

CERTIFIED ENERGY MANAGERS / ENERGY AUDITORS - CEM/CEA CEM/CEA FLASH CARDS

128+ key terminology flash cards!

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Paper 1: General Aspects of Energy Management & Audit

**Energy Conservation
Act, 2001**

Indian law promoting efficient use of
energy

BEE

Statutory body under the Ministry of
Power, set up in 2002

**Designated Consumer
(DC)**

Energy-intensive facility notified under
the Act

PAT

Perform, Achieve and Trade:
market-based efficiency scheme for
DCs

ESCert

Energy Saving Certificate, equal to 1
toe saved

toe

Tonne of oil equivalent (10^7 kcal)

Paper 1: General Aspects of Energy Management & Audit

SEC

Specific Energy Consumption: energy used per unit of production

Energy audit

Systematic study of energy flows to find saving opportunities

Walk-through audit

Quick preliminary audit with low-cost findings

Detailed audit

In-depth audit with measurements and financial analysis

Energy balance

Accounting of all energy inputs against outputs and losses

Sankey diagram

Diagram showing energy flows and losses

Paper 1: General Aspects of Energy Management & Audit

Baseline

Reference energy use against which savings are measured

Benchmarking

Comparing performance against best practice

M&T

Monitoring and Targeting: tracking use against targets

CUSUM

Cumulative sum of differences between actual and expected use

Energy intensity

Energy used per unit of GDP or output

Primary energy

Energy in its natural form, such as coal or crude oil

Paper 1: General Aspects of Energy Management & Audit

Secondary energy

Converted energy, such as electricity or steam

Simple payback

$\text{Investment} \div \text{annual savings}$

NPV

Net Present Value: discounted benefits minus costs

IRR

Discount rate at which NPV equals zero

ROI

Return on investment

Discount rate

Rate used to bring future cash flows to present value

Paper 1: General Aspects of Energy Management & Audit

Life cycle cost

Total cost of owning an asset over its life

Sensitivity analysis

Testing how results change as assumptions change

ESCO

Energy Service Company delivering efficiency projects

Performance contracting

ESCO paid from the savings it delivers

Shared savings

Savings split between client and ESCO

Guaranteed savings

ESCO guarantees a minimum saving level

Paper 1: General Aspects of Energy Management & Audit

M&V

Measurement and Verification of
achieved savings

IPMVP

International protocol for M&V

GHG

Greenhouse gases that trap heat in the
atmosphere

Carbon footprint

Total GHG emissions caused by an
activity

GWP

Global Warming Potential:
heat-trapping power relative to CO₂

ECBC

Energy Conservation Building Code

Paper 1: General Aspects of Energy Management & Audit

Star labelling

BEE scheme rating appliance efficiency

Paper 2: Energy Efficiency in Thermal Utilities

GCV (HHV)

Gross Calorific Value: heat released including latent heat of water vapour

NCV (LHV)

Net Calorific Value: heat released excluding that latent heat

Stoichiometric air

Exact air needed for complete combustion

Excess air

Air supplied above stoichiometric to ensure complete combustion

Flue gas analysis

Measuring O₂ or CO₂ to check combustion quality

Dry flue gas loss

Heat lost with the dry flue gases (usually the largest boiler loss)

