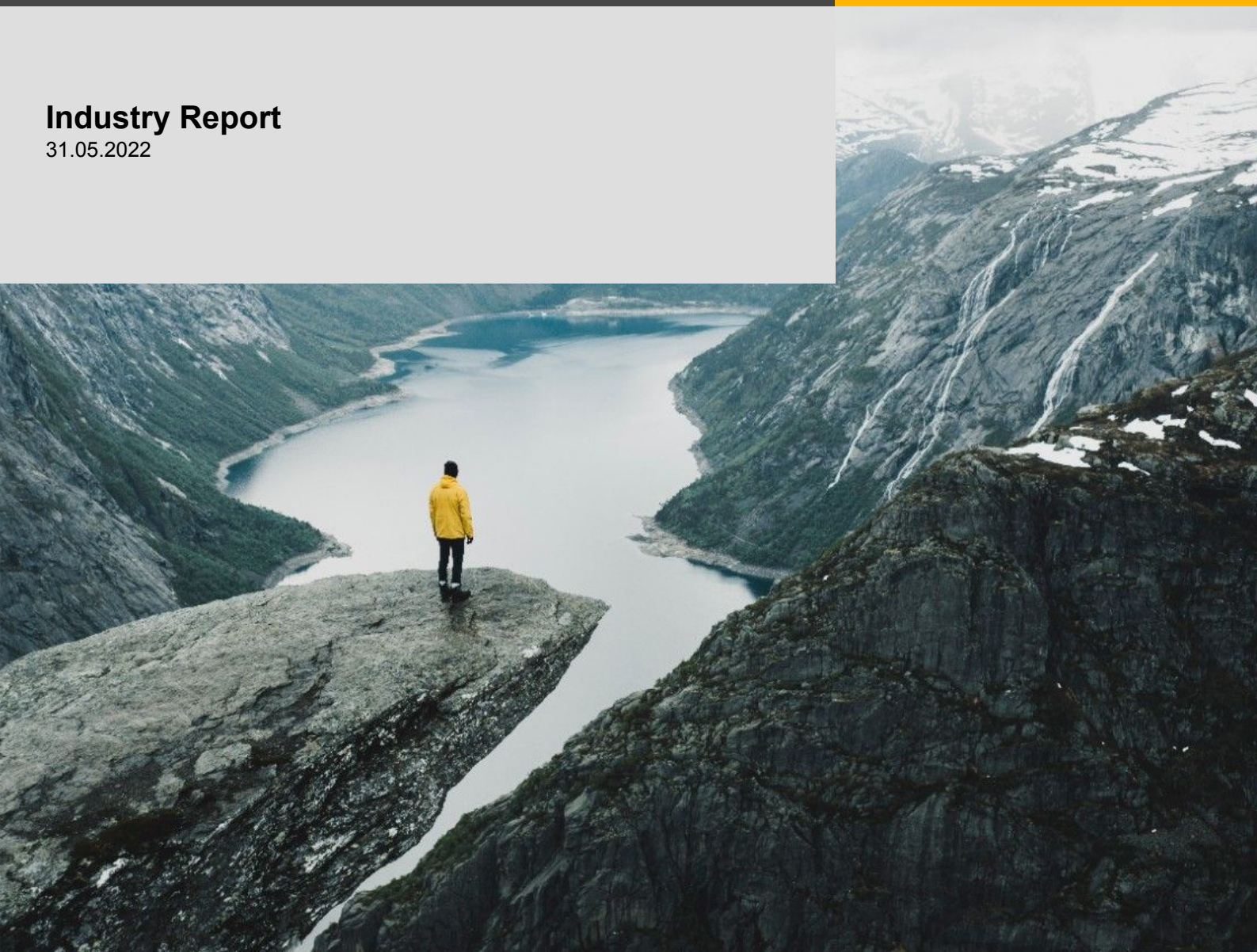
Competency Analysis of the E&P Industry

Industry Report
31.05.2022



This report has been prepared by PricewaterhouseCoopers in collaboration with Neptune Energy Norway and Wintershall Dea Norway. This is a contribution to the industry that can be used by E&P companies in their planning and implementation of competence-enhancing measures, and by educational institutions in their planning of new study programs. We would like to extend a big appreciation to all the key businesses and knowledge actors in the breadth of Norwegian business and industry who, with commitment and significant effort, have contributed in this project.

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Preface

We live in an era of change where the European Green Deal and EU's industrial strategy provide clear guidelines for which energy solutions that will be in demand the next decades. New climate ambitions set the direction towards new energy industries like Hydrogen and Offshore wind and also measures to reduce CO_2 footprint such as Carbon Capture and Storage (CCS). This raises the need for the traditional oil and gas industry to move into new areas of operations. While Norway can be well positioned to succeed in several new energy industries it necessitates that we act quickly and make good strategic choices. Concern relates - amongst others - to the pace of this development in Norway and as Kristin Kragseth, CEO at Petoro, so delicately puts it "Norwegian authorities must learn a little from the sport of skating - it must go a little faster in the turns". Thus, it is gratifying to see that the government is starting to really invest, and see how the competence and capacity needed is the core of making it happen (Hovland, 2022).

The expertise that the E&P companies currently possess is a great competitive advantage and can result in a strong strategic position in new industries if it is utilised in a timely and good manner. As an energy nation we have established competitive networks and research environments which will be critical in utilising existing knowledge and skills in new industries. While the production and use of hydrocarbons as a driver for climate change has been communicated broadly, the E&P sector's role as a central part of the solution and transition to renewables has been insufficient. Thus, this project aims at providing insight into how a vast majority of the current E&P competencies are, and continue to be, critical in the energy transition and that the importance of transferable E&P knowledge and skills must be acknowledged. More specifically this entails a framework of the transferability of the E&P competence towards CCS, Hydrogen and Offshore Wind, and identified competency gaps. Moreover, it aims at illustrating where E&P companies have the best conditions to succeed and how great the potential in utilising E&P competency in new industries can be.

We hope this report will provide valuable insight and work as a mean to support an industry which is, and will continue to be, very important for Norway in ensuring and handling the energy transition.

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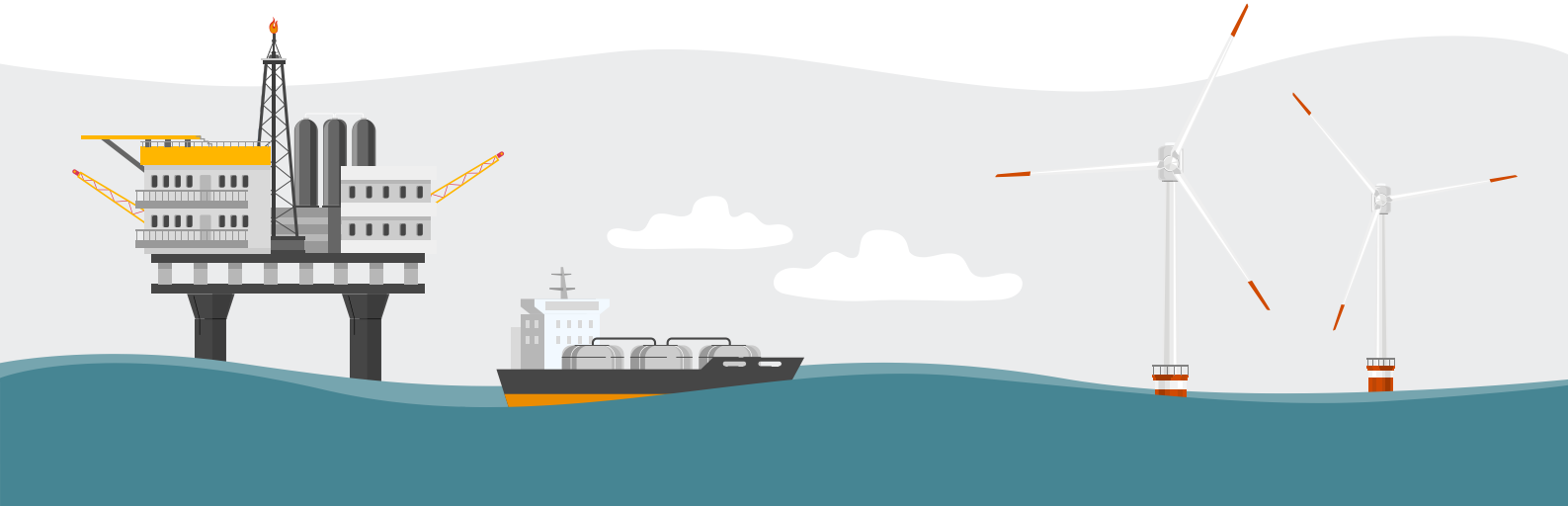
Executive Summary

To meet the ambitions of reducing global warming there is a need for change and extensive efforts towards new energy industries need to be taken. Norway has great opportunities within several new industries where CCS, Hydrogen, and Offshore wind are particularly highlighted as important contributions to a future low-carbon vision for Norway and the activities on the NCS. While the E&P industry is highlighted as relevant in the energy transition, there is a high degree of uncertainty related to the magnitude of the transferable competency and required organisational restructuring. Thus, PwC have in collaboration with Wintershall Dea Norway and Neptune Energy Norway conducted a mapping of the competency within E&P companies and the transferability of the competence towards CCS, Hydrogen and Offshore wind value chains. The purpose is to identify whether E&P companies to a large extent possess the competency required for the energy transition, and to develop a competency framework to aid companies to utilise existing knowledge and skills in new energy industries. Moreover, it aims to contribute at communicating how the E&P industry is a central part of the solution and the importance of the E&P competency in the energy transition.

Within the **CCS value chain**, findings indicate that E&P companies can take a particularly strong position within carbon storage, but that Norway also has unrealised potential within carbon transport. The **Hydrogen value chain** provides great opportunities within production and export of green and blue hydrogen. Lastly, there are great opportunities for **floating wind farms** on the NCS where E&P companies can take a strong position in several value chain phases. Findings suggest that Business Development & Commercial, Leadership and Project Management, Topside & Subsea Engineering, Joint Venture & License Management, and HSEQ are amongst the top critical competencies transferable from the E&P industry to CCS, Hydrogen, and Offshore wind. This is based on the current maturity of the value chains in these industries and, thus, the need for different competencies, like operations and maintenance, may change in the future. The base education and knowledge within the different competency areas are generally found to be transferable and highly relevant for the value chains of the new industries. However there have been identified gaps and the main challenges in transitioning to new energy industries lie within understanding the new value chains and framework conditions, changing the way of working and the prevailing mindset of the oil and gas industry today.



1

Hypotheses and Methodological Approach

The E&P industry need to adapt to changing framework conditions and market needs and is essential in the energy transition

Background for the study

We live in an era of change and extensive efforts need to be taken to meet the ambitions of reducing global warming. This is at the heart of the political agenda and it is a top priority for an increasing number of companies. Sustainability as such is also key for the workforce of the future, which to a large extent is guided by their core values when choosing an employer. The oil and gas industry finds itself at the core of this challenge, and particularly Stavanger, where the Norwegian Minister of Trade and Industry has stated that whether Norway succeeds with the industrial restructuring or not is decided in the Stavanger region (Woie, 2022).

