



Article

Geographical Analysis of the Impact of Rapid Urbanization on Electricity Consumption in Karbala Governorate for the Period (2015–2025)

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Abstract: This paper explores the effects of high urbanization on electricity usage in Karbala Governorate in the year 2025 and its geographic distribution. The governorate had around 1,518,544 people. Another problem examined in the research is the consumption of electricity due to the growth in the number of people in Karbala. A descriptive-analytical approach to the theoretical part of the study and an applied approach, analyzing the indicators of importance during the 2015-2025 period, were the approaches used by the researcher basing on official and academic sources and data. Karbala Governorate, according to the findings, has a severe shortage of electricity supply and unequal distribution of the urban and rural regions. The consumption of electricity rose to 8,415,397 megawatt-hours in 2025 against 3,970,440 megawatt-hours in 2015 without leaving out that the consumption was highest in the urban areas where there is a high density of human settlement. The introduction, theoretical proposal of the study, and its framework were covered in the first chapter. The second chapter addressed the concept of rapid urbanization and electricity, as well as its main concepts and terms. The third chapter discussed the key measures of electricity distribution and consumption. At the end, the paper gave recommendations and proposals, and the conclusion was that the variables of high rates of urbanization, population growth in Karbala, and electricity consumption are directly related.

Keywords: Rapid Urbanization, Electricity Consumption, Impact.

1. Introduction

Electricity has been referred to as one of the most significant sources of energy during the modern times. Its spheres of application have become diverse and extended so far that it has become part of all spheres of human activity, and it is considered as one of the basic supports of economic development. Consequently, it exerts a clear influence on development sectors. Therefore, meeting the growing demand for electricity in any country is regarded as one of the most crucial elements of its development. Among the most prominent factors leading to an increase in electricity demand is the rapid growth in population size and its growth rates. Population increase inevitably results in a rise in the demand for electrical energy and higher levels of consumption for various human uses. This necessitates taking population growth into account when estimating electricity needs in order to keep pace with this increase. The study aims to analyze the reality and trends of population indicators in Iraq and selected Arab countries and their reflections on electricity consumption indicators. It is also aimed at defining the position of Iraq among

those countries in the indicators examined and to learn the experience of these countries in the sphere of population policies, which are regarded as one of the most significant instruments in the context of gaining comprehensive development because they are one of the most important determinants of development. The factors affecting the production and consumption of electrical energy include some of the most important, the first of which is the growth of the population of the Holy Governorate of Karbala between 2015 and 2025. Such development is explained by the growing number of migrants to the governorate because of the dire security situation in the home cities. This has, in its turn, had a negative impact on the state of the infrastructure services, the most apparent of which is electricity.

It is important to mention that the connection between the use of electricity and population is complicated, just as the correlation between population and other economic and social phenomena. The mass displacement caused by the wars and conflicts is not only enough to define the population growth in the developing countries such as Iraq, but also by the natural population equation which is represented by the higher population birth rate than death rate or even by the traditional net migration. This causes urban sprawl and generation of demand of energy and other services. This is what has been the case with Iraq and Algeria where these nations must take the threat of urban growth seriously and they must also respond to the increasing energy demand so as to enhance the standards of living among their citizens. As for Egypt, it has witnessed an increase in the demand for electricity and other services as essential requirements. It has also focused on rural population development by improving the level of services in these areas, including electrical energy. Egypt, along with Algeria, has succeeded in meeting the electricity needs of its population and exporting surplus energy to neighboring countries.

The Theoretical Framework of the Study

This chapter presents the main steps of the research methodology, including the clarification of the research problem, the presentation of its scientific significance, the formulation of the main hypothesis, as well as the identification of the variables adopted and the methodology used. It also outlines the spatial and temporal boundaries of the study, as follows:

First: Research Problem:

The research problem can be illustrated through the following questions:

1. What is the population growth rate in the Holy Governorate of Karbala?
2. What is the amount of electrical energy produced and consumed in the Holy Governorate of Karbala?
3. What is the per capita share of electricity in the governorate?
4. Is there a relationship between rapid urbanization and electricity consumption in the Holy Governorate of Karbala?

Second: Research Hypothesis:

To address the research problem, the researcher assumes the following:

1. The increase in population growth in the Holy Governorate of Karbala has led to an increase in the consumption of produced energy.
2. There has been an increase in the rates of both produced and consumed energy in the Holy Governorate of Karbala.
3. There is a decline in the per capita share of electrical energy in the governorate.
4. There is a positive relationship between rapid urbanization and electricity consumption in the Holy Governorate of Karbala.

