Partnership for Smart Energy and Energy Efficiency

Power and Cost Saving Solution
Intelligent Energy Management System (IEMS)
Successful Project Implementation 2015-16

Institute for Information Industry (III)
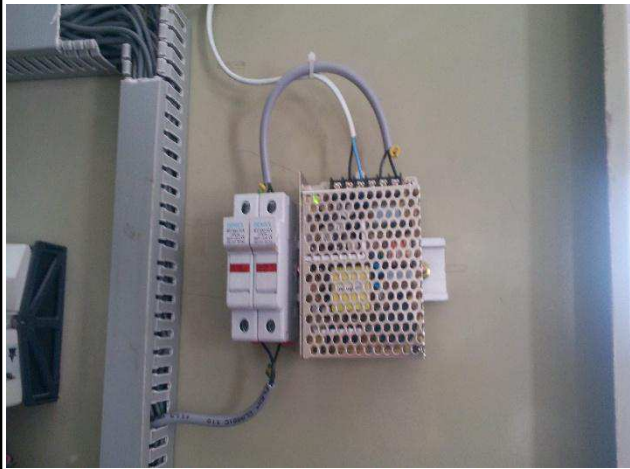
2016-04-05

1. Successful IEMS Project Implementation 2015-16
   - Annual Power and Cost Saving 12%
2. IEMS - Intelligent Energy Management Service Process
3. Phase 1 – Demand Power Management
4. Phase 2 – Compressor System Diagnosis and Analysis
5. Phase 3 – Transformer Efficiency Diagnosis and Analysis
6. IEMS – Insnergy Provides 4 + 1 Energy Solutions

1. Successful IEMS Project Implementation 2015-16 - Annual Power and Cost Saving 12%

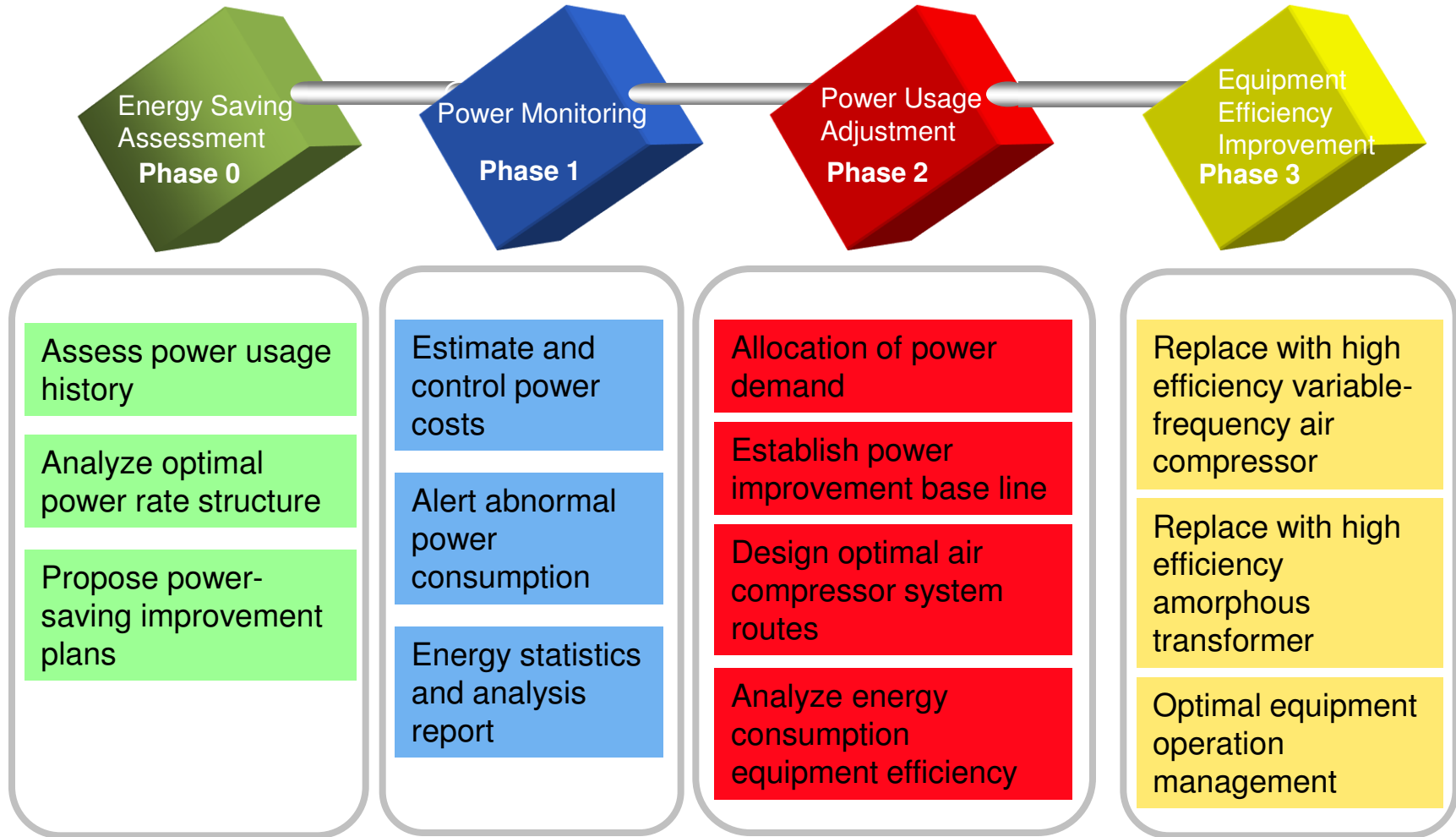| Smart Gateway installation	DC power supply installation	Split CT installation
Smart Gateway communication wiring	ST-12 Smart Meter power transmission test	IEMS System installation inspection and acceptance

