Second Pillar: Energy

Overview of Current Situation

The energy sector is mainly responsible for providing for the energy needs for all economic sectors as well as families, in addition to increasing the sector's contribution to GDP. In order to achieve sustainable development, the energy sector has to take into account national and global environmental considerations and standards, besides reaching the 7th goal of SDGs, "affordable and clean energy."

The energy sector in Egypt is mainly dependent on fossil fuels (oil and natural gas), particularly natural gas due to the expansion of explorations for new gas fields in the Western Desert and offshore, as well as relatively stagnant oil production. Egypt's oil and natural gas production rates have decreased in the last few years due to the general political and economic unrest, also because of the unsigned concession and exchange agreements during the years 2010-2012. As for electricity, most is produced via thermal power plants, whose main operational capacity depends on steam turbines. One-third of the production facilities have been in service for more than 20 years.[1] The energy sector contributes nearly 20% to GDP, especially through direct foreign investment. Notwithstanding that, it's been noticeable lately that there has been decreasing investment during the period from 2009-2013 by 6% especially in the exploration and development fields.[2]

Energy subsidization represents a burden on the Egyptian economy. The state general budget for the fiscal year 2012-2013 included subsidies of LE 120 billion for petroleum products, whereas it reached LE 126.2 billion for the fiscal year 2013-2014; however, due to the government's approach towards phasing out subsidies in the 2014-2015 budget, it was reduced to LE 100.3 billion.[3]

Egypt is earnestly trying to increase energy production: 36 new concession agreements were signed during the fiscal year 2013-2014 in addition to 20 other agreements currently being drafted.[4] Also, the state is seeking new variations in its energy mix through relying on renewable energy sources, especially wind and solar power. Egypt exploits almost all of its hydroelectric energy and nearly 5% of Egypt's electricity generation depends on it.[5]

The Egyptian government has launched several initiatives to reform the energy sector institutionally and legislatively to encourage the private sector's participation, especially for building wind and solar power farms, in addition to encouraging technological solutions and applications for rationalizing energy consumption and optimizing exploitation of available energy

1 Egypt Economic Recovery Plan, unpublished report

2 Ibid

3 Ministry of Finance, the financial monthly report, September 2015

4 Egypt Economic Recovery Plan, unpublished report, and the American Chamber of Commerce's report on energy in Egypt, 2015.

5 Ibid

resources and reducing the west. And in its quest for variation of the energy mix, the government approved the use of coal in electricity generation or as an alternative fuel for some industries since 2014 and encouraged applying sustainable and environmentally friendly technologies. As the State continues its efforts to expand the use of nuclear energy, it has started building Al Dabaa nuclear power plant project. For the short-term, the State's initiatives will concentrate on supporting the production of oil and gas alongside with the reform of the subsidization system.

Strategic Vision for Energy to 2030

An energy sector meeting national sustainable development requirements and maximizing the efficient use of various traditional and renewable resources contributing to economic growth, competitiveness, achieving social justice, and preserving the environment. A renewable energy and efficient resource management leader, and an innovative sector capable of forecasting and adapting to local, regional, and international developments and complying with SDGs.

Strategic Objectives for Energy to 2030

Energy strategic objectives to 2030 include:

Objective	Definition
Ensuring energy security	Providing the required energy while maintaining the aspired growth rates
Increasing the contribution of energy sector to the GDP	Increasing the share of energy sector to the GDP
Maximizing utilization of domestic energy resources	Increasing the energy production of local resources and maximizing its reliability
Enhancing rational and sustainable management of the sector	Working on the energy mix to reach international levels
Reducing the intensity of energy consumption	Reducing energy consumption rate for all sectors
Limiting the environmental impact of the sector's emissions	Reducing the levels of sector's emissions and pollutants

The first strategic objective aims to provide energy supplies required to fulfill the needs of the productive and household sectors in a sustainable manner. This objective includes providing the

required infrastructure for importing and transferring energy to fulfill all needs of productivity, household, or other needs. In order to achieve that, the optimum energy mix should be identified as a cost and as an energy production rate. It also includes the role of stakeholders in developing the reliability of renewable energy resources and increasing the efficiency of energy use in order to achieve energy security.

