Essay

The current and potential energy exchange relations

between the Northern Flank of Europe and Northwest Europe

Essay on the current and potential future energy exchange relations between the Nordics and Baltics (Northern Flank of Europe, NFoE) and Northwest Europe, and the Netherlands in particular.

Some reflections on: why the role of NFoE area as future suppliers of clean energy seems underexplored; why its potential role to deliver clean, reliable and affordable energy is considerable; and how this role could be enhanced via joint actions.

Authors

Catrinus J. Jepma
Prof. em. University of Groningen
senior advisor New Energy Coalition

Miralda van Schot
Strategy advisor
Port of Amsterdam

This essay was commissioned to New Energy Coalition
by Topsector Energie (Energy Innovation NL), 2024

2024.V1

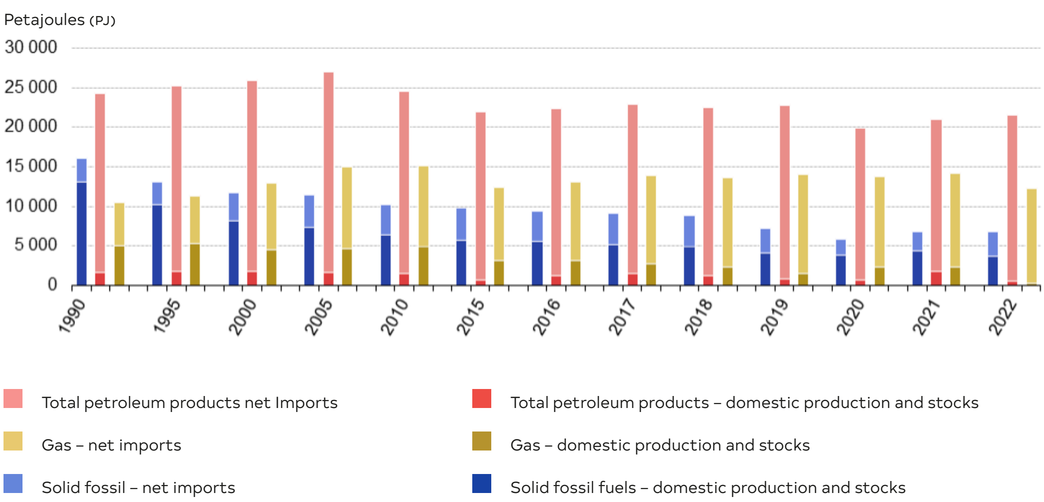
Introduction

EU Energy import dependence

The EU as a whole faces a formidable triple energy transition challenge: to switch from a primarily fossil-based energy and feedstock system to a carbon neutral system by 2050; to considerably improve its security of supply of energy especially since the Ukraine crisis revealed its vulnerability for hiccups in external supply; and to secure affordability of energy since energy poverty revealed itself during the last years even in the highly industrialized member states including the Netherlands. This related set of challenges is reinforced by the fact that the EU cannot satisfy its demand for energy from its own sources, simply because of a lack of energy sources on its own territory even if renewables dominate, and therefore is and will remain import dependent (usually defined as the ratio between net imported total of energy and total energy use in PJ). In fact, the traditionally already quite **high level of energy import dependence of the EU (1990: some 60%) has further increased recently to levels in the order of 75%, mainly due to much larger levels of natural gas imports (see also figure 1)**. That is why after Russia's invasion of Ukraine the REPowerEU package was adopted in May 2022 aiming a.o. to reduce import dependence and involving targets such as raising both own production and import capacities of hydrogen to levels of 40 GW by 2030, each generating some 10 mln. tonnes of hydrogen.

Figure 1: **EU energy import dependence 1990 – 2022**

Note: the upper stack of each column shows net imports with respect to gross inland energy consumption (including international maritime bunkers), which is represented by total column height Source.· Eurostat (online data code: nrg_bal_s)



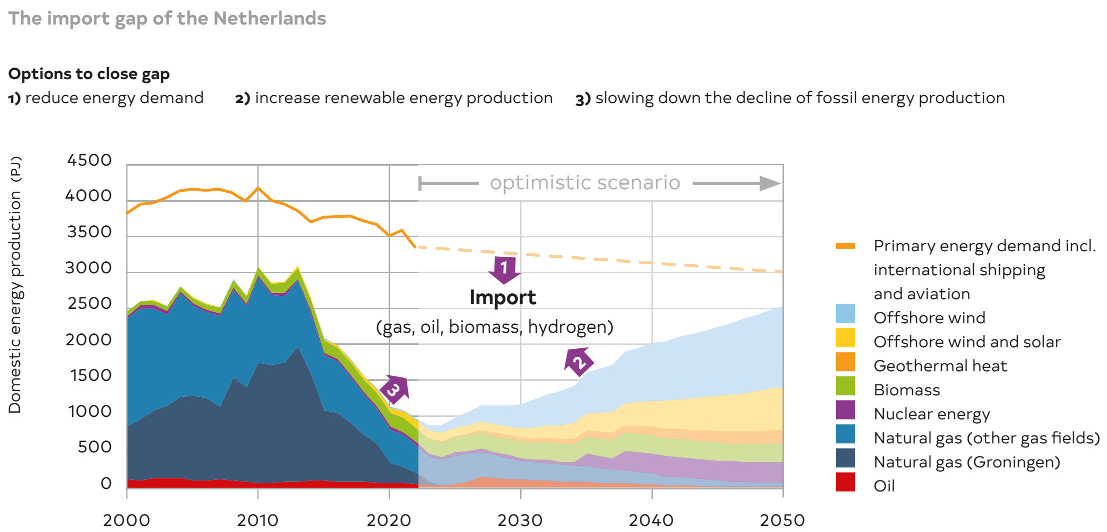
Source Eurostat, 2024a

So, it is realistic to assume that, just like in the past and in the greener decades ahead, **a considerable share of future EU member states' energy use will need to be covered by imports**. Moreover, future energy imports have to be carbon neutral, reliable and affordable to serve the traditional mix of energy policy targets and may therefore need to be sourced from other groups of suppliers than the traditional fossil ones thereby raising the strategic issue of developing energy diplomacy and issues such as what potential energy supplying regions to focus on. This may involve a shift toward more imports from within the EU to reduce security of supply concerns. Current non-energy exporting countries may develop into new players in the field of energy trading shifting trading balances within Europe.

