An Overview of Human Development and Energy Sector in Egypt

Submitted by

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ABSTRACT

This study provides a review of the human development index in Egypt with an analysis of its three dimensions (education, health, and economic performance). In addition, the study presents an overview of CO2 emissions, energy efficiency and its indicators, and energy policies in Egypt. The policies include energy subsidies and renewable energy investments; including; hydroelectric energy, wind energy and solar energy

Keywords: Carbon dioxide emissions; Human development index; Energy efficiency; Energy subsidies and Renewable energy investment

1. Introduction

Since the issuance of the United Nations Development Program's (UNDP) first Human Development Report in 1990, the international discussions around the concept of human development have emphasized the idea that people are the real wealth of a nation. The report underlined that economic growth in itself is a mean for development but not the primary target. Human development is the process of expanding the range of people's choices and although these choices may change through time, they include three major elements: access to knowledge, healthy life, and access to the resources required to live at a good standard. If these choices are not available, people will not be able to access opportunities (Farrow, 1991). several factors help to foster development, such as social and economic reforms that generate inclusive growth, decrease poverty, and improve well-being.

2. review of human development index in Egypt

It may be useful to compare Egypt's rankings with similar countries, in terms of the HDI. In the 2020 Human Development Report issued by the united nations development program, Egypt ranked 116th out of 189 countries, coming ahead of many middle-income countries such as Vietnam (117th), India (131st), and Pakistan (154th) (UNDP, 2020a). in contrast, some countries in the same income group came ahead of Egypt, including South Africa (114th), the Philippines (107th), and Tunisia (95th) as

shown in table (4.1). The report (HDR 2020) also stated that for the first time, Egypt's HDI was higher than the Arab world's average. Egypt's rank was 102nd out of the 189 Arab countries.

Table (1) shows human development and sustainable development indicators in Egypt and selected countries in the same income group. It shows that of the ten countries that came ahead of Egypt on the HDI's rankings, six of them are less than Egypt in terms of GNI per capita and life expectancy at birth. The average number of years of schooling is one of the main declining indicators in Egypt. It is lower than the countries that precede it in the human development index, although the expected number of years of schooling for Egypt precedes all countries in the table

Table (1): human development and sustainable development indicators in Egypt and selected countries.

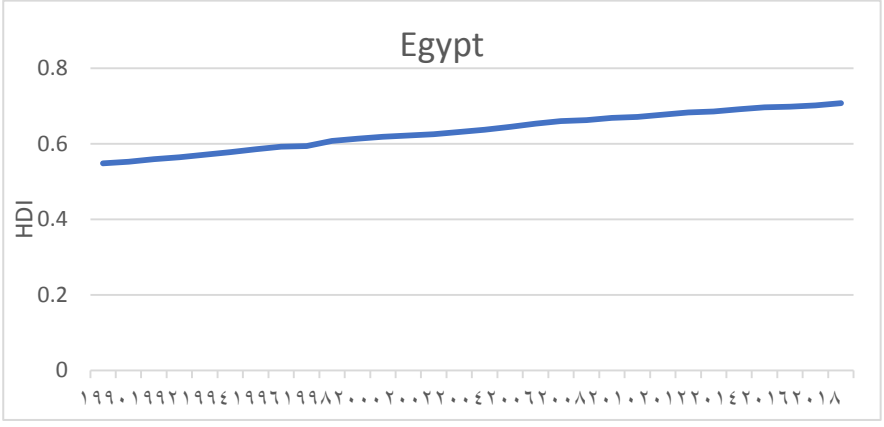
Country	Ranking	HDI value	Life expectancy at birth (years) SDG3	Expected years of schooling SDG 4.3	Average years of schooling SDG 4.6	Average GNI per capita (2017 PPP $) SDG 8.5
Uzbekistan	106	0.720	71.7	12.1	11.8	7,142
Bolivia	107	0.718	71.5	14.2	9	8,554
Indonesia	107	0.718	71.7	13.6	8.2	11,459
Philippines	107	0.718	71.2	13.1	9.4	9,778
Belize	110	0.716	74.6	13.1	9.9	6,382
Samoa	111	0.715	73.3	12.7	10.8	6,309
Turkmenistan	111	0.715	68.2	11.2	10.3	14,909
Venezuela	113	0.711	72.1	12.8	10.3	7,045
South Africa	114	0.709	64.1	13.8	10.2	12,129
Palestine, State of	115	0.708	74.1	13.4	9.2	6,417
Egypt	116	0.707	72.0	13.3	7.4	11,466

Source:(UNDP, 2020b)

Table (2): human development and sustainable development indicators in non-oil-exporting MENA countries.

