ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1532

Effects of Tariffs on Electric Consumption

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Publication Date: 2025/05/10

Abstract: Electricity companies rely heavily on electricity sales volume for revenue. Tariff design has a direct impact on consumption patterns and, consequently, revenue. Therefore, it is important to design an efficient and fair electricity tariff. This does not aim to increase the budget, but rather to reduce electricity consumption in order to reduce pressure on the electricity grid.

How to Cite: Luqman Hwayyiz Asaad (2025). Effects of Tariffs on Electric Consumption. *International Journal of Innovative Science and Research Technology*, 10(4), 3017-3022. https://doi.org/10.38124/ijisrt/25apr1532

I. INTRODUCTION

The implementation of a fair electricity tariff aims to control demand for electricity consumption and promote sustainability by incentivizing households to reduce consumption and use more energy-efficient household appliances. Price levels can be structured to encourage customers (especially those with increasing electricity demand) to reduce their overall demand. Restructuring electricity subsidies in the residential sector is of great importance to the country's economy, as well as more effective management of electricity consumption and its environmental impact, laying the foundation for more sustainable development. Data collected from the residential sector indicates that the average consumption of unsubsidized households is approximately 297 kilowatt-hours per month, while the average consumption of subsidized consumers is approximately 615 kilowatt-hours per month. Energy consumption increases in winter and summer, particularly among subsidized beneficiaries, with increased demand for heating and cooling. The implementation of (non-subsidized) electricity tariffs provides an effective means of controlling demand. The tariff structure can incentivize consumers (especially those with high electricity consumption levels) to reduce their overall consumption, as well as reduce peak demand (which reduces pressure on the grid and power plants), by requiring them to pay for electricity at the highest price.

- *Demand for Energy Consumption*

Studies show that the average growth rate of global energy consumption nearly doubled in 2018 since 2010, driven by the global economic recovery following the global financial crisis, as well as improved quality of life in certain regions, which led to increased demand for electricity and heating and cooling appliances. As a result of the increased energy demand, carbon dioxide emissions from power generation rose by 1.7% to a historic peak of 33.1 gigatonnes of carbon dioxide. Despite the overall increase in emissions from the burning of fossil fuels, nearly two-thirds of the increase is attributable to the energy sector. Furthermore, the annual growth rate of primary energy intensity worldwide has recently declined (from a peak of around 3% in 2015 to 1.9% in 2017), largely due to an increased focus on renewable energy sources. In 2018, global energy demand grew by 4%, nearly double total energy demand, marking the highest growth rate since 2010. Most of the additional demand was met by renewable and nuclear energy sources. However, there was a significant increase in energy production from gas- and coal-fired power plants, causing carbon dioxide emissions to rise by 2.5%.

- *Energy Consumption Comparison*

According to studies and analyses, the average consumption of a typical household (paying the regular tariff) is approximately 296 kilowatt-hours per month, while that of a subsidized electricity tariff group is 615 kilowatt-hours per month. Energy consumption peaks in the winter and summer due to heating and cooling needs, as shown in Figure 1. Comparing the two curves, it can be concluded that those paying the subsidized electricity tariff peak in the winter, particularly during January when temperatures reach their lowest. Electricity consumption remains at its lowest for typical consumers paying the regular tariff, who attempt to meet their heating needs with other means (such as gas, diesel, and coal), despite the additional costs of fossil fuels, to avoid paying a higher electricity tariff. Utility employees are able to use electricity at much lower costs.