Netherlands' energy import dependence

The general picture of **energy import dependent EU even more so holds for the Netherlands,** especially since natural gas production from the Groningen field strongly declined to be terminated this year. Although the expansion of national renewable wind and solar capacities have been considerable and are projected to increase much further, total national demand for energy sources is very unlikely to become completely covered by domestic energy sources in the near future. In fact, recent data and projections published by EBN (2024), suggest that **the energy import dependence of the Netherlands since 2000 has never been larger than nowadays (some 75%** of 3300 PJ primary use including international shipping and airflight), and will still be present, although at a much lower level (some 15-20% of 3000 PJ primary use), **by 2050** (see figure 2).

Figure 2: **Dutch energy import dependence 1990 – 2021.**



Source : EBN, 2024

Moreover, **imports of energy** typically flowing through the Dutch ports so far **to a considerable extent have served as throughput towards Germany, Belgium, UK and further surrounding countries**. If the traditional energy trading and transit hub function is to stay – which is highly desirable – part of the national economic activity in the future, **a considerable part of the future domestic energy imports will remain not being available for meeting domestic energy and feedstock demand**.

The potential role of Nordics and Baltics as net energy exporters

So, during the last few years the Netherlands government introduced several initiatives aiming for future green energy and particularly hydrogen, hydrogen carriers and biofuel imports from various potential sources abroad. For that reason, bilateral contacts have been established with several countries in especially Latin America, Africa, South of Europe and the Middle East to explore if future hydrogen (or hydrogen derivatives) imports may be feasible from sources in these countries. **In the general search for new sources of hydrogen for imports, however, so far,** with some exceptions (e.g. two regional trade missions from Groningen to Scandinavia in 2023), **relatively modest, albeit growing, attention has been given in trade missions etc. to the potential deliveries from the suppliers from the North Seas, i.e. the Nordics and the Baltics.** The limited policy attention for the Northern region as energy supplier also from the European perspective is illustrated in the text of art. 8 of the EU Green Deal dealing with green energy imports from non-EU countries, where an explicit reference is made to the Southern and Eastern neighbouring countries, but not the Northern non-EU ones (Norway, UK and Iceland) (European Commission 2019).

In fact – and unlike the energy import dependent character of the EU, the Netherlands and much of the rest of Europe – the energy situation is traditionally quite different in what could be called the **Northern flank of Europe (NFoE),** i.e. the Nordic and Baltic Seas areas both onshore and offshore. These areas on the whole: are much less densely populated than the industrial centre areas in Northwestern Europe and elsewhere; have large shares of renewable energy in their domestic energy nmix and especially the Nordics are (much) closer to self-reliance in energy terms; and have considerable resources (for exports) of biomass (forests, Sweden Finland, Baltics); wind (onshore Denmark, Finland, and offshore especially Norway, Denmark); and sometimes also large hydro and natural gas and CO_2-storage capacities (Norway). Some of these countries, with Norway being the clear champion, therefore already developed a serious low carbon export position to typically service energy demand from Northwestern Europe, part of which runs via the Netherlands' ports.

The issue

What role can the Nordics and Baltics play as clean energy suppliers of the Netherlands and surrounding countries (and Germany in particular)?

All this raises a number of strategic energy policy questions on how in energy diplomacy to relate to this 'clean-energy-well-endowed Northern Flank of Europe', consisting of the Nordics and Baltics. **How much clean energy could eventually commercially be imported via the Netherlands from the NFoE;** in what form (electricity, hydrogen, ammonia, methanol, LOHC, biomass); via what transport (and storage) modes; **and against what relative conditions** in terms of carbon neutrality, security of supply/reliability and affordability? In answering that question, it also needs to get clearer how the future NFoE energy delivery conditions compare with those from (much) further away non-EU prospective sources such as the Middle East, Latin America, US, Australia, etc.

In the assessment the assumption will be made that the Netherlands' energy system will eventually keep being based on **molecules and electrons in about equal proportions** (currently about >80% - <20%). Energy molecules will in any case be needed for feedstock purposes, and for industrial high temperature processes and heavy transport, and may show the best business cases in many other applications due to their relatively low transport and storage costs, extensive existing grid, and high energy density compared to power. It is also assumed that the Netherlands, in trying to meet its demand for energy by way of power, will get this predominantly from its own, increasingly offshore-based, renewable electricity production. Electricity transport and storage costs are simply too high to justify much electricity imports from faraway sources but could – due to the relatively small distances – be derived from the NFoE areas, and in fact already is (e.g. in the case of the Netherlands via the NorNed, and Cobra cables). Also, the current EU additionality rules forcing green hydrogen production to use power from additional power capacities from the same bidding zone only may – as long as they will stay in place – have an impact by complicating and slowing down own green hydrogen production investment thereby increasing the need to import carbon neutral energy/feedstock molecules. **Most of the imports of energy** therefore **is likely to predominantly be by way of energy molecules, partly to be converted into low carbon hydrogen, entering via our seaports or interconnecting gas pipelines**.

Essay structure

All these issues will be addressed in this essay to sketch what role the NFoE area can play in the Netherlands future energy imports. In doing so, we will first shortly address the issue of how the energy trading relation between the Netherlands and the NFoE area developed so far (section 1). Next the issue will be discussed what the NFoE clean energy export potential can look like: how much energy could these regions generate for exports in the future; and why would the Netherlands be advised to direct part of its clean energy import demand to these areas rather than others? In doing so, we will also consider the main types of clean energy trade flows that could be considered: low carbon and green hydrogen and its derivatives, biomass, and power. What could the roles of each of these be, how are they interrelated, and what kind of mutual relations between the NFoE and the Netherlands would each of them require (section 2)? Next, we will discuss what the future energy nexus between the Netherlands and the NFoE area may involve in terms of common challenges, and require in terms of collaboration and coordination agreements, contracting and broader bilateral agreement, rules and regulations, etc. (section 3). Finally, some concluding remarks and possible joint initiatives are mentioned for further consideration (section 4).

The analysis will be based on desk research on statistical data and qualitative information on the issues, and on a few interviews with energy experts from the various countries. The focus will be on the broad picture rather than providing an extensive picture covering as much details as possible of the actual and possible energy trade relations between the Netherlands and NFoE area.

1 Energy trade balance

1.1 Existing energy trade position of the NFoE

Traditionally the Nordic countries already played some role as energy suppliers to the Netherlands and more generally Northwestern Europe. An extensive overview of the policy landscape and market opportunities of the individual Nordic countries has been published by RVO (2023) providing detail information on the current energy balances and hydrogen export ambitions. The reader is referred to this source for much detailed information.