The expertise of the oil and gas sector is highlighted as very relevant in the energy transition, and in some cases critical to enable the transition to new industries including CCS, Hydrogen, and Offshore wind as an initiative to reduce carbon footprint. There is, however, a high degree of uncertainty related to the magnitude of the transferable competency needed and the organisational restructuring required to make the shift towards these new industries. Moreover, we have yet to find a publicly available report or study that - in detail - covers the transferability of different E&P competencies to other relatable industries on a discipline level.

To cover this gap PwC has, together with Wintershall Dea Norway AS and Neptune Energy Norway AS, conducted a mapping of the competencies within E&P companies to assess the degree of competency transferability to the CCS, Hydrogen, and Offshore wind industries. The purpose of this analysis has been to establish a competency framework that E&P companies can use in their planning and implementation of upskilling initiatives. This involve identified gaps between current competency base and what is needed for the future when transitioning to new energy markets, and how companies can close these competency gaps.

Hypotheses

Based on the identified research gap in current literature and the defined industry need for such a study, three hypotheses have been developed:

Competency framework

A competency framework can support in developing competence-enhancing initiatives to cover competency gaps

Generic competencies

Generic E&P disciplines are highly transferable to new industries

Technical competencies

Technical E&P disciplines are critical in new industries but require upskilling

Methodological approach based on an organisational and discipline perspective

The methodological approach is based on an organisational and discipline perspective as illustrated in figure 1 below. This forms the basis for the competency model developed for the E&P companies that can be utilised in their planning and implementation of upskilling initiatives. The scope includes 13 E&P competency areas that are generated based on 27 different competency disciplines. The competency areas include five technical competencies and eight generic competencies to ensure a proper aggregation level for the model. Competency mapping is conducted through desktop analysis of existing studies; quantitative data through questionnaires; and qualitative data through interviews with personnel from participating companies, renewable industries, and educational institutions.

The project was completed in 14 weeks and consisted of four phases:

1. Preparatory work included document review, generation of hypotheses, identification of interview sample, and suggested approach.
2. Establishment of working group from participating companies, scope, project plan, design criteria, and validation of sample and research strategy.
3. Competency analysis through quantitative and qualitative data collection techniques.
4. Consolidation of results and completion of customised reports for participating companies and the aggregated industry report.

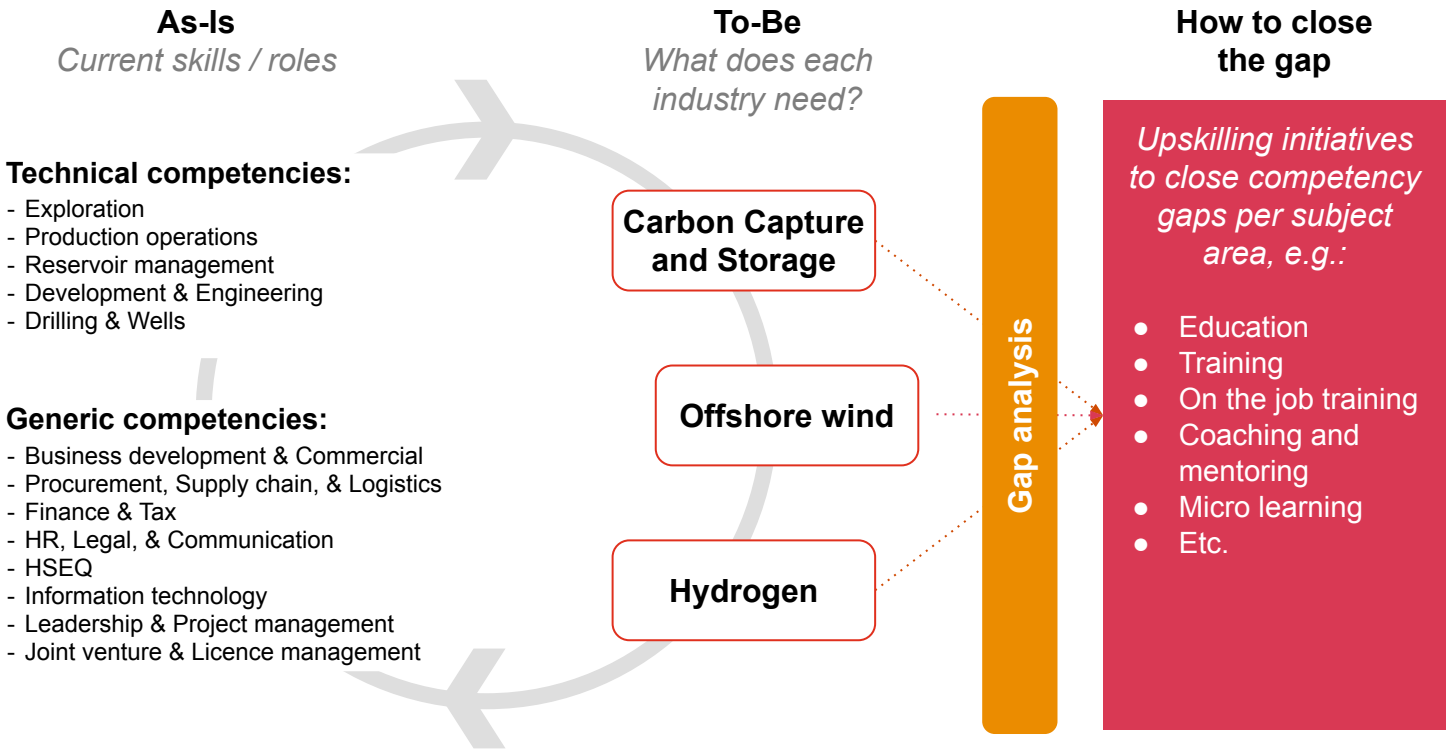


Figure 1. Offshore wind top level value chain

We have analysed 27 different competency disciplines across 13 E&P competency areas

A brief overview of a selection of the E&P competencies covered in the different competency areas.

Exploration
Geologists conduct interpretation and processing of reservoir geological data. Geophysicists manage the geophysical program ensuring it is aligned with project schedule and delivery. Covers G&G from all departments.

Reservoir Management
Allocation of resources to optimise oil and gas recovery from a reservoir while minimising capital investments and operating expenses. This includes subsurface and reservoir engineering.

Offshore Technicians/Operators
Activities and processes related to offshore operation, production and maintenance. This includes; automation-, mechanical-, electrical-, and process technicians; as well as crane- and deck operators/Material Coordinator.

Topside and Subsea Engineering
Design, development and operation of systems and facilities for locating and extracting oil and gas. This include subsea- and topside engineering.

Drilling and Wells
Drilling and completion engineering includes planning and execution of well related projects. This includes drilling engineers, well integrity engineers, completion engineers and intervention engineers.

Business Development and Commercial
Support in development of corporate and exploration strategy; optimise portfolio; identify, initiate and develop new business opportunities; negotiation and management of commercial agreements.

Joint Ventures and License Management
Managing area and asset value creation, delivering on KPIs, monitoring performance and correcting deficiencies, and capture value for non-operated assets through analysis and stakeholder management.

Leadership and Project Management
Plan, coordinate and manage projects, ensuring clear agreements of objectives, defining scopes and costs for projects, and ensuring that project goals are achieved within the given constraints.

HSEQ
Responsible to monitor, report and follow-up on Health, Safety, Environment, and Quality performance for operated and non-operated assets.

Supply Chain Management
Deliverables to operations onshore and offshore; supply chain strategies; contract-, purchase-, and material management; coordination of logistics according to demand covering different supply operations.

Finance and Tax
Conduct annual financial statements, ensure correct capitalisation of exploration expenditures, ensure timely and accurate closing of accounts and provision of related reports, and secure timely delivery of tax return etc.

Data and IT
Establishment of information governance, architecture, and standards in the company; monitoring performance and correcting deficiencies; and provide technical support.

HR, Legal, and Communications
Effective and efficient management of the human resources in the company, legal governance ensuring compliance with laws and regulations, and development of communication strategy and guidelines to ensure one-voice policy.

Quantitative and qualitative data collection techniques applied to identify potential competency gaps

Thematic areas

To identify and define competency requirements based on current and future needs, the project is divided into four thematic areas:

1. Current competency status of the E&P industry
2. Competency requirements and needs in CCS, Hydrogen, and Offshore wind
3. Gap analysis of transferable E&P competency to CCS, Hydrogen, and Offshore wind
4. Upskilling initiatives and initiatives to close the gap

Questionnaires

Questionnaires were developed for each of the three industries in scope: CCS, Hydrogen, and Offshore wind. Competency needs for the different value chains were in focus and the purpose of the questionnaires was to identify which technical and generic competency areas (p.8) from the E&P industry that are transferable to the different value chains. Personal data was not collected or processed. The questionnaires were distributed to 125 companies, and the response rate was 35%.

Interviews with companies within CCS, Hydrogen, and Offshore wind

In-depth interviews were conducted with 10 companies with relevant and thorough insight and understanding of CCS, Hydrogen, and Offshore wind value chains (figure 2, p.10). The focus was on recognising how the different generic and technical competencies in scope can be relevant and transferable. Moreover, the interviews aimed at identifying how these E&P competencies need to be adapted to succeed in these new industries, and how different competency gaps can be closed through upskilling initiatives.

Interviews with educational institutions

In-depth interviews were conducted with six educational institutions to uncover how current study programs and the need for new studies can contribute to utilise the competencies of E&P companies towards new industries. The aim was to get a better understanding of how educational institutions contribute in the competency development towards CCS, Hydrogen, and Offshore wind. This included their research and development activities as well as their different educational offerings.

Workshops with Wintershall Dea Norway AS and Neptune Energy AS

Individual workshops were conducted with the two participating case companies to identify their internal competency gaps which they need to cover to transition to the specific industries aligned with their strategies.The workshops were built on their existing competence base within their organisation based on job profiles (personal data was not collected); findings related to competency needs for CCS, Hydrogen, and Offshore wind value chain; and identified competency gaps that must be covered to transition to these industries. Aggregated results from these workshops will be presented as they can provide valuable insights concerning the transferability of specific E&P competencies to CCS, Hydrogen, and Offshore wind.

The sample for the in-depth interviews and workshops covers different areas of the CCS, Hydrogen, and Offshore wind industries

Qualitative data were collected through interviews from 17 organisations and educational institutions relevant for these industries. The sample consists of organisations specialising in production of different energy sources as well as advisory and educational organisations, and they cover to various degrees the value chains of CCS, Hydrogen, and Offshore wind.

Organisation	Type of organisation
Aker Carbon Capture	Production
Aker Offshore wind	Production
Arena Ocean Hyway Cluster	Cluster
Cowi	Consultancy
Energy Innovation	Cluster
Explocrowd	Consultancy
Neptune Energy	E&P
Norwegian Offshore wind Cluster	Cluster
Spirit Energy	E&P
Wintershall Dea	E&P
Fagskolen Rogaland	Education
Høgskulen på Vestlandet	Education
Nautilus / RPS Group	Education
NTNU	Education
University of Bergen	Education
University of Stavanger	Education

Figure 2. Interview sample

Competence is more than formal education and includes knowledge, skills, abilities and attitudes

Competence is more than formal education and includes knowledge, skills, abilities and attitudes as debated by Linda Lai*. Competence is what we do and are able to do, based on the composition of different components. It is the overall knowledge, skills, abilities, and attitudes that make it possible to perform relevant tasks in line with defined requirements and goals in an organisation. Strategic competence work involves a targeted and holistic investment in competence to achieve the organisation's goals and increase value creation. The components of competence are closely linked and difficult to distinguish beyond a purely analytical level. In practice, these components will blend into each other and together provide a meaningful expression of an individual's or department's competence.

