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OFFSHORE RENEWABLE ENERGY DEVELOPMENT: U.S. EXPERIENCE AND TAKEAWAYS FOR UKRAINE

ABSTRACT

This article is an analysis of the development of global offshore renewable energy in general with a focus in offshore wind, as the most rapidly maturing source in a body of water. Considering the rapid growth of clean power technologies and keeping in mind the target set out by the United Nations' Intergovernmental Panel on Climate Change to limit global temperature increases to 1.5°C versus higher levels, the world can witness 100% transition to renewable energy by 2050. The overview of a recent study published by Stanford University in which authors designed a framework to replace 99.7% of fossil fuel energy in 143 countries with wind, water and solar provides a vision of future energy infrastructure and climate change policymaking as it is seen by scientists. Offshore wind is assumed viable in Ukraine; however, at the date of writing this article no offshore wind farms exist in this country. Are there offshore renewable prospects for Ukraine? Why offshore wind would be beneficial? Can this industry evolve successfully without government support? And if it cannot, what legislative activities can drive offshore renewable power in Ukraine? The article aimed to answer these questions based on the experience in the United States where offshore wind is poised to play a significant role in future energy infrastructure.

The key words: climate change, wind, renewable energy projects, energy resources, wind power, legislative renewal, USA, Ukraine.

Introduction

The energy economy and climate change concerns are forcing oil and gas industry actors to review their businesses from scratch. Sustainability, climate-related performance, commitment to high standards of Environmental, Social, and Governance factors now play a more crucial role in determining operational policies of the major fossil fuel companies and are seen as unavoidable for driving investments (ExxonMobil; Chevron; Shell). Furthermore, in the recent years, the global environment protection trend and rapid development of new technologies has significantly heightened interest in renewable energy even among those who have been at the forefront of oil and gas industry since its very beginning. British Petroleum, Exxon, Shell and other major U.S. oil companies invested in renewable energy projects, including acquisitions of wind and solar firms by fossil fuel giants (Murray, 2020). Wind turbines and solar panels now produce energy more cheaply than coal and natural gas. International Renewable Energy Agency (IRENA) report 2019 found that the cost of installation and maintenance of renewables continues its downward trajectory. According to the latest cost data from IRENA, the global weighted-average levelized cost of electricity of utility-scale solar photovoltaics fell 82% between 2010 and 2019, while that of concentrating solar power fell 47%, onshore wind 39% and offshore wind 29% (IRENA, p. 12). Levelized cost of electricity present value of the total cost of building and operating a power plant over an assumed lifetime. The lower levelized costs are driving the decline in the cost of electricity from different technologies (e.g., wind, solar, hydro).

The effect of COVID-19 on oil prices might also be a drag on the growth of renewables (Gardiner, 2020). Due to the decrease in demand followed by the spread of the coronavirus pandemic the price of West Texas Intermediate crude dropped by almost 300% on April 20, 2020, trading at around negative $37 per barrel, which was a historic drop in the U.S. oil market (Paraskova, 2020). While plummeting prices and consumer demand are squeezing the oil market, investments in green energy become more attractive. Experts forecast that more than $200 billion in capital expenditure will be deployed in offshore wind between 2020 and 2025 (Lassen, Evans, 2020).

Methodology

The assess of gaps between the potential offshore wind energy in Ukraine and actual availability based on the accumulation the latest data provided by intergovernmental organizations. The respective data includes cost reductions of electricity produced from solar power, onshore and offshore wind over the past decade. In addition, the overview estimates a capacity factor of offshore wind technologies comparing to onshore ones and addresses advantages of the offshore wind development in countries with a limited onshore energy resource. The analyses of legal framework accounts that offshore wind in the United States is not as well-developed as it is in Europe. However, the focus is made on a legal initiatives and policies introduced by state governments to drive offshore renewable energy power.

1. The Development of Offshore Wind Energy Industries as A Response to Global Environmental Goal

Emerging technologies will make a body of water a separate renewable energy market. These sources include offshore hybrid platforms which can generate power from waves, wind and solar, ocean currents, some of which can be found on the outer continental shelf of the Gulf Stream, Florida, and California or submerged water turbines which are similar to wind turbines and may be deployed on the outer continental shelf in the coming years to extract energy from ocean currents (Renewable Energy on the Outer Continental Shelf).

For the countries with a limited onshore energy resource that possesses a power potential, offshore renewable energy installations and offshore wind as the most developed source can be a viable option to ensure diversification of a national energy portfolio as well as decarbonizing the power sector. The international approach to future energy market might be helpful for the development of the offshore renewable energy in Ukraine, where offshore wind remains foreign.