Norway has been a reliable source of natural gas supplies to mainland Europe since the mid-1970s. The Russian invasion in Ukraine showed once again the importance of the country's role in securing supply of natural gas to the European continent. A clear recent case of the vital role of Norwegian gas supplies also for the Netherlands was in the country's contribution in dealing with the '22-'23 gas security of supply crisis leading to the introduction and continuous supply of two LNG vessels in Eemshaven. The abundant Norwegian capacities of renewable electricity generation (esp. hydro capacities) also led since 2011 to net exports of power to the Netherlands via the 580 km HVDC 700 MW NorNed cable landing in Eemshaven. Additionally, low carbon hydrogen is expected to develop into an important source of energy supplies in the years to come.

Since 2019 also **Denmark** has a 700 MW HVDC electric bi-directional 325 km interconnection with the Netherlands via the so-called Cobra cable through which most of the time net power is supplied from Denmark to the Netherlands. The power gets onshore at Eemshaven. The typical net export energy position of Denmark-Netherlands is also illustrated by the fact that in 2020 in order for the Netherlands to comply with the EU 2020 RES targets, an agreement was signed by the Netherlands and Danish authorities (under art 8 of Dir. 2018/2001 on RES promotion) on a statistical delivery of 8 TWh renewable energy from Denmark to the Netherlands at a price of euro 12.50/MWh (so 100M€ in total) with an option to duplicate (Rijksoverheid, 2020).

According to Eurostat data(2024b), **Sweden** developed in 2022 into a large electricity exporter of the EU due to its 33 TWh exports of electricity, mainly based on hydro (as well as nuclear and wind) capacity. The country suffered relatively little from the Ukraine crisis due to its traditionally strong focus on fossil-free (by 2040) and large hydro and RES capacities.

So far, the role of **Finland** as an exporting of energy to Europe has remained rather small. This may however change significantly in the near future given the county's ambition to achieve climate neutrality by 2035 and to use its extensive capacity for wind power production for export purposes. By February 2023, a government resolution declared that Finland could supply 10% of the EU's green hydrogen needs (Finnish Government, 2023). This illustrates that the country could play a crucial role in meeting the future EU's green hydrogen goals. A promising sign illustrating the Finish progress in hydrogen production is the fact that their bid in the recent European Hydrogen Bank auction was accepted as the most attractive out of the bids rewarded (European Commission 2024c).

As far as energy flows from the **Baltics** to the Netherlands is concerned, biomass plays an important role especially for the 1600 MW power plant of RWE at Eemshaven. Currently the plant has already replaced some 20% of its coal input by biomass (mainly residues) that is partly imported from the Baltics. Due to a formal Provincial decision by March 2024, the plant is allowed to introduce BECCS technology full-scale by 2030. BECCS is a negative emissions technology whereby biomass is used for power production, while (most of) the resulting CO_2 is neutralized by storage, in the case of RWE most likely offshore via the Norwegian Northern Light project. The decision mentioned will most likely lead to a considerable (but sometimes disputed) expansion of the imports of biomass from the Baltics in the foreseeable future. Though, uncertainty exist about these negative emissions due to political changes.

1.2 Overall energy trade picture

The general picture of the energy trade between the NFoE area and the Netherlands, however, is that – except from significant natural gas deliveries from Norway, and even if some deliveries of power, biofuels and biomass have meanwhile developed during the last decades – **overall the NFoE-based energy volumes imported so far have remained quite modest,** especially if compared with the enormous oil and gas imports into the Netherlands' ports from the Middle East and elsewhere and – until recently – Russian natural gas imports. In fact, CBS (2024) import data on total Netherlands' energy imports reveal that the share of non-fossil imports remained less than 2%, which in itself already illustrates how modest imports of green energy sources still are, but also how significantly such imports will have to expand in order to comply with the EU mitigation targets.

All this may explain why in the current energy diplomacy of the Netherlands in searching for new foreign suppliers of clean energy, attention for the NFoE area has remained modest. The question, however, is if this position is justified in view of the **considerable energy export potential that the region seems to have,** as discussed in the next section.

2 The clean energy export potential

2.1 The clean energy export potential of the NFoE areas towards mainland Europe and the Netherlands in particular

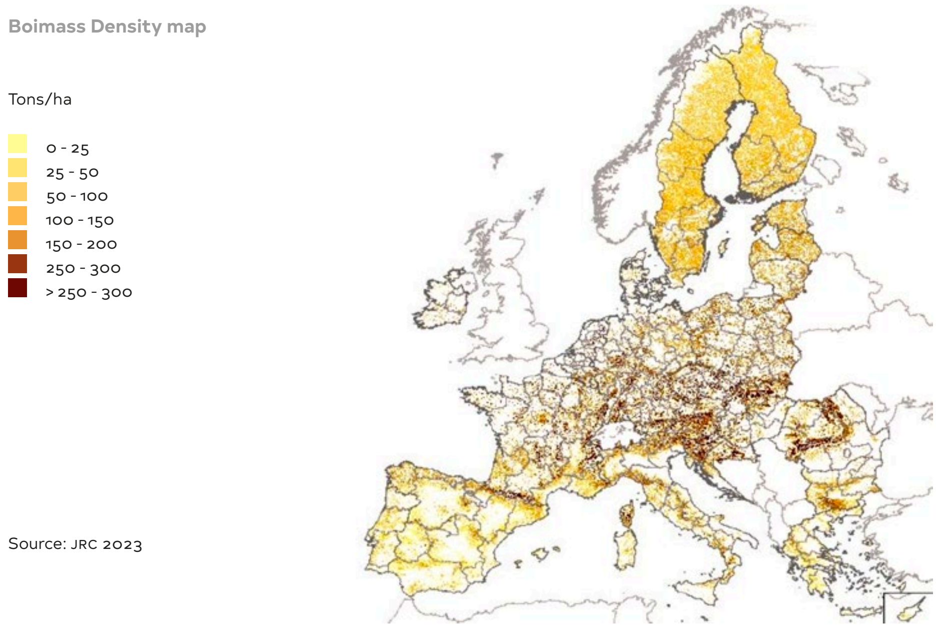
Six reasons why there are great opportunities to improve security of supply by establishing tight energy-trade relations with the NFoE countries.

