TENAGA NASIONAL

Better. Brighter.

ENERGY EFFICIENCY AND ENERGY SAVING FOR BUSINESS

CONTENTS

How electricity is delivered

Why save electricity

Background on Energy Efficiency

Your Energy Status

Saving Opportunities

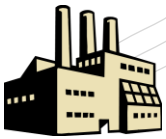
- Commercially
- Technically

HOW ELECTRICITY DELIVERED

HOW ELECTRICITY IS DELIVERED

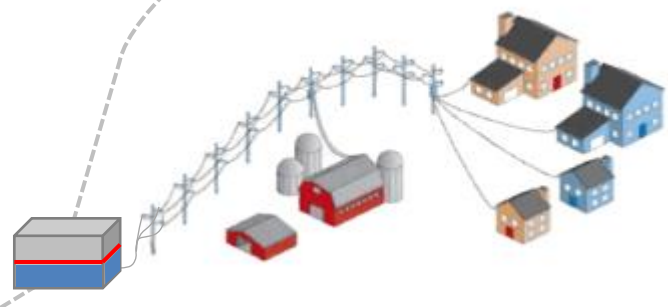
1. Electric Power Stations
Energy sources such as hydro, coal and gas are converted into electricity i.e. electricity generation.

2. High Voltage Transmissions Lines
Energy generated at power stations transported to high voltage customers and distribution system in bulk.



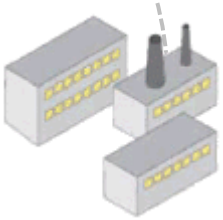
PMU

PPU



PPU

3. Distribution System
Electricity distributed to domestic, commercial and industrial customers through medium and low voltage systems.



WHY SAVE ELECTRICITY

Why Save Electricity

Energy Scenario & Environmental Impact

National Policy & Law-Related

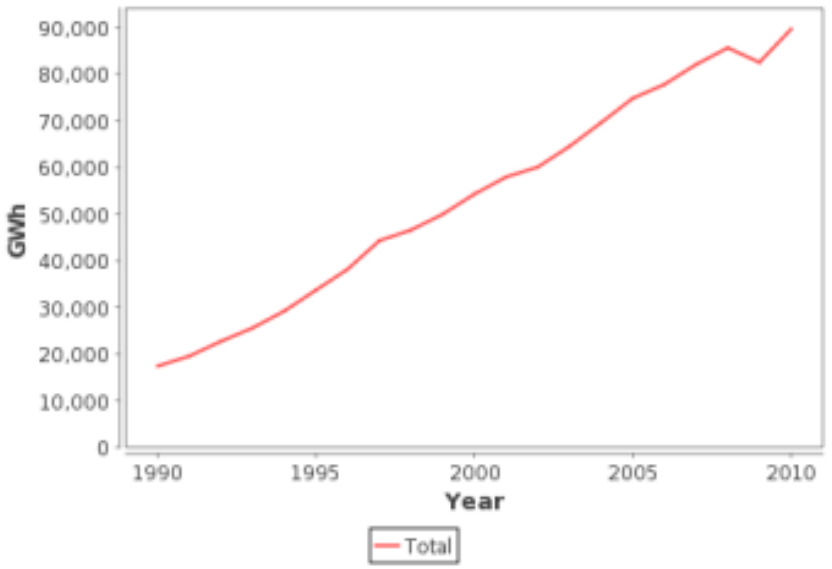
Economy

WHY SAVE ELECTRICITY

Energy Scenario & Environmental Impact

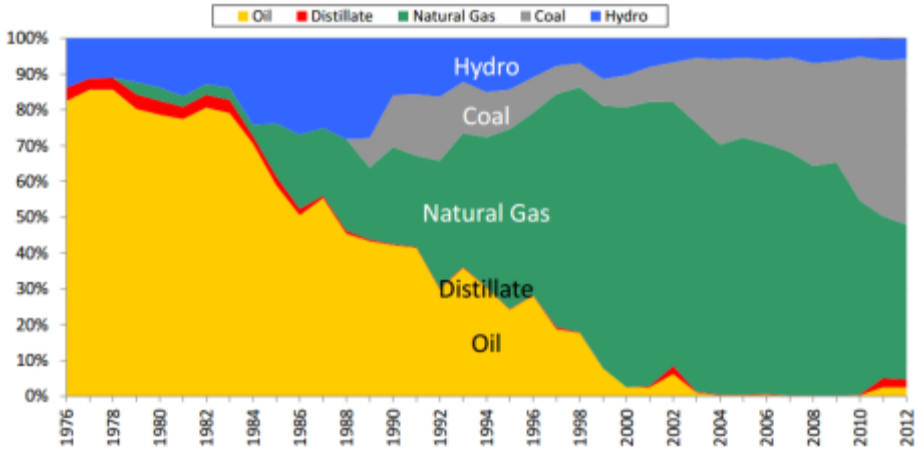
Energy Scenario

Electricity Supply in Semenanjung Malaysia



Source: Malaysia Energy Information Hub - http://meih.st.gov.my/

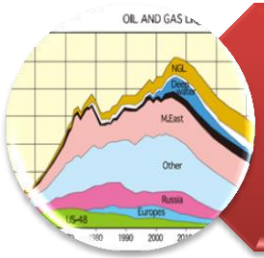
Electricity generation by type of energy resources in Semenanjung Malaysia



Source: Brief Outlook On Malaysian Electricity Supply Industry, http://www.csee.net.cn/data/zt_aorc_cigre2013/ppt/ps4.pdf

- Malaysia's energy supply increased significantly over last 20 years.
- Malaysia's electricity generation is primarily using depleting fossil fuel resources.

