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Cover Page Footnote

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RESEARCH ARTICLE

Lesson-drawing and Policy Diffusion of GCC Countries in the Development of Renewable Energies: The Case of the Kingdom of Bahrain

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Abstract

The Gulf region is a booming economic region whose fast development depends very much on its natural energy resources. However, the accelerating pace of regional development and mega-projects also meant using more power generation and energy availability. Gas consumption in Saudi Arabia, Qatar, Kuwait, and the UAE surged by 50% between 2002 and 2008. GCC states occupy the top global rankings in carbon dioxide emissions per capita.

The comparative study of public policy is concerned with how different governments respond to a common problem. Comparisons can be made in terms of programs, resources, or outcomes. The paper compares how GCC countries have been investing in renewable sources of energy since 2004 to cope with increasing energy demands due to their fast development, the diminishing available resources, and the fall of hydrocarbure prices sources of energy. Some countries are pioneers in the process of adoption of renewable energy policies and some are laggards. The paper argues that GCC member states used lesson-drawing (Rose 1993) and policy diffusion (Berry and Berry 2019). We use the case study of the Kingdom of Bahrain and check whether Bahrain drew lessons (copying, adapting, making a hybrid, synthesis, or inspiration) in the case of solar energy. The data is collected through reports on renewable energy programs, speeches, and interviews with government officials and executives from the energy sector on the strategy of the country in this field. The findings show that Bahrain drew lessons from others in a creative way.

Keywords: Renewable energies, Lesson-drawing, GCC, Policy diffusion

1. Introduction

The development of the economy of the Gulf region has been conditioned by its natural energy resources. The accelerating pace of regional development and mega-projects also meant using more power generation and energy availability. The consumption of gas in Saudi Arabia, Qatar, Kuwait, and the UAE increased by 50% between 2002 and 2008. GCC states are one the leading global emitters of carbon dioxide emissions per capita.

The comparative study of public policy is concerned with how different governments respond to a common problem. Comparisons can be made in terms of programs, resources, or outcomes. The study compares how GCC countries have been investing in renewable sources of energy since 2004 to cope with increasing energy demands due to their fast development, the diminishing available resources, and the fall of hydrocarbure prices sources of energy. Gulf countries possess as many renewable resources as hydrocarbons. They have daily sunshine, they have the space to develop solar plants and they also have wind, geothermal, and biomass from urban waste (IRENA, 2019).

The carbon-neutral Masdar City project in Abu Dhabi as well as the choice of Abu Dhabi to be the headquarters for the International Renewable Energy Agency (IRENA) or the $10 bn-endowed King Abdullah University of Science and Technology which dedicated a research track on clean combustion energies and solar and alternative energy science in Saudi Arabia illustrate how active GCC

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member states have been in developing renewable energy programs. Some countries are pace-setters (Börzel, 2002) and pioneers in the process of adoption of renewable energy policies and some are laggards (Walker, 1969).

The paper argues that GCC member states used lesson-drawing (Rose, 1993) and policy diffusion (Berry & Berry, 2019). To test the hypotheses, we use the case study of the Kingdom of Bahrain and check whether Bahrain drew lessons (copying, adapting, and making a hybrid, synthesis, or inspiration) or not in its renewable energy policies. The data is collected through secondary data, from reports on renewable energy programs, interviews with government officials in the press, and experts from the energy sector on the strategy of the country in this field. The findings show that Bahrain drew lessons from others in a creative way especially from Dubai a leader in renewable energy technologies, but also collaborated with other members in developing renewable energy programs. We will first define the various types of renewable energies, then assess the opportunities to develop them in the region, review the literature on policy diffusion and convergence, and then specifically look at the record of the Kingdom of Bahrain and whether it drew lessons from neighbors or beyond the region from pioneers in this area. The article shows that the UAE has been a leader in the development of Renewable energy technologies, closely followed by the Kingdom of Saudi Arabia which inspired the Kingdom of Bahrain.