In October 2018 the Intergovernmental Panel on Climate Change (UN IPCC) released a special report on the impact of global warming of 1.5°C, finding that it is necessary and even vital to maintain the global temperature increase below 1.5°C versus higher levels (IPCC Special Report on the impacts of global warming, chapter 3). Based on observations and model projections in the assessment of changes to climate at 1.5°C versus 2°C, UN IPCC articulates that the adaptation to 2°C will be extremely difficult, leading to more negative impacts on intensity and frequency of extreme events, on resources, ecosystems, biodiversity, food security, cities, tourism, and carbon removal (IPCC Special Report on the impacts of global warming, chapter 3.21). Considering that human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C (IPCC Special Report on the impacts of global warming, Introduction), the report set out an ambitious goal for the world, stating that global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 percent from 2010 levels by 2030, reaching "net zero" around 2050 (Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C). While UN IPCC concludes that central strategy for limiting global warming to 1.5°C is a rapid and far-reaching transitions in energy which include low-emission energy sources, renewables, nuclear and fossil fuels with carbon dioxide capture and storage, Mark Z. Jacobson, Mark A. Delucchi and the team in Stanford University released an updated study showing the electrical generation mix for 143 countries worldwide using only wind, water, and sunlight (WWS) (Jacobson, Delucchi, et al, 2019). The study suggests roadmaps to transform the all-purpose energy infrastructures (electricity, transportation, heating/cooling, industry, agriculture/forestry/fishing) to ones powered by renewables, excluding nuclear power and expressly reflects 2030 targets of the UN IPCC report (Green New Deal roadmaps). According to Mark Z. Jacobson et al., to avoid 1.5°C global warming, we must stop at least 80% of all energy and non-energy fossil fuels and biofuel emissions by 2030 and stop 100% no later than 2050 (Jacobson, Delucchi, et al, 2019, p. 449). The net present value of the capital cost of transitioning to WWS energy worldwide is $72.8 trillion over all years of the transition between today and 2050 (Jacobson, Delucchi, et al, 2019, p. 458).

Green New Deal roadmaps follow up on previous work presented by Mark Z. Jacobson and his team in Stanford on August 23, 2017 where authors introduced a vision of the electrical generation mix for 139 countries (Jacobson et al, 2017). Based on the National Renewable Energy Laboratory (NREL) estimates of technical potential, offshore wind is assumed viable in the 108 out of 139 countries with ocean or lake coastline. According to NREL the annual average capacity of the wind, including offshore one in Ukraine equals to 310.46 GW (Arent, et al, 2012). This quantity is two times bigger than the capacity of Germany (124.34 GW), the world's second largest offshore wind market (Offshore Wind).

The Green New Deal roadmap provides a vision where offshore wind constitutes 15,2% of the 2050 projected energy mix of Ukraine. This estimate is equal to solar plants (15.2%). According to Jacobson et al., transition to WWS will create 40-year jobs for Ukrainians where 96,407 are in construction and 95, 522 in operation. The work also estimates the reduction of energy demand by 61% due to improvement of energy efficiency (Jacobson, Delucchi, et al).

The harsher marine environment and higher costs for access to the wind site for performing maintenance on turbines and cabling operations makes operation and maintenance costs for offshore wind farms higher than those for onshore wind (IRENA, p. 83). Still offshore wind has many benefits compared to onshore one. NREL reports that capacity factor of offshore wind is 2% higher than onshore (NREL 2020). Turbines in a 15-mph wind can generate twice as much energy as turbines in a 12-mph wind (What are the advantages and disadvantages of offshore wind farms). Consequently, due to offshore wind power a country can produce more clean energy and satisfy energy demand effectively.

IRENA report 2019 finds that the global weighted-average total installed cost of offshore wind farms increased from an average of around USD 2 600/kW in 2000 to an average of over USD 5000/kW between 2011 and 2014, as projects moved farther from shore and into deeper waters. The global weighted-average total installed cost peaked in 2013, when it reached USD 5 740/kW, and has since fallen to USD 3 800/kW in 2019. Electricity costs from onshore and offshore wind both fell about 9% year-on-year, reaching USD 0.053/kWh and USD 0.115/kWh, respectively, for newly commissioned projects (IRENA, Overview). Consequently, offshore wind develops in a way to provide the cheapest sustainable energy.

