North Sea Energy
offshore system integration

2.2

North Sea Energy 2020-2022

Legal Challenges for Offshore System Integration in Energy Hubs

North Sea Energy 2020-2022

Unlock the low-carbon energy potential North Sea with optimal value for society and nature

The North Sea Energy program and its consortium partners aim to identify and assess opportunities for synergies between energy sectors offshore. The program aims to integrate all dominant low-carbon energy developments at the North Sea, including: offshore wind deployment, offshore hydrogen infrastructure, carbon capture, transport and storage, energy hubs, energy interconnections, energy storage and more.

Strategic sector coupling and integration of these low-carbon energy developments provides options to reduce CO2 emissions, enable & accelerate the energy transition and reduce costs. The consortium is a public private partnership consisting of a large number of (international) partners and offers new perspectives regarding the technical, environmental, ecological, safety, societal, legal, regulatory and economic feasibility for these options.

In this fourth phase of the program a particular focus has been placed on the identification of North Sea Energy Hubs where system integration projects could be materialized and advanced. This includes system integration technologies strategically connecting infrastructures and services of electricity, hydrogen, natural gas and CO2. A fit-for-purpose strategy plan per hub and short-term development plan has been developed to fast-track system integration projects, such as: offshore hydrogen production, platform electrification, CO2 transport and storage and energy storage.

The multi-disciplinary work lines and themes are further geared towards analyses on the barriers and drivers from the perspective of society, regulatory framework, standards, safety, integrity and reliability and ecology & environment. Synergies for the operation and maintenance for offshore assets in wind and oil and gas sector are identified. And a new online Atlas has been released to showcase the spatial challenges and opportunities on the North Sea. Finally, a system perspective is presented with an assessment of energy system and market dynamics of introducing offshore system integration and offshore hubs in the North Sea region. Insights from all work lines have been integrated in a Roadmap and Action Agenda for offshore system integration at the North Sea.

The last two years of research has yielded a series of 12 reports on system integration on the North Sea. These reports give new insights and perspectives from different knowledge disciplines. It highlights the dynamics, opportunities and barriers we are going to face in the future. We aim that these perspectives and insights help the offshore sectors and governments in speeding-up the transition.

We wish to thank the consortium partners, executive partners and the sounding board. Without the active involvement from all partners that provided technical or financial support, knowledge, critical feedback and positive energy this result would not have been possible.

North Sea Energy 2020-2022

Legal Challenges for Offshore System Integration in Energy Hubs

Prepared by:

University of Groningen
Lisa van Nieuwkoop
Martha Roggenkamp

Approved by:

TNO
Madelaine Halter

The project has been carried out with a subsidy from the Dutch Ministry of Economic Affairs and Climate, National Schemes EZK-subsidies, Top Sector Energy, as taken care of by RVO (Rijksdienst voor Ondernemend Nederland)

Table of Contents

List of abbreviations

BBergG	Bundesberggesetz
BNetzA	Federal Network Agency
BSH	Federal Maritime and Hydrographic Agency of Germany
CCS	Carbon capture and storage
CO_2	Carbon dioxide
CS	Continental Shelf
EBN	Energiebeheer Nederland
EEZ	Exclusive Economic Zone
EIA	Environment Impact Assessment
EOR	Enhanced Oil Recovery
EU	European Union
ICJ	International Court of Justice
IMO	International Maritime Organization
NECP	National Energy and Climate Plan
NSA	North Sea Area
NSE	North Sea Energy
NSTA	North Sea Transition Authority
nTPA	Negotiated Third Party Access
OECD	Organization for Economic Cooperation and Development
OFTO	Offshore Transmission Owner
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PCI	Project of Common Interest
PtG	Power-to-Gas
rTPA	Regulated Third Party Access
SoS	Secretary of State
TCA	Trade and Cooperation Agreement
TFEU	Treaty of the Functioning of the European Union
TPA	Third party access
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UNCLOS	United Nations Convention on the Law of the Sea

Executive Summary

Historically the North Sea basin has primarily been utilized for navigation purposes as well as for exploiting fishery resources. Technical developments in the mid-20th century, however, gave rise to mining activities as the North Sea Area contains large oil and gas reserves. Due to (i) climate change commitments, (ii) security of supply considerations, and (iii) the diminishing availability of fossil fuels, the North Sea Area has increasingly been used to produce renewable energy as off the beginning of the 21st century. The main difference between the initial offshore activities (*i.e.*, navigation and fishery) and the offshore activities which evolved at a later stage (*i.e.*, mining, and renewable energy production), is the latter's common denominator of utilizing (fixed) installations or structures. In addition, nowadays, it is possible to multi-use or re-use existing installations. These trends may require a new focus on the regulation of offshore installations rather than the type of energy produced. Therefore, the objective of this report is to go beyond a general analysis of system integration and focus in particular on whether the development of 'energy hubs' will stimulate system integration and possibly, *vice versa*, how system integration will be a prerequisite for developing energy hubs. The rationale for selecting energy hubs is to stimulate system integration in order to support the North Sea Roadmap towards 2050. The main focus will be on (i) platform electrification, (ii) offshore hydrogen production and (iii) carbon capture and storage.

The report analysis the legislative and administrative powers of the Netherlands, the United Kingdom, Denmark, and Germany offshore, *i.e.*, in their territorial sea, on their Continental Shelf (CS) and in their Exclusive Economic Zone (EEZ). Whereas coastal states have full sovereignty in their territorial waters, there rights are limited on the CS and in the EEZ. In the latter offshore zones, they have an exclusive right to produce energy (oil, gas, and electricity from renewables) and develop other economic activities as long as they take into account other obligations under international law such as the protection of the marine environment and the freedom of navigation and fishery but also the freedom to lay (transit) cables and pipelines, except for those cables and pipelines that are subject to a coastal state's sovereign rights. As a result of these sovereign rights, coastal states can apply and/or develop legislation governing these offshore activities. Increasingly the legislation is influenced by EU law (e.g. Hydrocarbons Licensing Directive, Electricity Directive, Renewable Energy Directive and Directive on geological storage of CO_2). However, so far EU law (and national law) does not explicitly refer to system integration neither to energy hubs. This may change in the future as the European Green Deal provided for the first time in 2020 a policy strategy on system integration. However, it remains to be seen whether the definition presented in the strategy is sufficiently precise and/or it will (ever) become part of EU law and thus binding on Member States.

Our analysis of the selected offshore energy hubs shows that the North Sea states endorse the development of such hubs but in varying degrees and pace. Policy documents support, for example, platform electrification but practical examples in the North Sea area are limited to one cross-border project in the territorial waters of the Netherlands and Germany. This project is therefore not illustrative for platform electrification in the EEZ. The practical application will also depend on the possibility that wind farm developers will be granted an exemption to the general rule that offshore wind parks need to be connected to the offshore transmission system. Moreover, there is a need to qualify the cable connecting a wind farm and platform. Also with regard to offshore hydrogen production, we note that national policies support hydrogen production and the development of a hydrogen market. However, some legal uncertainty exists as an EU legal framework is not yet in place. Nevertheless, some projects are (being) developed in the Netherlands and Germany. Both projects integrate an electrolyser in another installation (gas production platform or wind turbine). Such integration/multi-use depends on the extent

to which the applicable laws allow for such integration (e.g. a combined gas hydrogen platform or combined wind hydrogen turbine) and how to qualify the pipeline bringing the hydrogen to shore. Although the development of carbon dioxide transport and storage is legally less complicated as a EU legal framework is in place, still some uncertainties exist if (almost) depleted reservoirs and installations are reused and how coastal states will take over responsibility of any reservoirs that are permanently closed. Additional complications may arise when developing cross-border projects (e.g., NOR-EG project). Another interesting example of an offshore energy hub is the development of an offshore artificial energy island in the Danish part of the North Sea. Although the project is still in its early stages of development, Denmark has drafted a separate law enabling the construction of such island and will organise a tender next year. As it is likely that this island will be used for wind energy and hydrogen production, it will become a true offshore energy hub and an example of system integration.

Each of these functional hubs integrate various stages and players of the energy chains, various energy carriers and actors in the value chain and adjacent sectors. At first glance, these hubs thus meet the definition of system integration used in this project. However, it could be questioned whether these hubs really are examples of system integration. When considering platform electrification, we conclude that the oil and/or gas production installations actually become electricity consumers, which in itself is not a new development. Similarly, it can be questioned that transport and offshore storage of CO_2 is a matter of system integration as CO_2 is not an energy carrier and part of the energy value chain. Offshore hydrogen conversion is maybe the best example of system integration, especially as hydrogen production is directly integrated in another energy carrier or value chain such as gas or electricity production. However, the outcome might be different when combining or integrating these energy hubs (e.g. electrification of a platform used for CO_2 storage).

We conclude that there is a trend towards system integration and that (integrated) functional energy hubs can play a role in this process. However, we find that the current definition of system integration presented by the EU (and also used in the North Sea Energy projects) is not sufficiently clear and to the point. A more precise definition that presents more clearly which value chains are integrated and how, would be helpful as well as some guidance on when a development should be considered as system integration. As a next step it could be assessed whether an EU policy of system integration should get a legal basis, and/or whether it should be part of individual sector laws or a separate law on system integration.

1. Introduction

Historically, the sea was considered as international territory and all nations were free to use the sea for seafaring purposes such as navigation and fishery. It was thus not delimited for any national use. Technical developments in the mid-20th century, however, gave rise to discussions about the extent to which coastal states should be given some exclusive rights offshore and be entitled to regulate specific energy activities such as the exploration and production of offshore oil and gas reserves and, more recently, renewable energy sources like offshore wind. In 1958, the United Nations presented the Geneva Conventions, consisting of, *inter alia*, the Convention on the Territorial Sea and Contiguous Zone[1], the Convention on the High Seas[2] and the Convention on the Continental Shelf.[3] The latter Convention provided a legal basis for coastal states to exclusively explore and produce oil and gas resources on their continental shelf. The 1982 United National Convention on the Law of the Sea (hereafter: UNCLOS) gave coastal states additional exclusive powers to produce renewable energy offshore, upon the condition that they had proclaimed an exclusive economic zone (see further chapter 2 below).[4]

All North Sea states have signed and ratified the 1958 Geneva Conventions and UNCLOS. Since the 1970s, the North Sea Area (hereafter: NSA) has been used extensively for oil and gas exploration and production. However, due to climate change commitments and security of supply considerations, the NSA has increasingly been used to produce electricity from renewable sources (*i.e.*, wind) since the beginning of the 21st century.[5] Given the limited powers of coastal states offshore, each activity required coastal states to assess which laws should be applied offshore and/or the need to draft specific offshore legislation. In practice, specific acts have often been issued to regulate offshore exploration and production of oil and gas (e.g., an offshore petroleum law or a continental shelf mining act) and/or the production of offshore wind energy (e.g., an offshore wind energy act). So far, offshore energy law has thus developed in a fragmented way.

In the (near) future the NSA will also be used for other novel energy solutions such as carbon dioxide transport and storage, hydrogen production and electricity generation from floating solar panels.[6] Apart from carbon dioxide storage and transport, these activities have often not yet been regulated by law and this could hamper offshore energy innovation; without regulatory certainty energy investments may not be made. This regulatory uncertainty impedes the energy transition, especially as the European Commission stipulated the need to reduce greenhouse gas emissions by at least 55% instead of 40% by 2030, compared to 1990 levels[7] and the even more ambitious goal to become carbon neutral in 2050.[8] These climate goals require a societal shift from conventional energy sources to a renewable energy system. An increasing and varied use of renewable energy sources offshore will involve the need to assess several types of system integration but also a possible multi-use or re-use of existing installations and the use of floating installations. This may require a new focus on the regulation of offshore

---

[1] Convention on the Territorial Sea and the Contiguous Zone, Geneva, 29 April 1958.
[2] Convention on the High Seas, Geneva, 29 April 1958.
[3] Convention on the Continental Shelf, Geneva, 29 April 1958.
[4] United Nations Convention on the Law of the Sea, 10 December 1982.
[5] J. Matthijsen et al, '*The future of the North Sea – The North Sea in 2030 and 2050: a scenario study*', PBL Netherlands Environmental Assessment Agency, no. 3193, 2018.
[6] World Energy Council, 'Bringing North Sea Energy Ashore Efficiently', 2018, p. 11.
[7] European Commission, '*2030 Climate & Energy* Framework. *Greenhouse gas emissions – raising the ambition*', September 2020.
[8] F. Simon, 'EU-leaders secure deal on raising 2030 climate ambition' (*EURACTIV*, 12 December 2020) <https://www.climatechangenews.com/2020/12/11/eu-leaders-secure-deal-raising-2030-climate- ambition/> accessed 13 December 2020.

installations (being the common denominator of these offshore activities) rather than the type of energy produced.[9] The ambition to integrate activities and re-use installations as part of offshore energy hubs can be considered as an attempt to create such new focus.

1.1 Objectives

The above presented process of an increased and more varied use of the NSA for energy purposes will require a new regulatory focus. It may be necessary to depart from the earlier fragmented legal energy source-based legal framework to a more overarching regulatory energy system. This approach will involve the need for system integration as presented and analyzed in the earlier NSE programs. In North Sea Energy 2 'system integration' was defined as:

> *"a process of integration between various stages and players of the energy value chains, between various energy carriers, between actors in the value chains and with adjacent sectors in the system, as a consequence of which solutions to bottlenecks are being offered and as a consequence of which opportunities arise for new products and services."*[10]

This definition highlights that system integration is about linking previously separated stages, players, energy carriers and adjacent sectors through innovative methods into one large energy system. Consequently, system integration benefits society as it, *inter alia*, contributes to a more resilient energy supply and reduces decommissioning costs as well as corresponding negative environmental effects of oil and gas platforms by extending their economic lifetimes.[11]

The objective of this report is to go beyond a general analysis of system integration and focus in particular on how the development of 'energy hubs' will stimulate system integration and possibly, *vice versa*, how system integration will be a prerequisite for developing energy hubs. The rationale for selecting energy hubs is to stimulate system integration and to support the 'North Sea Roadmap towards 2050'.

As the concept of 'energy hubs' is not (yet) legally defined, this study makes use of the definition presented in work package 1:

> *'Multi-carrier (both electrons and differing molecules) offshore energy systems consisting of production, conversion and/or storage. In this way, energy hubs are search areas for offshore system integration opportunities. These energy hubs are connected to the shore via national (transport) cables or interconnected internationally.*[12]

It will in particular study the regulatory issues that have been identified in relation to the energy hubs that have been determined in work package 1: Hub West (which is situated close to the United Kingdom), Hub East and Hub North (which both are located close to Germany and Denmark). This report will thus focus on what is needed to legally enable the set-up of these selected energy hubs. Within these energy

---

[9] Article 56(1)(b)(i), 60 and 80 UNCLOS.

[10] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, pp. 23-26.

[11] See Deliverable 7.1; TKI Energy <https://www.topsectorenergie.nl/systeemintegratie> accessed 20 January 2021.

[12] More details on the hub locations can be found in D1.1. The phrase 'search area' should not be mistaken for the term as used in the Wind Energy at Sea Act.

hubs the focus will be on three developments. The first development is platform electrification, which means that oil and/or gas production installations can be supplied with electricity by connecting the platforms via a cable to the onshore grid, the offshore grid or directly to an existing or future wind farm. These options have been examined previously in North Sea Energy 2.[13] The second development is offshore power-to-gas (hereafter: PtG) and refers to the use of electricity to produce hydrogen and methane through electrolysis and mechanization.[14] Offshore production of hydrogen at existing (potentially disused) hydrocarbon installations and subsequently transporting it via natural gas pipelines have been analyzed in North Sea Energy 3.[15] This research aims at creating further guidance with regard to offshore PtG but in order to avoid duplication of research efforts, the research will rely on the outcome of other research directly related to North Sea Energy 4. The third development included in the energy hub scenario is the offshore storage of CO_2 in (almost) depleted hydrocarbons reservoirs. This development has also been discussed in North Sea Energy 2 and more elaborate in the Align CCS project.[16]

These three developments have as a common denominator the possibility of a multi-use and/or reuse of offshore installations. This possibility requires a legal analysis of the role of offshore infrastructure in system integration and the development of offshore energy hubs. Whereas UNCLOS makes use of the terms 'installations' and 'structures', it does not clearly define these terms and neither whether 'installations' could or should legally be distinguished from 'structures'. However, it is generally accepted that both terms cover large physical infrastructures and are subject to coastal states' functional jurisdiction. Nevertheless, this is not necessarily the case with regard to the construction and use of all offshore cables and pipelines. Sometimes, these may be subject to the freedom of navigation and therefore be excluded from a states' functional jurisdiction. Consequently, this may impact the development of energy hubs, especially if these hubs involve a cross-border element.

1.2 Methodology

This report seeks to establish how to (overarchingly) regulate the differing energy technologies which are united in the designated energy hubs; partly based on the questions deriving from work package 1. Legal-dogmatic research will be carried out based on both written and unwritten rules, principles, and legal concepts.[17] To that end, this report will entail a comprehensive overview of the current status of international, European, and national law pertaining to the determined offshore energy activities. Based on the locations of the selected hubs, an additional focus will be on the offshore energy regimes of the United Kingdom (Hub West), Germany and Denmark (Hub East and Hub North respectively); this requires a legal comparative approach to investigate the country-specific laws. Therefore, this report will examine developments in national law and policy in order to identify legal incentives and challenges regarding offshore energy hubs to enhance future legislative processes.

[13] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, pp. 23-26.

[14] International Energy Agency, '*The Future of Hydrogen: Seizing today's opportunities*', report prepared by the IEA for the G20, Japan, 2019.

[15] L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 80.

[16] J. Gazendam & M.M. Roggenkamp, 'Legal aspects of reuse of offshore hydrocarbon infrastructure for CCS', Align CCUS – Deliverable 3.3.4, May 2020.

[17] I. Dobinson & F. Johns, 'Legal Research as Qualitative Research', Research Methods for Law (eds. M. McConville, W.H. Chui), Edinburgh University Press, 2017.

1.3 Structure

This chapter introduced the topic of the underlying report. The next chapter discusses the legal aspects of offshore energy activities from an international legal perspective, based on the concepts presented at the beginning of this chapter. Chapter three analyses the applicable EU policy and legislative frameworks pertaining to offshore energy developments, system integration and the hub functions. Chapter four will then focus specifically on the energy hub functions, including the element of ‘system integration’ and presents the legal challenges that need to be addressed. Chapter five continues by displaying the national legal frameworks of the Netherlands, the United Kingdom, Denmark, and Germany and is based on a comparative approach. Chapter six presents a final analysis and some recommendations.

2. International Law

The ocean is the earth's greatest natural resource since it covers 71% of her surface. As a result of technological change, the traditional uses of the ocean (e.g., navigation and petroleum production) are undergoing significant modifications and scientific progress provides a promising frontier for continued technological discovery.[18] This progress comprises mainly power generation technologies. Increasing legal certainty is proven to be vital for investments in the development of these offshore energy technologies. However, there is no one-size-fits-all approach to clean energy transitions.[19] This can also be questioned with regard to the development of clear energy sources offshore as coastal states have less legislative and administrative powers at sea. This chapter will focus on the role of international law on offshore energy developments and the extent to which it provides the opportunity to regulate a range of different technologies in a holistic manner. To that end, this chapter will first elaborate on the sources of international law (§2.1). This will be followed by an assessment of coastal states' exclusive rights offshore (§2.2) and how these apply to the development, use and decommissioning of offshore infrastructure (§2.3).

2.1 Sources of International Law

The sources of international law as applied by the International Court of Justice (hereafter: ICJ) are (i) international conventions, (ii) customary international law, (iii) general principles of law as recognized by civil nations and (iv) judicial decisions.[20] The ICJ is not obliged to follow previous decisions but in the absence of treaties, customs, or general principles, the ICJ examines previous decisions in order to solve a dispute.[21] Of main importance are treaties and customary international law. Once a treaty has entered into force, it becomes binding on all states that have both signed and ratified that particular legislative document. Customary international law can exist when states have adopted a certain practice or custom and perceive this custom or practice as a legal norm.[22] Contrary to treaties, it does not have to be explicitly enshrined in legal frameworks to have legal effect.

Regarding offshore activities, the 1958 Geneva Convention on the Continental Shelf, and the United Nations Convention on the Law of the Sea are the prominent sources of international law.[23] Both conventions provide, *inter alia*, the legal basis for coastal states to exclusively regulate offshore energy activities. Additionally, there are several other conventions that create both duties and obligations for coastal states, including the Convention for the Protection of the Marine Environment of the North-East Atlantic[24] (hereafter: OSPAR) and the London Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter[25] (London Convention). These latter treaties focus in essence on

---

[18] John Warren Kindt, The Law of the Sea: Offshore Installations and Marine Pollution, 12 Pepp. L. Rev. Iss. 2.

[19] International Energy Agency, Net Zero by 2050, A Roadmap for the Global Energy Sector, May 2021.

[20] Article 38(1) of the Statute of the International Court of Justice.

[21] S.T. Helmersen, 'Finding 'the Most Highly Qualified Publicists': Lessons from the International Court of Justice' [European Journal of International Law] 2019, pp. 509 – 535.

[22] Y. Tan, 'The Identification of Customary Rules in International Criminal Law', Utrecht Journal of International and European Law 2018, p. 94.

[23] UNCLOS serves as a basis for customary international law. See for more information: G.L. Scott & C.L. Carr, *Multilateral* Treaties, *and the Formation of Customary International Law*, 25 Denv. J. International Law and Policy (1996).

[24] Text as amended on 24 July 1998, updated 9 May 2002, 7 February 2005, and 18 May 2006. Amendments to Annexes II and III adopted at OSPAR 2007.

[25] Adoption 13 November 1972; entry into force 30 August 1975; 1996 Protocol Adoption 7 November 1996; entry into force 24 March 2006).

the protection of the marine environment from activities offshore. All in all, international law essentially regulates the conduct and activities of states.

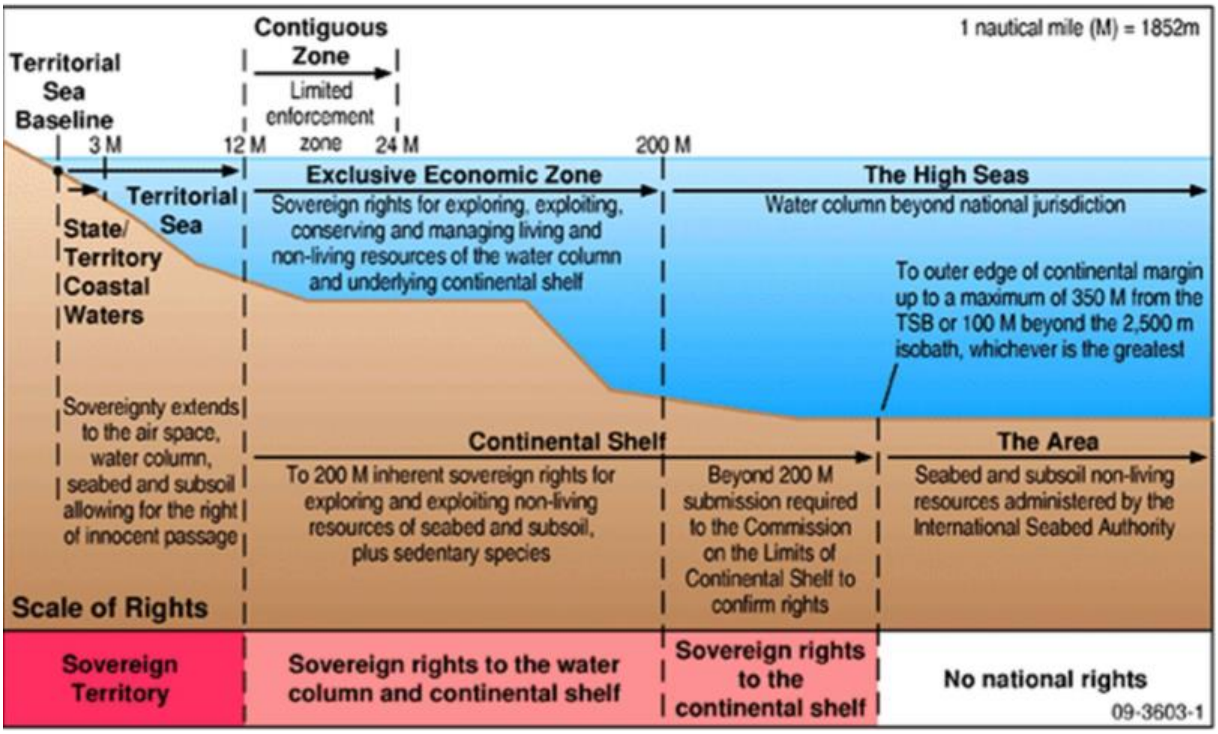


Figure 1. UNCLOS' international maritime zones.[26]

2.2 Coastal States' Exclusive Rights Offshore

State sovereignty is one of the key principles of international law and implies that states have the exclusive authority to rule over their territory and the people within their borders. The extent to which coastal states may exercise exclusive rights offshore is also a matter of international law and regulated by international law of the sea treaties, which distinguish various offshore zones within which coastal states may have exclusive rights. To begin with, the 1958 Geneva Conventions identified three different offshore zones: the territorial sea, the continental shelf (hereafter: CS) and the high seas. The territorial sea has been codified as a belt of sea adjacent to a state's land territory and internal waters, extending up to twelve nautical miles from the state's baseline.[27] In addition, a coastal state may have a CS, i.e. part of the continent that lies under the ocean in relatively shallow waters and no further than a distance of 200 nautical miles from the outer edge of the territorial sea.[28] The 1982 United Nations Convention of the Law of the Sea[29] introduced an additional offshore zone: the Exclusive Economic Zone (hereafter: EEZ). This zone consists of an area of the ocean beyond and adjacent to the territorial sea (including the water column) and cannot extend beyond 200 nautical miles from outer edge of the territorial sea. Moreover, an EEZ needs to be proclaimed by coastal states. In practice, however, a CS and EEZ may overlap. The area outside the CS and EEZ is generally referred to as the High Seas (see for more detail about the zones figure 1 above).

[26] Image by National Oceanic and Atmospheric Administration.
[27] E.D. Papastavridis, 'Protecting Offshore Energy Installations under International Law of the Sea. Natural Resources and the Law of the Sea, University of Oxford, p. 10.
[28] Article 76 para 1 UNCLOS. Please note that the definition in the Geneva Convention on the Continental Shelf differed as article 1 para 1 referred to a depth of 200 meters or to a depth where exploitation of natural resources would be possible.
[29] Convention on the Law of the Sea, 10 December 1982, 1833 U.N.T.S. 397.

Traditionally, the territorial sea is considered as part of a coastal state's territory. Hence, coastal states have full jurisdiction in the territorial sea. Generally, national laws (with some exceptions) also apply to the territorial sea. By contrast to the territorial sea where coastal states have full sovereignty, coastal states have limited rights on the CS and EEZ. In case there is a CS or an EEZ, coastal states *ipso jure* exercise sovereign rights for the purpose of exploring these zones and exploiting their natural resources (e.g., oil and gas)[30], the production of energy from water, currents and winds (e.g., renewable energy sources) and (other) economic activities.[31] These 'sovereign rights' must be distinguished from 'sovereignty' given that the former are of specific functional purposes that are exclusively exercised by a coastal state on the CS and in the EEZ. Hence, national legislators need to decide whether or not they want to extend national law to the CS and/or EEZ or to draft specific offshore legislation for the relevant offshore activity. Based on its functional jurisdiction, coastal states also have the exclusive right to establish and use installations and structures (and artificial islands) necessary to for the exploration and production of these energy sources.[32] However, the establishment and use of fixed offshore (energy) installations may conflict with the traditional principle that all nations are free to use the sea for seafaring trade.[33] Therefore, coastal states are also obliged to comply with rules on freedom of navigation and to ensure adequate provisions for the safe and unhindered passage of ships in their waters.

As the seabed of the NSA qualifies as one CS, all adjacent and opposite states had to agree on a delimitation of the shelf. Hence, the North Sea states (the United Kingdom, Belgium, the Netherlands, Germany, Denmark, and Norway) concluded a series of bilateral agreements in the 1960s and 1970s.[34] The delimitation of the CS was a prerequisite for coastal states to ensure their exclusive right to explore and exploit oil and gas resources in their part of the NSA. Similarly, all North Sea states proclaimed an EEZ around the turn of this century given there was a keen interest to developing offshore wind energy.[35] See in more detail about the demarcation of the NSA figure 2 below.

[30] Article 2(1) 1958 Geneva Convention on the Continental Shelf and article 77 (1) UNCLOS.

[31] Article 56(1)(a) and (1)(b) UNCLOS.

[32] Article 5(2) 1958 Geneva Convention on the Continental Shelf and articles 60 and 80 UNCLOS.

[33] E.D. Papastavridis, 'Protecting Offshore Energy Installations under International Law of the Sea. Natural Resources and the Law of the Sea, University of Oxford, p. 12.

[34] See C. Redgwell, in 'Energy Law in Europe' (ed. M. Roggenkamp et all), 3d edition, 2016, p. 58.

[35] See chapter 5.

Figure 2. Delimitation of the NSA.

Since the 1970s, the number of offshore installations has increased considerably. These installations may facilitate offshore energy production but can also have an environmental and/or climate impact. Although UNCLOS addresses the need for environmental protection offshore[36], more elaborate rules have been included in other regional treaties such as the earlier mentioned OSPAR and the London Convention. Regional arrangements are considered as the most appropriate instruments to deal cooperatively with issues such as pollution from offshore installations. Extensive geographical differences between various regions make efforts towards global cooperation both extremely complicated and unnecessary. Regional bodies such as the European Union (hereafter: EU) lend international legitimacy to intrusions on state sovereignty, as regional bodies are seen as more directly accountable than global orders such as the United Nations.[37] Over the years, global cooperation has increased but often measures are still largely national oriented and relate to the individual energy sources (*inter alia*, hydrocarbons). This study takes a different approach as it applies system integration as a means to provide for a transnational, integrated and a step-change to a build out of hubs in the NSA and, consequently, interdependencies across key regulatory and policy topics.[38] A key element of this approach is the role of offshore energy infrastructure. We will therefore discuss below the role of international law in the development and use of energy infrastructure offshore.

2.3 Regulating Offshore Infrastructure

Offshore energy developments make use of a number of fixed installations like hydrocarbons exploration and production facilities and wind turbines but also pipelines, cables, and ships to transport energy to shore.[39] Such infrastructure also plays a key role in developing offshore energy hubs. Below we will

[36] Articles 192-201 UNCLOS.

[37] M. Fitzmaurice, International Environmental Law and Governance, Brill Nijhof 2018.

[38] North Sea Wind Power Hub Programme, Towards the first hub-and-spoke project, 2021; 38 B. Brouwers, 'Series of energy islands in North Sea to meet the Paris climate agreements' < https://innovationorigins.com/en/series-of-energy-islands-in-north-sea-to-meet-the-paris-climate-agreements/> accessed on 23 June 2021.

[39] D. Drankier & M.M. Roggenkamp, North Sea Energy II Regulatory Framework: Barriers or Drivers for Offshore System Integration, North Sea Energy, Deliverable B.1, 2018, p. 6-15.

examine the role of international law in constructing and using offshore infrastructure, the extent to which coastal states are entitled to regulate the infrastructure and the legal framework relating to the earlier mentioned infrastructure if it is no longer in use.

2.3.1 Installations *vs* Structures

International Law of the Sea applies a range of different concepts. Whereas the 1958 Geneva Convention on the Continental Shelf refers to 'installations and devices', UNCLOS speaks about 'installations and structures'.[40] Neither of them provides a clear definition of the terminology used. However, as the word 'devices' usually refers to a piece of equipment or tool designed to do a particular job[41], it can be assumed that 'devices' are part of or closely connected to constructing or using installations. Unfortunately, UNCLOS does not provide more clarity as it introduces the term 'structures' without further defining both concepts. Although during the negotiations of UNCLOS a number of attempts were made to define the term 'installation'[42], these did not meet with success.[43] An additional complication arises from the fact that elsewhere in UNCLOS reference is made to 'platforms' as a type of man-made construction at sea but then in particular in relation to the offshore disposal of waste (e.g., dumping).[44] Whereas UNCLOS distinguishes between 'vessels' and 'platforms' as two different types of man-made structures, the International Convention for the Prevention of Oil Pollution from Ships includes 'platforms' in the definition of 'vessels'.[45] By contrast to fixed installations, vessels are subject to flag state jurisdiction, i.e. the jurisdiction under whose laws the vessel is registered or licensed.[46] Although the term vessel is broader in scope than the term 'ship'[47], their common denominator is that they are floating objects. As in practice use is made of floating mobile offshore units (*inter alia*, floating production, storage and offloading units), the distinction between 'ships and vessels' and 'structures and installations' remains complex as the functional jurisdiction of coastal states only applies to installations and structures.[48] As a general rule, their categorization depends on whether or not the unit is self-propelled, its mode of operation and activity.[49] In addition, it needs to be assessed how and for how long the unit is attached to the seabed. Floating structures attached to the seabed via anchors can be considered as fixed installations or structures if they are kept at the same position for a long time. As fixed installations and structures may impact the freedom of navigation and fishery due notice has to be given of its construction and a permanent means of warning of their presence must be maintained.[50] If necessary, coastal states may establish safety zones with a maximum distance of 500 meters around these installations.[51]

Apart from these general rules contained in UNCLOS, other international agreements contain more detailed rules, especially concerning installations and structures. Reference can, for instance, be made to the Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms located on the

[40] Art. 5 para 2 Geneva Convention on the Continental Shelf, art. 56 para 2 UNCLOS.
[41] Oxford Dictionary.
[42] International Law Commission, 3 May 1999.
[43] Rules for Classification and Construction of Industrial Services 2007.
[44] Article 1 para 5 UNCLOS.
[45] A.G. Oude Elferink, 'Artificial Islands, Installations and Structures', Max Planck Encyclopaedia of International Law 2013, p. 2.
[46] Article 31 UNCLOS.
[47] H. Manaadiar, 'Difference between a ship and a vessel', (Shipping and Freight Resource 20 January 2011) <https://www.shippingandfreightresource.com/difference-between-a-ship-and-a-vessel/> accessed 31 August 2022.
[48] According to article 60 para 2 UNCLOS this includes jurisdiction regarding customs, fiscal, health, safety and immigration laws and regulations.
[49] A.G. Oude Elferink, 'Artificial Islands, Installations and Structures', Max Planck Encyclopaedia of International Law 2013, p. 5.
[50] Article 60 para 3 UNCLOS.
[51] Article 60 para 4 and 5 UNCLOS. K. Landgren, 'Safety Zones and International Protection: A Dark Grey Area', New York University 1995.

Continental Shelf[52] and the IMO Guidelines and Standards.[53] Additionally, in light of the *rationae materia* scope of application of MARPOL, the London Convention and the International Convention on Oil Pollution Preparedness, Response and Cooperation[54], the relevant obligations under these conventions partly cover activities related to the operation of fixed or floating platforms engaging in offshore energy production.[55] In essence, these instruments impose due diligence obligations on states – individually or collectively – to take all practicable measures to prevent marine pollution from different sources.[56]

In addition to 'installations' and 'structures', UNCLOS introduces the concept of 'artificial islands'.[57] So far, artificial islands offshore have been developed for a variety of purposes (*inter alia*, airports and housing) in territorial waters but more recently attempts are made to develop offshore energy islands in the EEZ. There are essentially two possible categorisations for an energy island under international law. The first is the definition of an 'island' under Article 121(1) UNCLOS, which defines it as 'a naturally formed area of land, surrounded by water, which is above water at high tide'.[58] The second is the concept of artificial islands under Article 60 UNCLOS.[59] Such artificial island is a man-made structure created by the dumping of natural substances like sand, rocks and gravel.[60] As a general rule, the provisions applying to installations and structures also apply to the construction and use of artificial islands, i.e., installing a permanent means for giving warning of their presence and, if necessary, establish a safety zone around the artificial island. By contrast to (natural) islands, artificial islands do not have a territorial sea, EEZ or CS and as such their presence does not affect the delimitation of these zones between adjacent and opposite states.[61]

2.3.2 Cables and Pipelines

Cables and pipelines are a *sine qua non* for transporting energy to shore. When discussing the applicable legal framework, one needs to distinguish between cables and pipelines subject to (i) the freedom of communications and (ii) a coastal state's functional jurisdiction.

Articles 2 Convention on the High Seas and 87 UNCLOS establish a freedom of communication that includes (i) freedom of navigation, (ii) freedom of shipping, (iii) freedom to lay submarine cables and pipelines and (iv) freedom to fly over the high seas.[62] This freedom also applies to the EEZ and CS of

[52] United Nations Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf, 1992.

[53] B. Leerberg, 'FLNG – 'ship' or 'offshore installation'? Common pitfalls for investors, operators, and regulators', <https://www.internationallawoffice.com/Newsletters/Energy-Natural-Resources/International/Simonsen-Vogt-Wiig-Advokatfirma/FLNG-ship-or-offshore-installation-Common-pitfalls-for-investors-operators-and-regulators> accessed on 24 June 2021.

[54] International Convention on Oil Pollution Preparedness, Response and Cooperation of 30 November 1990.

[55] N. Giannopoulos, 'International Law and Offshore Energy Production. Marine Environmental Protection through Normative Interactions' 2020, p. 18.

[56] N. Giannopoulos, 'Global environmental regulation of offshore energy production: searching for legal standards in ocean governance', Wilforey 2018.

[57] See for a more elaborate analysis of (artificial) energy islands also E. Pernot & M.M. Roggenkamp, 'Legal Assessment of the Development of a Sand-Based Offshore Energy Island', North Sea Energy III – Appendix K Report, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, June 2020.

[58] Article 121(1) UNCLOS.

