International Association of Oil & Gas Producers

IOGP Report 665

Design guidance for subsea carbon capture and storage systems

DATE 21st Feb 2024

PRESENTER David Saul

Introduction & Focus of Presentation

- My role
- Who are IOGP
  - The IOGP Subsea committee
- Drivers for the development of subsea CCS guidance
  - Development process
  - Structure
  - Maintenance
- Use case examples
- Other IOGP Energy Transition activities

About IOGP

We are the global voice of our industry

We bring the industry together

We drive good practices

We serve stakeholders around the globe as go-to experts

International Association of Oil & Gas Producers

We speak on behalf of a global membership

IOGP has 90 Members (as of 1st January 2024

Companies

Associations

Associate Members

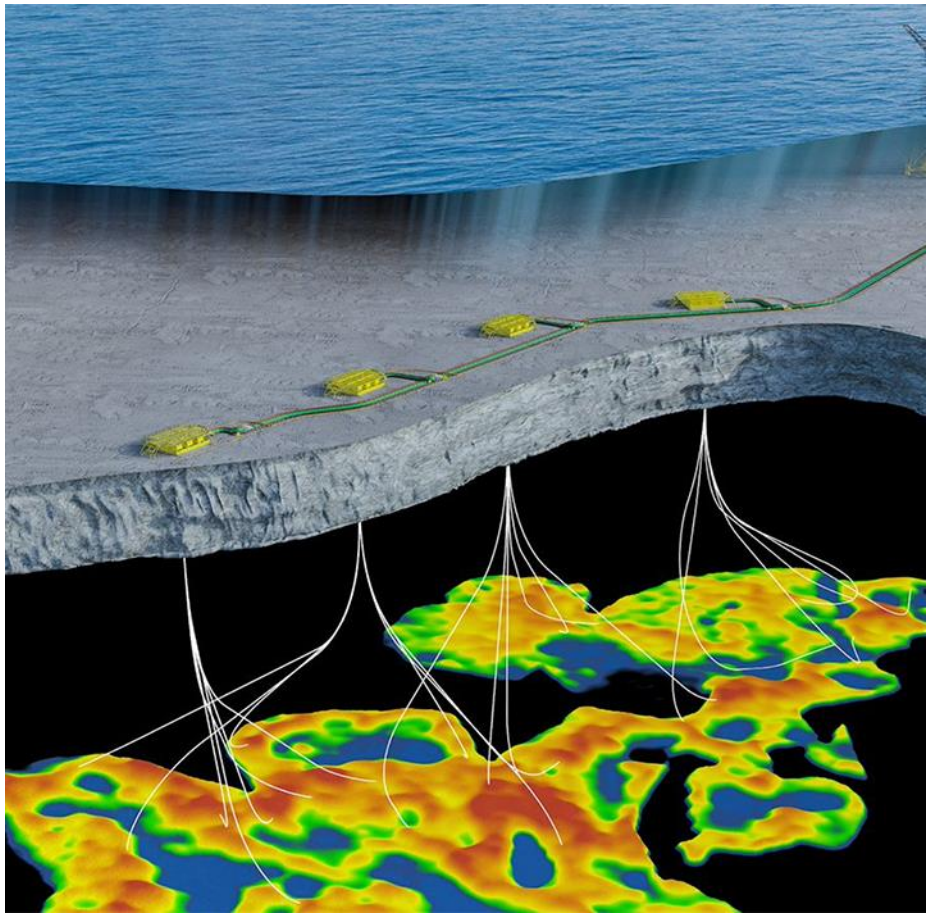
International Association of Oil & Gas Producers

IOGP Subsea Committee Vision & Structure

The Subsea Committee purpose and vision is to:

- improve HSSE (Health, Security, Safety, Environment) performance
- contribute to value creation (including standardization & industrialization)

In 2023 the Subsea Committee prioritized development of industry guidance for subsea CCS systems to expedite the SSI process and add value to the subsea industry for this new area of subsea work.



