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Financial risk of the MENA's energy architecture

El riesgo financiero de la arquitectura energética de países del MENA

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Contents

ABSTRACT:
Energy firms all over the world are faced with the problems: rapid change in consumer demand, rising costs and a decrease in economic efficiency. The paper analyzes the economic situation of the MENA (Middle East and North Africa) countries. The main aim is to assess the development of the energy sector of the economy and the financial risks of the development of distributed network power structures in such countries. During the research, indicators reflecting the energy market development in the MENA region were calculated. The findings revealed an ambiguous energy security situation in the said countries.
Keywords: Energy; Financial risk; Asia; Middle East; North Africa

RESUMEN:
Las empresas energéticas de todo el mundo se enfrentan a los problemas: cambio rápido en la demanda del consumidor, aumento de los costos y una disminución en la eficiencia económica. El artículo analiza la situación económica de los países de MENA. El objetivo principal es evaluar el desarrollo del sector energético de la economía y los riesgos financieros del desarrollo de estructuras de energía de red distribuida en dichos países. Durante la investigación, se calcularon indicadores que reflejan el desarrollo del mercado energético en la región MENA. Los resultados revelaron una situación ambigua con seguridad energética en dichos países.
Palabras clave: Energia; Risco financeiro; Ásia; Médio Oriente; Norte de África

1. Introduction

The region of the Middle East and North Africa has rich human and natural resources. It has a large share of world's oil production and export. It also has an acceptable standard of living. However, countries vary significantly in terms of resources, economic and geographic conditions, population, and standard of living. Most countries experience rapid population growth. The birth rate significantly exceeds in comparison to other countries with a similar per capita income. Kuwait, Libya, Oman, Qatar, Saudi Arabia and the United Arab Emirates recorded population growth rates exceeding 3.5 percent in recent years, while Bahrain, the Islamic Republic of Iran, Lebanon and Tunisia recorded rates below 2 percent (Global Economic Prospects: Middle East and North Africa, 2019).

The region has a significant inflow of interest income. The latter reflects a high level of foreign assets, while current transfers with the rest of the world remain insignificant. From the perspective of intraregional capital flows, there are two separate groups: foreign aid providers - mainly oil exporters, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates - and recipients. Changes in the external environment affect the economy of the region. Although the growth of the world economy is expected to remain steady, there are signs that the countries of the region face uncertainty in the overall situation and significant risks. The region's sensitivity to international oil and food prices is obvious. In addition, it can be assumed that countries in the region that have not yet attracted significant capital inflows may have to compete in a more cautious environment among investors. Countries will need to solve their political tasks quickly, in order to reduce the risks associated with the external environment as well as to increase their potential for achieving sustainable economic growth.

The apparent transformation of energy trade in countries such as the UAE directly affects global energy dynamics. The UAE is the world's largest exporter of fossil fuels for energy production. Thus, it is necessary to analyze the regional domestic energy market as the first in terms of improving demand. The efficiency of energy supply to consumers will be improved through the development of distributed energy. Such distributed energy will supplement the existing centralized energy system (Center for strategic research North-West, 2016).

Distributed energy is based on the idea of involving distributed generation and consumer resources in the management of electric power systems with the achievement of the growth effect of the total available capacity. However, with the development of distributed energy there are problems of increasing transaction costs. Transaction costs of distributed energy are proportionally distributed between participants. Such costs are associated with economic activities between participants. Other costs include their information integration into control relations. As well as the cost of integrating their equipment into electrical networks, while the power system maintains its stability and reliability (Center for strategic research North-West, 2016).

Thus, it is necessary to analyze the economic situation of developing countries on the example of the region of the Middle East and North Africa. In order to assess the development of the energy sector of the economy and the financial risks of the development of distributed network structures in the region.

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2. Sources overview

According to many analytical reviews, the countries of the region vary considerably in economy, population, standard of living, public and private sector balance, natural resource endowment, external debt, and trade and financial relations with the rest of the world (Krarti & Dubey, 2018; Global Economic Prospects: Middle East and North Africa, 2019). At the same time, intra-regional interaction is small, since it depends heavily on labor flows between some countries, with rather limited trade in goods and insufficient integration of capital markets. As noted in (Popescu, 2015) in the 21st century, access to energy depends on a complex system of global markets, extensive cross-border infrastructure networks. As well as a small group of primary energy suppliers and interdependencies of financial and technological markets. In this context, governments around the world should pay more attention to energy security. The term "energy security" is found in the literature more often and becomes the subject of research. In (Popescu, 2015), the economic component of energy security was analyzed, the concept of energy security from an economic and financial point of view was considered.