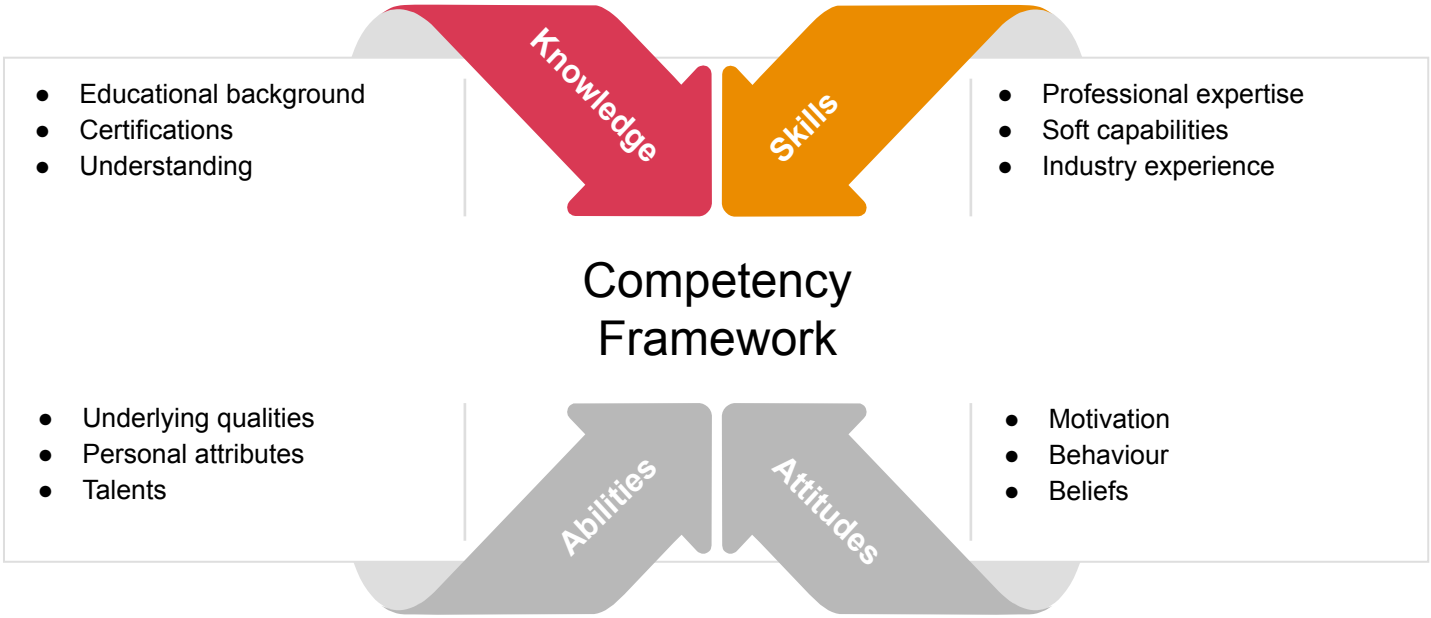


*Figure 3. "Strategic competence management", 2013, by *Linda Lai (Professor of management and organisational psychology at BI Norwegian Business School)*

Due to the organisational and discipline perspective of the analysis, abilities and attitudes have been excluded from the competency framework because of the personal nature of these parameters. The basic abilities of employees are not considered to vary between the traditional E&P industry and the new energy industries. As the willingness to change may vary it will be essential to work on the culture and mindset, and motivate towards working within lower-margin industries. Moreover, the curiosity and willingness to explore and test to find new ways of working will be essential to succeed in the new industries. However, knowledge and skills will, in this report, form the main foundation for identifying competency gaps between the existing E&P competency and the necessary competency for CCS, Hydrogen, and Offshore wind value chains. The qualitative findings are visualised through Harvey balls in a competency framework that cover the identified knowledge and skills gaps and upskilling initiatives. Moreover, as some findings relate to the organisational mindset, which we find particularly interesting, will part of these attitudes be covered on a general level for the different competency areas.

Assessment criteria for knowledge and skills competency transferability

The following classification guideline was created to ensure a consistent valuation of the competency transferability for the different disciplines to CCS, Hydrogen, and Offshore wind. The different classification criteria were constructed based on the need for different competence enhancing measures to cover the identified competency gaps.

Knowledge

Directly transferable, no need for upskilling initiatives

Highly transferable but need for upskilling initiatives such as shorter courses (approx. from one day to three months) and training

Partly transferable but need upskilling initiatives such as subjects and longer courses (approx. from three months to six months) that result in new certificates or diploma

Somewhat transferable but need for upskilling initiatives including further education resulting in a new degree or specialisation

Not transferable → in need of full retraining (new degree) for the new industry

Skills

Directly transferable, no need for upskilling initiatives

Highly transferable but need upskilling initiatives such as basic self study to understand the new industry

Partly transferable but need for upskilling initiatives including on-the-job training and follow-up, and also self study on the new industry

Somewhat transferable but need upskilling initiatives including extensive guidance, on-the-job training, and self study

Not transferable → in need of full retraining (new degree) for the new industry

2

Industry Background on CCS, Hydrogen, and Offshore wind

Great opportunities for Norway to take the lead position in CCS, Hydrogen, and Offshore wind markets in Europe

Large parts of the electricity and energy consumption in Europe are based on coal, oil and gas. In 2019, there were about 160,000 employed in the Norwegian oil and gas industry which accounts for six percent of the total employment in Norway (SSB, 2021). It has now been politically decided that this will be reduced and replaced by renewable energy sources. While Norway have great opportunities within several new industries the energy transition is argued to be going too slow and that Norway potentially will not be able to keep up with the green industrial development in the rest of Europe (Ask, 2022). Both technology and development have come a long way in several countries, while Norwegian industries are concerned that relevant framework conditions are delayed which lead Norway to fall behind (Vikingstad, 2022).

For Norway to succeed in the transition to a low-emission society and create profitable and sustainable value chains, politicians, business, research institutes and universities will have to work together and act quickly (Sintef, 2019). To prevent high unemployment as the oil and gas market decrease, it is crucial to transition to industries where the E&P competency can be transferred and utilised for new value creation. The industries of CCS, Hydrogen and Offshore wind are some of the areas highlighted as important contributions to a future low-carbon vision for Norway and the North Sea. There is a need for integrated energy systems where CCS, Hydrogen, and Offshore wind must be seen in context and in combination with existing measures such as electrification of offshore platforms (Banet, 2020). The highlighted industries are estimated to provide over 170.000 new jobs in 2050 (Menon Economics, 2022; Sintef, 2018).

Carbon Capture and Storage

Norway has great opportunities to strengthen our leading position and become Europe's largest CO_2 bank. This involves carbon capture technologies, blue Hydrogen using CCS, CO_2 storage, and infrastructure for CO_2 transport.

Hydrogen

Norwegian gas, hydropower and wind power allows Norway to produce green and blue Hydrogen cheaper than competitors. We have great opportunities within production, Hydrogen export to Europe, and supply of Hydrogen technology.

Offshore wind

Half of Europe's electricity from Offshore wind in 2050 can come from the North Sea. This involves great opportunities for Offshore wind farms in the North Sea, and as a supplier industry.

Carbon Capture and Storage

For CCS to become a powerful measure against climate change the CO_2 must be captured in an effective way, before being transported and eventually safely stored for decades. This will require continued investment in new technology to make the process faster, easier and cheaper than today. The focus in this report is the capture of hydrocarbons offshore and geological storage under the seabed of the NCS.

CAPTURE

CO_2 can be captured from exhaust gas at power plants and in industrial production. It is also possible to separate CO_2 directly from natural gas in connection with the treatment the gas undergoes to achieve the correct quality before it is sent to customers in pipes or by ship. Capturing CO_2 can be done through post-combustion, oxy-combustion and pre-combustion processes (Hofstad, 2021).

TRANSPORT

Compressed CO_2 will be transported by pipelines, ships, trains, or trucks depending on the amount of CO_2 to be transported and the the distance between CO_2 source and CO_2 storage. Ship transport is most relevant for smaller quantities and long distances and offers great flexibility. Pipe transport is better suited for larger quantities and shorter distances (Olje- og energidepartementet, 2021).

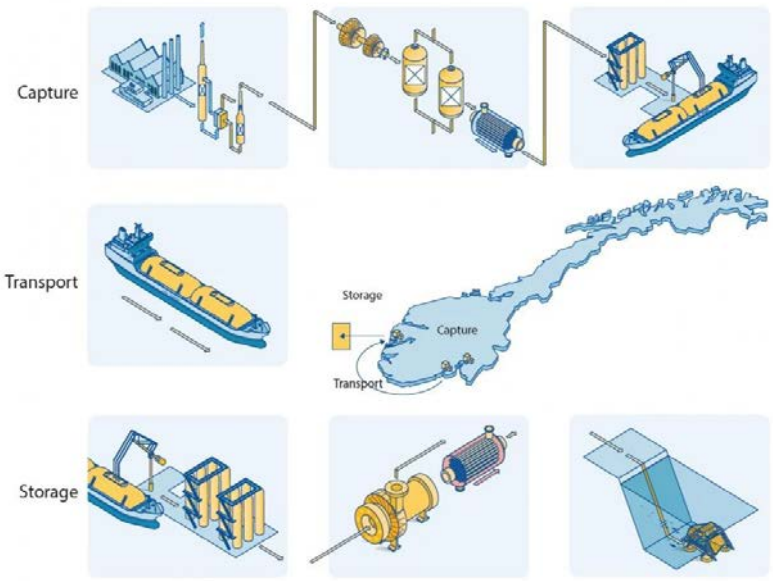
STORAGE

Large amounts of CO_2 can be stored through geological storage under the seabed (well injection) on the Norwegian Continental Shelf (NCS). Norway has large reservoirs at depths that provide suitable pressure and temperature conditions and which prevent CO_2 from moving through the rock and sand layers towards the seabed (Olje- og energidepartementet, 2022).

Langskip - a good example of a key CCS project in 2021

In 2021 the full-scale project "Langskip" for capture, transport and storage of CO_2 was initiated in Norway. The project will receive funding from the Norwegian government of a total of NOK 16.8 billion. It is a collaboration between Norcem, Fortum Oslo Varme, and Northern Lights (collaboration between Equinor, Shell and Total).

CO_2 will be captured at Norcem and FOV, made to liquid and collected by ships. It will then be transported to an intermediate storage facility in Øygarden and pumped through pipes to the shelf where it will be stored safely 2600 meters below the seabed (Olje- og energidepartementet, 2022).



Energi og Klima (2020)

Hydrogen

For Hydrogen to be part of the energy transition, the production method is decisive. Based on how Hydrogen is produced determine whether it is considered sustainable or not. The main types of Hydrogen are green, blue, turquoise and grey (see table 1).

