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# Exploratory Study on the Renewable Energy Policy Framework in the Gulf Cooperation Council (GCC) Countries

## Challenges and Opportunities in Rentier States

Master's thesis in Globalisation and Sustainable Development

Supervisor: John Eilif Hermansen

July 2020



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Faculty of Economics and Management  
Dept. of Industrial Economics and Technology Management





## Problem description

According to UN (2018), the GCC countries are one of the most energy-intensive economies in the world and they are the only to have registered no reduction in their energy intensity over the past 25 years, whilst energy consumption was twice the one recorded since 1990. Increasing urbanisation and growing economic activities have spurred energy production from oil and natural gas, that the Gulf monarchies have extensively subsidised in order to sustain cheap energy tariffs and competitive national industries. Nonetheless, this economic system led to an overreliance on government subsidies and fossil fuel dependence that have locked the region into a vicious circle.

The purpose of this study is to explore the potential deployment of renewable energy technologies in the GCC countries. In particular, it will be investigated the potential for scaling up the implementation of solar and wind power technologies, by analysing the present policy framework and economic drivers for achievement. The study will draw the attention to the positive externalities linked to the energy reform and the extent to which renewable energy can be beneficial for enhancing sustainable development in the GCC countries.



## Preface

The thesis is written under the supervision of the Department of Industrial Economics and Technology Management (IØT) during the spring semester 2020. The research, analysis and discussion are the result of an exploratory study conducted for the MSc in Globalisation and Sustainable Development (MSGLOPOL).

During the Autumn semester 2019, I have devoted my curricular internship at the United Nations Environment Programme (UNEP) Regional Office in West Asia. Through this working experience, I have learnt the environmental agenda, the main issues affecting the region, and I have discovered the contextual challenges underlying the initiatives' design. Since I was living in Bahrain, I have developed an interest towards renewable energy in the GCC countries after observing the environment that was surrounding my daily activities. View the enormous renewable energy potential, I was astonished by the fact that the little Gulf countries did not have solar plants covering the desertic landscape and buildings to power the households and economic activities.

For the purpose of my study, I have analysed reports from different institutions and organisms operating in the region, and I have selected literature from the regional academic institutes. Owing to the outbreak of Covid-19 pandemic, I had to size differently my research and rely almost exclusively on published content, therefore applying a text analysis. The circumstance has limited the capacity to contact my informants in the region and it has also affected the overall working routine.

I would like to thank for the supervision of this thesis Professor John Eilif Hermansen, for supporting me in all stages of this work. He has been a valuable and constructive help in guiding me through this entire *iter* and for being very motivating and patient. I am grateful to my family – everyone –, that despite the situation, they were encouraging me to invest my precious time in this work and be audacious even though I was insecure. To – all – my friends that in different degrees were there when I needed to simply have a talk or discuss deeply on my progress, I want to say: “Thank you to exist”!





## Abstract

The GCC is a fast-growing region in the Middle East both in economic and demographic terms. The traditionally hydrocarbon-based economy has exploited national resources for the export sector and for energy-intensive industries. Governments and state-owned fossil fuel companies have benefited from the revenues generated that were used to finance public expenditure, employ a large number of national citizens and energy subsidies that have guaranteed low-priced energy. Owing to the increasing domestic energy demand and fossil fuel price fluctuations and crises, the Gulf countries have agreed to implement a national long-term strategy plan that aims to diversify the economy and shift it from a resource-dependent regime to a liberal model.

Furthermore, in light of the environmental impact of the oil and gas industry, the diversification of the economy represents a chance for an energy reform that encompasses the gradual hydrocarbon phase out and the progressive advancement of renewable energy. Overall, this strategy will be relevant to maximise multiple benefits and synergies, considered the cross-sectoral interlinkages between a transition towards renewable energy with virtually all SDGs. This effort has to be supported by a policy framework that on the one hand norms and regulates the design and the implementation of the projects with long-term programming; on the other hand, it stimulates and attracts investments from stakeholders and it creates a favourable economic environment for renewable energy deployment. Transparent and efficient national institutions are the key enabler for renewable energy implementation, and they are responsible to foster the decarbonisation of the energy sector through proactive and integrated policies.



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## Acronyms and Abbreviations

AED	United Arab Emirates Dirham
AER	Authority for Energy Regulation
BTI	Bertelsmann Stiftung's Status Index
CO <sub>2</sub>	Carbon dioxide
CSP	Concentrated solar power
EU	European Union
GCC	Gulf Cooperation Council
GCI	Global Competitiveness Index
GDP	Gross domestic product
GHG	Greenhouse gas
GW	Gigawatt
INDCs	Intended Nationally Determined Contributions
IRENA	International Renewable Energy Agency
kWh	Kilowatt hour
LCOE	Levelized cost of electricity
MENA	Middle east and North Africa
MMbtu	Million British Thermal Unit
MW	Megawatt
NDC	Nationally Determined Contribution
NTNU	Norwegian University of Science and Technology
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
R&D	Research and development
SDGs	Sustainable Development Goals
TWh	Terawatt-hour
UAE	United Arab Nations
UNEP	United Nations Environment Programme
USD	United States Dollar





## 1. Introduction

The Gulf Cooperation Council (GCC)<sup>1</sup> is an intergovernmental union of six countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates - UAE) that share common geo-political and geo-economic goals and strategies. Owing to the discovery of oil and natural gas in the early XX century, the Gulf economies have experienced a dramatic transformation leading to one of the most attractive and prosperous regions in the world. The GCC accounts for about 45% of the world's proven oil reserves and 25% of the world's oil export (Mondal et al., 2016). Thanks to the fossil fuel abundance, the resource rich countries have gained revenues that have almost exclusively contributed to gain global resonance for their dynamic macroeconomic environment and ease of doing business.

In the recent decades, the oil-led countries of the GCC have encountered a comprehensive economic, industrial and demographic growth. Due to subsidised energy prices, the cheap labour cost and very low taxation, the Gulf monarchies have rapidly implanted an industrial fabric that focused on the oil and gas industry and the petrochemical sector. Hence, the two economic sectors are the one that employ most of the Arab citizens and the large foreign non-skilled labour force. They have contributed to raise the quality and standard of life of people and today they are among the wealthiest countries on a per capita basis.

The unprecedented growth pace that has interested the GCC countries comes with certain consequences. By expanding the energy-intensive industries and registering an exponential demographic increase, the Gulf states have doubled their total final energy consumption since 2000 and almost quadrupled since 1990 (IRENA, 2019). The combination of these two trends poses questions on how the GCC countries will handle the growing need for more energy to satisfy domestic demand, while preserving their status of leading exporters in the oil and gas industry and maintaining high revenues.

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<sup>1</sup> In this study, the following terms will be referred to the same geographic and political union: GCC (Gulf Cooperation Council), Gulf countries or region, Gulf monarchies, resource abundant or dependent countries and rentier states. On some occasions, it will be applied a combination or omission of these terms.

At the end of the day, this tendency shows how the region is not anymore at the margins of the economic, financial and industrial global trends and, therefore, it is acquiring prominence as a hub where innovative and ambitious projects can flourish and create the ground for a wider industrial fabric.

## 1.1 Background of the study

The GCC countries are richly endowed with natural resources that have provided revenues to sustain national expenditure and prosperity in many sectors of the Gulf society. In addition, they are blessed with alternative source of energy generation: renewable energy. The region lies in the so-called 'global sunbelt', an area that benefits from solar radiation of more than 6 kWh/m<sup>2</sup> per day and it has 59% and 56% of its surface available for respectively solar and wind deployment (Poudineh et al., 2018).

In spite of the considerable potential of the Gulf countries to exploit these clean energy sources, they have not spent any substantial effort to foster renewable use and, in contrast, they have prioritised fossil fuels in power generation and consumption. If this strategy was perhaps the only possible, nowadays that is no longer the case. The Gulf countries have pledged to the Agenda 2030 and the Paris Agreement, among other multilateral agreements, and they have declined the Sustainable Development Goals (SDGs) into national long-term plan, named 'Vision'. They aim to diversify their economy highly constrained by the oil and gas industry against the backdrop of growing domestic energy demand. Furthermore, they envisage the reduction of risks related to the dependence of oil and gas revenues that are rather susceptible to fossil fuel fluctuations and changes in the global market dynamics.

If sustainability is conceived as policy imperative in order to safeguard economic development, social justice and environment protection, it takes a very different meaning in the Gulf context. In light of the increasing energy demand, they will reduce their internal hydrocarbon consumption with the purpose of saving it for the export while developing little share of renewable energy projects in order to contrast the lack of fossil generation capacity. Thus, fossil fuel revenues will continue to represent the bulk of GDP and, at the same time, they can gain legitimacy internationally thanks to the progressive phase-out of hydrocarbons.

## 1.2 Research questions

In a context of economic and demographic growth, the energy demand is rapidly increasing and the GCC has the chance to take advantage of the enormous renewable energy potential. In order to deploy them, institutions are called to design and implement a policy framework that regulates and guides public and private stakeholders to channel future investment. Two decisive factors determine the effectiveness of energy governance in the renewable sector: the firm government commitment and a clear focus on a supportive business environment for investments.

The study will address the following research questions:

1. What is the potential for resource dependent countries of the GCC to deploy to a larger extent renewable energy for power generation?
2. How are institutional capacity and efficient governance debated in rentier GCC countries in connection to the diversification strategies?
3. What are the positive externalities that can be associated with the implementation of renewable energies and the phase out of hydrocarbons in the GCC?

## 1.3 Limitations

The selected topic is wide, and it offers many opportunities of analysis in different subtopics or connections with other subjects. Therefore, the exploratory study does not include energy efficiency analysis, technical and technologies in-depth analysis.

## 1.4 Structure of the study

The thesis is structured in seven chapters. After the introduction and methodology chapters, chapter 3 outlines the energy production, consumption and demand trends in the GCC countries. Chapter 4 analyses the status of renewables in every country under a policy framework perspective, including the strategies they wish to achieve. Chapter 5 analyses the policy theories related to policy dissemination and implementation in the region, as well as institutional capacity and quality of governance. Chapter 6 argues the potential externalities of renewables in the region under the sustainability dimensions. The conclusion addresses a short summary, findings and recommendations.



## 2. Methodology

The research topic of this master thesis is centred on the regulative framework and on the strategic visions of the Gulf Cooperation Countries on the deployment of renewable energy programmes and projects for power generation in order to attain a satisfactory energy mix in line with the Sustainable Development Goals.

In this study a qualitative methodology is applied. The choice of this methodology answers the need for an extensive spectrum of analysis tools that allow a comprehensive and systematic organization of his work task. According to Hay (2016), qualitative methodology is a broad basin of methods that involves several methods at the same time, and it aims to focus on understanding individual experiences, social processes and human environments. The analysis conducted in this study requires a holistic approach that comprise the complexity and dynamicity of the GCC energy market and growing interest of these countries on alternative sources of energy generation. For this reason and view the multi-faceted and layered aspects characterising this topic, qualitative research is the optimal methodology because it tends to highlight “multiple meanings and interpretations rather than seeking to impose any one ‘dominant’ or ‘correct’ interpretation” (Hay, 2016: 8). Compared to a quantitative methodology, a qualitative methodology implies the employment of critical reflexivity with the purpose of reflecting about the “ethical implications of our activities” (Hay, 2016: 34). Thus, the student is more involved in the research and analytical process because the subjective component enables him to actively intervene with his own positions and background by agreeing or disagreeing with the sources (Coccatto, 2018). However, subjectivity will result effective when the researcher has a clear big picture of the operational context.

Thanks to an internship at the United Nations Environment Programme at the West Asia Office in Bahrain, the student had the chance to explore the socio-economic setting that drives the main development forces in the region. By contextualizing and gaining a substantive background, the student got acquainted with several factors that play a consistent role in the analysis process and discussion formulation. The exploratory and background work has therefore allowed a broad insight of the energy market intricacy. Nonetheless, the student has found useful to reference at initial stage to the literature in order to get a conceptual and theoretical understanding (Coccatto, 2018).

