

Rationalization of Electric Consumption

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Abstract:-The production of electrical energy is a complex process and consists of several stages, starting with generating stations, power lines, and transmission stations, and ending with low-voltage distribution networks. Therefore, the cost of producing electrical energy is very high. For this reason, it is necessary to find ways to rationalize consumption so that it benefits the consumer first through a decrease in the electricity bill and thus leads to a decrease in the load on the electricity networks.

I. INTRODUCTION

The electricity is the basic factor for continued progress and prosperity. Electricity has entered all lifestyles and the need for it, benefiting from it, and reliance on it has increased in homes, schools, offices, stores, and in industrial, commercial and agricultural projects, and it has been used. In transportation, communications, medicine, heating, refrigeration, and various fields of life, this is because electrical energy is easily transformed into forms of energy with high efficiency yields, such as thermal, kinetic, sound, and light energy, etc.

Due to the advantages of electric energy, the most important of which are the possibility of transporting it to remote places, its simplicity of use, ease of control, cleanliness, lack of waste, and high level of reliability, its use has increased rapidly to the point that it now contributes (in many countries) to the equivalent of 60% of the total energy used. At the global level, the demand for electrical energy has grown, and will continue to grow, at a higher rate than the demand for other energies. The future will also witness an increasing percentage of the use of electrical energy, as it represents the basic element of development and growth and the backbone of development and prosperity.

Accordingly, electricity demand management and rationalization programs are now among the most important considerations that affect not only electricity companies' strategies but also their plans and programs. Studies have proven (in some cases) that electricity demand management and energy conservation programs are a competitive and feasible alternative compared to the option that depends on establishing generation stations, extending transmission lines, and expanding distribution networks. Rather, they represent an ideal solution to confront the steady growth in future electrical loads.

The concept of rationalizing electrical energy consumption appeared three decades ago, and during this period this concept began to expand and crystallize around preserving this energy, making good use of it, and developing the efficiency of energy-consuming electrical appliances and equipment. In addition, an important factor influencing

electric energy strategies has emerged, which is the necessity of preserving the environment, protecting it from pollution, reducing the phenomenon of global warming, and reducing emissions of toxic gases, including carbon, sulfur, and nitrogen oxides emitted from all sources, including power plants that operate on fossil fuels (Coal, gas, petroleum and its derivatives). This concept has promoted energy conservation and load management programs and the trend towards increasing reliance on renewable energy sources (i.e. what is known as clean and environmentally friendly energies).

II. THE IMPORTANCE OF RATIONALIZING ELECTRICAL ENERGY

The importance of rationalizing electrical energy is that it is one of the most important basic pillars for the optimal exploitation of fossil energy sources such as petroleum and its derivatives, which are used in power generation plants, which helps preserve these sources for future generations. Rationalizing the use of electrical energy provides many benefits:

- Reducing the subscriber's electricity bill.
- Reducing emissions affecting the environment as a result of saving fuel consumption in power plants.
- Supporting the manufacture of energy-efficient equipment, especially local production, to help develop the national economy as a whole.
- Reducing the investments needed to establish new projects and directing them towards improving the quality of service.
- Avoid load shedding at peak times and during the period when demand for energy increases and loads rise to the maximum, which is between six in the evening and ten in the evening during the winter and between seven in the evening and eleven in the summer.
- The electricity sector bears huge sums of money annually to cover peak loads, which only take a limited number of hours during the summer. Therefore, it is necessary to educate citizens about the importance of rationalization and its benefits for shifting unnecessary loads outside peak times, in addition to following rationalization guidelines in the use of lighting and electrical appliances, which benefits the public. Citizen and state.

III. WAYS TO RATIONALIZE ELECTRICAL ENERGY CONSUMPTION IN SOME DEVICES

A. The Air Conditioner

The air conditioner is one of the most widely used devices due to high temperatures during the summer, as this device consumes a large amount of electrical energy, which is reflected in the consumption bill. The following are ways to rationalize the electrical energy used in air conditioners.