2. Renewable energy technologies

We need to first define what we mean by renewable energy technologies. According to the Extension on Natural Resources from Penn State, *"Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished)."* Renewable energy technologies range from solar power, wind power, hydroelectricity/ micro-hydro, biomass and biofuels for transportation" (Ciolkocz, 2009). Those sources of energy are developed from resources that are always replenished and never run out.

According to the Energy Information Administration, in 2020, renewable sources of energy represented 12% of total primary energy consumption. The implications of developing RET are twofold: first renewable energy technologies meant strengthening the energy security of the US and second improve environmental quality and contribute to developing an energy economy (Energy Information Administration, 2021).

Let us now review the various types of renewable energies: solar power, wind power, hydroelectricity/ micro-hydro, biomass, and biofuels for transportation.

- Solar Power utilizes the energy from sunlight either indirectly or directly. It can be used for heating and cooling, generating electricity, lighting, water desalination, and many other commercial and industrial uses.
- Wind Power captures the energy of the wind through wind turbines.
- Biomass Energy uses the energy from plants and plant-derived materials, such as wood, food crops, grassy and woody plants, residues from agriculture or forestry, and the organic component of municipal and industrial wastes.
- Geothermal Energy utilizes the heat from the earth, drawn from hot water or steam reservoirs in the earth's mantle located near the earth's surface.
- Ocean Energy traps thermal energy from the sun's heat and mechanical energy from the tides, underwater currents, and waves. · Hydropower captures the energy from flowing water to power machinery and produce" (Meisen & Norton, 2007).

The various forms of renewable energy technologies (RETs) offer solutions to energy needs across countries: electricity, thermal energy for heating and cooling, and fuels for transportation. The benefits of renewable energy sources are numerous. RES are freely available, and most countries are endowed with at least one source. They are not threatened by depletion and will contribute to meeting the constantly increasing global energy demand, beyond the availability of fossil fuels. Renewable energy production is typically CO_2 neutral and does not harm the atmosphere, making it the energy form of choice for climate-conscious policymakers and a means to prevent climate change induced by our heavily fossil fuel-based energy system.

3. Lesson-drawing literature

The comparative analysis of public policies across countries has been well researched in political science. One of the main questions is whether and why different countries develop similar policies over

time (Knill, 2005). One possible answer is that countries tend to develop similar policies over time, a phenomenon called 'convergence'. 'Convergence' is related to a deeper level of integration regionally and globally. Countries with strong linkages tend to develop similar policies. Kerr defines convergence as *'The tendency of societies to grow more alike, to develop similarities in structures, processes, and performances'* (Kerr, 1983). The comparative study of public policy is also concerned with how different governments respond to a common problem. Heichel, Pape, and Sommerer even came up with a framework to review previous convergence studies: the study would need to address one policy field, second, researching the similarity should be the central theme and third, the study should include an investigation of policy similarity related to concept and measurement (Heichel et al., 2005).

The identification of differences in inputs or outputs invites explanation. A major concern of comparative social science is to test alternate theories offering explanations through−the-factitive analysis of observed differences in programs (Dogan & Pelassy, 1990). The result is a set of statements explaining why a program that produced a given effect in country X did or did not do so in country Y, or why the existence of a common problem such as rising unemployment, led to the adoption of one type of program in each group of countries, and another type in a second group.

Convergence is often linked to neighboring concepts such as isomorphism, policy transfer, and policy diffusion. Dolowitz and Marsh define for example policy transfer as 'processes by which knowledge about policies, administrative arrangements, institutions and ideas in one political system (past or present) is used in the development of policies, administrative arrangements, institutions and ideas in another political system' (Dolowitz & Marsh, 2000).

Lesson-Drawing is another neighboring concept, which is concerned with questions whether programs are fungible, meaning being put into effect in more than one place. In the policy process, a lesson can be defined as a program for action based on a program or programs undertaken in another city, state, or nation, or by the same organization in its past. Lessons can be drawn across time or space (Rose, 1993). The boundaries crossed depend on the involvement of policymakers with local, state, or national problems. Because policymakers are action-oriented, they tend to focus on specific measures that a public agency can undertake; lesson focus is therefore not necessarily concerned with the academic analysis of determinants of policy beyond the control of public officials (Rose, 1993). A lesson takes the form of a program specifying the cause-and-effect mechanisms by which governments actions are expected to produce a specific policy outcome (Rose, 1993). A program includes laws and regulations authorizing the action, an administrative agency responsible for delivering it, an appropriation of money, public employees to deliver the service, and rules for determining which individuals or organizations receive the program's outputs. It is about what is learned, the programs that public officials develop in efforts to deal with immediate substantive problems.

