Technical Study

MSP as a tool to support Blue Growth

Roundtable discussion paper: Oil & Gas, 11/12 October 2017

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Offshore Oil & Gas Production

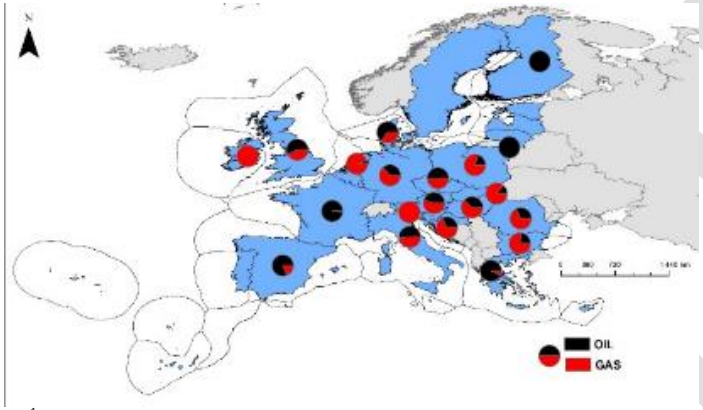
1 Introduction

Overall size of the sector and industry structure

Mature ☒ Since 1896 Growing ☐ Emerging ☐

Offshore Oil & Gas production was developed when land-based oil and gas reserves started diminishing, while the consumption did not, and the production had to be moved to the so-called "Offshore Production". More than 80% of current European Oil & Gas production is offshore. Main activities can be found in the North Sea, but also in the Mediterranean, Adriatic and Black Seas. Most of the extraction fields are mature, with declining production and rising costs[1]. However, it is important to stress that substantial reserves still exist (WoodMac study in the making) and that new technologies allow to compress costs[2].

Figure 1: Offshore Oil & Gas production in EU.



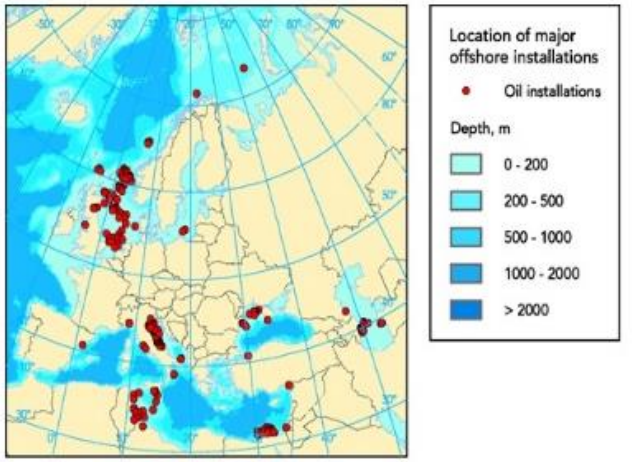
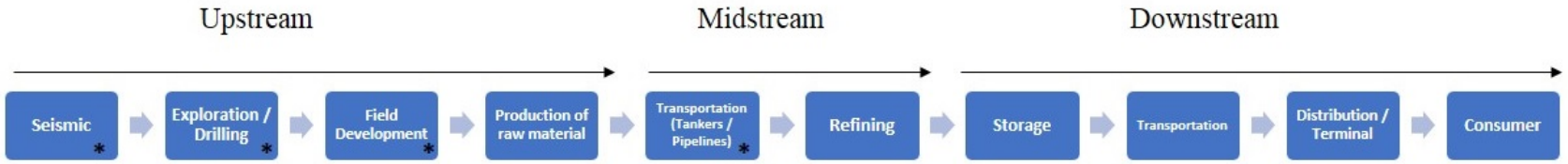


Figure 2: Location of major offshore oil installations

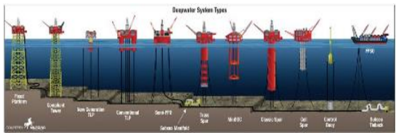
[1] https://webgate.ec.europa.eu/maritimeforum/en/node/2946

[2] Bernard Vanheule, IOGP, Pers. Comm.