[59] E. Pernot & M.M. Roggenkamp, 'Legal Assessment of the Development of a Sand-Based Offshore Energy Island', North Sea Energy III – Appendix K Report, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, June 2020.

[60] A.H.A. Soons, 'Artificial Islands and Installations in International Law, Occasional Paper Series, p. 1; K. Ulrich-Evers, 'Report on fixed as well as floating offshore structure concepts', ACCESS 2014.

[61] Article 60 para 8 UNCLOS. N. Dundua, 'Delimitation of maritime boundaries between adjacent States', *United Nations (Nippon Foundation Fellow)* 2006, p. 85.

[62] M. Adi, 'The application of the Law of the Sea and the Convention on the Mediterranean Sea', UN 2008, p. 17.

coastal states.[63] This freedom to lay submarine cables and pipelines is not completely unrestricted. Account needs to be taken of cables and pipelines already in position.[64] In case of submarine pipelines, it is important that the delineation of the course of such pipelines on the CS is subject to the consent of the coastal state.[65] A similar consent is, however, not required for the development of submarine cables. This is probably due to the fact that submarine oil and gas pipelines may have more impact on the environment in case of damages. This again is in line with the fact that coastal states have protective jurisdiction in order to preserve the marine environment.[66] Under UNCLOS, coastal states must adopt measures necessary to ensure that activities under their jurisdiction or control are conducted as not to cause damage and thus must adopt measures to limit pollution from pipelines.[67] This freedom to lay submarine cables and pipelines applies to cables and pipelines crossing a CS and/or EEZ. By contrast, coastal states have full jurisdiction in their territorial waters, and functional jurisdiction if the cable or pipeline is connected to an installation on their CS or in their EEZ.

Some submarine cables and pipelines are subject to a coastal state's functional jurisdiction, for example, if a cable or pipeline connects an offshore installation (e.g., hydrocarbons production facility or wind farm) with a facility or grid onshore and within the same jurisdiction. This is confirmed by article 79 para 4 of UNCLOS, which provides that coastal states have the right to establish conditions for cables and pipelines entering their territory and have jurisdiction over cables and pipelines constructed or used in connection with the exploitation of the CS or the operation of installations and structures subject to its jurisdiction. A different approach usually applies to those cables and pipelines that are considered as an integral part of the installation (e.g., inter-array cables or pipelines) and they are thus treated as part of the installation.[68]

2.3.3 Removal or Reuse of Offshore Infrastructure

The right to construct infrastructure offshore needs to be balanced with the interests of those parties who historically made use of the maritime space, namely navigation and fishery.[69] Abandoned and disused installations pose two main problems: (i) they consist of a threat to the safety of navigation and (ii) they can be harmful to the marine environment.[70] Therefore, the international law of sea conventions explicitly provide for abandoned or disused installations or structures to be removed.[71] However, the extent to which such installations need to be removed has changed over time. Initially, article 5 para 5 of the 1958 Geneva Convention on the Continental Shelf required that such installations must be entirely removed. However, when negotiating UNCLOS, parties were confronted with several obstacles relating to such complete removal. In addition, it became clear that the number of installations and structures reaching their end of life would be increasing. Hence, UNCLOS now only refers to 'removal'[72], which

---

[63] Art. 58 para 1 and article 78 UNCLOS.
[64] Art. 79 para 5 UNCLOS.
[65] Art. 79 para 4 UNCLOS.
[66] T.G. Puthucherril, 'Protecting the Marine Environment: Understanding the Role of International Environmental Law and Policy', Indian Law Institute 2015.
[67] A.H.A. Soons, 'Artificial Islands and Installations in International Law, Occasional Paper Series, p. 5.
[68] C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020, p. 36.
[69] L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 19.
[70] S. Trevisanut, 'Decommissioning of Offshore Installations: a Fragmented and Ineffective International Regulatory Framework', Brill Publishing 2020, p. 18.
[71] E. Pernot & M.M. Roggenkamp, 'Legal Assessment of the Development of a Sand-Based Offshore Energy Island', North Sea Energy III – Appendix K Report, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, June 2020, p. 8.
[72] This excludes the removal of disused parts below the seabed. See also Article 1(c) OSPAR Decision 98/3.

opens up for the possibility of partial removal.[73] Any decision on removal (partial or complete) has to take into account generally accepted international standards established by a competent international organization. Such standards were drafted with the offshore hydrocarbons sector in mind and have been issued in 1989 by the IMO in Resolution A.672(16).[74]

Following these guidelines, all installations in shallow waters (e.g., less than 100 meters)[75] and all installations weighing less than 4000 tons in air have to be entirely removed as of 1998.[76] Such removal has to be performed in such a way to cause no adverse effects upon navigation and the marine environment.[77] However, a decision to partially remove disused installations in shallow waters or so-called lightweight platforms can only be made if the removal is not technical feasible or results in unacceptable risks to personnel and the marine environment.[78] Decisions about the removal of disused (heavier) installations and structures in deeper waters are made on a case-by-case basis as an assessment has to be made of whether parts of the installation or structure impacts such removal (accompanied with a cost analysis).[79] In case of partial removal, the coastal state needs to ensure (i) that the position of the remaining parts are indicated on nautical charts and properly marked and (ii) it is clear who is responsible (has the legal title) for the maintenance and financial liable. Next to the IMO Guidelines, which have a global geographic scope, there are also specific Guidelines on the North-East Atlantic which were adopted in the context of the OSPAR Convention in 1998.[80] Whereas the IMO Guidelines stay silent on what should happen with the installation that was removed, OSPAR makes clear that dumping of the installation is not permitted unless derogation is granted.[81] However, both Guidelines rely on the coastal states' implementation of the rules, which leads to a diversity of rules in the NSA.[82]

This removal obligation applies to installations and structures and thus not necessarily to abandoned or disused cables and pipelines. Again, it may be necessary to distinguish between categories of cables and pipelines. Cables and pipelines closely connected to the (production) installation and thus part of the installation, will usually be removed together with the installation in case the installation needs to be removed entirely. By contrast, other infrastructure (e.g., major transport and supply systems) are not likely to become disused soon as it serves many producers and suppliers. In practice, a decision to remove submarine cables and pipelines and fixed installations in deeper waters will be made on a case-by-case basis. Pursuant to OSPAR a permit is required to maintain a disused submarine pipeline.[83]

The above has shown that the removal obligation applies to disused installations and structures. This leaves open the question when an installation or structure can be considered as disused. UNCLOS does not provide any guidance on this matter but the IMO Guidelines specifically refer to the possibility of another use as it states that coastal states may leave an installation wholly or partially in place where

---

[73] Article 60(3) UNCLOS.

[74] Resolution A.672(16) adopted on 19 October 1989. Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone.

[75] This covers, amongst others, the Dutch and Danish CS and the southern part of the UK CS.

[76] Article 3.2 IMO Resolution. In addition, Article 3.7 stipulates that disused installations near or in international navigation routes always need to be removed entirely.

[77] D. Drankier & M.M. Roggenkamp, 'The Regulation of Decommissioning in the Netherlands. From Removal to Re-Use' in M.M. Roggenkamp & C. Banet, *European Energy Law Report* (Volume XIII, Intersentia, 2020), p. 293.

[78] Article 3.5 IMO Guidelines.

[79] Articles 3.4 and 3.5 IMO Guidelines.

[80] Communication from the Commission to the Council and the European Parliament on Removal and Disposal of Disused Offshore Oil and Gas Installations (1998).

[81] Article 2 OSPAR Decision 98/3.

[82] See chapter 5 below.

[83] Article 5.1 OSPAR Decision 98/3.

they serve a new use, including the enhancement of a living resource.[84] Some further guidance can be found in OSPAR, which provides that installations and structures serving another legitimate purpose are not to be considered as disused offshore installations.[85] However, any reuse requires a permit from the competent authority of the relevant coastal state.[86] In principle, all fixed offshore installations (e.g., oil and gas platforms and wind turbines) in the NSA have to be removed entirely or partially once they become disused, unless these installations are being repurposed and serve another use.[87] Such a change in function is accompanied by a number of legal challenges, mainly regarding licensing and financial liabilities.[88]

2.4 Interim Conclusions

This section has analysed the powers of coastal states offshore, i.e., in the territorial sea, CS and EEZ. It has become clear that pursuant to the international law of the sea, each North Sea state has full jurisdiction in their territorial sea but only sovereign rights on the CS and in the EEZ where they have the exclusive right to produce energy offshore as long as they take into account other obligations under international law such as the protection of the marine environment and the freedom of navigation and fishery but also the freedom to lay cables and pipelines. The latter is not self-evident as it needs to be balanced with the exclusive right to develop cables and pipelines that are subject to a coastal state's sovereign rights (e.g., connected to an offshore installation of the coastal state's CS or EEZ). As a result of these sovereign rights, coastal states also have functional jurisdiction and are entitled to draft all relevant legislation governing the energy activity, customs, health, and safety. Increasingly, the national legislation of the North Sea states is influenced by EU law. Therefore, the next chapter will present an overview of some important elements of current EU law that are relevant for the development of offshore energy projects and, in particular, energy hubs.

[84] Article 3.4 IMO Resolution.

[85] Article 1 OSPAR Convention. See also C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020, p. 41.

[86] Article 5.1 OSPAR Convention.

[87] S. Trevisanut, 'Decommissioning of Offshore Installations: a Fragmented and Ineffective International Regulatory Framework', Brill Publishing 2020, p. 23.

[88] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, p. 31.
The hurdles accompanied to licensing procedures will be elaborated in the chapter pertaining to the different North Sea states.

3. EU Level

This section examines EU law and policy relevant for this study. Although international law only provides coastal states and not the EU with exclusive rights offshore, the European Court of Justice has ruled in several cases that EU law 'follows' national sovereignty.[89] In other words, as offshore energy developments are subject to coastal states' sovereign rights and functional jurisdiction, the relevant EU laws governing the three main pillars of EU energy law and policy also apply offshore. These three pillars are (i) creating an internal (energy) market, (ii) combating climate change and (iii) securing energy supply.[90]

The first goal is to create a common (now 'internal') market is founded in the 1957 EEC Treaty[91], the subsequent EC Treaty[92] and the current Treaty on the Functioning on the European Union (hereafter: TFEU)[93] and based on the key principles of free movement of goods, services, persons, and capital without hindrance of competition. Since 1988, these principles also apply explicitly to the energy sector. Climate goals apply to the EU and the individual member states since the UN Framework Convention on Climate Change of 1992 and have since then been further defined at different levels (global, European, and national). The EU is actively working to achieve the goals as enshrined in the 2015 Paris Agreement.[94] The European climate mitigation commitments are included in several policy documents and more recently in the European Climate Law.[95] The need to secure a regular and affordable energy supply was not high on the political agenda at the end of 1990s as there was no lack of energy supply (fossil fuels) in the EU, but this has changed as oil and gas production in the EU is ceasing and Russian gas supplies to the EU have been severely reduced since the war started in the Ukraine early 2022.[96] This has also led to a new interest and focus on the need to further develop energy projects in the NSA. This section will, therefore, first elaborate on the policy framework and measures relevant for developing offshore energy production, the use of the concept 'offshore system integration' and the development of energy hubs in the NSA (§3.1). Thereafter, we will discuss relevant EU law (§3.2).

3.1 EU Policy

Since the 1990s, the European Commission has issued an ever-increasing number of policies on energy and climate change developments. These policies can be part of a white paper or a communication. Whereas a white paper aims at presenting the Commission's policy or approach on a particular matter, a Communication goes a step further as it is a means for the Commission to set out its own thinking on a topical issue and to present an action plan and potentially some concrete proposals for legislation.[97] Although neither of them has mandatory authority, article 288 TFEU refers to recommendations as a

[89] C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020, p. 55 and following.

[90] These three goals are often referred to in literature is defined as the energy triangle. Article 194 TFEU reflects the importance of these three goals.

[91] Treaty of Rome of 25 March 1957 establishing the European Economic Community.

[92] Treaty establishing the European Community of 1992.

[93] Treaty on the Functioning of the European Union, OJ C 326, 26.10.2012

[94] Paris Agreement (adopted 12 December 2015, entered into force 4 November 2016).

[95] Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law).

[96] P. Sauer, 'Russia will not resume gas supplies to Europe until sanctions lifted, says Moscow', (*The Guardian*, 5 September 2022), <https://www.theguardian.com/world/2022/sep/05/russia-will-not-resume-gas-supplies-to-europe-until-sanctions-lifted-says-moscow> accessed 6 September 2022. See section 3.1.3.

[97] EUR-Lex, The Role of national parliament in European affairs.

legal document. By contrast to regulations and directives, recommendations have no legal effect in itself. Nevertheless, they are often acting as a first step for developing EU law on a particular matter.

3.1.1 European Green Deal

The European Green Deal reflects the European Commission's goal to show global leadership and make Europe the first-climate neutral continent by 2050.[98] It aims at decoupling economic growth from resource use by referring to a transition that must be 'just' and 'inclusive'. As the Green Deal requires strong actions from all citizens, it pays special attention to (i) regions, (ii) industries and (iii) workers who will face the greatest challenges. In order to achieve a climate neutral and circular economy, a holistic approach is needed.[99] In other words, the Green Deal affects several EU policy areas, including energy and climate change. It consists, *inter alia*, of the European Climate Pact, the 2030 Climate Target Plan, the EU Strategy for Energy System Integration (§3.1.1.1), and the Hydrogen Strategy (§3.1.1.2). Considering the aim of this project, the last policy documents are of special importance.

3.1.1.1 EU Strategy for Energy System Integration

The EU Strategy for Energy System Integration was presented on the 8 July 2020.[100] It defines 'energy system integration' as:

> *the planning and operating of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors, by creating stronger links between them with the objective of delivering low-carbon, reliable and resource-efficient energy services at the least possible cost for society.*[101]

This definition is to a large extent in line with the working definition used in the NSE project.102 The EU's Energy System Integration Strategy particularly aims at:

- "creating a more circular energy system, which promotes energy efficiency and reuse of waste energy,
- accelerating the use of electricity produced from renewable sources and promoting low-carbon fuels for sectors that are hard to decarbonize. The aim is to increase generation from electricity from renewables, promote the production of (clean) hydrogen, and enable carbon capture and storage to support further decarbonization,103
- adapting energy markets and infrastructure in order to achieve an integrated energy system as such integrated system will minimize the costs of transition towards climate neutrality. As energy infrastructure investments have an economic life of 20 to 60 years, steps need to be taken in the next five-to-ten years in order to achieve carbon neutrality in 2050".[104]

The latter two points are relevant for this project and the three energy hubs identified - Hub West, Hub East, and Hub North – as these involve (i) platform electrification and thus introduce a specific category

---

[98] Explanatory Memorandum | Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation 2018/1999 (European Climate Law), p. 1; COM(2019) 640 final.

[99] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions (the European Green Deal), COM(2019) 640 final, p. 16.

[100] European Committee of the Regions, The integration of the EU's energy system is key to achieve a climate neutral Europe, 2021.

[101] Committee on Industry, Research and Energy, Report on a European strategy for energy system integration, 2020.

[102] See Chapter 1.

[103] Communication from the Commission to the European Parliament; Powering a climate-neutral economy: an EU Strategy for Energy System Integration, p 7.

[104] Ibid, p. 2

of offshore electricity consumers, (ii) the use if offshore wind[105] by means of offshore conversion to hydrogen[106] and (iii) the transport and geological storage of carbon dioxide offshore. In addition, these three developments also require a new approach to using and reusing existing infrastructure, which is one of the key components of energy system integration.

3.1.1.2 Hydrogen Strategy

On 8 July 2020, the European Commission issued a Communication for an EU Hydrogen Strategy[107] which is an important element of the overall EU Strategy for energy system integration and the hydrogen goals set in the European Green Deal.[108] For the industrial sector, the ambition in the EU Hydrogen Strategy is to replace fossil fuels by green hydrogen in some carbon-intensive processes such as the steel and/or chemical industry.[109] The EU's plan is to install electrolysers next to large consumers, e.g., refineries, steel and chemical installations. Although the development of green hydrogen offshore is closely related to large-scale offshore wind (renewable) energy developments, offshore wind is not mentioned in the EU Hydrogen Strategy.[110] Nevertheless, several EU countries have incorporated green hydrogen in their political ambitions (see chapter 5 below).[111]

3.1.2 EU Strategy to Harness the Potential of Offshore Renewable Energy for Climate Neutral Future

The promotion of offshore renewables is the focus of a separate communication of 2020.112 The EU Strategy considers offshore renewables as one of the renewable technologies with the greatest potential for a climate neutral future.[113] The term 'offshore renewable energy technology' refers to a number of technologies that are at a different stage of maturity, namely floating solar, wave energy, tidal energy, and offshore wind by means of fixed or floating installations. As the present projected installation capacity only leads to approximately 90 GW in 2050[114] and the ultimate target is set on 300 GW by 2050, the strategy acknowledges the need for more involvement by the EU and its Member States to achieve these goals. Therefore, it requires additional involvement by the EU and national governments to develop a long-term plan guaranteeing that offshore energy installations can coexist with other users of the offshore maritime space.[115] To this end, national (offshore) spatial plans[116] need to consider offshore renewable projects as well as other developments and users. Furthermore, the Strategy reiterates the importance of establishing a clearer EU regulatory framework for offshore renewable energy, which should address the challenge to connect offshore renewable projects to several markets with different

---

105 Ibid, p 7.

106 Communication from the Commission to the European Parliament, A hydrogen strategy for a climate-neutral Europe, p. 2 and Communication from the Commission to the European Parliament; Powering a climate-neutral economy: an EU Strategy for Energy System Integration, p 7.

107 Communication from the Commission, 'A hydrogen strategy for a climate-neutral Europe' COM(2020) 301 final.

108 Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, 'The European Green Deal' COM(2019) 640 final.

109 EU Hydrogen Strategy 1 and 10.

110 Communication from the Commission, 'A hydrogen strategy for a climate-neutral Europe' COM(2020) 301 final, p. 5.

111 The national green hydrogen policies issued in recent months also show an increased focus on the development of hydrogen.

112 Communication from the Commission to the European Parliament, An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future, COM(2020) 741 final.

113 Ibid, under 1.

114 This number is based on the National Energy Climate Plans submitted to the EU by Member States.

115 Communication from the Commission to the European Parliament, An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future, 2020.

116 Pursuant to the Maritime Spatial Planning Directive (Directive 2014/89/EU) member states were required to submit their national plans to the EU Commission before 31 March 2021. Only Belgium, Denmark, the Netherlands, Finland, Latvia, and Portugal met this deadline.

connection rules.[117] Therefore, a common approach to grid connection should be further developed for the NSA.[118]

3.1.3 REPowerEU

In response to the global energy market disruption due to Russia's invasion of Ukraine, the European Commission presented the REPowerEU Plan on 18 May 2022.[119] It aims at (i) ending the EU's dependence on Russian fossil fuels and at the same time (ii) tackling the climate crisis. This goal will be achieved by enhancing energy savings, diversifying energy supplies, and accelerating the roll-out of renewable energy and (green) hydrogen in order to replace the use of fossil fuels. The EU plans to build 17.5 GW of electrolysers by 2025 and develop a modern regulatory framework for hydrogen. In the medium term, the EU also plans to increase its renewable energy target for 2030 from 40 percent to 45 percent. Offshore wind energy is (again) considered as an important solution to develop additional sources of renewable energy.[120] To bring forth this massive offshore wind plan, integrating and harmonizing national policies is one of the top priorities. This approach ties in with the Esbjerg Declaration, which was also presented on 18 May 2022 by the Ministers of Energy from Belgium, Denmark, the Netherlands and Germany at the North Sea Summit in Esbjerg, Denmark.[121] During this summit the Ministers agreed on the ambition to achieve 65 GW offshore wind power by 2030 and to increase the capacity to at least 150 GW by 2050 and thus be able to deliver half of the green offshore wind power required by the EU in 2050. Ideally, the North Sea will become the Green Power Plant of Europe. This will require the offshore renewable energy system to consist of multiple connected offshore energy projects and the development of green hydrogen interconnectors. Additionally, the Ministers plan to develop energy islands in the North Sea, with one of the first steps being to maximize the capacity of the world's first energy island to 10 GW in 2040 at the latest.[122] In essence, the document refers to the need to develop offshore energy 'hubs', although the term itself has not been used.

3.2 EU Law

The TFEU is currently the legal basis of EU energy and climate law. It, *inter alia*, aims at creating an internal market that ensures the free movement of goods (e.g., energy)[123], persons, services, and capital, without distortion of competition.[124] These treaty provisions can be relied in Court but mainly apply *ex post*. Other provisions give the EU and its Member States a shared competence to legislate and adopt legally binding acts. Since the Single European Act of 1986[125], it has been possible to adopt directives and regulations based on majority voting. It resulted in a gradual development of directives and regulations based on the EU competence to create an internal market, including an internal energy market.[126] Following the

---

[117] Communication from the Commission to the European Parliament, An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future, 2020, p. 12.

[118] Communication from the Commission to the European Parliament, An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future, 2020; C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020.

[119] European Commission, 'REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition', <https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131>.

[120] See also A. Buljan, 'New offshore wind targets to fuel REPowerEU green hydrogen ambitions', 20 May 2022 <https://www.offshore-energy.biz/new-offshore-wind-targets-to-fuel-repowereu-green-hydrogen-ambitions/> accessed 10 August 2022.

[121] The Esbjerg Declaration on the North Sea as a Green Power Plant of Europe, 2022.

[122] The Declaration of Energy Ministers on The North Sea as a Green Power Plant of Europe 2022.

[123] C-393/92 Gemeente Almelo e.a./Energiebedrijf IJsselmij.

[124] Article 26 TFEU.

[125] Single European Act of 28 February 1986.

[126] This development is based on the Commission's policy presented in the 1988 Working Document 'Towards an Internal Energy Market'. See COM 1099 (238).

adoption of the TFEU, a separate provision has been included which gives the EU shared competences with regard to energy matters.[127] In the sections below we will discuss the most important directives and regulations that are relevant for this project as they relate to the development of offshore energy projects and energy hubs in the NSA.

3.2.1 Hydrocarbons Licensing Directive

Of special interest for the NSA is the Hydrocarbon Licensing Directive.[128] This directive has been adopted in 1994 and has never been amended. This directive needs to be read in conjunction with the Gas Directive as it provides for a legal regime governing the production of gas. The key principle of this directive is that authorisations governing the exploration and production of hydrocarbons (oil and gas) need to be awarded on a competitive basis and the authorisation conditions should be known in advance.[129] Applicants need to have the necessary technical and financial means and states can participate pursuant to some specific conditions.[130] Notably, the directive does not refer to the construction and use of upstream pipelines (which therefore are regulated in the Gas Directive (see section 3.2.2 below)) and neither has any references to the issue of decommissioning, removal and/or reuse of installations.

3.2.2 The Internal Electricity and Gas Market Directives

Since the early 1990's, the EU has issued several directives regulating *ex ante* the internal energy market. The first energy market directives have been amended regularly since they were adopted in the 1990s. The most recent amendments follow the 2019 Clean Energy for all Europeans Package.[131] Currently, the main directives governing the EU electricity and gas markets are the 2019 Electricity Directive[132] and the 2019 Gas Directive[133] but these are accompanied by other legislative acts such as EU Regulation 2019/942 establishing a European Union Agency for the Cooperation of Energy Regulators[134] and EU Regulation 2019/943 on the internal market for electricity.[135]

The directives establishing an internal market for electricity and/or gas are based on the key fundamental principles of the TFEU, i.e., free movement of goods, services, persons, and capital without distortion of competition. These principles now apply to the entire energy chain. Production and supply are based on market principles and no longer bound by any exclusive rights and consumers have the freedom to choose their supplier. In order for producers, suppliers, and consumers to participate in a liberalised market, third party access (hereafter: TPA) to the transmission and distribution system is a fundamental requirement. For this purpose, the directives provide for a regime of regulated tariffs and conditions (regulated TPA) and ways in which system operators are acting independent from producers and suppliers. Such independence can be achieved by means of requiring full ownership unbundling or the possibility to extensively regulate the activities of the system operators. This regime governing unbundling and regulated TPA does not apply to all energy systems. A different approach applies to

---

[127] See article 194 TFEU. In addition, the EU has competences relating to the internal market and the environment.

[128] Directive 94/22/EC of the European Parliament and of the Council of 30 May 1994 on the conditions for granting and using authorisations for the prospection, exploration, and production of hydrocarbons.

[129] Article 5 Hydrocarbons Licensing Directive.

[130] Article 5 Hydrocarbons Licensing Directive.

[131] See for an overview of the package https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en

[132] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast).

[133] Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73EC concerning common rules for the internal market in natural gas.

[134] Regulation 2019/942 establishing a European Union Agency for the Cooperation of Energy Regulators.

[135] Regulation 2019/943 on the internal market for electricity.

upstream gas pipelines (pipelines connecting a gas production facility with the transmission system) and direct lines (pipelines or cables connecting one producer with one consumer).[136] In these cases, unbundling is not required, and access needs to be negotiated as the pipeline and/or cable still can be an essential facility. A different regulatory approach also applies to interconnectors (a cross-border transmission line connecting two national transmission systems).[137]

Both directives apply to the NSA. So far, the impact has been limited to provisions dealing with production and system operations. However, as soon as offshore parties will start acting as electricity and/or gas consumers the impact of both directives will increase.

3.2.3 Renewable Energy Directive

Although the Electricity Directive regulates the production of electricity, it does not present any means to promote the use of renewable sources. For this purpose, a specific directive was introduced in 2001, which has been amended thereafter and more recently replaced by recast Directive 2018/2001.[138] One of the differences is that the 2018 directive applies to all renewable energy sources (including renewable gas) and no longer is limited to the generation of electricity from renewables. In order to qualify as a producer making use of renewable sources, the directive requires the use of guarantees of origin.[139]

The measures presented in the directive to promote the use of renewables vary from the possibility to support renewable projects financially to speed up existing authorisation procedures. By contrast to before, this directive does not longer present any national renewable goals. Instead, there is a common goal and the way in which this goal can be achieved by the EU Member States is enshrined in the Governance Regulation (see section 3.2.5 below), which will be discussed below. In addition, the directive foresees the possibility of cross-border cooperation as it provides for cooperation mechanisms such as joint support schemes and joint projects. These mechanisms can become relevant when discussing cross-border energy hubs.[140]

3.2.4 Directive Governing Geological Storage of CO_2

In 2009 the EU adopted Directive 2009/31/EC[141], which governs the geological storage of CO_2 onshore as well as offshore. This directive is relevant for this NSE project as it may be part of the development of offshore energy hubs. Similar to the Hydrocarbons Directive (see section 3.2.1 above) this directive presents a permitting regime that may consist of an exploration and/or a storage permit. It envisages that CO_2 can be permanently stored in the subsoil because of which CO_2 is not emitted. As such it serves a climate change goal and potentially prolongs the lifetime of fossil fuel projects.

Two elements are of special importance when discussing CO_2 storage projects. First, the provision that captured and stored CO_2 is considered as being not emitted. This should or could be a major incentive for CO_2 emitters subject to the EU CO_2 emissions trading regime as they do not need any CO_2 allowances for non-emitted CO_2, and they either must buy less allowances on the market or can trade any excess

[136] See Article 34 Gas Market Directive, Article 38 Gas Market Directive and Article 7 Electricity Market Directive.

[137] Art. 2 Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity.

[138] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast).

[139] Article 15(8) Renewable Energy Directive.

[140] See chapter 5 below.

[141] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (Text with EEA relevance), OJ L140/114.

allowances on the market. Another important issue is the question when CO_2 that has been injected in the subsoil can be considered as permanently stored. The latter is a precondition for a storage operator to transfer any liability of the stored CO_2 to the State. Any investments by potential CO_2 storage operators depend on the certainty that it will be possible to transfer any liability after a storage facility has been permanently closed. Finally, it needs to be mentioned that the possibility of geological storage offshore touches upon the possibility of reusing hydrocarbons facilities (see section 3.2.1 above). However, this possibility is not mentioned in the directive.

3.2.5 Governance Regulation and European Climate Law

The Regulation on the Governance of the Energy Union and Climate Action of 2018 describes in detail how the EU and its Member States will cooperate in achieving the 2030 energy and climate targets.[142] Although the main emphasis is on the achievement of the 2030 targets, it also lays the foundation for further policies and measures towards reaching the 2050 decarbonization goals. One important provision of the Regulation is that all Member States are required to draft, in line with the Paris Agreement, a National Energy and Climate Plan (hereafter: NECP), which needs to include detailed information on the policies and measures foreseen to deliver on the national energy and climate objectives. In addition, Member States have to report regularly on their progress towards these 2030 targets and objectives.[143] Regular and integrated reporting will enable for more integrated assessments and greater alignment between initiatives that seek to reduce GHG emissions and promote renewable energy production. The initiatives included in the NECPs can refer to the extent to which Member States aim at developing offshore, green hydrogen or subsoil storage of CO_2.

The European Climate Law entered into force in July 2021 and provides a legal basis for achieving the climate targets in the above-mentioned Green Deal, i.e., reducing greenhouse gas emissions by at least 55% by 2030 and climate neutrality by 2050.[144] Its main objective is to shape the EU's green recovery and to ensure a socially just green transition.[145] The Climate Law includes measures to keep track of progress based on already existing systems such as the earlier mentioned NCEPs. The Commission will assess together with the assessment required under the Governance Regulation every five years the consistency of national measures presented in the NCEPs.[146] Thus, it lacks any reference to 'system integration' as such.

3.2.6 Regulation governing Trans-European Transport Energy Networks

The development of an internal energy market requires the availability of adequate infrastructure and, in particular, systems to facilitate cross-border trade. The 1992 Maastricht Treaty therefore introduced the concept of Trans-European Networks in the areas of transport, telecommunications, and energy (currently Article 172 – Article 174 TFEU). The EU sees the need to stimulate the development of such networks to help to achieve the internal market and to strengthen economic and social cohesion. A key instrument to achieve these goals is to identify for each category of networks (transport, telecommunications, and energy), projects of common interests (hereafter: PCIs).[147] To enhance the development of these PCIs, account has to be taken to the need to (i) streamline administrative and

---

[142] European Union, Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, mending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directive 94/22/EC, 98/70/EC, 2009/31/EC, 21 December 2018.

[143] Article 11 Governance Regulation.

[144] Regulation (EU) 2021/1119 of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2019/1999 (European Climate Law).

[145] Article 2 European Climate Law.

[146] Article 6 European Climate Law.

[147] H. Vedder et al, 'EU Energy Law' in M.M. Roggenkamp et al (eds), *Energy Law in Europe* (Oxford University Press 2016), p. 299.

permitting procedures to avoid delays when developing cross-border infrastructure and (ii) financially support the development of PCIs, for example, via the EU Cohesion Fund[148] and/or the EU Regional Development Fund[149] (both being European Structural & Investment Funds), loans of the European Investment Bank[150] and funding from the Connecting Europe Facility.[151]

Since 2013, Regulation 347/2013 on Trans-European Energy Networks forms the legal basis for designating energy PCIs.[152] The European Commission presents every two years a list of PCIs; the most recent one was adopted on 19 November 2021.[153] Of specific relevance for this project are the designation of the following projects in the NSA: (i) the Priority Corridor Northern Seas Offshore Grid, (ii) the North Sea Wind Power hub[154], (iii) the Aramis project, which is a cross-border CO_2 transport and storage project bringing CO_2 from Rotterdam harbour area via a pipeline to a storage facility on the Dutch CS[155], and (iv) CO_2 TransPorts (Porthos) which aims to establish infrastructure to facilitate CO_2 capture, transport and storage (Rotterdam, Antwerp and the North Sea Port).[156]

The concept of Trans-European Energy Networks is relevant for this study as it in particular focusses on energy infrastructure in the broadest sense and could thus apply to all three hub functions identified in this study. Moreover, the 2021 PCI list specifically refers to the concept of 'hubs' as the Priority Corridor Northern Seas Offshore Grid is defined as "one or more hubs in the North Sea with interconnectors to bordering North Sea countries (Denmark, Germany, Netherlands)".[157] Potentially, also other national and cross-border energy hubs can be designated as a PCI in the future as long as they are considered relevant for the internal market and foster social and economic cohesion.

3.3 Interim Conclusions

This chapter has provided an overview of EU policy and law relevant for the NSA and the development of offshore energy hubs. The number of directives and regulations facilitating the development of energy hubs, or at least individual parts of these hubs, is increasing. However, so far there is no legal framework governing energy system integration offshore. Although the European Green Deal provided for the first time in 2020 a policy strategy on system integration, it remains to be seen whether or when this policy will become part of EU law and thus binding on Member States.

---

[148] European Commission, Cohesion *Fund*, <https://ec.europa.eu/regional_policy/en/funding/cohesion-fund/> accessed 28 September 2022. However, the Cohesion Fund provides support for Member States with a gross national income per capita below 90%, which does not concern any of the NSA countries for the 2021-2017 period.

[149] European Commission, Regional *Development Fund*, <https://ec.europa.eu/regional_policy/en/funding/erdf/> accessed 28 September 2022.

[150] European Commission, *Connecting Europe Facility*, <https://ec.europa.eu/inea/en/connecting-europe-facility> accessed 28 September 2022.

[151] European Climate Infrastructure and Environment Executive Agency <https://cinea.ec.europa.eu/programmes/connecting-europe-facility/energy-infrastructure-connecting-europe-facility-0_en> accessed 28 September 2022.

[152] Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing decision No 1364/2006/EC.

[153] Commission delegated Regulation (EU) 2022/564 of 19 November 2021 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

[154] Ibid, Annex VII(B)(1).

[155] Ibid, Annex VII(B)(12.7).

[156] Ibid, Annex VII(B)(12.3).

[157] Commission Delegated Regulation (EU) 2022/564 of 19 November 2021 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest, Annex VII(B)((1.19).

4. International and EU Law Perspectives on the Hub Functions

The above chapters have analyzed the extent to which coastal states have exclusive rights offshore and, in particular on the CS and in the EEZ, the role of EU law and policy in the NSA. Below we will discuss in more detail how this affects the development of offshore energy hubs. As mentioned in the introductory chapter, 'energy hubs' are not (yet) a legal concept and for the purpose of this study has been defined as:

> *Multi-carrier (both electrons and differing molecules) offshore energy systems consisting of production, conversion and/or storage. In this way, energy hubs are search areas for offshore system integration opportunities. These energy hubs are connected to the shore via national (transport) cables or interconnected internationally.*[158]

This definition corresponds to the definition of the term 'hub' as displayed in the Oxford Dictionary: "the effective center of an activity, region or network".[159] So far, the concept of 'hubs' seems primarily to apply to single carrier energy systems like the Henry hub in the US and Zeebrugge hub in the EU (Belgium). These hubs are situated at connection points of several gas pipelines and thus gas is being traded. This study takes a broader approach as it looks at multi-carrier energy systems and takes into account several parts of the energy chain. This chapter will, therefore, discuss the main functions of the hub identified in this study (as follows from the term 'multi-use') such as platform electrification (§4.1.1), offshore power-to-gas (§4.1.2) and offshore CO_2 transport and storage (§4.1.3). Thereafter, it will present some legal challenges relating to future offshore developments such as floating solar and ocean energy as these techniques could potentially become part of offshore energy hubs (§4.2).

4.1 Hub Functions

4.1.1 Platform Electrification

Electrification is viewed to be the most efficient way to meet most energy needs as it can lower total energy system costs while delivering environmental benefits.[160] Currently, most offshore platforms make use of diesel- or gas-fired generators and turbines for power supply. A different option is to electrify platforms, which involves linking platforms to an external source of electricity.[161] Such electrification involves a connection of existing or new offshore oil and gas installations to the electricity system. Therefore, connecting these offshore installations to the electricity system establishes some sort of system integration.

Three types of connection may be considered. First, a platform can be connected via a cable to the onshore electricity system. Secondly, a platform may be connected to an offshore cable. A third option

---

[158] More details on the hub locations can be found in D1.1. The phrase 'search area' should not be mistaken for the term as used in the Wind Energy at Sea Act.

[159] Oxford Dictionary 'hub'.

[160] D. Gielen et al, 'The Role of Renewable Energy in the Global Energy Transformation' [Energy Strategy Reviews] 2019, p. 45; IEA, *Hydrogen in North-Western Europe. A vision towards 2030*, p. 5.

[161] PBL Netherlands Environmental Assessment Agency, *Decarbonization options for the Dutch Offshore Natural Gas Industry*, April 2020, p. 8.

is to connect the offshore platform directly to an existing or future offshore wind farm. These options have been investigated in previous phases of the North Sea Energy Project.[162] International law (UNCLOS) provides coastal states with powers to implement these scenarios, but as coastal states will develop national laws to regulate these options, different legal approaches may exist according to national law. These differences may also be the result of EU law and the different categories of electricity systems identified in the abovementioned EU directives.

