

Comparison of Energy Sources and Use by Different Sectors in Israel and Jordan

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Abstract

Along with the instability and constant uprising events which are happening in neighboring countries in the middle east, more focus should be placed on increasing energy security, as some countries like Jordan with poor natural resources were having a big reliance on other countries in oil imports, throughout the research it turned out that Israel recently enriched its energy security by the new discoveries of natural gas and the new energy explorations, and it is planning to improve its economy much further by exporting the excess quantities as liquefied natural gas, this comparative study focuses on the changes that happened in these countries during the years of 2003-2015 in an attempt to understand the changes occurred in these countries and evaluate the importance of the geopolitical factors, in addition by hovering over the energy roadmap for these two countries, more findings were anticipated regarding next phases these countries are heading toward, and pointing to what major concerns should be more prioritized to further increase energy security, it was found that a country like Jordan with a very high dependency should imitate Israel's strategy of shifting to natural gas because of its steady situation and low prices relatively, and the tendency of diversifying the energy resources, in addition to update of energy strategy frequently, to be able to adapt the concurrent instability of political situation in the middle east.

Introduction

Energy is one of the top crucial issues in the world that undoubtedly plays a major role in pushing the development in the social and economic fields, and many countries in the world are depending on their natural resources for production, generating electricity, fueling automobiles, and many other domestic needs. On the other hand, some other countries are facing energy scarcity, and as a result, they should adopt new strategies for their use of energy or even trying to find new sources of energy that they may be able to afford, especially with the sharp rising in the prices of oil since 2001[1], and that is in addition to the negative impacts of oil, gas and other conventional resources on the environment, whether by oil spills and contamination of water, emissions of CO₂, NO_x, SO₂ and many other air toxics that affects both environment and human health [2].

Different political and demographic changes are constantly arising in the Middle East which are absolutely adding more challenges for some countries with little resources, more specifically the reliance on certain energy sources like Oil and Natural Gas in Israel and Jordan have to be addressed explicitly. According to the "Worldbank data" organization, Jordan is considered to be one with the highest records in terms of depending on external resources in the world with a

dependency of 96% in importing oil and natural gas, and recently has signed a 15-years contract for importing natural gas from Israel [3], while in comparison Israel has a dependency of 64% in energy imports [4]. Nevertheless, regardless of how to ensure a more consistent-like energy resources, more research has to be conducted in these two countries to identify what interrelated aspects exist regarding energy usage and the possible solutions which can take place in order to reform energy subsidies.

As Nuclear has its drawbacks regarding the possibility of accidents or the large amounts of radioactive material which may cause genetic damages, and that is in addition to being a non-renewable resource like fossil fuels. Renewable energy resources are entering the battlefield with a more promising results, especially when talking about solar power and biomass. Israel and Jordan share the same Mediterranean climate with a hot and dry weather in the summer, with temperatures that can reach up to 35-40 Celsius [5]. However, despite the proper geographical conditions in this region to invest in large scale in solar power for electricity generation, currently though it is an expensive and of high cost investment, besides some other barriers like Jordan for instance which has unclear policies and legislations of the government, in addition to the slow process of private's sector renewable energy projects approval [6].

U.S. Energy Information Administration forecasts renewable energy will be the fastest-growing power source through 2040 [7]. By understanding the geopolitical challenges and their effects on the energy situation in these countries, in addition to finding relationships and dependencies in between sectors and energy sources, and identifying the major changes in the energy supply and trying to understand those changes, and eventually by investigating of the current energy situation, there will be more room to identify the options and the steps Jordan for instance, has to consider to mitigate its dependency on oil imports.

Methodology

Information were collected from different sources and articles regarding the current energy situation in Israel and Jordan to evaluate their expenditures on different sectors and how they are currently managing the fueling of each sector, furthermore, a study on what future plans that are envisaged is taken place to foresee their next plans and how well they can manage their resources.

Correlative and descriptive research was conducted on data regarding energy imports and productions in Israel and Jordan for the years of 2003-2015, which were collected from the International Energy Agency (IEA) portal, organized and refined in "excel sheets", and using

them afterwards for producing comprehensive chart that explains the different changes and variations in the energy supply.

