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Wind energy in the Gulf Cooperation Council region: progress, challenges and strategies for development

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Abstract

Purpose – Until recently, the Gulf Cooperation Council (GCC) region, whose members consist of Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Oman and Bahrain, has not significantly focused on the green transition. Specifically, wind energy development has made minimal progress relative to that of other regions.

Design/methodology/approach – The abundance of cheap fossil fuels in the region has not incentivized renewable energy development, and where this has taken place solar technologies are often preferred.

Findings – However, lower technology costs together with lost investment opportunities – also common elsewhere in the world, has increased the pressure on the GCC region from developers. This work qualitatively addresses the challenges and the strategies for the wind development in the area. It focuses on the analysis of different proposed type of investments – driven by a state-supported proposed fund – such as utility-scale investments, industry-specific investments, manufacturing investments and regional accelerators.

Originality/value – The work also suggests that Gulf sovereign wealth funds should act as the lead investors under new schemes, such as joint ventures, for wind development in the GCC, using their wealth to offering their populations with new sources of employment as well as energy that is sustainable.

Keywords Gulf cooperation council, Sovereign wealth funds, Utility-scale investments, Wind energy development

Paper type Conceptual paper

1. Introduction

The development of renewable energy resources in the states of the Gulf Cooperation Council (GCC) – an intergovernmental economic and political body including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates – region has been slow in most cases. The organization's six member states have made most of their progress in the field of solar power, while the development of wind resources remains both recent and limited. As the GCC's



member states are some of the most prolific oil and gas producers in the world, their power generation sectors have enjoyed artificially low-priced oil and gas resources for decades (Krane, 2019). Though perhaps unintentionally, this dynamic has created some of the most energy intensive economies in the world and contributed to extremely high levels of power demand across all segments of society. This has also turned the Gulf states into some of the heaviest per capita carbon emitters, with Saudi Arabia alone responsible for 1.8% of global carbon dioxide emissions in 2018 (BP, 2019). With volatility in energy markets causing severe fiscal distress for many of the Gulf States, the need to diversify the power generation mix across the region appears more urgent with each passing year.

Beyond that, based on the oil and gas production in the states of the GCC, severe environmental problems have been noted. Desertification and drought (Kannan, 2012), biodiversity loss (Gasparatos *et al.*, 2017), pollution in coastal sites (Sakthipriya *et al.*, 2015) and air pollution (Al-Saidi and Elagib, 2018; Omidvarborna *et al.*, 2018) are only few of the traditional energy-transitional challenges in the area.

Though wind power has been slow to develop in the Gulf region, it holds strong potential to increase efficiency in strategic industries across the region and to contribute to national development goals (Figure 1).

The Middle East along with Africa report some of the lowest percentages of wind energy use worldwide, yet recent trends are beginning to reveal the extent of the Gulf region's potential for wind energy usage (Mahmoodi *et al.*, 2020; Amirinia *et al.*, 2017). Furthermore, one of the main business goals of the region – which has been neglected so far – is that due to its geographical position, serious wind power development could lay the grounds and create links with the European electricity, heating and gas markets with the energy sector of Middle East and Asia in general, hoping to end electricity isolation of the two continents and create new investment opportunities.

This paper will first explore some of the progress that wind energy has made in the GCC region in recent years, and review some of the scientific literature that has attempted to assess the potential for further wind resource development in different countries throughout the