Oil & Gas Value Chain:



(with * those steps with marine spatial implications)

<table>
<tr><th colspan="3">Time horizons</th><th colspan="3">Spatial characteristics</th></tr>
<tr><td>Seasonal</td><td colspan="2">No</td><td>Place based</td><td>Yes</td><td rowspan="2">Figure 3
  </td></tr>
<tr><td>Planning horizon</td><td colspan="2">2045</td><td>Linear</td><td>No</td></tr>
<tr><td rowspan="3">Development time[3]</td><td>5-10 years</td><td>Exploration phase (for an average rig type involving seismic studies, discovery and evaluation).</td><td>Distance to shore</td><td>It varies depending on rig type (i.e. fixed, floating, etc.). Figure 3[4].</td><td rowspan="2"></td></tr>
<tr><td>1-5 years</td><td>Development phase</td><td>Water depth</td><td>Between 25 - 3700m depth. It varies depending on rig type and location.</td></tr>
<tr><td>15-30[5] years</td><td>Production phase</td><td>Moving</td><td>Yes & No</td><td>Exploration and Transport (through tankers) phases are moving while the production phase and transport (through pipelines) is not.</td></tr>
<tr><td>Lifetime of installation</td><td>15-30 years</td><td>At least 25 years and a max of 40 years[6] depending on location (environment issues), the size of the reservoir, the materials being used and if they have suffered from accidents such as blowouts or cyclones (which will drastically reduce the life of the rig).</td><td>Land Sea interaction</td><td>No</td><td></td></tr>
</table>

[3] These times will vary depending on rig type, development depth and distance of rig to shore.
[4] Offshore Magazine "2006 Deepwater Solutions & Records"- Bpp-tech
[5] IFP Energies nouvelles (IFPEN) School
[6] Energy sectors and the implementation of the Maritime Spatial Planning Directive report: Luxembourg, 2015.

2 Relevance

Legend: ◆ = low presence ◆◆ = medium presence ◆◆◆ = high presence
➡ = none / limited potential ➡➡ = medium potential ➡➡➡ = high potential

Status in each Sea Basin (Table 1) [7]

Sea Basin	Sector	Presence	Potential	Comments
Atlantic	Oil	◆◆	➡	Its presence is already mature and its potential to discover new exploitation sites is low. More development to be seen in terms of efficiency improvement and lowering of production costs.
	Gas	◆◆	➡	Its presence is already mature and its potential to discover new exploitation sites is low. More development to be seen in terms of efficiency improvement and lowering of production costs.
Baltic Sea	Oil	◆◆	➡	Its presence is already mature and its potential to discover new exploitation sites is low. More development to be seen in terms of efficiency improvement and lowering of production costs.
	Gas	◆◆	➡➡	Its potential to discover new exploitation sites is medium.
Black Sea	Oil	◆◆	➡➡➡	The Black sea generally remains an unexplored basin with few wells drilled to date but with very high potential.
	Gas	◆◆	➡➡➡	
East Med	Oil	◆◆◆	➡➡➡	The Eastern Mediterranean is the focus of much industry attention, with a number of prospective discoveries having made in the region in recent years. According to IHS, the Eastern Mediterranean has potential gas volumes in place which are similar to Norway´s.
	Gas	◆◆◆	➡➡➡	
North Sea	Oil	◆◆◆	➡➡➡	Especially by Norway with greater operational efficiency and cost reductions.
	Gas	◆◆◆	➡➡➡	

[7] Table based on expert judgment and assessment of the sources quoted throughout the document.

West Med	Oil	◆◆	➡	Its presence is already mature and its potential to discover new exploitation sites is low. More development to be seen in terms of efficiency improvement and lowering of production costs.
	Gas	◆◆	➡	Its presence is already mature and its potential to discover new exploitation sites is low. More development to be seen in terms of efficiency improvement and lowering of production costs.

