INTERNATIONAL STANDARD

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Petroleum and natural gas industries — Life-cycle costing —

Part 3: **Implementation guidelines**

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

Partie 3: Lignes directrices sur la mise en oeuvre

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15663 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15663-3 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*.

ISO 15663 consists of the following parts, under the general title *Petroleum and natural gas industries — Life-cycle costing*:

— *Part 1: Methodology*

— *Part 2: Guidance on application of methodology and calculation methods*

— *Part 3: Implementation guidelines*

Introduction

The principle objective of ISO 15663 is to speed up the adoption of a common and consistent approach to life-cycle costing within the oil industry. This will happen faster and more effectively if a common approach is agreed internationally.

Life-cycle costing is the systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset. It is an iterative process of estimating, planning and monitoring costs and revenues throughout an asset's life. It is used to support the decision making process by evaluating alternative options and performing trade-off studies. While it is normally used in the early project stages evaluating major procurement options, it is equally applicable to all stages of the life-cycle, and at many levels of detail.

This part of ISO 15663 has been produced to provide guidance on practical steps that can be taken to introduce the organizational and functional aspects of life-cycle costing into the offshore oil and gas business. It focuses on the implementation issues identified by the industry, both those common to all and those specific to each participant. Key issues addressed are

— **life-cycle costing within the organization**:
how it should be organized, coordinated and managed;

— **the contract**:
the procedural elements of incorporating life-cycle costing within pre-qualification, tender and responses;

— **risk and uncertainty**:
primarily viewed from the contractual standpoint within risk sharing or risk transfer frameworks (such as alliances);

— **communication**:
across the supplier chain (operator <---> contractor <---> vendor), how it can be achieved and configuration control or an audit trail maintained.

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.

There are opportunities and challenges for all parties within the oil production industry to benefit from the introduction and use of life-cycle costing techniques.

The aim of this part of ISO 15663 is to provide practical guidance to operators, contractors and vendors in the introduction and role of life-cycle costing techniques. It seeks to address the issues associated with life-cycle costing within evolving industry custom and practice. This is illustrated in Figure 1 which shows the evolving situation.

From Figure 1 it can be seen that

— vendors are often involved in early project stages such as FEED, during which they can add value in the area of system design,

— contractors and vendors are playing an increasing role in conceptual design and operations support.

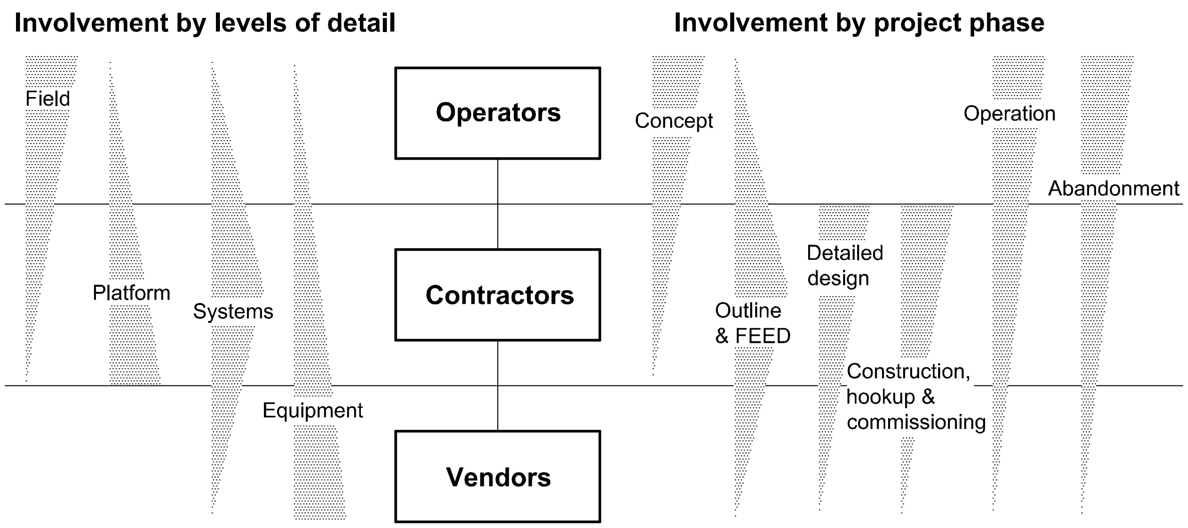

Figure 1 — The traditional role of participants is evolving and becoming less distinct

For a life-cycle costing implementation strategy, two key components emerge. These are the **interface issues** (the relationships between participants at the boundaries) and the **internal business processes** required to support the management and presentation of the information flowing across the interfaces.