Total Annual Power and Cost Saving Benefit Realized 12%

◆ This project implementation has three phases: monitoring>management>improvement. The factory has successfully saved power cost by **3,300,000PHP/year, 12%**.

   - overall power cost saving benefit $3,319,558 = power cost saving through demand management $776,595 + air compressor system improvement $2,250,448 + compressor replacement and improvement $292,515

◆ Implementing intelligent cloud energy management system can effectively control power costs in the short-run and substantially realize power cost saving in the long-run.

◆ I-Cloud, Intelligent, Integration to enhance collective management and help save power consumption and manpower.

◆ Facing future low carbon economy (saving 1kWh can reduce carbon emission by 0.521kg, according to Bureau of Energy's 2015 power emission factors in Taiwan), introducing energy management system and mechanism can ensure effective and continuous energy savings, and further increases corporate competitiveness as well as contribute to the sustainable environment.

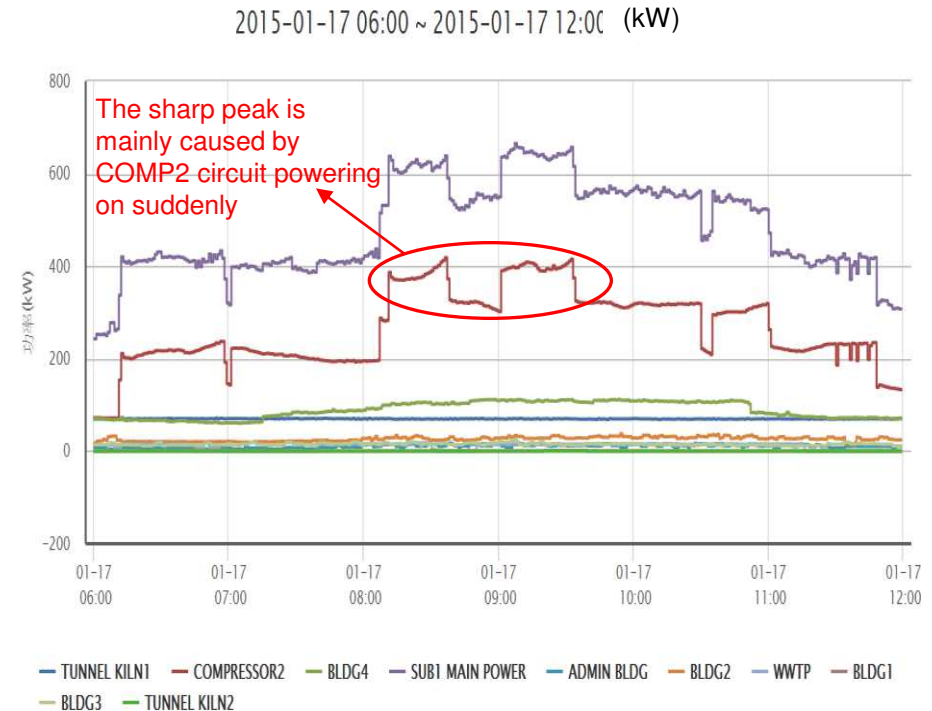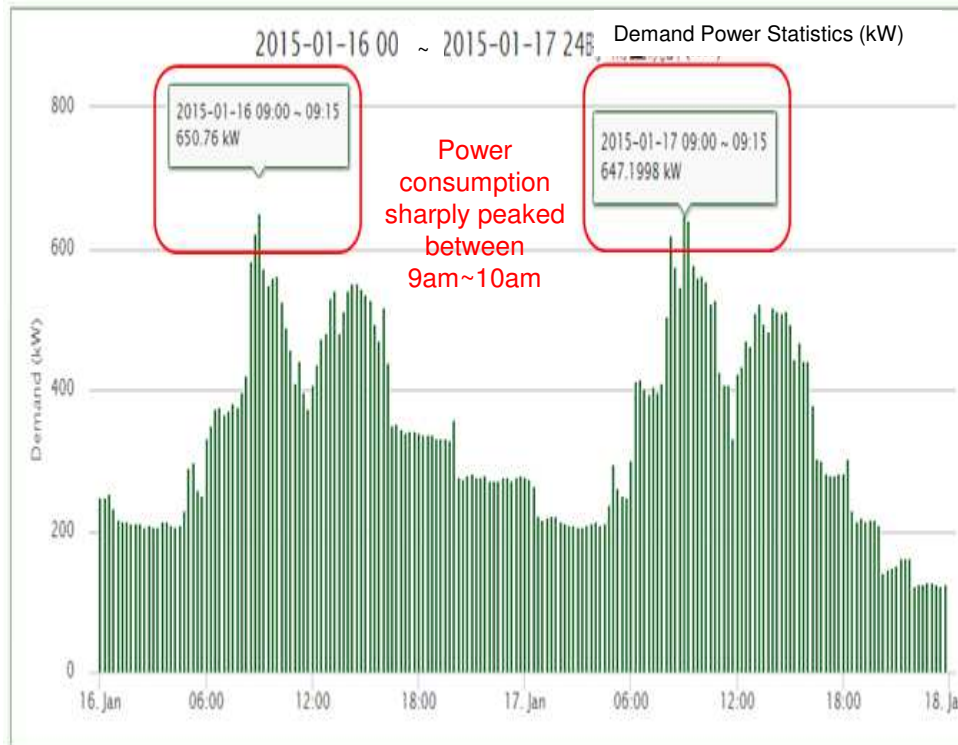# 2. IEMS - Intelligent Energy Management Service Process

