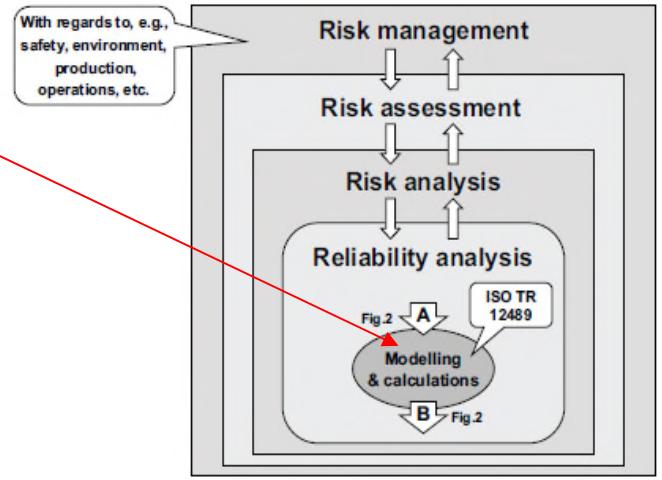
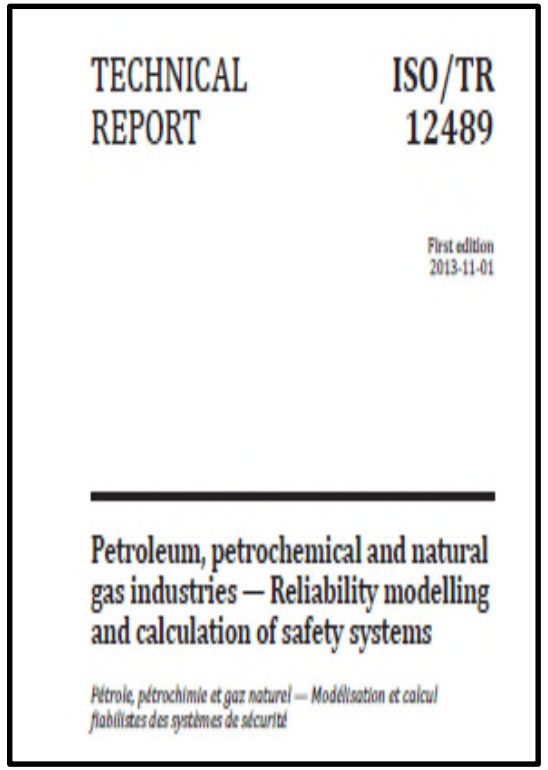


Figure 1 — ISO/TR 12489 within the framework of risk management



ISO/TR 12489:2013 is also quoted in:

Norway: “Norwegian Oil and Gas Association, 070 –Norwegian Oil and Gas recommended guidelines for application of IEC 61508 and IEC 61511 in the Norwegian petroleum industry (Recommended SIL requirements), Rev. 4, April 2020”.
ISO references were introduced in Rev. 3, June 2018.

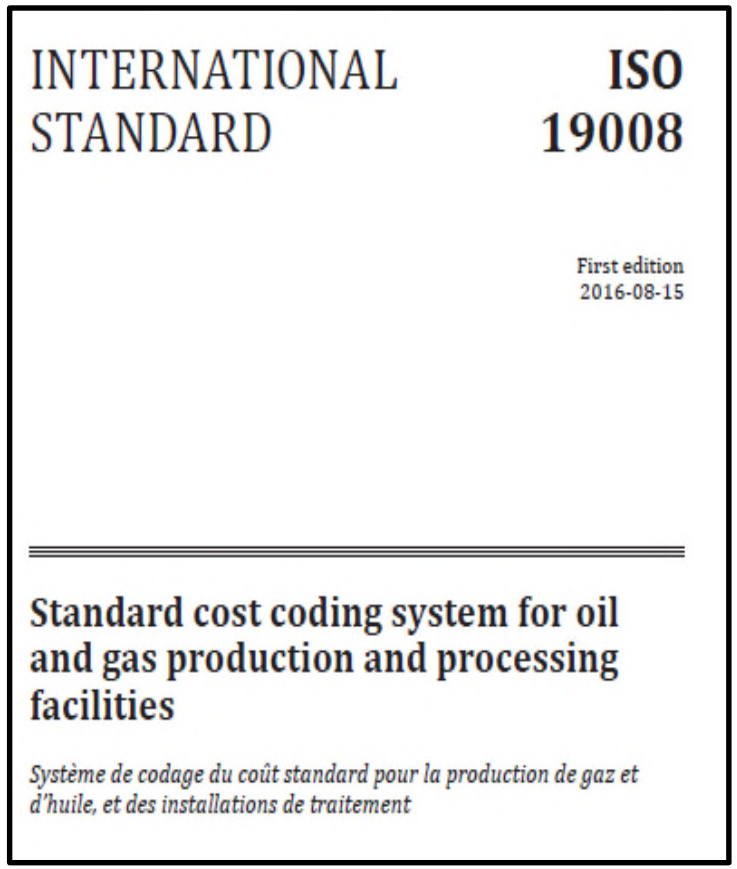
USA: International Society of Automation (ISA),”ISA-TR84.00.02-2022, Safety Integrity Level (SIL) Verification of Safety Instrumented Functions. Ed. 3, April 2022”. It now includes ISO/TR 12489 as an “authoritative source”.

