



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107



AN AUTONOMOUS INSTITUTION

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

ENERGY SCENARIO IN INDIA - DOMESTIC PURPOSE

India's domestic energy scenario focuses on meeting the energy needs of households across the country. This involves electricity supply, cooking fuel, and heating, as well as addressing challenges related to energy access, affordability, and sustainability. Here's an overview:

1. Electricity Access and Consumption

- **Electrification:** India has made significant strides in electrification, with the Saubhagya scheme achieving near-universal household electrification. As of 2023, over 99% of households have access to electricity.
- **Energy Consumption:** The average household electricity consumption is increasing due to rising incomes, urbanization, and the proliferation of electrical appliances such as fans, refrigerators, televisions, and air conditioners.
- **Power Supply:** While access has improved, ensuring reliable and continuous power supply remains a challenge, particularly in rural areas. Power outages are still common in many regions.

2. Cooking Energy

- **Liquefied Petroleum Gas (LPG):**
 - **Ujjwala Yojana:** The Pradhan Mantri Ujjwala Yojana (PMUY) has played a critical role in expanding access to clean cooking fuel. The scheme provided over 80 million LPG connections to women from below-poverty-line households.
 - **LPG Penetration:** As of 2023, around 99% of Indian households have access to LPG, making it the primary cooking fuel in urban and many rural areas. However, the cost of refills remains a concern for low-income families, leading some to revert to traditional biomass.
- **Biomass and Solid Fuels:** Despite the growth in LPG usage, a significant portion of rural households still rely on traditional biomass (wood, dung, crop residues) for cooking. This practice is associated with indoor air pollution, which poses serious health risks, especially for women and children.
- **Electric and Solar Cooking:** Electric cooking appliances, such as induction cooktops, are gaining popularity in urban areas. Additionally, solar cookers are being promoted as a clean alternative in sunny regions, although adoption remains limited.

3. Heating and Cooling

- **Space Heating:** In colder regions, particularly in the northern states, households use electric heaters, wood stoves, or kerosene heaters. The use of biomass for heating is common in rural areas.
- **Cooling:** With rising temperatures and increasing affordability, the use of air conditioners and coolers is growing rapidly. This is contributing to higher electricity demand, particularly during peak summer months.
- **Energy Efficiency:** The Bureau of Energy Efficiency (BEE) promotes energy-efficient appliances, such as star-rated fans, refrigerators, and air conditioners, to reduce energy consumption in households.

4. Renewable Energy for Domestic Use

- **Solar Home Systems:** Solar rooftop systems are becoming increasingly popular, particularly in urban and semi-urban areas. Government subsidies and net metering policies are encouraging households to install solar panels, which can reduce electricity bills and provide backup power during outages.
- **Solar Water Heaters:** Solar water heaters are widely used in many parts of India, particularly in regions with ample sunlight. These systems provide an affordable and sustainable way to meet domestic hot water needs.
- **Off-Grid Solutions:** In remote and rural areas, off-grid solar solutions, such as solar lanterns, home lighting systems, and microgrids, are providing essential energy services where grid connectivity is limited or unreliable.

5. Challenges in Domestic Energy

- **Affordability:** While access to modern energy sources has improved, affordability remains a challenge, especially for low-income households. The cost of LPG refills, electricity tariffs, and the initial investment in solar systems can be prohibitive for some families.
- **Reliability:** Despite improvements in electricity access, reliability remains a significant issue, particularly in rural areas where power cuts and voltage fluctuations are common.
- **Sustainability:** The continued use of biomass for cooking and heating in many rural areas poses environmental and health challenges. Transitioning these households to clean energy sources is crucial for reducing pollution and improving health outcomes.

6. Government Initiatives and Policies

- **Subsidies and Support:** The government provides subsidies for LPG connections, electricity for low-income households, and solar installations to make clean energy more accessible and affordable.
- **Energy Efficiency Programs:** Initiatives like the Unnat Jyoti by Affordable LEDs for All (UJALA) scheme promote energy efficiency in households by distributing LED bulbs, tube lights, and energy-efficient fans at subsidized rates.

- **Awareness Campaigns:** Programs to raise awareness about the benefits of clean energy, energy efficiency, and safety in the use of LPG and electrical appliances are critical in driving adoption and ensuring safe usage.

ENERGY SCENARIO IN INDIA - INDUSTRIAL PURPOSE

India's industrial energy scenario is crucial to the country's overall energy landscape, as the industrial sector is one of the largest consumers of energy. The sector's energy needs are diverse and growing, driven by rapid industrialization, economic growth, and the push towards modernization. Here's an overview:

1. Energy Demand in the Industrial Sector

- **High Consumption:** The industrial sector accounts for around 40-45% of India's total energy consumption, making it the largest energy-consuming sector in the country. This includes energy-intensive industries like steel, cement, aluminum, textiles, chemicals, and manufacturing.
- **Growth Trends:** Energy demand in the industrial sector is growing steadily due to ongoing industrialization, increased production capacities, and the expansion of sectors like manufacturing, construction, and infrastructure.