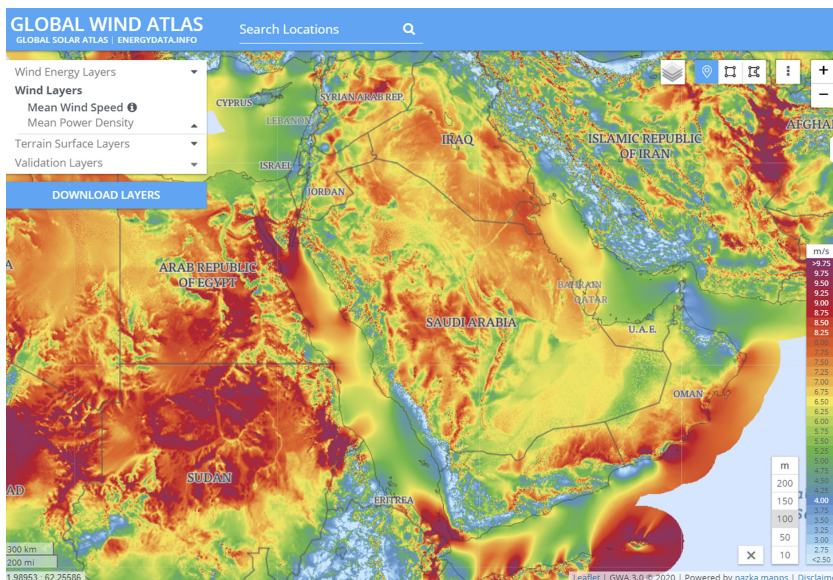


Figure 1.
High wind energy
resources in the GCC
region (Global Wind
Atlas, 2020)

region. It will then propose ways in which sovereign wealth funds that have experience in renewable energy development, including wind energy, can attempt to accelerate the growth of this sector in the region by leveraging both international and regional partnerships.

2. Literature review

In order to gain an understanding of the way wind resources have been assessed in the GCC region, this paper consulted a variety of peer-reviewed publications, many of which attempted to assess both wind resources and potential wind technology applications across the GCC in Saudi Arabia, Oman, Kuwait, Qatar and the United Arab Emirates. Several of these countries have already begun operating or constructing their first wind farms, which will be discussed after the literature review. While each state varies in size and available wind resources, they are all reliant upon hydrocarbon revenues for approximately 70–85% of the government budget in each country, highlighting the importance of the energy industry to each country’s fiscal position. Additionally while Saudi Arabia, Kuwait and Oman have higher wind energy potential than Qatar and the UAE, a study conducted in the latter demonstrated ways in which wind energy could be used to promote efficiency in oil and gas industries and water desalination processes, which is a model that many national energy and utility companies may be interested in embracing (2019 Oman State Budget, 2019).

A common theme of wind energy assessment literature in the GCC region is the acknowledgement of the fact that not only is the region’s wind industry underdeveloped, but its wind resources are considerably under-assessed. A study on wind energy potential in the state of Qatar discussed that, one of the first assessments performed in the country in 1990 was conducted at only 10 m, with limited extrapolation to 25 m (Mendez and Bier, 2019). There are several studies that focus on the photovoltaics (PV) production, but no studies were found on the wind resources of the country. Further, the study concluded that the overall wind potential of Qatar has been greatly underestimated in the past, noting in its findings that the country has 1,421 h of full-load wind per year. Yet perhaps most importantly, the study demonstrated that a small 17 MW wind power plant could yield as much as \$3.32 million per year if it were used to generate power for nearby natural gas extraction and processing facilities. This will be a critical component in establishing the viability of wind energy in the region, as heavy industries are some of the region’s largest consumers of electricity.

According to the latest data from IEA (2019), the importance of renewables can also be seen from the results in energy demand for the first few months of the COVID-19 outbreak. The only “fuel” that their projected demand did not fall was renewables (Figure 2). Two additional

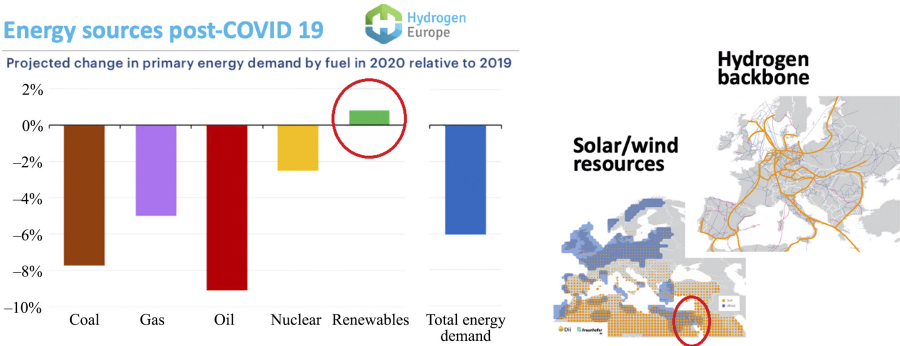


Figure 2.
An opportunity for
renewables and
hydrogen growth in
GCC region (van
Renssen, 2020)

Source(s): IEA April 2020

graphs in Figure 2 illustrate that wind energy is also rather important in North Africa and Middle East regions. Furthermore, based on the pompous European hydrogen growth plans, expansion of the areas for wind produced hydrogen is needed especially in areas where fossil fuels are still dominant in the transportation sector, and therefore it is a unique opportunity to develop green energy in interconnected Europe and Middle East (Zhang *et al.*, 2017).

