The Role Of Energy Service Companies (ESCOs) in Developing Financially Viable Energy Efficiency Projects

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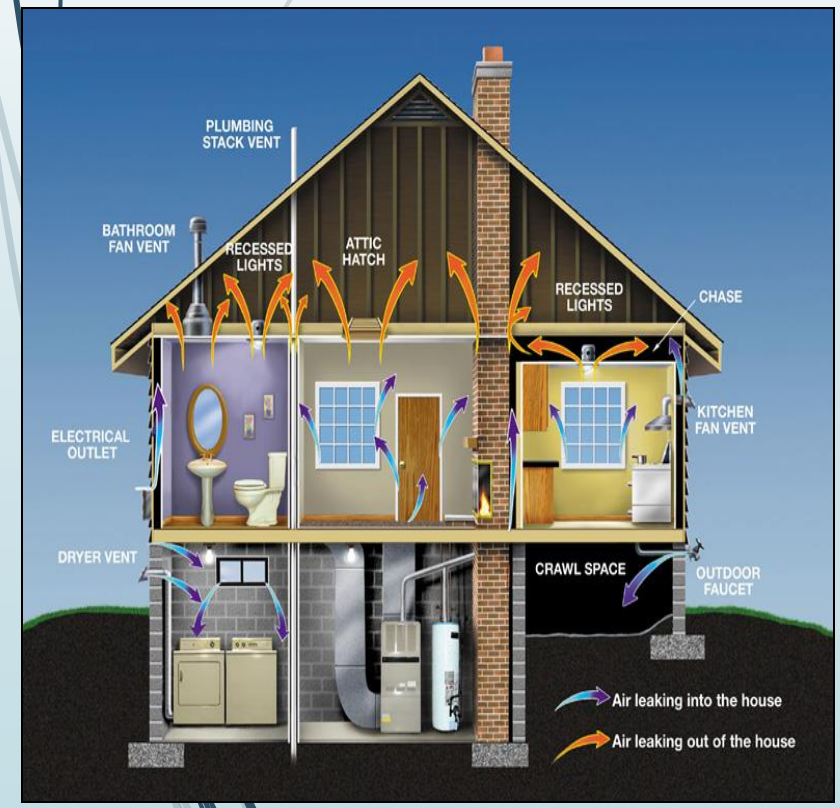
Presentation Outline

- Who are ESCOs and What are their roles in projects
- How does ESCOs facilitate effective design and planning
- What are measurement and verification standards available
- How can ESCOs help manage risk

Energy Efficiency

- Designing or retrofitting towards the optimal energy usage in residential, commercial, industrial, transportation and utilities sectors.
- Energy efficiency is using less energy to provide the same level of service.



Example:

1. Home Appliances
2. Building Design - Passive
   - Active
3. Industry -Co-generation (CHP)
4. High Efficiency Motors (HEM)
5. Vehicles -Alternative Fuel
   - Plug-in Hybrid

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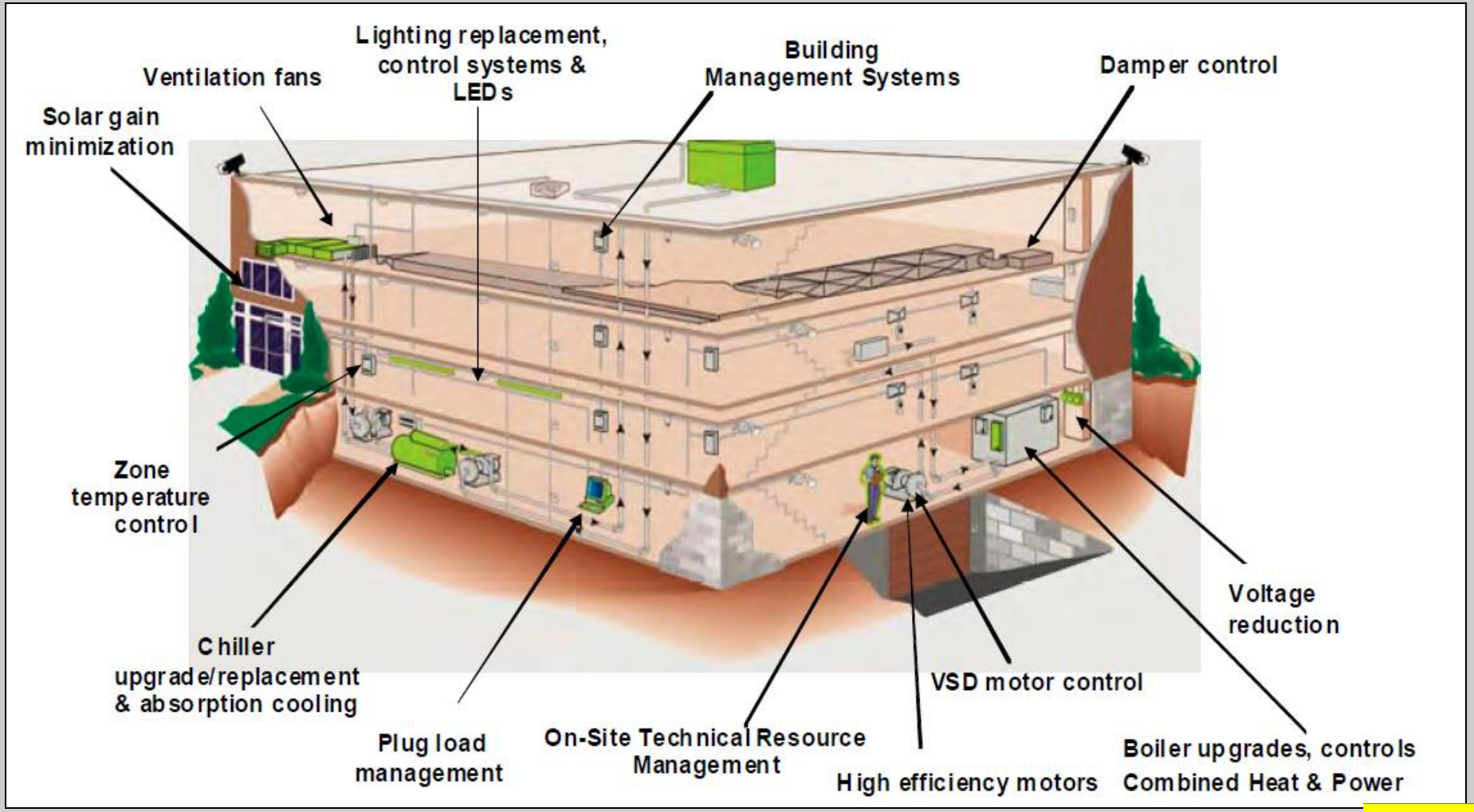
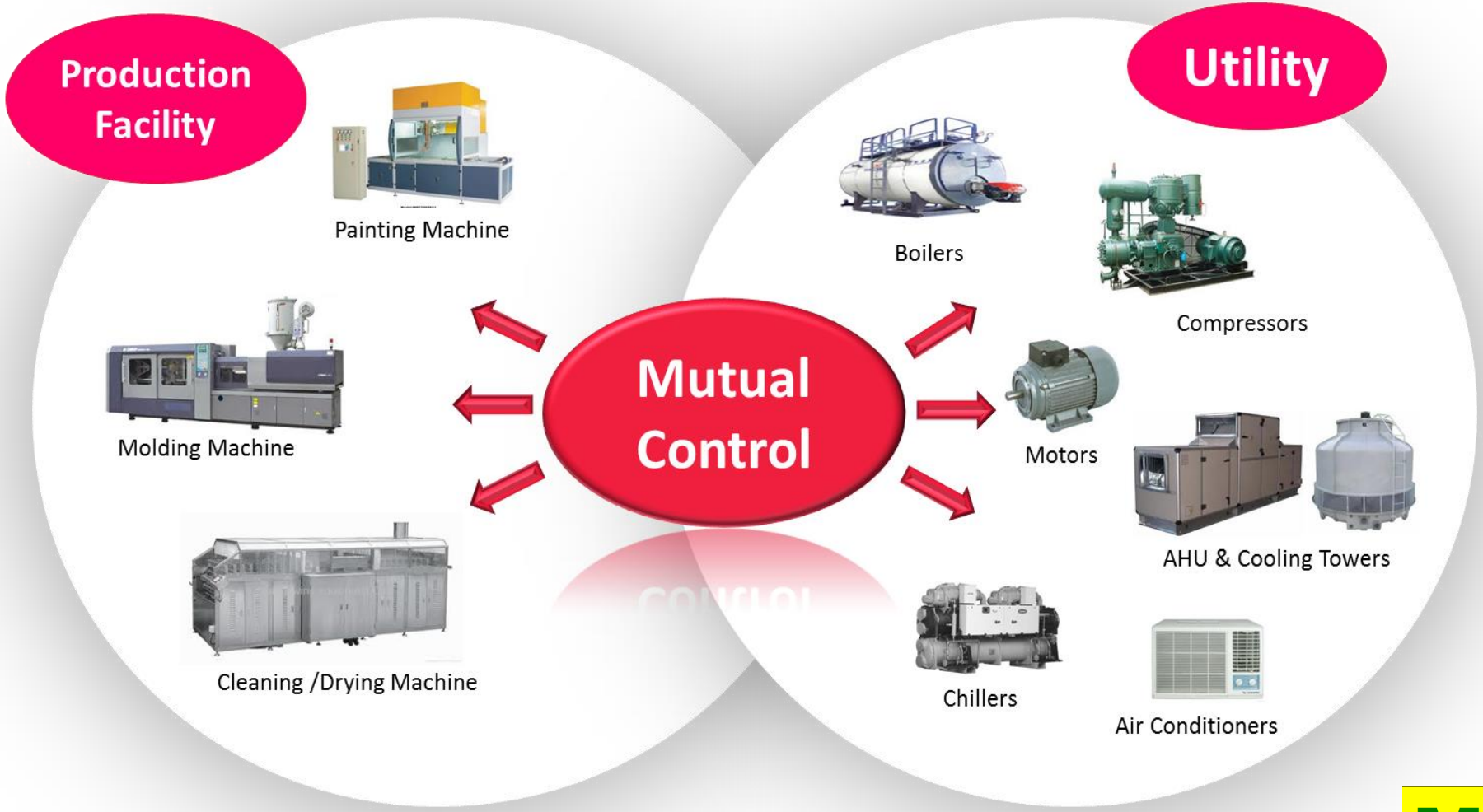
Typical Active Energy Conservation System in Commercial Buildings



