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From Economic to Extrinsic Values of Sustainable Energy: Prestige, Neo-Rentierism, and Geopolitics of the Energy Transition in the Arabian Peninsula

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Abstract: Energy transition in the region of the Gulf Cooperation Countries (GCC) has recently commenced and is now being implemented through large-scale renewable projects, nuclear plants, and energy efficiency measures in the built environment. This paper highlights how alternative energies are associated with non-economic factors such as prestige, modernity, and (soft or symbolic) power. It analyzes the specific ways of delivering energy diversification in the Gulf through renewable megaprojects, the reorganization of the energy sector, and the incorporation of nuclear energy as an add-on source. These decisions serve GCC states in showcasing modernity, maintaining centralized control, posturing geopolitically, and extending the rent distribution mechanisms. On one hand, the energy transition in the Gulf has been domesticated through policies and strategies suiting the political systems in the region. This can have an acceleration effect on this transition. On the other hand, the implications of the adaptation of the energy transition to the reality of the Gulf remain open. The success of this transition will depend on the ability of GCC states to ecologically modernize the Gulf societies, reduce environmental risks, and enhance GCC-wide cooperation.

Keywords: energy transition; geopolitics; nuclear power; political economy; renewable energy; Gulf Cooperation Council (GCC)

1. Introduction

The development of alternative energy sources is an integral element of the national strategies of countries in the Gulf Cooperation Council (GCC). These wealthy countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates or UAE) have accelerated the push for alternative energies through targets for renewables as an integral part of ambitious national visions of economic diversification and low-carbon transformation [1,2]. At the same time, nuclear energy has been incorporated as part of the future energy policy mix, while consumers' energy tariffs have been significantly increased and the energy production sector restructured to allow for independent power suppliers (usually as public-private partnerships) [3–5]. Renewables (particularly solar energy) and nuclear energy—together described in this paper as alternative energies—are incorporated in ambitious plans to promote sustainable energy alongside the abundant oil and gas resources. GCC governments have often justified the promotion of alternative energies by citing factors attesting to their sustainability and the economic benefits in comparison to fossil fuels. The bulk of academic research on energy transition in the Gulf has so far focused on analyzing the status of developing alternative energies in different countries, the political economic considerations for their adoption, and the challenges facing their advancement. For example, respective studies have analyzed issues relating to cost–benefit ratios, the potential of renewables in the region or the implications of the rising domestic energy demands and intensities [5–9].

Similarly, in other regions, the adoption of renewable energies is fully underway due to the multiple economic (e.g., cost and subsidy savings in comparison to fossil fuels), social (e.g., enhancing rural electrification and development), and environmental benefits (e.g., emission reductions). Changes to the energy mixes (replacing certain energy types with others) are considered to be mainly driven by economic or political-economic considerations. Here, the traditional argument in favor of renewable energies cites the comparative cost in relation to the total economic cost (i.e., including environmental and other externalities) of fossil fuels. For example, the significant reductions in the production costs of solar energy for electricity, together with promotional public policies, have accelerated the adoption of this energy type in China and elsewhere [10]. In China, the energy transition is also motivated by the transition away from the environmental and health perils of coal production, which has been the main energy source for economic growth (60% of primary energy consumption in 2018), with China consuming half of the global coal production [11]. Renewable energy will play an important role in the low-cost electrification of underdeveloped regions such as in Africa, where a mixture of decentralized systems for rural areas and grid connected systems for denser areas are envisioned [12]. Often, the renewable energy transition is contextualized beyond pure economic issues to include political economic factors such as equity, employment, or balancing the interests of winners and losers [13]. In the European Union for example, the policy designs of remuneration schemes (e.g., feed-in tariffs or industrial support programs) and technological differentiation correspond to the decentralized decision-making and the need to accommodate different political and economic interests in (large) European countries such as Germany [14]. Similarly, Denmark has become a pioneering country in the deployment of renewable energies by using economic instruments such as carbon taxes and incentives for renewables such as combined heat and power or wind energy [15]. Along the same line, the diversity of deployed renewable energy technologies and initiatives has been explained via political economic considerations in other cases such as South Africa [16] and China [17].

While the political economic approaches are dominant in explaining the energy transition in the Gulf [5,18–20], less attention has been paid to hidden/inferior factors that might be necessary to fully capture the push for alternative energies. A small number of factors such as geopolitics and the role of megaproject mentality in promoting modernization have been highlighted in some studies, indicating that energy transition is embedded in regional competition and rivalries for showcasing grandeur and affluence [2,3]. However, there has so far not been a systematization of non-economic factors in the Gulf energy transition. This conceptual-narrative paper aims at analyzing the drivers of the energy transition in the GCC countries by highlighting extrinsic values of different energy types from the specific perspective of these countries (i.e., benefits to policymakers not solely related to price and cost considerations). Using a review of insights from key literature on the energy transition in the Gulf, the paper contrasts secondary values (e.g., showcasing prestige, geopolitical posturing or extending the rentier state instruments) to the traditional political economic arguments for alternative energies in terms of affordability (price), environmental benefits (externalities), and conservation potentials of carbon resources (opportunity costs). Furthermore, it explains how renewables are delivered through megaprojects and the reorganization of the energy sector. This reorganization is geared toward facilitating the transformation of rentier states from direct forms of rent disbursement into new forms of subsidies (e.g., attractive public jobs and supplier subsidies to semi-public companies). In this sense, the paper argues for incorporating the intangible benefits of energy transition in the context of GCC countries.