Another study performed on the tools used to assess wind potential in neighboring Saudi Arabia pointed to the fact that previous assessments performed in Saudi Arabia were relatively limited in their geography; generally covering a few areas of the Red Sea and Gulf coasts (Shaahid *et al.*, 2019). This has resulted in many regions of Saudi Arabia, the largest of the GCC states, being overlooked for their wind energy potential. The same study selected two areas of the country; Khamis Mushayt in the southeastern province of Asir and Badanah in the Northern Borders Province to assess the wind resources in these areas. While the study demonstrated that these locations were viable for wind energy generation during 48 and 59% of the year, it also stressed the importance attached to seasonal considerations. The wind resources in these regions displayed most of their potential in the summer, which coincides with the highest power demand due to increased usage of air conditioners (Krarti and Ihm, 2016).

A study, conducted in the Saudi city of Dhahran, located in the coastal region of the Eastern Province, attempted to assess the viability of deploying small-scale, hybrid wind power solutions for the “average commercial building.” So far, hybrid wind-based systems are preferred for isolated (Hansen and Xydis, 2020) and autonomous areas (Michalitsakos *et al.*, 2017). However, due to the mass electrification of our demand, the technological progress and the decrease of costs, hybrid systems appear even on grid-connected areas (Xydis, 2013; Xydis *et al.*, 2017).

For the purposes of the study, this was defined as a building with an annual electricity demand of 620,000 kilowatt-hours (kWh). The study concluded that a 100 kW turbine system with a 37 m hub-height paired with a 175 kW diesel generator experienced 25% wind penetration, effectively decreasing the number of hours in which it would be necessary to run an accompanying diesel generator. The study considered this to be a viable model due to the fact that if a diesel generator operates at less than 40% of its full load, its efficiency and lifespan decrease, with the need for maintenance becoming more frequent. With Saudi demand for electricity expected to reach 55,000 MW within 2020–2021, the ability to provide generation options with zero fuel cost is likely to becoming increasingly appealing in the kingdom’s power market (Shaahid, 2015).

Another study, which performed an assessment of wind energy potential in the coastal city of Duqm, Oman, highlighted the potential of wind energy resources for reducing costs for strategic development projects. The Special Economic Zone at Duqm (SEZAD) is a project to construct a massive new port and industrial city on the Indian Ocean which has attracted billions in international investment. Noting the reduced potential for solar energy resources in this area due to high concentrations of mineral dust in the air, the study concluded that the site’s 2,463 h of full-load wind per year could potentially generate up to 75GW h net AEP (Al-Yahyai and Charabi, 2015). What this study as well as the earlier research conducted in Qatar are able to prove is that wind energy potential in the GCC can be used to power strategic industries and projects beyond the construction of utility-scale capacity, which is an area that is likely to be of particular interest to the GCC power sector.

In contrast to some of the older assessments taken in the Gulf region, a 2018 study of potential wind resources in Kuwait used elevations of 50, 80, 100 and 120 m to measure wind energy potential. The study also claimed to be one of the first assessments of wind energy potential in coastal and offshore areas of the country (Alkhalidi *et al.*, 2019). As with other studies and most other literature on energy consumption in the GCC, the literature discusses Kuwait’s high levels of power demand growth, with the country moving from 178 GW

generated in 1995 to 504 GW in 2014; an increase of 183% in a period of less than twenty years with the country's population more than doubling in the same period of time. The study reported that at least three offshore locations showed promise for wind energy potential, with at least one offshore location classified as "possible," stating that a hub height of at least 100 m would be recommended for these sites. What is unique with respect to this study is that it is one of the few peer-reviewed publications that has made an attempt to assess offshore wind resources in an Arab Gulf state; while there is a growing body of literature of onshore wind resources in the region, there is little information about offshore potential, which is an area that may have much to gain given the pre-existing offshore oil and gas infrastructure that many states already possess in their territorial waters.

