The need for cooperation in offshore wind energy development in the North Sea

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Abstract

Offshore wind energy is a renewable energy source that will play a large role in the energy transition and therefore, countries are developing offshore wind energy in the North Sea. Increasing international collaboration in developing offshore wind and the support system could bring many benefits, such as cost reductions, grid stability, a strong offshore sector, and security of supply. However, there are hurdles to overcome in regulation, finance, subsidy, legislation, and environmental concerns. These hurdles bring uncertainties and this hampers cooperation. Political willingness to increase international cooperation and to harmonize the systems will help to overcome these hurdles and increase the cooperation. Therefore, political willingness in North Sea countries should increase. A clear vision of the desired energy system in the North Sea and the surrounding countries is needed to overcome hurdles and harmonize the systems.

1. Introduction

Countries from around the world committed themselves to fight climate change by reducing their greenhouse gas emissions. An important step to reduce the greenhouse gas emissions is to switch from electricity generation by fossil fuels to renewable energy sources (International Energy Agency, 2017).

Offshore wind is key to the European Union's long-term climate targets and the decarbonisation of the European energy system (Wind Europe, 2017b). The conditions for offshore wind energy in the North Sea are very good, with good wind speeds and relative shallow waters (De Bruijne et al., 2016). Therefore, many countries are developing offshore wind farms in the North Sea.

North Sea countries are developing offshore wind energy in the North Sea. These countries are: Belgium, Denmark, France, Germany, Norway, the Netherlands, Sweden, and the United Kingdom. It is estimated that there will be almost 48 GW offshore wind energy capacity in the North Sea by 2030. High scenarios estimate this capacity on 65 GW by 2030, and this number will increase after 2030 (WindEurope, 2017a).

Large-scale developments in offshore wind energy could push economic growth in Europe and create sustainable jobs. The best way to increase efficiency, push economic growth, and create jobs is when the countries of the North Sea work together. Currently, cooperation is only limited. This lack of cooperation in the region is hindering efficient development of offshore wind power in the North Sea (European Commission, 2017).

This paper presents a research that is conducted in the field of cooperation in the development of offshore wind energy. The paper is structured as follows: section 2 presents the need for international cooperation in the development of offshore wind and what initiatives are already taken. Section 3 explains the benefits of cooperation in the offshore wind power development. Section 4 describes the hurdles that need to be overcome for cooperation in offshore wind power developments. Section 5 discusses the results. Finally, section 6 concludes and gives recommendations.

2. Transboundary cooperation

Benefits of cooperating on several issues across national borders within the European Union have been recognized. The underlying motive for increasing transboundary collaboration is the increase in globalization, increasing interdependencies between countries, and increased interconnectedness between countries (Dühr, Stead & Zonneveld, 2007).

In 2016, the European Parliament published a manifesto in which they appeal to the North Sea countries to increase regional cooperation, because they believe that "regional cooperation is the best way to realise the full potential of the Northern Seas energy system, to help create sustainable growth" (Belet et al., 2016).

Transboundary cooperation in the offshore wind energy sector can take place in the entire value chain of offshore wind energy. The value chain of offshore wind energy consists of the following phases: project development, turbine & support structure manufacturing, logistics & installation, grid connection, operation and maintenance, and decommissioning (Roland Berger, 2013). Transboundary cooperation can also take place in the supporting processes of the value chain, these are: Initial planning, permission, policy making, financing, education, and research & development.

Energy policies in the European Union are simultaneously made at the national and the European level. Offshore wind properties, such as its potential role in connecting various transmission systems countries that share sea-borders and the scale at which offshore wind is developed in nations, show that it is a transnational policy are by nature. This means that cooperation between countries is needed, to coordinate between the different national policy paths (Fitch-Roy, 2015).

One of the most important issues on which cooperation is needed, is infrastructure. When renewable energy generation capacity becomes sufficient large, there will be a need for a coordinated infrastructure policy. However, "promoting cross-country electricity trade and transmission infrastructure is a major European policy issue" (Abrell & Rausch, 2016). Infrastructure plays an important role in achieving the climate targets. Without the right transboundary infrastructure policies, it will be very hard to achieve the European climate targets (Abrell & Rausch, 2016).