Data regarding the amounts of energy consumption by energy sources and their use by different sectors in both Israel and Jordan, were acquired from the International Energy Agency (IEA) portal for the year of 2015, and were linked in such a way to create a cross-sectional figure, showing inter-relations between the different sectors and energy sources available, which the latter were predominantly imported from other different countries.

Results

Despite the fact that there are some different values of production in specific energy sources in Israel and Jordan, though in this research analysis it was preferred to merge renewable energy sources into one group, due to the negligible values of production for each distinct energy source, and during the research it was wholly found that the most dominant energy sources in Israel and Jordan are Oil and Natural gas. On the other hand, Israel is still using coal as a fuel for some electric power stations, and hopes to reduce coal use to less than 10% of the fuel mix in the production of electricity by 2025 [8]. However, the amount of energy imports and production in Israel will be demonstrated in Figure.1 that explicitly shows the approximate values in the energy supply.

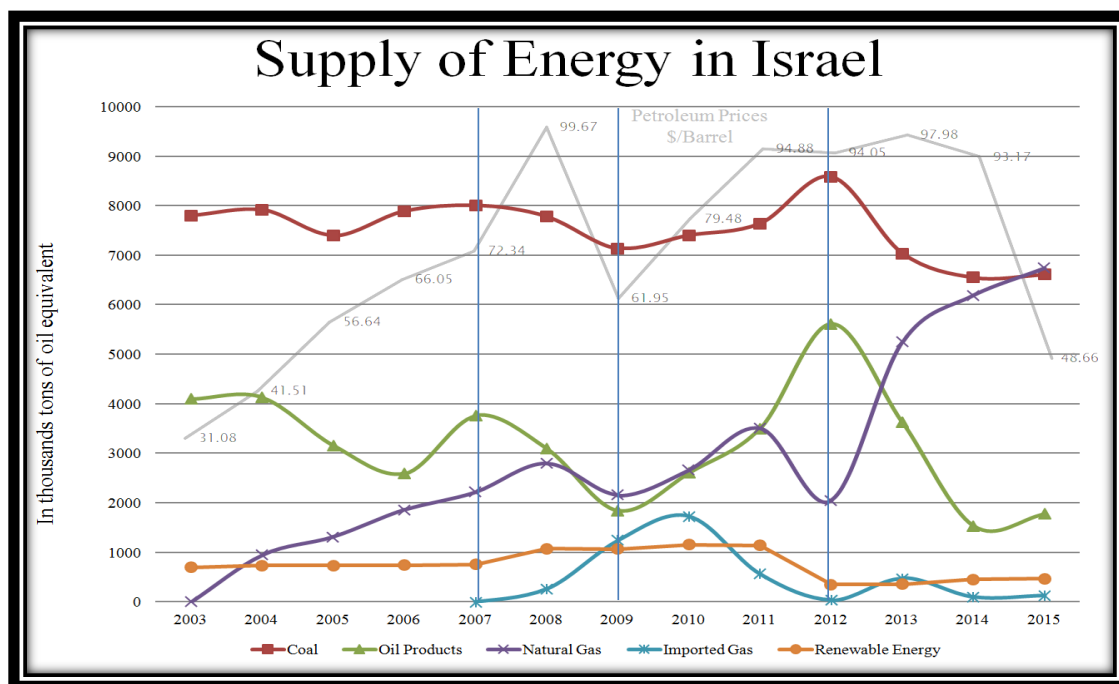
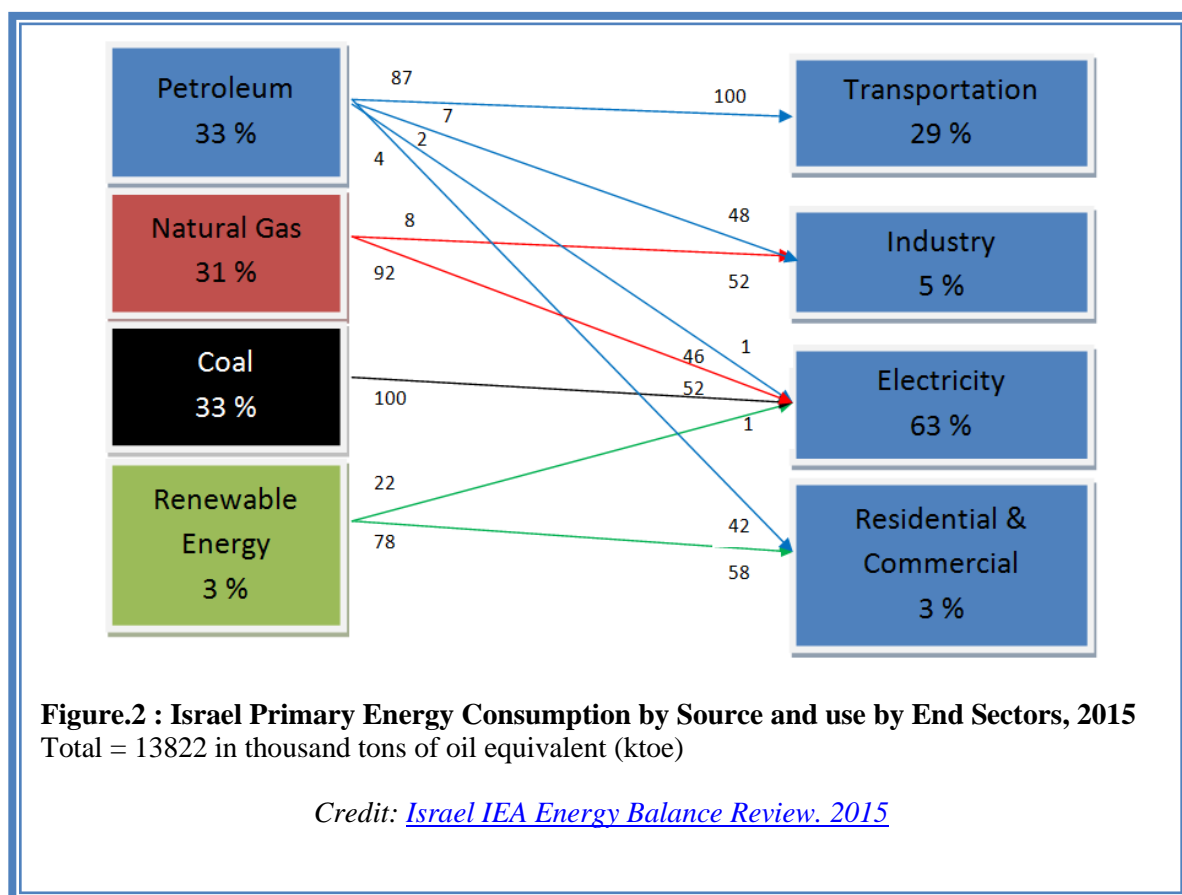


