

# National strategy for digitalization of LCI exchange

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## Foreword

National strategy for digitalization of LCI exchange was approved by Sector Board Petroleum 2022-MM-DD.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost-effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactorily;
- replace oil company specifications where possible;
- be available as references for the authorities' regulations;
- be cost effective; and
- promote the Norwegian sector as an attractive area for investments and activities.

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOK A-001 directive.

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

## Introduction

A current industry goal is to digitalize processes beyond company boundaries. There is, as such, an urgent need for standards and technical solutions that enable digital exchange of machine-readable technical information between all stages and functions throughout the life cycle of energy installations. Although most such life cycle information (LCI) is already exchanged between digital systems, most of it is still locked in proprietary data solutions (e.g. 3D applications and models), or in the form of documents and diagrams that digital systems are unable to understand. Interoperability, i.e. the ability of two or more digital systems to exchange information and understand this information, is therefore a key challenge in realizing digitalization strategies related to digital twins, data-centric forms of organization, further automation, and secure and efficient operation of physical facilities.

NORSOK EG Z-TI is mandated by the Sector Board Petroleum to develop an industry-wide strategy for the Norwegian oil and gas industry to digitalize LCI exchange across stakeholders throughout assets' lifecycle. The digitalization strategy is outlined in this document and is therefore governed through a mandate from the Sector Board Petroleum. The digitalization strategy's overall goal is to develop (1) standards for digital exchange of LCI and (2) digital solutions that adopt and implement these standards at an industry level.

NOTE 1 EG is an abbreviation for expert group. Z-TI is the technical information discipline.

Meeting the strategy's two goals can only take place through close cooperation between existing Standards Development Organizations (SDO's) and industry bodies on the national (Standards Norway, NEK, NORSOK, PCA, NOROG) and international (ISO, IEC, IOGP, CFIHOS, JIP33, DEXPI, Industry 4.0) arenas. Many of these bodies already have different standards that are partly related to LCI (e.g. ISO15926, IEC81346, IEC61987, ISO14224). The challenge is that several of these standards are not comprehensive and require further development before they can be adopted and implemented in technical solutions. In addition, many of the standards build on different technical foundations. It is thus difficult, if not even impossible, to combine them a technical solution. A goal for the current digitalization strategy is therefore to help ensure that LCI standards can fit together as independent building blocks in the future.

Solutions to these challenges, however, does not reside with individual stakeholders and their local environments. Rather, solutions are to be found on the common arena, in the interface between stakeholders. There are already significant investments made in developing technical solutions based on existing standards. This is mainly often pursued through company-internal initiatives (e.g. the technical solution MMD at Aibel), through large cap ex projects (e.g. NOAKA) and in various joint industry projects (e.g. READI, EqHub, IMF). While many of these are initiated as autonomous initiatives, there is a currently movement towards more cross-initiative coordination (e.g. NOAKA/READI). However, there remains work to be done on the common arena to ensure that the resulting technical solutions and deliverables solve the overall challenges associated with digital exchange of structured and machine-readable information in a systematic and consistent manner.

The current digitalization strategy is based on an innovative approach to standardization. This approach utilizes the momentum of independent project deliverables to continuously create business value, to deliberately expand upon, further develop, and harmonize existing standards. This requires orchestration of standardization activities across individual delivery projects. The current strategy offers a road mapping process as method for achieving this. Road mapping offers the energy industry a way to will jointly (1) identify key standardization activities and (2) prioritize which of these are to be pursued through different delivery projects. A necessary additional element is a set of underlying principles that will ensure that the standardization activities in the delivery projects become technically consistent, and thus applicable for industry level adoption and implementation.

**Postadresse**

Standard Norge  
Postboks 242  
1326 Lysaker

**E-post**

petroleum@standard.no

**Telefon**

67 83 86 00

**Organisasjonsnummer**

985 942 897

www.standard.no

NOTE 2 Members of the Sector Board Petroleum are representing the NORSOK owners, Petroleum Safety Authorities, DNV and labour organisations.

## 1. Scope

Included in clause 4.

## 2. Normative references

There are no normative references in this document.

## 3. Terms and definitions

### 3.1

#### **digitizing**

process of converting analogue information to digital format

EXAMPLE Paper-based documents to PDF documents or paper-based tabular data into spreadsheet or database.