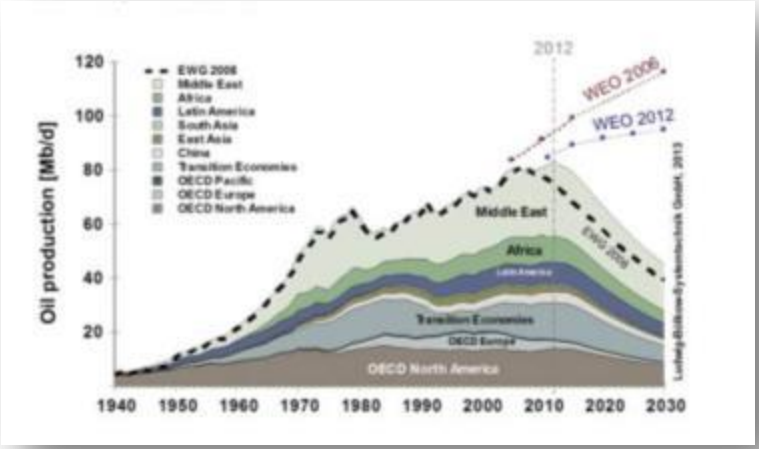
The problems with fossil fuels



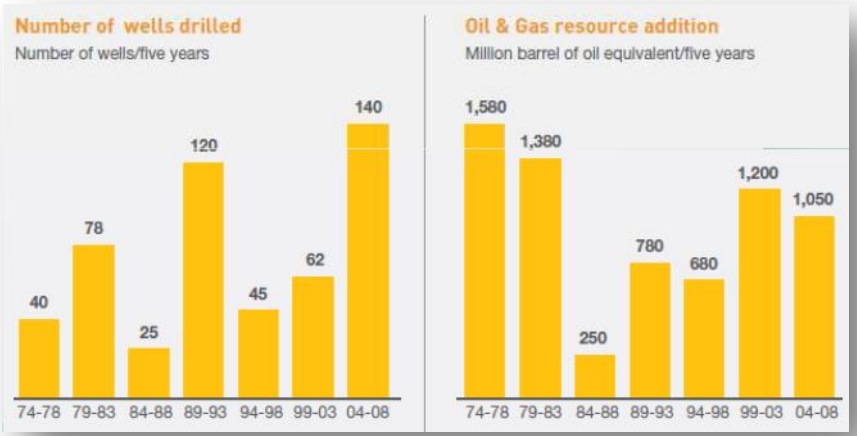
Limited supply

Environmental Impact

Limited Supply of Fossil Fuel



Source: energywatchgroup.org



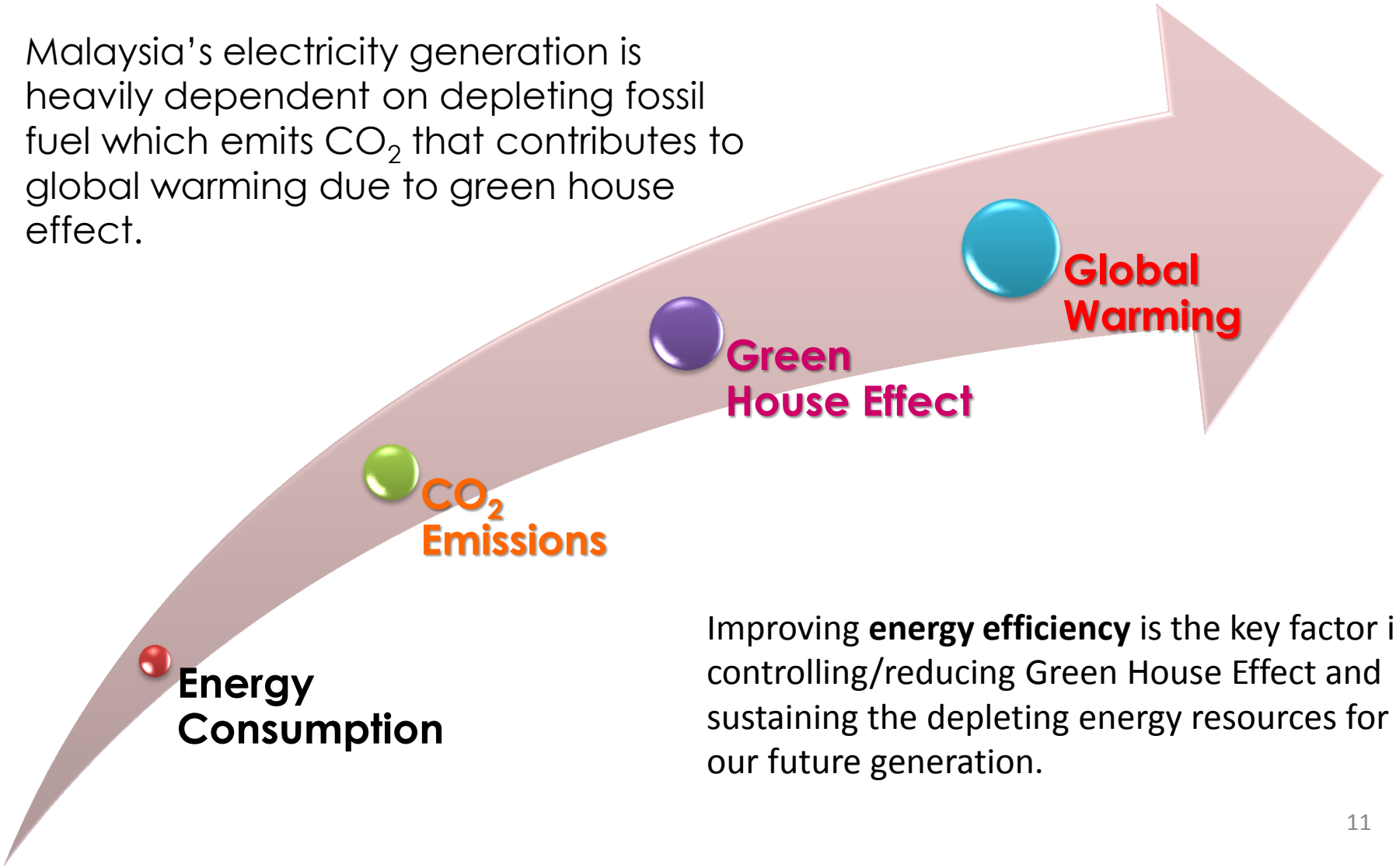
Source: Petronas

- Fossil fuel sources is depleting and we have passed the peak oil era.
- Cost of extraction of resources from the earth is higher than previously.

- Total accumulated sources are reduced although oil exploration activities have been increased.
- More oil exploration but less quantity of oil & gas extracted from each well.

Impact of fossil fuel in electricity generation on the environment

Malaysia's electricity generation is heavily dependent on depleting fossil fuel which emits CO_2 that contributes to global warming due to green house effect.



Improving **energy efficiency** is the key factor in controlling/reducing Green House Effect and sustaining the depleting energy resources for our future generation.

WHY SAVE ELECTRICITY

National Policy & Law-Related

Malaysia's Commitment During COP 15

"I would also like to announce here in Copenhagen that Malaysia is adopting an indicator of a voluntary reduction of up to **40%** in terms of **emissions intensity of GDP** by the year **2020** compared to 2005 levels. This indicates conditional on receiving the transfer of technology and finance of adequate and corresponds to what is required in order to achieve this indicator"

Prime Minister

- **A reduction of 40% in carbon emission will have to be achieved through:**
  - Energy Efficiency
  - Energy Conservation
  - Renewable Energy

Efficient Management Of Electrical Energy Regulations 2008

- A regulation under Electricity Supply Act (1990) effective 15 December 2008.
- Any installation which receive electrical energy from a licensee or supply authority with a total electrical energy consumption equal to / or exceeding 3,000,000 kWh as measured at one metering point or more over any period not exceeding 6 consecutive months.
  - To implement Electrical Energy Management & appoint Registered Electrical Energy Manager (paragraph 6)

WHY SAVE ELECTRICITY

Economy

Economic Benefits

By implementing energy efficiency, your energy consumption can be reduced. Thus the following benefits can be achieved:

- REDUCE ENERGY BILL
- REDUCE OPERATIONAL COST
- INCREASE PROFIT
- GOVERNMENT INCENTIVES (e.g. MIDA)

ELECTRICAL ENERGY STATUS

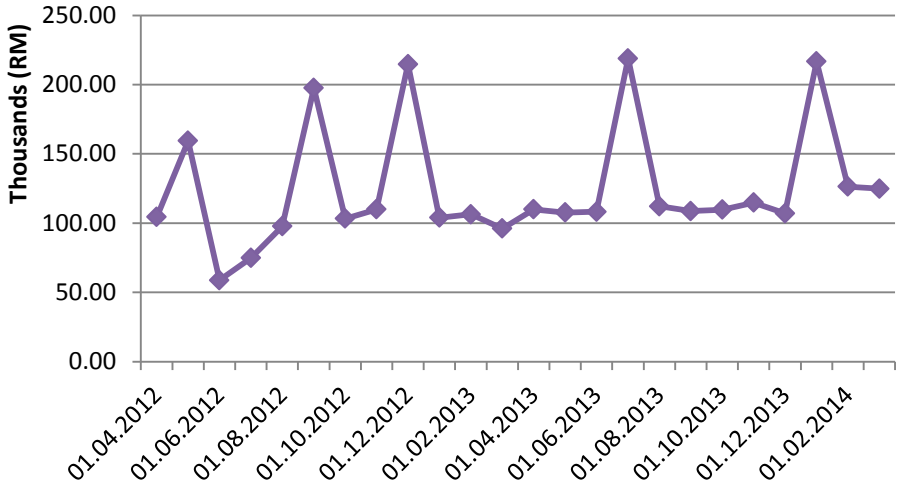
MONITOR YOUR BILL

Bill nr	XXX69641
Read Date	01/03/2014
RM Payable	124,894.50

KWH	247,975
KW	727
KVARh	88,358
Power factor	0.94

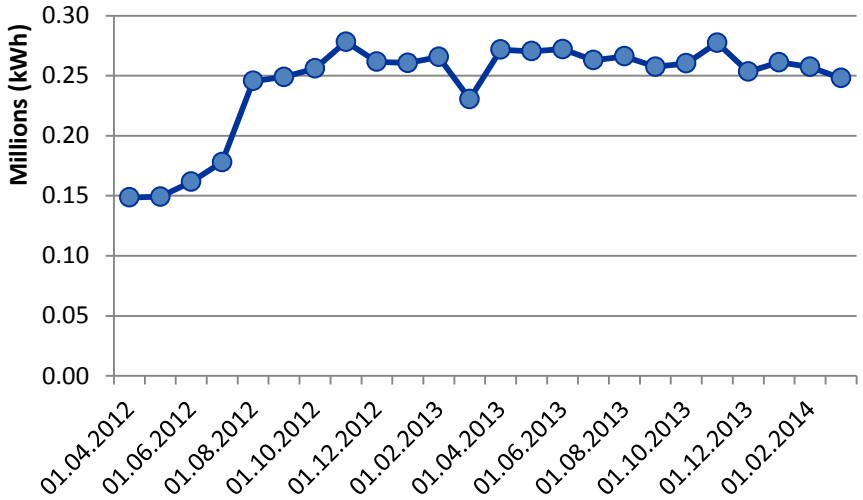
Sample Energy Trend

RM Payable (Monthly Electricity Bill)