International Association of Oil & Gas Producers

IOGP Report 665

International Association of Oil & Gas Producers

Subsea CCS Expert Group – Terms of Reference

Key elements of the Terms of Reference

Background: as industry embraces the “energy transition” and seeks to reduce carbon emissions, operators and suppliers are planning projects that involve capture carbon and storage offshore

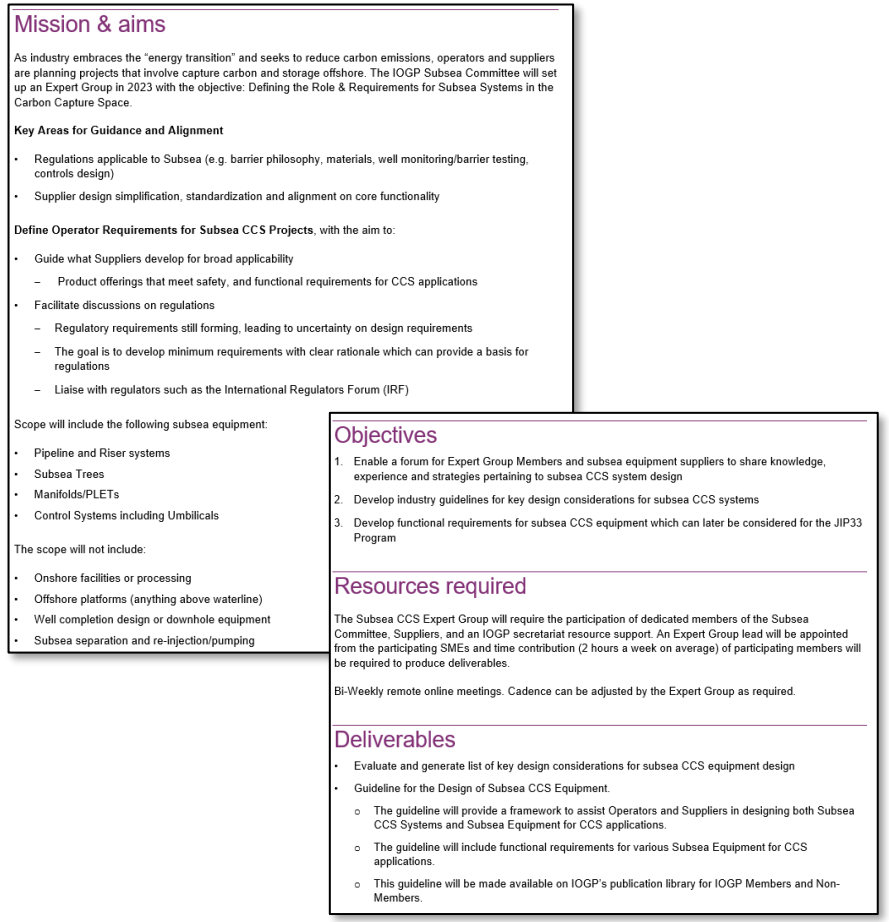
Objective: define the role & requirements for subsea systems in the carbon capture space

Develop: guidance and alignment

- Regulations applicable to subsea
- Supplier design simplification, standardization and alignment on core functionality

Define: Operator requirements for subsea CCS projects

- Guide what Suppliers develop for broad applicability
- Facilitate discussions on regulations



Mission & aims

As industry embraces the “energy transition” and seeks to reduce carbon emissions, operators and suppliers are planning projects that involve capture carbon and storage offshore. The IOGP Subsea Committee will set up an Expert Group in 2023 with the objective: Defining the Role & Requirements for Subsea Systems in the Carbon Capture Space.