2. Research Outline and Case Study

2.1. Overview of Terms and Research Approach

The analysis of the role of extrinsic factors in the energy transition in the Gulf was carried out by conceptually contrasting these factors to intrinsic ones. The basic premise is that the focus on extrinsic factors offers a critical and needed perspective in comparison to the more traditional

view of energy transition as being motivated by technical and economic considerations (intrinsic factors). Table 1 summarizes the key terms and ideas of this conceptualization and offers some examples (to be further analyzed in the course of this paper) as well as broad bodies of literature commonly used in the two contrasted perspectives. In essence, the extrinsic values are add-on benefits of the energy transition that are desired by states, in addition to the essential requirements from certain types of energies. For example, solar energy is intrinsically clean, renewable, and (if a good potential exists) feasible or cost-effective, while certain states can also target other non-economic or non-essential benefits from this energy type (extrinsic values). In this sense, this paper refers to the extrinsic values as commonly characterized to be non-economic, non-technical, or non-traditional. Here, the differentiation between intrinsic and extrinsic factors is geared toward clarifying the focus this paper, and less toward the concretization of two precise economic terms. In fact, extrinsic values can be conceptually associated with (positive) externalities or related to different non-use values, thus, in theory, implying the incorporation in the total economic value of certain energy types. However, this paper purposefully avoids such a conceptualization as the latter described extrinsic values are neither priced nor adequately integrated in the economic or technical literature on energy transition.

Table 1. Overview of key terms and concepts.

Key Properties of the Value Category	Intrinsic Values	Extrinsic Values
Term description	Essential benefits commonly sought and required by states.	Non-essential or add-on conveniences desired and expected by states.
Common characteristics	Related to the nature of different energy types, e.g., being renewables, safe or clean; often considered as prerequisites for implementation (need to be there); mostly technical and economic factors, e.g., cost-advantages, technical feasibility or resource availability/potentials.	Secondary or inferior advantages (they don't stand alone); mostly related to the implementation or the promotion policies of a certain energy type; highly context- and case-specific; often not purely economic or technical, but rather involve socio-political or cultural elements.
Examples of category of factors in the Gulf region	Cost competitiveness and high potential of renewables; contribution to economic diversification and meeting rising energy demands; fulfillment of sustainability requirements.	Display of modernity and affluence; signaling primacy in a global city competition; power instruments in state-based rivalry; provision of new means for distribution of state-provided rents/benefits.
Supporting bodies of literature	Energy economics and energy-growth; energy infrastructure; energy infrastructure and feasibility studies.	Urban development; energy geopolitics; political economy of energy transitions; energy security studies.

In order to understand the importance of the non-economic motivations for energy transition in the Gulf, this paper did not solely focus on renewable energies. Moreover, it analyzed alternative energies (i.e., renewables plus nuclear energy) as both types have been harnessed for important non-economic motivations in the Gulf region. For example, as to be explained later, both nuclear and renewable energies are delivered using megaprojects and used by Gulf states to display power and achievement. Extrinsic values might be more associated with nuclear energy (than renewables) since nuclear energy in the Gulf is largely replaceable by renewables, and can only be adequately differentiated in terms of real benefits by citing non-economic values such as geopolitical posturing [3]. Both nuclear and renewables are emerging energy resources in the Gulf region, and thus constitute important elements of the ongoing energy transition. They are propagated by GCC states as sustainable (thus the term "sustainable energy") because they are associated with less emissions and have good potential to satisfy the increasing local energy demands. Naturally, as to be explained later, sustainable energy can be a

controversial and imprecise term since nuclear energy, for example, is argued to be unclean and more risky than the option of renewable energies (clean energy).

2.2. Sustainable Energy in the Gulf: A Review of Political Economy, Trends, and Common Justifications

The energy transition in GCC countries is rather recent, despite the region exhibiting significant potential for renewable energy sources such as solar and wind energies. While much of the focus by GCC governments in the last decades has been on scoping the potential of renewables and finalizing the energy mix plans, the pace of implementation of alternative energy projects has arguably accelerated. Solar energy plants have recently opened (including some directed toward solar desalination) and some major new ones are regularly announced or commissioned. Table 2 summarizes some of the key energy indicators for the region including the future targets for renewables. One can observe that the current capacity of renewable energies is rather small in all GCC countries except for the UAE. For example, in 2019, the capacities in Qatar and Saudi Arabia were 43 MW and 397 MW, respectively [21], which were far below the targets of 200–500 MW for 2020 in Qatar and 9.5 GW by 2023 in Saudi Arabia [22]. Similarly, the renewables share in electricity generation was negligible in 2018. However, considering the versatile race for renewables, some countries can overachieve while others might deviate from the announced targets after completing the undergoing projects.