Energy Conservation System In a Production Facility



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Commercial and Financial Benefits for implementing Energy Saving Measures (ESM)

- **Increase productivity** while **reducing costs** and your impact on the environment;
- Increase shareholder value—**improve your profits**, image and performance;
- Achieve **improved rates of return** on your investment;
- **Minimise controllable costs**—such as energy, waste, and equipment wear and tear;
- **Minimise peak load costs**—understand and manage your peak/off peak energy profile;
- Achieve **process efficiency improvements** right across the board;
- Demonstrate the **responsiveness** of your industry sector and company **to key environmental issues**; and
- Become an **employer of choice.**

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Benefits Working with ESCOs

ESCO is a one-stop solution provider which aims to bring together capital and technology to develop and implement turnkey solutions that enable companies to reduce their energy consumption and operating costs while meeting sustainability goals.

- No upfront investment for the Host on Shared Savings Basis.
- Enduring Operating Cost Savings.
- Asset Upgrade and Value Uplift.
- Carbon Emissions Reductions/Compliance with Building /Energy Management Regulation.
- Corporate Social Responsibility agenda.
- Highest Performance Standards with equipment and technology that is commercially proven and with warranties and guarantees as to the performance of contractors and suppliers.
- Savings Cover the Investment Cost.
- Risk Transfer.
- Service payment only starts when the equipment is fully installed and commissioned. As a result, the Host transfers all the procurement and construction risks to ESCO
- Flexible Service Payment including shared savings, progressive payment, buy-out clause etc.
- Collateral or Guarantee Requirement subject to a credit risk assessment funding for the project without any collateral or corporate/directors guarantee from the Host.

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Role of an ESCO

1. Carry out Energy Performance Contracting (EPC) in facilities and shows an understanding of issues inherent with working on similar sites
2. Ability to carry out Investment Grade Audits (IGA) in:
   - Energy Management
   - Mechanical
   - Electrical and Thermal
   - Control Systems
3. Ability to:
   - identify potential EE projects
   - design solutions
   - procure required equipment
   - project manage the implement and energy saving measures
4. Ability to provide post implementation services such as:
   - operational and maintenance support
   - energy management support
   - inhouse training

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Typical ESCO Service

- Detailed/Investment Grade Audit
- Establish baseline of energy use for specific equipment or facility as whole
- Design project in consultation with customer
- Undertaking turnkey supply/installation and commissioning of equipment
- Training, briefing customer personal
- Operating and maintaining the equipment for the life of contract
- Conducting Measurement and Verification (M&V) to determine the actual savings
- Provide savings and equipment guarantees

Total packaging the main difference to conventional contracting

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Who need to understand Energy Performance Contracting (EPC)

- Business owners and CEOs and MDs of organization
- FMs, building owners/managers, plant and process engineers, financial controllers and procurement office
- Financial institutions, Insurance companies, Leasing companies
- Government agencies and relevant regulators
- Professionals such as Engineers, Green Building Specialist, Architects, Lawyers

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COMMON Options for EPC MODEL

1. GUARANTEED SAVING

- The loan goes on the client's balance sheet

2. SHARED SAVING

- The loan goes on ESCO's balance sheet

BOTH PERFORMANCE GUARANTEED!