Status in each EU Country (Table 2) [8]

Sea Basin	Country	Sector	Presence	Potential	Comments
Atlantic	Ireland	Oil	◆	➡➡	Ireland imported all its oil requirements.
		Gas	◆	➡➡ ➡➡	Ireland imported all its gas requirements until 2015 when the first gas field became operational. In February 2016 new oil and gas licenses were awarded.
Atlantic	Portugal	Oil	◆		It mostly imports oil and gas from Nigeria. However, some new deep offshore licensing rounds are known.
		Gas	◆	➡	
Atlantic / North Sea	United Kingdom	Oil	◆◆◆	➡➡	New fields and enhanced production efficiency. However, fields are too interconnected and the "domino effect" from closing one installation might affect others.
		Gas	◆◆◆	➡➡	25% of gas consumption in the UK is produced locally whilst its demand continues to increase over time.
Atlantic / West Med	France	Gas	◆	➡	Limited potential. Only development of new LNG facilities.
Atlantic / West Med	Spain	Oil	◆	➡➡	Exploration activity is very low and public acceptability of new developments remains a key challenge. However, some new potential at the Canary Islands.
		Gas	◆	➡	

[8] Table based on expert judgment and assessment of the sources quoted throughout the document. **Note: No information was found for the status of either oil or gas at the following countries: Estonia; Finland; Latvia; Lithuania; Slovenia; Belgium; Malta. No information was found for the status of oil for: France; Poland; Germany; Croatia; Cyprus; Greece; Netherlands. No information was found for the status of gas for: Denmark.**

Baltic Sea	Poland	Gas	◆	➡➡	Potential is not big but expansion is planned (new sites).
Baltic Sea	Sweden	Oil	◆	➡	Sector´s development due to highest estimated industrial prices in consumption.
		Gas	◆	➡	
Baltic Sea / North Sea	Denmark	Oil	◆◆	➡➡	In recent years a decline in production, ageing facilities, increasing operational costs. However, there are still resources available which confirms the remaining potential for development. The Danish Energy Agency has estimated that Denmark could remain self-sufficient with oil up to 2021 and with gas up to 2023.
Baltic Sea / North Sea	Germany	Gas	◆◆	➡	Despite having some reports indicating the potential of Germany for shale gas, it is still a challenge to start new developments and new approvals are being blocked.
Black Sea	Bulgaria	Oil	◆	➡➡➡	Further exploration work is planned in Bulgarian waters for the next years.
		Gas	◆	➡➡➡	Further exploration work is planned in Bulgarian waters for the next years.
Black Sea	Romania	Oil	◆◆	➡➡➡	https://en.wikipedia.org/wiki/Natural_gas_in_Romania https://en.wikipedia.org/wiki/Category:Natural_gas_in_Bulgaria
		Gas	◆◆	➡➡➡	Romania´s offshore gas resource could enable self-sufficiency of the country by the end of this decade, as well as potential exports to support the development of a south-east Europe gas hub involving Bulgaria and Greece.
East Med	Croatia	Gas	◆	➡➡➡	Croatia currently meets 65% of its gas demand from domestic production and aims to increase its supply. Large gas potential.
East Med	Cyprus	Gas	◆	➡➡➡	The region´s gas potential is recognized and, according to IHS, the Eastern Mediterranean has potential gas volumes in place which are similar to Norway´s.
East Med	Greece	Gas	◆	➡	86% of its demand comes from Algeria