Although there is a logical connection between Lesson-drawing and diffusions studies, political scientists in this field have been surprisingly indifferent to the actual content of programs diffused. The issue is not whether a particular type of response has been made but whether a state has done anything at all in a given field of policy. Programs adopted by different states in response to a common or similar problem. The focus is on general categories. Diffusion studies are usually concerned with the timing and sequence of program adoption. The initial goal is to identify why some governments are leaders in some laggards. The second step is to identify why governments differ in their readiness to act. Diffusion may be explained by geographical propinquity, the availability of resources, or the attributes of governments.

3.1. Drivers for the development of renewable energy technologies

The last decade has witnessed significant growth and capacity build-out in Europe, in terms of RET development. In the GCC, the deployment of RETs in the last decade has been slow due to various barriers. However, a handful of landmark renewable energy projects have been developed.

More recently, the GCC countries have shown a keen interest in engaging in a more sustainable development path, including the deployment of Renewable energies. There is a strong strategic and economic case for RE, based on the abundant resources in this region, the limitation of hydrocarbon resources, the rapid development of Renewable

energy technologies, and the global drive to reduce greenhouse gas emissions. The current status of regional integration in the GCC countries is summarized in terms of RE available resources in the region, the Research and Development (R&D) facilities, projects, and RE-related legislative framework and targets. RETs offer promising opportunities in the GCC, particularly solar energy technologies.

3.1.1. The abundance of renewable resources

Among the renewable energies, solar and wind are the fastest-growing sectors primarily due to indigenous abundance and relatively advanced technological development.

Solar energy is the most promising source of energy since conditions for solar energy potential for GCC are the most favorable in the world: GCC countries are in a rainless region in the world with 80% clear skies throughout the years extending from North Africa to Southern Asia. GCC has substantial solar radiation with the Kingdom of Saudi Arabia (KSA) having the highest resource potential.

The GCC countries lie in the so-called Sunbelt, with global horizontal irradiance (GHI) values ranging from 1900 kWh/m^2/y in Kuwait to 2160 kWh/m^2/y in Bahrain, and direct normal irradiance (DNI) varying from 2000 kWh/m^2/y in Qatar to 2500 kWh/m^2/y in Saudi Arabia. This is one of the best-endowed areas of the world concerning solar energy (Al Shidi & Sulaiman). Al Shidi and all came up with renewable energy readiness score and according to their research, Qatar, Kuwait, Bahrain, and Oman received a renewable energy readiness score of 5.6, 5.5, 5.3, and 5.2, respectively due to their substantial solar and wind resources. UAE and KSA had a lower score of 4.7 and 4.55 respectively due to their inadequate wind resources (Al Shidi & Sulaiman, 2016).

The GCC region has also potential for wind power generation capacity. The average wind speed in the GCC countries is about 6 m/s. But the wind potential varies substantially. Full load hours per year range from 1176 in the UAE to 2463. According to most RES experts, countries with more than 1400 h per year are considered to have economically viable wind energy utilities. Promising wind energy resource is also reported in Saudi *Arabia, where the greatest potential for offshore wind is on some of the sites on the 2000 km coastline.* (Al Shidi & Sulaiman, 2016).

3.1.2. Energy security

Energy security has been a major driver of developing RET at the national and regional levels. The European Union (EU) is a case in point in considering RES as a domestic source of energy that adds to the region's security of supply by reducing energy import dependency from its current high levels (around 70 percent). In this framework, the EU has led the way in the transition towards RES, reaching nearly 44 percent of global (non-hydro) renewable capacity. Historically, the EU has also been an advocate of renewable energy policies given the different supportive measures that have been adopted over time in the different countries.