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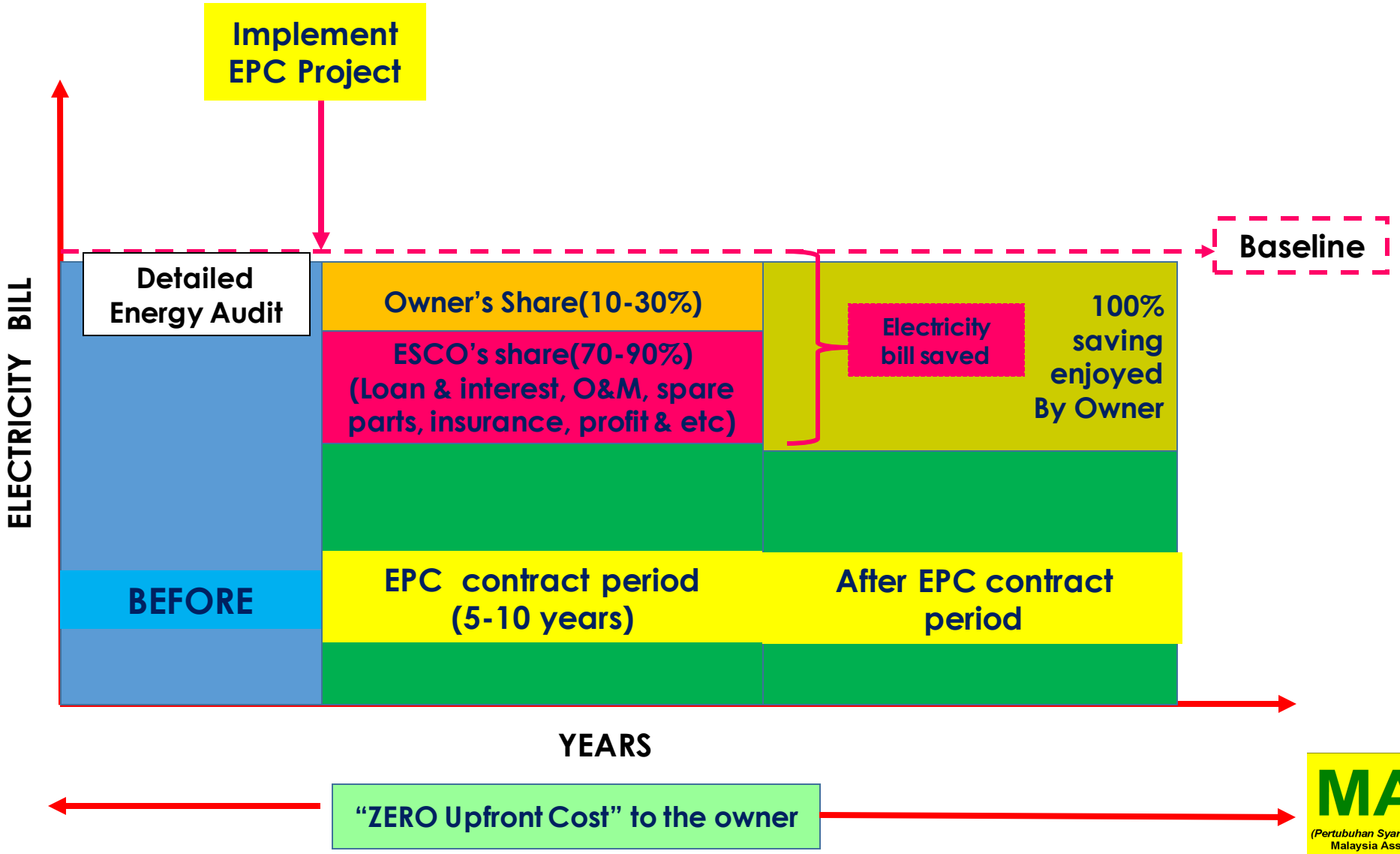
EPC –shared saving



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Fundamental Funding Principal of EPC

If the cost of ESMs installed under EPC contract is to be paid from savings, the accumulated savings over the life of the contract need to be equal or greater than the total cost of the project, including financing cost.

Main Factor Influencing the Effectiveness of using EPC

1. Facilities in one location and not scattered in different locations
2. The tariff structure of the facility
3. The total area/size of the facility
4. Total annual energy bill (all fuels)
5. Age of the facilities
6. Years since last significant upgrade

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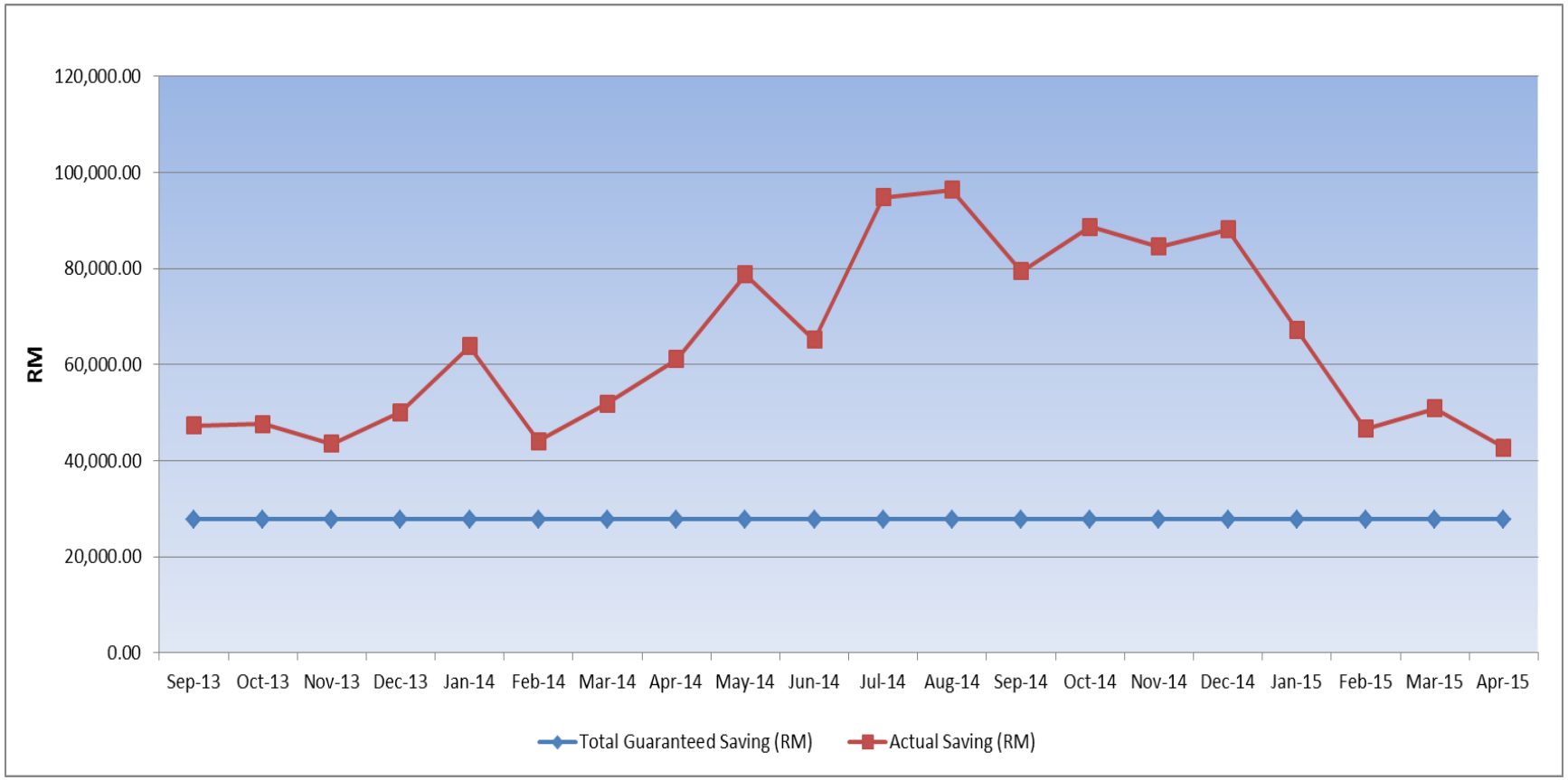
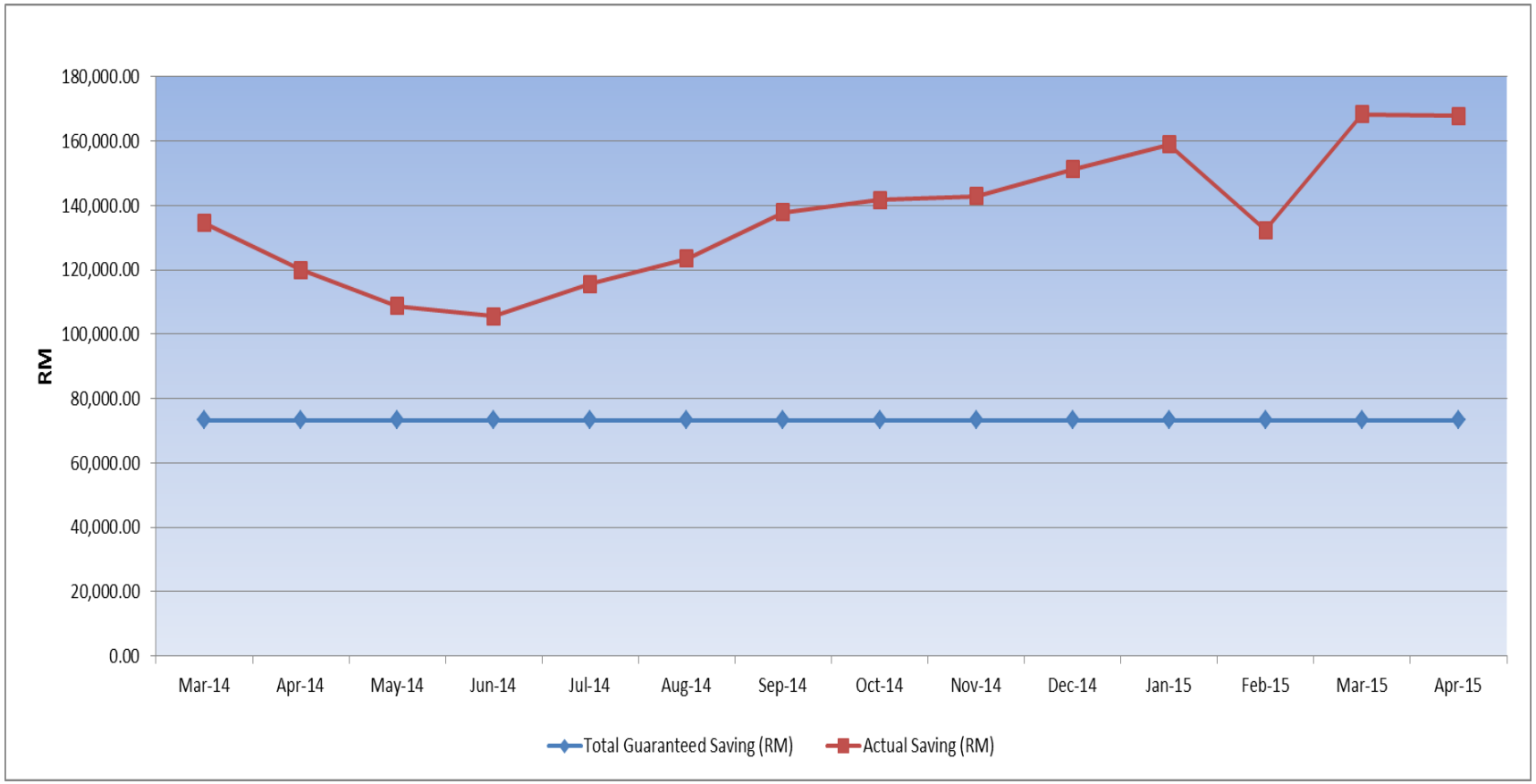
ESCO EPC Case Study in Malaysia



