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Value Creation by use of the ISO 15663 Life Cycle Costing Standard

Runar Østebø, Equinor, Advisor and ISO 15663 Project leader,

Endre Willmann, Willmann Engineering, Manager and ISO 15663 Technical editor,

Eduardo Montalvao, Petrobras, Project coordinator, Brazilian ISO/TC67/WG4/PG4 expert member

Karl Woods, Woodside, Senior subsea reliability engineer, Australian ISO/TC67/WG4/PG4 expert member

Standardization session, 30 August 2022:
Standardization accelerates value creation in the Oil and Gas Sector – Energy transition

IOGP International Association of Oil & Gas Producers

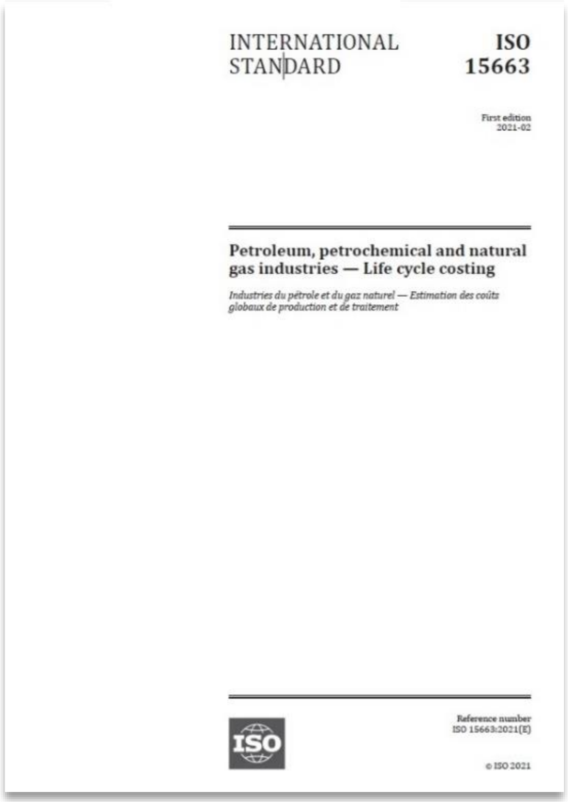
ISO

Standards Norway

Presentation Overview

- Business framework and standards application arena
- Management of life cycle costing
- Methodology and economic evaluation measures
- Industry application examples
- Concluding remarks

New publication issued 25 Feb 2021


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

Reference number ISO 15663:2021(E)

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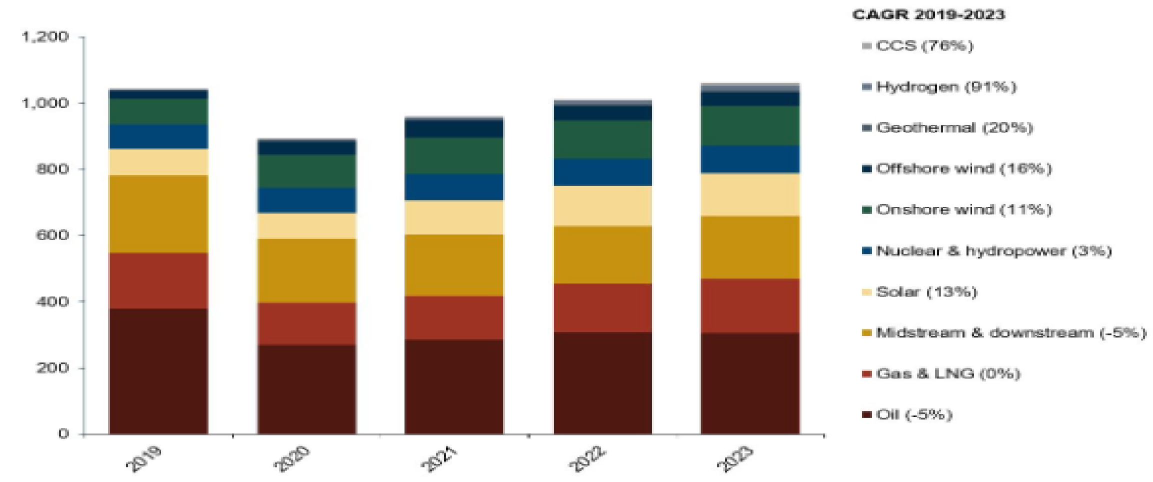
Translated and national adopted versions:

