Korea's ESCO Market Status & M&V Issue

KAESCO's Director Mr. Dien Yoon

2024.10.

KAESCO

KAESCO Introduction

Establishment

: July 1999

Chairman

: Lee Im Sik

Address

: 31 30gil Digital-ro Guro-gu Seoul

Goal

: The association aims to support the rights of ESCO member companies by enhancing friendship and mutual cooperation among ESCO members and to make contribution to the promotion of energy conservation markets and the establishment of climate change framework by dealing with environmental changes for the sake of economic development of Korea. .

History

- . 1999 Establishment of KAESCO
- . 2003 ESCO Performance Business Assignment (Ministry of Trade, Industry and Energy)
- . 2006 Business Assignment based on Investment Capabilities(MOTIE)
- . 2007 International Cooperation of ESCO Business
- . 2010 Building Energy Efficiency Improvement Program
- . 2016 CMVP Courses for International M&V Experts

Membership

: Full Memberships 114, Special Membership 4

KAESCO - main Business

ESCO Status - Overview

CONCEPT

ESCO provides Energy Users with Integrated Energy-Saving Solutions

- It offers project cost and receives the benefits and investment fee in return from the saving cost
- It works to improve energy efficiency, offers maintenance services and technical support, and builds infrastructure
- It proposes integrated efficiency management system during payback period

MAIN ROLE

ESCO supplies service in the course of exchanging or supplementing the existing facilities with energy efficient ones

* Field Survey, Audit, Project Proposal, Installation/Construction, Test Run, Maintenance Service

Major Project Areas of ESCOs

- Management and Service for Energy Savings in Energy Using Facilities
- Energy Efficient Facility Investment
- Research and Development on Energy Efficient Facilities and Equipments

ENERGY SERVICE COMPANY

ESCO Status - Registration

ESCO Registration Criteria

- Application for registration(KEA)→Document review→On-site Inspection→Registration certificate(Issued in 15days)→Annual report (Sales performance, compliance of registration qualification)→Report review, Withdrawal request(KEA→MoTIE)

➢ **Legal Basis : Energy Use Rationalization Act, article 25 (Also, article 30, asterisk 2)**

Type	Contents		Criteria
Equipment	1. Infrared thermometer		1 or more
	2. Data recorder		1 or more
	3. Thermometer・Hygrometer		1 or more
Asset	Corporate	Capital	$200,000 or higher
	Private	Estimated value of asset	$400,000 or higher
Technical HR	Technicians in the areas of architecture, machinery, materials, chemistry, electricity, electronics, telecommunication, energy or gas in accordance with the National Technical Qualification Act		3 persons or more

ESCO Status - Market size

ESCO Market Size

- After reaching the peak of 310 million USD in 2013, it has been continuously decreasing to 152.4 million USD in 2016 and 50.2 million USD in 2019 because of internal and external factors around the market. Since then, it shows growth at 5.5% (CAGR*)

  * CAGR(Compound Annual Growth Rate)

(Unit: USD million)

Type	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23
Total	320.9	299.9	316.6	275.3	187.1	152.4	81.5	88.8	50.2	96.8	101	70.5	116.2

Government Fund Supports

(Unit: USD million)

Type	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23
Project No.	223	292	227	149	83	80	24	31	21	28	15	8	25
Value (USD)	297.9	276.6	309.7	254	163.1	123.5	52.1	53.7	16.1	41.3	41	37	88.2

* Exchange rate : 1USD = 1,000KRW

ESCO Status - Market size

Government Fund Supports(by Facility)

- The Funds were focused on the lightings of buildings at first but now diversified to recovery of waste heat, industrial process improvement, cooling & heating, LED and other ECMs and renewable energy facilities (New/renewable energy facilities were excluded from the funding since 2017)

(Projects No. (USD Million))

Type	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23
Lightings	75 (16.1)	102 (18.6)	53 (14.3)	20 (6.6)	17 (4.0)	21 (7)	8 (6.5)	10 (4.7)	9 (5.1)	18 (12.6)	7 (6.1)	3 (2.3)	5 (5.3)
Boiler	18 (40.4)	24 (43.4)	2 (2.4)	2 (1.9)	3 (1.6)	-	2 (1.8)	1 (0.5)	-	5 (19.6)	-	-	-
Process improvement	33 (46.9)	67 (58.3)	75 (108.7)	55 (95.2)	21 (31.8)	23 (29.3)	7 (11)	7 (9.6)	8 (8.9)	2 (8.2)	2 (1.1)	1 (0.6)	7 (54.5)
Recovery of waste heat	49 (149)	49 (107.9)	24 (91.5)	20 (60.4)	8 (35.9)	3 (3.2)	-	5 (11.6)	-	-	2 (16.2)	1 (15)	1 (14.2)
Cooling/heating equip.	14 (11.5)	9 (8.1)	2 (2.6)	1 (2)	1 (6)	-	-	1 (1.7)	1 (0.6)	-	-	-	-
Power equipment	20 (6.1)	21 (4.5)	47 (37.9)	32 (17.3)	18 (13.2)	13 (5.1)	2 (3)	3 (1.5)	2 (1.4)	3 (0.9)	1 (0.3)	-	6 (13)
New/renewable	13 (27.9)	12 (27.8)	11 (36.9)	12 (63.3)	14 (76)	18 (77.8)	4 (36.9)	3 (23.9)	-	-	-	-	-
Others	1 (1)	8 (8.1)	13 (15.4)	7 (7.3)	1 (1)	2 (1.1)	1 (5)	1 (0.2)	1 (0.1)	-	3 (17.3)	3 (19.1)	6 (1)
Sum	223 (297.9)	292 (276.6)	227 (309.7)	149 (254)	83 (163.1)	80 (123.5)	24 (53.7)	31 (53.7)	21 (16.1)	28 (41.3)	15 (41)	8 (37)	25 (88.2)

* Exchange rate : 1USD = 1,000KRW

ESCO Status - Market size

Government Fund Supports(by Target)

- The share of public sectors in terms of ESCO investment becomes bigger, and the markets of buildings sectors should be discovered further.