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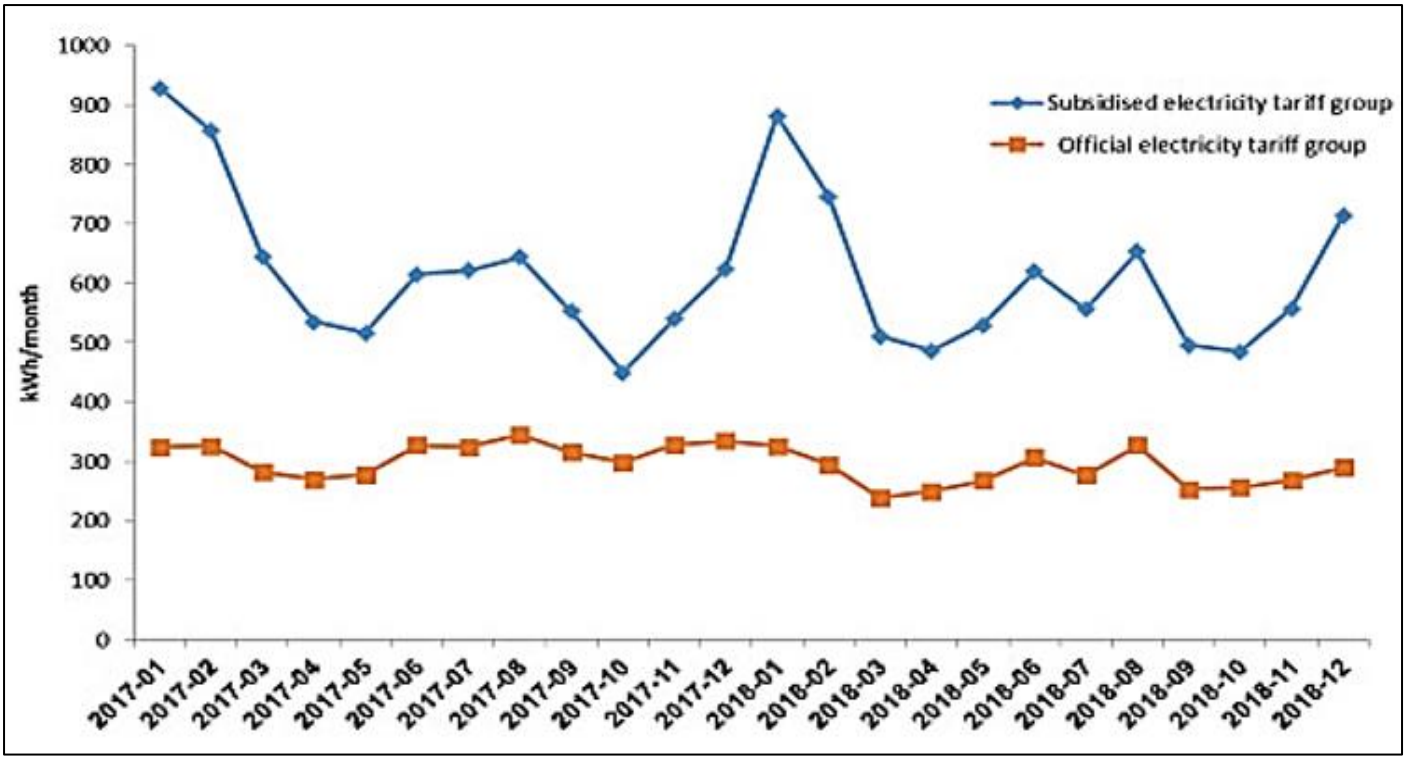

Fig 1 Energy Consumption Comparison in Jordan

➢ *The Impact of the Electricity Tariff Change*

The impact of the electricity tariff change was positive in Saudi Arabia. The graph in Figure 2, which displays the average trends in per capita electricity consumption for households over the four years, shows that average per capita electricity consumption has generally been steadily declining since the implementation of the new tariff pricing. The results indicate a positive development in household electricity consumption patterns, with mixed results observed between 2017 and 2018 (statistically significant decreases in electricity consumption were observed in 5 out of 12 months), followed by a significant decline in electricity consumption in 2019 compared to 2017. Clearly, a delay is expected between the adoption of the new tariffs and the decrease in consumption. While this gap between the electricity price increase and the conservative behavioral change can be considered a learning period, it may also be due to the long-term effects of energy efficiency. While households were developing an understanding of the new tariff structure and realizing its financial implications, 2018, the year that saw the implementation of the revised tariff structure, could be considered a year of monitoring, as households began making the necessary adjustments for the future. This is particularly evident in the months following the summer, the so-called monitoring period, when electricity demand is lower.