4.1.2 Offshore Power-to-Gas

Power-to-X is the general term for conversion of electricity to heat and gaseous or liquid energy carriers such as hydrogen, methane, ammonia, formic acid and methanol.[163] It is viewed as one of the methods to make the energy system flexible.[164] Countries in North-Western Europe are at the forefront of hydrogen technology and policy developments and have developed their vision about the role that hydrogen should play in their long-term energy strategies (see chapter 5 below).[165] Given the approach of this study, the next paragraphs will solely focus on the production and transport of hydrogen offshore and their role in developing energy hubs.[166]

Any production of hydrogen offshore requires that an electrolyser will be installed offshore on an existing hydrocarbons production installation that is still in use or suitable for reuse or a new installation or structure specifically designed for this purpose or a sand-based offshore energy island.[167] These options are investigated in previous phases of the North Sea Energy Project.[168] In addition, as a small-scale option, an electrolyser could be sited directly onto an existing operational turbine.[169] In general, these installations can be considered as an 'installation' or 'structure' as defined by article 60 UNCLOS and this provides coastal states with functional jurisdiction and the means to legislate hydrogen production. At the moment, such legislation is not yet in place. Notably, North Sea Energy 3 concluded that under national law electrolysers that are situated on existing hydrocarbon platforms cannot be viewed as part of the oil and gas installation as it serves a different purpose.[170]

One of the advantages of producing hydrogen offshore is the ample means to transport hydrogen to shore. Apart from transporting green hydrogen by ship, the focus is currently mainly on transportation via submarine pipelines. Existing pipelines could partially be repurposed to facilitate the transportation of hydrogen. Potentially, hydrogen can also be fed into the existing gas transportation system. The latter

[162] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, pp. 23-26.
[163] TNO Whitepaper, Offshore System Integration as a Transition Accelerator in the North Sea, May 2018, p. 7.
[164] IEA, Hydrogen in North-Western Europe. A vision towards 2030, April 2021, p. 5.
[165] European Union Global Strategy, Shared Vision, Common Action: A Stronger Europe. A Global Strategy for the European Union's Foreign and Security Policy, June 2016, p. 11, and IEA, Hydrogen in North-Western Europe. A vision towards 2030, April 2021, p. 12
[166] In practice, the production of hydrogen takes primarily place onshore so far but this may change over time, amongst other because of lack of capacity in the electricity transport system and the possibility to reuse existing gas pipelines.
[167] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, pp. 23-26.
[168] IEA, Hydrogen in North-Western Europe. A vision towards 2030, April 2021, p. 13.
[169] Vattenfall, World's first hydrogen-producing offshore wind turbine gets 9.3 million pounds funding boost, May 2022, <https://group.vattenfall.com/uk/newsroom/pressreleases/2022/aberdeen-hydrogen> accessed 5 August 2022.
[170] L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 80.

is currently already facilitated by EU law, namely in the Internal Gas Market Directive.[171] Although there have been harmonization attempts by CEN-CENELEC, these have not been successful to date.[172]

The technique to convert PtG aligns fully with the definition of an offshore energy hub as it consists of a multi-carrier system that consists of production and conversion (and possibly storage) and will be connected to shore via a pipeline. In addition, it creates an opportunity to facilitate system integration. Although the current policy landscape can facilitate this transformation of PtG, a legal framework on EU level is not yet in place.

4.1.3 CO_2 Transport and Storage

The third hub function examined in this study is the possibility to transport and store CO_2 offshore. This process assumes that the capture of CO_2 from any industrial or energy production facilities takes place onshore and that captured volumes are transported to a geological formation in the NSA.[173] In the NSA, offshore geological storage can either be realized in subsoil aquifers (e.g., Norway) or in depleted oil and gas fields (e.g., the Netherlands and the UK).[174] Transport of captured CO_2 can take place via new of reused pipelines or via ships. Storage in aquifers will require the storage operator to develop new installations to inject carbon dioxide in the subsoil. In case of depleted oil and gas fields a reuse of installations is possible. These installations will be considered as ‘installations’ and/or ‘structures’ in the meaning of Article 60 of UNCLOS as they serve the economic exploitation of the EEZ. The EU and Member States have made use of their functional jurisdiction as a directive on geological storage was adopted in 2009 (see §3.2.4 above).

The Directive on Geological Storage of CO_2 is based on the idea that captured CO_2 is transported by pipeline and not by ship. Article 3(22) of the Directive defines the transport network as “(…) the network of pipelines, including associated booster stations, for the transport of CO_2 to the transport site”.[175] By contrast to pipelines transporting CO_2 to a storage facility, the transport of greenhouse gases by ship is not subject to the EU ETS and, therefore, does not require an emissions permit.[176] Although transport by ship as such seems advantageous, it creates a financial obstacle (and thus a disincentive for CCS) as only operators listed in Annex I of the EU ETS Directive are entitled to transfer and subtract the transferred CO_2 from their yearly emissions.[177] Ships are not (yet) subject to the EU ETS. When ships are covered by the EU ETS, the cost of maritime transport will increase as shipping companies will likely pass-through allowance costs to the charterers. Transporting CO_2 by ship will thus increase costs.[178] However, the

[171] Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73/EC concerning common rules for the internal market in natural gas.

[172] CEN, *Hydrogen in Energy Systems*, <https://standards.cencenelec.eu/dyn/www/f?p=205:7:0::::FSP_ORG_ID:2121095&cs=1C768ED5384A10C0D3BDFAADF1D285AB6> accessed 29 September 2022; See work package ‘Standardization’.

[173] In principle also major offshore oil and gas production installations emit CO2 and therefore could be subject to a regime of capture and storage. This option is likely and will be disregarded in this study.

[174] N. Romasheva and A. Illinova, ‘CCS Projects: How Regulatory Framework Influences Their Deployment’ [MPDI] 2019, p. 182.

[175] Article 3(22) of the Directive on geological storage.

[176] L. Squintani et al, ‘Regulating Greenhouse Gas Emissions from EU ETS installations: What Room is Left for the Member States?’ in Climate Law in EU Member States: Towards National Legislation for Climate Protection (Edward Elgar 2012), p. 67; M.M. Roggenkamp, ‘Transportation of Carbon Dioxide in the European Union: Some Legal Issues’ in I. Havercraft et al (eds), *Carbon Capture and Storage. Emerging Legal and Regulatory Issues* (Hart Publishing 2018), pp. 245-266.

[177] See Directive 2003/87/EC and Case C/460-15 *Schaefer Kalk GmbH*, 19-01-2017, ECLI:EU:C:2017:29.

[178] E. Woerdman, M. Holwerda & J. Gazendam, ‘Carbon Capture and Storage’ in *Essential EU Climate Law* (E. Woerdman, M.M. Roggenkamp & M. Holwerda eds) (forthcoming in 2021), p. 22.

Commission's impact assessment states that this increase in cost will be marginal.[179] Another issue relates to the cross-border transport of CO_2 by ship is that the London Protocol[180], by contrast to the Directive, considers CO_2 as waste and prohibits the export of waste for dumping (including storage).[181] An amendment to this provision was adopted in 2009 but has not yet entered into force given an insufficient number of ratifications.[182] Of all North Sea states only Denmark, the Netherlands, Norway, and the United Kingdom have ratified the amendment so far.[183] However, in October 2019, a provisional application of the amendment, based on Article 25 of the Vienna Convention on the Law of Treaties, was accepted.[184] Such provisional application allows for transboundary transport of CO_2 for the purpose of geological storage.[185] So far, only the Netherlands, Norway, and Denmark have deposited a declaration of provisional application to the IMO.[186]

Once the CO_2 has been transported to the offshore location, it can be stored. The directive governs the storage of CO_2 in the EEZ (see section 3.2.4 above). One of the main pending legal issues is the transfer of liability to the state after the storage site is closed as this requires the CO_2 to be permanently stored. In case of storage in depleted oil and gas fields, another important issue relates to the possibility to reuse installations for storage purposes, especially, when a new licensee will hold the storage license and operate the storage facility. Such reuse implies that the removal of the installation will be extended until the storage site can be closed and the installation removed. Who will be liable for such removal? Can the holder of the production license still be liable for any removal costs? As this is not regulated by international or EU law, this is a matter of national law (see chapter 5 below).[187]

Although transport and geological storage of CO_2 according to the definition used by the Oxford Dictionary can be considered as part of a hub, it does in fact not fulfill the criteria of the definition of system integrations used for this project as CO_2 is not a multi-carrier energy system in itself. Nevertheless, transport and storage of CO_2 may be part of an extensive network and play a role in system integration as it needs to take into account several legal regimes when considering reuse, transport, and liabilities.

---

[179] European Commission, Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757.

[180] 1996 Protocol to the convention on the prevention of marine pollution by dumping of wastes and other matter (as amended in 2006).

[181] Article 6 London Protocol, and C. Redgwell, *International Regulation of Energy Activities,* in M.M. Roggenkamp et al, *Energy Law in Europe* (Oxford 2013), p. 73.

[182] According to Article 21(2) London Protocol an amendment to a provision must be ratified by two-thirds of contracting parties. See also Martha M. Roggenkamp, Transportation of CO2 in the EU, in: I. Havercroft et al eds, Carbon Capture and Storage – Emerging Legal and Regulatory Issues, Hart Publishing.2018, p.261 – p. 262; J. Garrett & S. McCoy, 'Carbon capture and storage and the London Protocol: recent efforts to enable transboundary CO_2 transfer' [Energy Procedia] 2013, pp. 7747 – 7755.

[183] Resolution LP.3(4) on the Amendment to Article 6 of the London Protocol.

[184] 41st Consultative Meeting of Contracting Parties to the London Convention and the 14th Meeting of Contracting Parties to the London Protocol (LC 41/LP 14); Resolution LP.5(14) on the Provisional Application of the 2009 Amendment to Article 6 of the London Protocol; United Nations, *Vienna Convention on the Law of Treaties*, 23 May 1969.

[185] IEA, *Exporting CO_2 for Offshore Storage – the London Protocol's Export Amendment and Associated Guidelines and Guidance*, <https://www.club-co2.fr/files/2021/04/IEAGHG-2021-TR02-Exporting-CO2-for-Offshore-Storage-The-London-Protocol-s-Export-Amendment-and-Associated-Guidelines-and-Guidance.pdf> accessed 30 September 2022.

[186] See the amended Article 6 of the London Protocol. I. Havercroft & C. Consuli, *Development and Opportunities – A review of national responses to* CCS *under the London Protocol*, Global CCS Institute, May 202, p. 3.

[187] M.M. Roggenkamp, 'Carbon Capture and Storage in the Netherlands. A Long and Winding Process' in M.M. Roggenkamp & C. Banet (eds), *European Energy* Law *Report XIII* (Cambridge, Intersentia, 2020), p. 407.

4.4 Future Developments

Some offshore energy technologies are still at an early stage of commercialization and have not yet been regulated specifically. These are, *inter alia*, floating offshore wind, aquatic biomass production, floating solar and ocean energy.[188] Floating solar is a relatively new type of large-scale power generation.[189] According to a 2020 IEA report, solar power itself is the world's cheapest source of electricity.[190] Currently, floating solar takes place in landlocked water but the technology for offshore floating solar panels ('solar farms') is progressing towards commercial viability.[191] However, unlike fossil fueled generators, solar farms need quite some space to generate sufficient electricity to keep up with demand. The main reason for developing solar farms offshore is, like wind energy, the availability of offshore space and less public resistance.[192] An additional benefit in terms of investment would be to develop solar farms close to offshore wind farms. One option would be to integrate solar panels in existing or future wind farms. However, the integration of floating photovoltaic technologies and offshore wind farms is still at an early stage and may be difficult from a legal point of view, especially if such integration is envisaged in dedicated safety zones.[193] Even in countries with significant floating solar development there are no clear, specific regulations on permitting and licensing of these activities.[194]

Ocean energy refers to all forms of renewable energy derived from the sea. Three main types of ocean energy can be distinguished, namely (i) tidal, (ii) wave and (iii) ocean thermal.[195] Wave energy is generated by converting the energy within waves into electricity. Tidal comes in two forms: (i) tidal range technologies harvest the height difference between high and low tides (thus, it uses the same principles as hydropower) whereas (ii) tidal stream technologies capture the energy of currents which flow in and out a tidal area.[196] In the EEZ, the focus is on wave and ocean thermal.[197] Ocean thermal energy is generated by converting the temperature difference between the ocean's surface water and deeper water into energy; usage will be made of either fixed or floating ocean thermal energy conversion plants.[198]

---

[188] Ecofys, *'Offshore Wind Farms = Seaweed = Biofuel'. The Netherlands*, 3 May 2012, <https://www.renewableenergymagazine.com/biomass/offshore-wind-farms--seaweed--biofuel> accessed 20 September 2022.

[189] Offshore energy, *Floating solar farms could mitigate harmful climate change effects on water*, 6 April 2021 <https://www.offshore-energy.biz/floating-solar-farms-could-mitigate-harmful-climate-change-effects-on-water/?web=1&wdLOR=c45DB4D50-9C82-ED4A-AADD-46DE7C456033>.

[190] World Bank Group, *Where Sun Meets Water. Floating Solar Market Report*, 2018; IEA, *Data and* statistics. *CO_2 emissions from fuel combustion*, 2019 <https://www.iea.org/data-and-statistics/data-product/co2-emissions-from-fuel-combustion>

[191] World Bank Group, Where *Sun Meets Water. Floating Solar Market Report*, 2018; Norton Rose Fulbright, *Floating solar*, 19 August 2020.

[192] TNO, *National Consortium Solar on Water*, 2019 <https://www.tno.nl/en/focus-areas/energy-transition/roadmaps/renewable-electricity/solar-energy/solar-farm/floating-solar/>.

[193] J. Kroon, *Offshore Solar Energy*, <https://www.tno.nl/en/focus-areas/energy-transition/roadmaps/renewable-electricity/solar-energy/solar-farm/offshore-solar-energy/> accessed 31 August 2022.

[194] NREL, International Applications for floating Solar Photovoltaics, June 2019 <https://www.nrel.gov/docs/fy19osti/73907.pdf> ; Offshore Energy, Floating solar farms could mitigate harmful climate change effects on water, 6 April 2020; SolarPlaza, Floating solar projects, January 2019 <https://www.solarplaza.com/channels/markets/11968/top-100-floating-solar-projects/>.

[195] Australian Renewable Energy Agency, *Ocean energy*, March 2021, accessed <https://arena.gov.au/renewable-energy/ocean/> ; World Economic Forum, *Floating solar farms could cool down lakes threatened by climate change*, April 2021 accessed <https://www.weforum.org/agenda/2021/04/floating-solar-farms-lakes-threatened-climate-change/> ; Rödl & Partner, *Floating photovoltaics – is floating solar a new trend?*, February 2019 < https://www.roedl.com/insights/renewable-energy/2019-02/floating-photovoltaics>.

[196] IRENA, *Ocean Energy*, March 2021 accessed <https://www.irena.org/ocean>; A.E. Cagle et al, 'The Land Sparing, Water Surface Use Efficiency and Water Surface Transformation of Floating Photovoltaic Solar Energy Installations', *Sustainability 2020*, p. 854.

[197] EU-SCORES project, 'Combining offshore wind with wave and floating solar energy' <https://windandwaterworks.nl/cases/combining-offshore-wind-with-wave-and-floating-solar-energy-eu-scores-project> accessed 31 August 2022.

[198] Australian Renewable Energy Agency, Ocean *energy*, March 2021, accessed <https://arena.gov.au/renewable-energy/ocean/>.

In order to license offshore solar and ocean energy developments, it needs to be assessed whether solar panels and ocean energy converters are considered as an ‘installation’ or ‘structure’ in accordance with Article 60 UNCLOS.[199] By contrast to thermal energy conversion plants, solar panels are usually movable (e.g., not fixed to the seabed) and therefore could fall under the category of ‘ships’ and be subject to flag state jurisdiction. However, if these solar panels are fixed to the sea bottom for a longer period of time, it is more likely that coastal states will agree on the application of a coastal state’s functional jurisdiction. As regards EU law, the exploitation and use of solar panels and thermal energy conversion plants are subject to the Regulations and Directives relating to renewables and electricity. Further research regarding the legal framework governing these offshore energy technologies is necessary as these technologies will become of increasing importance and potentially become part of future energy hubs.

4.5 Interim Conclusions

The above has analyzed the main three hub functions included in this study. We have seen that coastal states have the exclusive right to legislate these hubs and/or the activities that are part of these offshore energy hubs and that they need to take into account relevant EU law. However, as directives need to be transposed in national law and the Member States often have considerable flexibility to do so, the next chapter will discuss the national legal regimes and how they affect the development of offshore energy hubs and system integration.

[199] Rödel & Partner, *Floating photovoltaics: is* floating *solar a new trend?*, February 2019 <https://www.roedl.com/insights/renewable-energy/2019-02/floating-photovoltaics>; NL Netherlands, Next-generation solar power. Dutch technology for the solar energy revolution.

5. National level

The NSA will become a major energy source and play a role in meeting the goal of net-zero ambitions in 2050. As two-thirds of total energy supply in 2050 will be based on wind, solar, bioenergy, geothermal and hydro energy (see chapter 1 above)[200], it seems obvious that coastal states will aim at using the CS and EEZ as much as possible. Higher levels of energy production from renewables will also assist in safeguarding energy supply. Following the crisis in the Ukraine and reductions in gas supply from Russia, the possibility of gas production from the NSA is also on the agenda again. However, in general oil and gas production has reached its peak and fields gradually have to be closed down and installations to be removed. This opens up for new possibilities relating to re-use of installations and carbon dioxide storage. This chapter will examine in more detail the developments in four North Sea States, namely the Netherlands, the United Kingdom, Denmark, and Germany. The structure of each section is similar as it first presents some basic information about offshore energy sources and the national energy and climate goals. Thereafter, we will present the key policy documents and the laws applying to the CS and EEZ. When discussing the legal framework, we will focus on those laws that govern the production and supply of energy (petroleum and electricity) offshore and hydrogen (if any). We will not specifically address environmental (protection) and climate laws as their impact is more indirect. Next, we will focus on the three hub functions – platform electrification, offshore hydrogen production and offshore carbon dioxide transport and storage – whilst taking into account the three hubs – Hub West, Hub East, and Hub North – selected for this project (see figure 3 below). Are such hubs being developed and does national law facilitate such developments and are references made to energy system integration?

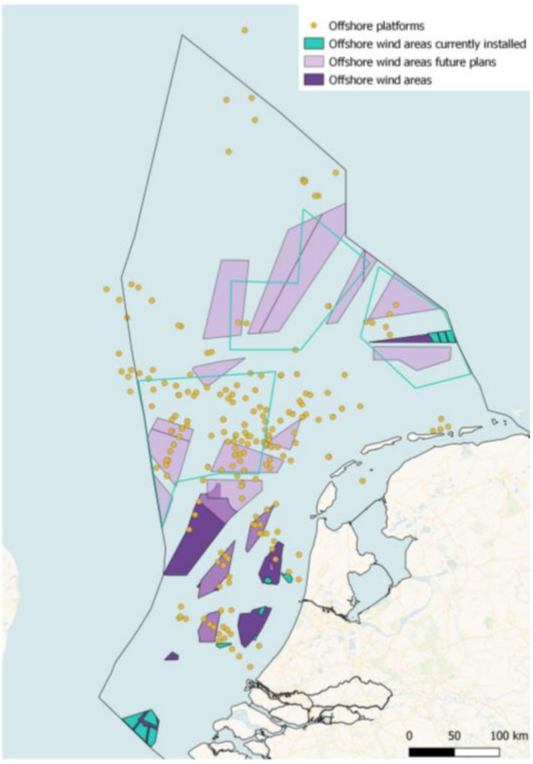


Figure 3. Selected energy hubs and planned and existing offshore infrastructure up to 2040.[201] The areas in between the green lines are the designated hubs.

---

[200] IEA, Net-zero by 2050. A Roadmap for the Global Energy Sector, May 2021, p. 15.
[201] See Work Package 1.

5.1 The Netherlands

The Netherlands is a small country with a relatively large coastline.[202] The Netherlands has thus been granted a significant part of the CS of the North Sea. The Netherlands declared an EEZ in 1999.[203] By contrast to the CS and the EEZ, the Netherlands and Germany have disagreed about the delimitation of the territorial sea since the 15th century. Given the absence of a border agreement, both governments agreed in 1960 on a common use of the Eems-Dollard area until the 3-miles zone and in 2014 on the common use of the remainder of the disputed area in the territorial sea (the area between 3 and 12 nautical miles).[204] Currently, the Dutch part of the NSA is, *inter alia*, being used for shipping (navigation lanes) and fishery but increasingly for the production of oil and natural gas and electricity from offshore wind.[205]

Following the delimitation agreements with the bordering countries, the Netherlands started to explore the CS for oil and gas in the 1970s. Given the position of the Groningen gas field it was assumed that hydrocarbons deposits would be found offshore as well. After the discovery of the first offshore gas field in 1970, several other discoveries were made but generally the finds were smaller than expected. A cross-border gas field (the Markham field) straddling the Dutch and UK border, is developed jointly on the basis of an international agreement.[206] At the moment, around 160 offshore oil and gas platforms are situated on the Dutch CS and approximately 50 installations have been removed.[207] The gas produced is transported to the Dutch coast via three major pipelines (namely, Noordgastransport, Westgastransport and NOGAT), which are operated by the companies operating the fields. A more recent development is the possibility to reuse depleted fields. Although re-use has been discussed for some time and primarily in relation to carbon dioxide storage, it has not been successful yet, mainly due to financial reasons. However, more recent attempts to develop an open access CO_2 transport and storage project (e.g., the Porthos project) may proof to be more successful (see also further below).

The development of offshore wind energy started some 20 years ago as the first offshore wind farm was constructed in 2006.[208] Since then the number of wind farms has gradually increased and currently seven offshore wind farms are situated in the Dutch EEZ, which equals a total installed capacity of around 2.450 MW.[209] On 16 September 2022, the Dutch government announced to be aiming for a total installed

---

[202] R. Schuttenhelm, 'In face of rising sea levels the Netherlands 'must considered controlled withdrawal', VN, 7 February 2019, accessed via <https://www.vn.nl/rising-sea-levels-netherlands/>.

[203] Besluit van 13 maart 2000, houdende vaststelling van de grenzen van de exclusieve economische zone van Nederland en tot inwerkingtreding van de Rijkswet instelling exclusieve economische zone (Besluit grenzen Nederlandse exclusieve economische zone).

[204] See Treaty between the Netherlands and Germany (Eems-Dollardverdrag) of 8 April 1960. On 14 May 1962 the treaty was supplemented with an agreement on the use of the common area for the exploration of natural gas (Tractatenblad 1962, nr. 54). The Westereemstreaty of 24 October 2014 (Tractatenblad 2014, 182) does not refer to energy and is thus in the process of being amended.

[205] PBL Netherlands Environmental Assessment Agency, The future of the North Sea. The North Sea in 2030 and 2050: a scenario study, 2018.

[206] Markham Agreement of 26 May 1992, Stb. 673.

[207] Noordzeeloket, 'Olie- en gaswinning', <https://www.noordzeeloket.nl/functies-gebruik/olie-gaswinning/> accessed 31 August 2022; Nextstep, 'Re-use and decommissioning rapport. Ontmanteling in de praktijk', <https://docplayer.nl/150403344-Re-use-decommissioning-rapport.html> accessed 31 August 2022, p. 8.

[208] Windfarm Egmond aan Zee.

[209] Netherlands Enterprise Agency, 'Operational wind farms in the North Sea', <https://english.rvo.nl/subsidies-programmes/sde/offshore-wind-energy-sde/existing-wind-farms-north-sea> accessed 31 August 2022.

capacity of 50 GW by 2040 and 70 GW by 2050.[210] Whereas initially each wind farm had its own cable connection to shore, new wind farms are clustered and connected to one cable.[211]

5.1.1 Policy Developments

The goal set in the Paris Agreement to reduce greenhouse gas emissions by 49% in 2030 (compared to 1990 level) has been replaced by more ambitious goals in the coalition agreements of 2017 and 2021 respectively.[212] The 2019 Climate Agreement aims at zero emissions in 2050. The legal basis for meeting these goals is the Climate Act that entered into force in July 2019. The Climate Agreement is concluded by interested parties (e.g., industry, governments, NGOs, and trade unions) and presents a series of measures to be taken in order to meet these climate goals. In addition, the Dutch government presented in 2019 the Dutch Integrated National Energy Climate Plan 2021-2030 as required under the Governance Regulation (see section 3.2.5 above). This NECP is largely similar to the Climate Agreement. Apart from these more general climate policies, some specific policy documents have been issued relating to the promotion of renewable energy sources in the North Sea. Whereas the Climate Agreement deals with all industrial sectors, the 2021 Hydrogen Programme focusses on one industrial development in particular, i.e., hydrogen. Of special relevance for the NSA are the Programme North Sea 2022 – 2027 focusing on the Dutch part of the NSA as a whole and the North Sea Energy Outlook.

5.1.1.1 The Climate Agreement and Integrated National Energy and Climate Plan

Climate Agreement

The Dutch Climate Agreement was presented in June 2019.[213] Its main aim is to reduce the level of greenhouse gas emissions by 49% in 2030 and 95% in 2050 (compared to 1990 levels). In the current Coalition Agreement of 2021, these goals were increased to 70% in 2035 and 80% in 2040.[214] As part of the policy to decrease greenhouse gas emissions, the Climate Agreement also considers the need to promote the use of renewables. In 2019, 8.7% of all energy produced was traced back to renewable sources, which needs to be 27% as of 2030.[215] One of the important renewable sources is offshore wind. Whereas the total installed capacity of offshore wind power was around 2.5 GW in 2021, the Agreement estimates that this should increase to at least 4.5 GW in 2023 and 21 GW in 2030.[216] Due to the integrated character of the Climate Agreement, it addresses the five dimensions of the Energy Union, namely (i) decarbonization, (ii) energy efficiency, (iii) energy security, (iv) internal energy market and (v) research and innovation.[217]

Of major importance is the creation of technological opportunities.[218] In order to achieve the climate goals of 2030 and 2050 respectively a growing potential of offshore wind energy combined with the electrification of the industry is foreseen, especially in the coastal zone.[219] Assumingly, offshore will be

---

210 Ministry of Economic Affairs and Climate, DGKE-E/22174505.

211 P.A. Adedeji et al, 'Cluster-based wind turbine maintenance prioritization for a utility-scale wind farm' [2022] Procedia computer science 200 1726.

212 Coalition Agreement 'Vertrouwen in de toekomst', 10 October 2017, Coalition Agreement 'Omzien naar elkaar, vooruitkijken naar de toekomst', 15 December 2021.

213 Climate Agreement as published on 28 June 2019.

214 Coalition Agreement as published on 15 December 2021, p. 10.

215 Dutch government, <https://www.rijksoverheid.nl/onderwerpen/duurzame-energie> accessed 31 August 2022.

216 Government of the Netherlands, 'Offshore wind energy', <https://www.government.nl/topics/renewable-energy/offshore-wind-energy> accessed 4 September 2022.

217 Integrated National Energy and Climate Plan (2021 – 2030). The Netherlands <https://energy.ec.europa.eu/system/files/2020-03/nl_final_necp_main_en_0.pdf> accessed 4 September 2022, p. 7.

218 Ibid, p. 70.

219 Ibid, p. 159.

the greenest power source of the Dutch economy and society in the future. However, of importance is predictability. Therefore, obstacles in the regulatory framework need to be dealt with. Whether this will result in, inter alia, a hydrogen market depends on the demand for hydrogen, which in turn depends on the availability and cost-efficiency of other manners to reach the earlier mentioned goals (see section 5.1.1).[220] In addition, the Climate Agreement covers understandings on how to ensure flexibility within the electrical system. It focuses on transferring electricity to sustainable molecules, on system integration and on fostering technological developments.[221] Thus, several sectors have been covered. By 2030, approximately 70% of the renewable electricity production depends on the weather. Until 2050, there will be moments in which demand equals supply but also moments different energy sources are needed due to unfavorable weather conditions. Consequently, the need for flexibility mechanisms, hybrid electrification and storage facilities increases.[222] Therefore, the sustainable energy system of the future should not be static, but rather adaptive. The main focus is on aligning energy demand and supply.[223]

Integrated National Energy and Climate Plan 2021-2030

In line with the earlier mentioned Governance Regulation (see section 3.2.5 above), the Integrated National Energy and Climate Plan 2021-2030 stipulates how the Netherlands aims to meet the EU's energy and climate targets for 2030.[224] It supplements the measures presented in the Climate Agreement as it also contains policy arising from European obligations dealing with interconnectors. Although the Netherlands does not have a specific quantitative target for interconnection, it will examine in the event of any new interconnectors the welfare effects combined with the projected costs.[225] Nevertheless, of main importance is that the Netherlands already far exceeds the European interconnection target of 15% by 2030.[226]

In line with the objectives of the North Seas Countries' Offshore Grid Initiative (NSCOGI)[227], the NECP stipulates that investments in the necessary infrastructure for transporting and distributing gas and electricity will continue to grow. This will involve connecting wind farms in the North Sea to the onshore transmission grid, as well as strengthening the existing grids by constructing offshore wind and solar farms. The NECP clearly demonstrates the need for the Netherlands to replace generation from fossil fuels with generation from renewable sources. Thus, the Dutch government encourages large-scale development of offshore wind energy. To this end, the government will take the lead in preliminary research for plot decisions and issue the license and tenders, including instructing TenneT to construct the offshore electricity grid.

---

[220] Ibid, p. 172.

[221] Climate Agreement as published on 28 June 2019, p. 185.

[222] Government of the Netherlands, *Dutch vision on climate action*, 2015, accessed via <https://www.government.nl/topics/climate-change/dutch-vision-on-global-climate-action>

[223] M. Maeder et al, 'Assessing the need for flexibility technologies in decarbonized power systems: a new model applied to central Europe' [Applied Energy], 2021.

[224] Integrated National Energy and Climate Plan (2021 – 2030). The Netherlands <https://energy.ec.europa.eu/system/files/2020-03/nl_final_necp_main_en_0.pdf> accessed 4 September 2022.

[225] Ibid, p. 43.

[226] Parliamentary Document 21 501-20-968.

[227] The NSCOGI is a regional cooperation of 10 countries to facilitate the coordinated development of a possible offshore electricity grid in the greater North Sea area. Since 2016, the cooperation has been integrated into the new Political Declaration on energy cooperation between the North Seas Countries. See further https://maritime-spatial-planning.ec.europa.eu/practices/north-seas-countries-offshore-grid-initiative-nscogi

In addition, given that the Netherlands is part of the North Seas Energy Cooperation[228], the NECP also focuses on offshore energy synergies with the other countries. A special focus is on offshore wind deployment and potential joint projects.[229] It reiterates the need of four distinguishable support groups, namely (i) Maritime Spatial Planning and environmental assessment, (ii) the development and regulation of offshore grids and other offshore infrastructure, (iii) a support framework for offshore wind projects and (iv) standards, technical rules and regulations in the offshore wind sector.[230] Its reference to the creation of a North Sea Wind Power Hub embodies an example of a hub based approach.

5.1.1.2 Hydrogen Programme

The government has issued several documents since 2019 based on the above mentioned Climate Agreement (see section 5.1.1.1 above) and which together can be regards as a programme or strategy for developing hydrogen in the Netherlands.[231] It acknowledges that blue hydrogen is an important immediate step[232] but focuses in particular on unlocking the production and supply of green hydrogen, developing the necessary infrastructure, and cooperating with various sector programmes.[233] Although green hydrogen will play an important role in the future energy system, it remains one component of the broader energy system.[234] The ambition of this programme is to have achieved 3-4 GW installed electrolyser capacity by 2030, in which the development must be consistent with the additional growth in the share of renewable electricity.[235] Several documents also discuss the design of a hydrogen market[236] and the transportation of hydrogen.[237]

An important component is the infrastructure that is needed at sea.[238] Therefore, government is specifically focussing on the link between green hydrogen production and offshore generation.[239] In the next months, a North Sea Energy System Development Programme (*Ontwikkelingsprogramma Energiesysteem Noordzee)* will be drafted in order to coordinate the linkage of hydrogen with offshore wind.

---

[228] Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, and the European Commission are members of the North Seas Energy Cooperation (NSEC), which supports and facilitates the development of the offshore grid development and the large renewable energy potential in the region. See also https://energy.ec.europa.eu/topics/infrastructure/high-level-groups/north-seas-energy-cooperation_en

[229] Integrated National Energy and Climate Plan (2021 – 2030). The Netherlands <https://energy.ec.europa.eu/system/files/2020-03/nl_final_necp_main_en_0.pdf> accessed 4 September 2022, p. 21.

[230] Ibid, p. 22

[231] CSWW, *Werkplan Nationaal Waterstof Programma 2022-2025,* 7 July 2021, <https://open.overheid.nl/repository/ronl-47be8733-0b7f-4d80-a293-79031070271c/1/pdf/bijlage-bij-kamerbrief-aanbieden-werkplan-nationaal-waterstof-programma.pdf> accessed 2 October 2022.

[232] Netherlands Enterprise Agency, *Excelling in Hydrogen. Dutch Technology for a Climate-Neutral World* <https://www.rvo.nl/sites/default/files/2022-05/NL-Dutch-solutions-for-a-hydrogen-economy-V-April-2022-DIGI.pdf> accessed 26 September 2022.

[233] DGKE-E/ 21255684.

[234] CIEP, 'Waterstof en elektriciteit: naar een nieuwe ruggengraat van het energiesysteem', 2019, <https://www.clingendaelenergy.com/publications/publication/van-onzichtbare-naar-meer-zichtbare-hand-%20waterstof-en-elektriciteit> accessed 1 October 2022.

[235] Work plan 'National Hydrogen Programme' 2022-2025, July 2021, <https://www.zelfenergieproduceren.nl/wp-content/uploads/2021/07/Nationaal-Waterstof-Programma-werkplan.pdf>.p. 6.

[236] Ministry of Economic Affairs and Climate, DGKE-E/22229490.

[237] Ministry of Economic Affairs and Climate, DGKE-E/22263775.

[238] Work plan 'National Hydrogen Programme' 2022-2025, July 2021, <https://www.zelfenergieproduceren.nl/wp-content/uploads/2021/07/Nationaal-Waterstof-Programma-werkplan.pdf>.Appedix, p. 2.

[239] Ministry of Economic Affairs and Climate, DGKE-E /22174505.

5.1.1.3 Programme North Sea 2022-2027

The Programme North Sea 2022-2027, being part of the National Water Plan 2022-2027[240], focuses on the spatial planning of the North Sea Area.[241] It can be considered as a policy document that aims at using the North Sea in such a manner that it will accommodate the differing usages. This policy document is in line with the North Sea Energy Outlook.[242] It also elaborates on the future possibilities of the growth of offshore wind energy and its consequences for the national energy system. It is expected that in 2030 approximately 70% of our electricity consumption will be generated by offshore windfarms. After 2030, offshore wind energy will increase even more, which requires infrastructure to be available.[243] In addition, the programme highlights the possibility of CO_2 storage in depleted offshore fields.[244] Due to the available storage capacities and wind potential, the NSA will be essential to reach the 95% CO_2-reduction by 2050.[245]

The strategy does refer to system integration, especially when it comes to the production of hydrogen offshore and infrastructural planning.[246] It underpins the possibility of interconnecting the different energy systems of the NSA by focusing on 'hubs' and hybrid projects. These hubs are defined as junctions where energy originating from several offshore wind farms or several interconnectors connect, where they are potentially converted to a different energy carrier and, consequently, are transported to shore.[247]

5.1.1.4 North Sea Energy Outlook

The Ministry of Economic Affairs and Climate presented the North Sea Energy Outlook in December 2020.[248] It specifically deals with offshore wind. One important precondition for the growth of offshore wind energy after 2030 is that the electricity generated must be integrated into the energy system. This entails that the required infrastructure (e.g., cables and substations) must be available in time, which requires a proper coordination. New areas for developing offshore wind energy will be designated in accordance with the Programme North Sea 2022-2027. This includes the need for an environmental impact assessment (hereafter: EIA) and incorporating the results from the Offshore Wind Ecological Programme (see work package 4 'ecology').[249] This policy document thus mainly focuses on the

---

[240] National Water Plan 2022-2027, p. 17; Work plan 'National Hydrogen Programme' 2022-2025, July 2021, <https://www.zelfenergieproduceren.nl/wp-content/uploads/2021/07/Nationaal-Waterstof-Programma-werkplan.pdf>.

[241] Government of the Netherlands, *Ontwerp Programma Noordzee 2022-2027*, 24 March 2021, accessed via <https://windopzee.nl/actueel/nieuws/nieuws/ontwerp-programma-noordzee-2022-2027-gepubliceerd/>.

[242] Government of the Netherlands, *Noordzee Energie Outlook brengt randvoorwaarden voor toekomstige groei windenergie op zee in kaart*, 4 December 2020, accessed via <https://www.rijksoverheid.nl/actueel/nieuws/2020/12/04/noordzee-energie-outlook-brengt-randvoorwaarden-voor-toekomstige-groei-windenergie-op-zee-in-kaart>.

[243] Noordzeeloket, *Energietransitie op de Noordzee*, accessed via <https://www.noordzeeloket.nl/functies-gebruik/windenergie/energietransitie-noordzee/>.

[244] Ibid, p. 64.

[245] Noordzeeloket, *Energietransitie op de Noordzee*, accessed via <https://www.noordzeeloket.nl/functies-gebruik/windenergie/energietransitie-noordzee/>; Government of the Netherlands, *Ontwerp Programma Noordzee 2022-2027*, 24 March 2021, accessed via <https://windopzee.nl/actueel/nieuws/nieuws/ontwerp-programma-noordzee-2022-2027-gepubliceerd/>.

[246] Government of the Netherlands, *Ontwerp Programme Noordzee 2022-2027*, 24 March 2021, accessed via <https://windopzee.nl/actueel/nieuws/nieuws/ontwerp-programma-noordzee-2022-2027-gepubliceerd/>, p. 57.

[247] Ibid, p. 58.

[248] Government of the Netherlands, *North Sea Energy Outlook establishes framework conditions for future growth of offshore wind energy*, 4 December 2020, accessed via <https://www.government.nl/latest/news/2020/12/04/north-sea-energy-outlook-establishes-framework-conditions-for-future-growth-of-offshore-wind-energy>.

[249] Noordzeeloket, *Wozep ecological programme*, accessed via <https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/ecology/offshore-wind-ecological-programme-wozep/>.

integration of offshore wind in the national power system whilst protecting the environment but does not focus on nor mention system integration as such.[250]

5.1.2 Legal Framework governing Offshore Energy Projects

5.1.2.1 Mining Act

Since 2003 the Mining Act applies to exploration, production and storage of oil, gas, and carbon dioxide onshore as well as offshore.[251] This Act replaces the French Mining Act 1810 and the 1965 Continental Shelf Mining Act. The Act is supplemented by a Royal Decree (*Mijnbouwbesluit*)[252] and a Ministerial Decree (*Mijnbouwregeling*)[253], which provide further rules on exploration, production, and storage.