The water supply and power supply company ADWEC (Abu Dhabi Water & Electricity Company), the key role of which is to act as a guarantor of the security of electricity and water supply to consumers, has been publishing statistics and analytical reports since 2004 on its website (Statistical Data, 2018). General information about the company, as well as historical and current data related to demand, power generation, water demand and production, fuel consumption, demand forecasts and production capacity from 1990 to the present could be found in (Statistical Data, 2018).

As noted in (Global Economic Prospects: Middle East and North Africa, 2019), due to the combination of strong domestic policies and external financial assistance to certain countries, the region of the Middle East and North Africa can count on increased growth and development. The countries of this region have the opportunity to benefit from globalization and the integration of the global economy while minimizing the associated risks. Taking into account economic relations in the region - through labor flows and, in the long term, an increase in the volume of trade and private capital operations - the beneficial effect of the reform is significant, as the development of

individual countries is enhanced by increasing wealth throughout the region (Global Economic Prospects: Middle East and North Africa, 2019). As a result, all countries in the region will be in a better position to use their significant economic potential and meet the legitimate aspirations of a growing population.

The reduction of financial risks in the energy sector is considered in (Töppel & Tränkler, 2019). The authors note that certain barriers to investment can be overcome by entering into energy efficiency contracts or energy efficiency insurance. The financial industry, and especially insurance companies, have good reasons for participating in energy investments. Despite this, there are not much research and the practical application of risk transfer contracts for private decision-makers. The study (Töppel & Tränkler, 2019) quantitatively compares the risk reduction potential in risk transfer contracts. The latter is based on an integrated forecast model for saving energy bills. The model includes stochastic processes for the weather, raw materials prices and the technological energy efficiency. The model is equipped with a unique data set for German residential buildings. The results show that risk transfer contracts have a positive effect on the willingness of individual decision makers to invest in energy efficiency. The authors note that energy efficiency contracts exceed most scenarios, in which transaction costs are not taken into account.

The selection of risk factors is important for measuring corporate energy risk (Wei et al., 2019). However, the complex identification of risk factors is still a challenge. Article (Wei et al., 2019) proposes an approach for the comprehensive identification of corporate risk factors in the energy sector based on the analysis of texts presented in the financial statements. Based on 3707 applications on the form 10-K from US energy corporations, 66 types of risk factors have been identified for the period 2010–2016. These risk factors affect corporate energy risks. In addition, the authors (Wei et al., 2019) proposed a hierarchical system for corporate energy risk factors, highlighting nine subsectors.

Some authors, for example, (Nefedova & Soloviev, 2018), are studying the problems of expanding the energy infrastructure and options for regional energy supply. Segments for development of the distributed generation are allocated and options of creation of local area networks are studied. From these positions, risk factors for the development of distributed generation, as well as a number of modern financial risk management methods are highlighted.

Questions of financial risk management are also discussed in (Jonek-Kowalska, 2019). The main objective of the study is to evaluate the effectiveness of the implementation of ERM-systems. Evaluation was carried out in the context of company's exposure to financial performance risk. During evaluation, a four-stage system was used. The following was covered by this system. Accounting of financial results in the form of profit or loss. Percentage changes in net financial result on an annual basis. Profitability of total assets and return on equity. All enterprises studied in (Jonek-Kowalska, 2019) introduced the ERM system, given the high exposure of the fuel and energy industry to risk, including market risk. Nevertheless, the introduction of ERM-systems did not lead to a clear stabilization of the financial result and value of the enterprises. The parameters used for the evaluation were characterized by high variability over time and the lack of clear development trends, even in short, two-year periods of observation.

As noted in (Krarti & Dubey, 2018), almost 90% of all electricity (produced in the UAE), is consumed by buildings. In (Krarti & Dubey, 2018) there is a comprehensive review of recent energy consumption trends in the construction sector. The current efforts of energy efficiency promotion in the UAE are covered as well. In addition, the article considers the available opportunities for improving the energy efficiency of the construction sector in the UAE. In particular, there are three levels of energy modernization. Their impact is identified quantitatively, based on the results from existing literature and analysis based on bottom-up optimization for residential, commercial, and government buildings. The analysis shows that any level of energy upgrades can be effective for an existing building fund. Mostly in reducing energy consumption and peak energy demand, as well as in reducing carbon emissions in the UAE.

Renewable energy is a fast-growing sector that works to meet global energy needs (Qamar & Janajreh, 2016). Today, there is a boom of energy production integration with energy needs. This became possible with the advent of intelligent networks and micro networks. The work (Qamar & Janajreh, 2016) considers the deployment of isolated micro networks for powering small settlements in remote places. The authors analyzed the economic feasibility of using wind and solar energy to meet the energy needs of these micro networks. The latter as an alternative to using fossil fuel generators. Energy production is estimated using wind and solar analysis data. According to the authors (Qamar & Janajreh, 2016), solar energy turned out to be a better alternative than wind.