2. The Regulatory Environment of the Offshore Wind Energy Industry in the U.S. and Ukraine. Takeaways for Ukraine

Unlike onshore wind which is limited by suitable terrestrial location for wind turbines, offshore wind helps to preserve lands for agriculture or other purposes which are better for a country's economy. Last but not least is that with some exceptions offshore wind can sidestep nuisance suits some communities can have about nearby wind turbines – namely, that they are noisy. In the U.S. onshore sites are likely to be on private property and the most probable argument advanced by the opponents of a wind farm will be nuisance. A nuisance is a condition which substantially interferes with the use and enjoyment of land by causing unreasonable discomfort or annoyance to persons of ordinary sensibilities attempting to use and enjoy it (*Holubec v. Brandenberger*). As Stephen Harland Butler observes, this sort of litigation raises basic questions about whether the nuisance mechanism, once the most common method of asserting an environmental right in U.S. private law, is now being used to undermine environmental progress and continues reliance on fossil fuels (Butler, 2009).

Although aesthetic objections which were advanced by the opposition to Cape Wind, the Americas' first biggest offshore wind farm project, were rejected as grounds for nuisance (Smith, 2007, p. 290), the objectors' strategy of tying up the project in legal disputes worked. The project collapsed in 2017, after 16-years of litigation. Cape Wind became known as a "requiem for a dream" (Davidson, 2018). The proposed site for offshore wind farm's location was less than 8 kilometers from part of the Massachusetts mainland, to which it would have supplied power, along with the tourist hotspot islands of Martha's Vineyard and Nantucket (Davidson, 2018). Once announced, the proposal evoked immediate and vigorous opposition from landowners on Nantucket Island, the governor of Massachusetts, and a wide variety of business, tourist, environmental, sailing, fishing, and citizens' groups (Smith, 2007, p. 285). As a result, Cape Wind which was first mooted in 2001 did not reach financial close in 2014 and enabled National Grid to walk away from power purchase agreements for 77.5% of the project's output in January 2015 (Heap, 2018). The Block Island Wind Farm came to be the Americas' first successful offshore wind project. It came online in 2016 (America's new ocean energy resource).

Unlike the permit procedure which applies to onshore facilities in the U.S. and subjects them to state authority decision (Public Utility Commission or other siting agency)[1], siting and construction of energy power installations on the Outer Continental Shelf (OCS) is governed by the federal power since August 2005. In general, the OCS begins 3 nautical miles (mi) off coastal shorelines and extends to about 200 nautical mi offshore, with depths ranging from a few meters to thousands of meters. Exceptions are offshore of Texas and Florida, where the OCS begins 9 nautical mi offshore (Executive Summary).

Section 388 of the Energy Policy Act of 2005 amended the Outer Continental Shelf Lands Act (OCSLA) to clarify the federal government's role in siting offshore renewable energy facilities, including offshore wind power (OCS Land Act History). It gave the U.S. Secretary of the Interior, in coordination with other agencies, authority over offshore renewable energy facilities on the OCS (Outer Continental Shelf Lands Act, sec. 388). The Department of the Interior has exclusive jurisdiction over the production, transportation, or transmission of energy from renewable energy projects on the OCS including offshore wind and solar power (Partnering With Federal Energy Regulatory Commission). Through delegation from the Secretary of the Interior, in 2009 Bureau of Ocean Energy Management (BOEM) came to be the main federal agency responsible for managing energy development on the OCS

[1] The Texas Zoning Enabling Act empowers Texas cities to zone. This delegated power from the state to the exclusive authority of a city to zone.

(Partnering With Federal Energy Regulatory Commission). At the same time, states leverage over federal offshore activities is reflected in the Coastal Zone Management Act (CZMA). The latter entitles states to enact coastal zone management plans for the protection of habitats and resources in coastal waters and requires that federally permitted activities comply with approved state programs (16 U.S.C. § 1452, Congressional declaration of policy, sec. 303).

