

# ISO 50001 Energy Management System

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Build4Asia  
May 2016

*Designed for Reliability*



*Manufactured to Last*

# Tommy Li - Profile

**CET**

**Hong Kong, China**

Marketing and Communication Manager (International Business)



**Schneider Electric**

**Since 2008**

**Victoria, Canada**

Metering System Development & Application

**CLP Power**

**Since 1999**

**Hong Kong, China**

Power Quality Project Management

**BEng(Hons.)**

HK Polytechnic University

**MSc**

City University of HK

**MIET**

Member of IET

**Chartered Engineer**

Engineering Council, UK



# Energy Management System

What is EMS

01

02

ISO 50001 Model

03

Why implement EMS

04

Implement an EMS  
based on ISO 50001

05

Conclusion

# What is EMS



**Monitoring**

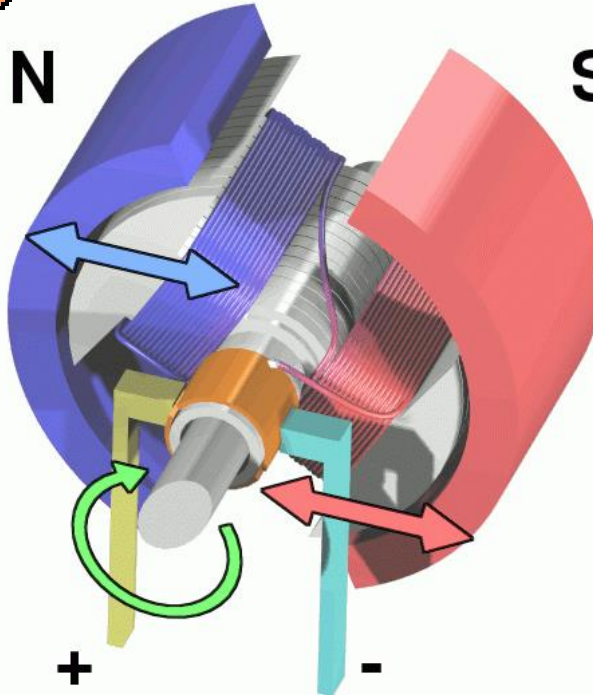
**N**

**S**

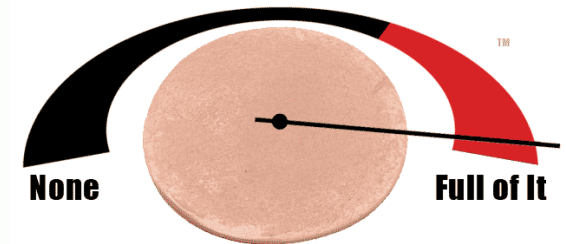
**Control and Adjust**



**24 hours Running**



**+ -**  
**Energy Asset**



**Max. Energy Efficiency**

A System running 24hrs a day to monitor, control and adjust the Energy Asset so as to maximize its Energy Efficiency

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# Historical EMS Solution



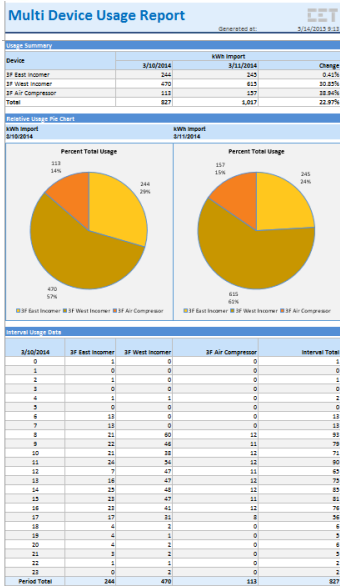
- Human Error in Meter Reading
- Only Post Consumption Reporting
- Absence of Real-time Status of Electrical System

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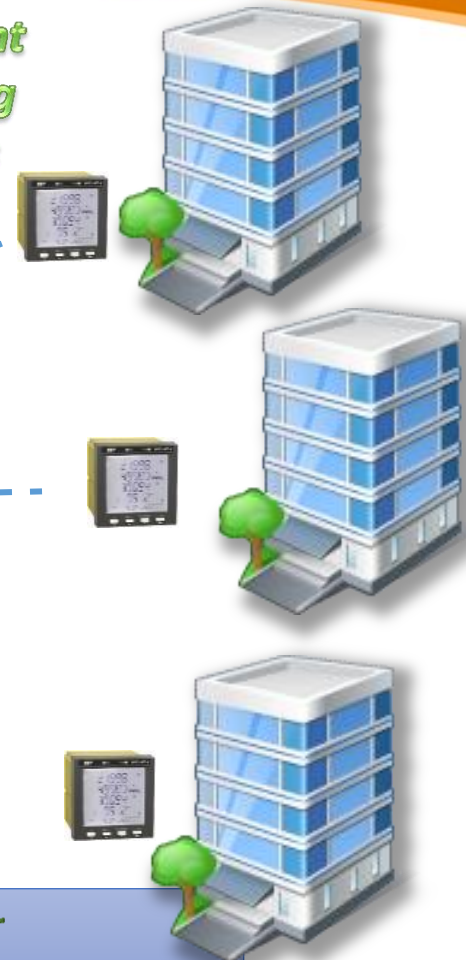
# Intelligent EMS Solution



**Energy Management System**



**Intelligent Metering Devices**



**Energy IT Layer for Centralized Real-time Energy Management**

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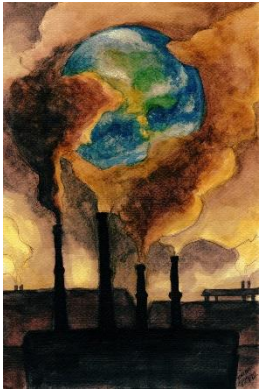


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# Why Implement EMS?

Individual organizations cannot control energy prices, government policies or the global economy.

**But, we can improve the way we use energy**



Reduce the depletion of energy resources



Reduce carbon emission.  
Mitigate worldwide effects of energy use, such as global warming, pollution

Better Energy Conservation and Efficiency Management



Reduce operation costs.  
More competitive in the business



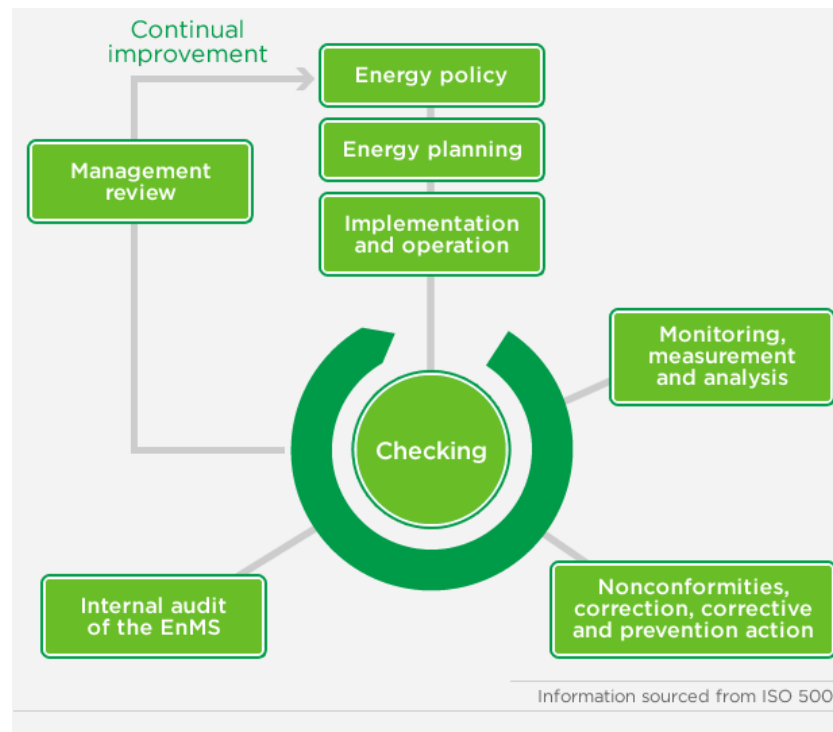
# ISO 50001 EMS



**Establishes the Requirements** for energy management system

**Creates a framework** for organizations to manage energy

**Provides benefit drivers** for organizations all over the world to target broad applicability across different sectors.