Among the different methods comprising the qualitative research in human geography, Winchester & Rofo (in Hay, 2006) define three main types: oral, textual and observational. After the initial field research, the student has decided to employ the textual analysis (mentioned later on also as content analysis). Textual analysis can be described as “the attempt to understand the content, mode of address and authority, organization, and other aspects of language-in-use, specifically for the purpose of understanding their contribution to the intellectual scaffolding” (DeLyser et al., 2009: 282). Krippendorff (in White and Marsh, 2006) illustrates the necessary steps that guide the researcher in the textual analysis. First he suggests “sample the text”, or to select the relevant elements; contextualize the different propositions and relate them with known circumstances, situations and events; finally, “have specific research questions in mind” that guide the researcher.

Based on these assumptions and guidelines, the research has touched an interdisciplinary bibliography that embrace among them international environmental studies, international relations, political science, multi-level governance and energy market studies. The literature research was mainly conducted on the NTNU online library portal (Oria) and Google Scholar. The most frequently keywords used in the research portals were: renewable energy, middle east, GCC, sustainability, SDGs, vision and strategies. In addition, certain reports which information are a core support for both the descriptive chapters and the discussion chapter are part of a selection of material that was used by the student during his internship. The background of the student has helped him to select theories that have therefore supported the construction of the analysis of the renewable energy market in the GCC and the discussion of the ways the regulative framework and strategies should improve in order to accommodate a wider deployment of alternative sources of energy generation. The result will be accomplished only if the correct employment of intertextuality will be in place. This method involves the use of different texts in the qualitative research. Whilst in the first stage it is useful to apply texts that have a direct implication with the research topic, in the second stage it is important to take into consideration texts that have a parallel or indirect relation. Following this system, it will be possible to gain a broader insight on the topic thanks to the different types of texts that span from different areas of studies, period and argumentations.

In qualitative methodology, the research design is very important because it ensures rigour playing a fundamental role in the development of the work. It is necessary to establish trustworthiness in the relation between the researcher and the text. A strict discipline is necessary when dealing with

the texts. Interpretation plays also a very important role because it allows the student to explore the different aspects and relate them with other elements of the research. Finally, an ethical approach has to be considered also in the textual analysis because the student needs to be respectful of the opinions and argumentations found in the texts, while also not manipulate them.





### 3. The GCC energy sector

Since the discover of enormous amounts of fossil fuels both inland and offshore, the Gulf Cooperative Council (GCC) countries' economy has flourished and the whole energy sector has brought a significant change in the development pattern. Once the economy was based on traditional activities that spanned from selected agriculture cultivations, desert animals breed and fishing. The economic shift into the fossil energy sector has shaped the entire economy because the industry required knowledge and skilled workers able to conduct it; the relevant infrastructure and the technology capable to support the activities scale-up; and a monarchic or state managerial body that had the ability to govern and manage these assets. The high dependency on fossil fuels for export has generated a notable increase in per-capita income levels and decent living standards. Thanks to the rapid and dramatic development that has generally embraced all the gulf economies, the GCC nations have transformed into modern states during the past few decades (Zaidan et al., 2019: 672).

Compared to the rest of the West Asia region, the GCC nations have encountered a progressive transformation of quality of life and standards of living. The gulf states have gradually urbanised and cities started to host thousands of people that before used to live in rural areas. Moreover, the concentration of more and more people in few urban centres has created issues with regards to the general ecosystem conservation and the over exploitation of the natural resources necessary for the advancement of the society and its wellbeing. Apart from the extraordinary increase of domestic use of energy useful for daily operations, the GCC countries have encountered a considerable rise in energy consumption in all economic activities. The great "reliance on fossil fuels causes detrimental impacts on the economy and the ecosystem, the environment and public health" (UNEP, 2016: 24).

The energy consumption patterns in the GCC countries have undergone a remarkable transformation. While in the 1970s these countries were still underdeveloped and the population growth was not so consistent and the consumption reached only per cent of global demand, in 2001 the Gulf's consumption was equal to 220 million tons of oil (Krane, 2015: 3). The Gulf countries represent also a major repository of natural gas, but almost the entire production is consumed domestically, with the exemption of Qatar (Krane, 2015: 4).

With regards to electricity consumption, GCC countries' demand has risen exponentially due to the population growth (IRENA, 2019)

While the economy will rely for many years to come on the exploitation on fossil fuels and on the activities related to the derivatives, the Gulf nations have already introduced programmes and projects aiming to switch power production and consumption with alternative sources. National governments, energy companies, centres of research and other influential actors in the energy sector have promoted an improvement in energy efficiency and diversification of the energy mix.

The promotion of renewable sources of energy is seen in the region as a potential for the economic growth whilst fostering the conservation of the local environment and the reduction of the global carbon emissions. The potential development of the current technologies applied to renewable energy infrastructures is large. Therefore, GCC countries are working on establishing innovative ways for emerging clean energy installations through partnerships with relevant stakeholders and the creation of a dynamic market. These actions can be met if the existing energy monopolies are addressed and when policies and measures to reduce the investment risk are deployed (UNEP, 2016: 27). The last element is a key factor in the realisation of advanced renewable energy facilities. In this sense, governments' participation in securing a low investment risk is very important in order to facilitate the transition to an economically and environmentally sustainable way of producing energy. However, the GCC countries can potentially scale up the implementation of renewable projects if there is a synchronised action among different stakeholders across different sectors. According to the GEO 6 on West Asia, "the ease by which the transition takes place depends mostly on national commitment and the presence of regulatory and policy frameworks, coupled with financial instruments, under stable institutional conditions" (UNEP, 2016: 28).

### 3.1 Background on the GCC energy sector

#### 3.1.1 Energy resources

Historically, the GCC countries are among the greatest producers in the world of fossil fuels and their economy has grown thanks to the gains coming from the exports of this asset. The six countries members of the Council are leaders in the world in the extraction of oil and gas, and at the same time they have developed a varied industrial fabric that support multiple sectors in the

petrochemical sectors. According to International Renewable Energy Agency, the GCC holds about the 30% of proven crude oil reserves and about 22% of global gas reserves (IRENA, 2019: 27). On a total global provision of 1696 thousand billion barrels in 2017, the crude oil share owned by the GCC countries amount to a share of 29%, with Saudi Arabia representing the second biggest owner ranking second after Venezuela and it could produce at current rates for the next 60 years. Owing to large their large reserves, the Gulf countries have oriented their fossil fuel's economy towards the external and they have strategically oriented their economy in the export sector. Moreover, countries such as Saudi Arabia, UAE and Kuwait have engineered in the last thirty decades several productions of oil derivatives like gasoline, liquid petroleum gas, propylene, naphtha, diesel, kerosene and jet fuel (IRENA, 2019: 26).

In the case of natural gas, on a global total provision of 193.5 trillion cubic metres in 2017, the share owned by the GCC is equal to 21% as a share of world total, with Qatar that represents the third biggest owner after Russia and Iran (BP, 2018). Interestingly, natural gas has become since 1980 the preferred source of power generation over oil and countries like Saudi Arabia has planned to increase the natural gas extraction in the coming ten years. Qatar is the biggest player in the GCC as it exports 85% of natural gas productions among GCC countries and the rest of the world.

### 3.1.2 Energy supply and demand

In general, GCC countries are almost entirely dependent on fossil fuels for energy production and consumption. The International Energy Authority (IEA, 2018) has recorded in 2016 that Saudi Arabia is the leading country in the GCC for energy consumption, using 52% of the total final energy consumption share in the region followed by UAE (23%). Since energy 1990 the total final energy consumption in the GCC has quadrupled and While Bahrain, Oman, Qatar and the UAE use natural gas for about 90% both in the domestic and industrial sectors, Kuwait and, more significantly, Saudi Arabia register the highest use of oil as mean for power generation.

GCC countries are encountering an increasing need for electricity. Many factors come to play in a scenario in which GCC are transforming their socio-economic profile. The answer to this transformation is relate to the dramatic economic growth especially in energy-intensive industrialization projects led by national strategic projects and through the hands high rates of labour migration. On the domestic side and commercial sector, year-round air conditioning and

water desalination are two of the highest power-demanding facilities that require enormous amount of electricity. The transport sector requires also considerable amounts of fuel due to the growing number of private vehicles, a poor public transportation system and heavy transportation.

### 3.2 Regional renewable energy status

From a global perspective, renewables are gaining prominence in every sector from power generation to industrial consumption and from domestic and commercial usage to transportation vectors. It is estimated that renewable energies have contributed to 26% of global power by year's end. The global renewable energy capacity grew to around 2,378 GW in 2018 that corresponds to an increase of 181 GW since 2017 (REN21, 2019). "For the fourth year in a row [2015/2018], additions of renewable power generation capacity outpaced net installations of fossil fuel and nuclear power combined" (REN21, 2019: 18).

In spite of the general prejudice that considers the Gulf countries as unwilling to diversify their energy mix, some of them are leaders in the region in the generation of renewable energy. At the end of 2018, the GCC had 146 GW installed power capacity and the share corresponding to renewable energy was less than 1% (867 MW). The two leading countries in these sectors are UAE and Saudi Arabia, accounting respectively for 68% and 16% (IRENA, 2019: 49). Nonetheless, the share of renewable energy in total electricity capacity in 2018 is higher in UAE (2.0% corresponding 589 MW) and the lowest in Bahrain, representing only the 0.1% or 6 MW (IRENA, 2019: 50).

The fundamental source of renewable energy in the GCC comes from solar photovoltaic (PV) and concentrated solar power (CSP) that combined provide 94% of the total. PV and CSP are technologies that are particularly suitable for the environmental and geographical characteristics of the region. In fact the global horizontal irradiance (GHI) reveals that in the north-western and central regions of Saudi Arabia and southwestern region of Oman, solar resources are more abundant (GHI values are above 2 200 kWh/m<sup>2</sup>/year) they are ideally fitted to host solar plants that allow to capture higher irradiation and benefit from more days of sun exposure (IRENA, 2019). The second resource of renewable energy in the region comes from wind. Certain countries such as the western part of Kuwait, the south western regions of Oman and the north western part of Saudi Arabia enjoy high wind resources.

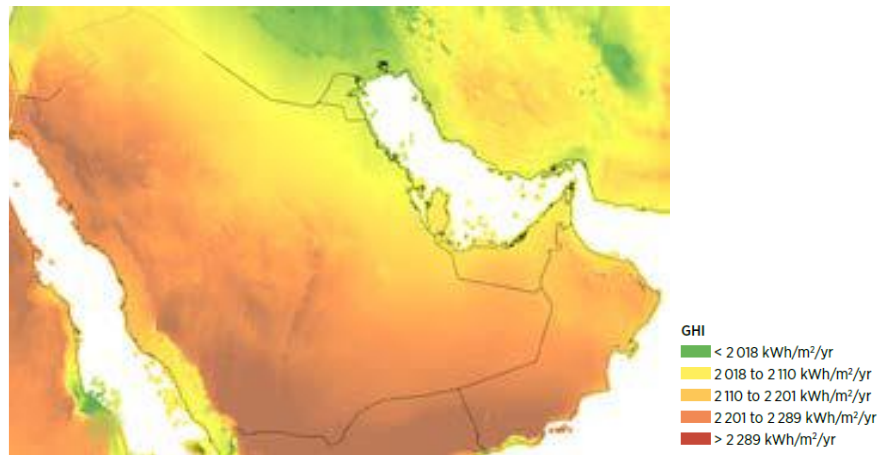


Figure 1 shows the Global horizontal irradiation (kWh/m<sup>2</sup>/yr) (IRENA, 2019).

Renewable energy facilities and plants in the GCC countries are identified and designed according several methods. One of these is the suitability analysis that takes into account “factors such as distance from the grid, population density, topography, land cover and protected areas to identify regions for project development” (IRENA, 2019: 34). According to this analysis, the potential development of on-grid solar PV of only 1% of the suitable area could bring 608 GW of solar capacity. In the case of on-grid wind the potential development of only 1% of these technologies could result in attainment of 26 GW of capacity (IRENA, 2019: 34). The Figure 2 shows the potential for solar and wind deployment in the GCC countries.

