

# Energy Audit Translation Tool for Non-Experts

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**Abstract**— Energy audits play a vital role in identifying inefficiencies and recommending energy conservation measures in residential, commercial, and industrial facilities. However, conventional energy audit reports are highly technical in nature and are often difficult for non-expert stakeholders such as small business owners, facility managers, and residential users to understand and implement. The presence of complex engineering terminology, detailed numerical analysis, and advanced financial metrics like Net Present Value (NPV), Internal Rate of Return (IRR), and power factor discourages practical adoption of audit recommendations. As a result, a significant gap exists between energy audit findings and real-world implementation.

This paper presents the **Energy Audit Translation Tool for Non-Experts (EATT)**, a digital solution designed to bridge this communication gap. The proposed tool accepts conventional energy audit reports as input and converts them into simplified, user-friendly outputs using natural language processing (NLP), data normalization, and rule-based prioritization techniques. Technical parameters such as energy consumption, load demand, and efficiency indicators are translated into plain language explanations, while complex financial evaluations are simplified into easily understandable metrics like simple payback period and estimated cost savings.

The system also prioritizes Energy Conservation Measures (ECMs) based on potential savings, ease of implementation, and urgency, enabling non-technical users to make informed decisions. The methodology, system architecture, and working principle of the tool are discussed in detail. The results indicate that EATT significantly improves comprehension, increases user confidence, and encourages the implementation of energy efficiency measures. The proposed tool demonstrates strong potential to enhance energy management practices and promote sustainability by making energy audit outcomes accessible to a wider audience.

**Keywords**— Energy Audit, Energy Conservation Measures, Natural Language Processing, Sustainability, Non-Experts.

## I. INTRODUCTION

Energy audits are systematic procedures used to analyze energy consumption patterns within a facility and identify opportunities for reducing energy usage and operational costs. They form the foundation of effective energy management and sustainability initiatives. A typical energy audit provides detailed technical analysis, equipment-level data, and financial feasibility of recommended improvements.

Despite their importance, energy audit reports are often difficult for non-expert stakeholders to interpret. The heavy use of technical jargon, engineering calculations, and complex financial models limits their practical usefulness. This challenge leads to poor implementation rates of recommended energy conservation measures. The objective of this work is to develop a system that translates technical audit information into simple, actionable insights for non-experts.

## II. LITERATURE REVIEW

**Prabhu, Valdi, and Arjunan (2023)** presented a framework for explainable AI in energy prediction and anomaly detection for smart buildings, aiming to make building energy systems more efficient, reliable, and auditable [1].

**de Wilde (2023)** proposed a simplified energy audit method for low-complexity and non-residential buildings as an alternative approach to assess electricity end-uses, providing a practical and faster option for auditors to pinpoint efficiency opportunities [2].

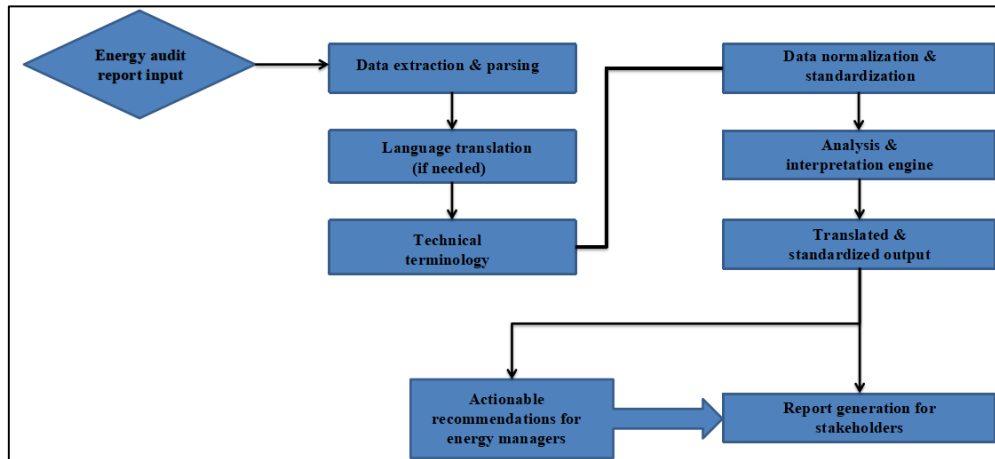
**Narciso and Martins (2021)** reviewed the application of machine learning tools for energy efficiency in industry, examining how ML algorithms utilize operational data for critical tasks like energy forecasting and process optimization [3].