# ISO 50001 Model

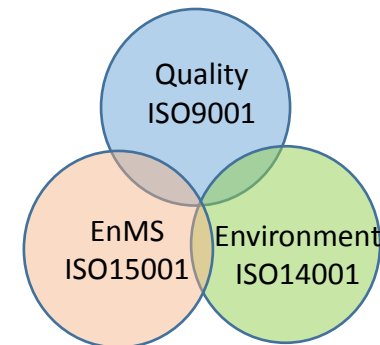
**Published in June 2011**

Developed by ISO project committee ISO/PC 242, Energy Management

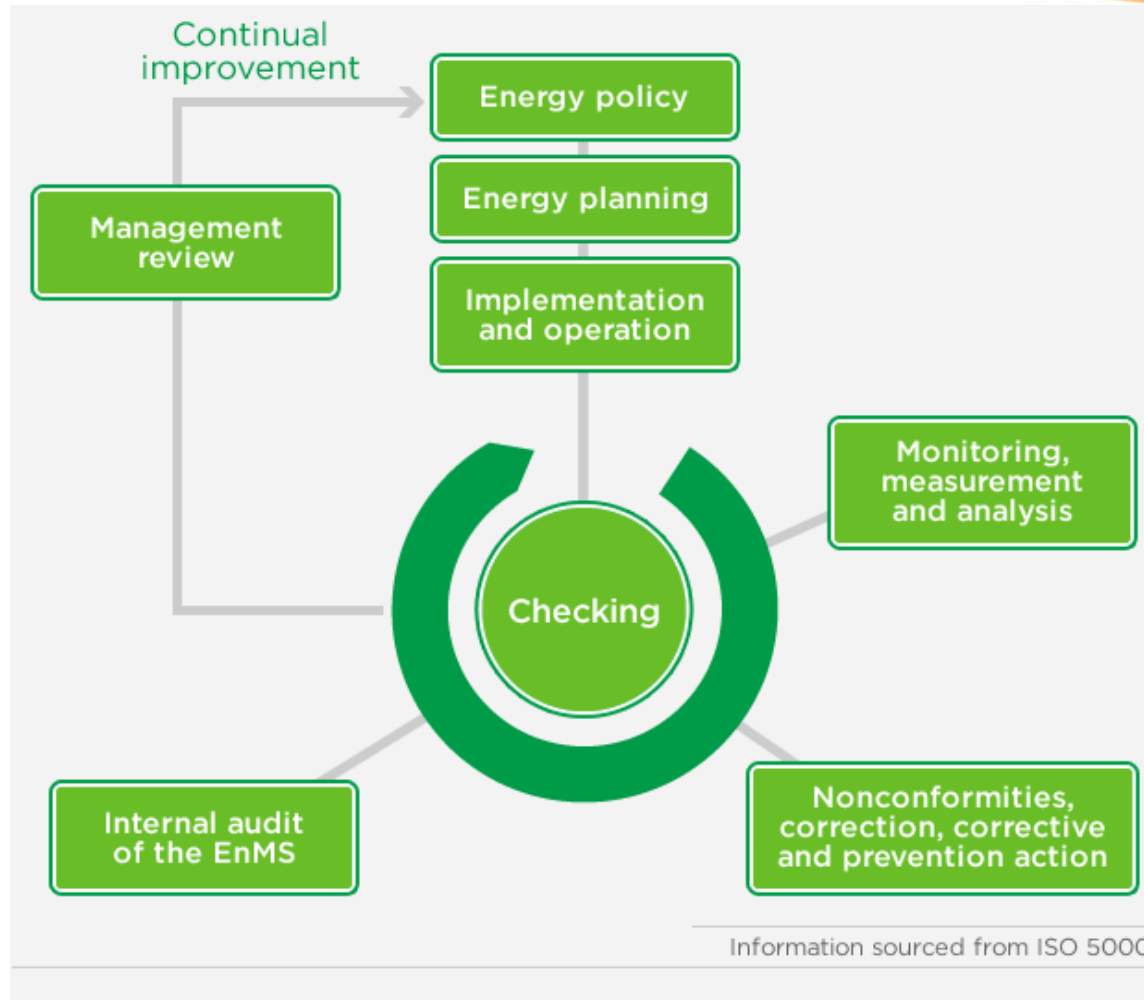
Use common elements as in all ISO's system



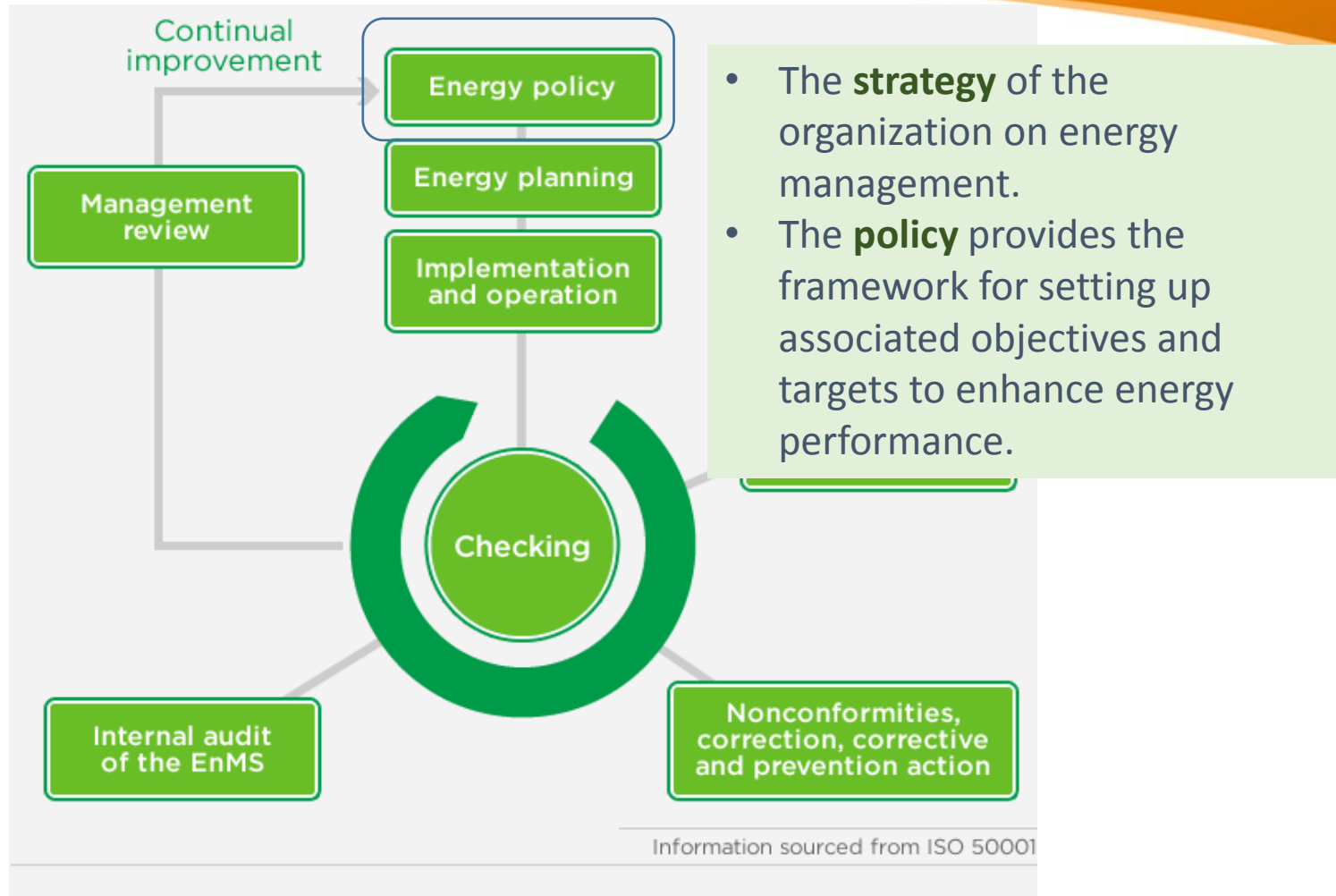
**Integrate ISO50001  
easily with ISO9001,  
ISO14001**



# ISO 50001 Model



# Implement an EMS based on the ISO 50001 Model



Example:

## Energy Policy

We shall **comply with all applicable legal and other requirements** related to energy management.

