



Ministry of Energy and Mineral Resources -

Summary of the Jordan Energy Strategy for (2020-2030)

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Introduction

“Energy is at the heart of the economy. We were amongst the first countries in the region to realize the importance of gradual diversification of energy sources to protect our country against fluctuations in international market prices, and thus entrench the sovereignty and stability of our economic and development-related decision-making.”

His Majesty King Abdullah II Bin Al-Hussein

The Ministry of Energy and Mineral Resources (MEMR) is currently engaged in various tasks, including the definition of policies and legislation for the energy sector. Ongoing efforts involve the review and development of strategies related to the sector, with the most recent being the energy sector strategy for the period 2015-2025.

In pursuit of a participatory approach, a higher committee has been established, chaired by HE Minister of Energy and Mineral Resources, and comprising members from different authorities in various energy-related sectors. The committee aims to develop a comprehensive strategy for the energy sector covering the period 2020-2030, with a general outlook extending until 2050. This initiative is designed to address challenges and changes in political, economic, social, technological, and environmental domains, ensuring sustainable energy supply security. Emphasis is placed on understanding the impact and relationships between the energy sector and other energy-intensive sectors.

To achieve these objectives, technical committees have been formed, involving partners from relevant authorities. These committees are tasked with the development of the strategy, with technical support provided by the Renewable Energy and Energy Efficiency Program II (REEE II), financed by the EU. The process includes a thorough review of previous strategies, developments, accomplishments, and lessons learned to illustrate available scenarios and determine appropriate solutions. The ultimate goal is to create an executive plan that encompasses the projects required for implementing the chosen alternative.

Achievements and Challenges of the Energy Sector 2018

Achievements

The energy sector is one of the most vital sectors in the Hashemite Kingdom of Jordan due to its significant impact on sustainable development. Despite facing considerable challenges, including the lack of local energy sources and heavy reliance on imports, the sector has achieved remarkable accomplishments in recent years. In 2018, Jordan imported approximately 93% of its total energy needs, a slight decrease from 97% in 2014.

In recent years, the energy sector has adopted a clear policy aimed at achieving energy supply security. This involves diversifying imported energy sources and forms, developing and exploiting both conventional and renewable local energy sources, and transitioning towards sustainable energy practices. Additionally, a policy has been implemented to liberalize energy markets, including the market for oil byproducts. This

approach provides opportunities and encourages private sector investment in energy sector infrastructure projects. The strategy also focuses on promoting and optimizing inter-regional energy projects and enhancing the efficiency of energy consumption across all sectors. These integrated policy themes are being executed through clear and specific action mechanisms.

Electricity Sector

Work has continued to strengthen and develop the Jordanian electrical system, enabling it to handle increased electrical loads and integrate new conventional and renewable electric power generation plants. One of the most significant achievements in this domain is the establishment of the Green Corridor Project connecting Maan with Qatraneh electrically. This project has substantially increased the electricity transmission capacity from the south to the center of the Kingdom, expanding it from 500 to 1400 megawatts.

Additionally, efforts have been completed to deliver electricity to all consumers by enhancing distribution networks. As a result, the volume of electricity coverage has reached 99% in all regions of the Kingdom, with the Rural Electrification Program playing a crucial role in this accomplishment.

Electricity coverage of all regions of the Kingdom is 99% in 2018



Work has also persisted in completing Jordan's electrical connections with neighboring countries and reinforcing existing interconnection lines. Electrical energy exchange with Egypt has been ongoing, contributing to the stabilization of the Jordanian electrical network. Agreements have been reached to increase the export capacity of the Jericho area, and negotiations for electricity supply contracts to Iraq are in progress. Memoranda of understanding have been signed for the electrical connection of Jordan and Egypt with Gulf Cooperation Council (GCC) countries. Furthermore, there is an agreement with the Saudi side to finalize an electrical connection agreement once feasibility has been established for both parties.

Renewable Energy and Energy Efficiency

MEMR has successfully established a legislative and procedural foundation in the renewable energy domain, resulting in a notable increase in the share of renewable energy in the overall energy mix. This progress has been achieved through the execution of Power Purchase Agreements (PPA) vital for the initiation of renewable energy projects in accordance with the Direct Proposals Bylaw. Additionally, the utilization of solar energy to fulfill the consumption needs of various sectors has been facilitated through the implementation of the Net-Metering and Wheeling systems.

As a result of these initiatives, there has been a significant rise in the contribution of renewable energy, including solar and wind, in the electrical energy mix, reaching approximately 1130 megawatts by the end of 2018. This accounted for 10.8% of the total generated electrical energy, showcasing a substantial increase in the incorporation of renewable sources.

The contribution of renewable energy in electricity generation is 10.8% in 2018

These achievements have triggered a positive economic impact in the local investment sector, significantly contributing to the generation of hundreds of direct and indirect job opportunities. The momentum in the renewable energy sector has also activated support works across various industries, fostering a social developmental movement in the regions where these projects are located.

In a parallel effort, MEMR established the Renewable Energy and Energy Efficiency Fund (JREEEF) at the beginning of 2015. This initiative aimed to implement a comprehensive and integrated package of programs and projects spanning various sectors. While MEMR and the private sector successfully completed large-scale investment projects, the Fund focused on supporting small-sized projects across diverse sectors. This collaborative approach has created a cohesive effort within the broader landscape of the energy sector. Measures were implemented to enhance energy efficiency and usage, including small-scale renewable energy schemes.

Furthermore, MEMR, through the Rural Electrification Program, funded projects to complement efforts in promoting renewable energy use and reducing electricity costs for economically challenged families. The initiative targets providing solar energy systems to impoverished households with a capacity of 2 kW per house, subject to specific conditions.

Simultaneously, the Government approved the National Energy Efficiency Action Plan (NEEAP) in April 2018, covering the period 2018-2020. MEMR is actively working in collaboration with partners to implement this plan, representing a crucial strategic step. The NEEAP integrates parallel and harmonious sectorial plans with renewable energy

plans, involving all ministries and public and private institutions. The overarching goal is to improve energy efficiency, aiming to achieve a 20% reduction in energy consumption by 2020, referencing the average consumption during the years 2006-2010, while aligning with the global trend to reduce greenhouse gas emissions.



Natural Gas Sector

The liquefied natural gas (LNG) import project via ships through the port of Aqaba has played a pivotal role in achieving the strategic goal of augmenting the contribution of natural gas to the overall energy mix. The commercial operation of Sheikh Sabah LNG Port in Aqaba commenced in July 2015 and has since provided a new and additional source of supply for natural gas in Jordan. The port has effectively secured the electrical system's natural gas requirements, leading to approximately 88% of electricity generation from natural gas by the end of 2018. This initiative has significantly bolstered Jordan's energy security and diversified its energy sources.

The contribution of natural gas in electricity generation is 88% in 2018



To enhance the supply of natural gas, efforts have been made to resume importing natural gas from the Egyptian side since September 2018, following agreements and understandings reached with the Egyptian counterpart. In addition to this, a significant agreement for the sale and purchase of natural gas was signed in 2016 between the National Electric Power Company (NEPCO) and Noble Energy. This agreement

outlines the supply of 215 million standard cubic feet per day (MMSCF/d) of natural gas to the Kingdom for a 15-year period, with commercial supply expected to commence at the beginning of 2020. These initiatives further diversify Jordan's sources of natural gas, ensuring a more robust and secure energy supply for the country.