Energy Saving Assessment **Phase 0**	Power Monitoring **Phase 1**	Power Usage Adjustment **Phase 2**	Equipment Efficiency Improvement **Phase 3**
Assess power usage history	Estimate and control power costs	Allocation of power demand	Replace with high efficiency variable-frequency air compressor
Analyze optimal power rate structure	Alert abnormal power consumption	Establish power improvement base line	Replace with high efficiency amorphous transformer
Propose power-saving improvement plans	Energy statistics and analysis report	Design optimal air compressor system routes	Optimal equipment operation management
		Analyze energy consumption equipment efficiency	

Phased service procedure saves money effectively and instantaneously!!!

2. Phase 1 - Demand Power Management

Traditionally power bill only shows the highest power consumption record, but does not indicate time of peak consumption, reason behind high consumption nor consumption structure. Without this information, factory users have difficulty to effectively control and reduce power consumption costs.
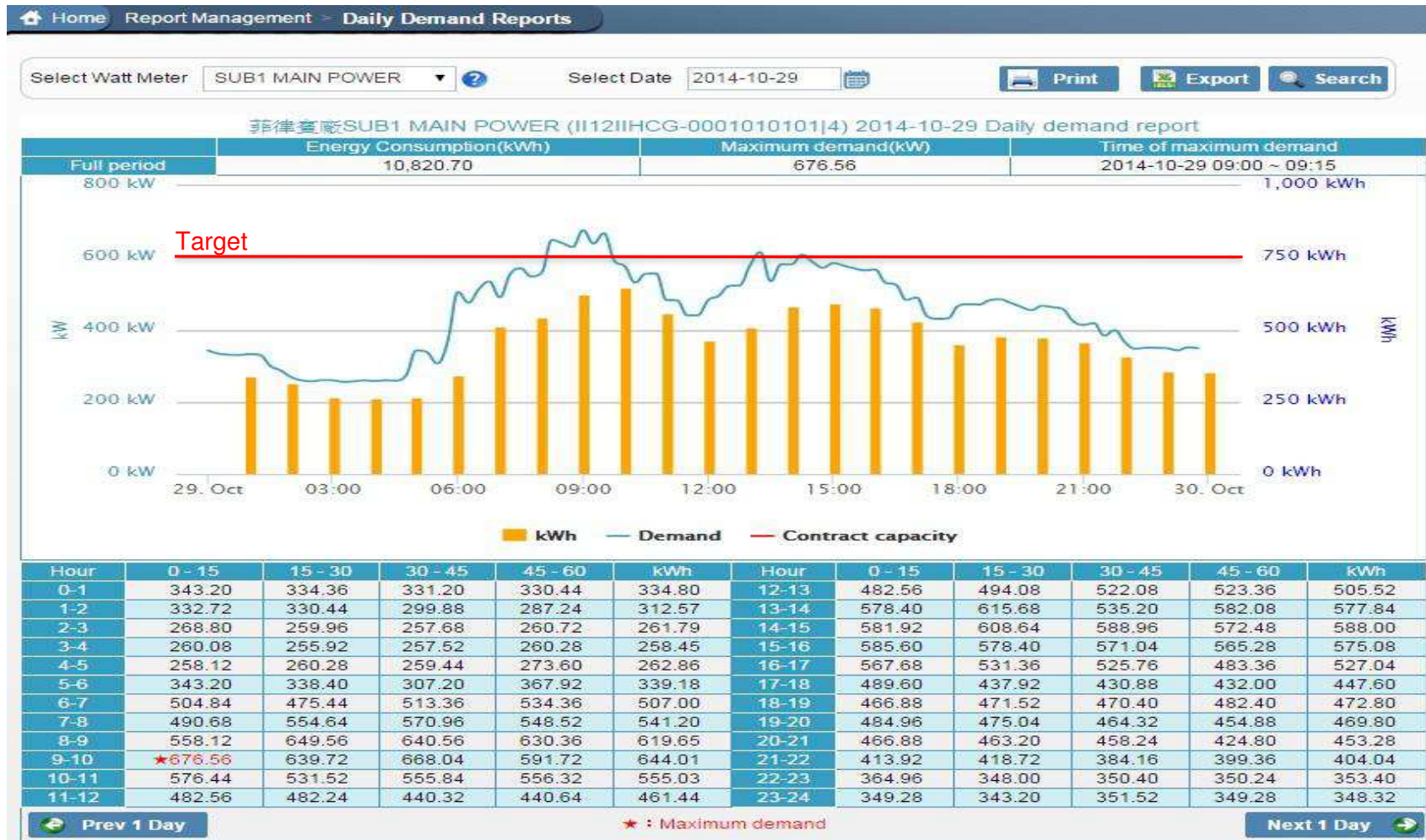
Power saving should begin from setting up an intelligent cloud computing system for energy management, then use smart meter to automatically and instantaneously monitor power consumption statistics. Reports generated can be used to analyze the factory's overall power consumption (see charts below), in order to adjust factory equipment operation procedures and models for effective power and cost saving.