ISO 19008:2016

”Standard Cost Coding System for oil and gas production and processing facilities”

Scope

- Provide standard cost coding for classification and coding of:
  - Cost (e.g. equipment purchase cost)
  - Activities (e.g. duration of construction)
  - Physical quantities (e.g. equipment weight and pipeline length)
- Excel files with codes can be found in the ISO Standards Maintenance Portal: http://standards.iso.org/iso/19008


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

PDO/PIO Guidance, for Norway (13 Sep 2022):
NS-EN-ISO 19008 shall be used for cost estimation.

ISO 15663:2021 - Scope and key content

Scope

- Specifies **requirements** for and gives **guidance** on application of life cycle costing to **create value**
- The life cycle costing process applies when comparing **competing options** that are differentiated by cost and/or economic value implications
- Guidance on the management methodology and application of life cycle costing in support of **decision-making** across **life cycle phases**
- Definitions of **key cost terms**

- Applicable for Oil & Gas industry (and also for Energy Transition, e.g. offshore wind)
- Replaces previous ed.1 from 2000 & 2001 (3 parts)

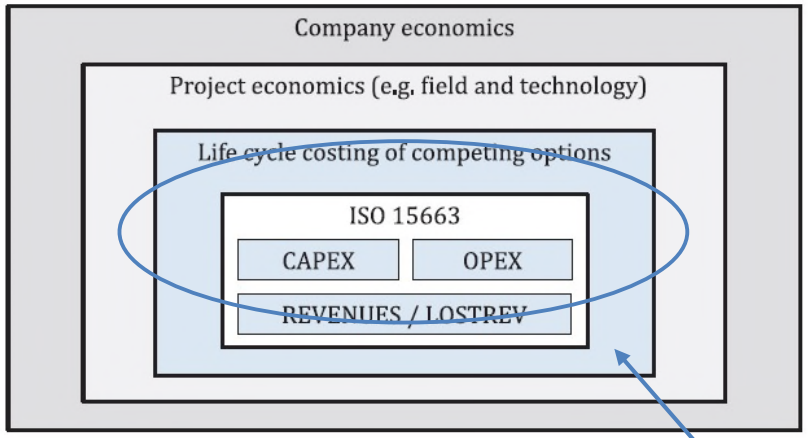
Note the corrected French sub-title for ISO 15663:2021 at the ISO website:

ISO 15663:2021
Industries du pétrole, de la pétrochimie et du gaz naturel — Evaluation des coûts globaux de production et de traitement
Indisponible en français

CEN version approval of revised 1st edition (adopted by 36 European countries, e.g. in Norway as NS-EN ISO 15663:2021).