In a significant move to promote the wider adoption of natural gas in national industries, comprehensive regulatory, contractual, and technical requirements for the supply of natural gas to industries were established. The government has undertaken robust efforts to incentivize industries to transition to natural gas, a more cost-effective alternative compared to various other fuels. This strategic initiative aims to enhance the competitiveness of industries and reduce production costs.

The reduction of special tax on natural gas for industries from 16% to 7%

To facilitate the transition, devices and equipment associated with the extension of ex-works natural gas lines have been granted exemptions as outlined in Investment Law No. (30) of 2014. Furthermore, there have been adjustments to the taxation framework, with the special tax on natural gas for industries reduced from 16% to 7%. Additionally, industries transitioning to natural gas enjoy an exemption from the special tax for the first three years after initiating the use of natural gas in their facilities. These measures collectively contribute to creating a favorable environment for the increased utilization of natural gas in national industries.

Oil Sector

In pursuit of enhancing the security of energy supply, the Jordan Oil Terminals Company (JOTC) was established by MEMR in 2015 as a government-owned entity tasked with managing and operating oil terminals dedicated to storing oil byproducts. To further bolster strategic storage capabilities for oil byproducts, a project was implemented in the central region of the Kingdom, resulting in storage capacities of 440,000 cubic meters (equivalent to 250-300 thousand tons of oil byproducts and 8000 tons of liquefied petroleum gas (LPG)).

Continuing these efforts, ongoing projects include the addition of three petroleum gas tanks with a capacity of 11,000 cubic meters (6000 tons). Additionally, a project is underway to construct storage capacities for crude oil and its byproducts in Aqaba. This project involves the creation of six tanks with a combined capacity of 120,000 cubic meters (equivalent to 100 thousand tons). Furthermore, the plan includes the construction of three dome liquefied petroleum gas tanks with a capacity of 11,000 cubic meters (6000 tons). These initiatives collectively contribute to the development of robust infrastructure, ensuring efficient storage and management of oil and petroleum products to support energy security in Jordan.



Efforts have been dedicated to opening a market for oil byproducts since 2013, resulting in the licensing of three companies to market these products. This initiative has played a crucial role in enhancing energy supply security, fostering the development of the byproduct distribution market, and improving services provided to consumers. In mid-2016, these licensed companies commenced the importation of a portion of the Kingdom's diesel requirements. Subsequently, by the end of 2016, the companies expanded their imports to include gasoline 95, alongside diesel. Notably, by the beginning of May 2018, marketing companies were granted the capability to import all their oil byproduct needs. These measures have contributed to a more dynamic and competitive market, ensuring a reliable and diversified supply of oil byproducts in Jordan.

3 marketing companies for distribution of oil byproducts

Regarding oil refining, the Jordan Petroleum Refinery Company (JPRC) is actively engaged in implementing its fourth expansion project. The primary objective of this expansion is to increase the refining capacity of the Jordan Petroleum Refinery to approximately 120 thousand barrels per day. A key focus of the project is the conversion of heavy products, particularly fuel oil, into more economically viable light products such as gasoline and diesel. The endeavor also aims to enhance the specifications of the oil byproducts produced at the refinery, ensuring they align with both Jordanian and international standards. The completion of this significant fourth expansion project is anticipated in 2023. These efforts underscore the commitment to modernizing and optimizing the refining capabilities to meet evolving energy demands in Jordan.



In the same context, by the end of 2017, the strategic project between Jordan and Iraq took shape, focusing on the establishment of an oil pipeline connecting Basra to Aqaba. The Jordanian and Iraqi sides finalized the framework agreement, and preparations were made for its official signing by the respective governments after obtaining the necessary approvals. The pipeline is designed to transport crude oil from Basra to export terminals at the port of Aqaba, boasting a capacity of 1 million barrels per day. As part of this project, tanks with a total capacity of 7 million barrels will be constructed in Aqaba, along with a dedicated port for oil export.

This project is anticipated to bring several benefits to Jordan, including the opportunity to receive crude oil passing through its territory for local consumption, based on purchase contracts between the relevant authorities in both countries. The agreement spans 25 years from the project's operational date, and one of the advantages is the collection of financial returns from Iraq as transit fees for the passage of crude oil through Jordanian lands. Additionally, the project is expected to create direct and indirect job opportunities during both the establishment and operational phases. This collaboration signifies a significant development in regional energy cooperation and economic integration between Jordan and Iraq.

Oil and Gas Exploration Sector

The National Petroleum Company (NPC) has undertaken efforts to boost gas production from the Risha gas field by expanding explorations within its concession area. In 2019, an ambitious work plan was adopted, enabling the National Petroleum Company to significantly increase the rates of natural gas production from the Risha gas field. By mid-2019, the production rate reached 16 million standard cubic feet per day (MMSCF/d), marking a notable increase compared to the 2018 production rate of approximately 9 million cubic feet per day. These endeavors reflect the company's commitment to enhancing domestic gas production and contributing to the energy needs of the region.

Increase of natural gas production from Risha gas field to 16 million cubic feet



The Ministry of Energy and Mineral Resources is currently working to focus on the possibility of developing production in Hamza oil field and carrying out the necessary technical maintenance for existing wells.

In the field of marketing open exploratory areas, an announcement was made at the end of October 2017, signaling the commencement of the expression of interest process for oil and gas exploration in six open sites. These sites encompass Al-Sarhan, Al-Azraq, West Safawi, North Highlands, Al-Jafr, and the Dead Sea. Additionally, the Al-Sarhan development zone has recently been opened for exploration purposes. The opportunity remains available for companies interested in participating in exploration activities in these areas, reflecting an ongoing commitment to encouraging and facilitating investment in the exploration of oil and gas resources in Jordan.

6 open sites for oil and gas exploration

Oil Shale Sector

The Ministry of Energy and Mineral Resources (MEMR) has sustained its support for the four companies that entered into concession agreements to carry out retorting projects through surface mining of oil shale. These projects aim to produce oil through various surface retorting technologies or thermal injection methods. MEMR's ongoing support underscores its commitment to fostering the development of oil shale resources in Jordan and exploring innovative technologies to extract oil from this unconventional source.

In addition to the existing four areas, the Ministry of Energy and Mineral Resources (MEMR) has undertaken efforts to divide the regions with oil shale deposits in the Kingdom into 21 new explorative areas. These areas are open for investment with the aim of extracting crude oil, and they have been classified based on the quantity and quality of crude available. This classification is intended to encourage new companies to invest in these areas and enhance the economic feasibility of extracting crude from them. MEMR's initiatives reflect a strategic approach to attract investment and promote the responsible development of oil shale resources in Jordan.

21 new explorative areas for oil shale



Work is also underway on a project to produce electricity from direct combustion of oil shale with a capacity of (470) megawatts, to be operational in 2020.

Attachment No. (1) includes energy sector performance indicators until the end of 2018

Challenges of the Energy Sector in Jordan Until the End of 2018

The energy sector in Jordan has made significant achievements in recent years, but it faces various challenges. The key challenges can be summarized as follows:

Oil and Gas

The Kingdom's reliance on imports to meet its primary energy needs, specifically for oil and gas, has exposed it to vulnerabilities due to recent regional events. These events have led to shortages in availability or resulted in high prices. The energy sector in Jordan has encountered two significant challenges in its energy supplies. The first involved the suspension of oil supply to Jordan at preferential prices from Iraq after 2003. The second challenge was the fluctuation and interruption of the supply of natural gas from Egypt during the period from 2011 to 2018. These experiences underscore the importance of addressing energy security concerns and developing strategies to mitigate the impact of external factors on the Kingdom's energy supply. Efforts to diversify energy sources, invest in domestic production, and explore renewable energy options can contribute to enhancing Jordan's resilience to potential disruptions in the future.

