

# **ENERGY AUDIT SCHEME FOR LARGE CONSUMERS OF ENERGY**



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**Resource Conservation Department**

## ENERGY AUDIT SCHEME FOR LARGE CONSUMERS OF ENERGY

1. The National Environment Agency (NEA) oversees the energy audit systems and energy management programs of large consumers of primary energy.
2. All facilities are welcome to participate in the Scheme. NEA strongly encourages facilities that consume in excess of 10TJ per annum to participate.
3. The main objective of the Energy Audit Scheme is to ensure that Energy Management Programmes are in place to improve the energy efficiency of these companies and of Singapore as a whole. Through improvement of energy efficiency and adoption of cleaner energy technologies wherever feasible, pollutive and greenhouse gas emissions from fossil fuel-based power production could be mitigated, thereby helping the environment.
4. The intention of the Energy Audit Scheme is to spur companies to systematically identify and rectify weaknesses in their plant design, management systems and practices that adversely affect energy efficiency. The Energy Audit for the whole facility should be conducted once every 5 years or less, according to the companies' strategies and target setting, but preferably not exceeding 5 years. For facilities that have not been audited since the beginning of year 2000, a first audit should preferably be conducted by 2005
5. Companies under the Scheme can either conduct their own Energy Audit in-house or engage external consultants.
6. Companies should notify NEA if they decide to use an in-house audit team. When appointing the in-house audit team, the companies should ensure that:
  - a. The team leader will not feel inhibited from disclosing strengths and weaknesses in the management of energy and in recommending necessary actions;
  - b. The team and team leader's qualifications, skills and experience are appropriate, and team members have about 5 years of related working experience;
  - c. Senior management is confident that team members have the necessary skills and experience and will act on their recommendations if they are found to be viable.
7. The elements to be audited under the Scheme are in **Annex 1**.
8. The guidelines for the Energy Audit Report are in **Annex 2**. The guidelines have been written to be applicable to all types of manufacturing industries. Hence, companies should bear in mind that these guidelines are to be used as reference when preparing the report. The report format should adhere to the guidelines so as to facilitate evaluation.
9. The information in the report will be treated with strict confidentiality and NEA staff will have access to them only on a need-to-know basis. Before any company-specific information is disseminated or made public, approval will be sought from the respective companies.

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"Facility" refers to the complex of processing plants, buildings and equipment that are or have been built, installed or established on a site.

## **ANNEX 1**

### **ELEMENTS OF THE ENERGY MANAGEMENT PROGRAM TO BE AUDITED UNDER THE ENERGY AUDIT SCHEME**

#### ENERGY MANAGEMENT POLICY

The audit shall ascertain whether the company has a written energy policy endorsed by top management in which energy conservation and efficiency are adequately covered.

#### ENERGY MANAGEMENT MONITORING SYSTEM

The audit shall ascertain whether the management of the company has set up and maintained a comprehensive set of real-time or data logging monitoring system for all parameters required to compute the energy efficiency of all processes to enable staff to identify abnormal energy usage and areas for improvement.

#### BENCHMARKING

The audit shall ascertain whether the management of the company has a regular review of energy performance against the latest benchmarks as part of a continuous improvement circle.

#### MANAGEMENT OF CHANGE

The audit shall ascertain whether the company has developed and instituted a system including use of proper written procedures to ensure any work procedure changes must take into consideration and include energy efficiency possibilities.

#### TRAINING

The audit shall ascertain whether training provided to staff responsible for the operational and all associated processes are effective and that such training adequately covers the retrieval, management and analyses of predefined parameters captured from the monitoring system. The training shall ensure that staff are kept up to date on changes to the work procedures pertaining to improved energy efficiency.

#### GENERAL AUDIT REVIEW

The audit shall ascertain whether regular reviews on implementation of the audit findings are carried out, and procedures for reporting remedial actions are established.

#### ADDITIONAL ITEMS

The audit shall ascertain whether the facility conforms generally to guidelines pertaining to the energy management program in place.

