Development of an Energy Management System for the Electromechanical Services Department Ministry of Communication and Works based on ISO50001:2011

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February 2014

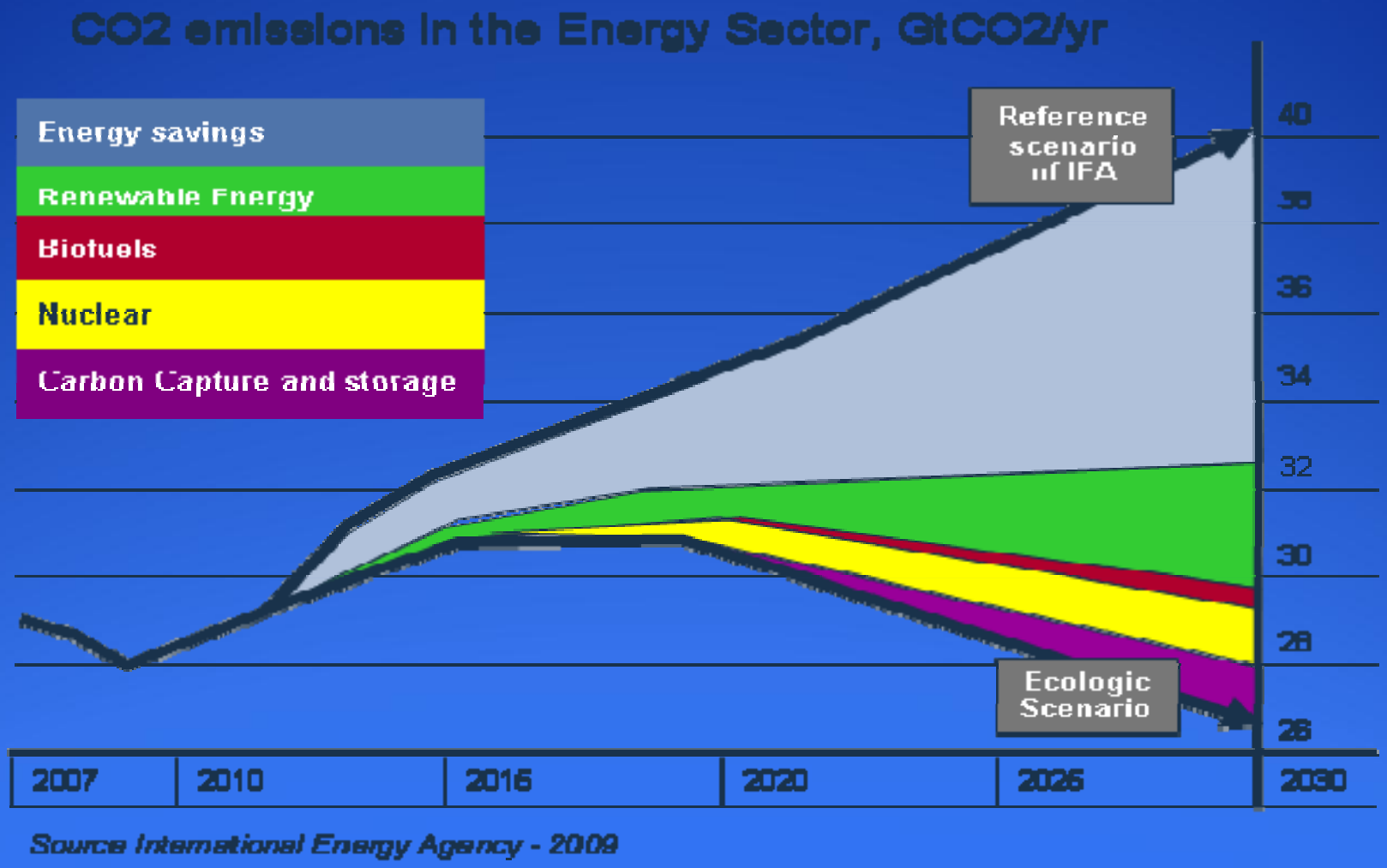
ABSTRACT

- European Directive for Energy Efficiency (2002/91/EC)
- Energy Consumption in European Union
  - 40% Buildings energy consumption
  - 36% CO_2 emissions
- Energy Objectives by 2020
  - 20% reduction of greenhouse gases
  - 20% energy savings
- Public Sector to lead the change by example
- Procurement of products, services and buildings would prioritize energy efficiency

OBJECTIVES OF ENERGY MANAGEMENT

- To achieve and maintain optimum energy procurement and utilization, throughout the organization
- To minimize energy costs / waste without affecting production & quality
- To reduce import dependency
- To enhance energy security, economic competitiveness, and environmental quality

THE WEIGHT OF ENERGY SAVINGS COMPARED TO OTHER TECHNOLOGIES



Source International Energy Agency - 2009

ISO 50001: ENERGY MANAGEMENT SYSTEMS STANDARD INTRODUCTION

- ISO 50001- the International Standard for Energy Management Systems (EnMS)
- Energy Management Systems offers a comprehensive and structured approach for energy efficiency improvement.
- ISO50001: 2011 defines EnMS as "set of interrelated or interacting elements to establish an energy policy and energy objectives, and processes and procedures to achieve those objectives
- Applicable to any organization, whatever the size, industry or geographical location
- An organization embracing ISO 50001 is likely to further accelerate adoption of energy efficiency practices and to continuously improve its energy performance and cost.
- The fact that it's based on measurement and verification will help organization stay on track to meet their declared energy policies.