With respect to energy policy in the GCC region, it is also important to understand that this collection of states can be defined as Heavily Energy Subsidized Economies, or HESEs (Sarrakh *et al.*, 2020). David Newberry defines HESEs as "those countries that devoted more than 1.5% of GDP in 2014 to explicit subsidies to energy." However, his paper claims that on average HESEs actually devote closer to 4% of GDP to subsidy spending (Newberry, 2017). Using figures from the paper, GCC states spent an average of 2.06% of GDP on electricity subsidies in 2013, with an average total subsidy cost of \$18.86 billion. These numbers vary quite greatly, with Saudi Arabia spending \$71.3 billion on energy subsidies the same year. Such high levels of spending in an era when energy prices no longer guarantee a consistent level of government revenue highlights the urgency of energy subsidy reform in the GCC, many of which have not been revised since the 1970s (Sarrakh *et al.*, 2020). This is due to the fact that the need to increase and diversify sources of government revenue has led governments in the region to implement major increases in the price of gasoline, diesel and other fuels, many of which are used in power generation processes. However, as in other literature, Newberry asserts that there is greater interest in renewables from the Gulf due to falling costs; so much so that renewable sources are now in many cases competitive with thermal power generation methods. Newberry also concurs with other available literature in pointing out that wind resources in the GCC region are generally stronger at night, and as such are able to complement the intermittency of solar renewables, which are the preferred renewable technology of the region. As with other literature, the paper also notes the lack of reliable wind data for the Gulf region.

A recent report written by Robin Mills for the Columbia University Center on Global Energy Policy sheds interesting new light on the further evolution in attitudes toward usage of renewable energy in the Gulf. Mills notes that renewable energy sources in the region are gaining momentum after several "false starts" and states that wind energy resources are very much a part of this dynamic, which he attributes at least in part to the expected 24% drop in average regional capital costs for onshore capacity development (Mills, 2020). Mills also takes time to note that while his work does not thoroughly explore offshore wind potential in the Gulf (perhaps due to the aforementioned scarcity of research on the topic), there is growing interest in developing offshore wind potential in the region. This is a sentiment that was demonstrated by energy officials in Oman in late 2019 (Oman mulls offshore wind energy projects, 2020). With respect to onshore potential, Mills forecasts installed wind power generation capacity in the Middle East to rise to 21.5 GW between 2019 and 2035, with 10.6 GW installed in Saudi Arabia alone. Additionally, Mills notes that outside of the GCC, most wind energy capacity in the Middle East region is expected to emerge in Egypt, Jordan, Iran and Iraq, the latter of which is estimated to have up to 5 GW in wind potential.

With respect to sovereign wealth funds, there is a considerable body of work available on the topic, one of the most prolific of which is Karen E. Young. Young describes sovereign wealth funds in the modern context as "based upon the shared rents from oil production, but as they have evolved they are also becoming transformative in new national development

strategies. Some SWFs now veer from traditional practices of safeguarding wealth to more experimental and high-risk strategies that claim to be able to diversify national economies from oil dependency, while also promising high returns,” (Young, 2020). Young also notes that GCC funds are active investors that use their resources in their attempts to create jobs and diversify national economies. As it is discussed later in the paper, sovereign funds in most parts of the Gulf have made considerable investments into renewable energy both in their own region and beyond.

3. GCC fund proposal

This paper proposes – on a qualitative basis – that Gulf sovereign wealth funds act as lead investors in the establishment of a new fund for wind development in the GCC. The authors followed a methodology which was based on their own experience in the GCC region (also interviews-based) and in the expanding literature over the last years. There are four proposed activities for the fund (utility-scale investments, industry-specific investments, manufacturing investments and regional accelerator), which are the development of utility-scale wind farms in GCC states, development of industry-specific wind power opportunities, investment into turbine component manufacturing and the establishment of a regional accelerator for wind energy researchers and developers based in the Middle East. The characteristics of each activity were pointed out and interventions and comparisons were given. State-backed funds acting as lead investors may inspire confidence from institutional investors from other parts of the world, which will also serve to assist GCC states in their need to attract foreign direct investment and diversify their primarily hydrocarbon-based economies.