The second objective of the economic aspect of the energy sector including the energy contribution to GDP through export of petroleum or electricity products, or by providing sustainable technologies for the renewable energy fields and selling it to other countries such as smart meters and solar energy generation products. Also to provide the energy needs to economic sectors and household sector.

The third objective aims to maximize the use of local energy resources through increasing the efficiency of production plants and sustainable rational management of the sector's institutions. For example, increasing the efficiency of electricity production plants either administratively, economically, or technologically and reduction of losses in transfer and distribution. As for the petroleum sector, the sustainable technologies needed would be provided to achieving maximum efficiency of exploration in addition to enhancement of supply networks for petroleum products such as gas and oil.

The fourth objective focuses on enhancing rational and sustainable management of the energy sector to reach international levels of the energy mix.

The fifth objective aims to reduce the intensity of energy consumption by rationalization of energy consumption rates for all sectors.

The sixth objective aims to limit the environmental impact of the energy sector's emissions by providing the needed sustainable technology and applying legislative regulations to guarantee citizens' safety against these various emissions caused by production, transfer, or usage. It is worth mentioning that this objective concerns enhancing the efficiency of the current energy production plant and limiting global warming gases.

Key Performance Indicators for Energy to 2030

Quantitative Indicators

S.N.	Indicator Category	Indicator	Definition	Current Status	2020 Target	2030 Target
1		Ratio of primary energy supply to the total planned energy consumption (%)	Measures the State's ability to meet its energy needs by comparing the primary supply of energy (domestic production and imports) with expected energy consumption. It will be measured quarterly in order to meet any significant increases in demand	*	100%	100%
2	Strategic results	Average duration of outages	Measures the degree of electricity provision, taking into account the access degree to the consumer	*	0	0
3		Percentage change in energy intensity	Reflects trends in the ratio of total energy use to the GDP	The intensity value of the base year (2010): 0.65 (1)	-1.3%	-14%
4		Contribution of energy sector to GDP %	Measures the contribution of the energy sector to the GDP	13.1% (7))	20%	25%
5	Outputs	Percentage decline in greenhouse gas emissions from the energy sector	Measures the total greenhouse gas emissions produced during the production, transfer, and use of energy	*	-5%*	-10%*
6		Crude oil reserves (years)	Shows the future ability to meet the needs of domestic crude oil production	15(2)	15	15
7		Natural gas reserves (years)	Shows the future ability to meet the needs of domestic natural gas production	33 years(2)	33 years	33 years
8		Efficiency of electricity production	Measures the thermal efficiency for electricity production by comparing the total input with the total input	41.3%(3)	*	*

9		Efficiency of electricity transmission and distribution	Measures the efficiency of electricity systems by calculating the total losses during the transmission and distribution process	15%(4)	12%	8%*
10		Percentage of residential, commercial, and industrial buildings connected to electricity	Measures the progress achieved regarding the connection to electricity service for all kind of building units	99(5)	100%	100%
11		Percentage of primary fuel mix	Shows the optimal fuel mix of all primary resources.	Gas: 53% Oil: 41% Renewable: 1% Coal: 2% Hydro-electric: 3%(1)	*	*
12		Percentage of fuel mix for electricity production	Shows optimal mix of various resources used to produce electricity, including both fossil fuels and renewables	Oil and Gas: 91% Hydro-electricity: 8% Solar and Wind: 1% (4)	*	Oil and Gas: 27% Hydro-electricity: 5% Solar: 16% Wind: 14% Coal: 29% Nuclear: 9%
13		Value of fuel subsidy	Measures the value of fuel products, which are planned to be redistributed	LE 126.2 billion in 2013-2014(6)	0	0

[1] Egypt, Economic Recovery Plan, unpublished report

2 BP Statistical Review, 2014

3 Electricity Regulation Authority and Consumer Protection report, the Holding Company of Electricity, 2013

4 Ministry of Electricity and Renewable Energy

5 Central Agency for Public Mobilization and Statistics, statistical yearbook, 2014

6 Ministry of Finance, the financial monthly report, September 2015

7 Ministry of Planning, Monitoring, and Administrative Reform (GDP data in 2013/2014)

Suggested New Indicators

Indicator Category	Indicator	Reason	Measurement Mechanism
Outputs	Efficiency of transportation and distribution of petroleum products	Reflects the efficiency of delivery systems for petroleum products to different consumers	Will be measured by an equation that includes the demand, supply (includes local production and imports), and inventory of various petroleum products, whereas consumption will be measured via new smart cards introduced by the government