ISO 50001: KEY ELEMENTS

Plan - Do - Check - Act

- Energy policy top management's official statement of the organization's commitment to managing energy
- Energy management team led by a representative who reports directly to management (Chief mechanical engineer)
- Energy review to assess current and planned energy use, energy sources and consumption
- Baseline(s) of the organization's energy use
- Energy performance indicators (EnPIs) that are unique to the organisation
- Energy objectives and targets for energy performance improvement
- Action plans to meet those targets and objectives
- Operating controls and procedures for significant energy uses
- Measurement, management, and documentation for continuous improvement
- Internal audit of progress reported to management based on these measurements.

Plan - Do - Check – Act (PDCA)

ISO 50001 is based on the Plan - Do - Check - Act (PDCA) continual improvement framework and incorporates energy management practices into everyday organizational activities. As per ISO 50001:2011:

- **Plan**: conduct the energy use assessment, establish the baseline, energy performance indicators (EnPIs), objectives, targets and action plans necessary to deliver results that will improve energy performance (measurable results related to energy efficiency, use and consumption) in line with the organization's energy policy;
- **Do**: implement the energy management action plans;
- **Check**: monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives, and report the results;
- **Act**: take actions to continually improve energy performance and the EnMS.

ENERGY MANAGEMENT SYSTEM MODEL FOR ISO 50001

ENERGY MANAGEMENT IN BUILDINGS

- **Energy efficiency building**
  - Minimise energy operating costs
- **Cooling, Heating, Ventilation, Lighting and Equipment**
- **Focus on Public Building**
  - Savings in energy bills
  - Lead by example
  - Transform the market through Green Procurement
  - Raise public awareness

Development of an Energy Management System (EnMS) for the Electromechanical Services Department

General Requirements

The Department is required to establish, documents, implement and maintain an energy management system (EnMS)

- Steps
  - Developing an energy policy
  - Energy planning process
  - Physical implementation and operation of the EnMS
  - Checking performance
  - Management review of the performance
- Define and document the scope and boundaries
- Improvement of energy performance and EnMS

Management Responsibility

Top management has to:

- Establish the Energy Policy
- Appoint a management representative approve En MS team (Chief Mechanical engineer)
- Provide resources
- Scope and boundary of the EnMS
- Communicate
- Ensure energy objectives and targets
- Ensure Energy Performance Indicators (En PIs)
- Planning
- Management Reviews

OBJECTIVES AND TARGETS

Objective: outcome to meet the Department's Policy

Target: Detailed and measureable energy performance

Energy Objectives and Targets

Objectives	Targets	Responsibility
1. Energy compliance: Comply with all applicable energy-related environmental laws and regulations	Zero penalties or fines per year	Senior electrical Engineer of Legislation Sector
2. Minimize wasted energy	To reduce energy expenditures	Chief Mechanical Engineer Senior Electrical Engineer of the Maintenance Sector
3. Conserve energy	Reduce electricity consumption by 10%	ENMS program manager (Chief Mechanical Engineer)
4.Improve the ENMS	Obtain ISO 50001 certification	

Energy performance Indicators (En PIs)

Energy performance Indicators (En PIs)

- Help the Department to achieve energy performance improvements
- Annual Energy Consumption per m^2 (KWh/m^2)
- Annual Energy Consumption per employee (KWh/employee)

Energy Policy

- Commitment by top management
- Continual improvement of energy performance
- Commitment to comply with applicable legal and other requirements
- Framework for energy objectives and targets
- Supports purchase of efficient products

ENERGY POLICY STATEMENT

ENERGY POLICY STATEMENT

The Department of Electrical and Mechanical Services (EMS) is the responsible Governmental Department for the management of all the workshops and staff employed in the maintenance of electrical and mechanical equipment and machinery.

The Department of Electrical and Mechanical Services (EMS) is committed to compliance and to continual improvement of its energy efficiency. EMS will implement effective energy management programs that support all operations within its central offices and customer satisfaction while providing a safe and comfortable work environment.

It is the mission of the Department of Electrical and Mechanical Services (EMS)to promote energy management practices and to comply with all legal requirements. We commit to tracking our energy use, to achieving reductions in energy use and costs, and to creating a culture of energy awareness and conservation.

The Department of Electrical and Mechanical Services is fully committed to maintaining throughout the Departmental Energy Management System which is based on the requirements
of ISO 50001:2011
and of applicable legislation.

