ECE 575 Group 4 Task Progress Report 6: 7-11-2023

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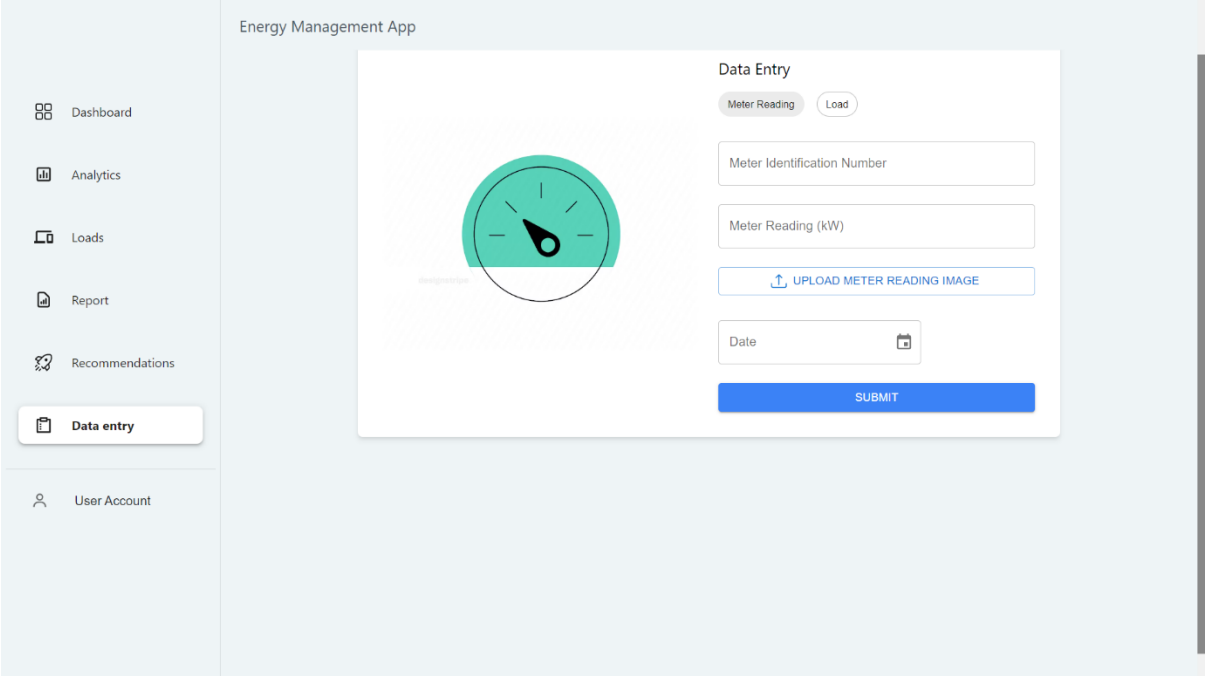
Application development progress report

We added a data entry section to our application to allow the users to key in data related to the meter readings, and the also the various types of loads. The different fields to be provided for the meter readings include:

1. Meter identification number – To provide a field for users to enter a unique identifier for the meter, such as a serial number or location code.
2. The total energy consumption given by the meter reading,
3. An image of the meter reading captured during the data collection for verification and reference.
4. The date the reading was taken to help in proper and chronological record-keeping and to also be used in future analysis to help track usage patterns and identify anomalies.

