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Entwurf

Erdöl- und Erdgasindustrie – Betriebsdauerkosten (ISO/DIS 15663:2019); Englische Fassung prEN ISO 15663:2019

Petroleum, petrochemical and natural gas industries – Life cycle costing (ISO/DIS 15663:2019); English version prEN ISO 15663:2019

Industries du pétrole et du gaz naturel – Estimation des coûts globaux de production et de traitement (ISO/DIS 15663:2019); Version anglaise prEN ISO 15663:2019

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2019-10-04 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal von DIN unter www.din.de/go/entwuerfe bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
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Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 119 Seiten

DIN-Normenausschuss Erdöl- und Erdgasgewinnung (NÖG)

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Nationales Vorwort

Dieses Dokument (prEN ISO 15663:2019) wurde vom Technischen Komitee ISO/TC 67 „Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 12 „Materialien, Ausrüstungen und Offshore-Bauwerke für die Erdöl-, petrochemische und Erdgasindustrie“ (Sekretariat NEN, Niederlande) erarbeitet.

Für Deutschland hat hieran der Arbeitsausschuss NA 109-00-01 AA „Materialien, Ausrüstungen und Offshore-Bauwerke für die Erdöl-, petrochemische und Erdgasindustrie — Spiegelausschuss zu CEN/TC 12 und ISO/TC 67“ im DIN-Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) mitgearbeitet.

Dieser Europäische Norm-Entwurf enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 1/2004 nur die englische Originalfassung von prEN ISO 15663:2019 und ISO/DIS 15663:2019.

Für die in diesem Dokument zitierten internationalen Dokumente wird im Folgenden auf die entsprechenden deutschen Dokumente hingewiesen:

ISO 9000:2015	siehe	DIN EN ISO 9000:2015-11
ISO 9001:2015	siehe	DIN EN ISO 9001:2015-11
ISO 14224	siehe	DIN EN ISO 14224
ISO 19008	siehe	DIN EN ISO 19008
ISO 20815:2018	siehe	DIN EN ISO 20815:2019-08
ISO 21500:2012	siehe	DIN ISO 21500:2016-02
ISO 31000:2018	siehe	DIN ISO 31000:2018-10

Änderungen

Gegenüber DIN EN ISO 15663-1:2008-01 wurden folgende Änderungen vorgenommen:

a) dieses Dokument fasst die drei Teile der ersten Ausgabe der Reihe ISO 15663 (ISO 15663-1:2000, ISO 15663-2:2001 und ISO 15663-3:2001) zu einem einzigen Dokument zusammen;

b) mehrere neue Begriffe, Definitionen, Symbole und Abkürzungen;

c) neuer Abschnitt 4 „Application“;

d) neue Abschnitte 5 und 6 zur Beschreibung des Managements und der Methodik der Betriebsdauerkostenrechnung;

e) Anhang A enthält umstrukturierten Text aus ISO 15663-3:2001;

f) neuer Anhang C, der die Techniken der Betriebsdauerkostenrechnung beschreibt und auch Text aus ISO 15663-2:2001 enthält.

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Nationaler Anhang NA
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Begriffe, Symbole und Abkürzungen

Die Benummerung der folgenden Begriffe und Abkürzungen ist identisch mit der Benummerung in der englischen Fassung.

3 Begriffe, Symbole und Abkürzungen

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

— IEC Electropedia: verfügbar unter http://www.electropedia.org/

— ISO Online Browsing Platform: verfügbar unter https://www.iso.org/obp

3.1 Begriffe

3.1.1
Vermögenswert
Asset
Ressource im Eigentum einer Organisation, die üblicherweise zur Generierung von Einkommen oder zur Wertsteigerung dient

3.1.2
beste verfügbare Techniken
BAT
(en: best available techniques)
letzter Stand der Entwicklung (Stand der Technik) von Prozessen, Einrichtungen oder Betriebsverfahren, der die praktische Eignung einer bestimmten Maßnahme für die Begrenzung von Ausstößen, Emissionen und Abfällen anzeigt

[QUELLE: OSPAR Convention: 1992, Appendix 1]

3.1.3
Kostendeckungspreis
Preis, der bei pauschaler Anwendung auf die verkaufte Produktion einen NPV = 0 ergibt

Anmerkung 1 zum Begriff: Die Produktion kann sich auf Materialien, wie z. B. Öl, Ausrüstung oder Dienstleistungen beziehen. Siehe weitere Informationen in C.6.3.8.

3.1.4
Kostendeckungsvolumen
Volumen, bei dem eine Bilanz des Einnahme- und Kostenstroms zu einem NPV = 0 führt

Anmerkung 1 zum Begriff: Das Volumen kann sich auf Materialien, wie z. B. Öl, Ausrüstung oder Dienstleistungen beziehen, die Einnahmen erzeugen. Siehe weitere Informationen in C.6.3.7.

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3.1.5
Kapitaleffizienzindex
CEI
(en: capital efficiency index)
NPV eines Projekts nach Steuern geteilt durch den NPV des Zahlungsstroms nach Steuern bis zu einem festgelegten Endpunkt

Anmerkung 1 zum Begriff: Der Kapitaleffizienzindex veranschaulicht die Wertschöpfung im Verhältnis zum Kapitaleinsatz. Siehe weitere Informationen in C.6.3.9.

Anmerkung 1 zum Begriff: Der Kapitalwert des kumulierten Zahlungsstroms nach Steuern gilt bis zu dem Punkt, an dem dieser positiv wird (siehe Gleichung (C.8)).

3.1.6
Invesitionsausgaben
CAPEX
(en: capital expenditure)
Einlagen, die zum Kauf, zur Einrichtung und zur Inbetriebnahme eines Vermögenswertes aufgewendet werden

Anmerkung 1 zum Begriff: Siehe weitere Informationen zur Abschätzung des CAPEX in C.2.

3.1.7
Ressourcen-Code
COR
hierarchische Struktur des SCCS, die alle Projektressourcen nach Art des Vertrags bzw. der Ressource klassifiziert, der bzw. die in die Tätigkeit involviert ist und einen damit verbundenen Ratensatz aufweist

Anmerkung 1 zum Begriff: Es gibt eine spezifische Ressourcen-Code-Struktur, d. h. das SCCS ist in ISO 19008:2016 beschrieben. COR-Codes sind verfügbar unter http://standards.iso.org/iso/19008.

[QUELLE: EN ISO 19008:2016, 2.1, modifiziert – Anmerkung 1 zum Begriff wurde ergänzt.]

3.1.8
Bereitschaftskosten mit langfristiger Bindungsdauer
diejenigen Fixkosten, die sich nicht ohne erhebliche Auswirkungen auf den Gewinn oder die Ziele der Organisation eliminieren oder auch nur reduzieren lassen

3.1.9
Beschränkung
Grenzwert, der dem Projekt von innen oder außen auferlegt ist und die Wahl einer bestimmten Option im Falle seiner Überschreitung ausschließt

3.1.10
Kostenstrukturplan
Struktur, die sich auf die Verfahren bezieht, die eine Organisation anwendet, um die Kosten zu erfassen und Bericht darüber zu erstatten

Anmerkung 1 zum Begriff: Es gibt einen spezifischen Kostenstrukturplan, d. h. das SCCS ist in ISO 19008:2016 beschrieben. Siehe http://standards.iso.org/iso/19008.