The regulatory process for offshore energy facilities includes the following phases: The Planning and Leasing phases are aimed at establishing an Intergovernmental Task Force for any identified wind energy areas to ensure that all stakeholders with relevant expertise, including state and sometimes local governmental authorities are engaged with BOEM from early in the process. Any lease issued for an offshore renewable energy development is done on a competitive basis – through the auction (A Citizen's Guide to the Burau Of Ocean Energy Management's Renewable Energy Authorization Process). At the very first stage of an application process, BOEM must conduct an environmental review and assessment of an offshore wind project under National Environmental Policy Act. The latter requires federal agencies to assess the environmental and related social and economic effects of the proposed actions prior to making decisions on permit application (Code of Federal Regulations, Title 40, § 1508.18). Environmental evaluation is intended to ensure that a project is complied with the following U.S. Federal wildlife laws: Endangered Species Act (ESA), Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, List of Endangered and Threatened Wildlife and the List of Endangered and Threatened Plants which contain the names of all species that have been determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service to be in the greatest need of federal protection. Section 7 of the ESA mandates BOEM and all other federal agencies to consult with the Secretary of Commerce and Interior to ensure that any agency action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of an endangered or threatened species' critical habitat. The consultation procedure begins when BOEM provides Environmental Protection Agency with details on the proposed activity. The process ends with finding that there is no likelihood of an adverse effect on a listed species, or in the issuance of a biological opinion. Migratory Bird Treaty Act and Coastal Zone Management Act federal consistency provisions require federal actions that are reasonably likely to affect land or water use of the coastal zone to be consistent with enforceable policies of a state's coastal management plan (Coastal Zone Management Act, Sec. 307).

If the auction results in a lease, at the second phase lessee receives access and operational rights to produce, sell and deliver renewable energy generated from the facilities on the OCS in the lease area with the exception of doing construction. The third phase is the Site Assessment which requires the lessee to submit to BOEM the description on how the lessee will conduct its assessment activities and technology testing on the OCS. This data should be reflected in Site Assessment Plan (SAP) and General Action Plan which includes a geotechnical survey, a shallow hazards survey, an archaeological survey, a geological survey, and a biological survey. BOEM must review and evaluate the SAP and GAP annually, including conducting its own environmental review and ultimately deciding whether to approve, disapprove, or approve the SAP with conditions. At the fourth phase, the lessee has to submit Construction & Operation Plan (COP). The latter to contain decommissioning plans when the lease ends. Similar to the SAP, BOEM will conduct its own environmental and technical reviews of the COP, including an evaluation of reasonable project alternatives. In addition, the agency will solicit public comment before ultimately deciding whether to approve, with conditions, or disapprove the COP. Finally, if BOEM approves the COP, then the project developer typically would be granted a 25-year commercial lease with right for renewal.

Importantly, the BOEM can order suspension when continued activities pose imminent threat of serious harm to natural resources, life, marine, coastal environment (Code of Federal Regulations, Title 30, § 585.417). Then the lessee might be requested to provide a site-specific study that evaluates the cause of the harm, the potential damage, and the available mitigation measures.

States can review leases. If the State objects to an Exploration Plan, BOEM can approve the plan but cannot issue permits. If the State objects to a development or management plan, BOEM cannot approve the plan and the lessee can either choose to appeal the State’s decision to the Department of Commerce or amend and resubmit it.

Although this complex and lengthy regulatory process is a commonly noted as a barrier to the offshore wind industry in the U.S. (Mills, et al, 2018), offshore wind remains of interest and can set an example for Ukraine due to high standards related to environment protection. Even though Ukraine and the U.S. are countries with different legal systems, nowadays the world observe a significant rise in environmental opposition and climate change litigation. Consequently, consideration of the legislation applicable to new technologies as well as its compatibleness with environment is crucial. Furthermore, as offshore installations imply harsher marine environment and higher costs for access to the site for performing maintenance, cabling operations, building transmission lines, offshore renewable energy sources need to be explicitly separated from other sources for the purpose of feed-in tariff application in the Law of Ukraine “On alternative sources of energy”. Unlike the current version of the mentioned Law which does not reflect the understanding of this difference, Maryland’s Offshore Wind Energy Act of 2013 amended the state’s renewable portfolio standard to include offshore wind and to provide financial support for projects in the form of Offshore Wind Renewable Energy Credits (Offshore Wind Energy Development in the U.S.). It set an example of effective state’s activities aimed to drive offshore renewable energy power.

Last but not least is taking measures to ensure full grid access for independent generators of renewable power from offshore renewable energy sources. Full grid access for renewable power plants, did not emerge in the U.S. until the issuance of Federal Regulatory Commission Order No. 888 in 1996, which required that generators have open access to utilities' transmission lines (Eisen, Hammond, Rossi, Spence, Wiseman). Apart from federal regulations which broke open power market, the majority of the U.S. states developed their own policies to drive offshore wind demand. For instance, Massachusetts passed a law in August 2016 requiring utilities in the state to procure 1,600 megawatts of offshore wind power by 2027. The state passed new legislation in August 2018 that would double the offshore wind target to 3,200 MW by 2035 (Offshore Wind Energy Development in the U.S.). Likewise, New Jersey passed legislation in May 2018 to increase its offshore wind target from 1,100 MW to 3,500 MW by 2030, fulfilling the Governor's Executive Order (Offshore Wind Energy Development in the U.S.).