Third: Research Objective:

The paper will be used to show what rapid urbanization entails and how it has affected electricity consumption in the Holy Governorate of Karbala by presenting plans and strategies that play a role in improving and developing electrical energy in the different sectors.

Fourth: Research Methodology:

The proposed paper is descriptive-analytical as it outlines the study region and evaluates the data and variables that influenced the rise of per capita electricity use in the Holy Governorate of Karbala.

Fifth: Importance of the Study:

The significance of the study lies in the fact that electrical energy is the foundation of the national economy as this is manifested in its direct representation in all economic sectors and its influence on development. Therefore, meeting the increasing demand resulting from population growth and rapid urbanization, driven by migration and displacement, poses a significant challenge for the state. This necessitates the formulation and implementation of plans and strategies to address the growing demand and consumption of electrical energy.

Sixth: Spatial and Temporal Boundaries of the Study:

The study area is represented by the Governorate of Karbala within its full geographical boundaries and administrative divisions, including districts and sub-districts. It is located between latitudes (32°10'–32°51') north and longitudes (43°12'–44°20') east. The governorate consists of seven administrative units: three districts (Karbala, Al-Hindiya, and Ain Al-Tamr) and four sub-districts (Al-Hurr, Al-Husseiniya, Al-Jadwal Al-Gharbi, and Al-Khairat).

Administratively, it is bordered to the north and west by Al-Anbar Governorate, to the northeast and east by Babil Governorate, and to the south by Al-Najaf Al-Ashraf Governorate. It is located in the central-western part of Iraq (Map 1). Its area is approximately 5,034 km², representing about 1% of Iraq's total area, which is estimated at 435,052 km² [1].

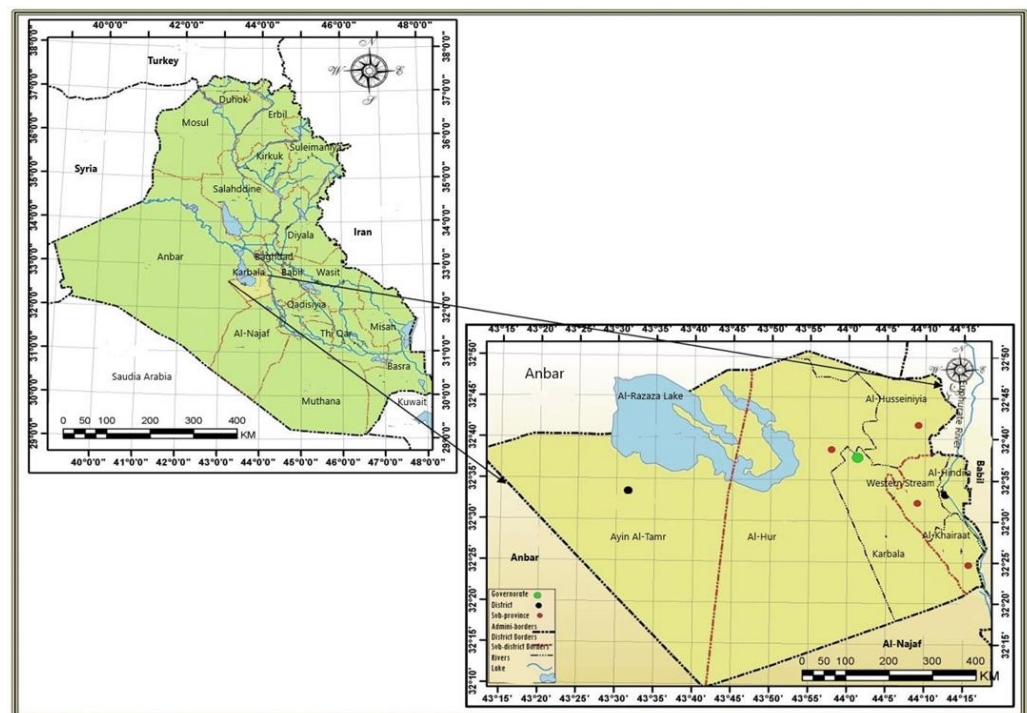


Figure 1. Location of the Holy Governorate of Karbala within Iraq.

Source: Zain Al-Abidin Aziz, *Cartographic Representation of the Population Characteristics of Karbala Governorate for the Period 1997–2020*, Unpublished PhD Dissertation, College of Education, University of Kufa, 2022.

