

# Solving the Electricity Power Shortages in the Kurdistan Region Through the Lighting Project

Luqman Hwayyiz Asaad<sup>1</sup>

<sup>1</sup>Senior Electrical Engineer / Power and Machine Director of Electric Distribution Erbi / Iraq

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**Abstract:** Due to climate change, rising fuel prices and changes in the needs of life, the demand for electricity has increased and is constantly increasing because electricity production is very complicated and expensive. This requires the provision of fuel, so work must be done to reduce electricity consumption.

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## I. INTRODUCTION

Electricity is the lifeblood of cities. No country can advance and develop without electricity services. Therefore, it is considered a sign of modern civilization. Without electricity services, industry and the industrial and technological progress witnessed by the world, especially developed countries, cannot exist. Iraq is one of the developing countries that suffers from a lack of national electricity services due to the large increase in population, which leads to increased demand for electricity production. This is in addition to the age of power plants and their exposure to constant breakdowns.

Increase electricity production is very hard due to lack of financial capacity and due to lack of fuel because electricity production is not only about installing power plants but also requires uninterrupted fuel supply. Therefore, the shortest way

to avoid power cut off from the partners and to provide 24-hour electricity needs is to resort to reducing demand. One of these effective ways is an increase in electricity prices to reduce demand.

## II. POWER SHORTAGE

In Kurdistan region of Iraq due to unbalance between power production and demand consumers suffering from power cutout ages daily. Therefore, reliance was placed on private generators that run on diesel, after the deficit in the national grid reached frightening levels throughout Iraq. As a result of the population increase and the extreme rise in temperatures, coupled with the large deficit in the national energy networks, all this led to an increase in demand for electricity. Private generators have become a common phenomenon in the streets, alleys, and shops. These generators are the foundation of energy generation, Figure 1.



Fig 1 Generator Lines

➤ **Generators**

To provide consumers with electricity in case of power outages, small generators located inside population area in

Figure 2 shows that total generator locations are 3028 in Kurdistan region, some of locations include one generator and others more than one.



Fig 2 Generator Locations

The number of generators in any location depends on vertical complexes, i.e. residential apartments, the number of generators can be collected in one location. The living conditions also affect it due to the greater demand for energy.

Figure 3 the number of subscribers and the area of the residential site. For example, in horizontal residential complexes, each location includes one generator, and in.