We shall **improve energy efficiency** as a continuous improvement process.

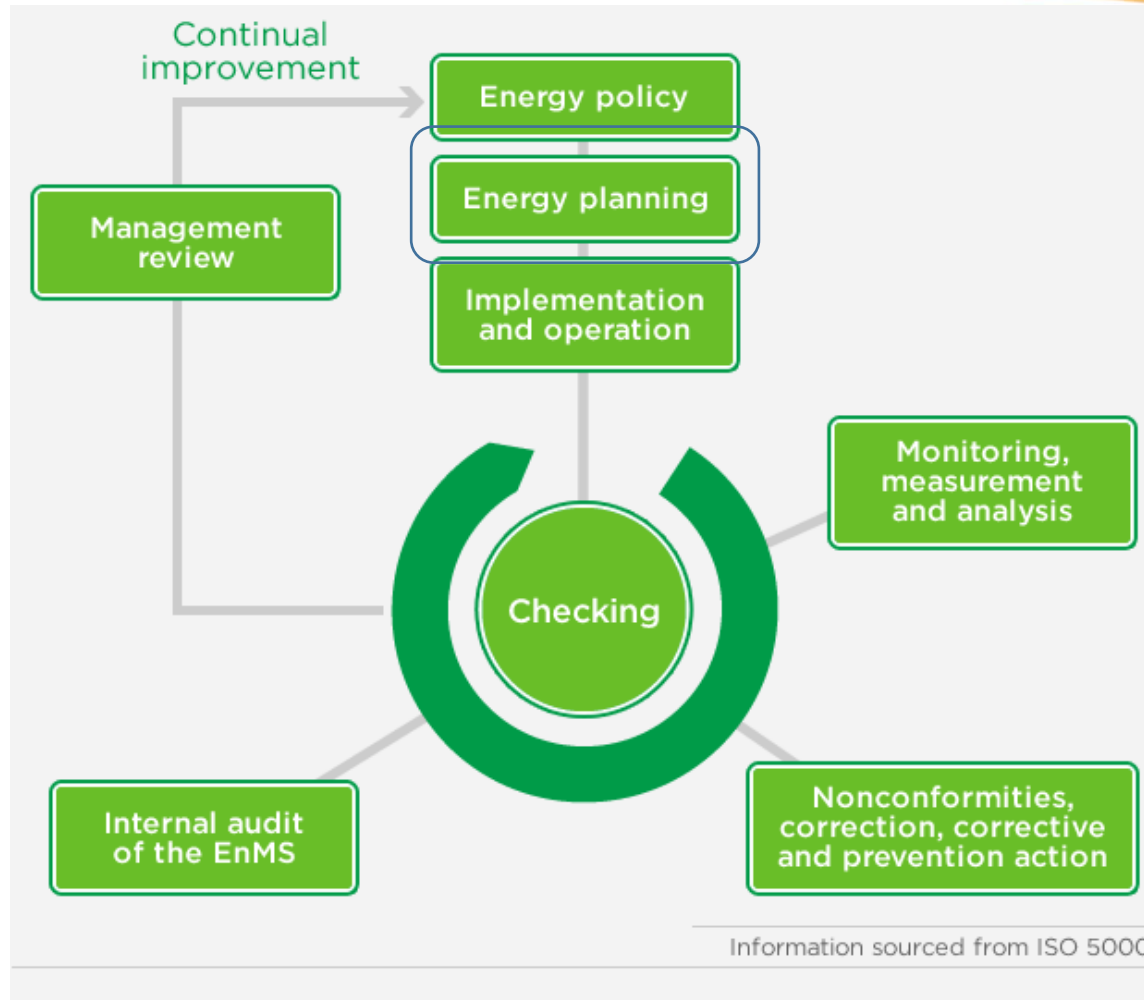
We shall **assure the availability of information and resources** to meet our objectives and targets.

We shall **incorporate energy efficiency as a key component for new equipment**, major renovation, and new design.

We shall **promote energy saving awareness to our staff**.