Baselines Electricity Bill (RM)	: ~ RM 520k per month
Shared Saving Ratio	: 80:20 and 75:25
Contract Term (years)	: 7 years
Guaranteed Shared Saving to Client side (RM)	: RM 5,547.25per month
Actual Shared Saving to Client side (RM)	: ~ RM 74k per month

ESCO EPC Case Study in Malaysia



Baselines Electricity Bill (RM)	: ~ RM 1 mil per month
Shared Saving Ratio	: 80:20 and 75:25
Contract Term (years)	: 7 years
Guaranteed Shared Saving to Client side (RM)	: RM 14,644.10 per month
Actual Shared Saving to Client side (RM)	: ~ RM 98k per month

ESCO EPC Case Study in Malaysia

Private Commercial Shopping Complex

Areas of Implementation:

1) Transformers
2) Cooling System – Chillers, Cooling Towers, AHUs, CHW & CDW Pumps
3) Lighting System – Internal, External & Parking
4) Demand Controls

Total Actual Saving Achieved
= RM 1,495,000/year

Source: ESCO

Private Warehouse

Application Areas:
- Fluorescent Lamps
- High bay Lighting - HID

Total annual Saving
= 42.2%
= 3,283,200 kWh,
= RM 920,000

TREASURY BUILDING, MINISTRY OF FINANCE OF MALAYSIA
17% reduction of electricity bill in 2011
based on 2010 baseline consumption – *SEDA Malaysia*

MIEEIP Experience

Cement Sector

No	Measure	Energy Savings		CO2 Reduction	Capital expendi tures ('000) RM	Annual Cost savings	Payback time
		Electricity MWh/yr	Fuels GJ/yr	t/yr		th. RM/yr	yr
1	**Use of palm kernel shells**		1,276,686	118,803	2,986	2,514	1.19
2	**New transformer 132/22 kV**						
2.1	Energy invoicing				7,436	3,195	
2.2	Load management				426	434	
2.3	Power factor management				-	79	
	Total new transformer				7,862	3,708	2.1
3	**Local sequence controllers**	883		602	202	174	1.2
4	**Heat recovery for drying**		28,061	2,430	90	479	0.2
	Total	**883**	**1,304,747**	**121,835**	**11,141**	**6,875**	**1.6205**

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MIEEIP Experience

Ceramic Sector

No	Measure	Energy Savings		CO2 Reduction	Capital Expenditures	Annual Cost savings	Payback time
		Electricity MWh/yr	Fuels GJ/yr	t/yr	(1000) RM	(1000) RM/yr	(yr)
1	**Raw material preparation**						
1.1	Reduction of the grinding time Continuous wet grinding	26.3	-	18	30	7	4.4
2	**Dryer**						
2.1	Optimize dryer efficiency	-	2,854.0	186	40	95	0.4
2.2	Replace existing fans in the dryer with new fans						
3	**Tunnel kiln**						
3.1	Optimization of kiln car loading	-	8,617.1	560	-	228	-
3.2	Installation of low thermal mass kiln car	-	15,882.6	1,032	1,320	527	2.5
3.3	Heat recovery from the cooling zone	-	1,278.7	83	10	42	0.2
3.4	Installation of kiln doors	-	3,140.9	204	45	104	0.4
3.5	Implementing periodic inspection and adjustment of burners in the kilns	-	4,306.6	280	30	143	0.2
3.6	Changing to fast roller kiln						
3.7	Stabilizing the pushing speed of kiln car						
4	**Lighting**						
4.1	Good housekeeping	11.1	-	8	-	3	-
6	**Energy Management**						
6.1	Implementation of an Energy Monitoring and Targeting (M&T) system	40.5	2,075.8	163	230	80	2.9
7	**Compressed Air**						
7.1	Good housekeeping and reduce leakages	28.5	-	20	-	7	-
	Total	**106**	**38,156**	**2,553**	**1,705**	**1,237**	**1.4**

