



2020 Project Cooperation

Cloud-based Smart IoT Lab

– Power Saving and Cyber Security



New Bulgarian University (NBU)
Bulgaria



Taiwan Environmental Information Association (TEIA)



Institute for Information Industry (III)
Republic of China (Taiwan)

2020-10-07



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1. Cloud-based Smart IoT Lab Project Initiation

- a cyber secured digital solution for environment friendly world

1.1 Project Objectives and Benefit – Cloud-based Smart IoT Lab Partnership in Intelligent Lighting/Energy Efficiency Development and Cybersecurity

It is proposed that a Cyber Secured Cloud-based Smart IoT Lab partnership be built to address intelligent lighting, energy efficiency management and air quality monitoring with the objectives/benefits:

- (1) Implementing innovative Cyber Secured Cloud-based IoT (Internet of Things) Intelligent Lighting and Air Quality Monitoring System in New Bulgarian University (NBU) for power efficiency, conservation and cost saving, and CO2 reduction demonstration leading to financial and environmental benefits for sustainable green environment and global development.
- (2) Forming partnership for Smart IoT Lab best practice in planning and implementation to support continuous research and development for energy and lighting operational strategies.



1.2 Partnership in Cloud-based Smart IoT Lab

(1) New Bulgarian University (NBU), Sofia, Bulgaria



www.nbu.bg

Established – September 18, 1991

Students – 12,000

Undergraduates – 54 Programmes

Postgraduates - 100 Programmes

Doctorate Students – 30 Programmes

Location – Sofia, Bulgaria





2017 Project Cooperation - NBU and III

- Intelligent Energy Management System Installation
- Smart IoT Lab Site Survey



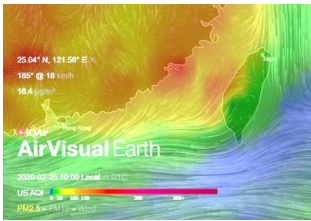


(2) Taiwan Environmental Information Association (TEIA)

<https://teia.tw/en>

A. Taiwan Environmental Information Association (TEIA) is a non-profit and non-governmental organization established in Taipei, Taiwan in June of 2001. The mission is to work towards a world where human coexists harmoniously with nature.

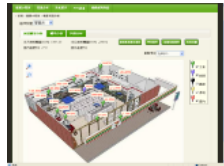
B. TEIA is dedicated to two primary goals: enhancing the distribution of environmental information and promoting the model of environmental charitable trust.



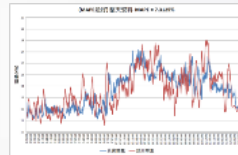


(3) Institute for Information Industry (III) www.iii.org.tw

- ❖ Founded in 1979 by government and industry jointly as a non-profit organization sponsored by the Ministry of Economic Affairs (MOEA) with founding mission:
 - Facilitate the development of Taiwan's ICT industry
 - Promote the deployment of ICT in public and private sectors, and provide innovative ICT services worldwide
- ❖ Provides fully integrated Smart Grid and Intelligent Energy Management R&D and system implementation solutions.



Intelligent Device and Tools for Management



Analytics



Event Detection



Smart Meter

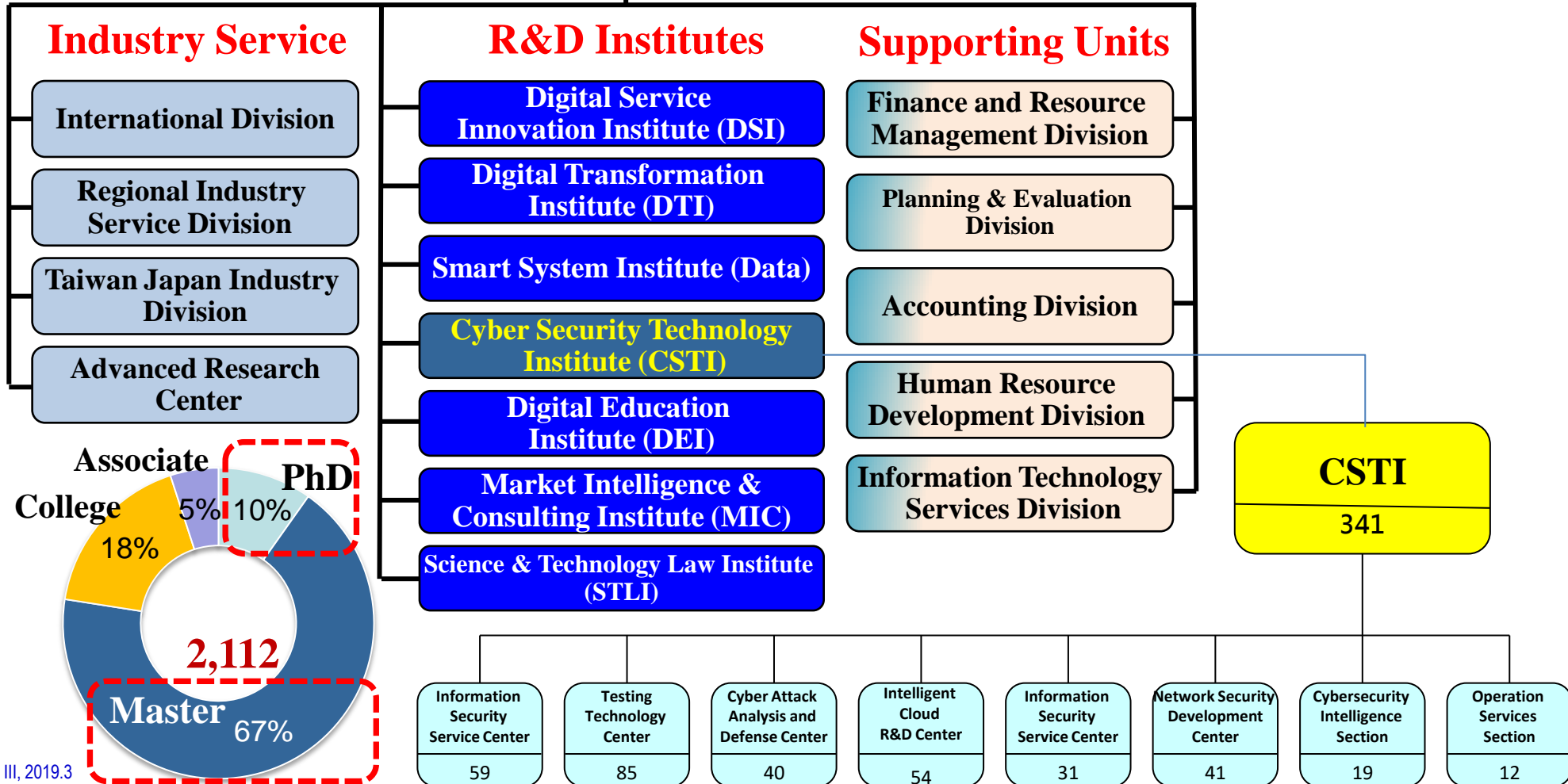
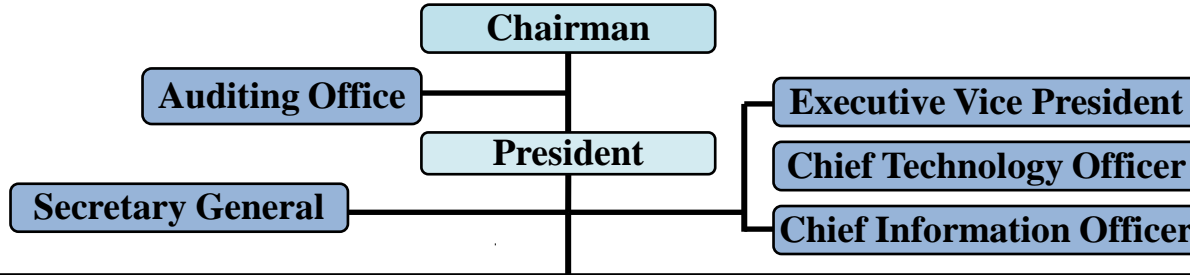