## **ANNEX 2**

### **GUIDELINES ON THE ENERGY AUDIT REPORT**

#### **GENERAL**

The report shall be structured as follows:

Chapter 1 Executive Summary

Chapter 2 Introduction

Chapter 3 Energy Management Organisation

Chapter 4 Training

Chapter 5 Process Stock Information

Chapter 6 Energy Use Tracking Systems

Chapter 7 Utilities Infrastructure

Chapter 8 Operations and Maintenance

Chapter 9 New Constructions, Major Remodels and Renovations

Chapter 10 Assessment, Reporting and Recommendations

Chapter 11 Certification

The report shall be bound in A4-size. 2 copies shall be submitted to NEA.

#### **1 EXECUTIVE SUMMARY**

1.1 Summary of site mission and how energy efficiency supports the mission.

1.2 Goals and objectives of the Energy Management Program.

1.3 Strengths of current energy management programs and efforts.

1.4 Major challenges and goals for the upcoming Fiscal Years.

1.5 Major action items to meet challenges and goals.

#### **2 INTRODUCTION**

This section shall:

2.1 provide a general description of the company and its activities.

2.2 elaborate the audit's scope, schedule, methodology and rationale for the choice of methodology used in the audit.

2.3 introduce the audit team leader and members. Their qualifications and experience should be listed.

### **3 ENERGY MANAGEMENT ORGANISATION**

This section shall:

3.1 depict organisational structure which defines energy management responsibilities at all organisational levels, including the lines of responsibility for facility management, energy management, operation and maintenance, retrofits, new plant or process design and contracting for shared energy type contracts.

3.2 indicate if the personal performance evaluation of personnel responsible for energy management contain elements pertaining to this responsibilities such that there is personal accountability throughout the organisation to meet energy management objectives.

3.3 identify any goals or actions needed to improve current organisation, responsibilities, coordination and interaction, accountability, etc.

### **4 TRAINING**

This section shall:

4.1 provide information on employees who have been trained in one or more of the following areas: Energy Management, Energy Auditing, Life Cycle Costing, Renewable Energy Technologies, Plant Commissioning, Utilities Management, Energy Efficiency Design, and other pertinent courses.

4.2 describe means of continually updating Operations and Maintenance staff through refresher course or specific training on new systems.

4.3 describe energy efficiency related training programs, workshops, seminars, etc conducted recently or held on a routine basis.

4.4 identify personnel designated as Energy Managers. Provide information on the responsibilities of the designated Energy Manager both within the area of energy management as well as other areas, and the proportion of time spent in each of these major areas.

4.5 identify any actions needed to maintain or improve knowledge of efficiency practices.

### **5 PROCESS STOCK INFORMATION**

This section shall:

5.1 describe the process or structure intended to be covered in this Energy Audit. Include general information on process or structure such as location, age, construction type, condition, owned or leased, area, etc. Description by building or structure of fuels used, metering arrangements, annual fuel usage by fuel type, utilities consumption, etc. Include a matrix or database printout if a number of buildings or structures are involved.

5.2 describe the method of organising and updating all process stock information, process use changes, remodels or retrofit, drawings, etc. Include names of spreadsheets or databases, responsible parties, drawing locations, etc.

- 5.3 identify any actions needed to establish or improve information availability, data collection, data updates, etc.

## **6 ENERGY USE TRACKING SYSTEMS**

This section shall:

- 6.1 indicate all data sources, methodology and system that are employed to establish the Year 2000 baseline energy usage for all processes in the MW per unit output category and any other parameters based on the various specified feedstock and fuel types for the processes.
- 6.2 show the information and graphs of usage by feedstock and fuel type.
- 6.3 state information and graphs of historical energy use (minimum of 3 years, or less, whichever is lower, up to 10 years). Information and graphs in Year 2000 in comparison with Year 2010 – is facility-wide 10% reduction goal achievable and economically viable?
- 6.4 provide information on industrial and process energy usage. Identify processes used, latest change or updating of processes, usage attributed to processes. For all operational processes, energy input and/or output in any form shall be identified, with the respective NEA-approved performance indicators. For non-operational processes, energy consumption shall be identified.
- 6.5 provide information on benchmarking data employed and how energy use compares with these benchmarking data.