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MIEEIP Experience

Food Sector

No	Measure	Energy savings		CO2 Reduc.	Capital expend.	Annual cost savings	Non energy savings (water)	Payback time	Priority
		Elect.	Fuel						
		MWh/yr	GJ/yr	t/yr	th RM	th.RM / yr	th.RM / yr	yr	
	No cost								
1.0	Boiler excess air improvement	0	4,573	338	0	103	0	0.00	1
2.0	Increasing low-pressure boiler water TDS level	0	193	14	0	4	0.45	0.00	1
3.0	Boiler pressure reduction	0	319	24	0	9	0	0.00	2
4.0	Steam leak maintenance	0	1,108	82	0	18	0	0.00	1
5.0	Compressed air pipe leakages	296	0	0	0	48	0	0.00	1
	Low Cost								
6.0	Main silo fan redesign	181	0	0	17	38	0	0.45	1
7.0	Insulation maintenance	0	20,582	1,512	20	510	0	0.04	1
8.0	Boiler combustion air increase	0	3,492	258	20	56	0	0.36	3
	High Cost								
9.0	Fract plant cooling system optimization	548	0	0	131	131	0	3.05	3
10.0	Monitoring & Targeting	120	5,345	394	200	95	0	1.66	1
11.0	Boiler fuel switching	0	0	0	360	1,468	0	0.25	1
12.0	Installation of boiler economizer	1	14,096	1,035	400	331	0	1.21	2
13.0	New scheme for condensate recovery system	0	25,377	1,878	500	418	12	1.20	2
	Total	**1,146**	**75,085**	**5,536**	**1,648**	**3,227**	**13**	**0.51**	

MIEEIP Experience

Glass Sector

No	Measure	Energy savings		CO_2 Reduction	Capital expenditure	Annual cost	Payback time
		Electricity MWh/yr	Fuels GJ/yr	t/yr	th. RM	th.RM	yr
	Measures on the production side						
1	Increase of cullet portion in the batch		3,533	258		59	0
2	Batch preheating*		16,958	1,238	1,200	232	5.2
3	Reduction in production losses	473	9,624	1015	50	267	0.2
4	Reduce excess air to furnace and maintain regular control		2,675	192	10	50	0.2
5	Process control saves energy and raw materials		1,683	121	114	64	1.8
6	Improving annealing equipment	312		215	150	59	2.6
	Measures on the supply side						
7	Monitoring & Targeting system	167	5,101	480	400	79	5.1
8	Implement compressed air leakage repair and awareness program	233		160	0	44	0
9	Improve lighting housekeeping	11		8	0	2	0
	Total	**1,196**	**39,574**	**3,685**	**1,924**	**854**	**2.3**

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MIEEIP Experience

Steel Sector

No	Measure	Energy savings		CO2	Capital	Annual	Payback	Priority
		Electricity MWh/yr	Fuels GJ/yr	Reduction t/yr	expenditure th.RM	cost saving th.RM	time yr	
	Energy saving measures at SM2-Steel making plant							
1	SM2 compressor control adjustment	189		130		33		2
2	SM2-inlet air cooler installation	309		212	30	54	0,6	2
	Energy saving measures at RM1-rolling mill							
3	RM1-Cooling water flow reduction	169		116		30		2
	Energy saving measures at RM1-compressed air							
4	RM1-RF furnace and rolling mill air systems interconnection	308		212		54		1
5	RM1 compressed air pressure reduction	24		16		4		3
6	RM1-Repair of compressed air leakages	74		51		13		3
7	RM1-inlet air cooler installation	29		20	15	5	2,9	3
	Energy saving measures at RM1-reheting furnace							
8	RM1RF-Furnace outlet door repair and adjustment		7 922	578		88		1
9	RM1RF-Lower combustion air excess resetting		11 960	873	100	132	0,8	1
10	RM1RF two -stage recuperator installation		19 223	1 403	400	213	1,9	3
	Energy saving measures at RM2-quenching system							
11	RM2 Steel quenching pumps VSD	2 292		1 574	250	403	0,6	1
12	RM2-cooling water flow reduction	185		127		32	2,4	2
	Energy saving measures at RM2-rolling mill							
13	RM2-cooling water flow reduction	185		127		32		2
	Energy saving measures at RM2-compressed air							
14	RM2-Repair of compressed air leakages	243		167		43		3
15	RM2-Inlet air cooler installation	85		59	20	15	1,3	3
16	RM2-Compressor control	1 120		769	15	197	0,1	1
	Energy saving measures at RM2-reheting furnace							
17	RM2RF Combustion air fan variable speed control	120		82	60	21	2,8	3
18	RM2- Furnace door adjustment		7 110	519		79		1
19	RM2RF-Combustion air excess immediate reduction		2 337	171		26		2
20	RM2RF-Fuel atomization at upper and soaking zone		1 846	135	20	20	1,0	3
21	RM2RF Lower zone burners refurbishment		2 325	170	50	26	1,9	3
22	RM2RF Flue gas utilization in heat recovery steam boiler		37 966	2 772	500	420	1,2	1
23	RM2RF recuperator pipe temperature control		3 020	220	5	33	0,1	2
	Energy saving measures at boiler rooms							
24	Boiler RMD1259 excess air reduction		215	17		2		none
	Other energy saving measures							
25	RM1 & RM2 Compressors predictive maintenance	126		86		22		2
26	SM2 cleaning of the compressor 1st. stage blading	171		118	25	30	0,8	2
	Total	**5 479**	**93 925**	**10 622**	**1 505**	**2 003**		

Kriterium used for priority evaluation (1-high, 2-middle, 3-lower) was net cost saving within 2 years.

0-Detail

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Pulp & Paper Sector

No	Measure	Energy savings		CO2 Reduction t/yr	Capital expenditure th. RM	Annual cost savings th.RM	Payback time yr
		Electricity MWh/yr	Fuels GJ/yr				
	No cost measures:						
1	Power shut down at night	171	-	118	-	44	-
2	Air Compressor leaks	157	-	108	-	40	-
	Change compressor operation	15		10		4	
3	Compr.+Dryer shut off	104	-	72	-	27	-
4	Boiler readjust	-	767	56	-	14	-
5	Reduce Boiler blowdown	-	100	7	-	2	-
6	Repair steam leaks	-	2165	160	-	45	-
	Low cost measures:						
7	Replace pneumatic pumps	24	-	16	3	6	0.5
8	Insulate boiler + condensate	-	3503	256	7	73	0.1
9	Insulate piping to the WWD	-	2291	170	50	48	1.0
10	Pump condensate from WWD	-	1409	104	25	29	0.8
Total		**471**	**10,235**	**1,077**	**85**	**333**	

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MIEEIP Experience

Rubber Sector

No	Measure	Energy Savings		CO_2 Reduction	Capital Expenditures	Annual Cost savings	Payback time
		Electricity MWh/yr	Fuels GJ/yr	t/yr	th. RM	th. RM/yr	yr
1	**Thermo oil heaters**						
1.1	Readjustement of burners		14,765	1,093	0	248.6	-
1.2	Flue gas heat recovery		7,734	572	100	43.4	2.3
2	**Waste water treatment**						
2.1	Reduce air intake	144.3		98	13	25.2	0.5
3	**Compressed air system**						
3.1	Reduce pressure	97.9		67	8	17.1	0.5
4	**Preparation activities**						
4.1	Reduce agitation in active vessel	45.4		31	1	7.9	0.1
4.2	Conduct grinding in off peak times				0	2.3	-
4.3	Shift homogenation to night shift				0	3.3	-
5	**Leeching bath**						
5.1	Reduce Waterflow		3,867	286	0	65.1	-
5.2	Cover bath		241	18	3	4.1	0.7
6	**LPG shock heating**						
6.1	Divide LPG-burner head		304.9	20	8	7.3	1.1
	Total	**288**	**26,912**	**2,185**	**133**	**424**	

