International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 05 May 2025, pp: 84-90 www.ijaem.net ISSN: 2395-5252

Electricity Saving – Necessary Solutions For Daily Life And Business Production

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Date of Submission: 01-05-2025 Date of Acceptance: 10-05-2025

ABSTRACT
Through studying and updating information from books, newspapers, and other relevant sources, the author recognizes that energy conservation has always been a major concern for society. Saving electricity, using the right methods will bring results practical. To make it happen, the author has give specifics calculation problems, attachec familive life and business, helps see more clearly simple yet effective olutions that can be applied by individuals, families, and society as a whole.
Keywords: Solutions for efficient and economical energy use

I. INTRODUCTION

Solutions for using energy efficiently and economically are no longer unfamiliar to us. However, they remain a top concern, especially as fossil energy resources are becoming increasingly depleted. According to the Ministry of Industry and Trade, the industrial sector currently accounts for 50% of the total national energy consumption, with a potential saving of (20 ÷ 30)%.

Saving energy helps households reduce electricity consumption and lower electricitycosts.For businesses, energy savings optimize production and operational costs, contributing to increased profitability and market competitiveness.

Additionally, saving electricity contributes to achieving environmental goals, such as reducinggreenhouse gas emissions and carbon emissions in production processes, leading to greener products that meet consumer demands.

II. RESEARCH OVERVIEW

Given the current state of electricity consumption, the author has studied various documents, books, and reports, as well as real electricity usage in households, schools, and production enterprises. By summarizing consumption patterns, specific solutions andcalculations have been proposed to provide a clearer understanding of electricity savings. These solutions are not only applicable to large-scale industries but also to households, institutions, and businesses.

2.1. Current state of electricity consumption
2.1.1. General situation

Rising electricity demand: Electricity demand in Vietnam has significantly increased in recent years due to urbanization and economic development.

Dependence on traditional energy sources: Vietnam still relies heavily on conventional energy sources such as coal, oil, natural gas, and hydropower, which constitute the majority of total energy consumption.

Potential for renewable energy development: Vietnam has great potential for renewable energy sources such as solar, wind, and biomass power.

2.1.2. Specific situations
a. Electricity consumption in households

The proportion of electricity used for household lighting in Vietnam is relatively high compared to other countries.

There is still significant electricity wastage in daily life, especially in lighting and the use of non-energy-efficient electrical appliances.

Inefficient electricity usage habits, such as leaving lights, fans, and air conditioners on continuously without turning them off when not needed.

High electricity consumption during peak hours due to the use of power-intensive appliances.

Lack of awareness and wasteful electricity consumption habits: Many people are unaware of the importance and benefits of saving electricity.

b. Electricity Consumption in Production

Many businesses and service providers have become more aware of rearranging their

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electrical equipment usage throughout the day to avoid peak hours. However, inefficient electricity use still exists. Many factory machines are not regularly maintained or upgraded, leading to low operational efficiency. The use of outdated technology and equipment consumes excessive electricity, resulting in resource and production waste.

Lighting systems often exceed the necessary power limits, with many facilities still using inefficient incandescent bulbs, increasing unnecessary electricity consumption.

c. Electricity Consumption in Offices, Schools, and Public Areas

Air conditioners are often set to excessively low temperatures, outdated electrical appliances that consume a lot of energy are still in use without regular maintenance.

Office equipment such as computers, printers, and air conditioners are often left running even when not in use.

Street lighting is often set too bright, lights in buildings remain on both day and night, leading to unnecessary energy waste.

2.2. Causes of inefficient electricity use

Lack of awareness and saving habits: Some people do not recognize the importance of electricity conservation and its impact on the environment.

Inefficient electricity usage habits: Wasteful behaviors such as forgetting to turn off lights and electrical devices when not in use; keeping office equipment such as computers, printers, and air conditioners running unnecessarily.

Overuse of air conditioning: Air conditioners are often set at excessively low temperatures, leading to unnecessary energy consumption.

Overuse of lighting in public areas: Lights in buildings and public spaces are often left on at unnecessary brightness levels or even kept on during the daytime, wasting electricity.

Outdated technology and equipment: Some buildings and production facilities still use old, energy-inefficient technology that does not ensure high performance, leading to electricity waste.