The Public Investment Fund (PIF) of Saudi Arabia, which owns a 45% stake in ACWA Power, and Mubadala of Abu Dhabi, which owns 100% of Masdar, are the most likely candidates for participation in a fund of this nature. However, each GCC state possesses one or more sovereign funds, all of which have either displayed a history of investment in renewable energy opportunities or other technology-centered investments. According to a 2019 IRENA report on renewable energy investment in the GCC, the Kuwait Investment Authority (KIA) owns a 25% stake in Global Power Generation, a Spanish firm with 3 GW of both wind and solar projects (Renewable Energy Market Analysis: GCC 2019, 2019). The Abu Dhabi Investment Authority, (ADIA), not to be confused with Mubadala, also owns an undisclosed share of ReNew Power Ventures, which holds a 5.8 GW portfolio of solar and wind projects.

Despite the area’s oil extraction focus there are development plans for the next five years of more than 1.5 GW of wind projects in total. Masdar in partnership with EDF Renewables have invested in a 400 MW project (Dumat Al Jandal site) in Saudi Arabia approx. 1,000 km north of Riyadh. The project’s construction has already started. Also, Oman, Kuwait and UAE have approx. 300 MW of cumulative wind installations and they have plans for mass deployment (Al-Salem *et al.*, 2018).

Country	Project	Size (MW)	Completion year
Bahrain	Al Dur (solar-wind hybrid)	5	N/A
Kuwait	Shagaya	10	N/A
Oman	Dhofar phase I	50	2019
	Dhofar phase II	150	2023
Saudi Arabia	Dumat Al Jandal	400	2022

Source(s): IRENA (2019)

Table 1.
Current wind energy projects in the GCC

3.1 Utility-scale investments

In 2019, first power was reported from the 50-megawatt (MW) Dhofar Wind Farm, which is the first utility-scale wind farm in the GCC region. It will be followed in 2022 by Dumat Al Jandal, which will be the largest such facility in the region with 400 MW of installed capacity. What both of these projects have in common is the involvement of Masdar, an energy development company based in the UAE and fully owned by the Mubadala Investment Company, one of the UAE’s sovereign wealth funds. Masdar’s involvement in this process should come as little surprise, given its investment in wind projects around the world for a number of years prior to involving itself in wind energy development in the Gulf.

Additionally, Masdar’s involvement makes it clear that while some Gulf countries have liberalized the generation segment of the power sector, development of renewable generation sources is highly likely to be led by state-owned enterprises (SOEs). Masdar’s only real competitor in this realm is a Saudi Arabian company called ACWA Power. The company is 45% owned by the Public Investment Fund, Mubadala’s Saudi Arabian counterpart, and also has extensive experience as a driver of significant power generation capacity in its region and beyond. While ACWA Power has participated in the development of wind farms in Jordan and Morocco, Masdar has participated in the development and operation of at least 12 wind farms across the world, including the London Array, Hywind and the Dudgeon Offshore Wind Farm ([ACWA POWER Assets, 2020](#); [Clean Energy Project and Ventures By Masdar, 2020](#)). The experience both companies have gained working on these projects around the world can be leveraged for greater exploitation of Gulf wind resources, which from Masdar’s involvement in projects in Saudi Arabia and Oman looks to be well underway. There are numerous examples on Masdar’s initiatives in Abu Dhabi ([Mezher et al., 2010](#)), but also elsewhere ([Madichie, 2011](#)).

While this indicates that there is a new drive to develop the region’s wind resources, the sector still remains behind those of its peers in other regions of the world. By providing a new source of capital for investment in wind energy across the region, international wind firms may increase their interest in developing the region’s wind resources by raising the profile of the industry’s prospects in the region. This is a dynamic that would likely be attractive to regional governments, many of whom have set national goals for the development of wind resources, some of which are more ambitious than others.