Country	Ranking	HDI value	Life expectancy at birth (years) SDG 3	Expected years of schooling SDG 4.3	Average years of schooling SDG 4.6	Average GNI per capita (2017 PPP $) SDG 8.5
Israel	19	0.919	83.0	16.2	13.0	40,187
Malta	28	0.895	82.5	16.1	11.3	39,555
Lebanon	92	0.744	78.9	11.3	8.7	14,655
Tunisia	95	0.740	76.7	15.1	7.2	10,414
Jordan	102	0.729	74.5	11.4	10.5	9,858
Palestine, State of	115	0.708	74.1	13.4	9.2	6,417
Egypt	116	0.707	72.0	13.3	7.4	11,466
Morocco	121	0.686	76.7	13.7	5.6	7,368
Syria	151	0.567	72.7	8.9	5.1	3,613
Djibouti	166	0.524	67.1	6.8	4.1	5,689
Yemen	179	0.470	66.1	8.8	3.2	1,594

Figure (1) The development of Egypt's human development index from 1990 to 2019.

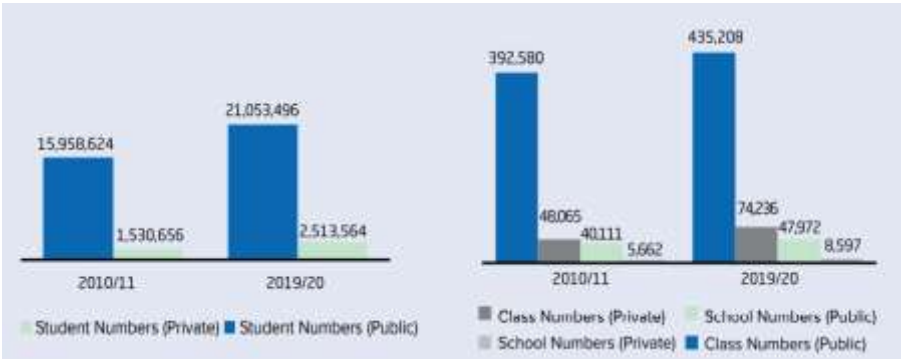


Source:(UNDP, 2020b)

3. Review of education sector indicators in Egypt

Both the private sector and the public sector provide pre-university education services in Egypt. However, the public sector is the most important within the system. between 2010 and 2020, public education accounted for around 90% of total pre-university education pupils in Egypt and around 86% of all schools(Langsten et al., 2020). Egypt's pre-university education sector has improved over the last ten years, with net and gross enrolment rates increasing at all educational levels. Figure (2) presents the number of students in the pre-university education system in Egypt for the two years (2010/2011 and 2019/2020).

Figure (2) Numbers of students, schools, and classes in the pre-university education system in Egypt at the two years (2010/2011 and 2019/2020)



The pre-university education sector in Egypt is one of the largest worldwide in terms the numbers of students and teachers by around 23.6 million students (i.e. nearly a quarter of the

Egyptian population) enrolled in the system and around 1,019,000 teachers employed. these estimates are in the year 2020.39. table 3 shows numbers of students, schools and classes in the he pre-university education system in the two years (2010/2019).

Egypt seeks to raise the enrolment rates at both the lower secondary and secondary education levels to reflect the principle of obligatory education till the end of secondary school as stated in Article (19) of the Constitution (Ewiss et al., 2019). The relatively low enrolment rates at the lower secondary and the secondary education levels in Egypt are due to many reasons related to the demand side. Some reasons are related to the social and economic situation of poor people and their cultural preference, which may encourage the parents to be satisfied with only primary education for their kids so they can work at a young age.