Implementation of this policy is the responsibility of every member of staff.

The Department of Electrical and Mechanical Services is committed to invest in people training and development, new technology and tools, and modern methods and system and pursue continuous improvement in all aspects of operations related to its energy management system.

APPROVED BY:

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Managing Director

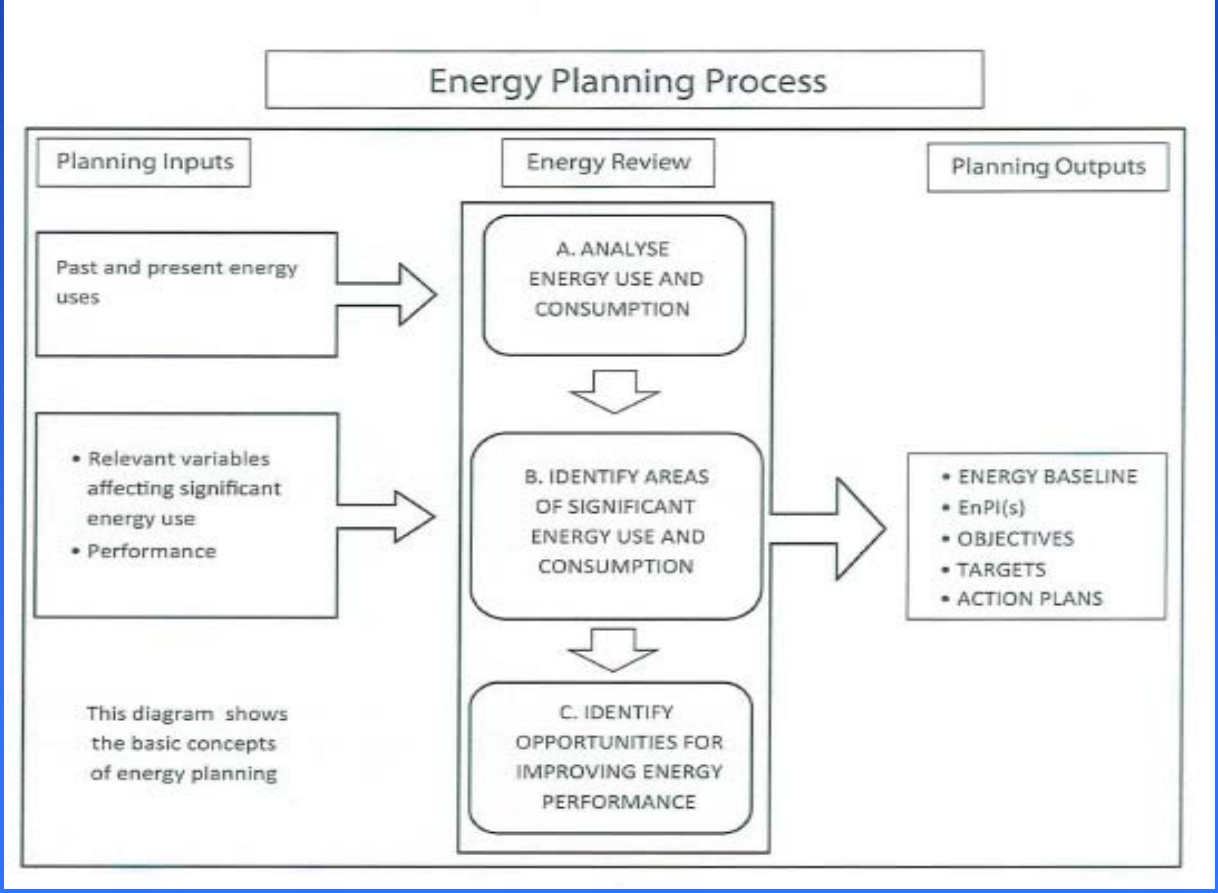
DATE: 01/02/2013

LEGAL AND OTHER REQUIREMENTS

LEGISLATION	APPLICATION
Law 142(I)/2006 Law 30(I)/2009 Directive 2002/91/EC	Energy Conservation of Buildings
Law 33(I)/2003 -2007 2009/28/EK	Renewable Energy
142(I)2006 Ministeral order 2009	Audit of Air-conditioning systems

ENERGY PLANNING

Leads to activities to improve energy performance



ENERGY REVIEW

- Analyse energy use based on measurement
- Evaluate past and present energy use and consumption
- Future energy use
- Opportunities for improving energy performance
- Significance of energy consumption

Significance of Energy Consumption Levels as a Priority Tool

Energy use	Consumption (KWh/year)	Significance score
Space cooling	165.200	High
Lighting	-	Medium
Space heating & hot water	138.500	High
Office equipment	-	Low

Note: In the consumption, lighting is included because there is no individual measurement for this type of consumption.