2. Method and Materials

Using a descriptive – analytical method, the study has found that urbanisation and electricity consumption do have a geographical relationship in Karbala governorate during (2015–2025). The study is based largely on secondary data from official governmental databases such as population statistics, statistics on population transfers, and electricity production and consumption statistics, so the data set is reliable and consistent. The methodology proceeds with an analysis of demographic trends such as population growth, migration, urbanization, and electricity production, consumption, and per capita consumption trends during the time span of the study. Fed by statistical and comparative methods to identify temporal shifts and gauge population and energy growth. Moreover spatial analysis is used to illustrate the urban-rural gap in electricity distribution within the governorate - adding the spatial dimension to energy consumption analysis. In addition, correlation analysis is used to determine the underlying causal associations between urbanization and electricity use, providing previously lacking insights into the nature and directionality of these relationships. A graphic-time and tabular-data is used underpin the temporal development and assists interpretation of result. This interwoven methodological framework provides a holistic evaluation of the role of population growth and migration in driving increases in electricity demand and infrastructure pressure from rapid urban growth, thereby providing a sound basis for understanding energy consumption patterns in the context of urban change.

3. Results and Discussion

First Section: Urbanization (Concept, Importance, and Causes)

Before examining the concept of urbanization, it is necessary to distinguish between two important terms that are often confused: *urbanization* and *urbanism*. The former refers to the increase in the proportion and size of the urban population due to migration from rural to urban areas, along with the resulting changes in social organization and the transition from rural life, with all its characteristics, to urban life with its complexity and sophistication [2]. According to the United Nations, urbanization is defined as the growth in the number of people residing in urban residential areas. The level of urbanization is measured by the proportion of the urban population to the total population of a country. This aligns with Kingsley Davis, who defined urbanization as the percentage of people living in urban settlements out of the total population. From this emerges the concept of urban growth, which refers to changes in the urban population between two specified points in time, either due to migration or natural increase (the difference between births and deaths). However, Costello, in his work on urbanization in the Middle East, does not adopt these definitions. Instead, he emphasizes two main dimensions: the demographic dimension, which concerns the spatial distribution of the population, and the dimension of associated social processes and the sources from which populations derive both material and non-material cultural elements related to urban patterns of behavior. Accordingly, he uses the term *physical urbanization* to refer to patterns of population settlement, and *social urbanization* to encompass urban social processes [3].

Developing countries, including Arab nations, have come to face severe urban crises, as these rapid shifts are not matched by corresponding economic development. Rural areas in these countries have also begun to suffer from serious problems due to population migration and the deterioration of agricultural conditions. Urbanization has not only brought its effects in rural areas but there have also been waves of migrants which have posed a greater threat to the lives of already struggling cities. Migration flows into cities have therefore also become an added burden to the urban development facilities. Due to these massive city leaps, there are cities that have seen the growth of their population by more than two times in brief durations. According to some societies in Africa and Asia, a new trend of urbanization has been created which is termed as chaotic, disorderly or even

explosive. This has led to the breakdown of traditional social structures and the inability of cities to function effectively as components of development, to the extent that it may trigger social upheavals capable of undermining achievements accumulated over centuries [4].

Clear disparities can be observed in levels of urbanization across different regions of the world. These differences are evident among continents and regions. In 1999, the global level of urbanization reached 46%, ranging from 33% in Africa to 75% in North America, making North America the highest and Africa the lowest. The lowest urbanization rate was recorded in East Africa at 20%, while the highest was in the temperate regions of Latin America, reaching 90% in Argentina. Rwanda recorded one of the lowest rates at 5%, while Belgium had one of the highest at 97%. The phenomenon of the “city-state” is exemplified by countries such as Kuwait, Hong Kong, and Singapore.

The second term, *urbanism*, refers to the process that characterizes the lifestyle of urban society, that is, the way people live, behave, and perceive life, often shaped by the temporal dimension imposed by living in a city environment. In other words, it expresses the civilization of cities or the mode of life within them. Thus, urbanism does not merely mean moving to an urban society; it must be accompanied by changes in behavioral and social concepts, as well as a distinct way in which individuals interact with their environment. These concepts may either follow from or result from the process of urbanization [5].

Urbanism does not necessarily accompany urbanization. A city may exhibit a high level of urbanization while maintaining a low level of urbanism, a situation often observed in countries experiencing intense rural-to-urban migration. Likewise, urbanism does not have to coincide with urbanization, as the issue is subject to relative and interpretive perspectives. Therefore, urbanism is considered one of the essential necessities for the emergence of cities. From a philosophical perspective on the changes associated with urbanism and the differences between rural and urban areas, it can be observed that the large population size of cities contributes to higher levels of urbanization due to the complex relationships among individuals with diverse orientations.

Second: The Importance of Rapid Urbanization in Urban Areas

Rapid urbanization is the process of swift transformation from a rural society to an urban one, in addition to the significant increase in the proportion of urban populations compared to rural populations.