Factors related to the supply side include for example the unavailability of educational services in some remote regions of the country. the low gross enrolment ratio in pre-primary education (around 29% in the year 2020) means that around two-thirds of children aged 4–5 do not enroll in early education(UNDP, 2021).

The number of pupils per teacher and the average size of the classes are key indicators of the quality of the educational process. The average class densities of all levels have raised between 2010 and 2020 to reach their peak in the primary (53

students) and lower secondary (49 students) in 2020, while the student-teacher ratio for all stages of education remained unchanged except for the pre-primary level, that witnessed a significant reduction during this period (UNDP, 2020c).

The average size of class at the primary stage in Egypt is remarkably higher than in many other middle-income countries such as Argentina (24 pupils), Indonesia (27 pupils), and China (37 pupils) (Jafari et al., 2021). This could be due to the age structure of the population; the proportion of the population at primary school age to the total population in Egypt is higher than in other nations. furthermore, the high cost of private education increases the pressure on public education and so devours the continuous attempts of the government to address this challenge through increasing the number of classes(Assaad & Krafft, 2015).

Regarding higher education, around 3 million students were in private and public higher education institutions (universities, higher institutes, academies, and top tier technical institutes) in the year 2020 and around 73% of them are enrolled in public universities (BEKELE & IBRAHIM, 2020). The number of faculty members and their assistants has increased from about 93,600 in 2011 to about 126,000 in 2020 (of whom about 80 % were at public higher education institutions (UNDP, 2021).

Overall, the average number of years of education for people aged above 25 years in Egypt is higher than comparable many other middle-income countries such as the Philippines, Bolivia and Indonesia, that are among the 10 countries that precede Egypt in the HDI according to the 2020 HDR (Unisco Institute of Statistics, 2018).

4. Review of health sector indicators in Egypt

Table (4.3) presents the number of hospitals and beds in the health sector in Egypt and their distribution between the private sector and the public sector. Although hospitals within the private system constitute around two-thirds of the total number of hospitals in Egypt, they have only around 27% of the number of beds. So, it's obvious that the average number of beds at a private hospital is lower than the average number of beds at a public hospital, indicating the lower capacity of private hospitals compared to public hospitals.

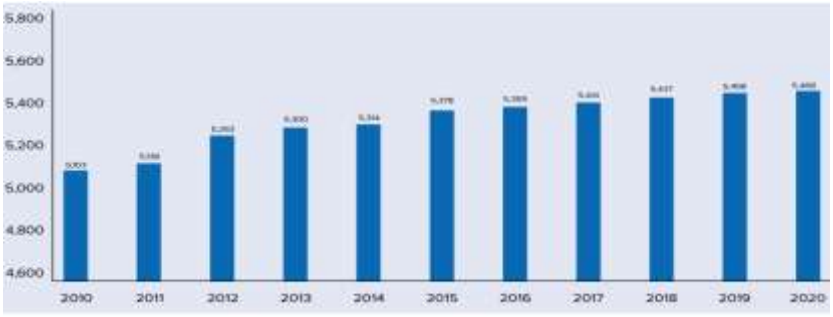
Table (3) Number of hospitals and beds in the health system in Egypt and their distribution between the public and private sectors in 2018

	Hospitals		Beds	
	Total number	Share (%)	Number	Share (%)
Public	691	37	95,683	73
Private	1,157	63	35,320	27
Total	1,848		131,003	

Source: (UNPD,2021)

The number of government hospitals expanded from 660 to 691 during the period between 2010 and 2018. However, this growth is considered very limited when compared with the rise in the number of patients which increased from around 86,000 visitors to around 136,000 (Central Agency for Public Mobilization and Statistics). This limits the ability of the public health sector to provide healthcare to people who need it. So, public investment is required to build new treatment institutions and hospitals and equip them adequately to meet the increasing demand for public health systems due to the growth in population and the increase in the cost of private health services.

Figure (3) Number of primary health care units during the period (2010-2020)



Source: The figure depends on Central Agency for Public Mobilization and Statistics.

The number of primary health care units raised by around 365 over the period from 2010 to 2020, as shown in Figure (3). However, this growing number of health care units also did not match the increase in population (World Bank Database, 2020).