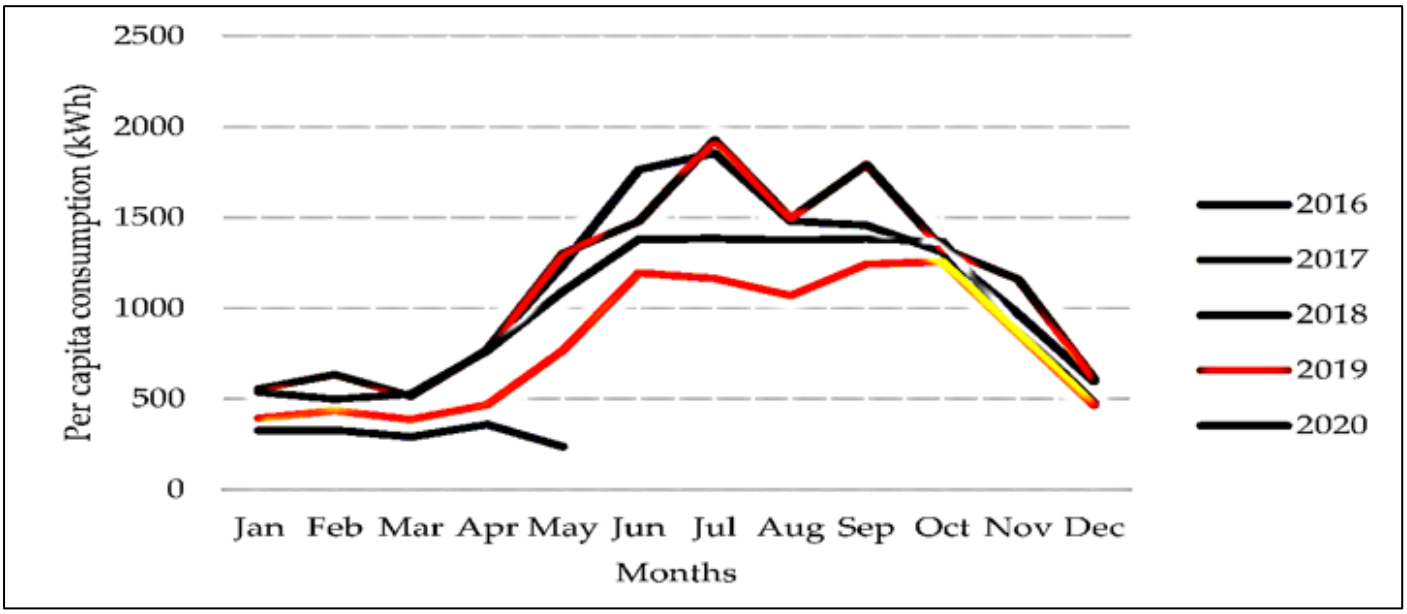

Fig 2 Effect of Change Tariff in KSA

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➢ *Comparison of Electricity Prices between Countries*

Electricity is one of humanity's most important resources, providing almost universal energy and essential for daily life in most parts of the world. However, because a country's ability to generate electricity is greatly influenced by factors including its geographical location, geological composition, level of development and technological advancement, and whether it is a high-, middle-, or low-income country, the price of electricity can vary significantly from one country to another.

Electricity can be generated using a wide range of methods, from simple waterwheels and windmills to coal-fired power plants, solar panels, hydroelectric dams, and nuclear power plants. Each of these methods has its own costs, strengths, and weaknesses, and most are more suitable for some countries and locations than others, as shown in Figure 3.