Lack of regular maintenance and cleaning: Electrical equipment that is not periodically maintained operates inefficiently and consumes more electricity.

2.3. Consequences of electricity waste

Impact on energy security: Electricity waste increases overall energy demand, especiallyin lighting and inefficient appliances used in public areas. This can lead to electricity shortages, affecting production, transportation, healthcare, and daily life. Vietnam may face electricity shortages, especially during periods of rapid economic growth and urbanization.

Increased costs and reduced competitiveness: Electricity waste raises electricity production costs, potentially increasing electricity prices and reducing competitiveness in energy-dependent industries.

Environmental impact: Inefficient electricity use leads to excessive exploitation of energy resources, contributing to air pollution and climate change.

III. SOLUTIONS AND STRATEGIES FOR ELECTRICITY CONSERVATION IN DAILY LIFE AND PRODUCTION

Raising awareness and practicing electricity conservation helps reduce costs while also contributing to environmental protection.

Example: In classrooms, if teachers or students forget to turn off lights, it results in electricity waste.

Long-term use of electrical devices when unnecessary: Leaving air conditioners or fans running continuously even when no one is in the room also leads to wastage.

Inefficient lighting choices: Using incandescent bulbs instead of LED bulbs.

Not turning off devices when leaving a room: TVs, air conditioners, and tablets left on when not in use.

Lack of regular maintenance: Unmaintained equipment operates inefficiently and consumes more electricity.

Not utilizing natural light: Offices or classrooms that do not take advantage of natural light and instead rely on artificial lighting unnecessarily.

3.1. Calculation of Replacing Incandescent Bulbs with LED Bulbs

Old device: 60W incandescent bulb

New device: 9W LED bulb (with equivalent brightness)

Usage time: 4 hours/day

Usage days: 30 days/month

❖ Calculation

Formula for calculating electricity consumption:

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A = P.t (3.1)
Where:
A = Amount of electricity consumed over time t
P = Power consumption (unit: kW)
t = Time (unit: hours)

✓ Electricity consumption per month
For incandescent bulb:
$A_{sđ}$ = (0.06 x 4) x 30 = 7,2 (kWh_

For LED bulb:
A_{led} = 0.009 x 4 g x 30 = 1,08 (kWh)
Formula for calculating electricity cost:
$T_p = A \times C_e$ (3.2)
Where:
Tp = Cost of consumed electricity
A = Electricity consumption (kWh)
Ce = Electricity price per kWh

Table 3.1. Residential electricity tariffs [5]

Eletricity price tier	Electricity Consumption (kWh)	Unit Price (VND/kWh)
1	From 0 – 50	1.893
2	From 51 – 100	1.956
3	From 101 – 200	2.271
4	From 201 – 300	2.860
5	From 301 – 400	3.197
6	From 401 and up	3.302

✓ Electricity cost calculation
For incandescent bulb:
$T_{psđ}$ = 7,2 x 1.893 = 13.629 (VND)
For LED bulb:
T_{pled} = 1,08 x 1.893 = 2.044 (VND)

✓ Monthly and Annual Savings
Monthly savings:
$\Delta T_p = T_{psđ} - T_{pled}$ = 13.629 – 2.044 = 11.585 (VND)

Annual savings:
ΔT_p = 11.585 x 12 = 139.020 (VND)

3.2. Application of smart devices in energy saving
Using the LG ThinQ app to monitor air conditioner power consumption

The app allows users to set power consumption limits for air conditioners, enabling proactive energy adjustments and better control over monthly electricity bills.

The app provides real-time energy usage tracking, allowing users to remotely adjust the thermostat and other household appliances during peak hours to optimize energy consumption and reduce electricity costs.

- ✓ Intelligent air conditioner control helps reduce electricity bills efficiently.
- ✓ Using smart, energy-efficient appliances contributes to long-term energy savings.

The role of LG ThinQ in energy saving
In the current context, the LG ThinQ app plays a crucial role, especially when integrated with LG's smart electrical devices. It offers several key features:

- Monitoring and controlling power consumption

kW Manager: The app provides a "kW Manager" feature that allows users to track the air conditioner's power consumption. It enables real-time monitoring, usage trend analysis, and identification of areas for improvement.

Setting Consumption Limits: With kW Manager, users can set a limit on power consumption for the air conditioner. This feature helps prevent excessive energy use and allows for better control of electricity bills.