In practical terms, these translate into the need for a non-prescriptive life-cycle costing implementation strategy that provides a basic framework to assist in the development and introduction of an engineering and design strategy and support strategy at all levels, together with its translation into a contract.

It should be noted that, whilst the provision of plant and equipment which has been optimized for whole life cost (WLC) performance may require its selling price to be increased, the integration of WLC/life-cycle costing principles into an equipment manufacturer's business should enable this optimum performance to be achieved without a significant increase in selling prices.

Equipment vendors and purchasers therefore need to work towards ensuring that wherever possible value, and not price, is increased by the life-cycle costing process.

This part of ISO 15663 is structured into the following sections:

— **the project or field life-cycle**;
implementation issues specific to the different phases of the life-cycle.

— **common issues**;
a variety of concerns common to all participants, the key one being the need for a focal point, or coordinator, within each organization.

— **the operator**;

— **the contractor**;

— **the vendor**.

The three last-mentioned sections addressing the implementation issues are considered important to each participant.

Recognizing that there are cultural and procedural differences across different companies in the industry, this part of ISO 15663 does not set out to be prescriptive, but to isolate and amplify the issues under a series of headings. The guiding principle is that the life-cycle costing discipline does not stand in isolation, but should be integrated within existing support functions to extend their capability.

Petroleum and natural gas industries — Life-cycle costing —

Part 3: Implementation guidelines

1 Scope

This part of ISO 15663 provides guidelines for the implementation of life-cycle costing for the development and operation of the facilities for drilling, production and pipeline transportation within the petroleum and natural gas industries. This part of ISO 15663 is applicable when making decisions on any option which has cost implications for more than one cost element or project phase. The process can be applied to a wide range of options, particularly when decisions are being considered on the following:

— the process concept;

— equipment location;

— project execution strategies;

— health, safety and environment;

— system concept and sizing;

— equipment type;

— equipment configuration;

— layout;

— maintenance and logistic support strategies;

— manning strategy;

— manning levels;

— operation strategies;

— facility modifications;

— spares and support strategy;

— reuse and/or disposal.

This part of ISO 15663 is applicable to all project decisions, but the extent of planning and management of the process will depend on the magnitude of the costs involved and the potential value that can be created.

The guidelines will be of value when decisions are taken relating to new investments in projects or during normal operation to optimize revenue.

2 Terms, definitions and abbreviated terms

For the purposes of this part of ISO 15663, the following terms, definitions and abbreviated terms apply.

2.1 Terms and definitions

2.1.1
benefit
creation of a capital asset, earning of revenue or improvement of a project environment

2.1.2
budget
estimate approved by management or the client as the cost control mechanism for a project

2.1.3
capital expenditure
money used to purchase, install and commission a capital asset

2.1.4
constraint
limit imposed externally or internally by the project which rules out the selection of an option if it is exceeded

2.1.5
cost breakdown structure
structure which relates to the methods that an organization will employ to record and report costs

2.1.6
cost driver
major cost element which, if changed, will have a major impact on the life-cycle cost of an option

2.1.7
cost element
identifiable part of the life-cycle cost of an option which can be attributed to an activity

2.1.8
life-cycle
cycle which comprises all development stages, from commencement of the study up to and including disposal of an item of equipment or function

2.1.9
life-cycle cost
discounted cumulative total of all costs incurred by a specified function or item of equipment over its life-cycle

2.1.10
life-cycle costing
process of evaluating the difference between the life-cycle costs of two or more alternative options

2.1.11
net present value
sum of the total discounted costs and revenues

2.1.12
operating expenditure
money used to operate and maintain, including associated costs such as logistics and spares

2.1.13
sensitivity analysis
process of testing the outcome of a life-cycle costing so as to establish if the final conclusion is sensitive to changes in assumptions

2.2 Abbreviated terms

CAPEX	capital expenditure
EPIC	engineer, procure, install and commission
FEED	front-end engineering design
FMEA	failure mode and effects analysis

FMECA	failure mode, effects and criticality analysis
NPV	net present value
OPEX	operating expenditure
OREDA®	offshore reliability database
RCM	reliability centred maintenance
WLC	whole life cost

3 Life-cycle costing within the asset life-cycle

3.1 General

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. While the life-cycle costing principles are identical across all phases, the organization in each phase differs in terms of

— the actions that need to be taken;

— the contribution each participant can make.