Challenges of Energy

The energy sector faces three groups of challenges:

The first group of challenges is high impact and relative ease of control:

- **Legislative and monitoring trends affecting feasibility of the decision making process.** This challenge leads to stalling business activities and increases bureaucracy due to fear of legal responsibility in case of worker problems; hence there is a need to create balance between disciplinary actions according to the type of violation to be deterrent to officials who waste the country's national resources and play around the nation's future and hold everyone who cause delays to the work's achievement to be accountable for his deeds.

- **Lack of investors' trust in the government's ability to commit to financial responsibilities** due to the public debt accumulation and the delay of financial payments due. These causes leads to reduce the investments in various levels of the value chain.

- **State monopolization of importing or exporting petroleum products**. There is an urgent need to liberalize energy markets by preparing legislation to encourage the private sector to participate in import and export of petroleum products and participate in achieving energy security.

- **The absence of a specific agency responsible for the preparation and implementation the sector's strategy.** The absence of an integrated and sustainable plan for energy production leads to multiple losses in various sectors and the inability to anticipate the recurring challenges in the various stages of the value chain, production, and trade. In addition to the need for a futuristic vision for the energy sector in order to raise production efficiency and achieve the desired development rates.

- **Lack of required accurate data and information.** Data and statistics for the energy sector are the main determinant of the level of progress achieved in various objectives and indicators. Availability of required data must be ensured to decision-makers.

The second group of challenges, which is of relatively low impact and less ability to control, includes:

- **Lack of integrated subsidy management plan.** A unified plan should be prepared for the energy sector through coordination between the electricity and oil sectors, and to be integrated with Egypt's unified subsidy plan.

- **Absence of clear identification of energy subsidy beneficiaries,** which causes uneven distribution of subsidies and forms a significant financial burden on the State's general budget while not delivering support to those who deserve it.

- **Absence of a unified utility for energy regulation.** This challenge causes conflicts of interest between the electricity and petroleum sectors. In addition, there isn't a specific authority responsible to prepare an integrated and sustainable plan for energy and to protect consumers and investors.

- **Unfair competition between the private and public sectors.** There is conflict of interest due to the role of the State as regulator and investor and the government participation in various value chain levels, as the government plays the role of the regulator, investor, and operator at the same time and thus the energy sector needs liberalization.

- **Weakness of attraction factors for working in the energy sector**, which reflect on migration of skilled manpower abroad, which raises costs and results in lack of investment and low productivity.

- **Limitation of sector's ability to manage renewable energy operations.** This challenge may lead to a reduction of renewable energy capacity to achieve the objective of new energy mix ratios, especially with non-developed technology. Also, this challenge includes the capability of control center and storage capacity management, as energy storage is a main element that needs to be addressed.

- **Development of institutional management for the energy sector.** Inefficient management leads to breakdowns and interruptions that cause negative impact on productivity of electricity plants. This challenge consists of several issues, e.g.: economic management of plants and the absence of an electronic management system for plants and storage.

- **Insufficient expenditure on research and development and the limitation of research systems' effectiveness.** This challenge leads to the slow pace of efficiency in improving technology in exploration and using available solutions and to import foreign technology.

- **Inadequate infrastructure to import gas and petroleum products.** The State's plan needs strong infrastructure to import gas and petroleum products, including gas grid lines, extended oil pipelines, in addition to building re-gasification of liquefied natural gas processing facilities.

- **Poor infrastructure for deep water exploration.** Exploration infrastructure needs renewal and development, as the current infrastructure represents poor design and non-developed technology lagging behind modern technology, and it is needed for foreign investment and foreign experts to carry on seismic surveys and other technical work.

- **Bureaucratic procedures of commitment and mutual benefit agreements** that lead to weak participation of investors in the discussions of commitment agreements, mutual benefits, and modifications of current agreements.

- **Environmental impacts of energy production facilities.** Current legislation doesn't include control procedures to reduce emissions of various pollutants from companies or electricity production plants, as well as the use of coal as an alternative fuel for energy plants in the production of environmental problems. For that a treatment technology should be implemented and the control system for environmental performance.