(Unit : %)

Type	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23
Industrial facilities	58	66	75	90	82	76	71	67	46	29	53	75	80
Buildings	31	27	19	6	8	8	4	12	10	14	-	-	-
Public sectors	11	7	6	4	10	16	25	21	44	57	47	25	20

Korea's EE Policies

Set up NDC Plan

- Set up "2020 GHG National Determined Contribution"(NDC) ('09.11)
- Set up "2030 GHG NDC('15.6)
- Make a basic Roadmap to achieve "2030 NDC"('16.12)
- Updated a basic Roadmap to achieve "2030 NDC"('18.7)
- Final updated "2030 NDC" and submitted to UN('20.12)

Government EE Goals

- "3rd Basic Energy Plan"('19.6)
  – improve Final consumption unit by 38% by '40 compares to '17
- "Energy Carbon Neutrality Innovation Strategy"('21.12)
  – Improve by more than 30% by '30 compared to '18, and by more than 40% by '50
- "Comprehensive Measures for Energy Demand Efficiency"('22.6)
  – Improve energy unit by 25% over the next 5 years(until '27)

Korea's EE Policies

EE Policy status of Implementation

- **(Industrial Sector)** – Identifying energy waste factors in industrial companies ⇒ Encouraging energy saving ⇒ Supporting investment in energy saving facilities
- **(Building Sector)** – Encouraging energy saving building design ⇒ Expanding the supply of high-efficiency buildings ⇒ Optimizing building energy performance

Industrial Sector

1 Identifying energy waste factors in industrial companies

– Energy consumption report for energy-intensive businesses : Collecting and analyzing trends in information such as energy usage status, investment in energy-saving facilities and savings performance, and facility status

– Energy Audit : Mandatory audit every 5 years or less for energy-intensive businesses (over 2,000 toe per year)

2 Inducing savings

– Energy Efficiency Goal Management System : Certify companies that have achieved voluntary efficiency improvement goals as excellent workplaces and provide incentives.

– Cooperation on energy-saving technology information : Establish a joint consultative body for energy conservation among similar industries and share energy management information.

– Small and medium-sized business efficiency improvement consulting and facility investment assistance : Provide free consulting and partial subsidy for individual energy-saving facility costs to improve the efficiency of small and medium-sized businesses

Korea's EE Policies

EE Policy status of Implementation

Industrial Sector

3 Investment in energy-saving facilities

– Financial support for facility investment : Investment in energy-saving facility installation and financial support for energy-saving specialized companies (ESCOs)

– Support for establishing energy management systems : Support for establishing energy management systems and FEMS for small and medium-sized enterprises

Korea's EE Policies

EE Policy status of Implementation

- **(Industrial Sector)** – Identifying energy waste factors in industrial companies ⇒ Encouraging energy saving ⇒ Supporting investment in energy saving facilities
- **(Building Sector)** – Encouraging energy saving building design ⇒ Expanding the supply of high-efficiency buildings ⇒ Optimizing building energy performance

Building Sector

1 Design

– Energy-saving design standards : Review and evaluation of energy-saving plans submitted to local governments when applying for building permits.

2 Architecture

– Building Energy Efficiency Rating : Based on design documents, the energy required for building operation such as heating, cooling, and hot water supply is evaluated and 10 grades (grades 1+++ to 7) are given according to performance.

– Zero Energy Building Certification : Maximizes building energy performance through high insulation and high airtightness, and grades (grades 1 to 5) are given according to the level of energy self-sufficiency for buildings that utilize new and renewable energy

3 Operation management

– Building Energy Management System (BEMS) distribution : Confirmation of BEMS installation and operation performance, mandatory construction for public institutions (over 10,000㎡)

Activities by Sectors in Industry

Food Industry

- High efficiency equipment replacement(boiler, pump, motor, freezer etc.)
- Exhaust gas heat(Economizer), Used steam recovery(heat exchanger, heat pump), condensate recovery
- Operational improvement & Waste removal – Air ratio control, leak steam removal, EMS & Inverter installation.
- Transition – Biomass(Wood-pellets, Wood-chip, BIO-SRF), B-C Oil → LNG, LPG → LNG

Food Industry case

- ORION – Recovery of exhaust heat from a potato chip production fryer
- LOTTE CHILSUNG BEVERAGE – Water tube boiler heat exchanger installation
- Maeil – High efficiency utility installation, use of eco-friendly packaging
- CJCHEILJEDANG – Biomass fuel transition, buying waste heat incineration heat
- DAESANG – Exhaust fan inverter control, fuel transition(B-C Oil → LNG), pump efficiency improvement, High efficiency equipment(turbo blower, compressor)