	Production method	Current CO_2-intensity[1] ($t\ CO_2 / t\ H_2$)
Green Hydrogen	Hydrogen produced through electrolysis of water with sustainably generated electricity	0
Blue Hydrogen	Hydrogen produced through oxidation of fossil fuels **with** CO_2 capture and storage (CCS)	< 5
Turquoise Hydrogen	Hydrogen produced from methane pyrolysis that split the methane in gaseous Hydrogen and solid carbon	TBC
Grey Hydrogen	Hydrogen produced through oxidation of fossil fuels **without** CO_2 capture and storage (CCS)	Natural gas: 10 Oil products: 12 Coal: 19

EU-Taxonomy concerned with **carbon intensity:** $3tCO_2e/tH_2$

Table 1.
1) Includes complete value chain emissions
Sources: DENA, International Energy Agency, WEC New Hydrogen Economy

We address green and blue Hydrogen in this report, as they will be the preferred type based on emissions (see table 1). For blue Hydrogen we will address both oxidation of fossil fuels offshore, as well as transporting the fossil fuels onshore, and carrying out the oxidation onshore. For green Hydrogen we will address the electrolysis of water onshore, and also offshore from seawater.
The Hydrogen value chain will follow a similar value chain set-up as the traditional energy value chain, once the Hydrogen economy matures (see figure 1). In this report we mainly focus on the first part of the value chain; energy supply and Hydrogen production. We also touch upon trading, transmissions, storage and distribution to some degree.

Energy supply	H_2 production incl. CCUS[1)]	Trading	Transmission	Storage	Distribution	Retail
• Renewable energy (e.g. PV, onshore/ Offshore wind) • Natural gas • Biomethane	• Generation of grey, blue and green (regional and central) Hydrogen • Hydrogen from biomethane • Marketing of by-products (e.g. oxygen) • Marketing of further processed products (e.g. ammonia, synfuel)	• European and global (i.e. imports and exports) Hydrogen trading • Trading of CO_2 certificates/ allowances • Potentially trading of green certificates (analogue to guarantee of origin)	• Cross-European long distance transport • Transport via global long-distance pipelines (e.g. North Africa) • Operation of compressor stations	• Interseason storage of Hydrogen • Storage at ports for global import/export	• Distribution via pipeline, truck and trains	• Retail to residential and commercial customers • Sales via fueling stations infrastructure

1) Going forward also marketing of by-products from new Hydrogen production technologies (e.g. solid carbon from molten metal pyrolysis).

Offshore wind

Offshore wind energy is the process of generating electricity offshore through wind farms. Offshore farms generate more electricity per amount of capacity installed, than onshore due to higher wind speeds. The foundation of the Offshore wind farm are either fixed to the seabed or as a floating construction. In this report, we will address both types of installations.

The supply chain for Offshore wind is described in the figure below (BVG Associates, 2019). In this report we assess the transferability to the whole value chain.

Development	Turbine Supply	Balance of Plant	Installation and commissioning	Operations, Maintenance and Service	Decommissioning
Development includes finding a site and service related aspects. Investigation of the site with geotechnical and geophysical studies (site characteristics). Get permission and negotiate licenses. Planning the wind farm and cable routes (design) and environmental surveys accounting for wildlife. Work on engineering consulting and project management as well as legal and potential due diligences. Create an economic assessments and plan to reduce lead time and potential risks. Plan and prepare the financing.	Turbine supplies include mechanical and electrical components including three major parts ▪ Rotor components ▪ Nacelle components ▪ Tower components	Balance of plants covers the non-turbin related infrastructure and include supporting components that are needed in order to deliver energy.	Installation and commissioning using jack-up vessels to install turbines. It takes 2-3 days to install a turbine on average. This phase also includes installation of turbine, foundation installation, cables and offshore substation – electrical systems mounted on platforms. And also installation of port and logistics as well as grid connection.	This phase includes continuous work throughout the life of the wind farm. There is a need for continuous logistics solutions and accomodation. It also includes support to minimise downtime and maximise energy production. Expected lifetime of the wind farms are 25 years with a 5-15 years service agreement. Planned service will be 1-2 times a year	Decommissioning phase includes removal or repower of the Offshore wind farms including salvage and recycling

3

E&P Competency Assessment towards CCS, Hydrogen, and Offshore wind

Exploration

- Geologists
- Geophysicists

Geologist

Current Competence in the E&P Industry

Geologists are scientists who study the Earth, it's composition, structure, development and it's natural mineral and energy resources. In the oil and gas industry they explore the Earth for oil and gas deposits. They analyse geological information to identify sites that should be explored.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Geology is a cutting-edge expertise that is needed and transferable to some point, where the activities is related with structure and composition of rocks.

CCS: From our findings we see that the competence is highly transferable to storage of CO_2 in reservoirs. The same tools and methods will be applied, but it would be for new parameters and there is a need for a deeper understanding of CO_2's behaviour and specifications.

Hydrogen: Currently there are no geological activities within hydrogen. However, the competence is somewhat transferable due to expectations of decreased activities that include structure and composition of rocks. If Hydrogen are used in large-scale, geologist are relevant for storage of Hydrogen. Hydrogen will potentially be stored in salt caverns necessitating upskilling on these, assuming that oil and gas geologist does not have the expertise on this matter on hand.

Offshore wind: For Offshore wind, the competence is highly transferable in the early development phase and in the design phase of the Offshore wind farms. The focus will be to examine and evaluate the seabed environment rather than only focusing on the subsurface environment.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS, a deeper understanding of CO_2 behaviour and specifications. Limited geophysical activities within Hydrogen, need upskilling on salt caverns, but could also be a need for a new specialisation or degree. For Offshore wind there is a need to understand the seabed environment.*
Skills				*Understand the CCS industry. Understand the Hydrogen industry, and the need for learning a new specialisation. Understand the Offshore wind industry and professional experience with seabed environment*

Geophysicist

Current Competence in the E&P Industry

Geophysicist studies the Earth using gravity, magnetic, electrical, and seismic methods. They measure changes of physical properties and calibrate the measured geophysical attributes with rock properties.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Geophysicist competence is needed and transferable to all areas where the activities are related to the physics of earth's surface and beneath. The findings for geophysicists are fairly identical to the findings for geologists, even though they are two different disciplines.

CCS: We find that the competence is highly transferable to storage of CO_2 in reservoirs. The same tools and methods will be applied, but it would be for new parameters and there is a need for a deeper understanding of CO_2's behaviour and specifications.

Hydrogen: For Hydrogen the competence are somewhat transferable due to expectation of decreased activities on geophysical attributes with rock properties. If Hydrogen are used in used in large-scale, geophysicists are relevant for storage of Hydrogen. Hydrogen will potentially be stored in salt caverns, they would therefore need upskilling on salt caverns, assuming that oil and gas geophysicists does not have an expertise on this matter on hand.

Offshore wind: The geophysicist competence is partly transferable in the early project phases for the Offshore wind farm. The focus will be to examine and evaluate the seabed environment rather than only focusing on the subsurface environment.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS, a deeper understanding of CO_2 behaviour and specifications. Limited geophysical activities within Hydrogen, need upskilling on salt caverns, but could also be a need for a new specialisation or degree. For Offshore wind there is a need to understand the seabed environment.*
Skills				*Understand the CCS industry. Understand the Hydrogen industry, and the need for learning a new specialisation. Understand the Offshore wind industry and professional experience with seabed environment*

Reservoir Management

- Subsurface Engineering
- Reservoir Engineering

Subsurface Engineering

Current Competence in the E&P Industry

Subsurface Engineers are responsible to monitor reservoir performance and correcting any performance deficiencies. Moreover, they are responsible (in collaboration with drilling and wells department) for the design, building, management, technical analysis and planning of well-constructions and well-abandonments. This includes the execution method, equipment requirements, cost analysis, detailed well design, internal and external approvals etc.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

CCS: The findings for subsurface engineers show that the current competence and expertise is highly transferable to CCS for storage of CO_2 in reservoirs. The competence is similar and already in place from the storage phase, as the engineers have experience with well design. In addition, the methods and tools used to monitor the reservoir will be the same, only with different parameters and measures.

Hydrogen: For Hydrogen the competence are less transferable due to decreased work with reservoirs. However if Hydrogen are to be stored in a large-scale, the competence are relevant for designing and building wells in order to store Hydrogen.

Offshore wind: For Offshore wind the competence is less transferable due to decreased work with reservoirs. The competence might be relevant in the installation phase when installing cables on the Offshore wind farm to onshore.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS, a deeper understanding of CO_2 behaviour and specifications. Limited subsurface activities within Hydrogen, need upskilling on Hydrogen behaviour and specification, but could also be a need for a new specialisation or degree. For Offshore wind there is a need to understand electrical cables and the dynamic movements for Offshore wind farms*
Skills				*Understand the CCS industry. Understand the Hydrogen industry, and the need for learning a new specialisation. Understand the Offshore wind industry and professional experience with installing electrical cables.*

Reservoir Engineering

Current Competence in the E&P Industry

Reservoir Engineers provide technical expertise like dynamic reservoir simulation for field developments and production. They are responsible for estimating how much oil or gas that can be recovered from the underground deposits, reservoirs. They study the reservoir characteristics and determine which methods that will get the most oil or gas out of the reservoirs.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

CCS: The competence and technical expertise from reservoir engineers are found to be highly transferable for storage of CO_2. The existing methodology and work processes for reservoir simulation, and the current technology and software applications (ex. Eclipse, Petrel, RMS, etc) will be used within the CCS industry. However, there will other measurements for the reservoir and the working commodity will be CO_2.

Hydrogen: For Hydrogen the competence are less transferable due to decreased work with reservoirs. However if Hydrogen are to be stored in a large-scale, the competence are relevant for simulation and estimation when storing Hydrogen.

Offshore wind: As for Offshore wind, the competence is somewhat transferable for the reservoir engineers. Within this industry there will not be any activities related to subsurface storage or production. There will not be need for the competence of simulation for field development and production. However, their basic competence within simulation and statistics make them somewhat transferable for this industry.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS, a deeper understanding of CO_2 behaviour and specifications. Limited reservoir activities within Hydrogen, need upskilling on behaviour and specification when storing Hydrogen, but could also be a need for a new specialisation or degree. For Offshore wind there is a need for a new specialisation or degree.*
Skills				*Understand the CCS industry. Understand the Hydrogen industry, and the need for learning a new specialisation. For Offshore wind there is a need for a new specialisation or degree.*

Offshore Technicians/ Operators

- Automation Technician
- Mechanical Technician
- Electrical Technician
- Process Technician
- Crane Operator
- Deck Operator/Material Coordinator

Automation Technician, Mechanical Technician and Electrical Technician

Current Competence in the E&P Industry

Automation Technician are responsible to follow-up maintenance of the platforms surveillance-, management- and regulating systems i.ex. communication- and telecommunication, measuring instruments, turbines etc. **Mechanical Technician** are responsible to follow-up maintenance related to the platforms processing plant, help-systems and structure. **Electrical Technician** are responsible to follow-up maintenance related to the platforms power station, emergency power, boards- and/or high-voltage plant. We have chosen to evaluate these three disciplines together, since they are all mainly related to maintenance activities in various areas.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

The competence within Automation Technician, Mechanical Technician and Electrical Technician are highly transferable to all of the new industries. As there will be a large amount of maintenance activities, findings imply that their skills and knowledge is highly relevant for other facilities.

CCS: Within CCS these disciplines will be highly transferable to all areas that are in need of maintenance. Particularly if storing of CO_2 is performed offshore on a platform.

Hydrogen: For Hydrogen it will be necessary to familiarise with new facilities, working areas, work tasks, integrity, gouvernance, etc. However, the basis competence and skills required to perform the maintenance tasks will be the same.