Figure 2 shows the “standard” field or project life-cycle together with some of the technical decisions taken at each stage, which may be the subject of life-cycle cost studies.

The technical processes in Figure 2 apply to both the original field development and subsequent changes made to the design.

Time scales, from concept to conclusion of commissioning, have been considerably shortened in recent years due to business pressures from the operators. Contractor and vendor selection is happening earlier 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. It is in this context that the life-cycle is discussed.

3.2 Concept selection

3.2.1 Scope of this stage

The scope of this stage normally includes gross comparisons of the major technical options. Processing and delivery are considered as well as procurement options (lease or buy) and the options for operation and support. The work normally includes examining and comparing alternative technical solutions. The focus is on the major cost and revenue trade-offs with minimum detail.

3.2.2 Contributions

This stage is normally undertaken by the operator in conjunction with a contractor who will help evaluate concepts within an accelerated procurement programme or within an alliance framework. Vendor contributions are likely to be limited to advice on major packages.

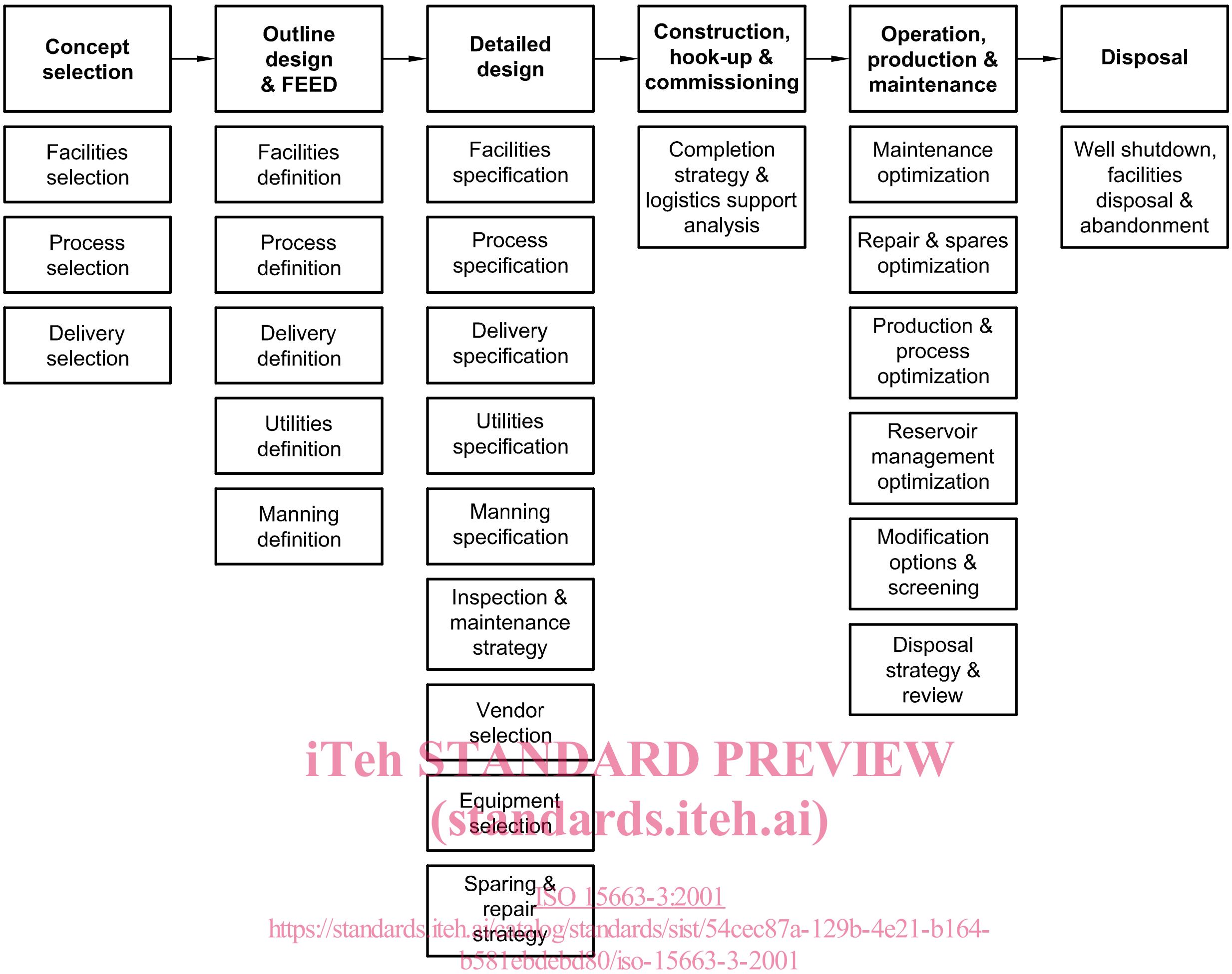

Figure 2 — Technical processes

3.2.3 Life-cycle costing activities

At the start of concept, a coordinator should be appointed with responsibility for developing the life-cycle costing strategy for the overall programme. In the majority of instances, the coordinator would come from the operator. Considerations in developing the strategy include ensuring that life-cycle costing contributes towards the development of the engineering and design, support and contract strategies; in practice this requires discussion and agreement from other internal functions and partners to achieve buy-in.

Consideration should also be given to generating a plan for conducting the work in detail for the system concept and in outline for later stages.

This plan should include

— **resource requirements**: to establish a budget for internal and external resources,

— **who should undertake the work**: potentially a team comprising operator, contractor, vendor and consultant personnel,

— **how the work will be conducted**: assessment criteria, constraints, options to be appraised and potential sources of data (internal and external),

— **training needs**: both general (to raise awareness for all team members) and specific (for those who will undertake the work),

- **life-cycle costing deliverables on completion of concept**: covering the contribution towards decision-making, establishing an audit trail for future phases and the inclusion of life-cycle costing within any future competitions (requirements specification and tender assessment),
- **the methodology to be used**: this should be the methodology detailed in ISO 15663-1:2000, Figure 1 [2], or an alternative methodology together with a justification as to why the standard methodology cannot be used,
- **the reporting relationships of those involved in undertaking the work**: particularly the reporting relationship with the manager accountable for delivering asset value,