Activities by Sectors in Industry

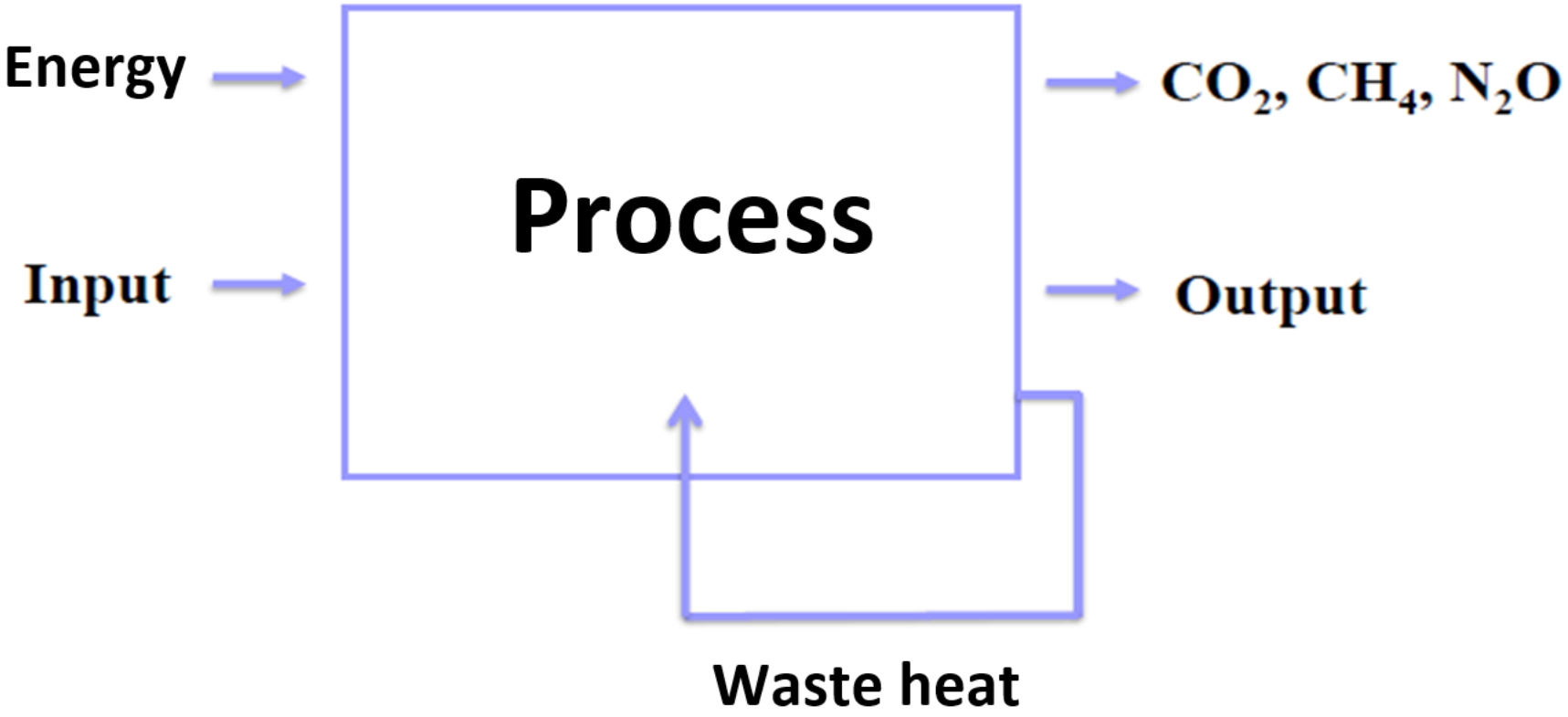
Cement Industry

- **Expansion of recylcled fuel –** Expansion of waste synthetic resin and bio use.
- **Raw material recycling –** Waste concrete recycling
- **Efficiency improvement –** High efficiency process & equipment installation, FEMS, waste heat power generation
- **Green power use, CCUS utilization**

Textile Industry

- **High efficiency equipment –** improving efficiency(boiler, motor, air compressor etc)
- **Raw material, yarn manufacturing process –** High speed spinning system, waste recovery
- **Raw fabric, dyeing, processing** – minimize water use such as high-speed digital printing and color printing, installation of process continuation system
- **Improvement of productivity** such as automation & robot sewing machines

Why ESCO?



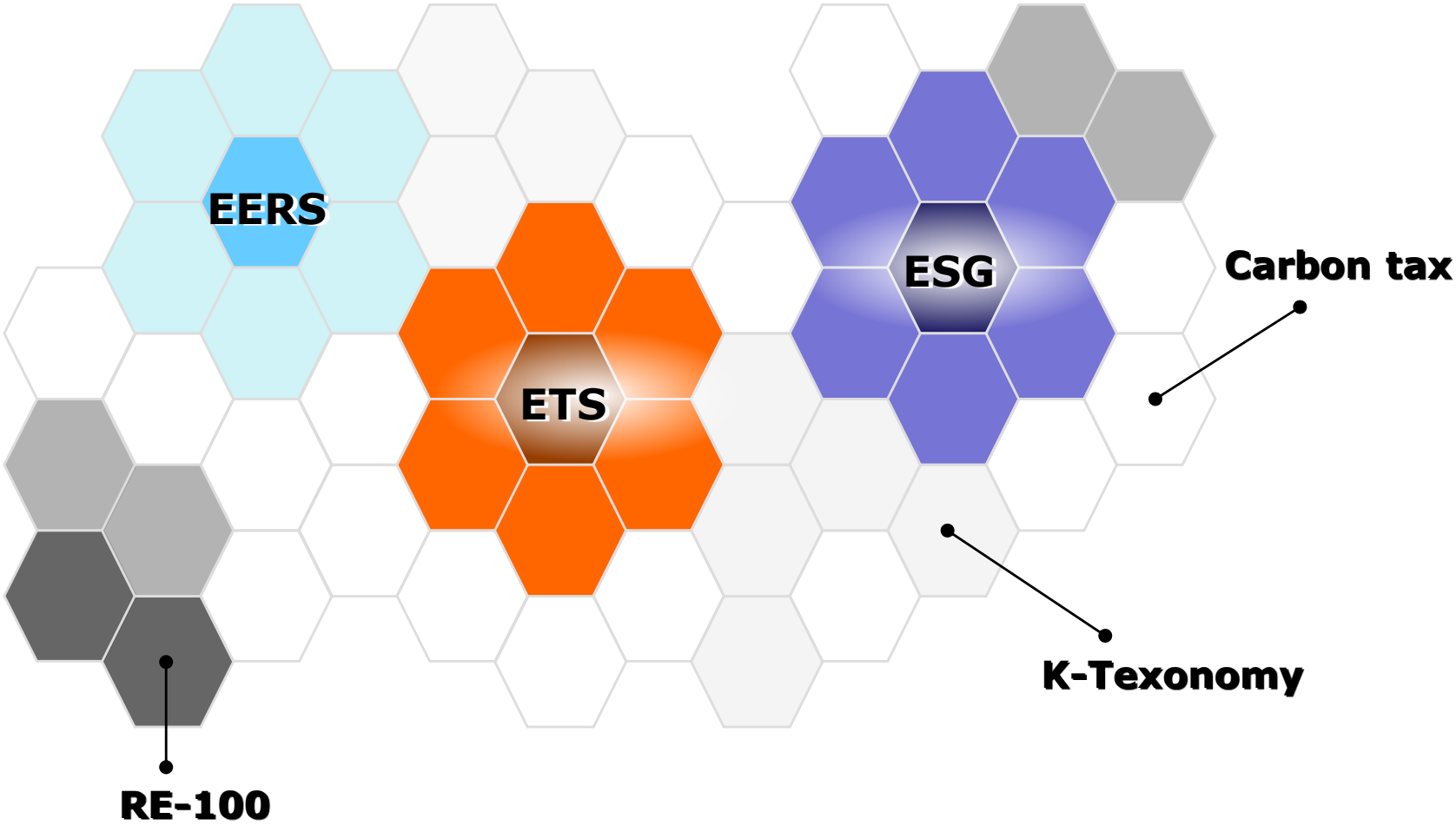
* 출처 : Dr. JaeHoon Lee(2019)

