

SUSTAINABLE ENERGY TRANSITION IN SAUDI ARABIA: MULTI-LEVEL PERSPECTIVE

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Overview

In recent years, the energy sector of Saudi Arabia observed several transformations and reforms. This continuing transition resulted in a shift in various sectors at the local level. In other words, different interactions between actors and institutions within the energy system are compared with the previous energy system. It has been shown that understanding the energy transition, as they move from one energy mix structure to another not only depends on such national policies that are led by governments but also other various aspects, dimensions, and complex interplay in different levels of energy industry besides the barriers that involve legal, infrastructure, financial factors, competing interests and agendas between the actors, etc.

This research goes on the role of these actors who intervene in the energy transition progression through diverse stages. Saudi Arabia has the most fossil fuel-intensive electricity and demand per capita rises at a pace according to a report published by "Ember's Global Electricity Review". The renewable energy contributions in the total energy mix compared with the electricity generation from gas and oil are very low. According to BP's Statistical Review of World Energy 2021, there is only 0.3% of its electricity supply came from renewable energy in 2020. Nevertheless, the current consequences do not necessarily reflect the reality when we look at developments at different levels happening in recent years.

These improvements can be divided into different levels and dimensions to identify the role of the main actors in the energy transition progress to evaluate and improve understanding of transition. This abstract attempts to using the Multi-level perspective framework to see eventually what actions and actors are the real driver's elements to facilitate the energy transition process?. The importance of the research is that no previous research has investigated energy transition whether in Saudi Arabia or GCC countries by using this framework. Therefore, this study aims to provide a starting point for understanding energy transition at the local level by describing the current interaction between actors and identifying the enablers, and barriers to, low-carbon energy transitions within the local power system. It is important to indicate that given the fact of how depth and complication explain transition at these three levels, the study tries to shed light on the main topics and developments in kind and rates of renewable energy transition deployment in Saudi Arabia.

In 2017, Saudi Arabia has proposed National Renewable Energy Program, planning to address the increasing demand for using renewable resources. On contrast, Public Investment Fund (PIF) is leading the development of 70% of the renewable energy target through direct negotiations with investors to develop Giga-scale projects. However, the Renewable Energy development project office (REPDO) would auction the remaining 30% of Utilities. It oversees the procurement of 30% of this target via a competitive process. In this context, there are growth in renewable energy projects with launched five new projects to produce electricity using renewable energy under the NREP, REPDO moving ahead with plans for the fourth and fifth phases of its ambitious renewable energy programming, with a total capacity of 3,300 megawatts in 2021. In the last round, the government finalized power purchase agreements (PPAs) for seven solar power projects with an average price of about \$18.3/MWh. On the other hand, sustainable hydrogen usage and reduced emissions by 278 mt by 2030 through the Circular Carbon Economy (CCE) approach, put Saudi Arabia in a great position to preserve driving transformation and raise prospects for sustainable growth. Additionally, the steps that have been taken in the national strategies resulted in significant accomplishments. For instance, Saudi Arabia has received attention for its announcements of the shipment of Blue Ammonia to Japan; the world's first shipment of environmentally-friendly high-grade blue ammonia.

Methods

Sustainable energy transition theories such as the Multi-Level Perspective (MLP). For instance, it has been developed to analyze and understand the change processes in a complex system. The framework has been used to evaluate transitions through interaction processes within three analytical levels: niches, socio-technical regimes, and a socio-technical landscape. These three levels represent a structural hierarchy of an industry (Geels, 2002). The landscape level is defined as an exogenous environment that involves, macro-economic, political developments, deep cultural patterns, international governance, international geopolitical economics, and social sitting. Regarding the socio-technical regime, this level is

described as the Meso-level which is formed by engineering practices and routines alongside dominant technologies linked together. According to (Geels et al., 2017), “this level involves Social practices, scientists, policymakers and other interdependent groups that help to shape the regime level”. However, the socio-technical regime in general is not eager to change and possesses certain resistance. For the Niches level, it is considered as the micro-level with special conditions for the rise of radical innovations. Also, it is understood as the level governed by the dominant from the socio-technical regime and socio-technical landscape. Regarding the explanatory nature of the study, the research follows the thematic analysis, to identify the actors and enablers, of the energy transition. Data collection was conducted in two steps. The first was focused on gathering data from, documents including government reports, national strategies, policy documents, and industrial and academic publications. The second was from interviews with relevant actors and stakeholders at the national level.