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Wood Sector

No	Measure	Energy Savings		CO_2	Capital	Annual	Payback
		Electricity MWh/yr	Fuels GJ/yr	Reduction t/yr	Expenditures th.RM	Cost savings th.RM/yr	time yr
1	**Log yard**						
1.1	Reduce moisture content of logs	-	13,035.3	1,017	270	213	1.3
2	**Chip-dryer**						
2.1	Replacement of the dust-burner *)		64,882.0	5,061	1,000	1,063	0.9
				-			
3	**Thermal oil heat supply**			-			
3.1	Retrofit economizer of the heater		3,085.7	225	55	51	1.1
3.2	Replacement of the oil fired heater*)		37,385.5	2,729	1,700	440	3.9
4	**Compressed air**						
4.1	Reduce compressed air pressure*)	39.6		27	10	7	1.5
5	**Energy management**						
5.1	Load management*)				40	26	1.5
Total	Low cost option, items: 1.1 , 2.1, 3.1, 4.1 and	**39.6**	**16,121.0**	**1,269**	**375**	**297**	**1.3**
Total	High cost option, items 2.1, 3.2, 4.1 and 5.1	**39.6**	**102,267.4**	**7,817**	**2,750**	**1,536**	**1.8**

*) no-cost/low-cost measure

**) Measure which has been considered in the evaluation mentioned in Table 0.2-1

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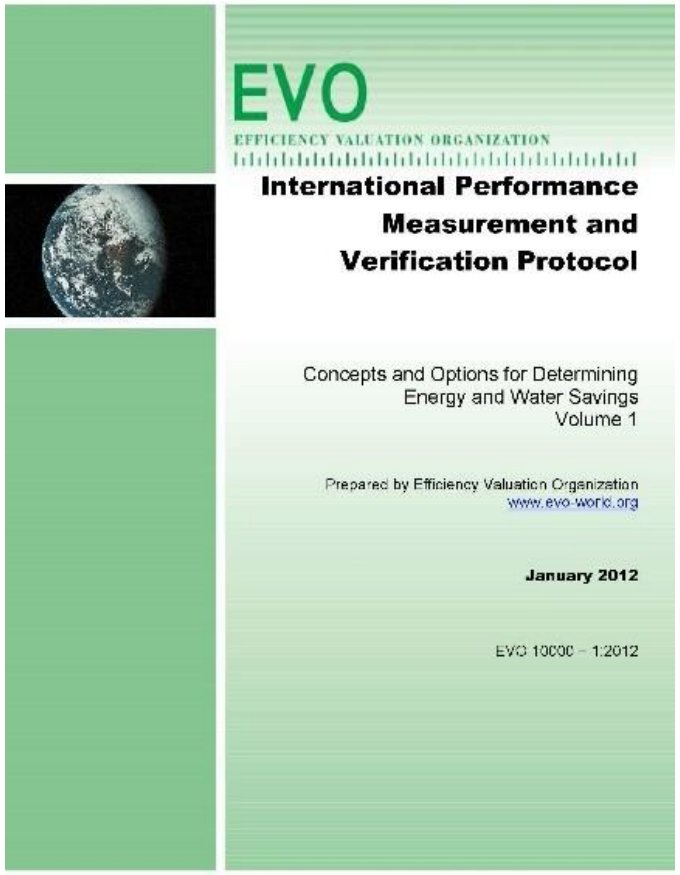
INTERNATIONAL

International Performance Measurement and Verification Protocol (IPMVP)



Developed by a volunteer committee under the U.S. DOE in 1994, the first version of this protocol was released in 1996 under the name North American Energy Measurement and Verification Protocol (NEMVP). At the time, investments in energy efficiency were low because of the considerable uncertainty about energy savings.
The different measurement and verification protocols that existed were for the most part inconsistent, which increased doubt about savings computations.

To reduce this uncertainty, an international protocol was established describing the different methods to determine the water or energy savings of an energy efficiency project.

To date, the IPMVP is in its seventh edition, version, translated into more than 11 languages and is distributed for free throughout the world. Since 2001, the committee in charge of the IPMVP has developed into EVO, a not- for- profit organization to improve the protocol's content and promote its use.

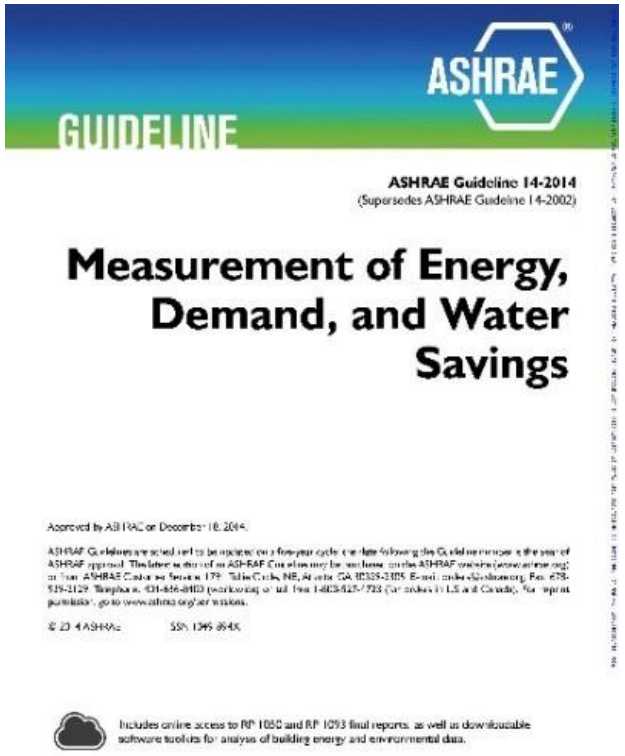
INTERNATIONAL

FEMP M&V Guidelines Version 4.0

FEMP M&V Guidelines was developed to provide specific methods and directives for the measurement and verification of energy savings obtained from a performance contract targeting a federal building. It contains procedures and guidelines for quantifying the savings resulting from cogeneration, renewable energy, water conservation and energy efficiency equipment projects. The current is Version 4.0 published in November 2015.

INTERNATIONAL

ASHRAE Guideline 14 - 2014



ASHRAE Guideline 14-2014 provides guidelines for reliably measuring the energy, demand and water savings achieved in conservation projects.

It provides procedures for using measured pre-retrofit and post retrofit billing data (e.g., kWh, kW, others) used for the calculation of energy, demand and water savings. The procedures:

i) include the determination of energy, demand and water savings from individual facilities or meters;

ii) apply to all forms of energy, including electricity, gas, oil, district heating/cooling, renewables; and to water and wastewater; and

iii) encompass all types of facilities: residential, commercial, institutional, and industrial.

