Renewable Energy 85 (2016) 206–214

Contents lists available at ScienceDirect

Renewable Energy

journal homepage: www.elsevier.com/locate/renene

Adoption of renewable energy technologies in oil-rich countries: Explaining policy variation in the Gulf Cooperation Council states

Yasemin Atalay*, Frank Biermann, Agni Kalfagianni

Department of Environmental Policy Analysis, Institute for Environmental Studies, VU University Amsterdam, 1087 De Boelelaan, 1081 HV, Amsterdam, The Netherlands

ARTICLE INFO

Article history:
Received 16 September 2014
Received in revised form
3 May 2015
Accepted 16 June 2015
Available online xxx

Keywords:
Gulf Cooperation Council
Renewable energy
Policy transfer
Endogenous policy
International regimes

ABSTRACT

While the member states of the Gulf Cooperation Council have economically and politically been dominated by the exploitation of fossil fuels, recent years have seen an increasing adoption of renewable energy technologies, the reasons of which are not yet sufficiently understood. This paper argues that the recent adoption of renewable energy technologies in the Gulf and its striking variation can be explained by theories of policy transfer. In addition, we find some support for the alternative hypothesis of endogenous policy development regarding political leadership. Yet there is no support for the alternative hypothesis of a strong direct influence of the international climate regime. Furthermore, the policy transfer hypothesis and political leadership stand as coexisting influences on renewable energy adoption, rather than competing ones. Based on an extensive study of primary and secondary sources, local reports and country analyses of international organizations, and personal interviews with key experts, this paper lays out in detail how transfers of renewable energy policies take place in the Gulf; their drivers; and their impacts. We also discuss the factors that lead countries to lag behind, which can be helpful for prospective research on a more extensive utilization of renewable energy in the region and beyond.

1. Introduction

It is often assumed that the states of the Arab Gulf are strong laggards when it comes to the development of renewable energy. Having vast oil resources, these countries are expected to strongly oppose the phase-out of fossil fuels and the worldwide development of renewable energy such as wind energy or solar power, which would reduce their export profits. Gulf Cooperation Council states are also widely seen as typical examples of the "rentier state," that is, countries that are characterized in their political and economic systems by the exploitation and export of abundant natural resources. Indeed, these member states still lead the international rankings of climate-polluters: In a global ranking of countries according to their 2009 carbon dioxide emissions (metric tons per capita), Qatar ranked first, Kuwait third, the United Arab Emirates fifth, Bahrain seventh, Saudi Arabia eleventh, and Oman thirteenth, among a total of 214 countries [62]. The United Arab Emirates also has the dubious distinction of being the country with the largest per-capita ecological footprint globally [37].

And yet, these statistics hide numerous important trends in this region. Several Arab Gulf states have begun to diversify their energy economy by investing in renewable energy technologies. Revenues from the export of fossil fuels have enabled these countries to invest in newly emerging technology-intensive sectors. For instance, the Emirate of Abu Dhabi established the "Masdar Initiative" to develop breakthrough projects in renewable energy and sustainable solutions, such as residential architecture and public transport. Also, Saudi Arabia has invested in solar technologies for both domestic use and larger scale energy production, such as desalination plants [18]. Likewise, the Emirate of Dubai initiated a Green Building code that is compatible with the U.S. Green Building Council's LEED certification system [58]. Moreover, all Gulf countries have signed or ratified the International Renewable Energy Statute for increasing the share of renewables in their energy grids [28]. These initiatives promise numerous benefits for these states: For example, when fewer fossil fuels are used domestically, more oil and natural gas can be exported. Importantly, such initiatives prepare the Gulf Cooperation Council countries for the post-oil age, and help them to contribute to combating climate change and hence improving their international

* Corresponding author.
E-mail addresses: yasemin.atalay@vu.nl (Y. Atalay), frank.biermann@vu.nl (F. Biermann), a.kalfagianni@vu.nl (A. Kalfagianni).

http://dx.doi.org/10.1016/j.renene.2015.06.045
0960-1481/

reputation. Gulf Cooperation Council countries could also assist their less developed neighbors in climate protection policies [55].

However, there is also a strong variation in the adoption of renewable energy technologies in the Arab Gulf. While some countries have begun to seriously engage in the development of renewable energy, other – seemingly similar – countries are lacking behind and remain stuck in the traditional fossil-fuel economic model. So far, not much research is available to explain this variation. Why do some oil-rich Gulf countries slowly begin to embark on a post–fossil future, while others stay behind? What are the determinants of the development and deployment of renewable energy technologies in the Arab Gulf countries? These are the questions at the center of this article that seeks to explain the variation in the adoption of renewable energy in these countries.

Theoretically, three main hypotheses could explain the emergence of renewable energy development in some oil-rich countries in the Arab Gulf area.