3.1.11
Kostenangaben
Kosteninformationen, die mit einem festgelegten Kostenelement verbunden sind

Anmerkung 1 zum Begriff: Bei den Kostendaten kann es sich um qualitative oder quantitative Kosteninformationen handeln.

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3.1.12
Kostentreiber
wesentliches Kostenelement, das im Falle seiner Änderung erhebliche Auswirkungen auf die Lebenszykluskosten einer Option hat

3.1.13
Kostenelement
Untermenge auf jeder beliebigen Ebene der Gesamtkosten für einen Kostenstrukturplan

Anmerkung 1 zum Begriff: Die Kosten eines Gegenstandes/einer Einheit, Ressource, Aktivität oder einer Kombination aus diesen.

Anmerkung 2 zum Begriff: Bei Anwendung von ISO 19008:2016 gibt es spezifische Kostenelemente, d. h. den Begriff „Kostenposition“, wie in 3.1.15 definiert.

3.1.14
Kostenpunkt
Kostenelement, das im Falle seiner Änderung keine wesentlichen Auswirkungen auf die Lebenszykluskosten einer Option hat

3.1.15
Kostenposition
bestimmter Teil/bestimmte Stufe, der/die durch das SCCS codiert/klassifiziert ist

[QUELLE: ISO 19008:2016, 2.2]

3.1.16
Diskontsatz
d
Zinsfuß, der bei der Bestimmung des Kapitalwerts des zukünftigen Zahlungsstroms angesetzt wird

3.1.17
Fixkosten
Kosten, die keiner Schwankung mit dem Produktionsvolumen oder dem Aktivitätsniveau unterliegen

Anmerkung 1 zum Begriff: Fixkosten bleiben nicht notwendigerweise über die gesamte Lebensdauer einer Aktivität oder eines produzierenden Vermögenswertes konstant.

Anmerkung 2 zum Begriff: Sowohl CAPEX als auch OPEX können Fixkostenpositionen aufweisen.

3.1.18
Erstinvestition
erste Investitionen in ein Projekt

Anmerkung 1 zum Begriff: Die Erstinvestition ist Teil des Gesamt-CAPEX oder des Gesamt-CAPEX für das Projekt selbst und von der Art des Projekts abhängig. Die Wahl des Zeitpunkts für die Erstinvestition kann variieren, und es ist wichtig, sie in den LCC-Berechnungen eines gegebenen Projektes zu beschreiben.

3.1.19
interner Zinsfuß
IRR
(en: internal rate of return)
Zinsfuß des zukünftigen Netto-Zahlungsstroms, der einen NPV = 0 ergibt

Anmerkung 1 zum Begriff: Siehe weitere Informationen in C.6.3.4.

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3.1.20
Betrachtungseinheit
Einheit
betrachtetes Subjekt

Anmerkung 1 zum Begriff: Die Einheit kann ein Einzelteil, ein Bauelement, eine Untereinheit, ein Betriebsmittel, ein System, ein Werk oder eine Anlage sein.

[QUELLE: IEC 60050-192:2015, 192-01-01, modifiziert – Nur Anmerkung 1 zum Begriff wurde aufgenommen und angepasst.]

3.1.21
Lebenszyklus
Lebensweg
Abfolge identifizierbarer Stufen, die eine Einheit durchläuft von ihrer Konzeption bis zur Entsorgung

Anmerkung 1 zum Begriff: Die identifizierten Stufen sind als Lebenszyklusphasen definiert, siehe 3.1.26.

[QUELLE: IEC 60050-192:2015, 192-01-09, modifiziert – Anmerkung 1 zum Begriff wurde ergänzt.]

3.1.22
Lebenszykluskosten
LCC
(en: life cycle cost)
im Lebenszyklus aufgelaufene Gesamtkosten

Anmerkung 1 zum Begriff: Die LCC sind die diskontierte Summe aus CAPEX, OPEX und LOSTREV, siehe C.6.3.3.

Anmerkung 2 zum Begriff: In einigen Fällen wird es vorgezogen, anstelle der LCC die Gesamtkosten der Eigentümerschaft heranzuziehen, um die Anwendung der Bewertung der Lebenszykluskosten (d. h. die Methodik) zu erklären, im vorliegenden Dokument wird dieser Begriff jedoch nicht verwendet. Siehe weitere Informationen in 4.2.

[QUELLE: IEC 60050-192:2015, 192-01-10, modifiziert – Die Anmerkungen 1 und 2 zum Begriff wurden ergänzt]

3.1.23
Lebenszykluskosten-Analyse
LCC-Analyse
systematische Bewertungen und Berechnungen, die durchgeführt werden, um miteinander konkurrierende Optionen anhand wirtschaftlicher Bewertungsmaßnahmen im Rahmen der Bewertung der Lebenszykluskosten zu beurteilen

Anmerkung 1 zum Begriff: Die wirtschaftlichen Bewertungsmaßnahmen sind in C.6.3 beschrieben.

3.1.24
Lebenszykluskosten-Modell
LCC-Modell
mathematische Beziehung zwischen Kostenelementen und den Differenzen von Lebenszykluskosten

Anmerkung 1 zum Begriff: Das LCC-Modell wird verschiedene wirtschaftliche Bewertungsmaßnahmen enthalten, wie in C.6.3 beschrieben.

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3.1.25
Bewertung der Lebenszykluskosten
Prozess der Bewertung der Differenz zwischen den Lebenszykluskosten von zwei oder mehr alternativen Optionen

Anmerkung 1 zum Begriff: Die Bewertung der Lebenszykluskosten kann quantitative und/oder qualitative Beurteilungen umfassen.

3.1.26
Lebenszyklusphase
diskrete Phase im Lebenszyklus, die einen festgelegten Zweck hat

Anmerkung 1 zum Begriff: Die verschiedenen Lebenszyklusphasen sind in 4.5 ausführlicher beschrieben.

3.1.27
Umsatzausfälle
LOSTREV
(en: lost revenue)
Verlust an Einnahmen, der eintritt, wenn generierte Einnahmen aufgrund innerer oder äußerer Faktoren geringer ausfallen als erwartet

Anmerkung 1 zum Begriff: Für den Fall, dass sich die generierten Einnahmen auf eine Produktion beziehen, definiert ISO 20815:2018, 3.1.25 die Umsatzausfälle als: Gesamtkosten der verloren gegangenen oder verzögerten Produktion auf Grund von Unklarzeiten. Die Produktions- und Zeitverlustkategorien sind in ISO 20815:2018, Anhang G.3 definiert.

Anmerkung 2 zum Begriff: Siehe weitere Informationen zur Abschätzung der Umsatzausfälle in Abschnitt C.4.