Energy consumption issues are important for the analysis of the energy system. Some authors model the processes of energy consumption. In (Kiani, 2017), the air conditioner was modeled for the largest emirate of Abu Dhabi in order to understand the long-term impact and monetary implications for the economy of the UAE. Commercial and residential properties were target sectors as leading energy consumers. An assessment of the current situation showed clear changes in energy production, consumption and reduction of greenhouse gas emissions. The effects were predicted using an alternative energy source modeling tool. According to the authors (Kiani, 2017), the savings amounted to millions of dirhams per sector due to the unique preliminary structure of tariffs and subsidies and reduction of emissions in accordance with the concept of Abu Dhabi for 2030.

United Arab Emirates (UAE) is an oil-rich country located in the eastern part of the Persian Gulf. The country is considered one of the highest energy consumers in the world. As in other countries of the region, the UAE's economy is mainly dependent on oil, gas and other types of fossil fuels (Jamil et al., 2016). Recently, with the constant growth of the UAE's population, there has been a constant demand for energy production, which is important for the economic growth of the country. Since fossil fuels are a limited source, there is a need to explore additional sustainable and renewable energy resources. In this context, alternative resources are considered in the UAE in order to overcome mentioned problems as well as reduce environmental pollution and carbon emissions. The paper (Jamil et al., 2016) addresses issues and problems related to renewable energy technologies. It is necessary to study renewable energy technologies. As long as renewable energy sources might provide a suitable solution to the energy, economy and environment problems in the UAE and other countries in the region.

The main goal of (Said et al., 2018) is to analyze and propose a plan for combining renewable energy sources in the UAE for 2030. This is in order to achieve the government's goal of reducing greenhouse gas emissions while keeping minimum electricity prices. The study (Said et al., 2018) includes many proposals for a combination of energy for electricity generation and the selection of the most appropriate plan for a combination of energy in terms of reducing emissions while maintaining the price of electricity. The analysis was carried out for two options. The first case, when the government does not tax for the use of hydrocarbon fuel for electricity generation. The second case reflects the situation when the government applies taxes on hydrocarbons. The paper (Said et al., 2018) also presents a basic analysis of electricity consumption in the UAE and government’s plans for the future.

When hydropower sources are developed to their full potential, then developed economies start considering renewable energy sources. There is an increased use of solar and wind energy, biofuels and the municipal solid waste. The architecture of centralized energy is implemented in the existing energy systems of different countries. The architecture of centralized energy has unidirectional flows of electricity from concentrated generation to distributed consumers. It has a single hierarchical market for electricity and power, centralized dispatch control, standardized power system. There is also regulated levels of quality of power supply. Such architecture of centralized energy cannot meet new, diverse and dynamically changing requirements of consumers (Center for strategic research North-West, 2016). Within the framework of a centralized architecture, there are no possibility for power systems that can simultaneously function efficiently and reliably in the conditions of implementation of the described trends.

3. Methods

In accordance with the classification presented by the World Bank (Global Economic Prospects: Middle East and North Africa, 2019), the countries of MENA region include Saudi Arabia, Egypt, United Arab Emirates, Iraq, Algeria, Kuwait, Qatar, Libya, Bahrain, Tunisia, and Syria. The key problem of energy development in the modern world is in energy systems with the existing economic architecture. Such energy systems cannot respond to the requirements imposed by the global energy market.

To assess the situation in the MENA region, the following indicators were calculated for each country:

-Total Primary Energy Production;

-Net electricity generation;

-Electricity export;

-Level of primary energy intensity;

-Energy imports;

-Electricity production from renewable sources.