Smart Grid

- ❖ Implements Intelligent Energy Management System (IEMS) in more than 370 sites worldwide.



III Organization and Manpower



Source: III, 2019.3



III Major e-Government Systems Development

Citizen ID Card Household Reg



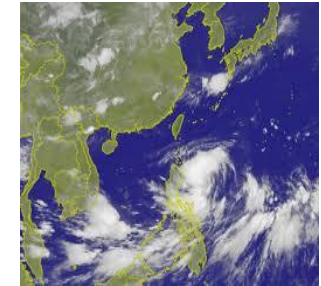
E-Agriculture



E-Healthcare



Weather



Banking



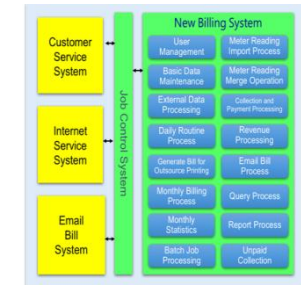
E-Tax / Custom



E-Pension



Utility Billing



E-Passport / E-Gate



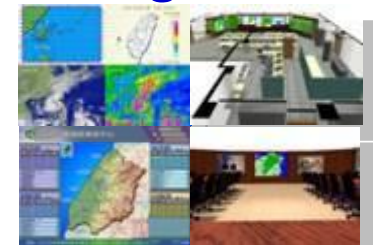
Scheduling



E-Transportation



Disaster Mitigation





III Global Presence



H.Q. ● Liaison Offices ● Digital Divide Partnership Digital Economic/Smart City Partnership



In-Light



**LED Lighting Saves More Than 60% of Power and Cost
With CO2 Reduction for Environmental Friendliness and
Return of Investment (ROI) less than 2 Years for
Outdoor and Indoor Lighting**

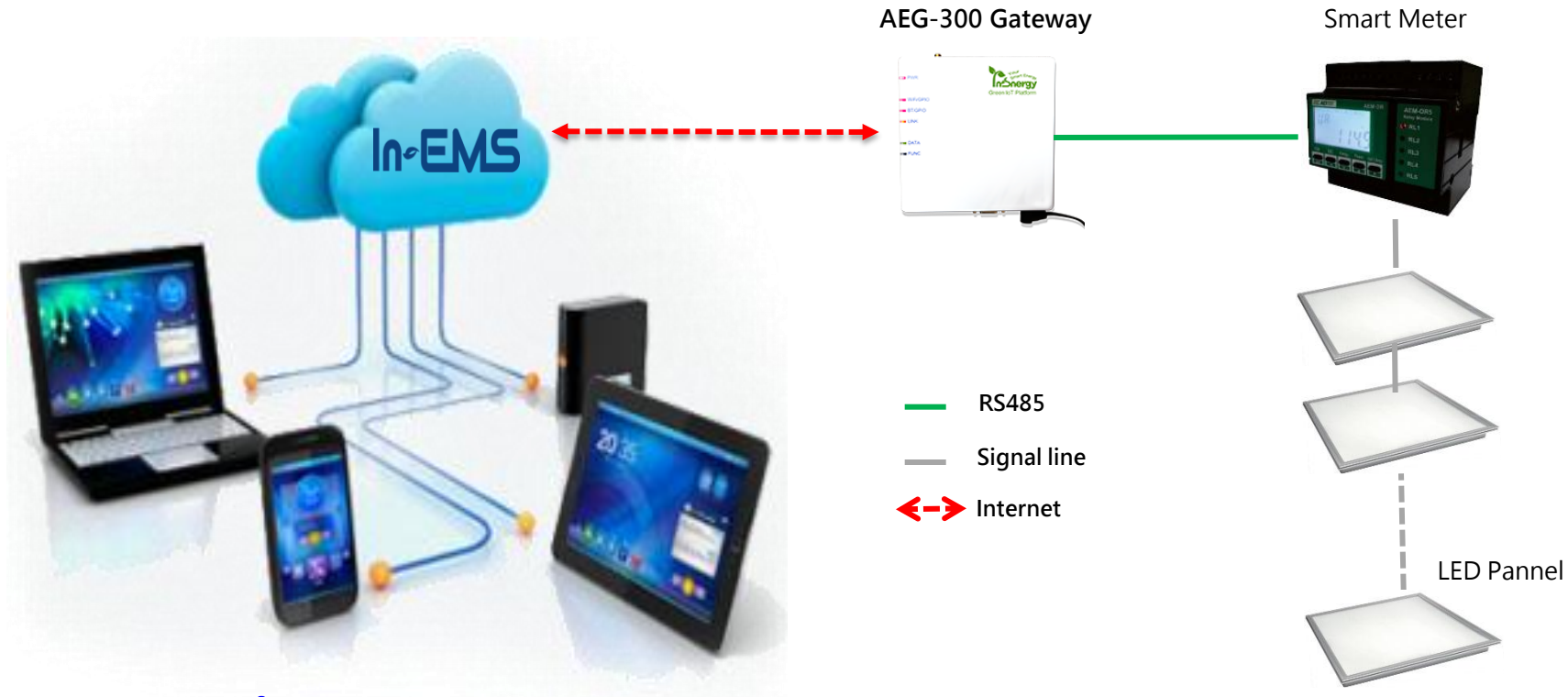


LED Panels for Indoor Lighting - Saving 60% Power with Better Lux





Smart LED Lighting Power Saving and Monitoring System Architecture - Power Saving 60%