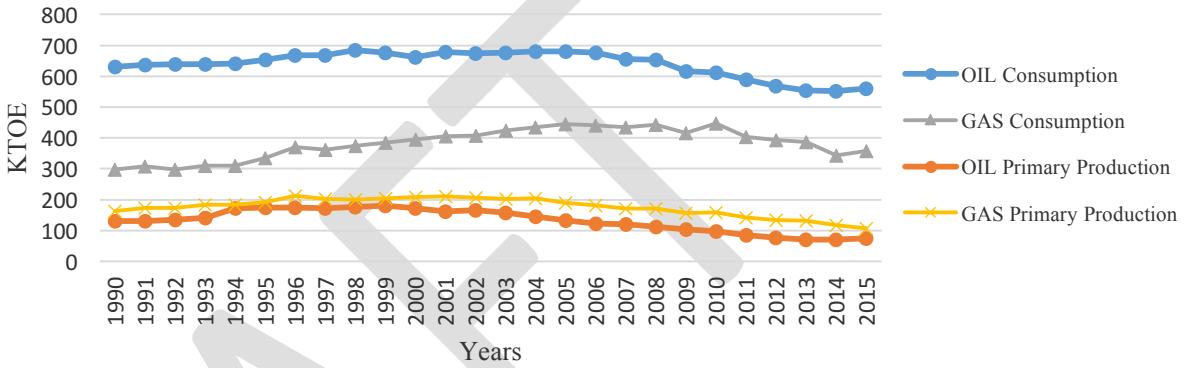
East Med / West Med	Italy	Oil	◆	➡➡	Medium potential
		Gas	◆	➡➡	
North Sea	Netherlands	Gas	◆◆◆	➡➡	Despite recent declines in production, enough reserves remain to be produced.

Legend: ◆ = low presence ◆◆ = medium presence ◆◆◆ = high presence

➡ = none / limited potential ➡➡ = medium potential ➡➡➡ = high potential

3 Status and Evolution Analysis

Current Status



Despite having experienced and survived the downturn that the oil and gas sector has experienced over the last two years, the EU´s oil and gas industry had grown accustomed to an oil price sharp fall and are now positioning themselves to survive and succeed in the long-term at $50 per barrel with the ability to tolerate the possibility of even lower prices. Thus, the existing critical trends of commodity prices should not be overestimated as an issue as the offshore oil and gas sector has proven, with long term experience, to be able to face oil "crashes" and "readjustments" in oil prices in the past. Each time the industry re-invents itself, innovates and compresses its costs.

Thus, while some indications suggest that the oil and gas extraction activity may have finally hit the bottom of the market in 2016, provided cost and efficiency improvements continue and commodity prices hold up, revenues may begin to increase in 2017 both for extraction companies and across much of the supply chain. Therefore, although the demise of oil is still some time away, it's clear that the sector is going through one of the most transformative periods in its history, which will ultimately redefine the energy business as we know it.

At the same time, EU energy needs, linked to the absence of new explorations and production, could only increase EU´s dependency to external sources of supply.

Drivers

- ✓ Consumption demand
- ✓ Barrel prices (affected by drivers of supply and demand)
- ✓ Energy security
- ✓ Diversification of supply

Barriers & Bottlenecks

Note: *Direct spatial implications* would be those which already hold a spatial characteristic (i.e displacements, re-routings, etc.); *Indirect spatial implications* would be those which might occur or not depending if we solve the barrier/bottleneck or not (i.e. efficiency improvements might bring more efficient developments and less new developments might be needed in the future which would create less spatial implications in terms of less space required)

Barriers & Bottlenecks	Direct spatial implications	Indirect spatial implications	Comments
Deep water explorations			The increasing uncertainty over the supply of oil and gas might trend to push most countries out into deeper waters further offshore to look for new oil and gas supply zones
Efficiency improvements			Industry's focus has turned towards delivering efficiency improvements, building on cost reductions (lower unit costs per barrel) and a rationalization of activity, enabling fields to continue operations that would have otherwise been uneconomic. Investments in Automation and Internet of the Things might be a way to go in the future[9].
Barrel / Commodity prices instability			Prices per barrel are affected by many drivers of supply and demand (geopolitical uncertainty, etc.). This instability on the commodity prices makes it hard to establish business trends and limits investments when risks are thought to be high. This might affect existing /new developments and their spatial implications.
Investments for explorations & licensing			Many investors are still unable to access the finance they require to develop offshore assets and to increase the rate of exploration drilling[10]. This might affect existing /new developments and their spatial implications. MSP could improve the leasing/permitting processes for oil and gas development (See MSP Platform FAQ´s page).
Investments in infrastructure			To guarantee life extensions of platforms. Especially needed in the North Sea. This might affect existing developments and their spatial implications.