Why ESCO?

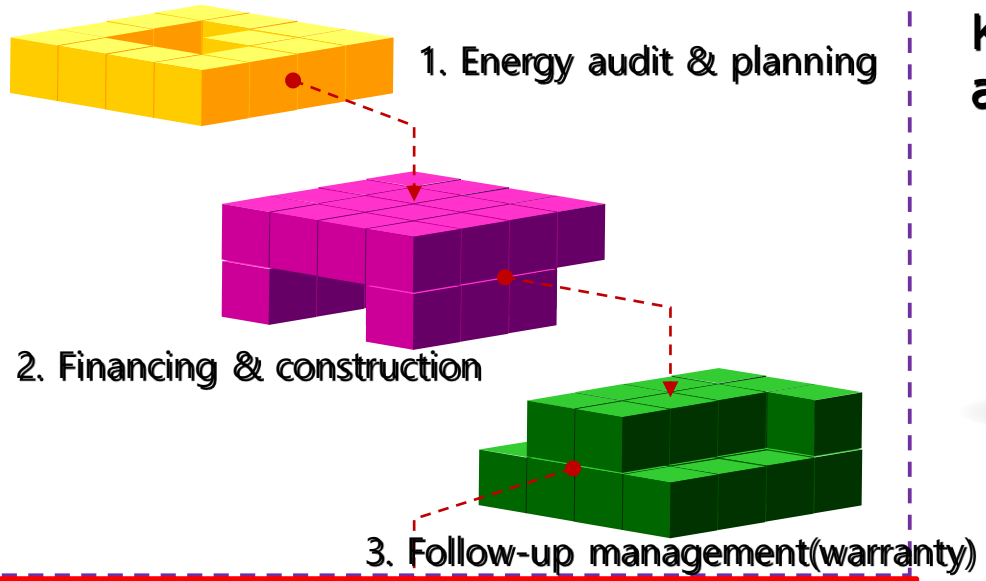
GHG = Energy Problem

Carbon Neutrality related ESCO Issues

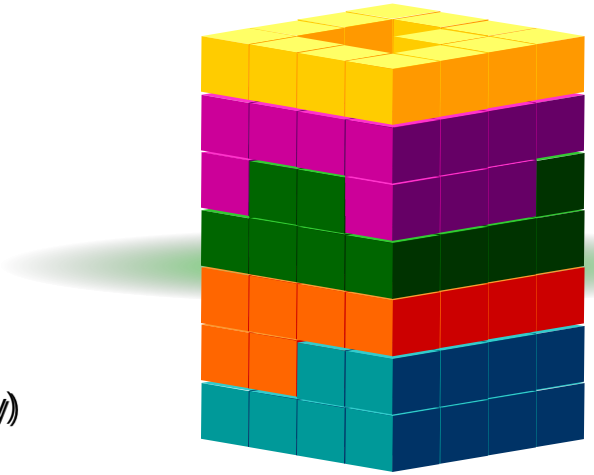
Issue & Issue



ESCO Role?



Key to improve energy efficiency and reduce GHG



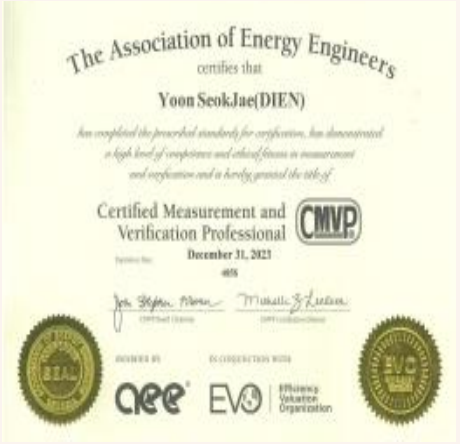
Expectation to play a leading role in achieving carbon net-zero and achieving NDC

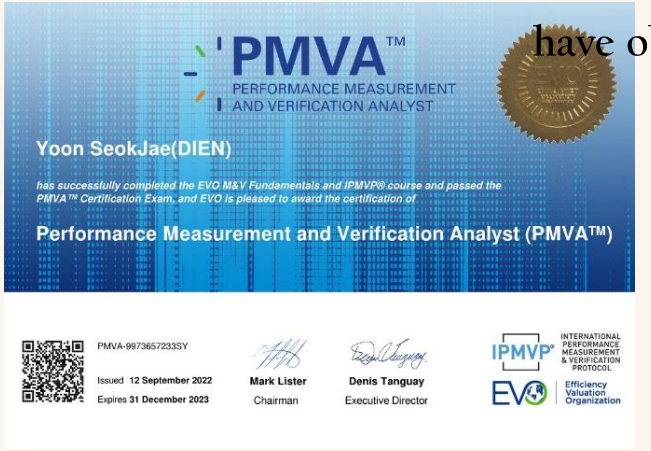
EE Measurement & Verification Expert

☑ “Energy Efficiency Measurement & Verification Expert” selected as a new government-funded job (2021)

We are continuously discussing additional support measures, such as preferential treatment for ESCOs with credible M&V experts, and the development of national competency standard ‘energy saving service’ related curriculum through autonomous school regulations for universities (mid to long term).