1. High-quality construction materials and well-designed transportation networks and residential units in urban areas.
2. Ease of mobility within the city through the availability of paved roads and advanced public transportation systems, allowing movement with less effort and cost compared to private cars.
3. Urban areas are characterized by the availability of numerous recreational facilities such as green spaces, playgrounds, sports clubs, hotels, restaurants, and cinemas, especially in densely populated areas.
4. Cities provide advanced healthcare services through the presence of clinics and hospitals.
5. Urban areas are distinguished by broad social relations among their residents.
6. As the population increases, the size of the labor force in available jobs also grows.
7. Availability of high-quality educational opportunities through well-established institutions, services, and advanced educational tools [6].

Third: Causes of Rapid Urbanization

1. Population Growth:

Population growth is one of the most influential factors in this study. It results from two main components: natural increase (the difference between births and deaths) and

migration. Population growth is a crucial topic that must be considered in population geography studies, as every society is characterized by continuous change due to increases and decreases in population size. It is also one of the primary drivers of urban expansion, as urban growth reflects the substantial increase in urban populations resulting from rapid urban and physical development in the study area [7].

Table 1. Population Growth Rate in the Holy Governorate of Karbala for the Period (2015–2025).

Census Year	Population
2015	1,179,259
2016	1,209,459
2017	1,240,432
2018	1,272,198
2019	1,304,778
2020	1,338,192
2021	1,372,462
2022	1,407,609
2023	1,443,656
2024	1,480,627
2025	1,518,544

Source: Prepared by the researcher based on data from the [8].

Republic of Iraq, Ministry of Planning and Development Cooperation, Central Organization for Statistics and Information Technology, *Annual Statistical Group: Population Estimates (2015–2025)*, unpublished data.

As it can be seen in Table (1), the population of the Holy Governorate of Karbala was 1,179,259 in 2015 and that of 1,338,192 in 2020, and then 1,518,544 in 2025. This shows that there has been a consistent growth in population of the governorate. In this regard, there arises a need to plan population policies that seek to deal with population growth by preparing strategic plans that can handle this growth and balancing it with the available resources within the governorate and hence have a sustainable future of the future generations. The Holy Governorate of Karbala has experienced a fast and steady population growth since it has developed upward as seen in Table (1), which gives the numbers, the size of the yearly growth, and the growth rates of the population. This expansion is greatly credited to migration caused by the fact that the stability was improved after 2020, the majority of displaced families came back to the governorate following the consequences of the recent conflicts, and economic conditions improved. The population has increased and will reach 1,518,544 in 2025.

2. Migration:

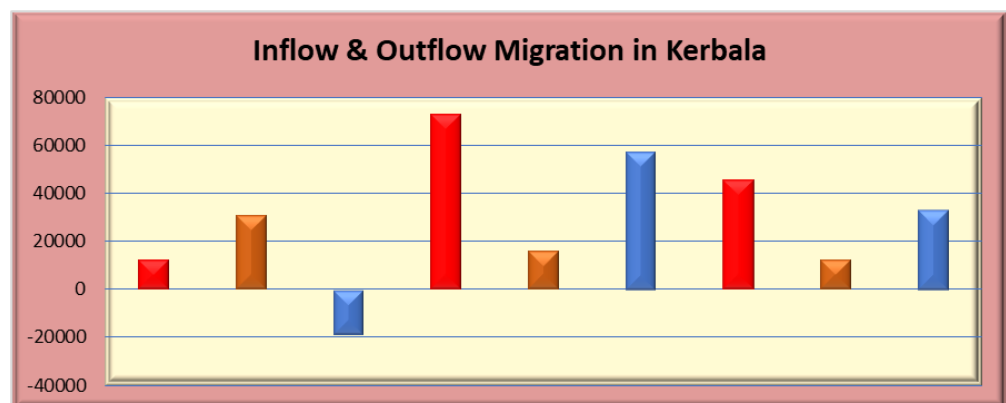
Migration means the act of people that have left the residential place they have lived in permanently or temporarily to go to another place in search of better living conditions, proper housing as well as safety. Relocation to the Holy Governorate of Karbala is deemed as one of the major social and economic trends that have been witnessed over the last few years. The governorate has witnessed a significant stream of people and families that have left different cities of Iraq to escape the conflict regions and the instability of security. Karbala is considered to be a desirable place to visit because of its religious and sightseeing value besides the employment opportunities that are available. It was also a place of refuge to the people of southern governorates during the Iran with Iraq war and in 2015 with the recent conflict with (ISIS) which resulted in a massive displacement towards the governorate. This has been perceived to add up to population growth and has escalated housing units demands [9].