- **Limitation of domestic refining capability.** The current refining capacity doesn't provide for local needs as many of the refineries are not well developed and this leads to limited capability.

- **Lack of consumer awareness of the importance of energy conservation.** Lack of sufficient awareness of the importance of rationalizing consumption leads to electricity network wastage.

- **Poor mechanisms for encouraging decentralization in electricity production.** The current situation depends on one source and one network for electricity distribution, and there is no mechanism to encourage energy transfer in different ways to connect remote locations through the decentralization of production and micro networks.

The third group of challenges is the least in terms of priority and the most difficult to deal with, but that does not mean they should be ignored. All the challenges mentioned are important and must be addressed.

- **High cost of exploration.** The high cost of search operation, exploration, and development, leads to reduce the investments, discoveries, and total production.

- **Shortage of dollar liquidity.** The shortage of dollar liquidity keeps many local and foreign investors from investing, due to their fear of inaccessibility of their financial dues, thus leading to a lack of investment in the sector and causing a noticeable loss of energy available for local demand.

- **Increasing demand due to population growth.** Continued population growth leads to an increase in total consumption, which needs increasing local productivity capacity and energy imports.
- **Difficulty of network planning due to overcrowding.** This challenge causes an increase in the cost of network connectivity due to the difficulty in avoiding populated areas.
- **Increase of the number of laborers in the production, distribution, and transportation companies**, causing an increase in wages, salaries, and additional sector personnel costs rising, in addition to many administrative problems.
- **Low efficiency of local companies.** Poor technical capacity and the limited ability of human and financial resources cause a decrease in the productivity of companies and their ability to meet the needs of citizens.
- **Lack of coordination with other sectors to establish the Smart Grids.** Smart Grids significantly contribute to the saving and rationalization of consumption and help reduce interruptions and must therefore be taken into account when planning and coordinating with other sectors, such as urban development.
- **The need for developing the education system curriculum to be compatible with the energy sector's needs.** Failure to develop and modernize the curriculum to keep pace with the requirements of the energy sector for competencies and qualified human resources forms a gap in the provision of technical expertise, which affects the level of efficiency and leads to the use of foreign expertise.

Energy Programs to 2030

In addition to the energy programs and projects included in the government program for 2016-2018, other relevant programs and projects for the period 2016-2030 are presented in the following parts of the document.

Programs and Projects Relevant to Implementation Mechanisms

Developing an integrated medium- and long-term energy strategy:

Program Description: The development of a medium- and a long-term integrated strategy for the energy sector that is approved by all stakeholders. It should be noted that this strategy is currently being prepared, and will begin to be implemented during the period 2016-2020. This is a low-cost program.

Key Elements: An integrated plan for the energy sector includes the various elements of the value chain (planning, production, transportation, distribution and control, refining and petrochemicals, and consumption) including:

- Ratios of energy fuel mix required for production
- Exporting and importing plan for energy
- Mechanisms for increasing efficiency of energy production
- Policies to rationalize energy consumption for the following sectors: industry, transport, electricity production, and construction
- A plan for energy pricing for the medium- and long-term in accordance with global changes
- Studying the development of the refining capacity and petrochemical production in the medium- and long-term
- Considering the development of energy production, transport, and distribution networks.

Restructuring the energy sector:

- **Program Description:** The development of a plan for restructuring the energy sector in order to increase its efficiency in achieving energy security and its contribution to the GDP, while maximizing and organizing private sector participation and creating a fair competitive market. It is targeted to start the implementation of this program in 2018 and to be completed by 2030. This is a high-cost program.

- **Key Elements:**

  - Accelerate the establishment process of the "Energy Planning Agency" to be responsible for making general policies and integrated and sustainable strategy for the energy sector, monitoring and evaluation of its implementation, as well as ensuring agreement of all concerned parties

  - Consider merging the two energy ministries (Ministry of Petroleum and Ministry of Electricity and Renewable Energy) in order to increase efficiency in the operating, planning, and management process and to curb bureaucracy

  - Establish a unified energy regulatory utility including petroleum products, gas, and electricity networks to be responsible for consumer and investor protection and ensuring level of competence

  - Forming a specialized emergency management work team following the Supreme Energy Council, to be responsible for determining the current and future challenges of the sector, and developing a plan to manage and address the relevant risks behind it such as expectations of the global oil price, developing and modifying current importing procedures, and following-up and dealing with the international cases brought against Egypt.