3.1.28
Kapitalwert
NPV
(en: net present value)
Gegenwartswert, der durch Diskontierung des zukünftigen Netto-Zahlungsstroms mit dem geforderten Zinsfuß als der Diskontsatz berechnet wird

Anmerkung 1 zum Begriff: In diesem Dokument wird die Benennung Kapitalwert verwendet, obgleich in der Wirtschaft in einigen Fällen auch die Benennung Gegenwartswert verwendet wird, was aber denselben Diskontwert widerspiegelt. Siehe weitere Informationen in C.6.3.2.

3.1.29
Betriebskosten
OPEX
(en: operating expenditure)
Ausgaben, die für den Betrieb und die Instandhaltung aufgewendet werden, einschließlich der damit verbundenen Kosten für z. B. die Logistik und Ersatzteile

Anmerkung 1 zum Begriff: Siehe weitere Informationen zur Abschätzung des OPEX in Abschnitt C.3.

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3.1.30
Kapitalrückflusszeitraum
Zeitraum, innerhalb dessen die Erstinvestition durch die ab der ersten Einnahme gezählten und akkumulierten Reineinnahmen getilgt wurde

Anmerkung 1 zum Begriff: Der Kapitalrückflusszeitraum wird in einigen Fällen auch als Amortisationszeit bezeichnet. Siehe weitere Informationen in C.6.3.6.

Anmerkung 2 zum Begriff: Bei der Berechnung des Kapitalrückflusszeitraums ist es wichtig anzugeben, ob dieser auf einer Summierung von Nennwerten oder auf Diskontwerten basiert, wobei Letzteres zu einem etwas längeren Kapitalrückflusszeitraum führen kann.

3.1.31
physischer Strukturplan
PBS
(en: physical breakdown structure)
bestimmter Teil/bestimmte Stufe, der/die durch das SCCS codiert/klassifiziert ist

Anmerkung 1 zum Begriff: Es gibt einen spezifischen physischen Strukturplan, d. h. das SCCS ist in ISO 19008:2016 beschrieben. PBS-Codes sind verfügbar unter http://standards.iso.org/iso/19008.

[QUELLE: ISO 19008:2016, 2.6, modifiziert – Anmerkung 1 zum Begriff wurde ergänzt.]

3.1.32
Kapitalwertrate
PI
(en: profitability index)
Verhältnis des NPV des Projekts zum diskontierten CAPEX

Anmerkung 1 zum Begriff: Siehe weitere Informationen in C.6.3.5.

3.1.33
geforderter Zinsfuß
vom Entscheidungsfinder gestellte Anforderung an den Diskontsatz, um einen Mindestgewinn aus dem Investitionsprojekt zu ziehen

3.1.34
Erlös
Einnahmen, die aus normalen Geschäftsaktivitäten generiert wurden

3.1.35
Mehreinnahmen
generierte Einnahmen, die aufgrund innerer oder äußerer Faktoren höher ausgefallen sind als erwartet

3.1.36
Strukturplan für Standardaktivitäten
SAB
(en: standard activity breakdown structure)
hierarchische Struktur des SCCS, die die Art der ausgeführten Tätigkeit festlegt

Anmerkung 1 zum Begriff: Es gibt einen spezifischen Strukturplan für Standardaktivitäten, d. h. das SCCS ist in ISO 19008:2016 beschrieben. SAB-Codes sind verfügbar unter http://standards.iso.org/iso/19008.

[QUELLE: ISO 19008:2016, 2.8, modifiziert – Anmerkung 1 zum Begriff wurde ergänzt.]

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3.1.37
Standardkosten-Codierungssystem
SCCS
(en: standard cost coding system)
Standardsystem zur Klassifizierung und Codierung von Kostenschätzungen, Kostenkontrolle sowie Endmengen und Kostenangaben

Anmerkung 1 zum Begriff: Der SCCS-Code beinhaltet drei individuelle hierarchische Codierungs-Strukturen PBS, SAB sowie COR, die auf jeweils unterschiedlichen Aspekten/Facetten der Arbeitsbeschreibung basieren.

Anmerkung 2 zum Begriff: In diesem Dokument bedeutet SCCS die Anwendung von ISO 19008:2016.

[QUELLE: ISO 19008:2016, 2.7, modifiziert – Anmerkung 2 zum Begriff wurde ergänzt.]

3.1.38
Unsicherheit
vorhergesagte(s) Aussage, Quantität oder Ereignis, die/das nicht als vollständig wahr oder falsch bekannt ist

3.1.39
Variabilität
Schwankungen der Leistungs-Messgrößen über unterschiedliche Zeiträume unter festgelegten Rahmenbedingungen

[QUELLE: ISO 20815:2018, 3.1.62]

3.1.40
gewichtete durchschnittliche Kapitalkosten
WACC
(en: weighted average cost of capital)
durchschnittliche Kosten der verschiedenen Kapitalquellen, einschließlich Obligationen und verzinslicher Schulden, eines Unternehmens nach Steuern

Anmerkung 1 zum Begriff: Die WACC sind der durchschnittliche Satz, den ein Unternehmen zur Finanzierung seiner Vermögenswerte zu zahlen erwartet. Siehe weitere Informationen in C.6.3.2.

3.2 Symbole

d	Diskontsatz
n	Projektlebensdauer in Perioden (d. h. Jahren)
NCF_i	Netto-Zahlungsstrom am Ende jeder Periode i
NPV_{NCF}	Kapitalwert des kumulierten Zahlungsstroms nach Steuern bis zu dem Punkt, an dem dieser positiv wird
t	Anzahl an Perioden (d. h. Jahren) in die Zukunft

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3.3 Abkürzungen

CAPEX	Investitionsausgaben (en: capital expenditure)
CEI	Kapitaleffizienzindex (en: capital efficiency index)
COR	Ressourcen-Code (en: code of resource)
DRILLEX	Bohrkosten (en: drilling expenditures)
EPC	Detail-Planung und Kontrolle, Beschaffungswesen, Ausführung der Bau- und Montagearbeiten (en: engineering, procurement and construction)
EPCI	Engineering, Procurement, Construction, and Installation
EPIC	Engineering, Procurement, Installation, and Commissioning
FEED	Front-End Engineering Design
FID	endgültige Investitionsentscheidung (en: final investment decision)
FPSO	Schwimmende Produktion und Lagerung (en: floating production storage and offloading)
HSE	Gesundheitsschutz, Arbeitsschutz und Umweltmanagement (en: health safety and environment)
IRR	interner Zinsfuß (en: internal rate of return)
LCC	Lebenszykluskosten (en: life cycle cost)
LCCMP	Lebenszykluskosten-Managementplan (en: life cycle costing management plan)
LOSTREV	Umsatzausfälle (en: lost revenue)
MU	Währungseinheiten (en: monetary units)
NPV	Kapitalwert (en: net present value)
OPEX	Betriebskosten (en: operating expenditure)
PBS	physischer Strukturplan (en: physical breakdown structure)
PI	Kapitalwertrate (en: profitability index)
SAB	Strukturplan für Standardaktivitäten (en: standard activity breakdown)
SCCS	Standardkosten-Codierungssystem (en: standard cost coding system)
WACC	gewichtete durchschnittliche Kapitalkosten (en: weighted average cost of capital)

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Nationaler Anhang NA
(informativ)

