

Sector Fiche: Oil and Gas

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1 Basic Facts

Gross Value added	State of the sector	Presence across sea basins
N/A	Mature and in decline. More than 80% of current European oil & gas production takes place offshore. Most activity takes place in the North Sea, and to a lesser extent in the Mediterranean, Adriatic and Black Seas. Most of the extraction fields are mature, with declining production and rising costs ¹ .	Predominantly North Sea, minor activity Atlantic and East Mediterranean.

Land-sea interaction	Temporal aspect	Lifetime of installations
Pipelines for transfer of product, shipping for supply, maintenance and off-loading.	Fixed platforms and pipelines present until decommissioning.	Optimal design life of 25 years, extended as profitable.

Interaction with other uses

Exclusion of fishing from safety zones, some potential for multi-use.

¹ Ecorys (2012).

2 Composition of the oil and gas sector

This sector fiche will focus on hydrocarbon exploration and production. Operating and service vessels as well as connection cables and pipelines are excluded from this sector fiche analysis. Installations can be distinguished by type (see Figures 1 & 2)

Installation type		
Conventional fixed platforms (CFP)	These platforms are built on concrete and/or steel legs anchored directly onto the seabed, supporting a deck with space for drilling rigs, production facilities and crew quarters ² . Fixed platforms are economically feasible for installation in water depths up to about 150 m ³ .	
Compliant tower (CT)	The rig consists of narrow, flexible (compliant) towers and a piled foundation supporting a conventional deck for drilling and production operations. Compliant towers are designed to sustain significant lateral deflections and forces, and are typically used in water depths ranging from 450 to 900 m ⁴ .	
Tension leg platform (TLP)	A vertically moored floating structure normally used for the offshore production of oil or gas, and is particularly suited for water depths greater than 300 metres and less than 1500 metres. Use of tension-leg platforms has also been proposed for wind turbines ⁵ .	
Spar	Type of floating oil platform typically used in very deep waters, and is named for logs used as buoys in shipping that are moored in place vertically. A spar platform consists of a large-diameter, single vertical cylinder supporting a deck. The cylinder is weighted at the bottom by a chamber filled with a material that is denser than water ⁶ .	
Semi-submersible platform	A semi-submersible platform is a specialised marine vessel used in a number of specific offshore roles such as offshore drilling rigs, safety vessels, oil production platforms, and heavy lift cranes. They are designed with good stability and seakeeping characteristics. In water depths greater than around 520 meters.	
Floating production, storage, and offloading facility	Is a floating vessel used by the offshore oil and gas industry for the production, processing of hydrocarbons and for the storage of oil. They are divided into: <ul style="list-style-type: none"> • FSO, Floating Storage and Offloading • FPS, Floating Production and Storage • FPSO, Floating Production, Storage and Offloading • FDPSO, Floating, Drilling and Production, Storage and Offloading • FSRU, Floating Storage Regasification Unit 	
Sub-sea completion and tie-back to host facility	Consists essentially of a wellhead assembly and Christmas tree (sometimes referred to as a wet tree), which is basically identical in operation to its surface counterpart, with the primary exception of reliability refinements, to permit operation at the seabed. Subsea wells have been used in support of fixed installations as an alternative to satellite or minimum-facility platforms for recovering reserves located beyond the reach of the drillstring or used in conjunction with floating systems such as FPSOs and FPSs ⁷ .	
Drill ships	A marine vessel that's been modified to drill oil and gas wells. Typically employed in deep and ultra-deep waters, drillships work in water depths ranging from 610 to 3,048 meters ⁸ .	

Figure 1: Composition of the oil and gas sector

² Pike, J. (2017)

³ Sadeghi, K. (2007).

⁴ Offshore Magazine (n.d.).

⁵ Offshore Magazine (2010).

⁶ Offshore Magazine (2014).

⁷ INTECSEA (2016).

⁸ RIGZONE (n.d).