System Functions:

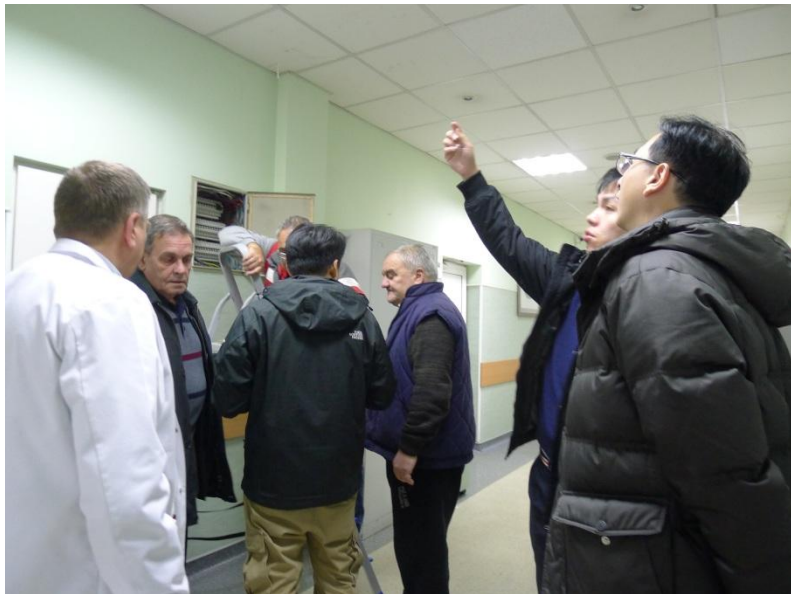
1. Real-time automatic power consumption recording via smart meters installation
2. The smart gateway collects power information from the smart meters, and send to the cloud server for data analysis and processing
3. The resulting power consumption data will be produced in report format, and can be accessed on-line



2.1 2018 Smart LED Lighting System Project - Pirogov Emergency Hospital, Sofia, Bulgaria

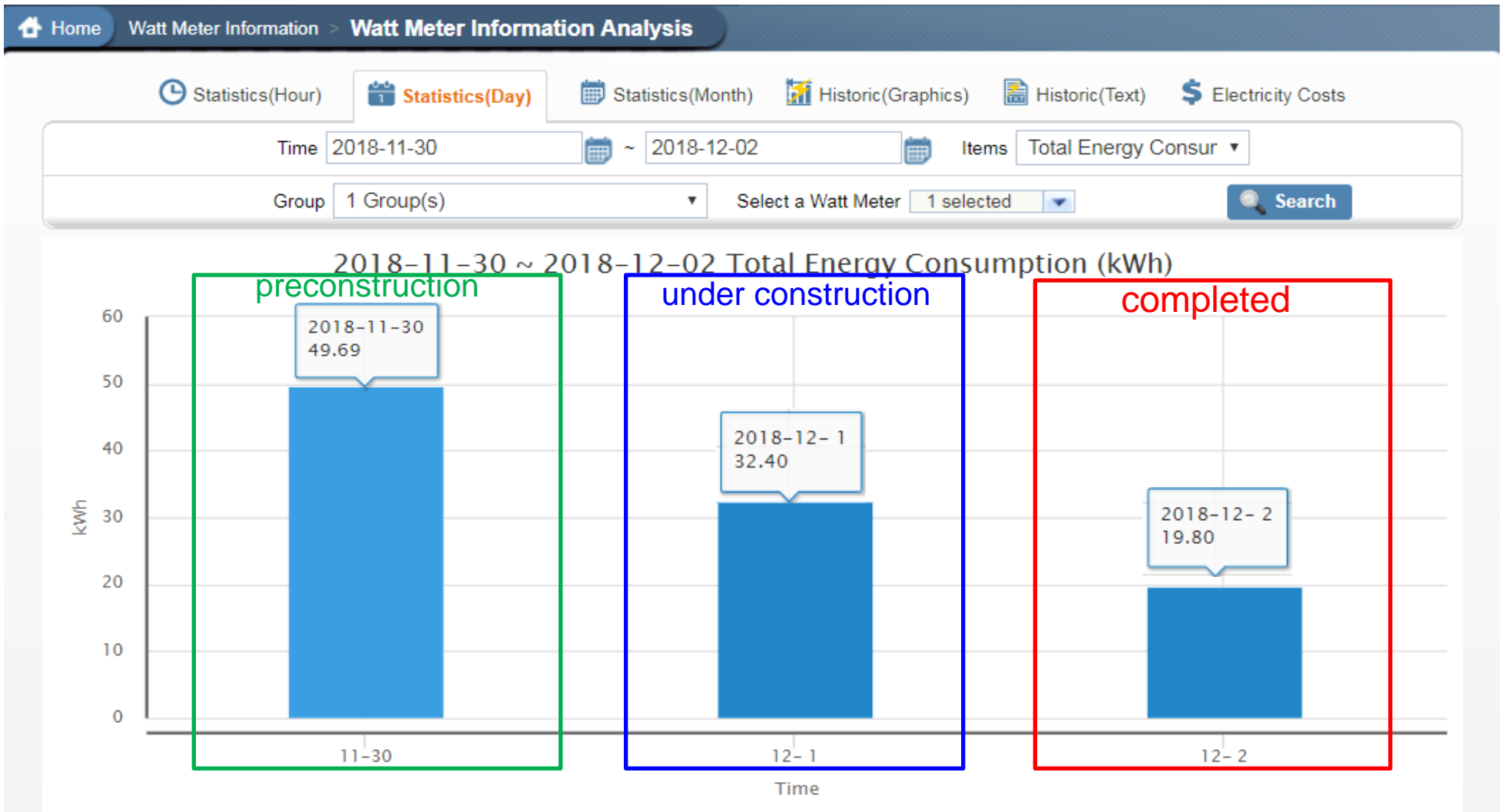


Power Saving 60%





Lighting Power Consumption Saving 60%



49.69kWh (11/30 before LED replacement) - 19.80kWh (12/2 after LED replacement) = **29.89kWh**
Lighting Power Saving Rate = 29.89kWh/49.69kWh = **60.2%**