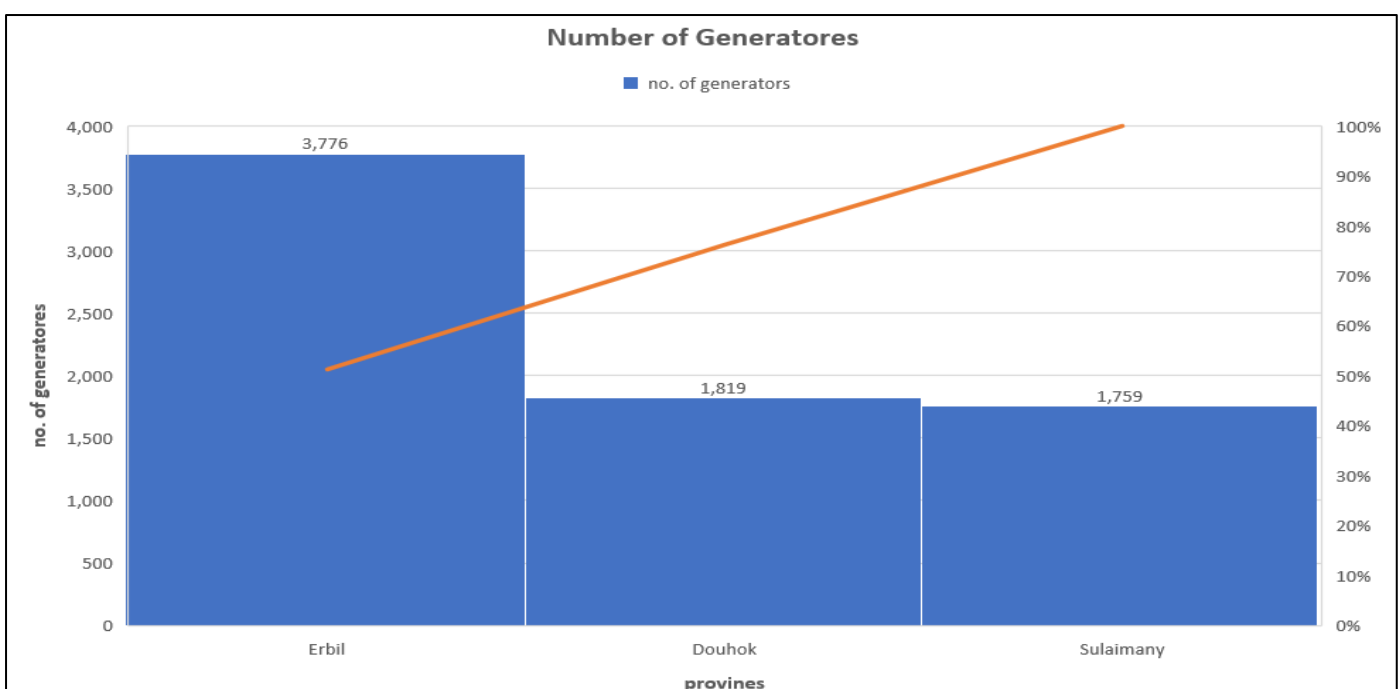


Fig 3 Number of Generators

In previous years, there was a deficit in the generation of electrical energy reaching 60% or more. In order to fill the shortage, generators were operated during power outages to supply homes and shops with the required energy. According to the study and available data, the total capacity produced by

malls is in the minority and reaches 2865 megawatts according to the designated capacity of the generators. However, the capacity distributed to consumers is 53% of the total capacity of the generators in order to maintain the sustainability of the generators., as shown in Figure 4.