[9] DNV GL's Technology Outlook 2025

[10] Economic Report 2016, Oil & Gas- UK. ISBN 1 903 004 75 9. 2016 The UK Oil and Gas Industry Association Limited, trading as Oil & Gas UK; http://oilandgasuk.co.uk/wp-content/uploads/2016/09/Economic-Report-2016-Oil-Gas-UK.pdf

Rapid development of the global market			EU is competing with rapidly growing gas markets in Turkey, the Middle East and North Africa. Thus, EU gas market needs to develop at the same pace if willing to remain competitive. This might affect existing /new developments and their spatial implications.
Safety and oil spills			Maximizing the safe exploration will remain an important focus for the industry. Access of safety vessels and the requirement of a safety zone boundary will bring spatial implications.
Low carbon economy			Objectives agreed in Paris at COP21 demanded that EU should remain under the 2°C scenario. In order to do so natural gas remains a fundamental part of this transition to low carbon economy. This might affect existing /new developments and their spatial implications.
Timing licensing			Reducing the timing devoted to licensing will encourage new investments in explorations (which will affect their spatial implications).
Increasing geopolitical uncertainty			60% of world oil production in areas of high geopolitical risk bringing uncertainty over the supply of oil and gas. Most countries might trend to push out into deeper waters further offshore to look for new supply zones. This might affect existing /new developments and their spatial implications.

Policy & Management

Prior to Extraction Legislation:

- *Environmental Management / Assessment*: OSPAR (Recommendation 2003/5 on the Promotion of the Use and Implementation of EMS); EU (European Strategic Environmental Assessment (SEA) Directive (2001/42/EC))
- *Licensing*: EU (Prospection, Exploration, and Production of Hydrocarbon Directive (94/22/EC))

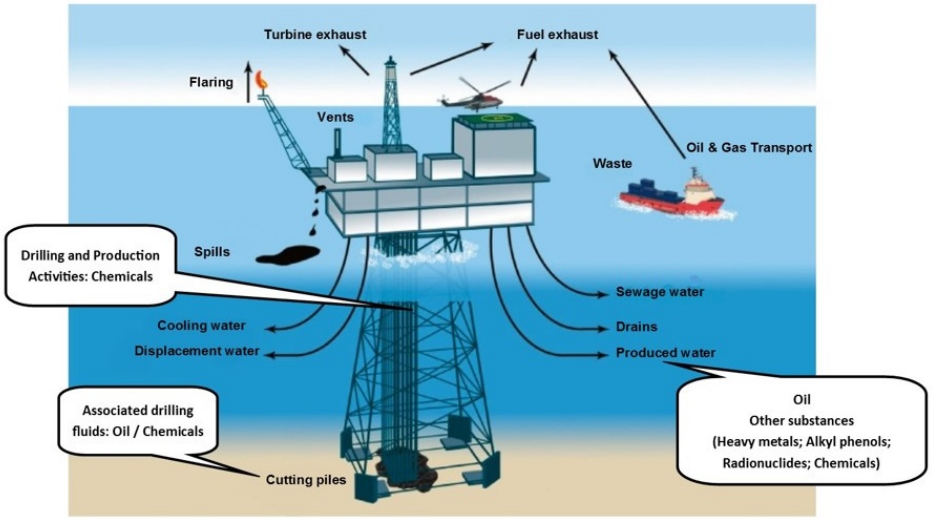


Image modified from https://qsr2010.ospar.org/en/ch07_01.html

Trends[11]