✔ CMVP/PMVA





“About 200 people” have obtained domestic qualifica

ESCO - M&V Paln

M&V Plan Guidline

(사)에너지절약전문기업협회
Korea Association of ESCO

M&V 프로토콜은 대표적으로 IPMVP, FEMP, ASHARE Guideline14 등이 있으며, 그 외 목적에 따라 여러 프로토콜이 개발되어 있다.

IPMVP를 중심으로 M&V 계획서 작성방법을 소개하고 있으며, IPMVP M&V원칙인 정확성, 온전성, 보수성, 일관성, 적절성, 투명성 등을 준수하기 위한 최소한의 요구사항들을 포함하여야 한다.

☞ **일반적인 M&V 비용 < 에너지절감액**

☞ **M&V에 추정치나 판단이 많이 반영되는 경우, 에너지절감액을 더욱 보수적으로 평가하여 정확성을 높여야 함**

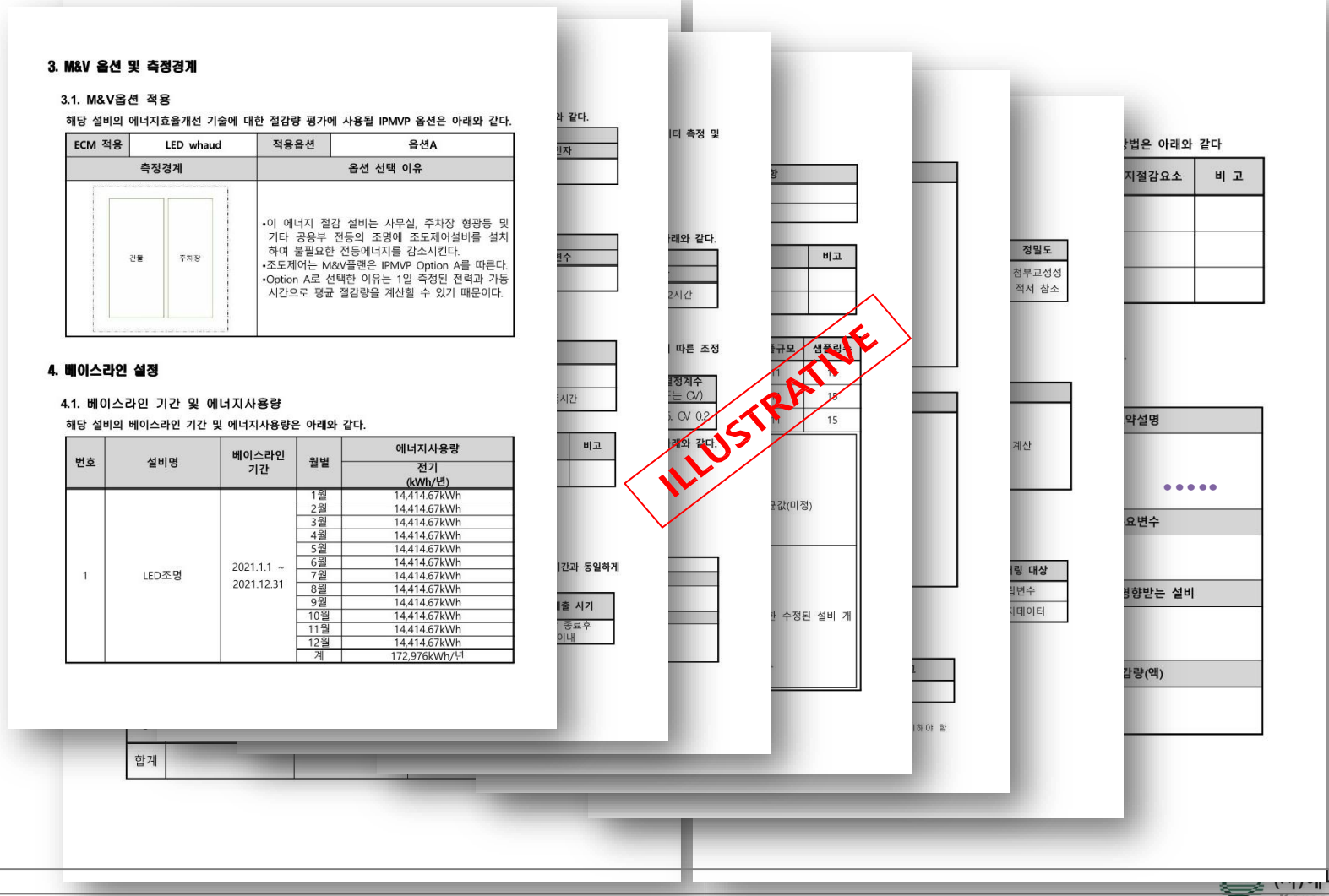
IPMVP를 준수하는 M&V 계획의 필수적인 요구사항은 아래 표와 같이 14가지 항목으로 각 항목별 작성방법을 참고하여 작성한다.

< M&V 계획 작성시 필수항목 >

1	시설 및 사업개요	2	ECM 의도(취지)	3	IPMVP옵션 및 측정경계
4	베이스라인: 기간, 사용량 및 조건	5	보고기간	6	조정 근거
7	계산방법론과 분석절차	8	에너지가격	9	측정장비 사양
10	모니터링 책임	11	예상 정확도	12	예산
13	보고서 형식	14	품질보증		

ESCO - M&V Paln

M&V Plan Writing Case Study



3. M&V 옵션 및 측정경계

3.1. M&V옵션 적용

해당 설비의 에너지효율개선 기술에 대한 절감량 평가에 사용될 IPMVP 옵션은 아래와 같다.