First, **the natural endowment of clean energy capacity in the area is vast and largely still not explored.**

Biomass

This holds true for biomass (figure 3), in almost the entire NFoE area. Woody biomass resources of the NFoE region are considerable indeed (some 7.300 million m^3) of which about a third is secondary wood biomass. A similar share is being used as a source of energy for the obvious reason that using timber for energy generates relatively small value compared with alternative uses. Also several environmental NGOs are cautious on the option because of fear that large-scale forest exploitation for energy may eventually harm forest quality and quantity. In actual practice, however, most of the timber-based input in e.g. power plants is based on timber manufacturing residuals that otherwise would have been without any further use and lost, while on the whole quite reliable schemes are applied in the NFoE area to guarantee sustainable forest management via certificates.

Figure 3: **Map of forest biomass density matching the harmonised reference statistics for 2020.**



Source: JRC 2023

But biomass – and its residuals in particular – can commercially be used for the production of biofuels (e.g. bio methanol or any other biofuels), or via gasification technologies be turned into carbon neutral hydrogen and carbon to be used as feedstocks in various chemical processes. An example of such a development is the recent announcement by the Netherlands' company Power2X (2024) to invest EUR 1 bn. in a gasification plant in Parnu, Estonia to produce 500.000 tons of green methanol per annum starting 2028, generated from Estonian wind and biomass resources.

Also, if NFoE biomass or its residuals is used as input in power plants, one can turn such green power producing plants into net sinks if carbon emissions are prevented via CCS, called Bioenergy with Carbon Capture and Storage or BECCS-technologies. **If BECCS is going to be extended into the future, the NFoE area could even turn into both a major supplier of biomass and offshore storage area of its carbon or CO_2 residuals after use.** An illustrative case underlining the latter option is the recently (April 2024) concluded agreement between Netherlands, Norway, Denmark, Belgium and Sweden (building upon earlier bilateral agreements) to remove obstacles to CCS-market activity in the North Sea area, thereby contributing to an emerging European CCS-market (Rijksoverheid 2024).

Wind

Onshore wind conditions are also quite favourable especially in the Nordics. The mean power density of onshore wind (1408 W/m²) in Norway is, for instance, twice as high as that of the Netherlands (692 W/m²)'and also in Denmark (799 W/m²) and Sweden (743 W/m²) densities are higher than in the Netherlands (but not in Finland 473, Lithuania 456 and Estonia 586) (Global Energy Monitor, 2024). The offshore wind potential is recognized by the NFoE countries and ambitions have been worked out in deployment plans. Norway plans to install 3 GW offshore wind capacity by 2030 (about half of which floating) and will award areas suitable for 30 GW by 2040. Denmark will be the first to have an energy island installed in the North Sea and plans to have 3 GW offshore wind capacity by 2030 (to be further expanded thereafter).

Power and green hydrogen

As far as electrolysis for turning power into hydrogen is concerned, **NFoE areas possessing surpluses of renewable power have the choice either to directly export these surpluses, or to domestically turn them into hydrogen (or derivatives) to subsequently sell the product abroad.** It is still unclear which option is optimal under what conditions. So far 'early' projects selling power directly to mainland Europe via interconnecting offshore cables have been relatively attractive to benefit from still open arbitrage options (e.g. NorNed cable), or from options to benefit from contributing to balancing and price fluctuations (e.g. Cobra cable), but theoretically such 'bonuses' at some stage may level off, enhancing business cases of domestic conversion and exporting the hydrogen rather than directly exporting power.

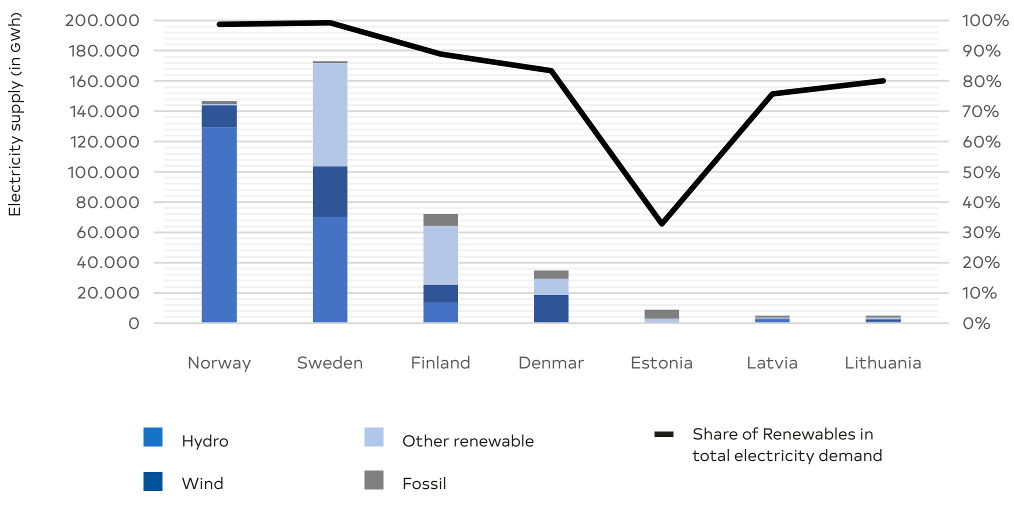
2.2 **Little NFoE clean energy imports needed**

Second, **the NFoE countries, due to their relatively high levels of energy self-sufficiency and availability of green energy from their own resources, on average face much less needs for energy imports than the Netherlands. In fact, if they were to produce more energy, this could lead to more net exports quite easily,** simply because they do not need much of that energy for themselves. To illustrate, of most of the NFoE countries the share of renewables in (domestic) electricity demands already 80% or more (renewables in national energy use in: Norway, 99%; Sweden, 99%; Finland, 89%; Denmark, 83%; Latvia. 76%; Lithuania, 80%, while only Estonia has a much lower percentage), while almost all renewable power is from domestic energy sources (figure 4).