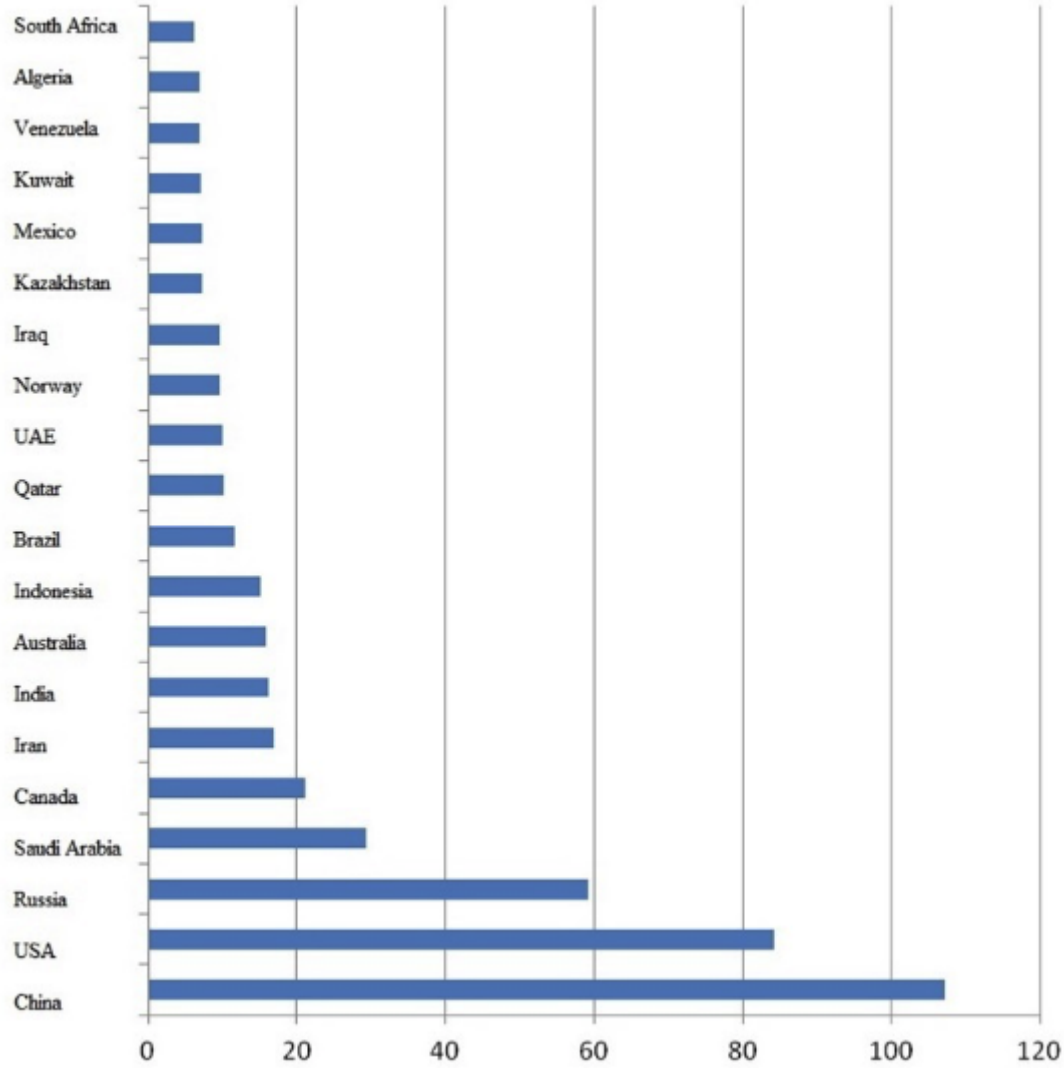
These indicators reflect the energy market status from different points of view; therefore, such an analysis makes it possible to comprehensively determine the efficiency of risk diversification and energy security in the region.

The findings were graphically compared with the use of histograms. Based on a graphical analysis, an economic interpretation of the energy market trends in the Middle East and North Africa was given. To calculate the said indicators, the statistical data from the following sources were used: Center for strategic research North-West, 2016; Statistical Data, 2018; Global Economic Prospects: Middle East and North Africa, 2019; Source of global data 'Knoema', 2019.