Offshore wind: The offshore competence is an advantage within Offshore wind. It is expected that there will be more work performed in heights and over open sea. The basis competence and skills required to perform the maintenance tasks will be the same. But there is also a need to familiarise with the new facilities, working areas, work tasks, integrity, gouvernance, etc.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS the knowledge is directly transferable. For Hydrogen it is highly transferable, but there will be need for upskilling on Hydrogen and the risks associated with it. For Offshore wind it is highly transferable, but there will be need for minor upskilling*
Skills				*For CCS learn the new industry.* *For Hydrogen and Offshore wind there will be different work environments and need to learn the new industries.*

Process Technician

Current Competence in the E&P Industry

Process Technicians operate and maintain the offshore processing plant, in accordance with applicable work processes and procedures within their area. Some process technicians will hold the role Central Control Room (CCR) operator. They have a key role in activation/de-activation of work permits for activities across their designated areas on the offshore installation.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Process Technicians are relevant for all industries with processing modules. Their experience from working offshore, is transferrable for processing modules onshore.

CCS: Competence related to CO_2 storage offshore are highly transferable for the process technicians. For other activities such as CO_2 capture, the process modules will be different wrt. new working conditions, documentation, procedures, and best practice.

Hydrogen: This competence is highly transferable to the process modules within hydrogen production. However, with different process modules, procedures, documentations and regulations.

Offshore wind: With the lack of process modules in wind farms, process technicians has limited transferability to Offshore wind. Process technicians with CCR competence and experience from HSE procedures, work permits, safe work, etc. will be partly transferable to offshore wind CCRs.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Understanding of the product (CO_2 and Hydrogen). Offshore wind knowledge, new competence area. If the process technician does not have CCR competence the score for offshore wind would be 1 of 4.*
Skills				*For CCS, learn the new industry. New working conditions within Hydrogen. No process modules within Offshore wind, less relevant competence. If the process technician does not have CCR competence the score for offshore wind would be 1 of 4.*

Crane Operator

Current Competence in the E&P Industry

Crane Operators have an expertise in facilitating, preparing and completing lifting operations. It is also the crane operators responsibility that the lifting operations are performed according to the HSE procedure/best practice.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

From our findings we see that this competence is needed for all lifting activities within the new industries. Crane operators cover the planning, preparing and also performing the different lifting activities. If the operations are performed offshore, the crane operator will have the relevant professional experience.

CCS: Competence related to central activities performed offshore, such as storing of CO_2, is directly transferable. The working areas and best practices will be the same.

Hydrogen: This competence is highly transferable to Hydrogen. The working areas may differ from O&G and potentially other best practices that need to be learned. The HSE focus and procedures may also differ from O&G.

Offshore wind: The competence is highly transferable to Offshore wind. Most of the lifting operations will be performed offshore by cranes attached to jack-up rigs or vessels. However there is a need to understand the best practices within the different phases of the industry. For example when installing and constructing the Offshore wind farm there will be a lot of heavy lifting operations, as for the operation and maintenance phase the competence will be less relevant with the exceptional replacement of for example rotor blades or the nacelle.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Educational background considered to be sufficient for the transition*
Skills				*How to plan and prepare for different lifting activities including procedures and risks. Best practice for installing, maintain and repair wind turbines.*

Deck Operator/Material Coordinator

Current Competence in the E&P Industry

Deck Operators have competence in serving the stock, packing, receiving and convey commodities and internal transport on the platform. This includes support on deck during lifting operations. Normally, they also have experience with helideck and flight logistics.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

This competence is highly relevant for all of the industries where logistics and material handling is required.

CCS: Directly transferable competence for activities related to CO_2 storage offshore, since the equipment and operations will be the same as for O&G. It is also highly transferable to other areas facilities within CCS that require logistics and material handling. There will be a need to develop understanding the value chain and industry specifics of CCS.

Hydrogen: This competence is highly transferable to the hydrogen production. Optimisation of logistics and material handling will require understanding of the industry and value chain.

Offshore wind: The competence in supporting during lifting operations will be transferable to offshore wind, in particular during the installation phase. Furthermore, the the competence with deck operations and material handling will be relevant on the vessels involved in maintenance of the offshore wind farms. The working conditions will be different, and there will be a need for understanding the specific procedures and best practices for offshore wind farming.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Need to understand the value chain within the industries*
Skills				*Need to understand the industry and for offshore wind they will require procedures and best practice for material handling and supporting lifting operations*

Topside and Subsea Engineering

- Subsea Engineering
- Topside Engineering

Subsea Engineering

Current Competence in the E&P Industry

Subsea Engineers are responsible for designing, construction, installing and maintaining the underwater components and systems used to produce oil and gas, including subsea structures and production systems, umbilicals, risers and flowlines.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

This specific competence is highly transferable to all components and systems that will be underwater for the new industries. Their basic engineering knowledge and skills is transferable to all industries.

CCS: Findings indicate that the competence required within this area for CO_2 storage is directly transferable. CCS offshore will require the development, installation and maintenance of subsea structures, systems and infrastructure.

Hydrogen: This special competence is less relevant, with the exception of potential storage of Hydrogen in subsea tanks or in the potential case of transport of Hydrogen in existing and new offshore pipelines.

Offshore wind: The wind farms will be built on floating foundations or fixed structured meant to last for decades. The competence and experience in the design, construction, installation and maintaining such structures are highly transferable from the O&G industry.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Understanding the behaviour and specification for CO_2 and Hydrogen. Understand the subsea specifics of Offshore wind farms.*
Skills				*Industry knowledge, including regulations and technical standards. Skills related to underwater storage and transportation of Hydrogen and subsea elements of Offshore wind farms*

Topside Engineering

Current Competence in the E&P Industry

For this analysis, we define topside engineering to include the engineering competencies required for designing, construction, installing, operating, maintaining and modifying topside structures, facilities and equipment. It includes a wide range of engineering disciplines such as mechanical, structure, corrosion, electrical, automation/instrumentation/metering, process, and marine.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

For all of the new industries there will be a need for new or modified topside modules or facilities, and ensuring optimised operation and integrity of these. As such, these engineering disciplines are highly relevant to all industries.

CCS: Highly transferable, in particular related to the topside elements of CCS systems. Need to understand the technical and safety specifics of CCS.

Hydrogen: For both green and hydrocarbon based Hydrogen production, the competence design to operating and maintaining topside structures, facilities and equipment in the O&G industry is highly relevant. Competence on technical and safety specifics of Hydrogen production is required.

Offshore wind: The disciplines related to the offshore structures, and equipment, e.g. electrical, automation, structure, corrosion, is highly transferable. Mechanical engineering relevant for wind turbine engineering. The extensive use of vessels in installations and maintenance of Offshore wind farms maked the competence of marine operations highly relevant. Engineering disciplines closely related to the HC production and processing (process and flow assurance engineers) are less transferable to Offshore wind.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Understanding the behaviour and specifications for CO_2 and Hydrogen, and design, construction, operations and maintenance of Offshore WInd Farms*
Skills				*Industry knowledge, including regulations and technical standards.*

Drilling and Wells

- Drilling and Wells Engineering

Drilling & Wells Engineering

Current Competence in the E&P Industry

Drilling and Wells (D&W) Engineering are the engineering disciplines responsible for planning and designing work related to drilling different types of wells to access the reservoir using different techniques, prepare the wells for production or injection, and planning of well workovers or interventions. They are responsible to follow-up operation on a daily basis during the execution phase.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

The D&W engineering disciplines described above are highly relevant for all activities where wells are part of the technical concept. However, there is a significantly decrease of well activities within all of the new industries. Their basic engineering competencies such as math, physics and chemistry are relevant for other industries, but they would need a new specialisation or new degree.

CCS: Highly transferable for subsurface CO_2 storage. The main differences here would be the choice of metal/material and cement for the well, due to CO_2's behaviour and specification.

Hydrogen: Within hydrogen, the activities related to wells will be in case of hydrogen storage at a large-scale, either in salt caverns or suitable reservoirs. The D&W engineering disciplines will therefore be somewhat transferable for the hydrogen industry.

Offshore wind: There are no activities related to wells within Offshore wind. However, the D&W engineering disciplines basic engineering competence make them somewhat transferable.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*For CCS, a deeper understanding of CO_2 behaviour and specifications. Lack of wells activities within Hydrogen, need for a new specialisation or degree. If subsurface Hydrogen storing is relevant they need a deeper understanding of the Hydrogens behaviour and specification. For Offshore wind there is a need for a new specialisation or degree.*
Skills				*Understand the CCS industry. Understand the Hydrogen industry, and the need for learning a new specialisation. Understand the Offshore wind industry, and the need for learning a new specialisation.*

Business Development and Commercial

- Business Development
- Commercial

Business Development

Current Competence in the E&P Industry

Business Development are responsible to optimise portfolio according to strategy, identify, initiate and develop new business opportunities including market intelligence monitoring, lead/participate in BD projects, lead/participate in exploration farm-in/out, negotiate and execute transactions, follow-up of deal completion and completed agreements post-signing, follow-up of post-deal audit, lead/participate in the process of developing and updating Area Strategy and building and maintaining internal and external business relationships.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Business Development is critical when entering into the new industries and is equally important across the three industries. Their contribution is key in the intersection between technical, finance and legal, LCOE (levelised cost of energy - for Offshore wind) and break-even assessments. This competence will be critical in the early phase of the new industries, which we now are in. The competence that will be especially important is building thorough business cases and to establish an understanding of the new parameters and value chains, and also key figures. This competence is also important in evaluating outsourcing vs. insourcing, which will be important entering into new industries.

As the core principles of the industries and their respective frame conditions differ, the competency gaps which need to be closed relate to industry specific understanding, infrastructure knowledge, consequence evaluations, and understanding of the different value chains. Moreover, it involves price mechanisms, the various frame conditions (policies and regulations) relevant for the respective industries and the alliances and collaboration initiatives which may exist and evolve over time. For instance, the Hydrogen segment will raise new challenges regarding the marketing and sale of the lifted Hydrogen. The E&P are used to a market that will take off all volume lifted in a well functioning market. For Hydrogen, this is currently not a perfect marketplace, and it will require new ways of working to offload the volume in the market. Furthermore they should have an understanding of how the different industries relate to each other.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within BD is relevant for all industries.*
Skills				*Understanding of the whole ecosystem surrounding the development project as well as the related infrastructure*

Commercial

Current Competence in the E&P Industry

Commercial are responsible for upstream commercial activities, such as tie-in and processing agreements, gas transportation agreements etc., as well as to ensure marketing of products for sale, provide commercial support and advice to licenses and assets, provide technical support to tenders and contracts, participate in audits and verifications of partners and contractors, as well as participation in license committees. Commercial also maintains good relationships with joint venture partners/counterparties, pipeline operators and other relevant parties.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Commercial is important when entering into the new industries and are equally important across the three industries. The competence commercial holds within pricing models, sales contracts- and mechanism, and also the customer perspective will be important when establishing this for the new industries. Competence within leading negotiation teams consisting of license partners, legal and technical personnel as well as communicating with authorities regarding new contracts will be especially important in the first phases of the new industries, which we now are in Norway. There is a need for upskilling for commercial as the core principles of the industries and their respective frame conditions differ. The competency gaps which need to be closed relate to industry specific understanding, understanding of the different value chains, price mechanisms, the various frame conditions (policies and regulations) relevant for the respective industries and the alliances and collaboration initiatives which may exist and evolve over time. Furthermore they should have an understanding of how the different industries relate to each other. Lastly, the commercial staff needs to look at value chain spanning more than just Norway including emissions from central Europe, cross border transport, and storage in Norway.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within Commercial, is relevant for all industries*
Skills				*Understanding of the whole ecosystem as well as the related infrastructure*