Cross-country infrastructure to increase efficiency in offshore wind power could be an offshore grid, which will bring socioeconomic benefits to the North Sea countries (Navigant, 2017). Ten European countries, the North Sea countries plus Ireland and Luxembourg, signed the Memorandum of Understanding, to enhance cooperation on renewable energy and in particular the cooperation on offshore wind energy (WindEurope, 2016). The objective was to create a collaborative framework for the development of an offshore grid in the North Sea; the North Seas Countries' Offshore Grid Initiative (NSCOGI). This collaboration should increase energy security and cost-efficiency and it should stimulate renewable energy integration in the region. In 2016, the member states of the European Union and the European Commission stimulated this initiative by signing the Political Declaration, that included a work program for the member states for the coming years (Navigant, 2017).

3. Benefits of cooperation in offshore wind power development

Cooperation of the North Sea countries is essential to achieve a substantial level of cost reductions, which would not be possible when countries do not cooperate. Cost reductions could be achieved by working together on e.g. interconnections, an offshore hub, a work island or combining operation and maintenance efforts. Interconnections could increase cost reductions in the offshore wind farms, due to more efficiencies in electricity generation and more grid stability. Interconnections could be onshore and offshore, e.g. in an offshore grid. For an international offshore grid a vision is required (Van Dijk, Müller, Van Steen, Tack, Truijens & Zigterman, 2016).

There is a big challenge of connecting large capacities offshore wind power to the onshore grid (NWEA, 2017; Energy Academy Europe, TNO & ECN, 2017) and transport cables offshore are very costly (Jepma & Schot, 2017). Multiple North Sea countries face these problems with the grid connection. As more wind farms are built, the construction of a European offshore grid could bring benefits as it can be used for transmission and trade of electricity. Working together on an offshore grid could bring a combined solution: instead of each country connecting the wind farms with radial connections to shore and building separate interconnectors, this can be combined. This will significantly reduce the length of cables, and therefore reduce costs. It will increase the security of supply, the utilization of the grid, grid stability, and it will reduce the impacts of intermittency, because there is an increased level of interconnection between countries (De Decker & Woyte, 2013; Jacobsson & Karltorp, 2013; Navigant, 2017). Next to this, the markets are also coupled, resulting in more competition in the market, and this results in average lower energy prices for consumers. However, it is possible that in countries that mostly export electricity the prices increase for the consumers, because they can serve a larger energy market.

An international offshore grid will allow for areas far offshore to be used for wind farms, because grid connection distances will be shorter (Navigant, 2017). These far offshore areas, are areas where usually are higher wind speeds and more wind hours than close to shore. There is already a trend of building wind farms further offshore. It is believed that this trend will continue in the coming years. Cooperation in an

offshore grid will bring the needed cost reductions to facilitate an increase in this, because the investment costs of projects further offshore are rising with deeper waters and longer distances to shore (Rodrigues et al., 2015)

Most companies in the offshore wind sector operate internationally, and already see the North Sea as one area (De Brouwer, 2017). Companies from one country can construct wind farms in another country's waters. Planning a European roll-out of offshore wind power development projects will create efficiencies and cost price reductions (Belet et al., 2016). When the roll-out is on a European level, and not on a national level, planning when to tender and construct the wind farms, will be better scheduled. This will increase predictability for investors as this will "ensure a steady flow of projects in the pipeline" (Belet et al., 2016). Material and personnel could have a more continuous work load, and spreading the work load and this will reduce investments. This will reduce the construction costs per project (Romeijn, 2017; Molenaar, 2017; Van Bergen, 2017; Van Hövell, 2017).

European cooperation in offshore wind projects is very important, to keep up with global developments in the offshore wind sector (De Brouwer, 2017; Van der Putten, 2017). It will help Europe to stay competitive in the global offshore market and more effective than when every European country does this by themselves. Technological innovations e.g. deep-water foundations, and cost reductions as a result of cooperation will increase the development of offshore wind energy in other European waters, such as: the Mediterranean Sea and the Baltic Sea. This will expand the market for European offshore wind. The European offshore wind energy sector will benefit from these developments, which is good for employment opportunities and economic growth in the European Union (Belet et al, 2016).