- *CEN version* approved February 2021: EN ISO 15663
- Per 15 August 2022: Adopted by 34 CEN-countries (Europe)
- E.g. adopted in Norway in March 2021 as NS-EN ISO 15663:2021.

Cost focus and need for cost management in the energy industries

- Business arena for ISO 15663

Figure 1: Global energy investments by sector in the supply chain
Billion USD



Source: Rystad Energy ServiceCube

CAGR: Compound annual growth rate

Source: Rystad Supply Chain Newsletter (February 2022)

A legacy of underperformance paired with COVID-19

Even at the most sophisticated companies, the approval of major infrastructure projects such as deep-water wells, long-haul pipelines, liquefied natural gas facilities or petrochemical plants is a risky and often arduous process. Historically, the oil and gas industry has underperformed on capital projects, spending too much time and money to plan, design and build new infrastructure. In 2019, EY analyzed 500 completed oil and gas capital projects of $1b or more from the previous five years. Of the projects analyzed, 60% experienced schedule delays, and 38% had cost overruns.

Capital project analysis

60%

of the projects analyzed experienced schedule delays, and 38% had cost overruns.

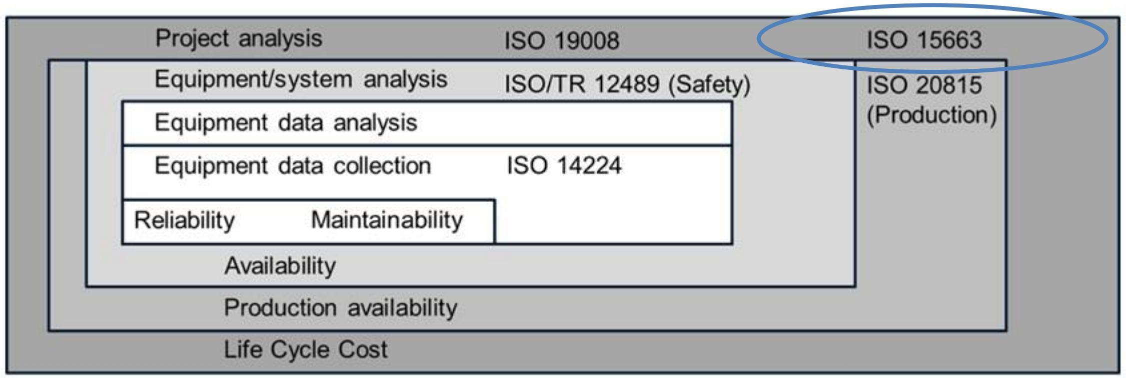
Source: EY (Sep 2020)

ISO/TC67/WG4 “Reliability engineering and technology”

See ISO/TC67 committee webpage

- Reliability and cost related ISO/TC67 standardization in the field of oil & gas industry, including petrochemical and lower carbon energy activities
- ISO 15663:2021 developed by experts from 8 countries.