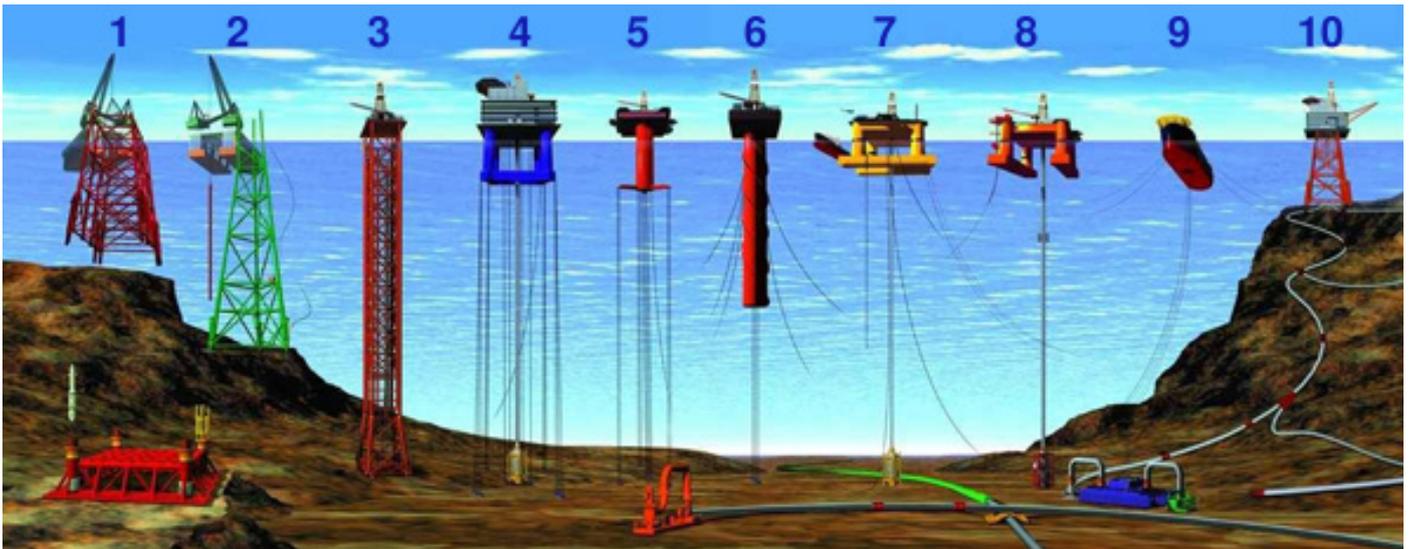


Figure 2: 1 & 2) conventional fixed platforms; 3) compliant tower; 4 & 5) vertically moored tension leg and mini-tension leg platform; 6) spar; 7 & 8) semi-submersibles; 9) floating production, storage, and offloading facility; 10) sub-sea completion and tie-back to host facility⁹.

3 Relationship between offshore oil and gas and MSP

3.1 What are present spatial needs of the offshore oil and gas sector?

The oil and gas sector is locked in physically to the specific location where geological processes lead to those materials to be extracted. Thus, the spatial aspect is of the greatest importance for these sectors, as the spatial availability of the resource cannot be altered. At the same time, a re-allocation of the activity would therefore not be possible.

The material transport to ports also follows a linear structure connecting the collection point to the point of delivery (by ship or pipelines), which will follow the most direct route in order to minimize shipping costs.

In order to avoid potential spills, during extraction all other uses are to be spatially avoided so that focus remains on a safe exploration.

At the same time, the advent of directional drilling has reduced the amount of surface structures required for hydrocarbon extraction activities, since many wells can be operated from a single platform, and at a distance of several kilometres¹⁰.

Similarly, extended reach drilling can be used to access offshore reserves from onshore facilities, as is undertaken from the German North Sea coast.

⁹ Office of Ocean Exploration and Research (2008).¹⁰ Sadeghi, K. (2007).

¹⁰ WOR (2014).

3.2 Which anticipated future developments of the industry are relevant to MSP?

Declining reservoirs	Moving into deeper waters
<p>Domestic production in Europe is set to decline sharply as existing fields mature and are not replaced, a growing dependence on imported hydrocarbons. In some parts of Europe, namely in the Black Sea and the Mediterranean there is unexploited oil and gas potential, with some exploration potential in Cyprus, Greece, Malta, Bulgaria, Romania and Portugal¹¹. In the Mediterranean region, offshore oil production could increase by 60%, and gas production could increase five-fold, between 2010 and 2020¹².</p>	<p>Reservoirs in shallow waters are in decline, and with technological advancements in drilling and extraction, production is moving to deeper waters¹³. Enhanced oil recovery (EOR), injecting water or other substances to maintain reservoir pressure, is increasingly being utilised to access declining reservoirs.</p>
Influenced by geo-political factors and crude oil price	Technological innovation
<p>The activity of the sector fluctuates, influenced by a number of geo-political factors and particularly crude oil price¹⁴, and the location of future exploration is dependent on the acquisition of capital¹⁵. It can be expected to grow through installation of new offshore structures and pipelines in areas of high resource potential, when economic conditions are favourable, and in others where production is declining, activities will shift to decommissioning (with no associated further demand for space).</p>	<p>Technological innovation and improvements in efficiency and cost-reduction may extend the life of some fields that would have otherwise been uneconomic¹⁶. However, reserves still exist and new technologies are enabling companies to produce hydrocarbons more cost effectively¹⁷.</p>
Other energy sources	Decommissioning
<p>Development of renewable energy technologies, particularly offshore wind, and increasing emphasis on emissions reductions and alternative sources of clean energy affect the oil and gas sector, although the use of fossil fuels will continue to dominate energy production for the next decades¹⁸.</p>	<p>As the sector ages, decommissioning of oil and gas infrastructure will become increasingly active, with over 200 platforms forecasted for complete or partial removal, nearly 2,500 wells to be plugged and abandoned and 7,800km of pipeline to be decommissioned in the North Sea between 2017 - 2025¹⁹. Current requirements under OSPAR Decision 98/3 (1998) requires full removal upon decommissioning of all rigs located in the OSPAR maritime area (which includes the North Sea), unless the structure conforms to specific exemption requirements, in which case permission may be given to leave part or all of the structure in place. While there are some projects investigating the re-use of infrastructure, as artificial reefs or for other uses such as energy generation, tourism and aquaculture, projects are in their infancy hence cost-effectiveness and feasibility is unknown.</p>