  - Improving efficiency of some energy facilities including:

    - Companies affiliated to the Electricity Holding Company including raising their productive, administrative, and economic efficiency; and reconsidering their financial and administrative structure, and the role of the private sector in their management, as well as increasing the efficiency of the Electricity Transmission Company.

    - Companies affiliated to the Petroleum General Authority by determining a deadline for approving and updating of the mutual benefit agreements, and updating the necessary financial items of the research and development agreements and improving the efficiency of the Gas Company.

Reforming the current legislative framework:

- **Program Description:** Revision of laws that prevent achieving the desired objectives of the energy sector. It is targeted to start implementation of this program in 2015 and to be completed by 2020. This is a low-cost program.

- **Key Elements:**

  - Providing a fair competitive environment for the energy sector through reconsidering laws related to the participation of the private sector in energy production in order to achieve energy system efficiency and identify the role of the government as a regulator. Introducing incentives to strengthen the role of the private sector, facilitate

investment procedures, provide guarantees for the payment of financial dues, and provide required dollar liquidity.

- Drafting a unified law for energy (including electricity and petroleum) to identify and organize the relationships between different parties, especially the role of the private sector in production operations, transportation, distribution, and sale of energy, in addition to giving permission to the private sector to participate in the processes of importing and exporting petroleum products for the purpose of energy market liberalization.

- Drafting supportive decentralization laws for both production and distribution of petroleum or electricity such as micro networks.

- Enacting laws regulating information circulation, access, and ensuring accuracy to support decision-making processes in the public and private sectors, and the development of a system for energy information management.

- Facilitating decision-making processes and reducing bureaucracy by updating laws to allow administrative accountability rather than criminal trials for decision makers, as well as to develop policies defining a matrix of powers and responsibilities for every decision-maker in the sector.

- Amending laws and regulations that regulate coordination of entities working in the field of energy, to make coordination with the Ministry of Environment mandatory for the application of environmental standards.

Developing the energy sector's infrastructure:

- **Program Description**: The development and modernization of basic infrastructure for the various stages of the value chain in the energy sector in order to achieve the objectives and realization of energy security. It is targeted to start implementation of this program in 2015 and to be completed by 2030. This is a high cost program.

- **Key Elements:**

  - Development of the exploration and current oil and gas services infrastructure, especially exploration in deep water, to enhance Egypt's competitiveness and support the exploration companies to improve their performance.

  - Develop the capacity of refining and petrochemicals in the medium and long term to help meet domestic market requirements.

  - Development and expansion of existing gas networks to raise the degree of access for citizens and industrial conglomerates.

- Development of the basic infrastructure of import and storage of natural gas and coal, due to the expected increase in energy imports in Egypt from these resources.

- Development and expansion of the infrastructure for the transportation of petroleum products, especially diesel and natural gas.

- Modernization of the current electricity network to facilitate dealing with expansion of renewable energies and assimilation of its requirements, such as developing a control center for the management of the network and mechanisms of energy storage, the use of smart grids, smart meters, and management of demand-side.

- Development of the infrastructure for energy exports, especially for electrical power to accommodate the renewable energy requirements.

Promoting innovation in the energy sector:

- **Program Description**: Enhancing innovation in the energy sector by increasing expenditure on research and development and promoting the use of modern technology to develop the sector. It is targeted to start implementation of this program in 2016 and to be completed by 2020. This is a high cost program.

- **Key Elements:** Developing policies that encourage companies to increase their spending on research and development in the following areas:

  - For the Ministry of Petroleum:

    - Developing and improving the technology of exploration in deep water.

    - Enhancing the added value of the refining ability and petrochemical sector and improving efficiency.

For the Ministry of Electricity and Renewable Energy:

- Developing the electric power generation process and encouraging its decentralization, with the development of technologies and operating systems such as micro-networks.

- Concentrating on means of developing renewable energy and raise its productive efficiency;

- Improving efficiency of electric power generation and reducing of greenhouse gas emissions through the use of environmentally friendly advanced technologies.

Skills development:

- **Program Description**: providing and improving human resources in the energy sector in order to keep up with the requirements for achieving objectives. It is targeted to start

implementation of this program in 2016 and to be completed by 2020, and this is a low cost program.