Paper 2: Energy Efficiency in Thermal Utilities

Direct method

Boiler efficiency = $\text{heat output} \div \text{heat input}$

Indirect method

Boiler efficiency = 100 minus the sum of losses

Evaporation ratio

Kg of steam produced per kg of fuel

Blowdown

Water drained from a boiler to control dissolved solids

TDS

Total Dissolved Solids in water

Deaerator

Removes dissolved oxygen from feed water

Paper 2: Energy Efficiency in Thermal Utilities

Economiser

Recovers flue gas heat to preheat feed water

Air preheater

Recovers flue gas heat to preheat combustion air

Sensible heat

Heat that changes temperature

Latent heat

Heat that changes phase without changing temperature

Saturated steam

Steam at the boiling temperature for its pressure

Superheated steam

Steam heated above saturation temperature

Paper 2: Energy Efficiency in Thermal Utilities

Dryness fraction

Proportion of steam by mass in wet steam

Steam trap

Removes condensate and air without losing steam

Condensate recovery

Returning condensate to the boiler to save heat and water

Flash steam

Steam formed when hot condensate drops in pressure

FBC

Fluidised Bed Combustion: fuel burned in a bed of suspended particles

Thermal conductivity

A material's ability to conduct heat

Paper 2: Energy Efficiency in Thermal Utilities

Economic thickness

Insulation thickness giving the lowest total cost

Refractory

Heat-resistant lining material for furnaces

Furnace efficiency

Heat absorbed by the load ÷ heat input

Opening loss

Radiation lost through furnace openings

Recuperator

Heat exchanger that preheats combustion air from flue gas

Regenerator

Heat exchanger using alternating hot and cold flow through storage media

Paper 2: Energy Efficiency in Thermal Utilities

Waste heat recovery

Capturing heat from exhaust streams for reuse

Cogeneration

Combined production of power and useful heat

Topping cycle

Power is produced first, and exhaust heat is used afterwards

Bottoming cycle

Waste heat is used to produce power

Fouling / scaling

Deposits that reduce heat transfer

Thermic fluid heater

Closed-loop heater using oil as the heat carrier

Paper 3: Energy Efficiency in Electrical Utilities

kW / kVA / kVAR

Real, apparent and reactive power

Power factor

$\text{kW} \div \text{kVA}$

PF correction

Adding capacitors to cut reactive power

Maximum demand

Highest kVA or kW drawn in a billing period

Contract demand

Demand agreed with the utility

Load factor

$\text{Average load} \div \text{maximum demand}$

Paper 3: Energy Efficiency in Electrical Utilities

Demand factor

Maximum demand ÷ connected load

Diversity factor

Sum of individual maximum demands
÷ combined maximum demand

Two-part tariff

Demand charge plus energy charge

ToD tariff

Rates vary by time of day

Harmonics

Distortions in current or voltage at
multiples of the fundamental frequency

THD

Total Harmonic Distortion

Paper 3: Energy Efficiency in Electrical Utilities

No-load loss

Transformer core (iron) loss, constant while energised

Load loss

Transformer copper loss, varies with load squared

Max transformer efficiency

Occurs when copper loss equals iron loss

Synchronous speed

$$120 \times f \div P \text{ (rpm)}$$

Slip

$$(\text{Synchronous speed} - \text{rotor speed}) \div \text{synchronous speed}$$

IE class

International efficiency class for motors

Paper 3: Energy Efficiency in Electrical Utilities

VFD / VSD

Drive that varies motor speed to match load

Soft starter

Reduces motor starting current and stress

Affinity laws

Flow $\propto N$, head $\propto N^2$, power $\propto N^3$

BEP

Best Efficiency Point of a pump

NPSH

Net Positive Suction Head, which guards against cavitation

Throttling

Valve control of flow, which wastes energy

Paper 3: Energy Efficiency in Electrical Utilities

FAD

Free Air Delivery of a compressor

**Specific power
consumption**

kW per unit of air delivered

**Compressed air
leakage**

Often a major compressed air loss

TR

Ton of Refrigeration = 3,024 kcal/h =
3.516 kW

COP

Cooling effect ÷ power input

kW/TR

Chiller power per ton of cooling; lower
is better

Paper 3: Energy Efficiency in Electrical Utilities

IPLV

Integrated Part Load Value

Cooling tower range

Hot water temperature minus cold
water temperature

**Cooling tower
approach**

Cold water temperature minus wet-bulb
temperature

Effectiveness

$\text{Range} \div (\text{range} + \text{approach})$

**Cycles of
concentration (COC)**

Ratio of dissolved solids in circulating
water to make-up water

Lumen / Lux

Light output and illuminance (lumen
per m²)

Paper 3: Energy Efficiency in Electrical Utilities

Luminous efficacy

Lumens produced per watt

LPD

Lighting Power Density (W/m²)

CRI

Colour Rendering Index

DG set SFC

Specific Fuel Consumption in litres per
kWh

Paper 4: Energy Performance Assessment (CEA only)

Power analyser

Measures kW, kVA, PF, voltage, current and harmonics

Ultrasonic flow meter

Non-invasive liquid flow measurement

Pitot tube

Measures air or gas velocity via pressure difference

Flue gas analyser

Measures O₂, CO₂ and CO in flue gas

Infrared thermography

Finds hot spots and heat losses

Lux meter

Measures illuminance

Paper 4: Energy Performance Assessment (CEA only)

Tachometer

Measures rotational speed

Psychrometer

Measures wet-bulb and dry-bulb temperature

Hydraulic power

$Q \times \rho \times g \times H$, giving the useful work done by a pump

Pump efficiency

Hydraulic power $\div$ shaft power

Fan efficiency

Air power $\div$ shaft power

Compressor FAD test

Measures actual air output from a receiver pump-up test

Paper 4: Energy Performance Assessment (CEA only)

Chiller TR test

Cooling load from flow and temperature difference

Boiler efficiency test

Applying the direct and indirect methods

Furnace efficiency test

Applying the direct and indirect methods