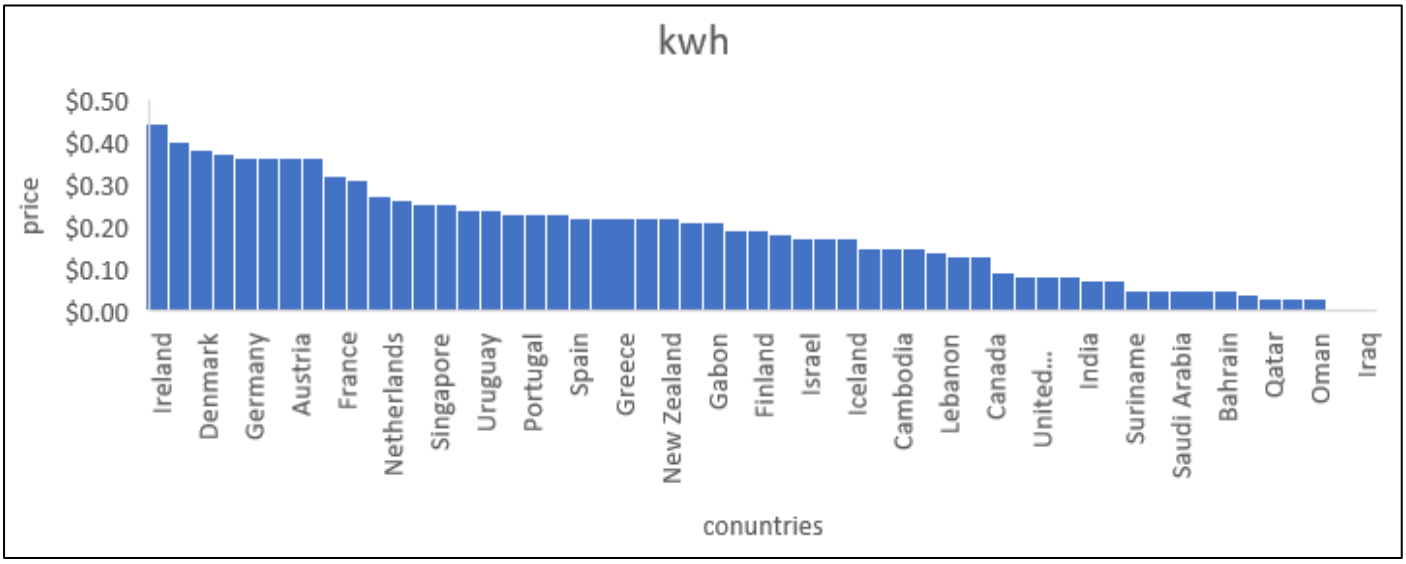

Fig 3 Price of Electricity in some One Countries

➢ *What is a TOU Rate Plan?*

Examples of these types of tariffs abound, and include demand-based pricing, real-time pricing, critical peak pricing, and time-of-use (ToU). Most previous studies on ToU focus on the extent to which these tariffs cause changes in electricity consumption, including temporary dips in electricity demand during peak periods and absolute net conservation effects. More recently, the distributional effects of these tariffs on different types of residential consumers have been analyzed, recognizing that tariff changes may create advantages for certain socio-demographic groups. Compared to fixed rates, TOU rates more accurately reflect the cost of electricity at the time of consumption. This means that electricity costs depend on the time of day. During the evening hours, when electricity demand is high as we turn on the lights and cook dinner, higher (peak) energy rates are charged. During the daytime hours, when consumption and demand are lower, lower (off-peak) energy rates are charged.

A TOU rate plan encourages you to use electricity when demand is lower and energy is cheaper. It helps relieve pressure on the electrical grid during peak times. TOU rates support a cleaner energy grid by encouraging energy use when renewable resources are most readily available. Solar energy production typically peaks in the early afternoon, and wind energy peaks in the evening. Energy demand tends to peak from 4 to 9 p.m., when renewable energy resources are not at their peak production levels. Fig.4