4. Results

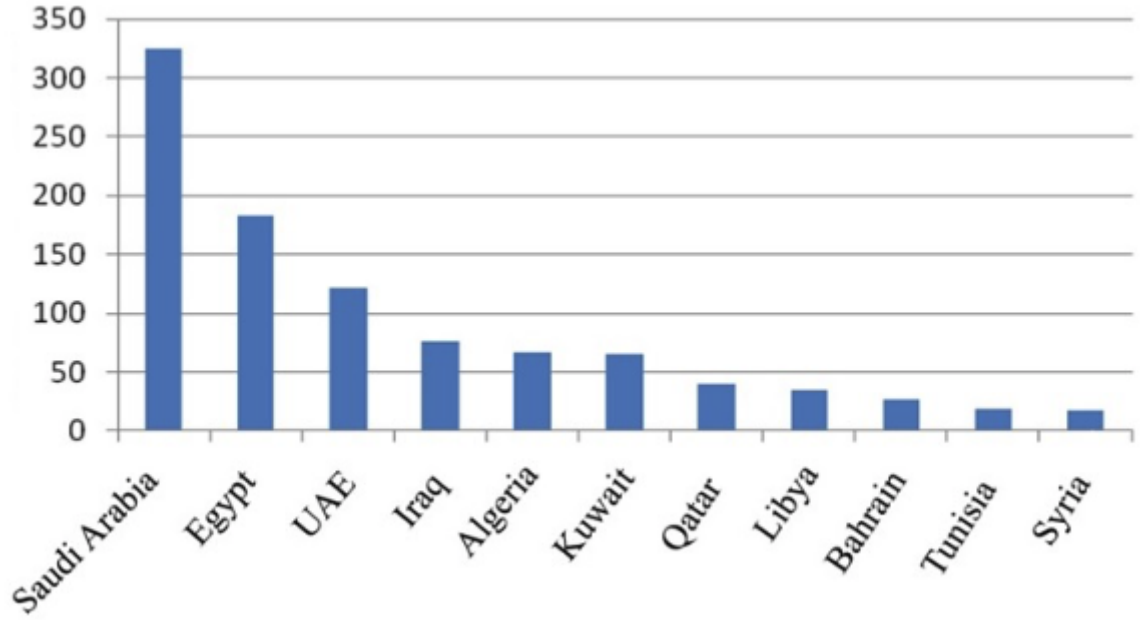
For many years, China, the USA and Russia, as well as the EU countries, have been among the leading participants in the global energy market. The leading position, which they occupied, resulted from the size of their economy and its focus. The developing countries Russia and China consume a lot of energy because high population demands many products on the domestic market. In this regard, the absence of high-tech exports becomes a factor in strengthening the industry, in which electricity plays a huge role. Exports make up a significant portion of a developing country's budget and because of this, industries such as heavy engineering, mining and mineral processing, metal production, polymer & petrochemical production do not reduce their energy consumption but rather increase it. This happens because the authorities are interested in producing these products. Although the US is a highly developed post-industrial country (i.e., having a high level of innovation in products and services as well as a high standard of living), it became competitive by focusing on the industrial and military sectors. The USA has a highly developed and diversified industry, the main sectors of which include machinery, mining, chemical and food industries, and trade. It should be noted that the national structure of consumption of primary energy sources is determined both by the availability of its own natural resources and transport capabilities, and by the current specificity of domestic needs. In 2017, Russia, China and the US accounted for about 49% of world production and 58% of energy consumption. These countries, however, also serve as energy producers. From data in fig. 1, it can be seen that these countries are the obvious leaders in terms of production, followed by Asian countries, which are actively developing their infrastructure but do not have industrial sites that are as powerful as in Russia, China and the US.

Figure 1
Total Primary Energy Production



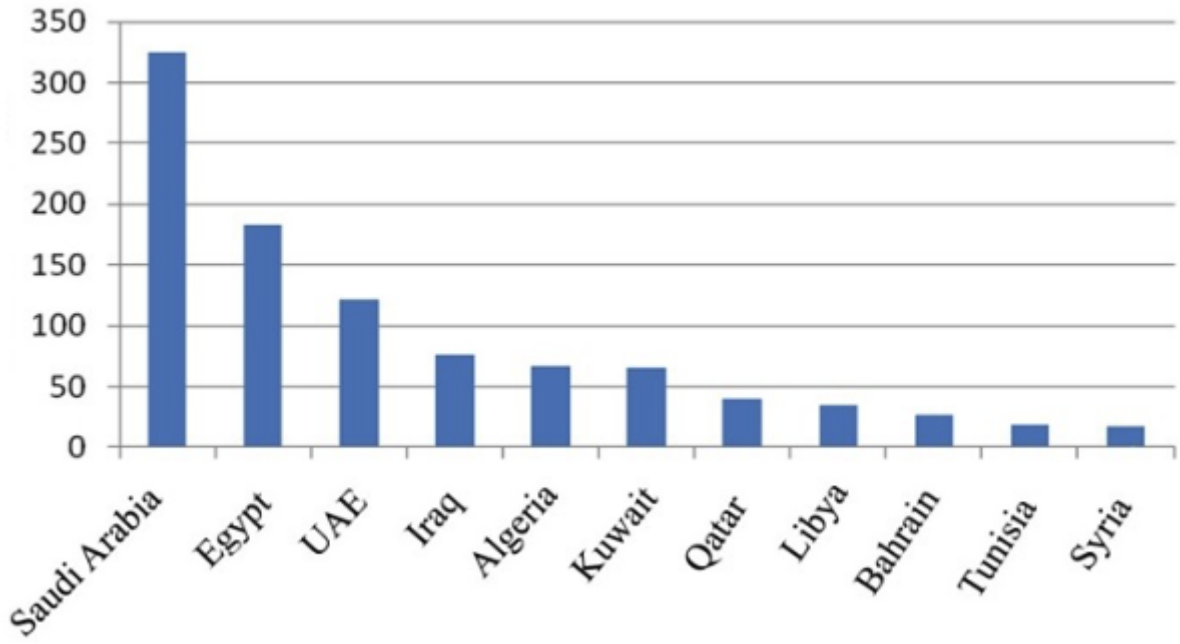
Net electricity generation is the amount of gross energy generation minus the electricity consumed in power plants for station service. The electricity required for pumping water in the pumped storage system is considered as electricity for plant needs and is subtracted from total electricity production. As can be seen from Figure 2, there is a significant variation in values: Saudi Arabia and Egypt have the highest indicators, while Tunisia and Syria the smallest. This picture can be a result of the specific geopolitical position of these countries. For instance, the rivers in Egypt contribute to the development of hydroelectric power plants, while disturbances that take place in the Syrian region do not allow for the sustainable electricity generation.