Regarding indicators of quality and competitiveness of health services, the number of doctors increased from around 73 thousand to 91thousand and the number of nursing staff increased from 162 thousand to 197 thousand. However, due to the increase in the number of patients visiting public hospitals, the average number of doctors and nurses decreased. consequently, this could have a negative impact on the quality of the health service provided by the public health system (UNDP, 2021).

Regarding indicators of health outcomes, Life expectancy at birth in Egypt increased from 70.3 years (72.6 years for women and 68.2 years for men) in 2010 to 71.8 years (74.2 years for women and 69.6 years for men) in 2019 (ref). life expectancy at birth in Egypt is lower than the global average and than many comparable middle-income countries such as Jordon, Morocco, Lebanon, Thailand, and Turkey. However, it is higher than Indonesia and South Africa, which are within the ten countries preceding Egypt in the human development index (UNDP, 2020a).

5. review of the economic performance in Egypt

Before 2010, the Egyptian economy experienced its highest gross national product growth rate in 2006 at 7%. The economic Growth subsequently decreased to 5.1% in 2009 and the per capita gross domestic product was 3.1%(Ellithy & Hiba, 2019). Social debates at this time were around the fair distribution of growth among the various segments of society.

Although there were improvements in economic performance before the 2011 revolution, the development process faced many challenges.

One of the major challenges was the high population growth rate, which reached 2.5% annually and included a high dependency rate. This put high pressure on the Egyptian government in allocating sufficient resources for infrastructure investment, providing education and health service, and improving services and their geographical distribution. In 2008, the poverty rate was 21.6% and increased to 25% in 2010 and 26.3% in 2013 (Ellithy & Hiba, 2019).

Also, The unemployment rate raised from 9% in 2009 to 12% in 2011 (World Bank Database, 2020). Moreover, the inequality in the distribution of income and the proceeds of development between the various segments in the society and between the various regions was a major challenge for Egypt. These disparities in addition to the increased corruption rate, the poor investment environment and the poor competitiveness of the Egyptian economy were major keys for the 2011 revolution.

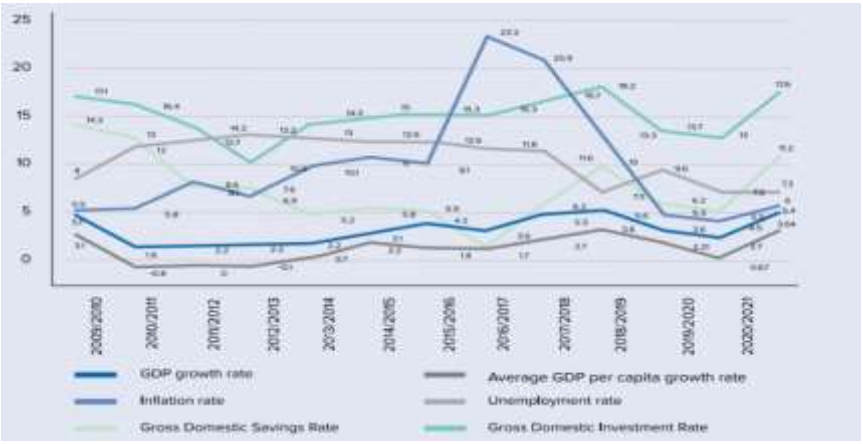
After January 2011, macroeconomic indicators declined. The growth rate declined to around 2% in 2011, the unemployment rate increased and the inflation rate rose (World bank Database, 2020).

Due to these economic conditions after the 2011 revolution and the decrease in the financial recourses, Egypt had to

implement a comprehensive national economic and social reform program (IMF, 2020). In 2016, the IMF agreed to give Egypt a loan of $12 billion, with three years repayment period and this financing was a part of a comprehensive adjustment program.

The major reforms in the program supported by the International Monetary Fund included the implementation of a value-added tax, the introduction of a new and simplified tax regime for medium and small-sized businesses and defining measures to raise tax administration efficiency, and the adoption of energy subsidy reform. Moreover, liberalization of the exchange rate was a main element in the monetary policy after the post-2014 period (IMF, 2020). After implementing the reform program, the growth rate increased to 5.6%, and the unemployment rate decreased to 7.5% in 2018/2019 (IMF Database, 2021). Also, the domestic investment increased, before decreasing followed the COVID-19 pandemic and then grew again during 2020/2021as shown in Figure (4).

