

**Targeted Energy Audit Report Format  
REEEP-GREEN  
(Exhibit 02)**

**Rastriya Banijya Bank Limited**

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## **1. Background:**

Towards ensuring desirable quality requirements and also as a consistent template for Targeted Energy Audit Reports and to enhance their utility for monitoring and evaluation, an energy audit report structure along the following lines is recommended for adoption.

While the report structure compliance in entirety is desirable from programmatic perspective, flexibility needs to be accommodated, as, the extent of detailing; customization and client centric information may vary as per specific situations, warranting simplified presentation on the one hand or far more elaborate detailing on the other. In presentation part, a good balance between quantitative and qualitative detailing and text and visual content is desirable, for the purpose of readability, understandability, and utility from client perspective. An illustrative energy audit report format/guideline for adoption is presented as under.

## **2. Title Sheet of the report to indicate:**

- Nature of audit namely: Targeted Energy Audit (targeted equipment/process, etc. to be specified).
- Name of the industry/audited entity
- Date/Timeframe of audit
- Sponsors, stakeholders as applicable

## **3. Opening page:**

Table of contents of targeted EA report.

## **4. Acknowledgements:**

The acknowledgements page may acknowledge contributions of key stakeholders associated in audit activity from client side as well as sponsors, signed by auditor with date.

## **5. Study Team:**

On this page, the list of study team members with designations may be presented, for future follow up references.

## **6. Abbreviations/Nomenclature used in report:**

In this page, the report may list the abbreviations, nomenclature used in report, for ease of understanding purposes.

## **7. List of instruments used:**

In this page, the list of instruments used in audit need to be mentioned

## 8. Executive summary:

In this section, the report should present the synopsis of study findings, which would at-least, include:

- General/Important information of the audited entity.

Description		Comment/Value
Name of Organization		
Sector		Dairy /Biscuit/Chocolate & Confectionary/Bakery/Vegetable oil and Ghee/Beverage/Pulp & Paper/Rolling mill/Metal Fabrication/Soap/Chemical/HDPE-PVC pipe fittings/Pharmaceutical/Hotel/Hospital  Others (pls. specify):
Scale (size)		Cottage/Small/Medium/Large
Year of Establishment		
Year of Operation		
Main Products		
Main raw materials		
Location of manufacturing/service unit	Place	
	District	
Corporate Office Address		Place:                      Tel:                      Email:
Name of contact person, Designation		
Contact Tel No.		
Operation	Working Hour per day:	
	Number of shift:	
	Annual operation days:	
Compliance with any National/International Standard or certifications (NS/ISO/any other):		

Manpower employed	<b>Gender wise:</b> Male: Female:
Presence of Energy Manager or anyone dedicated for energy saving initiative	Yes/No

- Baseline details of the audited entity.

Description	Comment/Value
Annual Production capacity	
Annual Production	
Type of Energy Used	Electrical: NEA/DG/Solar PV/etc. Thermal: Diesel /FO/rice husk/firewood/etc.
Reference year (baseline year) AD	
Annual Energy Consumption	Electrical (kWh): Thermal (lit/kg/etc.):
Specific energy consumption	Electrical: Thermal:

- EE Option summary listing in a table, covering all EE opportunities identified: option wise annual energy savings potential, cost savings potential per annum, Investment needs and simple payback period and CO<sub>2</sub> savings.

## Chapter 1: INTRODUCTION:

### 1.1 Background of the Study:

### 1.2 Scope of energy audit:

The scope of this targeted energy audit includes but not limited to evaluating the current operational efficiency/performance, identifying key performance metrics, and uncovering opportunities for energy savings. This involves a thorough measurement of operating parameters and analysis of derived parameters to assess performance/efficiency of equipment/process to be audited.

Recommendations will focus on actionable improvements to reduce energy consumption, optimize operating practices, and enhance overall performance, with cost-benefit analyses provided for the proposed measure.

### 1.3 About the unit/facility:

(Coverage may present name, location, year of establishment of the unit. Further information on

products, raw material used, design production capacity, actual production, reference year, shifts/day and days/year of normal operation, electrical and thermal energy consumption, source of energy used and cost of different types of energy per annum may be presented).

#### **1.4 General flowchart of the production process:**

General flowchart of the industry should be presented

### **Chapter 2: Equipment/Process Description**

(EA report to present description of equipment or the section audited)

Illustrative example of minimum information/specifications required of the audited equipment are given below for 1) Steam boiler 2) Furnaces 3) Air Compressor 4) Power factor and load management 5) Electric motors and 6) Chillers. Similar and suitable format for (minimum information/specifications required) should be used for any other type of the audited equipment/process not illustrated in this document.