Table 2. Types of Migration to Karbala Governorate for the Years (2009, 2015, 2025).

Year	Type of Migration	Number
2009	Inflow	12,175
	Outflow	30,953
	Net	-18,775
2015	Inflow	73,023
	Outflow	15,704
	Net	57,318
2025	Inflow	45,502
	Outflow	12,307
	Net	33,192

Source: Prepared by the researcher based on data from the [10]. Directorate of Migration and Displacement, Karbala Branch, unpublished records, 2025.

Table (2) illustrates that there is a positive correlation between population movement and electricity consumption in Karbala Governorate. The population growth will necessitate a considerable rise in electricity consumption since the governorate is registering the highest number of net in-migration (57,318 people in 2015). This extra strain on the power grid necessitates the necessary increase in the infrastructure and infrastructure in generating and transmitting energy to satisfy the demand of new dwellers in apartments and service plants. Negative net migration arguments like 2009 can result in a relative fall in the demand or redistribution of consumption. Thus, the demographic data is a critical aspect that should be considered in the case of planning the projects in the sphere of electrical energy and providing the stability of the networks.

**Figure 1.** Illustrates migration patterns to Karbala Governorate.

Source: The figure was prepared by the researcher based on the data in Table 2.

Second Section: Electrical Energy: Concept, Importance, and Types

Electrical energy is considered one of the clean and safe energy sources that plays a vital role in the process of development and economic well-being of any country. It represents an essential element in human life for meeting increasing needs that cannot be dispensed with. It is also one of the key requirements of the economy due to its close connection with the advancement of the technological level of production processes, including industry, communications, transportation, scientific fields, as well as agricultural, commercial, and governmental uses. Accordingly, electrical energy has become one of the most important pillars of development in all human societies through its role in improving living standards. It represents the backbone of life for all vital facilities across the governorate, as it is involved in all economic and social activities and cannot be

dispensed with as a fundamental element in achieving state progress and economic prosperity, as well as ensuring the continuity of various activities. Electrical energy production in the Holy Governorate of Karbala has witnessed significant development; therefore, it is necessary to study the volume of electricity production in the governorate [11].

Based on Table (2) and Figure (1), it can be observed that electricity production in the Holy Governorate of Karbala has followed an upward trend. Production increased from 4,120,440 megawatt-hours in 2015 to 8,545,397 megawatt-hours in 2025, with an increase of 393,237 megawatt-hours and a growth rate of 4.8% in 2025. Electricity production has continued to rise, reaching its highest levels, which indicates that Karbala Governorate possesses generating capacities that could exceed peak demand if allocated solely to the governorate. This would be sufficient to meet its needs and could lead to a high level of economic well-being if properly utilized.

Table 3. Electricity Production in the Holy Governorate of Karbala for the Period (2015–2025).

Year	Energy Produced (MW/h)	Increase Amount	Change %
2015	4,120,440	-	-
2016	4,440,210	319,770	7.8
2017	4,800,500	360,290	8.1
2018	5,170,770	370,270	7.7
2019	5,680,320	509,550	9.9
2020	6,180,150	499,830	8.8
2021	6,730,900	550,750	8.9
2022	7,360,600	629,700	9.4
2023	8,020,300	659,700	9.0
2024	8,152,159	131,859	1.6
2025	8,545,397	393,237	4.8

Source: The table was prepared by the researcher based on data from [12].

Middle Euphrates Electricity Production Directorate, General Company for Electricity Production, Planning Department, unpublished data (2015–2025).