Often, the trend of increasing development of alternative energy sources is explained through three dominant, but interrelated, (political) economic explanations. First, the cost-competitiveness of renewable energies has made them quite interesting for GCC states. IRENA (International Renewable Energy Agency) [21] explains this notion further citing factors such as the well-designed auctions, favorable financing conditions, and declining renewable technology costs. According to this study, solar PV is now the cheapest way of electricity generation in new GCC projects (priced between 2.34 and around 10 USD cent/kWh), thus beating natural gas, liquefied natural gas (LNG), oil, coal, or nuclear. Other reasons behind the decreasing costs are the increasing familiarity with the technology and investments in the value chain [21]. The price per kWh in some of the current projects are relatively low (e.g., 7.3 USD cent for CSP and between 2.4 and 5.85 for solar PV for the Mohammed bin Rashid Al Maktoum Solar Parks in the UAE, or 2.34 USD cent for solar PV in the Sakaka plant in Saudi Arabia) [21]. These prices are lower than other countries. For example, in 2019, the global, weighted-average levelized cost of electricity accounted to 6.8 USD cent from utility-scale solar PV and 18.2 from CSP [23].

The second explanation is related to the economic diversification efforts. Particularly after the 2014/15 fall in oil prices, the energy mix policies of GCC countries have witnessed major changes. These changes are reflected in the formalization of ambitious development plans (national visions) geared toward economic diversification, which include investments in alternative energies and bold reforms to the tariffs and organizational structure of the domestic energy supply markets. In fact, economic diversification strategies have been around since the early development plans in the 1970s, but with modest success since the private sectors only grew in periods of low energy prices [24]. The fate of the current diversification efforts might not be different. However, there are some indications of serious pressure to provide other sources of revenues other than the rents from the sale of oil and gas. Above all, the growing populations and economies have resulted in increasing demands for basic amenities such as state provided electricity, desalinated water, or public jobs. GCC states might not be able to fulfill some of these demands. Renewable energies provide an opportunity to address these growth needs and can also help in decoupling economic growth from the harmful carbon dioxide emissions [25].

For example, in the next decade in Saudi Arabia, considering current energy demand intensities, the country might need all of its currently produced oil for meeting local energy demands, thus resulting in foregone oil exports [26]. In fact, the two largest countries of the GCC, Saudi Arabia and the UAE, hold the last two ranks out of the 25 biggest energy-consuming nations in the 2018 energy efficiency scorecard produced by the American Council for an Energy-Efficient Economy [27]. The push for

alternative energies is seen as a way to free up fossil fuels for export, while reductions in energy subsidies are geared toward reducing expenditure and increasing energy efficiency. In fact, the energy subsidies (calculated as price reductions on efficient consumer prices or as hidden producer subsidies) have decreased significantly in the last decade (e.g., the share of energy subsidies in Saudi Arab reduced from 9.5% of GDP in 2014 to 3.7% in 2019) [4]. Although there are still significant energy subsidies in the region in comparison to other countries (e.g., subsidies' share of GDP in Russia and China account for 1.5% and 0.2% of GDP, respectively) [28], the subsidy reforms have been across the board in all GCC states, which have also reduced other benefits and subsidies (e.g., for water) [29].

Table 2. Summary of key energy indicators for Gulf Cooperation Council (GCC) countries.

Indicator (Year)/ Country	Renewables Targets [i]	Energy Efficiency Targets [i]	Total Renewable Energy Capacity in MW (2019) [ii]	Electricity Production from Renewables (% of Total Production in 2018) [iii]	Energy Intensity Level of Primary Energy (MJ/$2011 PPP GDP) (2015) [iv]	Total Fossil Fuel Subsidies as Share of GDP (%) (2019) [v]	Average Subsidization Rate (2019) [iv]
Bahrain	2035: 10% of elec. generation	2025: 6% less elec. consumption	7	0%	9.78	2.0%	25%
Kuwait	2030: 15% of elec. generation	2030: 30% less energy consumption	106	0.12%	5.31	4.0%	59%
Oman	2025: 10% of elec. generation	2030: 2% less emissions	8	0.01%	6.30	-	-
Qatar	2020: 200–500 MW of solar	2022: 15% less per-capita water consumption and 8% less per-capita elec. consumption	43	0%	6.40	0.3%	12%
Saudi Arabia	2030: 30% of generation from renewables and others (nuclear)	2021: 8% less elec. Consumption and 14% less in peak demand	397	0.04%	5.79	3.7%	47%
United Arab Emirates	2050: 44% of capacity	2050: 40% less elec. consumption	1885	0.96%	5.08	1.4%	23%

Sources: [i] [21]; [ii] [22]; [iii] [30], [iv] [31]; [v] [28].

Third and finally, renewable energies can be seen as a response to sustainability and environmental requirements to decrease the large ecological footprints in the region and reduce the carbon-intensity of economies. Al-Saidi and Elagib [2] examined ecological modernization in the region and linked renewables and interventions in the built environment to low-carbon policies. Al-Saidi et al. [32] explained the increased engagement of GCC states in the global sustainability agenda, including the Sustainable Development Goals (SDGs) and the Paris Agreement. Here, renewables provide a means of reducing environmental costs and damage, while the sustainability engagement of GCC governments is mainly embedded in the broader agenda of economic diversification as an overriding policy objective [2,32,33].