**Al-Sabbagh et al. (2020)** presented energy audit as a step toward effective energy management, involving data analysis and on-site inspection to precisely identify all sources of energy waste and inefficiency [4].

Agostinelli et al. (2017) examined how Artificial Intelligence is fundamentally transforming energy audits in industrial settings to improve performance and efficiency [5].

### III. METHODOLOGY

The proposed Energy Audit Translation Tool follows a structured methodology



**Figure 1: Block Diagram of Energy Audit Translation Tool (EATT)**

#### 3.1 System Workflow Description

**Energy Audit Report Input (Start):** The process begins with the energy audit report input (PDF or digital document), containing raw, technical data generated by professional auditors.

**Data Extraction & Parsing:** The EATT electronically reads and separates the input report into recognizable data segments, identifying key information points like equipment types, energy consumption, retrofit costs, and savings projections.

**Language Translation (If needed) & Technical Terminology:** This step handles reports in different human languages. The system then isolates technical jargon (e.g., kW demand, power factor, NPV) that needs simplification.

**Data Normalization & Standardization:** Extracted data is processed to ensure consistency, converting various measurement units and financial models into a common format.

**Analysis & Interpretation Engine:** This core component translates complex financial metrics into simple concepts (e.g., converting NPV or IRR into simple payback time) and determines the urgency and cost-effectiveness of each recommendation.

**Translated & Standardized Output:** The engine produces data that is easy to read and internally consistent, forming the foundation for final documents.

**Actionable Recommendations for Energy Managers:** Using translated data, the system automatically drafts concise recommendations focusing on benefits, costs, and payback periods.

**Report Generation for Stakeholders (End):** Final simplified report is generated.

### IV. SYSTEM APPLICATIONS AND BENEFITS

The Energy Audit Translation Tool for Non-Experts (EATT) helps non-experts understand complicated technical energy audit reports. Traditional audit reports use technical language and complicated math, leading to energy-saving measures not being implemented correctly. This tool makes information easier to understand by presenting it in plain language with practical advice. As a result, it helps users make informed decisions, encourages the adoption of energy-saving measures, and supports effective energy management and sustainability.

## V. RESULTS AND DISCUSSION

The output of the proposed system includes a concise summary of audit findings, a simplified glossary of technical terms, and a prioritized action plan. Testing with sample audit reports shows that non-expert users are able to understand recommendations more easily and demonstrate higher willingness to implement suggested measures. The tool effectively bridges the communication gap between energy auditors and end users.