### 3.2

#### **digitalization**

application of digital technologies and information to improve work processes and organizational structures (roles, and responsibilities)

Note 1 to entry: *Digitizing* (3.1) is a technical pre-requisite for digitalization.

### 3.3

#### **standardization**

activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context

Note 1 to entry: Standardization is a pre-requisite for digitalization on the common arena.

Note 2 to entry: The creation, diffusion, adoption and governance (3.4) of standards.

[SOURCE: NS-EN 45020:2016, Standardization and related activities - General vocabulary (ISO/IEC Guide 2:2004)]

### 3.4

#### **governance**

process by which stewardship responsibilities are organized and carried out

rules (principles, policies, frameworks) for organizing and carrying out processes (e.g. standardization, digitalization)

organization of stewardship of standards – requirements – prerequisites – environmental issues – object of interest – domain – collaboration -

#### **Postadresse**

Standard Norge  
Postboks 242  
1326 Lysaker

#### **E-post**

petroleum@standard.no

#### **Telefon**

67 83 86 00

#### **Organisasjonsnummer**

985 942 897

www.standard.no

Note 1 to entry: Rules includes principles, policies and framework by which an organization is directed and controlled

Note 2 to entry: RoadMapping is an activity to support the governance process

### 3.5

#### stewardship

responsibility for the maintenance applicable to one or more administered items (e.g. standards)

## 4. Scope of work

This document outlines the national strategy for digitalization of LCI exchange and includes strategic roadmapping and foundational principles and mechanisms necessary to govern this process.

**What?** Central to the national digitalization strategy is to establish national standards for structured and machine-readable LCI. These standards will be based upon relevant existing international and/or national standards or best practices - where such are available, further develop standards when necessary, and offer additions back to the relevant standardization bodies upon completion. However, instead of developing standards and digital solutions that implement these standards independently, this strategy offers an approach to standardization where standards are adapted and expanded as part of developing digital solutions that deliver short-term business value. Such digital solutions need to be developed through multiple parallel digitalization initiatives. Acknowledging that these initiatives will be formally and practically independent of each other, the national strategy offers mechanisms for orchestrating among such initiatives through strategic roadmapping. Grounded in a set of foundational principles, strategic roadmapping is a recurring process of updating and adjusting a shared roadmap for digitalization of LCI exchange throughout the Norwegian energy industry, including oil & gas and renewables.

**Why?** The national LCI strategy seeks to address the persisting challenge of little or no coherence to jointly solve central challenges to digitalization of LCI exchange throughout the Norwegian oil and gas industry.

Although most companies to a large extent have digitalized their internal business processes, much of the technical information exchange between companies remains extract from databases as documents and images. There is consensus that shared digital information exchange formats is key to transitioning from document-centric information exchange towards exchange of structured and machine-readable technical information across stakeholders throughout assets' lifecycle (i.e., to digitalized life-cycle information exchange). Yet, much of the work on digitalization of LCI exchange is currently driven through disparate activities within individual enterprises, through larger capital expense projects or across various joint industry initiatives.

Much of the potential for digitalization of LCI exchange remains unreleased because of a lack of coordination among these initiatives about which standards to use, as well as to what extent existing standards need to be modified, how, and in accordance with whose needs. The result is a situation with independent activities with little or no coherence to jointly solve central challenges related to digitalization of LCI exchange with standardized information exchange formats. The national LCI strategy offers strategic roadmapping as an approach to address these persisting coordination challenges.

**Postadresse**

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Postboks 242  
1326 Lysaker

**E-post**

petroleum@standard.no

**Telefon**

67 83 86 00

**Organisasjonsnummer**

985 942 897

www.standard.no

## 5. Strategic roadmapping

Strategic roadmapping is the instrument to pursue the LCI strategy's goal of maturing existing standards through continuous delivery of business value. Roadmapping is a strategy process centred on the creation and continuous updating of a shared roadmap for digitalization of the exchange of digital information across stakeholders throughout the lifecycle of assets. The roadmap presents an overview of interdependencies between standards, their elements, and an ordering of the standardization activities that need to be addressed next.

## 6. Foundational principles

The roadmapping process is grounded in a set of foundational principles that operationalize the strategy's overall goal of maturing existing standards through continuous delivery of business value.