In summary, the economic reasons related to cost considerations, diversification benefits, and the internalization of environmental externalities explain an important part of the energy transition in the Gulf that is manifested through projects of alternative energies, subsidy reforms, and energy efficiency measures. However, they do not provide a comprehensive explanation. For example, they are insufficient at explaining the need for nuclear energy in the region or the specific model of energy provision through megaprojects, national certification programs, and centralized control. In the next section, other explanations are discussed in order to capture some of the neglected or critical aspects of the energy transition in the region.

3. A Critical Perspective: Extrinsic Values of the Energy Transition

3.1. Modernity Display and (Regional) Environmental Competition: Renewables via Megaprojects

The implementation of the energy transition can be revealing about the meaning and the values attached to energies. One striking characteristic of energy transition is that it is mainly carried out through megaprojects in terms of large-scale power plants and major planned cities incorporating sustainable energy use. Table 3 provides data on the largest of such plants and cities. A handful of large utility-scale plants dominate the installed capacity, while the solar technologies (mostly solar PV) are expected to account for 89% of the around 220,000 renewable energy jobs expected in the GCC region by 2030 [21]. In fact, utility-scale solar energy is on the rise worldwide due to technological advancements, policy changes, and the relative cost competitiveness of large-scale plants (e.g., economies of scale), which are cheaper than the decentralized approach of distributed solar energy systems [34]. Distributed systems are relatively small (e.g., less than 1 MW) and mostly deployed on rooftops of residential and non-residential buildings. While the distributed solar systems originally formed the bulk of the annual growth in renewables capacity, utility-scale solar has increased rapidly to exhibit, nowadays, a large majority of the energy market in cases such as Europe and the United States [35]. In the GCC region, the proportion of distributed generation—although growing as an option for remote areas—is expected to be small (e.g., accounting for around 10% of the total renewables jobs by 2030 despite being more job-intensive) [21]. At the same time, utility-scale renewables are rendered mainly through mega plants (Table 3) operated by independent power producers (IPPs). In comparison, the median capacity per IPP is around 38 MW in the European Union and 67 MW in the USA [35], which are far smaller numbers than in the bulk of utility-scale projects in the GCC region, each having several hundred megawatts.

With regard to energy efficiency efforts in the built environment, they are usually concentrated in a number of megaprojects to construct planned cities showcasing modern smart city design and sustainability technologies [2,36]. Some of these planned cities incorporate local and international energy certifications for buildings, for example, the U.S.-based certification Leadership in Energy and Environmental Design (LEED) (implemented in Education City and Musheireb City in Qatar as well as Masdar City in the UAE) and the local certification systems of Qatar (the Global Sustainability Assessment System or GSAS), Abu Dhabi (Estidama system), and Dubai (Al Safat rating system). Furthermore, the bulk of distributed (rooftop or decentralized) solar capacity is concentrated in these planned cities (e.g., solar installations in Masdar city in the UAE and Education City and Musheireb in Qatar). Energy-related megaprojects include nuclear plants, which are already constructed in the UAE (the Barakah nuclear power plant of around 5000 MW capacity) or planned projects in Saudi Arabia.

Altogether, the notion of megaprojects playing a major role in delivering the energy transition in the GCC region requires a look into the extrinsic or secondary values of this centralized and large-scale approach. Here, urban studies literature on the GCC region provide some relevant insights. The transformation of GCC cities through megaprojects has often been contextualized within the pursuit of spectacle and modernity by the ruling elites in the GCC [37,38]. These ruling elites might encourage lavish lifestyles in order to gain legitimacy as providers of wealth and modern amenities [39]. Such explanations go along with the theories of rentier states, which explain how Gulf states distribute rents (e.g., from oil and gas or levies from expat population) to national citizens. The ruling elites demand no taxes in exchange for obedience and the lack of political participation. Megaprojects serve GCC states in promoting a nationalist vision that incorporate global city images, best practices, and stereotypes of modernization and sustainability while these states are trying to (symbolically) maintain local culture and identity [40,41]. However, they sometimes fail due to the unintended consequences such as the oversized design, the rhetoric adherence to sustainability, or non-compliance with the original goals (e.g., the target of Masdar city of being carbon-neutral) [39,42,43].

Table 3. Overview of the largest renewable plants and planned cities with sustainability features.