Joint Venture and License Management

- License Management

Joint Venture and License Management

Current Competence in the E&P Industry

Joint Venture and License Management are responsible for strategic objectives within the different assets. They recommend annual budgets, action plan with associated KPIs and, in cooperation with asset controller, follow up performance and seek areas for improvement and challenge operators. They are responsible to ensure that license decisions are properly assured, build good relationships and alliances with license operators and partners, authorities and other stakeholders.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Collaboration as such is emphasised as critical by all respondents in our interviews. The ability and experience from such collaboration is a competitive edge for Norway when entering into the new industries. As such, experience from working within and managing Joint Ventures will be key when moving into the new industries. The collaboration may take other forms, and move more into clusters and strategic alliances across different parts of the value chains, however, the mind-set and the experience from JVs is highly relevant for the new industries, and consequently the competence of the employees working within Joint Venture and License Management is considered to be transferable.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within JV and License management, is relevant for all industries*
Skills				*Understanding of the whole ecosystem surrounding the development project and the related infrastructure*

Leadership and Project Management

- Leadership Capabilities
- Project Management

Leadership Capabilities

Current Competence in the E&P Industry

Leaders are responsible to lead, motivate and develop their teams, define and implement strategy, follow-up KPI's and budgets, plan and implement agreed initiatives and budgets. They are people-centric and responsible for the overall success and vision of an activity/project. Their focus should lie on empowering others to do a good job and they have a responsibility for the activity/project success.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Leaders are crucial in the Energy Transition and the competence they have is vital for implementing the changes that will follow with the transition. Especially in regards to implementing, motivating and acknowledging the right mindset and culture for change. The competence within leadership in E&P companies are highly transferable to CCS, Hydrogen and Offshore wind. There will be a need for some upskilling initiatives within the new value chains and the new industry as such.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Highly transferable but need for upskilling and understanding of the value chains within the new industries.*
Skills				*Overall professional knowledge on the activities* *Need to understand the industries and value chains*

Project Management

Current Competence in the E&P Industry

The E&P industry has extensive experience and capabilities in realising large and complex projects on the NCS. It includes maturing a discovery to a facility ready to be handed over to operations, through structured decision gate process of technical, commercial, health, safety and environmental considerations and decisions. Next to the specific engineering disciplines and the key interfaces with e.g. HSEQ and SCM required for the project delivery, key project competencies include project management, project control, project planning, cost engineering, estimation, interface management and more.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Project expertise is directly transferable to CCS, Hydrogen and Offshore wind. In the establishment of these industries it is especially important that the projects are commercially and technically successful with strong HSE performance to set the foundation for further industry development.
Additional key competencies for project success in these industries are knowledge of the technical, regulatory, HSE, infrastructure and supply chain specifics of CCS, Hydrogen and Offshore wind, as well as the the commercial opportunity space, e.g. alliances and collaboration initiatives which may exist and evolve over time, compared to the E&P industry. Furthermore they should have an understanding of how the different industries relate to each other.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Highly transferable but need for upskilling and understanding of the value chains within the new industries.*
Skills				*Overall professional knowledge on the activities* *Need to understand the industries and value chains*

HSEQ

- Health, Safety, Environment and Quality

HSEQ - Health, Safety, Environment and Quality

Current Competence in the E&P Industry

HSEQ are responsible to monitor, report and follow-up on Health, Safety, Environment, and Quality performance for operated and non-operated assets. HSEQ are responsible to maintain and improve management system, guide the organisation with regards to ensuring compliance with requirements stipulated in the Norwegian health, safety and environment legislation and also follow up operations and all activity in regards to HSEQ. Together with technical disciplines, they ensure technical safety, as well as the overall follow up of HSE on a daily basis. This includes to prepare and maintain emergency preparedness strategies and requirements. Moreover, they are responsible to ensure compliance with relevant ISO standards (14001, 45001, 50001).

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

HSEQ is an area which is defined as critical when entering into the new markets. The experience from a highly regulated industry such as the E&P industry, will be beneficial to ensure that the relevant standards and procedures are implemented and followed. For some parts of the value chain, the overall HSEQ risk can be considered as lower, however for Hydrogen, the risk is considered to be higher due to the explosive nature of the chemical produced. Consequently, barrier management and barrier control is key, and upskilling on chemicals is needed. Consequence evaluation will be focused towards new/other parameters, but the established methodology and approach can be utilised. HSEQ is on the top of the agenda for the E&P industry, and its requirements and standards drive cost. The mind-set of the HSEQ disciplines will need to be adjusted towards lower-margin industries while at the same time ensure the safety for people and the environment.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within HSEQ, is relevant for all industries*
Skills				*Industry knowledge and understanding of new aspects related to risk and HSEQ*

Supply Chain Management

- Contracts and Procurement
- Logistics

Contracts & Procurement

Current Competence in the E&P Industry

Contracts and Procurement supports in evaluating suppliers and issuing tenders. They are responsible for obtaining quotes and negotiate prices, conditions, terms and specifications when acquiring goods or services from external vendors.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

In general, the basic competence of the Contracts and Procurement function is considered to be transferable. However, we are now faced with new alliance parties and potential new vendors. For Offshore wind for instance, it is important to understand the commodity prices and cost, such as steel, turbines, etc. Moving into lower margin industries, the Contracts and Procurement function is key to remain cost competitive and ensure good collaboration with suppliers and vendors. Consequently, the Contracts and Procurement competence will need to be enhanced with focus on understanding the pricing mechanisms and life cycle costs of a new industry, contractual matters and how to negotiate for the best outcome. Also the new ways of collaboration in strategic alliances, clusters, etc., will be important to understand and enhance their competence within.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within Contracts and Procurement, is relevant for all industries. Some upskilling may be needed with regards to new categories and management of such*
Skills				*Understanding of the whole ecosystem surrounding the industry and how this affects contracts and negotiations*

Logistics

Current Competence in the E&P Industry

Logistics are responsible for overseeing and managing company's overall supply chain and logistics strategy and operations to maximise the process efficiency and productivity. In addition, they play a crucial role in developing and maintaining good relationships with vendors and distributors. Logistics are responsible for development, implementation and maintenance of all onshore and offshore logistics processes and ensure that all logistics services are available when required.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Logistics are considered a key competence for the new industries, and especially for Offshore wind. Local content, the understanding of the supply and value chain and how this relates to the supply of equipment, parts, materials and tools to both develop, build and operate the facilities, will be key to succeed, and the knowledge and experience from the E&P sector is considered very important and valuable. However, as for other disciplines and competencies, the employees within Logistics will need to upskill themselves to understand the new businesses, the new value chains and the - to some extent - new landscape of suppliers and bases. This is especially important for Hydrogen where the production and operation most likely is moved onshore.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The education, which may differ for those working within Logistics, is relevant for all industries*
Skills				*The understanding of new supply and value chains, as well as suppliers and bases*

Finance and Tax

- Finance
- Tax

Finance and Tax

Current Competence in the E&P Industry

Finance are responsible for all finance related matters such as accounting and (statutory) reporting, JV accounting, contact with external auditors, develop, update and measure KPI's, facilitate, manage and execute operational and financial planning, forecasting, cost controlling processes, economic analysis, cash management and hedging, optimisation of liquidity, risk management and insurance. Tax are responsible for all tax related matters, secure timely delivery of tax return and input for annual statutory accounts, transfer pricing documentation, providing tax advice and task risk management, tax processes and procedures.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

In general the competence within Finance and Tax is transferable to all the new industries. There is, however, a shift to lower-margin industries which may require a change in mind-set and also understanding of a new set of KPI's as well as the taxonomy relevant for the industry. Common for all the industries may be new contract formats, pricing mechanisms, new KPI's and reporting standards, new tax regime, control activities, investment analysis and JV set-up, as well as how to support new business models/cases and the reporting that may require. The collaboration between BD & Commercial and Finance & Tax will be critical when establishing into the new industries, as well as the understanding of how the different commodities play together and affect each other. For CCS, the pricing of the projects will be business critical. There will be a need to understand the pricing mechanisms and ensure that the price model covers the whole value chain from capture, transportation, storage of x cubics CO_2 and monitoring the stored CO_2.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The various educational backgrounds across Fiance and Tax are relevant for all industries*
Skills				*Understanding of the new business models and the new reporting standards and regimes*

Data & IT

- Information and Technology
- Data and Information

Information Technology

Current Competence in the E&P Industry

Information Technology (IT) are responsible for establishing the information governance, architecture and standards, as well as ensuring the IT hardware in the organisation. IT are also responsible for developing and maintaining the information strategy, application licenses and internal services.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Within Information Technology, the E&P companies and the new industries vary in terms of whether or not they insource or outsource their IT management. But regardless of this, IT as a competence is considered to be directly transferable to the new industries. On the other hand, there will be a need to make use of new technology and modeling tools to increase efficiency in a lower-margin industry, especially for Hydrogen. IT competence, combined with creativity and curiosity to test and try new technology, will be critical for the transition. IT will be a key support function to develop and enable new technology to increase efficiency and enhance productivity.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Educational background considered to be sufficient for the transition*
Skills				*Understanding of the industry*

Data and Information

Current Competence in the E&P Industry

Data and Information is the group of employees responsible to manage and distribute master data internally and externally. They are responsible to structure and secure the right documentation of i.e. projects and modifications (incl. Life Cycle Information), ensure the General Data Protection Regulation (GDPR) and other relevant information management regulation, developing and taking responsibility for the company information meta- and master-model and the overall Enterprise Information Architecture (EIA). They are also responsible for identifying data from various sources and make them available to relevant user groups/domains, coordinate and create standards for result capturing and also actively contribute and initialise effective processes for data usage.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

The ability to gather, analyse and interpret big data is increasingly important for the new industries, especially when the development phase is complete and you move over to production. One need to become even more data-driven and have an understanding of ownership of data when entering into new alliances and collaboration formats; what can and should be shared, what will benefit the company versus the alliance, and how will the alliance partners be mutually dependent on the data gathered to improve production, efficiency and safety. Competence on how to manage new types of data and how to make data-driven decisions needs to be enhanced. The current competence are considered to be transferable, but it will be increasingly important. In general, and across all industries, upskilling within this area is needed to support future business need.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Upskilling on key tools to support analytics, together with studies on the industry as such.*
Skills				*General understanding of data needed to support decision making. Industry understanding*

HR, Legal, and Communications

- Human Resources
- Legal
- Communications

Human Resources

Current Competence in the E&P Industry

Human Resources (HR) is a strategic business partner, responsible for the employment life cycle in the company. They are responsible to define and drive comprehensive attraction, recruitment and retention measures, manage compensation and benefits, labor law, regulations and agreements, learning, development, leadership development, training, transfer processes (inpat/expats) as well as manage employee representatives/work council.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

The E&P industry in general has strong HR capabilities, and the competence required for the new industries within HR is considered highly transferable. HR holds great competence within capability/resource workforce planning, learning and development, employment law and talent management, etc., all of which are highly transferable to the new industries. However, HR needs to enhance their knowledge on competence need to support recruitment as well as upskilling measures within the new industries for employees such as coursing, training and further education. This will be important for succession planning, retention and development of employees in line with the new strategic ambitions. HR will need upskilling in terms of new rules and regulations including enterprise/rental agreements, employee contracts and duty schemes. HR will also play an important role in the transition phase in regards to developing leaders, change management, developing a new mindset and culture. Close collaboration with Communications will be key moving forward.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Highly transferable but need for upskilling and understanding of the value chains within the new industries.*
Skills				*Understanding of the whole ecosystem surrounding the industry as well as stakeholder landscape, including educational institutions and potential future employees.*

Legal

Current Competence in the E&P Industry

Legal provides legal service to all departments and functions including public law matters, JV's, M&A, corporate finance, investor relations, disposal of assets, litigation and arbitration, regulation, contract review, drafting and standardisation, capital market regulation etc. They are responsible for legal governance, provide counselling on legal risks associated with business practices and internal investigations and provide legal advice to the management. Legal is also responsible for guiding the organisation with regards to compliance with national and relevant international rules, regulations, laws, company policies, and procedures

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

Legal expertise is critical when entering into the new industries and there is reason to believe that the capacity need will increase during the next few years. Legal will need to understand the new frame conditions, policy and regulations, as well as taxonomy - and how this affects contractual matters, internal and external governance, collaboration/alliance, and Joint Venture set-up and also structures. Understanding of a changed risk landscape and how to mitigate new and unknown legal risks, for example through insurance and governance, will also be key for the Legal department moving forward.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*Being a professions in its nature, Legal is considered to be directly transferable. However, upskilling on specifics will be needed.*
Skills				*Industry knowledge and understanding of changed frame conditions*

Communications

Current Competence in the E&P Industry

Communications are responsible for internal and external communication. Communications also support the work to ensure the organisation's reputation inside and outside the industry, develop and maintain contact with relevant stakeholders and communities, crisis communication, media relations and manage internal and external communication channels.