Oil and Gas Exploration

The exploration of oil and gas in Jordan is still proceeding very modestly, and the main reason for this is the lack of sufficient financial allocations to invest in exploration in promising fields. Over the past years, government budgets have not allocated adequate funds to enable the Ministry of Energy and Mineral Resources (MEMR) to conduct exploration operations.

Additionally, there is a shortage of seismic studies and surveys in open areas designated for oil and gas exploration. These studies require adequate financial allocations to be carried out, posing a challenge in attracting investments in this domain.

Oil Shale Exploitation

The most significant investment challenges in oil shale include the high cost of producing a barrel of oil from oil shale, which is linked to international oil prices. Additionally, there is difficulty in securing the necessary financing for oil shale retorting projects. Furthermore, there are technical and operational difficulties associated with the technologies, primarily due to their reliance on the quality of the crude.

Concerning projects involving the direct combustion of oil shale to generate electricity, the most significant challenge is the high cost of electricity produced from these projects.

Electricity Sector

Over the past decades, the electric power sector in Jordan has been characterized by the stability of its technical performance. The Jordanian electrical system is regarded as one of the best in the region, operating within the highest technical standards. However, in recent years, the sector has faced significant financial challenges, with the most noteworthy being the financial strain on the National Electric Power Company (NEPCO). This strain resulted from accumulating debt exceeding 5 billion JOD, primarily due to the Egyptian gas cutoff between 2011-2015. During this period, alternative fuels were used in response to a substantial increase in oil prices, with an aim to avoid passing on costs to consumers.

Additionally, a recent decrease in the demand for electric power, attributed to the introduction of renewable energy projects owned by end consumers, the widespread adoption of energy-saving devices, and a slowdown in economic growth, has led to a deceleration in the anticipated growth of electrical loads. The surge in fuel prices has resulted in increased electricity tariffs, particularly affecting productive sectors. This escalation has prompted major consumers to transition away from the grid and adopt renewable energy sources, causing a substantial decline in electricity tariff revenues.

The significant rise in the contribution of renewable energy projects to the electric energy mix within a relatively short time has posed numerous technical and financial challenges. Chief among them is the difficulty in operating the electrical system according to the optimal economic and technical model, leading to the depletion of available capacities in the transmission and distribution networks. Furthermore, there is a challenge of high electrical losses in the electricity distribution networks, with non-technical losses constituting a significant proportion.

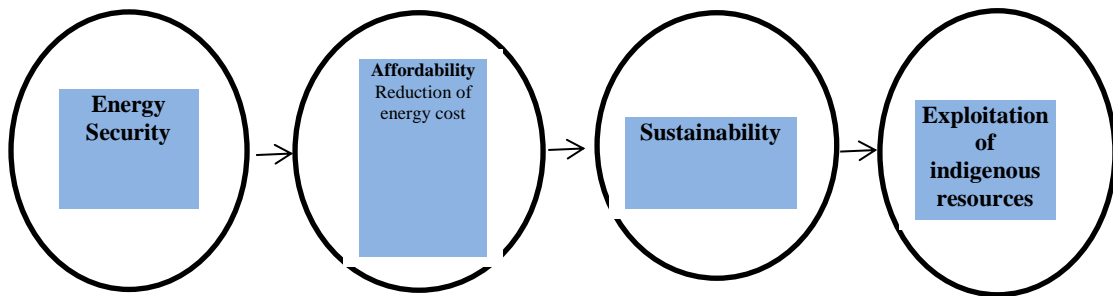
In Energy Efficiency

The lack of adequate awareness among consumers regarding available measures to enhance energy efficiency utilization and its impact on users is one of the most significant challenges in this domain. Despite the provision of numerous incentives for various sectors to implement measures aimed at improving energy efficiency, the demand for such projects still falls below desired levels. Additionally, there is a lack of a comprehensive, integrated planning approach across all sectors to enhance energy

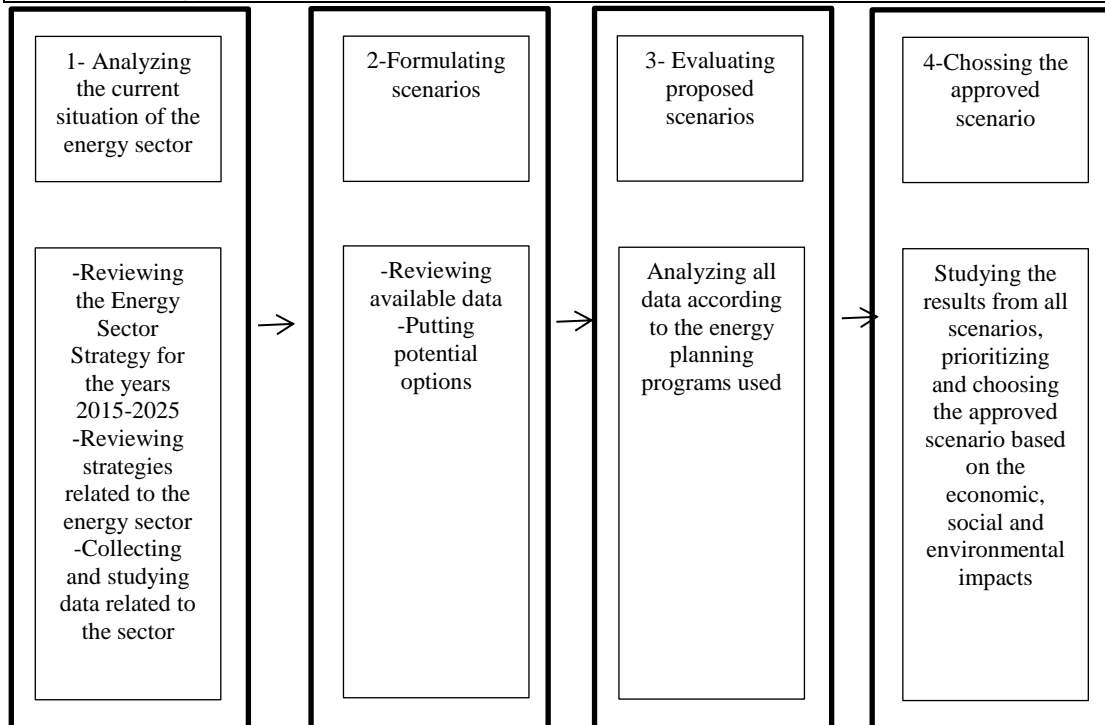
efficiency utilization. This is evident in the absence of public transport means at the required level to encourage citizens to use them instead of individual modes of transport. Moreover, there are considerable losses in water transmission and distribution networks, accounting for approximately 15% of the total electric power consumed in the Kingdom.