Literaturhinweise

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DIN EN ISO 19008, *Standardkosten-Codierungssystem für die Öl- und Gasproduktion und Verarbeitungsanlagen*

DIN EN ISO 20815:2019-08, *Erdöl-, petrochemische und Erdgasindustrie — Betriebsoptimierung und Zuverlässigkeitsmanagement (ISO 20815:2018); Englische Fassung EN ISO 20815:2018, nur auf CD-ROM*

DIN ISO 21500:2016-02, *Leitlinien Projektmanagement (ISO 21500:2012)*

DIN ISO 31000:2018-10, *Risikomanagement — Leitlinien (ISO 31000:2018)*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries.*

This second edition cancels and replaces the three parts of the first edition (ISO 15663-1:2000, ISO 15663-2:2001 and ISO 15663-3:2001), which have been merged into a single document and technically revised. The main changes compared to the previous edition are as follows:

— Clause 3: several new terms, definitions, symbols and abbreviations;

— Clause 4: a new clause has been introduced;

— Clause 5 and Clause 6: new clauses describing life cycle costing management and methodology which have been restructured from previous edition;

— Annex A: contains restructured text from the previous edition, Part 3;

— Annex C: new annex describing life cycle costing techniques which also includes text from previous edition, Part 2;

— Annex B, Annex D, Annex E and Annex F are new clauses, but contain also some elements from the previous edition.

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Introduction

Cost management within the petroleum, petrochemical and natural gas industries is important and will benefit from adoption of a common and consistent approach to life cycle costing.

Life cycle costing is the systematic consideration of costs and revenues associated with alternative options required to fulfil the objectives of the business. It is an iterative process of planning, estimating and monitoring costs and revenue differences throughout an asset's life. It is used to support the decision-making process by evaluating alternative options and performing trade-off studies. While the largest benefits are typically achieved in the early life cycle phases, it is equally applicable to all life cycle phases and at many levels of detail.

The petroleum, petrochemical and natural gas industries have historically assessed the financial viability of project options based on minimum capital expenditure and achieving project schedule, whilst operating expenditures and lost revenue have received less focus in the decision-making process. This has ignored potentially large cost factors and has in some cases resulted in selecting non-optimal solutions.

Recognizing this situation, life cycle costing is increasingly being applied by a variety of organizations within the industry. All participants in the process — operators, contractors and vendors — can have a substantial impact on the life cycle cost, and it is not until all are involved that the benefits sought from the use of life cycle costing will be realised.

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Petroleum, petrochemical and natural gas industries — Life cycle costing

1 Scope

This document specifies requirements for, and gives guidance on, the application of life cycle costing for the development activities and operations associated with drilling, exploitation, processing and transport of petroleum, petrochemical and natural gas resources. This document covers facilities and associated activities within different business categories (upstream, midstream, downstream and petrochemical).

The life cycle costing process as described in this document is applicable when making decisions between competing options that are differentiated by cost and/or economic value implications. This document is not concerned with decision making related to the economic performance of individual options or options differentiated by factors other than cost or economic value.

Guidance is provided on the management methodology and application of life cycle costing in support of decision making across life cycle phases. The extent of planning and management depends on the magnitude of the costs involved, the potential value that can be created and the life cycle phase. It also provides the means of identifying cost drivers and provides a cost-control framework for these cost drivers, allowing effective cost control and optimization over the entire life of an asset.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14224:2016, *Petroleum, petrochemical and natural gas industries — Collection and exchange of reliability and maintenance data for equipment*

ISO 19008:2016, *Standard cost coding system for oil and gas production and processing facilities*

ISO 20815:2018, *Petroleum, petrochemical and natural gas industries — Production assurance and reliability management*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions

3.1.1
asset
resource owned by an organization, normally for the purposes of generating income or increasing value

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3.1.2
best available techniques
BAT
latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicates the practical suitability of a particular measure for limiting discharges, emissions and waste

[Source: OSPAR Convention:1992, Appendix 1]

3.1.3
break-even price
price which applied flat to the production sold gives NPV=0

Note 1 to entry: The production can be related to material such as oil, equipment or services. See further information in C.6.3.8.

3.1.4
break-even volume
volume where a stream of revenues and cost balance resulting in NPV=0

Note 1 to entry: The volume can be related to material such as oil, equipment or services that generates income. See further information in C.6.3.7.

3.1.5
capital efficiency index
CEI
NPV of project after tax divided by NPV of cash flow after tax up to a defined end point

Note 1 to entry: The capital efficiency index illustrates value creation relative to capital exposure. See further information in C.6.3.9.

Note 2 to entry: The net present value of cumulative cash flow after tax applies until the point where this becomes positive (see Formula (C.8)).

3.1.6
capital expenditure
CAPEX
investment used to purchase, install and commission an asset

Note 1 to entry: See further information regarding estimation of CAPEX in Clause C.2.

3.1.7
code of resource
COR
hierarchical structure of SCCS that classifies all project resources according to the type of contract/resource that is involved in the activity and has an associated set of rates

Note 1 to entry: Specific code of resource structure exist, i.e. SCCS is described in ISO 19008:2016. COR codes can be found at http://standards.iso.org/iso/19008.

[SOURCE: ISO 19008:2016, 2.1, modified — Note 1 to entry has been added.]

3.1.8
committed costs
those fixed costs that cannot be eliminated or even cut back without having a major effect on profits or on the organization's objectives

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3.1.9
constraint
limit imposed externally or internally by the project which rules out the selection of an option if the limit is exceeded

3.1.10
cost breakdown structure
structure related to the methods that an organization employs to record and report costs

Note 1 to entry: Specific cost breakdown structure exists, i.e. SCCS is described in ISO 19008:2016. See http://standards.iso.org/iso/19008.

3.1.11
cost data
cost information associated with a defined cost element

Note 1 to entry: Cost data can be qualitative or quantitative cost information.

3.1.12
cost driver
major cost element which, if changed, will have a major impact on the life cycle cost of an option

3.1.13
cost element
subset at any level of the total cost for a cost breakdown structure

Note 1 to entry: The cost of an object/item, resource, activity or a combination of those.

Note 2 to entry: Specific cost element exists when ISO 19008:2016 is applied, i.e. the term 'cost item' as defined in 3.1.15.

3.1.14
cost issue
cost element which, if changed, will not have a major impact on the life cycle cost of an option

3.1.15
cost item
particular part/level that is coded/classified using the SCCS

[SOURCE: ISO 19008:2016, 2.2]

3.1.16
discount rate
d
rate of return used in determining the net present value of future cash flow

3.1.17
fixed cost
cost that does not vary with production volume or with the level of activity

Note 1 to entry: Fixed cost is not necessarily constant along the full life of an activity or a producing asset.

Note 2 to entry: Both CAPEX and OPEX can have fixed cost items.

3.1.18
initial investment
first investment for a project

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Note 1 to entry: Initial investment is a part of the overall CAPEX or the overall CAPEX for the project itself and will depend on the type of project. The timing of initial investment can vary and is important to describe in the LCC calculations in a given project.