Figure.3 Israel's Energy Imports & Production values in between 2003– 2015

<https://www.iea.org/statistics>

For Israeli electric corporation, oil and coal were the most used and accounted for 80% for generating fuels [9], but lately with the recent discovery of natural gas in 2003 and started to operate in 2004 [10], more reliance started to grow on natural gas accordingly, till 2007 when the prices of oil had increased to reach up to 99.67 \$/Barrel [11], Israel realized the importance of relying on natural gas, and started to import gas accordingly to offset the lack of its natural gas production. There was another discovery of new natural gas reservoirs of Tamar, and Leviathan in 2009 and 2010 respectively [12]. Israel accordingly develop new strategies and plans to start investing and increase its dependency on natural gas and even planning to export to other countries, and in 2012 we can see a huge decrease in oil imports, besides the fact that even the number of solar companies went from 130 in 2010 down to 60 in 2015, and that is mainly because of the new abundance of natural gas in the country and the beginning on shifting their investments to this source.

In Figure.2, it is noticed the approximate balance between the three main energy sources, taking into consideration, that Israel is intending to reduce its usage of coal and increase its dependency on natural gas, and it is noticed as well the extreme dependency of the transportation sector on oil products, while in contrast, electric sector depends on different sources, besides plans to increase the dependency on natural gas and renewable energies, as coal will not be extremely available according to Israel's future plans.