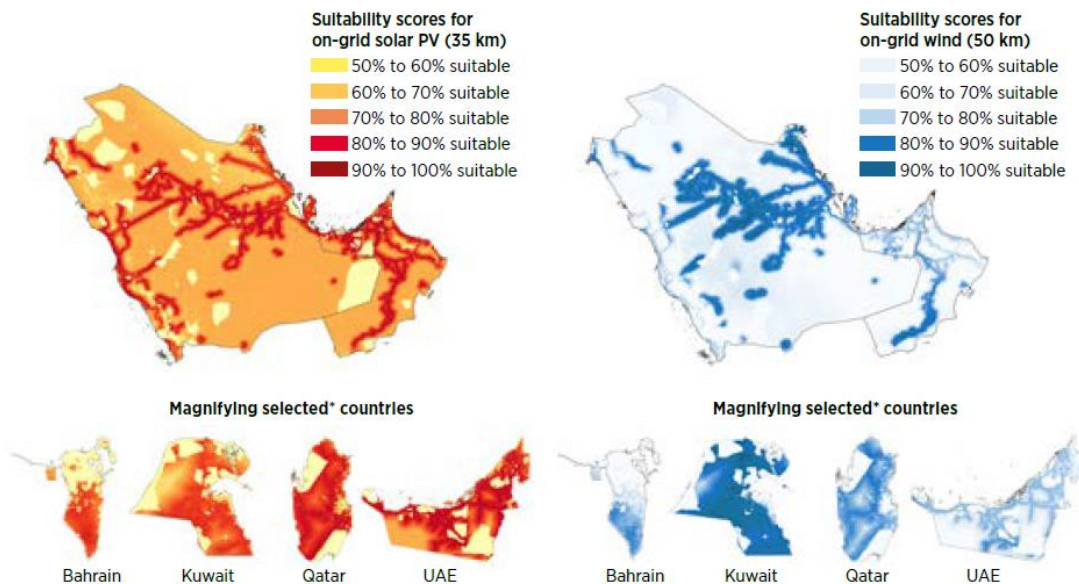


Figure 2 Fig. Suitability analysis solutions for onshore-grid solar PV and onshore wind (IRENA,2019).

### 3.3 Renewable energy investments

The whole MENA region is experiencing a stronger interest towards renewable energy investments following the ambitious targets decided by countries and initiatives of private companies financing utility scale projects. According to the Regional Center for Renewable Energy and Energy Efficiency, the total accumulative investments in renewable energy projects over the past decade are estimated at around USD 15 billion compared to only USD 1.2 billion in 2008 (2019: 71).

The country that has attracted most of the investments and has the ideal ground for renewable energy investments and projects is the UAE. The Emirates alone have received the largest amount of investments both public and private and their leadership in the GCC can result in the deployment of 44 GW of renewable capacity by 2050. Investments are expected to rise in particular in Saudi Arabia where the Saudi royals are pushing for a diversification of the Kingdom's energy mix. Bahrain, Kuwait, Oman and Qatar are also eager to increase their domestic share of renewable energy through small and big scale projects in the best suitable areas. The highest records in investments between 2006 and 2018 are registered in 2011, 2015, 2017 and 2018. In 2017 the total investment amounted to USD 6055 and was in line with major projects in the region (IRENA, 2019: 80).

Besides direct public and private investments, there is another strategic segment of investment in the renewable energy sector that can be identified in the value chain. Both public and private entities have focused their attention on project development, manufacturing, R&D and designed funds. These forces combined have fostered the capacity of different entities in developing tools that support the design and the implementation of renewable energy projects. Public venture has demonstrated relative positive achievements as in the case of the Saudi Arabia's Public Investment Fund and Saudi Public Pension Agency holding significant stakes in ACWA Power (25% and 5.7% respectively), enabling the company to develop a significant portfolio of conventional and renewable energy projects. Moreover, several GCC countries have invested in R&D in order to establish local research on sustainable territorial solutions in the region. Examples can be found in the research departments within universities and independent centres like the Khalifa University, Qatar Environment and Energy Research Institute and the Kuwait Institute for Scientific Research.

Institutions have created specific funds that address the needs of the growing Renewable energy sector through credit support in order to raise.

### 3.4 Renewable energy costs

Renewable energy across the world is becoming increasingly convenient compared to traditional fossil sources. Many factors have played a great role in reducing the cost of electricity produced by renewable energy infrastructures. Innovation and research have improved technologies, credit funds and institutions have facilitated the access to low cost finance, the upscale of larger projects has enhanced confidence in the GCC region and therefore created the grounds for the strategic deployment of renewable energy in the countries' energy mix programmes.

The global weighted average levelized cost of electricity (LCOE) allows to understand “the benefits and drawbacks of various energy systems” by combining both the fixed costs and variable costs into a single measurement (Bethel Afework, 2018). The LCOE for solar PV plants worldwide decreased by 73% between 2010 and 2017, while in the case of onshore wind declined by 22%. This fall in the cost of electricity was followed in large-scale solar PV: from 5.98 US cents/kWh bid in late 2014 in Dubai for the 200 MW Phase II of the Mohammed bin Rashid Al Maktoum Solar Park, to 2.99 US cents/kWh bid for the 800 MW Phase III of the Mohammed bin Rashid Al Maktoum Solar Park (IRENA, 2019: 84).

Costs for renewable energy implementation in the region are decreasing rapidly owing to a combination of factors that are progressively shaping a welcoming environment for energy diversification. Auctions have created the ideal ground to enable large-scale renewable energy infrastructures at competitive prices. This tool has had a considerable success especially in the UAE, where about 88% of the awarded projects have been developed through this mechanism. Other countries have followed the UAE because auctions foster “competition, which allows falling technology costs to be more fully reflected in bid prices (IRENA, 2017).

The second tool used to increase the attractiveness of renewable energy sources is a favourable ecosystem for financing projects. Positive conditions that allow the spread of large-scale projects are low interest rates, long loan duration and high debt-to-equity ratios (IRENA, 2019). Commercial local banks have been supporting projects, while foreign investors are becoming more and more

present in the region for financing innovative developers. An interesting feature that has authorized institutional investors to integrate in the financing scenario are the green bonds. This tool provides large-scale long-term non-bank capital and it has gained influence in the renewable energy market, accounting for 33% of proceeds in 2017 globally.

The third factor is the maturation of the existing technologies through a wide-spread deployment and the improvement and encouragement in the R&D to innovate and produce technologies able to acquire new markets for renewable power generation. Solar PV is the technology that has registered the most consistent drop in the overall cost. Thanks to “improvements in the production processes, efficiency gains associated with increased adoption of newer cell designs, intense market competition and overcapacity”, PV modules price decreased from USD 4 394/kW in 2010 to USD 1 388/kW in 2017 (IRENA, 2019: 98).



## 4. The institutional and policy framework

As illustrated in the previous chapter, the GCC economy is largely grounded on the production of oil and natural gas that represent the primary source of private revenue and public funding for national expenditure. These countries are the perfect example of what is a rentier state, that is a “state that lives from externally generated rents rather than the surplus production of the population” (Karl, 2007: 661). Being overly dependent on one economic sector has channelled Gulf economies on a dangerous way that brought them to be severely influenced by external forces such as the energy market and climate change.

In the last decade two major energy market events have increased the concern on the oil-led development strategy of GCC countries. One is the price fall in 2014 due to mainly to a weakening of oil demand (Prest, 2018) and later in early 2020 an other crisis plummeted Brent crude to its lowest in nearly two decades, falling toward USD 20 a barrel (Javier Blas, 2020). On the other hand, the oil industry is the one of the major contributors and source of pollution in the region. Human activities have an enormous impact in the environment, in fact “CO2 emissions per capita, energy intensities and CO2 emissions per GDP in the GCC countries are higher than the average of 25-EU and the average of the OECD countries” (Reiche, 2010: 2395).

Taking into consideration these essential aspects in the design of energy policies and regulative framework for the implementation of renewable energy projects is very important. GCC countries embracing new technologies and creating a solid financial environment for investors. They last element makes the difference compared to other MENA countries because they can attract from foreign investors looking for favourable business conditions, while also encouraging internal stakeholders to participate in national auctions. Certain countries, especially the UAE, have paved the way for a more conscious understanding on the role of the state in fostering national adoption of renewables for the diversification of the energy mix. The world is preparing for a sustainable transition in power generation and consumption, nonetheless the Gulf states are lagging behind for many reasons.

The economic ground on which GCC countries have laid foundations will for the next decades be the milestone for the future energy policies. The oil industry is and will be the strategic asset on

which much of the decision-making will focus and the national energy ministries and agencies will continue to defend its operations. The fact that industrialized economies are transitioning into alternative sources of power and energy will have a considerable effect on net-hydrocarbon exporters such as the GCC countries. For this reason, it will be necessary to rethink the set of policies needed to face new energy perspectives and design a comprehensive and strategic programme for a sustainable energy and power market. In other words, the undergoing transformative dynamics of international energy markets are influencing and impacting the historical policy strategies that seen the oil sector as the leading segment of the Gulf economies. Now the region is in the midst of transition process that can potentially bring a greater diversification of power generation (Griffiths, 2017).

The following section will focus on the GCC countries' governance in the field of renewable energies. Firstly, it will draw the institutional landscape in which national entities and other relevant state actors contribute to norm the sector. Secondly, the section will investigate the policy framework of the six Gulf countries by illustrating the policy framework, including the regulations in place and long-term strategies and visions for the future with goals and objectives in light of the Agenda 2030.

#### 4.1 The institutional landscape

Before the illustration of the policy framework and the long-term strategies that the GCC countries have implemented, it is important to understand the institutional landscape and the governance of the renewable energy sector. The sustainable transition into alternative and clean sources requires an efficient set of institutions with clear mandate and goals. Each country has its own specificities due to the different constitutional and government setting. Nevertheless, they are associated with institutions that guarantee the design of national regulative frameworks and policy mechanisms.

The UAE has at the federal level the Ministry of Energy and Industry that is responsible for renewable energy legislation and deployment. However, each singular Emirate has entities that regulate the sector at the local level. In the two main Emirates of Abu Dhabi and Dubai, there are authorities that are charged with the implementation of policies; in addition, they are involved in conducting auctions, buying renewable energy power from IPP's and manage small-scale grid (IRENA, 2019). The country hosts centres of excellence in the R&D sector with specific regards to the research of sustainable technologies in energy production. Among these centres, Masdar has

become one of the most notorious centres in the development of large-scale projects of power generation alternative to traditional fossil fuels.

In Saudi Arabia, the Ministry for Energy, Industry and Mineral Resources has created in 2017 the Renewable Energy Project Development Office with the mandate of enabling an environment where different stakeholders can cooperate in project development. Besides the Kingdom institutional bodies', the country has several university centres and institutes that support and enhance scientific applied in the renewable energy field.

Bahrain, Kuwait, Oman and Qatar have national ministries devoted to regulating the energy sector with specific portfolios related to renewable energy. In some of them, the institutional capacity to norm the sector is limited as the departments or offices in charge of the renewable sector do not have enough financial resources or technical and legislative expertise. Nonetheless, they are striving to produce important regulations that help to stimulate the emerging sector. In the following sections that will focus on countries' goals on renewable energy deployment projects, there will be specific references to intended Nationally Determined Contribution (NDC) and national strategic programmes with regards to the policy framework that will support the achievements of these goals.

#### 4.1.1 Bahrain

The little archipelago consisting in low-laying islands in the Arabic Gulf has a very limited size that allows few economic operations and it has a relative low responsibility on the total greenhouse emissions in the region. To accompany the demographic and industrial growth, the energy demand has gradually increased and therefore the search for more energy supply. The increase in energy production and consumption has risen from 1,447 MW in 1999 to 3,934 MW in 2016 (Bahrain, 2018). In 2017, the installed renewable based capacity was 6 MW which corresponded to 0.1% of the renewable capacity share in the total installed power generation capacity (IRENA, 2019). Notwithstanding this poor score, the country has endorsed national energy plans through the National Energy Efficiency Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP) by

setting targets for 2025 and 2035, respectively for 5% and 10% of the national renewable energy target.