2.3 **The NFoE experience/knowledge base (biofuels and hydrogen)**

Third, **given the strong endowment with wind, biomass and natural gas (Norway), the area can on the one hand develop into an increasingly powerful supplier of electricity, hydrogen and biofuels,** synthetic fuels and in fact already has a quite strong experience and knowledge base of this covering most of the value chains. On the other hand, **Norway can develop into a major supplier of blue hydrogen to the rest of Europe** if it succeeds to further develop offshore CCS activity to remove the carbon from the natural gas. Whether in the future the actual production of the hydrogen via steam reforming takes place in Norway itself, anywhere else in the NFoE area, or in mainland Europe closer to the final destination of the product, is probably a matter of costs or (other) political considerations. Yet in the about 1 GW Equinor plans considered to deliver blue hydrogen to the Netherlands via a production plant at Eemshaven one prefers hydrogen production to take place in the Netherlands shipping back the CO_2 to

Figure 4: **Share of renewable electricity production per NFOE country**



Source: IEA, 2022 data

Norway. However, if a positive FID will be made by 2025, effectively considerable volumes of blue hydrogen will be quasi-exported by Norway to the Netherlands to be transported further from Eemshaven via the backbone to regional and other NW European industrial centres. Note that Norway also awarded a subsidy via the European Hydrogen Bank auction for its green ammonia SKIGA export project (EnBW, 2023)

2.4 Additionality rules do not apply in some strategic NFoE regions

Fourth, unlike the Netherlands, **much of the NFoE region does not 'suffer' from the EU additionality rules with respect to the green hydrogen label** (for details see also section 3 next). Basically, and simply put this rule, as formulated in a Delegated Act approved by the EC in Feb. 2023, requires renewable power used for green hydrogen production to come from proven additional (not yet existing) renewable sources, at least – to stimulate 'early projects' – for hydrogen production coming on board starting 2030. If, however, at least 90% of a country's national energy mix is green already, according to the EU rules additionality is assumed automatically and thus does not need to be proven for green hydrogen conversion projects carried out in that country. Norway and Sweden already comply with this 90% criterion, and Finland, Denmark and Lithuania may reach this benchmark in the foreseeable future. As a result, these countries are relatively well placed to generate green hydrogen because it allows them to also use existing green electricity capacities for green hydrogen production, including non-intermittent hydropower. If combined with the 'green' carbon from their domestic biomass resources, the key ingredients for producing exportable e-fuels (green methanol, green gas, or biofuels) are present as well.

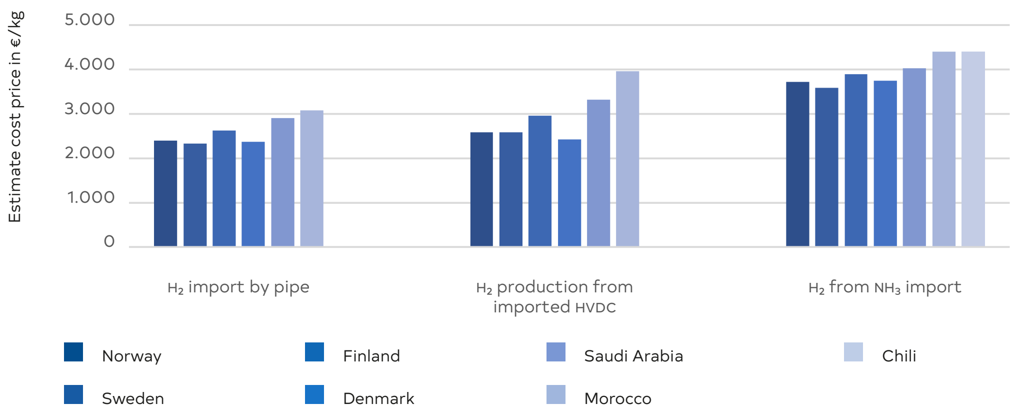
2.5 Existing infrastructure connections support (cost levels of) NFoE energy deliveries abroad

Fifth, because much of the infrastructure for energy production, conversion, transport and storage, including port facilities and various national and interconnecting transport modes is already there in many of the NFoE regions, often already well-connected with the ports of mainland Europe around the North Sea, and because it is based on a tradition of skills and experience, extensions of energy exports in whatever form often do not require many new facilities. Additional human capacity building requirements for the realisation of renewable energy (export) projects can therefore be handled more easily. This on the whole keeps the costs of getting additional clean energy/feedstock from the production/conversion points in the NFoE area to the ports of the Netherlands and surrounding countries relatively low. This obviously does not automatically make clean energy from the Nordic and Baltic regions cheaper than from elsewhere, but the costs of transportation do matter for the simple reason that **the relevant energy costs in an international competitive market are the combined costs of producing it and getting it from the production area abroad to the port of import destination.**

This cost combination puts the NFoE area in a very strong competitive position compared to many alternative sources of non-EU energy supply (see also figure 5). In fact a model-based assessment of such costs (based on the HyChain 2 model) comparing Nordic cost levels of hydrogen and ammonia delivered at Rotterdam port with those of hydrogen suppliers generally considered competitive, Morocco, Chili and Saudi Arabia, reveals that the Nordics will outcompete the latter countries, irrespective whether hydrogen deliveries are imported by pipeline or by ship (ammonia), or produced domestically from Nordic electricity. One of the explanations why is that the NFoE countries share common EU policy regime and favorable and reliable macro-economic conditions such as inflation and interest rates and access conditions to capital markets. [Note that in order to be able to mutually compare, costs of converting ammonia into hydrogen have been included]. Although the figures relate to 2019, it seems fair to assume that current costs, although at higher levels, will show comparable relative levels.

Sixth and finally, energy deliveries from the NFoE area to nearby parts of Northwestern Europe can be supplied relatively flexibly in many respects so that system optimization is relatively easy: because in fact almost the full spectrum of low-carbon or green energy modalities can be provided from the NFoE region; because of the huge variety of onshore and 'joint' (North Sea) offshore location options for production, conversion, transport and storage activities; and because distances allow for interconnecting cables and pipelines, which is often no option if energy is imported from further away areas (shipping transport only).

Figure 5: **Share of renewable electricity production per NFoE country**



Based on HyChain 2, John Kerkhoven, Rob Terwel, version 12-6-2019

3 The energy collaboration perspectives

3.1 Joint clean energy policy initiatives

The energy policy frameworks of the NFoE countries and of the Netherlands show some communalities. What the Nordic countries first of all have in common with countries such as the Netherlands are a strong focus on offshore energy production traditionally of fossils, but more recently typically based on offshore wind capacity instalment and related infrastructure. The countries increasingly work together on the latter themes to create synergies and avoid unnecessary costs due to duplication and other inefficiencies of non-cooperation. Common policies and targets and further coordination of this has, for instance, been expressed in joint policy declarations on North seas energy such as The **Esbjerg Declaration** on the North Sea as a Green Power Plant of Europe, signed by the MPs of Belgium, Denmark, Germany and Netherlands on May 18, 2022 and the **Ostend Declaration of EU Energy ministers** on the same issue of April 24 2023 (Rijksoverheid 2022 en 2023).