There are also benefits in cooperation in the operation and maintenance phase. Operation and maintenance contributes significantly to the levelized cost of energy. Innovative operation and maintenance concepts can bring significant cost reductions to offshore wind energy in this phase, especially when distances to shore are longer and the time to go to the site takes longer. Regional cooperation in clusters for the operation and maintenance of wind farms is one of these innovative concepts.

4. Hurdles to overcome

Despite the several initiatives that are taken to increase (regional) cooperation between countries to develop offshore wind energy and the many benefits that it has, there is actually not much regional cooperation. The lack of cooperation to overcome differences between different nations make it difficult to develop international projects and facilitate offshore wind power integration in a more efficient way (Dedecca, Hakvoort & Herder, 2017). North Sea countries need to overcome several hurdles to increase regional cooperation and to increase regional projects. These hurdles are in regulation, financing, subsidy schemes, political willingness, uncertainties, and environmental concerns (Navigant, 2017). These hurdles are described below.

The first hurdle to overcome is the political willingness of countries for international cooperation (Van Dijk et al., 2016). Nations whose policy makers believe that their countries have the ability to cope with the challenges that offshore wind energy integration brings, are more likely to resist further cooperation (Mišík, 2016). Often, political willingness is also related to other hurdles. There should be political willingness to overcome these hurdles together. If there are no efforts made by policy makers and governments, it will be very difficult to overcome these hurdles.

Subsidy schemes differ per nation. They are determined and granted on a national level. When working on international projects, where multiple countries participate and multiple subsidy schemes could be applicable agreements could be made to overcome these differences (Flynn, 2015). However, there is not a standard process to do this yet. For example: if a large offshore wind farm is developed in the waters of country A, but the cable goes to shore in country B, and the electricity flows to country C, which country will grant the subsidy and how are the revenues divided over the countries? Also, political willingness is needed to change national subsidy schemes to regional or EU subsidy schemes and the regulatory systems need to be harmonized for the allocation of the revenues.

Regulatory regimes also differ per nation. Each country in the North Sea region has its own regulator and each country has a different set of policy-measures for electricity transmission and interconnection (Navigant, 2017). This is a problem, when plans are made for an international offshore grid. In the regulation of an international offshore grid, there can be a very vague allocation of costs and acceptable profit margins differ per country (Jay & Toonen, 2015). Also, health, safety, planning, permitting, and environmental regulations of different nations are sometimes conflicting. This can be a bottleneck in the cooperation in the operation and maintenance phase and in the installation phase of offshore wind energy, when these differences cannot be resolved. It can also be a bottleneck when there is a cluster of countries that organize the operation and maintenance together, because when rules and regulations are different, the workforce may not be operating in another country (Andersen et al., 2017).

Even when there is a regulatory system in which all countries have the same rules and regulations, there is still the question who the regulator will be. This can be a regional North-Western European regulator, a pan-European regulator, or a separate regulator for the offshore grid. Another problem concerning the regulatory regimes, is that countries have different perceptions about the concepts of the stimulation to have cost reductions, efficiency, and quality in the developments of offshore wind power. These systems of different nations need to be harmonized, before a European roll-out of projects can take place (EY, 2013).

Offshore wind energy developments are mainly driven by national interests. This creates a challenge in the strategic spatial planning in a European roll-out of offshore wind energy projects and creating an offshore grid (Jay & Toonen, 2015). The planning of an optimal offshore grid and the location where the cables and the wind farms will be, can be different from national spatial agendas. Also, some already existing wind farms might not be connected to the offshore grid, because they are not in the right location. This strategic spatial planning also influences the timing of projects, because if the wind farms should be connected to an offshore grid and not directly to the shore, it is important to plan this right. Otherwise, there might be a situation where a wind farm is developed, but can't be used for a long time and in the meantime the farm will have degradation and needs maintenance to keep it in the right conditions, resulting in costs and no revenues. The planning could also differ from the current planning of offshore wind farms from countries. This can create resistance to cooperate in these sorts of projects among policy makers.