Demand Power Statistics (kW)

2015-01-16 00 ~ 2015-01-17 24

2015-01-16 09:00 ~ 09:15
650.76 kW

2015-01-17 09:00 ~ 09:15
647.1998 kW

Power consumption sharply peaked between 9am~10am

2015-01-17 06:00 ~ 2015-01-17 12:00 (kW)

The sharp peak is mainly caused by COMP2 circuit powering on suddenly

TUNNEL KILN1 — COMPRESSOR2 — BLDG4 — SUB1 MAIN POWER — ADMIN BLDG — BLDG2 — WWTP — BLDG1
BLDG3 — TUNNEL KILN2

- Daily power demand report: Hourly records of power consumption and time of *maximum demand, with trend diagrams

菲律賓廠SUB1 MAIN POWER (II12IIHCG-0001010101|4) 2014-10-29 Daily demand report

	Energy Consumption(kWh)	Maximum demand(kW)	Time of maximum demand
Full period	10,820.70	676.56	2014-10-29 09:00 ~ 09:15

| Hour	0 - 15	15 - 30	30 - 45	45 - 60	kWh	Hour	0 - 15	15 - 30	30 - 45	45 - 60	kWh
0-1	343.20	334.36	331.20	330.44	334.80	12-13	482.56	494.08	522.08	523.36	505.52
1-2	332.72	330.44	299.88	287.24	312.57	13-14	578.40	615.68	535.20	582.08	577.84
2-3	268.80	259.96	257.68	260.72	261.79	14-15	581.92	608.64	588.96	572.48	588.00
3-4	260.08	255.92	257.52	260.28	258.45	15-16	585.60	578.40	571.04	565.28	575.08
4-5	258.12	260.28	259.44	273.60	262.86	16-17	567.68	531.36	525.76	483.36	527.04
5-6	343.20	338.40	307.20	367.92	339.18	17-18	489.60	437.92	430.88	432.00	447.60
6-7	504.84	475.44	513.36	534.36	507.00	18-19	466.88	471.52	470.40	482.40	472.80
7-8	490.68	554.64	570.96	548.52	541.20	19-20	484.96	475.04	464.32	454.88	469.80
8-9	558.12	649.56	640.56	630.36	619.65	20-21	466.88	463.20	458.24	424.80	453.28
9-10	★676.56	639.72	668.04	591.72	644.01	21-22	413.92	418.72	384.16	399.36	404.04
10-11	576.44	531.52	555.84	556.32	555.03	22-23	364.96	348.00	350.40	350.24	353.40
11-12	482.56	482.24	440.32	440.64	461.44	23-24	349.28	343.20	351.52	349.28	348.32

★ : Maximum demand

IEMS Demand Power Management Benefit

IEMS system analysis charts, professional diagnosis and suggestions for power consumption management are provided to help factory users to adjust equipment power on-and-off strategies. New strategies (without replacing equipment) have been proven to save yearly average power rate by **14.57%** and save **776,595 PHP/year (see charts below).**

Item\Month	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total/Average
(A) Before Max Damand (2013/12~2014/10)	901.25	845.25	915.25	1,022.00	1,062.25	1,111.25	871.50	924.00	883.75	1,088.50	1,128.75	**977.61**
(B) After Max Damand (2014/12~2015/10)	801.25	833.00	931.00	883.75	813.75	831.00	810.25	785.75	850.50	794.50	852.25	**835.18**
(C) Max Damand reduction Remark：C=B-A	-100.00	-12.25	15.75	-138.25	-248.50	-280.25	-61.25	-138.25	-33.25	-294.00	-276.50	**-142.43**
(D) Transmission Charge (PHP/kW)	332.27	350.50	383.91	386.85	360.38	382.02	361.92	357.558	328.898	319.328	325.918	**353.60**
(E) Transmission fee reduction Remark：E=C*D	-33,227.00	-4,293.63	6,046.58	-53,482.01	-89,554.43	-107,061.11	-22,167.60	-49,432.39	-10,935.86	-93,882.43	-90,116.33	**-548,106.20**
(F) Distribution Charge (PHP/kW)	205.83	205.83	205.83	205.83	205.83	205.83	205.83	182.66	182.66	182.66	182.66	**197.40**
(G) Distribution fee reduction Remark：G=(874.16-A)*F	-5,575.93	0.00	-8,457.55	-30,429.91	-38,714.56	-48,800.23	0.00	-9,103.77	-1,751.71	-39,151.34	-46,503.41	**-228,488.43**
Save Money	-38,802.93	-4,293.63	-2,410.97	-83,911.92	-128,268.99	-155,861.34	-22,167.60	-58,536.17	-12,687.57	-133,033.78	-136,619.74	**-776,594.63**