Figure 2
Net electricity generation



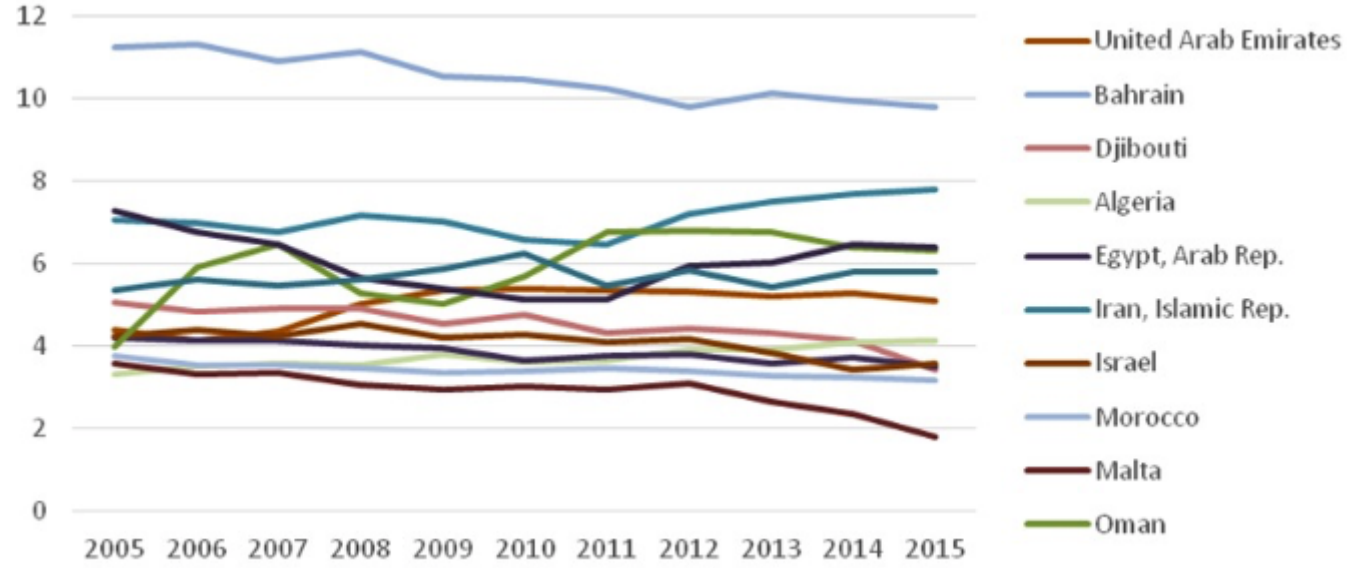
The Saudi Arabia's leadership in net electricity generation is driven by the country's size and its favorable location on the Arabian Peninsula, which allows selling surplus electricity to small neighboring countries (Figure 3).

Figure 3
Electricity export (according to data of 2017)



The world knows a few cases when countries received more income from electricity sports, rather than domestic sales. This necessitates the knowledge of the primary energy intensity, which will allow estimating the amount of energy used to produce a unit of product. In doing so, the target (external or internal) energy market of a particular county will be identified. Figure 4 presents comparative graphs of the dynamics of changes in the level of primary energy intensity in the given countries as of 2017.