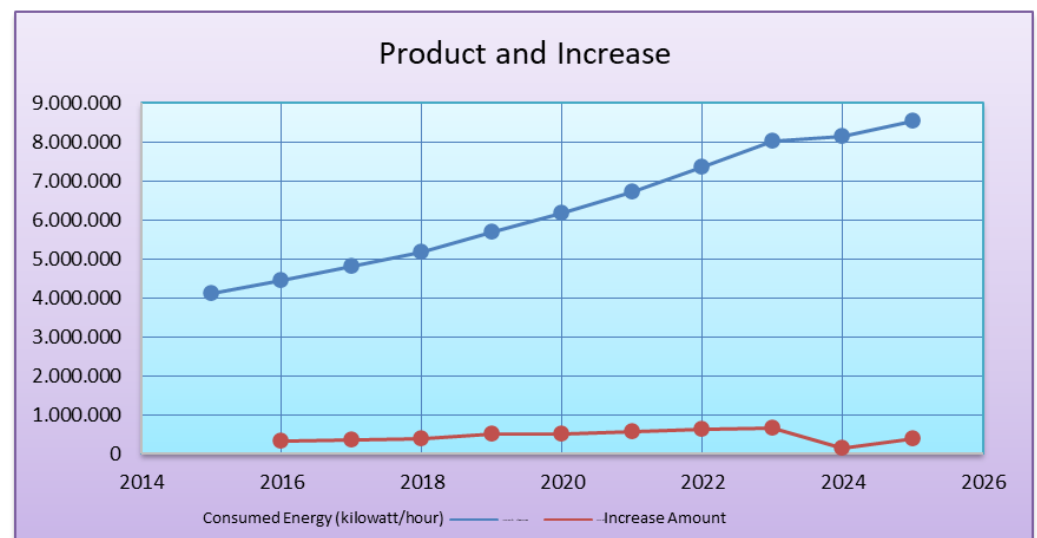


Figure 2. Development of Electricity Production in the Holy Governorate of Karbala for the Period (2015 to 2025).

Source: The figure was prepared by the researcher based on the data in Table (3).

Third Section: Analysis of the Development in the Rate of Change of Electricity Consumption in the Holy Governorate of Karbala

Electricity consumption is defined in kilowatt hours as the average annual electrical consumption of all the possible sources of energy (including domestic imports and exports). Energy consumption, particularly, electric demand, is one of the basic elements of the economical, social, and industrial development. The quality of life and the cost of living are mainly dependent on the amount, quality, and price of the energy consumed. The high population growth and the better standards of living in the Holy Governorate of Karbala have observed a tremendous development in electricity demand and this is more so in the rising use of the electrical appliances that relate to the economic development objectives. Electricity consumption contributes to improving living conditions by enabling the establishment of various service projects. Therefore, the increase in electricity consumption is directly linked to population growth and rapid urbanization [13].

Based on the data presented in Table (3) and Figure (2), electricity consumption in the Holy Governorate of Karbala during the period (2015–2025) has shown noticeable growth. Consumption increased from 3,970,440 megawatt-hours in 2015 to 8,415,397 megawatt-hours in 2025, representing an increase of 676,475 megawatt-hours and a growth rate of 5.2% in 2025. This rise is attributed to several factors, including the pressure and damage inflicted on high-voltage transmission towers, population growth resulting from the recent ISIS conflict, and the consequent increased load on the governorate. Additionally, the decline in the efficiency of power generation stations and frequent power outages have significantly impacted industrial activity, leading to the shutdown of some factories and increased production costs, which in turn contributed to the decline of the industrial sector.

Table 4. Development of Electricity Consumption in the Holy Governorate of Karbala for the Period (2015–2025).

Year	Energy Consumed (kw/h)	Increase Amount	Change %
2015	3,970,440	-	-
2016	4,280,210	299,770	7.8
2017	4,660,500	332,290	8.9
2018	5,060,770	393,270	8.6
2019	5,540,320	423,550	9.5
2020	6,050,150	466,830	9.2
2021	6,610,900	502,750	9.3
2022	7,200,600	534,700	8.9
2023	7,840,300	598,700	8.9
2024	8,002,159	635,000	2.1
2025	8,415,397	676,475	5.2

Source: The table was prepared by the researcher based on data from [12].

Middle Euphrates Electricity Production Directorate, General Company for Electricity Production, Planning Department, unpublished data, 2015–2025.

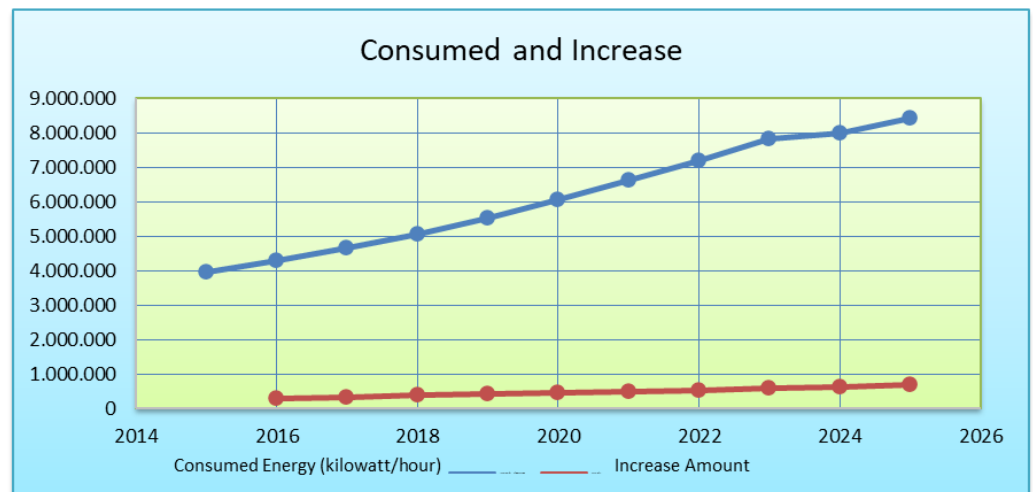


Figure 3. Development of Electricity Consumption in the Holy Governorate of Karbala for the Period (2015–2025).