Source: HCG PHP Crop's electricity bill of Meralco
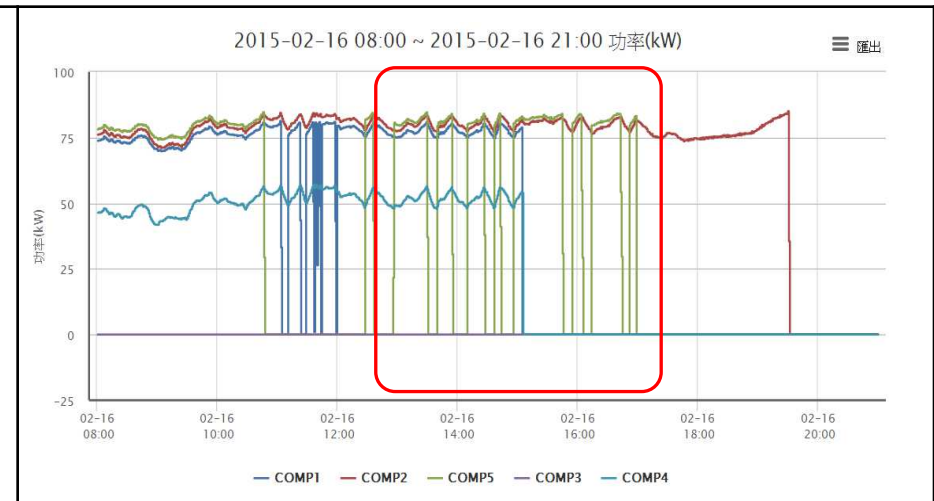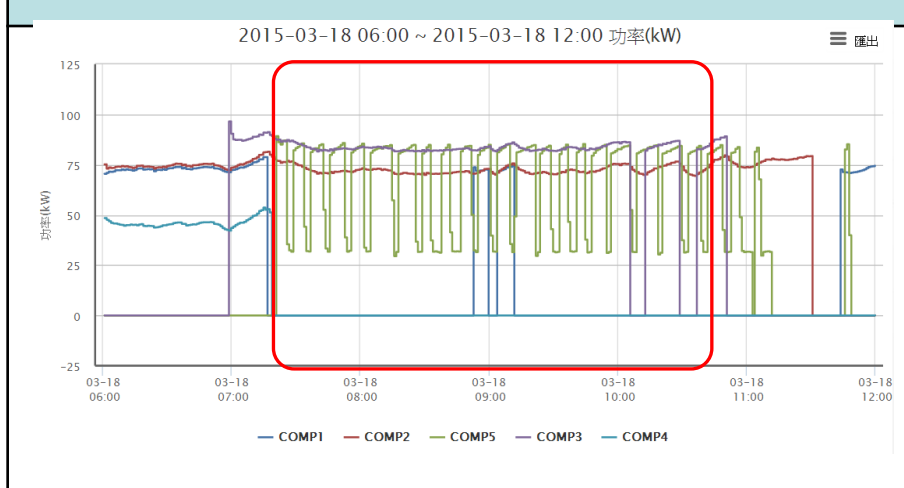