- Close windows and doors to prevent hot air from entering the interior
- Make sure to close the holes to prevent hot air from entering by placing gaskets around door frames, windows, extractor fans, and any other places where wires and pipes pass through the walls
- Close the insulating curtains on the windows to prevent external heat from entering the interior.
- Avoid installing wall-type air conditioners (window type) in skylights or narrow places to ensure good ventilation of the device and not to increase consumption.
- Pay attention to cleaning air conditioner filters, as it is difficult for air to pass through unclean filters, and thus

air conditioners consume more energy and raise the consumption bill

- Wash the air conditioner at maintenance centers before entering the summer season.
- Make sure to turn off the air conditioners when leaving the room or office.
- Installing heat-reflecting, double-glazed windows to reduce heat transfer into the room.
- Set the air conditioner thermostat (temperature control device) at 25 degrees Celsius (75 degrees Fahrenheit), which is the most appropriate temperature for comfortable cooling.

Table 1: No. of consumer wit

Type of consumers	No. of consumers	ratio of consumer %
DOMESTIC	31,378	85.51
COMERCIALS	3,305	9
GOVERNMENT	802	2.18
INDUSTRIAL	141	0.38
AGRICULTURE	1,065	2.9
TOTAL	36,691	100

B. Lighting

Lighting is considered one of the most obvious uses of electricity, but this fact is often ignored when it comes to saving energy. The following tips help save the energy used in lighting.

Choosing appropriate lighting devices, i.e. fluorescent lamps with high efficiency and lower consumption, and dispense with ordinary lamps that are less efficient and have higher consumption using natural lighting and reducing reliance as much as possible on electric lighting during daylight hours will provide comfort and a natural atmosphere in carrying out daily work and reduce the energy costs spent on lighting.

C. Water Boiler And Heating

Using electricity for boiling and heating can be classified as heavy loads especially in cold places in winter Hot water is responsible for 25 percent of the average electric energy bill in Household, boilers power normally reach 3000 watt and heater not less than 1000 watt, any steps to rationalize must start with this two loads , the effect of this type of load are clear when overall load rises to peak in winter and callapse to minimum in spring.fig 3.

IV. TYPE OF CONSUMERS

In order to study ways to reduce electricity use we must start with each type of consumers which has majority in electric consumption . According to date that taken on end of oct..2023 from electricity distribution system in IRAQ / Erbil / Koya sub district, domestic consumers use approximately 70 % of over electric consumption , as described in table 1 below.

According to above data 85 % of consumers are domestic consumer , therefore an steps toward reducing electric using it is better to focus on domestic consumers due to using many electrical appliances (air conditioners, refrigerators, irons, washing machines, televisions, etc.).

The most energy consuming appliances in the home can vary depending on several factors such as family size, consumption habits, and the energy efficiency of the appliances. However, here are some of the most common power consuming devices:

- Air Conditioners and Electric Heaters : Air conditioners and electric heaters are often the largest consumers of electricity, especially when used for long periods during the day and night.
- Refrigerators and Freezers : These appliances are constantly working to keep food cold, making them major energy consumers.
- Clothes Dryers : Clothes dryers take a lot of energy to dry clothes, especially if you use them frequently.
- Water Heaters : Electric water heaters can be power-hungry because they constantly heat water to make it available at all times.
- Pool Pumps : If you have a pool, pool pumps can also use a lot of electricity to filter the water.