Figure 2: Website View - First Page

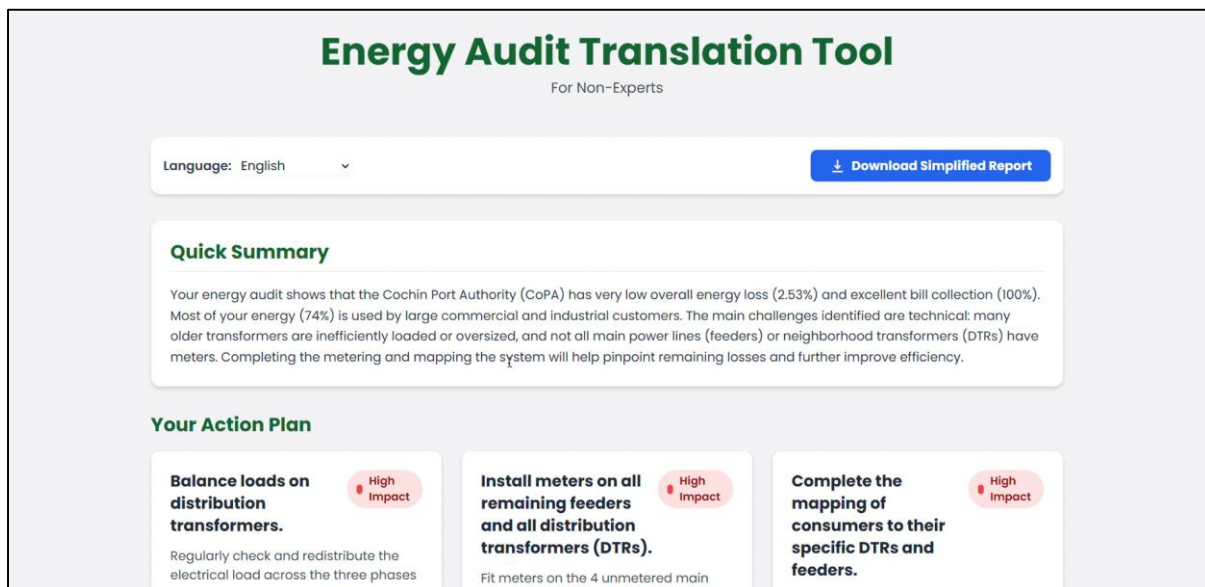


Figure 3: Website View - Last Page

### Example Translation

#### Original Audit Report Conclusion:

*"Based on our audit in the Premier Foods processing unit and above given energy saving opportunities in detail we are recommending the below given energy efficient technology upgradation:*

1. Replacement of reciprocating compressor with screw compressor with VFD

2. *Replacement of existing V-Belt drive with synthetic Energy Efficient S.P.C saver belt in the compressor motor*
3. *Installation of THERMOSIPHON SYSTEM (GAS COOLING) for Compressor*
4. *Automation of refrigeration plant by using PLC controller"*

#### **Translated Output (English):**

"After checking the Premier Foods factory, experts found some ways to save electricity and improve efficiency. They recommend these upgrades:

1. *Replace the old reciprocating compressor with a new screw compressor with VFD (this will save more energy)*
2. *Replace the old V-belt with a more energy-efficient SPC saver belt in the compressor motor*
3. *Install a Thermosiphon system (gas cooling system) for better cooling of the compressor*
4. *Automate the refrigeration plant using a PLC controller (automatic control system)"*

#### **Translated Output (Hindi):**

"Premier Foods फैक्ट्री की जांच के बाद कुछ बिजली बचाने के तरीके सुझाए गए हैं।

1. *पुराने reciprocating compressor की जगह नया screw compressor (VFD के साथ) लगाना।*
2. *पुराने V-belt की जगह energy efficient SPC saver belt लगाना।*
3. *Compressor के लिए Thermosiphon system (gas cooling system) लगाना।*
4. *Refrigeration plant को PLC controller से automatic बनाना।"*

#### **Translated Output (Marathi):**

"Premier Foods कारखान्याची तपासणी केल्यानंतर वीज बचतीसाठी काही सुधारणा सुचवण्यात आल्या आहेत।

1. *जुना reciprocating compressor काढून screw compressor (VFD सह) बसवणे।*
2. *जुना V-belt बदलून energy efficient SPC saver belt बसवणे।*
3. *Compressor साठी Thermosiphon system (gas cooling system) बसवणे।*
4. *Refrigeration plant PLC controller वापरून automatic करणे।"*

## **VI. CONCLUSION**

The Energy Audit Translation Tool for Non-Experts successfully addresses a critical limitation of conventional energy audit reports. By translating technical content into plain language and presenting actionable recommendations, the tool enhances understanding and adoption of energy efficiency measures. The proposed system supports effective energy management, cost reduction, and sustainability goals.

#### **Key Contributions:**

- Bridges communication gap between technical auditors and non-expert stakeholders
- Simplifies complex financial metrics (NPV, IRR) into simple payback periods
- Provides multilingual output (English, Hindi, Marathi) for wider accessibility
- Prioritizes recommendations based on savings potential and ease of implementation

**Future enhancements** may include real-time data integration, advanced financial modeling, mobile application support, and integration with building management systems.

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### CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this research paper. This work has been carried out as part of an academic study and is based entirely on publicly available research papers, journals, and technical resources. The authors confirm that they do not have any financial, commercial, or personal relationships that could influence the content or conclusions of this work. No external funding or industry support has been received.

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