- First, it can be hypothesized that the adoption of renewable energy technologies is the result of horizontal policy transfers from other countries, both within the region (intraregional policy transfer) and from outside the region (international policy transfer) (*policy transfer hypothesis*).
- Second, it can be hypothesized that the adoption of renewable energy technologies is the result of endogenous developments within the countries themselves, for example due to specific political-economic circumstances, political leadership or driven by domestic environmental movements or problems that stem from the dominance of fossil resources (*endogenous policy hypothesis*).
- Third, it can be hypothesized that the adoption of renewable energy technologies is a consequence of the implementation of international regimes, such as the United Nations Framework Convention on Climate Change (*international regime hypothesis*).

We chose the Gulf Cooperation Council states as our empirical domain because of their similar political systems that allow for a focused comparison; their vast resource revenues and high dependencies on oil, making them interesting cases; and their potentially leading function within the larger group of Arab and Middle Eastern countries. Although there are slight differences among these countries, such as their organization of government and administration, electoral rules, and the degree of participation of women and minorities, they are not significant for our research question. The fact that all these states strongly rely on resource rents and practise rentierism makes them comparable in our analysis of renewable energy technology adoption.

Our research is largely qualitative and provides new empirical knowledge on the most prominent scientific and technological developments in this region and the conditions which explain these developments and their variation. We used primary sources in English and Arabic, such as institutional databases and statements of influential policy-makers; secondary sources, such as journal and newspaper articles and conference papers; along with quantitative data sets such as renewable energy performance indicators, energy capacity, and generation and consumption data.

The paper is structured as follows: Section 2 presents the variation in renewable energy technology adoption in the Arab Gulf Area on the basis of three quantitative indicators: (a) intensity of renewable energy as percentage of total energy mix, (b) installed renewable energy capacity, and (c) installed renewable energy capacity per capita. Section 3 explains variation relying primarily on the policy transfer hypothesis, specifically through international research cooperation with prestigious research institutes, and technological knowledge-based public-private partnerships with major corporations. This section also examines the endogenous policy and international regime hypotheses as alternative explanations for the variation observed in the Arab Gulf region regarding renewable energy technology adoption. Section 4 concludes the paper by reflecting on the potential for similar developments in the remaining laggard countries in the region.

2. Variation in the adoption of renewable energy technologies in the Arab Gulf area

This section outlines the deployment of renewable energy in Gulf Cooperation Council states and it highlights the variation among the six countries, that is, between ‘leaders’ and ‘laggards’ in the field of renewable energy adoption. The countries in the Arab Gulf region are prominently rich in various sorts of renewable energy, particularly solar. These states have significant resource potentials that remain yet to be fully utilized. Accordingly, for instance, less than 0.2% of the Saudi land area has to be covered with solar photovoltaic cells to provide for all the energy needs of the country [7]; (p. 2300). As for Oman, despite its wind potential particularly during the summer monsoon between April and September, no utility-scale wind turbines have yet been connected to the grid [4]; (p. 1585) as of 2009. Only in Fall 2014 it has been announced that the Masdar Initiative of Abu Dhabi will build the first large-scale wind farm in Oman, with 50 Megawatts capacity [42].

Importantly, despite largely similar political and economic systems, as well as vast potentials, there is a sizeable variation in the adoption of renewable energy technologies in the Gulf Cooperation Council area. We use three indicators to distinguish “laggards” from “leaders”:

Our first indicator is the intensity of renewable energy as percentage of total energy mix. Intensity is calculated by dividing total energy capacity by total installed renewable energy capacity, which is the sum of photovoltaics, concentrated solar power, wind, biomass and waste energy in megawatts (MW). This is the most important indicator because it shows the accurate comparison among the GCC states in terms of the level of energy sector diversification with renewable resources. Their energy sectors are not the same size, yet these intensive values outline the current proportions, making them comparable regardless of their differences in sector size.

Our second indicator is the absolute amount of installed renewable energy capacities of GCC states. Total capacities also need to be examined, as they also reflect the state's willingness to expand the share of renewables within the energy mix, even though the current renewable energy intensity is at a negligible level.

Our third indicator is installed renewable energy per capita. Even though GCC states share numerous common characteristics, demography-wise there is a substantial differentiation among them. While, it is important to see the total amount of installed renewable energy capacity and its intensity within total energy mix, it is also crucial to see how much each citizen can benefit from the total adoption. Even though these figures are still incremental and these states still have some time before they fully utilize their renewable energy potential, especially in highly populated countries, the current level of adoption per person can be a positive indicator of what can be expected from that country in the future.

On the basis of these three indicators we observe the following:

Regarding intensity values, we see that United Arab Emirates and Qatar have the highest share of renewable energy adoption within the total energy mix, hence the highest renewable energy intensities. Even though none of the GCC States have substantial levels of renewable energy utilization yet, current intensities in the