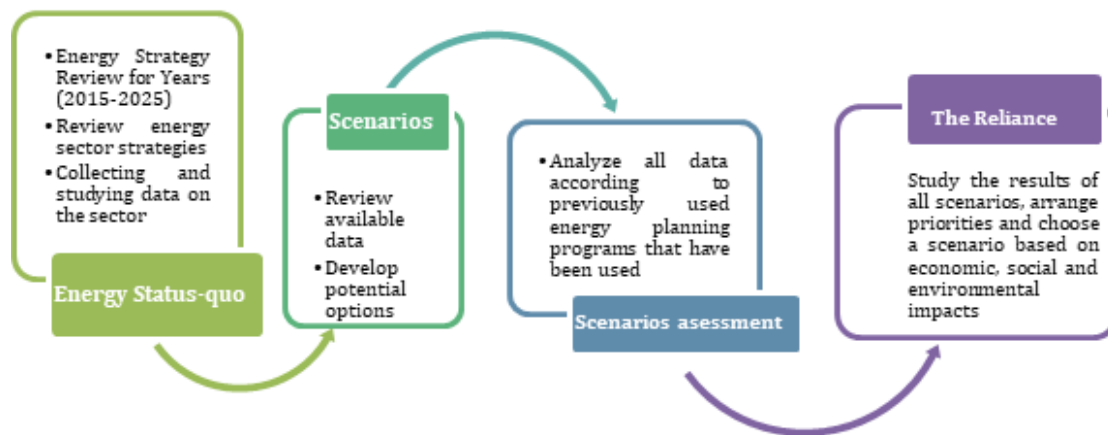
The Strategy's Main Pillars

To face these challenges and foresee the future, the Comprehensive Strategy of the Energy Sector adopted the following themes:



Methodology





PESTEL Analysis

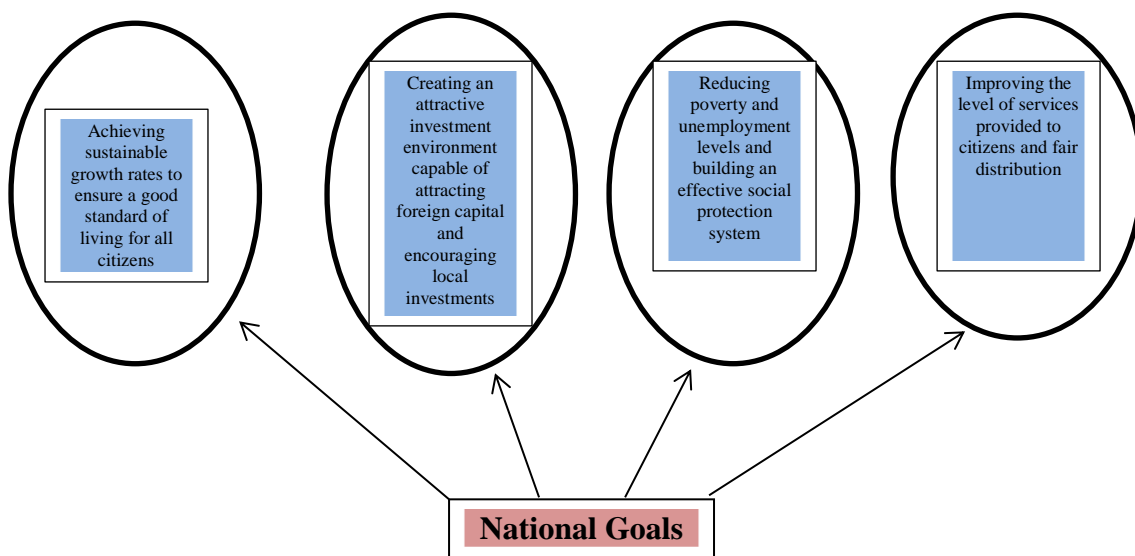
Opportunities	Threats
First: Political changes	
Reform, openness and political stability in Jordan	Political instability in the region
Jordan's good relations with neighboring countries	The need for long-term agreements with neighboring countries to ensure continued energy supplies
	Oil prices are affected by political stability in the region
Second: Economical changes	
Increase partnership with the private sector	Decline in economic growth
Availability of grants and aid	Increased national deficit and debt
	The need for a balanced budget for National Electric Power Company to maintain low electricity tariffs
	The inter-relationship between energy cost and economic growth, which requires lowering energy prices, in order to enhance economic growth
Third: Social changes	
Availability of competencies in various disciplines	Increasing the population at high rates
Young people make up the majority of the population which makes it possible to boost energy efficiency and protect the environment	The influx of Syrian refugees
	The majority of families have low incomes and are more vulnerable to rising energy prices
Fourth: Technological changes	
Increasing the trend towards renewable energy projects (RES)	
Technological development in energy technologies (renewable energy, storage)	

Fifth: Environmental changes	
Effectiveness of environmental laws and compliance with international agreements	The need to use water desalination plants
	The performance of PV panels is reduced due to dust storms even if the solar radiation is excellent
	The sulfur content of benzene and diesel products of Jordan Petroleum Refinery exceeds international standards
Sixth: Legislation and Laws	
The existence of laws aiming at activating partnership with the private sector Updating the legislation related to the sector	

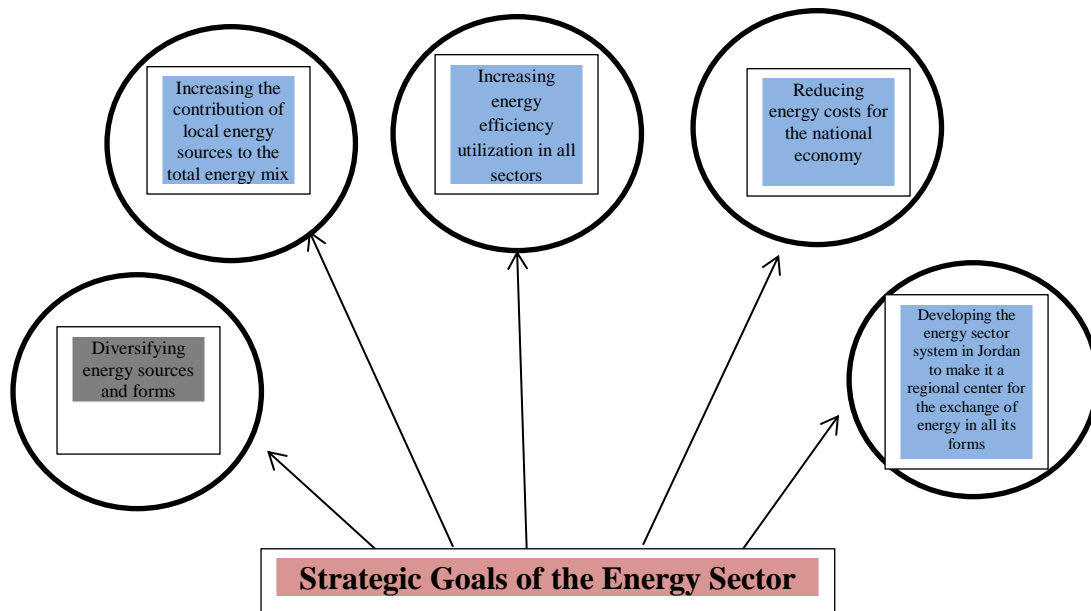
Vision and Strategic Goals

Vision: Achieving sustainable energy security of supply and optimum utilization of natural resources

In order to address the changes within the external environment that have been studied, along with the challenges related to energy import reliance, high annual costs of importing energy, and the elevated intensity of energy consumption, the national goals that the Ministry of Energy and Mineral Resources (MEMR) contributes to achieving were identified. These goals are based on the Jordan Vision 2025 document and align with MEMR's objectives within the priorities of the government's work plan, "In the footsteps of the Renaissance," for the two years (2019-2020). This plan revolves around three themes: the state of law, the state of production, and the state of solidarity. The goals are outlined as follows::