- Remote Control and Adjustment

Turn On/Off & Remote Settings: Users can remotely control LG appliances via the app, including turning the air conditioner on/off and adjusting settings such as temperature and operating modes. This feature helps users optimize energy use, for example:

- Turn on the AC before arriving home
- Turn off the AC when leaving home to prevent unnecessary electricity usage.

Scheduling Feature: Users can set an automatic schedule for their air conditioner, such as pre-setting on/off times. This ensures that the device operates only when necessary, optimizing energy use.

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- Additional Smart Features

Freeze Cleaning: The app can activate the "Freeze Cleaning" mode on LG air conditioners, cleaning the evaporator coil, eliminating bacteria and dust, and improving efficiency. This helps the AC operate more effectively and saves energy.

Energy-Saving Mode: Some LG air conditioners come with AI-driven smart energy-saving technology, which automatically switches to energy-saving mode or turns off after a set period when no one is in the room. The app enables users to control these features, ensuring effective energy conservation.

Open-Door Detection: If the AC has built-in sensors, the app can detect open windows or doors and automatically switch to energy-saving mode when room temperature changes significantly.

Reducing Usage Time: If users forget to turn off the air conditioner, the LG ThinQ app can help them check and switch it off remotely, reducing unnecessary energy consumption.

Temperature Control: The app allows easy temperature monitoring and adjustment, helping users choose an optimal temperature for efficient cooling while saving electricity.

Setting Power Consumption Limits: Users can set a limit on power usage for the air conditioner through the app. If the AC exceeds the limit, the app sends an alert so users can adjust settings to save energy.

- **Case Study:** Energy Savings Using LG ThinQ for air conditioner control(after implementing energy-saving measures, the daily power consumption of the air conditioner is reduced to 6 hours/day).

❖ **Assumptions**

Air conditioner capacity: 1.5 HP (~1200W or 1.2 kW)
Daily usage time: 8 hours/day
Number of usage days per month: 30 days
Electricity price for residential use (EVN 2025): 2,103.1 VND/kWh (average retail price)
After applying energy-saving measures, the new usage time is 6 hours/day

❖ **Calculation**

Daily energy consumption:
A = 1,2 x 8 = 9,6 (kWh)
Monthly energy consumption:
A = 9,6 x 30 = 288 (kWh)
Monthly electricity cost breakdown:
Tier 1:T_{p1} = 50 x 1.893 = 94.650 (VND)
Tier 2:T_{p2} =50 x 1.956 = 97.800 (VND)
Tier 3:T_{p3} = 100 x 2.271 = 227.100 (VND)
Tier 4:T_{p4} =88 x 2.860 = 251.680 (VND)
Total monthly electricity cost:
$T_p = T_{p1} + T_{p2} + T_{p3} + T_{p4}$ =94.650 + 97.800 + 227.100 + 251.680 = 671.230 (VND)

- Calculation of Electricity Consumption &Costs (After Energy-Saving Measures)

Daily energy consumption (after reduction to 6 hours/day):
A = 1,2 x 6 = 7,2 (kWh)
Monthly energy consumption:
A = 7,2 x 30 = 216 (kWh)
Monthly electricity cost breakdown:
Tier 1:T_{p1} = 50 x 1.893 = 94.650 (VND)
Tier 2:T_{p2} = 50 x 1.956 = 97.800 (VND)
Tier 3:T_{p3} = 100 x 2.271 = 227.100 (VND)
Tier 4:T_{p4} = 16 x 2.860 = 45.760 (VND)
Total monthly electricity cost (after savings):
$T_{ptk} = T_{p1} + T_{p2} + T_{p3} + T_{p4}$ = 94.650 + 97.800 + 227.100 + 45.760 = 465.310 (VND)
Monthly savings:
$\Delta T_p = T_p - T_{ptk}$ = 671.230 – 465.310 = 205.920 (VND)
Annual savings:
$\Delta T_p = T_p - T_{ptk}$ = 205.920 x 12 = 2.471.040 (VND)

3.3. Automation Solutions for Energy Savings

Automation in electricity plays a crucial role in the Industry 4.0 era, bringing innovative solutions for modern times. This field applies electrical, electronic, telecommunications, and information technology to automate production and service processes, improving efficiency, quality, and workplace safety.
Using automation to save electricity can be implemented in the following ways:

- Energy Management System (EMS)

This system monitors and manages the energy consumption of devices and production processes, helping to detect and optimize electricity usage.
Benefit: Through analysis and performance tracking, EMS helps businesses minimize waste and optimize energy usage.