3.1.19
internal rate of return
IRR
rate of return of future net cash flow that gives NPV=0

Note 1 to entry: See further information in C.6.3.4.

3.1.20
item
subject being considered

Note 1 to entry: The item can be an individual part, component, subunit, equipment, system, plant or installation.

[SOURCE: IEC 60050-192:2015, 192-01-01, modified – Note 1 to entry included only and adjusted.]

3.1.21
life cycle
series of identifiable stages through which an item goes, from its conception to disposal

Note 1 to entry: The identified stages are defined as life cycle phases, see 3.1.26.

[SOURCE: IEC 60050-192:2015, 192-01-09, modified — Note 1 to entry has been added.]

3.1.22
life cycle cost
LCC
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.

Note 2 to entry: Total cost of ownership is sometimes used in preference to LCC when explaining the application of life cycle costing (i.e. the methodology), but this term is not used in this document. See further information in 4.2.

[SOURCE: IEC 60050-192:2015, 192-01-10, modified — Notes 1 and 2 to entry have been added]

3.1.23
life cycle cost analysis
LCC analysis
systematic evaluations and calculations carried out to assess competing options using economic evaluation measures of as part of life cycle costing

Note 1 to entry: The economic evaluation measures are described in C.6.3.

3.1.24
life cycle cost model
LCC model
mathematical relationship between cost elements and life cycle cost differences

Note 1 to entry: The LCC model will contain different economic evaluation measures as described in C.6.3.

3.1.25
life cycle costing
process of evaluating the difference between the life cycle cost of two or more alternative options

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Note 1 to entry: Life cycle costing can involve quantitative and/or qualitative assessment.

3.1.26
life cycle phase
discrete stage in the life cycle with a specified purpose

Note 1 to entry: The different life cycle phases are further described in 4.5.

3.1.27
lost revenue
LOSTREV
income loss which occurs when generated income are less than expected due to external or internal factors

Note 1 to entry: When the generated income is related to production, ISO 20815:2018, 3.1.25 defines lost revenue as: Total cost of lost or deferred production due to down time. Production and time loss categories are defined in ISO 20815:2018, Annex G.3.

Note 2 to entry: See further information regarding estimation of lost revenue in Clause C.4.

3.1.28
net present value
NPV
present value that is calculated by discounting the future net cash flow with the required rate of return as the discount rate

Note 1 to entry: In this document, the term net present value is used, even though industry sometimes uses also the term present value reflecting the same discounted value. See further information in C.6.3.2.

3.1.29
operating expenditure
OPEX
expenses used for operation and maintenance, including associated costs such as logistics and spares

Note 1 to entry: See further information regarding estimation of OPEX in Clause C.3.

3.1.30
payback period
period after which the initial investment has been paid back by the accumulated net revenue counted from first income

Note 1 to entry: The payback period is also sometimes called pay-out time. See further information in C.6.3.6.

Note 2 to entry: When payback period is calculated, it is important to state whether it is based on summation of nominal values or based on discounted values where the latter can lead to somewhat longer payback period.

3.1.31
physical breakdown structure
PBS
particular part/level that is coded/classified using the SCCS

Note 1 to entry: Specific physical breakdown structure exists, i.e. SCCS is described in ISO 19008:2016. PBS codes can be found at http://standards.iso.org/iso/19008.

[SOURCE: ISO 19008:2016, 2.6, modified — Note 1 to entry has been added.]

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3.1.32
profitability index
PI
ratio of NPV of the project divided by the discounted CAPEX

Note 1 to entry: See further information in C.6.3.5.

3.1.33
required rate of return
discount rate requirement by the decision-maker for minimum profit for the investment project

3.1.34
revenue
income generated from normal business activities

3.1.35
revenue gain
generated income that is higher than expected due to external or internal factors

3.1.36
standard activity breakdown structure
SAB
hierarchical structure of SCCS that defines the type of activity that is being performed

Note 1 to entry: Specific standard activity breakdown structure exists, i.e. SCCS is described in ISO 19008:2016. SAB codes can be found at http://standards.iso.org/iso/19008.

[SOURCE: ISO 19008:2016, 2.8, modified — Note 1 to entry has been added.]

3.1.37
standard cost coding system
SCCS
standard system for classification and coding cost estimates, monitoring and final quantities and cost data

Note 1 to entry: The SCCS code comprises three individual hierarchical coding structures named PBS, SAB and COR, each based upon a different aspect/facet of the scope of work.

Note 2 to entry: In this document, SCCS means use of ISO 19008:2016.

[SOURCE: ISO 19008:2016, 2.7, modified — Note 2 to entry has been added.]

3.1.38
uncertainty
predicted statement, quantity or event that is not known as completely true or false

3.1.39
variability
variations in performance measures for different time periods under defined framework conditions

[SOURCE: ISO 20815:2018, 3.1.62]

3.1.40
weighted average cost of capital
WACC
average after-tax cost of a company's various capital sources, including stocks and interest-bearing debt

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Note 1 to entry: WACC is the average rate a company expects to pay to finance its assets. See further information in C.6.3.2.

3.2 Symbols

d	discount rate
n	project lifetime in periods (i.e. years)
NCF_i	net cash flow at the end of each period i
NPV_{NCF}	net present value of cumulative cash flow after tax until the point where this becomes positive
t	number of periods (i.e. years) into the future

3.3 Abbreviated terms

CAPEX	capital expenditure
CEI	capital efficiency index
COR	code of resource
DRILLEX	drilling expenditures
EPC	engineering procurement and construction
EPCI	engineering procurement construction and installation
EPIC	engineering procurement installation and commissioning
FEED	front-end engineering design
FID	final investment decision
FPSO	floating production storage and offloading
HSE	health safety and environment
IRR	internal rate of return
LCC	life cycle cost
LCCMP	life cycle costing management plan
LOSTREV	lost revenue
MU	monetary units
NPV	net present value
OPEX	operating expenditure
PBS	physical breakdown structure

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PI	profitability index
SAB	standard activity breakdown
SCCS	standard cost coding system
WACC	weighted average cost of capital

4 Application

4.1 Users of this document

This document is intended for users responsible or involved in life cycle costing and associated activities such as:

— installation/plant/facility: operating facility, e.g. HSE, engineering, construction, installation, operation and maintenance personnel;

— operator/owner/company: project management and control, technology development, technology qualification, concept and system design, HSE, integrity management, maintenance management, production assurance, etc.;

— contractor: main contractor for engineering, procurement, construction, drilling, installation, operation, maintenance services, etc.;

— vendor/manufacturer/supplier: technology development, technology qualification, system design to ensure product quality and improvements, etc.;

— authority/regulatory body: regulatory requirements that can refer to this document to enhance HSE, production availability, system availability, operability, maintenance and resource utilization;

— consultant: consultancy services for supporting system design, production assurance and reliability management, technical safety, etc.;

— industry: any other user involved in life cycle costing activities in the industry.