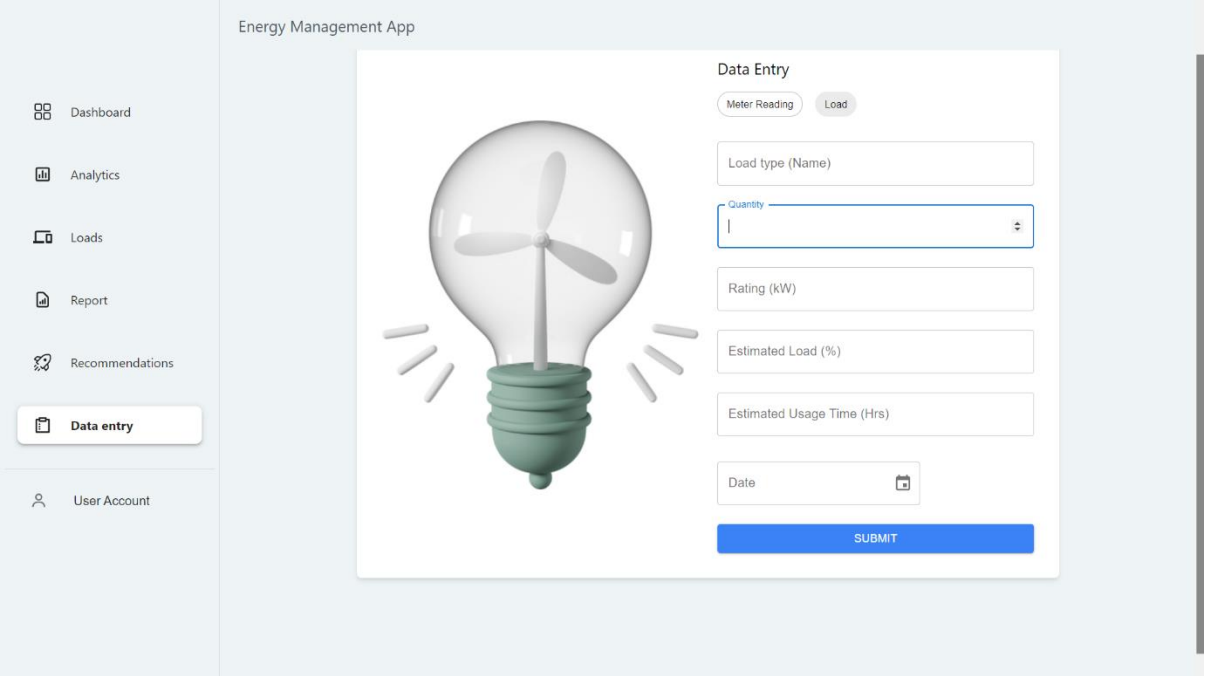


We also added a section on the data entry page of our application to enable the users to key in data related to the different types of loads and facility equipment and their specifications such as:

- Equipment type
- Equipment rating
- Estimated running time
- Estimated Load (in percentage e.g is the equipment running at full load or not)

Load and equipment data provide a complete picture of energy consumption within a facility. By including this information in our app, it will help us identify the most significant energy users and prioritize areas for improvement. Collecting data on individual loads and equipment will also help us identify specific areas where energy inefficiencies exist which will help us come up with lead to targeted solutions to reduce energy waste and improve overall energy performance. Load and equipment data help establish baseline energy consumption levels. This baseline is essential for measuring the effectiveness of energy-saving measures implemented during and after the audit.

Through the application, we can identify which loads and equipment consume the most energy which will enable us to make recommendations on energy efficiency measures based on potential savings and return on investment.



Data Analysis Report

Meeting held on 4th November,10:00 am

This energy audit report presents discussion and results on the energy saving measures to be implemented related to the energy consumption within the Margaret Thatcher Library and its associated facilities. The audit primarily focused on the energy management plan and the conservation measures.

Energy Management Plan

This Energy Management Plan outlines our group's commitment to optimizing energy usage and promoting sustainability. Building on the implementation of a Smart Power Management System for desktops, this plan provides a comprehensive approach to effective energy management.

Goals:

- Optimize energy usage during non-peak hours.
- Reduce energy consumption and greenhouse gas emissions.
- Promote sustainable practices within the organization.

Energy Management Plan:

1. Desktop Power Management:

    Operation of a Smart Power Management System for desktops to schedule automatic shutdowns and sleep modes during non-peak hours.

    Monitor energy consumption regularly and assess the effectiveness of the system.

    Provide ongoing training and support for employees to ensure proper usage.

2. Lighting Optimization:

    Implement energy-efficient lighting systems, such as LED bulbs, throughout the library.

    Use natural daylight whenever possible and install occupancy sensors to control lighting in unoccupied areas.

    Regularly maintain and replace lighting fixtures to ensure optimal performance.

3. HVAC System Efficiency:

    Conduct regular maintenance and tune-up of heating, ventilation, and air conditioning (HVAC) systems to ensure they operate at peak efficiency.

    Upgrade HVAC systems to newer, more energy-efficient models when necessary.

    Implement temperature setback strategies during non-working hours.

4. Renewable Energy Sources:

    Explore the possibility of integrating renewable energy sources, such as solar panels, to reduce reliance on conventional electricity sources.

5. Employee and students Engagement:

    Foster a culture of energy conservation and sustainability by educating and involving employees in energy-saving practices.

    Encourage employees/students to report energy waste and suggest improvements.