A clean energy transition could be in hydrocarbon fuel producers' strategic interest. This would be the case where the region is affected greatly by the various negative consequences of climate change, including weather extremes and/or a lack of fresh water (Al Katiri, 2016).

3.1.2.1. Increasing energy demand. The GCC countries are major energy consumers because of higher-than-average economic growth rates, huge development projects in the domestic, service and infrastructure sectors, as well as growth in industrial consumption, driven by the steel, aluminum, and petrochemical industries.

Electricity consumption figures are even higher. Demand for electricity (mainly natural gas-based) has increased at three times the global average over the last few years. The compound average annual growth between 2000 and 2009 is about 7 percent.

With consumption growing at an average of 7–11 percent annually, power generating capacity has to be doubled every decade.11 The GCC countries will require 100 GW of additional power over the next 10 years, the equivalent of $25 billion in investments.12 Rising GCC energy demand is expected to put pressure on government budgets and reduce hydrocarbon export potential, thereby resulting in a loss of foreign exchange revenues.13 In this respect, the UAE and Kuwait have already become net importers of natural gas, and other GCC countries (e.g., Oman) have seen their gas exports constrained by rapidly increasing domestic energy demand.

3.1.2.2. International market trends. The uncertainties linked to the uncertainties of the likely duration of the American trend in oil and gas fracking operations and future demand market dynamics have

been two reasons for concerns for researchers, policymakers, and decision-makers in various Arab and other energy-exporting countries. Such uncertainties led countries' governments to further explore the potential of alternative sources of energy. They are pursuing such measures not only to preserve the region's valuable natural resources. They also want to ascertain what additional benefits could emerge, such as national job creation and the furtherance of a regional knowledge economy. These benefits would shore up the belief that all members of the region have shared since the modern oil era began, namely that with oil being a perishable source of wealth, future generations must prepare for a time without it (Al Katiri, 2016).

3.1.3. Importance of the diversification of sources of energy

In the Gulf Cooperation Council (GCC) region, the drivers for RES have been different. Global energy prices have been high for much of the last decade, and income from oil and gas exports in the GCC region is at record levels. GCC countries have been then forced to diversify their resources of renewable energy. In all GCC countries, total government revenue is about 80 percent dependent on hydrocarbon activities and hydrocarbon exports account for over 50 percent of the total exports of goods and services (Al Katiri, 2016). In this context, GCC governments have shown increased interest in renewable energy, illustrated by national-level targets and project implementation.

3.1.3.1. Public policy framework. According to the International Renewable Energy Agency IRENA, clean energy could meet 90% of the CEO emissions reductions required to meet the goals of the Paris Climate Agreement. The goals of the Paris agreement were certainly ambitious (limitation of temperature rise to 2 °C meaning cutting CO_2 emissions by 70% in 2050) but it translated a strong public policy shift towards the development of renewable energies (UNFCC, 2017).

During the 2014 Middle East and North Africa Renewable Energy Conference, the Gulf Cooperation Council (GCC) states − Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE − pledged to mobilize $100 billion into renewable energy projects over the next 20 years. Morocco, Tunisia also recently pledged to use only renewable energy by 2050.

Governments do recognize however that there are institutional, regulatory, and technical barriers to renewable energies. Expanding the energy mix for example might mean opening the national energy market to private capital away from the national governments (El-Katiri & Husain, 2014).

GCC governments underscore that these initiatives remain at their beginnings. Among the constraints encountered has been a work-in-progress regulatory framework, yet insufficient financial incentives, and limited private sector involvement in the energy sector.

4. Lesson drawing and policy diffusion

In this paper, we examine if countries in the GCC drew lessons from each other. We are following the methodology from Richard Rose (Rose, 1993). Rose's model requires several stages, which will be described in the following shortly:

4.1. Drawing a lesson

The problem is not whether to select the information but how. The process of drawing a lesson involves two stages.

