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(ANALYSIS OF THE DEMAND FUNCTION FOR ELECTRIC POWER IN DIWANIYAH GOVERNORATE)

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Summary :

Electric energy is one of the important and basic elements of economic activity as well as other life activities, so the research was concerned with one of the important elements involved in generating gross domestic product (GDP), the research problem centers on the difficulties and obstacles that the electricity sector in Iraq faces, despite the continuous rise in energy production However, there is a large gap between the supply and demand for that energy, resulting from the large increase in the volume of losses due to the weakness of the transmission lines of electrical energy. And the frequent excesses by citizens.

Carrying out a comprehensive campaign for the maintenance and maintenance of electric transmission networks and lifting the excesses can contribute to reducing the volume of waste and increasing the volume of supply and thus raising the processing hours for the units consuming electrical energy.

Introduction :

The electric power suffers from a noticeable deterioration that started in the year 1991 as a result of wars and international sanctions that affected various sectors, including the electrical sector, and despite the efforts made to create a real balance between supply and demand for electric power and the increase in the number of generating stations, the high demand made solutions In solving the electricity crisis, it is taking place in a vicious circle, especially after the

year 2003, the increase in the standard of living of citizens, the increase in the holdings of electrical appliances, and the expansion of residential homes and neighborhoods.

Research problem :

The high demand for electric power, the high percentage of wastes in the electric transmission networks, in addition to the excesses on the electrical system, have a clear impact on the hours supplied to the electricity consuming units.

Research hypothesis:

The development of strategic plans represented in increasing the number of generating stations, reforming the transmission networks and lifting the excesses of the electrical system would put an end to the continuity of the electric power crisis.

research importance :

The research dealt with an important topic related to the continuity and permanence of economic activity, as electric energy is one of the important elements that contribute to generating gross domestic product (GDP), as the research sheds light on the analysis of the demand for electric energy, and the reality of production and consumption of that energy.

First: The reality of electric energy in Iraq:

Since 1991 and as a result of air strikes carried out by the US coalition forces on most civilian and military installations, including electric power plants, the electrical system has collapsed, and despite international sanctions and by self-efforts, the power plants have been rebuilt and maintained, but they are below the target production level,

As the imposed sanctions prevented the import of basic spare parts used in generating electric power, as the daily production volume reached approximately (4) thousand megawatts. After the year 2003, successive governments worked to pay attention to the electricity sector, and a number of power stations were established, but the high population growth rates and the accompanying expansion of cities, the increase in residential homes and neighborhoods, in addition to the increase in electrical household appliances, led to an imbalance between electricity supply and demand On it, in addition to the administrative and financial corruption of the electricity sector, which is the main factor in the deterioration of the electrical reality in Iraq[(1)] .

Electric power generation stations are distributed over most of the governorates, and it varies between:

A- Steam stations: These stations use fuel to evaporate the water and then convert thermal energy into mechanical energy, which is converted into electrical energy by the generator attached to the turbines. There are (8) stations distributed in the governorates (Baghdad, Babil, Salah al-Din, Basra, Dhi Qar, Wasit), and their production capacity is approximately (29) million megawatts / with a percentage (27%) of the total energy produced with other types.

B- Gas stations: which depend on liquefied gas to generate electric power. There are 33 stations distributed among the governorates (Baghdad, Babylon, Diyala, Kirkuk, Karbala, Nineveh, Maysan, Basra, Dhi Qar, Muthanna, Qadisiyah) with a capacity Productivity (49) million megawatt hours, with a share of (46%) of the total energy produced with other types of stations.

C- Diesel stations: These stations use diesel fuel or heavy oil to convert thermal energy into kinetic energy, which the generator in turn converts into electrical power. There are (12) stations distributed among the governorates (Baghdad, Muthanna, Salah al-Din, Anbar, Maysan, Diwaniyah, Karbala) and produce Annually, approximately (2) million megawatt hours, with a participation rate of (2%), of the total electricity produced.

D- Hydroelectric stations: depend on the passage of water currents in the generation of electric power and on what arises in the streams of rivers and dams, as the generation capacity depends on the height of the water level of the dam and the quantities of this water, and the number of (8) stations are located in the governorates (Salah al-Din, Diyala, Anbar) , Karbala, Najaf, Nineveh) and its production capacity is approximately (2) million megawatt hours, with a participation rate of (2%) of the total energy produced.[(2)]

Second: The size of the electric power output:

As a result of urban and population expansion and the widening gap between supply and demand for electric power, a number of foreign companies have been contracted to generate new generating stations, in addition to an agreement with some neighboring countries such as Iran and Turkey to import electricity to fill the shortage of electric power, which contributed to the increase in the volume of available quantities. From this energy, from the following table we notice the high volume of energy.