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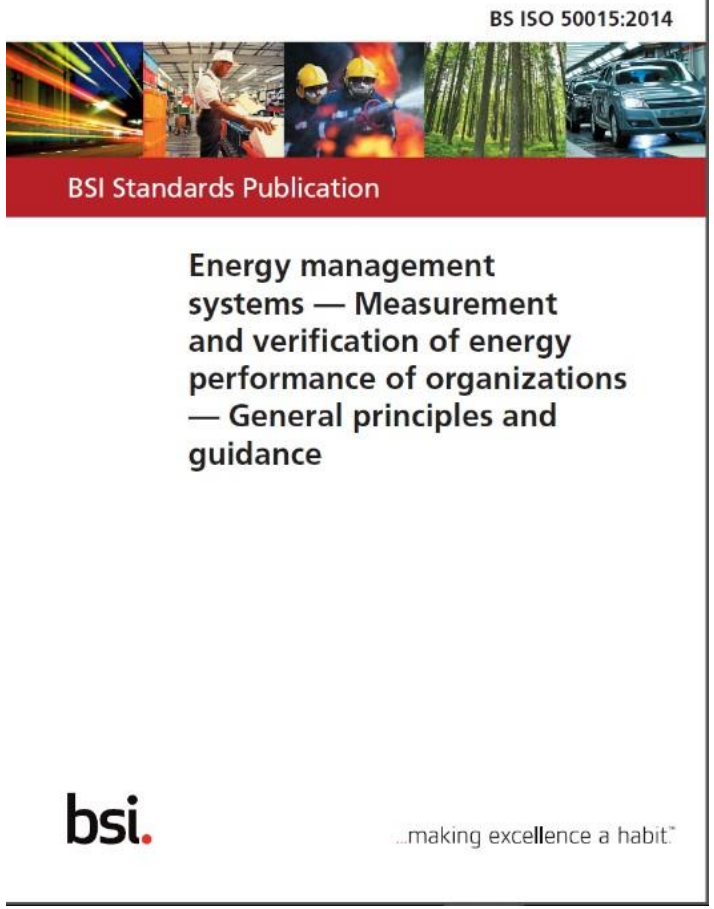
INTERNATIONAL STANDARD

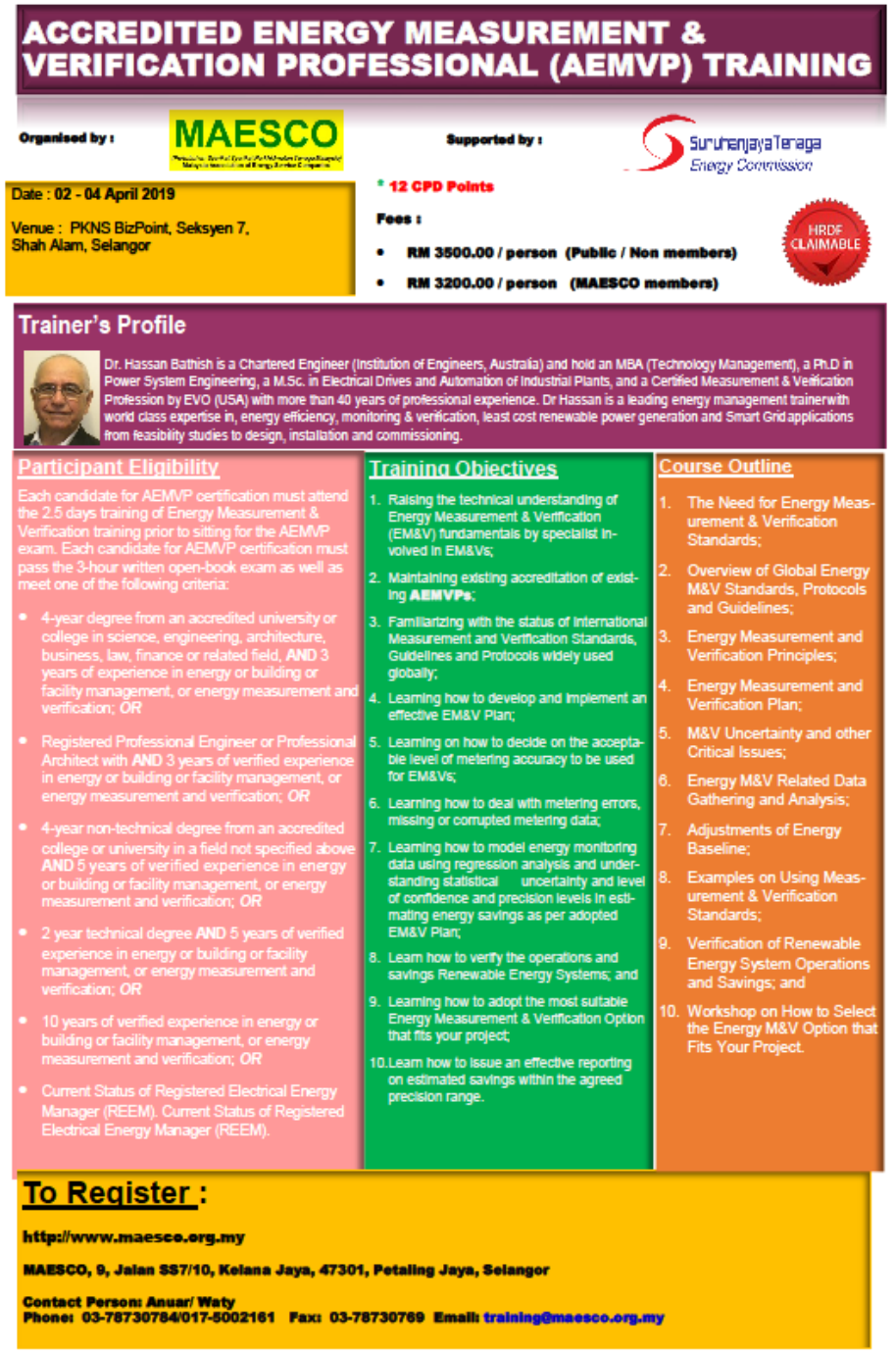
ISO 50015, 2014 Standard



In December of 2014, the International Organization for Standardization (ISO) issued the first edition of ISO 50015:2014. This Standard is labelled Energy management systems - Measurement and verification of energy performance of organizations--General principles and guidelines. ISO 50015 was developed to work in conjunction (or independently) with other standards such as ISO 50001:2012 - Energy management system that outlines the model of improving efforts for quality and environment standards. The new issue, ISO 50015, outlines the framework for measurement and verification of these energy management systems.

ISO 50015 complements the International Performance Measurement and Verification Protocol (IPMVP) although they are not officially linked. This standard sets out to establish a common set of principles and guidelines to be used for the measurement and verification of energy performance.

LOCAL CERTIFICATION



ACCREDITED ENERGY MEASUREMENT & VERIFICATION PROFESSIONAL (AEMVP) TRAINING

Organised by : MAESCO

Supported by : Suruhanjaya Tenaga Energy Commission

Date : 02 - 04 April 2019

Venue : PKNS BizPoint, Seksyen 7, Shah Alam, Selangor

* 12 CPD Points

Fees :

- RM 3500.00 / person (Public / Non members)
- RM 3200.00 / person (MAESCO members)

HRDF CLAIMABLE

Trainer's Profile

Dr. Hassan Bathish is a Chartered Engineer (Institution of Engineers, Australia) and hold an MBA (Technology Management), a Ph.D in Power System Engineering, a M.Sc. in Electrical Drives and Automation of Industrial Plants, and a Certified Measurement & Verification Profession by EVO (USA) with more than 40 years of professional experience. Dr Hassan is a leading energy management trainerwith world class expertise in, energy efficiency, monitoring & verification, least cost renewable power generation and Smart Grid applications from feasibility studies to design, installation and commissioning.