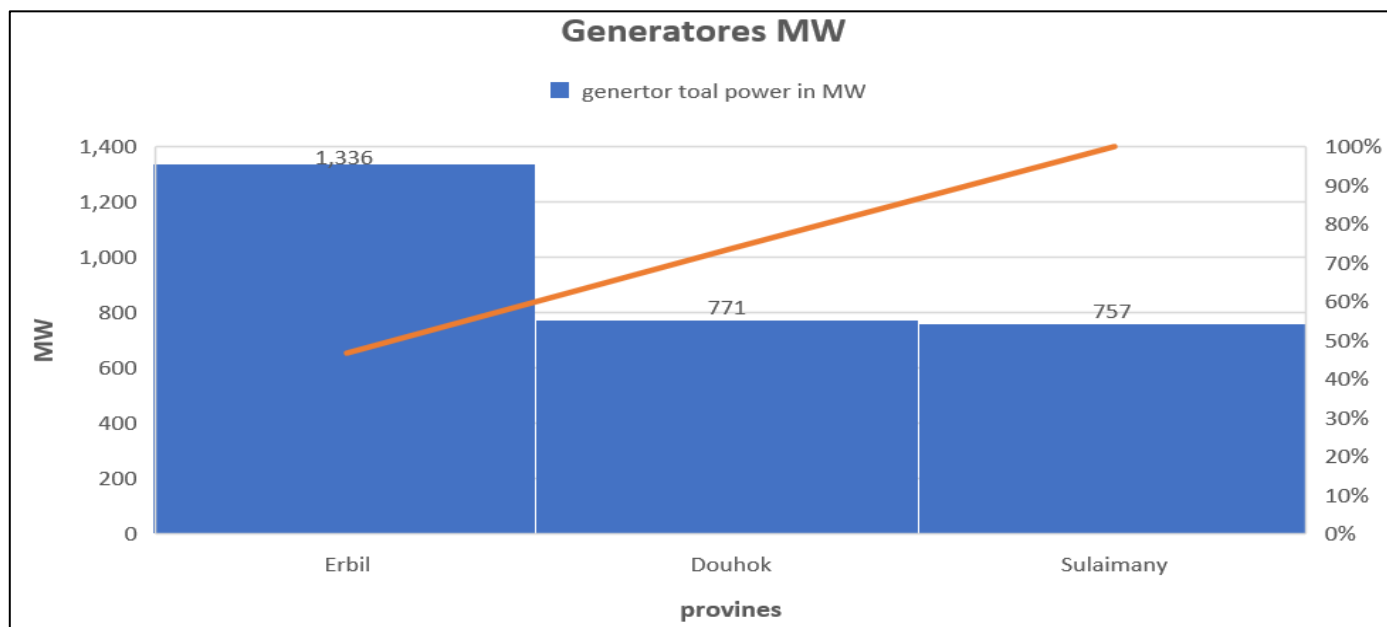


Fig 4 Generatores MW

### III. EFFECTS ON ENVIRONMENT

Result of operating the large number of generators, this has led to the spread of pollutants, both in the air and soil of Baghdad, through the fumes and smoke emitted by the generators. The most important of these gases are carbon dioxide and carbon dioxide. Nitrogen oxide, sulfur dioxide, and other pollutants, as well as soil contamination with oils, generator waste residues, and, this step has Many disadvantages, the most important of which are:

- Environmental pollution resulting from gases emitted from generator operation and its impact on human health
- The network through which electricity is distributed from generators in a messy and uncivilized manner, and at the same time, it is a danger to people's lives fig/1
- Providing electricity through generators is expensive and, in most cases, not efficient and up to the required standards.

### IV. GENERATORS BILLING

In the system followed for the electricity bill for generators in Iraq in general, there is no energy meter, but rather the electricity fees for the generator are paid based on the number of amperes, and the number of amperes is determined by the circuit breaker, so that the power is cut off when the specified ampere is exceeded.

- *The Fee Per Ampere is Calculated as Follows:*

Monthly electricity fee = Number of hours generators run per month \* 42 dinars (factor may be different from place

to place) \* Number of amperes for example, if the generator operates 300 hours per month, Current electricity fee =  $300 * 42 * 1 = 12,600$  Iraqi dinars per ampere.

If we wanted to obtain the value of the expenditures according to the above model in kilowatts:

Watt-hour = Current \* Voltage \* Hour \* Number of days in the month =  $1 * 220 * 10 * 30 = 66,000 = 66$  kilowatt-hours.

If we divide the rent by the expenditures (12,600/66), the cost of one kilowatt-hour is 190.9 Iraqi dinars.

- *Domestic Tariff*

According to old tariffs for domestic consumers in order to support the low-income class, Tariff was ascending so that wages for small expenses are at the lowest level, then they increase according to usage. Table 1 indicate the levels of electric tariff If we compare electric bill for generators with above tariff we get result as below:

Electric bill = kwh \* price

=  $66 * 18 = 1188$  ID

Ratio between government bill and generator bill are

=  $1188/12600$

= 9.42 %

Table 1 Levels of Electric Tariff

| Type of consumer | Kwh ranges / month | Price in ID |
|------------------|--------------------|-------------|
| Domestic         | 1-450              | 18          |
|                  | 451-900            | 24          |
|                  | 901-1500           | 42          |
|                  | 1501-2100          | 72          |
|                  | 2101-3000          | 90          |
|                  | 3001-5000          | 181         |
|                  | 5000-...           | 241         |

## V. SOLUTION

In order to solve the problem of electric generation shortage, it is necessary to increase the production of electrical energy by building new power plants. However, building power plants requires a large budget and providing fuel. With the financial and political problems that we are currently experiencing, it is very difficult to build new stations, and constructing new ones requires time to be ready.

As previously mentioned, building new power plants in the Kurdistan Region is not feasible. Therefore, a new project was launched to solve the problem of the electricity generation shortage and provide consumers with continuous, 24-hour electricity without reliance on private generators. The project is called the Lighting Project.

The project's primary goal is to achieve a balance between available electricity and consumption by reducing consumption. Consumption reports confirm that electricity consumption, compared to international standards, is very high, reaching unacceptable levels. It is impossible to achieve a balance between energy generation and energy consumption at such current consumption levels.

### ➤ The Project's Steps Can be Summarized as Follows:

- Tariff increase
- Switching to smart meters
- Eliminating all energy thefts on the electricity grid
- Installing smart meters on distribution transformers to monitor expenditures and detect energy thefts

Table 2 below shows that residential users account for 85.03% of the total electricity consumption in Koya/Erbil in Jan.2025.

To reduce electricity demand we have to start with residential consumers.

It is worth noting that these data may vary from country to country depending on needs and living standards, or the number of large enterprises or projects in the agricultural and industrial sectors, as well as private sector projects and enterprises.