On the other side, Jordan has almost no indigenous resources, and depends mainly on oil and natural gas imported from other countries with nearly zero production of either oil or natural gas. The energy supply in Jordan in the years of 2003-2015 is represented in Figure.3, which starts showing the variation of energy supply after 2003, where before that there was a fair supply of crude oil from Iraq in a preferential prices during saddam husseins' regime, but got suspended when Iraq's system collapsed, and that was the milestone at which Jordan started to face a problem of finding alternative energy suppliers, Egypt started to provide Jordan with natural gas to compensate the oil lack of supply till 2009, when again there was a threatening for Husni Mubarak's regime, and the gas supply was decreasing because of different attacks on the gas pipeline between Egypt and Jordan, at that time Jordan was forced to buy crude oil from Saudi Arabia at a higher price, also Jordan was vulnerable to be used by Saudi Arabia into taking a more active role against the Syrian regime in exchange for financial support.

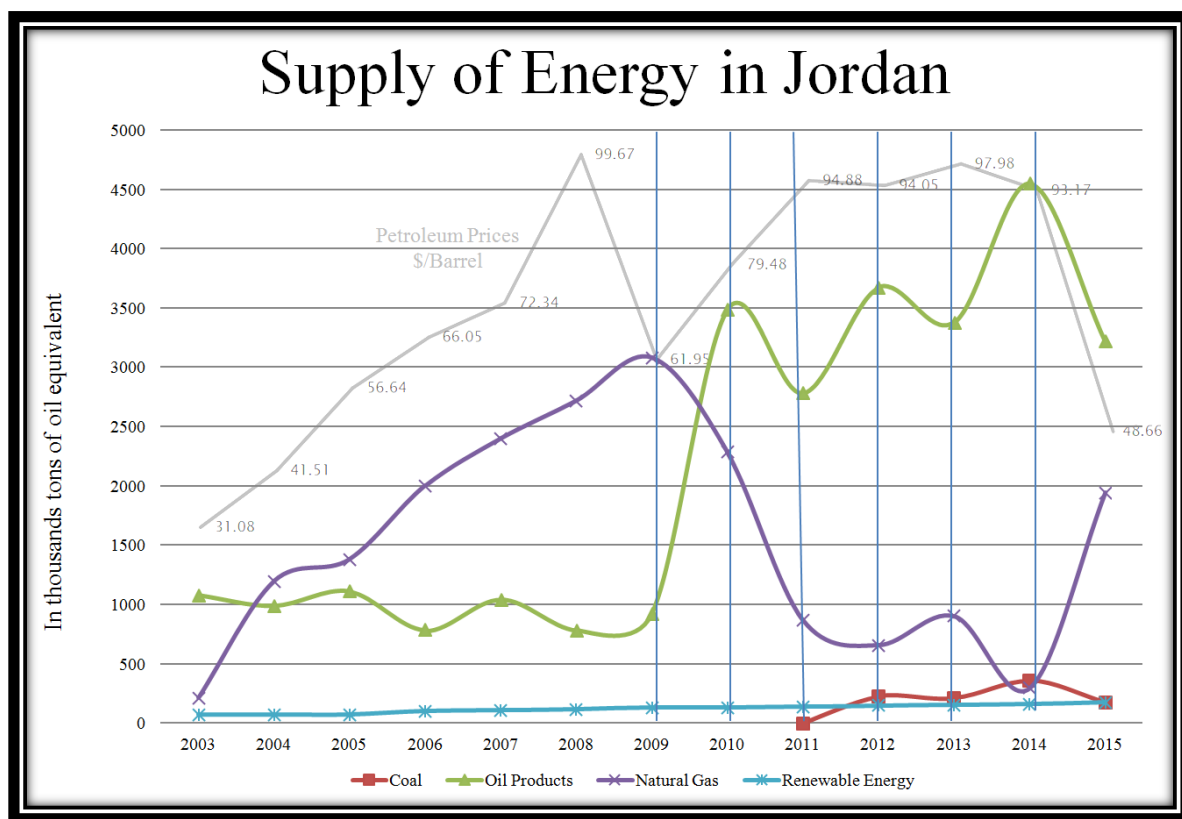