ENERGY REVIEW

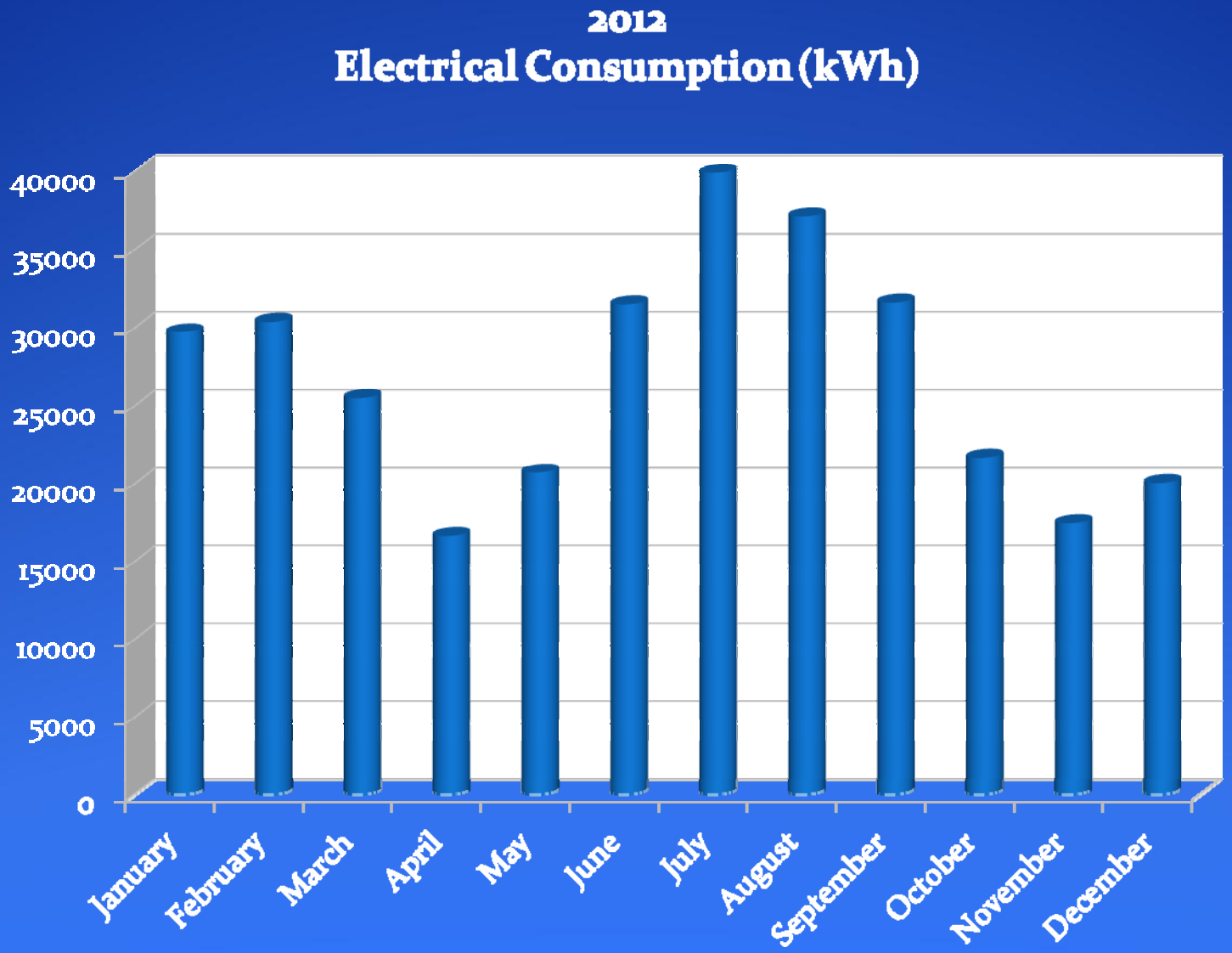
Month	2004 Electrical Consumption (kWh)	2005 Electrical Consumption (kWh)	2006 Electrical Consumption (kWh)	2007 Electrical Consumption (kWh)	2008 Electrical Consumption (kWh)	2009 Electrical Consumption (kWh)	2010 Electrical Consumption (kWh)	2011 Electrical Consumption (kWh)	2012 Electrical Consumption (kWh)
January	28210	31020	33320	30240	34480	33283	32086	31733	29718
February	26500	28300	27010	30840	31520	30703	29887	30180	30383
March	20630	22100	25540	29050	21190	23397	25604	27838	25491
April	18210	19200	25320	18630	18460	20320	19564	19904	16672
May	17060	25820	25010	25290	28790	24270	26089	24928	20724
June	35830	34850	40730	41190	38420	39512	37607	36587	31533
July	42180	42250	41150	45770	43940	47650	44449	29502	39925
August	37060	43730	42640	47180	42570	40123	46651	31867	37138
September	36390	41460	36290	35530	39860	34990	42566	32313	31642
October	27100	22860	23320	27950	23180	26051	25344	20629	21672
November	18300	22750	23120	23890	18070	22075	20783	21179	17477
December	30580	22530	28650	28850	23220	28524	26694	22921	20060
Total	**338050**	**356870**	**372100**	**384410**	**363700**	**370898**	**377324**	**329581**	**322435**