---

[250] S. van Elden et al, 'Offshore Oil and Gas Platforms as Novel Ecosystems: A Global Perspective', Frontiers in Marine Science, 4 September 2019.

[251] Wet van 31 oktober 2002, houdende regels met betrekking tot het onderzoek naar en het winnen van delfstoffen en met betrekking tot met de mijnbouw verwante activiteiten (Mijnbouwwet).

[252] Besluit van 6 december 2002 houdende regels ter uitvoering van de Mijnbouwwet (Mijnbouwbesluit).

[253] Ministerial Mining Decree of 16 December 2002 (Staatscourant WJZ 02063603).

Exploration and production of hydrocarbons

The provisions in the act governing the exploration for and production of oil and gas are based on the same principles as the Hydrocarbons Licensing Directive (see chapter 3 above). Hence, exploration and production are subject to a separate licence.[254] Both licences are exclusive, which means that only one exploration or one production licence can be awarded for a particular source in a specific area.[255] Licences need to be awarded in a fair, competitive, and transparent manner. The Netherlands has opted for an open-door procedure; this entail that when a natural or legal person applies for a licence for a particular area, the Minister of Economic Affairs and Climate invites other parties to submit a competitive application[256] and after an assessment of all applications awards a licence within a period of six months.[257] Usually, the state-owned company Energiebeheer Nederland (hereafter: EBN) participates in the production activities (and since the year 2000 also in exploration) as a non-operating partner on the basis of an agreement of cooperation. State participation is set at 40% in the 2003 Mining Act.[258]

In line with UNCLOS, the Mining Act 2003 explicitly provides that 'a mining installation that is no longer in use has to be removed'.[259] Given that the Dutch CS has shallow waters with an average water depth of 35 meters, rising to well over 60 meters in the northern parts, these installations will have to be removed entirely (in accordance with the earlier mentioned IMO Guidelines).[260] The closure, abandonment and removal of offshore installations are subject to an abandonment and removal plan, which is issued by the operator and requires approval from the Minister of Economic Affairs and Climate. The plan needs, at least, to describe the way in which the installation will be removed as well as its destination and the timing of the activities.[261] As production has taken place for several decades and the reservoirs on the Dutch CS are relatively small, it is no surprise that several installations have already been abandoned and removed. In fact, the first time an offshore installation was decommissioned was in 1988.[262] However, more recently also in the Netherlands the possibility of reuse has been discussed, for example in relation to carbon dioxide storage. As of 2022, the Mining Act has been amended in order to allow for reuse.[263] As a result, an abandonment plan can also present the way in which the installation could be reused. In such case an exemption of the removal obligation might be granted.[264] Notably, the amendments do not specify whether such reuse entails the involvement of a new licensee and how any responsibilities (including future removal) will be transferred to that licensee. Anyway, given the large number of wells, platforms and pipelines are approaching the end of their economic life, it is important to map out now which installations are suitable for re-use and which options are most feasible.[265]

---

[254] Article 6(1)(a-b) Mining Act.

[255] Article 7 Mining Act.

[256] Article 15 (1-5) Mining Act.

[257] Article 17 Mining Act.

[258] Chapter 5.2.1 and 5.2.2 Mining Act. Before 2003 the State could be given a share of 40% or 50%. See also J. Gazendam and M.M. Roggenkamp, 'Accelerating Low Carbon Industrial Growth through CCUS', May 2020, p. 14.

[259] Article 44(1) Mining Act.

[260] Resolution A.672(16) adopted on 19 October 1989. Guidelines and Standards for the removal of offshore installations and structures on the continental shelf and in the exclusive economic zone.

[261] Article 60(1) and 61 Mining Decree.

[262] Nexstep, *Re-use and decommissioning report*, 2018 <https://www.nexstep.nl/wp-content/uploads/2018/07/Re-use-decommissioning-report-2018-English-Version.pdf> accessed 5 July 2022, p. 6.

[263] Besluit van 11 November 2021 tot wijziging van het Mijnbouwbesluit (het verwijderen of hergebruiken van mijnbouwwerken), Article 44a; M.M. Roggenkamp, 'Re-using (nearly) Depleted Oil and Gas Fields in the North Sea for CO_2 Storage: Seizing or Missing a Window of Opportunity?' in C. Banet (ed) *The Law of the Seabed* (Brill 2020).

[264] Article 44a and Article 44b Mining Act.

[265] Nexstep, *Re-use and decommissioning report*, 2018 <https://www.nexstep.nl/wp-content/uploads/2018/07/Re-use-decommissioning-report-2018-English-Version.pdf> accessed 5 July 2022, p. 6.

Geological storage of carbon dioxide

The Directive on geological storage of CO_2[266] has been implemented in the 2003 Mining Act. Natural and legal persons who have the required technical and financial capability can obtain (i) an exclusive licence to explore for suitable CO_2 storage sites and (ii) an exclusive licence to store substances.[267] When use is made of depleted oil or gas fields[268], it is most likely that sufficient knowledge of the reservoir is available, and a storage licence may be applied for and awarded right away. In such a case, a reuse of installations might be possible. Although a storage licence cannot be awarded if another licence already applies and the award should be made in a competitive manner, the Mining Act provides for an exemption for a licence to store CO_2 in an already licensed area.[269] The licence will be subject to several conditions such as the duration of the licence, the total amount of CO_2 that may be stored, the risk mitigating processes and the amount of financial security that is to be provided.[270] Such security is necessary to cover any costs following any leaks and thus potential CO_2 emissions.[271] Therefore, the licensee also is required to have a CO_2 emissions licence.[272] A similar obligation applies to the person operating a CO_2 transportation pipeline. Apart from this, the legal regime is rudimentary (as is the case for upstream oil and gas pipelines) and limited to some sort of construction permit pursuant the Mining Decree.[273]

Following the Directive on geological storage, the Mining Act also provides for TPA to a storage facility and/or a pipeline transporting CO_2 to the storage site.[274] Such provision is in line with general provisions of EU law but also takes into account the situation that suitable geological storage is not available everywhere and that specific infrastructure can be considered as essential facilities which use cannot be restricted to one exclusive party. As regards the design of the TPA-regime, the Mining Act, just like the directive, seems to be based on the regime governing access to upstream gas pipelines, i.e., negotiations regarding tariffs and conditions and exemptions mainly limited to lack of available capacity and incompatibility of technical specifications.[275] As this is a minimum obligation, it would be possible to further regulate access by way of a regime of negotiated TPA or regulated TPA. However, this would increase the regulatory burden of the operator.

The post-closure obligations in the 2003 Mining Act are similar to the directive. Hence, storage licence applications need to describe how the storage location will be closed[276] and this needs to be in line with the abandonment and closure plan that will be submitted to the Minister of Economic Affairs and Climate. Closure and post-closure will be monitored by the State Supervisor of the Mines.[277] The licensee remains responsible for the site until responsibility can be transferred to the State after a period of twenty years but only if the installations have been removed and the CO_2 is permanently stored.[278] As such

---

[266] Directive 2009/31/EC on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/E, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006.

[267] Article 25(1) Mining Act and Article 26(6) Mining Act.

[268] M.M. Roggenkamp et al., 'Energy Law in Europe', 2016, p. 802.

[269] Article 27 (7) Mining Act. J. Gazendam and M.M. Roggenkamp, 'Accelerating Low Carbon Industrial Growth through CCUS', May 2020, p. 16.

[270] Article 31d Mining Act.

[271] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, p. 13.

272 Article 16.5 Environmental Management Act.

[273] Article 94 Mining Decree.

[274] Article 32 (1) Mining Act.

[275] Article 32 (2)(3) Mining Act. See also Martha M. Roggenkamp, 'Transportation of CO_2 in the EU' in: Havercroft et all (eds), *Carbon Capture and Storage – Emerging and Legal Regulatory Issues*, Hart Publishing, 2018, p. 253.

[276] Article 31d(1)(j) Mining Act.

[277] Articles 126-130 Mining Act.

[278] Article 31j(1) Mining Act and Article 31k(1) Mining Act.

responsibility also entails climate liability, the finding that the CO_2 is permanently stored is crucial as the State is responsible for leakages and possible CO_2 emissions.[279]

5.1.2.2 Wind Energy at Sea Act

The Wind Energy at Sea Act (*Wet windenergie op zee*) of 2015 governs the development of wind energy offshore.[280] It also provides for an important change in the legal framework that was based on a 'first come, first served' regime and the possibility of developers to choose the most suitable site in the EEZ.[281] As of 2015, the Ministry of Economic Affairs and Climate determines the offshore locations (*kavels*) where offshore wind can be developed and the wind energy plots within these locations that can be licensed (a plot decision). Wind Farm Zone Decisions (*kavelbesluiten*) fill in the exact coordinates of the wind farms as well as the capacity of the wind farms to be built in that zone.[282] In addition, an environmental assessment has been done before the plot is licensed.[283]

The licensing procedure is to a large extent similar to the one presented in section 5.1.2.1 above. An important distinction is that two licensing regimes apply: one with a request for financial support and one without such request. Financial support can be granted if the cost of the production of offshore wind energy is higher than for conventional electricity production. As production costs go down and electricity prices increase, the latter type of application is increasing.[284] A licence to develop an offshore wind farm is granted upon specific conditions.[285] These involve the number and size of turbines but also the duration of a licence, with a maximum period of 40 years.[286] The duration of the license is based on the technical lifespan of the turbines as obviously access to wind will not be depleted.

Disused wind turbines need to be removed. By contrast to the Mining Act, such removal obligation is not included in the Wind Energy at Sea Act but is part of the plot decision (*kavelbesluit*) and thus indirectly part of the licence. The plot decision includes a reference to Article 6.16l para 1 of the Water Decree (*Waterbesluit*), which requires the removal of disused wind parks and export cables.[287] The latter is surprising as it goes beyond the requirements of UNCLOS (see section 2.3.3 above). With regard to the removal of the wind turbines it can be assumed that this follows the requirements of UNCLOS and OSPAR and wind turbines in shallow waters thus need to be removed entirely. However, partial removal is possible according to Article 6.3 para 1 (d) of the Water Act but only if such removal would lead to 'damage to the marine environment or to other rightful usages of the sea'.[288] Similar to mining installations, any removal requires a removal plan which has to be submitted by the licence holder at least four weeks prior to removal.[289] Once the wind farm or the cable is removed, this has to be notified to the Minister.[290]

---

[279] Article 31k(2) Mining Act.

[280] Wet van 24 juni 2015 houdende regels omtrent windenergie op zee (Wet windenergie op zee).

[281] Article 15(1)(b) Wind Energy at Sea Act.

[282] Article 3 Wind Energy at Sea Act.

[283] The allocation of these areas (*kavels*) is based on the National Water Plan, which is a spatial plan pursuant to article 1.1(2)(a) of the Spatial Planning Act. See regarding an EIA Article 3(3) Wind Energy at Sea Act.

[284] Article 28(3) Wind Energy at Sea Act.

[285] Article 4 Wind Energy at Sea Act.

[286] Article 15(2) Wind Energy at Sea Act.

[287] Ministerial Water Decree (*Waterbesluit*) of 30 November 2009.

[288] See for instance, *Kavelbesluit V windenergie Hollandse Kust (noord)*, <https://www.rvo.nl/sites/default/files/2019/04/Kavelbesluit_V_windenergiegebied_Hollandse_Kust_noord_definitief%20w.g.pdf>.

[289] Article 6.16(l)(6) and Article 1.1 Water Decree (the Minister of Infrastructure and Water Management).

[290] Article 6.16(l)(7) Water Decree.

5.1.2.3 Water Act

The Water Act (*Waterwet*)[291] is relevant for this study as it provides a general framework for the regulation of all activities taking place in water systems to the extent that they are not partially or entirely regulated by specific sectoral legislation, such as the earlier mentioned Mining Act or Wind Energy at Sea Act. This Act thus applies in case of other uses such as the development of offshore solar ocean energy.[292]

A permit is required to establish or leave behind an installation or structure in the EEZ.[293] A request for such a water permit can only be rejected if the usage of the permit would be incompatible with general purposes of the Act, i.e. the prevention of floods, water scarcity, the chemical and biological quality of the water systems and societal functions of the water system.[294] In accordance with the Water Regulation (*Waterregeling*), a request for a water permit for the construction of an installation or structure should always include information on the removal of that installation or structure.[295] Hence, the Minister can include instructions in the water permit with regard to, *inter alia*, the compensation, financial security and removal of negative effects to the environment when the activity ceases.[296] This can include an instruction in the Water permit with regard to the removal of the physical infrastructures when these will become disused.[297]

5.1.2.4 Gas Act, Electricity Act and Forthcoming Energy Act

Gas Act

The impact of the Gas Act[298] offshore is limited. Currently, the Act provides that it applies to gas storage facilities, LNG-facilities and interconnectors situated in the EEZ and on the CS.[299] Notably, upstream gas pipelines are not mentioned. This seems to imply that the Gas Act does not apply to pipelines that are part of a gas production installation or used to transport gas from such installation to a treatment or storage facility or to an onshore terminal. The reason for this omission may be that the Gas Act does not provide any specific rules on upstream gas pipelines, except for the provision that competition law applies to upstream gas pipelines on the CS.[300]

Electricity Act

Similarly, only part of the Electricity Act[301] applies offshore. Currently, the Act only governs the production of electricity in the EEZ, interconnectors crossing the EEZ, and the electricity grid (net op zee) situated in the EEZ.[302] The reason for applying the Electricity Act to offshore production was the need

[291] Wet van 29 januari 2009, houdende regels met betrekking tot het beheer en gebruik van watersystemen (Waterwet).

[292] D. Drankier & M.M. Roggenkamp, 'Regulatory Framework: Barriers and Drivers for Offshore System Integration', North Sea Energy II – Deliverable B.1., Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2018, p. 15. By contrast to the Mining Act and the Wind Energy at Sea Act, the Ministry of Infrastructure and Water Management and the supervisory authority *Rijkswaterstaat* are responsible for the execution and enforcement of the provisions of the Water Act

[293] Article 6.5 of the Water Act.

[294] Article 2.1 of the Water Act.

[295] Article 6.26 of the Water Regulation of 22 December 2009.

[296] Article 6.20 (1) of the Water Act.

[297] The Minister has for example used this possibility regarding the offshore network constructed by TenneT, see for example the Water permit for the offshore network in the Borselle Area, permit RWS2016/28137, instruction 14, p. 10.

[298] Wet van 22 juni 2000 houdende regels omtrent het transport en de levering van gas (Gaswet).

[299] Article 1(3) Gas Act.

[300] Article 17 Gas Act.

[301] Wet van 2 juli 1998 houdende regels met betrekking tot de productie, het transport en de levering van elektriciteit (Elektriciteitswet 1998).

[302] Article 1 para 5 Electricity Act.

to be able to financially support (via MEP and now SDE++) renewable electricity production.[303] In addition, there is the need to apply EU law provisions on interconnectors to cross-border Dutch cables. The last option is relatively new and is the result of the new regime for offshore wind production that has been introduced in 2015.

The new regime has also led to a change regarding the cable connections. Instead of individual cables connection wind farms to the onshore transmission system, a plot decision now also specifies the location/route of the cables connecting the wind farm to the electricity network. Moreover, following an amendment to the Electricity Act in 2016, the grid connection now takes place offshore. This entails that the offshore wind farm is connected to the offshore grid operated by the TSO at sea, unless the offshore wind farm is connected directly to an installation.[304] The offshore converter station and the cable connecting the converter station to shore are currently by law constructed and operated by the TSO at sea, i.e. TenneT.[305] In September 2016, TenneT was certified as the TSO at sea by the national regulatory authority.[306] As a result, the costs of production have decreased but as consumers are not directly connected to the offshore electricity grid, the transmission costs are covered by a government subsidy and, if necessary, the TSO TenneT itself.[307] A crucial matter is the need to align production and transport as neither of them want postpone their activities until the other has finished construction activities. Currently, converter stations (which have generally a longer lifespan) need to be removed and need to be connected to windmills specifically (via so-called inter-array cables).[308]

Forthcoming Energy Act

An important development is the proposal to integrate the Electricity Act and the Gas Act into a new Energy Act, which also has to serve as the basis for implementing the 2019 Electricity and Gas Directives in national Dutch law.[309] A draft Energy Act was launched in December 2020[310] and aims at (i) strengthening the regulatory framework for system integration, (ii) utilizing the potential of so-called 'energy data', (iii) accelerating the roll out of mechanisms which support the energy transition, (iii) creating room for market initiatives, (iv) protecting end-consumers and (v) incorporating monitoring mechanisms.[311] Although Article 1.6 of the draft Energy Act states that the provisions also apply to the Dutch EEZ regarding (i) transmission systems, (ii) interconnectors for both gas and electricity, (iii) the storage of gas, (iv) offshore wind farms and (v) final customers of electricity, the Act does not provide for a specific framework pertaining to offshore system integration.[312] Given the important role of the NSA to achieve net zero emissions by 2050, the lack of focus on offshore development is notable.[313]

---

303 Netherlands Enterprise Agency, 'Stimulation of sustainable energy production and climate transition (SDE++) <https://english.rvo.nl/subsidies-programmes/sde> accessed 5 September 2022.

304 In November 2021, Article 1 of the Wind at Sera Act was amended in order to define a 'connection point' as 'the point at which a cable (aansluitverbinding) is connected to a network or to an installation'.

305 Article 16(2)(n) of the Electricity Act. For a more comprehensive understanding see Nieuwenhout, C.T., Legal Framework and Legal Barriers to an Offshore HVDC Electricity Grid in the North Sea, PROMOTioN, Deliverable 7.1, 2017, p. 95.

306 Article 15a Dutch Electricity Act.

307 Article 42a Electricity Act and article 77g Electricity Act.

308 C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020, p. 45.

309 Draft proposal for a law containing rules on energy markets and energy systems (Energy Act), 17 November 2021.

310 Ministerie van Economische Zaken en Klimaat, *Memorie van Toelichting wetsvoorstel Energiewet*, 17 December 2020.

311 Conceptvoorstel van wet houdende regels over energiemarkten en energiesystemen (Energiewet).

312 Ministerie van Economische Zaken en Klimaat, *Memorie van Toelichting wetsvoorstel Energiewet*, 17 December 2020.

313 Conceptvoorstel van wet houdende regels over energiemarkten en energiesystemen (Energiewet), 17 November 2021.

Moreover, although the new Energy Act is said to become the cornerstone of the Dutch energy transition[314], it does neither regulate the development of green hydrogen.

5.1.3 Impact of Offshore Energy Law on Developing Energy Hubs

5.1.3.1 Platform Electrification

So far, there are no national examples of platform electrification on the CS/in the EEZ. However, two examples have emerged in the territorial waters. This involves the electrification of an offshore installation via an onshore connection and the connection of a nearshore wind farm in Germany with a gas production facility in the Dutch territorial waters.[315]

The PosHYdon project aims at producing green hydrogen on the Q13-a platform operated by Neptune (see also section 5.1.3.2 below). The platform Q13a-A is situated 13 kilometers of the coast in the territorial sea and is connected via a 25 kV subsea cable to a high-voltage station of the distribution system operator Stedin in The Hague. This entails that the platform is connected to the onshore electricity system. However, is the cable to be considered as part of the connection (*aansluiting*)? According to article 1b of the Electricity Act 1998 a connection is defined as 'one or more links between the grid and an immovable property', i.e., a property registered in the land register (*kadaster*). However, as in general municipal borders do not go beyond 5 kilometers of the coast and platform Q13-a is situated further out, it is most likely not registered and thus not an immovable property. This entails that the cable from a legal perspective does not meet the requirements of a 'connection' as defined in the Electricity Act 1998. From a mining law perspective, it is pursuant to Article 1(al) of the Mining Act and Article 92(b) of the Mining Decree a cable connecting a mining installation (platform Q13-a) and another work (high voltage station) necessary to transport electricity. Consequently, the cable is subject to a construction permit pursuant to article 106 Mining Decree.

The second example involves a cable that connects platform N05-A of One-Dyas with the German wind farm Riffgat (see further section 5.4.3.1 below). The Dutch Minister of Economic Affairs and Climate granted a licence in July 2022 to produce natural gas in block N05-A.[316] The licence is granted to ONE-Dyas (operator) and Hanse Hydrocarbons, and EBN will join as state participant. Production is expected to commence in 2024. The gas production installation will include, *inter alia*, an offshore gas treatment facility, which exclusively will make use of offshore wind energy.[317] Since platform N05-A is situated in the Dutch territorial waters and the Riffgat wind farm in German territorial waters, the cable is crossing the Dutch-German border in the disputed area (see introduction above), which obviously complicates its development. Another complication relates to the qualification of the cable. At first glance it seems to qualify as a direct line, which is defined as a line connecting an isolated/single producer with an isolated/single consumer. Although Riffgat also is connected via a cable to the German coast, the Dutch-German cable will most likely meet the requirements of being a direct line. However, EU law limits cross-border connections to 'interconnectors' and the German and Dutch governments have so far not been

---

[314] Rijksoverheid, 'Nieuwe Energiewet wordt fundament van de energietransitie', 1 July 2022, <https://www.rijksoverheid.nl/actueel/nieuws/2022/07/01/nieuwe-energiewet-wordt-fundament-van-de-energietransitie> accessed

[315] See www.gemsnoordzee.com.

[316] Permit N05-A (One Dyas) <https://www.nlog.nl/index.php/n05-one-dyas> and <https://www.rvo.nl/onderwerpen/bureau-energieprojecten/lopende-projecten/gaswinning-n05a> accessed 5 September 2022.

[317] Ministry of Economic Affairs and Climate Policy, 'Ontwikkelingskader windenergie op zee', May 2021 <https://www.rvo.nl/sites/default/files/2021/06/Ontwikkelkader%20windenergie%20op%20zee%20versie%20mei%202021.pdf> accessed 5 July 2022' L. Sijtsma, 'Conceptadvies SDE++ 2021 Elektrificatie van Offshore Productieplatformen', 28 August 2020 <https://www.pbl.nl/sites/default/files/downloads/pbl-2020-conceptadvies-sde-plus-plus-2021-elektrificatie-offshore-productieplatformen_4123.pdf>.

supportive of enabling cross-border direct lines, although in this case the situation is easier as the cable is not crossing a geographical area of a distribution system operator.[318] Nevertheless, when focusing on the situation in the Dutch territorial waters it is not very clear how to qualify this cable. Although the cable is connecting a mining installation and another work (e.g., a wind farm)[319], the wind farm is not subject to Dutch jurisdiction and Dutch mining law. In other words, is this cable to be considered as a cable in accordance with Dutch mining law and thus subject to a permit in accordance with article 106 of the Mining Decree or is a permit required on the basis of the Water Act (see section 5.1.2.3 above)?

The above examples of platform electrification are situated in the territorial sea. However, the situation would not differ very much if situated in the EEZ. In that case it would still be doubtful (and even more so) whether a cable connecting the platform with the coast could be considered as a connection as defined in the Electricity Act 1998. Similarly, it remains questionable whether a cable connecting a platform in the Dutch CS and a wind park in the German EEZ can be qualified as a cross-border direct line and whether the cable that is situated in Dutch waters is to be qualified as a cable to transport electricity pursuant to the Mining Act and Mining Decree. If the platform and the wind park both would be situated in Dutch territorial waters and/or CS and EEZ, the situation would differ again as this cable most likely would be a direct line as well as a cable to transport electricity pursuant to the Mining Act and the Mining Decree and thus subject to a permit on the basis of article 16 Mining Decree.

5.1.3.2 Hydrogen

Hydrogen in the Netherlands is mainly used as a feedstock and in recent years also as an energy carrier.[320] So far, mainly grey hydrogen is being used but the trend is to produce more green hydrogen, also offshore. The abovementioned PosHYdon project is the first initiative for an offshore hydrogen project.[321] However, more projects can be expected as can be deducted from the proposals submitted following the offshore wind tender 'Hollandse Kust West'.[322]

PosHYdon is a pilot project that aims at generating (green) hydrogen out of seawater.[323] The pilot is relevant for several reasons. First, as it converts seawater into demineralised water on the platform Q13-A operated by Neptune Energy.[324] The demineralised water is then converted into hydrogen via electrolysis. Electricity will be used for this conversion. For this purpose an arrangement has been made with Eneco who 'virtually' supplies electricity from the offshore wind park 'Luchterduinen' (129 MW) and that is located 25 kilometres north of platform Q13-A. The wind farm and platform will not be connected via a cable. Instead the electricity will be supplied via the earlier mentioned cable connecting the platform with a high voltage installation of Stedin. Eneco will provide all necessary data ('wind profile') to simulate

---

[318] L. Diestelmeier & M.M. Roggenkamp, 'Current Legal Framework for Cross-Border Local Energy Markets – National Legal Frameworks' – SEREH project. December 2021, p. 28.

[319] See Article 1(al) of the Mining Act and article 92 (b) Mining Decree.

[320] See HyLaw, J.P. van der Meer, R Perotti, F. de Jong, *National Policy Paper – Netherlands*, available at <https://www.hylaw.eu/sites/default/files/2019-%2003/HyLAW_National%20Policy%20Paper_Netherlands.pdf>.

[321] PosHYdon, <https://poshydon.com/en/home-en/> accessed 30 September 2022. Given that the PosHYdon is connected to the onshore electricity transmission grid, there is not guarantee that the hydrogen produced on it can be labelled as 'green'. This could only be guaranteed if the onshore transmission grid was fed electricity generated only from renewable energy sources, which is currently not the case. See: energy mix of the Netherlands <https://www.iea.org/countries/the-netherlands> accessed 2 October 2022.

[322] Netherlands Enterprise Agency, 'Hollandse Kust West Wind Farm Zone', 27 September 2022, <https://english.rvo.nl/information/offshore-wind-energy/hollandse-kust-west-wind-farm-zone> accessed 1 October 2022. The wind farm 'Hollandse Kust West' will be in operation as of 2025. RWE, Vattenfall, Shell/Eneco, Orsted/TotalEnergies and BP submitted proposals stating their willingness to use the plot, *inter alia*, for green hydrogen production.

[323] TNO, 'Groene waterstof uit zeewater dankzij unieke proef', < https://www.tno.nl/nl/duurzaam/co2-neutrale-industrie/schone-waterstofproductie/groene-waterstof-zeewater/> accessed 28 September 2022.

[324] In addition to Neptune Energy two other partners are involved in the platform: Taqa Offshore BV and EBN BV.

real time hydrogen conversion.[325] Another relevant part of the pilot is to examine the re-use and/or multi- use of platform Q13-A as the platform is no longer serving gas production only and is/will be used to produce and supply green hydrogen as well.

Currently, there is no specific legal framework governing hydrogen conversion and transport.[326] In the absence of a specific legal framework, permitting is based on the Water Act (see section 5.1.2.3 above).[327] The production of hydrogen on an offshore platform would thus depend on a water permit pursuant to Article 6.13 of the Water Decree.[328] However, exemption exists for activities of minor importance (*ondergeschikt belang*).[329] In this pilot project, the production takes place on an existing platform that still is in use as a gas production facility. Hence, is it possible that the activities aiming at hydrogen conversion can be considered as being of minor importance? Does such an assessment depend on the importance of the installation as a gas production facility? If so, the hydrogen activities could become of more importance if gas production ceases and then become subject to a water permit? In addition, it can be questioned whether the equipment installed on the platform used for hydrogen conversion can be treated as part of the mining activities and thus be covered by the gas production licence. This shows the need for legal certainty in case of a multi-use of installations that are subject to different legal regimes.

The (green) hydrogen produced on the platform will be injected in and transported via the existing (upstream) gas pipeline system. This entails that there will be a comingled stream of natural gas and green hydrogen in the pipeline system. The gas needs to meet the required technical specifications of the pipeline operator(s).[330]

5.1.3.3 CO_2 Transport and Storage

Offshore CO_2 transport and storage has been discussed for some time but so far not been successful. The most recent project under development is Porthos (e.g., Port of Rotterdam CO_2 Transport Hub & Offshore Storage). It is an initiative of the Port of Rotterdam, the gas infrastructure company 'Gasunie', and the company EBN. The project consists of a pipeline running through the Rotterdam port area where it can serve several industries emitting CO_2 and terminating at a (almost) depleted gas field about 20 kilometres of the coast.[331] Taqa is the licensee/operator of the gas field in block in P18-A, and has also been awarded the CO_2 storage licence.[332] This means that the (parts of) the production installation situated P18-A will be reused. By contrast to previous attempts to store CO_2 offshore like the ROAD project, Porthos is designed as an open access project, which means that third parties can request non-discriminatory access to the system. However, parties who have declared interest during the 'open

---

[325] Eneco, 'Neptune Energy verwelkomt Eneco als partner in de offshore groene waterstofpilot PosHYdon', 29 April 2020. <https://nieuws.eneco.nl/neptune-energy-verwelkomt-eneco-als-partner-in-de-offshore-groene-waterstofpilot-poshydon/> accessed 28 September 2022.

[326] See for a more elaborate overview L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 80.

[327] Article 6(5)(c) of the Water Act.

[328] See Article 6.13(c) and (d) of the Ministerial Water Decree (*Waterbesluit*) of 30 November 2009.

[329] Article 6(12) (f) Water Act

[330] The Ministerial Decree on Gas Quality (*Regeling Gaskwaliteit)* of 11 July 2011, Annex 2, states that the maximum content level of hydrogen in high calorific gas is 0,2mol% (in parts of the onshore low calorific gas networks it entails 0.05% mol).

[331] Porthos, 'CO_2 reduction through storage beneath the North Sea' <https://www.porthosco2.nl/en/> accessed 10 August 2022; Rijksdienst voor Ondernemend Nederland, 'Porthos transport en opslag van CO_2' <https://www.rvo.nl/onderwerpen/bureau-energieprojecten/lopende-projecten/porthos> accessed 10 August 2022.

[332] See also Martha M. Roggenkamp, Carbon Capture and Storage in the Netherlands – A Long and Winding Process, EELR XIII. Intersentia 2020, p. 405 – p. 417.

season' organized in 2019 will be granted priority access.[333] The project will thus be financed on the basis of, *inter alia*, the transportation fees and a SDE++ subsidy. In addition, it has been included on the PCI list and may thus receive EU subsidies as well (see section 3.2.6 above). The start of the project has been delayed to 2024, amongst others, due to complaint procedures.[334]

Another offshore CO_2 transport and storage project is Aramis, which is an initiative of Shell, Gasunie, Total and EBN.[335] The aim is to transport CO_2 via ships or onshore pipelines to the port of Rotterdam where the Maasvlakte will serve as a 'collection hub' (comprising a compressor station and a shipping terminal) and provide temporary storage for the liquid CO_2 that arrives by ship.[336] The final part of the process will see CO_2 transported from the hub to be injected into the offshore gas fields 3-4 km below the seabed. The project aims at an operational start-up in 2026.[337] Furthermore, it is like Porthos designed as an open access project.[338]

5.1.4 Interim Conclusions

The Netherlands has a legal framework in place governing hydrocarbons exploration and production, transport and storage of carbon dioxide and the production of electricity from offshore wind. All developments require a permit. So far, the production and supply of hydrogen is not regulated and, consequently, the governance is limited to a 'construction' permit under the Water Act. However, this will change as soon as on EU level a legal framework is adopted that needs to be transposed in national law. Another change may be the introduction of an Energy Act, replacing the current Electricity and Gas Acts. This new Act will be an attempt to accelerate system integration. However, in its current shape it does not have a clear focus on offshore developments and offshore system integration.

Although policy papers regularly refer to the need of system integration, it remains to be seen when this will become law and how this will affect the development of offshore energy hubs. Nevertheless, there is a need for legal changes as the analysis of the development of the three hub functions has shown that the current regime is not sufficient. When considering offshore platform electrification, we analyzed two examples in the territorial waters. We noted that electrification via a cable from shore raises an issue with regard to the definition of 'connection' as defined in the Electricity Act. The other example involving a cross-border cable connecting a German wind farm and a Dutch platform is complicated, as in principle cross-border direct lines are not envisaged. So far, there is no practical experience with cables connecting a wind farm to a platform within the Dutch EEZ. Although the PosHYdon project involves an offshore wind farm and a platform in Dutch waters, the pilot project has not led to the construction of such cable and an assessment whether this could be a direct line. The PosHYdon project also illustrates the legal

---

[333] D. Drankier & M.M. Roggenkamp, 'The Regulation of Decommissioning in the Netherlands: From Removal to Re-Use' in M.M. Roggenkamp & C. Banet (eds), *European Energy Law Report* (Volume XIII), p. 297.

[334] Ministerie van Economische Zaken en Klimaat, Staatscourant 2022, 18510 (14 July 2022).

[335] Gasunie, 'Aramis', <https://www.gasunie.nl/projecten/aramis> accessed 28 September 2022; ACM, 'Project Aramis. Joint Market Initiative' (ACM/UITNZP/001473) 27 June 2022 <https://www.acm.nl/sites/default/files/documents/informele-zienswijze-samenwerking-shell-totalenergies-co2-opslag-noordzee.pdf> accessed 1 October 2022.

[336] Gasworld, 'Aramis CCS Project aims for large-scale carbon reduction', 13 September 2021 <https://www.gasworld.com/aramis-ccs-project-aims-for-large-scale-carbon-reduction/2021701.article> accessed 28 September 2022.

[337] Ocean-Energy Resources, 'Partnership to develop an offshore CCS-project: Aramis', 8 September 2021 <https://ocean-energyresources.com/2021/09/08/partnership-to-develop-an-offshore-ccs-project-aramis/> accessed 28 September 2022.

[338] ACM, 'Shell en TotalEnergies mogen samenwerken bij de CO2-opslag in lege gasvelden op de Noordzee', 27 June 2022 < https://www.acm.nl/nl/publicaties/shell-en-totalenergies-mogen-samenwerken-bij-de-co2-opslag-lege-gasvelden-op-de-noordzee> accessed 1 October 2022. See in addition: https://www.rvo.nl/sites/default/files/2022/02/Vragen-en-antwoorden-Voornemen-en-participatieplan-informatieavond-26-januari-2022-Aramis.pdf. Aramis will be located in the K and L blocks (see in addition: https://www.rvo.nl/sites/default/files/2022/02/Vragen-en-antwoorden-Voornemen-en-participatieplan-informatieavond-26-januari-2022-Aramis.pdf).

challenges relating to a multi-use of a gas production for hydrogen conversion. Although a legal framework governing the production and transport of hydrogen is in the making, it remains uncertain how this will affect developments offshore and potential multi-use of installations. Furthermore, we noted that a regime governing transport and storage of CO_2 offshore is in place and open access projects are being developed. The shift from dedicated capture and storage projects seems to be pivotal, although some legal issues still need to be solved.

As the Dutch CS and EEZ borders British waters and this study takes into account developments relating to Hub West, it is worthwhile mentioning a potential cross-border combined wind energy project: the WindConnector.[339] It aims to combine the wind farm 'IJmuiden Ver' with an interconnector to the United Kingdom. The WindConnector option is currently examined by the Dutch TSO TenneT, the Dutch Ministry of Economic Affairs and Climate and the potential British parties (British Government, TSO and parties holding a licence for wind farms situated close to IJmuiden Ver). In 2020, the Minister of Economic Affairs and Climate determined that TenneT must design the converter stations necessary for developing the wind farm. 'IJmuiden Ver' has to be designed in such a way that they are suitable for a Windconnector to the UK.[340]

5.2 United Kingdom

The United Kingdom (hereafter: UK) is of importance regarding the position of Hub West. Whereas production of natural gas began in 1967 with the West Sole field in the Southern North Sea, offshore oil production began with the Argyll field in 1975.[341] In the beginning, production was dominated by a small number of very large fields but nowadays, oil and gas production comes from some 300 predominantly small fields operated by nearly 500 installations, approximately 5.000 wells and 3.300 kilometres of pipelines.[342] The UK and the Netherlands jointly developed a straddling gas field (see section 5.1 above). However, although the North Sea Transition Authority (hereafter: NSTA) (formerly the Oil & Gas Authority)[343] estimates that there are still around 10 to 20 billion barrels of oil equivalent remaining offshore, domestic production has more than halved since 2000.[344] As reservoirs are being depleted, the reuse of reservoirs and installations is high on the agenda, amongst others for storing CO_2 offshore.

In order to develop offshore wind energy, the UK declared a Renewable Energy Zone in 2004, which extends up to a maximum of 200 nautical miles from the baseline.[345] Pursuant to the Marine and Coastal Access Act of 2009[346] the Renewable Energy Zone was replaced by an EEZ.[347] In early 2022, the UK had a total installed capacity of over 24.4 GW, of which 10.4 GW is generated offshore capacity (which

[339] Rijksoverheid, 'Wind op zee na 2030', <https://windopzee.nl/onderwerpen/wind-zee/wanneer-hoeveel/wind-zee-2030-0/> accessed 29 September 2022.

[340] TenneT, 'Programma 2030', < https://www.tennet.eu/nl/programma-2030> accessed 30 September 2022. See also https://windopzee.nl/onderwerpen/wind-zee/wanneer-hoeveel/wind-zee-2030-0/

[341] UKEITI, Oil and Gas in the UK, <https://www.ukeiti.org/oil-gas>, accessed 5 July 2022.

[342] Nexans, 'Supplying cables for the world's first floating windfarm' <https://www.nexans.com/en/business/power-generation-transmission/offshore-wind/Hywind---floating-windpower.html> accessed 15 July 2022.

[343] The North Sea Transition Authority regulates the oil, gas, and storage industries. See for more information <https://www.nstauthority.co.uk/about-us/> accessed 28 September 2022.

[344] Oil & Gas Authority, *Reserves and Resources Report*, September 2021 <https://www.ogauthority.co.uk/media/6407/oga-production-and-beis-demand-projections-february-2020.xlsx> table 4.