	Largest Renewables Plants: Capacity in Megawatt	Plant Status (End of 2020)	Largest Planned City with Sustainability Features (Cost in USD Billions)	City Energy Profile
Bahrain	Solar PV Plant: 100 MW	Contracts awarded	-	-
Kuwait	Al Dibdibah/Shagaya Phase II: 1200 MW	Project suspended after COVID-19	-	-
Oman	Miraah Solar for enhanced oil recovery (EOR): 1000 MW-th	Under construction	Madinat Al Irfan ($13)	Energy certifications of buildings, solar energy use.
	Ibri PV Plant: 500 MW	Bids received		
Qatar	Al-Kharsaah Solar PV: 700 MW	Financing closed	Lusail city ($45), Musheireb City ($5.5), Education City ($15)	Energy certifications of buildings; solar energy.
Saudi Arabia	Sakaka Solar PV: 300 MW	Under construction	Neom (ca. $500)	Designed as completely using renewable energies and low-carbon technologies.
	Dumat Al Jandal Wind plant: 400 MW	Under construction		
United Arab Emirates	Noor Abu Dhabi Solar PV: 1177 MW	Under construction	Masdar City ($18–22)	Originally as carbon-neutral city, extensive use of renewables and energy certifications.
	Mohammed bin Rashid Al Maktoum Solar Park, Phase I: 13 MW, Phase II: 200 MW, Phase III: 800 MW, Phase IVb: 250 MW, Phase Iva: 700 MW, Phase V: 900 MW	Phase I-III: completed; Phase IV: under construction; Phase V: planned		

The sustainability (or energy) transition through megaprojects is also indicative of a regional competition (among some GCC states) and an international one (among major global cities). Acuto [41] characterized megaprojects as a race for "symbolic power" and a manifestation of "rivalry for primacy" among global cities, which Dubai has been exemplifying for decades now. This indicates that megaprojects are seen as an instrument to convey power and modernity in an effort to attract visitors and cement the legitimacy of the ruling elites. Other GCC cities such as Doha and Abu Dhabi have also witnessed an array of mega-developments in the last decade. The megaprojects are commonly developed through a master developer, namely a public entity that defines the master plan for the infrastructure and cooperates with property developers for the construction of certain plots. Currently in the GCC region, there are megaprojects worth around 1 trillion USD with the participation of investors and funding partners, which can be private entities or (in most cases) state-dominated enterprises or banks [44]. These projects rely on the expertise of prestigious international consultancy firms, whereas the regulatory frameworks are often vague with personal relationships (with the ruling elites) influencing the selection of clients/partners [40]. In this sense, megaprojects can serve (rival) political agendas in the Gulf and reflect the interplay of regional power and competition.

In fact, recent evidence indicates the heightened competition among GCC states with regard to the sustainability agenda. Al-Saidi [45] showed how regional environmental cooperation among GCC states on key aspects of the SDGs agenda is lacking, and often resembles competition rather than a complementary policy approach. Here, Qatar and the UAE are spearheading the competition for low-carbon cities, energy certified buildings, achievement of renewable targets, tourism or hosting mega-events. In fact, the GCC states are increasingly depending on international (rather than the regional) arenas through alliances and engagements with global networks in an effort to promote local sustainability [32]. Although there are relevant GCC-wide initiatives such as the integrated power grid,

other cooperation areas have not materialized (e.g., coordinating climate policies including energy certification systems [46], enhancing environmental policies on the Gulf ecosystems [45], or developing long-term gas trading agreements [47]).

3.2. Reorganization and Reforms toward Neo-Rentierism: A New Energy Supply Sector

The introduction of renewables has made some reform decisions necessary in terms of slashing energy subsidies and reorganizing the energy sector. These decisions led to the creation of new local energy sectors, but also redefined the main instruments of the rentier states in the Gulf. First, with regard to the reorganization of the energy sector, one can elaborate on the adopted reforms to deliver renewable energies. As mentioned earlier, energy subsidies have been significantly reformed despite still being higher than other benchmark countries [4]. The energy subsidy reforms serve multiple purposes. They can be framed within the context of raising local energy demands or outside pressures to address climate change and the negative externalities of fossil fuel use [29,32]. In this sense, they represent an initial necessary step for ecological modernization in the Gulf. This modernization process is currently being carried out through country-specific agendas (e.g., national visions, megaprojects or partnerships with international networks) and influenced by domestic factors (e.g., demographic and economic changes or fossil fuel production capacities) [2,48]. Here, ruling elites in the Gulf are considering their need for revenue from the export of fossil fuels, but also the negative ecological impacts (e.g., emissions, air pollution) from consuming these fuels locally. All GCC countries export much more than they locally consume, for example, the exports and final consumption figures for all countries are (mentioned respectively in mtoe): 12.2 and 6.6 for Bahrain, 135.8 and 17.3 for Kuwait, 55.8 and 23.4 for Oman, 171.7 and 21.1 for Qatar, 492.5 and 148 for Saudi Arabia, 184.7 and 59.8 for the UAE [30].

At the same time, the energy subsidy reforms are considered as specific policies to advance renewables, alongside energy efficiency standards, raising awareness, introducing smart technology (e.g., metering, energy-efficient lighting etc.), and encouraging better cooling systems such as district cooling [2,21]. They allow for more competition in the energy market while introducing an economic incentive for consumers to save energy and reflect on consumption. The high energy intensity in GCC states have often been attributed to the heavily subsidized prices [25,48].