Findings on the transferability of E&P Competence to CCS, Hydrogen and Offshore wind

The E&P industry in general has strong communications capabilities, and the competence required for the new industries within Communications is considered transferable for all of the three industries. In the transition into new industries, communication will be critical, especially for the oil and gas companies. The importance of branding and creating a company profile towards ESG as a whole, will be key to attract the right candidates for recruitment, keep employees, secure financing, stakeholder management such as investors and owners, governmental bodies and alliance partners. Communication strategy towards emissions and regulations will also be important. Communications will also, together with HR, play an important role in the transition phase in regards to developing leaders, change management, building a new mindset and culture. On this matter there will be a need for upskilling measures such as understanding and knowledge of the sustainability agenda including taxonomy, regulations, emissions etc. The supportive role to authority contact/public affairs within the new industries will also require this competence.

	CCS	Hydrogen	Offshore wind	Identified competency gaps
Knowledge				*The knowledge is relevant for all industries*
Skills				*Understanding of the ecosystem, ESG as a whole, collaboration and alliances, the respective value chains, demands from the market (people, investors/owners and governmental authorities)*

4

Covering the Competency Gap through Training and Learning

Technical Competencies

- Exploration
- Reservoir Management
- Offshore Technicians / operators
- Topside and Subsea Engineering
- Drilling and Wells

Carbon Capture and Storage

Technical Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives
Exploration	Geologist	For CCS storage, they need shorter courses and training on CO_2 behaviour and self study.	✓ ✓
	Geophysicist	For CCS storage, they need shorter courses and training on CO_2 behaviour and self study.	✓ ✓
Reservoir Management	Subsurface Engineering	For CCS storage, they need shorter courses and training on CO_2 behaviour and self study.	✓ ✓
	Reservoir Engineering	For CCS storage, they need shorter courses and training on CO_2 behaviour and self study.	✓ ✓
Offshore Technicians/ Operators	Automation technician	New working conditions	✓
	Mechanical technician	New working conditions	✓
	Electrical technician	New working conditions	✓
	Process technician	Understand the behaviour and specifications of CO_2 and new working conditions.	✓ ✓
	Crane operator	*No identified competency gap*	
	Deck operator/ Material Coordinator	New working conditions	✓ ✓
Topside & Subsea Engineering	Subsea Engineering	Understand the behaviour and specifications of CO_2 and new working conditions.	✓ ✓
	Topside Engineering	Understand the behaviour and specifications of CO_2 and new working conditions.	✓ ✓
Drilling & Wells	D&W Engineering	Professional expertise and industry experience due to lack of transferable specialisation	✓ ✓

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance

Hydrogen

Technical Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives					
								
Exploration	Geologist	For storage of Hydrogen, shorter courses or training in salt beds, self study and on-the-job training.	✓	✓	✓	✓	✓	✓
	Geophysicist	Limited geophysical activities, need upskilling on salt caverns and obtain new specialisation.	✓	✓	✓	✓	✓	
Reservoir Management	Subsurface Engineering	Understand the behaviour and specifications of Hydrogen, and new working conditions.	✓	✓	✓	✓	✓	
	Reservoir Engineering	Understand the behaviour and specifications of Hydrogen, and new working conditions.	✓	✓	✓	✓	✓	✓
Offshore Technicians/ Operators	Automation technician	New working conditions, tasks, regulations and governance.	✓			✓	✓	
	Mechanical technician	New working conditions, tasks, regulations and governance.	✓			✓	✓	
	Electrical technician	New working conditions, tasks, regulations and governance.	✓			✓	✓	
	Process technician	Understand the behaviour and specifications of Hydrogen, and new working conditions.	✓			✓	✓	
	Crane operator	How to plan and prepare for different lifting activities including procedures and risks.				✓		
	Deck operator/ Material Coordinator	New working conditions, tasks, regulations and governance.	✓			✓		
Topside & Subsea Engineering	Subsea Engineering	Understand the behaviour and specifications of Hydrogen, and new working conditions.	✓	✓		✓	✓	
	Topside Engineering	Understand the behaviour and specifications of Hydrogen, and new working conditions.	✓			✓		
Drilling & Wells	D&W Engineering	Professional expertise and industry experience due to lack of transferable specialisation	✓	✓	✓	✓	✓	✓

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance

Offshore Wind

Technical Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives
Exploration	Geologist	Understand the seabed environment.	✓ ✓ ✓
	Geophysicist	Courses, on-the-job training and self-study	✓ ✓ ✓
Reservoir Management	Subsurface Engineering	Construction and design for Offshore wind farms, and how electricity is produced, stored, transported etc.	✓ ✓ ✓ ✓
	Reservoir Engineering	Construction and design for Offshore wind farms, and how electricity is produced, stored, transported etc.	✓ ✓ ✓ ✓ ✓ ✓
Offshore Technicians/ Operators	Automation technician	New working conditions, tasks, regulations and governance.	✓ ✓ ✓
	Mechanical technician	New working conditions, tasks, regulations and governance.	✓ ✓ ✓
	Electrical technician	New working conditions, tasks, regulations and governance.	✓ ✓ ✓
	Process technician	There is no process modules within Offshore wind, thus the need for several upskilling measures.	✓ ✓ ✓ ✓
	Crane operator	Best practice for installing, maintain, and repair wind turbines	✓ ✓
	Deck operator/ Material Coordinator	Best practice to pack, receive and convey commodities	✓ ✓ ✓
Topside & Subsea Engineering	Subsea Engineering	Understand the elements that will affect the wind turbine floater.	✓ ✓
	Topside Engineering	Understand the construction and design for Offshore wind farms.	✓ ✓
Drilling & Wells	D&W Engineering	Professional expertise and industry experience due to lack of transferable specialisation	✓ ✓ ✓ ✓ ✓ ✓

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance


SONGA DELTA

Generic Competencies

- Business Development and Commercial
- Joint Venture and Licence Management
- Leadership and Project Management
- HSEQ
- Supply Chain Management
- Finance and Tax
- Data and IT
- HR, Legal, and Communications

Carbon Capture and Storage

Generic Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives
Business Development & Commercial	Business Development	New frame conditions and the ecosystem surrounding development projects and infrastructure	✓ ✓
	Commercial	New frame conditions and the ecosystem surrounding development projects and infrastructure	✓ ✓
Joint Venture and Licence management	Joint Venture and Licence management	New frame conditions, policies and regulations, ways of working together and the agreements related to such collaboration.	✓
Leadership and Project management	Leadership	New frame conditions, value chain, and overall professional and industry knowledge	✓ ✓
	Project Management	New frame conditions, value chain, and overall professional and industry knowledge	✓ ✓
HSEQ	HSEQ	New risks and environmental aspects.	✓ ✓
Supply Chain Management	Contracts & Procurement	New frame conditions, commodity pricing and costs, and pricing mechanisms	✓ ✓ ✓
	Logistics	The value chain, supplier landscape, commodity pricing and costs, and pricing mechanisms	✓ ✓
Finance and Tax	Finance and Tax	Business models, EU's taxonomy, and the new reporting standards.	✓ ✓
Data & IT	Information Technology	The technology needed to perform core activities, technological trends and developments.	✓
	Data and Information	Become more data-driven an develop analytical skills to support decisions (Alteryx, Power BI)	✓ ✓ ✓
HR, Legal, and Communications	Human Resources	The value chain, ecosystem surrounding it, and the stakeholder landscape.	✓ ✓
	Communications	The value chain, ecosystem, ESG, collaboration/alliances and stakeholder landscape.	✓ ✓
	Legal	New frame conditions, policies and regulations.	✓ ✓

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance

Hydrogen

Generic Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives
Business Development & Commercial	Business Development	New frame conditions and the ecosystem surrounding development projects and infrastructure	✓ ✓
	Commercial	New frame conditions and the ecosystem surrounding development projects and infrastructure	✓ ✓
Joint Venture and Licence management	Joint Venture and Licence management	New frame conditions, policies and regulations, ways of working together and the agreements related to such collaboration.	✓
Leadership and Project management	Leadership	New frame conditions, value chain, and overall professional and industry knowledge	✓ ✓
	Project Management	New frame conditions, value chain, and overall professional and industry knowledge	✓ ✓
HSEQ	HSEQ	New risks, environmental aspects, barrier management and chemicals related to Hydrogen	✓ ✓
Supply Chain Management	Contracts & Procurement	New frame conditions, commodity pricing and costs, and pricing mechanisms	✓ ✓ ✓
	Logistics	The value chain, supplier landscape, commodity pricing and costs, and pricing mechanisms	✓ ✓ ✓
Finance and Tax	Finance and Tax	Business models, EU's taxonomy, and the new reporting standards.	✓ ✓
Data & IT	Information Technology	The technology needed to perform core activities, technological trends and developments.	✓
	Data and Information	Become more data-driven an develop analytical skills to support decisions (Alteryx, Power BI)	✓ ✓ ✓
HR, Legal, and Communications	Human Resources	The value chain, ecosystem surrounding it, and the stakeholder landscape.	✓ ✓
	Communications	The value chain, ecosystem, ESG, collaboration/alliances and stakeholder landscape.	✓ ✓
	Legal	New frame conditions, policies and regulations.	✓ ✓

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance

Offshore Wind

Generic Competencies

Competency Area	Discipline	Identified competency gaps that needs to be covered	Upskilling initiatives					
								