However, the increase in the volume of electric energy produced did not match the increase in demand for it, the reason for this is the high rates of internal consumption and waste in production, transmission and distribution stations, as the volume of wastes reached more than (40%) and this number is very large compared to the global average of 8% .

Table No. (1) The quantity of production and import of electrical energy in Iraq for the period (2010-2018):

	output MW	ted energy with added power from investment MW	production in the electrical system MW
2010	41160667	6722050	47882717
2011	40796649	7233094	48029743
2012	46017574	10170234	56187808
2013	58422041	12201629	70623670
2014	67767995	12225551	80018546
2015	68688325	13104203	81792528
2016	80030253	11964878	91995131
2017	85532656	13644407	99152453
2018	83025303	22411874	104452068

Source: Republic of Iraq, Ministry of Electricity, annual reports for the period 2010-2018.

Through the previous table, we notice the continuous increase in the total production of the electrical system, as the generation of electric power increased from (47882710) megawatts in 2010 to about (104452068) megawatts in 2018, with a positive growth rate of 9% during the same period, this increase came as a result of maintenance and maintenance operations In power plants, in addition to the introduction of new stations into service, importing electricity from neighboring countries and added energy contributed to this increase, as the Ministry of Electricity invested in this sector as it could not cover demand alone, especially after fluctuations in oil prices and lack of Adequate investment budgets are available, as a number of projects were referred using the private investment method (IPP) with a total corrective capacity (8355) megawatts of which income for work (1500) megawatts in 2017.

Third: the volume of wasted electrical energy:

Despite the increasing increase in the production of electrical energy, the energy available for use is low due to the increase in internal consumption and the losses in electrical systems, especially in the distribution networks, which is one of the challenges facing the electricity sector as the problem of electric power in Iraq lies in these losses that reach Very high levels due to the increased loads and deterioration of the distribution networks:

Table No. (2) Net energy sold and volume of electricity waste for the period (2010-2018):

	e of sold energy			
		of Total output%	MWH	of Total output%
2010	27443762	59	19158957	41
2011	25735368	54	21088028	46
2012	35075355	62	16253228	38
2013	45041388	63,8	25594543	35,2
2014	43993346	55	36025200	45
2015	42034740	57	32180370	43
2016	38635804	48	42611431	52
2017	40770622	43	55720369	57
2018	39593993	38	65863447	62

Source: Republic of Iraq, Ministry of Electricity, annual reports for the period 2010-2018.

The waste, and through the previous table, we note that they have reached record levels compared to the volume of sold energy, as it reached about (65863447) megawatts in 2018, with 60% of the total energy produced, while the sold energy was (39593993) megawatts, at 40% of the total production. It indicates the weakness of the transmission and distribution networks by not preserving the energy delivered to the consumer in addition to the many excesses and loads on the distribution stations, The waste, and through the previous table, we note that they have reached record levels compared to the volume of sold energy, as it reached about (65863447) megawatts in 2018, with 60% of the total energy produced, while the sold energy was (39593993) megawatts, at 40% of the total production. It indicates the weakness of the transmission and distribution networks by not preserving the energy delivered to the consumer in addition to the many excesses and loads on the distribution stations, as the current transmission lines suffer from many bottlenecks, as the electrical loads exceed the capacity of the transmission network, so it is necessary to extend additional lines and establish transfer stations in order to improve the level of these The system and increase its ability to conduct electricity better. The most important challenges facing the electricity sector can be summarized in the following points[(3)]:

1- The demand for electric power has increased significantly, at a rate of 7% annually, due to the increasing number of housing units.
2- The inability to provide adequate fuel for existing stations, which reduces their efficiency.

3- Weak public investment in the implementation of projects, in addition to weak legislation for investment in the electricity sector.

4- The fluctuation of water quantities in the Tigris and Euphrates rivers and their low levels, which negatively affected the operation of steam stations.

5- Lack of cultural awareness of the process of rationalizing consumption, the citizen's failure to assume responsibility for participation, the inability to collect the costs of providing electric power, failure to implement legal procedures against those who have failed to pay electricity wages, in addition to the weak legal procedures against trespassers on the electrical network.

6- The equipment of the electrical system is obsolete and its continuous need for maintenance and rehabilitation programs, in addition to the failure to absorb the transmission and distribution networks of added energy.

Fourth: the economic reality in the province of Diwaniyah:

The viewer of Diwaniyah Governorate sees the urgent need for practical steps in order to promote economic and social development. The prevailing character in the province is agricultural, as approximately 48% of its population works in this sector, in addition to the presence of a number of factories and laboratories belonging to the public and private sectors. Some of them suffered losses that were not exceptional, but rather the escalation of the exaggerations of volume after the backwardness of the industrial sector in the 1990s, and the decline of this sector after 2003 due to competition from foreign products that flooded the market with cheap goods[(4)]. The number of establishments in the province of Diwaniyah reached about (1,465) establishments with a total production of about (17,185,1717) thousand dinars, while the number of workers is estimated at (8687) workers. These establishments were distributed among industries (food, textile, chemical, construction, metallurgy).