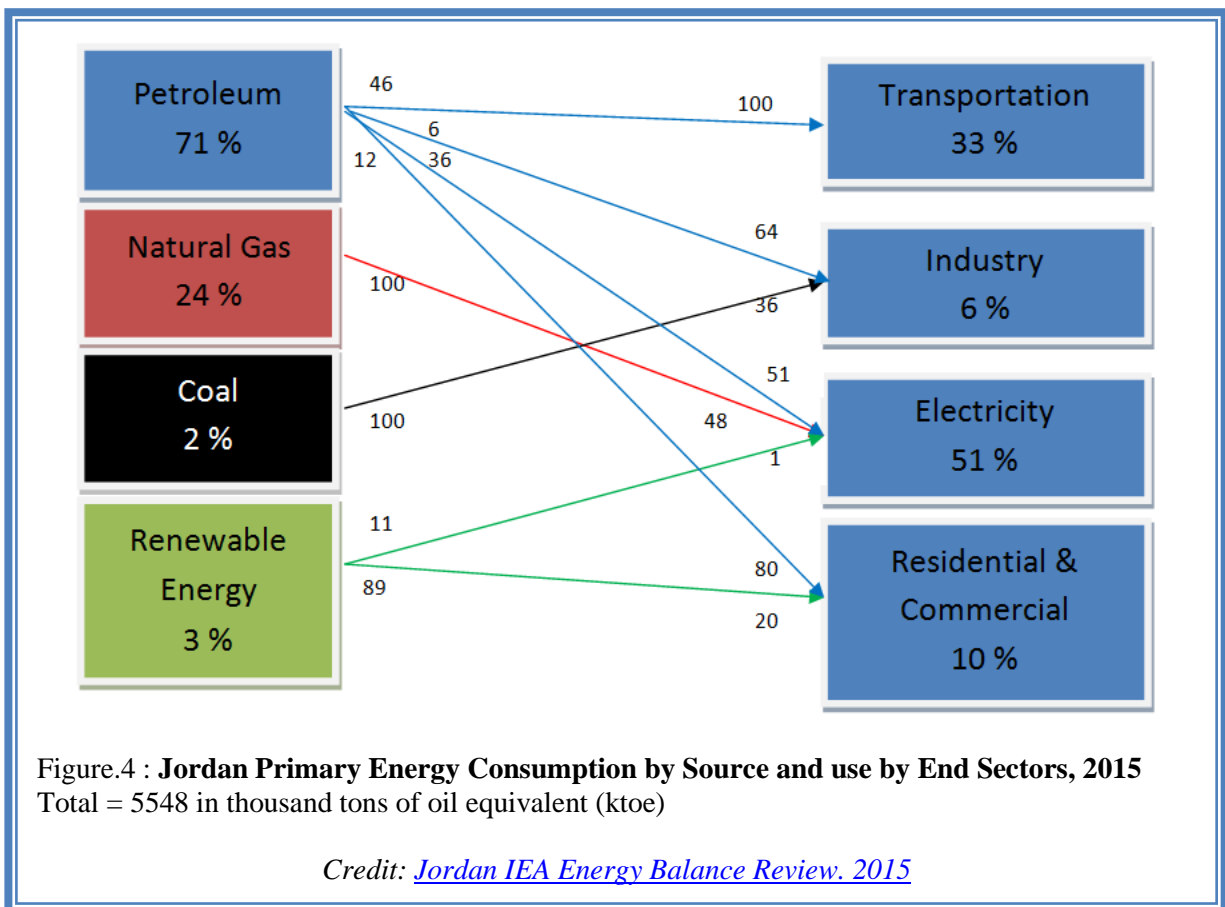
Figure.3 Jordan's Energy Imports & Production values in between 2003– 2015
<https://www.iea.org/statistics>

Prices of oil afterwards were getting higher, until in 2011 the terroristic attacks on the pipelines reached the peak, and likewise the regime collapsed and Egypt decided in 2012 to reduce Jordan's subsidies on natural gas as a result of Cairo's own economic difficulties, besides the

fact that Jordan even started to import coal in 2011 to fill the gaps in its energy requirements, because of the huge energy insecurity in Jordan, because of the risky energy situation in Jordan, an agreement had been signed a contract in 2014 with shell international to provide Jordan with Qatari natural gas based on a contract for 5 years. At the same time, Jordan signed a memorandum of understanding with Israel, for the latter to provide Jordan with natural gas starting from 2019 for 15 years contract [14].

Nevertheless, Jordan is not having stability in its energy supplies and thus recently has finished its establishment of a liquefied natural gas station in Aqaba, which was created for the purpose of Importing the natural gas from Qatar.