Figure (4) Key economic indicators, 2009/2010 to 2020/2021 (%)

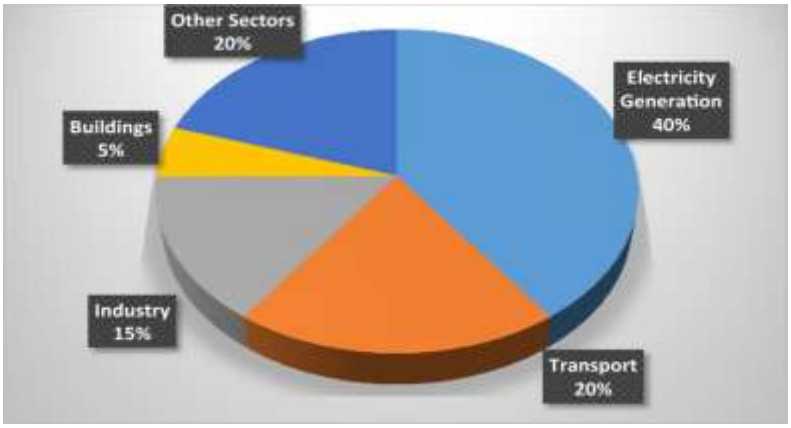


Source: ((UNDP, 2021)

6. Overview of Carbon Dioxide emissions in Egypt

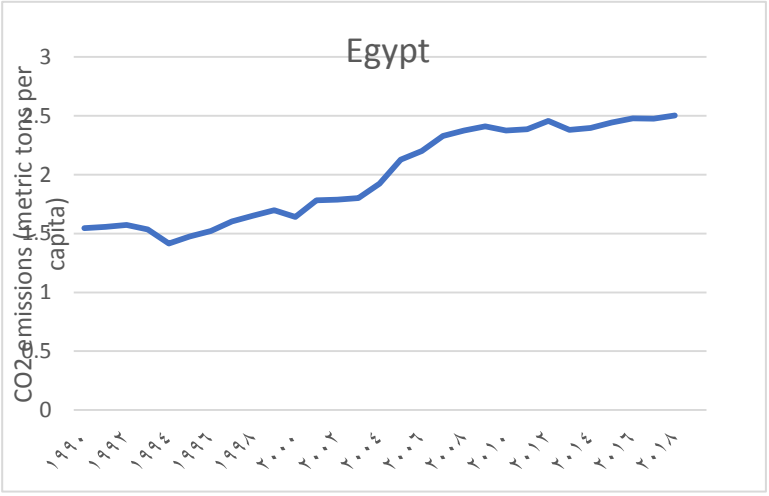
Egypt emitted 269.5 million tonnes (Mt) of carbon dioxide emissions and around 2.5 tonnes of per capita CO2 emissions in 2020. It ranks 27th in terms of energy-related carbon dioxide emissions worldwide and shares approximately 0.75% of the total global CO2 emissions (World Data Atlas, 2020). Electricity generation accounts for almost 40% of the CO2 emissions in the country, the transportation sector accounts for 20%, industry for 15%, residential units for 5%, and other sectors for 5% as presented in figure (5) (Janssens-Maenhout et al., 2019). Figure (6) shows the time trend of per capita CO2 emissions in Egypt.

Figure (5): sources of CO2 emissions in Egypt in 2019.



Source: (Janssens-Maenhout et al., 2019)

Figure (6): Time trend of per capita CO2 emissions in Egypt



Source: (World Bank Database, 2020).

Egypt is largely dependent on hydrocarbon-based fossil fuels. The renewable resources share in Egypt's energy mix

was about only 4% in 2019. the electricity generated from natural gas is around 73% of the country's energy mix (Fitch Solutions, 2020). This large percentage is because of the increasing natural gas reserves and the Egyptian government prioritized fossil-fuel electricity generation to address the continued energy blackouts that happened after the year 2011(Meier et al., 2014). consequently, the shortage of electricity became a surplus and the market became heavily dependent on gas and oil (World Bank Database, 2020).