- 1) Principle of COMMON TECHNICAL BASE.  
This means: A few technical principles must be commonly accepted and understood, and not being mixed with techniques and tools.  
This implies: Aspects (functional, location, product), systems breakdown and a common information modelling framework must be established.
- 2) Principle of AREA DIVISION THROUGH LAYERING.  
This means: Reduce technical dependencies between standards or parts of standards through clearly defined layers of standards and standard components.  
This implies: Enabling and using clearly defined interfaces between standard elements to avoid extensive coordination between all sub-activities.
- 3) Principle of DELINEATION.  
This means: Maturing existing standards through development of concrete joint digital systems.  
This implies: These systems will support of clearly delineated tasks, workflows, or information flows to avoid scope creep and focus shift, while quickly delivering business value to the stakeholders involved.
- 4) Principle of SUCCESSIVE GENERALIZATION.  
This means: Build on existing formats and standards already in use by national stakeholders.  
This implies: Reduce techno-organizational dependencies -- where possible -- by limiting number of stakeholders involved in activities and initiatives, and instead increase generalization and scope of standards successively.
- 5) Principle of STEPWISE TRANSITIONS.  
This means: Changes to the way organizations exchange LCI need to be negotiated against the conserving forces of technical, organizational, and financial investments  
This implies: Plan for gradual, stepwise changes that demonstrate value of new digital solutions for key stakeholders.
- 6) Principle of FOUNDATIONAL HARMONIZATION.  
This means: Ensure interoperability by developing a common foundational structure for Life Cycle Information (LCI) across sectors and industries.  
This implies: Also align standardization institutions (e.g. Industrie4.0, ISO, IEC).
- 7) Principle of STRATEGIC ALIGNMENT.  
This means: Influence through participation in specific initiatives, e.g. PCA and CFIHOS.

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**E-post**

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985 942 897

www.standard.no

This implies: Development of standards relevant to digitalization of LCI exchange unfolds in numerous standardization bodies and institutions. National actors will align with and work through a few chosen institutions to leverage joint influence instead of going it alone.

8) Principle of UNIQUENESS, OBJECTIVE AND ORGANISATION.

This means: The energy industry has for several decades been using proprietary and company specific databases and models, hence also company specific requirements.

This implies: To re-establish this through standards on the common arena requires the same magnitude of management attention, long-term funding and skilled resources.

9) Principle of RESOURCES AND CULTURE.

This means: Roadmapping requires both time and competency, and for it to succeed stakeholders involved need to dedicate internal resources over time to the roadmapping work.

This implies: A cultural change in the industry and within companies is necessary, not only to accept using the common arena, but also doing all business on the common arena.

10) Principle of ROADMAPPING AND PRINCIPLES.

This means: These 10 principles are necessary for creating a common understanding and Roadmapping will be a continuous process and tool for activity overview within and across initiatives. The roadmapping process is essentially an interactive learning process.

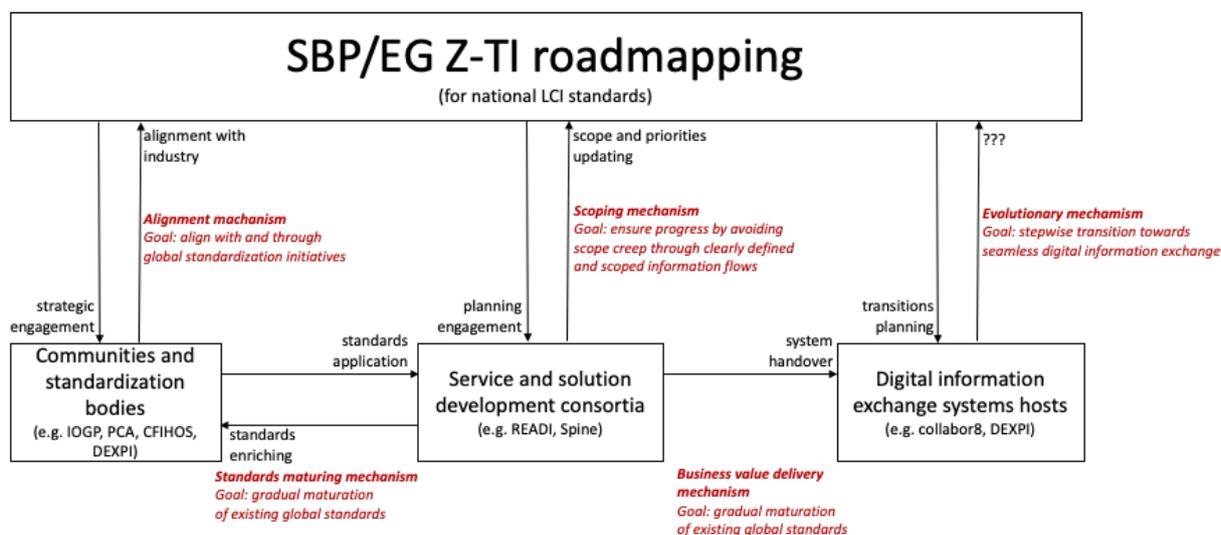
This implies: Bringing together stakeholders with different skills and competencies. The roadmapping result presents an overview of interdependencies between activities and standards elements, and an ordering of the standards elements that need to be addressed next.