The first, relatively short Declaration underlined the need to replace (non-EU) fossils by European renewables from the North Sea, and to jointly develop a multiple offshore renewable energy system connecting the four countries and possibly also the wider group of North Seas Energy Cooperation **(NSEC) countries** (Belgium, Denmark. France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden plus European Commission). Also, offshore wind targets for the four countries together of 65 GW (2030) and at least 150 GW (2050) were mentioned, as well as a joint onshore and offshore 20 GW green hydrogen capacity target already for 2030.

The more extensive and detailed Ostend Declaration of the Energy ministers of the NSEC countries plus UK, listed the various existing and looming North Sea(s) countries' national, bilateral and multilateral offshore energy initiatives and the various capacity, interconnection and collaboration targets. The Declaration also urged to intensify further international cooperation and coordination by also explicitly mentioning i.e. the creation of offshore energy islands (Denmark starting), hubs, interconnectors (e.g. based on TSO cooperation), offshore hydrogen production initiatives (Germany and Netherlands), exploring connections between offshore wind farms (Denmark, Germany, Netherlands), floating wind capacities (Norway), and the need to respect environmental and other non-energy concerns.

Under the former Netherlands (2023) and current (2024) Danish co-chairmanship (with the European Commission as permanent co-chair) of the NSEC, various issues have been put on the agenda already based on the shared vision that in the spirit of an integrated European clean energy system by 2050, the

North Seas will develop into Europe's Green Energy Hub. Examples of such issues are: joint planning of offshore wind capacities and related energy infrastructure, joint action on port capacity adjustment, joint articulation of upcoming energy and hydrogen demand profiles, coordinating activities of servicing wind, port and infrastructure investment; organizing and lining up potential parties to finance North Seas energy investment, creating the first offshore energy hubs (e.g. Danish Energinet and Netherlands/German TenneT working on this), and setting up the NSEC Agenda for 2025-28 (Danish Ministry 2024).

3.2 Some joint challenges

The offshore wind investment plans of the North Sea countries combined (the nine NSEC countries plus UK) are formidable indeed. The current offshore wind capacity of NSEC plus the UK of 33 GW is planned to expand to 120 GW in 2030 and 300 GW in 2050. This poses various challenges (except from those related to transport and storage infrastructure and their optimal configurations) most of which presenting themselves both to the NFoE countries and countries such as the Netherlands: getting to timely business cases for energy investment including dealing with funding (given increased material and wages costs), personnel, and materials availability; (timely) availability of port capacities to install and manufacture the needed equipment; satisfying requirements of 'just' imports; dealing with the EU Delegated Act additionality and correlation requirements; and social acceptance issues; to mention just a few.

Meeting the timely conditions of a sound business case

Any FID requires a satisfactory business case of the foreseen investment. To arrive at such a state is generally not easy for cases of new technologies, not yet existing value chains, uncertainty on price levels of outputs and idem on costs and availability of inputs, unclear policy incentives, economic conditions with steeply rising interest and inflation rates, and rapidly increasing geopolitical tensions. Each of the factors mentioned may already create investment bottlenecks in themselves, but if they all matter simultaneously – as seems to be the case the last few years e.g. in the hydrogen chain – investors may tend to postpone rather than operate proactively. Yet, the EU decided to mandatorily introduce the rule by 2030 that 42,5% of existing hydrogen flows need to be green (= RED III compliant, so blue or turquoise does not satisfy, but yellow = nuclear power-based does), while still sticking to the extensive additionality and correlation rules on green hydrogen production after 2030 (see also 'Dealing with…' Next). So, the time pressure to act is there but also the restrictions, creating a rather harsh incentive structure for green molecules value chains (which by the way seems to be almost diametrically different from the past quite generous subsidy regime for creating green electrons). Although this economic and policy environment creates a common challenge for all North Seas countries involved, it may also act as a catalyst to seek – possibly with EU support – for joint solutions to make first moves and proceed.

Port capacities

A particular shared challenge relates to the availability of port facilities to handle all new energy activities. As far as this potential bottleneck is concerned, Royal Haskoning expressed doubts in a recent report (November 2023) for NSEC if such port capacities can be introduced in time, because of spatial constraints. Total port gross storage area needed for offshore wind expansion in the entire NSEC plus UK region would amount to 850-1300 ha, against the existing area available for these purposes of 600 ha only and expansion plans of just 200 ha. Capacities of ports are therefore projected to be insufficient to handle the foreseen North Sea offshore wind activity with a deficit of storage area ranging between 50 and 500 ha in the optimistic case in which all planned extensions of port areas for this purpose will be realized in time. Because – when it comes to preparing for offshore wind expansion – port authorities are facing: demand uncertainties; sometimes weak business cases of their extension investments; unclear technological and regulatory requirements; competition from other claims on space; or no clear incentives or need to take responsibility for space availability, there is in their view considerable risk that port handling space around the North Sea will increasingly create a bottleneck in itself to develop offshore wind capacities according to planning. More international coordination and collaboration between the various ports and the responsible private and public stakeholders, as well as the right incentives and information sharing therefore seem utterly needed and will need to be introduced in time if only because the first offshore wind capacity bottleneck is already expected in the 2029-2031 period.

Just imports only and clear appointments with the countries of origin

Next to the challenges to realize the North Seas offshore wind capacities according to plans, public acceptance issues related to the source countries of imports of energy may increasingly gain public attention and become increasingly important for choosing the areas from where to import energy to get to 'just' imports. This relates to the issue of who should in the eyes of society be held accountable for any adverse impact of energy production and possibly transport: the exporting country, or equally the importing country as well? To the extent that energy production for exports may directly have adverse local impacts (e.g. shifting emission burdens, pollution, spoiling the landscape, adversely affecting biodiversity and/or social cohesion, or any other socioeconomic costs, etc.), importing rather than domestic production of that energy may domestically end comparable adverse impacts, but in fact shifts the problems to foreign regions, where by lack of proper regulation the adverse impact may be even worse. This can especially be critical in cases of carbon leakage, i.e. trading merely shifts emissions from one country to another, or cases of severe environmental damages due to lack of national regulation and control.

So, just as already happens with respect to e.g. imported timber (sustainable forest management certificates), food (sustainably grown), or clothing (no child labour and fair labour standards), so may energy imports increasingly get subject to a critical assessment of production and transport conditions in the countries of origin. Importing natural gas and many other products from Russia has been banned because of the sanctions based on Ukraine invasion, to just give another example. Imports of shale gas from the US are criticized because of its related serious local pollution, and so are imports of oil from the Middle East because of human rights conditions. The only way to deal with such issues is to systematically assess production conditions and, if needed, strike deals with the countries of origin forcing them to respect certain production conditions at the risk of no longer being accepted as a source of imports. Such interference, however, is not always easy to accomplish. For the future energy imports such developments towards promoting 'just' imports may imply that energy imports generally would be relatively undisputed from regions such as the NFoE areas having on average similar regulatory conditions and social and environmental standards as the Netherlands.

