

Link - <https://www.amrita.edu/unsdg-26/sdg7/energy-wastage-identification/>

Date - 1/Dec/2024



Energy Reviews to Identify Areas of Highest Energy Wastage at Amrita Vishwa Vidyapeetham



Comparing conventional buildings with green buildings to emphasize the need for sustainable, eco-friendly campus environments.

Amrita Vishwa Vidyapeetham conducts **comprehensive and systematic energy reviews on a monthly basis** to identify areas where energy waste is highest across its campuses. These reviews play a crucial role in analyzing energy consumption patterns, equipment efficiency, and building systems to pinpoint inefficiencies and wastage. Through this rigorous process, the university has established a benchmark for sustainability by identifying critical areas for targeted energy conservation efforts.^[1]

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Energy Review Methodology

The university implements a structured energy review process comprising five key steps designed to systematically identify and eliminate energy wastage:^[1]

1. Data Collection





Workers conducting an energy audit inspection on an HVAC unit to promote energy efficiency.

The university actively gathers comprehensive energy consumption data from various sources:^[1]

- **Utility Bills:** Monthly analysis of electricity, water, and other utility consumption records
- **Sub-Metering Systems:** Real-time data collection from meters installed in specific buildings and departments
- **Building Management Systems:** Automated systems that log continuous energy usage patterns^[1]

This comprehensive data collection ensures a thorough understanding of energy usage across the entire campus, forming the foundation for identifying wastage patterns.^[1]

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2. Energy Audits and Inspections



Organisation: Template Library
Project: Example Template Project
Team: Example Team

Template ID: DP-SAF-0089
Template Version: 10 **Form Version:** 1
Form created: Tuesday, 15 October 2019, 11:28:22 am

HVAC Inspection Checklist

Automated Form Number

---DP-SAF-0089-2

Location Details

Location	Building	ID #
Camden Road Upgrade	D3	HVAC-0190

Inspector Details

Completed by	Title
Dave Hodgson	Safety Director

Date Inspected

Thursday, 17 October 2019, 8:30:00 am

Outside Air Intake

Yes = OK

No = Needs attention

NA = Not applicable

Location	Zone 2B		
Checkbox	Open during occupied hours?	Yes	Comments:
Checkbox	Unobstructed?	Yes	Comments:
Checkbox	Standing water, bird droppings in vicinity?	Yes	Comments:
Checkbox	Odors from outdoors?	No	Describe odor: Strong gas like odour
Checkbox	Carryover of exhaust heat?	Yes	Comments:
Checkbox	Cooling tower within 25 feet?	Yes	Comments:
Checkbox	Exhaust outlet within 25 feet?	Yes	Comments:
Checkbox	Trash compactor within 25 feet?	Yes	Comments:
Checkbox	Near parking facility, busy road, loading dock?	Yes	Comments:

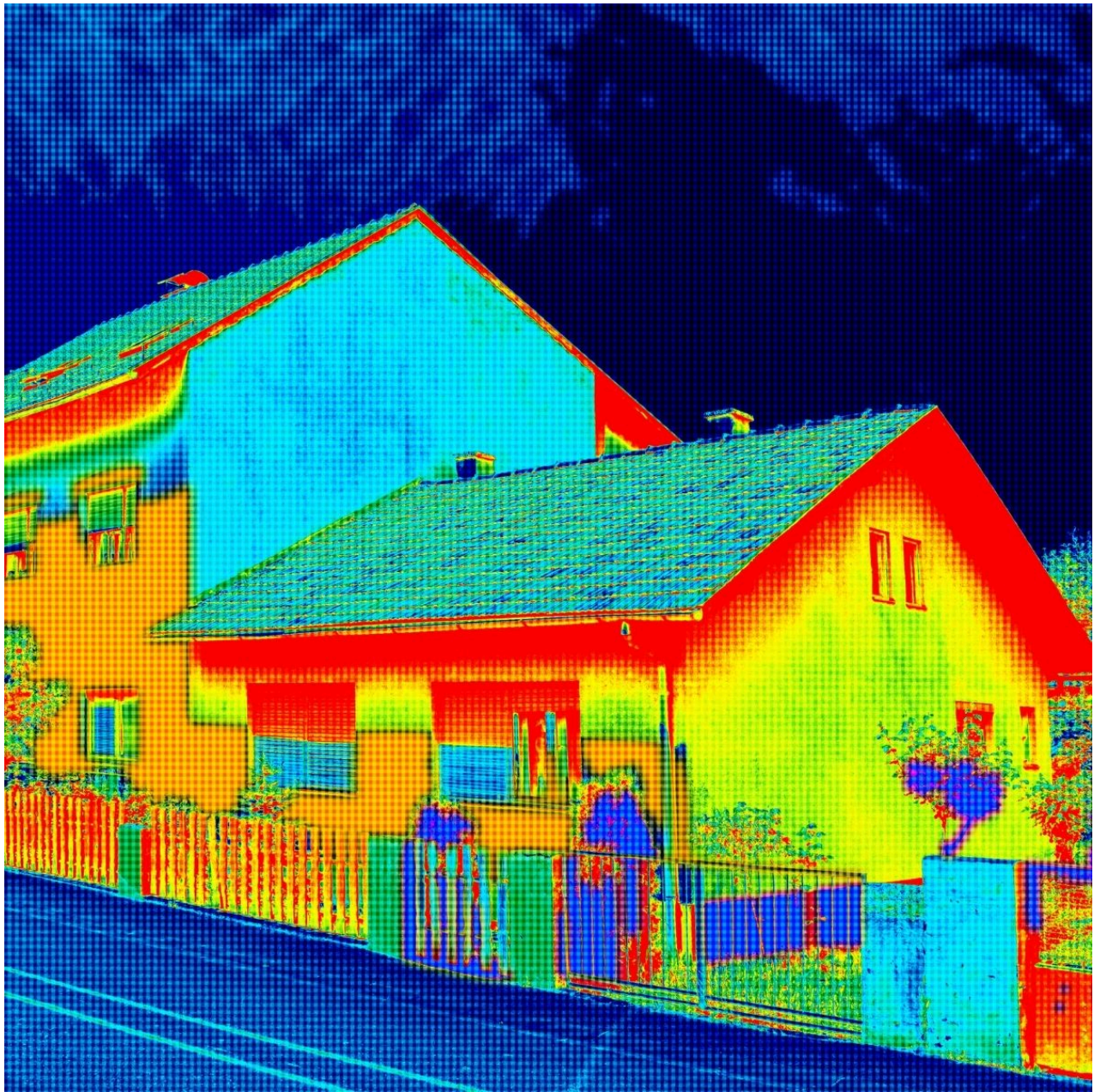
Bird Screen

Checkbox	Unobstructed?	NA	Comments:
Checkbox	General condition?	NA	Comments:
Checkbox	Size of mesh? (1/2" minimum)	NA	Comments:

Outside Air Dampers

Checkbox	Operation acceptable?	Yes	Comments:
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HVAC inspection checklist form showing detailed audit points for outside air intake, bird screen, and air dampers conditions.



Thermal imaging showing heat loss in buildings to identify energy waste areas.

Detailed audits of buildings, facilities, and equipment are conducted across the campus to identify energy inefficiencies:^[1]

Audit Coverage Areas:

- **Academic Buildings:** Classrooms, laboratories, administrative offices

- **Residential Facilities:** Dormitories, student housing
- **Research Facilities:** Research labs and specialized equipment areas
- **Common Areas:** Corridors, cafeterias, recreational facilities^[1]

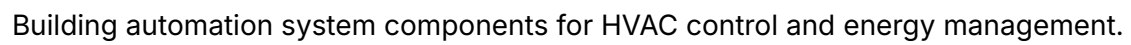
Comprehensive Assessment of:

- **HVAC Systems Performance:** Efficiency of heating, ventilation, and air conditioning units
- **Lighting Systems:** Functionality and efficiency of illumination across all spaces
- **Building Insulation:** Thermal resistance and heat loss prevention
- **Other Energy-Consuming Equipment:** Refrigeration units, water heaters, computing facilities^[1]