ISO/TC67/WG4 Portfolio – Reliability and cost related standards



Source: ISO 20815:2018, Figure D.2

- 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”
- 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”

Scope of the new ISO 15663:2021

- 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)

Content

Main part (normative)

1. Scope
2. Normative references
3. Terms and definitions
4. Application
5. Management of life cycle costing
6. Methodology

Annexes

A. Life cycle costing implementation
B. Life cycle phases
C. Life cycle costing techniques (normative)
D. Data input
E. Examples
F. Assessment and feedback

Management of life cycle costing

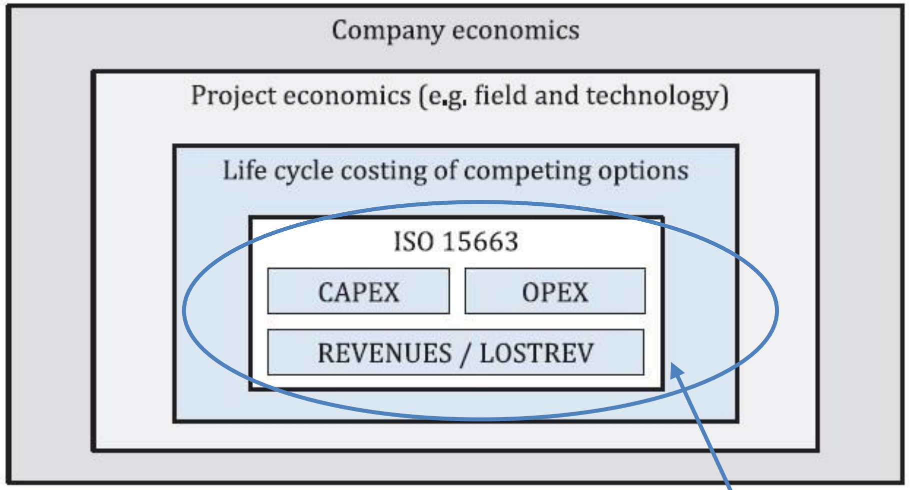
- Main objectives
  - Define the purpose of life cycle costing
  - Identification relevant life cycle costing subject matters
  - Communicate the objectives and role of life cycle costing throughout the organization
  - Achieve agreement and commitment at management level
- Three main dimensions
  - Organizational capability
  - Planning of activities in a specific project (Life cycle costing management plan – LCCMP)
  - Incorporation within a contractual framework
- Life cycle costing process
  - Any life cycle costing activity shall follow the 4-step process

The life cycle costing process

Source: ISO 15663:2021, Figure 4.
“the life cycle costing process”

Decision-support framework and users

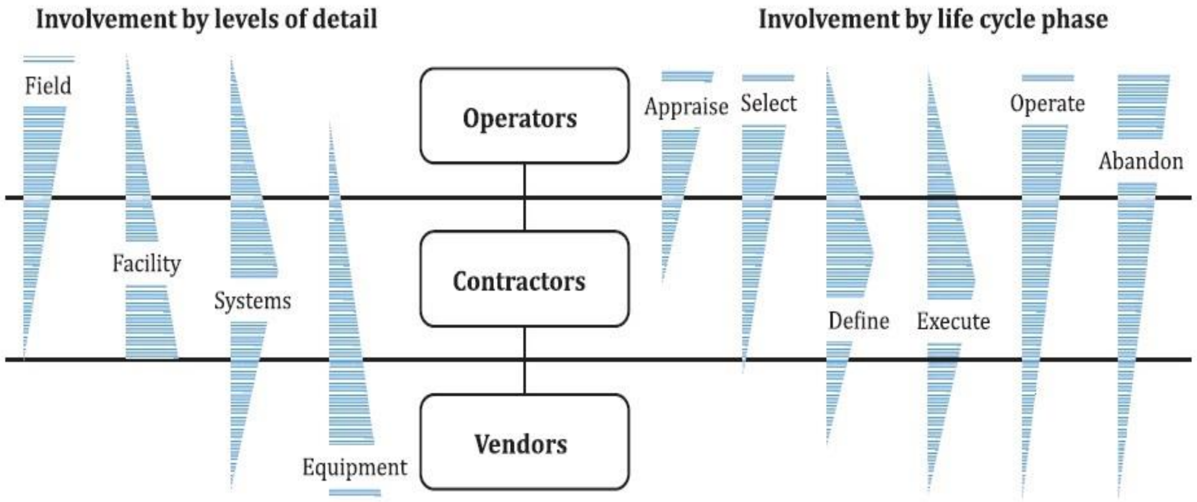
Framework conditions for life cycle costing