[345] Section 84 of the Energy Act 2004.

[346] Marine and Coastal Access Act 2009 c.23.

[347] The Exclusive Economic Zone Order of 2013 entered into force on 31 March 2014.

equals 2.552 turbines).[348] Right now, the UK is home to two floating offshore wind farms and by 2030 they intend to have scaled this twelvefold.[349] In addition, the UK has currently 2.647 kilometres of cables and 6GW of electricity interconnector capacity.[350]

It should be noted that the legal system of the UK (being a common law system) is different to the civil law system of continental Europe. The main difference between the two systems is that in common law countries, case law (mainly published judicial opinions) is of primary importance, whereas in civil law systems, codified statutes prevail.[351] UK energy law is, nevertheless, mostly based on acts of primary and secondary legislation, amongst others due to the influence of EU law since the UK became a member of the EEC in 1973. Following Brexit this will change as UK law gradually will replace existing EU laws. The relationship between the UK and the EU has also been redefined and is now based on the Trade and Cooperation Agreement (hereafter: TCA).[352] It, *inter alia*, provides a basic level of harmonisation of the rules governing the UK and EU electricity and gas. The key provisions of the internal energy market – non-discriminatory regarding the production, transmission, distribution and supply of energy and the freedom of energy choice – will continue to apply in the UK.[353] Yet, each party maintains the right to regulate its sector in order to achieve "a legitimate public policy goal [...] based on objective criteria".[354] The impact of the TCA for this study is thus limited.

5.2.1 Policy Developments

5.2.2.1 Roadmap 2035

The Roadmap 2035, which was announced in September 2019, identifies more than eight essential measures to reach a lower carbon society.[355] It presents the main goal of achieving net zero emissions by 2050 (as confirmed in 2021 by the Net Zero Strategy[356]) and reducing overall emissions by 78% in 2035 compared to 1990 levels.[357] The Climate Change Act 2008[358] provides legal instruments to achieve these goals, for example, by introducing maximum levels of CO_2 emissions (a carbon budget) for specific periods of time.[359] Offshore energy developments will have the capacity to deliver 30% of the UK's net

[348] Renewable UK, *Wind Energy* <https://www.renewableuk.com/page/WindEnergy> accessed 14 March 2022; Renewable UK, *Wind Energy Statistics* <https://www.renewableuk.com/page/UKWEDhome> accessed 5 September 2022; National Grid ESO, ‚Great Britain's monthly electricity stats' July 2022 <https://www.nationalgrideso.com/electricity-explained/electricity-and-me/great-britains-monthly-electricity-stats> accessed 4 August 2022.

[349] The Crown Estate, *Floating offshore wind* <https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/floating-offshore-wind/> accessed 5 September 2022.

[350] Ofgem, 'Interconnectors' <https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/interconnectors> accessed 28 September 2022.

[351] See further the definition of 'common law' by Merriam-Webster, available at <https://www.merriam-webster.com/dictionary/common-law>.

[352] Trade And Cooperation Agreement between the European Union and the European Atomic Energy Community on the one part, and the United Kingdom of Great Britain and Northern Ireland on the other part. The Agreement entered into force in March 2021/ See https://ec.europa.eu/info/strategy/relations-non-eu-countries/relations-united-kingdom/eu-uk-trade-and-cooperation-agreement_en

[353] Article 5 TCA.

[354] Trade and Cooperation Agreement, Part 2, Heading 1, Title 8, Chapter 2, art. 10.

[355] OGUK, *Roadmap 2035* <https://roadmap2035.co.uk> accessed 24 October 2021.

[356] HM Government, Net Zero Strategy: Build Back Greener, October 2021 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf> accessed 14 March 2022, p. 39.

[357] A. Haine, 'Britain's Net Zero Strategy Sets Out Roadmap to Clean Energy by 2035', NBusiness 19 October 2021 <https://www.thenationalnews.com/business/energy/2021/10/19/britains-net-zero-strategy-sets-out-roadmap-to-clean-energy-by-2035/> accessed 20 October 2021.

[358] UK Public General Acts, Climate Change Act 2008, c. 27.

[359] Ibid, section 4.

zero target.[360] Specifically, the UK aims at delivering up to 50GW of offshore wind by 2030, including up to 5GW of innovative floating wind. In addition, the UK will also focus on tidal and geothermal.[361]

Although this document focuses on 'energy integration', no specific reference has been made to 'offshore system integration'.[362] It does, however, identify developments relevant for offshore system integration such as offshore electrification, carbon dioxide storage and (blue and green) hydrogen conversion.[363] It aims at sustaining the competitiveness of the United Kingdom Continental Shelf (hereafter: UKCS) in order to continue to attract future investments while improving system reliability and fostering the benefits of innovation.[364]

5.2.1.2 10 Point Plan for a Green Industrial Revolution

In November 2020, the 10 Point Plan for a Green Industrial Revolution was published. It aims at innovation and the development of new sources of finance, which are fundamental to further the development of green technologies necessary to achieve the net-zero goal.[365] The government plans to create conditions for the private sector to invest in new green industries.[366] Advancing offshore wind is one of the main strategies.[367] By 2030, the aim is to quadruple offshore wind capacity in order to generate more electricity.[368] However, the estimated quadrupling of offshore wind capacity requires more coordination developing offshore energy networks.[369] To integrate clean technologies like offshore wind, the UK has to transform its energy system, to build more networks and utilize smart technologies like energy storage.[370] For this purpose, the 10 Point Plan was accompanied by the National Infrastructure Strategy, which sets out in more detail how the government intends to deliver its plan. This was further elaborated in the Energy White Paper.

---

[360] Oil & Gas Authority, *Offshore Energy Integration can deliver 30% of UK's net zero target*, 6 August 2020 <https://www.ogauthority.co.uk/news-publications/news/2020/offshore-energy-integration-can-deliver-30-of-uk-s-net-zero-target/> accessed 24 October 2021.

[361] C. McKenna & N. Olswang, 'Spotlight: Renewable Energy Project development in United Kingdom' 22 July 2022, <https://www.lexology.com/library/detail.aspx?g=8ae6189c-520a-4c41-9ee8-c36389bc51ca> accessed 28 September 2022.

[362] A. Exarhaes, 'OGUK Roadmap 2035 On Track', 2 September 2020 <https://www.rigzone.com/news/oguk_roadmap_2035_on_track-02-sep-2020-163181-article/> accessed 24 October 2021.

[363] Oil & Gas Authority, 'UKCS Energy Integration. Final Report' August 2020 <<https://www.nstauthority.co.uk/media/6625/ukcs_energy_integration_phase-ii_report_website-version-final.pdf> p. 4 (accessed 29 September 2022).

[364] OGUK, 'Harnessing technology to drive emissions reductions' <https://stories.oilandgasuk.co.uk/harnessing-technology-to-drive-emissions-reductions/index.html> accessed 24 October 2021.

[365] HM Government, *The Ten Point Plan for a Green Industrial Revolution*. Building Back Better, Supporting Green Jobs and Accelerating Our Path to Net-Zero, November 2020 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf> accessed 24 October 2021.

[366] HM Government, *Net Zero Strategy: Build Back Greener*, October 2021 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf> accessed 14 March 2022, p. 16.

[367] HM Government, *The Ten Point Plan for a Green Industrial Revolution*. Building Back Better, Supporting Green Jobs and Accelerating Our Path to Net-Zero, November 2020 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf> accessed 24 October 2021.

[368] J. Ambrose & F. Harvey, 'Powering all UK homes via offshore wind by 2030 will need 50 bn pound', The Guardian 6 October 2020 <https://www.theguardian.com/environment/2020/oct/06/powering-all-uk-homes-via-offshore-wind-by-2030-would-cost-50bn> accessed 24 October 2021.

[369] Ofgem, *Consultation on changes intended to bring about greater coordination in the development of offshore energy networks'*, 14 July 2021 < https://www.ofgem.gov.uk/publications/consultation-changes-intended-bring-about-greater-coordination-development-offshore-energy-networks> accessed 24 October 2021.

[370] CMS Law, *Offshore Transmission Network Review: further detail on enduring regime and multi-purpose interconnectors*, 28 October 2022 < https://www.cms-lawnow.com/ealerts/2021/10/offshore-transmission-network-review-further-detail-on-enduring-regime> accessed 14 March 2022.

5.2.1.3 Energy White Paper

The Energy White Paper of December 2020[371] is a policy document that provides more information regarding the completion of the abovementioned 'Ten Point Plan'. It focuses on ensuring that the North Sea becomes a net-zero basin by 2050.[372] Hence, the energy sector needs to reduce emissions associated with offshore oil and gas production.[373] Furthermore, additional coordination between the Offshore Petroleum Regulator for Environment and Decommissioning[374] and the North Sea Transition Authority is considered relevant.[375] The offshore safety competent authority[376] plays a pivotal role regarding (i) licence applications, (ii) operator applications, (iii) design or relocation notifications, (iv) safety case submissions, (v) well notifications and (vi) combined operations notifications.[377] The key features of the Energy White Paper relevant for our study are:

- "the target of 40 GW of installed offshore wind capacity by 2030 through 20 billions of private investments, and
- investing 1 billion in the UK's energy innovation programme to develop future renewable technologies such as green hydrogen, with the aim of 5 GW of low-carbon production capacity by 2030.[378]

As regards the latter, a Hydrogen Strategy was published In August 2021.[379] It presents how the UK will drive progress in the 2020s to deliver this 5GW production ambition by 2030 and positions hydrogen to help meet the net-zero commitments.[380] It takes a holistic approach on what needs to be done across the entire hydrogen system, ensuring to support the wider energy system as the UK drives to net zero.[381]

5.2.1.4 North Sea Transition Deal and the Offshore Transmission Network Review

The North Sea Transition Deal focuses on accelerating the energy transition by reducing greenhouse gas emissions[382] while simultaneously reducing the risk of high and volatile prices in the future in order to strengthen energy security.[383] It presents the joint government and sector's commitment to achieving a 50% reduction of emissions by 2030.[384] The declining levels of oil and gas production will play a role in reaching the required emissions reductions. [385] The North Sea Transition Deal thus particularly focuses on:

---

[371] HM Government, Energy White Paper, *Powering Our Net-Zero Future*, December 2020, p. 69.

[372] Ibid, p. 127

[373] Ibid, p. 138.

[374] This regulatory body is part of the Department for Business, Energy & Industrial Strategy.

[375] International Energy Agency, *Submissions and Decisions* 2021, 20 January 2022 <https://www.gov.uk/government/collections/eia-submissions-and-decisions-2021>.

[376] See section 5.2.2.2 below.

[377] Department for Business, Energy & Industrial Strategy, *The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 – A Guide*, July 2021.

[378] Mhairi Main Garcia, Dentons & Co, *International Comparative Legal Guide*. *Renewable Energy 2022*, Global Legal Group London.

[379] HM Government, UK Hydrogen Strategy (CP 475), August 2021.

[380] Ibid, p. 4.

[381] Ibid, p. 14; Department for Business, Energy & Industrial Strategy,

[382] OEUK, *North Sea Transition Deal*, <http://oeuk.org.uk/nstd/> accessed 24 October 2021.

[383] A. Haine, 'Britain's Net Zero Strategy Sets Out Roadmap to Clean Energy by 2035', NBusiness 19 October 2021 <https://www.thenationalnews.com/business/energy/2021/10/19/britains-net-zero-strategy-sets-out-roadmap-to-clean-energy-by-2035/> accessed 20 October 2021.

[384] Oil & Gas Authority, *Emissions Monitoring Report*, 14 October 2021 < https://www.ogauthority.co.uk/news-publications/publications/2021/emissions-monitoring-report/> accessed 14 March 2022. According to the (independent) Climate Change Committee the sector should aim at a further reduction of 68% emissions by 2030. Climate Change Committee, *2021 Progress Report to Parliament*, 24 June 2021 <https://www.theccc.org.uk/publication/2021-progress-report-to-parliament/> accessed 14 March 2022.

[385] Oil & Gas Authority, *Reserves and Resources Report*, September 2021 <https://www.ogauthority.co.uk/media/6407/oga-production-and-beis-demand-projections-february-2020.xlsx> table 4.

- "Supply decarbonization which aims to cut emissions through an emissions reduction programme.
- carbon capture and storage;
- offshore hydrogen to provide a realistic alternative for heating, heavy industry, and transport;
- supply chain transformation to develop expertise that underpins energy-sector wide export growth from the UK in order to create a globally competitive energy supply chain […]." 386

The Offshore Transmission Network Review led by the UK Department of Business, Energy & Industrial Strategy is relevant as it aims to deliver improvements in the way that offshore generation is connected to the onshore transmission network.[387] It specifically facilitates a more supportive approach for multi-purpose interconnectors.[388] Due to Brexit, uncertainty remains in relation to offshore cross-border hubs.

5.2.2 Legal Framework governing Offshore Energy Projects

Below we will discuss the most important laws governing the offshore sectors.[389] First, we will briefly discuss the Marine and Coastal Access Act 2009 as this act is relevant for all offshore activities. Then, we present the Petroleum Act 1998, which is the prime legal body for developing upstream hydrocarbon projects. Next, we will consider the Energy Act 2008 as it establishes a legislative framework for offshore CO_2 storage. Thereafter, we will examine the Electricity Act in so far as relevant for electricity generation and development of offshore wind farms. The Gas Act is not discussed but is relevant with regard to upstream pipelines as well as for the supply of hydrogen.[390]

5.2.2.1 Marine and Coastal Access Act 2009

The Marine and Coastal Access Act 2009[391] (for England) and the Marine Act 2010[392] (for Scotland) provide that certain activities carried out in and around the English and Scottish marine areas require a marine licence. In English waters, the Marine Management Organization is the responsible authority. In Scottish waters, the Marine Scotland Licensing Operations Team is a one-stop-shop for all marine licence applications.[393] For this study, and given the location of Hub West, only the former Act is of relevance.

A marine licence is required for the construction, alteration, or improvement of any works within the English or Scottish marine licensing area, in or under the sea, or on or under the seabed. This includes the laying of cables and the maintenance, alteration or improvement of existing structures and assets. This obligation, thus, directly applies to installations necessary for the exploration for and production of oil and gas, CO_2 storage and offshore wind turbines. It seems likely that such a licence will also be

---

386 Department for Business, Energy & Industrial Energy, *North Sea Transition Deal*, March 2021 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972520/north-sea-transition-deal_A_FINAL.pdf> accessed 14 March 2022, p. 6.

388 S. Goldberg & K. Rowe, 'Update on the Offshore Transmission Network Review' (26 May 2022) <https://hsfnotes.com/energy/2022/05/26/update-on-the-offshore-transmission-network-review/> accessed 14 July 2022.

389 UK law consists of three separate systems: England and Wales, Scotland, and Northern Ireland. This difference is less important when discussing developments in the NSA.

390 See section 48(1) of the Gas Act 1986.

391 Marine and Coastal Access Act 2009 (UK Public General Acts).

392 Marine (Scotland) Act 2010.

393 Scottish Government, *Marine Scotland Consenting and Licensing Guidance. For Offshore Wind, Wave and Tidal Energy Applications* <https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/govscot%3Adocument/Guidance%2BManual%2Bfor%2BOffshore%2BWind%252C%2BWave%2Band%2BTidal%2BEnergy%2BApplication.pdf> accessed 30 January 2022.

required for activities not governed by a sectoral law, i.e., an offshore installation to convert electricity into hydrogen.[394]

5.2.2.2 Petroleum Act 1998

The Petroleum Act 1998[395] governs exploration and production of petroleum, which is defined as “any mineral oil or relative hydrocarbon and natural gas existing in its natural condition in strata”.[396] All rights to the UK’s petroleum resources are reserved for the Crown, onshore as well offshore[397], and managed by the Crown Estate. The exploration for and production of petroleum as well as the construction and use of upstream gas pipelines requires a license. The NSTA has the power to grant licences that confer exclusive rights to search and bore for and get petroleum.[398] The licences confer such rights over a limited area and for a limited period of time.[399] As the Petroleum Act also has implemented the Hydrocarbons Licensing Directive, they key features of the licensing regime follows from the Directive although the UK has opted for (i) one exploration and production licence, (ii) the use of licensing rounds (presenting a standard Joint Operating Agreement) and (iii) no financial participation of the State. The UK government has regularly adapted the licensing regime to make it more attractive for investors.[400] In general, the UK strategy has been to encourage licensees to produce as long and as much as possible by using innovative techniques or transfer the license to a new licensee who is willing to continue production.[401] To facilitate such transfer and to provide the new licensee sufficient guarantee that decommissioning costs can be covered, use can be made of Decommissioning Relief Deeds.[402] As a result, installations may become disused at a later stage and decommissioning can be postponed.[403]

So far, around 10% of the UK part of the North Sea has entered in the decommissioning phase.[404] An additional 2.000 offshore projects will be decommissioned between 2021 and 2040.[405] In accordance with UNCLOS, disused offshore installations in the UK can either be removed entirely or partially; depending on whether they are located in the part of the CS with shallower or deeper waters.[406] If such case the Secretary of State (hereafter: SoS) may require the operator or any other party holding interest in the offshore installation to submit an abandonment programme, which needs to include an estimate of costs and the timing of the proposed measures. In case an installation will remain (partially) in place,

---

394 L.M. Andreasson & M.M. Roggenkamp, ‘Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore’, North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 70.

395 Petroleum Act 1998 (UK Public General Acts).

396 Petroleum Act 1998 (UK Public General Acts), Section 1.

397 See Continental Shelf Act 1964.

398 The Energy Act 2016 formally establish the OGA as a government company and provides the OGA with regulatory powers, including the ability to participate in meetings with operators. Oil & Gas Authority, *Legislative Context. Petroleum Act 1998* <https://www.ogauthority.co.uk/regulatory-framework/legislative-context/>.

399 Oil & Gas Authority, *Legislative Context. Petroleum Act 1998* <https://www.ogauthority.co.uk/regulatory-framework/legislative-context/>.

400 See for more details ‘Energy Law in the United Kingdom’ in: M.M. Roggenkamp et all (eds), Energy Law in Europe, 2016.

401 Oil & Gas Authority, *Notice. Section 9G of the Petroleum Act 1998* <https://www.ogauthority.co.uk/media/7039/oga-strategy-notice-february-2021.pdf>.

402 HM Treasury, ‘Decommissioning Relief Deeds: increasing tax certainty for oil and gas investment in the UK Continental Shelf’, 2012. In 2020 some 80 Deeds had already been concluded. See G. Gordon, J. Paterson, in EELR XIII, 2020, p. 323.

403 G. Gordon & J. Paterson, ‘Decommissioning of Offshore Installations upon the UK Continental Shelf’ in M.M. Roggenkamp & C. Banet (eds), *European Energy Law Report* (Volume XIII, Intersentia 2020) p. 324.

404 Shell, *Decommissioning in the UK* <https://www.shell.co.uk/sustainability/decommissioning/brent-field-decommissioning/decommissioning-in-the-uk.html> accessed 5 August 2022.

405 Energyst, ‘Decommissioning expected of 600+ offshore projects’ <https://www.energyst.com/news/decommissioning-forecast/> accessed 10 August 2022. In the UK decommissioning is expected to grow over the period of 2020-2025 due to decreasing production of natural gas and increasing alternate sources of energy. See Mordor Intelligence, ‘United Kingdom offshore oil and gas decommissioning market-growth (2022-2027) < https://www.mordorintelligence.com/industry-reports/united-kingdom-offshore-oil-and-gas-decommissioning-market> accessed 10 August 2022.

406 S. 29 (4)9c) Petroleum Act.

the plan needs to demonstrate maintenance procedures.[407] If the SoS approves the programme (either conditionally or unconditionally), it has to be executed.[408] Although this regime applies to hydrocarbon installations, the regime governing disused pipelines is quite similar. A notice to submit an abandonment programme can also be submitted to those holding a pipeline licence pursuant to section 14 Petroleum Act. In addition, pursuant to the Interim Pipeline Regime it is possible to postpone removal and/or leave a disused pipeline in place.[409]

Currently, the UK Petroleum Act considers the preservation or reuse of installations[410] and pipelines as the preferred option that needs to be taken into account when drafting the abandonment plan.[411] The NSTA is required to facilitate reuse and find reuse options like carbon dioxide and gas storage.[412] The UK has a clear policy striving for reuse based on a consultation on reuse options and strategies for offshore assets as conducted by the Department for Business, Energy and Industrial Strategy.[413]

5.2.2.3 Energy Act 2008

The UK Government expressed its interest in carbon capture and storage as a climate change instrument in 2006[414] but a supportive legal framework has only emerged because of the need to implement the Directive on geological storage of CO_2.[415] For this purpose, the Energy Act was amended in 2011. Although the legal framework for CO_2 storage applies onshore as well as offshore[416], the permanent storage of CO_2 will primarily take place offshore given the policy to reuse reservoirs and installations. Additionally, of relevance are the Environmental Damage Prevention and Remediation Regulation 2009[417], the CO_2 Storage Regulation[418] and the Greenhouse Gas Emissions Trading Scheme Regulations 2012.[419]

The main rule entails that it is prohibited to inject and store CO_2 in these areas without a licence.[420] Pursuant to the Energy Act 2008, the following activities require a licence: (i) exploring the area, (ii) converting the area to a storage site, (iii) using the area for CO_2 storage and (iv) establishing any installations to facilitate storage activities.[421] In addition, an environmental impact assessment is required.[422] A license pursuant to Section 18 Energy Act 2008 can be awarded by the NSTA[423] who also is entitled to issue further regulations for licensing and the license provisions.[424] The Storage of Carbon Dioxide

---

[407] Ibid.
[408] S. 36 Petroleum Act. S. 37 Petroleum Act provides for sanction in case of non-compliance,
[409] Department for Business, Energy, and Industrial Strategy, 'Guidance Notes Decommissioning of Offshore Oil and Gas Installations and Pipelines', 2018, p. 45.
[410] Including wells (S. 44(1)&(3) Petroleum Act).
[411] S. 29(2B)(a) Petroleum Act.
[412] Department for Business, Energy, and Industrial Strategy, 'Guidance Notes Decommissioning of Offshore Oil and Gas Installations and Pipelines', 2018, p. 23.
[413] HM Government, 'Clean Growth: The UK Carbon Capture Usage and Storage deployment pathway: An Action Plan', 2018, p. 28; Department for Business, Energy, and Industrial Strategy, 'Re-use of oil and gas assets for carbon capture usage and storage project', 2019.
[414] Nicolas Stern, 'The Economics of Climate Change: The Stern Review', 2006, p. 186.
[415] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC.
[416] Section 1 Energy Act 2008.
[417] Environmental Damage (Prevention and Remediation) Regulations 2009 (S.I. No. 153 of 2009).
[418] European Commission, *A Legal Framework for the Safe Geological Storage of Carbon Dioxide*.
[419] The Greenhouse Gas Emissions Trading Scheme Regulations 2012 (No 3038).
[420] Section 17 Energy Act 2008.
[421] J. Gazendam and M.M. Roggenkamp, 'Accelerating Low Carbon Industrial Growth through CCUS', May 2020, p. 14.
[422] This has been implemented in the Environmental Damage Prevention and Remediation Regulations 2009 (S. I. 2009/153).
[423] Or by any of the devolved authorities in Scotland, Wales, or Northern Ireland.
[424] Sections 19 and 20 Energy Act 2008.

Regulations 2010[425] provides for two different authorisations, namely (i) an exploration licence and (ii) a permit to inject and store CO_2 in the subsoil.[426] Applicants for an exploration licence need to state the period for which they need a licence and/or why exploration is not required.[427] As the EU Directive on geological storage, the UK regime provides for third party access. Such access is governed by the Storage of Carbon Dioxide (Access to Infrastructure) Regulations 2011.[428]

In addition to the requirement to have a storage permit, the Energy Act 2008 requires the operator to conclude a lease agreement with the Crown Estate.[429] This involves potentially three agreements, (i) an Agreement for Lease, (ii) a lease, and, if applicable (iii) a pipeline lease. An Agreement for Lease provides the holder with an exclusive option for a specific period of time to progress towards a full lease and to obtain a storage licence.[430] In order to deal with a possibility of climate damage resulting from any leakages, the operator is obligatory to hold a greenhouse gas emissions licence.[431] Other activities causing damage for which liability exists are listed in Section 15 of the CO_2 Storage Regulations.

Finally, the Energy Act 2008 includes rules on enforcement, non-compliance of the licence conditions and failures to comply with instructions by the competent authorities.[432] At the end of the injection phase, the operator must plan for the closure of the storage site (storage complex) and removal of the infrastructure. The regime for removal is similar to the regime discussed above with regard to disused petroleum installations.[433] After closure of the storage location, the licence holder remains responsible for monitoring the storage location for 20 years.[434] After this period has passed and sufficient evidence is gathered that CO_2 is contained within the storage location, a draft termination notice can be prepared.[435] When a termination notice is presented to the licensee is required to send all records, returns, plans, maps, samples, data and other information relating to the storage site, to the authorities.[436]

In addition, the UK government issued in September 2022 an Energy Security Bill, which amongst others aims at stimulating offshore CO_2 transport and storage.[437]

5.2.2.4 Electricity Act 1989

The Electricity Act 1989 governs generation, transmission, distribution, and supply of electricity as well as the operation of electricity interconnectors. These are all licensed activities unless an exemption has

---

[425] The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010. The Storage of Carbon Dioxide Regulations 2010 has been amended in 2019 as part of the EU (withdrawal) Act 2018 in order to omit EU terminology.

[426] Sections 2 – 8 CO_2 Storage Regulations.

[427] Section 3 CO_2 Storage Regulations. The period of an exploration license should be sufficient to assess the site and prepare for an application for a storage license.

[428] The Storage of Carbon Dioxide (Access to Infrastructure) Regulations 2011, No. 2305. In 2014 DECC published a guidance note on disputes over third party access to CO2 pipelines and storage sites.

[429] Section 18(3) Energy Act 2008.

[430] For an overview of the areas for which there are agreements with the Crown Estate see: <https://www.ogauthority.co.uk/media/2794/tce_leases_and_og_licences.pdf>.

[431] See Section 9 of The Greenhouse Gas Emissions Trading Scheme Regulations (S. I. 2012/3038).

[432] Section 20 – 28 Energy Act 2008.

[433] The Energy Act 2008 states the regime on decommissioning as laid down in the Petroleum Act 1998 also applies to CCS storage installations and that an abandonment plan has to be prepared (S. 30 Energy Act 2008).

[434] Section 7 Storage of Carbon Dioxide Regulations 2011.

[435] Section 8-9 Storage of Carbon Dioxide Regulations 2011.

[436] Section 13(1) Storage of Carbon Dioxide Regulations 2011.

[437] Department for Business, Energy & Industrial Strategy, 'Energy Security Bill', 6 September 2022, <https://www.gov.uk/government/publications/energy-security-bill-factsheets/energy-security-bill-overarching-factsheet%3E> accessed 29 September 2022.

been granted. This licensing regime has been extended to the UK's EEZ (and previously the Renewable Energy Zone).[438]

In order to develop offshore wind farms (including floating wind farms[439]), it will be necessary to have three different licences. In addition to a licence to generate and construct the generation station by the SoS,[440] it needs a license on the basis of the Marine and Coastal Access Act[441] and as currently offshore wind farms have a capacity of more than 100 MW also a licence on the basis of the Planning Act 2008 is required.[442] The latter is important as these wind farms then are considered as a nationally significant infrastructure project, which will enable an accelerated licencing process by the Department for Business, Energy & Industrial Strategy. The developer also needs a Development Consent Order by the Department for Business, Energy & Industrial Strategy on the basis of a recommendation by the Planning Inspectorate.[443] It enables this department to weigh the benefits of the project against its environmental impact.[444] Apart from these licences, a developer will need a lease agreement with the Crown Estate (see also section 5.2.2.2 above).[445] Such lease will not be awarded before all other relevant licences have been awarded. It is also the Crown Estate who identifies the development zones, which then are made available to interested developers via licensing rounds. Per round one or more zones are offered to interested parties based on competitive bidding (which was composed of four tender rounds). Based on such round, a developer will be granted the right to construct and operate an offshore wind farm. Such licence can be subject to several conditions and needs to take into account offshore navigation.[446] Similar to hydrocarbons installations, turbines may need to be removed if they are no longer in use. The same regime applies as the decommissioning regime presented above.[447]

Following the possibility provided for by the Renewable Energy Directive, renewable energy projects can receive financial support. Initially, the Electricity Act also provided for a financial support scheme requiring suppliers to purchase Renewable Obligation Certificates from eligible generators such as offshore wind farms.[448] This regime was replaced in 2017 by a scheme based on some sort of feed-in tariff: Contract for Difference. This is in fact a private law arrangement that pays the generators the difference between an estimated price (the 'strike' price) and the market price. Thus, the 'strike' price is a guaranteed price to be paid to wholesale generators of electricity. Based on this system the generator only receives support if the estimated price is below the market prices.[449]

The UK has introduced a specific regime to connect offshore wind farms to shore. In the UK, a third party is responsible for operating the park-to-shore cable (the so-called 'third party model'). This option utilizes third-party ownership and operation of the offshore electricity assets, which party is called the 'offshore

---

[438] Electricity Act 1989 c. 29.

[439] Catapult, *Floating Offshore Wind Development and Consenting Process – Risks and Opportunities*, 22 July 2021 <https://ore.catapult.org.uk/wp-content/uploads/2021/09/FOW-CoE-FOW-Development-and-Consenting-Process-Risks-and-Opportunities-Public-Summary.pdf> p. 20.

[440] Section 4 (1)(a) Electricity Act and section 36 Electricity Act.

[441] Sections 65 and 66 Marine and Coastal Access Act 2009.

[442] Sections 14 and 15 Planning Act.

[443] Section 42 Marine and Coastal Access Act 2009.

[444] H. Müller, 'The Coordinated Development of Offshore Energy Infrastructure: Legal Challenges and Possible Solutions' (Competition and Regulation in in Network Industries) 14(3) 2013, p. 299.

[445] Section 18(3) Energy Act 2008.

[446] Section 65 Marine and Coastal Access Act 2009.

[447] See sections 105-114 Energy Act; Marine and Coastal Access Act 2009, c.23.

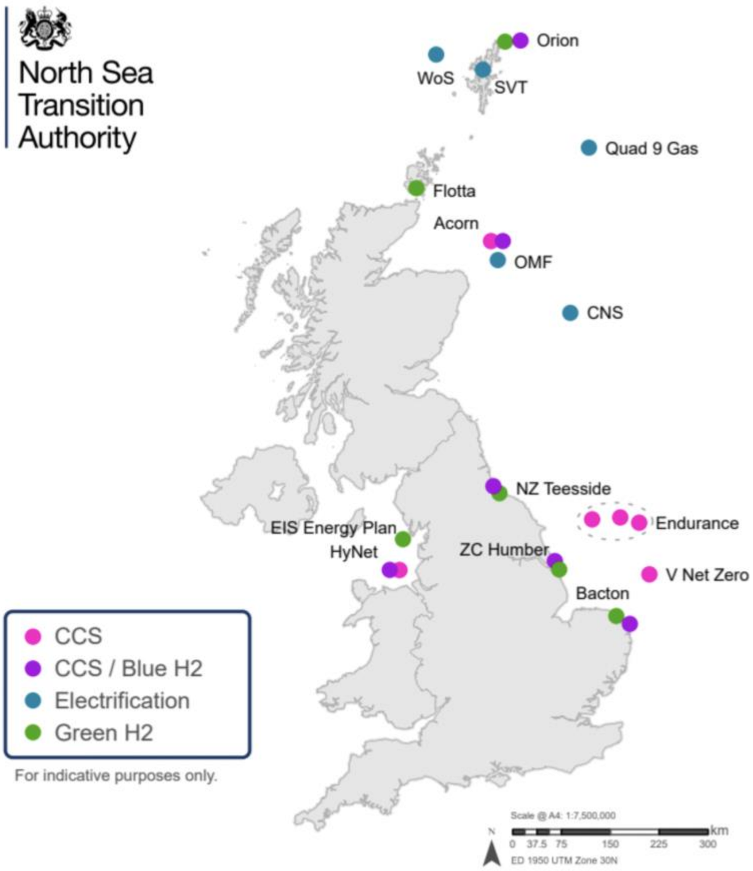
[448] Sections 32 and 32a Electricity Act. It was further developed in the Energy Act (section 32 ff).

[449] Section 2 Contract for Difference (Allocation) Regulations 2014; Energy Act 2013, c.32.

transmission owner' (OFTO).[450] Since the cable in general is considered as offshore transmission, it requires a licence.[451] The award of such a license involves a tendering procedure.[452] In practice, several types of OFTOs can be distinguished. The OFTO cable may be constructed by the wind farm developer and when the wind farm becomes operational afterwards be transferred to a third party (so-called 'generator build'), or a third party may construct the cable and operates it afterwards (so-called 'OFTO build'). Consequently, National Grid is the responsible authority to connect the cable to the onshore transmission grid, like they have the duty to connect all generators to the grid.[453] Moreover, in its role as transmission system operator it has the ultimate responsibility to coordinate and balance the entire British electricity system. It is, thus, required to interact with all OFTOs, *inter alia*, regarding outages as well as planned and unplanned maintenance work.[454]

5.2.3 Impact of Offshore Energy Law on developing Energy Hubs

The following sections will discuss the development of offshore energy hubs. The UK government presented the following overview of the potential locations of these hubs:



---

450 Electricity (Competitive Tenders for Offshore Transmission Licenses) Regulations 2015, no 1555 2015, section 3 and part 2.

451 Electricity Act 1989, Sec. 6C-6D.

452 H.K. Müller, A Legal Framework for a Transnational Offshore Grid in the North Seas, Intersentia, Antwerp 2016, pp. 182-183.

453 Müller (2016), p. 188. A 'Bilateral Connection Agreement' is required. In this document, it is described how the different codes (Grid Code, Connection Use of System Code and Balancing and Settlement Code) apply to the connection.

454 http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/System-Operator-Transmission-Owner- Code/. The STC Procedures set out the roles, responsibilities, obligations, and rights of each party in further detail. National Grid is the Code Administrator for the STC and maintains the Code.

Figure 4. Offshore energy hub developments in the UK.[455]

5.2.3.1 Platform Electrification

At the time of writing, offshore platform electrification has not yet taken place in the UK. However, this may change as the UK government has been studying the issue for some time. In August 2020 the (then) Oil and Gas Authority together with the Department for Business, Energy & Industrial Strategy, the Crown Estate and Ofgem published a report on platform electrification.[456] It shows that platform electrification could significantly reduce CO_2 emissions and would accelerate the growth of offshore wind energy sector but although existing platforms could potentially be supplied by offshore wind farms, electrification of new platforms is more attractive. The study presents several scenarios for the electrification of existing platforms varying from supplying several offshore platforms via one cable connecting the onshore grid and one hub platform, (ii) several platforms are supplied via an offshore hub with electricity from the UK and Norway, (iii) several platforms are supplied with power from a wind farm halfway between the hub platform and shore (approx. 80%) and via a cable from the UK shore (20%). The study also takes into account the wind farm expansion areas and concludes, *inter alia*, that the Southern North Sea is very suitable as current offshore wind part projects are close to oil and gas operations and the fourth licensing round for offshore wind (in the period 2021-2022). The NSTA added two other scenarios as it presents the option of offshore platforms being supplied by a dedicated wind farm without a connection to shore but with back up generation and battery storage (the 'offshore microgrid') and a standalone option consisting of one or more turbines providing electricity directly to a single platform (e.g., partial electrification with back-up power).[457]

Last but not least, it considers the regulatory framework and foresees that the electrification of platforms via an onshore cable will be subject to the existing petroleum regime (with a focus on the field development plan). The regulatory aspects of these cable connections, however, need special attention as these cables need a connection to the onshore grid (and thus involvement of TSO and DSO) and potentially could be subject to the OFTO regime, the unbundling regulations and the regulatory framework allowing for shared access. Platform electrification from offshore wind farms would fall under both the Petroleum Act 1998 and the Energy Act 2008 and would require a larger number of regulators. The study only addresses the cable connection in so far as it questions whether the OFOT regulation would apply would permit shared access.

Next, the NSTA launched a competition in 2021 (which was concluded in March 2022) as part of the North Sea Transition Deal in order to promote studies on platform electrification. The UK government allocated £1m to fund suitable studies / pilot projects. NSTA announced in June 2022 the three winning studies: (i) the Neos project, which provides for a direct or dedicated connection of Ørsted Hornsea offshore wind farm and an existing gas platform in the Southern North Sea, (ii) a project by Orcadian Energy and Partners studying the microgrid electrification concept (an off grid scenario with floating wind turbines), and (iii) a project by Kantoni Engineering studying the possibility to create an

---

[455] North Sea Transition Authority, Carbon Capture and Storage, <https://www.nstauthority.co.uk/the-move-to-net-zero/carbon-capture-and-storage/> accessed 20 September 2022.

[456] Oil & Gas Authority, 'UKCS Energy Integration', August 2020, <https://www.nstauthority.co.uk/media/6629/ukcs_energy_integration_annex-1-offshore-electrification-final-august-2020.pdf> accessed 29 September 2022

[457] https://www.nstauthority.co.uk/the-move-to-net-zero/platform-electrification/

offshore 'island' grid without a connection to the UK national grid (but relevant for platform electrification).[458]

Notably, these three studies do not take into account a connection to shore. In order to develop such projects it will be necessary to qualify the cable connections (being a direct or dedicated cable or a microgrid). Such qualification will, *inter alia*, depend on the technical design and the purpose of the cable. If it would be considered a transmission line, a transmission licence would be required.[459] However, in case of a direct or dedicated line or a microgrid, this may not be the case. In case of the Neos project it could be that the wind farm and the cable of it is a dedicated cable (standalone option)[460] or a direct line, it has to be treated as a direct line as long as it directly connects a generator (wind farm) with the offshore platform and provides the electricity directly to the platform (the off taker).[461] The option to create an offshore microgrid may be more challenging as require new regulatory insights.