Key Areas for Guidance and Alignment

- Regulations applicable to Subsea (e.g. barrier philosophy, materials, well monitoring/barrier testing, controls design)
- Supplier design simplification, standardization and alignment on core functionality

Define Operator Requirements for Subsea CCS Projects, with the aim to:

- Guide what Suppliers develop for broad applicability
  - Product offerings that meet safety, and functional requirements for CCS applications
- Facilitate discussions on regulations
  - Regulatory requirements still forming, leading to uncertainty on design requirements
  - The goal is to develop minimum requirements with clear rationale which can provide a basis for regulations
  - Liaise with regulators such as the International Regulators Forum (IRF)

Scope will include the following subsea equipment:

- Pipeline and Riser systems
- Subsea Trees
- Manifolds/PLETs
- Control Systems including Umbilicals

The scope will not include:

- Onshore facilities or processing
- Offshore platforms (anything above waterline)
- Well completion design or downhole equipment
- Subsea separation and re-injection/pumping

Objectives

1. Enable a forum for Expert Group Members and subsea equipment suppliers to share knowledge, experience and strategies pertaining to subsea CCS system design
2. Develop industry guidelines for key design considerations for subsea CCS systems
3. Develop functional requirements for subsea CCS equipment which can later be considered for the JIP33 Program

Resources required

The Subsea CCS Expert Group will require the participation of dedicated members of the Subsea Committee, Suppliers, and an IOGP secretariat resource support. An Expert Group lead will be appointed from the participating SMEs and time contribution (2 hours a week on average) of participating members will be required to produce deliverables.

Bi-Weekly remote online meetings. Cadence can be adjusted by the Expert Group as required.

Deliverables

- Evaluate and generate list of key design considerations for subsea CCS equipment design
- Guideline for the Design of Subsea CCS Equipment.
  - The guideline will provide a framework to assist Operators and Suppliers in designing both Subsea CCS Systems and Subsea Equipment for CCS applications.
  - The guideline will include functional requirements for various Subsea Equipment for CCS applications.
  - This guideline will be made available on IOGP’s publication library for IOGP Members and Non-Members.

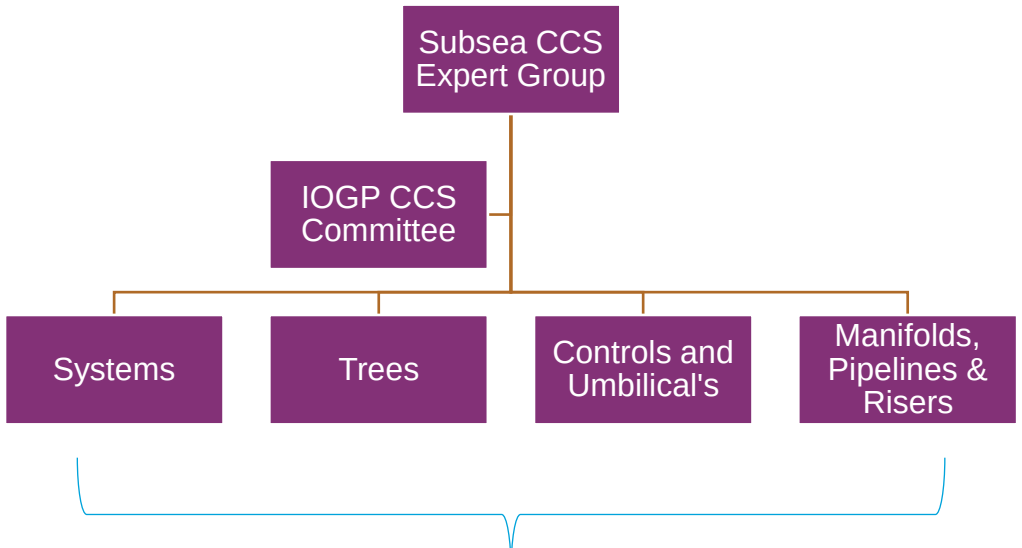
International Association of Oil & Gas Producers

Scope and Boundaries of Applicability

- Systems and equipment designed for CO2 transport subsea and injection into a well, for permanent sequestration in a geologic reservoir.
- Content applies only to equipment submerged underwater.
- Focus is on new build systems and equipment
- Wells are assumed to be designed, drilled, and completed specifically for CO2 injection and sequestration.
- Subsea pumping or compression is not in scope.