Lighting Luminance Improvement **74.8%**

Before (T8 Lighting)



Luminance : 282 Lux

After (LED Lighting)



Luminance : **493** Lux

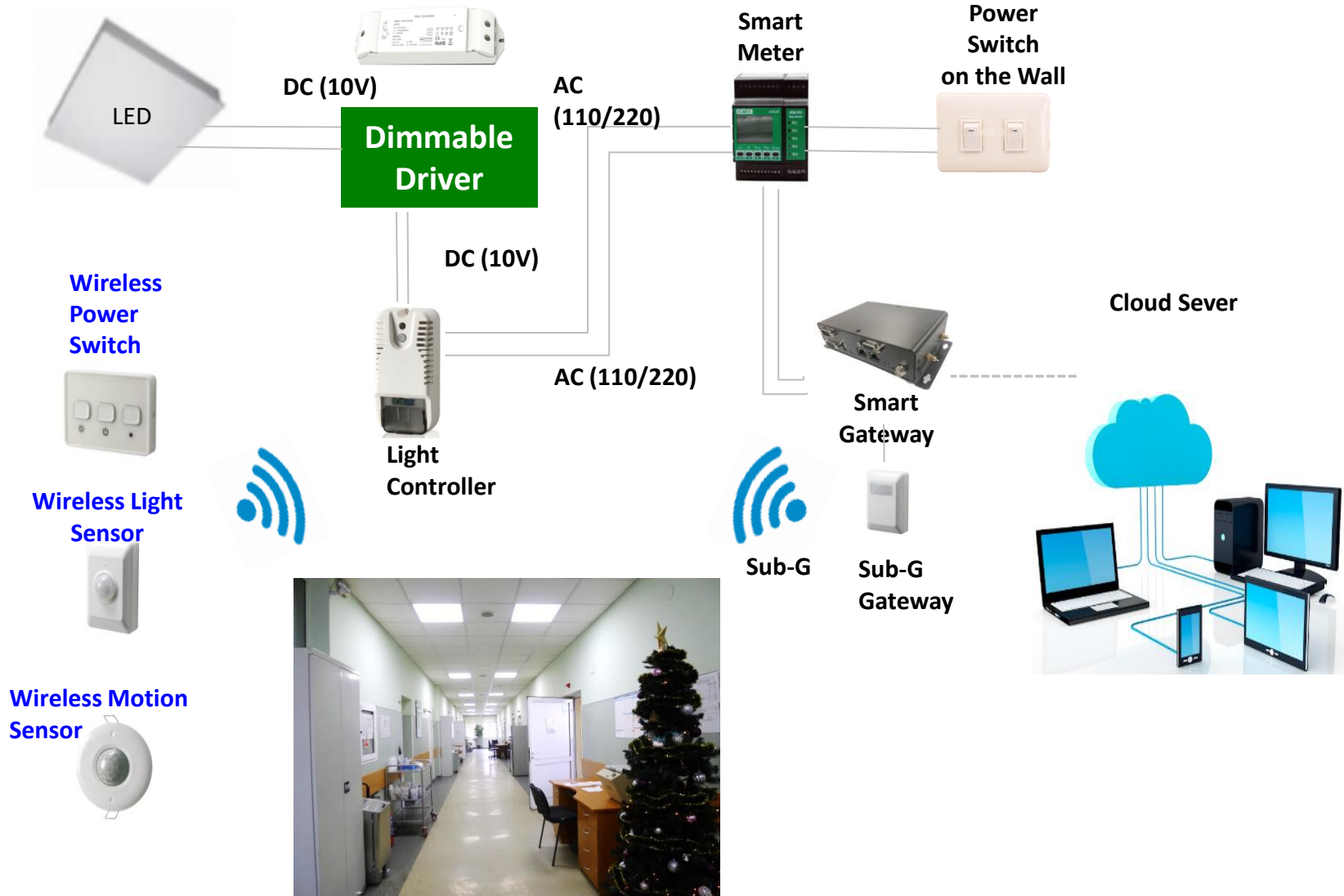
Lighting Luminance Improvement = $(493\text{Lux} - 282\text{Lux}) / 282\text{Lux} * 100\% = \mathbf{74.8\%}$