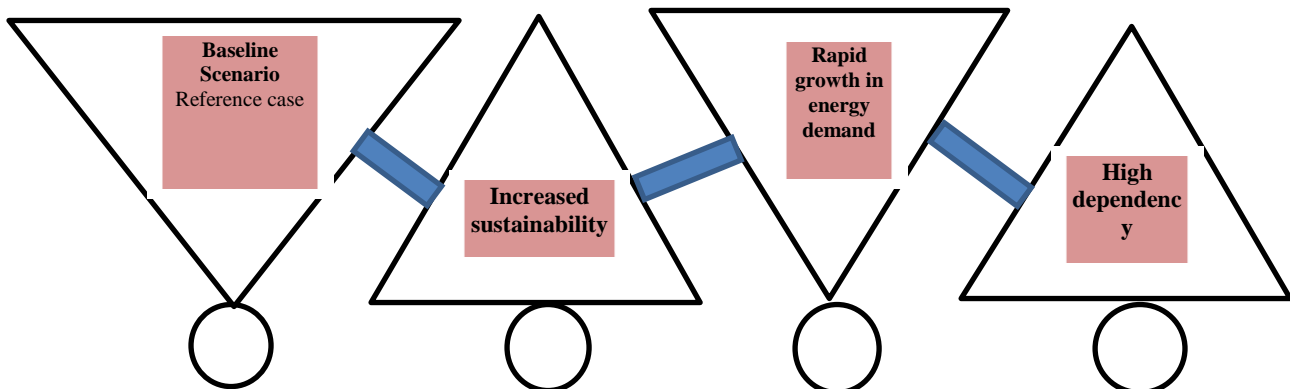


To contribute to achieving the national goals, the strategic goals for the energy sector were identified as follows:



Formulating Scenarios and Studying Alternatives

With the aim of working towards achieving the strategic goals of the energy sector and addressing challenges, four scenarios for energy demand have been studied. This approach is designed to attain more accurate results and recommendations by simulating reality through the utilization of specialized programs. The scenarios are as follows:



The first scenario is the baseline scenario, which represents continued energy demand according to the current situation: In this scenario, the analysis incorporates current trends in energy demand, considering all projects and contracts that the government has committed to.

The second scenario: Increased sustainability

According to this scenario, the analysis incorporates the commitments and obligations outlined in the National Energy Efficiency Action Plan (NEEAP). It takes into account

a higher participation of energy efficiency and renewable energy technologies, including storage. This scenario also considers the guidelines outlined in Jordan's Fourth National Communication on Climate Change.

The third scenario: rapid growth in energy demand

In this scenario, the analysis involves assuming an ambitious GDP growth. Accordingly, a revised scenario for the baseline scenario was formulated and analyzed.

Fourth scenario: high Dependency' scenario

In this scenario, the analysis incorporates a focus on increasing reliance on local sources of energy, reducing greenhouse gas emissions, and enhancing energy efficiency to achieve the highest possible percentage. This scenario takes into account the energy sector's obligations towards the contracts and agreements concluded.

**The Approved Scenario for the Energy Sector Strategy
for the Years 2020-2030**

Scenario of increased high independency

The results of all scenarios were studied, and priorities were arranged to choose the approved scenario based on economic, social, and environmental impacts. Consequently, it was determined that the "High Independency" scenario is the most suitable, aligning with the goals of the strategy. This scenario aims to diversify energy sources and forms, increase the contribution of local energy sources in the overall energy mix, and enhance energy efficiency utilization across all sectors. Additionally, it considers reducing energy costs on the national economy while developing the energy sector system in Jordan to position it as a regional center for the exchange of energy in all its forms.

The approved scenario includes the following:

Assumptions of the high independency scenario

The main assumptions for the constitution of the Minimum Dependency scenario are related to the following parameters:

- 1- Adoption of growth in GDP according to the current situation.
- 2- Contracted renewable energy projects.
- 3- Improvement of energy efficiency by (9%) by 2030, as the base year is 2018.
- 4- Improvement of energy efficiency in the water sector by (15%) until 2025, as the base year is 2018.
- 5- Implementation of the fourth expansion project of the Jordan Petroleum Refinery.

- 6- Quantities of shale oil to be produced from oil shale retorting projects.
- 7- Increasing Risha field production.
- 8- Technical specifications and requirements for operating the electrical system in accordance with the plans and obligations of National Electric Power Company.
- 9- Increasing the transportation sector's reliance on compressed gas and the use of electric transport vehicles.

Primary energy demand forecast for the high dependency scenario

Table (1)
Primary energy demand forecast for the period (2020-2030)

Year	Primary energy demand (for gross domestic consumption) thousand tons oil equivalent
2020	10.039
2021	10.267
2022	10.420
2023	10.595
2024	10.668
2025	10.967
2030	11.760

Figure (1)
Percentage of fuel contribution in the Total Energy Mix for (2020- 2030)

2020	2030
Renewable energy 11%	Renewable energy 14%
Coal 2%	Coal 2%
Natural gas 21%	Natural gas 25%
-Risha gas	-Risha gas
-LNG	-LNG
-Gas by pipeline	-Gas by pipeline
Oil shale 8%	Oil shale 8%
Crude oil and byproducts 58%	Crude oil and byproducts 51%

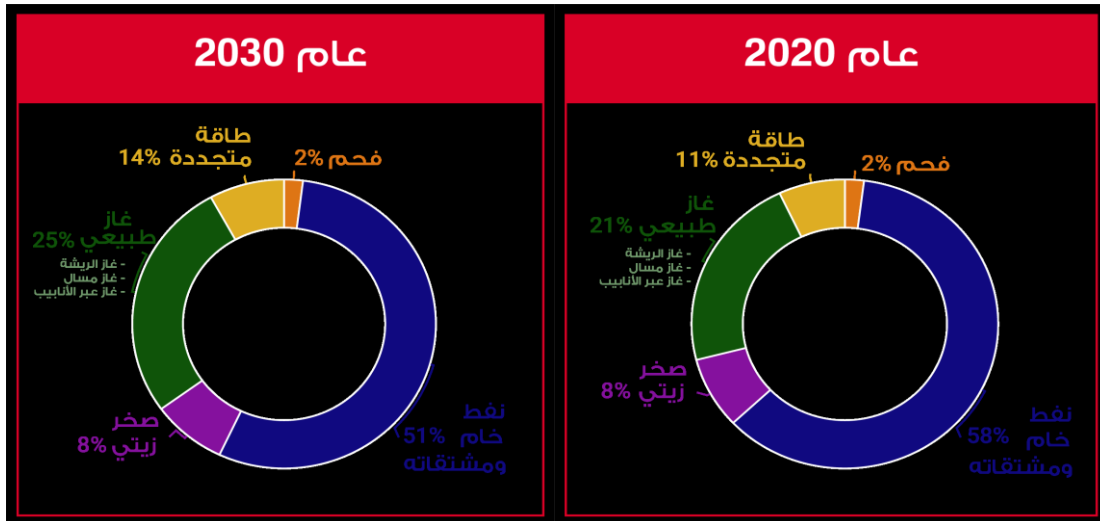


Figure (2)
Percentage of fuel contribution in the Total Energy Mix for (2020- 2030)