## **7 UTILITIES INFRASTRUCTURE**

This section shall:

- 7.1 describe existing electrical, water, steam, compressed air and condensate return, gas generation and distribution systems, and storage systems, including type, capacity, and physical description of each system, age and condition of the systems, maintenance standards, and problems associated with the system.
- 7.2 describe current initiatives to identify opportunities for control of load, peak shaving or valley filling, storage capability and capacity expansion, co-generation, etc.
- 7.3 identify studies performed, problems or opportunities identified, software utilised, etc.
- 7.4 identify opportunities for infrastructure evaluation, management, improvement, load control, etc.

## **8 OPERATIONS AND MAINTENANCE (O&M)**

This section shall:

- 8.1 identify administrative policies and procedures in place towards energy management and how these are translated to common language at the work floor level.
- 8.2 state the current method used to identify proper maintenance frequency and actions, whether O&M plans are in place, adequacy and accuracy of O&M manuals, and methods of tracking and maintaining O&M completion records. Describe whether O&M is performed in-house or under contract and provisions for incorporating energy efficiency as a goal.
- 8.3 identify directives applicable to O&M such as operating temperature and pressure ranges, hours of operations, steam pressure and temperatures etc. Describe how such targets are ensured round the clock at the plant control panel.

- 8.4 state surveys and follow-up methods used to identify and implement no cost/low cost O&M measures and practices. Outline services received from external parties, such as through contractors or consultants.
- 8.5 identify any actions needed to establish or improve O&M practices, directives planned, potential services available from utilities, etc.

## 9 NEW CONSTRUCTIONS, MAJOR REMODELS AND RENOVATIONS

This section shall:

- 9.1 state the procedure used to identify upcoming projects and opportunities to incorporate energy efficiency and utilities conservation to ensure that design and construction meets or exceeds local standards. Methods used to influence design standards, determine clauses to be incorporated into solicitation documents, and take advantage of design review services.
- 9.2 state methods used to minimise use of petroleum-based fuels to incorporate alternatives such as natural gas or renewable energy sources, and to incorporate utilities conservation measures. This section shall also state methods used to identify potential new technologies to accelerate commercial viability.
- 9.3 describe plant-commissioning program designed to ensure optimal functioning of energy using plant systems, including clauses to be incorporated into solicitations.
- 9.4 identify any actions needed to establish or improve design practices, take advantage of design review services, incorporating new technology, incorporate low maintenance practice, etc.

## 10 ASSESSMENT, REPORTING AND RECOMMENDATIONS

This section shall:

- 10.1 state the energy audit assessment procedures including a checklist to conduct self-assessment of progress of the energy management program. The assessment should track progress of individual action items as well as overall achievement of goals set by NEA.
- 10.2 provide description and samples of any monthly or quarterly post-audit implementation reports submitted to Headquarters or received from Management concerning energy and utilities usage, progress, etc.
- 10.3 describe methods of gathering and reporting data by facility personnel as part of the energy management programme.
- 10.4 identify actions to improve upon methods of reporting data on items such as the following:
- 10.4.1 Energy consumption statistics,
  - 10.4.2 Major activities in implementing energy conservation measures,
  - 10.4.3 Progress towards meeting goals and objectives related to baseline year and previous year,
  - 10.4.4 Description of shared energy savings contract activities, and
  - 10.4.5 Description of demand side management services activities.
  - 10.4.6 Benchmarking comparisons
- 10.5 present the key findings of the audit and recommendations to improve the energy management in detail along with their underlying rationale and an **action plan and schedule for their implementation.**

- 10.6 state the scheduled period of post implementation energy audit and the next re-certification energy audit.

## **11 CERTIFICATION**

This section shall:

- 11.1 indicate certification by audit team leader (or consultant) and senior management that:
- 11.1.1 The data collection for the energy management program has been carried out diligently and truthfully, and that all data monitoring devices are in good working condition and have been calibrated or certified by an approved agency or company periodically, and that no tampering of such devices has occurred.
  - 11.1.2 All reasonable professional skill, care and diligence had been taken in preparing the audit report and that the contents are a true representation of the facts.
  - 11.1.3 The site conforms generally to guidelines pertaining to energy management programs set.
  - 11.1.4 Adequate training provided to personnel involved in daily operations after implementation of recommendations.