These 10 principles must be acknowledged by stakeholders, project owners and project participants, organisations and initiatives in general, and the roadmapping process is orchestrated through a set of guiding principles.

## **7. Roadmapping mechanisms**

### **7.1 General**

Strategic roadmapping offers a set of mechanisms to orchestrate the digitalization of LCI exchange at the industry level. These mechanisms acknowledge that important decisions and control over central resources lies among companies and initiatives that are formally and practically independent of each other and the strategic roadmapping process. Roadmapping is essentially an interactive learning process to increase understanding of the complex technological and task interdependencies among standards or parts of standards, standardization initiatives, and concrete software development projects. Roadmapping achieves this by engaging with and bringing together stakeholders with different skills and competencies through five mechanisms: (1) scoping, (2) standards maturing, (3) business value delivery, (4) alignment, and (5) solution evolution.



**Figure 1 RoadMapping**

## 7.2 Scoping mechanism:

Through planning engagement EG Z-Ti offers advice, guidance, and assistance in setting up, defining, and planning service and solution development consortia. The purpose of this mechanism is to provide the consortia information of clearly defined and scoped information flows and/or workflows to support, relevant standards to apply, and activity priorities to ensure progress towards delivering business value (i.e., useful and innovative services and solutions). Planning engagement can take the form of active participation in project management, steering committee, or technical committees. Experience and insight gained from planning engagement will form the basis for scope and priorities updating of the roadmap.

## 7.3 Standards maturing mechanism:

Service and solution development consortia are the main instruments for maturing standards. The main purpose of the standards maturing mechanism is to ensure that service and solution development consortia apply relevant standards where these exist in order to expand and enrich them. Based on roadmapping, EG Z-TI will offer advice to service and solution development consortia on relevant existing standards to apply and how these need to be expanded. EG Z-TI can also provide assistance in feeding changes to existing standards back to the relevant standardization bodies (i.e. standards enriching).

## 7.4 Business value delivery mechanism:

By working from early proof of concepts and through tight iterations of changes and expanding, software development consortia will delivery functionality (i.e. business value) as the project advances. Through active participation scoping and prioritizing these software development activities, roadmapping is to ensure that the end product handed over to the hosting organization and the end of the software development project is useful and relevant (i.e. delivery business value) for the targeted stakeholders' information needs and work flows.

### Postadresse

Standard Norge  
 Postboks 242  
 1326 Lysaker

### E-post

petroleum@standard.no

### Telefon

67 83 86 00

### Organisasjonsnummer

985 942 897

www.standard.no

### 7.5 Alignment mechanism:

Roadmapping needs to constantly engage with international communities and standardization bodies, either through active participation or informal coordination, to work towards foundational harmonization internationally throughout the oil and gas industry and across industries. Strategic alignment means that EG Z-TI will seek influence through chosen standardization bodies rather than as an independent actor.

### 7.6 Solution evolution mechanism:

The choice of information and workflows to target for software development projects is grounded in long-term transition strategies towards digitalized exchange of structured and machine-readable life-cycle information. The long-term transition strategies are pursued by working with and through hosting organizations to modify and update systems in use to move the industry in the desired direction.

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**E-post**

petroleum@standard.no

**Telefon**

67 83 86 00

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985 942 897

[www.standard.no](http://www.standard.no)