These audits provide valuable insights into areas that require immediate improvement and optimization.^[1]

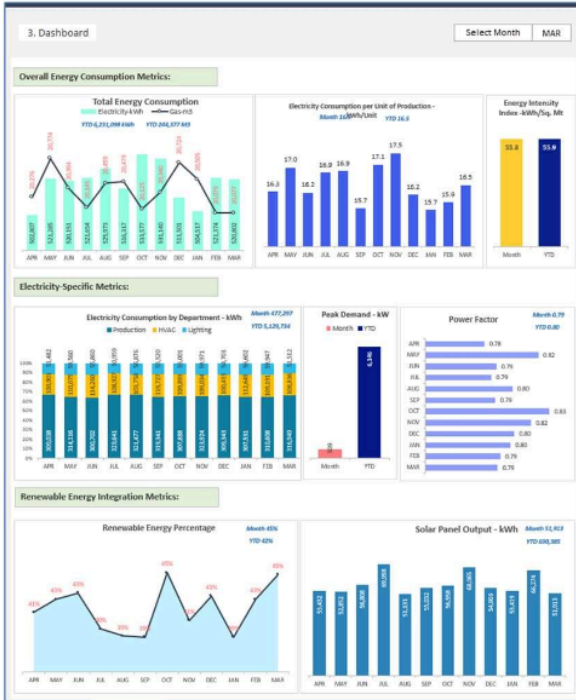
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3. Energy Monitoring and Real-Time Analysis



Energy Consumption Dashboard

Manufacturing Dashboard



Energy and manufacturing dashboards showing comprehensive metrics for monitoring energy consumption, efficiency, conservation, and emissions over time.

Amrita Vishwa Vidyapeetham has installed state-of-the-art energy monitoring systems to track real-time energy consumption:^[1]

Smart Energy Monitoring Infrastructure:

- **Smart Energy Meters and Sensors:** Installed in high-consumption zones to collect real-time data
- **Building Energy Monitoring Dashboard:** Provides comprehensive insights into energy consumption patterns
- **Real-Time Alerts and Anomaly Detection:** Automatically identifies unusual consumption patterns or equipment malfunctions^[1]
- **Carbon Footprint Tracking:** Monitors CO₂ emissions associated with energy use

Advanced Features:^[2]

- **Real-Time Visualization:** Current energy usage displayed across campus
- **Historical Trend Analysis:** Comparison of consumption over time to identify patterns
- **Key Performance Indicators Tracking:**
 - Energy Use Intensity (EUI)
 - Power Usage Effectiveness (PUE)
 - Carbon Footprint Metrics
- **Automated Alert Generation:** For anomalies or potential issues requiring immediate attention
- **Remote Access and Control:** Building managers can optimize energy consumption remotely^{[2][1]}

This proactive approach ensures that energy wastage is minimized and identified quickly for immediate correction.^[1]

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4. Stakeholder Engagement and Collaboration

Commercial Building Energy Audit Checklist

Pre-Audit Preparation



Gather bills and energy data
Identify building systems and issues
Set goals

Building Envelope Assessment



Check walls, roof, windows, doors
Weatherproofing, controls and openings

HVAC Systems Evaluation



Review fixtures, controls
Natural lighting

Electrical & Plug Load Analysis



Inspect equipment
Power strips, usage

Water Heating & Usage



Examine water heaters
Fixtures, usage

Renewable Energy & Onsite Generation



Evaluate feasibility of solar,
wind, or geothermal

Commercial building energy audit checklist outlining steps for evaluating energy use and identifying waste areas.