- Automated Lighting Systems

Using motion sensors and natural light sensors to automatically turn lights on/off in production spaces.
Benefit: Reduces electricity consumption by only turning on lights when necessary and adjusting brightness based on natural light.

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- Variable Frequency Drives (VFDs) for Motors

Using VFDs to adjust motor speed according to actual demand instead of running at a fixed speed.
Benefit: VFDs can help businesses save up to 50% of energy consumption compared to operating motors at full speed unnecessarily.

- Industrial Automation Systems

Applying automated robots and industrial automation systems in production processes to reduce human intervention.
Benefit: Reduces time and energy consumption by making production processes faster and more efficient.

- Maintenance and Equipment Cleaningregular

Establishing periodic maintenance schedules for equipment and machinery.
Benefit: Ensures equipment operates at optimal efficiency, reducing energy loss due to low-performance machinery.

- Optimization of Production Processes

Analyzing and optimizing production processes to eliminate unnecessary steps and minimize machine operation time.
Benefit: Reduces unnecessary energy consumption during production.

3.3.1. Problem math 1: Energy Optimization for a Textile Manufacturing Plant

A large-scale manufacturing plant with high energy consumption is experiencing rising monthly energy costs. Although operations are stable, the company aims to optimize energy usage to reduce costs and contribute to environmental protection.

✓ **Objectives**:

Reduce energy costs by at least 20% within one year
Improve energy efficiency of equipment and production processes
Lower CO_2 emissions related to energy consumption

✓ **Initial Parameters**:

Industry: Textile manufacturing
Annual energy consumption: 50,000 kWh
Electricity price: 2,103.1 VND/kWh
Energy consumption distribution:
- Weaving machines: 60% of total energy consumption
- Lighting system: 10%
- HVAC (Heating, Ventilation, Air Conditioning): 20%
- Other equipment: 10%

Implemented solution: Replaced traditional lighting with LED lights, reducing lighting energy consumption by 10%

✓ **Calculation**

- Cost Savings from the Lighting System by Using LED Lights

Energy consumption of the lighting system before switching to LED:
A = 50.000kWh x 10% = 5.000 (kWh)
Energy saved from LED lights (10% reduction):
ΔA = 5.000kWh x 10% = 500 (kWh)
Cost savings from LED lights:
ΔT_p = 500 x 2.103.1 = 1.051.550 (VND)

- Cost Savings from Installing Inverters for Weaving Machines

Energy consumption of weaving machines before installing inverters:
A = 50.000 x 60% = 30.000 (kWh)
Energy saved from inverters (15% reduction):
ΔA = 30.000 x 15% = 4.500 (kWh)
Cost savings from inverters:
ΔT_p= 4.500 x 2.103,1 = 9.463.950 (VND)

- Total Estimated Energy Savings (Excluding HVAC and Other Equipment)

Total energy saved:
ΔA = 500 + 4.500 = 5.000 (kWh)
Total cost savings:
ΔT_p = 1.051.550 + 9.463.950 = 10.515.500 (VND)

3.3.2. Problem math 2: Application of Inverters in Energy Savings

✓ **Objective:** Save energy and improve the efficiency of the pumping system.
✓ **Situation:** A manufacturing plant requires a pumping system to supply water for production. Previously, the pumps operated at a fixed speed, leading to significant energy waste when water demand fluctuated.

✓ **Solution:**

Installing an inverter: The inverter will be installed to control the pump motor speed. Instead of running at a fixed speed, the system will use the inverter to adjust the pump speed according to actual demand.
Sensors and automatic control: The system will be equipped with flow and pressure sensors. When water demand increases or decreases, the sensors will send signals to the inverter to adjust the pump speed.
Example: If the sensors detect a drop in water flow below a certain level, the inverter will reduce the motor speed to save energy.

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- **Optimizing operational demand:**

When demand is high, the pump will run faster to supply enough water.
When demand decreases, the inverter will automatically reduce the motor speed, consuming less energy.