ENERGY REVIEW

Fuel Oil Consumption		
Year	Lt	KWh
2004	1510	151751
2005	14161	143167
2006	9580	96834
2007	8177	82669
2008	7850	79364

Number of Employees	KWh/ employee	Year	Electrical Consumption KWh	Fuel Oil Consumption KWh	Total Energy Consumption KWh	Total Energy Consumption KWh/m2
60	5.102	2004	338050	151751	489801	306
72	4.341	2005	356870	143167	500037	313
78	3.757	2006	372100	96834	468934	293
82	3.560	2007	384410	82669	467079	292
78	3.550	2008	363700	79364	443064	277
79	2.257	2009	370898	0	370898	178
80	2.268	2010	377324	0	377324	181
74	2.141	2011	329581	0	329581	158
68	2.280	2012	322435	0	322435	155

ENERGY REVIEW



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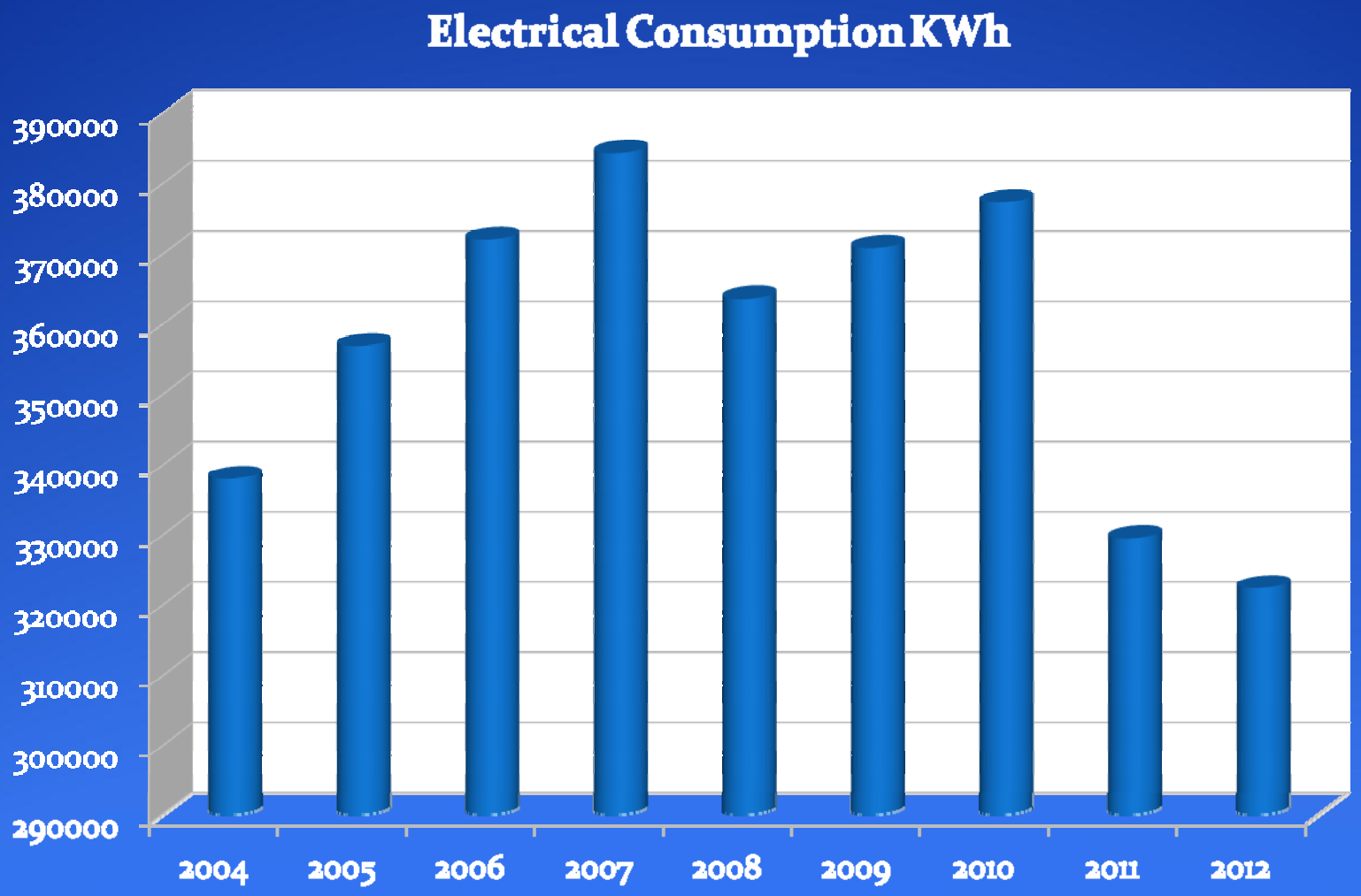