Source: The figure was prepared by the researcher based on the data in Table (4).

The above indicates that the current level of electricity consumption by the population is varied and does not conform to a stable trend during the course of the hours of the day, month, or year, and this variability has been contributed by the following human, natural and economic factors; high temperatures during the summer months and low temperatures during the winter month, high level of humidity, which increases the rate of consumption of electricity through heating, cooling, increased individual purchasing and increased use of electrical devices. Moreover, population, urban and economic growth have also increased, leading to a rise in the average per capita income which consequently increases demand of electrical energy as there is more purchasing power by individuals and increased usage of electrical appliances. This necessitates an increase in electricity production to meet the needs of various consumption sectors, including industrial, commercial, agricultural, domestic, and governmental [14].

Second Section: Average Per Capita Electricity Consumption in the Holy Governorate of Karbala

Introduction:

In this section, the population of the Holy Governorate of Karbala and the average per capita of electricity consumed in the period (2015–2025) will be discussed. Per capita electricity used is regarded as an index that shows the level of development and progress of countries. The mean electricity per capita differs in each region in the governorate. Table (4) and Figure (4) in the research area depict the trend of per capita consumption of electricity. In 2015, the average per capita share stood at 3.37 megawatt hours and in 2025, the share rose to 5.54 megawatt hours. The growth is explained by the reasons referred to earlier in the text, such as the COVID-19 outbreak and the ensuing consequences. The per capita consumption has still risen in recent years with a peak of 5.12 megawatt-hours in the year 2022 and a peak of around 5.40 megawatt-hours in the year 2024. In terms of comparison of the per capita electricity consumption in the Holy Governorate of Karbala against the other Arab countries, it is found to be relatively low. This has been contributed by the high rate of population growth in Karbala, and further aggravated by the increased periods of power interruptions, which diminish the amount of electricity supply.

Table 5. Average Per Capita Electricity Consumption in the Holy Governorate of Karbala for the Period (2013–2025).

Year	Population of Karbala Governorate	Energy Consumed (MW/h)	Per Capita Average (kW/h)
2015	1,179,259	3,970,440	3.37
2016	1,209,459	4,280,210	3.54
2017	1,240,432	4,660,500	3.76
2018	1,272,198	5,060,770	3.98
2019	1,304,778	5,540,320	4.25
2020	1,338,192	6,050,150	4.52
2021	1,372,462	6,610,900	4.82
2022	1,407,609	7,200,600	5.12
2023	1,443,656	7,840,300	5.43
2024	1,480,627	8,002,159	5.40
2025	1,518,544	8,415,397	5.54

Source: The table was prepared by the researcher based on data from the [12].

Middle Euphrates Electricity Production Directorate, General Company for Electricity Production, Planning Department, unpublished data, 2015–2025.

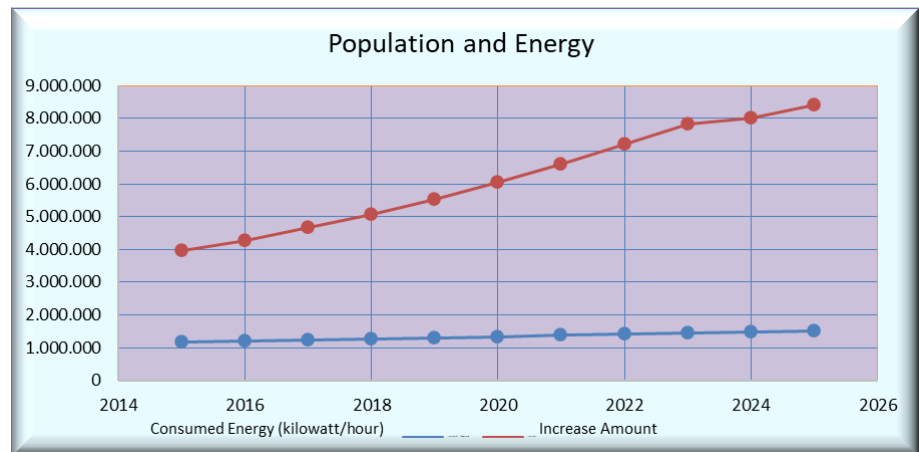


Figure 4. Population and Their Electricity Consumption in the Holy Governorate of Karbala for the Period (2015–2025).