As the governorate contains many industries such as the dairy industry represented by the Diwaniyah dairy plant, whose production capacity reaches (43200) tons per year while the current production is about (4320) tons, In addition to the grain mills, which number (5) mills that supply the ration card with flour, in addition to the cotton textile industry represented by the Diwaniyah textile factory, which was considered one of the important industries in the governorate and has a role in providing the local market with various types of cotton and silk fabrics for a period of time. The design capacity of this plant is about (17,000) thousand meters / year, but production has declined at the

present time to reach (1050) thousand meters / year due to the lack of government support and strong competition from foreign products in the local market.

The governorate also contains a number of petrochemical industries, such as the tire industry, represented by the Diwaniyah tire factory, which has had a long history in providing the local and even global market with the finest types of tires, but the competition of the foreign product, the lack of supplies and the high costs led to a decline in production, and even to the plant stopped production for several Years after 2003.

There are also oil refineries in the governorate with a production capacity of about (18,000) barrels / day, in addition to the asphalt plants distributed in the districts and suburbs of the governorate. As for the construction industries, they occupy an important position among other industries, as they are one of the most developed and prosperous industries in Iraq, As this development is linked to urban and industrial progress and the increase in housing and construction projects, the governorate contains about (20) brick factories that supply the local market with thousands of tons of bricks per day, and the Diwaniyah governorate contains many small industries represented by blacksmithing and carpentry workshops and the manufacture of tools and various supplies, Which has a role in meeting the needs of the local market, in addition to employing manpower[(5)].

As for the agricultural sector, the total areas for agriculture in Diwaniyah Governorate are about (988) thousand dunums, in which approximately (17784) workers work. The governorate produces various agricultural crops and animal products, as it is considered one of the important agricultural governorates that supplies the local market with various agricultural products. Like other sectors, the agricultural sector suffers from several problems, including the fluctuation of available water quantities, as well as the competition of foreign products for local products, which caused great losses for workers in this sector. Agricultural products are distributed among vegetables, grains and dates, as well as poultry projects, which have increased in number in recent years, in order for the governorate to achieve self-sufficiency of table eggs and white meat. The production of dates in the province of Diwaniyah amounted to about (40072) tons. As for the production of rice, which is characterized by the governorate, it reached (225,913) tons, which is a record number when compared with the production of previous years due to the availability of water and allowing farmers to increase the cultivated areas of this

crop, while the production of barley reached About (78787) tons, At the level of animal production, the governorate is distinguished by the presence of a number of poultry projects and fish lakes in addition to a number of cattle and buffalo fields, which have an important role in providing basic products, especially eggs, fish, red and white meat, as the number of poultry projects reached nearly (211) projects distributed over The various districts and sub-districts in the governorate[6].

Fifthly: production and consumption of electrical energy in the province of Diwaniyah:

A- Electrical power output:

As a result of the increased demand for electric power, a number of generation stations were established in various governorates, including the Governorate of Diwaniyah, as (3) obstetric stations were established with a design capacity of about (900) megawatts, as the (Diwaniyah gas) station was established, which contains four obstetric units Each unit has an output of (125) megawatts, in addition to the station (east of Al-Diwaniyah) and contains (28) diesel engines, each one with a production of (7,7) megawatts, with a total of (140) megawatts,[7] in addition to the station (north of Diwaniyah) and contains (40) Engine and total output (140) MW .

Table No. (3) generation stations Governorate of Diwaniyah:

ns	capacity(MW)	ction energy(MW)	ing units	reated
(east of Al-Diwaniyah	200	161	8	2012
(north of Al-Diwaniyah	200	168	8	2012
tion	500	345	4	2015

Source: Republic of Iraq, Ministry of Electricity, General Electric Power Transmission Company,Unpublished data.

The North and East of Al Diwaniyah stations operate with diesel fuel, while the gas station works with natural gas. The difference between the designed energy and the actual production energy is observed in the production of these stations, which amounts to about (226) megawatts, this is due either to the scarcity of fuel needed to operate these stations or to the lack of capable technical staff Turn it off [8]. The failure to keep pace with the production of energy with the increase in its consumption has created a gap and a continuous deficit in the

provision of electrical energy, and since the Diwaniyah Governorate is linked to the main system of electrical distribution, the challenges faced by individuals who consume energy in the rest of the governorates are the same that the people of the province face,The continuous interruption of electrical energy, especially in the summer season, is one of the main problems facing the governorate, and although the governorate's production of electricity is sufficient to fill the shortfall in it, the central connection to the system created a continuous gap between the energy supply and demand:

Table No. (4) The required and supplied load rate for the electrical system in Diwaniyah Governorate for the period (2010-2018):

	e required (MW)	processing (MW)	t ratio%
2010	400	132	67
2011	556	123	78
2012	500	140	73
2013	586	219	63
2014	493	287	42
2015	802	286	65
2016	913	350	62
2017	-	-	-
2018	1000	391	61

Source: Republic of Iraq, Ministry of Electricity, annual reports for the period 2010-2018.