5.2.3.2 Hydrogen

So far, there is no legal framework in place for developing an offshore hydrogen project and there are no references either to the conversion of wind energy to hydrogen at sea in any of the UK's marine spatial plans.[462] This may need to change as in May 2022, the UK government decided to fund the development of a hydrogen-producing offshore wind turbine, which means that the electrolyser will be sited directly onto an existing operational wind turbine.[463] The project will test the full integration of a hydrogen producing electrolyser with an offshore wind turbine.[464] The hydrogen produced will be piped to shore at the Port of Aberdeen.

Offshore hydrogen conversion poses some interesting legal questions, especially in case of a combined offshore wind/hydrogen installation. A licence is required to establish and operate one or more offshore wind turbines / wind farm (see section 5.2.2.1 above). However, can an electrolyser be considered part of the wind turbine and, thus, be part of the generation license or is another license required? A combined licence will be preferable but does not yet exist. The situation with regard to the transport of hydrogen to shore may be more straightforward as this activity is subject to the Gas Act 1986.[465] The definition of gas in the Gas Act 1986 also includes hydrogen.[466] According to the Gas Act anyone engaging in gas supply, gas shipping or gas transportation or who participates in the operation of gas interconnectors

---

[458] Ørsted, Goal7 and Neptune Energy, 'Electrification of offshore oil and gas assets using renewable offshore wind energy', <http://www.the-tlb.com/pdf/Orsted%20Neptune%20Goal7%20-%20Project%20Neos%20Public%20Report.pdf> accessed 29 September 2022.

[459] UK Public General Acts, Energy Act 2013 c.32., section 147; G. Gordon, A. McHarg & J. Paterson, 'Energy Law in the United Kingdom' in M.M. Roggenkamp et al (eds), *Energy Law in Europe* (Oxford University Press 2016), p. 1101.

[460] If this cable is not qualified as a direct line, it could be considered part of the installation and as such follow under Petroleum Act 1998.

[461] G. Gordon, A. McHarg & J. Paterson, 'Energy Law in the United Kingdom' in M.M. Roggenkamp et al, *Energy Law in Europe* (Oxford University Press 2016), p. 1011.

[462] European MSP Platform, *Maritime Spatial Planning Country Information'*, October 2018 <https://maritime-spatial-planning.ec.europa.eu/sites/default/files/download/uk_11.10.2018.pdf> accessed 30 January 2022; L.M. Andreasson, 'The regulatory framework for green hydrogen developments in the North Sea' in M.M. Roggenkamp & C. Banet (eds), *European Energy Law Report* (Volume XIV), p. 305.

[463] Vattenfall, *World's first hydrogen-producing offshore wind turbine gets 9.3 million pounds funding boost*, May 2022, <https://group.vattenfall.com/uk/newsroom/pressreleases/2022/aberdeen-hydrogen> accessed 5 August 2022.

[464] Government UK, *Low Carbon Hydrogen Supply 2 Competition*, 24 May 2021, <https://www.gov.uk/government/publications/low-carbon-hydrogen-supply-2-competition> accessed 12 September 2022; L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 80.

[465] Hydrogen is not considered to be 'petroleum' (see section 1(a) of the Petroleum Act 1998).

[466] Section 48 para 1 Gas Act 1986.

must have a licence.[467] If the hydrogen cannot be transported via an existing pipeline, the question remains how to qualify a pipeline bringing offshore hydrogen to shore. Could this be qualified as an upstream gas pipeline, i.e., as a pipeline operated or constructed as part of a gas production project [...] to a processing plant, a terminal or a final landing terminal, or is it a transportation pipeline or something else?[468] It is anyway a licensed activity.

5.2.3.3 CO_2 Transport and Storage

By contrast to the above hub functions, a facilitating regulatory regime is in place for carbon dioxide transport and storage. The UK Government expressed already a decade ago that it had high expectations for carbon capture and storage as this would allow for a smooth energy transition by facilitating the use of fossil fuels while at the same time drastically reducing CO_2 emissions.[469] Nevertheless, it has proved difficult to realise CO_2 storage projects. The reason is financial (and relating to public acceptance) rather than legal.

The first serious attempt failed as funds that had been allocated by the UK Government to develop a CO_2 storage (pilot) project has been withdrawn for budgetary reasons and, subsequently, the Peterhead CCS Project was terminated.[470] This project involved CO_2 storage in the depleted Goldeneye Gas Field and the reuse of infrastructure used for the production from 1996 to 2011.[471] However, in 2019 Pale Blue Dot Energy received a CO_2 storage licence. This project - the Acorn Project[472] - is expected to be in operation by 2024[473] and will store CO_2 in the Captain Sandstone saline aquifer, the formation that also contains the Goldeneye Field. Acorn plans the reuse of three pipeline systems (namely, Goldeneye, Atlantic and Miller Gas), which currently are subject to the interim pipeline regime as they are no longer in use, pending decommissioning.[474] Reuse of existing pipelines in this case would reduce the cost to a third of the amount that it would cost to construct a new pipeline.[475]

A more recent example of an offshore CO_2 storage project is the Net Zero Teesside Project just outside the coast of Teesside and Humber.[476] The project is intended to capture up to ten million tonnes (Mt) of CO_2 emissions a year. It involves the construction of an 840 MW gas-fired power station that will be equipped with carbon capture technology and also provide for a CO_2 gathering network to enable low-carbon hydrogen production and power generation in the Teesside area. Net Zero Teesside is being developed as part of the UK's East Coast Cluster CCUS infrastructure development project, which will be responsible to transport CO_2 and permanently store it in a geological aquifer located in the Southern North Sea.[477]

---

[467] CMS, *Hydrogen Law, Regulations and Strategy in the United Kingdom*, 24 November 2021, <https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/united-kingdom> accessed 5 September 2022; R. Peters, 'Blue Hydrogen paves the way for green hydrogen' (*TNO*) <https://www.tno.nl/en/focus-areas/energy-transition/roadmaps/towards-co2-neutral-industry/hydrogen-for-a-sustainable-energy-supply/blue-hydrogen-paves-the-way-for-green-hydrogen/> accessed 14 July 2022.

[468] Pipelines transporting offshore produced natural gas to the onshore transmission network have been permitted under the Petroleum Act 1998 (section 14).

[469] DECC, 'CCS Roadmap: Supporting Development of Carbon Capture and Storage in the UK', 2012, p. 4.

[470] Peterhead CCS Project < https://www.power-technology.com/projects/peterhead-carbon-capture-and-storage-ccs-project-scotland/>.

[471] IEA Greenhouse Gas R&D Programme, 'Reuse of Oil & Gas facilities for CO_2 transport and storage' 2018, p. 75.

[472] The CCS component of the Acorn project is expected to be operational in 2024. https://pale-blu.com/acorn/.

[473] Carbon dioxide appraisal and storage licence - CS003 (Pale Blue Dot Energy (Acorn) Ltd), 16 January 2019.

[474] Acorn, 'Project: ACT Acorn Feasibility Study', 2019, p. 25.

[475] Acorn, 'Infrastructure Re-use', 2018, p. 19.

[476] Net Zero Teesside, < https://www.netzeroteesside.co.uk/northern-endurance-partnership/> accessed 22 September 2022.

[477] NS Energy Business, *Net Zero Teesside Project*, <https://www.nsenergybusiness.com/projects/net-zero-teesside-project/> accessed 25 September 2022. Other CCS projects which take place on the UKCS are the Northern Endurance Partnership and Harbour Energy.

In 2022 the UK government changed its approach. Instead of relying on parties applying for storage licences (via an open door procedure), the NSTA launched on 14 June 2022 the UK's first carbon dioxide /storage licensing round, which closed on 13 September 2022.[478] The exclusive rights will be granted based on the applicant's technical and financial capacity as well as on other requirements as provided by the Offshore Petroleum Licensing Regulations 2015, such as tax considerations and other criteria (see section 5.2.2.2 above).[479] The tender presented 13 new areas off the coasts of Aberdeen, Teesside, Liverpool, and Lincolnshire in the Southern North Sea, Northern North Sea, Central North Sea and East Irish Sea. The areas comprise a mix of saline aquifers and depleted oil and gas fields.[480]

5.2.4 Interim Conclusions

UK policy focuses on energy transitions to combat climate change. As other North Sea states, the goal is to become net zero in 2050. The declining volumes of offshore oil and gas production will play a part in reaching that goal. However, for security of supply reasons the aim is also to prolonging production as much as possible but at the same time promoting electricity from renewables (e.g., wind) offshore and storing CO_2 in offshore geological formations. This can be facilitated by promoting reuse of installations. Reuse applies to all installations: oil and gas production facilities and wind turbines but also cables and pipelines.

The analysis of the three identified hub functions also shows that developing offshore CO_2 storage is the most straightforward option, mainly because a legal framework is in place. The two other hub functions are more challenging as a legal framework is lacking but also because any facilitative legal framework will require some sort of system integration. However, we note that serious attempts have been made to develop platform electrification and offshore hydrogen conversion and that the government is aware of regulatory and legal challenges, but solutions have not yet been provided.

Given the location of Hub West, platform electrification and offshore hydrogen production are of special importance for this study. The legal challenges relating to these hub functions are to a large extent similar in the Netherlands and the UK. However, they will become even more challenging in case of cross-border hub developments such as the earlier mentioned Windconnector (see section 5.1.4.4 above). In this case the influence of Brexit may be notable. By contrast to the national developments and hub functions where the influence of Brexit seems to be limited, cross-border hubs (like Hub West) will be impacted as they need to rely on the TCA. Moreover, currently most national energy laws are still based on the principles of EU energy law as they are the result of implementing EU directives. This will change as new national laws will emerge replacing existing laws based on EU law, and more importantly, new EU laws do not have to be implemented in UK law and the UK may also decide to take a different approach.

5.3 Denmark

The developments in Denmark are relevant with regard to Hub East, although maybe more indirectly as the Netherlands has no border with Denmark. Since the delimitation of the NSA, Denmark was able to

---

478 North Sea Transition Authority, *Carbon Capture and Storage*, <https://www.nstauthority.co.uk/the-move-to-net-zero/carbon-capture-and-storage/> accessed 20 September 2022.

479 The Offshore Petroleum (Offshore Safety Directive) Regulations 2015, No. 385.

480 Offshore Technology, 'UK secures bids from 19 firms in carbon storage licensing round' 22 September 2022 <https://www.offshore-technology.com/news/uk-bids-firms-carbon-licensing/> accessed 28 September 2022. The NSTA has received 26 bids. The storage permit granted will, pursuant to Article 25 of the Directive on Geological Storage be registered.

exercise its sovereign rights on the Danish CS.[481] It has invested in the exploration for and production of oil and gas on its CS since 1972 and has been a net exporter of oil and gas from 1997 until 2018.[482] In 2018, Denmark became a net oil importer due to output declines in the North Sea.[483] More than half of Denmark's current oil output is produced from the Halfdan and Dan fields which have been in decline since 2005 and 2001 respectively.[484] Currently, approximately 90 oil and gas fields are exploited offshore by some 60 installations.[485] Decommissioning of disused installations has not yet started but is expected to commence in the near future, most likely in combination with reuse options in order to develop CO_2 storage on the Danish CS.[486] The development of CO_2 storage offshore has been slower in Denmark than in the other oil and gas producing North Sea states but is now gaining serious interest as the first tender of CO_2 licenses is open for applications as of August 2022.[487] The decision to terminate oil and gas production by 2050 will inevitably enhance the need to decommission remaining installations.[488]

In addition, several pipelines have been installed on the Danish CS.[489] The offshore pipeline system consists of some 1.700 kilometres of pipelines of which considerable parts are transit pipelines crossing the Danish CS. Apart from this, there is one offshore oil pipeline to the Danish shore and two offshore gas pipelines that are operated by the gas TSO Energinet (previously DONG) as the gas transmission pipelines system extends to the CS. In addition, there are two cross-border connections: (i) the Fyra-gasfield that is connected to the NOGAT pipeline system in the Netherlands and the Ravn-oil field that is connected to a processing platform in field A6-A in German waters.[490]

Furthermore, Denmark is known to be an early explorer of offshore wind energy. As of April 2022, 630 offshore turbines have been exploited with a total installed capacity of 2.3056 GW.[491] These wind

---

[481] Denmark declared that it had sovereignty regarding the continental shelf by a Royal Decree of 7 June 1963. See Royal Decree of 7 June 1963 concerning the exercise of Danish sovereignty over the Continental Shelf, at http://www.un.org/depts/los/LEGISLATIONANDTREATIES/ PDFFILES/DNK_1963_Decree.pdf; accessed 10 August 2022.

[482] Danish Energy Agency, 'About oil and gas' <https://ens.dk/en/our-responsibilities/oil-gas/about-oil-and-gas> accessed 10 August 2022; R. Perkins & J. Dart, 'Denmark to end all North Sea oil, gas production by 2050, bans new exploration', *S&P Global*, 4 December 2020, <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/120420-denmark-to-end-all-north-sea-oil-gas-production-by-2050-bans-new-exploration> accessed 8 September 2022.

[483] Ibid.

[484] Ibid.

[485] Unknown, 'Oil and gas in Denmark', (*Nordsofonden* 2021) <https://eng.nordsoefonden.dk/about/oil-and-gas-in-denmark/> accessed 6 July 2022; Greenpeace International, 'Denmark cancels new oil and gas permits and sets date to end existing production' (Greenpeace International 4 December 2020) <https://www.greenpeace.org/international/press-release/45831/denmark-cancels-new-oil-and-gas-permits-and-sets-date-to-end-existing-production/> accessed 5 August 2022.

[486] Dansk Dekommisionering <https://www.dekom.dk/en/saadan-dekommissionerer-vi/> accessed 9 September 2022. Udvalget Vedrørende Udarbejdelse Af en Olie- og Gasstrategi, 'Fremtidens olie- og gassektor I Danmark' <https://ens.dk/sites/ens.dk/files/OlieGas/nordsoestrategi.pdf>, accessed 12 September 2022, p. 12.

[487] N. Kulovic, 'Denmark uncovers emission reduction potential of North Sea electrification', *Offshore Energy*, 4 April 2022 <https://www.offshore-energy.biz/denmark-uncovers-emission-reduction-potential-of-north-sea-electrification/> accessed 9 September 2022; Danish Energy Agency, ‚The Danish Energy Agency publishes an English version of the tender material for tender of licenses for investigation and CO_2 storage' <https://ens.dk/en/press/danish-energy-agency-publishes-english-version-tender-material-tender-licenses-investigation> accessed 9 September 2022.

[488] B. Lepic, 'Denmark to end oil and gas era by 2050', *Offshore Energy*, 4 December 2020 < https://www.offshore-energy.biz/denmark-to-end-oil-and-gas-era-by-2050/> accessed 9 September 2022.

[489] Energistyrelsen, 'Om olie og gas' < https://ens.dk/ansvarsomraader/olie-gasproduktion/om-olie-og-gas> accessed 12 September 2022.

[490] IEA, 'Denmark: Key energy statistics', 2020; Danish Energy Agency, *Denmark's Energy and Climate Outlook. Baseline Scenario Projection Towards 2030 With Existing Measures (Frozen Policy)*, 2019; Boskalis, 'Wintershall Ravn and A6-A' <https://boskalis.com/about-us/projects/detail/wintershall-ravn-and-a6-a.html> accessed 9 September 2022.

[491] Statistics on wind turbines in Denmark <https://turbines.dk/statistics/> accessed 7 September 2022.

turbines are clustered in 15 wind farms.[492] The early start is mainly due to the fact that the first wind farms were developed in the territorial waters. Denmark declared an EEZ in 1996.[493] The offshore wind farms to be developed in the coming years are mainly situated in the EEZ as public opposition towards wind turbines close to shore is increasing given the significant aesthetic impact offshore wind turbines can have on the coastal landscape.[494]

Finally, it is worth noting that Denmark is at the forefront of developing an artificial energy island in the North Sea which will serve as a hub for offshore wind farms supplying 3 GW of energy.[495] Electrolysers will also be developed on the island for hydrogen conversion.[496] In addition, Bornholm, an island in the Baltic Sea, will serve as a hub for offshore wind farms off the coast supplying 2 GW of energy.[497] The Baltic Sea also accommodates the offshore windfarm Kriegers Flak, which is operating as a hub with connections to Denmark and Germany.[498]

5.3.1 Policy Developments

For many decades Danish energy policy has been based on political agreements, which remained in place despite changing governments. Written political agreements issued by Danish parliament[499] are legally non-binding tools outside the normal legislative process[500] but commit parties to support the legislation which is required to actually implement it. Over the last 40 years, the political agreements regarding the energy sector, considered amongst other which fuel sources should be used to produce electricity, giving green energy priority.[501] The latest political agreement dates from 22 March 2012 and, *inter alia*, implies that heating consumption should also gradually be converted to renewables. In general, these political agreements are concluded between the Government and the majority of parties of the Danish Parliament and differ considerably from the agreements in contract law.[502] They may be characterized as non-legal in the sense that no legal sanctions exist for the purpose of enforcement. In practice, however, these political agreements are respected and fulfilled. Agreements are rather new means of public control, which at the same time raise unresolved problems for the parties involved, including the lack of legal enforcement.[503]

---

[492] Energistyrelsen, 'Etablerede havvindmolleparker i Danmark', < https://ens.dk/ansvarsomraader/vindenergi/havvindmoeller-og-projekter-i-pipeline > accessed 12 September 2022; Unknown, 'Oil and gas in Denmark', (*Nordsofonden* 2021) <https://eng.nordsoefonden.dk/about/oil-and-gas-in-denmark/> accessed 6 July 2022; Greenpeace International, 'Denmark cancels new oil and gas permits and sets date to end existing production' (Greenpeace International 4 December 2020) <https://www.greenpeace.org/international/press-release/45831/denmark-cancels-new-oil-and-gas-permits-and-sets-date-to-end-existing-production/> accessed 5 August 2022.

[493] Executive Order No. 584 of 24 June 1996 concerning Denmark's Exclusive Economic Zone.

[494] A. Durakovic, 'Denmark Rolls Out 18 GW Offshore Wind Map', 5 June 2020 < https://www.offshorewind.biz/2020/06/05/denmark-rolls-out-18-gw-offshore-wind-map/> accessed 25 January 2022.

[495] Climate agreement for energy and industry etc. 2020, p. 3.

[496] S. Verland, *Dansk Energi*, *Fra omskærer til energier*, 9 March 2022, p. 10.

[497] Climate agreement for energy and industry etc. 2020, p. 3.

[498] Kriegers Flak, <https://powerplants.vattenfall.com/kriegers-flak/> accessed 20 September 2022; C.T. Nieuwenhout, 'Regulating Offshore Electricity Infrastructure in the North Sea – Towards a New Legal Framework', PhD, 2020, 83.

[499] OECD, *The Danish Energy Agreements Towards a Carbon-Neutral Society* (International Programme for Action on Climate, 2021.

[500] Energi-, Forsynings- og Klimaministeriet, *Greener Heating* (Energy Agreement 2018), p. 6.

[501] A. Ronne, 'Heat Supply in Denmark: any lessons to be learned?' in M.M. Roggenkamp & C. Banet (eds), *European Energy Law Report* (Intersentia 2017), p. 242.

[502] C.G. Brett, 'Regulation of infrastructure decommissioning in the Danish offshore oil and gas sector' in M.M. Roggenkamp & C. Banet, *European Energy Law Report XIII* (Cambridge, 2020), p. 329.

[503] Ibid, p. 344.

Denmark has set as a binding goal in its NECP to reduce GHG emissions by 70% by 2030 (relative to 1990) and to reach net zero emissions by 2050.[504] Wind energy (offshore as well as onshore) play an important role in meeting this goal. The Climate Act of 2020 provides a legal basis for these targets and was amended in 2021 to set a new emission reduction target of 50-54% for the year 2025.[505] As part of achieving these goals, it is relevant that Danish Parliament decided to cancel future oil and gas licensing rounds and terminate oil and gas production by 2050.[506] At the same time, the production and use of renewable is expected to increase.[507] The draft NECP aimed, for example, a 55% share of renewables in gross final energy consumption in 2030, which is significantly above the 46% share recommended by the Commission.[508] The final NCEP includes a new national target of 70% by 2030 (being one of the world's most ambitious targets). Additionally, the International Energy Agency says that, in 2021, the EU imported 155 billion cubic meters of gas from Russia, representing 45% of its gas imports.[509]

5.3.1.1 The Energy Agreement towards a Carbon Neutral Society

Of importance for achieving the Danish energy and climate goals is the 2012 Energy Agreement, which sets the policy framework for the period 2012-2020[510] and was extended by the 2018 Energy Agreement for the period 2020-2024.[511] The 2018 Agreement was adopted by the Danish Ministry of Climate, Energy and Utilities and takes into account the recommendations given in 2017 by an independent energy commission.[512] Whichever instrument chosen to achieve the goals, it has to be cost-effective. The 2018 agreement identifies ten priorities for which around €560 million is allocated from the state budget for 2020-2024.[513] The following priorities are relevant for this study:

- World class offshore wind
- Renewable energy on market conditions
- Strengthened energy and climate research
- Denmark leading the way in exports of green energy solutions
- A smart and flexible energy system
- Reserve for additional investments in renewable energy from 2025 onwards."[514]

In order to implement these priorities, the agreement is supplemented with several programs and strategies, albeit no strategy relating to energy projects offshore. Nevertheless, the Danish Energy

---

[504] OECD, *The Danish Energy Agreements Towards a Carbon-Neutral Society* (International Programme for Action on Climate, 2021; Danish Energy Agency, 'EU Energy Union – Denmark's National Energy and Climate Plan' < https://ens.dk/en/our-responsibilities/energy-climate-politics/eu-energy-union-denmarks-national-energy-and-climate> accessed 9 September 2022.

[505] Climate Act, <https://climate-laws.org/geographies/denmark/laws/the-climate-act> accessed 10 August 2022. The Act also sets a series of reporting obligations on the government, including an annual parliamentary examination of the government's action towards meeting the targets. The Act was amended in 2021.

[506] B. Lepic, 'Denmark to end oil and gas era by 2050', *Offshore Energy* <https://www.offshore-energy.biz/denmark-to-end-oil-and-gas-era-by-2050/> accessed 4 December 2020.

[507] North Sea Agreement, <https://www.euractiv.com/section/energy/news/germany-denmark-netherlands-and-belgium-sign-e135-billion-offshore-wind-pact/> accessed 20 September 2022.

[508] See NECP and formula in Annex II of the Governance Regulation.

[509] The Local Denmark, 'Denmark announces major plan to replace gas heating in homes' *19 April 2022* <https://www.thelocal.dk/20220419/denmark-announces-major-plan-to-replace-gas-heating-in-homes/> accessed 9 September 2022.

[510] Energi-, Forsynings- og Klimaministeriet, *Greener Heating* (Energy Agreement 2018), p. 6.

[511] Energi-, Forsynings- og Klimaministeriet, *Greener Heating* (Energy Agreement 2018), p. 5.

[512] European Commission, Council Recommendation on the 2017 National Reform Programme of Denmark and delivering a Council opinion on the 2017 Convergence Programme of Denmark, p. 4.

[513] OECD, *The Danish Energy Agreements Towards a Carbon-Neutral Society* (International Programme for Action on Climate), 2021, p.2.

[514] Energi-, Forsynings- og Klimaministeriet, Energy Agreement of 29 June 2018, p. 3.

Agreement lacks any reference to offshore system integration or decommissioning or reuse of offshore installations.

5.3.1.2 Climate Agreement

Two years later, on 22 June 2020, the Danish Parliament presented the Climate Agreement for Energy and Industry.[515] This agreement has a strong focus on the development of offshore wind energy. The aim is to develop a total of 6 GW wind at sea (both offshore and nearshore) by 2030, which is more than three times Denmark's capacity in 2020. Of special importance is that half of this capacity (3 GW)[516] will be developed on the artificial island to be constructed in the Danish EEZ (see section 5.3 above). By doing so, Denmark becomes the first North Sea state to develop and construct an artificial energy island in the NSA. The Agreement also includes a tender to support the development of large-scale power-to-X plants with a total capacity of 100 MW.[517] Finally, the agreement also emphasises the importance of a proper regulatory framework for energy system operators, like Energinet, to facilitate the increasing electrification. For this purpose, the Government presented an additional electrification strategy in 2021.[518]

5.3.1.3 North Sea Agreement

On 3 December 2020 political parties entered into an agreement about the future of oil and gas developments on the Danish part of the CS.[519] This Agreement presents eight action points relating to oil and gas developments offshore with the view to meet the goals of the Paris Agreement and Danish Climate Act. According to this Agreement the production of oil and gas on the Danish CS will cease by 31 December 2050. Consequently, the 8th (and future) licensing will be called off and a legal basis will be created to compensate those licensees holding permits that are valid after 2050.[520] These unlicensed areas can be used for other purposes such as offshore wind energy developments. In addition, they agreed to invest in developing offshore CO_2 storage by making use of depleted reservoirs on the Danish CS and financially support some pilot projects with the aim of ensuring storage of carbon dioxide offshore as of 2025. At the same time, the Agreement calls upon parties to examine the possibilities for electrification of offshore oil and gas installations in order to reduce CO_2 emissions.[521] In order to compensate onshore areas affected by these developments (e.g., employment around Esbjerg) and stimulate the proposed measures, the Agreement provides for a permanent means of finances of 90 million Danish Kroner per year.

5.3.2 Legal Framework governing Offshore Energy Projects

Marine activities in Denmark are regulated by, *inter alia*, the Subsoil Act (*Untergrondsloven*)[522], the Act governing Energinet (*Lov om Energinet*)[523], the Electricity Supply Act (*Elforsyningsloven*)[524], the Act on

[515] Danish Climate Agreement for Energy and Industry 2020 – Overview (22 June 2020) < https://kefm.dk/Media/C/B/faktaark-klimaaftale%20(English%20august%2014).pdf> accessed 5 August 2022. In parallel it also presented the Climate Agreement for Waste Management.

[516] These volumes can potentially be increased to 10 GW. European Council, 'Paris Agreement on climate change' <https://www.consilium.europa.eu/en/policies/climate-change/paris-agreement/> accessed 5 August 2022.

[517] Danish Climate Agreement for Energy and Industry of 22 June 2020, <https://kefm.dk/Media/C/B/faktaark-klimaaftale%20(English%20august%2014).pdf> accessed 29 September 2022.

[518] Energinet, 'Strategi NYEVINDE', 2021.

[519] Aftale mellem regeringen (Socialdemokratiet), Venstre, Dansk Folkeparti, Radikale Venstre, Socialistisk Folkeparti og Det Konservative Folkeparti om fremtiden for olie- og gasudvinding I Nordsøen af 3 December 2020.

[520] Lov nr 2389 of 14 December 2021 om ændring af lov om anvendelse af Danmarks undergrund entered into force on 1 January 2022.

[521] The estimate is that some 0,6 million CO2 emissions reduction can be achieved.

[522] Subsoil Act (Undergrundsloven) no. 960 of 13 September 2011.

[523] Act governing Energinet (Lov om Energinet), no. 224 of 2009.

[524] Electricity Supply Act (Elforsyningsloven) no. 840 of 15 August 2019.

Promoting Renewable Energy (*Lov om fremme af vedvarende energi*)[525] and the Act on the Design and Construction of an Energy Island in the North Sea Act (*Lov om projektering og anlæg af en energiø i Nordsøen*).[526] Therefore, these laws will be discussed below.

5.3.2.1 Subsoil Act

Exploration for and production of oil and gas

The Subsoil Act (Undergrondsloven) of 1932 governs the exploration for and the production of subsoil natural resources. Important amendments to the Act follow from the 1971 Continental Shelf Act extending the scope of the Subsoil Act to the Danish CS and the Hydrocarbons Licensing Directive harmonizing the licensing regime.[527] The Subsoil Act states that oil and natural gas belong to the state and that exploration and production activities are depending on an exclusive license granted by the Minister of Climate, Energy and Utilities.[528] The Minister awards one single license for exploration and production (although the latter depends on a discovery being made).[529] These licenses are awarded for a specific period of time and area (either a block or a part of a block). The state is usually participating in exploration and production. The type of state participation has changed due to market liberalization. Instead of involving a state-owned company (e.g., DONG), the regime changed in 2005 and a new Act required that the Nordsøfonden (the Danish North Sea Fund) would take a 20% interest in new hydrocarbon licences.[530] The independent State-owned company — Nordsøenheden (the Danish North Sea Partner) - is administering the Fund.[531] Licenses are awarded in rounds and for each round the Danish Energy Agency[532] will present the specific terms and conditions in the form of a 'Model Licence for Exploration for and Production of Hydrocarbons' (hereinafter ML), which is attached to a general Invitation Letter to the public, outlining the main criteria for obtaining a license. Each licensing round has had a separate ML and Invitation Letter, reflecting different external conditions for the round, e.g., low oil prices, increased competition for international investments in oil and gas exploration activities, or the fact that it is known that the blocks may contain parts of discoveries already made. By law of 14 December 2021 the Danish government decided to terminate oil and gas activities offshore and this means that the planned 8th licensing round (and those thereafter) will not take place (see also section 5.3.1.3 above).[533]

Oil and gas are mainly transported via pipelines to shore. Today, there is one oil pipeline which is governed by the Danish Pipeline Act (Rørledningsloven).[534] Gas is transported via the (onshore) pipeline

---

[525] Act on the promotion of renewable energy (Lov om fremme af vedvarende energi) no. 1392 of 2008.

[526] Act on the Design and Construction of an Energy Island in the North Sea (*Lov om projektering og anlæg af en energiø i Nordsøen*) no. 2379 of 14 December 2021.

[527] The Subsoil Act (Undergrundsloven) no. 1533 of 16 December 2019.

[528] Section 2 of the Subsoil Act; see further Chapter 3 of the Subsoil Act.

[529] In addition to this license, the Act facilitates the award of a preliminary investigation licence.

[530] Act No 587 of 24 June 2005 and Order No 710 of 21 June 2007 and <http://www.nordsoefonden.dk>. As of July 2012, the State participant Nordsøfonden is also acting as a non-operating partner with a 20 per cent interest of the major actor in oil and gas. exploitation Dansk Undergrunds Consortium (DUC).

[531] C.G. Brett, 'Regulation of infrastructure decommissioning in the Danish offshore oil and gas sector' in M.M. Roggenkamp & C. Banet, *European Energy Law Report XIII* (Cambridge, 2020), p.339.

[532] The Danish Energy Agency is the Danish Energy Regulator. It often operates jointly or on behalf of the Minister of Energy, Climate and Utilities

[533] Lov nr 2389 of 14 December 2021 om ændring af lov om anvendelse af Danmarks undergrund entered into force on 1 January 2022.

[534] Orsted, 'Danish Oil Pipe' <https://orsted.com/en/our-business/customer-solutions/intelligent-supply-and-distribution/danish-oil-pipe>.

system of Energinet, which was established in 2004 by a separate Act.[535] Energinet is also responsible for two offshore gas pipelines situated in the territorial sea and on the CS. The licensees are still responsible for connecting their production installations to these two pipelines and operating the upstream gas pipelines. The Minister of Energy, Utilities and Climate is entitled to draft further rules regarding access to these pipelines and dispute resolutions.[536]

The Subsoil Act also takes into account the final phase of oil and gas production: the decommissioning phase. Its initial aim was to ensure the Danish state's right to take over any facilities in case a license was terminated. According to section 33 of the Subsoil Act a license must provide detailed provisions on the actions to be taken in respect of installations established by the licensee when the license expires. In accordance with section 37 of the license, the Danish state is entitled to take over all or part of any facility, equipment, or installations if a license terminates due to its expiry, relinquishment, lapsing or revocation. If the state does not wish to take over an offshore installation (or any part of it), the Danish Energy Agency may require the licensee to remove these facilities. In line with UNCLOS and the IMO Guidelines and the fact that the Danish CS has relatively shallow waters, Denmark must ensure a complete removal of unused installations.[537] Since an amendment to the Subsoil Act in 2015, section 32a provides that any application for approval with regard to a production and development plan (section 10), use of a pipeline (section 17), storage or other use (section 23) or additional work related to such licenses (section 28) of the Danish Subsoil Act, need to be accompanied by a plan for the decommissioning. This means that in practice all offshore petroleum operators pursuant to section 32 a(4) had to submit decommissioning plans in July 2018.These decommissioning plans have to be submitted to and be approved by the Danish Energy Agency in accordance with the Guidelines on Decommissioning Plans for Offshore Oil and Gas Facilities or Installations.[538] The objective of these guidelines is to present to the licensees the requirements stipulated by the Danish Energy Agency for the contents of decommissioning plans and the framework applying to the submission and approval of the plans. The guidelines are not exhaustive and must be applied in combination with other guidelines.[539] According to these guidelines, the decommissioning plans, inter alia, have to describe how and when the necessary funds for implementing the decommissioning plans are available, which installations will be decommissioned and which (parts of) the installations have to be removed or converted to another use.[540] Although reuse is considered as one of the options to be considered in a decommissioning plan, it has not yet been applied in practice.

Transport and Storage of CO_2

---

[535] Act No 1384 of 20 December 2004 on Energinet Danmark, of Consolidated Act No 1097 of 8 November 2011, see also <http://www.energinet.dk>. For more details see A Rønne," Merging the Electricity and Gas Transmission System Operators in one Company Owned by the Danish State" in M.M. Roggenkamp and U Hammer (eds), *European Energy Law Report III*. In *European Energy Law Report II* BOG Mortensen is focusing on the Danish experience in using" Ownership as a Regulatory Instrument in a Liberalized Energy Market".

[536] Article 21 Gas Supply Act.

[537] C.G. Brett, 'Regulation of infrastructure decommissioning in the Danish offshore oil and gas sector' in M.M. Roggenkamp & C. Banet, *European Energy Law Report XIII* (Cambridge, 2020), p. 332.

[538] The guidelines are available at www.ens.dk.

[539] Such as the Guidelines for Drilling (DEA 2018), Guidelines on security and insurances (DEA 2018) and Guidelines on Technical Capacity (DEA 2018).

540C.G. Brett, 'Regulation of infrastructure decommissioning in the Danish offshore oil and gas sector' in M.M. Roggenkamp & C. Banet, *European Energy Law Report XIII* (Cambridge, 2020), p. 333.

The Subsoil Act also governs in Section 23 and following the geological storage of CO_2, which is based on a licensing regime as outlined by EU Directive 2009/31/EC.[541] Hence, the Act provides for a licensing regime, consisting of an exclusive exploration license and an exclusive storage license regarding a specific area and period of time (Section 23). A subsoil geological formation may only serve as a CO_2 storage site, if there is no significant risk of leakage, and if no significant environmental or health risks exist (section 23f). The licensee shall establish a register of the quantities and composition of CO_2 injected[542], and a monitoring programme (section 23h-i).[543] The closure of a CO_2 storage site is subject to ministerial approval, and the licensee shall submit and comply with a post-closure plan (section 23k). Legal obligations relating to the storage site may be transferred to the state provided that all available evidence indicates that the stored CO_2 will be completely and permanently contained; that at least 20 years have passed after the closure; that an amount to cover the expected monitoring costs for a period of 30 years will be paid; and that the CO_2 storage site has been sealed and the injection facilities have been removed (section 23o). The licensee shall provide financial security for the estimated costs of all obligations connected to the CO_2 storage license (section 23q). As stipulated by the Directive, the Subsoil Act provides for a regime of third-party access to CO_2 transport networks and CO_2 storage sites against payment if there is the necessary capacity (section 23c). The establishment and operation of pipelines and CO_2 storages is subject to a licence setting conditions regarding routing, dimensions, ownership, and payment for use (section 23u). The more technical aspects of transport and storage of CO_2 are implemented in an executive order.[544]

The Danish Subsoil Act was amended on 1 July 2022.[545] In order to facilitate carbon dioxide storage the Act now provides for a state participation of 20% via the North Sea Fund in CO_2 storage licenses. By means of introducing such a regime of co-ownership, Denmark removes part of the risk from the private companies and thus promotes interest in investing in carbon dioxide storage.

Despite the transposition of the Directive into Danish law, Danish policy was initially to wait for results from several European pilot projects on CO_2 storage. Instead, there was more interest in the possibility to use CO_2 for enhanced oil recovery (hereinafter EOR). The Energy Agency has carried out a Strategic Environmental Assessment of a permit scheme for CO_2 injections into existing oil fields on the Danish CS in accordance with the Environmental Assessment of Plans and Programmes Act 2013 together with the preparation of the seventh round for oil and gas exploitation. This situation changed following the decision in the North Sea Agreement of December 2020 to promote offshore storage of carbon dioxide. This resulted in the abovementioned amendment of the Subsoil Act resulting in a 20% State participation in future carbon storage licenses and by doing so removing part of the risk from the private companies and thus promotes interest in investing in carbon dioxide storage. At the same time the political parties agreed in a new political agreement of the 14 December 2021 that CO_2 storage must be taxed in accordance with the general tax rules.[546]

---

[541] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (Text with EEA relevance).

[542] A CO_2 stream shall also consist overwhelmingly of CO2, and no waste or other matters may be added for the purpose of disposal.

[543] See C. Redgwell, in 'Energy Law in Europe' (ed. M. Roggenkamp et all), 3d edition, 2016, p. 58.

[544] Order No 859 of 14 July 2011.

[545] WSCO, 'Carbon capture and storage – the Danish perspective' <https://uploads-ssl.webflow.com/6183d750c2a4a2d74e966763/6234496d3d8d9d691f51ec2c_CCS%20-%20the%20Danish%20Perspective%2C%20March%202022.pdf> accessed 10 August 2022.