Source: ISO 15663:2021, Figure 1

ISO 15663:2021 – Life cycle costing

Participants - level of detail vs life cycle phases



Source: ISO 15663:2021, Figure 2

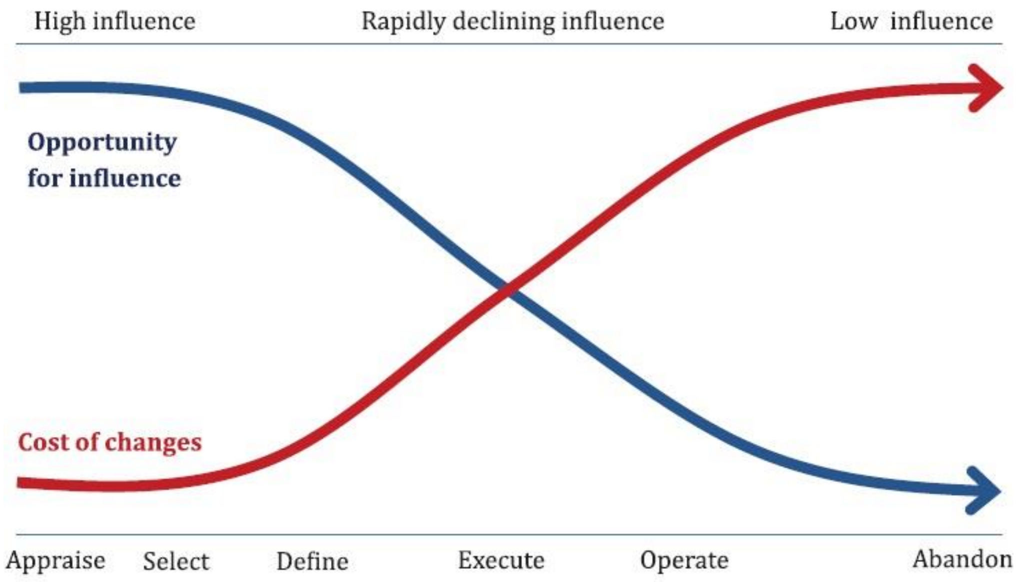
Application framework

Life cycle phases

Id.	Life cycle phase	Phase outcome/ delivery
0	Explore	Identified business opportunities
1	Appraise	Feasible installation concept(s)
2	Select	A selected (preferred) installation concept
3	Define	A defined (matured) installation concept for final investment decision (FID)
4	Execute	The installation is ready to start production/operation
5	Operate	End of installation operating life
6	Abandon	The facility has been removed and disposed

The establishment of the different life cycle phases is based on a survey amongst the major operators during the development of the standard