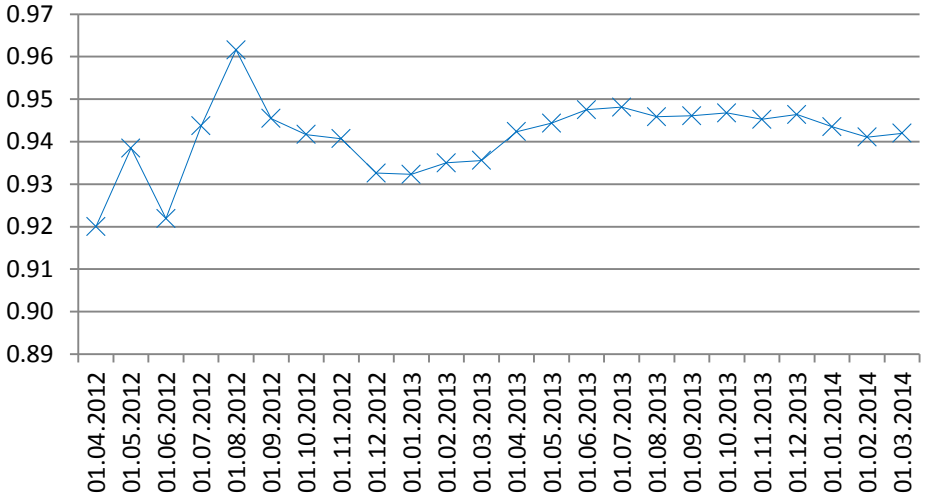


*Spikes >200k - tunggakkan

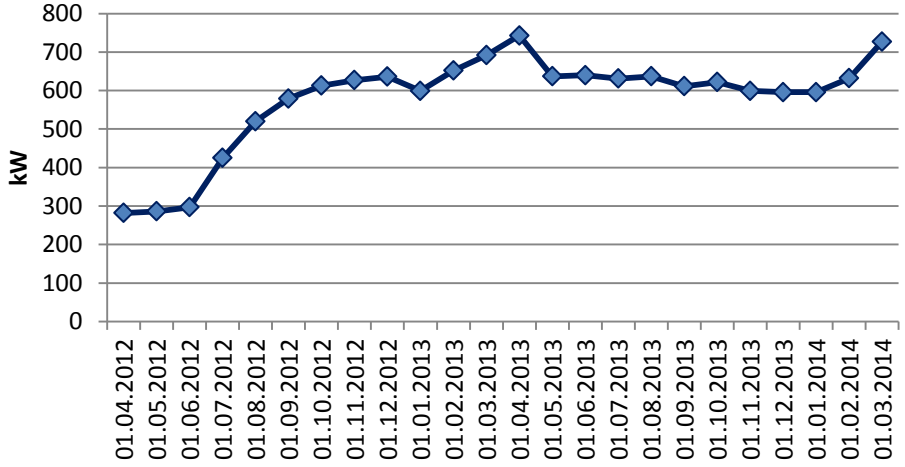
Total Energy Consumption



Power Factor

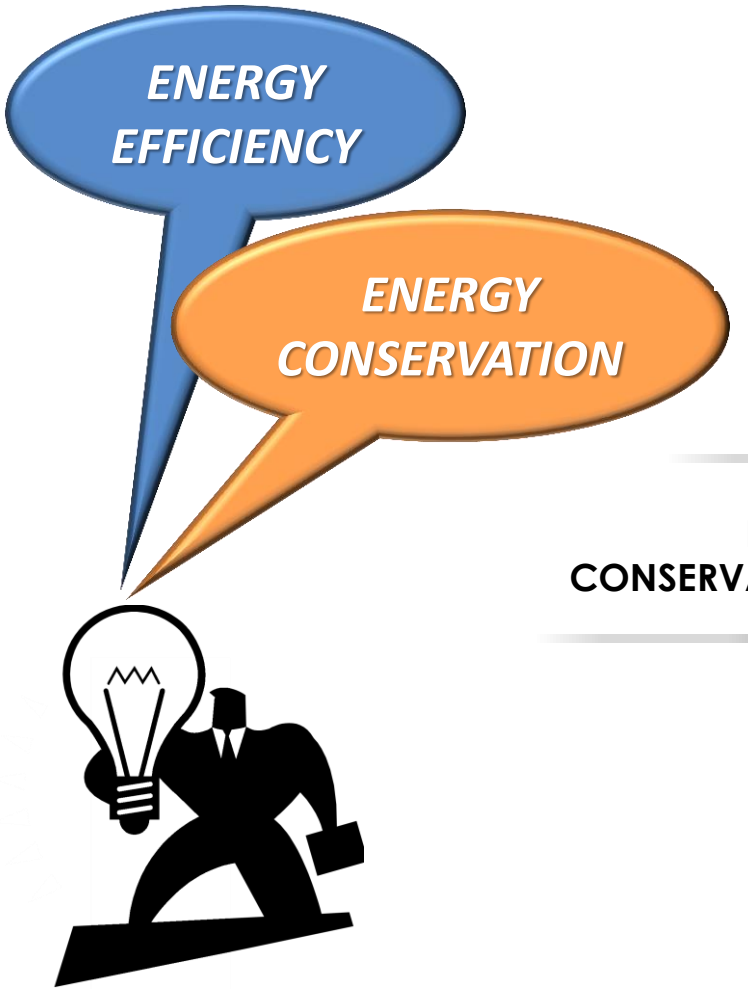


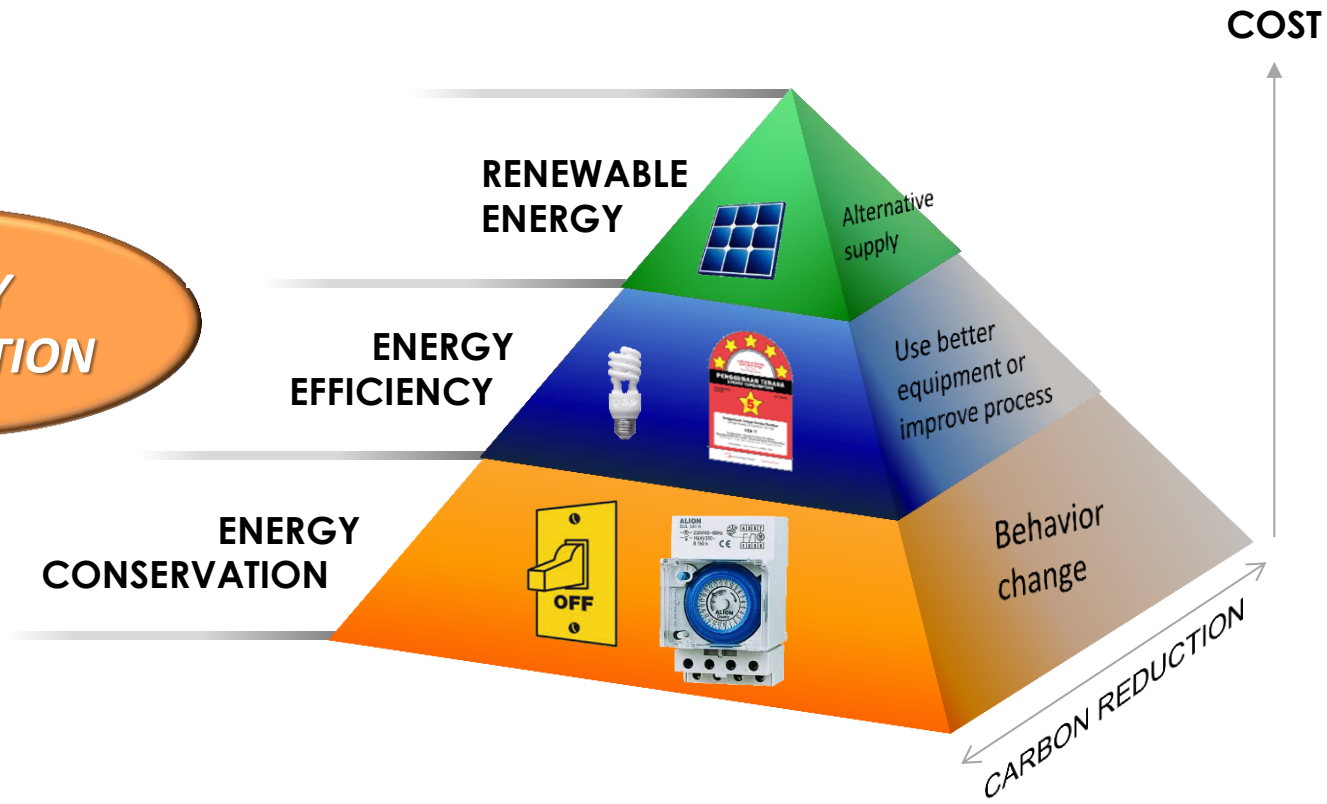
MD



BACKGROUND ON ENERGY EFFICIENCY

Energy Saving Approach

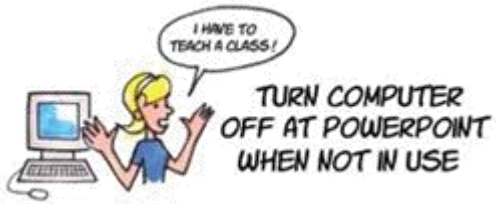


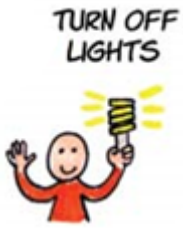


ENERGY CONSERVATION

- Behaviour and life style change.
- Rational use of energy.