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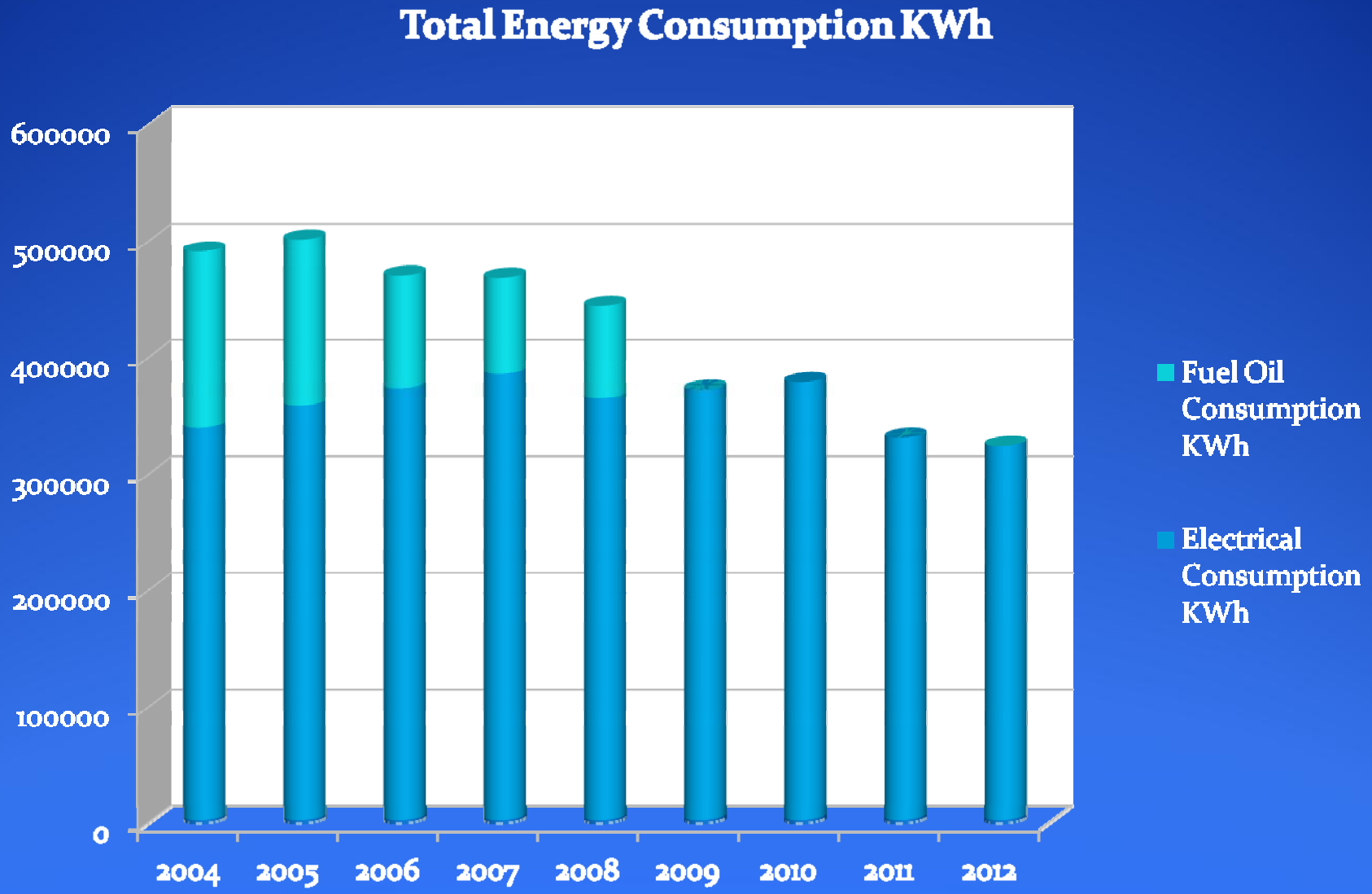