3.2 Industry-specific investments

Much of the literature consulted for this proposal implies that there is strong potential for Gulf states to utilize wind energy resources beyond their ability to compliment base load generation capacity ([Ucal and Xydis, 2020](#)). Targeted use of wind energy technology can improve efficiency in strategic national industries and development projects, and this is an area of development that the fund could accelerate through investment in the development of more innovative wind energy technologies ([Xu and Liu, 2020](#)).

As one case study conducted in Qatar demonstrated, wind energy projects have strong potential to help offset both carbon emissions and costs for the oil and gas industry, which at

Table 2.
Wind energy
development goals by
country

Country	Target capacity (GW)	Target date
Bahrain	0.35	2035
Oman	1.15	2024
Kuwait	0.7	2030
Saudi Arabia	9.0	2040

Source(s): [Columbia SIPA Center for Global Energy Policy \(2020\)](#)

present still constitutes the main source of government revenue for states in the GCC region (Mendez and Bier, 2019). Via a nexus, carbon emissions in Qatar can be offset and optimize water usage and planning (Lahlou *et al.*, 2020). Even discussions on hydrogen and its applications have started lately proposing a hydrogen-based economy (Kazi *et al.*, 2021) for Qatar. However, as both Qatar and the neighboring UAE have expansive offshore oil and gas infrastructure, the fund may show interest in investing in technology developing wind power sources for offshore oil and gas facilities. Similarly, another study conducted in Oman concluded that the coastal city of Duqm (Al-Yahyai and Charabi, 2015), in which a special economic zone is currently being built, also had strong wind energy potential. Further, the study which found viable usage for hybrid wind/diesel power generation in commercial facilities is a model that could prove feasible for remote areas of larger GCC states. There are many rural communities in both Saudi Arabia and Oman that have the potential to benefit from this type of distributed generation technology, and this would also ease the long-term burden of subsidy reforms on some of the populations most vulnerable to higher fuel prices (Xydis, 2015).

The potential for use of wind power in water desalination projects, which are a key component of the GCC's critical infrastructure, is an area that has received less attention. This is due in part to the fact that most of the region's installed desalination capacity still relies on thermal technologies that typically use natural gas or oil products to power their processes and are often established adjacent to power generation facilities (Mogielnicki, 2020). However, the increasing usage of reverse-osmosis (RO) desalination methods means that more of the region's desalination facilities only require electricity to operate pumps that move seawater through filtration membranes. An IRENA report from 2019 highlights two approaches to integrating renewables into the desalination sector. This involves either gradual electrification of desalination processes or co-locating renewable power facilities with desalination plants (Renewable Energy Market Analysis: GCC 2019, 2019). While there are not currently any desalination facilities in the Gulf that make use of wind technology, there is increasing interest in solar-powered desalination. As noted by many of the studies used in this paper, wind resources in the Gulf are typically stronger at night, and as such wind technologies may be able to compliment the use of solar power for desalination. Additionally, as almost all desalination facilities in the Gulf are located in coastal regions, this may increase the potential for greater wind energy penetration in the desalination sector. A 2017 study published in *Desalination* confirmed that the concept of wind-powered desalination, tested in the UAE, could produce water at a cost deemed competitive with thermal methods, although there are some obstacles remaining to greater commercial viability of this concept (Loutatidou *et al.*, 2017). This would be a prime area for the fund to invest and provide greater incentive for the development of renewable-powered desalination processes that incorporate wind power (Peng *et al.*, 2018).

3.3 Regional accelerator

This potential aspect of the fund's activities would focus on identifying new opportunities for funding research and development in the wind sector and could be accomplished through collaboration with research institutions that already exist in the region, such as the Masdar Institute, King Abdullah University for Science and Technology (KAUST) and the King Abdullah Center for Petroleum Studies and Research (KAPSARC). Many of the authors who participated in studies cited by this proposal are affiliated with these and other institutions in the GCC region. While these institutions have a proven record of producing valuable research and insight into many of the region's energy challenges, there is no unified mechanism to provide greater application for their efforts. A regional wind energy accelerator could assist researchers in addressing the lack of reliable data on the region's wind resources, which would in turn help to identify additional investment opportunities for the fund as well as other