# Implement an EMS based on the ISO 50001 Model



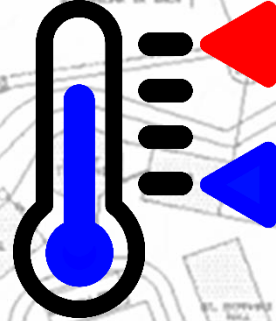
# Energy Planning

## PRIMARY DISTRIBUTION LAYOUT

- LEGEND
- TRANSFORMER
  - METROLOGICAL PULSE C
  - USE WITH POWER PL
  - 24-HR DISTRIBUTION



Identify Legal Requirements and Baseline



Formulate Energy Performance Indicators



Determine the Target



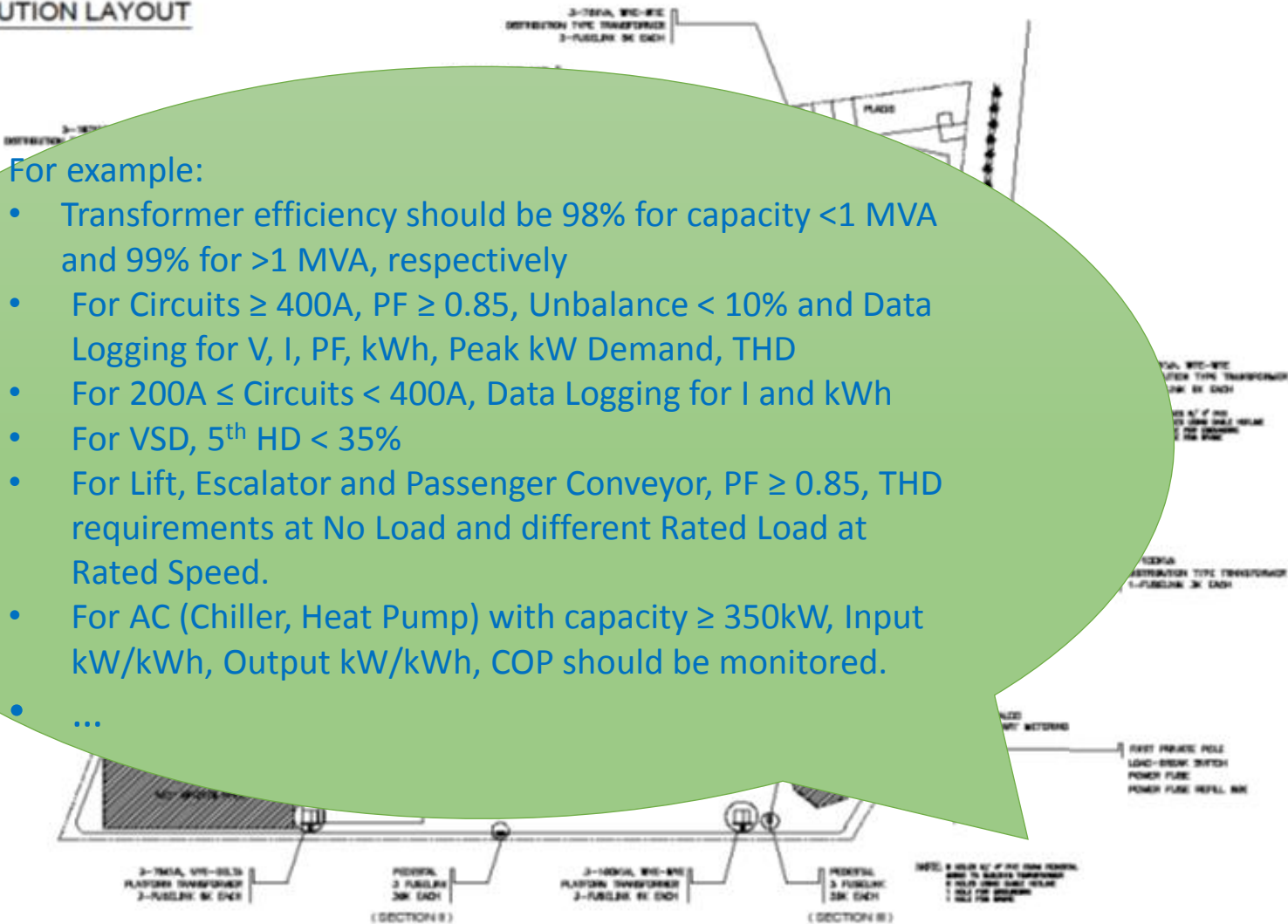
Action Plans to Achieve Target

# Energy Planning

## PRIMARY DISTRIBUTION LAYOUT

### LEGEND

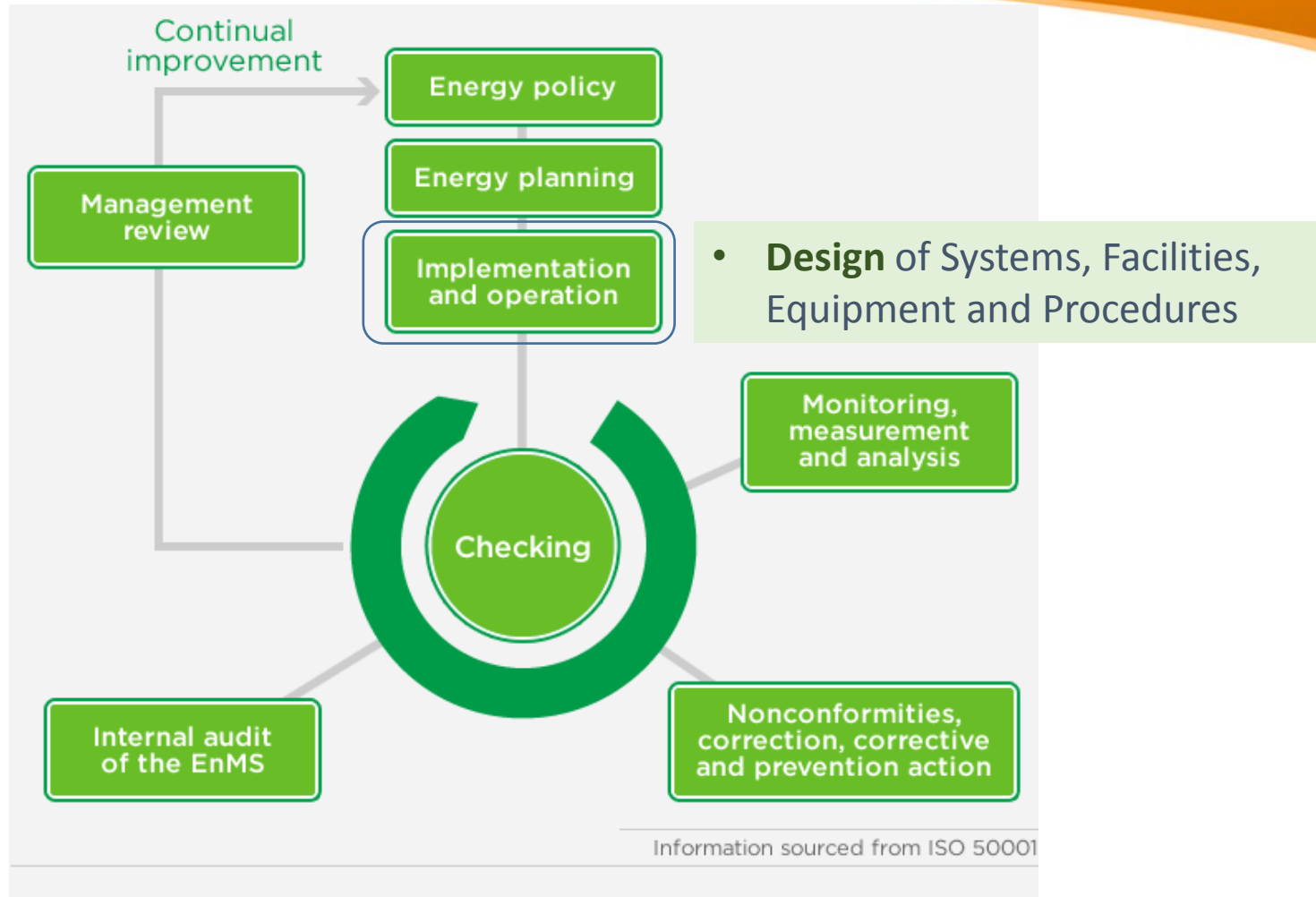
- TRANSFORMER
- METROLOGICAL, FUSE CUT-OUT
- LINE WITH POWER FUSE
- PRIMARY DISTRIBUTION LINE



For example:

- Transformer efficiency should be 98% for capacity <1 MVA and 99% for >1 MVA, respectively
- For Circuits  $\geq 400A$ , PF  $\geq 0.85$ , Unbalance < 10% and Data Logging for V, I, PF, kWh, Peak kW Demand, THD
- For  $200A \leq$  Circuits < 400A, Data Logging for I and kWh
- For VSD, 5<sup>th</sup> HD < 35%
- For Lift, Escalator and Passenger Conveyor, PF  $\geq 0.85$ , THD requirements at No Load and different Rated Load at Rated Speed.
- For AC (Chiller, Heat Pump) with capacity  $\geq 350kW$ , Input kW/kWh, Output kW/kWh, COP should be monitored.
- ...