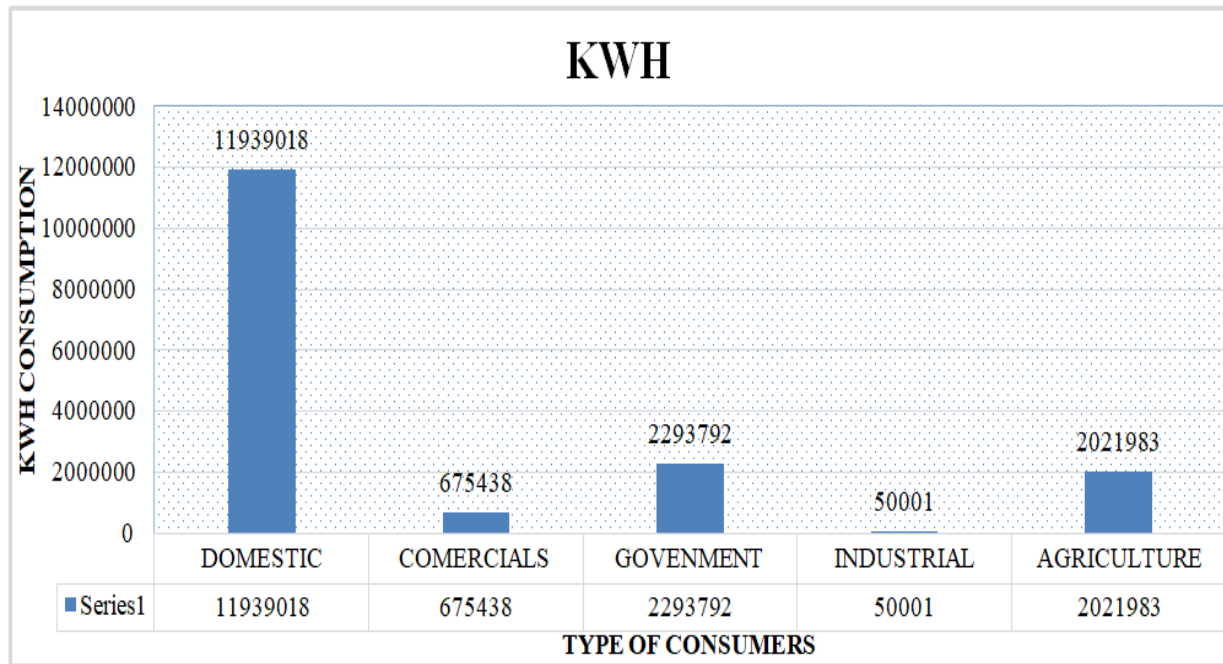


Fig. 1: Consumer electric consumption with 16 h daily outages

In order to study effect of reducing electricity use in households lets estimate that in table 1 each household consumer shutdown one lump 20 w “ $31,738 \times 20 = 634,760$ w or 634.76 kw

For 10 hours in one month

According to fig 1 / ratio of kwh consumption by each type of consumers are described as below:

- domestic 70.15 %
- commercials 3.96 %
- government 13.47%
- industrial 0.29%
- agriculture 11.882 %

V. REASONS FOR WASTING ELECTRICITY

Here are some of the main reasons for wasting electricity:

- **Comfort and Luxury:** The desire for comfort may lead some people to prefer excessive use of electricity. This could mean running the air conditioner or heaters for long periods, using multiple electrical appliances at the same time, or leaving appliances on standby to avoid turning them back on.
- **Old Appliances:** Using old appliances and electrical equipment, which may be less efficient, may lead to increased electricity consumption. Replacing this equipment with smart devices such as a thermal sensor can be expensive, discouraging the adoption of energy-efficient technologies.
- **Consumption Habits:** It may be difficult to change the electricity and energy consumption habits of some electricity consumers, even if this leads to a higher.

Electricity bill. For example, leaving lights on in empty rooms, or keeping appliances on standby can become routine and unimportant behavior for some wasteful and irresponsible people.

VI. BENEFITS OF APPLIANCE AND EQUIPMENT STANDARDS

Appliance and equipment standards, which can be attributed to the strong and positive impact they provide to consumers, businesses and governments alike.

- **Cost Savings** the Department of Energy should establish standards for appliances and equipment that are cost-effective for consumers. Manufacturers must ensure that increases in appliance and equipment prices are recouped by saving electricity during the life of the product.
- **Energy Saving** Energy efficient appliances and equipment use less energy consuming technologies to reduce the amount of electricity used per product. For example, compared to a refrigerator from 1973, today's new refrigerators use one-third the energy while costing consumers half the price and providing 20 percent more storage capacity.
- **Energy Security** Efficient appliances and equipment provide a cheaper, faster and more reliable way to meet growing consumer demand without the need to develop or import more energy sources.
- **Reducing emissions** Energy-saving devices and equipment contribute to reducing greenhouse gas emissions, as the decrease in electricity consumption requires generating less energy from fossil fuel power plants. According to building technology standards that have been in place since 1987, they have succeeded in avoiding 2.3 billion tons of carbon dioxide emissions, which is approximately equivalent to the annual emissions of 500 million cars.

- Technological Innovations Instrumentation and equipment standards provide a way to ensure that manufacturers move away from outdated technologies toward more efficient, innovative, and competitive product designs.

VII. EFFICIENCY STANDARDS

- RESIDENTIAL/CONSUMER Furnaces, central air conditioners and heat pumps, refrigerators and freezers, dishwashers, microwave ovens, televisions, battery chargers, ceiling fans.