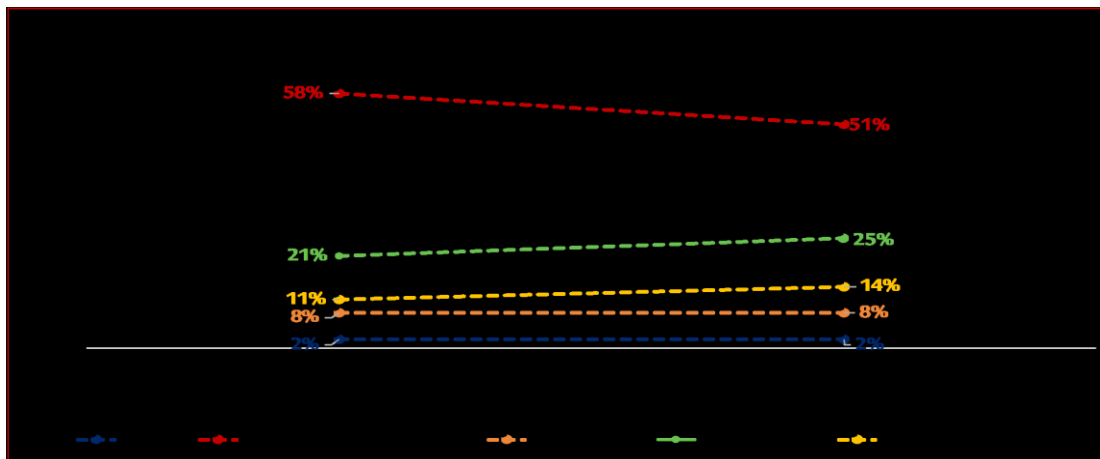


Table (2)
Electricity Demand Forecast for the period (2020-2030)

Year	Electrical power demand GWh
2020	17.672
2021	17.831
2022	17.860
2023	17.950
2024	17.958
2025	18.686
2030	19.701

Figure (3)
Percentage of Fuel Contribution in electricity generation for (2020 – 2030)

2020	2030
Renewable energy 21% 2.400 MW	Renewable energy 31% 3.200 MW
Natural gas 61% -Risha gas -LNG -Gas by pipeline	Natural gas 53% -Risha gas -LNG -Gas by pipeline
Oil byproducts 3%	Oil byproducts 1%
Oil shale 15%	Oil shale 15%

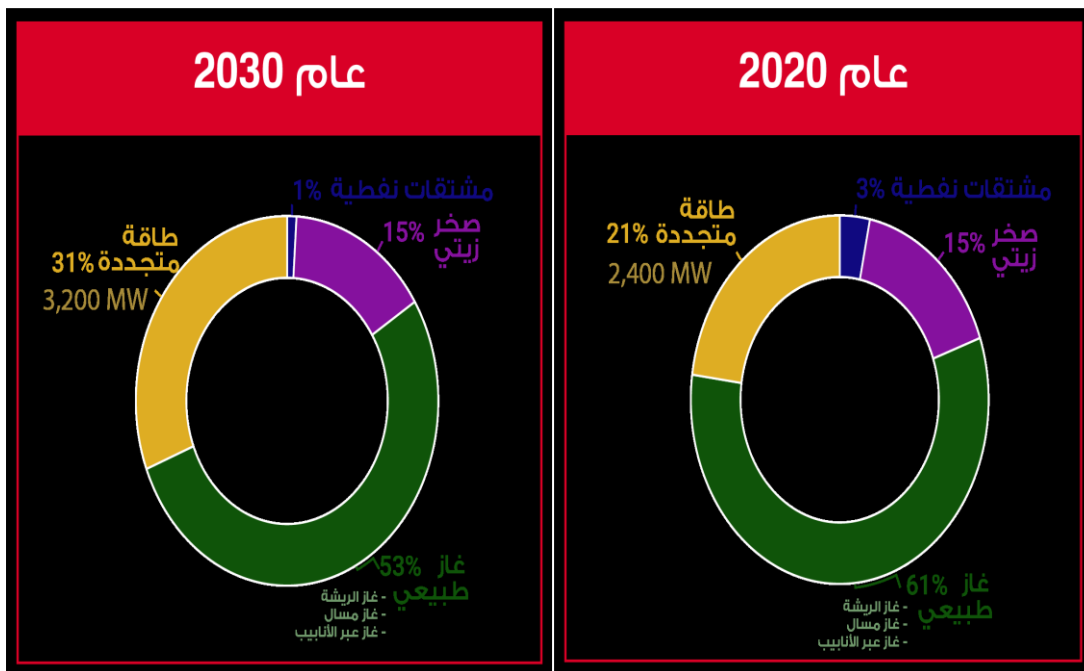
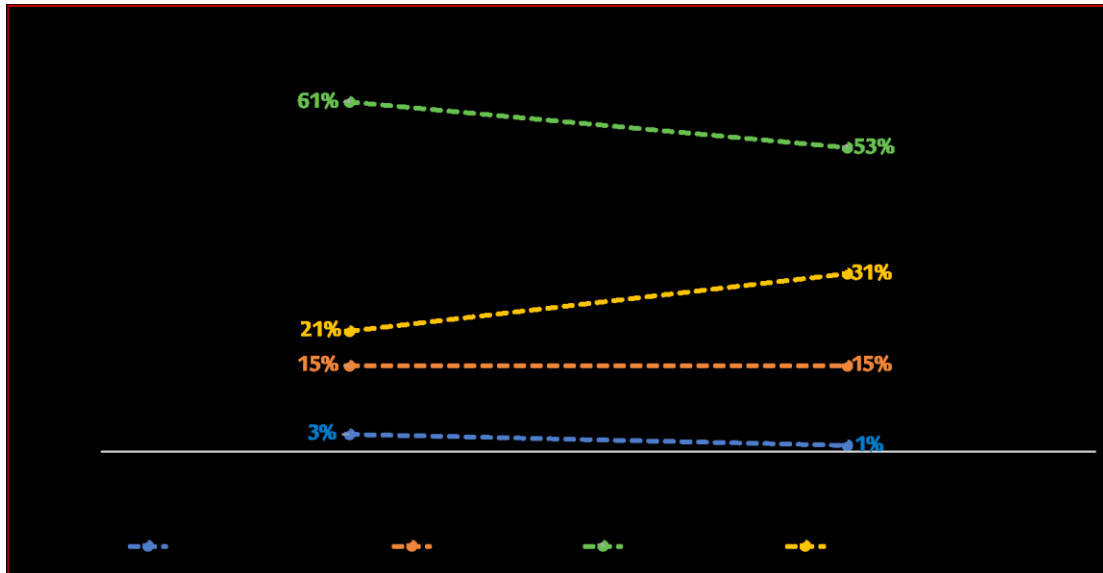


Figure (4)
Percentage of Fuel Contribution in electricity generation for (2020 – 2030)



Findings and Recommendations

Scenario of increased high independency

Based on the above, the comprehensive strategy for the energy sector concluded the following findings and recommendations:

In Electric Power Sector

- 1- Diversify electric power generation sources**
 - 1-1 Continue to generate electric power in the Kingdom, depending on natural gas, renewable energy, and committed projects.
 - 1-2 Continue to work on increasing the participation of renewable energy projects in covering the Kingdom's needs of electric power, to increase from (2.400) MW in 2020 to (3.200) MW in 2030.
- 2- Enhance electrical system safety and increase system availability and reliability**
 - 2-1 Conduct the necessary expansions of the electrical system, including adding generating units, strengthening transmission and distribution networks according to the system's needs and achieving technical requirements in accordance with international best practices.
 - 2-2 Continue to work on strengthening existing interconnection projects and creating new interconnection projects.
 - 2-3 Work on introducing storage projects into the electrical system (batteries, water dams) to avoid disconnecting the energy generated from renewable energy projects and to maintain grid stability.
 - 2-4 Reduce the losses in the electrical system to keep with international practices.
 - 2-5 Gradual transformation to smart network systems and smart meters, so as to complete the transformation process before the end of 2022.
 - 2-6 Encourage expansion of electric vehicles utilization in transportation.
 - 2-7 Promote integration between the energy and water sectors to cover the water sector's needs of electric power according to the best alternatives and establish joint projects between the two sectors.