# Implement an EMS based on the ISO 50001 Model

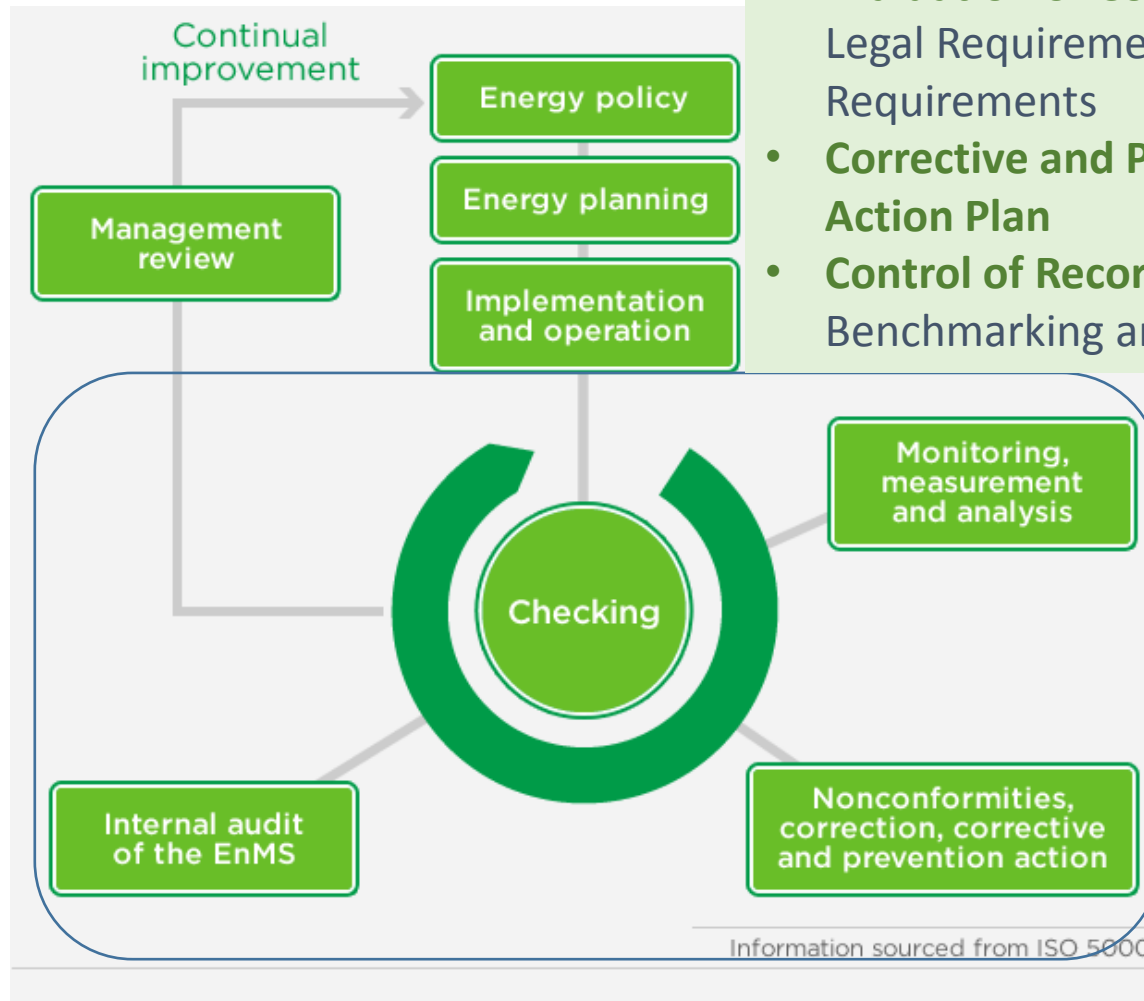






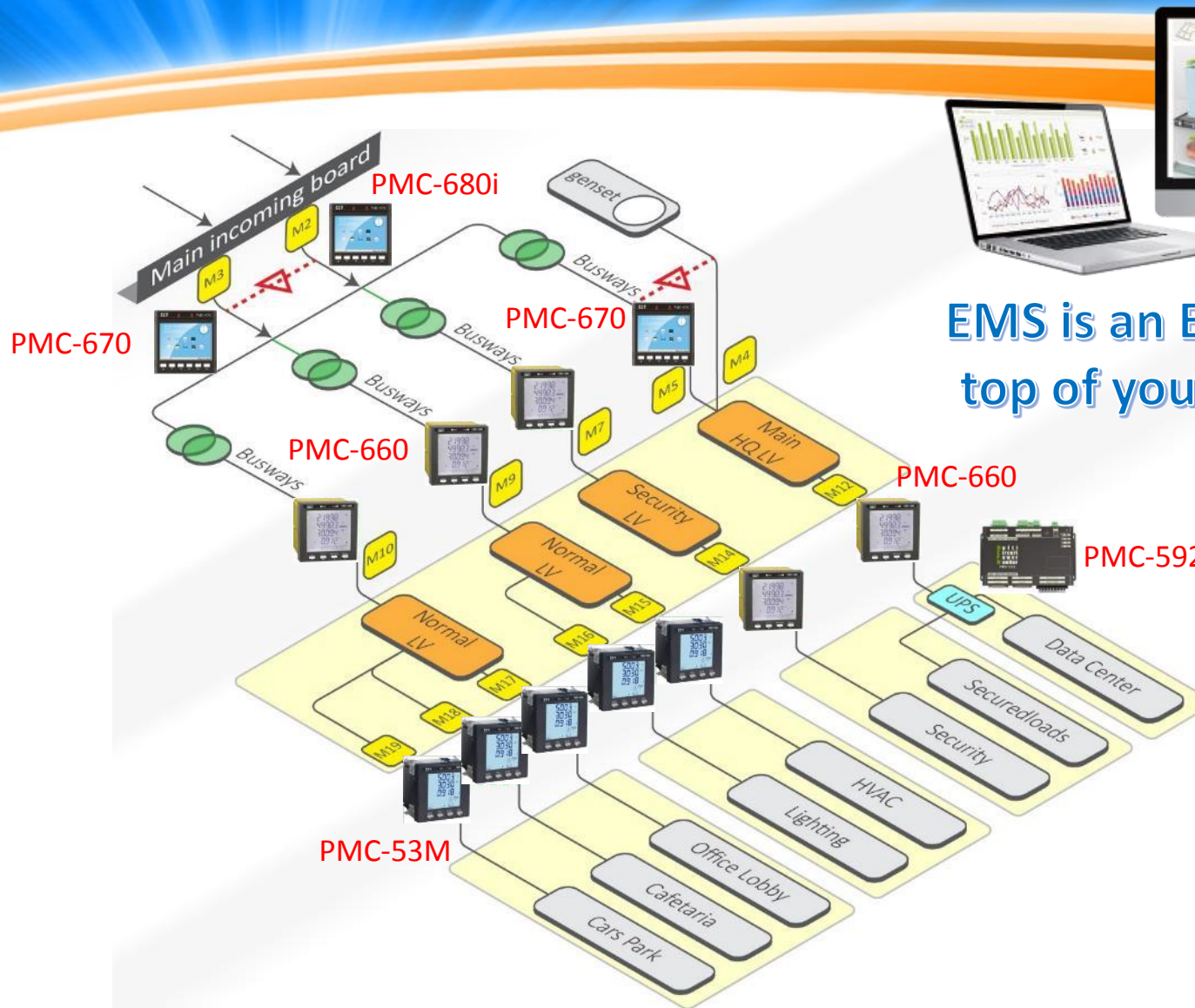


# Implement an EMS based on the ISO 50001 Model



- **Monitor, measure and analyze**
- **Evaluation of Compliance** with Legal Requirements and Other Requirements
- **Corrective and Preventive Action Plan**
- **Control of Records** for Benchmarking and Audit issue

# Monitoring, Measurement and Analysis



EMS is an Energy IT layer on top of your Physical Assets

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# KPI – Key Performance Indicator