1. Searching experience. The first step is searching for information about programs that have been introduced elsewhere to deal with a problem similar to that confronting searchers. Searching can extend across time or space, depending on the problem. Here, the GCC countries are relevant as they are faced with similar problems in terms of increasing energy demand. Initiatives related to renewable energy were traced back as early as the mid-seventies in KSA for example.
2. Making a model. Creating a conceptual model of how programs deal with a specific problem. A model is a checklist of program requirements. It also specifies the cause-and-effect relationship that makes a program operate effectively. Here, we can compare the various approaches from GCC countries to promote renewable energy policies.

4.2. Creating a lesson

Creating a lesson involves six stages.

1. Copying: enacting a program already in effect in another jurisdiction
2. Adaptation: adjusting for contextual differences in a program already in effect in another jurisdiction. Countries might adapt the policies in place or adjust the objectives and the size of the program.

3. Making a hybrid: combining elements of programs from two different places. A GCC state could draw from two neighbors' policies.
4. Synthesis: combining familiar elements from programs in several different places to create a new program
5. Inspiration: using programs elsewhere as an intellectual stimulus to develop a novel program
6. Prospective evaluation across time and space

Because the applicability of a lesson is contingent, the final stage is a prospective evaluation of the likelihood that a proposed program would be effective. An analysis across time and space is both comparative and dynamic.

A nearby government is the easiest place to look, assuming that resources are the same. Ideological propinquity, policymakers introduce programs consistent with their values. Regional cooperation and exchange of knowledge and lessons learned have been key to identifying the best policy and technology options (Yasemin et al., 2016). The GCC makes sense in terms of proximity and similar political traditions and models of economic developments.

In the following section, we will show which GCC member shows leadership in the region in terms of RET development and how the Kingdom of Bahrain drew lessons from such leaders.

4.3. Current status of RETs in the GCC

There has been progress in developing renewable energy initiatives not only to provide clean and increasingly economic energy supply options to the GCC but also to create valuable employment for its progressively skilled, technology-driven population (Al Katiri, 2016).

Qatar, Saudi Arabia, and the UAE have all begun to explore renewable energy technologies, particularly solar power, of which the region has plenty. Most GCC members have meanwhile issued plans and alternative energy targets, and late 2015 and early 2016 have witnessed an unprecedented shift in regional policymaking in the form of a series of national energy subsidy reforms (Yasemin et al., 2016).

The remarkable lesson from the past months is that progressive policymaking and bold economic reform did not trigger a political storm in the Gulf region, as some had feared. Indeed, "green" is now a popular buzzword among business circles and governments across the GCC, and the UAE's highly visible fuel and utility price reforms of 2015, followed by similarly bold moves in Riyadh, Doha, Manama, and Muscat, have been implemented more swiftly and smoothly than some had predicted (Yasemin et al., 2016).

We need to then identify who is a leader when it comes to renewable energy. The UAE seems the leader in the field of RET. The UAE recently announced that it would invest $163 bn in projects to generate half of the nation's power needs from renewables. The UAE has the ambition to have 44% of its energy needs be provided by renewables, with 38% from gas, 12% from cleaner fossil fuel, and 6% from nuclear energy by 2050. It seems that the UAE has been the leader in the field with high ambitions and that Bahrain and other GCC countries drew lessons from the UAE.

One of the original projects in the UAE's renewables push is the $13.6 billion Mohammed bin Rashid Al Maktoum Solar Park in Dubai, which aims to become the biggest solar power plant in the Middle East. It is expected to generate 5 GW of electricity – enough to power 1.5 million homes – by 2030. Dubai also plans to install around 100 electric car charging stations as part of its Green Charger Initiative. By 2050, Dubai wants to reduce its carbon emissions by 6.5 million tons every year, to become the city with the world's lowest carbon footprint, according to the Dubai Electricity and Water Authority.

The UAE has considerable solar power potential and is eager to reduce its use of fossil fuels. In 2014, Abu Dhabi opened what was hailed as the world's largest solar power operating station. In June, Dubai announced its intention to construct a huge solar power plant scheduled to be completed by 2030 (BBC, 2017). Abu Dhabi hosts one of the world's largest concentrated solar plants, Shams-1, while Dubai's Al Maktoum Solar Park in 2015 achieved photovoltaic costs of below U.S. cents 6/KWh – a record low achieved through world-class resources and a competitive bidding process that invited private technology producers to vie over cost. These initiatives have decreased technology costs to a level unthought-of only a few years ago (Al Katiri, 2016). Solar power has emerged as one of the quickest, least-risk investments to meet rapid demand growth for electricity and even boost export capacity and revenues (Ferroukhi et al., 2016).