Examples:

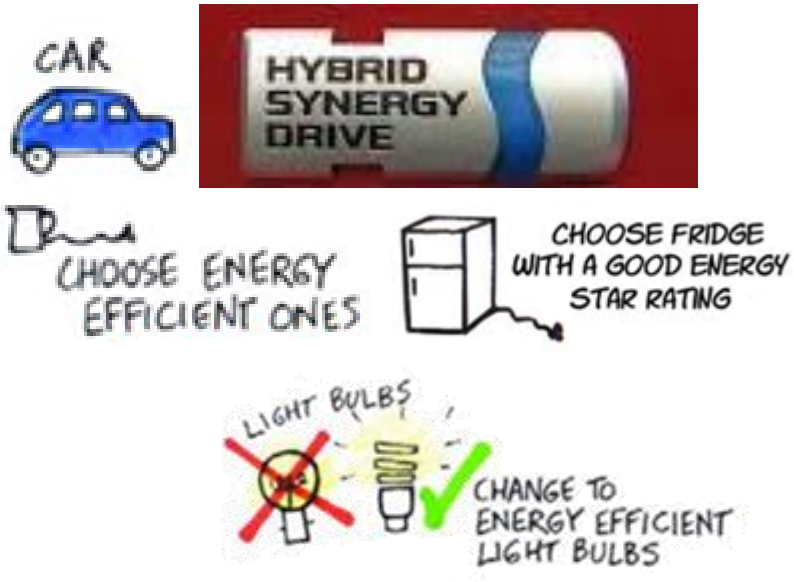


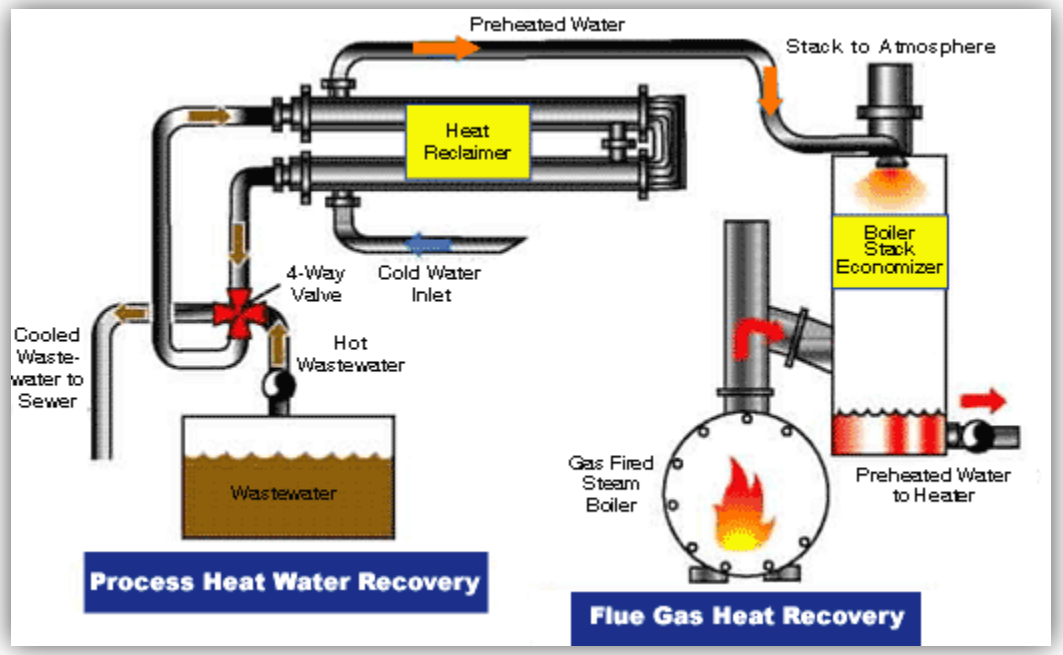


ENERGY EFFICIENCY

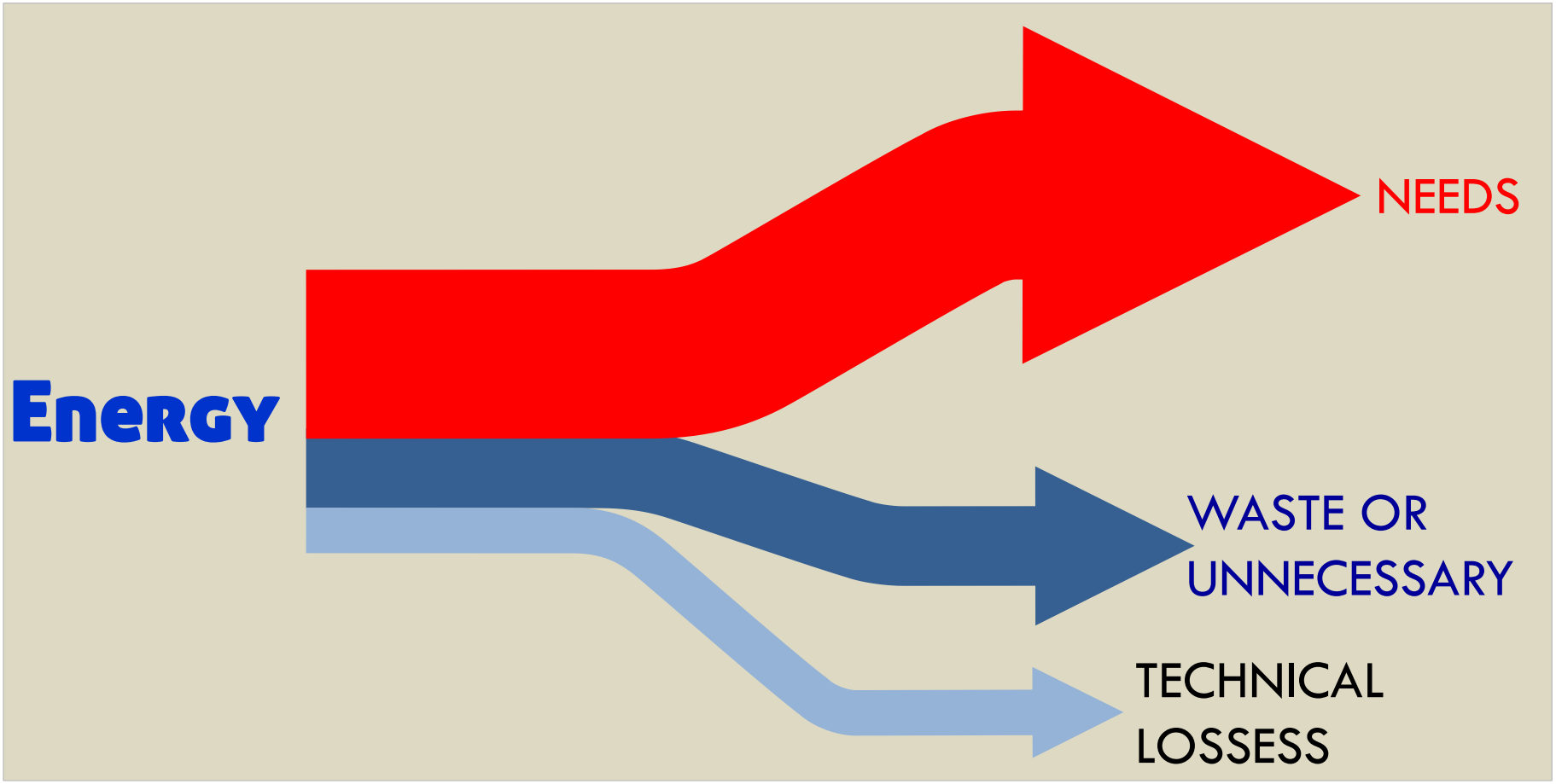
- Reduction in the energy used for a given service (cooling, lighting, etc.)
- Usually associated with technological changes i.e. equipment or processes.