2014

Annual Comprehensive Energy  
Consumption Evaluation



## Annual Budget & Cost

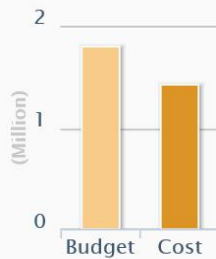


Percentage: 84%

Compare with  
Last Period: ↑ 2%

\$0.05 Million 150 ton

Daily Cost: \$153



Percentage: 79%

Compare with  
Last Period: ↓ -2%

\$0.27 Million 4.1 MWh

Daily Cost: \$7489

Total



Percentage: 81%

Compare with  
Last Period: ↓ -1%

\$0.32 Million 750 kgce

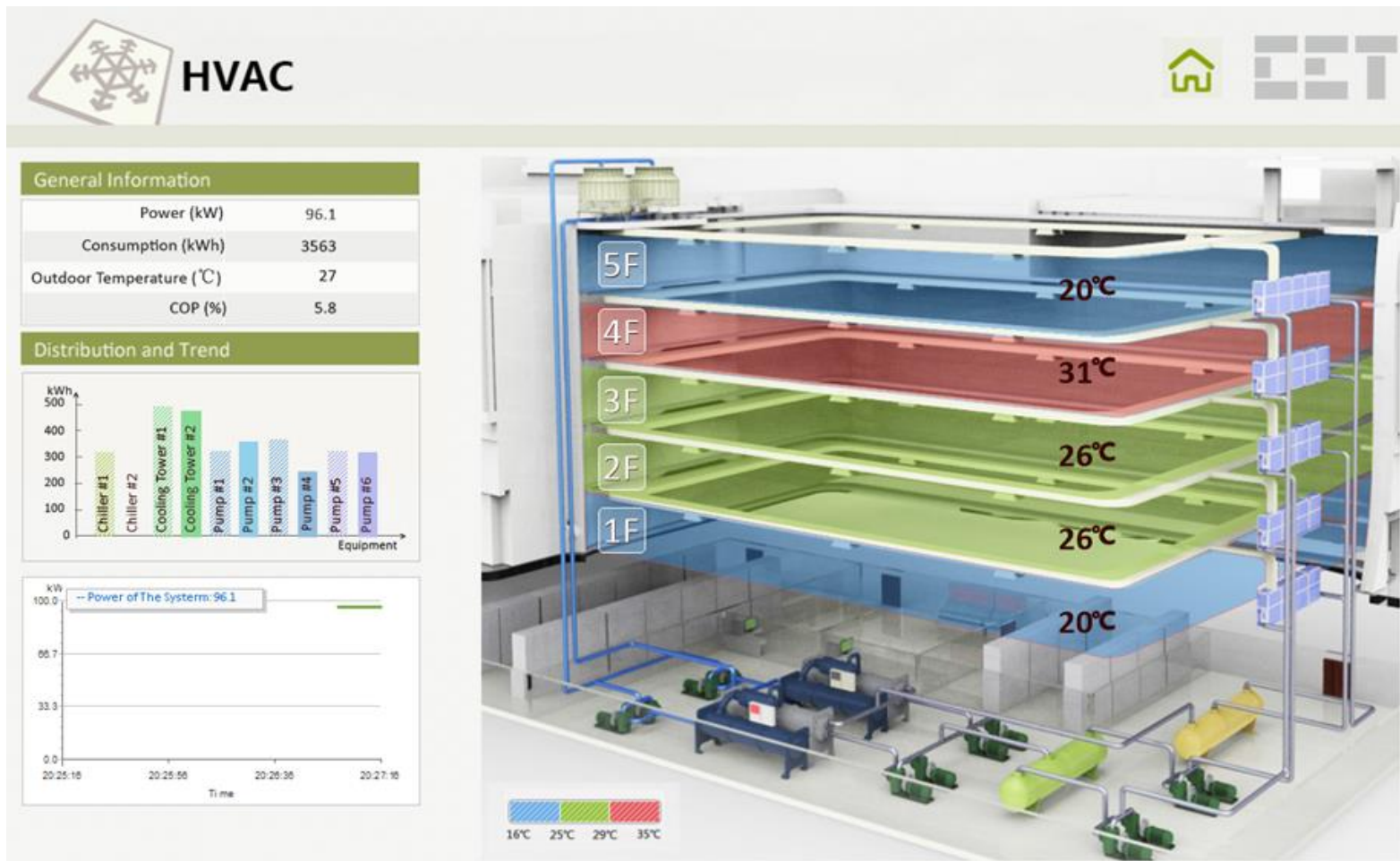
Daily Cost: \$7642

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# Real-time Analysis by Floor



# iEEM – Mapping Physical Information into Logical Analytics

## iEEM – Integrated Energy Efficiency Management

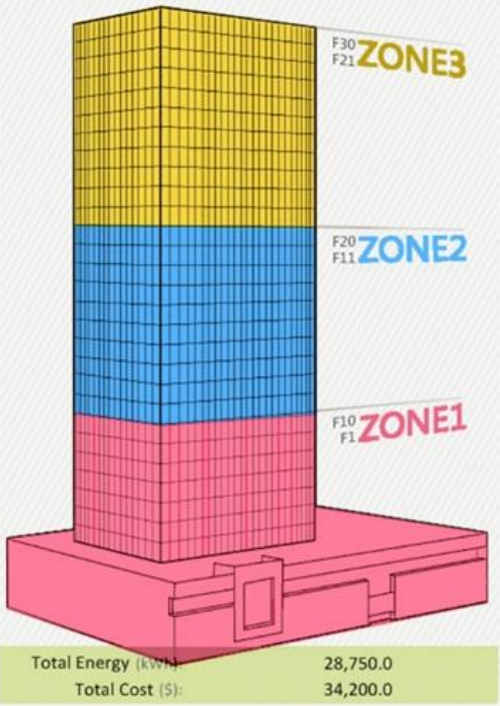


### Office Building A



Statistics Alert

Mechanical Services HVAC Lighting Special

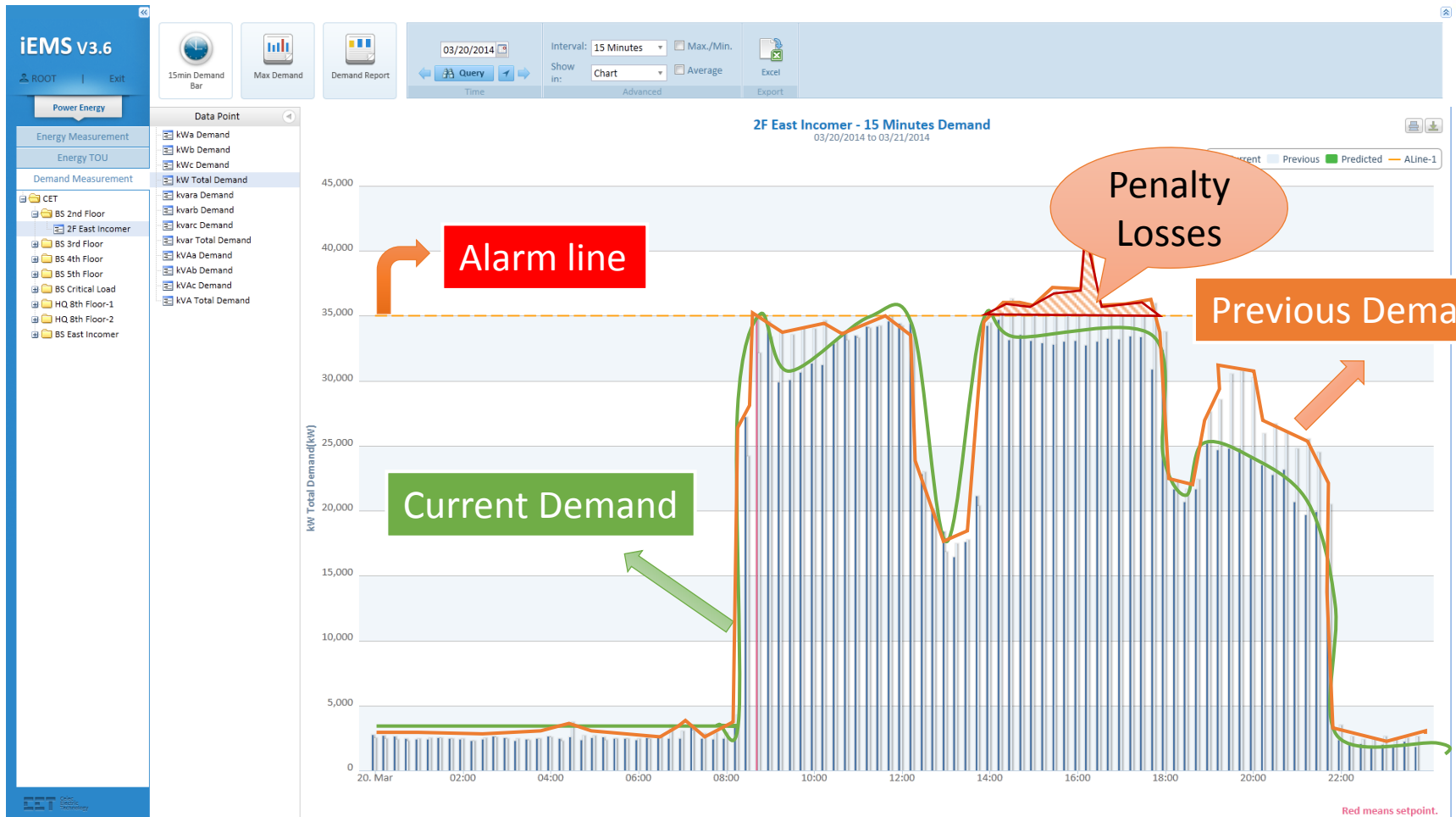


**Building A**

Categories	Today (kWh)	Cost (\$)	Percentage (%)	Yesterday (kWh)	Changes (%)
Mechanical Services	5934.59	1246.45	108	5478.65	+456
HVAC	3197.56	671.68	94.9	3368.65	-171
Lighting	1476.45	310.05	93.6	1576.98	-100
Special	3466.59	727.99	112	3078.45	+388



# Load Profiling



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# Advanced Logging and Analysis Functions

## Alarm List

**iEMS V3.6**  
ROOT | Exit  
Power Monitoring  
Trends  
Graphs  
SOE  
Node | Favorites  
Template  
Recent 30 Days  
Favorites  
Waveforms  
Realtime  
Reports