“Based on a broad survey of Bahrain’s resource potential, economic viability of various renewable energy technologies, the current energy situation, and the country’s unique geographical conditions, the Plan sets a national renewable energy target of: -5% by 2025 and -10% by 2035. The targets are based on the projected peak load electricity capacities, excluding industry’s own generation, and equate to 255 MW of installed capacity by 2025, and to 710 MW by 2035. The targets will be met by a proposed renewable energy mix consisting of solar, wind, and waste to energy technologies” (National Renewable Energy Action plan, 2017: 14).

According to the NREAP (SEU, 2017) the integration of renewable energy in the national energy mix with a target of 5% can generate 480 GWh per year, save 5,700,000 MMbtu of natural gas a reduction in greenhouse gas emissions by 392,000 tonnes of CO<sub>2</sub> per year. In 2019, the Bahrain Petroleum Company has signed a PV project of 100 MW through competitive bidding, making it one of the largest renewable energy projects in the country (IRENA, 2019).

In order to achieve the renewable energy targets, Bahrain has deployed a set of complementary policies that will support the correct implementation of projects whilst fostering the attractiveness of the country for private investors. The first policy tool, the net metering, allows “consumers to generate on-site, grid-connected, renewable energy power [...] by reducing electricity bill through on-site power generation and the ability to credit the excess electricity fed back to the grid” (SEU, 2017: 7). This measure is particularly relevant and useful for countries such as Bahrain that do not have a wide availability of land and it would increase the capacity to install roof PV or other technologies that do not require land. Tender-based and Feed-in tariffs have the potential to attract private investors through a competitive procurement process with the aim of achieving long-term power purchase agreements. The country has a positive environment for macro investment, and it has the right conditions to stimulate foreign and private investors to develop innovative renewable energy projects in Bahrain (RCREEE, 2019). The Gulf monarchy expects from architects to include renewable energy technologies in the building design aiming to reduce the total amount of energy amount of energy consumption, especially in the case of air conditioning.

#### 4.1.2 Kuwait

Even though the State of Kuwait has relatively small population, it has developed flourish economic and industrial activities that have transformed the state in a prosperous country. Fossil fuels have

always played a consistent role in the revenue sources of the Kuwaiti state: it consists for about 90% of export revenues and net oil-export revenues account for 40% of GDP. According to the last provisions and following the Business-as-Usual Case, the crude oil production is expected to increase up to 3.5 million barrels per day in 2035, while natural gas is projected to increase by 2.2% per year for the same period (KISR, 2019). This steady increase in fossil fuel production corresponds also to a dramatic raise in greenhouse gas: from “83 million tonnes of CO<sub>2</sub>-equivalent in 2015 to 103.4 Mt of CO<sub>2</sub>-equivalent in 2035 - at an annual rate of 1.1% - twice the global average” (KISR, 2019: 18).

“Kuwait relies almost exclusively on oil products and natural gas for electricity generation and its substantial desalination production. The country plans to increase the share of gas fired power plants in the future, but as gas production is underdeveloped, it is currently a net importer of liquefied natural gas (LNG). Kuwait has a soft target of increasing the share of renewables in total energy demand to about 15% by 2030, up from less than 1% today. The potential for increasing the share of renewables in the electricity generation mix in Kuwait is huge, given its substantial solar and wind resources” (Kuwait Energy Outlook, 2019: 24)

Renewable energy in this Gulf country has never played a significant role, in fact virtually all the energy produced and consumed comes from fossil sources. The installed renewable-based capacity in 2018 was 79 MW, meaning 0.4% of the total installed power generation capacity for the same year (IRENA, 2019). In line with the Paris Agreement, Kuwait presented a plan named Vision 2035 that aims to diversify its energy sources through wind and solar energy, by raising the percentage of using energy up to 15% in 2030 (Emir, 2012). In spite of this target, the country is not ready enough to encounter its goals. The main challenges in the renewable energy implementation are related to the “physical infrastructure, manpower capacity, local market, regulations and legislation” (Alsayegh et al., 2018: 3434). In the first implementation phase (2015/2020), the renewable energy installation rate was slower compared to the last (2025/2035), when at the end of the considered period the total amount of power generated by renewable sources will be about 14.0 GW with a total generated energy of 38.0 TWh.

One most interesting renewable energy plant in Kuwait is in Shagaya, which consists of 10 MW of solar PV capacity, 10 MW of wind, and 50 MW of CSP (ESCWA, 2019). The Kuwait National Petroleum Company (KNPC) has programmed to install first utility scale 1.5 GW solar project (RCREEE, 2019). On the regulative framework side, there is no net metering scheme and the lack of clear regulations supporting the deployment of renewable energies by the private renewable energy utility scale may undermine the targets forecasted in the Vision 2035.

### 4.1.3 Oman

The Sultanate has a limited amount of oil and natural gas reservoirs compared to the other GCC countries. Yet, it has based its economy around fossil fuel production and complementary sectors that support the oil economy. The Authority for Energy Regulation (AER) estimated that Oman has one of the of the world's highest solar energy potential for renewable energy production and it concluded that it is suitable for both small and large scale solar installations both in rural mountain areas and in large utility scale plants.

In 2017, the installed renewable-based capacity was 8 MW, accounting for 0.1% of the total share of installed power generation capacity (IRENA, 2019). In the Intended Nationally Determined Contributions (INDCs), Oman pledged to reduce its greenhouse gas emission by implementing mitigation and adaptation policies envisaging to "control" its growth by 2% during the period 2020-2030. One of the areas that will contribute to the reduction of GHG is stated to be the energy sector (MECA, 2015). In light of the regional long-term strategies for the economic diversification, Oman has published in 2015 Vision 2040. It targets to achieve 10% of the total energy capacity, or 2.6 GW, that will be produced from renewable sources by 2025 (IRENA, 2019).

Oman lead the GCC countries for an interesting project named the Sahim Initiative, an ambitious solar rooftop programme that aims to promote small scale rooftop solar power production with the collaborations of the local population. The contractor can benefit from the self-produced energy and by the energy sold to the national grid (AER, 2017). Moreover, Oman has developed a cleaner way to facilitate the extraction of oil by the enhanced oil recovery. Through the combination of gas and solar fields, steam is produced an injected into the oil well to enhance extraction (IRENA, 2019).

### 4.1.4 Qatar

The Qatari State presents a flourished economy owing to the hydrocarbon sector that has developed the country and increased the quality of life. Nonetheless, since 2008 the Gulf monarchy has encouraged the diversification of the economy by supporting a shift from an oil-based economy to a knowledge-based economy and a wider integration of the private sector into the labour market. This attempt to achieve a diversified economic landscape is illustrated in the Qatar National Vision 2030 that contains four pillars one of which stresses the importance of finding "a balance between development needs and environmental protection, and supports international efforts to mitigate

the effects of climate change” (MME, 2015: 1). In the National Vision, the concept of economic and environmental sustainability is conceptualized on the key theme of rights of the future generations that “would be threatened if the depletion of non-renewable resources were not compensated by the creation of new sources of renewable wealth” (GSDP, 2008: 9).

“Qatar has made limited progress in renewable energy production and the share of renewable energy of total national energy needs is negligible despite the high potential for renewable energy [...] The adoption of renewable energy projects will no doubt reduce CO<sub>2</sub> emissions, decrease the amounts of oil and gas used in desalination and power generation, and satisfy the growing demand for energy” (MDPS,2018: 79).

The Second National Development Strategy 2018-2022 sets out important targets in the deployment of renewable energy. In particular, the Strategy envisages to “reach a production of 200 megawatt of renewable energy by 2020 to be increased to 500 megawatts afterwards” (MDPS, 2018: 80). The Ministry of Energy and Industry foresees to extend the energy production capacity and it expects to generate 10 GW of solar power by 2030 (Ataullah, 2017).

The installed renewable-based capacity in Qatar in 2017 is negligible and is equal to 43 MW, mainly associated with waste-to-energy plants. Municipal wastes account for 38 MW of power production in 2017 (IRENA, 2019) and it is the largest and most productive plant in the GCC. The country has initiated several solar projects that are expected to be operational by December 2020. One of which, the Qatar’s utility Kahramaa has won a competitive bidding scheme for a 700-800 MW project (RCREEE, 2019).

#### 4.1.5 Saudi Arabia

The Kingdom is by far the largest total final energy consumer, accounting for about half of the GCC consumption and it is the biggest energy market in the region (IRENA, 2019). The Saudi’s renewable capacity in 2018 was 148 MW, equal to 0.2% of the total share of energy generated. Traditionally the Gulf Monarchy has invested in the hydrocarbon industry and it will be the primary focus. However, it has initiated an ambitious transition to alternative and clean forms of power production that do not entirely rely on fossil fuels. This initiative was presented to the world through the Saudi Vision 2030. In the general intention of diversify the entire economy, the Royal family plans to transform the energy market aiming to create a competitive renewable energy sector. Hence, it indicates that a strategic element for achieving this goal is to invest in the entire energy value chain,

especially in research and development, and manufacturing. Moreover, it highlights the importance to have a favourable legal and financial framework that enables a fruitful public-private partnership (KSA, 2016).

“Even though we have an impressive natural potential for solar and wind power, and our local energy consumption will increase three-fold by 2030, we still lack a competitive renewable energy sector at present. To build up the sector, we have set ourselves an initial target of generating 9.5 gigawatts of renewable energy” (KSA, 2016: 49)

Under Vision 2030, the government has launched in 2016 the National Renewable Energy Programme that aims to achieve the installation of 3.45 GW renewable power capacity by 2020 and later reach 9.5 GW by 2023 following an investment of USD 30-50 billion (ESCWA, 2019). Just recently, the Kingdom aims to generate 27.3 GW already by 2024 (Gnana, 2020). In the last stage, by 2030 Saudi Arabia expects to attain 30% of the power generated by renewable sources, whilst the remaining part would be generated by natural gas. The new energy scenario coupled with a more comprehensive economic and industrial sustainable diversification could avoid the emission of 130 million tons of CO<sub>2</sub> by 2030 (KSA, 2015).

At present, several renewable projects have been designed and awarded. The 300 MW solar PV plant at Sakaka “will be the country’s first utility-size renewable energy plant” and it was awarded for a bid of 2.34 cents/kWh (IRENA, 2019: 59). The largest wind project with a capacity of 400 MW is expected to be seen in the Dumat Al Jandal wind park. A 50 MW CSP plant was installed in Waad Al-Shamal (IRENA, 2019).

#### 4.1.6 United Arab Emirates

The UAE presents one of the most dynamic market for renewable energy in the GCC region. In the years 2017/2018, the Emirates accounted for a share of around 66% of the total renewable energy capacity in the Gulf region. This achievement is the consequence of an incredible investment that has allowed the country to quadruple its renewable-based power generation capacity between 2014 and 2017/2018 (ESCWA, 2019). The strategy of increasing renewable energy generation is in line with the main energy medium-term and long-term programmes of energy production. Aside from the conventional plan economy diversification, there is a need to reduce the carbon footprint of residential, commercial and industrial activities operating in the large cities, mainly Abu Dhabi



and Dubai, the two economic and most urbanized centres of the UAE. In addition, the Gulf country aims to become knowledge and technological hub for renewable energy research and development, while also supporting the manufacture of the local infrastructure.