Examples





How Energy Used



Energy savings can be achieved by reviewing and optimizing NEEDS and reducing WASTE & LOSSESS

ENERGY SAVING OPPORTUNITIES

ENERGY SAVING OPPORTUNITIES

Commercial Aspect

Tariff Switching

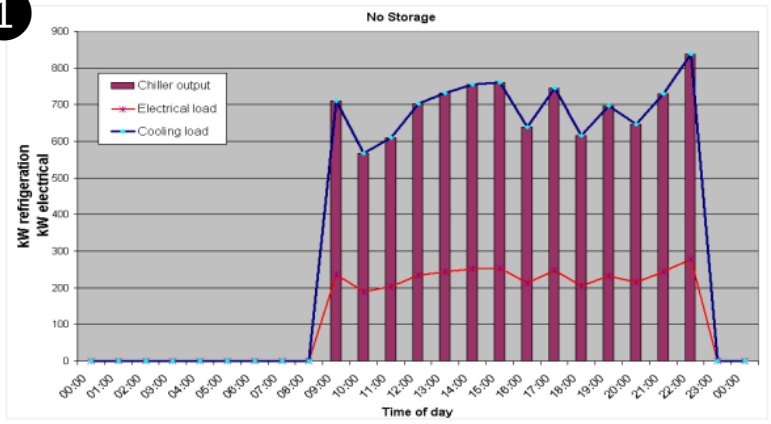
- Switch to lower tariff.
  - e.g. From C1 to C2

1	**Tariff C1 - Medium Voltage General Commercial Tariff**	
	For each kilowatt of maximum demand per month	30.3 RM/KW
	For all kWh	36.5 sen/kWh
	The minimum monthly charge is RM600.00	
2	**Tariff C2 - Medium Voltage Peak/Off-Peak Commercial Tariff**	
	For each kilowatt of maximum demand per month during the peak period	45.1 RM/kW
	For all kWh during the peak period	36.5 sen/kWh
	For all kWh during the off-peak period	22.4 sen/kWh
	The minimum monthly charge is RM600.00	

Maximum Demand Management

- Reschedule energy intensive & non-critical activities from **peak** to **off-peak** period to reduce maximum demand charges
  - E.g. use thermal storage system : Operate the A/C chillers during Off-Peak period to produce CHW in storage and use / discharge it during the Peak period.

1



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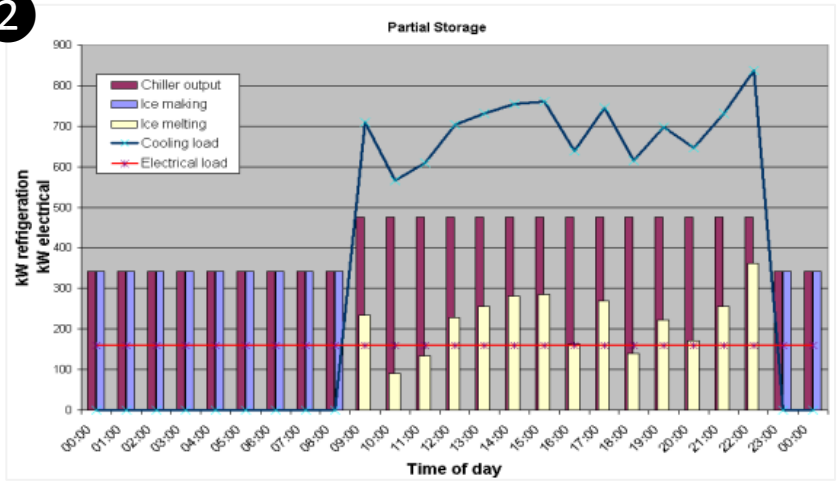

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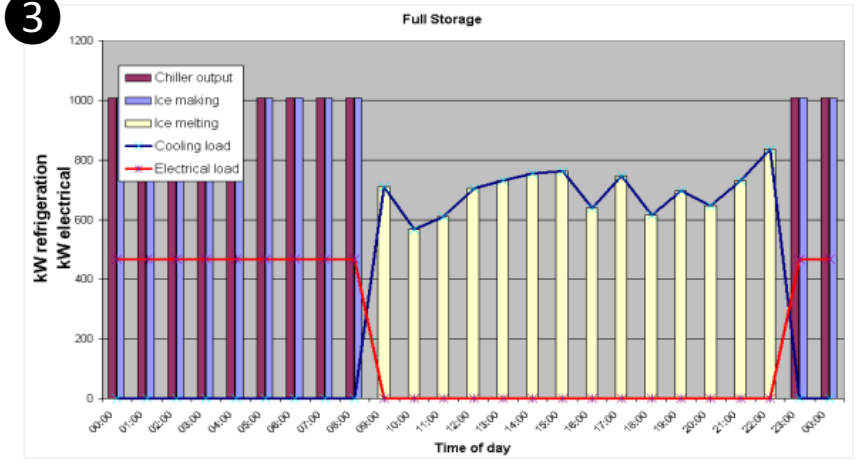
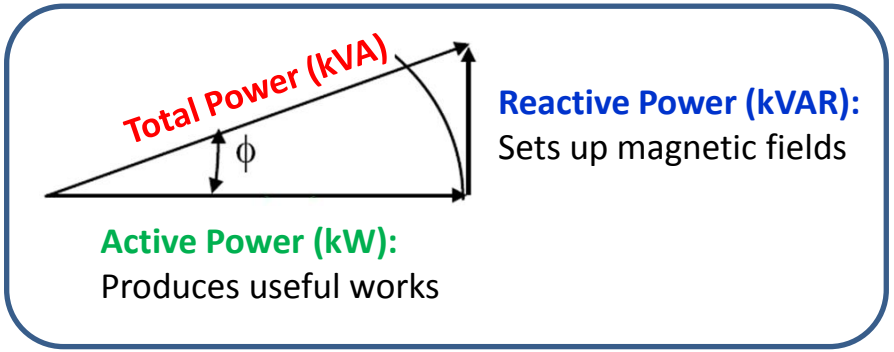


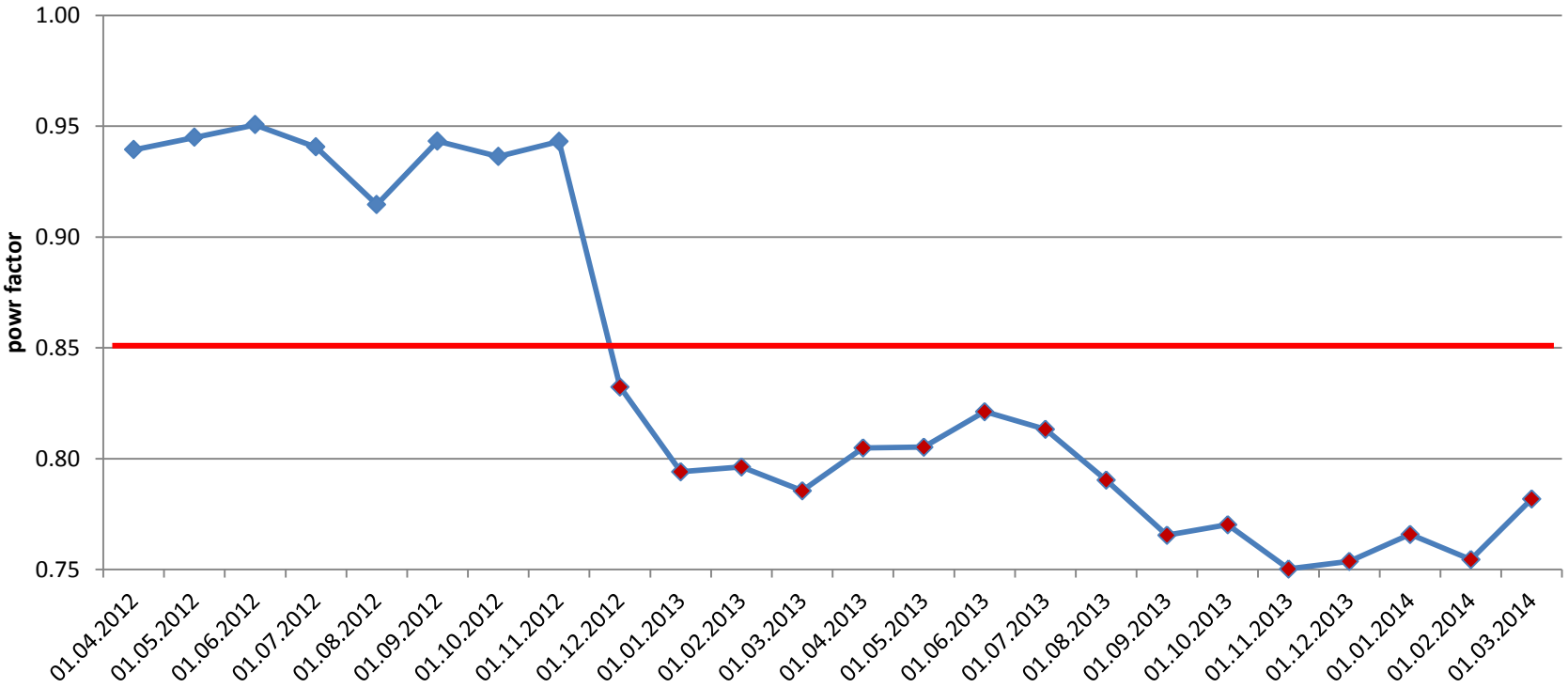
TNBES **Service:** Energy consumption monitoring

Power Factor Correction

- Eliminate Power factor penalty
  - penalties on customers with low PF
    - Below 0.85 (LV & MV)
    - Below 0.9 (HV)



Power Factor



	PF	PF Charge
Petaling Jaya	0.75	**817.78**

How TNB can help you be more energy efficient

- Through our subsidiary company, TNBES, we can offer a wide range of energy efficiency related services.