Dealing with additionality rules and temporal and geographical correlation to comply with RED III

One of the EC's Delegated Acts adopted in June 2023 specifies which renewable electricity (of non-biological origin) is accepted to be used for hydrogen production to be recognised as RES-based and therefore RED III compliant, irrespective if that power comes from inside or outside the EU. The set of conditions are essentially: that the electricity used – as specified in the power purchase agreement between power provider and hydrogen producer – should be renewable; that it should be based on new and unsupported electricity-generation capacity; that the PPA should satisfy temporal correlation (production of power and hydrogen in the same month (to be further strengthened in the future); as well as that it satisfies geographical correlation (derived from same bidding zone unless other, offshore and interconnected ones, but the latter only if electricity prices there are not lower than in the own bidding zone).

This list of conditions – even if in fact only applicable to hydrogen production after 2030 – is complicating green hydrogen production. **The additionality requirement creates clear incentives for companies towards green hydrogen production from own or directly contracted solar or wind farms requiring larger consortia.** Also for North Seas international collaboration on offshore power and hydrogen production the above set of conditions is quite restrictive, even though as a transition measure, long-term PPAs signed before 2028 with existing installations are exempted, even if countries with a >90% share of renewable power are exempted from the additionality regime, and even if an overwhelmingly large share of expected offshore wind capacity in the North Seas is still to be built creating degrees of freedom to combine.

Especially, **the issue of geographical correlation or bidding zones may function as an obstacle for business cases of combining RES power from the NFoE regions with hydrogen production in the 'mainland' of the EU.** The Delegated Act relevant bidding zones typically comprise the size of a country plus its own offshore continental shelf, but not that of other North Seas countries' shelves. This restriction may lead to suboptimal logistical patterns of green hydrogen production. That is why creating bidding zones would be accepted. Broader offshore bidding zones – covering multiple continental shelves – could be helpful to optimize energy system integration (while reducing grid congestion issues) of the entire North Seas regions. Also dealing with the other correlation requirement, temporal correlation, may probably become easier if broader offshore.

Societal acceptance issues

Another joint challenge may relate to **societal acceptance issues.** The North Sea is getting quite full of various offshore activities (e.g. O&G production, wind, fishery, tourism, defence, shipping) with sometimes mutually conflicting interests, and collectively threatening its marine ecosystem. Especially shallow near-coastal ecosystems may be quite vulnerable (e.g. Wadden Sea). All this may create acceptance issues and bottlenecks for investment in new energy capacities. Ecosystem losses, power cables through the landscape, large extensions of port areas, local pollution and noise, lower living comfort due to nearby solar parks or wind farms, can all give rise to protest, legal procedures and unrest e.g. caused by generic concerns or local NIMBY or NUMBY arguments. This **explains why governments may use tendering conditions for e.g. wind farms to force the winning bidder to take measures to deal with biodiversity and other ecosystem losses, compensate the local population in one way or another.** NFoE regions working together on dealing with these issues may be helpful to effectively try to meet such societal concerns.

Areas for collaboration

A challenge usually also means a chance. **International collaboration can be helpful in various areas:** on exchanging information on investment conditions and options for joint projects, on installing port facilities and taking shared responsibilities for port services; on specifying carbon and other environmental and societal footprints of mutual exchanges of energy; on finding ways to deal with the additionality and correlation rules regarding RFNBOs; or on dealing with North Seas energy-related social concerns. **Collaboration, moreover, will have to cover the complete triple helix to be the most effective:** knowledge, training, testing and research exchange can be helpful, just as collaboration between public authorities dealing with similar issues around the North Seas.

4 Concluding remarks & action initiatives

4.1 Some concluding remarks and options for joint policy and action initiatives

In order to further enhance the role of the NFoE area as energy suppliers, a serious policy effort seems necessary. This could involve the following set of measures.

Setting up joint formal and informal networks and data systems

- Develop a Northern green energy corridor between The Netherlands, Germany and possibly other countries at the southern flank of the Nord Sea(s) and the NFoE area to support the exchange of green energy and feedstock floats to the mutual benefit of all.
- Organize mutual regional (provincial and municipal governments), national and international (relevant ministries, RVO, etc.) trade missions between the NFoE areas and the Netherlands (or together with other NSEC countries) to assess options for collaboration on clean energy deliveries, hydrogen value chain development (e.g. joint production, conversion, transport, storage and implementation initiatives), and joint triple helix structures and activities on e.g. research and training, coordination issues, energy data exchanges, etc. Such missions could involve experts from industry, ports, TSOs/DSOs, government, knowledge sector, NGOs, etc.
- Strengthen joint lobbying capacity for interaction with European and national authorities discussing energy initiatives.
- Assess systematically which solid clean energy trade relations could be set up between NFoE areas and the Netherlands, and against which terms and conditions. More specifically, try to specify future NFoE export supply volume profiles of electricity, low-carbon and carbon neutral hydrogen(derivatives) and biofuels, incl. indications of their costs if delivered at ports of North West European Member states. Inventorise the related infrastructurel needs (cables, pipelines, port facilities, corridors etc.)
- Develop a data system of carbon and other environmental balances of international energy trades in the North Seas region to inventorize to what extent energy trades may involve burden shifting and changing carbon balances.
- Set up a joint North seas energy data, atlas, and knowledge base system.
- Inventorize the collective demand scenarios for low-carbon and carbon neutral hydrogen across the entire North Seas regions.

Mutual collaboration on jointly achieving EU RES and mitigation targets.

- Explore if and how the option provided under Dir 2018/2001, art. 8 (to comply with the EU 32% renewable energy target via statistical transfers between EU Member States) as activated by the Netherlands and Denmark in 2020, can be used in the future for other cases of renewable energy options.
- Explore what joint RES projects and RES support schemes with one or more NFoE countries on the one hand and the Netherlands and surrounding countries on the other hand can be initiated in the spirit of Dir 2018/2001 art. 9-12 leading to joint mitigation activities based on joint energy projects.
- Explore to what extent public investment funds (e.g. the European Hydrogen Bank) and private European investments funds such as the Danish investment firm Copenhagen Infrastructure Partners (CIP) can help funding joint RES projects.