The Emirati government has published numerous strategy plans in the recent past, including the UAE Vision 2021, the UAE Green Growth Strategy, the UAE Future Strategy and the UAE Centennial Plan (2071). All these programmes aim to strengthen the position of renewable energy in the total energy mix production capacity. In 2017, the UAE has presented the Energy Strategy 2050 that expects to give a wider room to clean and renewable energies in the total energy mix. In fact, “the energy equation targeted by the plan is as follows: 44 per cent clean energy, 38 per cent gas, 12 per cent clean coal and 6 per cent nuclear” by 2050 (WAM, 2017). The contribution of renewable energy will therefore account for half of the total energy mix (taking into consideration also the nuclear power), while curbing carbon footprint by 70% over the next decades. In this time frame, the strategy aims to invest AED 600 billion in order to meet energy demand, and at the same time it will result in AED 700 billion in savings (MOEI, 2017).

In light of the country’s commitment with the Paris Agreement, UAE has submitted its INDC in which it states the national strategies that focus on the reduction of the greenhouse gas emission. It addresses several issues, involving mitigation and adaptation measures. The reform of the energy production is a key enabler for accomplishing the goals of the Paris Agreement. The approach adopted by the federal government is to “ensure stable sources of energy sources” by diversifying the energy input, with a strong national connotation in the research and development and the exploration of local solutions to efficiently apply sustainable forms of energy production (UAESDGs, 2017).

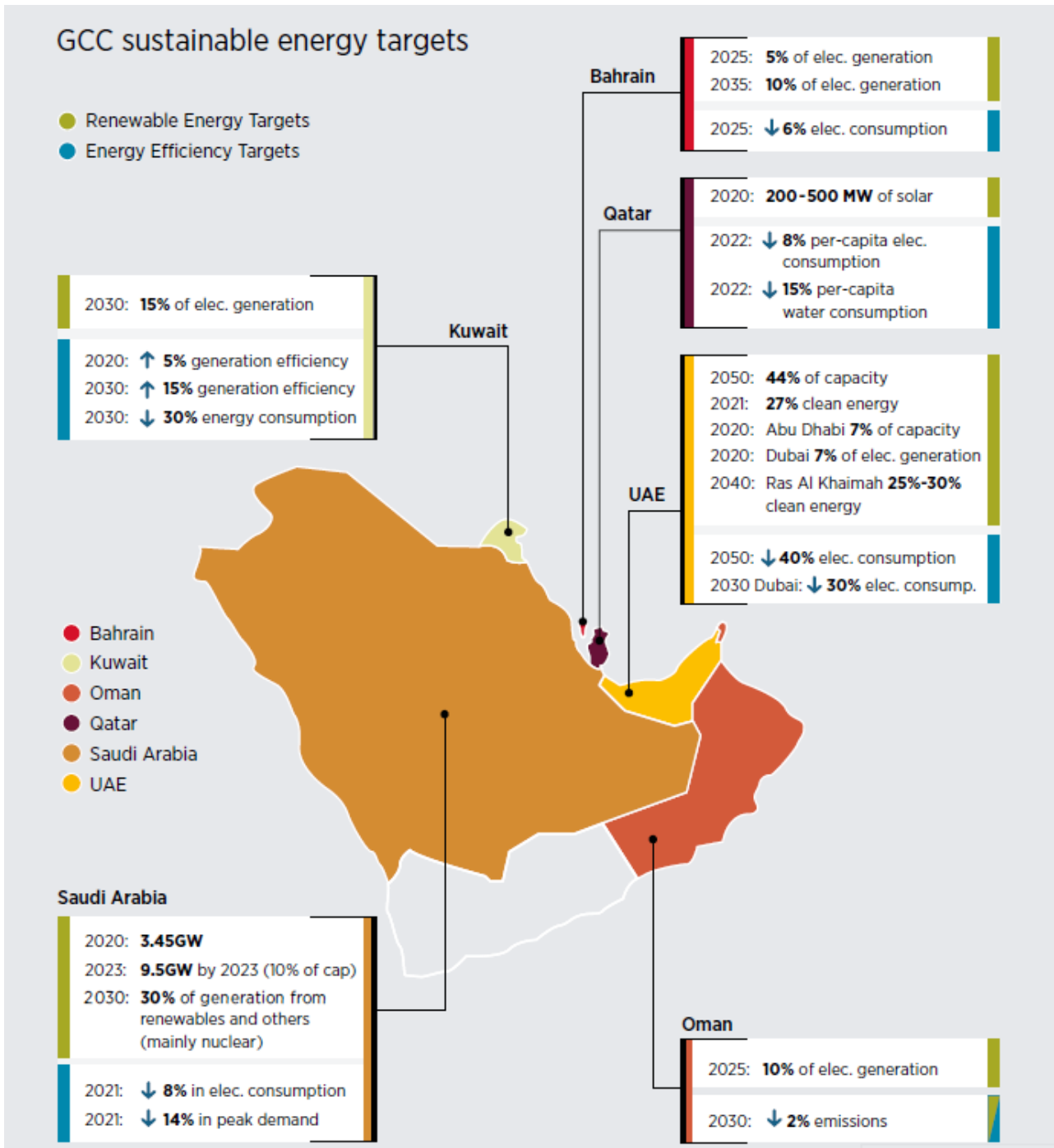


Figure 3 GCC countries renewable energy and energy efficiency targets for the period 2020/2050 (IRENA, 2019).

## 5. Analysis of the renewable energy policy framework

In order to understand the vital role played by energy in the development of every community in the world, the words used in the first annual report on the SDGs' progress can give an explanatory idea of the importance: "energy is crucial for achieving almost all of the Sustainable Development Goals, from its role in the eradication of poverty through advancements in health, education, water supply and industrialization, to combating climate change" (ECOSOC, 2016: 11). By providing clean, affordable and renewable energy, it is possible to achieve multiple goals because it would allow to ensure the socio-economic development, especially for those regions in the world that are lagging behind.

The Goal 7 of the Agenda 2030 aims to provide "access to affordable, reliable, sustainable and modern energy for all" (UN, 2015: 21). Moreover, it targets a wider expansion of renewable energy technologies in power generation by 2030. At the same time, the Goal stresses the importance on two key factors for its achievement: the enhancement of international political and financial cooperation to facilitate the deployment of renewable energies; and serve with a particular attention least developed countries, small island developing countries and landlocked developing countries. In the 2019 annual report on the progress of SDGs, globally "the renewable energy share of total final energy consumption gradually increased from 16.6 per cent in 2010 to 17.5 per cent in 2016" and the "global primary energy intensity (ratio of energy used per unit of GDP) improved from 5.9 in 2010 to 5.1 in 2016, a rate of improvement of 2.3 per cent" (ECOSOC, 2019).

Table 1 SDG 7 targets and indicators

Goal and Target number	Target definition	Indicator number	Indicator definition
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1	Percentage of population with access to electricity
		7.1.2	Proportion of population with primary reliance on clean fuels and technology
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1	Renewable energy share in the total final energy consumption
7.3	By 2030, double the global rate of improvement in energy efficiency	7.3.1	Energy intensity measured in terms of primary energy and GDP
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	7.a.1	Mobilized amount of United States dollars per year starting in 2020 accountable towards the \$100 billion commitment

<b>7.B</b>	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	<b>7.b.1</b>	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services
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Even though the GCC countries and the whole MENA region as a whole are not accountable as the largest contributor in greenhouse gas emissions, they are the exception in the world because they have registered no reduction in their energy intensity over the past 25 years and they have doubled their energy consumption since 1990 (UN, 2018). Furthermore, the GCC countries despite having in theory the largest financial capacity to deploy investments in renewable energy they remain still locked into the vicious circle of fossil fuels, while other MENA countries such as Egypt, Morocco and Sudan together account for over 80% of the region total renewable energy capacity (ESCWA, 2019).

Unfortunately, renewable energy deployment in the Gulf countries continue to be far below the potential these countries have. The geographical conditions allow an optimal radiation in almost all countries where large portions of their lands enjoy a lot of sunlight; similarly, in the case of wind, certain areas have also the capacity to host wind plants that could supply clean energy. However, the progress can be attained if the policy framework that regulates the implementation of renewable energies creates the right environment where these alternative sources of power generation can flourish. From a general point of view, the GCC countries require to change not only the normative framework that regulate the deployment, but most importantly the strategic and long-term vision on the diversification of power generation with the goal of achieving an energy mix in which alternative sources to fossil fuels take a wider position. Despite the position taken by many GCC countries on a larger installation of renewable energy projects and a greater utilization of energy efficiency measures, the strategic visions of certain GCC countries (especially in the case of Bahrain and Oman) lack of ambition and do not take into serious consideration the possibility to extend their renewable energy capacity.

Because the energy sector is one of the driving sectors of the Gulf economies, these countries have always actively participated by subsidising with consistent investments the traditional hydrocarbon sector. This approach is a characteristic of rentier states, in which the national focus is concentrated

on developing the national assets. However, the falling costs related to the deployment of renewable technologies are attracting public and private projects to invest on utility projects. Both at utility scale and in the off-grid sector, the declining costs have paved the way for the several renewable energy projects thanks to their cost-competitiveness with traditional and polluting fossil fuels. As illustrated in the previous chapters, there are several reasons attributed to renewable energy price reduction. The competitiveness of solar and wind against natural gas, oil, nuclear or coal is greater when considered that projects can be scaled up and therefore increase their competitive advantage compared to the later ones.

### 5.1 Analysis of policy variation in GCC countries

In this section it will be discussed the different approaches of GCC countries in renewable energy deployment. It will be investigated the determinants that attempt to explain why GCC countries are embarking or not on post-oil future. They are all high dependent on oil and they generate vast amount of their income by oil revenues. These countries share similar political systems and that is why it is possible to study their political and regulative strategies as whole. Therefore, the fact that Gulf monarchies heavily rely on resource rents and they are de facto rentier states, make them comparable.

The variation in the adoption of renewable energy for power generation in the GCC countries can be analysed and discussed through hypotheses that are grounded on a set of theories derived from political science. Atalay et al. (2016) have formulated three main hypothesis that are helpful to explore the emergence of alternative source of energy in oil-abundant countries. These hypotheses take into account the penetration degree of renewable energies depending on the variable considered.

The first hypothesis assesses the capacity of international environment regimes and institutions in bringing an active stimulus to embrace renewable energy friendly policies. By participating to international platform of environmental coordination, countries commit themselves to implement environmental sounding policies and are supposed to meet the expectations of those institutions and regime, and the goals and decisions taken. All GCC countries have signed the Paris Agreement and they are part of the UNFCCC. Nonetheless, they have showed several times a veiled opposition on the implementation of stronger obligations with regards to greenhouse gas reduction. It can be

taken as an example the relentless obstructionism of Saudi Arabia in the UNFCCC negotiations of the last decades (Flisnes, 2019). Similarly, all Gulf monarchies agree that the Paris Agreement and other climate conventions will create an economic disadvantage if oil revenues are reduced because of emission reduction initiatives (Atalay et al., 2016). Hence, it can be assumed that the international environmental institutions and regimes do not play a substantial influence in the development of advanced renewable energy policies that may strengthen the role of alternative source of energy generation to fossil fuels with the ultimate goal of reducing the regional carbon footprint.

The second hypothesis takes into consideration the endogenous variables that stem from national political-economic circumstances. Atalay et al. (2016: 211) suggest the following variables to support the endogenous policy hypothesis: “(a) dependence on oil for revenues and domestic energy consumption; (b) political leadership and presence of strong environmental institutions; and (c) pressure by domestic civil society actors”. Rentier states - such as the GCC countries – have historically over relied on the revenues coming from hydrocarbon export and they have extensively subsidised the sector with large investments. This energy strategy has undermined for a long time all the chances of economic diversification and the oil sector played as obstacle in the renewable energy deployment progress in these countries. During 2011-2014, hydrocarbon exports, “including crude oil, petroleum products and other liquids and natural gas” represented about 70% of the total export of goods and services on average in the region. On the other hand, fiscal dependence on oil revenues was even larger, corresponding for over 80% of the total fiscal revenues on average in the region (Khandelwal et al., 2016, Salim and Alsyouf, 2020). In the GCC countries, the presence of strong environmental-oriented institutions and political leadership is not relevant and does not shape the general socio-economic strategies of these countries. However, there are notable examples of political leaders, as in the case of the UAE, that have gathered local and foreign investors in order to create one of the largest hubs for renewable energy technologies research in the MENA region. The last variable (c) as well does not play a consistent role in the expansion of renewable energy in the GCC country. The lack of organised civil society in the region that markedly support the cause for a wider integration of renewable energy in the energy mix, hampers the potential political change that domestic civil society can bring when it effectively and actively addresses national deficiencies and stands for new solutions to put in place.