Power Factor Correction

Front view

Power Factor Correction Module

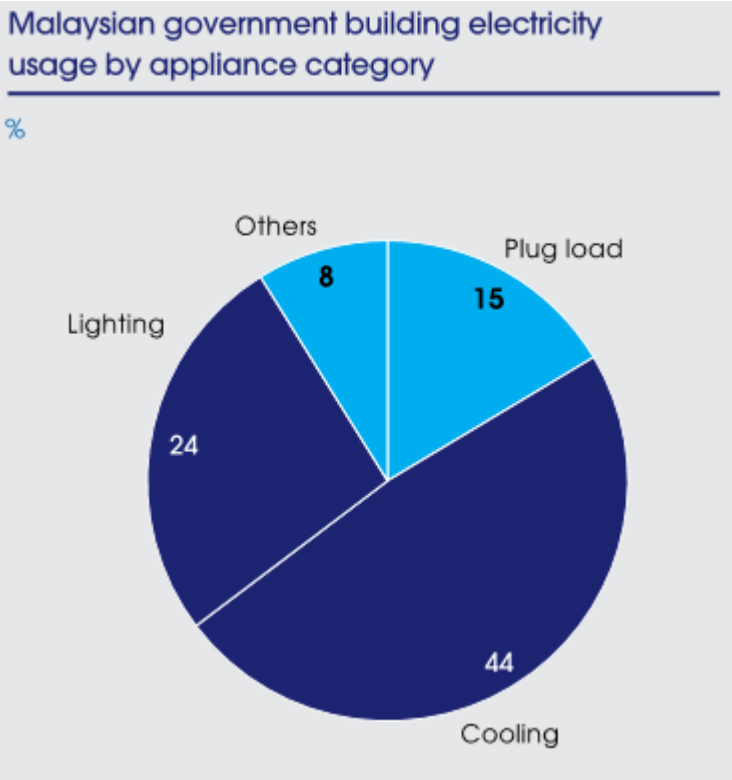
Sample

- Capacity : 20kVAR – 45kVAR
- Cost estimation : RM3,400 – RM4,100
- Payback period : < 12 months
- Warranty : 1 year

ENERGY SAVING OPPORTUNITIES

Technical Aspect

#1: Measure energy use



Source: http://etp.pemandu.gov.my/upload/etp_handbook_chapter_6_oil_gas_and_energy.pdf

- Can be determined through thorough energy audit.
- Energy audit results enable customers to determine suitable energy saving strategy and action plan.

Service: Energy Audit

How Your Equipment Affect Your Energy Bill Components

Energy Consumption = kWh

Maximum Demand (MD) = kW

kW h

kW (kilowatt)

Size & number of equipment installed

- Larger equipment capacity & number of equipment = more energy consumed.
- More equipment operate at the same time =, higher MD.

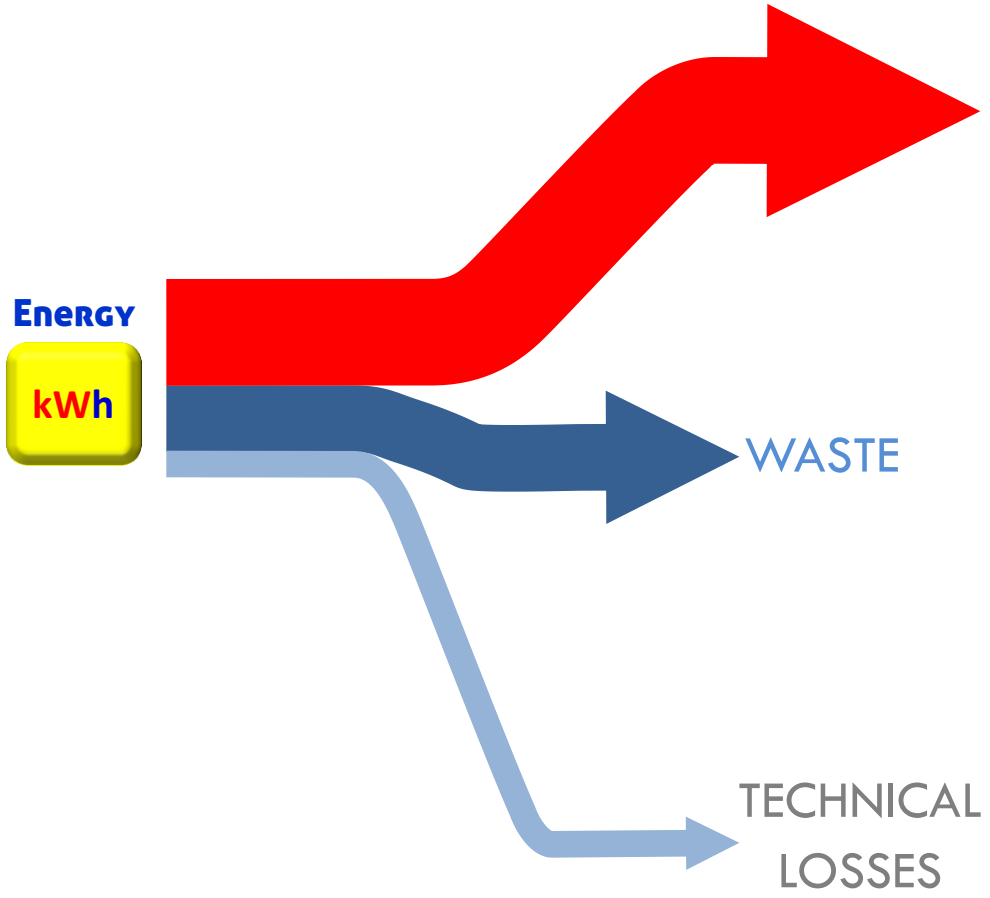
h (hour)

Duration of operation

Longer operation time (switched on) = more energy consumed.

***Number of equipment and their capacity will be measured / calculated in energy audit.**

Outcome of Energy Audit



Energy Audit enable customers to identify which area is using energy more than necessary.

e.g. Potential area for de-lamping due to over lit.

In energy audit, efficiency of equipment and systems are assessed

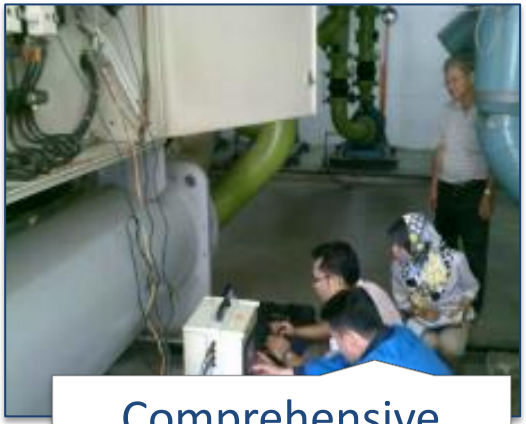
e.g. Motors loading are too low, improve cooling system efficiency by reducing the number of chilled water pumps.

How TNB can help you be more energy efficient

- Through our subsidiary company, TNBES, we can offer a wide range of energy efficiency related services.