Subsea Committee CCS Expert Group Organization and Team Structure

Work Organization



Individual Work Streams

International Association of Oil & Gas Producers

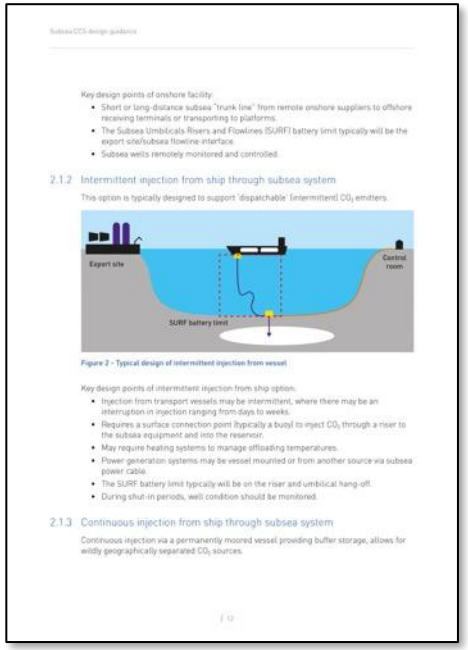
IOGP Report 665 Overview

IOGP Report 665 is written as design guidance, not a specification or requirement

- Highlights aspects that are unique vs same between CCS and hydrocarbon system/equipment design
- Provides references to existing industry documents & requirements to avoid duplication and promote standardization
- Provides recommendations for design (e.g., PSL, trim)

Main Content Sections

1. Subsea CCS projects overview
2. Subsea systems design
3. Subsea architecture
4. Equipment functional requirements
5. Appendices
   A. Reuse of equipment
   B. Installation, commissioning, and intervention



International Association of Oil & Gas Producers

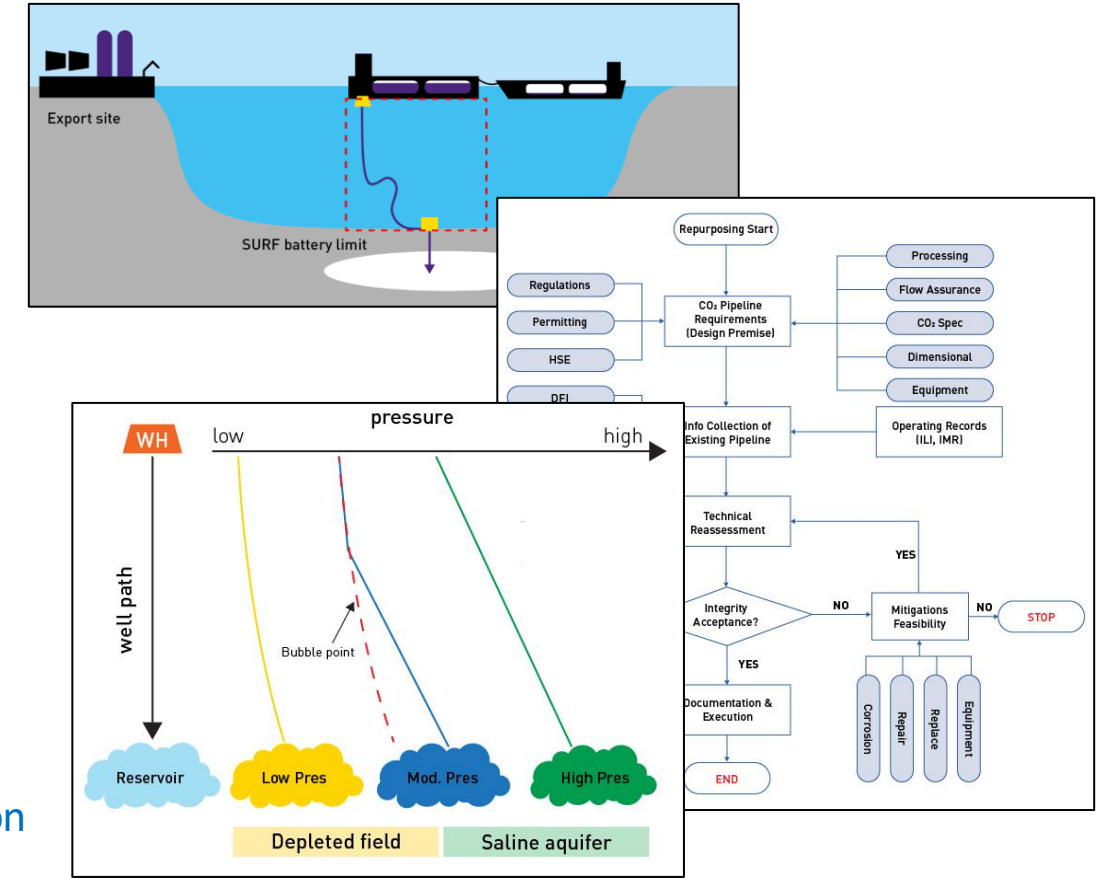
The Guidance Document in a Little More Detail