Another significant reform is the differentiation of the energy sector in terms of new actors, contract types, and sub-sectors. This reform and its implication has been highlighted by Tsai [5] and Tsai and Mezhar [49]. While the power (and water) sectors were previously owned and operated by the state, new actors have emerged in the last couple of decades in the form of independent (water and) power producers (IPPs or IWPP). The IPPs sell their outputs to a state-owned power (and water) company known as the single buyer (SB) through a long-term power purchase agreement (PPA) using price equal to the marginal economic cost. The IPPs receive subsidies through these PPAs in the form of buy-in guarantees and subsidized fuel costs delivered to them by the national oil companies (NOCs) and paid by the single buyer [5]. The implementation of the IPP-SB-PPA model is carried out through non-oil state-owned companies (SOEs) and public private partnership (PPPs) agents with state ownership who develop and operate the renewable projects [5,49]. The emergence of these new actors result in more complex and differentiated energy sectors in the Gulf in terms of contracts, regulations, and governing institutions.

The second issue is with regard to the consequences of the ongoing reorganization and differentiations in the national energy sectors on the instruments of the rentier states. Here, there seems to be a consensus in the relevant literature that the GCC rentier states are evolving and exploring new sources or instruments of distributing rents. According to Tsai [5], these rents are now provided through state-provided jobs in the now differentiated energy sectors. They present a substitution for energy subsidies, which previously represented a direct rent distribution system. In fact, maintaining or expanding public jobs benefits, which are usually associated with more job security but lesser efficiency than private sector jobs, represents a decision against reforming the social contract underlying the

rentier states. The wider Middle East region has witnessed some (limited) energy subsidy reforms, but no reforms of the over-sized public sector or the heavily regulated and segmented labor markets [50]. The energy sector reforms in the GCC represent a renovation of the rent distribution mechanisms while guaranteeing the continuation and the evolvement of the rentier state mentality [4,5,29]. Sim [51] saw, alongside public jobs, additional rent channels through the export of low-carbon electricity. Overall, the restructure of the energy sector cements the centralized control and state dominance over the energy sector with minimal impact on the private sector, while it can jeopardize market-based reforms or an effective carbon regulation [49,51]. The new approach of extending the rentier states through new means does not comply with the appeals for a new social contract through less distortionary systems (e.g., a more targeted welfare system, or even other reform ideas such as unconditional cash grants) [50]. However, GCC states might embrace renewables and adopt the state-dominated delivery model exactly for the secondary purpose of keeping the rentier state alive.

3.3. Reality and Choices of (Regional) Geopolitics: The Nuclear Energy Prestige

Another extrinsic value of the energy transition is bolstering the regional image and repertoires of geopolitical power instruments of GCC states. The emerging nuclear energy programs are exemplary of this notion. Currently, Saudi Arabia and the UAE are two states who have incorporated nuclear energy as part of their future energy mix policies. The UAE has begun the construction of the $25 billion Barakah nuclear power plant consisting of four units (to be completely by 2021) with a total capacity of around 5.4 MW. This came after the conclusion of a nuclear cooperation agreement with the U.S., ensuring that the UAE will not pursue enrichment and reprocessing of nuclear technologies and capabilities. In addition, the UAE has established several nuclear energy institutions and research facilities (e.g., the Emirates Nuclear Energy Corporation (ENEC) or the Federal Authority of Nuclear Regulation (FANR)). With regard to Saudi Arabia, its nuclear energy ambitions have received skepticism from the international community, especially after insisting on producing its own nuclear fuel [52,53]. Saudi Arabia has sought collaboration with the U.S. in implementing its nuclear program, but was later met with resistance from some U.S. lawmakers who questioned the Saudi's intentions to acquire nuclear weapon technologies as an effort to deter its regional rival Iran [54]. Recent reports indicate that the Saudi Kingdom might have secretly started to construct its programs and to rely on nuclear cooperation with China [55]. At the same time, other GCC states have been exploring the nuclear energy option, while the initially joint approach of developing a GCC-wide peaceful energy program was relinquished in favor of individual national policies.

The push for the nuclear energy in the Gulf shows the instrumentalization of alternative energies for geopolitical gains. This notion has been extensively examined by Al-Saidi and Haghirian [3], who linked the evolution and discourse of the nuclear power in the Gulf to posturing, rising tensions in the Gulf region and geopolitical rivalry (with Iran). In fact, the emergence of nuclear power as a seemingly stable option in the energy mix in the Gulf coincided with the resurrection of the Iranian nuclear program in the early 2000s. It can be linked to Iran in the public rhetoric of GCC states such as Saudi Arabia, who has openly hinted that it aspires to gain the same prestige from nuclear power of its regional rival Iran. Furthermore, all the political economic benefits from nuclear energy can be acquired by renewable energy, namely the benefits of diversification, centralized control, or preserving fossil fuels for exports [3]. For Saudi Arabia, solar energy might not be economically more favorable than natural gas (depending on the gas prices and the use purpose), while electricity generation from solar can become cheaper than nuclear, considering the total levelized cost [19]. In fact, recent studies have shown that solar energy is now cost-competitive with nuclear power, which at around 11 cent/kWh is more expensive than concentrated solar power and photovoltaics in the UAE [21]. Therefore, it might be more plausible that the nuclear option has been incorporated for geopolitical reasoning, namely being a political symbol and a power instrument toward Iran. Nuclear energy might have been chosen in order to lower eventual dependence on gas imports from Qatar, which has been economically and diplomatically boycotted by Saudi Arabia and the UAE since 2017 [3]. There is another argument

in this direction. The high potential of renewables in the GCC region and the ongoing megaprojects indicate that the nuclear power can be easily (and more economically in many cases) replaced by renewables such as solar energy. The nuclear energy might have been incorporated symbolically in the future energy mix since, for example, in the UAE, it constitutes only 6% of the future energy mix targets for 2050 [56].