Results

After giving a general outline of the developments in the energy sector. The results of the analysis are presented and discussed in more detail structured according to the three levels of the MLP.

The first is the landscape level, The progress of renewable energy projects at the local level is attributable, among others, to the shift in the government’s policy that set ambitious targets to meet Net Zero carbon emissions by 2060, In addition, to producing 50% of electricity from renewable energy sources by 2030. Moreover, the regional green initiatives, the Middle East Green Initiative Summit and Saudi Green Initiative Forum (SGI) announced during the Global Climate Change Conference (COP27) in the second edition can display extraordinary changes at the landscape level, which therefore exert pressure for change on the regime, and still characterized by centralized power generation based largely on both gas and fossil fuels. However, all these showing concrete commitments to implementing the strategy and bringing more developments in long term.

Second is the socio-technical regime, which involves institutions, socioeconomic and legal structures, and (incumbent) actor constellations. The socio-political system in Saudi Arabia is dominance of oil and gas culture in the power system and energy system in general weaker environmental tradition. Moreover, system is rentier-based structure that advocates high energy subsidies and living regulations, leading to inefficient energy consumption. However, the major change can be seen when Saudi Arabia's Cabinet formed a Supreme Committee for Energy Mix Affairs for Electricity Production to enable Renewable Energy Sector. As a response to the challenges, in 2020 during the pandemic, there were sharp downturns in economic activity have resulted in significant losses in electricity revenues because of the high subsidies for electricity, which have resulted in more reforms in the electricity sector. On the other hand, when it comes to self-consumption, the largest percentage of electricity consumption comes from the residential sector. Thus, there are many explanations for the slow growth of renewable energy percentage. For instance, Policy in promoting renewables mostly chooses Large-scale Options. While the Small-scale options face the obstacle that remains in the legal framework. However, It’s worth mentioning that, on February 28, 2020, Water and Electricity Regulatory Authority (WERA) issued the updated regulatory framework “Saudi Regulation for Small-Scale Solar” for distribution systems connected to the utility grid. (New framework uses Net Billing instead of a Net-metering Scheme. In this regard, the legal framework is the main barrier and concern. The main reason is that capacity for each facility ranges from 1 KW to 2 MW. Moreover, the capacity at the country-wide defined maximum cap can be calculated today as 1.8 GW on a national level.

The third is the niche level, the environment in which radical innovations can emerge and grow, and which initially is outside public awareness (Geels,2007). This is where technical innovations and new business models are developed. Though, the new trends on the landscape level that intention to move forward to the low-carbon system have enabled new actors. For example, new global projects such as NEOM stimulate the use of advanced renewable energy technology. In this, Saudi Arabia’s objective is to host the world’s largest green hydrogen plant to contribute to attracting more companies. Baker Hughes in collaboration with ACWA power, for example, announced it will provide Air Products with advanced hydrogen compression and gas turbine technology for global projects, including, the NEOM carbon-free hydrogen project in the Kingdom of Saudi Arabia. Furthermore, Saudi companies have received the world’s first independent certifications recognizing blue hydrogen and ammonia production such as Aramco, SABIC, and Ma’aden.

Conclusions

This research analyzes Saudi Arabia's energy transition toward a low-carbon energy system based on the multi-level perspective approach. These findings support the notion that local actors, political will, and regulatory framework could show a crucial role in future sustainable energy systems. The main finding is that there are developments on all three levels from the MLP perspective. On the other side, Generating electricity from renewables in the regime is still restricted. One of the reasons is that the regime has a relatively strong influence on the niche through the regulatory framework and there is a requirement for enabling instruments that permit new actors to perform a role such as self-consumers and producers. Thus, this can open a window of opportunity when self-consumers gain market share, ultimately will contribute to further enabling Saudi Arabia’s export infrastructure for clean fuels.