3- Sustain the financial position of the electricity sector

- 3-1 Switch from a single buyer model to a competitive structured system for the sector with the aim of improving services provided to citizens.
- 3-2 Implement a roadmap for the financial sustainability of the electricity sector, with the aim of seeking to reduce electricity costs and reflect them on the consumer.

In Oil Sector

1- Diversify sources of crude oil

- 1-1 Diversify sources of importing crude oil through the port of Aqaba, land transportation, and the Iraqi crude oil pipeline.
- 1-2 Work to develop production in Hamza oil field.
- 1-3 Attract international companies to invest in oil exploration in the open areas for exploration.
- 1-4 Attract international companies to invest in oil shale exploration and retorting in the open areas for exploration.
- 1-5 Construct and extend pipelines for crude oil and oil byproducts.

2- Improve the performance of the oil byproducts sector

- 2-1 Continue to open the market for oil byproducts.
- 2-2 Adopt international standards for oil byproducts in line with the Jordanian market needs.
- 2-3 Open the door to the refining activity, provided that this investment is based on market principles.
- 4-2 Enhance Jordan's role in providing logistics to transport oil and oil byproducts to and from neighboring countries.
- 5-2 Increase storage capacities for oil byproducts to comply with international standards and improve local logistics.
- 5-6 Switch from a regulated market to an open market through liberalizing oil byproducts prices.

In Natural Gas Sector

1- Diversify natural gas sources

- 1-1 Cover the Kingdom's needs of natural gas from the currently available sources that cover the Kingdom's needs until 2030.
- 1-2 Work on developing the production in Risha gas field.
- 1-3 Attract international companies to invest in conventional and unconventional gas exploration in open areas for exploration.
- 1-4 Maintain the option of importing LNG via Sheikh Sabah Port in Aqaba to ensure the security of the energy supply, provided that possible alternatives to replace the FSRU with other less expensive alternatives are evaluated.

2- Use of natural gas in various sectors

- 2-1 Support and encourage the use of natural gas and compressed natural gas in the industrial and transportation sector to replace oil byproducts with the aim of reducing emissions.
- 2-2 Establish natural gas distribution networks in major cities.

In Improving Energy Efficiency Consumption

1- Improve energy efficiency utilization in various sectors by (9%) of the average consumption in 2018 by 2030

- 1-1 Update and follow up on national legislation and plans in energy efficiency.
- 1-2 Implement programs to improve energy efficiency in the water sector by 15% by 2025.
- 1-3 Continue work on improving transportation and establishing express bus networks for transportation purposes and establishing a railway network.
- 1-4 Improve energy efficiency in the domestic sector, the industrial sector, the government sector, and the commercial and service sector.

Figure (5)

How the energy strategy contributes to the reduction of electric power production prices

How the energy strategy contributes to the reduction of electric power production prices					
Action		Result	Action		Result
1	-Retirement and non-renewal of electricity generating units whose contracts have expired -Promote and establish electrical interconnection projects -Reduce LNG infrastructure costs -Review electric power generation agreements (PPAs)	-Reduce fixed costs for the electrical system (capacity charge tariff) - Increase network stability and reduce operational costs	2	Gradual transformation to smart network systems and smart meters	-Reduce losses in the electrical system -Reduce the costs of supplying electric power to consumers -Apply time-based tariffs, which enables citizens to reduce their consumption costs
Action		Result	Action		Result
3	-Develop production from Risha gas field -Diversify gas sources to generate electricity	Reduce fuel costs used for electricity generation	4	Implement the financial sustainability plan for the electricity sector	Ensure the financial sustainability of the electric power sector

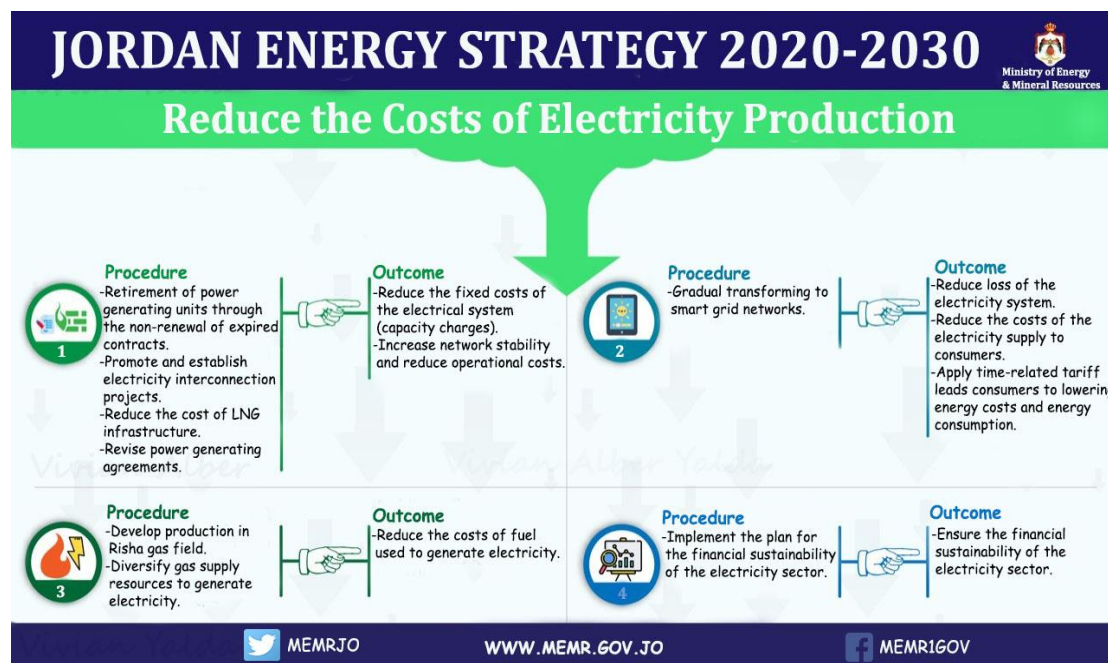
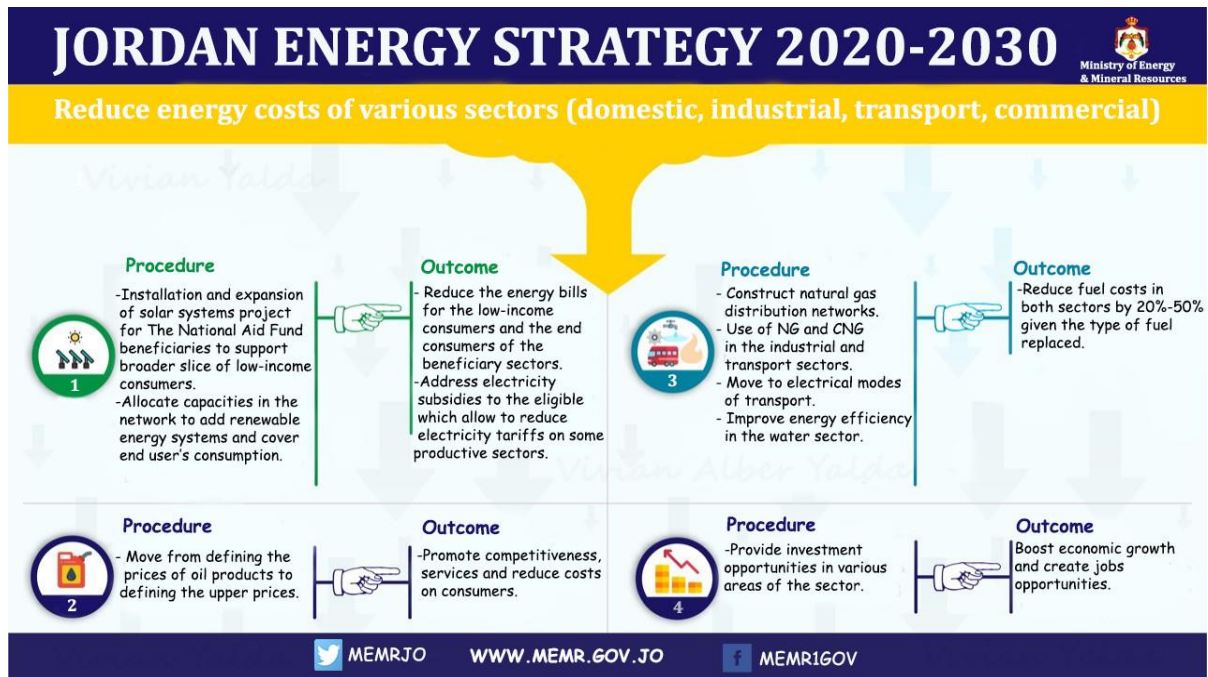