Consultancy

Walk Through Energy Audit



Comprehensive Energy Audit

Advisory Services

TNBES Track Record (Energy Audit)

Wisma Daiman, Johor Bahru

Plaza Angsana, Johor Bahru

Century Square 1 & 2, Enterprise Building (EB) 1, 2 & 3, Ericsson, Cyberjaya

TNB Head Quarters Bangsar, Kuala Lumpur

KLCC Urusharta Sdn Bhd

Hotel Best Western, KK

MOE – SM Teknik Kajang

UNITEN, Putrajaya Campus

Wisma SESB, KK

Wisma SEDCO, KK

How TNB can help you be more energy efficient

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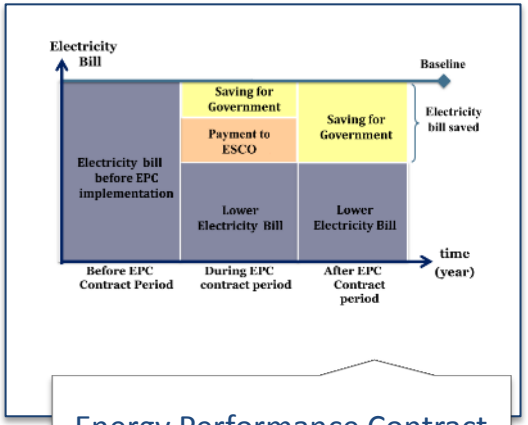
EE Project Implementation

Renewable Energy Systems

ACMV, Pump System Optimization, Lighting System, Energy Monitoring System



Energy Performance Contract (EPC)

TNBES Track Record

Solar Hybrid
RPS Kemar, Gerik

Solar Hybrid
Johor

Solar PV @ Car Park,
TNB Head Quarters
Bangsar, Kuala Lumpur

#2: Consider Total Life Cycle

To get the best energy saving results, energy efficiency & energy conservation should be observed throughout the equipment lifecycle:

Procurement

Installation

Operation

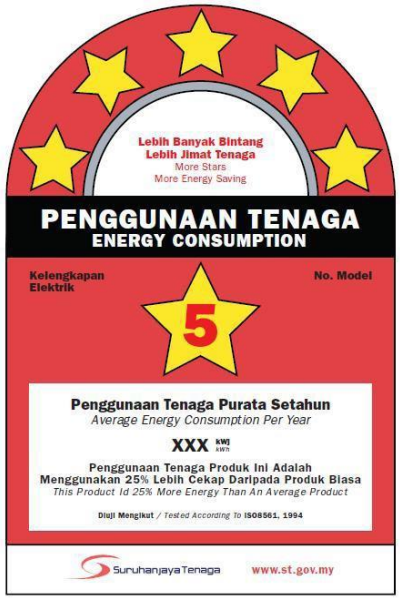
Maintenance

#2: Equipment Lifecycle

Procurement

Energy Efficient Equipments

- Energy efficiency label was introduced in 2006.
- Under purview of Energy Commission (ST)
- In collaboration with SIRIM.



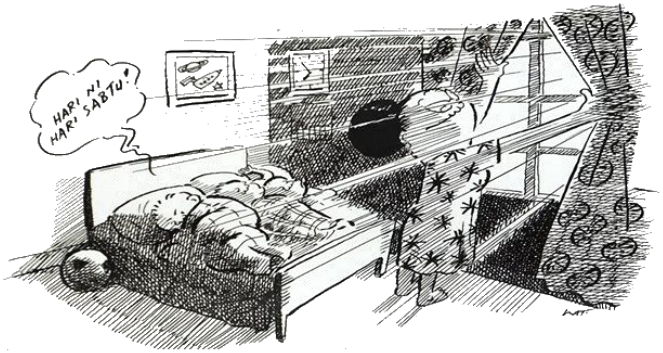
Endorsement Label used by Suruhanjaya Tenaga (Energy Commission)

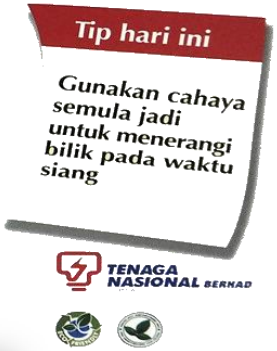
#2: Equipment Lifecycle

Operation

Alternatives

- Use alternative option whenever possible.
  - E.g. Day light.





Conserve Energy

- Reduce consumption wherever or whenever possible.
- Reduction in duration of using of electrical equipment:
  - Labelling: “Please switch off the lights”
  - Turn off lights and air-conditioning in the rooms not in use.
  - Install timer
  - Install sensor at less traffic area

Light with motion sensor

Switch Timer

Standby Mode = Vampire Power

- Do not leave equipment on **standby mode** unless necessary.
- Turn off the switch or unplug appliances.

Yearly cost (Tariff = C1):

- (1W/1000W) × 24hours × 365days × RM0.312 = **RM 2.73**
- 10W = **RM 27.33**
- 50W = **RM 136.66**
- 100W = **RM 273.31**
- 1,000W = **RM 2,733.12**

2.2 W

22- 80 W

Sleep Mode
CPU: 10 W
CRT Monitor: 10W
LCD: 2-4W

Sleep Mode
40-300W

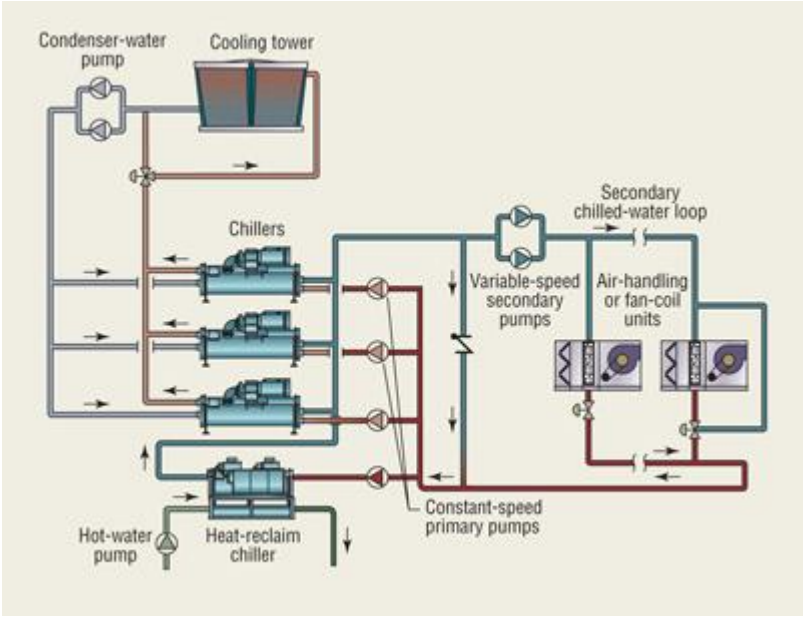
#2: Equipment Lifecycle

Maintenance

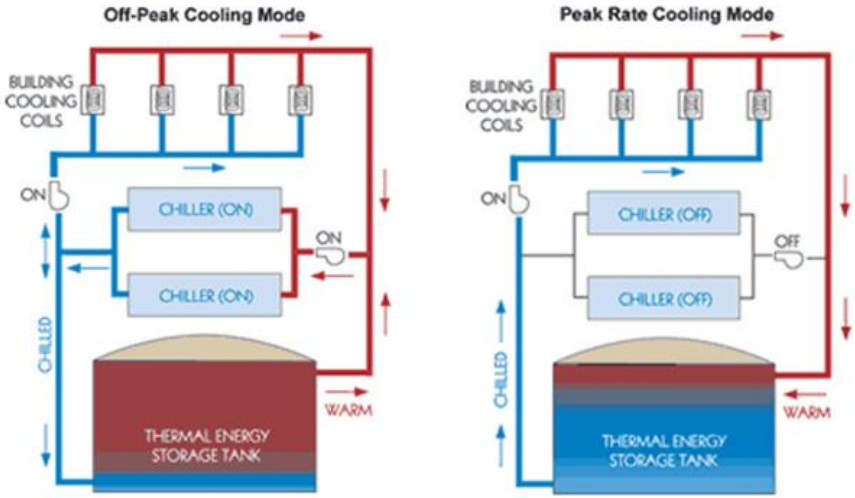
Maintenance

- Proper maintenance is vital in ensuring equipment's efficiency and prolonging their life.
  - Clean dusts on lamps.
  - Dusts on lamps and reflectors reduce brightness and its efficiency.

#3: Improve Existing Processes



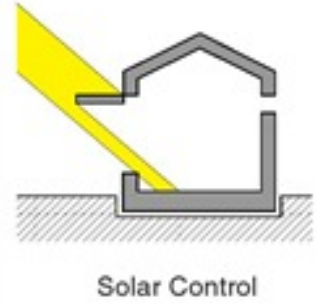
Recover heat from cooling system for hot water.



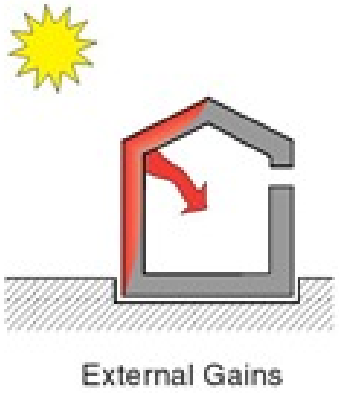
Use chilled water tank.
e.g. used at Greentech Malaysia

Building Management System.

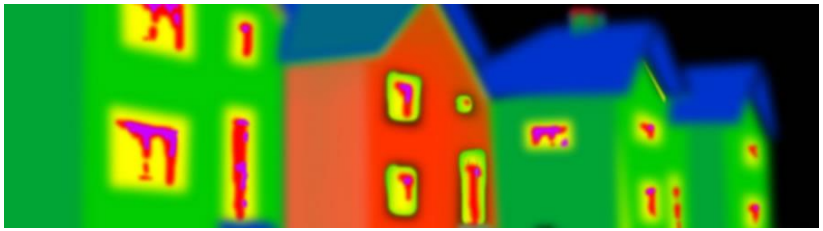
#4: Protecting from The Elements



Control heat gain from the sun to reduce energy for cooling.



