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To what Extent is Peak Oil a Threat to Saudi Arabia Energy Security

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Abstract

With the international oil market in extended surplus, few has been heard from peak oil philosophers. However, with significant support from international environmental organizations for greater attention to be paid to environmental issues, the attention has changed to the peak of oil demand. This study investigates and clarifies the impact of peak oil on Saudi Arabia. In light of the participants' critiques and the data analysis in this research, it appears that there are three peak oil assumptions in Saudi Arabia, namely, physical peak oil assumption, political peak oil assumption and oil demand assumption. This research study has called for substantial clarification of Saudi Arabia's peak oil to address some issues related to energy security. Based on the outcomes of this research, Saudi Arabia is likely to experience various energy security problems. The country could be at extremely high risk in the future because oil is the cornerstone of both its energy and economic security. This research study outlines ways in which the Kingdom might address its energy security concerns in the future.

Keywords
Peak oil, Saudi Arabia, Energy Security

1. Introduction

Peak Oil theory was first introduced by King Hubbert in 1956. King Hubbert theorizes that the rate of depleting petroleum minerals follows a bell-shaped curve where production first increases to a point where it peaks before it start declining to zero (Hubbert, 1956). This concept applies to any given geographical area with mineral resources, filed and the planet as a whole. Starting from this point, and looking at the wider picture, the supply of oil and gas will be reduced while demand for energy resources are at an increasing trend. This in turn will create a situation where demand for petroleum products cannot be met by the supply of these minerals, which will lead to an increase in prices of petroleum. This situation will mean that nations, companies, and individuals cannot afford to buy enough petroleum products at affordable prices: a situation described as energy insecurity (Abdo and Kouhy, 2016).

With the concern about climate change, renewable energy options have been promoted as a possible double solution for energy security and climate change (Abolhosseini et al., 2014). In this regard, there is a significant support from international environmental organizations and civil societies worldwide for greater attention to be paid to environmental issues in order to reduce pollution and carbon emissions. Whilst, this seems a reasonable solution for oil and gas importing nations, such as Japan, the impact may have different angle on producing countries, such as Saudi Arabia. Substituting oil and gas by renewable options initially has an impact on the import – export of fossil fuel. This impact has different impact on pure importing and pure exporting nations. If prices of renewable energy

options are reasonably low, which are not at the moment, pure importing countries would be better off should they have access to sufficient supply. For pure exporting countries, such as Saudi Arabia, where economic security is pretty much depends on export of petroleum products, the demand side of energy security equation will be unbalanced, thus creating unbalanced economic security. This can be a serious issue for such countries unless a substitute for oil and gas as a main exporting product be introduced.

Some of the key challenges the Kingdom faces can be characterized as follows: a) making economic diversification a top priority in the country's strategic plan, b) creating effective policies to increase energy efficiency, and most importantly c) meeting domestic and international energy needs through renewable energy (Vision 2030, 2019). In this context, and after the latest drop of oil price in 2015, Saudi Arabia creates the 2030 Vision for the Kingdom, which is built around three main themes: a vibrant society, a thriving economy and an ambitious nation (ibid).

Saudi Arabia strengthened its call for economic and energy diversification and there is now significant support from Saudi energy experts and policy makers for renewable energy technologies, solar energy in particular, as one of the future sources of energy in the Kingdom. This research comes at a time when the Saudi government is looking to move the economy away from sole dependence on oil profits and diversify its energy resources. In identifying the energy security threats and solutions in the country, this study offer pathways which will enable academic researchers, policy-makers and government energy agencies to outline new areas for future research and, most importantly, to understand the barriers that could arise within the energy sector during the implementation of the Kingdom's new vision for 2030.