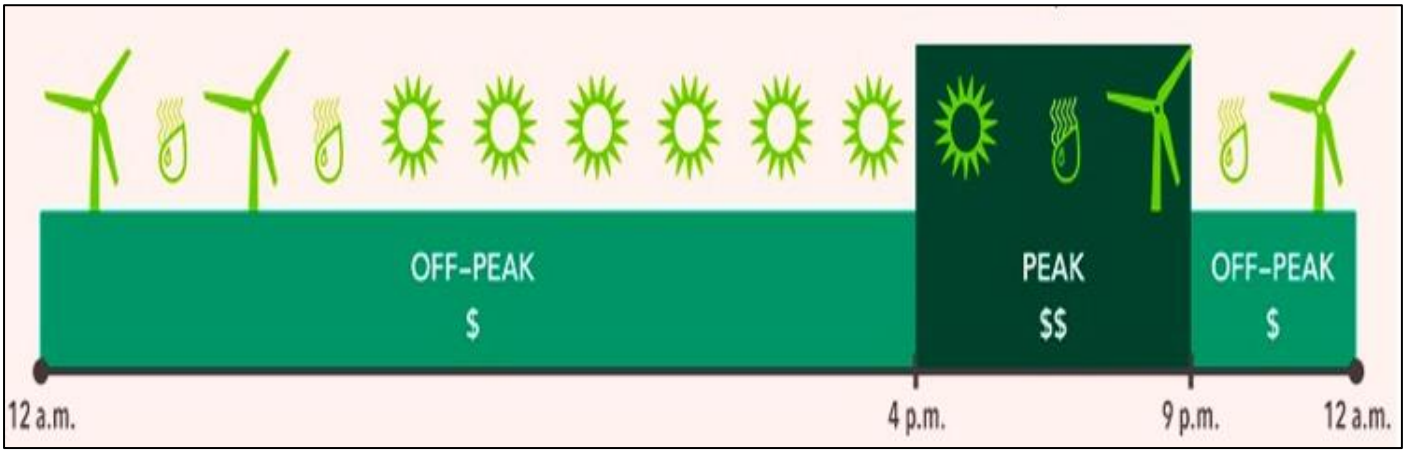

Fig 4 Tou Plan

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Customers with a TOU rate plan can take advantage of lower rates by scheduling their energy consumption during off-peak hours. Running major appliances like your washer and dryer during off-peak hours is a simple way to reduce your bill. You can also load your dishwasher or washing machine so it's ready to run later in the evening or during the day. Not only will you lower your bill, but you'll also support your country's clean energy future.

Electricity is one of humanity's most important resources, providing almost universal energy and essential for daily life in most parts of the world. However, because a country's ability to generate electricity is greatly influenced by factors including its geographical location, geological composition, level of development and technological advancement, and whether it is a high-, middle-, or low-income country, the price of electricity can vary significantly from one country to another.

➢ *Power Shortages*

The problem of power outages due to increased demand for electricity consumption because the demand for consumption is greater than the production of electricity, so citizens are constantly having shortages of electricity every day, this problem continues for several years.

The reason why it is not possible to install new power plants so easily is because it requires a lot of budget and cannot be provided with fuel, and what has been observed is that production according to international standards It is not bad compared to the population, but the electricity consumers use a lot of electricity, so the demand has dominated the production in fig 5 shows average daily hours that electricity provided to consumers on 12 months in 2024.