Figure 4
Level of primary energy intensity



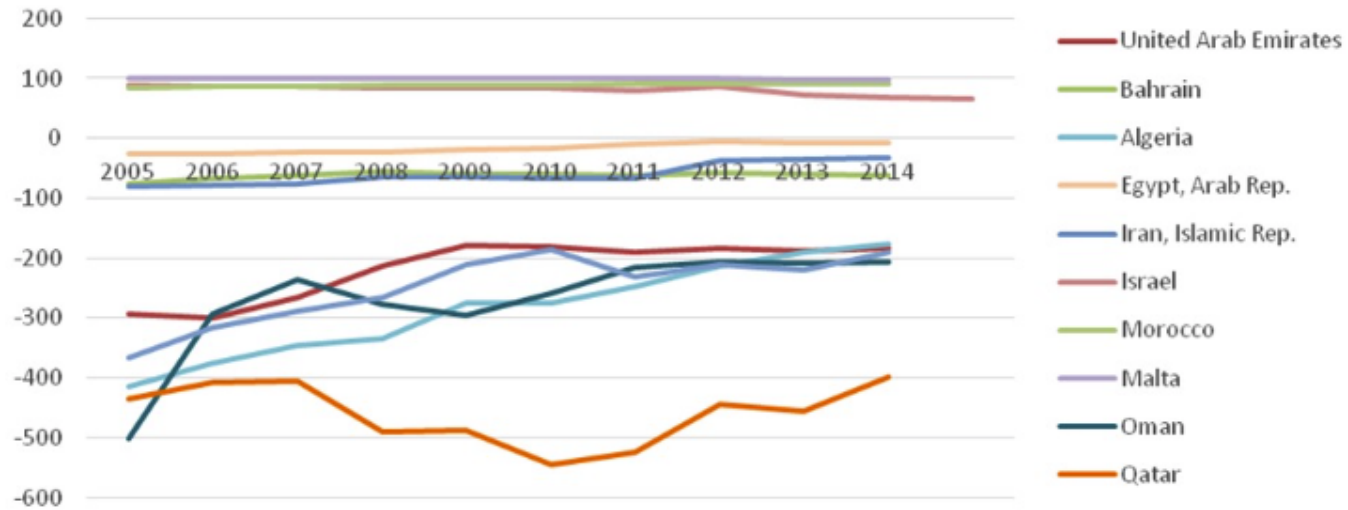
Energy intensity is a measure of the energy inefficiency of an economy. It is calculated as units of energy per unit of GDP. Low energy intensity indicates a lower price or cost of converting energy into GDP. However, this indicator has weak points. First, the GDP is based on the purchasing power parity (PPP), which means that the actual financial situation of a particular country is not taken into account. Since the PPP can only function in the case of free trade, the currency exchange rates will deviate significantly from the parity (the higher customs duties, export and import restrictions, transportation costs, the greater the difference between the nominal exchange rate and the parity value. In other words, you can rely on the primary energy intensity indicator only when taking account of the trade and financial conditions.

Second, a high level of primary energy intensity means not so much a high rate of energy consumption as an insufficient production of goods and services. Thereby, the relationship between values becomes distorted; GDP that lower than the amount of produced energy can create an illusion of high energy consumption per unit of output in the country, although a low GDP characterizes such a market as underdeveloped.

Third, it is believed that high energy intensity means high industrial output as portion of GDP, countries with low energy intensity signifies labor intensive economy. In our opinion, this approach does not take into account the structural characteristics of markets. For this reason, the primary energy intensity needs to be used alongside other indicators for a comprehensive and correct assessment of the energy situation in a particular economic system.

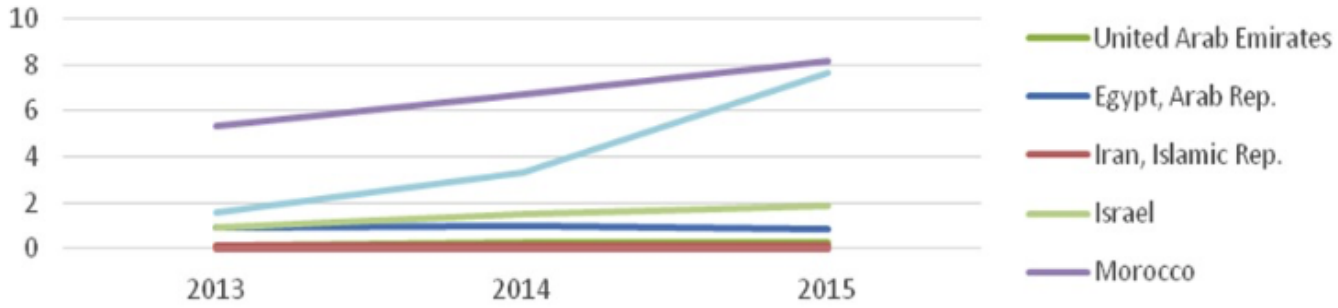
Among these, the net energy import (Fig. 5), which is estimated as energy consumption minus production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. Energy use refers to the use of primary energy before it is converted to other types of final consumption fuel. Which is equal to domestic production plus import and reserve changes, minus exports and fuel supplied to ships and aircraft engaged in international transport.