The third - and only - hypothesis that can provide the grounds for the reason why certain countries in the region have progressed in the renewable energy sector is through the policy transfer hypothesis. Thanks to a horizontal process of dissemination and adoption of successful projects coming from partner countries. Busch and Jörgens (2005) analyse the patterns of national policy changes and cross-national policy convergence, by providing an explanatory theoretical formulation of the policy transfer concept. The authors argue that “direct policy transfer or horizontal diffusion describes processes where nations learn from or imitate policies implemented elsewhere through bilateral communication and direct interaction or exchange of experiences” (Busch and Jörgens, 2005: 92). This proliferation pattern suggests that the integration in the national legislative, regulative and institutional framework of environmental policy innovations coming from third countries is a viable way to make a profound transition in the state apparatus and create a welcoming environment for the whole renewable energy sector, from R&D to the final installation of the power generation plants. Owing to the network of international relations, countries can connect to each other and learn the best practices and fit them into the national context.

In the case of the GCC countries, the channels of policy transfer are mainly two: international and/or interregional institutionalized research collaboration; and business partnership for the promotion of renewable energy technologies (Atalay et al., 2016). In the first scenario, the actors implicated vary from intergovernmental unions of countries like the EU and the GCC, independent and academic research centres. For instance, the EU and the GCC have partnered with the aim of sharing experiences, know-how and innovative mechanisms to integrate environmental sounding policy tools that address the quest for a diversified energy panorama. In the second scenario, the partnership at the corporate level can result very beneficial for the Gulf companies. Albeit their large funding capacity to support technology-intensive projects, they have insufficient know-how to implement such projects. The fact that the GCC countries share common geo-economic and geo-political assets and face similar challenges, it can be translated as a push factor in order to seek directly or indirectly new forms of policy advancement in the renewable energy sector.

## 5.2 Institutional capacity and governance

The implementation of small- and large-scale renewable energy projects in the GCC countries plays a vital role in the challenge of diversifying the power generation supply. It has the mandate to

channel efforts and investments into the deployment of alternative sources of energy, therefore enhancing future energy security and reducing CO<sub>2</sub> emissions. These countries have pledged to comply to the Paris Agreement and to decarbonize their political agenda, with the aim of transforming their economy and society into a prosperous and more open community of people.

There are several factors that compete to define whether a country can substantially make a transition in the economy: an open macro-economic environment; an efficient financial mechanism; a supportive fiscal system. However, these economic features are irrelevant if the governance lacks a comprehensive capacity of strategically planning the energy transition. A political system has to adequate its knowledge to the new challenges and find new opportunities for the national development. The institutional capacity to lead these changes is very important in order to accelerate the deployment of renewable energy technologies in the region. Thus, institutions are they enabler of the energy diversification plans of the GCC countries in the case they actively focus on their objectives and concentrate their efforts in efficiently governing and norming the energy policy framework of their countries.

A strong institutional capacity is critical to guarantee renewable energy targets are met. Two relevant elements are crucial for the correct and ambitious implementation of such targets: independent regulators and renewable energy agency. “Setting independent, transparent and cohesive regulatory frameworks for the power sector is necessary to ensure a functioning, open and trustworthy power market for investors” (RCREEE, 2019: 61). Regulatory bodies are delegated to “set tariffs, issue licenses, evaluate the power sector’s performance and enforces legal provisions for market operations” (RCREEE, 2019: 61). Among other responsibilities, regulatory institutions are in charge of designing renewable energy policies, rationalize administrative procedures and support private companies in the deployment of new projects. Thanks to their contribution, regulatory institutions can “ensure efficient use of existing human, capital, and technical resources in achieving renewable energy” (RCREEE, 2019: 62).



Table 2 Renewable energy actors' framework (RCREEE, 2019).

Country	RE Policy Maker	Other Key RE Institutional Stakeholders	Electricity Regulatory Agency
Bahrain	Sustainable Energy Unit (SEU)	Electricity and water Authority (EWA)	<i>Non existent</i>
Kuwait	<i>No dedicated RE department or agency in place yet</i>	Kuwait Institute for Scientific Research (KISR)	<i>Non existent</i>
Oman	Authority for Electricity Regulation	Oman Power and Water Procurement Company (OPWP) Oman Electricity Transmission Company	Authority for Electricity Regulation
Qatar	Qatar General Water and Electricity Corporation "KAHRAMAA"	Qatar Science and Technology Park (QSTP) Energy and Environment Research Institute (QEERI) Qatar Solar Technologies (QST)	<i>Non existent</i>
Saudi Arabia	The Renewable Energy Project Development Office (REPDO) within the Ministry of Energy	King Abdallah City for Atomic and Renewable Energy (KACARE) Saudi Electricity Company (SEC), Saudi Aramco	The Electricity and Co-Generation Regulatory Authority (ECRA)
UAE	Ministry of Climate Change and Environment	MASDAR	Abu Dhabi Regulation and Supervision Bureau (RSB)

The quality of institutions is a key enabler on the deployment of renewable energy projects in every country of the world. An efficient institutional environment shapes the legal and administrative frameworks that regulate public and private sectors. In addition, institutions are in charge of influence the long-term strategy in every economic sector that is vital for the country development and therefore they are responsible for producing wise and ambitious policy and investment decisions (Mondal et al., 2016).

International firms and investors that aim to design and implement new renewable energy projects are interested to invest in a promising investment climate and seek find a balance between risk and returns. There are several indicators that evaluate the governance performance and quality that assure the optimal conditions for new investments. These indicators are: Ease of Doing Business, Global Competitiveness Index (GCI), and Bertelsmann Stiftung's (BTI) Status Index. The first indicator shows the ease of doing business, meaning the higher in the ranking the more the regulatory environment is conducive to the starting and operation of a local firm (WB, 2019). The second indicator integrates different socio-economic areas enabling environment, markets, human capital, and innovation ecosystem (RCREEE, 2019).

Table 3 World ranking of the indicators: Ease of Doing Business and Global Competitiveness Index (RCREEE, 2019; WB, 2019). BTI Index (2020) represents the average value out of 10 according to factors on the Political transformation and Governance indicators.

Country	Ease of Doing Business (2019)	Global Competitiveness Index (2018)	Political transformation (2020)	Governance (2020)
Bahrain	43	44	3.00/10	3.24/10
Kuwait	83	52	4.70/10	4.52/10
Oman	68	62	2.90/10	3.52/10
Qatar	77	25	3.90/10	5.46/10
Saudi Arabia	62	30	2.45/10	3.54/10
UAE	16	17	3.90/10	5.35/10

The BTI Status Index is probably the most relevant in the governance and institutional quality evaluation because it assesses through three indicators. The two indicators that are taken into consideration for the purpose of this study are the political transformation and the governance indicators. The first indicator includes several aspects that contribute to a stable and efficient democratic system: rule of law, political representation and political culture. The second indicator, governance, “refers to the quality of the political management of transformation processes” (BTI, 2020a). In the GCC regional geo-political context, the progress in the governance and political transformation is very limited and or negative in certain scores as in the case of international cooperation and consensus-building. The region is dominated by “extremely repressive authoritarian rule” that “have done more to exacerbate domestic and international tensions than ever before” (BTI, 2020b: 8). As it will be illustrated in the following sections, the political organization of power results in a series of fundamental structural problems that hinder the constitution of democratic institutions. Thus, structural systemic issues are a toxic mix for governing institutions that should implement policies and strategies that ultimately focus on phasing out fossil fuels and scale up renewable energy technologies.

### 5.3 Structural factors hindering institutional capacity

The quality of institutions is a key enabler for advancing effective policies that shape the future of a country and bring development in all fundamental sectors. Barriers and limits to the institutional system hinder the capacity to design and implement necessary policies that give answer to the

present needs whilst contribute to drawing long-term vision for the years to come. In the case of energy policies and notably the renewable energy sectors, institutions are ought to create the regulatory, financial, financial, infrastructural, instrumental and informative conditions that support both public and private stakeholders in the development of renewable energy projects, independently of the size of the investment and nature of the renewable energy source.

As the previous sections have illustrated, the GCC countries share several similar characteristics in the management of energy resources. Due to their fossil fuel abundance, the six Gulf countries have built institutions that protect and strengthen the energy sector that has ultimately moulded the entire institutional system organization and development strategies. For this reason, ministerial bodies and entities, governmental agencies and energy authorities have been influenced themselves by the powerful fossil fuel sector. As consequence, they have built a socio-economic pattern governing those countries that responds to the needs of one economic sector and the relation between institutions and the society is strongly affected by the sector's demands.

The Gulf monarchies are a typical example of rentier states. Given the abundance of fossil sources and energy resources, they use large part of the production and generation for the export and thanks to the revenues received, they can sustain the national expenditure for public purposes, finance projects and provide services to the general population. Owing to this economic setting, the GCC countries can guarantee very cheap and subsidised energy as "an integral part of the wealth transfer to the domestic population from oil and natural gas generated revenues" (Reiche, 2010: 2397). Moreover, the state delivers a number of services to national citizens, for instance free medical care, education to all levels, low-income housing, a variety of public services. Albeit this large national effort, this mechanism is perverse because the state uses its power in form of national expenditure in "exchange of the population's compliance" to the ruling royal families (Reiche, 2010: 2397). By subsidising the costs of energy consumption for domestic, commercial and industrial use, they "buy peace and stability through large-scale distributive policies" that ensure on the one hand lower costs for households, businesses and industrial companies and, on the other hand, they are legitimised by the population to rule without any constraint. Among several authors, Lilliestam and Patt (2015: 8267) define this socio-political characteristic of Gulf rentier states as "social contract", where the states and the population are the two parties of non-written contract that establishes a

pact in which the state ensures community peace and economic stability through distributive measures.

As mentioned before, subsidised energy is one of the measures taken to ensure cheap energy to majority of the domestic and productive categories, as a part of the wealth transfer accumulated through oil and natural gas revenues (Reiche, 2010). Hence, the Gulf monarchies are relieved from the social pressure they may experience because the population enjoys very convenient energy prices as well as extremely low domestic taxes. In fact, taxpayers in the GCC countries are generally paying between 0 and 5 per cent of taxes on their revenues, which make the state overall not responsible to answer to the population pressure as they are contributing very little to the government revenue. The combination of these two elements (subsidised energy and low domestic and business taxation) make the GCC countries very strong towards the population and very attractive for businesses that want to invest.

Conversely, rentierism constitutes a “super-barrier” to the establishment of healthy and efficient institutions along with the deployment of renewable energy projects in the area. The redistributive strategy contributes to produce a colluded system in which the royal families allocate administrative position to selected elite members in order to guarantee privileges and obtain favours. This mechanism produces inefficient bureaucracies that safeguards their interests and does not promote the national sustainable development. Furthermore, Reiche (2010) stresses the attention on the lower taxation as an additional element that hinders the administrative capacity and therefore the political ambition to bring innovative and ambitious projects in the energy sector. Abdelkarim (1999: 56) argues that: “the absence of direct taxes, while freeing the government from any need to share power [...] reduces the distributional power of fiscal policy (...). Without taxation-induced political bargaining, rentier states are supposed to be generally autonomous from societal demands, free to pursue policies as they please, drawing on external resources the use of which they are not held accountable for”.

To sum up, rentierism has negative consequence for the well-functioning of institutions and for the development of renewable energies. On one hand the ruling family and the government seek to defend the interest of the oil and gas sector by appointing members of the elite class or the sector in relevant executive positions, therefore creating political clientelism, patronage and conflict of

interest. This mechanism results into a very inefficient and in some cases corrupted bureaucracy that does not aim to transition the energy consumption and production behaviour. Hence, rentierism and the resource dependence are structural fundamental issues for the GCC countries because they consequently create several important barriers to the expansion of renewables in the region. These barriers include: the inexistence of a market for renewables that deters that capacity to enter in the energy panorama; absence of support policies for clean energy sources, which includes also grid access regulations; disproportional use of financial sources to subsidise fossil energy and lack of fiscal support to innovative projects in the renewable field (Lilliestam and Patt, 2015).