Previous studies of energy security have engaged with Saudi Arabia for decades in the context of other countries' energy security because of the country's leading role as an oil producer and exporter and its role as a stabilizing force in the oil market, able to increase oil production to avoid oil supply shocks (IMF, 2013). However, limited previous studies appear to have analyzed energy security challenges and threats in Saudi Arabia itself and linked energy to the Kingdom's own economic security. Therefore, this research study focuses on the potential problems arising from challenges and threats to the energy sector in Saudi Arabia, filling a gap in the literature on energy security and its challenges, threats and possible solutions and addressing an area which has been largely neglected by previous research. Once the concept of energy security is defined clearly, the Saudi government and Saudi policy-makers will perhaps become more aware of the possible threats and concerns that might affect the country's energy security in the future. Previous studies on energy security concerns have mentioned Saudi Arabia, but only as an energy exporter. No studies are known to have been conducted which analyze the possibility that Saudi Arabia could itself face energy security concerns.

2. Research aim and objective

The aim of this research is to examine the seriousness of peak oil concerns in Saudi Arabia and its impact on the country's energy security position. The objective of this research paper is to examine the nature and causes of energy and economic security concerns in Saudi Arabia through the lens of peak oil theory.

3. Research Questions:

This study attempts to answer the following question:

- How serious a policy concern is peak oil in Saudi Arabia?

4. Significant of the study

The uniqueness of this study springs from the lack of research on the topic of energy security in Saudi Arabia. This research study is unique in focusing on the following points:

(1) After the drop of oil price in 2015, Saudi Arabia repeated its call for economic and energy diversification and there is now significant support from Saudi energy experts and policy makers for renewable energy technologies, solar energy in particular, as one of the future sources of energy in the Kingdom.

(2) There is significant support from international environmental organizations for greater attention to be paid to environmental issues in order to reduce pollution and carbon emissions. This initially has an impact on the import – export of fossil fuel, hence on the demand side of energy security for oil and gas exporting countries such as Saudi Arabia.

(3) After the recent attack on Saudi Arabian's oil facilities on September 2019, oil prices surged nearly 20% at one point, with Brent crude posting its biggest intraday gain since the Gulf War in 1991 (Reuters, 2019). This attack not only threaten the Kingdom's security, it threatens the international energy security.

5. Methodology

Quantitative and qualitative methods have been adopted in this research. This combination provides a better understanding of the research problem. Quantitative methods, as the research aiming to forecast the future of oil in Saudi Arabia and other oil importing countries, this method will explore the direct impact of peak oil on Saudi Arabia energy and economic securities. Qualitative methods, as the aim is to generate a rich dataset that can be subjected to qualitative analysis. This process will conclude with an analytical commentary that intertwines participants' extracts with a body of literature and a range of theoretical perspectives that relate to energy security in Saudi Arabia. Despite growing concern, the issue of energy security in Saudi Arabia has received insufficient research attention. Additionally, peak oil theory is a sensitive topic in Saudi Arabia that is still the subject of widespread debate for Saudi policymakers and energy experts.

5.1 Sampling Methods

The sample includes Saudi Arabian policymakers, managers, specialists and researchers of organizations. The criteria used to choose the research sample for this study was based on diversification of organizations and sectors within the Kingdom. Selecting the right participants and organizations enabled the researcher to answer the research questions and meet the research aim and objectives. This also allows for triangulation of responses across interviewees in different positions. Saunders et al, (2007) suggest that this type of sampling is commonly used when working with small samples and a researcher wishes to select cases that are full of rich information.

6. Energy Security Threats: Peak Oil

A number of participants in this study agreed that Energy Security is not clearly defined in the context of Saudi Arabia, which makes it hard to identify the difficulties that could affect the country's energy position in the future. Initial analysis of participants' interviews indicated that there are several reasons behind the difficulty in measuring and defining energy security in the country. Firstly, *"the non-democratic structure in Saudi Arabia might prevent Saudis from discussing and debating this matter"* as indicated by participant V. Participant M added, *"actual numbers and accurate statistics about oil revenue and reserves could be difficult to ascertain in the Kingdom". Participant R also pointed out that "it could be hard to identify matters relating to energy security in Saudi Arabia because it may negatively affect the political and economic position of the country".* Despite these difficulties, the present research was able to identify three signs related to energy security challenges and threats in Saudi Arabia; increase domestic oil demand, complete reliance on oil revenue and peak oil.