- COMMERCIAL package air conditioners and heat pumps, water heating equipment, refrigerated beverage vending machines, walk-in freezers, electric motors
- LIGHTING Compact fluorescent lamps, incandescent lamps, light emitting diode (led) lamps, illuminated exit signs, traffic signal modules and pedestrian modules.

VIII. HOUSEHOLD ELECTRIC USE

Using electricity in households is different from place to place and from country to country it depend on weather and economy states in fig 2 / shows type of Energy consumption in EU households 2021

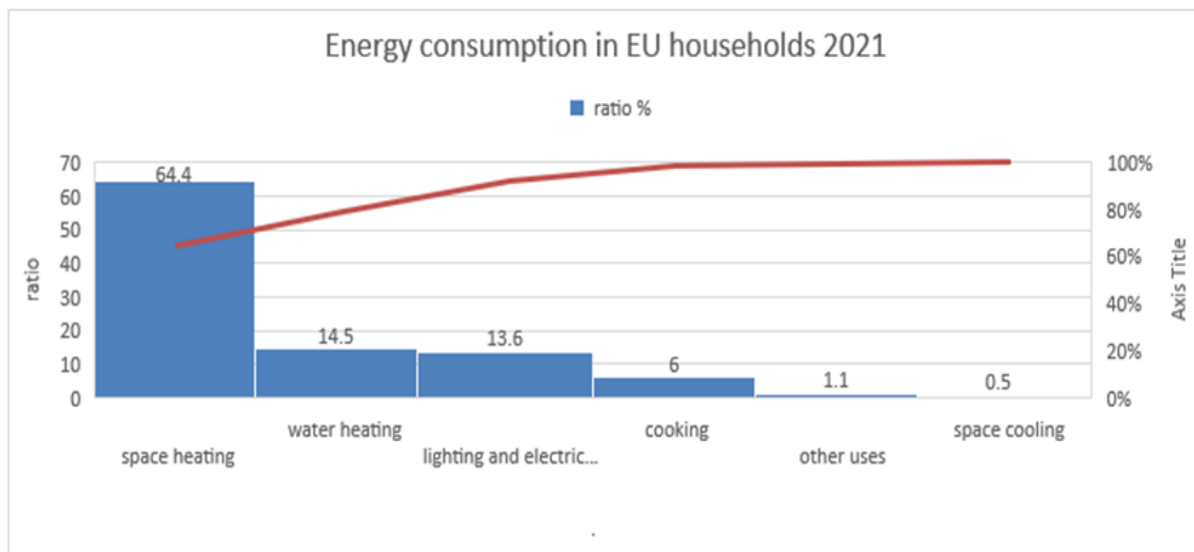


Fig. 2: Shows type of Energy consumption in EU households 2021

IX. RATIONALIZATION OF ELECTRICITY CONSUMPTION

By adopting these 12 ways to conserve electricity and these simple daily practices, you can not only reduce your electricity consumption, but you can also help conserve energy resources and protect the environment.

- Turn off the lights when you leave the room.
- Choose energy-efficient LED bulbs .
- Use programmable thermostats and controls to adjust heating and cooling to your needs.
- Turn off computers and monitors completely when not in use.
- Set the refrigerator to the correct temperature to avoid excessive energy consumption.
- Avoid opening the refrigerator door frequently to reduce cold loss.
- Turn off electronic equipment such as televisions, game consoles and computers at night.
- Reduce shower time to limit the use of hot water, which is generally produced using electricity.
- Properly insulate your home to reduce heat loss in the winter and cold in the summer.

- Certification of energy-efficient appliances and electronics with ENERGY STAR certification .
- Give priority to natural light and turn off artificial lights during the day.
- Educating your family members about the importance of spreading the culture of conserving electricity and water and adopting responsible habits together.
- “Turning appliances off and on again uses more electricity than leaving them on all the time.” This belief is wrong. In fact, turning off electronic devices when not in use saves energy. Sleeping devices continue to consume electricity unnecessarily. So it’s better to turn it off completely.
- “Setting the heater to a higher temperature will warm theroomfaster, This is also wrong. Heating operates with the same energy regardless of the set temperature. Setting the thermostat to a higher temperature will not cause it to heat up faster, but it will result in excessive energy consumption.
- “The energy savings achieved by adopting energy efficiency practices are minimal.” On the contrary, small actions can have a big impact in reducing electricity waste. Simple gestures like using LED lights, turning off backup appliances, and optimizing your heating and air conditioning settings can lead to significant energy savings in the long.