Beyond energy, the second-biggest source of CO2 emissions in Egypt is the transportation sector. carbon dioxide emissions from the transportation sector include domestic aviation, domestic navigation, road, pipeline transport, and rail. The main source of emissions in this sector is road transport. 60% of road transport emissions are from passenger travel (buses, cars, and motorcycles), while the other 40% are from road freight (trucks and lorries) (IEA, 2020).

Manufacturing and industrial processes in Egypt emitted around 30 million tons of carbon dioxide emissions in 2016, with an emission growth rate amounted around 3.8% during the period between1990 and 2016 (Climate Watch Database, 2020).

The agriculture sector in Egypt emitted around 32 million tons of CO2 emissions in 2018. The growth rate of this sector's CO2 emissions from 1990 to 2010 was around 2% (The Global Economy Database). This is because the sector share of GDP

declined over time and Egypt became more service and industry-oriented (Kassim et al., 2018).

Waste handling and management in Egypt accounted for 27 million tons of CO2 emissions in 2016, which is about 8.6% of the total country's emissions (Janssens-Maenhout et al., 2019). CO2 emissions are resulted from landfilling and disposing of waste instead of recycling. The emissions generated from this sector increased by around 5.6% during 1990-to 2016, indicating that the waste generated was higher than recycling activity growth (El Masry, 2019).

The COVID-19 pandemic has reduced carbon emissions in Egypt by around 7.7%. For the period between January to August 2020, total CO2 emissions were around 209 million tonnes with a declining rate of around 11.7% for the same period in 2019 (Madkour, 2021).

7. energy policies in Egypt

Egypt does not have an explicit carbon tax, nor a CO2 emissions trading system. However, it implemented energy subsidies reforms that consider a major tool to improve energy efficiency. Also, renewable energy investment is important to reduce polluting emissions and their negative consequences. The next sections present overviews of energy intensity as an indicator of energy efficiency, subsidies, and renewable energy investments in Egypt

7.1 overview of energy intensity in Egypt

Within the period (2000-2005), energy Intensity (EI) in Egypt (the ratio of total primary energy supply to GDP) increased significantly to reach 204 total oil equivalent/$ in 2005. Then it decreased to reach 123 toe/$ in 2019 (IEA Database, 2020). Compared to many other middle-income countries with similar GDP, Egypt has a relatively higher EI (IEA Database, 2020). This suggests that Egypt has the capacity to raise gross domestic product per capita while maintaining or even lowering primary ener gy intensity

per unit of gross domestic product. Raising per capita gross domestic product with an increasing population needs to increase the level of economic activities in the country. Decreasing EI in Egypt, while increasing the level of activities in the economy, needs to implement energy efficiency policies.

7.2 overview of energy subsidies in Egypt

Egypt has depended on energy subsidies for decades as a mean for wealth sharing and social protection. As a result, energy demand has risen quickly, with the subsidy bill rising at a compound annual rate of 26% in the period between 2002 and 2013 (IRENA, 2018). Energy subsidies for natural gas and oil products were USD 20 billion, with an additional USD 4.2 27 billion for the electricity sector(Rana & Khanna, 2020).

In 2013/2014, energy subsidies (total indirect, direct, and cross-subsidies) were around 22% of the government budget and

about 7% of gross domestic product (MOERE, 2017), and the electricity subsidies constituted nearly 20% of the energy subsidy bill. The decreasing resources because of energy subsidies posed a significant budgetary burden on the Egyptian government, contributing to the energy sector's fiscal deficit, which increased from 1.3 percent in 2010/11 to 16.8 percent in 2013/2014 (IRENA, 2018).

In 2014, the Egyptian government launched a comprehensive economic reform program to restore macroeconomic stability and enhance growth. As one of its key elements, the program includes energy subsidy reform and associated measures to minimize the expected negative impacts on the most vulnerable households. The subsidy reform has the target of reaching 100% of the price-to-cost ratio of the energy products through a gradual rise of the registered prices (Breisinger et al., 2019). The most significant rise in energy prices happened within the period (2014– 2017) as shown in Table (4).