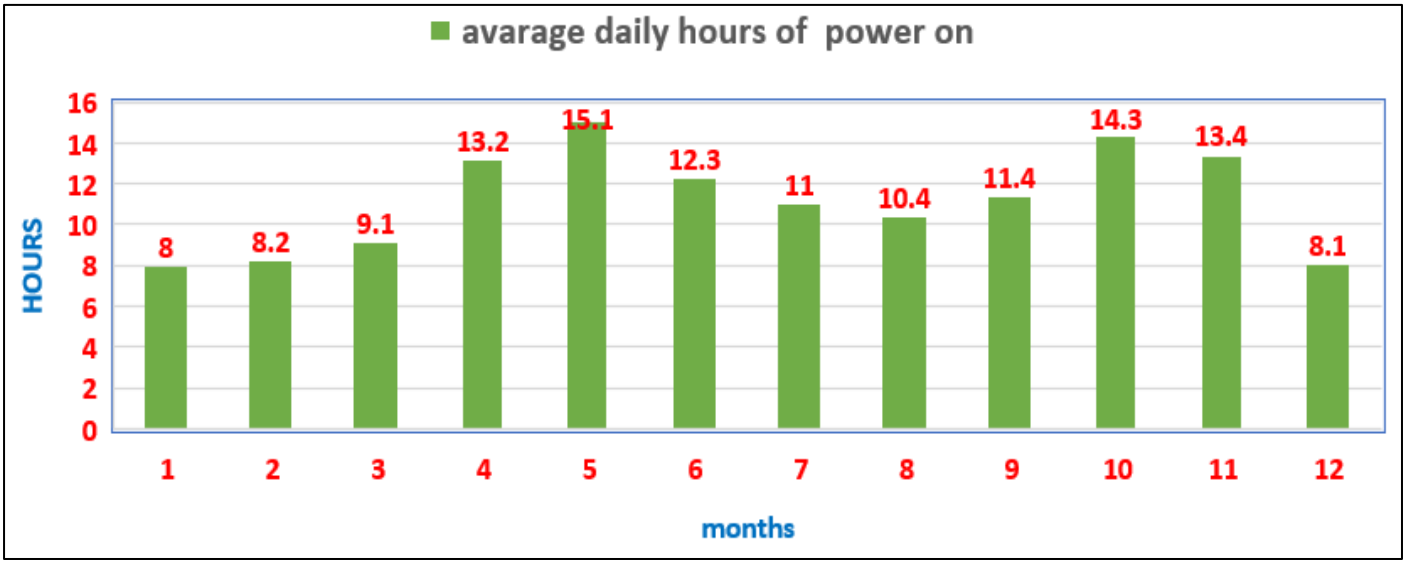

Fig 5 Average Daily Power on in Erbil KRG / Iraq

➢ *Consumption According to Type of Consumers*

To obtain accurate data on consumption rates, it's best to know which type of consumer has the greatest demand for electricity. The table 1 below shows that residential consumers accounted for 74% of total electricity consumption in Koya/Erbil in December 2024. To reduce electricity demand, we must start with residential consumers.

It's worth noting that this data may vary from country to country depending on the requirements and standard of living, or the number of factories or large projects in the agricultural and industrial sectors, as well as private sector projects and factories.

Table 1 Consumption According to Type of Consumers

Type of consumer	No. of consumers	Consumption in MWH	Ratio %
Domestic	31,918	13,001.224	74.11
Other consumers	5,723	4,540.339	25.88
	37,641	17,541.563	

➢ *Domestic Tariff*

One of the reasons for the high rate of electricity consumption is the low tariff and poor management of electricity collection. In the case mentioned above, we find that both conditions exist. The collection problem must be solved and the best way is to switch to pre-payment via smart meters. As for the tariff, the table below shows the current tariff for residential subscribers**.**

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Table 2 Domestic Tariff in KRG/ Iraq

Type of consumer	Kwh ranges / month	Price in USD
Domestic	1-450	0.012
	451-900	0.016
	901-1500	0.028
	1501-2100	0.048
	2101-3000	0.06
	3001-5000	0.12
	5000-...	0.16

➢ *Next Step*

In order to improve the current situation of electricity supply to consumers, a project called the Lighting Project is currently being implemented in the Kurdistan Region, where some places are being supplied with continuous electricity without reduction schedules, with the tariff changing to higher levels than before. So far, more than 70,000 consumers have been supplied in this way, which has led to an acceptable decrease in demand because consumers are rationalizing consumption for fear of high bills. The plan aims to complete the supply of all consumers in this way with continuous electricity within a period not exceeding two years. This experience shows that the tariff has a direct and fundamental impact on rationalizing and reducing energy demand.

The figure 6 shows that the load of mentioned feeders in Shadi substation in Erbil Governorate was very high during the power reduction schedule in 2024, but after the tariff change, the load of these feeders in the same month of 2025 decreased significantly because consumers forced to reduce electricity use in order to avoid high electricity bills, that is the project aim to reach minimum electricity demand in the future in order to getting balance between electric production and demand.