The current literature on this area shows that there are two main schools of thought regarding peak oil. The first is based on M. King Hubbert analysis of oil production, which correctly predicted that U.S. oil production would peak in 1970s (Hubbert, 1956). Most academics and scientists call those who follow this thought "pessimists" (Craft, 2011:14). The second is based on the "declining discovery rates and other technical observations" (Fisher, 2008: I-1) and most academics and scientists call adherents "optimists" (Craft, 2011:14). However, the results of the present research study suggest that the debate over "peak oil" in Saudi Arabia revolves around four separate views. These can be categorized as: (1) optimists, (2) pessimists, (3) believers in peak oil demand and (4) reticent participants who do not offer clear opinions about peak oil. Table 6.1 below shows how frequently ideas associated with these themes were mentioned by participants.

Table 6.1: Quantifying the Frequency of Peak Oil

Theme	Sub Themes	Number of participants who cited these sub themes	Percentage of participants who cited these theme
Peak Oil	Pessimists	8	34%
	Optimists	6	26%
	Believers in peak oil demand	4	17%
	Reticent participants	4	17%

6.1 Peak Oil views in Saudi Arabia

6.1.2 Pessimists

The high percentage of participants expressing pessimistic views came as quite a surprise. Contrary to the literature, which indicates that "there seems to be a widely-held disbelief among Saudis with regard to the notion of peak oil" (Al-Saleh, 2010: 253), the present research shows that 34% of participants predict a dark future for oil production and

argue that the oil production capacity peak is imminent. Pessimist participants agreed that fewer new oil fields are being discovered and that as opportunities to develop new oil fields diminish, so extraction will become more difficult and thus more costly. As participant P explained, *"Oil is an impoverished substance, whether we like it or not – new technology will keep oil around little longer but it will never create new oil fields".* Participant O offered further evidence to support this view:

> *"Whatever happens, oil is a finite substance, and I believe that the biggest well in the Kingdom - Al-Ghawar – has already started to produce at a lower rate. Technological developments will keep oil around for some time longer time, but there will be no more oil in the future."*

The above statement supports the work of Simmons (2005), who revealed that Saudi Arabian oil production depends on a small number of 'super-giant' fields, with little production capacity in other smaller fields. What is more, he indicates that the Kingdom has reported no new discoveries of oil outside these fields' basins (ibid). Further evidence to support the pessimist view was offered by participant I, who views the issue of peak oil from the perspective of an engineer rather than an economist:

> *"The fields that produce most of the oil have now reached a peak. Most people who argue about peak oil do not understand the real meaning of the theory… maybe because they are economists! I have worked for 30 years in drilling and production, and I have the experience to judge things in a scientific way. I see that peak oil is the peak of production, when demand is higher than the level of production".*

This view of the misunderstanding of the peak oil issue amongst Saudis is consistent with the opinion of Zittel and Schindler (2005: 56): "[g]eologists look for oil, engineers produce oil, and economists sell oil; beware of economists who tell you how much is there". Three significant points emerge from the above discussion: firstly, that new technology may help to reduce the cost of oil extraction (Sider and Ailworth, 2015). But cannot increase the size of the oil resources in Saudi Arabia; secondly, that the Al-Ghawar field, the world's largest oil field, might already have peaked; and finally that there is some misunderstanding of the term 'peak oil' amongst Saudi policy-makers. This lack of clarity around the precise meaning of the term was expressed by the study participants, several of whom discussed 'peak oil' during the interviews but confessed that they did not fully understand the concept. For example, participant B admitted: *"I did not have the chance to read about this topic before, but I think we still have plenty of oil in the Kingdom".*