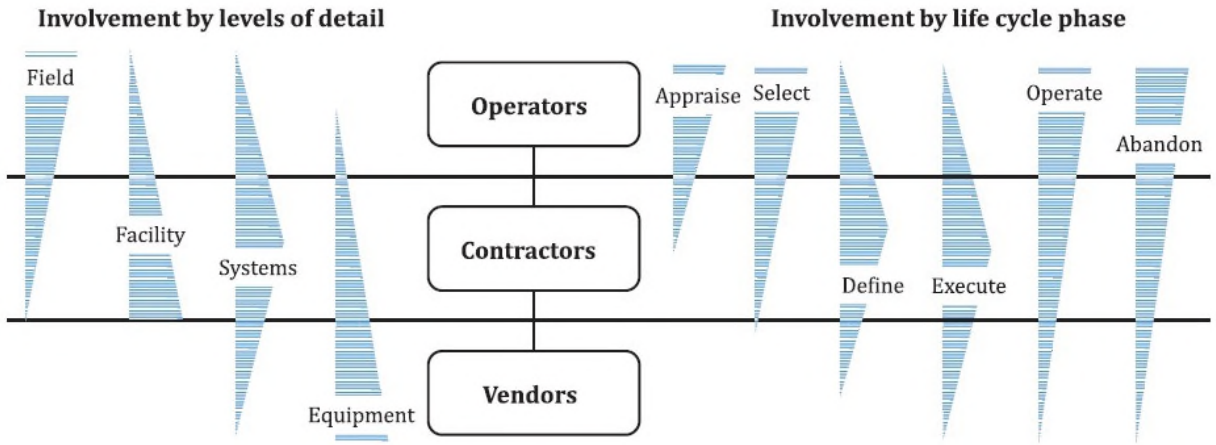
Decision-support framework arena and key users

Framework conditions for life cycle costing



Source: ISO 15663:2021, Figure 1

Participants - level of detail vs life cycle phases



Source: ISO 15663:2021, Figure 2

ISO 15663:2021 – Life cycle costing

Life cycle costing and Life cycle cost (LCC) are different terms

ISO 15663:2021, 3.1.27

life cycle costing

process of evaluating the difference between the life cycle cost of two or more alternative options

ISO 15663:2021, 3.1.24

life cycle cost

LCC

L_{CC}

total cost incurred during the life cycle

Note 1 to entry: LCC is the discounted sum of CAPEX, OPEX and LOSTREV, see C.6.3.3.

ISO/TS 3250:2021 - Scope and key content

Scope

- Requirements and guidance for calculation and reporting of production performance data and production loss data in the operating phase
- **Production efficiency (PE) + Injection efficiency (IE)**

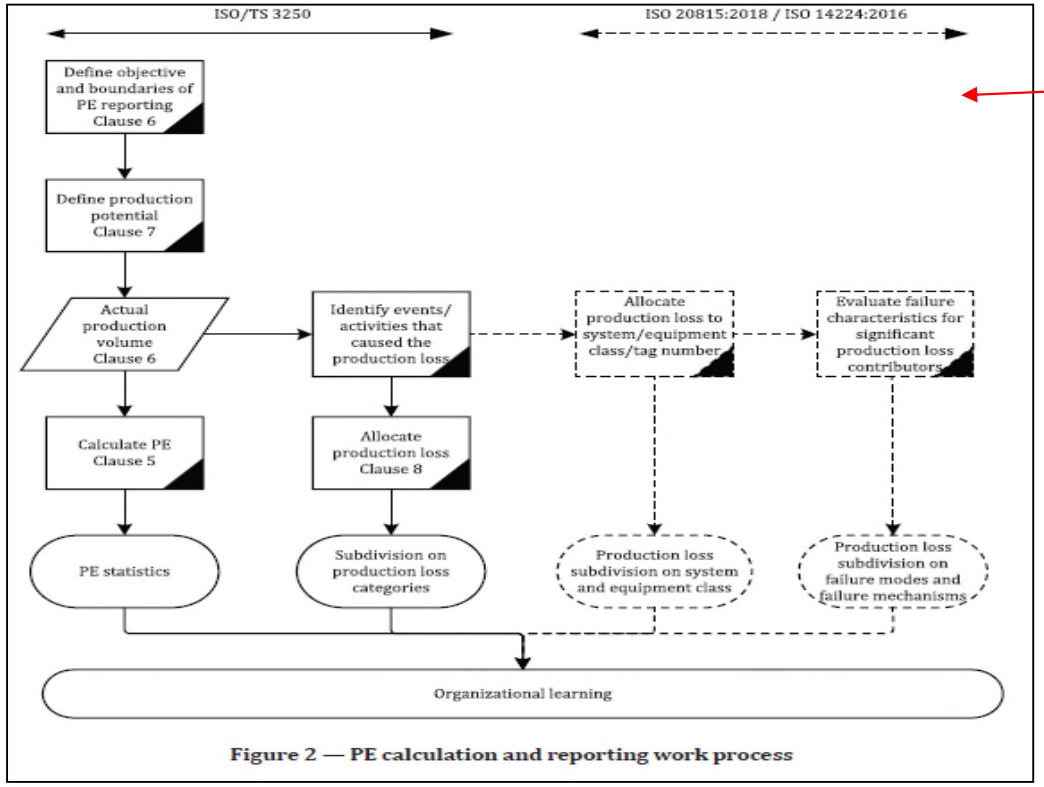
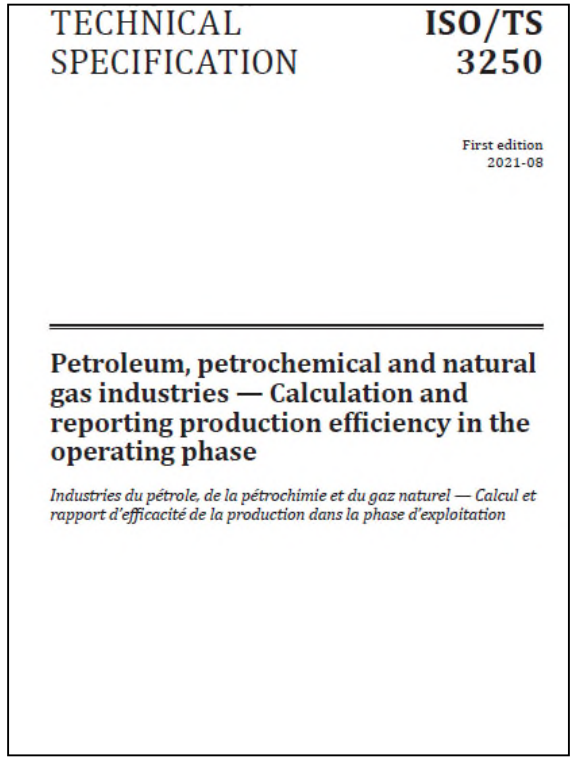