The Saudi government has also ambitious plans to cut its greenhouse gas emissions by building more solar power systems as well as the world's biggest carbon capture and storage plant. In addition, it aims to use more natural gas as well as set new standards to make buildings and cars more energy efficient. Saudi Arabia officials mention they want to

add another 9.5 GW of renewable energy capacity to its current capacity of 80 GW by 2030.

The two state-owned companies that control the energy sector—Saudi Aramco, the world's biggest oil company, and the Saudi Electricity Company, the kingdom's main power producer—are planning for as many as 10 solar projects across the country.

In addition, the King Abdulaziz City for Science and Technology (KACST), a national research and development agency based in Riyadh, is pushing hard for solar energy. The Saudi government sees investment in solar energy as a way to remain a global energy power especially as the country has all the required elements for success with vast expanses of open desert that are tailor-made for arrays of solar panels. Besides, labor is cheap, funds can be secured, and technology is being developed through entities like KACST (Raouf, 2016).

In the late 2000s, early 2010, several projects have been initiated in Qatar, Kuwait with ambitious targets. Qatar collaborated with French energy giant Total SA on a joint venture worth $500 million with state-run petroleum, electricity, and water companies to develop a solar-power project with a capacity of 1000 MW (MW). And with a 70 MW solar project due to be operational by 2017, Kuwait planned to meet 15 percent of its energy needs with renewables by 2030, according to the Kuwait Institute of Scientific Research (Saket, 2016). Oman's power sector regulator, the Authority for Electricity Regulation Oman, has announced it will expand rooftop soar installations across residential homes, industrial and commercial buildings.

4.4. Bahrain and lesson drawing in renewable energy technologies

To figure out whether Bahrain drew lessons from other countries, we need to check whether Bahrain started the project after its neighbors. UAE and Saudi Arabia have indeed led renewable energy projects. Has Bahrain led any significant initiative to replace hydrocarbures or are they just pilot initiatives? The answer can be yes. Bahrain as a smaller nation, could not necessarily embark on projects of the same size as the UAE or Saudi Arabia but understands that innovation is a key for the future of the Kingdom.

4.5. Public policy push

In this domain, Bahrain did follow the lead of the UAE and KSA. Bahrain has paid special attention to the issue of renewable energy and cleaner energy. The authorities in the Kingdom are consistently searching for novel and alternative energy source which is suitable for the local environment as indicated in the Vision 2030 mentioning that up to 7 percent of its energy needs are to be met by renewable sources within 15 years.

Another indicator of how Bahrain followed the lead of the UAE is the announcement of multi-billion-dollar investments into Bahrain power sector by 2020 right after the UAE.

A third aspect of the lesson is the similarity in the relay between the private sector and the public sector. The private sector's role remains crucial in implementing the strategy, especially at a time when the public sector spending is being squeezed due to the persistently low oil prices (ITA, 2021).

4.6. Increased energy growth and required solutions

The incentive for Bahrain to develop RET is also like the other GCC countries, which obviously cannot be 'copied' but the potential solutions to tackle this problem are like what the GCC neighbors did. The Kingdom has gone through an increased energy growth consumption due to its economic growth and rising population. In 2008, the total installed power generation capacity was 2780 MW. Power-generation capacity in Bahrain needs to be increased at the rate of 6 percent a year to match the rising demand, according to Apicorp. It is expected that a total capacity of 6500 MW will be required by 2030 to meet the projected demand. With its current capacity, Bahrain needs to double its natural gas supply to meet the growing demand or diversify its energy sources.

Bahrain has embarked on an ambitious program to upgrade and expand the current power infrastructure to meet the growing demand due to the rising population and upcoming industrial projects (BNA, 2021).