¹¹ JRC (2015).

¹² Piante, et al. (2015).

¹³ WOR (2014).

¹⁴ MARIBE (2015).

¹⁵ Oil and Gas UK (2016).

¹⁶ DNV (2016).

¹⁷ WOR (2014).

¹⁸ MARIBE (2016).

¹⁹ Oil and Gas UK (2017).

4 Interaction with other sectors

Shipping and ports	Pipelines and cables	Fishing
 <ul style="list-style-type: none"> • Continuous use of ports and harbours in supply, maintenance and hydrocarbon transfer. • Exclusion of shipping from a safety zone around infrastructure. • Decommissioning activities will require greater shore-based facilities for the dismantling of offshore rigs and platforms. 	 <ul style="list-style-type: none"> • Offshore oil and gas production represents the main demand for the installation and operation of pipelines. • Installation of new infrastructure needs to consider existing pipelines and cables to ensure that these aren't affected. 	 <ul style="list-style-type: none"> • Displacement of fishing activity from the installation during operation and decommissioning from a 500m safety exclusion zone, and temporary potential displacement during the installation of pipelines.
Marine aquaculture	Offshore wind and marine renewables	Conservation
 <ul style="list-style-type: none"> • Potential competition in demand for space development, although only where the resources are available for both types of development. • Where suitable, and if technological and regulatory hurdles can be addressed, co-location of aquaculture facilities with existing oil and gas infrastructure may be possible. 	 <ul style="list-style-type: none"> • Potential competition in demand for space development, although only where the resources are suitable for both types of development. • Potential for installing offshore wind turbines on existing or decommissioned infrastructure²⁰. • Synergies may take place in terms of supply chain services, grid connection and R&D efforts. 	 <ul style="list-style-type: none"> • Potential for ecological interactions, particularly during seismic use in exploration and associated disturbance of marine mammals. Oil spills are of increasingly low risk, but with significant potential ecological consequences, depending on the location and timing of the incident. This includes particularly coastal areas of conservation importance and which may be sensitive, such as saltmarsh. • Offshore installations have the potential to provide protected habitat in the form of artificial reefs, which can support associated biota²¹.

5 Recommendations for MSP processes in support of the sector

Engaging with the sector

Despite the spatial requirements for the oil and gas sector are predictable with little expansion of existing activities expected²², MSP processes should further engage with the sector to ensure their activities, current and future, are yet included. The sector may be established with presence of offshore infrastructure, safety and exclusion zones and maintenance/supply vessel activity and these should be included in the MSP.

Managing decommissioning effects

Decommissioning represents the next significant shift for the oil and gas industry as reserves decline and installations come to the end of their life. The spatial implications for MSP from this are minimal in terms of new demand for space, however, it is relevant to consider the potential increased pressure on ports and harbours for decommissioning activities, and the potential for offshore installations which remain *in situ* to be used for other purposes.

²⁰ Korpås et al. (2012).

²¹ Macreadie et al. (2011).

²² Oil and gas UK (2016).

6 Resources²³

6.1 Legal framework

Organisation	Title	Link	Short explanation
OSPAR	OSPAR Recommendation 2003/5 on the Promotion of the Use and Implementation of EMS	www.ospar.org/documents?d=32720	The purpose of this Recommendation is to promote the use and implementation by the offshore oil and gas industry of environmental management mechanisms which are designed to achieve the environmental goals established in fulfilment of the objectives of the Offshore Strategy and continual improvement in environmental performance. These mechanisms should include elements for auditing and reporting.
EU Commission	Prospection, Exploration, and Production of Hydrocarbon Directive (94/22/EC)	http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31994L0022	Regarding Oil and Gas Licensing. National governments have control over the oil and gas in their territories. They determine the areas in which companies can search for and produce these resources. When granting licenses for these areas, they must follow a set of common EU rules to ensure fair competition.