2. Primary Energy Sources

- **Coal:**
 - **Dominance:** Coal is the primary energy source for India's industrial sector, particularly for heavy industries like steel and cement. It accounts for a significant portion of the sector's energy consumption.
 - **Challenges:** The use of coal poses environmental challenges, including high carbon emissions and air pollution. However, it remains essential due to its availability and cost-effectiveness.
- **Electricity:**
 - **Industrial Usage:** Electricity is extensively used in industries for running machinery, processing, and lighting. The demand for electricity in industries is growing, driven by modernization and the adoption of energy-intensive technologies.
 - **Power Quality:** Industries require reliable and high-quality power supply. Power outages and voltage fluctuations can severely impact industrial operations, leading to increased reliance on captive power generation.
- **Natural Gas:**
 - **Rising Demand:** Natural gas is gaining importance in industries such as fertilizers, petrochemicals, and ceramics due to its lower environmental impact compared to coal. However, its usage is limited by supply constraints and infrastructure challenges.

- **LNG Imports:** India imports a significant portion of its natural gas in the form of LNG, which is used in industrial applications where gas supply pipelines are unavailable.
- **Oil and Petroleum Products:**
 - **Limited Role:** Oil and petroleum products like diesel and fuel oil are used in specific industrial applications, such as backup power generation and as feedstock in chemical industries. However, their role is limited due to higher costs and a focus on cleaner alternatives.
- **Renewable Energy:**
 - **Emerging Role:** Renewable energy sources, particularly solar and wind, are increasingly being integrated into industrial operations. Industries are investing in captive solar plants, wind farms, and biomass-based power generation to reduce energy costs and carbon footprints.

3. Energy Efficiency in Industry

- **Bureau of Energy Efficiency (BEE) Initiatives:**
 - **Perform, Achieve, and Trade (PAT) Scheme:** The PAT scheme is a flagship program under the National Mission for Enhanced Energy Efficiency (NMEEE). It sets energy efficiency targets for energy-intensive industries and allows trading of energy-saving certificates. Industries that exceed their targets can sell certificates to those who fall short, incentivizing energy efficiency.
 - **Standards and Labeling:** The BEE also sets energy performance standards for industrial equipment and machinery, encouraging the adoption of energy-efficient technologies.
- **Industrial Upgrades:** Industries are increasingly adopting advanced technologies, automation, and process optimization to enhance energy efficiency. This includes upgrading old machinery, adopting variable speed drives, waste heat recovery systems, and cogeneration technologies.
- **Energy Audits:** Regular energy audits are being conducted in industries to identify areas for improving energy efficiency and reducing energy costs. These audits help industries optimize their energy consumption patterns.

4. Renewable Energy Integration

- **Captive Solar and Wind Power:** Many industries are investing in captive solar and wind power generation to reduce dependence on grid electricity and lower operational costs. This also helps in meeting corporate sustainability goals and reducing carbon footprints.
- **Green Power Purchase Agreements (PPAs):** Industries are increasingly entering into green PPAs with renewable energy developers to secure long-term access to clean energy at stable prices. This trend is driven by both cost considerations and environmental commitments.
- **Biomass and Waste-to-Energy:** Biomass and waste-to-energy projects are being implemented, particularly in industries with significant organic waste generation, such as sugar mills and food processing units.

5. Challenges in Industrial Energy

- **Energy Security:** Ensuring a stable and uninterrupted energy supply is critical for industrial operations. India's dependence on imported energy resources, particularly oil and gas, poses risks related to price volatility and supply disruptions.
- **Environmental Regulations:** The industrial sector is under increasing pressure to reduce its environmental impact. Compliance with stringent environmental regulations, particularly related to emissions and waste management, requires significant investment in cleaner technologies and processes.
- **Cost of Energy:** High energy costs are a significant concern for Indian industries, particularly in energy-intensive sectors. Rising fuel prices, electricity tariffs, and the cost of implementing energy efficiency measures can impact industrial competitiveness.
- **Infrastructure Bottlenecks:** Infrastructure limitations, such as inadequate gas pipelines, transmission bottlenecks, and logistics challenges, affect the availability and cost of energy for industries.

6. Government Policies and Support

- **National Energy Policy:** The National Energy Policy outlines strategies for ensuring energy security, enhancing energy efficiency, and promoting the adoption of renewable energy in industries.
- **Incentives for Renewable Energy:** The government offers various incentives for industries to adopt renewable energy, including tax benefits, subsidies, and concessional financing for renewable energy projects.
- **Clean Energy Cess and Carbon Tax:** The Clean Energy Cess on coal and the introduction of a carbon tax are aimed at incentivizing industries to reduce their carbon emissions and invest in cleaner technologies.
- **Ease of Doing Business Reforms:** Reforms aimed at improving the ease of doing business include measures to simplify the process of setting up industrial energy projects and accessing grid infrastructure.