4.6.1. Lesson-drawing in assessment of potential and agenda-setting

As Abu Dhabi was opening Masdar City in 2014, Bahrain was only to assess the potential of solar energy and wind energy. Bahrain signed a contract with Fichtner Consulting Engineers of Germany to prepare a detailed techno-commercial feasibility study for solar and wind energy resources. The EWA of Bahrain also assessed solar and wind energy resources. The authority observed the possibility of using these resources for the production of electricity and desalinated water.

Bahrain however delivered one project and announced another one: Bahrain Petroleum

Company's (BAPCO) first zero-emissions house built with a hybrid energy system with a total capacity of 7 kW (hybrid: solar, wind, and fuel cell) and the 2009 announcement of a 5 MW capacity solar and wind project (Al Shidi & Sulaiman, 2016).

4.6.2. Lesson-drawing in actual projects

To this day, Bahrain has undertaken several initiatives in RET. Bahrain installed three wind turbines at its world trade center that meets 13% of the building's energy demand (Ventures, 2016). The country has a pilot solar energy street lighting project that was implemented by the Electricity and Water Authority (EWA). Bahrain also launched a major 400 kV electricity transmission line aimed at reducing short circuits and ensuring the transfer of electricity from the production plants to load centers across the kingdom. The USD 474 million project, implemented by the German company Siemens, at the Hidd Power Station The project aims to meet all the needs of development and facilitate the exchange of electric power with the GCC network.

In February 2010, Bapco (Bahrain Petroleum Company) installed the First Zero-Emission House project of a 7 kW solar, wind and fuel cell. The house is made up of a 4 kW photovoltaic, 1.5 kW wind turbine, and 1.2 kW fuel cell. Bapco has also formed a team consisting of the University of Bahrain, Electricity and Water Consumption Authority, Ministry of Housing, Ministry of Work, Ministry of Municipality and Agriculture, and National Oil and Gas Authority (NOGA) in ensuring follow up and promotion of renewable energy projects in the Kingdom and the world at large (Al Shidi & Sulaiman, 2016).

A 5 MW solar PV was launched in 2012, a joint project between Bapco, National Oil and Gas Authority (NOGA), and two other United States-based firms; Caspian Energy Holdings and Petra Solar. University of Bahrain Engineering Faculty has produced two mobile solar plants, one for water desalination and a 1.4 kW/100 W hybrid wind/solar power generation system. There is also a solar panel factory in Bahrain in collaboration with a Dutch company for US$ 200 million (SEA, 2017).

4.7. The case of solar energy

We established that the Kingdom of Bahrain has undertaken several initiatives in renewable energies technologies and seemed to have followed the lead of its neighbors, KSA and the UAE. To provide a more refined analysis of how Bahrain followed the lead of its neighbors, we focus on the case of solar energy. The Gulf has a huge potential when it comes to solar energy, which is comparable to its oil and gas, had even "that could eventually be on a comparable level to oil and gas," had mentioned Jonathan Walters, a former director at the World Bank (Saket, 2016). The enclosed Appendix Table 1 (the Supplemental Content can be found here: https://journals.usek.edu.lb/cgi/editor.cgi?article=1011&window=additional_files&context=aebj) shows how the various countries from the Gulf responded to the need to adopt a policy for solar energy, how it came about on the agenda and how they decided to approach it. Some members were innovative and pioneers, some more cautious and more like followers. The lesson drawing as mentioned earlier could take five shapes: copying, adaptation, making a hybrid, synthesis, inspiration. The five possible shapes of lesson drawing routes would allow us to assess whether the member state has been effective in its renewable energy approach. The Appendix Table 1 (the Supplemental Content can be found here: https://journals.usek.edu.lb/cgi/editor.cgi?article=1011&window=additional_files&context=aebj) highlights when a Gulf State started developing renewable energy (agenda-setting), the current number of projects, the targeted ratio of renewable energies, and the status of the country compared to the others (See Appendix Table 1) (the Supplemental Content can be found here: https://journals.usek.edu.lb/cgi/editor.cgi?article=1011&window=additional_files&context=aebj).