4.2 Framework conditions

The objective associated with life cycle costing is to provide decision support for selecting between alternative options (e.g. technical and operational items) and aligned with overall corporate business objectives. Figure 1 illustrates that it is different from company economics and project economics. In this context, ISO 19008:2016 related to cost coding, and ISO 14224:2016 and ISO 20815:2018 related to production assurance and reliability management shall be used in an appropriate manner (see e.g. Annex C). Quality management should also be considered, for which ISO 9000:2015, ISO 9001:2015 and ISO/FDIS 29001:2019 can be used.

LCC model is the quantitative model used when comparing competing options. This LCC model may be different from economic models used by operator for other purposes. In such specific cases, explanation of essential differences should be given.

In the majority of cases, a spreadsheet model represents the most cost efficient and flexible solution for LCC model for comparison of options (see 6.4.2). The LCC model developed should be simple enough to be transparent to the user, but accurate enough to represent the difference between options.

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Life cycle cost (LCC) is defined as the total cost incurred during the life cycle. As indicated in Figure 1, life cycle cost is derived numerically. This numerical output is sometimes referred to as the total cost of ownership rather than LCC, to provide distinction between life cycle costing as an activity and LCC as an output. While LCC and total cost of ownership can be considered numerically equivalent, LCC is used in this document. Total cost of ownership is not used to prevent possible confusion of with so-called "ownership cost", which can exclude cost elements and cost drivers that are included in LCC. Similarly, ownership cost may include costs relating to project economics (e.g. depreciation) that do not form part of LCC.

IEC 60300-3-3:2017 provides a general introduction to the concept of life cycle costing and covers all industry applications.

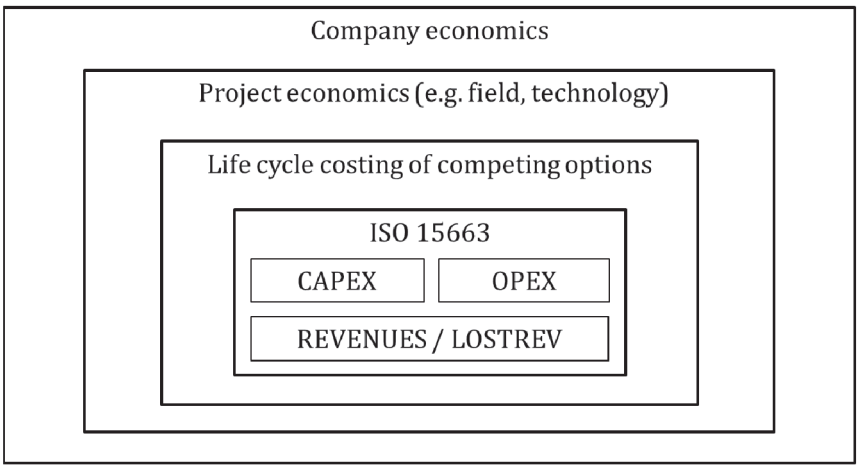

Figure 1 — Framework conditions for life cycle costing

4.3 Limitations

This document specifies requirements and give guidance for application and implementation for undertaking life cycle costing. Some limitations are described below.

— This document focuses on life cycle cost comparison between competing options for a subject matter (see also 4.6). Thus, the document is not intended for entire project economy evaluation of field development projects or investment appraisals, for which all cost issues need to be covered. Comparative life cycle costing will include only the relevant cost elements. This document also provides guidance for use in the selection of the relevant cost elements to ensure cost-effective life cycle costing.

— The detailed analyses required to accurately predict life cycle cost will, in many cases, require input data and information derived from other efforts, such as reliability modelling, maintenance analysis, logistic, material and spares studies or other techniques that help develop individual cost elements estimates. This document will not address in detail how to apply these specialist techniques. These techniques are not unique to life cycle cost analysis and are described in other relevant international standards, such as ISO 14224:2016 and ISO 20815:2018 (see also Annex C).

— This document does provide typical life cycle costing calculation methods and describes the common and best practice analytical concepts. Potential users are made aware that companies will often have specific requirements in areas such as the treatment of cash flow, discounting assumptions, views on uncertainty and risk management, guidelines on margin and their own decision support metrics and economic decision-making criteria. This document aims life cycle costing processes let companies reveal compliance and possibly (as needed) describe company specific issues used in this context.

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— Capital projects may require extensive value engineering studies to support incremental investments. The sensitivity analyses usually associated with value engineering can be varied and diverse. This document provides case specific examples, but it is important to understand the basic concepts and tailor them to particular study requirements as required.

— Contractual relationships between operators, equipment suppliers and engineering contractors can be complex and difficult to manage consistently. This document identifies common contractual considerations, some potential pitfalls and recommendations for successful outcomes when collaborating with third parties. It cannot be exhaustive in terms of covering all potential scenarios, relationships or contracting plans. The user should understand the basic life cycle costing concepts prior to starting a life cycle costing study which involves third parties.

— A more specific consideration between different companies are joint venture agreements, usually between oil and gas operating companies. In these situations, individual company economic considerations and investment decision criteria can be different between partners. For example, the treatment of cash flow can be different between companies.

— It is recognized that making decision on any option is not always driven by cost or economic value considerations. Different business drivers or objectives can determine the decision, even if some of these drivers could not be quantified in equivalent cost and/or benefits. For example, the opportunity to use and test new technology, HSE targets, energy efficiency, risk mitigation or opportunity exploitation, local or technical constraints, budget limitations or cost exposure, value of reputation, market context or contractual schemes, could drive or contribute to determine the final decision between options.

— This document provides recommendations on typical roles and competency expectations for staff involved in life cycle costing which are not intended to be considered requirements.

4.4 Benefits of life cycle costing

Applying life cycle costing has several benefits. Experience has demonstrated that:

— for the operator, life cycle costing integrates readily with existing appraisal techniques, can quantify and optimize costs and revenues over the total life of a field development, thereby reducing uncertainty;

— for the contractor, life cycle costing provides techniques to support the extension of his role into areas such as maintenance management, integrated service provision, engineering services contracts and life cycle costing consultancy;

— for the vendor, life cycle costing provides a common and consistent basis for demonstrating improved service and quality, thereby extending his role beyond technical compliance and lowest price.

Figure 2 illustrates the degree of participants involvement on the level of detail and the life cycle phase. This allows them to easily recognize where the maximum value can be reached in applying life cycle costing in their work processes.