Max Demand Trend
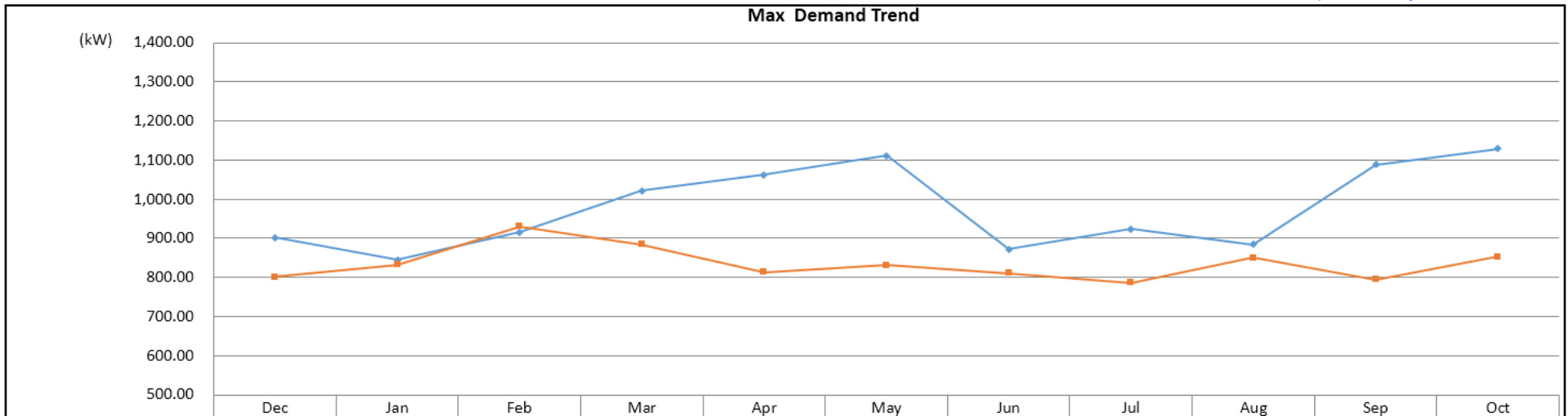
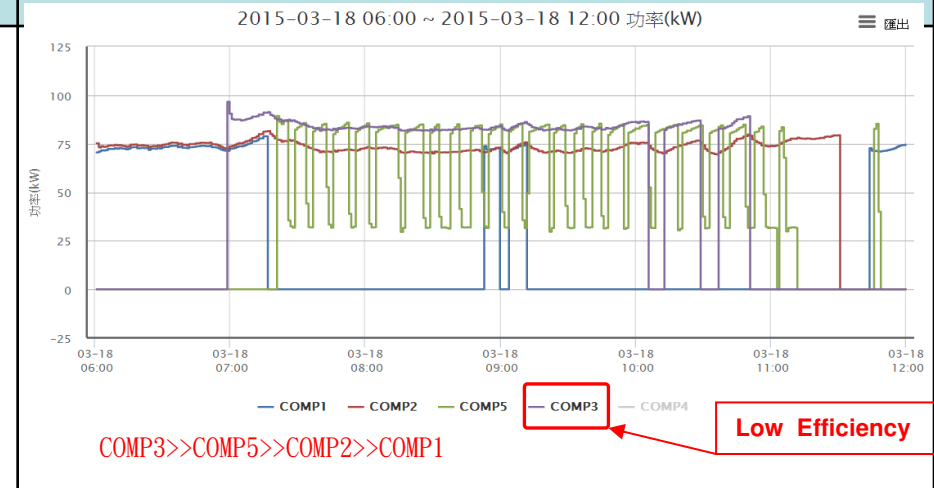# 4. Phase 2 – Compressor System Diagnosis and Analysis
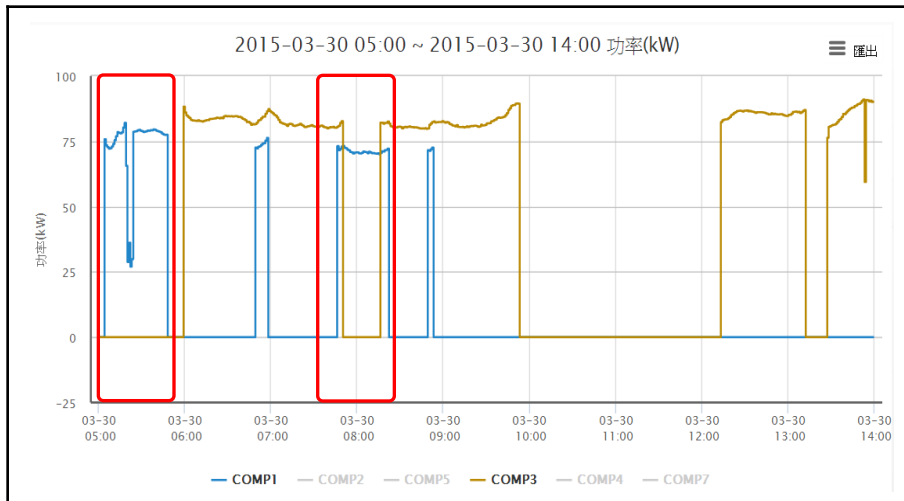
Compressor Group Operation Improvement (Turn off COMP1)

Compressor Hunting (Reduce On-off Frequency)