#### 5.4 Policy intervention analysis

In the previous section, the consequence of the rentier state institutional setting and its governance behaviour were presented. This system is responsible for an inefficient allocation of financial resources towards the fossil energy sector, and it has a direct repercussion on the policy regulation in place and the future strategies. These two barriers that hinder the development of renewables in the GCC countries are ought to be tackled at the same time. Addressing one of the two barriers while not considering the other is not a viable solution to the many issues that investors encounter when they want to invest in the region. Thus, resource-rich countries require to ensure that institutional capacity to orient the investments towards renewables and create the right normative and economic conditions that induce investors to find the GCC region as an ideal environment to dedicate innovative projects.

In this regard, the literature on the political economy of energy offers some suggestion that are worth to be analysed. Poudineh et al. (2018) contend that in order to diversify the energy mix in the Gulf monarchies and advance the renewables in the energy scenario, it is necessary to stress the attention on a toolbox of policies that can adjust to the national context. Governments are called to design the appropriate policy scheme that suits to the national context, taking into account the various risks related to the deployment of renewables, whilst considering the opportunities offered in the GCC countries. The authors illustrate two approaches that may be used to advance the renewables in the region: the fully market-based approach and the fully renewable subsidy programme. Before starting to explore the differences of these two polar cases, it is important to

note that these two positions are at the very opposite and they are built on two main energy strategies in the policy spectrum.

#### 5.4.1 The market-based approach

The market-based approach seeks to create favourable conditions for the deployment of renewable energy through markets and competition in order to facilitate the participation of the private sector. The steps taken to eliminate economic barriers to renewables and foster institutional capacity are two: removing fossil fuel subsidies and internalising the cost of externalities.

Energy subsidies are neither sustainable for the environment or the economy because they sustain the use of cheap fossil fuels in the power generation, production and dispatch, while they contribute to the emission of greenhouse gasses in the atmosphere. The negative spill-over effects caused by the subsidised energy pose questions on how to deal with this economic and environmental burden. One answer to this issue could be the removal of energy subsidies. In this remote and hard to be applied case, it would produce a sudden energy price rise, resulting in a sudden drop in consumption. Households would start to consume less energy and industries would be less competitive. Ultimately, the price rise combined with a supply-side shock can lead to a dramatic economic slowdown and stagnation. As illustrated in the previous section, energy subsidies are a vital element for the government and the monarchy legitimation. Hence, the removal of fossil fuel subsidies would dissolve the “social contract” and lead to unpredictable consequences on countries stability and order. One solution that would not destabilize the social pact between rulers and citizens is the gradual removal of subsidies through clear communication to citizens and mitigated by economic compensation (Poudineh et al.,2018).

The second step to be taken is the internalisation of externalities through carbon pricing. By directly taxing energy generation from fossil fuels, it incentivises the renewable energy efficiency and less carbon emitting source of energy (Abdmouleh et al., 2015). In the first term, low-income citizens would suffer and their demand would suddenly, but if the government balances the downwards effect of the carbon pricing it should alleviate new expenses. Besides the economic consequences of the introduction of this fiscal measure, there is another issue that the GCC countries historically detain. They lack of tax collection system and organization of a more developed and efficient system would take very long time. Moreover, taxation is a very sensitive socio-political topic and therefore

the Gulf monarchies are not willing to ask for more taxes and reduce the wealth distribution, knowing how costly that is in terms of consensus.

#### 5.4.2 Fully renewable subsidy programme

A fully subsidised renewable energy programme can support the deployment of alternative sources of energy production to fossil fuel through a heavy involvement of the government. It plays a very important role in designing, defining and implementing renewable supporting schemes that can be employed in the GCC context of non-liberalised electricity sector structure with the characteristics of a fossil dependent regime (Poudineh et al., 2018). There are several supporting schemes that can be adopted by resource-dependent countries and they may be selected depending on various factors such as “the project scale, degree of maturity of renewable technology, size of renewable targets, financial/fiscal constraints, risk attitude, presence of relevant institutions and stage of electricity market liberalization” (Poudineh et al., 2018: 140) .

The government is required not only to implement necessary supporting schemes. It is ought to design policies in light of the national strategies in place and the international agreements and programme of carbon emission and sustainable generation of energy. In addition, it has to provide supplementary support to investors that aim to invest in the region through coordinated and technical communication that ease the procedural mechanisms and bureaucratic demands.

Nonetheless, this model is not economically sustainable for GCC countries for several reasons. They do not have the institutional capacity to embrace the challenges that are given by innovative policy instruments. Rentier states do not have normative and regulative framework that suits to the renewable energy sector. The government does not have enough resources to subsidise renewable and at the same time guarantee the same standards of wealth distribution that rentier states used to spread.

#### 5.4.3 Combinatorial approach

Given the difficult implementation of both models in the GCC context, a trade-off between the two approaches may provide the opportunity for the deployment of renewable energy by combining elements of two models. The combinatorial approach suggested by Poudineh et al. (2018) is “part

of dynamic process in which country start from the most feasible point in the policy instrument spectrum [...] and gradually move towards phasing out fossil fuel subsidies over the medium to long term”. Initially, subsidies will be the first to be employed in order to incentivising renewables. It would create a disruptive effect in the GCC energy market, because gradually the renewable energy prices would become more competitive and these countries may dispose of fuel subsidies. Figure 4 shows the dramatic price fall of several renewable energy sources between 2010 and 2016 and demonstrate the competitiveness of renewables against fossil fuel sources.



Figure 4 Levelized cost of energy (LCOE) for renewables 2010-2016 (Poudineh et al., 2018).

Every country has its own specificities that rely on the setting of government bodies, level of renewable legislation and degree of subsidisation of energy. However, all GCC countries share the need for common steps to be taken. Price reform is probably the most urgent measure to be taken in order to reduce the impact of fuel subsidies while adjusting the renewable price costs for both generation and consumption. The reform needs to take into account the side effects of the removal and remodulation of those subsidies. In fact, the implementation has to fit to the countries' administrative and institutional capacities. The second important measure to be taken a compensatory action programme that targets households and industries that could potentially suffer from the removal of subsidies that reduced the price of electricity. One last measure that the authors suggest is to design a good communication between the government and the citizens so that they understand the changes that the price reform consist. Furthermore, they need to get acquainted with the new circumstances that a radical but progressive change in the energy strategy signify. This means that they have to learn the rights and obligations they will face and the new



opportunities that the renewable energy sector may create and how they can also take advantage by being themselves protagonist of the energy transition.

## 5.5 Supporting policy scheme

The risks and opportunities associated with renewable energy implementation in the GCC countries can be mitigated by a set of policies that reduce the negative consequences related to financing and deployment for the investors, lenders and stakeholders, and on the other hand galvanise the potential positive externalities linked to the renewables (RCREEE, 2019). At this stage, governments are pivotal players because they can design the “best-fit policies” for mature utility scale plants that are adapted to a dynamic market and variable conditions. Nevertheless, decentralised small and medium scale projects are still untapped view the unavailability or insufficient regulations that address these market (RCREEE, 2019).

Public competitive bidding and auctions result to be one of the most common schemes used not only in the GCC, but also in the MENA region. They offer private stakeholders to develop large-scale renewable energy project thanks to its financial efficiency and design flexibility (RCREEE, 2019). In UAE, the Emirates Water and Electricity Company has opened a tender for 2 GW Al Dhafra project and it the successful bidder will gain a 40 per cent stake in the plant that it is supposed to be operational by 2022 (RCREEE, 2019). Likewise, Bahrain and Oman have taken advantage of competitive binding and created a consortium with the Saudi ACWA Power for utility-scale projects.

Net metering is used to encourage local energy producer to install small-scale renewable energy system for self-consumption, while the excess is released in the grid. It is gaining popularity in the GCC countries due to the lower financial burdens and the flexible terms both for energy storage in house and compensation for the consumer with predeterminate tariff (RCREEE, 2019). According to RCREEE (2019), Bahrain has the most advanced net metering scheme in the region and the national energy authority provides many indications for investors about “inspection and testing guidelines, design recommendations, standards for PV systems connected to the distribution networks; PV connection processes; as well as several other forms for application and eligibility criteria and checklists and a list of approved contractors and consultants” (RCREEE, 2019: 54). Saudi Arabia has enforced the supporting scheme to systems up to 2 MW. The UAE have net metering scheme

consists of the surplus of power generated sold to electricity network and the local producer can enjoy tariff deductions from the future energy bills.

Feed-in-tariff is an ideal policy scheme for unmaturred renewable energy market. It has the potential to promote scalability and to put in place ambitious renewable energy objectives. In the Table 3 there are listed the major supporting schemes compatible with countries' structure of electricity market, regulatory organization and macro-economic environment.

Table 4 Definition of support schemes (Poudineh et al., 2018).

Type of scheme	Definition
<b>Feed-in-tariff</b>	Feed-in-Tariff (FiT) is a long-term contract (e.g., 15 years) between the off taker (usually government) and the producer of renewable electricity in which a guaranteed payment is made for each unit of energy fed into the grid.
<b>Feed-in-premium</b>	Feed-in-premium is a scheme in which the owner of renewable generation receives a payment on top of what he normally receives from the sale of his energy in the electricity market. The premium can be fixed, floating or can have a cap and floor.
<b>Net metering</b>	Net metering is a policy whereby the net consumption of user (which can be positive or negative) is tracked through a bi-directional meter. The consumer pays a retail electricity tariff when the net consumption is positive during the billing period. On the other hand, when the net consumption is negative, the consumer is compensated at retail tariff (or wholesale price). Alternatively, end-user can bank the surplus energy credit for the following period.
<b>Tradable green certificates</b>	A tradable green certificate (TGC) entitles renewable to the revenue from TGCs on top of the revenue from the sale of their energy in the electricity market. TGC is issued for each unit of energy by renewables (e.g., MWh). The electricity suppliers are required to surrender a sufficient number of TGCs in order to comply with their obligations. A penalty is imposed (per MWh) on suppliers in the event they fail to submit the required certificates which, in practice, acts as a cap for TGC prices.
<b>Grants</b>	It is a fund given by government to cover part of the capital expenditure of renewable facility.
<b>Tendering (production or investment)</b>	In the tendering model, the government specifies the quantity of renewable energy that needs to be procured and runs an auction in order to discover the price (per MWh or MW) and grant contracts to the most efficient suppliers
<b>Tax credit (production or investment)</b>	In a production tax credit, renewable facility is partially or totally exempted from tax liabilities during a specific year based on the amount of energy produced. Investment tax credit on other hand provides tax exemption based on the amount of capital expenditures on the renewable energy technologies.
<b>Tax reduction (production &amp; investment)</b>	Tax reduction is a cut in tax based on the energy produced or capital expenditure and can include sales, value added, carbon or energy taxes.
<b>Preferential loans</b>	In preferential loans governments cover part of the interest rate (e.g., 50%) for the finance provided by financial institution to renewable energy technologies. If the perceived project risk is high, the government may provide a guarantee to cover a share of the outstanding loan principal in order to lower the capital cost to investors.

## 6. Discussion of the renewable energy deployment in light of the sustainability pillars

“Energy is crucially interconnected with a whole range of other factors for developmental success. It plays a major role in ensuring the security of water and food supplies, and in enabling key development goals such as universalizing access to modern health services and education, gender equality and women’s empowerment, the creation of sustainable living spaces, technology innovation, and critical progress in mitigation of, and adaptation to, climate change” (UN, 2018: 172).