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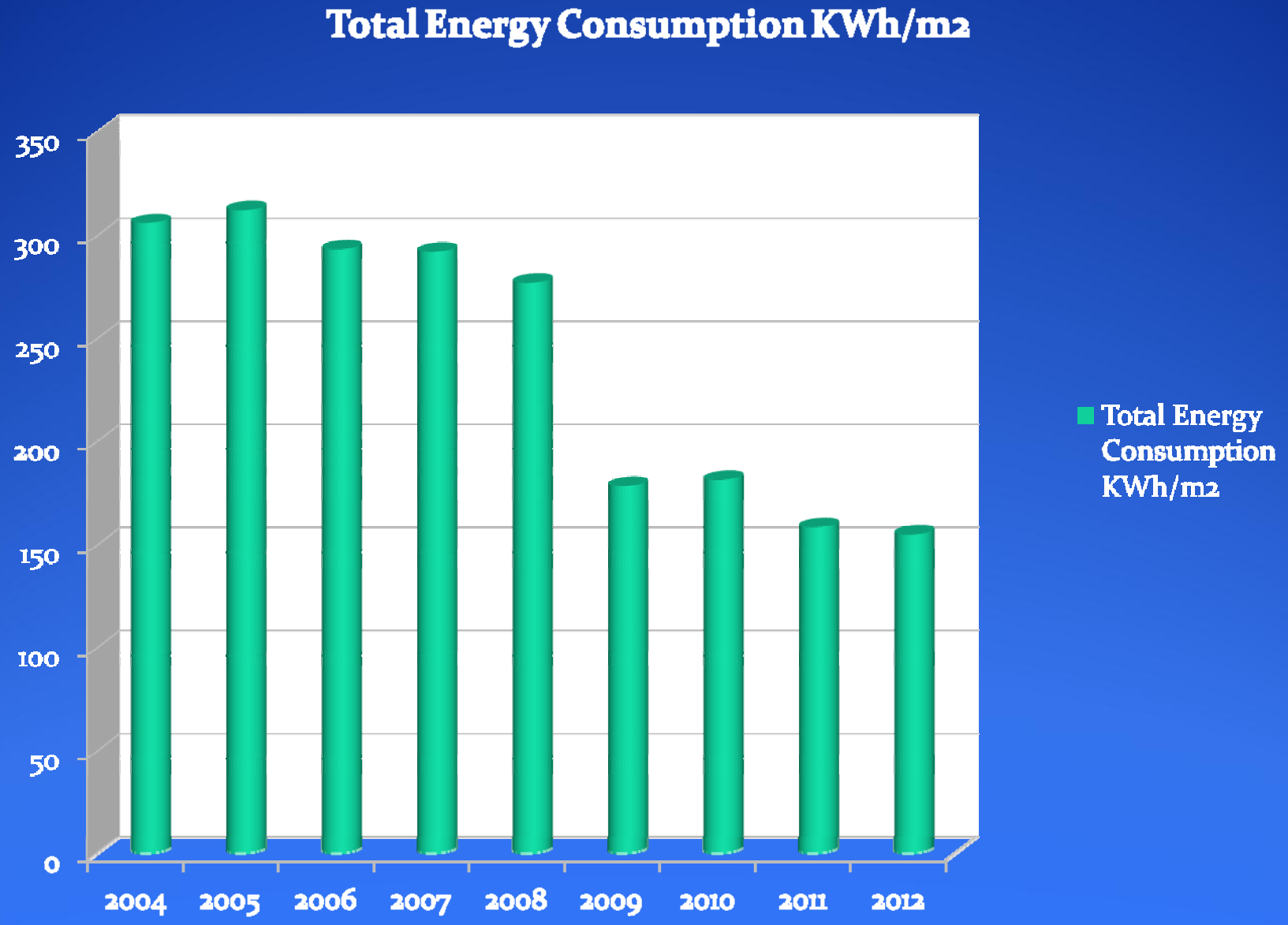
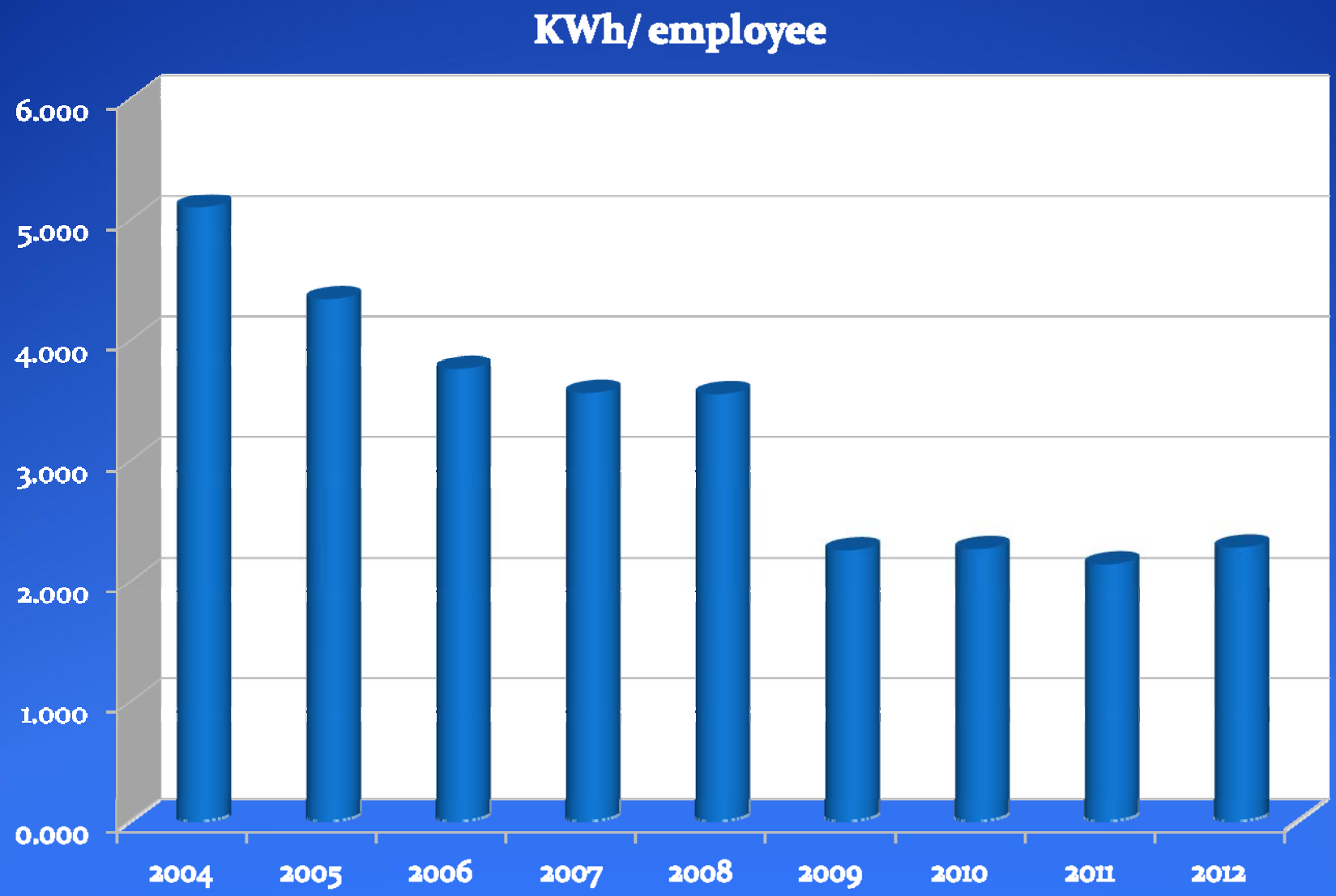