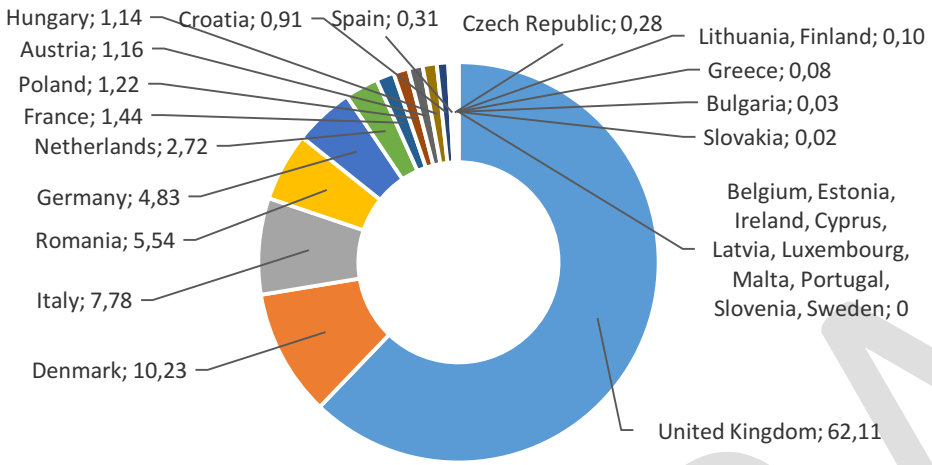


Figure 6: 2015 Total Oil Production (onshore +

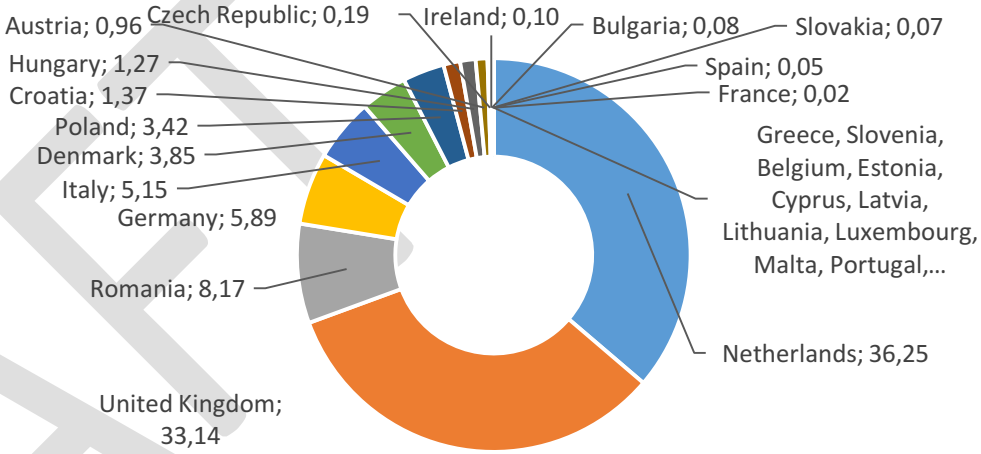


Figure 7: 2015 Total Gas Production (onshore +

- Europe is a generally highly mature operating region, with high costs. New discoveries tend to be smaller and technically challenging, requiring significant investments to develop (e.g. the case offshore Romania in the Black Sea). Thus, new explorations have lowered in Europe (apart from Norway) and finding investment for new explorations and developments still remains a challenge. This is of great concern are key to securing future production and addressing EU's imports dependency. This is why even with today's lower oil price, there are opportunities to better support European natural gas exploration (especially) and production, and encourage continued investment.

  In order to pursue oil and gas development these trends should be considered:
  - New explorations and developments further offshore and floating platforms

[11] 2015 Figure Data was taken from: Eurostat (last update 27.01.17; accessed 24 Apr 2017; search: "Complete energy balances - annual data [nrg_110a]";

- Investments in infrastructure to guarantee life extensions of platforms
- Automation: Internet of things (IoT)[12].