Opportunity for influence vs cost of change



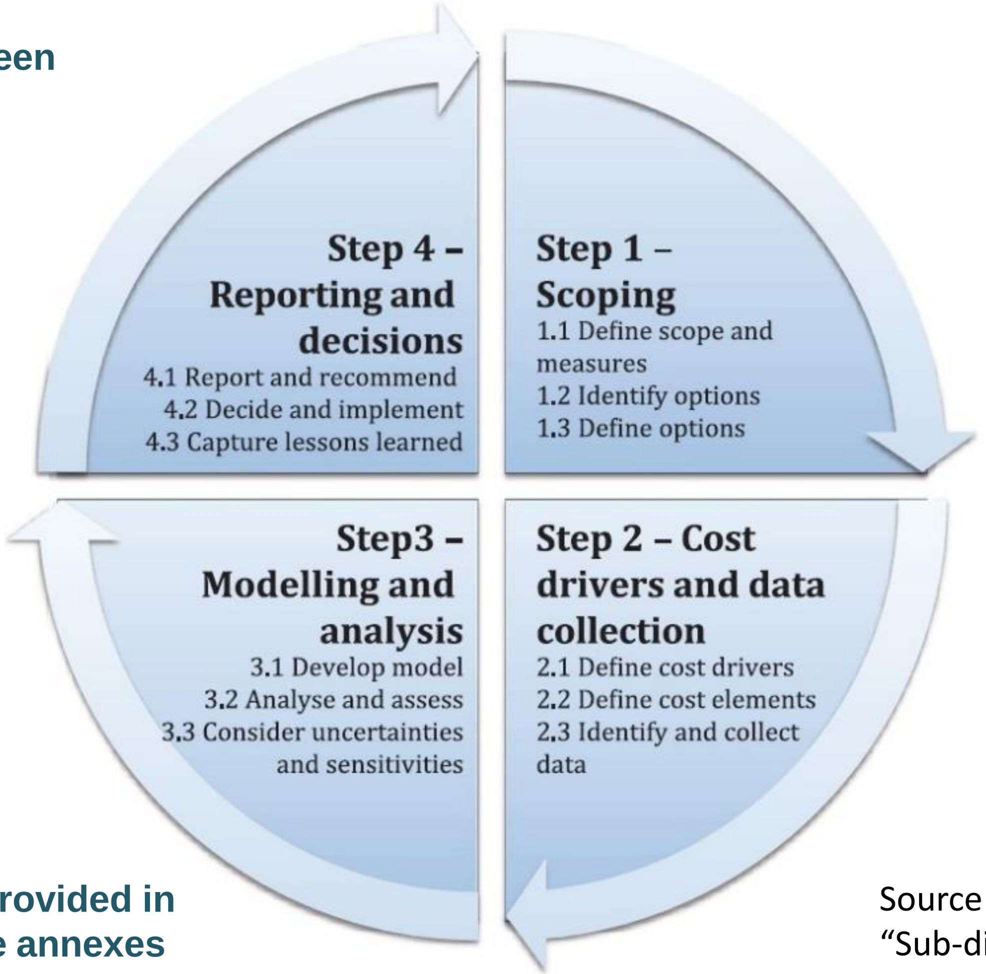
Source: ISO 15663:2021, Figure 3

Methodology of life cycle costing

Focus on differences between competing options

Life cycle costing scope and scale depend on business context and subject matter

Decision-making & criteria



Life cycle costing techniques in Annex C

Focus on cost drivers (main differentiators)

Guidance provided in informative annexes

Source: ISO 15663:2021, Figure 5.
"Sub-division of the life cycle costing methodology"

Terms and definitions are important

Term	ISO 15663:2021 clause reference	Definition of the term
cost driver	3.1.13	major cost element which, if changed, will have a major impact on the life cycle cost of an option
cost element	3.1.14	subset at any level of the total cost for a cost breakdown structure
economic evaluation measure	3.1.18	quantitative measure used to quantify economic characteristics
life cycle cost analysis	3.1.25	systematic evaluations and calculations carried out to assess competing options using economic evaluation measures of as part of life cycle costing
lost revenue	3.1.29	income loss that occurs when generated income are less than expected due to external or internal factors

Selected terms from ISO 15663:2021, Clause 3

Be aware that 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.

Economic evaluation measures – as defined by ISO 15663:2021

- Quantitative life cycle costing measures
- Not always calculated in full, but limited to the estimation of differences
- Comparison of options on a like-for-like basis

- Differences between options considered under the following three main elements of life cycle costing:
  - CAPEX
  - OPEX
  - REVENUES or LOSTREV

- Used also to determine the cost drivers

Term	ISO 15663:2021 clause reference	Definition of the term
net present value (NPV)	3.1.30	present value that is calculated by discounting the future net cash flow with the required rate of return as the discount rate
life cycle cost (LCC)	3.1.24	total cost incurred during the life cycle
internal rate of return (IRR)	3.1.21	rate of return of future net cash flow that gives NPV=0
capital efficiency index (CEI)	3.1.6	NPV of a project after tax divided by the absolute value of the NPV of cash flow after tax up to a defined end point
profitability index (PI)	3.1.35	ratio of NPV of the project divided by the discounted CAPEX
payback period	3.1.32	period after which the initial investment has been paid back by the accumulated net revenue counted from first income
break-even volume	3.1.5	volume where a stream of revenues and cost balance results in NPV=0
break-even price	3.1.4	price which applied flat to the production sold gives NPV=0