ENERGY REVIEW



OBJECTIVES, TARGETS and ACTION PLANS

EnMS Targets objectives, responsibilities and verification methods

Aspect No	Aspect description	Objective	Target	Action	Time Frame	Responsibilities	Method/ verification
1	Use of electricity for Air-conditioning & Heating	Reduce Annual electricity consumption	10% annual reduction	a)Use of BMS b)Training of Personnel c)Sub metering at the a/c equipment set of thermostats	DEC 2014	Senior Mech Engineer of the maintenance sector	Measurement
2	Use of electricity for lighting	«»	«»	a)Use of LED lighting b)Body detectors	DEC 2014 DEC 2014	Nicosia District Engineer	«»
3	Use of electricity for office equipment	«»	15% annual reduction	a)Turn off equipment b)use of efficient equipment	DEC 2013	All personnel	«»
4	Use of electricity for lift	«»	15% annual reduction	Use of stairs	DEC 2013	«»	«»
5	Use of electricity for hot water production	«»	10% annual reduction	Decrease of water consumption	DEC 2014	All personnel	«»

IMPLEMENTATION AND OPERATION

- Competence, training and awareness
- Training
- Communication
- Documentation
- Control of Documents
- Procurement of energy Services, Products and Equipment

CHECKING

- Monitoring, Measurement and Analysis
- Evaluation of Legal and other compliance
- Internal audit
- Control of records

MANAGEMENT REVIEW

- Management review to ensure the EnMS continuing suitability and effectiveness
- Review of the energy policy
- Review of the energy performance and EnPIS
- Extend to which the energy objectives and targets have been met
- Corrective and preventive actions
- Change of the above if necessary

RESULTS

- The energy performance indicators (EnPI) for the years 2004 until 2012 where improved:

		2004	2012
EnPI1	Annual Energy Consumption per m^2 (Kwh/m^2)	306	155
EnPI2	Annual Energy Consumption per Employee (Kwh/employee)	5102	2280

CONCLUSIONS

- Government must lead by example, this can be a force to shift the market toward energy efficiency.
- Green procurement of products and services for government buildings leads to environmental and financial benefits.
- Energy efficiency and renewable energy actions in public buildings raises the awareness amongst the public.
- Specifically for the EMS Department, the margins of further energy savings appear to be limited.

CONCLUSIONS

- Necessity of the use of new more specific performance indicators on the energy conservation.
- The development of the Energy management Systems (EnMS) is expected to achieve more annual savings of 10%.

FURTHER ACTIONS

The Department is currently preparing the tender documents of Energy Performance Contracting in order to promote energy efficiency through energy Saving Companies (ESCO´s). The basic philosophy is that Energy Saving Company is implementing energy measures (LED, E/M systems, thermal insulation, PVs) at a building. The savings in energy cost are used by the landlord to payback the capital investment of the project.

Thank you for your attention

благодаря ви за вниманието