Source: The figure was prepared by the researcher based on the data in Table (5).

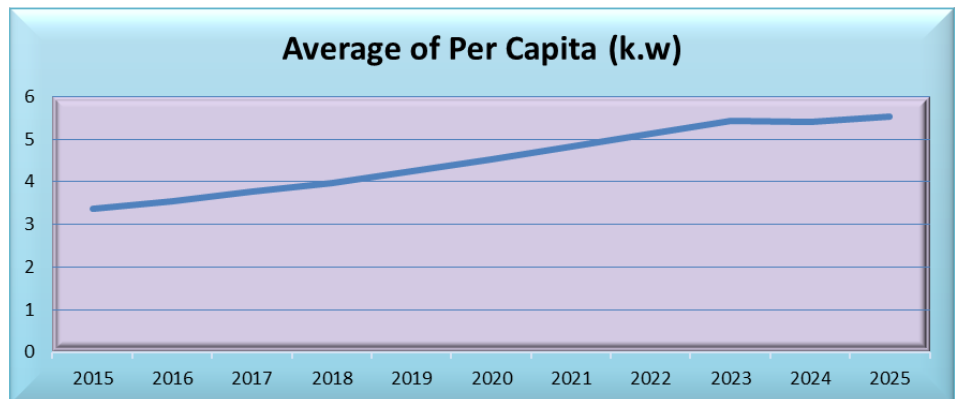


Figure 5. Population and Their Electricity Consumption in the Holy Governorate of Karbala for the Period (2015–2025).

Source: The figure was prepared by the researcher based on the data in Table (5).

Second Section: Implications of Rapid Urbanization on Electricity Consumption in the Holy Governorate of Karbala

The Holy Governorate of Karbala does not differ significantly from other cities in the developing world regarding urban challenges. The governorate's continual need for serviceable land and the growing demand for urban land with diverse uses has led many to encroach upon legally designated land uses.

The high level of illegal encroachments that developed after 2003 and especially on the lands owned by states requires urgent control. Also, the land owners have modified the use of land, whether through agricultural or industrial use to residential use without permission. Two waves of displacement of surrounding areas occurred in Karbala after the recent ISIS conflict. The initial wave followed the war immediately and a lot of newcomers were taking up the lands that were under public and state ownership and they destabilized a lot of projects needed to be implemented by the development plans of the country which had ineffective administrative control of such projects. There was a second wave of forced migration in 2014 in the governorate of western regions, Mosul, and Tikrit as a result of terrorist attacks. This wave resulted in an unparalleled housing demand, strained infrastructure, social services and labour market. These waves of migration are unlikely to change their effect on the governorate within the near future as the country is of exceptional circumstances. Karbala is similar to other emerging urban areas in the absence of natural environment that would help to counter the negative impacts of urbanization. The environmental impacts include the high use of energy and the mode of supplying electricity to the people, which is now being dependent on the small-scale generators that tend to cater to about 75 percent of urban energy demands [15].

4. Conclusion

1. The Holy Governorate of Karbala has shown a considerable growth in population as it is projected to have 1,179,259 in 2015, and 1,518,544 in 2025.
2. The effects of rapid urbanization are economical, social and environmental which can be either positive or negative based on government policies concerning how population growth, income distribution, savings, investment, capital formation and consumption can be used to manage the urbanization.
3. Karbala electricity production was on a steady upward trend with the production of 4,120,440 MWh electricity growing to 8,545,397 Mwh electricities as a result of the rising demands of electricity in 2015 and 2025 respectively.
4. The trend of electricity consumption during the study period in 2015 was 3,970,440 MWh to 2025 8415397 MWh, which shows a direct correlation with the rise in population: the higher the population growth, the higher the increase in electricity consumption.
5. The per capita consumption of electricity in Karbala is not high when compared to the other cities in Iraq.

Recommendations

1. Revise the electricity distribution system to conform to the number of people in every administrative unit within the governorate.
2. Establish an effective strategic plan to deal with the rapid urbanization, especially at the time of the rise in the population, does not correspond to the available resources.
3. Introduce the national population policies which will help to control the migration, help to encourage the displaced population to come back to their home cities and

motivate expatriates to come since they are necessary to the local development but make sure that the needed support is provided to resettlement.

4. Produce more electricity in Karbala and develop future strategic plans of developing new power plants to match the rapid urbanization demands.
5. Further encourage the production of electricity using renewable resources such as solar and nuclear power.
6. Spread awareness on reasonable use of electricity and its conservation to secure continuous supply and eliminate the economical, social, and environmental costs of energy wastefulness, in the form of media campaigns, social media, and outreach initiatives through the public.

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