Note that issues such as HSE and Sustainability (e.g. Lower Carbon) can also be part of the decision criteria

ISO 15663:2021 describes the relevant use of ISO 19008:2016, ISO 14224:2016 and ISO 20815:2018

Industry application example 1 – FPSO location

Decision context:

- 3 possible locations for a FPSO to be positioned in an offshore field development

Approach:

- Define cost drivers and collect data
- Experts and economic evaluations
- LCC chosen as economic evaluation measure for decision-making

Comparative assessment:

- Field location C (southern part of reservoir) has the lowest LCC

	Field Location A	Field Location B	Field Location C
Scope	**Above the reservoir**	**Northern part of reservoir**	**Southern part of reservoir**
CAPEX			
Well Well completion Well intervention Rig move	-	Low	High
Subsea X-mas trees / Manifolds Flowlines / Risers Subsea installation activities	-	Low	Low
FPSO Engineering, Procurement & Construction Commissioning Transportation and installation	-	Indifferent	Indifferent
OPEX			
Well Workover operations	-	Low (easier workover activities)	Low (easier workover activities)
Subsea Utility consumption Unplanned maintenance	-	High	High
FPSO Consumables Personnel Planned maintenance	-	High (longer distance from onshore operation base)	Low (shorter distance from onshore operation base)
LOSTREV			
Lost production – unplanned shutdown Lost production – planned shutdown	-	High (higher production unavailability)	Low (lower production unavailability)

Cost drivers	Field Location A	Field Location B	Field Location C
	Value (M.U.)	**Value (M.U.)**	**Value (M.U.)**
CAPEX	410	392	405
OPEX	380	410	370
LOSTREV	200	230	190
LCC (Life cycle cost)	**990**	**1 032**	**965**

Industry application example 2 – Obsolescence strategy

Decision context:

- Obsolescence strategy for subsea control modules (SCM) identified as last time purchase of spares
- Options for last time purchase of spares based on
  - Option 1: production maximization
  - Option 2: minimizing interventions

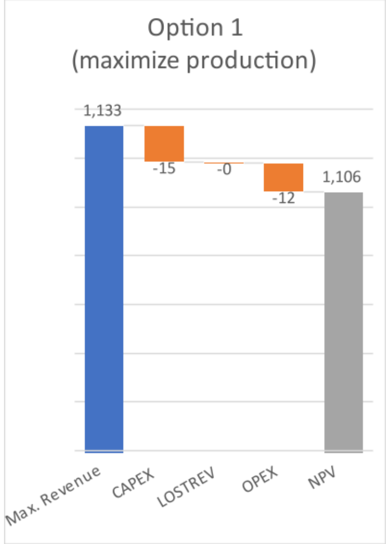
Approach:

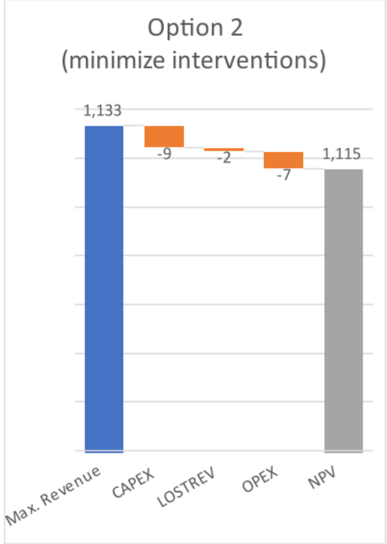
- Identify potential cost drivers and decide on cost elements to include
- Quantify cost elements and frequency of occurrence
- Agree economic evaluation measure