4. Discussion: Nuances and Implications of the Gulf the Energy Transition

The study of the energy transition in the Gulf region revealed a multitude of factors driving this transition. The separation of intrinsic factors—those essential (and theoretical) ones associated with comparative advantages of different energy sources—from extrinsic factors—secondary or inferior ones related to additional benefits from the promotion of a specific energy source in a certain manner —has arguably been artificial but helpful. This conceptual differentiation was used in this paper as a way of highlighting the often neglected aspects of energy transition such as politicization and non-economic aspects. Table 4 summarizes key insights and implications from the earlier described trends specific to the energy transition in the Gulf. The outlined adverse effects and risks relate to the promotion of alternative energies in a way to achieve non-economic and non-technical objectives. They revealed some trade-offs with the essential and intrinsic motivations behind the energy transition in the Gulf. This transition is supposed to yield economic and sustainability benefits in terms of improved energy efficiency and fewer emissions. However, its political instrumentalization might ultimately result in larger scales, risks, and waste, thus jeopardizing the basic premises behind the deployment of alternative energies. The implementation of the energy transition in such a manner might run against long-standing notions about the needs to consider limits to growth, bioeconomic constrains, or our ability to substitute resources (e.g., [57–61]). In fact, the viability of the current energy transition model to contribute to a more sustainable growth model in the Gulf requires a critical re-examination. Furthermore, any potential gains from emission reductions might be partly offset through negative spillovers on urban development (e.g., increased urban segregation in the built environment, urban sprawl or spectacular, but oversized (for the targeted function) infrastructure). In fact, it is important to consider the urban carbon footprint holistically and target carbon emissions using better estimations and multiple approaches (e.g., sequestration, reduction, compensation etc., e.g., [62–64]).

On a regional level, there are mainly two overarching insights from the analysis of the extrinsic values of alternative energies that can be discussed in this section. First, a nuanced understanding of the different motivations behind the energy transition in the Gulf reiterates the importance of this process. The energy transition through alterative energies (renewables and nuclear) is not only fully underway from a technical sense of emerging projects and increased diversification level of energy sources. Moreover, this transition has been domesticated (i.e., strategized and institutionalized in a way to fit local context, political-economic agendas or the forms of governing in the Gulf).

This paper highlights some examples of this domestication. The delivery of energy projects through megaprojects corresponds to the rapid pace of transformation of Gulf countries. This transformation relies on the transfer of international knowledge through global consultancy or engineering firms [40] and incorporates elements of showcasing primacy, grandeur, and modernity [38,41,42]. Another example is with regard to the reorganization of the energy sector. The energy transition has been reprogrammed in a way to maintain state dominance and sustain the rentier states' instruments of wealth distribution [5,49]. The nuclear energy option has also been harnessed to suit the geopolitical ambitions of GCC states, despite the lack of clear political-economic benefits [3]. In fact, these examples of additional benefits or specific uses of alternative energies in the Gulf can have an accelerating effect on the energy transition. They represent additional factors alongside the traditional or comparative political economic drivers behind the energy transitions (i.e., the declining costs of renewables, economic diversification requirements, sustainability obligations, the loss of oil revenues, the high potential of renewables, or the increased cash liquidity within climate regimes [1,65]).

Table 4. Summary of the analyzed energy transition trends and potential implications.

Energy Transition Trends	Main Characteristics	Immediate Outcomes	Long-Term Extrinsic Merits	Potential Adverse Effects and Risks
Megaproject-based provision	Utility-scale renewables provision; majority of renewables capacity through handful plants.	Centralization of energy provision; sustainability merits or energy transition (emission reductions, energy efficiency savings) dependent on megaprojects (energy plants and planned cities); national energy certification systems applied to megaprojects.	Exploitation of the energy transition in a regional, state-based competition and among global cities; accentuation of spectacular master planning and large-sized infrastructure design.	Symbolic fulfillment of sustainability requirements; inefficiencies in design (e.g., segregation or oversized systems); magnification of risks from critical infrastructure failures.
State-dominance in the renewables market	Public control and participation in renewables energy markets; hidden subsidies to energy providers.	State-dominance of energy markets; creation of public job in renewables sectors; differentiation of actors and regulations in energy provision; state-led measures to decrease energy intensity of economies.	Extension and diversification of rentier states' instruments; expansion of public sector actors in energy infrastructure; advancement of less distortionary energy subsidy systems.	Limited competition in the energy sectors; continuation of disincentives created through rentier state mentalities.
Incorporation of a nuclear option	Inclusion of nuclear energy as a part of future energy mix policies in some GCC states.	Construction of major, large-scale nuclear power plants; creation of nuclear energy actors for regulation, research and management.	Conveyance of primacy and power in the regional rivalry; minimization of energy (gas) supply dependence from neighbors.	Heightening of geopolitical tensions; increased requirements for energy safety and risk management.