2.2 2020 Project Cooperation Proposal

Smart Lighting - Dimming Scheduling and Sensor (Light/Motion) Control

- Power Saving 10~20%

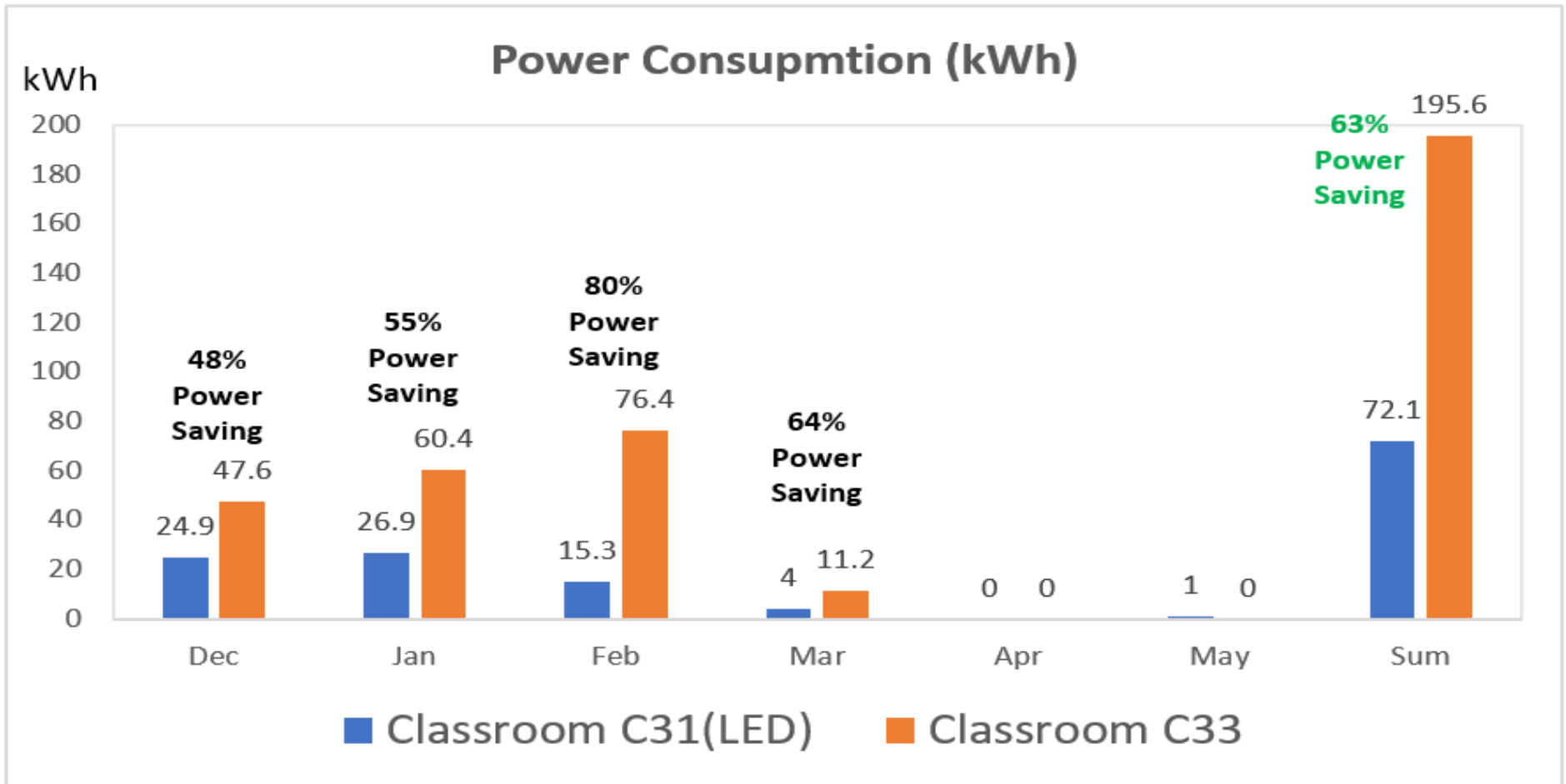




Smart Lighting System Result – Power Consumption Saving

- Smart Lighting System installed in Pelhimov Technology School, Czech Republic in December, 2019

- 2 classrooms have been installed with the system, C31 has been replaced with LED lights, C33 has not





2.2.1 User Scenario – University Room and Corridor

Smart Hospital Lighting Control Solutions:

1. Scheduling Lighting Dimming Control:

Example: 7am – 7pm (80%), 7pm – 7am (20%), Total Power Saving = 50%



2. Wireless Sensing Control:

- (1) Use motion sensor to detect the presence of person, and control the lighting on-off.
- (2) Use light sensor to detect illuminance, and control the lighting dimming for power saving
 - A. Sunny day: Illumination of the light close to the window will be adjusted to lower during the time for using.
 - B. Cloudy day: Illumination of the light close to the window will be adjusted to higher during the time for using.

3. Scenario Control: Use system setting for schedule/area scenario control/light dimming.

4. Emergency Mode:

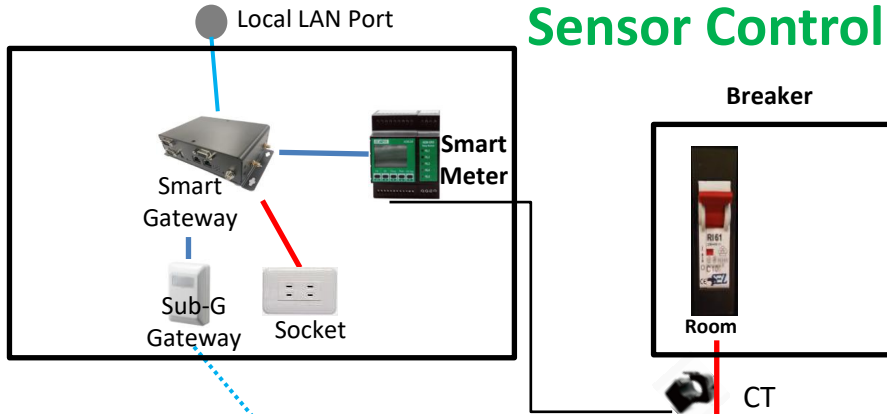
In case of emergency, the scheduled dimming and sensor functions will be off, all lights will be on.

5. Manual Mode:

In case the system is down, light should be managed manually as before.

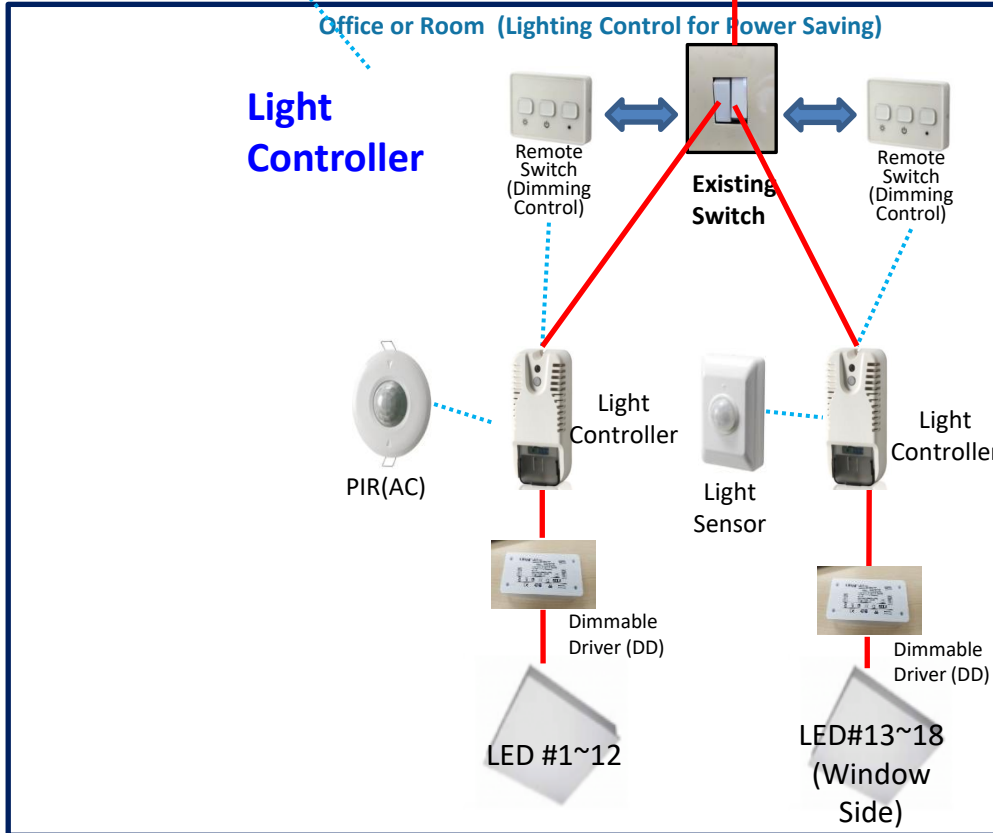


2.2.2 System Architecture – Smart Lighting Control (Dimming Scheduling and Sensor Control - Light Sensor and Motion Sensor)