- **Key Elements:**

  - The Ministry of Petroleum and Ministry of Electricity and Renewable Energy should coordinate with the Ministry of Education and Technical Education and Ministry of Higher Education and Scientific Research for providing of required efficient human resources in order to help achieving the objectives of improving efficiency of electricity use and production, and fulfilling all needs of renewable energy, nuclear energy and energy produced from coal ,…etc. providing these competencies should be considered in all levels of education including Pre-university, Vocational and University Education.

  - Raising level of legal competencies within the energy sector in order to deal with administrative issues.

  - Developing the educational curricula to help instill the culture of rational use of energy.

  - Raising the level of administrative and technical competencies of the control center and improve the efficiency of power usage.

  - Improving efficiency of forecasting system for energy sector, in terms of supply, demand or price changes through human resources training and providing the required sustainable technology.

  - Developing a training program for responsible persons of economic management for companies and authorities affiliate to the Ministry of Petroleum and Mineral Resources and Ministry Electricity and Renewable Energy, for help managing companies from an economic perspective and ensuring financial sustainability.

Establishing the nuclear station in Dab'aa:

- **Program Description**: The diversification of energy mix which mainly consists of oil and gas (about 96%), in order to reduce dependence on these resources and turn to more clean energies such as nuclear and renewable energies. It is expected that this program begin to be implemented during the period 2016-2030; and this is a high-cost program.

- **Key Elements:**

  - The program includes establishment of 4 reactors from the third generation which is characterized by high level of safety, simplicity design, low cost and long life time which can reach more than 60 years. The production capacity of each reactor reaches about 1200 MG with a total of 4800 MG.

- Capacity building of Egyptian scientists and engineers who are working in the field of nuclear energy technologies and creation many job opportunities for youth whether in the field of construction or complementary industries or other fields.

- It is planned that the first nuclear power plant will start working in 2024 according to strict environmental and safety standards.

- Currently, the first nuclear power plant is under construction including walls, guard towers, gates and residential building for workers in the plant with about 2050 residential units. In addition, the location for a new residential city with all facilities and general services for people who are living in El-Dabaa city has been determined according to the safety standards, the new city contains about 1500 "Badawy Houses" each one with an area of 300 m^2.

Initiatives Related to Specific Topics

Applying environmental standards and accurate measurements:

- **Program Description**: Limiting pollution produced from the energy sector and activating the supervisory system of environmental performance. It is targeted to start the program in 2020 and to be implemented by 2025. It is a medium-cost program.

- **Key Elements:**

  - Designing the environmental performance unified supervisory system in cooperation with the Egyptian Environmental Affairs authority by:

    - Developing and applying regulatory actions for reducing the emissions of various pollutants (dust and debris) on all companies/energy production plants.

    - Ensuring that there are indicators for the greenhouse gas emissions rates.

    - This initiative will be implemented by activating the role of environmental departments at each establishment, and amending the laws and regulations, for both projects and entities working in the field of energy which stipulates compulsory coordination with the Ministry of Environment.

Improving the efficiency of energy subsidies:

- **Program Description**: Restructuring the energy subsidization system and coordinating between relevant authorities in order to ensure access to those who deserve support through a unified plan. This includes fuel subsidies provided to all consumers, including private electricity production companies, and the subsidiary of the Holding Company for Electricity. This program is scheduled to start in 2015 and be implemented by 2020. It is a high-cost program.

- **Key Elements:**

  - Setting a unified price plan for petroleum products, gas, and electricity, and setting up a clear and transparent approach for raising the prices, based on a detailed analysis of consumer categories.

  - Defining compensation mechanisms for those who are affected by the change in the subsidization system, by converting fuel subsidies into monetary values delivered to those who are entitled to it.

  - Planning a strategy for communicating with citizens; to ensure smoothness of the planned development achievement.

  - Completing and updating the Feed-in Tariff and adding a fair tariff pricing for electricity production using new technologies such as critical mass.

  - The Supreme Council of Energy would be responsible for monitoring the implementation of this program in cooperation with the Ministry of Finance, and supported by the Egyptian Electric Utility, the Consumer Protection Regulatory Agency, and the Egyptian General Petroleum Corporation.