The university collaborates closely with multiple stakeholders to identify overlooked areas of wastage:^[1]

Stakeholder Involvement:

- **Students:** Provide feedback on energy usage in classrooms and residential areas
- **Faculty and Academic Staff:** Identify inefficiencies in research labs and teaching facilities
- **Maintenance and Operations Staff:** Share practical insights from daily building management experience
- **Department Heads:** Communicate specific energy concerns in their operational areas^[1]

This collaborative approach ensures comprehensive identification of energy waste from multiple perspectives, uncovering issues that might otherwise be overlooked.^[1]

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5. Data Analysis and Recommendations Development

The collected data and audit findings are meticulously analyzed to identify areas with the highest energy waste:^[1]

Analysis Process:

- **Efficiency Evaluation:** Assessment of equipment efficiency and performance metrics
- **Outdated Technology Identification:** Recognition of outdated systems requiring replacement
- **Operational Practice Assessment:** Evaluation of daily practices contributing to energy waste
- **Comprehensive Comparison:** Benchmarking against standards and best practices^[1]

Based on this thorough analysis, specific recommendations are developed to enhance energy efficiency and reduce wastage.^[1]

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Key Areas Identified with Highest Energy Wastage

The comprehensive energy reviews and audits have identified specific areas where energy wastage is most significant across the campus:

1. Lighting Systems - 40% Potential Reduction

Findings:^[2]

- High energy consumption due to **inefficient lighting** in classrooms, corridors, and common areas
- **Lights remain on in unoccupied spaces**, particularly in corridors during off-peak hours
- Inconsistent use of natural daylight in areas with adequate window exposure
- Continued use of older, less efficient lighting technologies in some facilities

Recommendations:^[2]

- Complete replacement of all conventional lights with **energy-efficient LED fixtures**
- Installation of **motion sensors in low-traffic areas** for automatic on/off control
- Implementation of **daylight harvesting systems** to maximize use of natural light
- Timeline: **3 months**
- **Expected Outcome: 40% reduction in lighting energy use**^[2]

The university has already made significant progress by replacing **1,200 LED lights in old buildings and 1,000 LED lights in newly built spaces**, with **100% sensor-based workspace automation** implemented to turn off lights in unused rooms and corridors.^{[3][4]}

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2. HVAC Systems - 25% Potential Reduction

Findings:^[2]

- Heating, Ventilation, and Air Conditioning (HVAC) systems account for a **significant portion of campus energy load**

- Several buildings exhibit **inefficient temperature management**, leading to substantial energy wastage
- HVAC systems running continuously without occupancy-based scheduling
- Lack of automated temperature control in many facilities

Recommendations:^[2]

- Adjustment of **HVAC schedules based on occupancy patterns**
- Installation of **automated, programmable thermostats** across all campus buildings
- Implementation of **Variable Frequency Drives (VFDs)** to optimize compressor operation
- Regular maintenance protocols including filter replacement and ductwork sealing
- Timeline: **6 months**
- **Expected Outcome: 25% reduction in HVAC energy usage**^[2]

Currently, **100% of buildings** have HVAC systems meeting **ASHRAE 62.1-2007 standards**, with all air conditioning systems programmed to maintain **24°C indoor temperature** in compliance with BEE recommendations.^{[4][3]}

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- <https://www.amrita.edu/unsdg-25/sdg7/upgrade-buildings/>

3. Laboratory and Research Facilities - 15% Potential Reduction

Findings:^[2]

- Specialized lab equipment frequently left running during off-hours
- Lack of standardized protocols for equipment shutdown procedures
- Continuous operation of fume hoods and exhaust systems during non-operational periods
- Research equipment maintaining high power consumption without active use

Recommendations:^[2]

- Development and implementation of **lab protocols for equipment shutdown** after hours

- Creation of **standardized checklists** for end-of-day procedures
- Installation of **automatic shut-down timers** on specialized equipment
- Training programs for lab staff on energy-saving practices
- Timeline: **Ongoing implementation**
- **Estimated Savings: 15% in energy use for laboratory facilities**^[2]

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4. Residential Areas and Dormitories - 10% Potential Reduction

Findings:^[2]