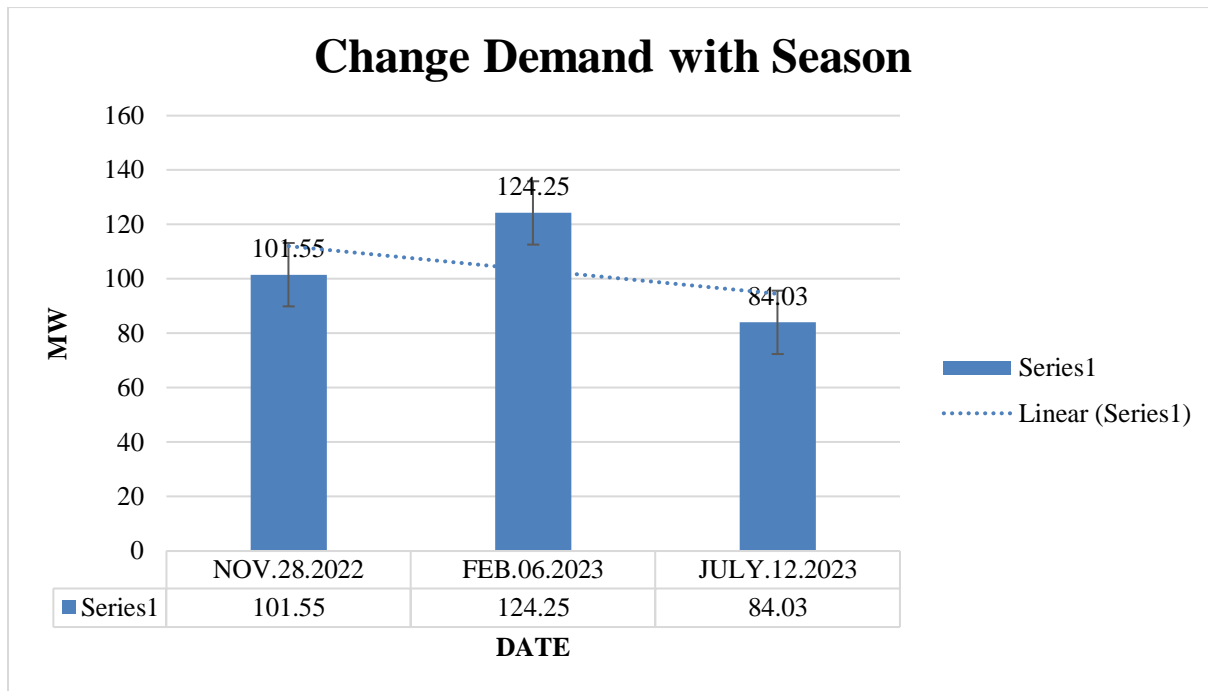


Fig. 3: Change Demand with Season

X. CONCLUSION

Accordingly, electricity demand management and rationalization programs are now among the most important considerations that affect not only electricity companies' strategies but also their plans and programs .Studies have proven (in some cases) that electricity demand management and energy conservation programs are a competitive and feasible alternative compared to the option that depends on establishing generation stations, extending transmission lines, and expanding distribution networks. Rather, they represent an ideal solution to confront the steady growth in future electrical loads.

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Experience always indicates that enacting laws and setting rules for the proper use of electrical energy and rationalizing its consumption in optimal ways may not alone be sufficient to educate, accustom, and adapt consumers to follow the best and most effective ways to exploit and make

good use of it, as there must be an effective force to enforce those rules and laws .It has become certain that rationalizing the consumption of electrical energy has become one of the important issues that has become a concern for both the supplying party (the electricity company) and the demand party (the subscribers), so it can be said that studying this issue in a scientific, applied and educational manner has become an urgent requirement to confront the phenomenon of growth. The rapid increase in demand for electrical energy, thus achieving optimal use of the capabilities of electrical systems and reducing their capital and operating expenses, as well as achieving optimal economic use of fuel, which will inevitably lead to reducing costs for electricity companies and their subscribers alike, in addition to protecting the environment from gases and pollution.

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