Table (4): Yearly growth rates of the registered prices of fuel product during the period (2014–2017)

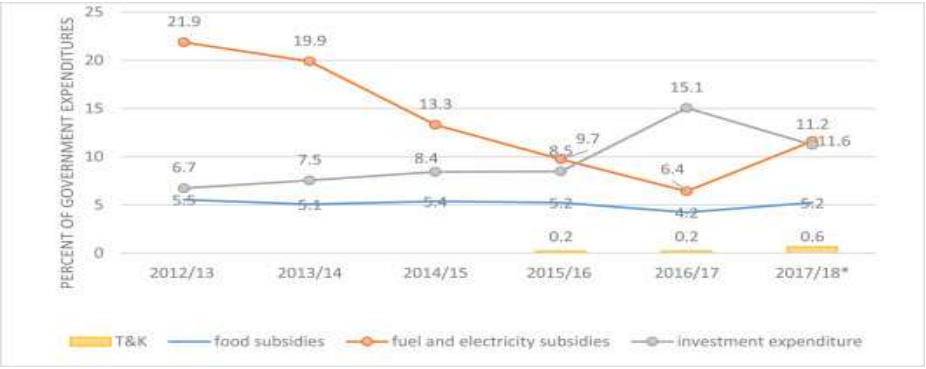
Product	2014	2015	2016	2017
Natural gas[a]	111	8.2	32	72.4
LPG	–	–	87.5	100
Gasoline 80	77.8	–	46.9	55.3
Gasoline 92	40.5	–	34.6	42.9
Gasoline 95	6.8	–	4	–
Kerosene	63.6	–	30.6	55.3
Diesel	63.6	–	30	55.3
Mazut	26.3	–	8.6	40
Electricity	26	17.3	30	40

Source: UNDP (2021).

Within the first wave of subsidy reductions in 2014, the government of Egypt introduced significant fuel price increases; around 64% rise in the prices of diesel, around 78% rise in gasoline 80 price, approximately 40% rise in the price of gasoline 92 and a 6 -fold increase in prices for the largest residential natural gas users. LPG was not included in the subsidy cut (MoP, 2014).

The decrease in international fuel prices in late 2014 and 2015 decreased the international-domestic prices gap, which provided a good chance to implement a more sustained program of subsidies cuts. Energy subsidies declined to around EGP 73.9 billion in 2014/2015 (Breisinger et al., 2019).

Figure (7) subsidies and investment as a percentage of total government expenditures.



Source: MoF, 2017a ***Notes*: * = Projected. T&K = Takaful** and Karama. The government of Egypt has been providing cash to poor households via Takaful and Karama which is a conditional cash transfer program.

Figure (7) shows the decreasing share of energy subsidies as a percent of government expenditures. The budget deficit for the year 2016/2017 was decreased to 10.9% of gross domestic product and public investment increased due to the redistribution of the saving of the subsidies following these measures. the reductions in the prices of oil decreased the bill of fuel subsidy

by USD 10 billion in 2015 from total energy subsidies of USD 25 billion in 2013(Breisinger et al., 2019).

Simultaneously, the government of Egypt raised the amount of subsidies for food and provided a cash transfer program to protect households from the effects of subsidy reform. Regardless of the substantial rise in energy prices, fuel remains heavily subsidized. This is largely a result of the floatation and the following devaluation of the Egyptian currency in 2016, which raised the cost of imported products.

The second energy subsidies reforms were undertaken in 2016. The Egyptian government continued to cut back on energy subsidies in the first quarter of the fiscal year 2020/21, decreasing the subsidies by 46 percent compared to the same period a year earlier (IMF, 2020). The government announced that energy subsidies would be lifted to another three years due to the negative repercussions of the covid 19 pandemic (Elkhashen et al., 2020).

7.3 Overview of renewable energy in Egypt

Since the 1970s, the Egyptian government undertook fruitful decisions to use technological tools for renewable energy. This was in collaboration with many other countries such as the USA, Germany, and England. Due to this coordination, there was obvious development in Egypt in installing solar water heaters (SWH), wind farms, and photovoltaic (PV) applications in plant desalination and pumping water(Salman & Hosny, 2021).