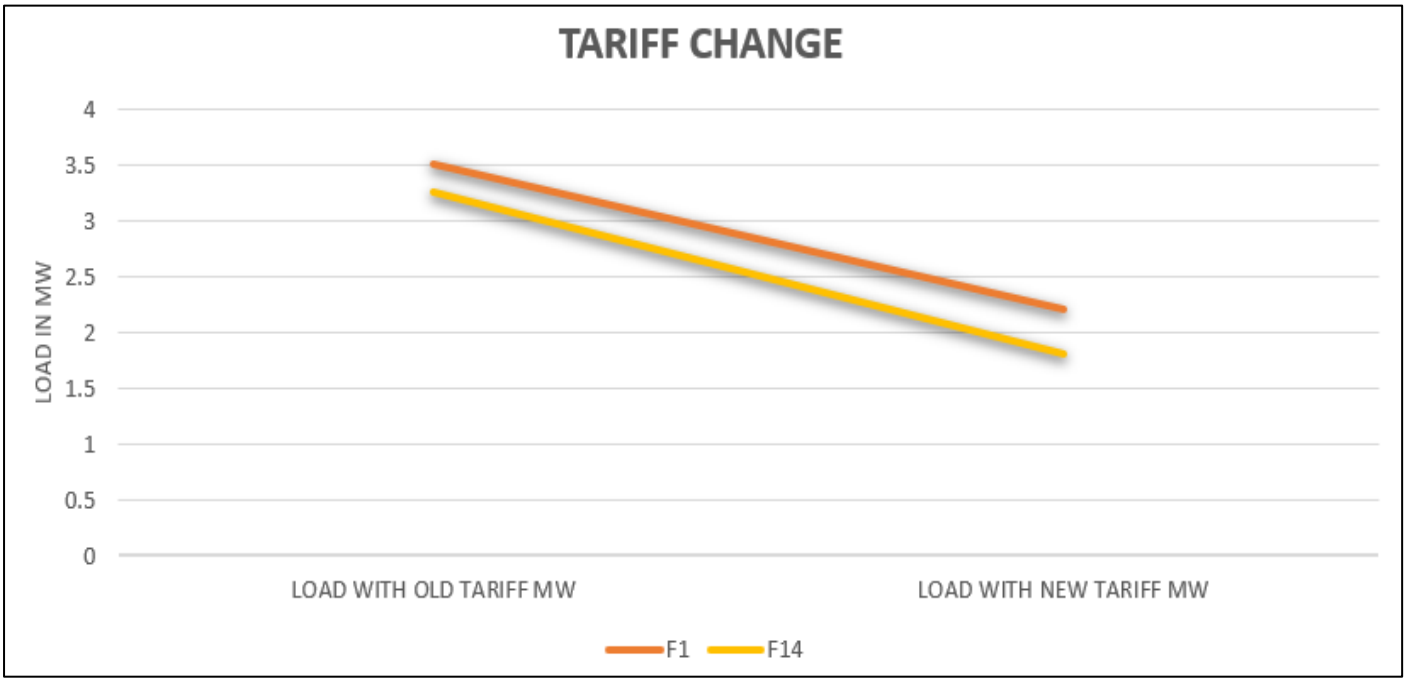

Fig 6 Effect of Tariff Change on Feeder Load in Erbil Shadi Substation

II. CONCLUSION

Fair tariffs , time of use tariff (TOU) and strong collection of electricity fees are the main pillars for reducing demand for electricity use. Of course, reducing losses, eliminating theft from electricity networks, and improving the quality of the electricity network serve the same purpose.

Smart meters have been implemented in many developed countries as demand-side measurement devices, integrated with variable electricity supply configurations. Smart meters provide a means of collecting highly accurate data on energy demand at the point of end-use. The costs of smart electricity meters are partly justified by balancing the electricity grid to reduce system costs, improving the balance between demand and renewables, 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 increasingly declines as the share of renewable electricity sources increases, especially with the need for additional generation and rising demand.

An important point must be noted, which is the individual's responsibility towards rationalizing electricity consumption and considering electrical energy a national resource that must be preserved and treating the use of electricity to the minimum possible as a duty and not out of fear of the electricity bill.

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