- Geopolitical uncertainty and self-sufficiency (especially for gas in EU): Increasing geopolitical conflicts creates an uncertain energy market which, in the case of Europe, still remains highly dependent on imports. This is why in 2014 the European Commission published its European Energy Security Strategy Communication, which aimed at improving Europe's resilience to supply disruptions in the short, medium and long-term. This strategy will help meeting the Energy Union objectives, both in relation to established areas (such as the North Sea) as well as new regions including the eastern Mediterranean and Black Sea.
- Safety: Maximising the safe exploration of Europe's oil and gas will remain an important focus for the industry in Europe
- Decommissioning and other uses: What to do with decommission of the oil platforms? Are other uses possible? Some have suggested using old gas fields to store CO2 emissions (eg. In the Netherlands this has been suggested in the MSP) or even as artificial reefs for conservation and recreational activities

Countries to have in mind in MSP due to their potential future increase in production of oil/gas (Future Energy Production data from EU Reference Scenario 2016).

Country	Sector	(2020-2015)	(2025-2020)	(2030-2025)	(2035-2030)	(2040-2035)	(2045-2040)	(2050-2045)
Bulgaria	OIL	X	X	X	X	X	X	X
	GAS	X	X	X	X	X	X	X
Croatia	OIL							
	GAS	X						
Cyprus	OIL							
	GAS		X	X	X	X	X	
Estonia	OIL		X					

[12] The Internet of Things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data.

	GAS							
France	OIL							
	GAS					X		
Ireland	OIL							
	GAS						X	
Italy	OIL	X		X				
	GAS							
Netherlands	OIL	X						
	GAS						X	
Poland	OIL	X						
	GAS	X	X	X	X	X	X	X
Romania	OIL	X	X	X	X	X	X	X
	GAS	X		X	X	X	X	X
Slovenia	OIL							
	GAS	X	X	X	X	X		
Spain	OIL			X	X	X		
	GAS	X	X	X				

4 Spatial Consequences of Future Trends

There are three potential options (A, B, C) for Oil and Gas Production Increase for EU Member States, some of which would have spatial implications (and would have to deal with EU MSP Directive), whilst others may not require a spatial growth of the space required by the activity.

A. An increase in offshore oil / gas production without the development of new exploration and drilling sites (no new rigs offshore) due to efficiency improvements at the extraction phase.
B. An increase in oil / gas production with the development of new exploration and drilling sites (new rigs onshore).

C. An increase in offshore oil / gas production with the development of new exploration and drilling sites (new rigs offshore).

Options A & B would not necessarily imply a spatial growth of the space required by the activity. Thus, these options would potentially not have MSP implications and would not create conflicts with other marine activities. This is envisaged to be the option to be followed by those EU Member States whose oil and gas production might have reached its upper limits or where the development of new offshore development areas is too expensive to pursue. Examples of these option states would be UK and Netherlands.
Option C would imply a spatial growth of the marine space required by the activity. Thus, this option would potentially have MSP implications and would potentially create conflicts with other marine activities.

At the same time, an increase of revenues coming from the offshore oil and gas activity might also come from cost of maintenance reductions due to automation and the application of new technologies (such as the Internet of Things) or an economic increase of the commodity price.

Relationship with other sectors

The matrix below indicates the potential Oil & Gas Sector compatibility (synergies and conflicts) with other marine sectors. Note: red = potential conflicts; green = potential synergies; grey = not applicable.

		Shipping and Ports	Tourism & Recreation	Oil & Gas Extraction	Pipelines & Cables	Fishing	Aquaculture	Marine Renewables	Marine Aggregates	Conservation
Oil & Gas	Synergies									
	Conflicts/Risks									

Recommendations in MSP

(After the conference)

5 Resources / Actors / References

Actors

Name of Actor	Type of Actor	LINK	Short explanation
World Petroleum Council (WPC)	Non-political organization	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)	Association	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.

Projects

Name	Type of Project	Duration	LINK	Short explanation
MERMAID (Innovative Multi-purpose offshore platforms: planning, design & operation)	FP7 Transport	3 years (2012-2015)	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.

References

- DNV GL's Technology Outlook 2025
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- Energy sectors and the implementation of the Maritime Spatial Planning Directive report: Luxembourg, 2015.
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