Coordination

- Develop a joint action plan to collectively enhance port facilities for offshore wind and energy developments around the North Seas.
- Develop a common framework for offshore wind tendering conditions, especially conditions related to local conditions in port regions.
- Develop a common framework for the development of North Sea energy hubs.
- Formulate common proposals to enlarge offshore bidding zones as defined under the additionality conditions for hydrogen production compliant with RED III.
- Formulate common standards/principles on the proposed use of low-carbon and carbon neutral hydrogen and of biomass as energy and feedstock carriers.
- Develop a joint North Sea hydrogen backbone connecting most of the North Sea ports.

So in concluding, while the EU in total has become more rather than less import dependent on energy during the last few years and since the Ukraine crisis, the picture for the Netherlands is even worse: the country, traditionally already showing a high level of energy import dependence, has also become even more import dependent (about three-quarters) during the last few years especially due to the strongly diminishing role of natural gas production from the Groningen field. This explains why energy security has increasingly become a serious policy concern of the Netherlands government, the more so since the country: hosts a relatively energy-intensive industrial and agricultural sector; has no longer gas production capacity from the Groningen field; traditionally plays a major hub role in re-exporting imported energy thereby supplying surrounding countries with energy; will in the spirit of the energy transition have to turn to other source countries than in the fossil era; and seems to face the risks of slower than anticipated offshore wind development on its North Sea territorial area and related own green energy production.

Imports of energy are and will remain vital for our country for our own use and to sustain our traditional strong energy hub function of North West Europe. This raises the issue to which regions to turn for setting up new or expanded energy imports, energy that needs to be clean, reliable and preferably quite affordable or at least competitively priced. In this search for new options, it looks like Europe's Northern Flank (NFoE), notably Scandinavia and the Baltics, have been underexplored. Imports of energy from these regions so far have remained quite modest (with the exception of Norway recently) compared to their potential, but in fact – as has been argued in this essay – **the NFoE role seems quite promising as future energy suppliers.**

5 Literature overview

CBS, 2024. Energy Balance sheet; supply and consumption, sector.
Retrieved from: https://tinyurl.com/mtws2kr5
Accessed on 23/06/2024.

Danish Ministry of Climate Energy and Utilities, 2024. The North Seas as Europe's Green Energy Hub.
Available at: https://tinyurl.com/mejyyv7p

DataM - Data-Modelling platform of resource economics.
Available at: https://tinyurl.com/4e7su32y

EBN, 2024, energietransitie infographic.
Retrieved from: https://tinyurl.com/2pfy8az2

EnBW, 2023. Norwegian-German collaboration on green energy.
Available at: EnBW invests in Norwegian pioneering project SkiGA | EnBW.

European Commission, 2019. The European Green Deal. COM(2019) 640 final.
Available at: https://tinyurl.com/yckx5dh9

European Commission, 2018. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2019 on the promotion of the use of energy from renewable sources (recast).
Available at: https://tinyurl.com/57j3dnnu

European Commission, 2023. Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin.
Available at: https://tinyurl.com/bdfknh83

European Commission, 2024. European Hydrogen Bank auction provides €720 million for renewable hydrogen production in Europe.
Available at: https://tinyurl.com/4jsfys5x

Eurostat, 2024a. Energy Statistics an overview.
Retrieved from: https://tinyurl.com/4277je28

Eurostat, 2024b. Exports of electricity and derived heat by partner country.
Retrieved from: https://tinyurl.com/mrzyzm9d
Accessed on: 23/06/2024.

Finnish Government – Ministry of Economic Affairs and Employment, 2023. Government adopts resolution on hydrogen – Finland could produce 10% of EU's green hydrogen in 2030.
Available at: https://tinyurl.com/3cr9kac8

IEA, 2024. Countries and regions/Europe/Denmark.
Retrieved from: https://tinyurl.com/2jnrns78
Accessed on: 03/06/2024.

IEA, 2024. Countries and regions/Europe/Norway.
Retrieved from: https://tinyurl.com/3jnynpsw
Accessed on: 03/06/2024.

IEA, 2024. Countries and regions/Europe/Sweden.
Retrieved from: https://tinyurl.com/ye2apv6p
Accessed on: 03/06/2024.

IEA, 2024. Countries and regions/Europe/Finland.
Retrieved from: https://tinyurl.com/mwje96ce

IEA, 2024. Countries and regions/Europe/Estontia.
Retrieved from: https://tinyurl.com/5dmz6w2x
Accessed on: 03/06/2024

IEA, 2024. Countries and regions/Europe/lithuania.
Retrieved from: https://tinyurl.com/vwjhhwxb
Accessed on: 03/06/2024

IEA, 2024. Countries and regions/Europe/latvia.
Retrieved from: https://tinyurl.com/993cs2p2
Accessed on: 03/06/2024.

JRC, 2023. Biomass production, supply, uses and flows in the European Union. JRC Science for policy report. Global Energy Monitor, 2024.
Retrieved from: https://tinyurl.com/29tvh7x7

RVO, 2023, Hydrogen in the Nordics: Collaboration Opportunities for Dutch Companies.

Parisi, C., Baldoni, E., M'barek, R. European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC).
[Dataset] PID: https://tinyurl.com/7yuvmy3w

Power2X Estonia, 2024.
https://tinyurl.com/3nh2sj2x

Rijksoverheid, 2020. Nederland en Denemarken sluiten overeenkomsten over energiesamenwerking en statistische overdracht.
Available at: https://tinyurl.com/3vnfb5uh

Rijksoverheid, 2022. The Esbjerg Declaration on The North Sea as a Green Power Plant of Europe.
Available at: https://tinyurl.com/53e4h9hx

Rijksoverheid, 2023. Ostend Declaration on the North Sea as Europe's Green Power Plant.
Available at: https://tinyurl.com/4cetemrw

Rijksoverheid, 2024. Five northern European countries conclude international arrangements on transport and storage of carbon across borders.
Available at: https://tinyurl.com/43fkykpu

Royalhaskoning DHV, 2023. Studying port infrastructure needs for offshore wind energy.
Available at: https://tinyurl.com/323kjwyb

Drivers of Change

New Energy Coalition

New Energy Coalition is a continuously growing network of knowledge institutions, industry and businesses, government bodies and NGOs working together on the energy transition for a sustainable future. The organisation connects knowledge, market and policy.

www.newenergycoalition.org