Through the previous table, we notice that the deficit in energy supply continues during the period (2010-2018), as the governorate recorded the highest deficit during the year 2011, at a time when the average required energy was about (400) megawatts, the rate of processing was about (132) megawatts, by Deficit of 78%

The deficit in the supply of electricity continued during the following years, at a rate of 60%, due to the high loads on the electrical network and the presence of a shortage in distribution transformers, as well as the large number of abuses, so there must be effective plans to lift the violations of the electrical system, and to repair transmission and distribution lines, And reduce loads on power transformers.

B- Electric Power Consumption:

With the increase in the number of houses and shops and the expansion of government departments, the consumption of electrical energy increased with it. Through Table No. (5) we note that the energy consumption of the household sector increased from (519.9) thousand

megawatts / hour in 2010 to about (1264.7) Thousand megawatt hours in 2017, this increase indicates the increase in population growth and the accompanying increase in residential homes and the increase in the acquisition of household electrical appliances such as cooling and heating devices:

Table No. (5) Energy supplied according to categories of consumers in Diwaniyah Governorate for the period (2010-2018): (thousand megawatts / hour)

	hold sector	ercial sector	ıment sector	ultural sector	rial sector
2010	519,9	31,6	131,7	51,0	24,7
2011	451,1	26,4	190,0	42,8	28,7
2012	600,1	41,8	199,8	63,4	66,9
2013	816,4	52,4	281,9	74,7	78,1
2014	983,8	70,7	476,0	87,9	97,3
2015	-	-	-	-	-
2016	1003,9	53,9	400,9	41,6	103,7
2017	1264,7	59,1	238,5	57,4	92,7
2018	-	-	-	-	-

Source: Republic of Iraq, Ministry of Planning, central Statistical Organization, Statistical group, For the years 2010-2018.

As for the commercial sector, its consumption of electrical energy increased, especially with the increase in the number of shops and commercial complexes and the expansion of markets, as it increased from (31.6) thousand megawatts / hour in 2010 to about (59.1) thousand megawatts in 2017. The same is the case with the government sector. With the expansion of government departments and institutions that provide services to citizens, their energy consumption increased from (131.7) thousand megawatts / hour in 2010 to (238.5) megawatt hours in 2017, while the industrial sector increased its consumption of electricity from (24.7) (One thousand megawatts / hour in 2010 to about (92.7) thousand megawatt / hour, as for the agricultural sector, its consumption of electricity was (51.0) thousand megawatt / hour, which rose to about (57.4) thousand megawatt / hour in 2017.

Conclusions:

1- The high demand for electric power and the high percentage of wastes in the electric transmission networks, in addition to the abuses of the electrical system, have a clear impact on the hours supplied to the electricity consuming units.

2- The generation of electric power increased from (47882710) megawatts in 2010 to about (104452068) megawatts in 2018, with a positive growth rate of 9% during the same period. This increase came as a result of maintenance and maintenance operations in the generation stations, in addition to the entry of new stations into service.

3- The increase in the volume of electric energy produced was not commensurate with the increase in demand for it, the reason for this is the high rates of internal consumption and waste in the production, transmission and distribution stations.

4- The absence of cultural awareness of the process of rationalizing consumption, and the citizen's failure to assume responsibility for participation, in addition to the large deficit in collecting the cost of supplying electric power, which is one of the challenges facing the electricity sector in Iraq.

5- The energy consumption of the household sector in the province of Diwaniyah increased from (519.9) thousand megawatts / hour in 2010 to about (1264.7) thousand megawatts / hour in 2017, this increase indicates the increase in population growth and the accompanying increase Residential homes and increasing the acquisition of household electrical appliances such as cooling and heating devices.

Recommendations:

1- Reducing the percentage of lost losses in the transmission and distribution networks by conducting replacement and repair of these networks and contracting with specialized international companies.

2- Spreading cultural awareness among consumers of the need to rationalize the use of electric energy and contribute to paying the costs of collecting electrical equipment.

3- Expanding the establishment of electric power plants with high capacities to match the rates of population growth and urban expansion.

4- Imposing legal measures against trespassers on electric transmission networks, with imposing high fees commensurate with the excessive consumption of electrical energy.

5-The necessity of encouraging the use of devices with low loads, and imposing high customs taxes on the import of devices with high consumption of electrical energy.

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