6.2 Actors

Name	Link	Short explanation
World Petroleum Council (WPC)	http://www.world-petroleum.org/	The World Petroleum Council (WPC) is a non-advocacy, non-political organization with charitable status in the U.K. and has accreditation as a Non-Governmental Organization (NGO) from the United Nations (UN). The WPC is dedicated to the promotion of sustainable management and use of the world's petroleum resources for the benefit of all.
International Association of Oil and Gas Producers (IOGP)	http://www.iogp.org/blog/category/eu/	The International Association of Oil & Gas Producers (IOGP) is the voice of the global upstream industry. Oil and gas continue to provide a significant proportion of the world's energy to meet growing demands for heat, light and transport.
Oil and Gas UK	https://oilandgasuk.co.uk/	Industry body for oil and gas producers active on the UK Continental Shelf, where most of Europe's exploration and production activity occurs.

6.3 Initiatives

Name	Link	Short explanation
MERMAID (Innovative Multi-purpose offshore platforms: planning, design & operation)	http://www.vliz.be/projects/mermaidproject/	MERMAID will develop concepts for the next generation of offshore platforms which can be used for multiple purposes, including energy extraction, aquaculture and platform related transport. The project does not envisage building new platforms, but will theoretically examine new concepts, such as combining structures and building new structures on representative sites under different conditions.

²³ The information provided under this section is non-exhaustive. The intention is to provide the reader with basic information on the sector.

6.4 Selected literature

Author	Title	Link	Short explanation
Oil and Gas UK	Economic Report 2016	http://oilandgasuk.co.uk/wp-content/uploads/2016/09/Economic-Report-2016-Oil-Gas-UK.pdf	Oil & Gas UK's Economic Report 2016 has been designed and developed to help our members, from operators through to SMEs, to make informed decisions about the industry and their businesses. Presents a broadened analysis, including in-depth insight on the whole offshore oil and gas supply chain, identifying where progress is being made and challenges remain in UK.
MARIBE	Socio-economic trends and EU policy in offshore economy. Chapter 6 - Offshore Oil and Gas.	http://maribe.eu/blue-growth-deliverables/blue-growth-work-packages/ http://maribe.eu/download/2588/	This report describes the main features of the offshore oil and gas industry along with the opportunities and barriers that it can suppose for the development of Blue Growth and Multi-use and Multi-purpose Platform concepts.

7 List of acronyms

Acronym	Full title
CFP	Conventional fixed platforms
CT	Compliant tower
EOR	Enhanced oil recovery
FDPSO	Floating, Drilling and Production, Storage and Offloading
FPS	Floating Production and Storage
FPSO	Floating Production, Storage and Offloading
FSO	Floating Storage and Offloading
FSRU	Floating Storage Regasification Unit
MSP	Maritime Spatial Planning
TLP	Tension leg platform

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Macreadie, P. I., Fowler, A. M., & Booth, D. J. (2011). <i>Rigs-to-reefs: will the deep sea benefit from artificial habitat?</i> . <i>Frontiers in Ecology and the Environment</i> , 9(8): 455-461.	http://www.esa.org/pdfs/Macreadie.pdf
MARIBE (2015). <i>Socio-economic trends and EU policy in offshore economy</i> . Chapter 6 - Offshore Oil and Gas.	http://maribe.eu/blue-growth-deliverables/blue-growth-work-packages/
Office of Ocean Exploration and Research (2008). <i>Types of Offshore Oil and Gas Structures</i> . NOAA Ocean Explorer: Expedition to the Deep Slope. National Oceanic and Atmospheric Administration.	http://oceanexplorer.noaa.gov/explorations/06mexico/background/oil/media/types_600.html
Offshore Magazine (2010). <i>Worldwide Survey of TLPs</i> .	http://www.offshore-mag.com/content/dam/etc/medialib/platform-7/offshore/maps-and_posters/0210OS-TLP-Poster012510Ads.pdf
Offshore Magazine (2014). <i>Deepwater Solutions & Records for Concept Selection</i> .	http://www.offshore-mag.com/content/dam/offshore/print-articles/volume-74/05/1405offdeepwaterposter.pdf
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Pike, J. (2017). <i>Fixed Platform</i> .	http://www.globalsecurity.org/military/systems/ship/platform-fixed.htm
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