Fixed Period Today  
2015-03-12 to 2015-03-13  
Query  
Time Advanced Add Export

Alarm List  
Recent 30 Days

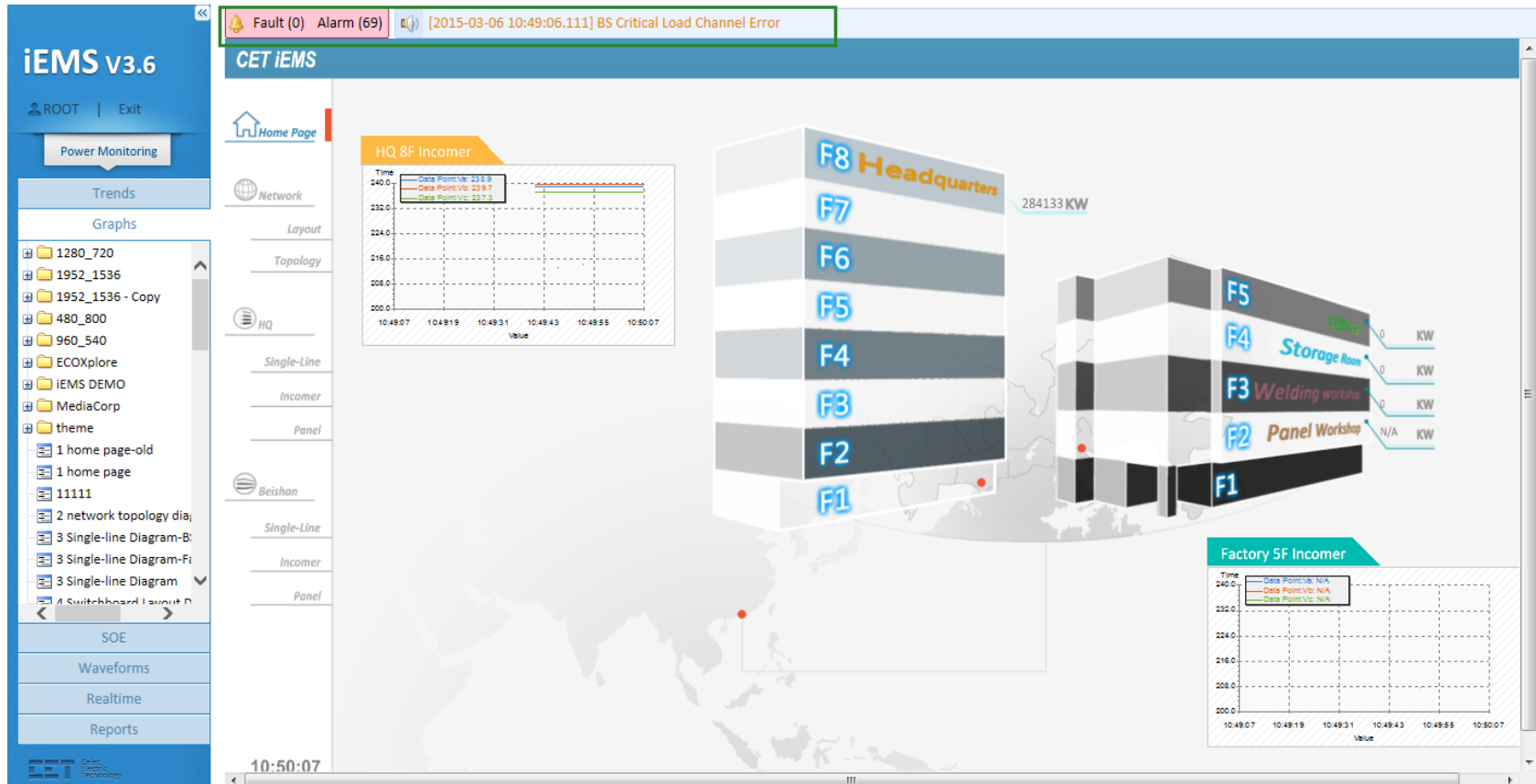
Double-Click to view similar events. Acknowledge the selected

No.	Time	Active	Description	Event Class	Acknowledge	Waveform	Event Type
1	2015-03-11 15:04:30.010	Inactive	8F West Incomer 2 Actual Demand(10.780) and predicted demand...	Alarm	Acknowledge	--	Unknown Even
2	2015-03-11 15:04:00.008			Alarm	Acknowledge	--	Unknown Even
3	2015-03-11 15:03:30.007			Alarm	Acknowledge	--	Unknown Even
4	2015-03-11 15:03:00.005			Alarm	Acknowledge	--	Unknown Even
5	2015-03-11 15:02:30.003			Alarm	Acknowledge	--	Unknown Even
6	2015-03-11 15:02:00.002			Alarm	Acknowledge	--	Unknown Even
7	2015-03-11 15:01:30.000			Alarm	Acknowledge	--	Unknown Even
8	2015-03-11 15:01:00.048	Inactive	8F West Incomer 2 Actual Demand(15.679) and predicted demand...	Alarm	Acknowledge	--	Unknown Even
9	2015-03-11 15:00:30.046	Inactive	8F West Incomer 2 Actual Demand(15.709) and predicted demand...	Alarm	Acknowledge	--	Unknown Even
10	2015-03-11 09:54:30.046	Inactive	8F West Incomer 2 Predicted Demand(9.655) exceeds contract val...	Alarm	Acknowledge	--	Unknown Even
11	2015-03-11 09:54:01.438	Inactive	8F West Incomer 2 Communication error.	Alarm	Acknowledge	--	Communicatio
12	2015-03-11 09:54:00.045	Inactive	8F West Incomer 2 Predicted Demand(10.184) exceeds contract v...	Alarm	Acknowledge	--	Unknown Even
13	2015-03-11 09:53:30.043	Inactive	8F West Incomer 2 Predicted Demand(12.371) exceeds contract v...	Alarm	Acknowledge	--	Unknown Even
14	2015-03-11 09:49:00.025	Inactive	8F West Incomer 2 Actual Demand(9.533) and predicted demand(...	Alarm	Acknowledge	--	Unknown Even
15	2015-03-11 09:48:30.024	Inactive	8F West Incomer 2 Predicted Demand(15.056) exceeds contract v...	Alarm	Acknowledge	--	Unknown Even
16	2015-03-11 09:48:00.005	Inactive	8F West Incomer 2 Predicted Demand(10.996) exceeds contract v...	Alarm	Acknowledge	--	Unknown Even

Page 1 of 5  
250 Events have been loaded. 1 ~ 50 are displayed. More will be loaded automatically if available when the last page is reached.

# Real-time Alarm Notification

Latest alarm



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## Daily Energy Consumption Report

**iEMS v3.6**  
Power Monitoring  
Trends  
Graphs  
SOE  
Waveforms  
Realtime  
Reports

**2015-03-11** 00:00:00 to 2015-03-12 00:00:00  
Query  
Excel  
Export

**Daily Energy Consumption Report (Individual)**  
2015-03-11

**8F West Incomer 2**

Time	kWh Reading of This Hour	kWh Reading of Last Hour	kWh Consumption
01:00	284741.00	284737.00	4.00
02:00	284745.00	284741.00	4.00
03:00	284746.00	284745.00	3.00
04:00	284751.00	284748.00	3.00
05:00	284754.00	284751.00	3.00
06:00	284757.00	284754.00	3.00
07:00	284762.00	284757.00	5.00
08:00	284766.00	284763.00	5.00
09:00	284779.00	284769.00	10.00
10:00	284789.00	284780.00	9.00
11:00	284798.00	284790.00	8.00
12:00	284810.00	284799.00	11.00
13:00	284817.00	284813.00	6.00
14:00	284824.00	284817.00	7.00
15:00	284835.00	284825.00	8.00
16:00	284845.00	284834.00	9.00
17:00	284852.00	284844.00	8.00
18:00	284861.00	284857.00	9.00
19:00	284870.00	284862.00	8.00
20:00	284878.00	284871.00	7.00
21:00	284886.00	284879.00	7.00
22:00	284893.00	284886.00	6.00

# Power Quality Monitoring and Reporting

## PQ Events with waveforms

The screenshot displays the IEMS v3.6 software interface. The main dashboard shows a bar chart of PQ Events from 2015-05-12 to 2015-05-13, with a total of 98 events. A red callout box points to a 'Click to view the waveform' button. Below the chart is an 'Event Statistics' table with columns for No., Time, Event Type, Duration (ms), Magnitude (%), Node, Waveform, and Acknowledge. The table lists several events, including a Sag event at 2015-05-12 16:04:40.125 with a duration of 277.000ms and a magnitude of 74.900% at node PMC-670. A 'WF Recorder' window is open, showing a detailed view of a Sag event at 2015-05-12 16:04:40.088. The recorder displays a waveform plot for three phases (Ua, Ub, Uc) and a detailed settings panel. The settings panel includes parameters such as V Nominal (100.000V), Worst Magnitude (74.900%), Duration (270.000ms), and various RMS and Min/Max values for voltage and current. A phasor diagram is also visible in the settings panel.