Each member state of the European Union has set its own national targets and policies for increasing renewable energy supply and decreasing greenhouse gas reductions (Heinimö et al, 2016). Offshore wind energy developments will contribute to both these targets and create a more sustainable energy system (De Brouwer, 2017; Hommel, 2017). In a situation where there is an offshore grid, and a wind farm is constructed in the waters of country A, the cable goes through country B, and the electricity is used in country C, the allocation of reduction targets can cause problems. Probably all these countries want to profit in a way from these reductions, and they have invested in the wind farm and infrastructure. Uncertainty in the decision of which country gets the reduction, can have a negative effect on the political willingness to cooperate in international projects. Harmonization of policy and targets are necessary to increase cooperation, but also for the harmonization itself cooperation is needed (Müller, 2017).

5. Discussion

This paper describes the need for cooperation between North Sea countries in offshore wind energy development, the existing initiatives, and the hurdles that need to be overcome. There are some points of discussion, related to this topic. These are discussed in this section.

The idea that cooperation is needed to optimize the system is not new, and is recognized by many parties. This can be seen in the existing and previous initiatives to increase cooperation between these countries. However, most of these initiatives are about making policies and plans, and did not result in concrete actions. To achieve the benefits of international cooperation, such as: cost reductions, a strong European offshore market, increased grid stability and security of supply, these international cooperation and meetings should result in a vision with concrete actions for each country.

Some parties that are promoting increased cooperation between the North Sea countries have a strong relation with institutions of the European Union, such as the European Commission and the European Parliament. These parties already have a focus on cooperation within the European Union. Therefore, it is not surprising that they want to increase cooperation between Member States.

One of the results that can be drawn from this study, is that the rules, regulation, and planning between the different North Sea countries should be harmonized. However, this could be a very lengthy process. In the meantime, countries will continue to develop offshore wind power. This could lead to an inefficient system, where on the one hand there is a European policy plan for the development of offshore wind, and on the other hand countries still continue to do their own projects.

The last important point of discussion is that while international cooperation could bring a lot of benefits, countries will be able to continue developing offshore wind energy without the increased cooperation. Also, countries already cooperate on some points, and it is likely that this will continue.

6. Conclusion & recommendations

This study described the need for cooperation in the offshore wind power sector between the North Sea countries. It starts with the already existing initiatives for cooperation and which countries are willing to cooperate. After this, the benefits of cooperation on the different parts of the value chain of offshore wind energy are described, followed by the hurdles that need to be overcome, and some points of discussion. This section concludes and gives recommendations.

The North Sea countries are developing offshore wind energy to achieve their greenhouse gas reduction targets and renewable energy targets. Large-scale offshore wind energy developments could bring benefits to countries surrounding the North Sea. It is expected that in the coming years cost reductions will continue, efficiency will increase, and the number of jobs in the offshore wind power sector will increase. These are all desired effects for the North Sea countries. However, international cooperation in the value chain of offshore wind power and in the supporting processes could bring significantly more cost reductions, could contribute to better integration of wind energy in the energy system, and solve problems related to large-scale wind power integration.

Developments in the value chain of wind energy and the supporting processes that could benefit from international cooperation and could significantly contribute to cost reductions and better integration of wind energy are: the development of an international offshore grid infrastructure, create a European roll-out of wind farms, and cluster wind farms internationally for the operation and maintenance phase.

However, there are some hurdles to overcome before international cooperation will really take off. The most important hurdles are in the differences between the North Sea countries in: regulation, finances, subsidy schemes, and environmental concerns. This gives rise to uncertainties for stakeholders. Political willingness for cooperation is needed to overcome these hurdles and decrease the uncertainties for stakeholders. However, the political willingness is sometimes lacking, when policy makers think that their country is able to overcome these hurdles without the help of other countries.

To overcome these hurdles, the political willingness for cooperation in the North Sea countries should increase, by clearly stating the additional benefits of cooperation. When there is sufficient political willingness, a vision should be made of the desired energy system of the North Sea and the surrounding countries. A clear vision of the desired energy system indicates the differences of existing energy systems and the desired system and which elements need harmonization.

After this, the harmonization of regulation, permitting processes, finances, subsidy schemes, and inspection can take place. When this is harmonized between the participating countries, processes can be standardized. This standardization could be in the entire value chain and supporting processes of the offshore wind energy sector, and this could bring significant cost reductions and decrease uncertainties. This will create a stable and very competitive European offshore market.

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