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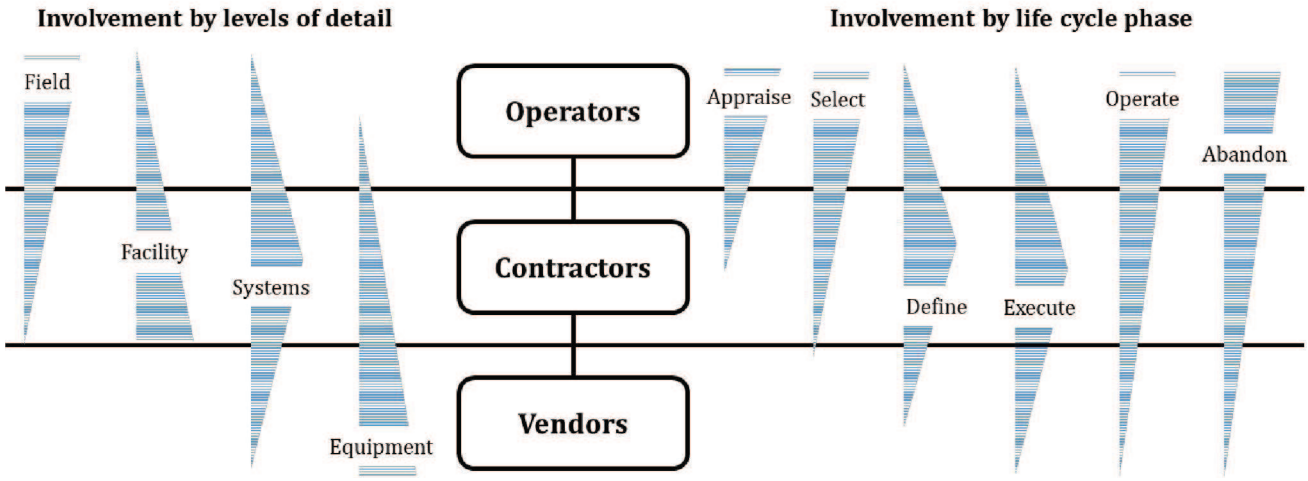

Figure 2 — The role of participants with respect to level of detail and life cycle phase

The systematic application of life cycle costing in a project development context will include any or all of the following benefits:

A. Strategic alignment: All engineering decisions being made by considering the consequences on operating expenditures and their effect on the revenue profile, in accordance with the corporate objectives of adding value on investments.

B. Improved framework for performance contracts and life cycle costing: Enhancing the overall quality level of materials and services in the supply industry through the development of performance contracts amongst operators, contractors and vendors with complementary metrics besides CAPEX, e.g. operating phase metrics (systems availability guarantee and risk-sharing clauses).

C. Improved decision criteria for selecting profitable option: Supporting the decision-making process with the establishment of predefined criteria for to rank and analyse the options with respect to their added value.

D. Increased operating predictability: To perform life cycle costing assessments, it is necessary that operating expenditure elements are identified at an early stage. In this sense, operating experience plays an important role in preventing cost underestimation and cost overruns. Technical operating experience is also a valuable resource that can be introduced early in a project development to select and evaluate options to be compared.

E. Targeted planning of the life cycle costing activities: An integrated planning for all stages of development ensures that the resources required to the life cycle costing assessments will be available in an adequate time to provide the necessary inputs to the task of comparing options for a process function and consider the effects of these decisions on other process functions. The use of an LCC model will enable to identify, target and reduce cost drivers. Then, a sensitivity analysis may indicate critical functions that will become targets for research and development, technology transfer and a focus for management effort.

F. Long-term economical perspective: The quantitative approach to life cycle costing provides an early diagnosis of the project's economic performance over time. This feature allows a common basis to compare not only the functions within a project, but also an integrated economical approach to the business portfolio.

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4.5 Life cycle costing within the life cycle phases

The primary purpose of life cycle costing is to assist in the delivery of the highest possible added value, i.e. profit, within a field development or project. It achieves this by extending profit improvement opportunities through a process of progressive optimization. The greatest benefit is realized when life cycle costing is integrated across the entire life cycle. The different life cycle phases are defined in Table 1.

Table 1 — Life cycle phases (for asset/project) — for facility owner/operating company

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

NOTE 1 Facility owner/operating company can be oil company, rig owner, etc.

NOTE 2 The life cycle phases are defined for the purpose of this document and further sub-division is given in Figure B.1

The typical scope and objectives of life cycle costing activities for each life cycle phase are as follows:

— Explore (e.g. identification of business opportunities). Life cycle costing activities for this phase are business opportunities, ranked utilizing high-level life cycle costing considerations.

— Appraise (e.g. identification and assessment of feasible concepts). The scope of this phase normally includes gross comparisons of the major technical options. The focus is on the major cost and revenue trade-offs with adequate level of detail.

— Select (e.g. concept development and concept selection). In this phase, alternative technical and operational solutions are normally examined and compared, aiming at selecting a preferred concept. Processing and delivery are considered as well as procurement options (lease or buy) and the options for operation and support.

— Define (e.g. conceptual/outline system design and front-end engineering design). Life cycle costing activities in this phase typically includes the identification and examination of the technical options for facilities, processes and delivery leading to a defined (matured) preferred concept or technical solution for FID.

— Execute (e.g. engineering, procurement, fabrication, testing, installation and commissioning). The scope of work will include system and equipment optimization within constraints defined during the life cycle phase ‘Define’, and also support to change control and project managers assessing the impact of concessions the relevant economic evaluation measures.

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— Operate (e.g. operation and maintenance, modification and life extension). For normal operations and maintenance, the work at this stage supports optimization of a wide range of facility operations and support. Life cycle costing is also applicable when assessing modifications to the facility or the potential to extend operations beyond the original design life. If major modifications are involved, this requires reference to the issues considered above under the 'Select', 'Define' and 'Execute' life cycle phases.

— Abandon (e.g. disposal and decommissioning). The work in this phase will typically include examination of when and how to decommission and dispose of all or part of the asset.

See Annex B for further details and guidance on life cycle costing activities for each of the life cycle phases.

Time to market, from concept to conclusion of commissioning, is shortened due to business and economic drivers. Contractor and vendor selection are performed early in the life cycle, with increased emphasis on their capability and performance. Contracting strategies are evolving in parallel, with a variety of partnering, alliance and framework agreements being established.

From a vendors' perspective, it is possible to add most of their value in the systems design since they are often involved in the early project phases such as the life cycle phase 'Define'. On the other hand, contractors can experience benefits coming from life cycle costing principles in all life cycle phases. For operators, it is important that a life cycle costing methodology be established in order to capture value especially in conceptual, operational and abandonment phases.

4.6 Life cycle costing subject matters

Life cycle costing is a methodology used in the oil and gas industry to determine the most cost-effective offer between alternative competing options that satisfy technical, operational, safety, environmental and regulatory requirements. Decision making is made throughout the life cycle of an oil and gas asset starting at the life cycle phase 'Appraise' through the 'Select', 'Define', 'Execute' and 'Operate' life cycle phases and even finally in the life cycle phase 'Abandon'.

The greatest opportunity of influencing the life cycle cost of an asset and its ultimate profitability is the 'Select' and 'Define' life cycle phases of a project (see Figure 3). Decisions and selections made in these two phases have repercussions in the later phases of a project, as the ability to make subsequent changes diminishes and the cost of change increase significantly. Hence, the importance of making the right decision in the 'Select' and 'Define' life cycle phases of a project.