Consequently, for a government which recognize UN IPCC goal for limiting global warming to 1.5°C and moving towards clean energy it is of crucial importance to support offshore renewable energy development by introducing a full grid access for offshore power plants, setting requirements to utilities to procure certain amount of power from installations constructed in a body of water and setting out separate feed-in tariff for the energy produced by offshore renewable energy installation.

Conclusions

Given the data provided by international agencies which was analyzed in this article, offshore energy power will expand impressively over the next decades. A country's water body might become a separate field which can represent not only all possible onshore installations with stronger capacity, but be the place for unique new technologies, such as offshore hybrid platforms or submerged water turbines. Whether Ukraine choose to be an active actor in fulfilling UN IPCC goal for limiting global warming to 1.5°C, or if Ukraine will accept a vision for the transition to 100% WWS, proposed by Jacobson et al, the significant changes in the future of energy market are unavoidable. Consequently, new rules and regulations in response to market developments should be in place.

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Іщенко В. Розвиток морської відновлюваної енергії: досвід США та можливості для України. – Стаття.

Ця стаття являє собою комплексний аналіз розвитку глобальної офшорної відновлюваної енергетики з акцентом на морські вітри, як найшвидше поновлюване джерело енергії, що формується над морськими і океанськими просторами. Беручи до уваги швидке зростання технологій чистої енергетики і беручи до уваги мету, встановлену Міжурядовою групою експертів ООН зі зміни клімату щодо обмеження глобального підвищення температури на 1,5°C у порівнянні з більш високими рівнями, до 2050 року світ може стати свідком 100% переходу на поновлювані джерела енергії. Огляд нещодавнього дослідження, опублікованого Стенфордським університетом, в якому автори розробили підстави для заміни 99,7% енергії, видобутої з корисних копалин, у 143 країнах вітром, водою і сонячною енергією, дає уявлення про розроблену вченими майбутню енергетичну інфраструктуру і розробку політики у сфері зміни клімату. Морські вітри є досить характерним явищем для

України, однак на момент написання цієї статті у цій країні немає жодної морської вітряної електростанції. Чи є в Україні перспективи використання відновлюваних джерел енергії? Чому морський вітер буде вигідний? Чи може ця галузь успішно розвиватися без державної підтримки? І якщо це неможливо, то як законотворча діяльність може стимулювати використання відновлюваних джерел енергії в Україні? Мета статті полягає у пошуку відповідей на ці питання, базуючись на досвіді Сполучених Штатів, де морський вітер починає відігравати значну роль у майбутній енергетичній інфраструктурі.

Ключові слова: зміна клімату, вітер, проекти відновлюваної енергії, енергоресурси, енергія вітру, оновлення законодавства, США, Україна.

Ищенко В. Развитие морской возобновляемой энергии: опыт США и возможности для Украины. – Статья.

Эта статья представляет собой комплексный анализ развития глобальной оффшорной возобновляемой энергетики с акцентом на морские ветра, как наиболее быстро возобновляемый источник энергии, формирующийся над морскими и океанскими пространствами. Принимая во внимание быстрый рост технологий чистой энергетики и принимая во внимание цель, установленную Межправительственной группой экспертов ООН по изменению климата относительно ограничения глобального повышения температуры на 1,5°C по сравнению с более высокими уровнями, к 2050 году мир может стать свидетелем 100% перехода на возобновляемые источники энергии. Обзор недавнего исследования, опубликованного Стэнфордским университетом, в котором авторы разработали основания для замены 99,7% энергии ископаемого топлива в 143 странах ветром, водой и солнечной энергией, дает представление о разработанной учеными будущей энергетической инфраструктуре и разработке политики в области изменения климата. Морские ветра достаточно характерное явление для Украины, однако на момент написания этой статьи в этой стране нет ни одной морской ветряной электростанции. Есть ли в Украине перспективы использования возобновляемых источников энергии? Почему морской ветер будет выгоден? Может ли эта отрасль успешно развиваться без государственной поддержки? И если это невозможно, то как законотворческая деятельность может стимулировать использование возобновляемых источников энергии в Украине? Цель статьи состоит в поиске ответов на эти вопросы, базируясь на опыте Соединенных Штатов, где морской ветер начинает играть значительную роль в будущей энергетической инфраструктуре.

Ключевые слова: изменение климата, ветер, проекты возобновляемой энергии, энергоресурсы, энергия ветра, обновление законодательства, США, Украина.