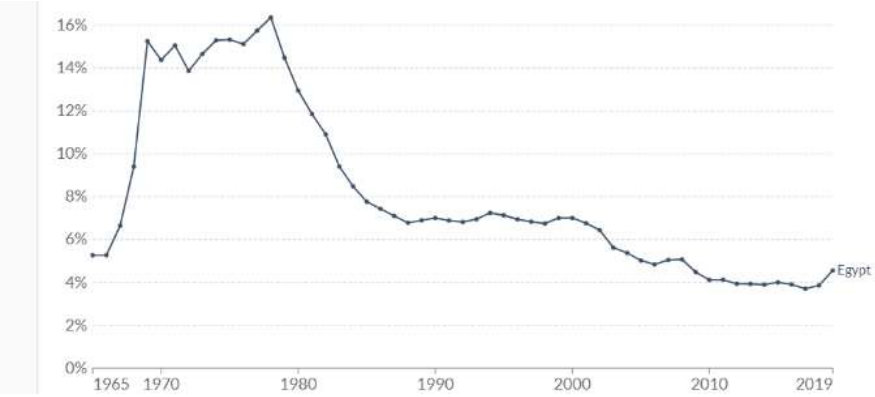
The main sources for the installed capacity of renewables in the preceding and the next years are coming from hydropower and the rest came from wind and solar power. The solar energy that could be taken from the daily sunshine is between nine to eleven hours per day, with an estimation of solar direct radiation intensity ranging between 2,000-to-3,000-kilowatt h per square meter. Beyond solar energy, the wind blows at an annual average speed range between eight to ten-meter per second near the Red Sea and between six to eight meters per second near the Western Desert and the Nile (Salman & Hosny, 2021).

Since the beginning of 2008, there has been a growing awareness of the crucial importance of renewable energy. In 2015, Egypt introduced the Sustainable Development Strategy vision 2030, to secure sustainable development and protect the environment. So, the government of Egypt took bold measures to adopt an energy diversification strategy titled by (ISES), with an increased improvement of renewable resources investments and implementation of energy efficiency policies (IRENA, 2018). Regarding the 2035 ISES, Egypt plans to raise the supply of power produced from renewable resources to 42 percent by 2035, with wind generating amounts 14%, hydropower amounts 2%, photovoltaic (PV) amounts 22%, and concentrating solar power (CSP) 3% (Lehr et al., 2017). The African Development Bank approved a $98 million loan to fund two of the Electricity and

Green Growth Support Program in Egypt in June 2021(Aboagye et al., 2021).

In 2020, renewable energy comprised around 4% of the total energy production, that is mainly from hydropower by around 3%/ and 1% from wind power (IEA Database, 2020). Figure (8) shows the share of renewable energy in total energy production for the period (199065-2019)

Figure (8) renewable energy as a percentage of total energy production in Egypt during the period (1965- 2019)



source: (IEA Database, 2021)

Hydroelectric energy:

Egypt's major reference for hydropower is the Nile River in Aswan, where numerous power facilities totaling 2,800 Megawatts are located. These power plants contribute to the annual generation of 13,545 gigawatts of electricity. Hydropower generated almost 50% of Egypt's electricity between the 1960s and 1970s; however, this share decreased to reach only 7.2% only in 2015/16 (IRENA, 2018).

Wind Energy

According to Egypt's Wind Atlas, the country is rich in wind resources and is regarded as one of the best sites in the world for wind energy generation, particularly in the Gulf of Suez region.

by 2023, it is expected to have 4 wind plants fully completed. The wind capacity of these 4 plants is estimated to be 2610 Megawatts. Apart from that, many energy projects have been established by Siemens, with 2000i installed capacity totaling 2000 Megawatts (IRENA, 2018). In 2018, The Ministry of Electricity and Renewable Energy (MOERE) managed to reach thirty percent of local content for wind farms(Salman & Hosny, 2021) .

Solar energy

Recently, the Egyptian government planned to build the hugest solar photovoltaic plant in the world at “Benban” in Aswan. This project is expected to cost about four billion dollars and is estimated to produce about 1.8 gigawatts of electricity (Sharaf & Kortam, 2020).

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