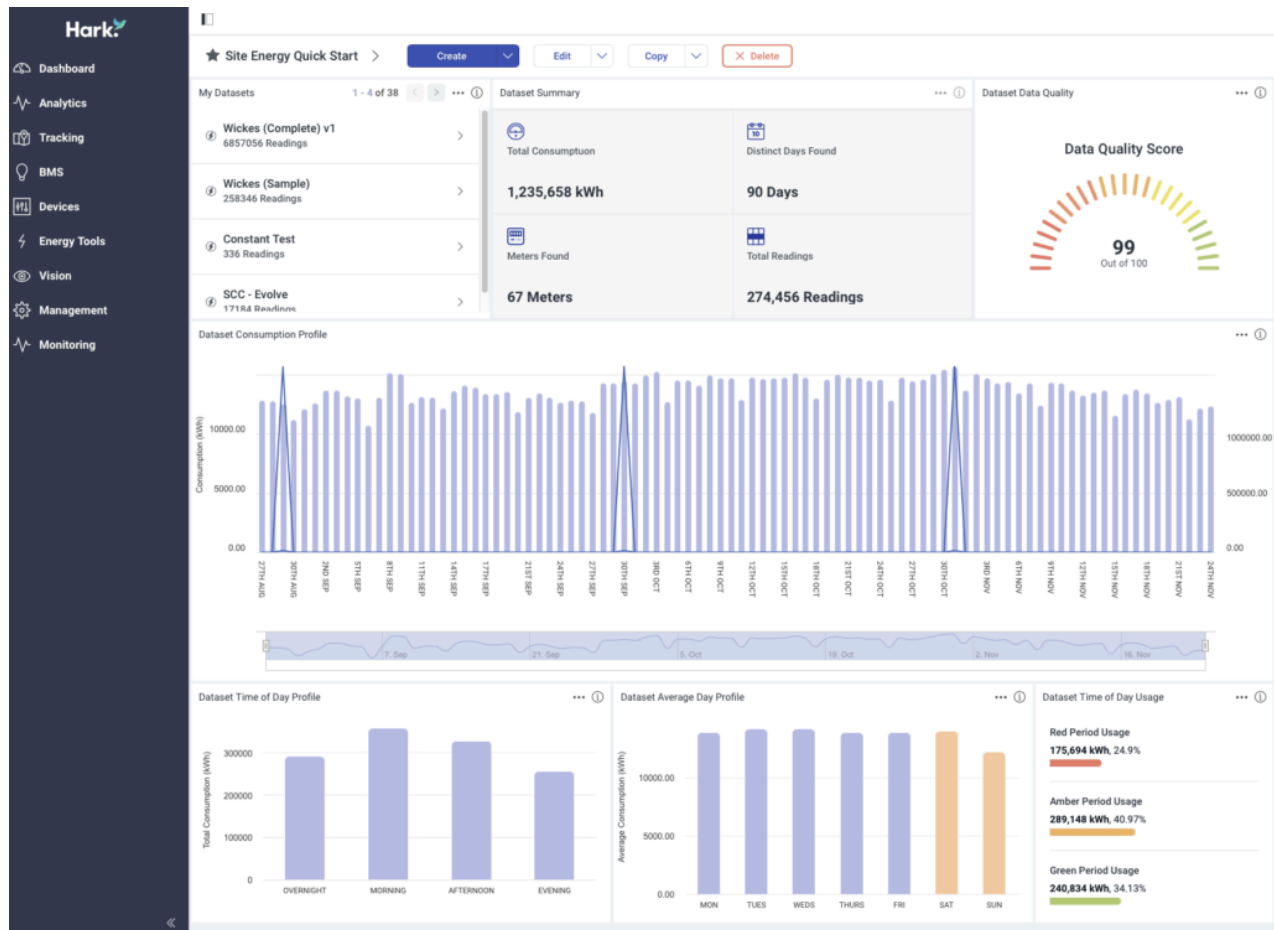
- Students and staff housing exhibit **high standby power usage** from electronic devices
- Multiple appliances and devices left plugged in continuously, draining power
- Inefficient use of heating and cooling systems in residential spaces
- Lack of awareness about energy-saving practices among residents

Recommendations:^[2]

- Installation of **smart power strips** to eliminate phantom power drain
- Awareness campaigns on unplugging devices and energy-saving practices
- Education about efficient use of heating and cooling in residential spaces
- Implementation of energy-saving incentive programs for dormitory users
- **Expected Outcome: 10% reduction in dormitory energy usage** through behavioral changes^[2]

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Real-Time Monitoring and Advanced Systems



Energy monitoring dashboard showing detailed consumption data, usage profiles, and data quality metrics.