international firms interested in the GCC wind industry. In Denmark, for example, the trade council of Denmark, Ministry of Foreign Affairs helps SMEs and large Enterprises in setting goals and achieve their ambitions within growth and innovation, by setting international offices in areas of interest ([Munch and Schaur, 2018](#)). This framework could also provide resources for the development of technologies that would be designed to address some of the unique applications for wind power in the region, such as desalination and offshore wind power for oil and gas platforms. International wind developers can also be encouraged to contribute their own resources and expertise to the accelerator as a means of satisfying in-country value requirements, which are typically defined as spending retained in-country that contributes to capacity building efforts in local industries.

3.4 Manufacturing investments

While this is an area of the fund's activity that would prove both time and capital-intensive, it is yet another area that would receive strong interest from GCC states interested in localizing the production of renewable energy technologies. Additionally, industry stakeholders have also expressed interest in participating in this process. A 2017 survey of 107 firms conducted by Saudi Arabia's Renewable Energy Project Development Office (REPDO) found that there is significant interest in participating in the country's renewable energy supply chain localization and distributed generation framework ([REPDO Suppliers Survey, 2017](#)). This is an area that would yield long-term benefits to the region's nascent manufacturing sector due to the fact that there is already significant installed wind generation capacity in the periphery of the GCC, such as in Jordan, Egypt and Morocco. Additionally, the presence of an expansive petrochemical industry as well as mining and metals processing industries might present a strong foundation for the establishment of turbine component manufacturing, given that many of the materials needed for this process are already produced by these industries ([Connelly, 2020](#)).

4. Further analysis

While sovereign investors would be providing most of the capital for an accelerated wind development program in the region, the establishment of an investment platform specifically interested in developing resources would present a comprehensive measure for addressing many of the challenges that the region's wind industry still needs to overcome. Further, the fact that two of the region's most experienced wind developers (Masdar and ACWA Power) are owned by sovereign wealth funds would put the fund ahead in its access to institutional knowledge on the development of wind energy resources elsewhere in the world. Both companies are better positioned than any other entities to understand the intricacies of Gulf power markets as well as their regulatory structure. Their track record of wind power development in the GCC to date will also help highlight the potential of regional resources; the Dumat Al Jandal project in Saudi Arabia set a world record for the lowest LCOE in onshore wind power at \$1.99/kWh ([Dumat Al Jandal wind project beats record low price for onshore wind power, 2019](#)).

Additionally, the international presence of these companies can help build investor confidence in the Gulf wind energy industry, which would likely be more difficult if this process were managed by government ministries or other relatively unknown state-owned entities. It is known that the presence of international companies increases the market confidence overall ([De Clercq et al., 2005](#)), but it needs to be supported on various sides. Multiple layers of state bureaucracy manage power markets, utility regulation, and national renewable energy programs in each part of the GCC. While these bureaucracies are a fact of

life that will have to be navigated by developers in the region, their track record on publicizing the region's wind energy potential leaves much to be desired.

Finally, the fund would be well-positioned to facilitate joint-venture (JV) partnerships between international energy companies and SOEs that are best able to locate strategic advantages for wind energy projects. Throughout the region, JVs have proven to be successful models for SOEs like Saudi Aramco, which entered into a JV with US-based Dow chemicals company to build the largest single-phase petrochemical complex in the world, located in Jubail, Saudi Arabia. There is little reason to believe that this model could not be applied to the development of wind resources in the Gulf, especially on offshore sites. International firms might also be more inclined to invest in regional projects if it were apparent that there was an equitable arrangement for cost-sharing, which would mitigate the risks of committing capital to a wind industry that is still developing. In China, for instance the JV model seems to work rather efficiently for the successful growth in the wind sector (Lacal-Arántegui, 2019).

5. Discussion

This proposal suggests a high level of state support for wind energy development in the GCC region for two specific reasons. The first of which is the fact that it is impossible to discuss wind development in the region without first acknowledging that photovoltaic (PV) solar power enjoys a strong competitive advantage as a renewable resource. Despite the fact that the LCOE is generally lower than solar PV in the average Middle Eastern context, the greater availability of solar resources makes this technology more attractive (Mills, 2020). As a result, the solar industry has received far more attention over the years and has contributed to the underdeveloped state of wind resources in the region. While a number of GCC states have released renewable energy development initiatives, solar projects continue to receive priority, and without establishing a strictly wind-focused development initiative such as the proposed fund, the development of wind resources will likely remain a secondary priority in the GCC renewables sector.