Figure 5
Energy imports, net (% of energy consumption)



As can be seen from the diagram above, there are only two countries that do not meet the energy demands of their domestic markets independently, the UAE and Bahrain. We believe that the reason for this situation in the UAE is the growing domestic demand for energy, which is associated with the active construction operations, tourism infrastructure development, and the growth of labor migration. The Bahrain situation is different, as it results from a small size and location of the country. A small country will benefit more from focusing on the social infrastructure, rather than independent energy sources. Such an approach provokes the development of alternative energy industries. Electricity generation from renewable sources (Fig. 6) includes geothermal, solar energy sources, tides, energy derived from wind, biomass and biofuels.

Figure 6
Electricity production from renewable sources, except hydropower (percentage of the total)



As can be seen from the analysis of statistical data, a small percentage of energy production from renewable sources is observed in the countries of the region. On the one hand, this creates undesirable prerequisites for the development of the energy sector. On the other hand, they can help provide energy to a certain number of households, which will have a positive social effect.

Thus, it can be concluded that the energy situation in the MENA countries remains ambiguous. Households, the corporate sector, and the government are setting the conflicting goals, which creates structural crises in some economic systems. Households demand affordable energy for living. The government attempts to create a budget surplus by affecting commodity markets and energy product sales. As the domestic demand grows, the need for cheaper energy imports grows too because the corporate sector diversifies its financial risks (i.e., by setting the energy product at high price to survive market disturbances). To sum up, consumers seek to buy more while spending less, sellers intend to sell less but earn more, and the government wants to reach a budget surplus as a platform for positive social changes.

The regional risks also have a role in this game. In MENA countries, companies selling energy resources are close to the authorities and the country's heads (e.g., presidents, monarchs, their families). In this regard, they often have a vertically integrated structure, which ensures an oligopolistic position of the company in the market and facilitates the management. In the conditions of resource exhaustion, market turbulence, and the enhancement of compliance with the Paris Convention, the important step is to transform vertical structures into horizontally integrated ones. This architecture allows for a greater impact on the market trends and for positive social effects. Horizontal integration contributes to the discovery of alternative energy industries, which, in turn, allows creating the mixed-type energy saving technologies and applying them to transform a company within the context of sustainable development.

5. Discussion

The distributed energy will play the decisive role in the next step in the development of the electric power industry. Low generation, energy storage systems, regulated end-user loads are integrated with each other and with a centralized power system, and represent a resource that has not yet been used to improve the efficiency of power systems and therefore is an appropriate solution to the problem. Distributed energy increases the efficiency of the power system by the following. Reducing the need for connected power. The emergence of local self-balancing unification generators and low power consumers. Large-scale involvement of small but numerous energy assets of end users in the power system management processes.

However, in the existing architecture of the energy sector, the large-scale development of distributed energy faces a rise in costs (Center for strategic research North-West, 2016):

• transaction costs of economic relations, growing with an increase in the number of transaction participants,

• costs and high capital costs for information integration of equipment into control framework,

• high capital and engineering costs for the integration of equipment into electrical networks, the costs of ensuring system sustainability.

Transition to the universal use in the electric power industry of digital controlled devices connected to the information networks of the Internet at all levels of the power system from generator devices and electrical networks to end devices, including residential, electricity consumers. Which provides the possibility of implementing intelligent control of power systems. Distributed power industry with decentralized management and markets will be able to meet these requirements. As well as the wide involvement of all power system users in the process of management in order to provide an economically optimal, flexible, high-quality and reliable power supply.

The countries of Asia with medium and low levels of development now only determine the vectors of their industrial and technological policies. The key areas of development in these countries are logistics, human resources, quality management, and infrastructural readiness of industrial sites for work within transnational relations.

6. Conclusions

Growth rates in developing countries are projected to decline to 5.7% in 2019 and to 5.6% in 2020. With the exception of the new high-income industrial countries, growth is expected to decline from 6.4% in 2018 to 6.2% in 2019 and 6.1% in 2020.

As oil prices rose and Asian currencies depreciated, inflation increased last year, but remained low by historical standards. In light of stable commodity prices, inflation is expected to remain at 2.5% in 2019 and 2020.

Risks show a downward trend. However, despite this, the protracted or exacerbated trade conflict between the People’s Republic of China and the United States of America can undermine investment and growth in developing Asia. There are various uncertainties, which are associated with US fiscal policy and the possible unpredictable consequences of Brexit. Due to this, growth in advanced economies may turn out to be slower than expected, which somewhat aggravates the prospects for the economies of the region.

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