Comparative assessment:

- Option 2 (minimizing interventions) has highest NPV

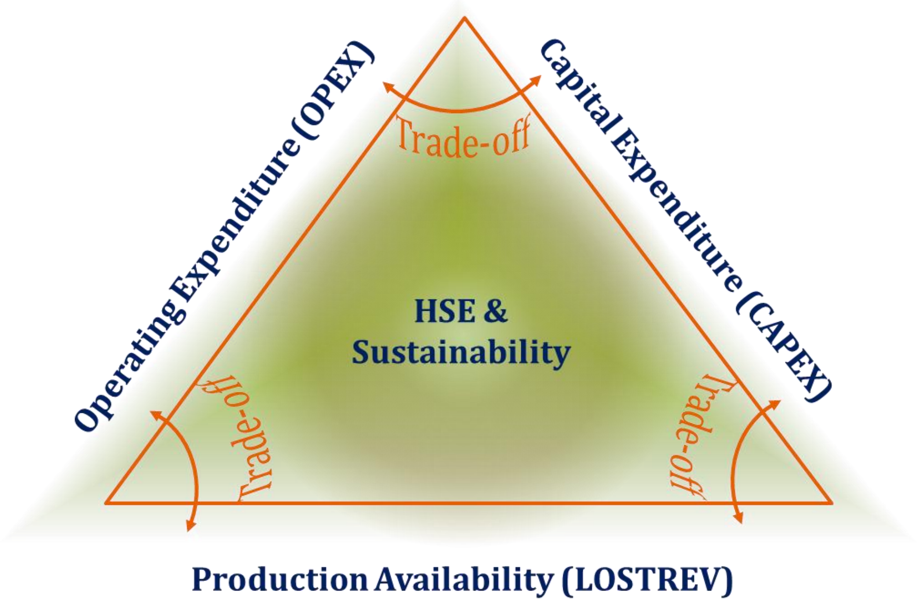
ID	Potential cost driver	Include as cost element?
1	Material storage facilities	**No:** Operator has sufficient warehousing and would not observe a cost differential between options.
2	Operation and maintenance	**No:** Option 1, which includes more spares, does incur greater maintenance cost for spares. However, it was decided that this potential cost driver was relatively insignificant and hence excluded from the analysis.
3	Subsea control module	**Yes:** Options are differentiated by the number of spares purchased as part of the last time purchase.
4	Company personnel overheads	**No:** The options are not differentiated by the production overheads related to normal operations.
5	Production loss impact upon critical failure	**Yes:** Options are differentiated by the frequency, timing and duration of production loss impact events throughout the remaining field life. **No:** Production loss impacts due to failure other equipment are not included.
6	Intervention system equipment and tools	**Yes:** While the cost (OPEX) for an individual subsea intervention is the same, the options are differentiated by frequency and timing of the subsea interventions.
7	Revenue	**Yes:** As NPV was identified as economic evaluation measure, differences in revenue are included. Revenue impacts from other sources are not included.





Concluding remarks

- The use of international standards developed by the Oil & Gas industry is a **responsibility** for this industry and the associated stakeholders
- Current economic conditions require attention to **cost management** also in the context of HSE, sustainability and production assurance requirements
- The new ISO 15663 standard is a **key ISO standard** for achieving these business objectives and for unlocking business opportunities
- The life cycle costing process:
  - provides decision-support regarding competing options
  - can be used by **all stakeholders** (operators, contractors and vendors) across all life cycle phases
- Life cycle costing to be applied only when **adding business value**



See ISO 15663:2021, Figure C.2

Acknowledgements / Thank You / Question

- ISO Central Secretariat and ISO/TC67 Management
- IOGP Standards Solution
- Equinor, Willmann Engineering, Woodside and Petrobras

For further information, see also: OTC-31203-MS – Value Creation and Cost Management by use of the New ISO 15663 Life Cycle Costing Standard (2021)

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