Table 2 Consumption According to Type of Consumers

| Type of consumer | No. of consumers | Consumption in MWH | Ratio % |
|------------------|------------------|--------------------|---------|
| Domestic         | 31,976           | 22,104             | 85.03   |
| Other consumers  | 5,743            | 3,891              | 14.96   |
|                  | 37,719           | 25,995             |         |

### ➤ Tariff Changing

The first step for a lighting project, i.e. a project to provide continuous electricity, is to adjust the electricity tariff so that it takes into account the limited-income class and restricts excessive energy consumption by relying on a progressive tariff, Table 3 describe tariff change for domestic consumers which represent the major electricity users.

Through this step, consumers get continuous electricity without interruption, with an increase in the price because consumers reduce consumption to avoid reaching high tariffs, because an increase in consumption is met with an increase in the tariff.

Table 3 New Tariff

| Type of consumer | Kwh ranges / month | Price in ID |
|------------------|--------------------|-------------|
| Domestic         | 1-400              | 72          |
|                  | 401-800            | 108         |
|                  | 801-1200           | 175         |
|                  | 1201-1600          | 265         |
|                  | 1601-above         | 350         |

### ➤ Non-Domestic Tariff

As for non-residential subscribers, industrial, agricultural, commercial and governmental only, the tariff has also been changed Table 4, but without relying on escalation,

i.e. a single tariff for all levels of energy consumption, in order to achieve rationalization in consumption and also to encourage consumers to switch to renewable energy and depend on their own energy.

Table 4 Non-Domestic Tariffs

| Type of consumer | Old tariff – ID/ kwh | New tariff– ID/ kwh |
|------------------|----------------------|---------------------|
| Industrial       | 144                  | 165                 |
| agriculture      | 36                   | 60                  |
| commercial       | 156                  | 185                 |
| government       | 80                   | 160                 |

### ➤ Impact of Tariff Increase on Consumption Values

After the implementation of the new electricity tariff, a significant change in consumption levels was observed across all types of consumers, both residential and non-residential. This indicates that citizens are trying to balance their expenses with their monthly income and avoid reaching the escalating tariff, as increased consumption leads to higher tariffs. A

graph shows a decrease in consumption in several feeders within Erbil Governorate after the implementation of the new tariff, ranging from 10% to 25%. This data represents loads taken without accounting for new subscribers from September 2024 to September 2025, as this undoubtedly has an impact. Therefore, it can be considered that the loads decreased by a greater amount Figure 5.

