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ENERGY EFFICIENCY AND CONSERVATION HANDBOOK



## PREFACE

This handbook was written to support the Department of Energy at the Prime Minister's Office's Energy Efficiency and Conservation initiative, which aims to provide guidelines and assistance to organizations or building occupants in undertaking energy saving measures as part of a collective effort in reducing energy consumption in buildings.

It should be noted that this handbook outlines the basic steps and strategies for energy management and auditing. Users are encouraged to refer to other handbooks for more detailed information and to seek professional advice from energy audit consulting firms. While this guideline provides foundational information, users must develop their own tailored strategies and justifications to meet the specific requirements of their facilities, by taking into account of the diversity in energy needs and usage of various building types such as offices, hotels, shophouses, shopping complexes, hospitals, universities, and more.

This handbook may be updated periodically by appropriate notices to reflect technological advancements and evolving industry practices that will further provide additional information on energy savings measures and strategies. @ Department of Energy, Prime Minister's Office 2024

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#### **1. INTRODUCTION**

The formulation of a simple energy management strategy can support organizations in their drive towards exploring a sustained competitive advantage to support an improved environmental performance. A more sustainable approach to energy practices can benefit organizations both in terms of impacting overall operating expenses as well as contributing towards Brunei Darussalam's climate ambitions.

This handbook serves its purpose as a guideline to assist organizations in establishing and maintaining energy-efficient practices in alignment with Sustainable Development Goal 12 (SDG12) which aims to ensure sustainable consumption and production patterns. SDG12 emphasizes the efficient use of resources, reduction of waste, and the promotion of sustainable practices across all sectors.



The Energy Transition Division (ETD) of the Department of Energy at the Prime Minister's Office has developed this Handbook as a general step-bystep guide to energy management and auditing. This handbook provides useful information for those wishing to undertake energy consumption reduction measures, energy consumption assessment baselines through energy auditing.

#### 1.1 Overview of Energy Management

Energy management aims to optimize energy usage to reduce consumption per economic activity without compromising product quality, services, safety, or environmental standards. Any organization, regardless of size, function, or values can develop effective energy management strategies through its willingness to make the commitment. Implementing an energy management program and activities helps organizations to monitor its energy consumption and its actual costs, promoting strategies to minimize energy waste.

Energy Management pyramid as shown below outlines the progression of energy management strategies, beginning with foundational conservation efforts, advancing through efficiency enhancements, and culminating in the integration of renewable energy sources. Each tier builds upon the one before it, forming a holistic approach to energy management aimed at maximizing cost savings, efficiency gains, and sustainability benefits. The following illustrates the energy management pyramid.



The descriptions for each tier of the energy management pyramid are as follows:



#### COMPLEXITY AND COST

To effectively identify suitable activities for energy-saving efforts, a thorough analysis is required. Activities higher up the pyramid generally involve greater costs and increased complexity. It is also essential to prioritize the implementation of foundational policies at the lower levels of the pyramid before advancing to the more complex and costly activities at the upper levels.

#### 1.2 Benefits of Energy Management

Energy Management offers numerous benefits to the organization's energy performance, which includes cost savings, environmental sustainability and improved operational efficiency. These benefits may help organization in:-

01 🟠	Reducing energy consumption while maintaining service and quality	Implementing efficient monitoring and management practices
02 👗	Fostering staff engagement in energy efficiency	07 expenses
03 😴	Promoting sustained adoption of best energy-saving practices	08 Constitution operational costs
04	Contributing to climate change mitigation efforts	09 Image: Raising awareness and encouraging behavioral changes
05 🕵	Enhancing resilience against energy cost fluctuations and supply disruptions	10 Solution 10 10 10 10 10 10 10 10 10 10 10 10 10

### 2. DEVELOPING AN ENERGY MANAGEMENT PLAN

The PDCA (Plan-Do-Check-Act) cycle is an effective framework for continuous improvement, and it can be applied to energy management as follows:



#### 2.1 Establishing an Energy Management Team

An effective energy management plan starts with forming a dedicated team responsible for overseeing initiatives. This team, including representatives from various departments, develops a strategy aligning with the organization's overall goals.



#### Steps to Establish an Energy Management Team:

Most common roles in energy management team include:



#### 2.2 Conducting a Baseline Energy Assessment

Understanding your current energy use is essential for identifying opportunities for improvement.



### 3. ENERGY AUDIT

#### 3.1 What Is An Energy Audit?

An Energy Audit is an inspection, survey and analysis of energy consumption to identify energy saving opportunities in a building. It encompasses numerous processes or systems to reduce the energy input into the system without negatively affecting the output(s).

The scope and detail of an energy audit varies depending on the significance of energy use and the intended purpose of the information. It can range from highly technical assessments to evaluations of organizational energy management practices and the influence of human behavior on energy consumption.