Advancing renewable energy deployment is a key enabler for sustainable development in all regions of the world. The SDG 7 aims to bring clean and affordable energy in disadvantaged areas that are not yet provided with energy and electricity to power their houses, economic activities and for many other the purposes. It stresses the attention on bringing energy through performant and efficient technological systems that produce the minimum impact on the environment. Thanks to the innovations achieved in the renewable sector, it is possible to scale up investments with cost-efficient solutions within many countries’ reach. However, without strengthening political involvement in setting energy transformation in the local, national and international agenda, it would compromise the progress made so far and hamper the chances of development for all. Political and financial coordination coupled with strategic coordination of actions are significant enabling factors that cannot be left behind. Hence, the mission stated in SDG 7 is to channel all efforts into framing political, financial and socio-cultural contributions in order to encourage the under-way energy transition.

The achievement of this goal is not only related on the fact that it will bring access to clean, modern and affordable energy and electricity in every corner of the world. Therefore, the potential outcome is not restricted to the energy transformation in itself, but it can foster the progress of the sustainable development goals. By furthering commitment in the accomplishment of goal 7, other SDGs are positively affected thanks to the combination of positive spill-over effects produced by energy transition. Cross-sectoral interlinkages between SDG 7 and other SDGs are a relevant outcome if we consider the extent of multiple benefits and synergies that come into play when a transformation process such as energy transition happen.

In the following sections, it will be discussed the potential for renewable energy deployment in the GCC countries, taking into account the role of institutions and the positive externalities that spur

from energy transition. The sections will be divided in three according to the three main sustainable development pillars or dimension: the economic, social and environmental. These dimensions are part of the historic classification made during the World Commission on Environment and Development in 1987.

### 6.1 Economic dimension: opportunities and spill-over effects

In spite of the extraordinary potential for renewable energy implementation, the GCC countries have barely taken into consideration the potentials offered by a large employment of these technologies. Historically, all six Gulf monarchies have over-relied on the hydrocarbon industry that has provided revenues, jobs for all and cheap energy. As it was analysed in the previous chapter, the diversification of economy aims to bring a change also into the share of energy mix attributed to fossil fuels. This means that the amount of oil and natural gas used for energy and electricity will be reduced and renewable energy technology will replace them in the generation process.

By achieving renewable energy targets, the GCC countries would save 2 billion barrels of oil in the period 2016/2030, which consist of USD 44 billion to USD 76 billion into savings, depending on oil and gas prices (IRENA, 2019). In this scenario, they would direct their natural resources to the export sector and to the petrochemical sector that are more profitable compared to the use for domestic power generation. IRENA (2019) estimates that if Saudi Arabia continues to its business-as-usual model of consumption of hydrocarbon products, they will no longer have substantial export and therefore their revenues would diminish dramatically. Similarly, in the UAE renewable energy would imply considerable savings in natural gas.

Part of the diversification of the economy, job creation in different economic sectors that do not include the public sector and the oil and gas industry are to be prioritised and privileged. In view of the very young and skilled population, the opportunities of employment in the renewable energy sector are considerably high. In the case of solar PV projects, IRENA (2019: 105) argues that sector creates “at least twice the number of jobs per unit of electricity generated than do coal or natural gas projects”. According to the Abu Dhabi-based agency, by 2030 the number of jobs created could reach 220 500 units and 135 000 direct jobs every year.

In line with further employment potential, GCC countries would benefit enormously as a result of value creation chain. Renewable energy deployment in countries where skilled workers coupled with manufactured technologies are located locally or regionally, they create a great advantage for scale up projects. SDG 8.2 aims to “achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors”. R&D institutes can be found in several GCC countries, particularly in Saudi Arabia and the UAE, but only in few cases there are enough departments dedicated to the research and development of renewable energy technologies. There are already present certain manufacturing facilities that produce renewable energy technologies. Yet, they need to enhance their production units through industrial innovation, advanced equipment and more investments. Local production of technologies is an extraordinary opportunity for value creation as it brings many benefits in different economic sectors and it ultimately secure a wider implementation of renewable energy technologies.

## 6.2 Social dimension: implications on inequality, gender and health.

The implications of renewable and sustainable energy deployment in the society are multiple. Diversifying the source of energy, upgrading the grids and infrastructure and connecting all households and economic activities, unlock significant positive externalities in the social dimension.

Energy is a commodity that is part of our daily life. However, the extent by which it is accessible and available is not at everyone’s reach. In the case of GCC countries, we cannot talk about “energy poverty” because the access to energy and electricity is extended to almost the entire population. Nonetheless, the access to clean and sustainable energy in the Gulf monarchies is far to be present and negative consequences of the non-utilisation of renewable energies prompts low human development and social inequalities.

Reducing regional disparities in energy through the implementation of renewable energy technologies is key to reduce income imbalances, gender inequalities and inequalities in other dimensions (UN, 2018). Investing in green and sustainable energy “empower and promote social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status” (SDG 10.2). Ensure renewable energy can provide households clean ways of powering their houses, clean cooking systems and efficient cooling facilities. It can

also provide to economic activities suitable solutions for in-house energy production that can cut the costs of purchase and raise competitiveness of their products.

Renewable energy can reduce and ultimately close the gender gap. Women and children are often two categories of the population that may take a wider advantage if renewable energy were implemented in the region. Integrating gender in the overall energy and economic strategy action plan, would unlock a huge potential because women would be empowered to create to business alternatives. Women entrepreneurs are very keen on managing sustainably resources and take extra care on energy efficiency; therefore, they would potentially increase their entrepreneurial innovation through new innovative tools and skills provided by alternative sources of energy. In the Gulf monarchies, it would be a challenge to encourage women participation. However, there are successful examples of women participation that have employed several people and enriched the commercial and industrial fabric with innovative products.

Renewable energy deployment is strictly related to health. The reduction in greenhouse gasses is a direct effect of clean source of energy and electricity. As a result of sustainable energy produced and consumed, the air quality is improved, less polluted and the population will be less likely affected by health diseases. Most of the population in the GCC lives in urban areas and air pollution is responsible for 90 per cent of the of the world's urban populations at increased risk of heart, brain and respiratory disease (UN, 2018). Scaling up renewable energy will be instrumental for accomplishing multiple health-related issues. It would reduce neonatal mortality and mortality related to cardiovascular disease, cancer chronic respiratory disease. In rural areas in the GCC, it would also improve ambient air pollution where cooking facilities are basic and polluting. Renewable energy would increase also safety and liveability of cities.

### 6.3 Environmental dimension: trade-off between conservation and development

The energy sector is responsible for about two-thirds of all human-induced greenhouse gas emissions (UN, 2018). The GCC countries have reported an increase in CO<sub>2</sub> emissions over recent decades due to the dramatic growth in energy production and consumption. As a result of the population increase and economic development, more energy is required to satisfy larger and emerging needs. According to the GEO-6 Regional Assessment for West Asia (UNEP, 2016), in 2011 the West Asia region was accountable for 3.5 per cent of CO<sub>2</sub> emissions. Yet, the population

corresponds to only 2.1 per cent of the world population (UNEP, 2016). The Gulf population – and in general the West Region – requires a lot of energy for daily use (namely air conditioning, desalinated water and power for energy intensive industries and economic activities). Therefore, the emission per person are way higher compared to the average of 4.98 tonnes: in 2011 Qatar led the West Asia region with 43.89 tonnes of CO<sub>2</sub> emitted per person in the atmosphere (UNEP, 2016).

The GCC ecosystem is one of the most prohibitive in the Earth for human development. The GCC's hyper-arid, arid and semi-arid climates, coupled with over utilization of energy sources, exacerbate the drivers of climate change in the region. Ecosystems are under stress owing to deeply urbanised centres and economic activities that have transformed local environment with evident negative effects on the flora and fauna. The energy sector is a driver for climate change in region: record high temperatures were recorded in several areas; lower precipitation rates have threatened water security and forced to rely on desalination plants; sea level rise is endangering coastal settlements.

View the tremendous effect of energy production and consumption on climate change and how it alters the climate variables that regulates ecosystem, a reform of the energy sector can be considered as one of the answers for climate adaptation and resilience. Alternative sources of energy and electricity production have the potential to mitigate climate change while fulfilling the SDG 7 on clean and affordable energy for all. Decarbonising the energy sector is one of the top priorities because from its achievement depends the accomplishment of several other SDGs that are focused on environment protection (13, 14, 15).

Energy is strategic sector for virtually all countries and climate change seriously threatens energy security and ecosystem stability. The Paris Agreement and the Agenda 2030 are two main long-term programmes for sustainable development that highlight the urgent transition required in order to guarantee for the present and future generation a peaceful and prosperous future. Hence, making energy systems climate-resilient will help keeping the 1.5 C° mean temperature and extend clean and efficient renewable energy in the GCC countries.





## 7. Conclusion

The intention of this study was to explore the potential for advancing renewable energy deployment in the GCC countries with a particular focus on the policy framework, meaning the support schemes that best suit to the national legislation, and the long-term strategies. Taking into consideration the similar statal constitution, the economic structure and the social composition, the GCC countries were interesting cases to investigate because they share common traits and they face challenges that are relatable. The Gulf countries are resource-rich countries that have based their economy on export hydrocarbon and on the petrochemical sector. Therefore, their economies are largely dependent from certain natural resources that provide large income, but they lock those countries into a vicious circle.

It was investigated the energy market composition, the demand and consumption rates, the evolution of the energy market in light of the changes occurring in these countries. The renewable energy status of each country was examined in order to have the big picture of the current deployment. Following this comprehensive background examination of the energy production and consumption trends, it was analysed the institutional role in implementing support schemes and favourable financing and investments conditions. The theoretical grounds on policy dissemination have illustrated the way policy implementation can successfully lead to renewable energy deployment in the region. At the end, it was discussed the renewable energy implications from three different perspectives that are related to the sustainable development pillars: economic, social and environmental dimensions.

### 7.1 Findings

The exploratory study shows the potential for future deployment of renewable energy in the GCC countries, especially in the case of solar and wind power that are abundant in many areas of the region. It takes into account the conflict with the oil and natural gas, the two dominant sources of energy and electricity generation in the region. Nonetheless, the study demonstrates that there are several elements that can encourage and spur renewable energy deployment in the Gulf countries. The macro-economic environment is very dynamic and open to private and public investments. The costs for renewable energy (raw materials, design, manufacturing, installation, maintenance,

coordination) are rapidly decreasing. As a consequence, clean energy is becoming more and more competitive compared to traditional polluting sources of energy. The study argues that renewable energy has extraordinary potential to generate many positive externalities in the Gulf economies. By locally contributing to the creation of value chain, the chances of creation of more opportunities exponentially grow. R&D is a fundamental part of the value chain and the research institutes that are disseminated in the GCC can be supported in developing projects sized to the needs, expectations and limits of the Gulf countries thanks to their local knowledge and competencies in the field. National industries would benefit from a local production and manufacturing of renewable energy technologies. They would employ skilled and qualified nationals and expatriates.

With regards to how the renewable energy policy framework can be further implemented the theory of horizontal diffusion supports the implementation methods used in the region. In fact, the regional cooperation among countries of the GCC is a key enabler for the renewable deployment. Through knowledge dissemination, exchange of best practices and policy advisory, these countries that share common goals in energy reform, they can pursue similar strategies hand to hand. It was argued that rentierism is limit and barrier for renewables. It has built in the years corrupted and inefficient institutions that have always prioritised the fossil fuel industry at the expense of other sectors, including the renewable energy sector. The GCC requires transparent and accountable institutions able to enforce proactive and integrated policies that aim to shift the energy paradigm and move to a more sustainable energy future.

## 7.2 Recommendations

The research question regarding the debate between institutional capacity and efficient governance on one hand, and diversification strategies needs to be further investigated. This study has not a full understanding of the limits to the diversification strategies caused by inefficient institutions. The study recommends further investigation about this aspect of governance in the GCC. It is very relevant to comprehend the elements that hinder the institutional capacity in the context of pending transformational issues.

In light of the Covid-19 pandemic, this study recommends exploring whether the energy transition in progress would be affected and what are the potential opportunities that profound global challenges can cause in the GCC countries.

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