6.1.3 Optimists

Whilst the pessimist view was predominant, six participants argued against the conclusions of the peak oil theory presented by M. King Hubbert (1956). Despite strong evidence in the literature review which indicates that oil fields do not magically re-fill (Deffeyes 2005), optimists believe that the peak oil theory is completely false and that Saudi Arabia will continue to enjoy plentiful supplies of oil because of the impact of technological advancements in finding new oil fields. Participant G mentioned the impact of new developments such as "*deep-water drilling, tar-sands extraction and the recent fracking techniques"* on oil production capacity; while participant R expressed the belief that *"more and more resources will be discovered and improvements in technology will enable Saudi Arabia to produce even more oil than it does now".* However, the literature indicates that worldwide "fewer new giants have been discovered since the decade of the 1960s…, [and] a majority of the largest giant fields are [now] over 50 years old" (Höök et al., 2009: 3). The Al-Ghawar field, established in 1948, is still the world's largest onshore oil field and there has been no new exploration of giant fields in the Kingdom (Fischbuch and Keith, 2010).

In addition to this problem, the observations from this associated theme did not capture any potential of the unsustainable domestic increase in energy demand in the country, which could challenge the country's ability to export its oil in future. This is something that most participants in this research agreed upon.

6.1.4 Peak-Oil-Demand Economists

The former Saudi oil minister Sheik Ahmed Zaki Yamani memorably expressed his opinion on the issue of peak oil in the following words: "the stone age did not end for lack of stones, and the oil age will end long before the world runs out of oil" (The Economist, 2003). This quotation might be a convincing response to those optimist participants, and others, who do not believe in the end of the oil age. As a rebuttal to both pessimists and optimists, four participants argued that economic security in Saudi Arabia should focus on maintaining the security of *demand* for its oil rather than the supply itself. For example, participant A said:

> *"Economic security in Saudi Arabia should be viewed more in terms of security of demand which is securing the outlets to export the oil. I would not have spontaneously considered security of supply as being a major concern for Saudi Arabia".*

With regards to Saudi Arabia's role as an oil supplier, the available data in the literature indicates that the country has been willing to respond to changes in the global oil market in order to balance supply and demand (Al-Darwish et al., 2015). For instance, "during the first Gulf War (1990–91), the Venezuelan strike and the second Gulf War (2002–03), Hurricane Katrina in 2005, the surge in China's demand in 2004, and the Libyan crisis (2010–11), Saudi Arabia increased its production to ensure that demand for oil was met in the face of declining supply from other sources" (IMF, 2013 cited at Al-Darwish et al., 2015: 13). However, some economists believe that human ingenuity will inevitably find alternative energy sources to replace oil. Evidence to support this belief might lie in the current expansion of the low-carbon transportation fuel infrastructure, and the subsequent reductions in petroleum use and GHG emissions across the global transportation sector (Melaina et al., 2013). It is worth noting that most developing countries are working hard to accelerate this expansion in order "to meet the GHG emissions reduction goal by 2050" (ibid: 7). Participant P referred to this issue directly:

> *"moving towards low-carbon transportation fuel will help oil-importing countries to reduce their oil consumption and therefore reduce the negative impact of transportation sectors on the environment".*

Moves such as this suggest that Saudi Arabia's major concern is not about managing the oil market effectively, but rather about guaranteeing that there will be a demand for its oil in the future. The question here is not whether Saudi Arabia is able to control the oil market or not, but rather whether the country is aware of new technologies that might reduce demand for oil. The statement by Prince Mohammed bin Salman may provide an answer to this point: he indicated that the Kingdom is currently planning to create the world's largest sovereign wealth fund (with a projected value of more than $2 trillion) to ease the transition into a post-oil era (Micklethwait et al., 2016).