ECM 적용	LED whaud	적용옵션	옵션A
측정경계		옵션 선택 이유	
건물 / 주차장		•이 에너지 절감 설비는 사무실, 주차장 형광등 및 기타 공용부 전등의 조명에 조도제어설비를 설치하여 불필요한 전등에너지를 감소시킨다. •조도제어는 M&V플랜은 IPMVP Option A를 따른다. •Option A로 선택한 이유는 1일 측정된 전력과 가동시간으로 평균 절감량을 계산할 수 있기 때문이다.	

4. 베이스라인 설정

4.1. 베이스라인 기간 및 에너지사용량

해당 설비의 베이스라인 기간 및 에너지사용량은 아래와 같다.

번호	설비명	베이스라인 기간	월별	에너지사용량 전기 (kWh/년)
1	LED조명	2021.1.1 ~ 2021.12.31	1월	14,414.67kWh
			2월	14,414.67kWh
			3월	14,414.67kWh
			4월	14,414.67kWh
			5월	14,414.67kWh
			6월	14,414.67kWh
			7월	14,414.67kWh
			8월	14,414.67kWh
			9월	14,414.67kWh
			10월	14,414.67kWh
			11월	14,414.67kWh
			12월	14,414.67kWh
			계	172,976kWh/년

Still the same Barriers

Barriers of ESCO

Finance

- Lack of Trust and Unprepared Contract Mechanism in regard to new technology
- High Transaction Cost in comparison with Project Size
- Low benefits of energy efficiency projects

ESCO

- High Cost of Project Development
- Limited Technology and Business and Incompetency of Risk Management
- Uncertainty of Government Support in Setting Business Plan
- Risk of Delay in Payment by Energy User

Public Side

- Budget Crunch in Energy Efficiency Improvement Project
- Fear of Risk and Lack of Awareness and Technology
- Lack of Awareness in regard to Contract Method of ESCO Program
- Limited Financing in relation to Operation Cost and Capital Stock

ESCO Project Case

ESCO case I

□ Replace a low efficiency boiler for increasing Waste Heat
- Installation Period : Sep. 2010 ~ Oct. 2011

Before

Low capa. Boiler(low efficiency)
15t/h x 2ea

Waste Water Evaporator
10t/h x 2ea

After

Replace with New High Efficiency boiler
30t/h x 2ea

Replace with New High Efficiency Evaporator
20t/h x 2ea

○ Energy Conservation Results

- Energy saving : 9,985 toe/y
- Investment Cost : 9.47 mill.(USD)
- Payback Period : 2.0 years