- RS485
- RJ45
- ⋯ Sub G(433Mhz)
- ⋯ WiFi
- CT Wire
- Local LAN port
- AC Power

Cloud Sever





IoT Cyber Security Test for Local Processor

Test Dimension	Test Item	OWASP IoT Top 10: 2018 Cross Reference
1. Application Program	1.1 Web service-Setting Management	I9. Insecure Default Setting
	1.2 Web service-User Verification	I1. Weak, Guessable, or Hardcoded Passwords
	1.3 Web service-Networking Management	Additional Test Item
	1.4 Web service-Input Verification	Additional Test Item
	1.5 Web service-Log Security	I6. Insufficient Privacy Protection
2. Operating System	2.1 Known Vulnerability	I2. Insecure Network Services
	2.2 Network Services	Additional Test Item
	2.3 Third-party Software/Library Vulnerabilities	I5. Use of Insecure or Outdated Components
	2.4 Identification Mechanism Strength Test	I1. Weak, Guessable, or Hardcoded Passwords
	2.5 Password Cracking	I1. Weak, Guessable, or Hardcoded Passwords
	2.6 Sensitive Data Storage	I6. Insufficient Privacy Protection
3. Transmission Security	3.1 API Input Security Test	I3. Insecure Ecosystem Interface



IoT Cyber Security Test for Local Processor – Con't

Test Dimension	Test Item	OWASP IoT Top 10: 2018 Cross Reference
	3.2 API Input Identification Mechanism Strength Test	13. Insecure Ecosystem Interface
	3.3 Sensitive Data Transmission	16. Insufficient Privacy Protection 17. Insecure Data Transfer and Storage
4. Firmware	4.1 Firmware Static Test	11. Weak, Guessable, or Hardcoded Passwords
	4.2 Known Vulnerabilities	12. Insecure Network Services 15. Use of Insecure or Outdated Components
5. Physical Entity	5.1 Physical Entity Debugging Interface	110. Lack of Physical Hardening



4. Project Tasks and Schedule

4.1 Tasks – Taiwan Environmental Information Association (TEIA) / Institute for Information Industry (III)

- (1) Sign a Memorandum of Understanding (MoU) with NBU to initiate the cooperation project for the funding support 60,000 USD by the Ministry of Foreign Affairs (MoFA), Republic of China (Taiwan)
- (2) Prepare for the hardware equipment and software for the system
- (3) Ship the system hardware equipment to NBU
- (4) Visit NBU for on-site system installation
- (5) Provide training for system operation and maintenance
- (6) Prepare the project report and submit to MoFA after successful project implementation



4.2 Suggested Tasks - NBU

- (1) Sign a Memorandum of Understanding (MoU) with TEIA to initiate the cooperation project for the funding support 60,000 USD by the Ministry of Foreign Affairs (MoFA), Republic of China (Taiwan) and send a Letter of Appreciation for Funding Support to MoFA after successful project implementation.
- (2) Prepare for the system implementation in selected site - including cabling and wiring, and Internet communication access.
- (3) Support the import of the hardware devices.
- (4) Assist the system installation, integration, testing, training of the system.
- (5) Hold system launching ceremony after the successful system implementation.
- (6) Assist in power/cost saving analysis and improving process based on the output of the system, including power usage analysis report, etc.



5. IoT Hardware Devices and Cost Estimation

Item	Item Name and Specification	Unit	Qty	Unit Price	Sub Total	Remarks	
1	IoT Communication Smart Gateway	set	1	1,600	1,600		
	Lighting Control Devices						
2	2.1 Wireless Converter	set	1	140	140		
3	2.2 Wireless Motion Sensor	set	1	140	140		
4	2.3 Wireless Light Sensor	set	1	120	120		
5	2.4 Wireless Controller for Lighting Adjustment	set	2	200	400		
6	2.5 Wireless Switch	set	2	120	240		
7	2.6 Dimmable LED Driver	set	8	20	160	For 8 sets of LED panels	
	Power Consumption Monitoring Devices						
8	3.1 Smart Meter - 1 for 5 Circuits, Single Phase	set	1	1000	1000		
9	3.2 Current Transformer (CT)	set	4	100	400		
	Air Quality Monitoring Devices						
10	4.1 6-in-One Sensor for Indoor Air Quality Monitoring – Temperature, Humidity, PM2.5, PM10, CO2, TVOC	set	1	900	900		
11	4.2 Wifi Module in Gateway	set	1	200	200		
12	4.3 Controller/or Air Quality Monitoring APP	Set	1	800	800		
	Air Conditioning Control Devices						
13	5.1 Air Conditioning Controller/or Smart Glasses	set	1	900	900		
Total Hardware Devices Cost					7,000 USD x 2 sets = 14,000 USD	7,000x2=14,000	1 set for IoT Lab installation
						1 set for training	



6. Project Cost Estimation and Funding Source Suggestion

	Funding Source of the Republic of China (Taiwan)		NBU Funding Support to Project
	Taiwan Environmental Information Association (TEIA)	Funding Support to TEIA by NGO International Affairs, MoFA	
1. System Components 52,000 USD 1.1 IoT Hardware Devices 14,000 USD 1.2 Local / Cloud-based IoT Intelligent Management System 36,000 USD (1) Smart Power and LED Lighting Control System 20,000 USD (2) Smart Air Quality Monitoring System 8,000 USD (3) Smart Air Conditioning Control System 8,000 USD /or Air Quality Monitoring APP or Smart Glasses 1.3 LED Lighting and Installation Material 2,000 USD	2,000 USD	45,000 USD	5,000 USD
2. Installation and testing for the system	5,000 USD	8,000 USD	8,000 USD
3. System engineering service for project contract, system requirement analysis, system specification confirming, procurement processing, system/user/maintaining manual, training material, cloud sever usage	10,000 USD	7,000 USD	4,000 USD
4. Project Management	3,000 USD		3,000 USD
Total 100,000 USD (100%)	20,000 USD (20%)	60,000 USD (60%)	20,000 USD (20%)



7. Device Specification (CE Certified)

(1) Smart Gateway (AEG-200)



- Universal gateway has expandability, can be connected with wire and wireless communication interfaces, including Zigbee, WiFi, RS-232, RS-485, USB.
- The universal gateway supports various application services, including temperature and humidity sensing, ventilation monitoring and control, solar energy, lighting control, power monitoring and control.
- Functional services - Service information collected will be sent to the backend database for analyzing and responding with instruction for equipment control. The gateway has built-in backup mechanism for system failure.
- Web-access – Support backend communication module, and can be accessed through a web interface for control.
- W×D×H (196×123×33 mm), excluding antenna.