Additionally, another factor that may have influenced the slow growth rate of wind resources in the region is the fact that most GCC states have weak private sector environments that are often “crowded out” by state-led investment. As wind energy development is a time-intensive process in economies with more mature private sectors, wind energy development will likely continue to lag in the GCC if there is not a greater degree of state support for the industry. As the expansion of renewable energy capacity is a strategic priority for much of the Gulf region, this proposal argues that waiting for the emergence of a more robust private sector to develop the wind industry is insufficient for GCC states to achieve their renewable energy goals.

Although the GCC region is typically thought of as a collection of countries that almost exclusively export crude oil or natural gas, most countries in the region possess well-developed petrochemical industries in addition to mineral resources that have enabled the production of steel, aluminum and copper. As such, there may be interest in localizing some elements of wind turbine component manufacturing, given that many of the metals and plastics needed for their production can be locally sourced (Kocsis and Xydis, 2019). While this industry would take some time to develop, there is already a long-term demand for wind turbine components in the wider Middle East and North Africa region, since Egypt, Jordan and Morocco are much further along in the development of their wind energy sectors.

These are also countries in which Masdar and ACWA Power have taken a direct hand in developing wind farms, and future need for turbine components may be able to contribute to many of the unemployment woes that persist in the region. IRENA estimates that the wind industry can create up to 11,000 new jobs in GCC by 2030, if the industry continues to grow with the proper support (Renewable Energy Market Analysis: GCC 2019, 2019). Additionally, many national vocational training programs have a proven record of providing customized

training courses for companies that are establishing a new presence in GCC states. This is especially the case in Saudi Arabia, where government authorities have established a network of tertiary-level industrial training institutions across the kingdom that are able to provide internationally accredited training courses in electrical, mechanical, and metals related skills (About Training NITI, 2020). ACWA Power was involved in the creation of one such institution in 2010, which alongside its counterparts throughout the country could potentially serve as a framework to create some of the 11,000 positions IRENA estimates that the wind industry can create (“At the forefront of sustainability,” 2020).

This can also serve to diversify the revenue stream of sovereign funds away from the oil and gas sector and provide resources that can then be used to promote private sector developments in less urgent sectors of the economy. While sovereign funds have accumulated enormous wealth from oil and gas revenues, oil price crashes in both 2014 and 2020 have exposed these revenue streams to new degrees of volatility. Yet, the wealth that has been amassed from decades of successes in global oil and gas markets can now be used to successfully reorient the energy landscape of the Gulf towards a future in which it remains a relevant part of the global power industry. Ultimately, if GCC states do not take greater initiative to develop their region’s wind resources, they will do so at their own peril. It may be somewhat ironic that there is so much renewable energy potential in a region that is famous mostly for the wealth it has gained from fossil fuel production. Nonetheless, there is no more opportune time for Gulf states to use their considerable wealth to create an industry that can have significant stakeholdership in the region while supplying their populations with new sources of employment as well as energy that is sustainable and affordable.

6. Conclusions

While the journey toward the energy transition has gained traction in the Gulf, there is a long road ahead. Not much has happened on introducing wind energy sources in the GCC region, due mostly to the dominance of national oil companies with low oil and gas production costs. Furthermore, highly detailed research in the field of wind energy is absent in the region. The goal of this work was to analyze the existing research that has taken place in the region and propose a fund of high level of state support for wind development in the GCC power sector. The suggested structured of the GCC Fund Proposal was evaluated via the four proposed activities utility-scale investments, industry-specific investments, manufacturing investments and regional accelerator. The fund could facilitate the transition to wind from the unilateral PV growth that has dominated renewable development in the Gulf. This state-driven fund will be able to attract investors and build confidence in the Gulf wind energy industry, while contributing to efforts toward satisfying power demand growth based on years of unsustainable energy subsidies.

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