Second, the implications of the complex set of driving forces and nuances of the domestication of energy transition in the Gulf are uncertain. In fact, the traditional focus on intrinsic factors of renewable energy (i.e., economic merits, comparative advantages, technical potential, and feasibility) has often resulted in a biased and overly optimistic perspective on the energy transition in the Gulf. It also disguises risks and potential derails in implementing such transitions. The megaproject mentality, for example, has produced mixed results with regard to their contributions to a genuine ecological modernization in the Gulf [2,40,42,48]. On one hand, they incorporate sustainability design and environmental technology through pioneer projects. On the other hand, they are oversized, overambitious, and inconsistent with the original goals, while sustainability can be used as a facade or only symbolically. With regard to renewable megaprojects, these need to be regarded more optimistically since they directly facilitate carbon reduction. However, the trend of increasing the integration of energy, water, and food supplies through centralized, large-scale infrastructure (near to coastal areas) exhibits some vulnerability to disasters, errors, interruptions and reliance on other sectors [66]. For example, linking renewable megaprojects to coastal infrastructure supplying water,

energy, and food services might increase the scale and interdependence of such infrastructure. There are mounting threats on such infrastructure arising from technological dependence, cascading effects, or major failures. The COVID-19 pandemic served as a reminder that system-wide disruptions can suddenly happen, although the exact impacts of this particular disruption are still unfolding.

The implications of the energy transition in the Gulf on environmental sustainability and economic diversification are also uncertain. While the use of renewables will increase, one can expect some emissions reductions. However, the sizable ecological footprints in the Gulf and the domination of the public sectors might remain. The extension of the rentier states through new rent distribution mechanisms in the energy sector might jeopardize economic diversification and market-based reforms [49]. At the same time, consumer awareness and responsible consumption are some of the major obstacles for a better environmental performance in the Gulf [2]. At the same time, some of the most urgent environmental problems (e.g., health of Gulf waters, risks to coastal supply infrastructure, or water security) require some level of regional cooperation beyond the current state of dispute and interstate competition [45]. The analysis in this paper showed that the energy transition did not follow a regional approach. In fact, some of the GCC-wide initiates (e.g., peaceful use of nuclear energy) have failed and national visions or interests have become the dominant driving force of change.

5. Conclusions

The energy transition has often been explained through the cost-competitiveness of renewables, the ongoing economic diversification efforts, and the sustainability push in the GCC region. These three reasons form an important part of the motivation of Gulf countries to diversify energy sources using projects for alternative energies, energy subsidy reductions, and energy efficiency measures. However, they are unable to highlight the reasons for the specific form of energy transition in the Gulf or the choices behind the future energy mixes of GCC countries. There are several extrinsic values of alternative energies that do not relate to technical comparisons with other energy types or (political) economic considerations. This paper highlights an often neglected and under-researched perspective on the energy transition in the Gulf. This transition needs to be embedded in the local context of young and modern states, the geopolitics of the volatile Gulf region, and the specific forms of centralized governance.

The energy transition in the Gulf is largely delivered through megaprojects in terms of renewable (and nuclear power) plants and planned cities incorporating energy efficiency in the built environment. While this design has some cost benefits (economies of scale) in comparison to the distributed generation, there are also non-economic motivations. One explanation lies in the ability to maintain central control and achieve quick compliance with the renewable targets without complex regulations or participation requirements. Furthermore, megaprojects render powerful symbols of modernity and primacy. They provide legitimacy for ruling elites and are also used to parade achievement among global cities or to gain more power in the ongoing GCC-based competition with regard to the sustainability agenda, among other fields of competition. Some of the energy megaprojects are targeting the development of nuclear power, which needs to be contextualized within the wider regional competition (with Iran). Nuclear power is so far incorporated as a part of the energy mix policies in Saudi Arabia and the UAE, although it can be (more economically) replaced by renewables such as solar energy.

It is worthwhile studying the totality of factors driving the energy transition in the Gulf. Alongside showcasing modernity and (regional) power, GCC states are eager to maintain the rentier states alive through new instruments of rent distribution. These instruments relate to the differentiation of the energy sectors through new actors under state-dominance. All the extrinsic factors combined indicate that the energy transition in the Gulf is domesticated (e.g., interpreted through policies and strategies that suit the political reality in the region). The implications of this process are still unclear and require future research grounded in the social sciences. There are some possible side effects associated with

the large scale and the high centralization of energy supply delivery (e.g., vulnerabilities to natural and human made risks). Furthermore, the economic diversification premises of the energy transition can be jeopardized by maintaining centralized control and hidden subsidies. Finally, environmental sustainability benefits of the energy transition require a broader perspective that tackle the behavioral aspects of energy consumers, energy efficiency in key use sectors, the safety and adequacy of some energy sources (e.g., nuclear), or regional environmental cooperation.

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