#### 3.2 Objective of Energy Audit

There are many advantages for undertaking an energy audit including:



#### 3.3 Types of Energy Audit

This handbook identifies three primary types of energy audits, each with unique objectives and varying levels of detail. Each type serves a specific purpose and is selected based on the organization's requirements, the complexity of its energy systems, and the desired outcomes. By choosing the appropriate audit type, organizations can effectively identify and implement measures, thereby enhancing their energy-saving overall energy performance.

ENERGY AUDIT Brief interviews with site operating personnel

WALK-THROUGH

A review of the facility's utility consumption and other operating data

A guick spot-on recommendation on energy improvement.

ENERGY AUDIT Based from Type 1 audit results

Detailed analysis on specified target electrical components

Greater detailed descriptions of relevant energy efficient technology

ENERGY AUDIT A precision subsystem audit which:

ETAILED

Evaluate all systems and equipment

Involves a stringent requirement for data accuracy

#### 3.4 Scope of Work

The scope of the energy audit will include, but not limited to, the following activities:

> Physical inspection of the facility, including buildings, equipment, and processes

Measurement of energy consumption at various points using appropriate instruments

Identification of energy-intensive areas and equipment

Collection of historical energy consumption data (electricity, gas, oil, etc.)

Review of utility bills, energy management records, and equipment specifications

Analysis of building design and operational parameters

Ŀг? Setting up a meeting with organizations to be audited

Sharing of deliverables and expected outcomes to manage expectations

> Setting of schedule for visit and audit

> > Preparation of a comprehensive energy audit report

Presentation of findinas. recommendations, and action plans

Estimation of potential energy and cost savings for each recommended measure



Development a list of energy fficiency easures

OT
feasible
e
m

**Technical and** economic evaluation of each measure

**Prioritization of** measures based on cost-effectiveness and ease of implementation

#### 3.5 Energy Audit Process

Preparation and planning are essential for conducting an effective building audit. This involves forming an Energy Audit Team within the organization, identifying key personnel and assigning roles, defining the audit approach including its scope, objectives, methodology, and expected outcomes developing and agreeing on a timeline for tasks and deliverables, and collecting necessary information such as utility bills, historical energy performance data, building layout drawings, asset listings, and other relevant details.

The audit will subsequently be conducted using a systematic approach, which includes the following steps:



# 4. IMPLEMENTING ENERGY EFFICIENCY AND CONSERVATION MEASURES

Energy efficiency and conservation measures will be implemented after concluding an energy audit's activity. These measures will involve the prioritized cost-effective actions such as the use of highly efficient electrical equipment such as LED lighting and smart thermostats. Continuous monitoring and employee engagement are also crucial in ensuring that regular evaluation and long-term planning contributes to sustain energy savings' practices.

#### **4.1 Energy Conservation Measures**

Encouraging energy-saving behaviors and optimizing operational practices can significantly contribute to energy saving. Energy conservation reduces unnecessary energy use and waste, which is crucial for long-term sustainability and minimizing environmental impact. Below are examples of energy conservation measures that can be implemented:



#### 4.2 Energy Efficiency Measures

Energy efficiency measures often involve the practice of using less energy to accomplish the same task or achieve the same outcome. This can be realized through several approaches, including the adoption of energy-efficient technologies and the refinement of operational practices. Some of the energy efficiency measures that can be undertaken are:



#### 5. Integration of Renewable Energy

The integrating and deployment of renewable energy technologies into buildings can increase energy capabilities and independence. Installing rooftop solar panels can significantly cut fossil fuel reliance, reduce energy costs, and lower carbon footprints. Benefits of rooftop solar include:



Implementing rooftop solar systems is one of the initiative to enhance energy efficiency, reduce operational costs, and contribute to environmental sustainability. By following these steps and leveraging available resources, organizations can successfully integrate rooftop solar into their energy management strategies. For further information on rooftop solar systems, please contact Renewable.energy@energy.gov.bn.

#### 6. Conclusion

The effective implementation of energy efficiency and conservation measures helps building owners and managers with greater control over their energy

usage, particularly for organizations aiming to reduce their energy consumption, lower operational costs, and minimize their environmental footprint. These measures not only contribute to immediate cost savings but also support long-term sustainability goals and align with global efforts like the Sustainable Development Goals (SDGs).



Key Areas of Focus:

#### 1. Energy Audits:

Regular energy audits are essential for identifying inefficiencies and areas for improvement, enabling organizations to target specific issues and prioritize actions that offer the most significant energy savings.

2. Technological Upgrades:

Investing in energy-efficient technologies like LED lighting, optimized Heating, ventilation, and air conditioning systems, and building automation reduces energy consumption and enhances operational efficiency, often providing quick returns through lower utility bills.

3. Renewable Energy Integration:

Incorporating renewable energy, such as solar power, into building operations reduces reliance on fossil fuels and decreases carbon footprint, contributing to energy independence and aligning with global sustainability goals.