Figure (6)
How does the energy strategy contribute to reducing energy costs for different sectors (domestic, industrial, transport, and commercial)

How does the energy strategy contribute to reducing energy costs for different sectors (domestic, industrial, transport, and commercial)					
Action		Result	Action		Result
1	-Install solar energy systems for the beneficiaries of the National Aid Fund and expand the project to include a wider segment of low-income people -Allocate capacities on the grid to add renewable energy systems to cover the consumption of the end user (final) consumers	-Reduce the electricity bill for low-income people and the final consumer of the beneficiary sectors -Direct electricity subsidies to those who deserve it, allowing tariff reductions on some productive sectors	3	-Establish natural gas distribution networks -Use natural gas and compressed natural gas in the industrial and transportation sector -Switch to electric transportation -Improve energy efficiency in the water sector	-Reduce fuel costs on these sectors by (20% - 50%) according to the type of fuel replaced
Action		Result	Action		Result
2	-Move from setting prices for oil byproducts to setting an upper limit for the price	Enhance competitiveness, improve services, and	4	Provide investment opportunities in various fields of the sector	Promote economic growth and provide a number of

		reduce costs for citizens			job opportunities
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Appendix (1)

Performance Indicators of the Energy Sector

Performance indicators of the energy sector by the end of 2018

Item	Unit	Amount
Energy Intensity	kgoe/ k dollars at fixed prices	235
Per capita energy consumption	kgoe	942
Per capita electricity consumption	kWh	1701
Production of electric power	GWh	19755
Electric power consumption	GWh	17532
Proportion of population supplied with electricity	%	99
Domestic energy production (crude oil and natural gas)	Thousand toe	79
Imported energy	Thousand toe	9121
Primary energy consumed	Thousand toe	9712
The cost of energy consumed	Million dinars	3010
Cost of consumed energy attributed to:		
Exports	%	64.5
Imports	%	21
Gross domestic product	%	10

Domestic production from crude oil and natural gas during the period (2014-2018)

Year	Oil production (thousands tons)	Gas production (billion cubic feet)	Contribution of domestic production of energy to total overall energy consumed (%)
2014	0.8	4.6	3.0
2015	0.5	4.3	3.0
2016	0.4	4.1	5.0
2017	0.3	3.6	6.0
2018	1.0	3.3	8.0

Imports of crude oil, oil byproducts and coal during the period (2014-2018) thousands tons

Year	Crude oil	Fuel oil	Gas	Diesel	Benzene	Fuel	Petroleum Coke	Coal	Total
2014	3221	1255	282	2373	552	51	474	130	8338
2015	3513	848	335	1121	670	34	230	204	6955
2016	2978	0	327	967	832	64	327	210	5705
2017	2795	0	368	1029	923	125	255	170	5665
2018	2366	0	357	1145	964	67	292	105	5296

Primary energy consumption during the period (2014-2018) thousand toe

Year	Type of primary energy						Total
	Crude oil	Petroleum Coke	Coal	Natural gas	Renewable energy	Imported electricity	

2014	7479	332	88	301	152	109	8461
2015	6331	161	165	1944	160	183	8944
2016	5327	220	182	3389	412	84	9614
2017	5671	165	148	3510	515	13	10009
2018	5242	205	92	3438	711	47	9712

Percentages of the sectorial distribution of final energy during the period (2014-2018)

Year	Sector				Total
	Transport%	Industrial%	Domestic%	Other%#	
2014	46	20	21	13	100
2015	48	17	22	13	100
2016	48	16	20	16	100
2017	49	14	23	14	100
2018	49	14	21.5	15.5	100

#Includes the commercial, service, agricultural and street lighting sector

Development of oil byproducts consumption during the period (2014-2018) thousand tons

Oil byproducts Year	LNG	Benzene	Avgas	Gasoline	Diesel	Fuel oil	Asphalt + other	Total
2014	371	1187	339	49	3274	2041	159	7420
2015	416	1319	321	91	2235	1705	185	6272
2016	433	1446	355	108	1726	606	238	4912
2017	431	1431	396	88	1859	505	226	4936
2018	429	1410	412	69	1672	515**	168	4675
Growth percentage (%)	(0.5)	(1.5)	4	(22)	(10)	2	(25)	(5)

*Quotation marks mean the mark is negative

**Includes quantities of exported fuel oil

Development of electric power production and peak load during the period (2014-2018)

Year	Peak load MW	Growth percentage %	Electric power production GWh	Growth percentage %
2014	3020	2.5-	18704	8.4
2015	3300	9	18911	1
2016	3250	1-	19390	2.5

2017	3320	2	20760	7
2018	3205	3.5-	19755	1.5-

Sectorial distribution of electric power consumption and growth percentage during the period (2014-2018) GWh

Sector Year	Domestic	Industrial	Commercial	Water pumping	Street lighting	Total	Growth percentage %
2014	6580	3877	2358	2287	316	15418	5.9
2015	6938	4013	2460	2426	336	16173	5
2016	7448	3939	2447	2485	350	16669	3
2017	7879	3910	2510	2683	403	17504	5
2018	8038	3877	2508	2706	404	17532	0.2

Percentage of sectorial consumption of electric power during the period (2014-2018)

Sector Year	Domestic %	Industrial %	Commercial %	Water pumping %	Street lighting %	Total %
2014	43	25	15	15	2	100
2015	43	25	15	15	2	100
2016	45	23	15	15	2	100
2017	46	22	15	15	2	100
2018	45.5	22.5	14	16	2	100

**Executive Work Plan of the Comprehensive Strategy
for the Energy Sector**

Ministry of Energy and Mineral Resources

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