[546] Ministry of Finance, *Denmark's National Reform Programme* <https://ec.europa.eu/info/sites/default/files/denmarks_national_reform_programme_2022_en.pdf> accessed 12 September 2022, p.36.

5.3.2.2 Act governing Energinet

Energinet was established in 2004 by a separate Act[547] because of the EU requirements to unbundle networks from production and supply activities. It is a state-owned company that operates the Danish transmission system for electricity as well as gas. The Act also applies to the Danish EEZ (Section 1a), and, consequently, Energinet is responsible for the part of the electricity and gas systems situated offshore. Given these offshore powers, Energinet is thus entitled to construct and operate transmission pipelines and cables offshore. The construction of the transmission systems needs prior approval of the Ministry of Energy, Utilities and Climate regarding location and layout.[548]

5.3.2.3 Electricity Supply Act

The Electricity Supply Act aims to ensure that the country's electricity supply is organized and implemented in accordance with the needs for supply security, economics, environmental and consumer protection.[549] It transposes the general principles of EU electricity market directives into Danish law. The entire Act also applies to the EEZ.[550] Consequently, the provisions governing electricity production apply to the EEZ. Production facilities with a capacity of more than 25 MW are subject to a license[551] that will be granted for at least twenty years but only if the applicant is able to demonstrate that it has the necessary technical and financial resources. In addition, applicants may require a permit demonstrating an installation's energy efficiency, fuel use and environmental impact.[552] Both a licence and a permit may include conditions requiring that the owner: (i) commits to modifying production volume as decided by the system operator; (ii) provides security for the dismantling of installations; and (iii) commits to inform the system operator at least one year in advance if a decision is made to shut down an installation or take it out of operation (section 12).

Sections 22a and 22b of the Electricity Supply Act focus on the energy system (cables) in the EEZ. The development of an electricity supply system and/or changes to an existing system requires permission from the Minister. A permit to develop an offshore transmission system is subject to a permit pursuant section 21 of the Act. The construction of a direct line also requires an authorisation from the Minister and can only be given if the applicant has not been given access to the existing supply system.[553]

5.3.2.4 Act on promoting Renewable Energy

The purpose of the Act on promoting renewable energy (hereafter: Renewable Energy Act) is to stimulate the production of energy using renewable energy such as wind, hydro, biomass, solar, wave and tidal energy and geothermal heat.[554] Consequently, it will assist in reducing dependence on fossil fuels, of CO_2 emissions and other greenhouse gases to achieve national and international targets. The Act applies to the EEZ and is thus relevant for promoting renewable energy sources offshore, which is limited to offshore wind energy at the moment.[555]

---

[547] Act No 1384 of 20 December 2004 on Energinet Danmark, cf Consolidated Act No 1097 of 8 November 2011, see also Company Owned by the Danish State" in M.M. Roggenkamp and U Hammer (eds), *European Energy Law Report III*. In *European Energy Law Report II* BOG Mortensen is focusing on the Danish experience in using" Ownership as a Regulatory Instrument in a Liberalised Energy Market".

[548] Section 4a of the Act on Energinet.

[549] Section 1 Electricity Supply Act.

[550] Section 2 Electricity Supply Act.

[551] Section 10.

[552] Section 11. See for also Order No 565 of 2 June 2014.

[553] Section 23 Electricity Supply Act.

[554] Act on the promotion of renewable energy (No. 1392 of 2008).

[555] Section 3 of the Renewable Energy Act.

Since Denmark has declared an EEZ, exclusive rights to develop offshore wind is vested with the State, who has exercised right by issuing a special licensing regime in the Renewable Energy Act.[556] The Act identifies three different licences:

- A licence to carry out preliminary surveys (Section 22)
- A licence to establish a wind turbine (Section 25)
- A licence to use wind energy (Section 25).

A license to use wind energy can be requested and awarded as soon as an installation is ready to supply electricity to the grid. The production period lasts for a certain period, usually some 25 years. A more detailed description of the area, including any special conditions applying to it, appears from the tender material and the Model Licence that is included as an attachment. If the wind farm has a capacity of more than 25 MW, the developer also needs a license based on the Electricity Supply Act (see above).

The licensing procedure is based on a regime of public tendering involving specific preselected offshore areas. Only prequalified applicants will be invited to participate, and an exclusive licence is awarded after a negotiated procedure. The award criteria relate to evaluation of the legal, economic, financial, and technical information provided, and the most crucial criteria is the amount of the feed-in price per kWh of electricity produced that applicants request to carry out a project. In preparation for a tender, crucial information for applications to set a competitive bid is already published beforehand.[557] However, the Renewable Energy Act also provides for an exemption to the regular tendering regime. Wind farm developers are entitled to apply directly for a wind energy permit but only with regard to areas, which have not been preselected for tendering. This regime was only applied regarding small wind farms close to shore.[558] The Energy Agreement of 2018 also introduced a new tender model for nearshore wind farms (at least 4 km from shore), which assumes that nearshore wind farms will be cheaper to build as they are located in shallower waters and require shorter cable connections. The tendering requirements are similar to those applying to onshore wind farms, which entails that the wind farm developer has to offer local residents and companies a share of at least 20% in the project and must develop the cable itself. The Thor Offshore Wind Park is a typical example of this new approach.[559]

5.3.2.5 Act on the Design and Construction of an Artificial Island in the North Sea

The Act on the Design and Construction of an Energy Island in the North Sea (*Lov om projektering og anlæg af en energiø i Nordsøen*) was adopted in December 2021.[560] The Act provides a legal framework governing the design and the construction of an artificial energy island in the Danish part of the North Sea.[561] The scope of the law is limited to the design and the construction of the island and does not govern any energy activities on island and/or energy generating facilities and electricity transmission systems connected to the island.[562] The latter are subject to the existing offshore legal framework (see section 5.3.2 above).

The Act authorises the Ministry of Climate, Energy and Utilities to take the necessary preparatory steps to prepare and design an offshore island, including the preparation of a tender.[563] The tender location is

---

[556] Section 22 Renewable Energy Act.

[557] C.T. Nieuwenhout & M.M. Roggenkamp, 'Legal Framework and Legal Barriers to an Offshore HVDC Electricity Grid in the North Sea', PROMOTioN – Deliverable 7.1, Horizon 2020, June 2017, p. 7.

[558] H.K. Müller, *A Legal Framework for a Transnational Grid in the North Sea*, Intersentia, 2015, p. 162.

[559] Danish Energy Agency at https://en.energinet.dk/Infrastructure-Projects/Projektliste/Thor-Offshore-Wind-Farm.

[560] Act on the Design and Construction of an Energy Island in the North Sea (*Lov om projektering og anlæg af en energiø i Nordsøen*) no. 2379 of 14 December 2021.

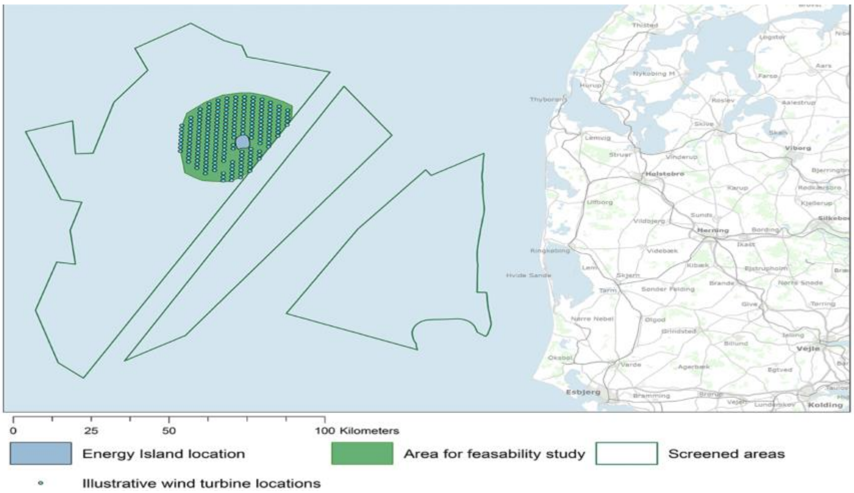
[561] Article 1(1) of the Act on the Design and Construction of an Energy Island in the North Sea.

[562] Article 1(3) of the Act on the Design and Construction of an Energy Island in the North Sea.

[563] Article 2 of the Act on the Design and Construction of an Energy Island in the North Sea.

limited to the area indicated in Appendix 1 of the Act on the Design and Construction of an Energy Island in the North Sea.[564] Applicants will be able to opt for an area within the Danish part of Dogger Bank (see figure 5 below). The selected bidder will be entitled to carry out preliminary research in accordance with conditions set by the government regarding time, progress, environment, and safety.[565] An authorisation to construct such island will include instructions about the exact location and design and is based on the accepted tender proposal and possibly additional conditions set by the Minister with regard to its construction, the construction activities work itself and maintenance of the island.[566] All conditions need to be in line with international and EU law and all relevant provisions regarding environmental impact assessments.[567] Finally, the Act provides for several procedures regarding appeal proceedings, supervision, fees and delegation of authority.[568]

Tender preparations are ongoing but have been delayed. The Danish Energy Agency expects the tender to be launched mid-2023. The ultimate aim is that the island will be operational in 2033. The envisaged design is that it will become a flexible island that in addition to being an electricity hub also can include other innovative activities like power-to-gas.[569] The Danish state will own 50.1% of the island and private parties the remaining 49,9%. This partnership is not defined in the Act but has been specified in the 'Tender-preparing partial agreement regarding the long-term framework of a call for tenders and ownership of the energy island in the North Sea', which was published as part of the Climate Agreement of June 2020.[570]



[564] FuellCellsWork, 'In Denmark CIP Proposed to Build a Hydrogen Island in the North Sea by 2030' 24 June 2022 <https://fuelcellsworks.com/news/denmark-cip-proposes-to-build-a-hydrogen-island-in-the-north-sea-by-2030-2/> accessed 28 September 2022.

[565] Article 3 of the Act on the Design and Construction of an Energy Island in the North Sea.

[566] Article 4 of the Act on the Design and Construction of an Energy Island in the North Sea.

[567] Articles 8 and 9 of the Act on the Design and Construction of an Energy Island in the North Sea.

[568] Article 10-17 of the Act on the Design and Construction of an Energy Island in the North Sea.

[569] Danish Energy Agency, 'The Danish Energy Agency sets time to tender for the energy island in the North Sea and maintains the overall schedule', 5 July 2022, < https://via.ritzau.dk/pressemeddelelse/the-danish-energy-agency-sets-time-to-tender-for-the-energy-island-in-the-north-sea-and-maintains-the-overall-schedule?publisherId=13560521&releaseId=13654832> accessed 2 September 2022.

[570] See Government of Denmark, 'Tender-preparing partial agreement regarding the long-term framework of a call for tenders and ownership of the energy island in the North Sea', Copenhagen, 1 September 2020 available at: <https://kefm.dk/Media/637661840231461613/Udbudsforberedende%20delaftale%20om%20langsigtede%20rammer%20-%20energiø%20Nordsø.pdf>.

Figure 6. Map of area indicating the possible location of the energy island as well as for offshore wind in the Danish part of the NSA.[571]

5.3.3 Impact of Offshore Energy Law on Developing Energy Hubs

Several of the identified energy hubs discussed below are associated to the planned development of offshore energy islands. As mentioned above (section 5.3) Denmark plans to build an artificial energy island in the North Sea, which will at least include an offshore windfarm with a capacity of 3 GW.[572] The energy island will serve as a hub to connect wind turbines to the electricity grid and is scheduled to be operational by 2030 (and possible earlier), However, a clear regulatory framework governing the construction and use of this island is not yet in place and this timeline may thus proof to be challenging.

5.3.3.1 Platform Electrification

Following up on the North Agreement of December 2020, the Danish Energy Agency published on 4 April 2022 an analysis of the possible electrification of oil and gas production installation on the Danish part of the North Sea.[573] The analysis focuses on four fields - Syd Arne, Tyra, Halfdan and Dan – as these production facilities are expected to operate until the 2040s.[574]

The analysis considers three electrification options, and several scenarios within each of them. Several of these scenarios rely on the development of an offshore energy island. These options (and scenarios) vary from supplying electricity via: (i) a dedicated cable between the offshore installation and the onshore system in Denmark, (ii) a cable connection with the energy island (and potentially in an area with 10 GW wind energy, (iii) a cable connection with a (new) offshore wind farm in the Norwegian EEZ (Sørlige Nordsø II havvindmøllepark), (iv) a cable between a Danish offshore wind farm situated near the oil/gas production site, (v) a cable connection the installation with an offshore wind farm and a gas turbine as a back-up facility, and (vi) a cable between the installation and wind farm followed by a cable to an energy island.[575] The analysis shows that a connection between the offshore installation and the wind farm alone is insufficient as it does not guarantee adequate supply security.

Section 5 of the analysis examines the legal framework and potential obstacles. Most of the obstacles identified relate to potential impact on environmental impact procedures, offshore planning, and a possible state aid approval. It does refer to the possibility that the cable connection is a direct line and needs approval subject of section 23 of the Electricity Supply Act. As there is no legal framework yet for developing and exploiting an energy island, the analysis remains silent on this issue. Regarding cross-border connections it recognizes that a connection to a Norwegian offshore wind farm needs to be coordinated with the Norwegian authorities and that cross-border connections to the energy island may

---

571 Danish Energy Agency, *Denmark's Energy Islands* <https://ens.dk/en/our-responsibilities/wind-power/energy-islands/denmarks-energy-islands> accessed 28 September 2022.

572 Energinet, 'Integrated Geological Model for the Energy Islands', 21 April 2022 <https://eu.eu-supply.com/ctm/Supplier/PublicPurchase/328231/0/0?returnUrl=&b=ENERGINET> accessed 10 August 2022.

573 Energistyrelsen, 'Analyse af CO2-reduktionspotentialer ved elektrifiserting af Danks olie- of gasproduktion in Nordsøen', 4 April 2022, at https://ens.dk/sites/ens.dk/files/OlieGas/elektrificeringsanalysen.pdf and Equinor, 'Electrification of platforms', <https://www.equinor.com/energy/electrification-of-platforms> accessed 10 August 2022.

574 See also N, Kulovic, 'Denmark uncovers emission reduction potential of North Sea electrification', 4 April 2022 <https://www.offshore-energy.biz/denmark-uncovers-emission-reduction-potential-of-north-sea-electrification/> accessed 10 August 2022.

575 Analysis af CO_2-reduktionspotentialer ved elektrificering af dansk olie- og gasproduktion i Nordsøen, <https://ens.dk/sites/ens.dk/files/OlieGas/elektrificeringsanalysen.pdf> accessed 10 August 2022.

be subject to access rules governing interconnectors (the rule that 70% capacity needs to be available for the market).[576]

5.3.3.2 Hydrogen

The Climate Agreement of 2020 identified the need to develop a strategy for Power-to-X as a climate change instrument (see section 5.3.1.2 above). The Ministry of Climate, Energy and Utilities published the Power-to-X strategy in June 2021.[577] The strategy, amongst others, is making use of the increasing quantities of offshore wind energy for hydrogen conversion. The necessary conversion will take place onshore. The strategy identifies about 20 onshore projects; it does not mention any offshore hydrogen projects (see for such projects North Sea Energy 3[578]). It does mention, however, the role of energy islands in promoting the production and supply of green hydrogen.[579] In the meantime it has become clear that the aim is to develop hydrogen conversion on the energy island. Less clear, however, are the conditions for such development as the current Act only governs the construction of the island and not its use. It is neither clear who will construct and operate the pipeline bringing the hydrogen to shore and how to qualify such pipeline.[580]

5.3.3.3 CO_2 Transport and Storage

As established in the North Sea Agreement (see section 5.3.1.3 above), Denmark is now focusing actively on CO_2 storage offshore to reach its climate goals and aims at putting its first carbon capture and storage facilities into service by 2025.[581] Therefore, the Danish Energy Agency announced the possibility to apply for an exploration and storage license from 15 August 2022 to 1 October 2022. Licenses are initially awarded for 6 years for exploring the subsoil and can be extended to a period of 30 years for subsoil storage if the location is found suitable for storage purposes.[582] The licensed projects will be subject to individual environmental assessments.[583] The tendered area covers the Danish part of the North Sea CS west of 6 degrees 15' east and north of 56 degrees 00' north. A strategic environmental assessment has been carried out before the tender. Although several hydrocarbons' activities are taking place in this area and there might be some potential in CO_2 storage in (nearly) depleted reservoirs, most of the area is unlicensed, which seems to indicate that storage also can take place in saline aquifers. As mentioned before in section 5.3.2.1, the state will participate via the North Sea Fund with a share of 20% in CO_2 exploration and storage licences.

In August 2022 the Danish Energy Agency also prequalified three applicants for financial support for large scale capture of CO_2. These three applicants are I/S Vestforbraending (Denmark's largest waste management and energy company), Ørsted Bioenergy & Thermal Power A/S (electricity generator) and Aalborg Portland (cement industry). These applicants have been assessed based on technical and financial merits and are expected to be able to reduce 0,4 million tonnes of CO_2 emissions per year as of

---

[576] C.T. Nieuwenhout, 'Dividing the sea into small bidding zones? The legal challenges of connecting offshore wind farms to multiple countries', *Journal of Energy and Natural Resources Law*, February 2022.

[577] This strategy is publish on https://ens.dk/sites/ens.dk/files/ptx/strategy_ptx.pdf

[578] L.M. Andreasson & M.M. Roggenkamp, 'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore', North Sea Energy III – Deliverable D2.2, 2.3, Topsector Energy: TKI Offshore Wind & TKI Offshore Gas, December 2020, p. 74.

[579] Strategy, p. 17.

[580] Danish Energy Agency, *Denmark's Energy Islands* <https://ens.dk/en/our-responsibilities/wind-power/energy-islands/denmarks-energy-islands> accessed 28 September 2022.

[581] Yale Environment, *Denmark Invests in Carbon Capture as It Phases Out Offshore Drilling*, Yale School of Environment <https://e360.yale.edu/digest/denmark-invests-in-carbon-capture-as-it-phases-out-offshore-drilling> accessed 9 December 2021.

[582] https://ens.dk/en/press/very-first-tender-co2-storage-licenses-opening

[583] See press release of this tender <https://ens.dk/en/press/very-first-tender-co2-storage-licenses-opening> and in more detail the website if the Energy Agency on CCS https://ens.dk/ansvarsomraader/ccs-fangst-og-lagring-af-co2

2026.[584] These prequalified candidates need to present their final bid on 16 December 2022. This prequalification is considered as providing for a first step in the CCUS chain. Another important step is the award of the storage licence, which is now open for tender. In principle these prequalified parties could also apply for an exploration and storage license alone or with others with more technical expertise on offshore mining activities, but they can also rely on the possibility to get third party access to the storage (and/or transport) facility.

5.3.4 Interim Conclusions

Like the Netherlands and the UK, Denmark is a North Sea state that has been actively involved in oil and gas production since the 1970s and for the last 20 years has increasingly been focusing on the development of offshore wind energy. However, some important differences can be noted.

First, Denmark distinguishes itself from the other North Sea states by using political agreements to facilitate the legislative process. These agreements are concluded between the Danish government and the majority of parties of the Danish parliament and although not legally enforceable, these political agreements are in practice honored by the parties involved. Secondly, Denmark has decided by law to terminate and to phase out oil and gas production by 2050. As this decision is established by law, it will not be easy to amend. Although this phase out may result in reuse of installations, the possibilities have not been highlighted so far. Thirdly, the energy transition process relies increasingly on the development of offshore energy islands, including one artificial energy island in the North Sea. Although such an artificial island will be key to several offshore energy developments[585], the legal framework is still being developed. An important first step is the law enabling the construction of the artificial island. Another important step would be the need to draft a law governing the use of the island. Therefore, it is yet unclear what its functions and possibilities may be. This might become relevant in relation to developing large scale hydrogen projects as so far, the focus is on onshore conversion. Nevertheless, the energy island can be viewed as a means of system integration and even cross-border system integration.[586]

When considering the three identified energy hubs, it is noticeable that none of these hubs have been developed so far. However, for all of them the Danish Energy Agency has developed a strategy or announced a tender procedure. Hence, projects to store CO_2 offshore and platform electrification can be expected soon. Offshore hydrogen conversion will probably take more time, also because this requires more insight in the applicable legal framework governing the energy island and the construction of the energy island. Last but not least, this energy island may play a role in the development of Hub East as also Dutch wind farms can be connected to this artificial energy island.

5.4 Germany

Offshore developments in Germany are also relevant with regard to Hub East. The situation in Germany differs from the other North Sea states discussed above given the absence of sizable oil and gas exploration and production activities on the German CS. So far, there is one hydrocarbons activity on the German CS and that is the production of conventional gas from a field located in shallow waters in block

[584] Energistyrelsen, "Tre selskaber er prækvalificeret til at byde på CCUS-puljen', <https://ens.dk/presse/tre-selskaber-er-praekvalificeret-til-byde-paa-ccus-puljen> accessed 12 September 2022.

[585] State of Green, ‚This is what the world's first energy island may look like', 26 January 2021 <https://stateofgreen.com/en/news/this-is-what-the-worlds-first-energy-island-may-look-like/> accessed 10 August 2022.

[586] Rijksoverheid, 'Wind op zee na 2030', <https://windopzee.nl/onderwerpen/wind-zee/wanneer-hoeveel/wind-zee-2030-0/> accessed 30 September 2022.

A06 and A6/B4 (Nordsee A6/B4 field). Production will probably continue until 2025.[587] New developments may take place in the future in or near block N05 in German territorial waters. The N05-A field operated by One Dyas (see paragraph 5.1.3 above) is situated in the Dutch territorial sea. Some prospects have also been identified nearby in the German territorial waters (N05-Q-North, N05-A-Southwest and the Diamant field).[588] The Mittelplate oilfield[589] is situated 7 kilometres of the shore of Schleswig-Holstein and is Germany's largest and most productive field since it holds nearly 65% of Germany's crude oil reserves.[590] Given the dependence of Germany on natural gas and the impact of the Ukraine war on Russian gas supply, several parties have now voiced an interest in promoting gas production in Germany.[591] The above shows that most oil and gas activities in Germany take place in the territorial sea of the NSA. Any further developments in this particular offshore area may be hampered as these waters also are designated as a nature conservation area, the 'Wadden Sea'.[592] Not very surprisingly, little attention has been paid so far to the issue of decommissioning and possible reuse of production facilities. The upcoming closure of the Nordsee A6/B4 field will require a process of decommissioning and most likely a complete removal given its position in shallow waters (if not being reused). On the (very) long term, it is possible that the existing oil and gas pipelines from offshore fields in Norway crossing the German CS and entering the territorial waters need to be decommissioned. This must take place in accordance with the rules of OSPAR.[593]

Germany declared its EEZ in November 1994.[594] In comparison to other North Sea states, the German EEZ is relatively small but is primarily used for offshore wind energy projects.[595] Although investors showed interest in offshore wind energy quite early and the first offshore wind farm was already developed in 2009, projects have in general been slow to develop. This changed with the entry into force of the Wind Energy at Sea Act in 2016. Currently, there are approximately 1500 offshore wind turbines with a capacity of 7.8 MW in the North Sea and Baltic Sea.[596] The vast majority of Germany's offshore turbines is located in the North Sea, with about 6.7 GW installed off Germany's western coast, compared to just 1.1 GW in the Baltic Sea.[597] This equals to 28 operational wind farms.[598] These wind farms are clustered and connected to a few offshore converter stations operated by the German TSO TenneT in

---

[587] Offshore technology, ‚Nordsee A6/B4 Conventional Gas Field, Germany', 13 May 2022 < https://www.offshore-technology.com/marketdata/nordsee-a6-b4-conventional-gas-field-germany/> accessed 13 September 2022.

[588] Offshore technology, ‚NO5-A Gas Field, Dutch North Sea', 16 November 2021 <https://www.offshore-technology.com/projects/n05-a-gas-field-dutch-north-sea/> accessed 13 September 2022.

[589] It is situated in block Heide-Restflache, Cuxhaven Verkleinerung and Heide-Mitteplate I and is operated by *RWE Dea AG* (but sold to Russian investors in 2015) and *Wintershall Holding GmbH.* See Wintershall dea, 'Mitteplate. Safe Production in a Sensitive Environment' <https://wintershalldea.com/en/where-we-are/germany/mittelplate> accessed 4 August 2022.

[590] Wintershall dea, 'Mittelplate crude oil production', <https://wintershalldea.com/sites/default/files/media/files/191125_Factsheet_Mittelplate_EN.pdf> accessed 12 September 2022.

[591] Reuters, 'German finance minister open to new oil, gas drilling in North Sea' <https://www.reuters.com/business/energy/german-finance-minister-open-new-oil-gas-drilling-north-sea-2022-03-13/> accessed 4 August 2022, and https://www.euronews.com/next/2022/06/24/ukraine-crisis-germany-gas-fracking

[592] Paragraph 24 Bundesnaturschutzgesetz.

[593] See chapter 1.

[594] Proclamation of 25 November 1994 by the Federal Republic of Germany concerning the establishment of an exclusive economic zone of the Federal Republic of Germany in the North Sea and in the Baltic Sea.

[595] B. Wehrmann, 'German offshore wind power – output, business and perspectives', 10 August 2022 <https://www.4coffshore.com/windfarms/germany/> accessed 11 August 2022.

[596] Mathias Fisher, 'German offshore share of total wind energy yield rises to almost 18 percent in 2021', (*TenneT*, 13 January 2022) <https://www.tennet.eu/tinyurl-storage/detail/german-offshore-share-of-total-wind-energy-yield-rises-to-almost-18-percent-in-2021-in-the-netherlan/>.

[597] BalticWind, 'German offshore wind energy – summary', <https://balticwind.eu/german-offshore-wind-energy-summary/> accessed 13 September 2022.

[598] Offshore Germany, 'Offshore windfarms in Germany' <https://www.4coffshore.com/windfarms/germany/> accessed 10 August 2022.

the North Sea.[599] Apart from efficiency gains clustering was necessary to limit the number of offshore cables crossing the Wadden Sea.[600]

5.4.1 Policy Developments

5.4.1.1 Energiewende

Following the Fukushima nuclear accident in March 2011, the German government decided to abolish nuclear energy and thus promote the closure of nuclear power plants in Germany (*Atomausstieg*). This decision is generally known as the *Energiewende* and although not included in a formal policy document it is often used as an umbrella term for the German process of energy transition. This process needed to be accompanied with an increase of electricity production from renewable energy sources. Whereas in 2013 the government introduced an intermediate target of 50% renewables in gross electricity consumption, this target was increased to 65% in 2040 and 80% in 2050.[601] The key instrument to achieve this energy transition was the policy to provide investors generous financial support in using renewable energy sources.[602] As a result of the given support, renewable energy sources generated more power than fossil fuels for the first time in 2020.[603] Nevertheless, the *Energiewende* still poses several financial and technological changes.[604]

Relevant for the *Energiewende* is also the German NECP. The goals presented in the NECP (being 14% greenhouse gas emissions in 2020 and 38% reduction in 2030 and a target of 30% renewables in 2030 of gross final, energy consumption)[605] are less ambitious than the ones presented below. In general, one can wonder whether these ambitious goals still are achievable given the impact of the current energy crisis.

5.4.1.2 Climate Action Plan 2050

The German government adopted the Climate Action Plan 2050 in 2016 to have a strategy to meet the goals of the Paris Agreement. The medium target is to cut greenhouse gasses by at least 55% by 2030 compared to 1990s levels and to be climate neutral in 2050.[606] The plan also identifies actions for individual sectors such as energy, transport, industry, and buildings. The plan is referring to the need to restructure the energy sector and recommended a phase-out of coal-fired power plants by 2038 at the latest[607] and to consider the possibility of CO_2 recycling, i.e., carbon capture and utilization.[608]

---

[599] See §4, §4a, §11 Energiewirtschaftsgesetz.

[600] C. Walsh et al, 'Wadden Sea Funding Guide' 2022 <https://www.waddensea-worldheritage.org/sites/default/files/2022_PROWAD_LINK_Funding_Guide.pdf> accessed 12 September 2022.

[601] The figures for gross final energy consumption are: 30% (2030), 35% (2040) and 60% (2050).

[602] International Energy Agency, Germany, <https://www.iea.org/countries/germany> accessed 28 December 2021.

[603] R. Rechsteiner, 'German Energy Transition (Energiewende) and what politicians can learn for environmental and climate policy' [Clean Technologies and Environmental Policy 2021], pp. 305-342.

[604] International Energy Agency, *Overview. Renewables' resilience is driven by the electricity sector*, <https://www.iea.org/reports/renewables-2020?mode=overview>, accessed 23 January 2022.

[605] Integrated National Energy and Climate Plan <https://energy.ec.europa.eu/system/files/2022-08/de_final_necp_main_en.pdf> accessed 13 September 2022.

[606] Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, Climate Action Plan <https://www.bmuv.de/en/topics/climate-adaptation/climate-protection/national-climate-policy/climate-action-plan-2050-germanys-long-term-low-greenhouse-gas-emission-development-strategy#c12749>.

[607] L. Braaksma, R. Fleming, 'Phasing Out Coal Fired Power Plants in the European Union – Examples from The Netherlands and Germany', in: M. M. Roggenkamp, C. Banet, European Enbergy Law Report XIII, p. 272 – p. 284.

[608] Federal Ministry for the Environment, Nature Conservation, Nucelar Safety and Consumer Protection, ‚Climate Action Plan 2050' <https://www.bmuv.de/en/topics/climate-adaptation/climate-protection/national-climate-policy/climate-action-plan-2050-germanys-long-term-low-greenhouse-gas-emission-development-strategy>.

The greenhouse gas emission targets are legally binding as they have been included the Climate Action Law.[609] Following a landmark ruling by the Constitutional Court on 29 April 2021[610], the law was amended to achieve climate neutrality in 2045 and a new target for 2030 (greenhouse gas emissions cut of 65% instead of 55%) and tougher emission budgets in all sectors. The climate targets are reviewed through continuous monitoring, which is done every two years by the Council of Experts for Climate Matters, and which is in line with the monitoring process outlined in the EU Governance Regulation (see section 3.2.5 above). The first report will be prepared in 2022.

5.4.1.3 National Hydrogen Strategy

The German government presented a National Hydrogen Strategy in June 2020.[611] It considers that hydrogen will be crucial to achieve the intended energy transition and a key element in the ongoing process of 'sector-coupling'. Moreover, (green) hydrogen can be used as a commodity but also plays a role to store renewable energy and balance supply and demand of energy. The strategy foresees an important role for renewables coming from offshore wind energy production.[612] In order to achieve these ambitions, Germany will invest heavily in green hydrogen until 2026.[613]

The strategy follows a dual approach regarding the transport of hydrogen via pipelines. It not only considers the construction of dedicated hydrogen networks but also foresees that existing transmission and distribution gas pipelines could be converted to hydrogen infrastructure.[614] With a view to the transport sector, `green´ hydrogen as well as synthetic fuels produced with the help of Power-to-X are envisaged by the German hydrogen strategy as a fuel for heavy-duty purposes such as aviation and the maritime sector.[615]

5.4.2 Legal Framework governing Offshore Energy Activities

Germany is a federal state and, consequently, the individual states (Länder) have legislative and administrative powers within their territories. Activities on the German CS and EEZ are, however, subject to federal jurisdiction.[616] Offshore energy projects can be governed by several sectoral laws, depending on the energy activity. These laws include the Maritime Facilities Act (*Seenanlagengesetz*)[617], the Federal Mining Act (*Bundesberggesetz*)[618], and the Offshore Wind Energy Act (*Windenergie auf See Gesetzt*)[619].

5.4.2.1 Bundesberggesetz

The Bundesberggesetz (BBergG) entered into force on 1 January 1982. It regulates the exploration, production, and processing of several mineral resources, including oil and gas offshore. These offshore resources are considered as 'ownerless' good (*Bergfreie Minerals*)[620] and thus subject to a regime of public

[609] The law entered into force on 18 December 2019 and was amended in 2021.
[610] 1 BvR 2656/18, 1 BvR 288/20, 1 BvR 96/20, 1 BvR 78/20.
[611] German Economic Ministry `Die National Wasserstoffstrategie´ available at: https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/die-nationale-wasserstoffstrategie.html [accessed 16/June/2020] at 2 (hereinafter: German Strategy). Isabelle Huber, ‚Germany's Hydrogen Industrial Strategy', (*CSIS*, 28 October 2021) <https://www.csis.org/analysis/germanys-hydrogen-industrial-strategy> accessed 4 August 2022.
[612] German Strategy p. 5 and p. 6.
[613] The initial investment of 1,4 billion Euro until 2026 was increased in 2020 with an additional investment of 7 billion Euro. See National Investment Plan 2.
[614] German Strategy, p. 7.
[615] See also R. Fleming, EELR XIV, p. 267 – p. 293.
[616] M. Münzer, ‚Energie und Klima Ländersache? Landeskompetenzen zur Förderung von Energiewende und Klimaschutz' [Resciptum 2014].
[617] Seeanlagengesetz vom 13 Oktober 2016.
[618] Bundesberggesetz vom 13 August 1980.
[619] Gesetz zur Entwicklung und Förderung der Windenergie auf See vom 13 Oktober 2016.
[620] Article 3 para 1 Bundesberggesetz.

authorisations. These authorisations consist of (i) an exclusive right to explore these offshore minerals[621] and (ii) exclusive rights to produce these minerals.[622] The Hydrocarbons Licensing Directive was transposed into the BBergG, and the 'open door' system applies, i.e., written applications for an authorisation may be submitted at any time after which the competent authority needs to invite others to apply as well.