#### **A) Steam Boiler**

##### Boiler Identification

Boiler ID / Name:

Location:

Manufacturer:

Model Number:

Serial Number:

Year of Installation:

##### Boiler Type and Specifications

Type: (e.g., fire-tube, water-tube, packaged, field-erected)

Rated Capacity: (e.g., steam generation rate in kg/hr or lb/hr)

Maximum Operating Pressure: (e.g., in psi or bar)

Steam Temperature: (e.g., in °C or °F)

Fuel Type: (e.g., oil, biomass, coal)

Design Efficiency: (as provided by manufacturer, in %)

##### Burner Specifications

Burner Type: (e.g., forced draft, natural draft, low NOx)

Fuel-Air Control: (e.g., fixed, modulating, with or without oxygen trim)

Combustion Control System: (e.g., presence of oxygen trim system)

##### Instrumentation and Control

Controls: (e.g., pressure control, temperature control, fuel-air ratio control)

Automated Systems: (e.g., presence of an economizer, preheater, or automated blowdown)

Monitoring Devices: (e.g., pressure gauges, temperature gauges, flow meters, stack gas analyzers)

##### Heat Recovery Systems (if applicable)

Economizer: (specify type and operating conditions)

Air Preheater: (specify type and operating conditions)

Blowdown Heat Recovery: (describe the blowdown system and any heat recovery applied)

## **B) Furnace**

### Furnace Identification

Furnace ID / Name:

Location:

Manufacturer:

Model Number:

Serial Number:

Year of Installation:

### Furnace Type and Specifications

Type: (e.g., Induction/melting furnace, re-heating furnace, crucible furnace, rotary kiln, Cupola furnace, etc.)

Rated Capacity: (e.g., kg/hr or lb/hr)

Operating Pressure: (e.g., in psi or bar)

Rated Temperature of different zone/chamber: (e.g., in °C or °F)

Fuel Type: (e.g., oil, biomass, coal)

Design Efficiency: (as provided by manufacturer, in %)

### Burner Specifications

Burner Type: (e.g., forced draft, natural draft, low NOx)

Fuel-Air Control: (e.g., fixed, modulating, with or without oxygen trim)

Combustion Control System: (e.g., presence of oxygen trim system)

### Instrumentation and Control

Controls: (e.g., pressure control, temperature control, fuel-air ratio control)

Monitoring Devices: (e.g., pressure gauges, temperature gauges, stack gas analyzers)

### Heat Recovery Systems

Combustion Air Preheater/Recuperator: (specify type and operating conditions)

## **C) Air Compressor**

### Compressor Identification

Compressor ID / Name:

Location:

Manufacturer:

Model Number:

Serial Number:

Year of Installation:

### Compressor Type and Specifications

Type: (e.g., rotary screw, reciprocating, centrifugal, scroll)

Drive Type: (e.g., direct-drive, belt-drive)  
Rated Capacity: (e.g., Free Air Delivery (FAD) in CFM or m<sup>3</sup>/min)  
Maximum Operating Pressure: (e.g., in psi or bar)  
Rated Motor Power: (in kW or HP)  
Motor Efficiency: (as specified by the manufacturer, in %)  
Cooling Type: (e.g., air-cooled, water-cooled)

#### Operating Parameters

Operating Pressure Range: (e.g., min-max pressure in psi or bar)  
Average Operating Load: (e.g., as % of capacity)  
Duty Cycle: (e.g., % time loaded/unloaded)  
Operating Hours:

#### Monitoring Devices

Pressure Gauges: (locations and range of readings)  
Temperature Sensors: (inlet and outlet temperature readings, ambient temperature)  
Flow Meters: (location, type, and reading range, if available)  
Power Meters: (to track actual energy consumption)  
Condensate Drains: (type of drains, e.g., manual, timed, or zero-loss)

### **D) Power Factor and Load Management**

#### Area/Section Identification

Main incomer/PCC/Individual drive:  
Voltage system: 33kV/11 kV/0.433 kV, etc.  
Transformer capacity: kVA (for main incomer)  
Connected load: kVA/kW

### **E) Electric Motor**

#### Motor Identification

Motor ID / Name:  
Location:  
Application/Connected Equipment: (e.g., pump, conveyor, air compressor)  
Manufacturer:  
Model Number:  
Serial Number:  
Year of Installation:

#### Motor Specifications

Type: (e.g., induction motor, synchronous motor)  
Rated Power: (in kW or HP)  
Rated Voltage: (e.g., 400V, 480V)  
Frequency: (e.g., 50 Hz, 60 Hz)  
Rated Current: (in Amps)

Power Factor: (at rated load)  
Efficiency: (nameplate efficiency in %.)  
Number of Phases: (e.g., single-phase, three-phase)  
Motor Speed: (RPM at rated load)  
Enclosure Type: (e.g., TEFC - Totally Enclosed Fan Cooled, open drip-proof)

## **F) Chillers**

### Chiller Identification

Chiller ID / Name:  
Location:  
Application/Purpose: (e.g., pasteurization, cooling, etc.)  
Manufacturer:  
Model Number:  
Serial Number:  
Year of Installation:

### Chiller Type and Specifications

Chiller type: (e.g., Air cooled, water cooled, centrifugal, reciprocating, etc.)  
Cooling Capacity: ton/kW  
COP (Coefficient of Performance): Ratio of cooling capacity to electrical input power, indicating the energy efficiency of the chiller.  
Temperature Range: Specifies the range of temperatures the chiller can maintain for the cooling water or refrigerant (e.g., -5°C to 20°C).  
Compressor Stages: Single-stage or multi-stage compressors, which affect efficiency and pressure capacity.  
Refrigerant Type: Specifies the refrigerant used (e.g., R134a, R410A, R407C), which influences efficiency and environmental impact.  
Evaporator Type: Shell and tube, plate heat exchanger, or brazed plate, which affects heat transfer efficiency.  
Condenser Type: Options include air-cooled, water-cooled, or evaporative condensers.  
Flow Rate: Flow rate for chilled water and condenser water, typically in m<sup>3</sup>/hr or GPM (gallons per minute).  
Energy Efficiency Standards Compliance: Compliance with local or international energy efficiency standards (e.g., ASHRAE, CE, ISO).

### Electrical Specifications

Power Supply: Voltage and phase requirements (e.g., 380V, 3-phase, 50Hz).  
Power Consumption: Total electrical power consumption, usually measured in kW.  
Current Draw: Electrical current required under full load conditions.  
Compressor Power: Power rating of the compressor in kW or HP.  
Compressor Speed Control: Variable speed or fixed speed, affecting energy consumption.

### Control and Monitoring Systems

Controller Type: Microprocessor-based or PLC (Programmable Logic Controller) with digital



controls.

Display and Interface: LCD or digital interface for easy operation, allowing real-time monitoring of temperature, pressure, and other operational parameters.

Connectivity Options: Availability of BMS (Building Management System) compatibility or IoT integration for remote monitoring and control.

### **Chapter 3: Measurement details and Analysis**

(EA report to present measured/observed data of equipment or the section audited)

Illustrative example of minimum information required are given below for 1) Steam boiler 2) Furnaces 3) Air Compressor 4) Power factor and load management 5) Electric motors and 6) Chillers. Similar and suitable format for (minimum information/specifications required) should be used for any other type of the audited equipment/process not illustrated in this document.

#### **A) Steam Boiler**

##### Operating Parameters

Operating Hours: (daily, monthly, or annually)

Average Operating Load: (as % of capacity)

Steam Demand Patterns: (description of demand peaks or fluctuations impacting boiler performance)

Steam utilization area/s:

Proximity and ultimate analysis of fuel used:

Fuel flow rate: kg/hr or lit/hr

Operating Pressure/range:

Flue Gas Temperature: (°C)

Excess Air Level: (%)

Measured CO<sub>2</sub> Level: (%)

Measured O<sub>2</sub> Level: (%)

Temperature of boiler body at different locations: (°C)

Other Measured parameters (if any):

Measured/Calculated boiler efficiency (direct as well as indirect method):

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

#### **B) Furnace**

##### Operating Parameters

Operating Hours: (daily, monthly, or annually)

Proximity and ultimate analysis of fuel used:

Operating Pressure: bar, kg/cm<sup>2</sup>, etc.

Fuel flow rate: kg/hr, lit/hr, etc.

Feed (input material) rate: kg/hr, etc.