Participant Eligibility

Each candidate for AEMVP certification must attend the 2.5 days training of Energy Measurement & Verification training prior to sitting for the AEMVP exam. Each candidate for AEMVP certification must pass the 3-hour written open-book exam as well as meet one of the following criteria:

- 4-year degree from an accredited university or college in science, engineering, architecture, business, law, finance or related field, **AND** 3 years of experience in energy or building or facility management, or energy measurement and verification; *OR*
- Registered Professional Engineer or Professional Architect with **AND** 3 years of verified experience in energy or building or facility management, or energy measurement and verification; *OR*
- 4-year non-technical degree from an accredited college or university in a field not specified above **AND** 5 years of verified experience in energy or building or facility management, or energy measurement and verification; *OR*
- 2 year technical degree **AND** 5 years of verified experience in energy or building or facility management, or energy measurement and verification; *OR*
- 10 years of verified experience in energy or building or facility management, or energy measurement and verification; *OR*
- Current Status of Registered Electrical Energy Manager (REEM). Current Status of Registered Electrical Energy Manager (REEM).

Training Objectives

1. Raising the technical understanding of Energy Measurement & Verification (EM&V) fundamentals by specialist involved in EM&Vs;
2. Maintaining existing accreditation of existing **AEMVPs**;
3. Familiarizing with the status of international Measurement and Verification Standards, Guidelines and Protocols widely used globally;
4. Learning how to develop and implement an effective EM&V Plan;
5. Learning on how to decide on the acceptable level of metering accuracy to be used for EM&Vs;
6. Learning how to deal with metering errors, missing or corrupted metering data;
7. Learning how to model energy monitoring data using regression analysis and understanding statistical uncertainty and level of confidence and precision levels in estimating energy savings as per adopted EM&V Plan;
8. Learn how to verify the operations and savings Renewable Energy Systems; and
9. Learning how to adopt the most suitable Energy Measurement & Verification Option that fits your project;
10. Learn how to issue an effective reporting on estimated savings within the agreed precision range.

Course Outline

1. The Need for Energy Measurement & Verification Standards;
2. Overview of Global Energy M&V Standards, Protocols and Guidelines;
3. Energy Measurement and Verification Principles;
4. Energy Measurement and Verification Plan;
5. M&V Uncertainty and other Critical Issues;
6. Energy M&V Related Data Gathering and Analysis;
7. Adjustments of Energy Baseline;
8. Examples on Using Measurement & Verification Standards;
9. Verification of Renewable Energy System Operations and Savings; and
10. Workshop on How to Select the Energy M&V Option that Fits Your Project.

To Register :

http://www.maesco.org.my

MAESCO, 9, Jalan SS7/10, Kelana Jaya, 47301, Petaling Jaya, Selangor

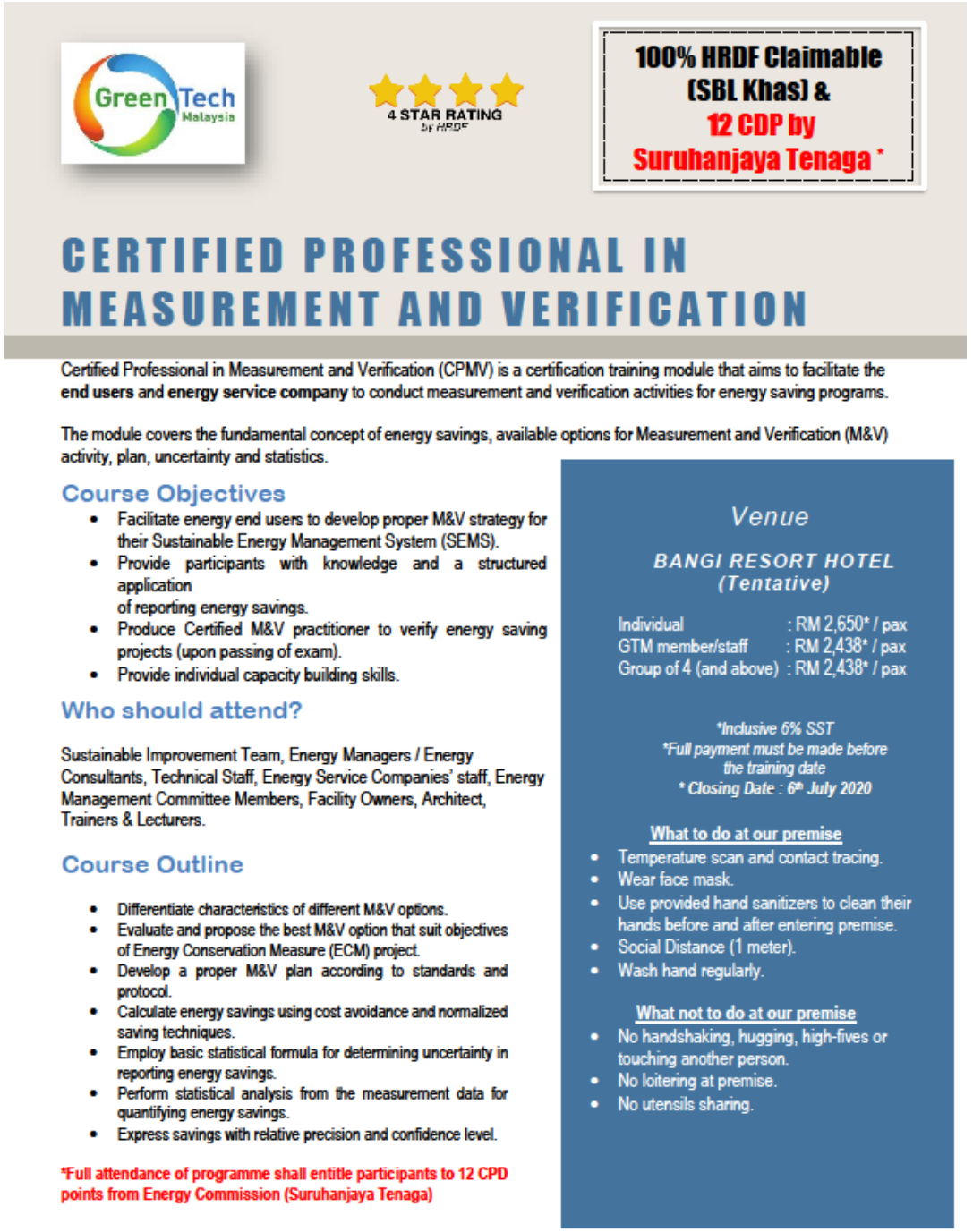
Contact Person: Anuar/ Waty
Phone: 03-78730784/017-5002161 Fax: 03-78730769 Email: training@maesco.org.my

Accredited Measurement & Verification Professional (AEMVP) by MAESCO

MAESCO
(Pertubuhan Syarikat Syarikat Perkhidmatan Tenaga Malaysia)
Malaysia Association of Energy Service Companies

LOCAL CERTIFICATION

Certified Professional in Measurement and Verification (CPMV) by GreenTech



MAESCO
(Pertubuhan Syarikat Syarikat Perkhidmatan Tenaga Malaysia)
Malaysia Association of Energy Service Companies


Together we can turn this crisis around
Lend a hand
And Remember
go RED to go GREEN
Thank You

-End of Session-

MAESCO
(Pertubuhan Syarikat Syarikat Perkhidmatan Tenaga Malaysia)
Malaysia Association of Energy Service Companies

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