Bahrain looked like the smallest member of the team but when one put things back in perspective, its achievements in solar are quite tangible compared to the other GCC. True, Bahrain embarked on the solar journey quite late (2017 versus 1975 in Saudi Arabia compared to KSA but Bahrain started on a solid foundation (national plan issued)). The scope of projects is limited but Bahrain started several projects of different nature. Bahrain is also quite innovative as it plans to install floating solar panels around the island to cope with the problem of land scarcity for larger solar farms (ITA, 2021). The country was also realistic in terms of the target of renewable energy compared to other countries (5% versus 15–44% in other GCC countries) and made sure there was a national plan in place to structure the effort. Bahrain has become a solid renewable energy player as it was able to

reach its 5% target six years ahead of schedule (ITA, 2021).

5. Conclusion

It would be interesting to see how nuclear energy will develop within the next ten years. The UAE is currently the only GCC state with an advanced civilian nuclear program likely to deliver electricity before the end of the decade. Saudi Arabia, whose nuclear development thus far has been confined to medical use in hospitals and research laboratories, has stated plans for some 18 GW of nuclear power capacity by 2032 as part of its ambitious strategy to raise the share of alternative energy sources in the country's electricity sector from zero to more than a third of its total production capacity. However, these plans seem to have been pushed back to 2040 (Al Katiri, 2016).

Firms from South Korea are also constructing four nuclear reactors near Abu Dhabi, which it is hoped will produce 1400 MW by 2020 (BBC, 2017). Nuclear energy requires considerable investments and has controversial environmental implications.

Large companies are already investing heavily in energy storage batteries to meet the growing demand for reinforcement of renewable energy supplies, in developed and emerging markets. Energy storage is also a growing area of focus for entrepreneurs, including in this region.

For governments across Mena, including the UAE, the emergence of an energy storage market opens a new set of decisions about how best to generate and distribute electricity. Critically, it offers the chance to lock in low-cost, emissions-free renewable energy for domestic consumption while reserving oil and natural gas for export.

Several Mena countries have already begun exploring energy storage to integrate new renewable generation resources and improve the stability and reliability of national grids. The outcome of a recent solar photovoltaic tender in Jordan that included battery storage indicates that a dependable electricity supply using solar power can be achieved at extremely cost-competitive pricing compared to fossil fuels (Le Houerou, 2017).

The EU as a region and as an organization has been interested in the development of renewable energy in the GCC whether it has been done at the bilateral level or through the EU-GCC relationship. The EU has initiated activities to promote the transfer of expertise and best practices to the GCC countries. The EU-GCC Clean Energy Network is the enabler for the development of concrete cooperation activities on clean energy, including the related policy and technology aspects, among various players from the EU and the GCC countries.

Here it might be relevant to check which countries have led the charge on this within the EU to drive the agenda. Would we expect the big member states such as France or Germany or could we envision the influence of Northern European states such as Finland, Sweden, or Denmark which have always been pioneers in terms of the environment?

The Gulf countries have all gone through progressive policymaking and bold economic reform to develop renewable energies. “Green” has become a popular buzzword among business circles and governments across the GCC. There have been common incentives to do so such as energy consumption needs, international market trends, public policy push. It is undeniable that the UAE has been at the forefront of this green revolution in the region followed closely by the Kingdom of Saudi Arabia, followed by similarly bold moves in Kuwait, Oman, and Bahrain. The case of the Kingdom of Bahrain shows how a smaller country did follow the lead of pacesetters such as UAE but also followed the steps of the Kingdom of Saudi Arabia, whose leadership in the region has constantly been supported by the Kingdom of Bahrain. The article shows that Bahrain has drawn lessons from the UAE and the Kingdom of Saudi Arabia in solar energy but has also well-structured its approach and ambition in its effort. Since the research relies mostly on secondary data and that the policy is at an infant stage, it would be interesting to gauge the progress made a couple of years from now and to interview policymakers on their intentions. In other words, is solar energy just for show or do the countries truly believe that there is a true significant potential as a main alternative source of energy and the status for other forms of renewable energy are going to be by then?

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