The criteria for awarding an authorisation are that applicants must, *inter alia*, demonstrate that they have the technical and financial capacity and intend to carry out production in an economically reasonable fashion. Grounds for refusal include the possibility that 'prior public interests' oppose exploration and/or production.[623] Offshore account must be taken of existing submarine cables and pipelines as well as shipping lanes and other means of navigation.[624] Mining activities need to take place in accordance with an environmental impact assessment and a production plan (*Betriebsplan*) that has been approved by the competent authorities.[625] An authorisation can be revoked if its holder does not pursue or interrupts the mining activities for a certain period of time, and if the holder is responsible for this inactivity without justification.[626]

Part nine of the Act contains some special provisions regarding mining research activities on the CS.[627] Most important is the provision that the Act also applies to the construction and use of oil and gas transit pipelines on the German CS.[628] The Act, however, does not regulate upstream oil and gas pipelines. Consequently, this is governed by the Energy Industry Act (*Energiewirtschaftsgesetz*).[629] Although it is less clear whether this also applies to upstream pipelines offshore since the Act does not explicitly state that it applies offshore, it can be assumed as several provisions in the Act include a reference to the EEZ.[630]

As mentioned above, production from the Nordsee A6/B4 field will soon come to an end and this will raise the issue about decommissioning and removal if the installation becomes relevant. The BbergG does not govern these activities. Therefore, it can be argued that the IMO guidelines and OSPAR (see section 2.3.3 above) will apply.[631] As these installations are positioned in shallow waters, it can be assumed that the installations need to be removed completely unless they can be repurposed.[632]

5.4.2.2 Marine Facilities Act

The Marine Facilities Act (*Seenanlagengesetz*) governs the construction and use of (and changes to) installations on the German EEZ in so far as these installations are used to produce and transport energy from water and currents or other economic activities, except for installations governed by the Wind Energy at Sea Act.[633] The main purpose of the Act is to provide for planning approval for such

[621] Article 7 Bundesberggesetz.
[622] Article 8 Bundesberggesetz.
[623] Sections 11 to 13 BBergG.
[624] Section 49 BBergG.
[625] Sections 50, 51 and 52(2)(e) BBergG.
[626] Section 18 BBergG.
[627] Sections 132 – 137 BBergG.
[628] Section 133 BBergG.
[629] Sections 3, 26 and 27 Energiewirtschaftsgesetz (BGBl. I S. 1325).
[630] J-C Pielow & H-M Koopmann, Germany, in M.M. Roggenkamp, C. Redgewell, A. Ronne & I. del Guayo (eds), Energy Law in Europe (Oxford University Press 2016), p. 1134; G. Kühne, *BBergG Bundesberggesetz: Kommentar* (De Gruyter 2015).
[631] J-C. Pielow & H-M Koopmann, 'Energy Law in Germany' in M.M. Roggenkamp et al, *Energy Law in Europe* (Oxford 2016), p. 639.
[632] J-C Pielow & H-M Koopmann, *Germany*, in M.M. Roggenkamp, C. Redgewell, A. Ronne & I. del Guayo (eds), *Energy Law in Europe* (Oxford University Press 2016), p. 1145.
[633] Section 1 Seenanlagengesetz.

installations.[634] Such approval is awarded by the Federal Maritime and Hydrographic Agency of Germany (BSH).[635] The BSH is also entitled to establish safety zones around these installations[636] and to supervise the offshore activities.[637] Any disused installation need to be removed in accordance with international (IMO) standards.[638]

5.4.2.3 Wind Energy at Sea Act

Whereas initially the development of offshore wind energy was based on a regime of 'first come, first served' as provided for by the Marine Facilities Act, this changed with the entry into force of the Wind Energy at Sea Act (*Gesetz zur Entwicklung und Förderung der Windenergie auf See*) in 2016. Since then, the development of offshore wind is based on a licensing regime linked to a tendering of designated areas. These areas are designed by the Spatial Planning Act, which designates '*Vorrangsgebiete*' that prioritize an activity (e.g., offshore wind) over all other activities.[639] Applicants can be invited to apply for a licence to produce wind energy in designated areas. The duration and conditions are included in the licence.[640] Since the entry into force of this Act, the number of offshore wind farms has increased considerably. This is also due to the attractive subsidy regime provided by the Renewable Energy Act (*Erneueurbare Energien Gesetz*), which was launched over 20 years ago and provides for a feed-in tariff.[641] Although the Act has been amended regularly since 2000 and most recently on 1 January 2021, no particular changes are proposed regarding the feed-in system.[642] However, this might change in 2023 due to proposed amendments to the Renewable Energy Act.[643]

On 7 July 2022, the Wind Energy at Sea Act was amended to include new criteria for future offshore wind energy tenders.[644] The next two offshore wind tenders are scheduled for June and August 2023 and will offer pre-developed offshore sites and a number of qualitative criteria, including (i) the use of wind energy, (ii) green hydrogen production and (iii) biodiversity protection concerning the installation of the wind turbines. Furthermore, the Act now stipulates that the next six annual tenders of 500 MW of installed offshore wind capacity will require that the licensee will produce offshore wind power for, *inter alia*, the conversion into green hydrogen. This plan is an essential step for promoting green hydrogen.[645]

Initially, offshore wind farm developers had to connect the wind farm to shore themselves. However, since 2006, Germany applies a hub-based approach as a result of which multiple windfarms are connected to one offshore converter station operated by the TSO. The Renewable Energy Act was

---

[634] Sections 2-5 Seenanlagengesetz.
[635] Section 6 Seeanlagensgesetz.
[636] Sections 10 and 11 Seenanlagengesetz.
[637] Section 14 Seenanlagengesetz.
[638] Section 15 Seenanlagengesetz.
[639] Unkown, ‚Spatial Planning Law', (*Umweltbundesamt* 10 January 2018) <https://www.umweltbundesamt.de/en/spatial-planning-law> accessed 10 July 2022.
[640] Section 69 Offshore Wind Energy Act (WindseeG 2017).
[641] Gesetz für den Ausbau erneuerbarer Energien.
[642] K. Appunn, *What's new in* Germany's *Renewable Energy Act 2021*, 23 April 2021 <https://www.cleanenergywire.org/factsheets/whats-new-germanys-renewable-energy-act-2021> accessed 24 January 2022.
[643] Federal Ministry for Economic Affairs and Climate Action, *First rules of new 2023 RES Act enter into force: 'renewable energy first' and higher remuneration for solar*, 29 July 2022 <https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/07/20220729-first-rules-of-new-2023-res-act-enter-into-force-renewable-energy-first-and-higher-remuneration-for-solar-power.html> accessed 15 September 2022.
[644] Adrijana Buljan, ‚Bundestag Passes New Offshore Wind Rules in Germany, Industry Points to Challenges' (*OffshoreWind*, 13 July 2022) <https://www.offshorewind.biz/2022/07/13/bundestag-passes-new-offshore-wind-rules-germany-industry-points-to-challenges/> accessed 4 August 2022.
[645] A. Buljan, 'Bundestag Passes New Offshore Wind Rules in Germany, Industry Points to Challenges', *OffshoreWind*, 13 July 2022 <https://www.offshorewind.biz/2022/07/13/bundestag-passes-new-offshore-wind-rules-germany-industry-points-to-challenges/> accessed 16 September 2022.

amended in 2012 to explicitly oblige the TSO to connect offshore electricity producers to the grid at a point as close as possible to the production facility.[646] Hence, the TSO is responsible for constructing and operating the offshore cable, which requires close coordination between windfarm developers and the TSO developing the cable. The TSO is liable in case the cable is not ready in time.[647]

Pursuant to the Wind Energy At Sea Act, installations need to be removed once a planning permit has lapsed.[648] The BSH may include in the planning permit a request for financial security regarding the decommissioning phase. In case of a transfer of the planning permit, the original permit holder remains responsible for decommissioning until the new permit holder has arranged the financial security for decommissioning.[649] Any removal needs to take into account the interest of the marine environment and existing and planned offshore infrastructure These interests are actually similar to the requirements included in the planning permit, i.e. the marine environment and mining activities if they have priority in that area.[650] Such removal needs to take into account international accepted standards and minimum requirements.[651] It depends on these standards whether any reuse of offshore wind turbines will be possible (see regarding OSPAR section 2.3.2 above).[652]

5.4.2.4 Carbon Dioxide Storage Act

The Carbon Dioxide Storage Act (*Kohlendioxid-Speicherungsgesetz*) aims at ensuring the possibility for permanent geological storage of CO_2.[653] The law regulates the exploration for, the demonstration and permanent storage of CO_2, onshore as well as offshore.[654] It required several legislative attempts to implement the EU Directive on the geological storage of CO_2 in German law.[655] Section 4 of the Act regulates quite extensively piped transportation of CO_2. Thereafter, sections 5-28 of the Act regulate via a permitting regime the exploration for suitable storage sites as well as permanent subsoil storage. Closure and a possible transfer of responsibility to the state are governed by sections 17-20 of the Act. Of special importance is that the Act provides for some important limitations, i.e., permits can only be granted if an application for a CO_2 storage facility has been made by 31 December 2016, storage is limited to 1.3 tons of CO_2 per year and has a maximum storage capacity of 4 tons of CO_2.[656] Last but not least and given the federal structure, it is important to note that individual states (Länder) may enact regional-level laws to prevent CCS activities to take place on their territory.[657] However, carbon dioxide storage in the EEZ is still a federal activity.[658]

---

646 Para 17 Renewable Energy Act and para 28 Wind Energy at Sea Act.
647 Ibid.
648 Section 58 Wind Energy at Sea Act.
649 C.T. Nieuwenhout & M.M. Roggenkamp, 'Legal Framework and Legal Barriers to an Offshore HVDC Electricity Grid in the North Sea', PROMOTioN – Deliverable 7.1, Horizon 2020, June 2017, p. 88.
650 Ibid., art. 48(2)-(4).
651 Ibid., art. 58(2).
652 Article 58(2) Wind Energy at Sea Act.
653 Gesetz zur Demonstration der dauerhaften Speicherung von Kohlendioxid vom 17 August 2012.
654 Section 2 para 4 Carbon Dioxide Storage Act.
655 J. Ch. Pielow, H.M Koopmans, ‹Energy Law in Germany‹, in: M.M. Roggenkamp et all (eds), *Energy Law in Europe*, ed 3dition, OUP, 2016, p. 639,
656 Section 2 para 2 Carbon Diopxide Storage Act. See also Candidate PCI-projects in cross-border carbon dioxide (CO_2) transport networks in view of preparing the 5th PCI-list, <https://ec.europa.eu/energy/sites/default/files/detailed_information_regarding_the_candidate_projects_in_co2_network.pdf> accessed 24 January 2022.
657 Art. 48(4)-(6) Carbon Dioxide Storage Act.
658 E. Meza, 'Economy ministry plans carbon capture strategy', *Clean Energy Wire*, <https://www.cleanenergywire.org/news/economy-ministry-plans-carbon-capture-strategy> accessed 15 September 2022.

More recently, the interest in carbon dioxide storage is changing as more generally it is agreed that such storage is a relevant tool in energy transition and climate change. Therefore, the Minister has announced that he will reassess the current legal framework and in particular will examine the injection of CO_2 under the North Sea and consider financial support for the first major projects, including operating cost subsidies.[659]

5.4.3 Impact of Offshore Energy Law on Developing Energy Hubs

5.4.3.1 Platform Electrification

The issue of platform electrification is less relevant in Germany as there are almost no oil and gas production installations on the German CS. However, there is one example of a cross-border electrification project as already discussed above in section 5.1.3.1.[660] The Riffgat offshore windfarm operated by EWE in the German EEZ will be connected to a gas production installation in block N05-A (GEMS project) operated by ONE-Dyas and which is situated about 1,5 kilometers from the Dutch/German border in the territorial waters. In addition to this cross-border, the wind farm is connected via a cable to the German coast.[661] In other words, the wind farm has two cable connections and is thus acting as a hub.

As the wind farm was licensed prior to the Wind Energy at Sea Act of 2016, the requirement for an offshore connection did not yet apply and the 80-kilometer 155 kV cable is thus connected by Riffgat to the 220 kV grid of TenneT via the Emden substation. [662] As the cable connection is governed by the 'old' regime, there were no legal obstacles for the Riffgat wind park to also be connected to the platform N05-A of One Dyas. The cable will be constructed by One Dyas and operated by Riffgat. However, as discussed in section 5.1.3.1 above, the legal status of this cable is unclear. Although according to German law it could be a direct line as German law[663] does not require that the producer and the consumer are fully isolated, it is doubtful that a cross-border direct line is possible under EU and national law.[664] In general cross-border infrastructure is limited to interconnectors, i.e., cables and pipelines connecting two transmission systems. Therefore, this cable seems to have no legal qualification. Each part of the cable needs to be permitted by the relevant national authorities. In Germany permits have been granted by the Lower Saxon State Department for Waterway, Coastal and Nature Conservation (NLWKN).[665]

5.4.3.2 Hydrogen

In line with the ambitions of the German Government to develop a green hydrogen market as presented in the National Hydrogen Strategy (see section 5.4.1.3 above), one offshore hydrogen project is currently being developed in Germany. In July 2022, the German government stimulated the AquaVentus project,

[659] https://www.cleanenergywire.org/news/economy-ministry-plans-carbon-capture-strategy

[660] A. Buljan, ‚Dutch Gas Platform to be powered by German offshore wind gets go-ahead‘, 3 June 2022 <https://www.offshorewind.biz/2022/06/03/dutch-gas-platform-to-be-powered-by-german-offshore-wind-gets-go-ahead/> accessed 10 August 2022.

[661] EnergyVoice, ‚ONE-dyas gains approval for North Sea's ‚first' wind-powered gas field‘, 3 June 2022 <https://www.energyvoice.com/oilandgas/north-sea/417123/one-dyas-gains-approval-for-north-seas-first-wind-powered-gas-field/> accessed 10 August 2022.

[662] Netzanbindungssystem NOR-0-1; TenneT <https://netztransparenz.tennet.eu/our-grid/offshore-projects-germany/riffgat/> accessed 21 September 2022.

[663] §3 (12) EnWG.

[664] L. Diestelmeier & M.M. Roggenkamp, INTERREG Project Smart Energy Region Emmen-Haren. Current Legal Framework for Cross-Border Local Energy Markets – National Legal Frameworks, 2021, p. 29.

[665] Lower Saxon State Department for Waterway, Coastal and Nature Conservation as founded in 2005. In addition, this information is based on correspondence with OneDyas.

which consists of several subprojects: Aqua Primus, Aqua Ductus and Aqua Sector.[666] The first step is the Aqua Primus project, which involves a 'hydrogen wind turbine'.[667] This installation integrates an electrolyser into the base of the turbine tower. This 15-megawatt unit will be part of a 433 MW offshore wind farm that will be built north of the island of Juist and put into commercial operation in 2026. The 'hydrogen wind turbine' will be connected via a pipeline to Helgoland where the green hydrogen will, *inter alia*, be used for vessel fueling.[668] It is considered as a pilot project in order to demonstrate the technical and commercial feasibility of producing hydrogen at sea.

At the moment a legal framework is still lacking. Although it is envisaged that the new Gas Market Directive[669] will provide some guidance, it remains to be seen how this will impact German developments offshore and in particular a combined 'hydrogen wind project'. However, by contrast to other North Sea states, German law to some extent facilitates these developments. First, the wording of the term '*Sonstige Energiewinnungsanlagen*' of para. 44 of the Wind Energy at Sea Act is so broadly phrased that it can apply to a combined 'hydrogen wind project'. Therefore, this project can be awarded a permit under this Act.[670] Another question relates to the pipeline connecting the turbine to shore. The Energy Industry Act defines a hydrogen network as 'a network supplying customers exclusively with hydrogen, which is not designed to a specific category of customers, but is open for the supply of every customer, regardless of the diameter.[671] Further rules regarding hydrogen networks are included in paras. 28 j – 28q of the Energy Industry Act and primarily provide for unbundling of networks from hydrogen production and supply, network connections and third-party access. A hydrogen pipeline operator can request for an exemption of these rules. The *Wasserstoffnetzentgeltverordnung* (H2NEV) entered into force on 1 December 2021 and regulates access fees for hydrogen networks. The pipeline connecting the combined hydrogen wind turbine to the coast of Helgoland can be considered a hydrogen pipeline but at the beginning it will serve one producer and a very few consumers. It can be assumed that the operator will request for an exemption of the rules of unbundling and TPA.

5.4.3.3 CO_2 Transport and Storage

As oil and gas production in Germany is very limited, and even more limited offshore, the potential to store CO_2 offshore is thus not a real viable option. Deep saline aquifers have in fact the largest potential for CO_2 storage in Germany.[672] Given the absence of proper offshore storage faciltiies and the relatively small size oif the German CS/EEZ, it is not surprising that parties increasingly consider CO_2 storage outside Germany and in other parts of the NSA such as Norway.[673]

---

[666] AquaVentus, 'Study illustrates clear advantages of hydrogen production at sea', 2 June 2022 <https://aquaventus.org/en/press-releases/study-illustrates-clear-advantages-of-hydrogen-production-at-sea/> accessed 15 September 2022.

[667] The Aqua Ductus project aims at developing an offshore hydrogen pipeline system and the AquaSector project aims at constructing a large-scale offshore hydrogen park in the German EEZ. See also https://www.rwe.com/en/research-and-development/hydrogen-projects/aquaventus.

[668] Maritime Executive, ‚Germany's Wind Industry Calls for 10GW Offshore Green Hydrogen Target', 2 June 2022 <https://maritime-executive.com/article/germany-s-wind-industry-calls-for-10gw-offshore-green-hydrogen-target> accesed 11 August 2022.

[669] Proposal for a Directive of the European Parliament and of the Council on common rules for the internal markets in renewable and natural gases and in hydrogen, COM/2021/803 final.

[670] Notably, this may apply to very small areas. However, the definition will be expanded when the amended para 65 of the new Renewable Energy Sources Act will enter into force in 2023.

[671] Para. 3 EWG

[672] BGR < https://www.bgr.bund.de/EN/Themen/Nutzung_tieferer_Untergrund_CO2Speicherung/CO2Speicherung/FAQ/faq_inhalt_en.html?nn=7981658#:~:text=The%20storage%20capacity%20of%20depleted,75%20Gt%20(billion%20tons).> accessed 20 September 2022.

[673] See https://www.gasworld.com/germanys-first-co2-hub-planned-for-bremen/2022849.article and https://www.offshore-energy.biz/wintershall-deas-hydrogen-and-ccs-project-to-support-wilhelmshaven-energy-hub/

On 22 August 2022, the companies Wintershall Dea (Germany) and Equinor (Norway) announced that they aim at developing a CO_2 transport and storage project connecting the German harbour of Wilhemshaven with a storage site on the Norwegian CS.[674] This project consists of a 900 kilometer long pipeline (NOR-GE Pipeline) with a capacity of 20-40 million tonnes CO_2 per year and some storage sites on the Norwegian CS, which can store some 15-20 million tonnes CO_2 per year. Wintershall Dea and Equinor plan to jointly apply for the necessary offshore storage licences.[675] The NOR-GE pipeline will be desinged as an open access pipeline as requirted by the EU Directive on geological storage (see section 3.2.5 above). Although not explicitly stated, it can be assumed the same will apply to the storage facility as the project aims at facilitating European CO_2 emitters. As it can take about 10 years to develop the pipeline, the parties will also consider shipping the captured and collected CO_2 to the storage sites. At the moment this will still be hampered by the provisions in international law considering cross-border shipment of CO_2 as dumping (see section 4.1.3 above).

As this project has been recently announced, there is little known about the legal framework that might regulate the project. It may be that use can be made of the international agreements concluded eralier for transporting oil and gas from the Norwegian CS to Germany such as the Norpipe (a pipeline connecting the Ekofisk field in Norway with Emden in Germany) and Europipe (two pipelines connecting directly and indirectly the Draupner field in Norway with Dornum in Germany). The construction and operastion of these pipelines is based on a bilateral treaty between Norway (as the sending State) and Germany (as the receiving State).[676] Potentially these treaties can serve as an example to create a legal basis for developing the NOR-GE pipeline, altough in this case Norway will be the receiving State.

5.4.4 Interim Conclusions

The situation in Germany differs from the other three North Sea states as the offshore oil and gas exploration and production activities are extremely limited in scope. This, thus, excludes two national hub functions: platform electrification and CO_2 transport and storage on the German CS. By contrast, Germany has developed on a large-scale offshore wind farms. Since 2016 these wind farms are connected to a converter station acting as offshore electricity hubs. As the German government aims at developing a green hydrogen sector, the output of offshore wind farms will be used increasingly for producing hydrogen, also offshore. German legislation seems to support this development.

The absence of an offshore oil and sector has also resulted in scenarios where some of the hub functions are being applied internationally, both with regards to cross-border electrification (relevant for Hub East) and cross-border CO_2 transport and storage. The example on platform electrification presented in this study involves a wind farm permitted before 2016. Although permissible, the qualification of the cable is unclear. Moreover, it can also be questioned whether cross-border platform electrification is feasible for German wind farms permitted after 2016 given the requirements of the planning permits and the need to be connected to an offshore converter station.[677] Another cross-border example relates to the plan to store CO_2 in geological formations on the Norwegian CS. Both cross-border developments require some harmonization of national laws, which may be facilitated by an international or bilateral agreement.

---

[674] See for a brief overview of this project https://www.offshore-energy.biz/two-oil-gas-firms-to-develop-ccs-project-that-connects-germany-norway/ (accessed 20 September 2022).

[675] J. Gazendam & M.M. Roggenkamp, 'Legal aspects of reuse of offshore hydrocarbon infrastructure for CCS', Align CCUS – Deliverable 3.3.4, May 2020, p. 22.

[676] See also M.M. Roggenkamp, ‹Petroleum Pipelines in the North Sea: Questions of Jurisdiction and Practical Status‹, Journal of Energy and Natural Resources Law, 1998, 16(1), p. 92-p.109 and I.A. Siddiky, ‹The International Legal Instruments for Cross-Border Pipelines ‹, in K. Talus (eds), *Research Handbook on International Energy Law*, 2014.

[677] Article 17b of the Energy Act.

5.5 Legal Comparison

5.5.1 Introduction

In the above we have discussed developments in four different North Sea states. First, the Netherlands as this is the starting point for the study. Thereafter we have discussed the UK, Denmark, and Germany as each of them is bordering the North Sea and close to one of the hubs (Hub West, Hub North, and Hub East) as identified in WP1. Given this hub-based approach the prime focus of this study is the North Sea and how the North Sea can facilitate a process of energy transition. Therefore, the analysis of each North Sea follows a similar pattern. After a short introduction, we present the energy and climate goals of each coastal state and this is followed by a brief overview of the country's policy framework in general and, if possible, regarding the North Sea. Then, we briefly present the legal framework relevant for developing offshore energy projects, ranging from oil and gas exploration and production to offshore wind energy developments. Subsequently, we discuss how each North Sea state approaches the three hub functions identified for this study. The offshore oil and gas sector is potentially a challenge for meeting existing climate goals. One of the possibilities to reduce offshore CO_2 emissions is the electrification of offshore production installations. A typical 'green' electrification would be to connect offshore wind farms to offshore oil and gas production platforms. This might be an attractive solution given the rise in offshore electricity production from wind energy. Given the expected large increase of offshore wind and a potential lack of export cables bringing the electricity to shore, an alternative might be to convert electricity offshore to hydrogen and transport green hydrogen to shore. Finally, in many North Sea oil and gas producing countries, production has past its peak as a result of which reservoirs will be closed and installations decommissioned. We will, therefore, discuss the way in which the selected North Sea states approach this process of decommissioning and potential reuse as the latter may also function as a means to energy transition, for example, in relation to carbon dioxide storage. By comparing these developments, we hope to be able to draw some lessons from national experiences.

5.5.2 Overview National Developments

All four North Sea countries have signed the Paris Agreement and have committed themselves accordingly. In addition, most North Sea countries, except for the UK, are bound by the EU energy and climate goals. Despite Brexit, the UK goals are currently still largely in line with the EU goals. This means that all countries aim at becoming carbon neutral by 2050 and Germany even earlier by 2045. Regarding the renewable energy targets, the Netherlands is aiming for a renewable energy share of 27% by 2030 (against gross final energy consumption), Germany of 30% by 2030, Denmark of 55% by 2030 and the UK of between 22% and 29% by 2030.[678] Furthermore, the NECPs all reiterate the importance of offshore wind in reaching these goals.

When comparing the four North Sea states we note the following. The Netherlands, the United Kingdom and Denmark are engaged in exploration and production of oil and gas offshore. Germany is the exception as it hardly has any oil and gas projects, and the existing and prospective projects are primarily taking place in the territorial waters. All countries have transposed the EU Hydrocarbons Licensing Directive in their national laws and, consequently, the national regimes are to a large extent comparable.

---

[678] Ministry of Economic Affairs and Climate, *Integrated National Energy and Climate Plan*, < https://energy.ec.europa.eu/system/files/2020-03/nl_final_necp_main_en_0.pdf> p. 8; Integrated National Energy and Climate Plan Germany <https://energy.ec.europa.eu/system/files/2022-08/de_final_necp_main_en.pdf> p. 42; Danish Ministry of Climate, Energy and Utilities, <https://kefm.dk/media/7095/denmarks-national-energy-and-climate-plan.pdf> p. 35; Department for Business, Energy & Industrial Strategy, *The UK's Integrated National Energy and Climate Plan* < https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/991649/uk-integrated-national-energy-climate-plan-necp-31-january-2020.pdf> p. 42.

The approach of the three oil and gas producing countries differs, however, regarding the future of oil and gas production. Whereas Denmark has decided (by law) to terminate oil and gas production by 2050 (the date they aim at being carbon neutral) at the latest, UK's policy is to try to produce as much and as long as possible. The Netherlands has not voiced a particular policy in this regard, although the war in Ukraine has led to more and renewed interest in offshore exploration and production. Apart from this, oil and gas production in these countries has passed its peak and, consequently, an increasing number of oil and gas reservoirs will be depleted and need to be closed. Although all countries are bound by general standards in international law (UNCLOS and OSPAR), their approach differ. By contrast to the UK where any decommissioning plan needs to include options for reuse, Dutch law does not explicitly refer to reuse. In Denmark, decommissioning has received very little attention so far.

More recently, all four North Sea countries have committed heavily on the development of offshore wind energy. The approach of the countries has changed over time. Whereas the Netherlands and Germany to start with applied a 'first come, first served' policy, the UK and Denmark have always applied a regime consisting of selecting designated areas, which then were offered to the market on a competitive basis. Licenses are awarded for a specific period of time, usually a period that aligns with the technical lifespan of the wind turbines (approximately 20 to 25 years).[679] The number of wind farms has increased exponentially during the last decade. Given the increasing number of wind farms and the limited life span of turbines and period of licences, the issue of decommissioning wind turbines will become relevant. The national policies differ and vary from including provisions in the planning instruments (e.g., the Netherlands and Netherlands) to provisions in the relevant law (e.g., UK). The most important difference at the moment is how these countries govern transport to shore. The UK has opted for appointing, on a competitive basis, private parties to operate the offshore grid (OFTO). These OFTO's are considered as transmission system operators. The regime in the three other North States is that the onshore transmission system operator is obliged to connect the wind farms offshore, *i.e.*, to extend the onshore transmission system to the EEZ. In case of Denmark, the TSO Energinet (and its predecessor) has always been responsible for constructing and operating the electricity and gas transmission system in the EEZ/on the CS. For the Netherlands and Germany, this is a new development and has applied since 2016 and 2012 respectively. It entails that several wind farms will be connected to one offshore converter station, which then in itself becomes an offshore electricity hub. The Netherlands has introduced an exemption to this rule as a result of wind farm developers may also opt for a connection to another installation.

Apart from these existing developments, new energy projects are being developed. All four coastal states foresee that large scale offshore electricity production may require alternative solutions such as a possible conversion to hydrogen. Similarly, the option of carbon dioxide storage offshore (in or outside their own EEZ) is considered by these coastal states. Finally, a completely new development is taking place, namely the possibility to construct an offshore artificial island. So far, Denmark is the only North Sea state that has developed a piece of legislation enabling the construction of such an island.

5.5.3 Platform Electrification

Platform electrification is one option to limit CO_2 emissions from oil and gas production platforms. Although there are several ways in which such electrification can take place, this study has examined existing and planned projects focusing on the connection of an offshore wind farm to an offshore oil and/or gas production installation. Although there is a keen interest, so far there is little practical

[679] A. Philipps, 'How Long Do Wind Turbines Last? Average Lifespan Explained', *Energy*, 14 January 2022 <https://energyfollower.com/how-long-do-wind-turbines-last/> accessed 20 September 2022.

experience with platform electrification. Given the absence of any practical experiences with this type of platform electrification, legal qualifications of such a cable do not (yet) exist. When considering existing qualifications, it looks most like a direct line (e.g., a cable connecting one producer and one consumer).[680] The extent to which this qualification applies to the CS and EEZ also depends on the applicability of the national laws governing direct lines offshore.

In the UK, the North Sea Transition Authority announced in June 2022 that they will financially support pilot projects aiming at demonstrating that the offshore petroleum industry can be supplied by offshore standalone power systems using renewable electricity. There is no mention of the governance of such cable. Given the requirement of involving OFTOs to connect offshore wind farms to shore, it is unclear how to qualify this line. It will anyway require a license pursuant to the Energy Act. Denmark has recently published a strategy regarding platform electrification. It looked at a few offshore installations that were considered suitable for electrification, either from shore or the planned energy island or from wind farms in or outside the Danish EEZ, including some hybrid options. A direct connection between a wind farm and an offshore platform without a hybrid solution was not considered as most favorable option given the lack of supply reliability. However, the cable is considered a direct line. The Netherlands and Germany have gone one step further and are planning a cable between a nearshore wind farm in Germany and a nearshore gas production platform in the Netherlands. Although the cable could be considered as a direct line, EU and national law do not allow for cross-border direct lines. Moreover, the German wind farm has been licensed before the entry into force before the new regime requiring clustering of offshore wind farms to one offshore converter station and transmission line. It is doubtful whether a similar approach is possible for wind farms licensed under the current regime. Although Dutch law is based on the same principle, a recent amendment allows for alternative cable connections and thus the construction of a direct line.

5.5.4 Offshore Hydrogen

The development of offshore hydrogen production is in even less advanced stage. From a legal perspective it is more complicated as a common EU legal framework has not yet been put into place. However, each coastal state is actively considering the possibilities. In the UK, a pilot project of the coast of Aberdeen has been announced. It aims at siting an electrolyser directly onto an existing operational wind turbine and pipe the hydrogen to shore.[681] A similar project is being developed in Germany and envisaged in the Netherlands. All three projects have in common the need to qualify such a combined wind and hydrogen installation. Does existing definitions of the concept 'wind turbine' allow for such an extended or ancillary service? So far, only the German Wind Energy at Sea Act seems to provide for such a broader scope. However, the UK Gas Act 1986 provides space for hydrogen production given that 'hydrogen' is incorporated in the definition of gas. In addition, in Denmark the ongoing discussions about offshore hydrogen seem to focus on the possibility to install electrolysers on the (new) artificial energy land in the Danish part of the North Sea. As the current law only governs the development and construction of such artificial island via a tendering system, there are no rules yet regarding the use of the island.

5.5.5 Carbon Dioxide Transport and Storage

Carbon dioxide transport and storage is a more straightforward option as all North Sea states have implemented the EU Directive on geological storage. Hence, more or less similar rules apply to the four

---

[680] Article 7 Electricity Directive.

[681] Vattenfall, *World's first hydrogen-producing offshore wind turbine gets 9.3 million pounds funding boost*, May 2022, <https://group.vattenfall.com/uk/newsroom/pressreleases/2022/aberdeen-hydrogen> accessed 5 August 2022.

coastal states discussed in this project. One of the main differences is that the Netherlands and the UK have been considering carbon capture and storage for a long time, even before the entry into force of the EU directive. For similar reasons, the focus of both countries is now on offshore storage (e.g., suitable locations and less public opposition). It is thus not surprising that some pilot projects are in an advanced stage of development. Nevertheless, the UK has changed its approach and instead of relying on private parties' initiative it has now launched a tender, inviting parties to apply for an exploration and storage license. Denmark and Germany have been more hesitant as regards CO_2 storage. Whereas Denmark at first wished to await the outcome of pilot projects in other EU member states and Germany was in general quite opposed to this technique, the situation has now drastically changed. By contrast to Denmark, however, Germany has no depleted oil and gas fields offshore that can be used for carbon dioxide storage. Nevertheless, concrete examples of attempts to transport and storage CO_2 can be found in both countries. The Danish Energy Agency is in the process of tendering the capture and storage of CO_2 in a predefined area of the Danish part of the North Sea and two commercial parties (Wintershall Dea and Equinor) are planning to develop a joint project where CO_2 will be transported from a German harbor (Wilhemshaven) to storage sites in the Norwegian CS. The pipeline (and storage facility) will be developed as open access facilities. This will be the first cross-border transport and storage project in the NSA. At the moment, the facilitating legal framework still has to be developed. One of the questions is whether the government of both parties will be involved and aim at concluding a bilateral agreement similar to the agreements used to transport oil and gas from the Norwegian CS via pipelines to Germany.

In general, we can note that projects increasingly are designed as open access projects instead of some designated capturers apply for a CO_2 storage permit offshore. Following this open access approach, it is likely that several CO_2 suppliers will be interested in offering CO_2 to the company or companies transporting CO_2 to the offshore storage facility. Therefore, the location where these CO_2 suppliers will offer their commodity can in fact be considered as "an effective center of an activity, region or network" and thus a CO_2 hub.

5.5.6 Assessment

In the introduction we stated that the objective of this report is to go beyond a general analysis of system integration and focus, in particular, on how the development of 'energy hubs' will stimulate system integration and possibly, *vice versa*, how system integration will be a prerequisite for developing energy hubs. The Oxford Dictionary defines a 'hub' as "an effective center of an activity, region or network". Work package 1 defines 'energy hubs' as:

> *'Multi-carrier (both electrons and differing molecules) offshore energy systems consisting of production, conversion and/or storage. [...] These energy hubs are connected to the shore via national (transport) cables or interconnected internationally.*[682]

Although more broadly phrased, this definition may include several activities and networks taking place in a specific area and thus fulfill the requirement of a (energy) hub. According to WP 1, these energy hubs are 'search areas' for offshore system integration opportunities. The concept of 'system integration' has been defined in North Sea Energy 2 as:

[682] More details on the hub locations can be found in D1.1. The phrase 'search area' should not be mistaken for the term as used in the Wind Energy at Sea Act.

> *"a process of integration between various stages and players of the energy value chains, between various energy carriers, between actors in the value chains and with adjacent sectors in the system, as a consequence of which solutions to bottlenecks are being offered and as a consequence of which opportunities arise for new products and services."*[683]

This definition is in line with the 2020 EU Strategy for Energy System Integration, which describes 'energy system integration' as:

> *the planning and operating of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors, by creating stronger links between them with the objective of delivering low-carbon, reliable and resource-efficient energy services at the least possible cost for society.*[684]

The key element of system integration is that it links previously separated stages, players, energy carriers and adjacent sectors through innovative methods into one large energy system. In other words, is it possible that the three functional energy hubs assessed in this study, are an example of linking separate stages, players, carriers, and adjacent sectors, and separately or together provide for system integration?

In this work package we have assessed the legal approach of the Netherlands, the United Kingdom, Denmark, and Germany regarding offshore energy projects. This entails that we have examined the existing legal framework and how this applies to or impacts the three functional hubs identified earlier (see section 4.1 above). We have concluded that the development of these functional hubs has the interest of governments, policy makers and industry but at the same time these hubs are being developed slowly, as is shown by the overview below:

[683] See Deliverable 1 of NSE2.

[684] Committee on Industry, Research and Energy, *Report on a European strategy for energy system integration*, 2020.

	Platform electrification	Hydrogen	CCS
The Netherlands	2024 (platform)	Unknown	2024
United Kingdom	2024	2025	2025
Denmark	Unknown	2030 (if on an artificial island)	2025
Germany	2024 (cable)	2026	Unknown

We also conclude that in some cases the slow progress is the result of legal barriers and/or legal uncertainties. Platform electrification may depend on an exemption to the general rule that a wind farm directly or indirectly has to be connected to the transmission system. There may also be some uncertainty on how to qualify a cable connecting a wind farm with a platform. Offshore hydrogen production may be hampered by uncertainty about the concept of a combined wind hydrogen turbine and/or the absence of a clear legal framework governing the development of offshore hydrogen installations and qualifying the pipeline bringing the hydrogen to shore. The development of carbon dioxide transport and storage is less complicated but still some uncertainty may exist if use is made of (almost) depleted reservoirs and installations. Is reuse possible and how does reuse liaise with decommissioning rules and liabilities? In addition, if CO_2 is transported across borders and use is made of open access pipelines, it may be necessary to make use of bilateral agreements.

Nevertheless, each of these three functional hubs link previously separated stages, players, energy carriers and/or adjacent sectors. However, is this always a matter of system integration? In case of platform electrification, the oil and/or gas production installation becomes an electricity consumer. This in itself is not a new development and therefore maybe not to be considered as system integration. Offshore hydrogen conversion is maybe the best example of system integration as it really combines previously separated stages, players, energy carriers and/or adjacent sectors. As at the moment a proper legal framework is lacking, legislators need to take into account the elements of system integration. Having an integrated Energy Act instead of a separate Electricity Act and Gas Act may be beneficial but will probably not be sufficient, especially if such developments take place offshore where separate Acts may apply (e.g., Wind Energy at Sea Acts). Another interesting example is the development of offshore artificial energy islands. So far Denmark has drafted a separate law enabling the construction of such island. It is less clear how and by whom such islands will be used and how this will be regulated? In case of multi-use, an integrated approach will be required.

Thus, it can be concluded that a clear definition of system integration is necessary, including some guidance when a development should be considered as system integration. This either requires an integrated approach or guidance on when a development can take place within the existing legal framework, albeit with some minor changes and clarifications.

6. Conclusion

The report sought to provide a legal analysis regarding offshore system integration and whether the development of 'energy hubs' stimulates this process. This report shows that existing legal frameworks of the selected North Sea States, namely the Netherlands, the United Kingdom, Denmark, and Germany, need some amendments in order to facilitate the following hub functions: platform electrification, offshore hydrogen production and carbon capture and storage.

The report analyzed the powers of the Netherlands, the United Kingdom, Denmark, and Germany offshore, *i.e.*, in their territorial sea, on their Continental Shelf and in their Exclusive Economic Zone. These states have full sovereignty in their territorial sea and the exclusive right to produce energy on the CS/in the EEZ as long as they take into account other obligations under international law such as the protection of the marine environment and the freedom of navigation and fishery but also the freedom to lay cables and pipelines. The latter freedom needs to be balanced with the exclusive right to develop cables and pipelines that are subject to a coastal state's sovereign rights. Although in general the national legislation of the North Sea states is increasingly influenced by EU law, so far there is no legal framework governing offshore energy system integration. Although the European Green Deal provided for the first time in 2020 a policy strategy on system integration, it remains to be seen whether or when this policy will become part of EU law and thus binding on Member States.

All four North Sea states have signed and ratified the Paris Agreement and have committed themselves accordingly. The three functional energy hubs play a role in reaching national climate change goals and reducing CO_2 emissions. However, in order to facilitate these hubs, some legal obstacles need to be addressed. In case of platform electrification, it will be necessary to be exempted from the general rule that a wind farm has to be directly or indirectly connected to the transmission system. In addition, the cable connecting a wind farm and platform requires a legal qualification. Offshore hydrogen production may be hampered by uncertainty regarding the concept of a combined wind hydrogen turbine and/or the absence of a clear legal framework governing the development of offshore hydrogen installations and qualifying the pipeline bringing the hydrogen to shore. In addition, although the development of carbon transport and storage is legally less complicated, still some uncertainties exist if (almost) depleted reservoirs and installations are reused. Nevertheless, carbon dioxide storage is clearly an important technique to reduce CO_2 emissions and important for industries who have no or limited means to otherwise 'go green'.

System integration is defined as a process of integration between various stages and players of the energy value chains, between various energy carriers, between actors in the value chain and with adjacent sectors in the system. This definition is quite broad and therefore it is helpful to consider how the development of energy hubs may facilitate this process. However, when considering platform electrification, we conclude that it results in a situation where oil and/or gas production installations become electricity consumers. It could thus be argued that system integration as such is not a new concept given that, for instance, gas can be used to generate electricity. It is also questionable whether carbon capture and storage in itself can be viewed as a means of system integration given that CO_2 is not an energy carrier and that it neither is directly or indirectly linked to another commodity. Nevertheless, the storage and transport of CO_2 may be part of an extensive network of pipelines and storage reservoirs and as such play a role in system integration, especially when considering the different legal regimes governing reuse and transport. Hydrogen conversion and the construction and use of artificial energy islands are the best examples of system integration as they are new developments and clearly combine previously separated stages, players, energy carriers and/or adjacent sectors. Given the above uncertainties we find that a clear and more precise definition of system integration is desirable and/or that the definition at least should be accompanied by some further guidance on when a development or project should be considered as system integration.

North Sea Energy offshore system integration

In collaboration and appreciation to

TNO
New Energy Coalition
Rijksuniversiteit Groningen
Royal HaskoningDHV
NEN
Energieke Communicatie
MSG
TKI Nieuw Gas
Total Energies
Shell
NAM
EBN
Gasterra
Gasunie
ONE-Dyas
Bilfinger Tebodin
DEME Offshore NL
Boskalis
Neptune Energy
IV Offshore & Energy
Bureau Veritas
HINT Europe
NGT
NOGAT
Peterson Energy
Port of Den Helder
Port of Amsterdam
Port of Rotterdam
SmartPort
Element NL
Equinor Energy
Net Zero Technology Centre

Sounding board

Dutch Marine Energy Centre
Ministerie Economische Zaken & Klimaat
IRO
Stichting Natuur & Milieu
Nexstep
Stichting Noordzee
NWEA
Tennet
TKI Wind op Zee
Visned
Rijkswaterstaat
Topsector Energie
BOZ

North Sea Energy

offshore system integration