6.2 Peak Oil Hypothesis

The issue of peak oil in Saudi Arabia has sparked unlimited debate among government organizations, researchers, policy-makers and energy experts. In light of this research participants' critiques, it appears that the three peak oil assumptions, namely, physical assumption, political assumption and oil demand assumption (Helm, 2011) are all pertinent to Saudi Arabia. This section will introduce these hypotheses, which lie behind the threats that Saudi Arabia might face in the future. Firstly, 'physical peak oil', is related to the peak oil theory named after American geophysicist M. King Hubbert. Secondly, 'political peak oil', which is related to the history of energy crises since the 1970s and other political war between countries. Thirdly, 'peak oil demand' which is embodied by two factors: diversification policy in oil importers to provide energy and secure their energy supply (Abolhosseini et al., 2014), and the reduction of carbon emissions, which is related to energy security and climate change concerns around the world (IPCC, 2007). Given these three hypotheses, a number of questions arise: How might political instability impact on oil availability, the global economy, and energy policy in Saudi Arabia? Is the world running out of oil? More specifically, will Saudi Arabia, a key player in the oil market run out of oil?

6.2 Political Assumption: it appears that most participants who work within government sectors are optimists about peak oil in Saudi Arabia. In addition, four out of seven participants who did not express a clear opinion on the subject also belong to the government sector. A possible explanation for this finding lies in the effect of Saudi government bureaucracy on some participants - government employees in particular. In an autocratic state such as the Kingdom, citizens cannot openly criticize the government. This could be one of the reasons why some participants were eager to avoid topics such as peak oil during the interviews and were extremely optimistic about the future of Saudi oil fields. The main important point in this assumption is "technology" and the belief that the country will never run out of oil due to technological advances in finding new oil reserves.

6.3 Physical assumption: it appears that most of the pessimists in this research either are retired or work in the private sector; they seem less bound by political opinions and much more willing to express their own views. The main critical point in this assumption is "geology" (Helm, 2011: 70) and the belief that "even if smaller reserves may be discovered, geologists have already found the big ones" (Campbell, 1997 cited in Helm, 2011: 71). These findings suggest that it is unsustainable to rely on Saudi Arabia to meet the rapidly increasing global oil demand because even the largest oilfield in the country is now producing less and, as Campbell indicates, if new oil reserves are discovered, they are likely to be smaller and less productive.

6.4 Oil demand assumption: participants with this perspective are both pessimistic about peak oil supply and optimistic about the possibility of growth in oil demand. It seems that global improvements in fuel efficiency, the coming of shale gas, the development of electric cars, and the search for clean alternatives, have affected the peak oil debate, moving it away from discussion about a peak in supply to focus on the possibility of a peak in demand. The main critical point in this assumption could be "climate change policies"

(Burgess, 2006; Melaina et al., 2013). Global moves to reduce carbon emissions and limit environmental damage will probably cause oil importing countries to reduce their reliance on fossil fuel, and encourage international energy demand to shift from fossil fuels to clean energy alternatives. The consequence of this transformation might reduce demand for Saudi oil and could therefore affect the economic security of the country.

7. Finding

This section presents a summary of how the research question is addressed. How serious a policy concern is peak oil in Saudi Arabia? The existing literature and semi-structured interviews inform the belief that Saudi Arabia does not face serious threats to its energy security in the short term, because of the widespread availability of fossil-fuels. In the medium and longer term, it is likely that the country will face greater energy insecurity problems because of the physical, political and economic concerns. Therefore, despite the fact that Saudi Arabia is currently one of the world's largest producer of oil, the country could face an energy crisis. What is clear is that Saudi Arabia cannot sustain its current position in the international energy market by continuing to rely on its conventional energy resources. The country could be at extremely high risk in the future because oil is the cornerstone of both its energy and economic security.

This research study defines the concept of Energy security in Saudi Arabia; it is about making sure that domestic consumption of fossil fuels does not affect the export of energy into the international market. However, even if exports are not adversely affected, the country still needs to take steps to reduce waste and preserve the nation's energy resources for use in the future.

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