(2) Equipment Specification – Sub-G Gateway (GW-RS-001-1)

Gateway (RS485)

GW-RS-001-1

Description

Bridge Livinup RX/TX through RS485

Spec.

12V input
433Mhz
RS485 interface
200MTX range
Support 99 TX/RX devices
CE, EMC, FCC, RCM approved





(3) Equipment Specification – Motion Sensor (RL-PR-D01-01)

Wireless Motion Sensor (AC version)

RL-PR-D01-01

Description

Automatically turns on the lights for a preset period when movement is detected.

Spec.

90V 250VAC, 50 / 60Hz

433.92Mhz

60 meters depends on atmospheric conditions

CE, EMC, FCC and RCM approved





(4) Equipment Specification - Light Sensor (RL-LS-C01-01)

**Wireless
Daylight Sensor**

RL-LS-C01-01

Description
Automatically turns on the lights for a preset period when dusk is detected.

Spec.
3V, CR-123A battery
433.92Mhz
60 meters depends on atmospheric conditions
1 years of battery life under normal operation
CE, EMC, FCC and RCM approved





(5) Equipment Specification - Dimmable Light Control and Wireless Switch

Wireless Dimmable Light Control (0-10V) Quick Set

Features

Easy to adapt to 0-10V of dimmable LED lights.
Dimming up and down with button press.
Smart memorized last dim level.

Description

1 channel dimmable control module x 1
Wireless dimmable light switch x 1

Spec.

Control Module :

AC input : 90V-250VAC, 50 / 60Hz
Dimm output : 0 -10VDC

Wireless Devices :

3V, CR2032 coin batteries
433.92Mhz
60 meters depends on atmospheric conditions
3 years of battery life under normal operation
CE, EMC, FCC and RCM approved





(6) Equipment Specification - Smart Meter (AEM-DR-125-ON)

AEM-DR Multi-circuit power meter(DIN rail)

■ Description

Provide high accuracy measurement, display and remote communication of single phase & three phase parameters (V, A, P, Q, S, PF, Hz, Kwh). Multi-circuit design and relay output modular expansion design decrease the overall cost and make the functionality more flexible. All monitored data is available via a RS485 serial , for the needs in energy management, alarming, and remote controlling. Embedded flash memory for Data-Logging can avoid any data missing once the communication is interrupted. Moreover, its ultra compact size DIN-rail mounting makes itself mountable in virtually any panel, enclosure or indoor Cabinet.



■ Feature

- Metering parameters of Voltage, Current, Frequency, Power factor, Active Power, Reactive Power, Apparent Power, Energy (Watt-Hr), et al in 1P2W, 1P3W, 3P3W, 3P4W unbalanced system
- 2-line display both with 6 digits, able to view the name and value of the parameter at the same time
- Modular Expansion Design, able to correspond to different parameters individually
- Relay output with Start Delay, Hysteresis, Energized, and de-energized delay functions
- With RS485 serial as standard for remote controlling relay output
- Standard DIN-Rail mounting
- CE Approved
- Embedded 1MB flash memory for Data-Logging
- With 20 words variables in Modbus address for acquiring the demand measurement at cost

■ Applications

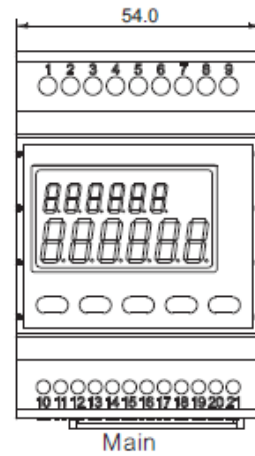
- Rental Building Electricity Charging Management
- Market/Vender/Stand Electricity Charging Management
- Rental Apartment Electricity Charging Management
- Distributed Generation Electricity Charging Management
- Booth Electricity Charging Management
- Dormitory Electricity Charging Management
- Trailer Coach Electricity Charging Management

AEM-DR

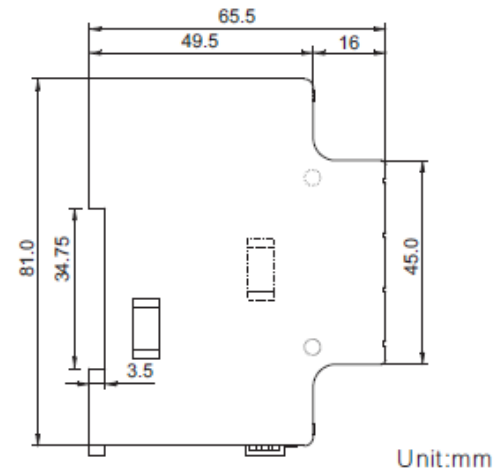
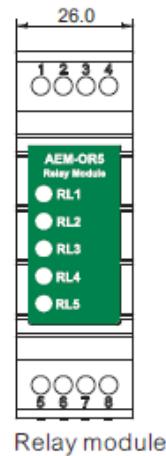


Smart Meter (AEM-DR-125-ON) Con't

■ Dimension



AEM-OR5





(7) Equipment Specification – Current Transformer, CT (US-CTV-16-060)

Picture of CT



Model	Primary Current	Secondary	Accuracy %F.S.	Variable ratio	Weight
US-CTV-10-005	5A	333	1.0	2000:1	60g
US-CTV-16-060	60A	333	0.5	3000:1	100g
US-CTV-16-100	100A	333	0.5	3000:1	100g
US-CTV-24-200	200A	333	0.5	3000:1	205g
US-CTV-35-300	300A	333	0.5	3000:1	375g
US-CTV-35-400	400A	333	0.5	3000:1	375g
US-CTV-35-600	600A	333	0.5	3000:1	375g



(8) Equipment Specification – Dimmable Driver (LF-GDE-042YF1000U)



Input: 100-240V~50/60Hz Max. 0.6A

Output Voltage: 27-42V Prated:42W

PF \geq 0.9

Control Mode: 0-10V & Resistance & PWM

Dimming Range: 10%-100%

For LED modules only

CE Passed



(9) Equipment Specification – Connected 5-in-1 Indoor Air Quality Monitor



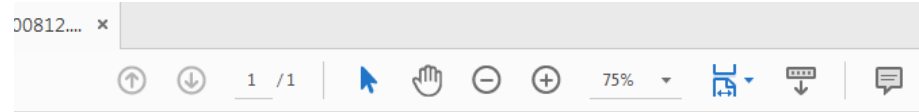
5 in 1 Air Quality Sensor

Temperature/ Humidity/ PM2.5/ PM10/ CO2



- Accuracy** >>> Signal response with accurate values
- CE** >>> CE certification
- Stability** >>> High stability with anti-noise interface
- Durability** >>> Power saving with high efficiency

The 5 in 1 air quality sensor is able to detect indoor air pollution, including humidity, particulate matter (PM2.5/PM10), carbon dioxide, etc. It is suitable for buildings, offices, computer rooms, restaurants, museums and homes to detect the air quality. The precision circuit design can detect pollutants in the air and provide accurate values to improve indoor air quality.