Subsea systems design
- alternative system concepts
- impacts of reservoir type

Subsea architecture
- layout, sizing & depth considerations
- qualification, availability
- barrier philosophy
- expansion

Equipment functional requirements
- trees
- structures
- pipelines
- controls & risers

Appendices
- reuse of equipment
- installation, commissioning & intervention



International Association of Oil & Gas Producers

Use Cases

- People new to subsea CCS
  - primer for subsea CCS
  - relevant standards
- Projects delivering a subsea CCS development
  - pros and cons of various options
  - design considerations
  - relevant standards
- Suppliers looking to develop subsea CCS hardware
  - Functional requirements
  - relevant standards

International Association of Oil & Gas Producers

Contributors & Reviews to New Guidance

Operators and Suppliers

Regulators*

*who accepted the offer to review the document prior to publication

Other IOGP Energy Transition Activities

CCS

- Methodology for CO_2 avoidance
- Subsurface Risk & uncertainty assessment tools
- Methodology to compare capture technologies

Electrification

- Technology Deployment Catalogue
- Early Concept Screening Methodology
- Specific Electrification Project Screening Methodology

Flares & Vents

- Recommended Practice to minimize/avoid flaring sources
- Database with typical venting situations and their possible solutions
- Guidelines to capture vent streams

Energy Efficiency

- Best Practices for energy Assessment & Audits
- KPIs for management of energy efficiency
- Compendium - Solutions

Hydrogen Opportunity Framing Workshop

- Revised mapping of stakeholders and ongoing activities
- Engagement with Integrated Gas Companies
- Refresh/update 2022 OFW

Collaborations

GGFR Global Gas Flaring Reduction Partnership

ipieca

OGCI OIL AND GAS CLIMATE INITIATIVE

METHANE GUIDING PRINCIPLES

GMP Oil And Gas Methane Partnership 2.0

API

energy institute

ISO

Next Steps

IOGP Subsea Committee anticipates revisions will be needed in the future

- Envision incorporating feedback, lessons, advances in technology and regulatory development
- Potential to handover document to a standards organization (e.g., API) to develop a specification, similar to JIP33 / IOGP work for S-561 and S-708

Work Plans in 2024

1. **Barrier and Isolation Philosophy Work Scope -** Interdisciplinary work with IOGP CCS and Wells Committee's to define barrier and isolation philosophies for subsea CCS applications
2. **Post Publication Support -** Review feedback / evaluation clarifications and questions
3. **Communication outside of IOGP -** Present at conferences / industry publications to raise awareness of document and utilization/feedback

International Association of Oil & Gas Producers

For more information please contact:

Diana Khatun – dk@iogp.org

IOGP Headquarters

City Tower, 40 Basinghall St, London EC2V 5DE, United Kingdom
T: +44 (0)20 3763 9700
E: reception@iogp.org

IOGP Americas

T: +1 713 261 0411
E: reception-americas@iogp.org

IOGP Asia Pacific

T: +60 3-3099 2286
E: reception-asiapacific@iogp.org

IOGP Europe

T: +32 (0)2 790 7762
E. reception-europe@iogp.org

IOGP Middle East & Africa

T: +20 120 882 7784
E: reception-mea@iogp.org

www.iogp.org