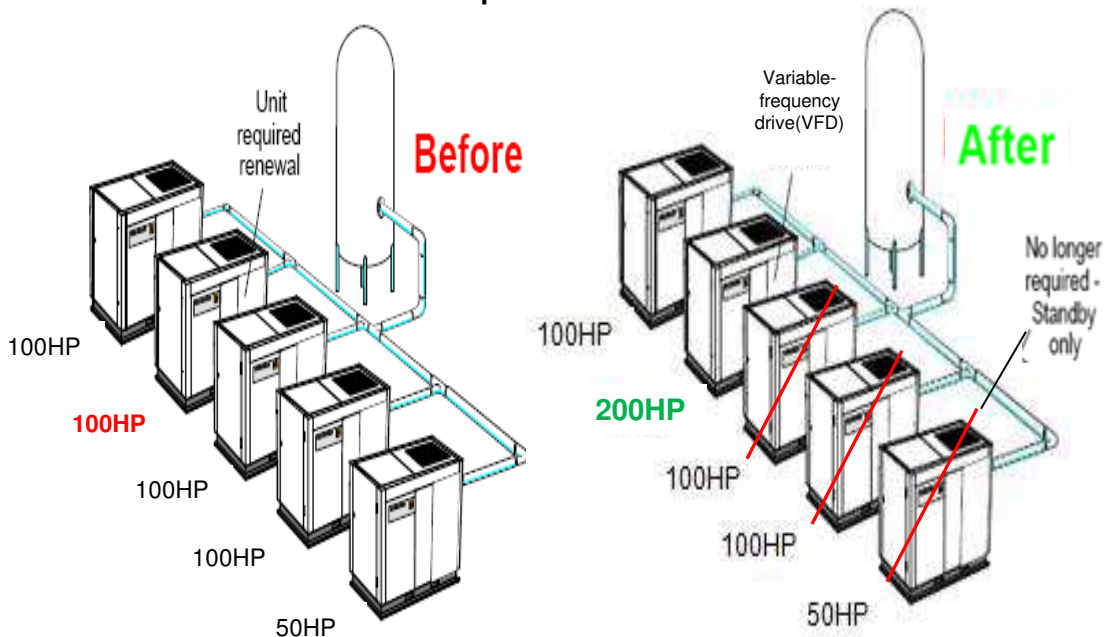Reversing Air Pressure (Abnormal Pipe Pressure)
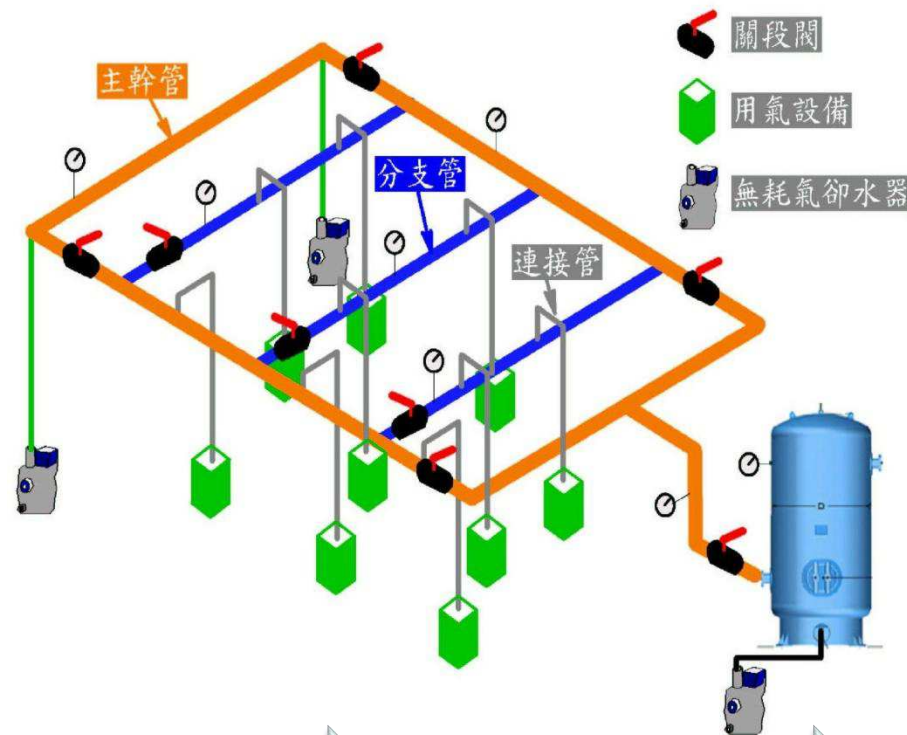
Compressor Efficiency Evaluation for Replacement

COMP3>>COMP5>>COMP2>>COMP1

Low Efficiency

Compressor System Efficiency Improvement

Multi-machine optimization control

Unit required renewal

Before

100HP
100HP
100HP
100HP
50HP

Variable-frequency drive(VFD)

After

100HP
200HP
100HP
100HP
50HP

No longer required - Standby only

Optimization design of piping systems

主幹管
分支管
連接管

關段閥
用氣設備
無耗氣卻水器

Energy Saving 44% ➤ **281,306 kWh** annual saving ➤ **2,250,448 PHP** annual saving ➤ **ROI >33%**

The improvement was implemented in 2015-10

5. Phase 3 – Transformer Efficiency Diagnosis and Analysis
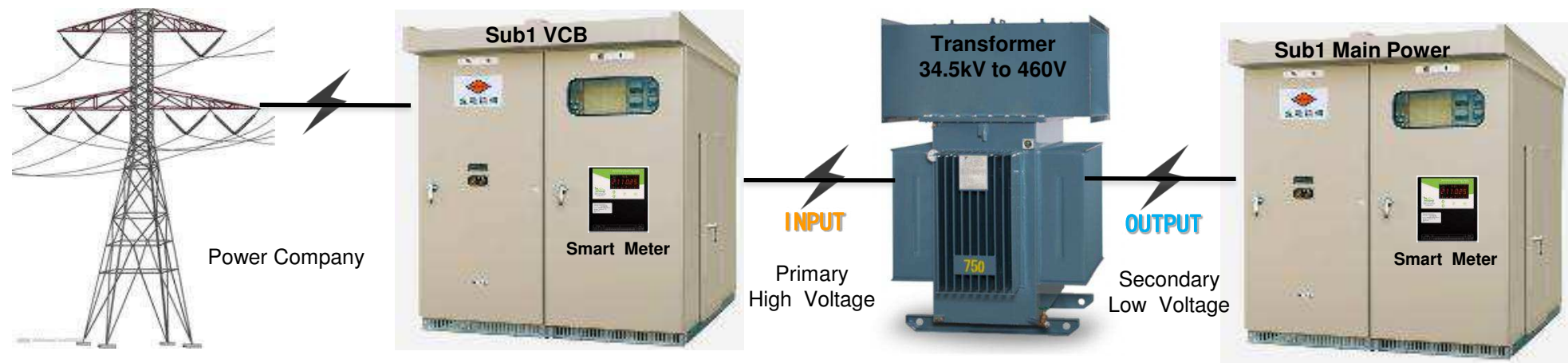
- ➤ **Input=587.32 kW**
- ➤ **Output=415.27 kW**
- ➤ **System Loss=587.32-415.27=172.05kW**
- ➤ **172.05/587.32*100%=29%**