Business Development & Commercial	Business Development	Assessments of LCOE and consequence evaluations	✓			✓		
	Commercial	Assessments of LCOE and consequence evaluations	✓			✓		
Joint Venture and Licence management	Joint Venture and Licence management	New frame conditions, policies and regulations, ways of working together and the agreements related to such collaboration.				✓		
Leadership and Project management	Leadership	New frame conditions, value chain, and overall professional and industry knowledge	✓			✓		
	Project Management	New frame conditions, value chain, and overall professional and industry knowledge	✓			✓		
HSEQ	HSEQ	New risks and environmental aspects.	✓			✓		
Supply Chain Management	Contracts & Procurement	New frame conditions, commodity pricing and costs, and pricing mechanisms	✓			✓	✓	
	Logistics	The value chain, supplier landscape, commodity pricing and costs, and pricing mechanisms	✓			✓		
Finance and Tax	Finance and Tax	Business models, EU's taxonomy, and the new reporting standards.	✓			✓		
Data & IT	Information Technology	The technology needed to perform core activities, technological trends and developments.				✓		
	Data and Information	Become more data-driven an develop analytical skills to support decisions (Alteryx, Power BI)	✓			✓	✓	
HR, Legal, and Communications	Human Resources	The value chain, the ecosystem surrounding it, and the stakeholder landscape.	✓			✓		
	Communications	The value chain, ecosystem, ESG, collaboration/alliances and stakeholder landscape.	✓			✓		
	Legal	New frame conditions, policies and regulations.	✓			✓		

Knowledge

Short courses

Subjects and longer courses

Formal education

Skills

Self study

On-the-job training

Extensive guidance

5

Opportunities in Transitioning to CCS, Hydrogen, and Offshore wind

Opportunities for E&P companies transitioning to **Carbon Capture and Storage**

While E&P companies can take a strong position in all of the CCS value chain phases, Norway have the most prominent prospects within carbon storage. CO_2 has been stored on the NCS for 25 years and in September 2021 the Norwegian Petroleum Directorate announced one new area in the Barents Sea and one in the North Sea for CO_2 storage (Oljedirektoratet, 2021). Due to the large empty oil and gas reservoirs, Norway can become a central storage bank for Europe with storage capacity of as much as 80 billion tonnes of CO_2 in the North Sea (McKinsey, 2022). Moreover, Norway may also have some unrealised potential within carbon transport. While there are pipelines in operation there are not large networks of pipes in place and the future prospects of being able to transport CO_2 depends on a pipe network from Norway and Northern Europe to the North Sea.

There is a lot of transferable knowledge from E&P companies related to reservoirs, subsea, transportation and logistics and they are well positioned to understand the technicalities of CCS. However, the transferability of E&P competencies may differ between the different value chain activities like Drilling and Wells Engineering which will be crucial in drilling of wells to store CO_2, but less important in the CO_2 capture phase. While the CCS technology has been used for many years there is a lack of established value chain and business models for large-scale operations. Companies will need to acquire competence to adapt to changing framework conditions including new framework conditions, management structures, different political and commercial value chains, lower margins, and higher standardisation of production. Thus, it is essential to allocate sufficient resources to upskill the workforce. The base education and knowledge are found to be transferable and highly relevant, however, the degree of relevant experience and skills are found to be a clear competency gap. Such experience and skills will be build over time as the industry matures, thus, findings indicate that the main challenge in transitioning to the CCS industry lies within changing the way of working and the prevailing mindset of the oil and gas industry today.

Top 5 critical competencies transferable from E&P to the CCS value chain

- **Business Development & Commercial**
- **Drilling & Wells Engineering**
- **Leadership and Project Management**
- **Topside & Subsea Engineering**
- **Exploration**

Opportunities for E&P companies transitioning to **Hydrogen**

Norway have the capabilities to produce and deliver both green and blue Hydrogen solutions, but the easiest and most cost effective is production of blue Hydrogen from natural gas (NTNU & Sintef, 2021). Hydrogen will be crucial for Norway and Europe's future energy system, and while the Hydrogen strategy of 2020 prioritises green Hydrogen it recognises the need for blue Hydrogen to establish a market. Norway has experience from a hundred years of industrial Hydrogen production used in refineries and production of ammonia and methanol (McKinsey, 2022). However, we are in the starting phase of exploring the use of Hydrogen for new purposes where direct electrification is not possible or less cost effective (NTNU, 2019).

It requires high technical competence and infrastructure to handle Hydrogen. Findings indicate that the E&P competency is highly relevant and transferable to the Hydrogen industry with particular emphasis on the subsea expertise. E&P companies have valuable experience with gas, robust infrastructures, transportation, logistics, and cutting-edge expertise in subsurface storage to potentially store Hydrogen on a large scale. However, the greatest challenge lies within understanding new framework conditions, value chains, and business models. For HSEQ this involve new regulations and the need to establish new standards, best practice, preparedness, and quality management. Moreover, engineers need to develop maintenance operation protocols for bigger process plants with a particular focus on optimisation and scalability. Lastly, findings imply that the central challenge, also in Hydrogen, lies within changing the way of working and the prevailing mindset of the oil and gas industry.

Top 5 critical competencies transferable from E&P to the Hydrogen value chain

- **Business Development & Commercial**
- **HSEQ**
- **Topside & Subsea Engineering**
- **Leadership and Project Management**
- **Joint Venture & License Management**

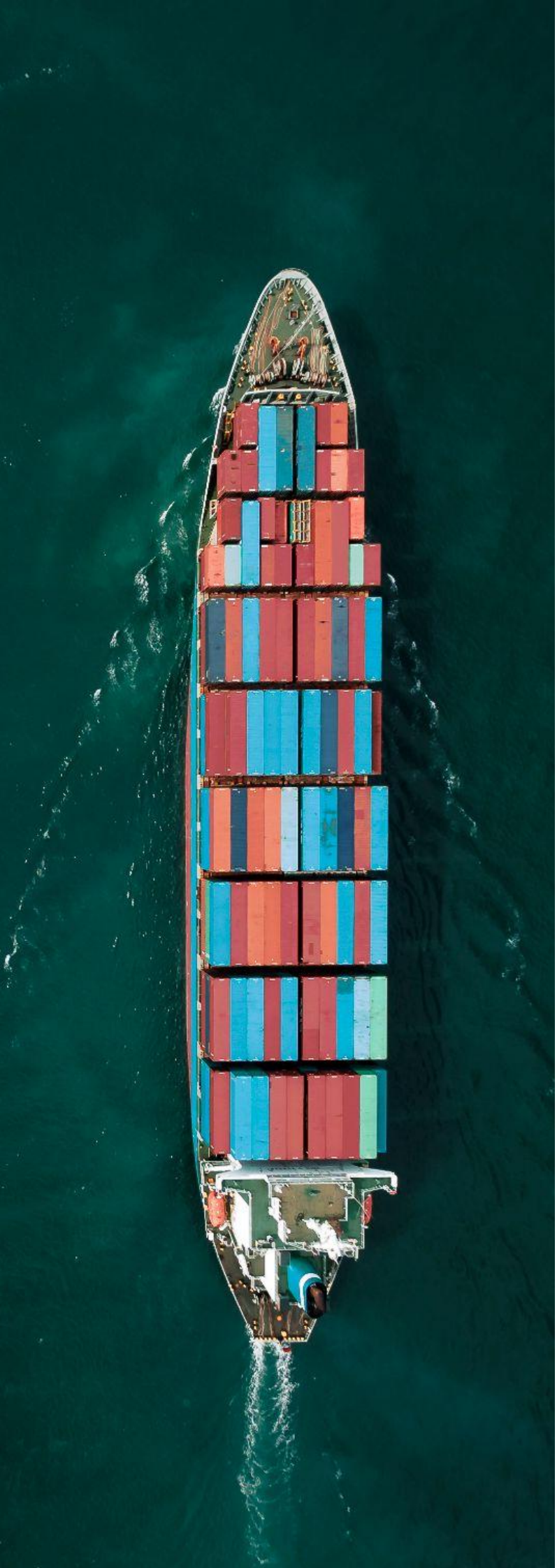
Opportunities for E&P companies transitioning to **Offshore wind**

Around half (140-150GW) of Europe's total offshore wind capacity in 2050 is estimated to be developed on the NCS (McKinsey, 2022). Currently, the Norwegian O&G industry is considered to have an international competitive advantage within floating wind farms. However, this position will be challenged as experience form deploying floating wind farms grows internationally (NTNU, 2019). E&P companies have the opportunity to take a strong position within significant areas of the value chain, including development, infrastructure, installation, commissioning, operations and maintenance. These areas are responsible for approximately 70% of the value creation for an offshore wind farm (McKinsey,2022).

The advantage of E&P companies relates to the considerable experience from years of offshore activities on the NCS including large and complex developments and significant operations and maintenance activities of offshore structures under harsh weather conditions. Their project management capabilities and their experience with managing multiple subcontractors for a common goal is highly transferable to offshore wind. The same applies for technology development, optimising operations and maintenance programs offshore industry. The experience from Joint Ventures and other collaborative business models is another area where the competence from E&P that can benefit offshore wind. Moreover, the NCS has a history of establishing and developing technical standards, regulations and best practices. This will be beneficial in establishing a strong, competitive offshore wind industry in Norway.

Top 5 critical competencies transferable from E&P to the Offshore wind value chain

- **Business Development & Commercial**
- **Joint Venture & License Management**
- **Leadership and Project Management**
- **Topside & Subsea Engineering**
- **HSEQ**



6

Concluding Remarks

Generic and technical E&P competencies are highly transferable to CCS, Hydrogen, and Offshore wind

A competency framework can aid in developing competence-enhancing initiatives to cover competency gaps

Based on the quantitative and qualitative data, a competency framework have been developed (chapter 4). Identified generic and technical competency gaps that needs to be covered are illustrated on a discipline level for the different industries in scope. This competency presents eligible upskilling initiatives to close the different competency gaps and can enable companies in their planning and implementation of competence-enhancing measures. Moreover, it provides an overview that can support educational institutions in their work in providing upskilling courses and new study programs.

Generic E&P disciplines are highly transferable to new industries

Findings suggest that generic E&P disciplines are to a high degree transferable to new energy industries. However, the disciplines in scope were not found to be 100% transferable as new industries necessitates new business models, frame conditions, policies and regulations, pricing mechanisms, ecosystem, and stakeholder landscape etc. To cover such knowledge and skills gaps there is a need for shorter courses and training as well as basic self study. Some of the generic competency areas were found to be critical competencies transferable from the E&P industry to CCS, Hydrogen, and Offshore wind, and this includes Business Development & Commercial, Leadership and Project Management, HSEQ, and Joint Venture & License Management.

Technical E&P disciplines are critical in new industries but require upskilling

Findings indicate that some technical E&P disciplines are critical in certain value chain phases in the new industries, but that there are also some disciplines that are in need of full retraining. CCS is identified as the industry that is most compatible with the current E&P competency, particularly within the CCS storage phase, while Hydrogen is found to be the least compatible. Identified competency gaps relates to new working conditions, tasks, regulations and governance, and a general understanding of the new industry like the behaviour of CO_2 and Hydrogen. The technical competencies found to be particularly critical and transferable within one or more of the industries in scope are Drilling & Wells, Topside & Subsea Engineering, and Exploration.

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Disclaimer

This report has been prepared for the E&P Industry in accordance with the final letter of commitment dated 31.10.2021. The results and assessments are based on information that have emerged from questionnaires, interviews, and workshops with companies with relevant knowledge and expertise from the E&P industry, CCS, Hydrogen, and Offshore wind industries. PricewaterhouseCoopers (PwC) has not carried out any independent verification of the information, and we do not guarantee that it is complete, correct and accurate. PwC accepts no liability for any decisions made on the basis of the information provided in this report.

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