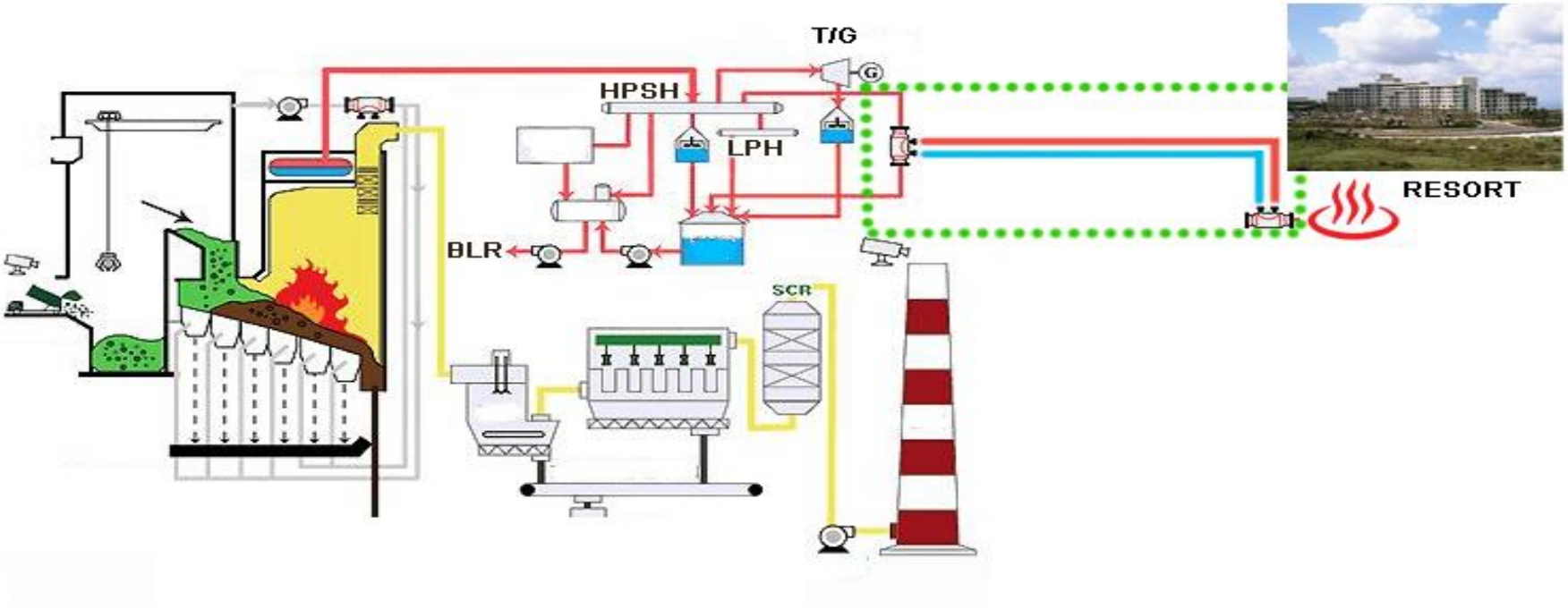
ESCO Project Case

ESCO case II

Project title: Waste Heat to energy trade business

Project owner: Jeju North Environment control center

- Project period:: January, 2012 ~ July, 2019



ESCO Project Case

ESCO case II

Financing analysis

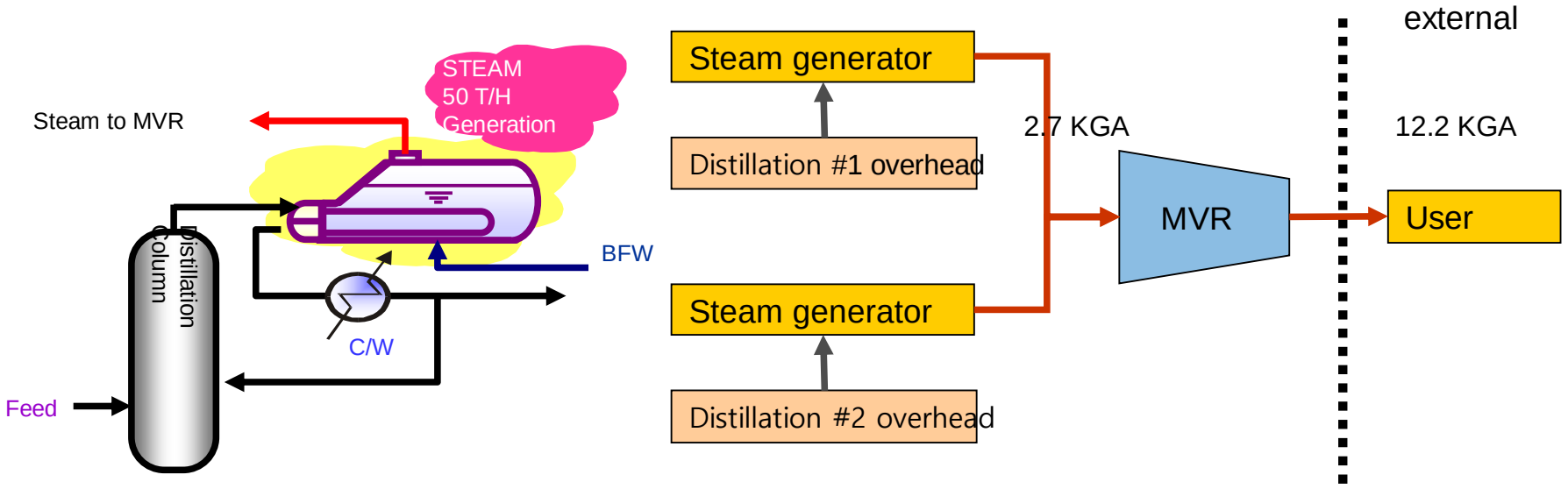
item	description	remarks
Heat supply (3 years)	3,702 Gcal/yr (370Toe)	300 days/year
Basic trading amount	3,400 Gcal/yr (340Toe)	Based on min. demand (saving amount)
Unit supply cost	KW85,200 Won/Gcal	Contract cost
Investment total	US$1,358,000	Including financing cost
Trade sharing amount (rate of sharing)	US$289,680/year	Jeju city : 30%. ESCO investor: 70%
Refunding amount of investment	US$202,776 /year	70% of trade amount
payback period	6.7 years	80 months

ESCO Project Case

ESCO case III - Waste Heat Recovery & Vapor recom

■ CLIENT	K - 社	■ SAVING ENERGY	13,000 TOE/Year
■ PERIOD	2009. 3 ~ 2010. 9	■ SAVING COST	8,700,000 USD/Year

- To recover energy from overhead vapor of two distillation columns, two steam generators installed respectively.
- Then, steam generated were compressed by using MVR in order to be supplied to external user.