The 5 in 1 air quality sensor is able to detect indoor air pollution, including humidity, particulate matter (PM2.5/PM10), carbon dioxide, etc. It is suitable for buildings, offices, computer rooms, restaurants, museums and homes to detect the air quality. The precision circuit design can detect pollutants in the air and provide accurate values to improve indoor air quality.

SPEC

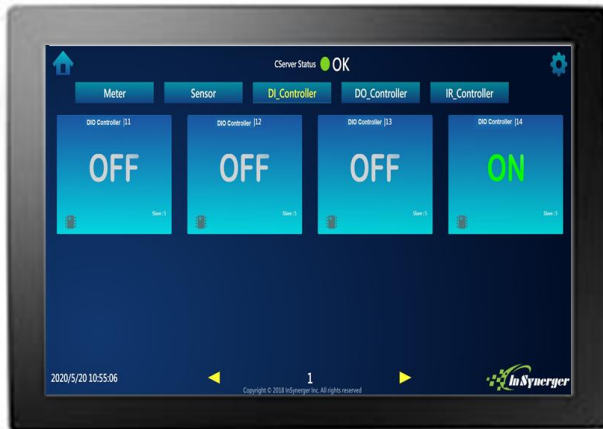
Model No.	CYHTC
Display Range	CO2: 0~10000 PPM PM2.5&PM10: 0~500 µg/m3 T: 10°C ~ 80°C / H: 0% ~ 100%
Accuracy	CO2 30ppm + Sen 3% PM2.5&PM10: 10% (100~500 µg/m3) 10 µg/m3 (0~100 µg/m3) Temp.: ±0.3°C / H: ±2 %RH
Waterproof	IP20
Dimension	86x86x26mm ; Wall mount
Power	DC 12 ~ 30V
Interface	RS-485 Modbus RTU mode
Working Temperature	-20°C ~+80°C



InSynerger Website



(10) Equipment Specification – Local Processor / Touch Panel



Processor System	CPU	Intel® Celeron® N3350 (UTC-310G)	
	Base Frequency	1.10 GHz (Dual-Core)	
	Cache	L2 Cache 1MB	
	Memory	1 x 204 pin SO-DIMM DDR3L 1600 MHz up to 8 GB	
	Storage	1 x M.2 2242 SSD / 1 x 2.5 internal SATA storage bay	
	Network (LAN)	2 x Gigabit Ethernet ports (Supports Wake on LAN)	
	I/O ports		2 x RS-232 COM (COM2 RS-232/422/485)
			2 x USB3.0 / 2 x USB3.0 (optional)
	Stereo Speaker		2 x Gigabit Ethernet ports (1 with PoE)
	Stereo Speaker		1 x 2W
	Bus expansion		1 x M.2 key2230, 1 x M.2 key2242
Mounting		VESA 75 x 75 mm (Screw Size, M4, 6mm)	
Dimensions (W x H x D)		251 x 170 x 32.5 mm	
Weight		1.12kg (2.46lbs)	
OS Support		Win 10 IoT Enterprise 64bit Android 6.0 Linux Ubuntu 18.04	
Environmental Specifications	Operating Temperature	0 ~ 40 °C (32 ~ 104 °F)*	
	Relative Humidity	10 ~ 95% @ 40 °C non-condensing	
	Vibration	0.5G	
	Shock	10G peak acceleration (11 msec. duration)	
	Certification	CE, FCC, CB, UL, CCC, BSMI	
	Front Panel Protection	IP 65 Compliant	
Power Supply	DC Input Rating	12 V/3 A ~ 24 V/1.5 A, 36W ITE Adapter	
	PoE	IEEE 802.3at/30W (Optional, N/A with 2.5" storage)	
	Power consumption	Typical 25W Max. 34W	
LCD Display	Size/Type	10.1" TFT LCD with LED backlight	
	Max.Resolution	1280 x 800	
	Max. Color	16.7M	
	Pixel Pitch (um)	169.5 x 169.5	
	Brightness (cd/m ²)	350	
View Angle		170°/ 170°	
Touch Screen Option (PE/GE)	Type	Projected Capacitive. Glass panel (by required)	
	Light Transmission	80% ± 5% / 90%	
	Controller	USB Interface	



Equipment Specification – Local Processor

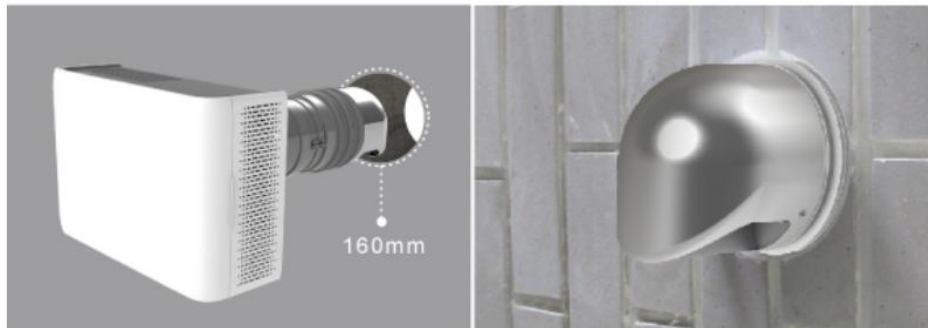




Air Quality Improvement Equipment

<https://vent.sunon.com/product.php?cls=3&id=14>

Air intake and PM2.5 filter
(in 30 square feet)



<https://pse.is/THRQK>

Air intake and PM2.5 filter
(in 60 square feet)



Thank You



*Taiwan Environmental Information Association (TEIA)
Institute for Information Industry (III)
Republic of China (Taiwan)*

2020-10-07