- **the audit requirements**, in particular any requirements for independent assessment of work carried out at each life-cycle stage.

Potentially, the work can be undertaken by a team supplemented by contractors, vendors and consultants. The value in their contribution is in supplementing the operators' expertise so that either a broader range of concepts can be examined, or information provided that allows concepts to be compared at the same level of definition. This is likely to be particularly true where new or novel concepts are proposed; input from contractors and vendors may reduce uncertainty for these options.

At this stage in the programme, external support should be selected on the basis of capability, competence and track record.

Where a number of contractors have been asked to make proposals for the most suitable concept for a specified development as part of a design competition, it may be appropriate to specify that any bid be supported by life-cycle cost information. The cost headings can be specified together with the data sources and estimating process to be used. The aim should be to ensure bids can be compared on an equal basis and all important costs have been included.

3.3 Outline design/FEED

3.3.1 Scope of this stage

The scope of this stage includes the identification and examination of the technical options for facilities, processes and delivery leading to the definition of a preferred technical solution. Sizing and scoping the required utilities (power generation, accommodation, water supply, logistic support, etc.) and examining the cost trade-offs between facilities/processes and utilities are also within the scope of this stage. Life-cycle costing activity stops when a preferred solution is identified, it does not attempt to optimize the solution. Overall layout, weight and dimensions are normally fixed on completion of outline design.

3.3.2 Contributions

This stage is normally undertaken by the operator in conjunction with a contractor who will evaluate the technical options. Vendors' contributions are likely to add significant value with their specialist knowledge of the cost and performance of alternative options.

3.3.3 Life-cycle costing activities

The life-cycle costing work undertaken during concept selection will include the identification of a preferred option together with a corresponding outline engineering and design, support and contracting strategy, all culminating in a requirement specification. This will define the content of the life-cycle costing programme during this stage. It is at the beginning of this phase that the process of making decisions on competing equipment options normally starts.

For life-cycle costing the principal objective in this phase is to evaluate alternative methods of meeting specific functional requirements and not to optimize the defined system solution. The most important feature of the life-cycle costing activities in this phase is knowing when to stop work. For example, if life-cycle costing analysis at concept identified the provision of water to the platform as an issue (either a risk item or cost driver), then work in outline design concludes when waste heat evaporation is identified as the solution. It will then be the objective of life-cycle costing activities during detailed design to develop and optimize the waste heat evaporation solution.