Building Energy Monitoring and Management System

Amrita has implemented an advanced monitoring system to track and manage energy consumption across all campus buildings:^[2]

System Capabilities:

- **Real-Time Energy Dashboards:** Display current energy consumption and usage patterns
- **Historical Data Analysis:** Tracking consumption trends over weeks, months, and years
- **Performance Metrics Calculation:**
 - **Energy Use Intensity (EUI):** Energy consumption per square foot
 - **Power Usage Effectiveness (PUE):** Overall efficiency ratio
 - **Carbon Footprint Tracking:** CO₂ emissions associated with energy use^[2]

- **Anomaly Detection and Alerts:** Automatic identification of unusual consumption patterns
- **Remote System Control:** Building managers can adjust settings remotely^[2]

Impact:

- **Annual Energy Saving:** 379,200 kWh^[2]
- **CO₂ Emissions Reduction:** 311 metric tons of CO₂ per year^[2]

Link: <https://www.amrita.edu/unsdg-25/sdg7/energy-wastage-identification/>

Carbon Monitoring System

A specialized real-time CO₂ monitoring system provides comprehensive oversight of campus emissions:^[2]

Features:

- **Real-Time Carbon Footprint Dashboard:** Displays CO₂ emissions from various energy sources
- **Historical Data Comparison:** Analyzes trends in carbon emissions over time
- **Carbon Intensity Analysis:** Evaluates emissions per unit of energy consumed
- **Energy Source Optimization:** Helps prioritize low-carbon energy options
- **Compliance and Reporting:** Generates detailed reports for environmental regulations and sustainability reporting^[2]

Link: <https://www.amrita.edu/unsdg-25/sdg7/energy-wastage-identification/>

Certification and Validation

The energy review findings are validated through external certifications and audits:^[2]

Internal Energy Audits:

- Comprehensive evaluation of energy consumption patterns
- Implementation of energy monitoring and management systems
- Installation of carbon monitoring systems
- Significant reduction in energy wastage and strengthened sustainability efforts^[2]

External Certifications:

- **IGBC Platinum Certification** (November 7, 2023): Highest recognition under IGBC Green Campus Rating System^[2]
- **LEED Gold Certification**: Recognition of sustainable infrastructure
- **90% Energy Efficiency Rating**: Achieved in the latest energy audit^[3]
- **100% BEE Standards Compliance**: Full compliance with Bureau of Energy Efficiency standards^[3]

These certifications validate the effectiveness of Amrita's energy review process and waste identification methodology.^[2]

Links:

- <https://www.amrita.edu/unsdg-25/sdg7/energy-wastage-identification/>
- <https://www.amrita.edu/unsdg-25/sdg7/plan-to-reduce-energy/>

Energy Awareness and Behavioral Change Programs



Participants at Amrita University promoting National Energy Conservation Day and energy-saving awareness.

Beyond technical measures, Amrita implements awareness campaigns to address energy wastage resulting from behavioral factors:^[2]

Energy Awareness Programs:^[2]

- **Campus-Wide Awareness Campaigns:** Education on energy-saving practices for students and staff
- **Training Sessions:** Workshops on efficient equipment use and energy conservation
- **Visual Reminders:** Posters and digital displays encouraging energy-conscious behavior
- **Incentive Programs:** Recognition and rewards for departments achieving energy savings
- **Expected Outcome:** 10-15% overall reduction in energy wastage through behavioral changes^[2]

Link: <https://www.amrita.edu/unsdg-25/sdg7/energy-wastage-identification/>

Implementation Timeline and Progress

The university has developed a phased implementation approach to address identified areas of energy wastage:^[2]