In Figure.4, it is noticed that almost half of energy consumption is mainly by the electricity sector which relied mainly on oil and gas, whereas the transportation sector depends entirely on oil, another thing is that oil is having the dominant share in term of its usage as an energy fuel for the four different sectors, with a very low dependency on imported coal and renewable energies.



Discussion

Throughout this study, It was realized that Israel had become more independent in its energy resources and further planning to shift most of its electricity generating fuel to natural gas, besides its tendency to create Liquefied natural gas (LNG) stations to start exporting to other countries as it is having a wide range of LNG export options, like turkey, Europe, and its first deal was signing a memorandum of understanding with Jordan that is to be active in 2019. Subsequently, even with the similarity between the two countries' past energy situation, Israel enhanced its energy security and became less dependent on oil imports, as the main natural gas discovery of Leviathan could meet Israeli's natural gas requirements for 100 years as estimated [9].

Jordan had initiatives to start producing and utilizing its oil shale resources to power a 500 MW electric plant which will account for less than 14%, and concurrent projects are projecting of having 30% of domestic buildings to use solar thermal systems by the end of 2020, additionally Jordan made an agreement with Russia to create a nuclear power plant with a total capacity of 2000 MW and is expected to operate in 2023, that is beside its renewable energy target of generating 1200 MW of wind energy, 600 MW of solar energy and another 20-30 MW of waste to energy, and that all of which will count for about 10% of energy mix in 2020. At all events, assuming that Jordan will be able to complete these projects as planned, still its energy situation will not be perfectly stable, and Jordan will keep depending on oil or natural gas as its main source [16].

Recently, Jordan established a liquefied natural gas station, and began importing LNG supplies of 4.2m cubic meter/day of gas in 2015, which accounts for about 25% of NEPCO's (National Electric power company) needs, which was a good progress for Jordan to start shifting its reliance on natural gas instead of oil which entailed high expenditures. However, regardless that oil prices are fluctuating most of the times, and Jordan was importing its oil from neighboring countries with preferential prices, still natural gas is the best option for Jordan especially with the creation of the Aqaba LNG station [17].

Conclusion

With respect to the current political challenges in the middle east, and the fast-pace changes of energy supply that has been shown in this study, it was clear that with such continuous changes and threatening events which may happen at any time, Jordan has to start updating and revising its energy strategy every 3 to 5 years, in order to be prepared for any unpredicted

events which in term may cause harm effects on the country's energy security and economy, furthermore, by creating LNG station at Aqaba port It had opened new horizons for Jordan to start diversifying its energy suppliers due to the fact that importing through the sea is much more reliable than depending on the current existing pipelines which are connected to the neighboring countries, and as a result, this new shifting will lead to a less restriction in choosing energy suppliers, and so getting more wide choices will not let Jordan's vulnerability to coax be exploited to take political or military actions against other neighboring countries, in exchange of financial support.

Recommendations

Besides that Jordan has began its preliminary steps in planning to exploit its domestic energy sources, which ultimately might not have a gigantic effect on the energy security, and as was presented throughout the study, the Transportation sector is totally depending on oil products, and during the research it was found that there are many countries trying to use compressed natural gas as a fuel instead of oil, Jordan likewise can start introducing new fleet of public transportation vehicles with dual-fuel engines in Amman that can work using diesel or natural gas, which will be considered as a starter project for the purpose of replacing all public transportation's traditional fuel by compressed natural gas, as a similar case has been implemented in France where they introduced a fleet of 128 new biogas busses, and that within 10 years the number of these buses had reached to 320 out of 450 buses in total [18]. At the same time, Jordan can grant exemptions to dual engine vehicles to give incentives for people to start shifting to compressed natural gas as a fuel, these vehicles can work on both fuels "petrol and CNG", meanwhile Jordan has the space to start injecting its petrol stations with compressed natural gas as a fuel.

As biogas basically can be upgraded to have almost the same natural gas efficiency, Jordan primarily can explore this untapped energy sources, especially with the abundance of biomass in Jordan. In fact Jordan had started its first biogas plant but for electricity generation. However, no legislation, laws, regulations or policies have been set by the local government regarding the use of "biogas as fuel" which can be very attracting for foreign investors to start considering this field for the Transportation sector.

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