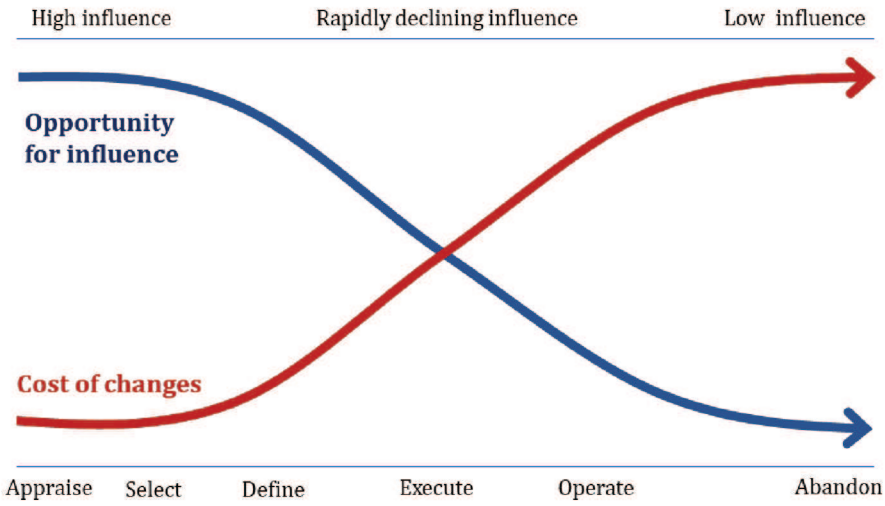

Figure 3 — Opportunity for influence vs cost of change

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Two primary life cycle costing decisions taken in the life cycle phase 'Select' for a project are:

— facility concept selection;

— process concept selection.

Examples include topside vs. subsea development, topside vs. subsea compression and full processing offshore vs. onshore treatment.

Having defined the concept to be developed, subsequent life cycle cost decisions to be made during subsequent life cycle phases may include:

— system concept and sizing;

— equipment type, configuration, vendor selection;

— layout and equipment location;

— future facility modifications;

— health, safety and environment;

— project execution strategies;

— maintenance and operation strategies;

— manning strategy and levels;

— logistic support strategy;

— spares and support strategy;

— reuse and/or disposal.

The lists above illustrate typical life cycle costing subject matters, and that they vary between life cycle phases. Identified life cycle costing subject matters are subject to the life cycle costing methodology as described in Clause 6.

4.7 Technology development

Decisions to develop and deploy new technologies in capital projects or during operations in support of performance improvements are partly based on consideration of life cycle economics. Life cycle cost analysis can be used as the basis for comparing alternative technology solutions or as input into assessment of larger systems also subject to critical economic evaluations.

Comparing alternatives which include new technologies should consider the risks and uncertainties associated with ability to qualify to specification and on schedule. These development factors are fundamental for relating expenditures and revenues. They require careful breakdown of cost related elements and rigorous data analysis and modelling to be carried out. Life cycle costing can be used to help subdivide technology development and deployment elements and assist with incremental economic comparisons of alternatives.

A characteristic of new technology projects is the challenge in handling uncertainties associated with input data, analysis results and ranking of alternatives, but analysis methods and techniques can be applied to reflect and describe the ranges of uncertainty. Depending on the complexity of the

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uncertainties, life cycle costing methodology can employ advanced simulation and detailed probabilistic assessments to critical areas requiring further attention.

5 Management of life cycle costing

5.1 General

Management of life cycle costing is important to add value and ensure cost-efficiency.

Clause 4 provides background and framework conditions for life cycle costing required to evaluate differences between costs and revenues when considering alternative competing options. Understanding the detailed analyses required to accurately predict relevant economic evaluation measures (e.g. life cycle cost) and to evaluate complex trade-offs between uncertain and variable revenues and associated cost elements requires disciplined and critical examination and structured (decision-support) management.

Life cycle costing as a capability area within organizations should be developed in terms of ability to consistently and reliably predict the total costs and revenues for the life cycle of an asset, with respect to competing options. The capabilities are required for application in both capital project environments and where incremental investments may be considered to improve HSE, production availability, and equipment and system performance during the life cycle phase 'Operate'. Life cycle costing also provides better decision support to assess the potential benefits and value of developing and deploying new technologies.

Regardless of whether life cycle costing is used in capital projects, performance improvement initiatives or the development and deployment of new technologies, organizations leveraging the techniques should use it to help confirm proposed solutions are commercially attractive and that results are developed in a manner that can be presented alongside or integrated with other assessments of indirect and non-economic benefits.

Because analysis supports significant investment considerations, it is crucial that management of life cycle costing capability aims for levels that are sufficiently developed and recognized in their role supporting high quality decision making. It further aims to ensure that economic objectives of projects are properly stated to allow effective life cycle costing to be carried out and that roles and responsibilities of those involved in life cycle costing are clearly defined. Management of life cycle costing also covers strategy and planning requirements, contractual considerations and systems to evaluate effectiveness through formal review and feedback activities. It also provides frameworks to ensure that life cycle costing competences and knowledge (i.e. standardized methods and application of life cycle costing methodology) are obtained and practiced in a quality-oriented manner for the users of this document.

This clause covers typical life cycle costing objectives, roles and responsibilities. It describes strategy, planning and contractual considerations, the assessment of life cycle costing effectiveness and minimum training and competency expectations. It has been written principally from the perspective of the operating companies who require high quality LCC analysis and evaluation to meet their end user needs, and also because they are more likely to have life cycle costing professionals within their organizations. It is recognized that engineering companies, equipment vendors and other entities involved in the project and operations value-chain have important roles in the planning and execution of effective LCC analysis.

Life cycle costing activities have an interdisciplinary character that requires expertise in economics, accounting, engineering and operations research and data analysis. Therefore, implementing a life cycle costing system involves management and can involve (depending on the organization) utilizing a team that can share competencies and resources in an effective and efficient manner to perform LCC analyses that have quality and sufficient accuracy.

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In order to conform with this document, an organization shall include elements of life cycle costing requirements in a management system. These elements can consist of:

— developing capability and competencies in life cycle costing techniques and best practices that adhere to this document;

— identification of high-level subject matters for which key life cycle costing activities and organizational roles need to be incorporated.

— inclusion of the selected life cycle costing considerations in project and operations strategy and planning cycles.

— defining the need for a project to establish roles, resources and competency requirements for carrying out life cycle costing activities;

— inclusion of life cycle costing requirements in contracting strategies reflecting customer-client relationship(s);

— incorporating life cycle costing considerations as a decision-support element in the selected commercial decisions associated with acquisition of equipment and/or services.

This document recommends that the listed processes and activities are initiated only if they can be considered to add value.

5.2 Objectives for management of life cycle costing

The main objectives for management of life cycle costing are:

— to achieve agreement at a management level on asset objectives and how life cycle costing is linked to these objectives;

— to communicate these objectives and the role of life cycle costing throughout the organization;

— to define the purpose of life cycle costing prior to any activities taking place.

Other underlying objectives are:

— describing how the principles of life cycle costing are to be applied to support projects and operations achieve business planning objectives;

— providing direction on key life cycle costing methods used in investment evaluations and decisions through detailed description of the techniques and presentation of case-specific examples;

— providing additional references on the latest best practices and sources of related information needed to carry out complex life cycle costing analysis;

— helping to communicate the role that of life cycle costing has in both capital project and operational phases environments;

— identifying typical roles and responsibilities of analysts, decision makers and others providing inputs to life cycle costing activities;

— providing guidance on planning, executing and assuring life cycle costing including contractual considerations and expected training and competence requirements.

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