Initiative	Timeline	Expected Outcome
Lighting System Upgrades	3 months	40% reduction in lighting energy use
HVAC Optimization	6 months	25% reduction in HVAC energy usage
Energy Awareness Programs	Ongoing	10-15% overall reduction in wastage
Smart Energy Monitoring	6 months	Data-driven continuous optimization

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Quantified Impact of Energy Reviews

The systematic energy review process has yielded measurable results:^[2]

- **Annual Energy Savings: 379,200 kWh** through Building Energy Monitoring and Management System
- **Carbon Emissions Reduction: 311 metric tons of CO₂ per year**
- **Energy Efficiency Rating: 90%** achieved in latest audit^[3]
- **Grid Dependency Reduction: 30% reduction** by 2025^[5]
- **Overall Energy Cost Savings: 32.4%** achieved through efficiency improvements^[4]

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Continuous Improvement Framework

Iowa's B3 Benchmarking Tool

Energy Reports

The B3 Benchmarking system provides simple reports using monthly utility billing and some basic facility data. Output includes the following information:

- **Summary view** displays high-level organizational information and completeness.
- **Benchmark view** displays energy consumption as if buildings were built to the current energy code.
- **Peer Comparison view** displays how your buildings compare to buildings with similar space usage.
- **ENERGY STAR® view** displays how energy star buildings compare nationally.
- **Baseline view** allows for buildings to be stack ranked to show variations of energy use between years.
- **Visualizations view** enables users to create visual reports displaying fuel sources, emissions, and energy use.
- **Reports view** contains a variety of printer-quality PDF report templates (e.g. B3 Energy Report Card) using the selected site or organization's data.
- **Improvement view** allows for energy targets to be set for organizations and sites.
- **Water Mode view** allows users to easily identify consumption of water at each site.



Iowa's B3 Benchmarking Tool outlines an 8-step process for improving energy efficiency with various report views to analyze energy use and performance.

Amrita Vishwa Vidyapeetham maintains a continuous improvement approach to energy management through regular energy reviews:^[1]

Key Components:

- **Monthly Energy Reviews:** Regular assessment of consumption patterns
- **Quarterly Analysis Reports:** Comprehensive evaluation of trends and effectiveness
- **Annual Comprehensive Audits:** Full-scale assessment and certification verification
- **Ongoing Stakeholder Engagement:** Continued collaboration with students, faculty, and staff
- **Technology Updates:** Regular upgrades to monitoring and control systems
- **Benchmarking Against Standards:** Continuous comparison with industry best practices^[1]

This systematic approach ensures that energy wastage is continuously identified and addressed, maintaining Amrita's position as a leader in campus sustainability.^[1]

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Research and Innovation in Energy Management

The university conducts extensive research to advance energy review methodologies and efficiency practices:^[6]

- Studies on behavioral aspects influencing adoption of energy efficiency measures
- Research on imperfect evaluation deterring implementation of audit recommendations
- Development of evidence-based intervention strategies
- Investigation of industrial energy conservation behaviors and practices

These research initiatives inform the university's continuous improvement in identifying and addressing energy wastage.^[6]

Through comprehensive monthly energy reviews, advanced monitoring systems, detailed audits, and stakeholder engagement, Amrita Vishwa Vidyapeetham systematically identifies areas of highest energy wastage and implements targeted solutions to achieve substantial

reductions in energy consumption and environmental impact.

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1. <https://www.amrita.edu/unsdg/sdg7/energy-wastage-identification/>
2. <https://www.amrita.edu/unsdg-25/sdg7/energy-wastage-identification/>
3. <https://www.amrita.edu/unsdg-25/sdg7/plan-to-reduce-energy/>
4. <https://www.amrita.edu/unsdg-25/sdg7/upgrade-buildings/>
5. <https://www.amrita.edu/unsdg-25/sdg7/carbon-reduction-and-emission/>
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15. <https://scholar.google.com/citations?user=yA8TQ48AAAAJ&hl=en>