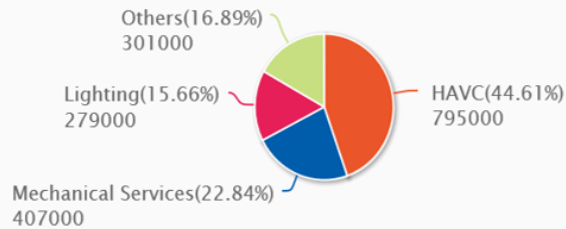
No.	Time	Event Type	Duration (ms)	Magnitude (%)	Node	Waveform	Acknowledge
53	2015-05-12 16:04:40.125	Sag	277.000	74.900	PMC-670		Acknowledge
54	2015-05-12 16:04:39.960	Sag	270.000	74.900	PMC-660		Acknowledge
55		Worst Magnitude		74.900%		Duration: 270.000ms	
56		100% Vb Min		100.000%	Vc Min	100.000%	
57		100% Vb Max		74.900%	Vc Max	74.900%	
60		Sag	0.276	74.987	PMC-680		Acknowledge

# Enterprise Summary for Multi-Site Installation

## Regional Consumption

### Enterprise Consumption by Category

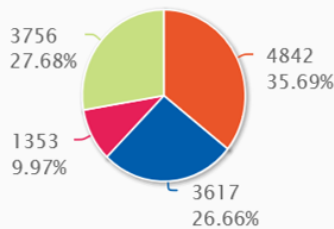
Total: 1782000kWh



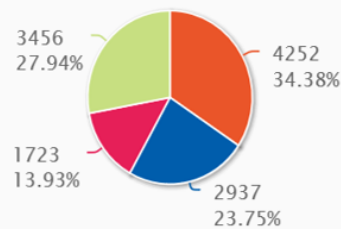
### Regional Details (kWh)

■ HVAC   
 ■ Mechanical Services   
 ■ Lighting   
 ■ Others

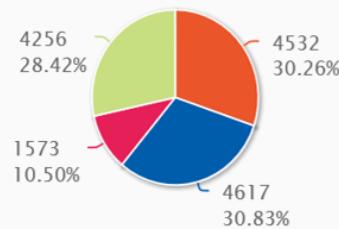
#### Malaysia



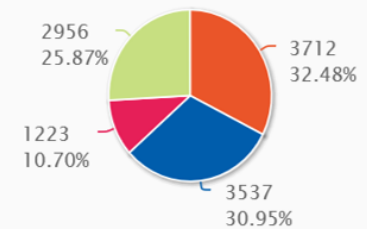
#### Singapore



#### Vietnam



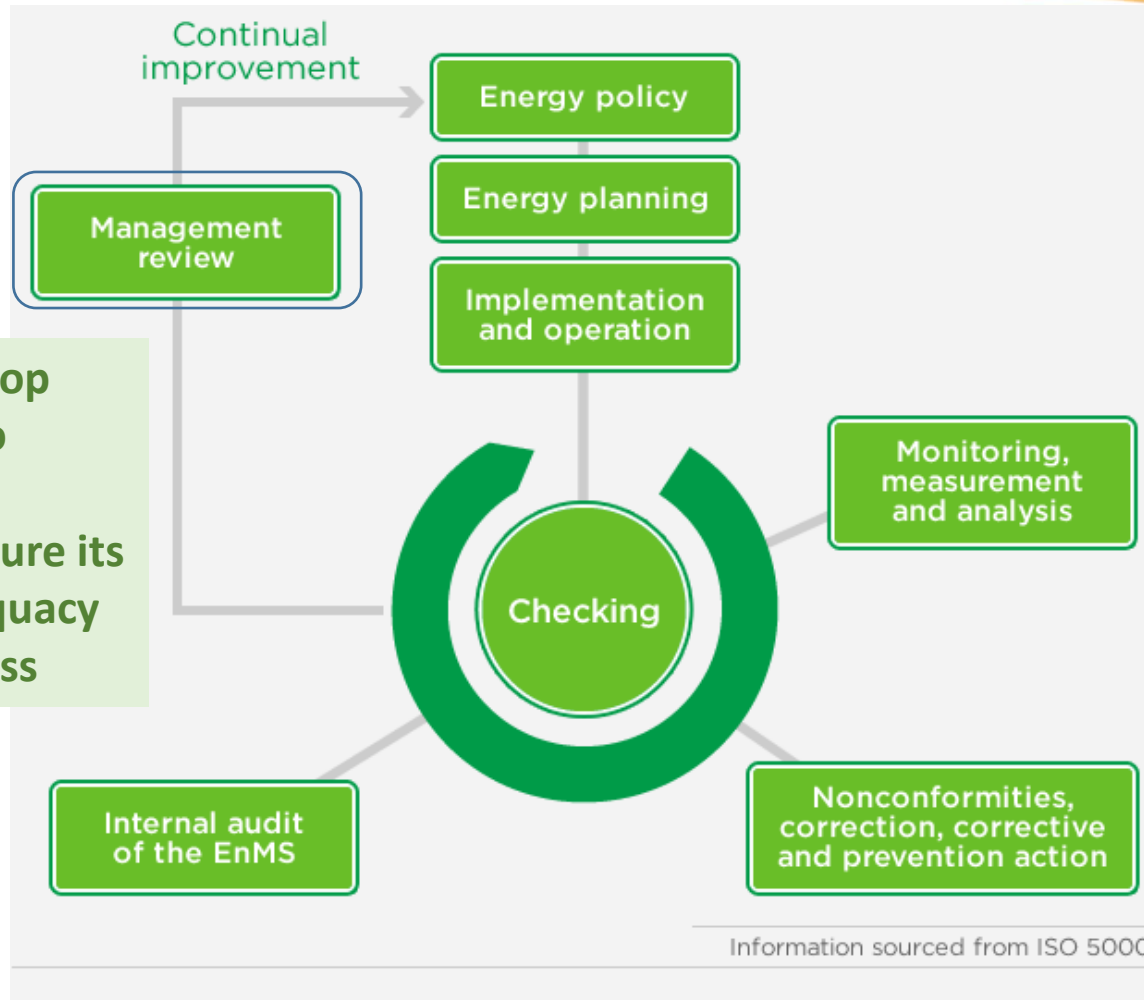
#### Cambodia



# The Value of Logical Analytics

- Real-time Compliance Reporting Against Energy Policy
- KPI Dashboard – Raise Awareness for Energy Management
- Category Based Energy Reporting
  - ❖ HVAC, Mechanical, Lighting, Special/Others
- Cost Allocation
  - ❖ Physical (by Floor, Area or Building), Departmental, Functional (Production Line), Logical, ...etc.
- Benchmark against Industry Standards or other installations

# Implement an EMS based on the ISO 50001 Model



It requires the top management to review the EMS regularly to ensure its suitability, adequacy and effectiveness

# Conclusion

*The ISO 50001 Standard, along with the local Green Legislations, could influence up to 60% of world's energy use and help organizations to*

- Reduce Energy Cost
- Increase Energy Efficiency
- Improve Equipment Performance
- Create a better and more sustainable environment for future generations





**THANK YOU**

*Our booth number  
1E-135*