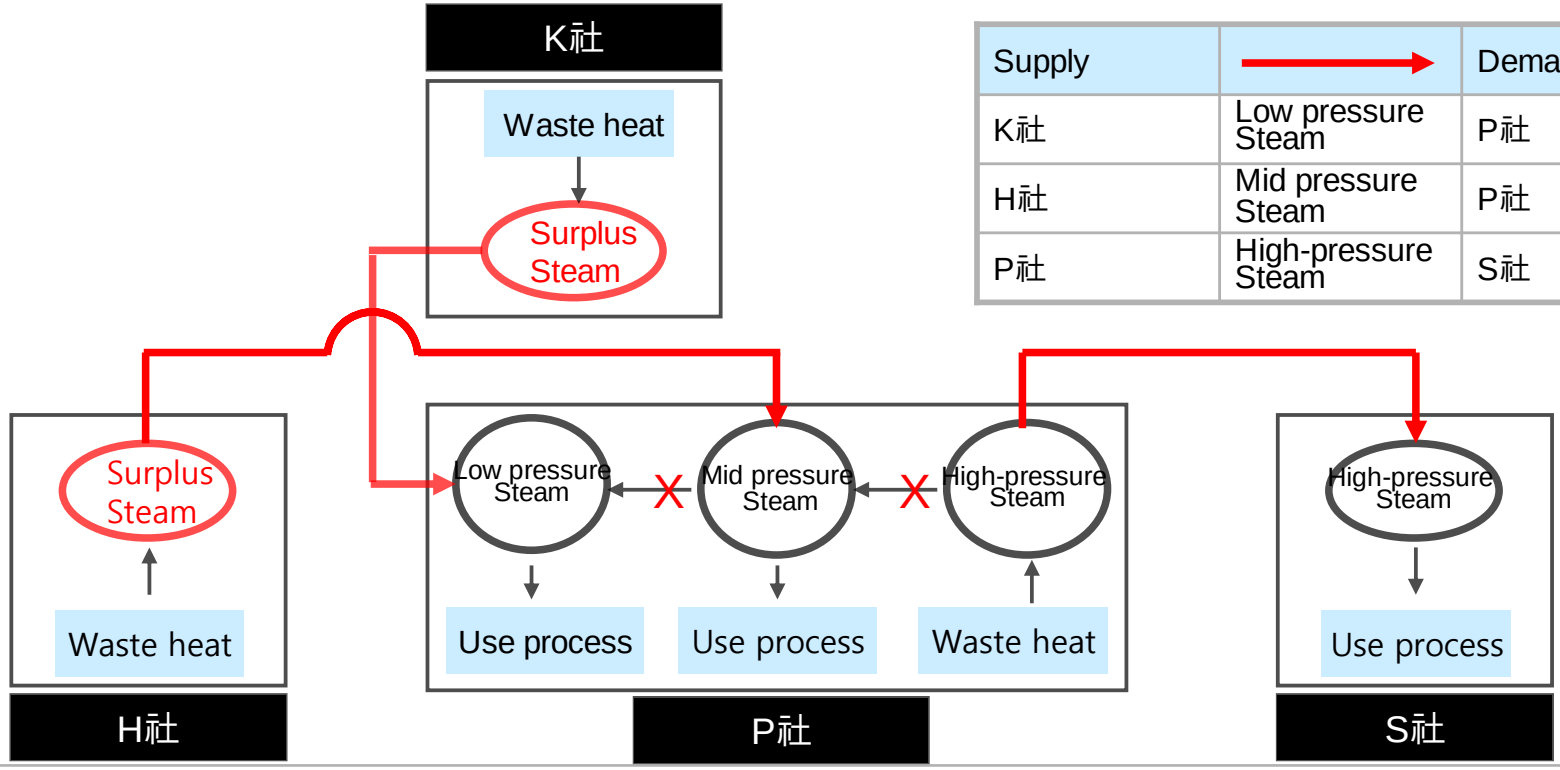


ESCO Project Case

ESCO case IV-Steam Network System

■ CLIENT	S-社 外 3個社	■ SAVING ENERGY	15,840 TOE/Year
■ PERIOD	2008. 7 ~ 2009. 2	■ SAVING COST	7,450,000 USD/Year

- **Integration of steam network for four companies made their revenues improved enormously.**



Supply	→	Demand
K社	Low pressure Steam	P社
H社	Mid pressure Steam	P社
P社	High-pressure Steam	S社

ESCO Project Case

ESCO case V – K** University Project

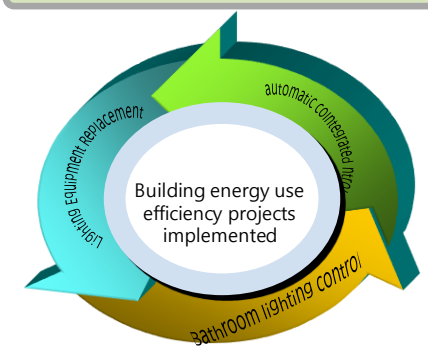
		투자정보	
Client	K - University		- Improved High-Efficiency LED Lighting Fixtures
Location	145 Anam-ro Seongbuk-gu Seoul Korea		
Scale facilities	Total ground area 514,126㎡, 65 building		- Integrated the building automation system
Investment	3,968 One million won		
Energy savings	692 one million/year		
Payback period	60 month		
ESCO Period	2012. 1 ~ 2012. 7		

SYSTEM OVERVIEW

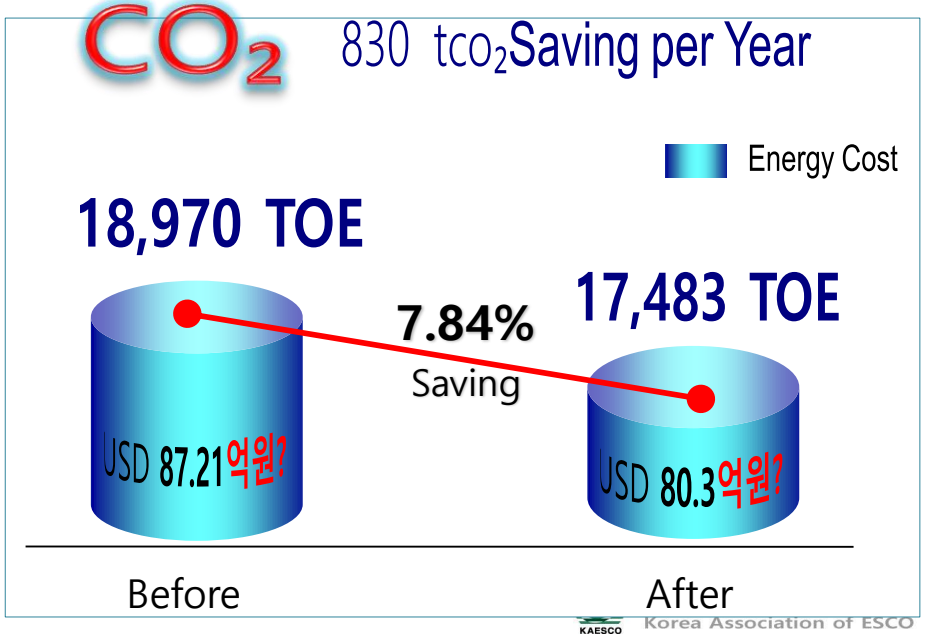
Improved High-Efficiency LED Lighting Fixtures
(55Buildings / Section 35,535 applies to public**)**
- **Energy savings for 688 million / year**
- 5 years free A / S can be added to reduce maintenance costs

Integrated building automation system
(First 4 buildings power / lighting integrated automatic control)
- The building energy consumption targets for lighting control and power monitoring
- Build a future based on the entire campus automation integration

Bathroom lighting control
(Buildings 49/495 points apply)
- Energy savings for 36 million dollars/year
- **Increased energy savings by adding 5 more**



ENERGY SAVING PEPORMANCE



ESCO Project Case

ESCO case VI - Local Government LED Lighting ESCO Project

(a) A City LED Street Lighting ESCO Project

- Investment : One Million USD
- Project Period : 2017.12 ~ 2018.4.

Energy Consumption(MWh)		Energy Saving(MWh)	Saving Ratio (%)	Saving Cost(M USD)	Payback Period(y)
Before	After				
1,450.4	466.55	983.85	67.83	0.12	8.4

(b) 00 Mountain Tunnel LED ESCO Project

- Investment : 480,000 USD
- Project Period : 2017.6 ~ 2017.8.
- Item : Before - High pressure Sodium lamp 150W, After – LED 75W

Energy Consumption(MWh)		Energy Saving(MWh)	Saving Ratio (%)	Saving Cost(USD)	Payback Period(y)
Before	After				
1,462.35	635.8	826.54	56.5	92,500	5.2

Thank You

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