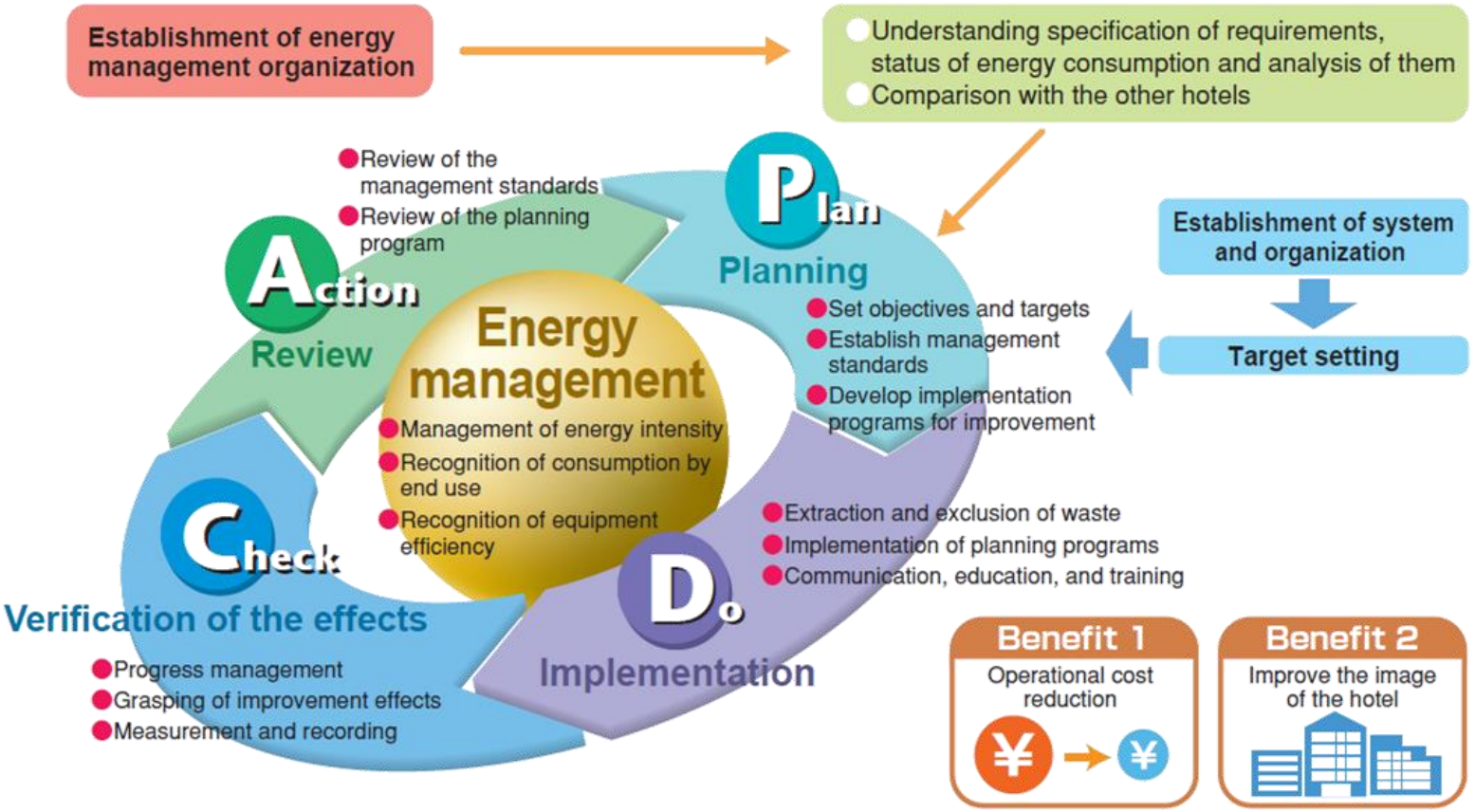
Improve insulation to reduce indirect solar heat gain.



Stop air infiltration to maintain room temperature.

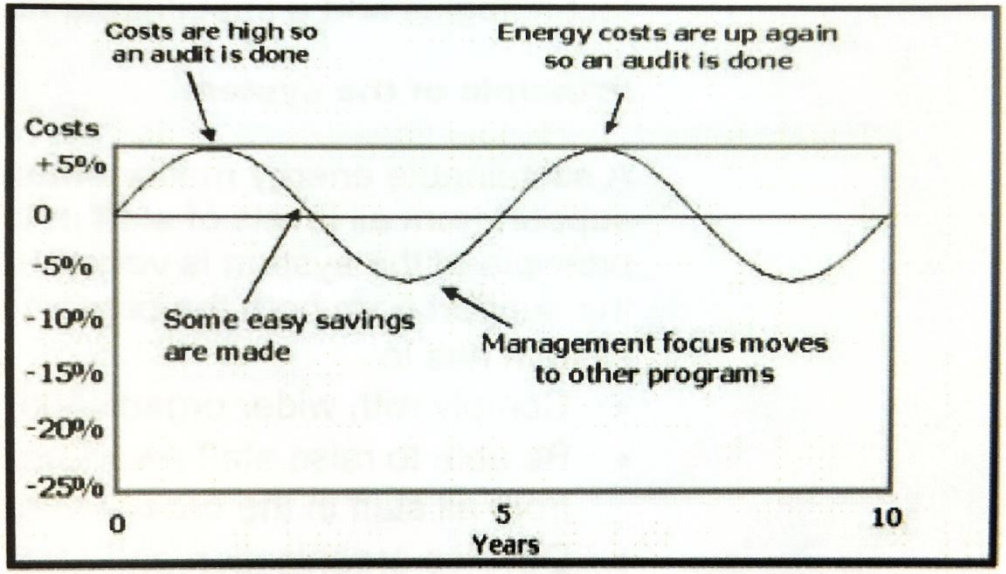
#5: Sustainable Approach

- Implement Energy management system

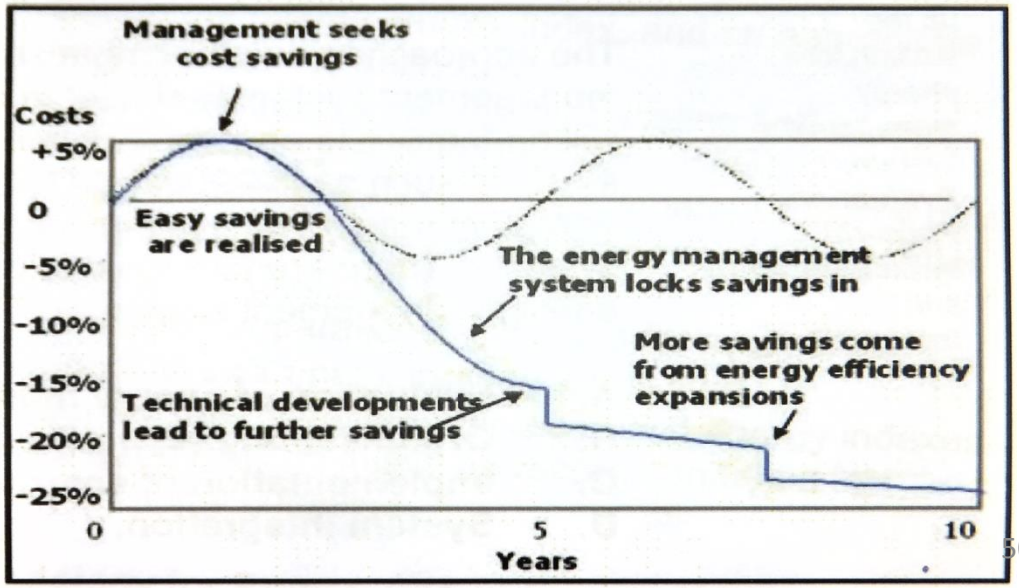


"WITHOUT SUSTAINABLE ENERGY MANAGEMENT SYSTEM, THE ORGANISATION WILL NOT BE ABLE TO CONTROL AND MAINTAIN THE SAVING RESULT"

Energy cost cycle of the energy conservation programme **without** sustainable energy management system



Energy cost cycle of the energy conservation programme **with** sustainable energy management system



EMS IMPLEMENTATION STAGES

STAGES	ACTIVITIES/OUTCOME
Evaluation of Energy Management Status	Energy Management Matrix
Organisation Preparation	Energy Policy Energy Committee Set up EM Component Awareness Training
Implementation of Energy Conservation Measures	Detailed Energy Audit Select Energy Target & Plan Set up Sustainable Improvement Team Technical Training
System Integration	Accreditation Scheme Integrate to ISO1400/Total Productivity Maintenance Procedural Training

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