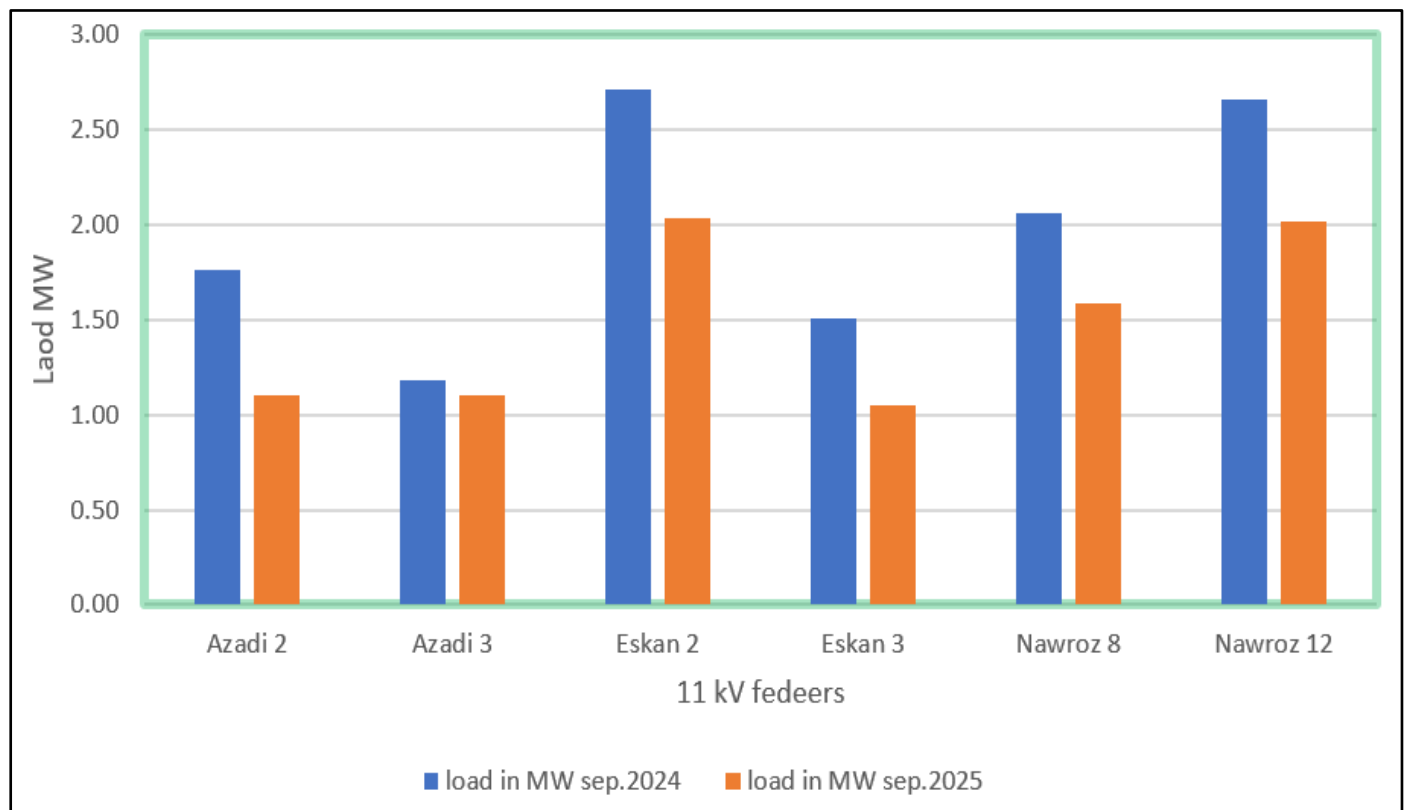


Fig 5 Effect of Tariff Change on Feeder Load in Erbil

### ➤ Electric Bill Before and After this Project

The average consumption in the residential type reaches 600 kilowatt-hours per month. Due to the existence of outages, the consumption can be considered to be 800 kilowatt-hours.

Let's compare the value of the electricity bill with the previous tariff, including generator fees, and the bill with the new tariff, of course, without outages and without generators as calculated in Table 5.

Table 5 Electric Bill Comparison

| Description     | levels  | bill  | Total in ID | Total amount payable for one month in ID |
|-----------------|---------|-------|-------------|------------------------------------------|
| previous tariff | 450×18  | 8,100 | 11,700      | 53,700                                   |
|                 | 150×24  | 3,600 |             |                                          |
| Generator (3A)  | 3×14000 |       | 42,000      | 72,000                                   |
| New tariff      | 400×72  |       | 28,800      |                                          |
|                 | 400×108 |       | 43,200      |                                          |

As shown in the table, the price difference is not significant. Furthermore, providing consumers with a continuous electricity supply while completely eliminating generator noise and environmental pollution, and ending the illogical generator electricity distribution network, can be considered a major achievement and a bold step. This price difference could encourage consumers to turn to alternative energy sources, such as solar power, thereby reducing the load on the national grid and lowering electricity bills. This is the primary objective of the lighting project.

## **VI. CONCLUSION**

Fair tariffs, time-based tariffs, and accurate electricity bill collection are the cornerstones of reducing electricity demand. Of course, minimizing losses, eliminating electricity theft from the grid, and improving grid quality all contribute to achieving this same goal.

Smart meters have been implemented in many developed countries as demand-measuring devices, integrated with variable power supply components. Smart meters provide a means of collecting highly accurate data on energy demand at the point of end use.

The cost of smart electricity meters is partly justified by balancing the electricity grid to reduce system costs, improving the balance between demand and renewable energy sources, and maximizing the use of distributed energy systems and battery storage. A key feature of smart meters is their ability to provide tariffs that more accurately reflect the cost of electricity generation, which is increasingly viewed as Renewable energy sources will increase, especially with the need for additional generation and rising demand an important point to emphasize is the individual's responsibility to conserve electricity and consider electricity a national energy resource that must be protected. Minimizing electricity consumption should be seen as a duty, not a fear of electricity bills.

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