✓ **Expected Results**

Energy Savings: By adjusting the pump speed based on actual demand, energy consumption will be significantly reduced. Studies show that using inverters in pump systems can save between 20% to 50% of energy consumption.
Improved Efficiency: The system will operate more efficiently, reducing wear and tear on the motor and related equipment.
Emission Reduction**:** Saving electricity means lower power consumption from the grid, which helps reduce **CO_2 emissions** from power plants.

- **Application math problem**

A manufacturing plant operates a water pumping system to supply water for production.Before using an inverter, the pump ran at maximum capacity, consuming excessive energy.The goal is to reduce electricity costs by installing an inverter for the water pump.

- **Initial Parameters**

Pump power: 30 kW
Operating time: 10 hours/day
Electricity price: 2,103.1 VND/kWh
Energy savings with an inverter: 30% (due to speed adjustment)
Operating days per month: 30

- **Calculations**

Monthly Energy Consumption Before Installing the Inverter:
A = 30 x 10 x 30 = 9.000 (kWh)
Annual Energy Consumption Before Installing the Inverter:
A = 9.000 x 12 = 108.000 (kWh)
Monthly Electricity Cost Before Installing the Inverter:
T_p = 9.000 x 2.103.1 = 18.927.900 (vnd)
Monthly Energy Consumption After Installing the Inverter:
A = 9.000 – (9.000 x 30%) = 6.300 (kWh)
Annual Energy Consumption After Installing the Inverter:
A = 6.300 x 12 = 75.600 (kWh)
Monthly Electricity Cost After Installing the Inverter:
T_{pbt} = 6.300 x 2.103.1 = 13.249.530 (VND)
Annual Energy Savings from Using the Inverter:
ΔA = (9.000 - 6.300) x 12 = 32.400 (kWh)
Total Monthly Cost Savings:
ΔT_p = 18.927.900 – 13.249.530 = 5.678.370 (VND)
Total Annual Cost Savings from Using the Inverter:
ΔT_p= 5.678.370 x 12 = 68.140.440 (VND)

IV. RESEARCH RESULTS

From the calculated results, can see that energy-saving solutions bring significant benefits. The following table summarizes the annual electricity and cost savings for each solution:

Table 4.1. Detailed Table of Annual Electricity Cost Savings When Applying Solutions

Solution		**Power Consumption (kWh)**	**Power Consumption After Savings (kWh)**	**Power Saved (kWh)**	**Annual Cost Savings (VND)**
Replacing incandescent bulbs with LED lights		7,2 x 12 = 86,4	1,08 x 12 = 12,96		**139.020**
Reducing air conditioner usage time		288 x 12 = 3.456	216 x 12 = 2.592		**2.471.040**
Automation solutions for textile factories	Using LED lights	5.000		500	1.051.550
	Using inverters	30.000		4.500	9.463.950
				5.000	**10.515.500**
Total savings from	108.000	75.600	32.400	**139.020**	**68.140.440**

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V. CONCLUSION AND RECOMMENDATIONS

Using electricity economically and efficiently not only helps reduce costs for consumers but also lessens the burden on the national power grid and contributes to environmental protection. Through the analysis of technical solutions and user behavior, it is evident that there is significant potential for electricity savings in households, businesses, and manufacturing facilities. The integrated application of energy-saving measures will bring about substantial benefits both economically and socially.

RECOMMENDATIONS

To improve electricity efficiency, it is essential to promote the use of energy-saving devices and enhance public awareness and training for households and businesses on rational electricity use. The government should support policies that encourage investment in energy-saving technologies, especially in manufacturing and service sectors. Additionally, implementing real-time monitoring and assessment systems for electricity consumption should be a priority solution.

✓ For Households:

Encourage the use of appliances with energy-saving labels.

Turn off electrical devices when not in use and replace incandescent bulbs with LEDs.

Schedule the use of high-power appliances during off-peak hours to reduce grid pressure.

✓ For Businesses and Manufacturing Facilities:

Invest in energy-efficient technologies and production lines.

Conduct regular energy audits to identify and address excessive energy consumption.

Promote a workplace culture that values electricity conservation.

✓ For Government and Regulatory Bodies:

Implement tax and financial incentives for businesses investing in energy-saving technologies.

Strengthen monitoring and enforcement of energy efficiency regulations.

Launch community awareness and education programs on electricity saving and clean energy use.

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