Initial temperature of feed material: (°C)

Final temperature of feed material: (°C)

Flue Gas Temperature: (°C)  
Excess Air Level: (%)  
Measured CO<sub>2</sub> Level: (%)  
Measured O<sub>2</sub> Level: (%)  
Temperature of furnace body at different locations: (°C)  
Other Measured parameters (if any):  
Measured/Calculated furnace efficiency (direct as well as indirect method):

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

### **C) Air Compressor**

#### Operating Parameters

Air Demand Patterns: (description of demand peaks or fluctuations impacting compressor performance)  
Power Consumption: (actual power draw in kW under loaded and unloaded conditions)  
Percent motor loading:  
Compressed Air Flow Rate: (e.g., CFM or m<sup>3</sup>/min, at specific load conditions)  
Air Receiver Size: (capacity in gallons or liters)  
Location of Receiver: (close to compressor or point-of-use)  
System Pressure Set Points: (target pressure range at discharge and for end-use)  
Distribution Network: (brief description of piping layout, including any significant drops in pressure).  
Measured free air delivery (FAD test to be performed):  
Leakage quantity (leakage test to be performed):  
Energy Efficiency Ratio: (kW per CFM or m<sup>3</sup>/min)

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

### **D) Power Factor and Load Management**

#### Operating Parameters

Date & Time: Record the date and exact time for each measurement.  
Voltage (V): Measure and record the voltage.  
Current (A): Measure the current flowing.  
Frequency (Hz): Measure the frequency of power supply.  
Active Power (kW): Record the active (real) power in kilowatts, which represents the useful power consumed by the load.  
Reactive Power (kVAR): Record the reactive power in kilovolt-amperes reactive.  
Apparent Power (kVA): Calculate or record the apparent power, the combined active and reactive power, representing the total load on the system.  
Power Factor (PF): Calculate/measure the power factor (PF) as the ratio of active power to apparent power (PF = kW/kVA).  
Total harmonic distortion: Total voltage and current harmonic distortions in percent.

Observations/Notes: Document any anomalies, irregular load behavior, or observations regarding load balancing, power factor improvement, or load shifting recommendations. Draw suitable graphs followed by detailed analysis of measured/observed data.

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

### **E) Electric Motor**

Load Profile: (average percentage of rated load, peak load, load variation)  
Duty Cycle: (continuous, intermittent, etc.)  
Operating hours:  
Operating mode: (daily, weekly, monthly, or annually)  
Power Consumption: (actual power draw in kW at various loads if available)  
Current Measurements: (record average current draw and variations)  
Voltage Measurements: (record voltage and voltage variations)  
Operating Power Factor: (recorded power factor during operation)  
Percent loading in percent:  
Control Type: (e.g., direct-on-line, soft start, variable frequency drive (VFD))  
Performance Concerns: (notes on underloading, overloading, or potential inefficiency, etc)

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

### **F) Chillers**

#### Operating Parameters

Chilled water flow (using a flow meter or assessed by level difference): m<sup>3</sup>/hr  
Chiller water inlet temperature to chiller: oC  
Chiller water outlet temperature from chiller: oC  
Actual cooling capacity: TR  
Compressor motor input power: kW  
Specific energy consumption: kWh/TR  
Input power to CT fan: kW  
Input power to chilled water pumps in operation: kW  
Input power to condenser water pumps in operation: kW  
Overall system specific energy consumption: kWh/TR

*Note: All parameters need to be presented in the table and relevant calculations to be presented. Report should also present detailed analysis and conclusion based on measured/observed data.*

## **Chapter 4: ENERGY EFFICIENCY OPPORTUNITIES**

Report to cover Energy efficiency opportunities in this chapter in a clear manner, presenting for each opportunity the following aspects:

1. Title of measure (EE opportunity)
2. Present situation (present operation condition/practice should be presented in significant detail)
3. Recommendation (should be based on the measured data and analysis/conclusion presented in chapter 03. It should also cover how the implementation of measure will help in improving the performance)
4. Cost benefits:  
Cost benefits should at least present:
  - Present energy consumption
  - Energy consumption after improvement (implementation of EE measure)
  - Annual energy savings
  - Annual cost savings
  - Annual CO<sub>2</sub> savings
  - Simple payback period in months or years

## **Chapter 5- EXHIBITS**

Each targeted EA report to include exhibits to support the report findings, as deemed necessary, for clarity, better understanding, and may include information like:

- Line diagrams,
- Historical energy data, if available
- Technical Specifications
- Design data
- Detailed calculations as applicable
- Vendor information and product literature
- Generic tips, Housekeeping measures, maintenance guidelines etc.

**Note:** For further insight, also refer to the Exhibit-01: [Detailed Energy Audit (DEA)/Investment Grade Energy Audit (IGEA) Report Guidelines]