Figure 2 — PE calculation and reporting work process

ISO 14224:2016 is a normative reference in ISO/TS 3250:2021.



TECHNICAL SPECIFICATION

ISO/TS 3250

First edition 2021-08

Petroleum, petrochemical and natural gas industries — Calculation and reporting production efficiency in the operating phase

Industries du pétrole, de la pétrochimie et du gaz naturel — Calcul et rapport d'efficacité de la production dans la phase d'exploitation

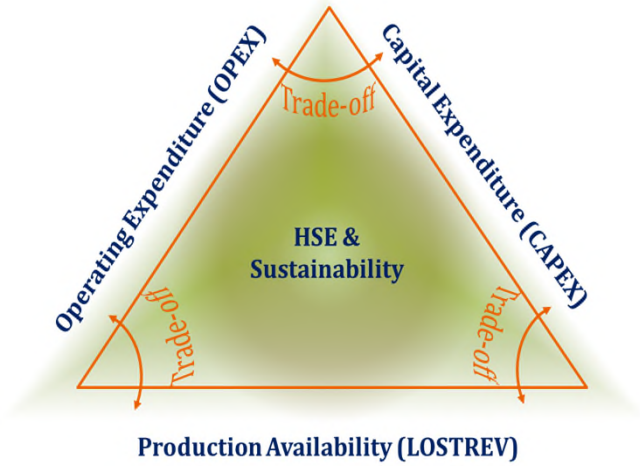
OTC-32056 paper presented at OTC - 4 May 2022

32056 **ISO Standardization As An Enabler For Production Efficiency In The Operating Phase**

H. Hamran, Proactima AS; R. Oesteboe, Equinor ASA; F.J. Alhanati, C-FER Technologies; A. Smith, Shell U.K. Limited

Closing remarks

ISO/TC67 Vision



Source: ISO 15663:2021, Figure C.2

Oil and gas industry: Standards actively used and integrated in governance systems

- Reduce risk (safety and environment) and optimize production assurance
- Ensure cost-efficiency and operational excellence
- Minimize company own specifications

The use of international standards developed by the Oil & Gas industry is a responsibility for this industry and the associated stakeholders – for affordable and sustainable energy supply needs and unlocking business opportunities.

For an efficient energy transition (energy supply, cost management and lower carbon) examples of industry needs & actions arising from ISO/IOGP standardization session at OTC 2022 & ONS 2022 are:

- Industry collaboration and alignment, with involvement of the new generation engineers
- Development of a global digital vocabulary (Standardised Reference Data Libaries (RDL)) unlocking digitalization values
- Collaborate to develop and maintain cost effective and relevant international standards that can be used world-wide
- Drive existing standards to an essential minimum enabling safety and cost-efficiency serving also lower carbon and renewable industries