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## 1. Module details

**Module name**

**ENERGY MANAGEMENT 2**

**Nominal duration**

One module  
It is anticipated that students will achieve the competencies specified in 35 to 40 hours.

**Module codes**

**EB146**

**Discipline code**

## 2. Module purpose

To provide the student with the knowledge and skills necessary to describe various methods of energy conservation within industrial buildings and associated mechanical services installations. Students will be able to perform the necessary tests and data collection procedures for a complete energy audit and analysis of a large commercial or industrial building. Students will be able to analyse results from test data and make recommendations on methods of reducing energy usage. This module will build on the knowledge gained in module EA144 'Energy Management System 1'.

## 3. Prerequisites

EA132 - HVAC Control Systems 1  
EA144 - Energy Management 1  
EA136 - Building Management Systems

## 4. Relationship to competency standards

TBA

## 5. Content

1. Identification of major energy consuming plant:
  - review of HVAC system components
  - lighting systems
  - building energy profiles
2. Methods of energy conservation:
  - review of energy conserving strategies
  - house keeping:
    - time schedules
    - lighting control
  - good maintenance practices:
    - filters, fans, appropriate setpoints, dead bands etc.
  - HVAC system control
    - night cycle
    - optimum stop/start
    - purge cycles
    - chiller/boiler/cooling tower sequencing
    - economy cycles (based on temperature or enthalpy).

- supply air reset
- condenser water temperature reset
- electrical load control
  - power demand control
  - load limiting
  - load shedding
  - set point relaxation
  - ventilation cycles

3. Tests and data collection procedures:

- use of BMS for data collection (trending)
- use of data recorders (loggers)
- monitoring of building operations generally

4. Analyse results from test data

- compare against standards (BOMA)
- review current practices against ideal
- total consumption vs peak load
- electricity tariffs and implications

5. Methods of reducing energy usage:

- plant retrofits
  - controls - application of strategies in 2
  - plant - fixed OA to economy, boiler to electric reheat, constant volume to VAV etc. cost/benefit (payback).

## 6. Learning outcome details

### Learning outcome 1

#### Assessment criteria

On the completion of this module, the learner will be able to:

Describe various methods of energy conservation within industrial buildings and associated mechanical services installations.

Short answer test.  
Assignments.

1.1 Discuss and list external and internal impacts on building energy consumption.

1.2 Identify and list major consumers of energy within buildings.

1.3 Describe best current HVAC design strategies practices within industrial buildings and associated mechanical services installations.

1.4 List and describe best energy management practices within industrial buildings and associated mechanical services installations.

1.5 List and describe all possible demand limiting strategies available for industrial buildings and associated mechanical services installations.

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**Learning outcome 2**

Perform the necessary tests and data collection procedures for a complete energy audit and analysis of a large commercial or industrial building.

**Assessment criteria**

Short answer test.

Projects/assignments.

2.1 Use building electrical distribution diagrams, sub main diagrams, metering equipment, to retrieve and collect data.

2.2 List and describe procedures to be adopted to complete an effective building energy audit.

2.3 List and describe the correct application, safe use and maintenance of all appropriate test equipment required to complete an effective building energy audit.

2.4 Accurately perform the necessary tests and data collection procedures for a complete energy audit and analysis of a large commercial or industrial building taking into consideration seasonal effects.

**Learning outcome 3**

Analyse results from test data.

**Assessment criteria**

Projects/assignments.

3.1 Given appropriate data, build building energy use profiles and comment in relation to ambient conditions, house keeping etc.

3.2 Discuss general philosophies to reduce consumption/peak load and relevance to reduce consumption/peak load and relevance to tariff structures and energy costs.

3.3 Provide a comment on current state of HVAC plant and control strategies.

**Learning outcome 4**

Effectively identify and evaluate the various components of building and its services that impact the total energy consumption and carry out a detailed computer simulation of building.

**Assessment criteria**

Project/assignment.

4.1 Identify the major energy consuming components of a building and its services. Describe their likely daily, weekly and annual profiles and the significance of this on the total energy consumption. Estimate the percentage of the total energy consumption that each of these components represents in a typical office building.

4.2 List at least three building energy simulation programs that are being used in Australia and detail the advantages and disadvantages of any two.

## **Learning outcome 5**

### **Assessment criteria**

- 4.3 List the significant items of input to an energy stimulation program that can often not be determined precisely and describe the likely impact of this on the accuracy of the results.
- 4.4 Using a software package, effectively model the building audited under learning outcome 2 and 3 and determine the estimated energy consumption. Compare this to the results obtained in learning outcome 2 and 3.
- 4.5 Describe how the results from this energy study can be effectively checked and provide an estimate of the expected accuracy of the results of the computer simulation.

Make recommendations on methods of reducing energy usage.

Projects/assignments.

- 5.1 Complete a report outlining recommendations on methods of reducing energy usage to include cost/benefit analysis or payback analysis.

See Assessment Criteria.

## **7. Assessment Strategies**

## **8. Module Delivery Strategies**

This module contains learning outcomes that will require both theory and practical instruction. As such, it will require resources to facilitate both on and off-the-job delivery strategies.

These strategies may involve:

- co-operative registered off-the-job provider/employer delivery sharing available resources.
- delivery by an employer who is subregistered as an off-the-job provider, with qualified trainers in-house using resources to facilitate on and off-the-job delivery.
- off-the-job objectives should focus on the industry context while on-the-job objectives should reflect application within enterprise operations.

Assessment instruments will need to be developed by the module provider. These instruments will need to reflect consistency with stated module learning outcomes and related assessment criteria.

Student records will be the responsibility of the off-the-job provider and where more than one off-the-job provider is involved, formal processes for transfer of student information must be established.

## **9. Resource Requirements**

AIRAH 1989. AIRAH Handbook.

AIRAH. Design Aids

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Airflow Developments Ltd. Airflow Measurements in Buildings.

ASHRAE. ASHRAE Handbook, Fundamentals, Atlanta.

ASHRAE. ASHRAE Handbook, HVAC Systems. Atlanta.

Carrier Air Conditioning Company - Handbook of Air conditioning Design. McGraw - Hill.

Haines R.W, Van Wostrand Reinhold, 19--. Control systems for Heating, Ventilation and Air Conditioning - Fourth Edition.

Honeywell, 1989. Engineering Manual of Automatic Control - SI Edition for Commercial Buildings.

Scheepers HP., Uitgewerij de Spil B V - Woerden 1991. Inside Building Management Systems.

SMACNA 1987. HVAC Systems Applications.

SMACNA 1988. HVAC Systems Testing Adjusting and Balancing.

State Projects NSW, Building Energy Text book, NSW Public Works 1993.

Standards - Australia - Latest Editions to be used:

ANSI/ARI310. Forced Circulation Air Cooling and Air Heating Coils.

AS1668 parts 1 & 2. The use of Mechanical Ventilation and Air Conditioning in Buildings.

AS1861 parts 1 & 2. Air Conditioning Units - Methods of Assessing and Rating Performance.

The Trane Company. DDC Control.

Software such as ESPII.

Additionally, further information may be sourced from - journal articles and literature from hydronic system specialist companies.