6. Data Monitoring and Reporting:

Continuously monitor and collect energy consumption data to track progress and identify areas for improvement.

Regularly present a report on energy usage and cost savings

ASPECT	**Energy Savings (KES)**	**GHG Savings (KES)**	**Cost Savings (KES)**	**Implementation Cost (KES)**	**Payback Period (in years)**
Lighting Upgrade	675,000	135,000	675,000	1,800,000	2.67 years
HVAC System Upgrade	900,000	180,000	900,000	3,000,000	3.33 years
Solar Panel Installation	1,350,000	270,000	1,350,000	4,500,000	3.33 years

These values have been converted using the exchange rate of 150 Kenyan Shillings for 1 US Dollar. Please note that exchange rates can fluctuate, so it's crucial to verify the current rate for precise calculations.

Formulas used to calculate the values in the table:

- Energy Savings:

Formula: Energy Savings (%) = ((Initial Energy Consumption - New Energy Consumption) / Initial Energy Consumption) * 100

Example: Energy Savings (Lighting Upgrade) = ((Initial Energy Consumption - New Energy Consumption) / Initial Energy Consumption) * 100

- GHG (Greenhouse Gas) Savings:

Formula: GHG Savings (%) = ((Initial GHG Emissions - New GHG Emissions) / Initial GHG Emissions) * 100

Example: GHG Savings (HVAC System Upgrade) = ((Initial GHG Emissions - New GHG Emissions) / Initial GHG Emissions) * 100

- Cost Savings:

Formula: Cost Savings (in KES) = Annual Energy Savings (%) * Annual Energy Cost (in KES)

Example: Cost Savings (Lighting Upgrade) = Energy Savings (Lighting Upgrade) * Annual Energy Cost (in KES)

- Implementation Cost:

Formula: Implementation Cost (in KES) is the upfront cost of the energy-saving measure.

Example: Implementation Cost (Lighting Upgrade) = Ksh 12,000

- Payback Period:

Formula: Payback Period (in years) = Implementation Cost (in KES) / Annual Cost Savings (in KES)

Example: Payback Period (Lighting Upgrade) = Implementation Cost (Lighting Upgrade) / Annual Cost Savings (Lighting Upgrade)

These formulas help estimate energy savings, GHG reductions, and cost savings, as well as determine the payback period for each energy-saving measure based on the data collected during the energy audit. Energy-Saving Measures:

Conservation Measures:

1. Lighting Upgrade:

Use of energy saving bulbs.

Energy Savings: The lighting upgrade is projected to result in a 15% reduction in energy consumption, leading to annual cost savings of 675,000 KES.

GHG Savings: The upgrade is expected to reduce GHG emissions by 3%.

Implementation Cost: The estimated cost for implementing this upgrade is 1,800,000 KES.

Payback Period: The payback period for this investment is approximately 2.67 years.

2. HVAC System Upgrade:

Energy Savings: The HVAC system upgrade is anticipated to yield a 20% reduction in energy use, resulting in annual cost savings of 900,000 KES.

GHG Savings: This upgrade is expected to reduce GHG emissions by 5%.

Implementation Cost: The estimated cost for implementing the HVAC upgrade is 3,000,000 KES.

Payback Period: The payback period for this investment is approximately 3.33 years.

3. Solar Panel Installation:

Energy Savings: The installation of solar panels is estimated to provide a significant 30% reduction in energy consumption, leading to annual cost savings of 1,350,000 KES.

GHG Savings: It is projected to reduce GHG emissions by 7%.

Implementation Cost: The estimated cost for implementing solar panels is 4,500,000 KES.

Payback Period: The payback period for this investment is approximately 3.33 years.

GHG Savings: This improvement is anticipated to reduce GHG emissions by 2%.

Implementation Cost: The estimated cost for implementing building envelope improvements is 2,250,000 KES.

Conclusion

The energy audit report highlights significant opportunities for energy efficiency improvements at Moi University Margaret Thatcher Library. The implementation of these energy-saving measures can lead to substantial energy and cost savings while contributing to reduced GHG emissions. It's important to note that the payback periods for these investments are relatively short, indicating the potential for rapid return on investment.

These measures not only align with sustainability goals but also promote responsible resource management, ultimately benefiting both the institution and the environment. It is recommended that Moi University, Margaret Thatcher Library consider implementing these measures to enhance energy efficiency and sustainability.