#### 4. Behavioral Changes:

Positive behavioral changes and awareness on energy efficiency are fostered through the initiation and internalization of energy conservation's steps within the organization. Engaging employees and promoting simple actions, such as turning off unused lights, can collectively have a significant impact. Strong leadership commitment is a key success factor.

5. Monitoring and Reporting:

Continuous monitoring and regular reporting of energy use are crucial for ensuring accountability, identifying new savings opportunities, and communicating progress to stakeholders.

Strategic and Long-Term Impact:

By focusing on these key areas, organizations can achieve immediate energy savings outcome and contribute to broader sustainability goals such as SDG 12, which emphasizes sustainable consumption and production. As energy efficiency practices evolve, staying informed and adaptable is crucial. Regular updates to the energy efficiency handbook will keep strategies current with the latest trends and regulatory changes.

#### Call to Action:

Stakeholders are urged to proactively implement the handbook's recommendations. Doing so not only enhances operational efficiency but also supports global efforts towards sustainable energy use and environmental stewardship, driving significant progress towards a more sustainable, energy-efficient future.

#### Inquiries and Clarification

Any agency that requires advisory services for the implementation of energy efficiency and conservation measures and activities, or wishes to conduct an energy saving talk session, can contact the Department of Energy.

For further inquiries, clarifications, and additional information on energy efficiency and conservation, please refer to the contact information provided below: -

Energy Efficiency and Conservation Unit, Energy Transition Division, Department of Energy at the Prime Minister's Office Jalan Perdana Menteri, Bandar Seri Begawan, BB3913, Negara Brunei Darussalam

Tel: +673 2384488 ext. 1298 / 3271

E-mail: efficiency.energy@energy.gov.bn

Website: www.energy.gov.bn

#### ENERGY AUDIT BUILDING DETAILS FORM

Name of Focal Person	
Contact Number	
E-mail	
Name of Building	
Address	
Gross Area <sup>*</sup> (m²)	
Building Age (Years)	
Main Use of Building	
Building Operating Hours Per Day	
No. of Stories <sup>+</sup>	
No. of Staffs / Occupants	
Meter Account Number	
* Gross area = T building, calcula	he total area of enclosed space measured to the exterior walls of a ted on a floor-by-floor basis

 $^{\rm +}$  No. of stories = Including basement (if any) and excluding roof

#### APPENDIX

#### Energy Management State Survey

Table 1 presents a form to assess the current state of energy management. Please indicate the status in the "check" column by marking either  $\circ$  (Circle: satisfactory, 1 point),  $\triangle$  (Triangle: partially achieved, 0.5 point), or X (Cross: needs improvement, 0 points) based on the present conditions. With six categories, labeled A through F, results can be plotted on a hexagon, as shown to the right, by connecting each marked point, providing a visual representation of the energy management status.



Category	Po int	Item	Question	Check
Management system (A)		Existence of organization	Is it determined any manager or department responsible for energy management system?	
		Will of top management	Is it fully communicated to everybody by means of posters or slogans?	
	3	Collaboration among relevant departments	Do members of multiple departments participate in activities?	
		Activity records	Are there any records of energy management	
		Human resources development plan	Does humanes, tech Does human resources development for energy management implementation?	
		Operation standard	Are there operation standards for main equipment?	
o n ent (B)		Operation managers	Is it determined any people who manage operation according to standards?	
perat agem	3	Maximum power management	Is maximum power observed carefully with demand meters, etc.?	
Man.		Review of standards	Are operation standards reviewed as necessary?	
Û		Energy use volume	Are there any records such as slips of energy use volume?	
record (	4.5	Equipment operation hours	Are there any records of operation hours of main equipment for combustion, air conditioning, lighting, etc.?	
ment		Individual en ergy volume	Is energy use volume understood by department or usage?	
asurei		Equipment operation data	Are operation data such as temperature, illumination, current, etc. measured?	
Æ		Precision management	Is precision management such as calibration implemented for main instruments?	
÷ ê	4	Maintenance inspection standard	Are there any maintenance inspection standards for main equipment?	
nance nent (		Maintenance inspection records	Are there any maintenance inspection records of main equipment?	
Mainter managen		Drawing management	Are completion drawings, system schematics, etc. well managed?	
		Repair, renewal plan	Are repair and renewal planned based on maintenance and inspection records?	
Energy Visualization (E)	2	Energy graph	Is energy data shown in graphs?	
		Comparison of past data	Are there energy data of previous fiscal years?	
		Sharing	Is energy use state, etc. shared in the company?	
		Intensity management	Is Energy Consumption Intensity managed?	
		Data analysis	Is cause of energy increase or decrease, etc. analyzed?	
PDCA management cycle (F)	1.5	Target setting	Is there any target set for energy conservation, etc.?	
		Target review	Are the energy conservation targets reviewed?	
		Equipment improvement	Are equipment improvement measures review ed?	
		Improvement effect	Is effect of improvement measures verified?	

#### Source: The Energy Conservation Center, Japan