Transformer Loss
29%
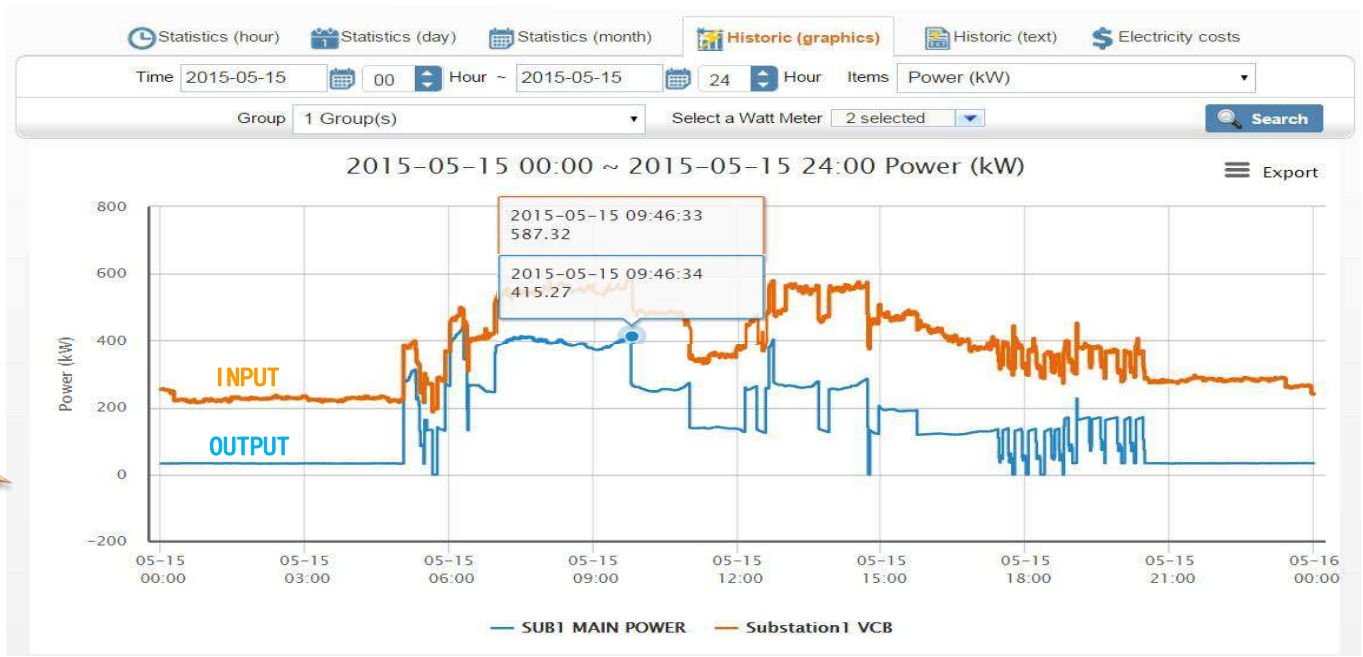
Transformer Efficiency Improvement Suggestion
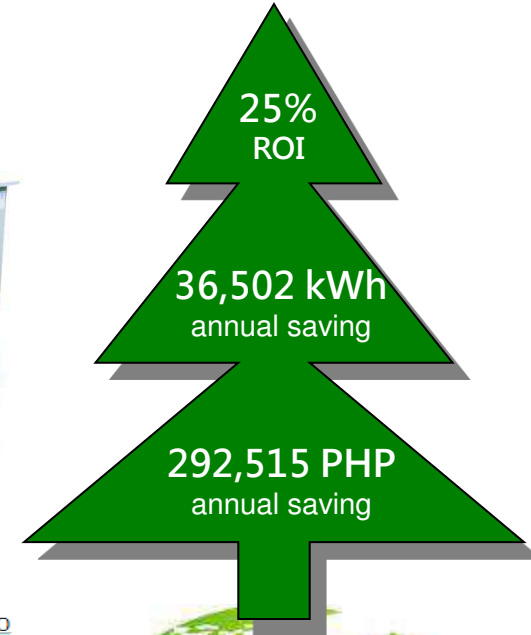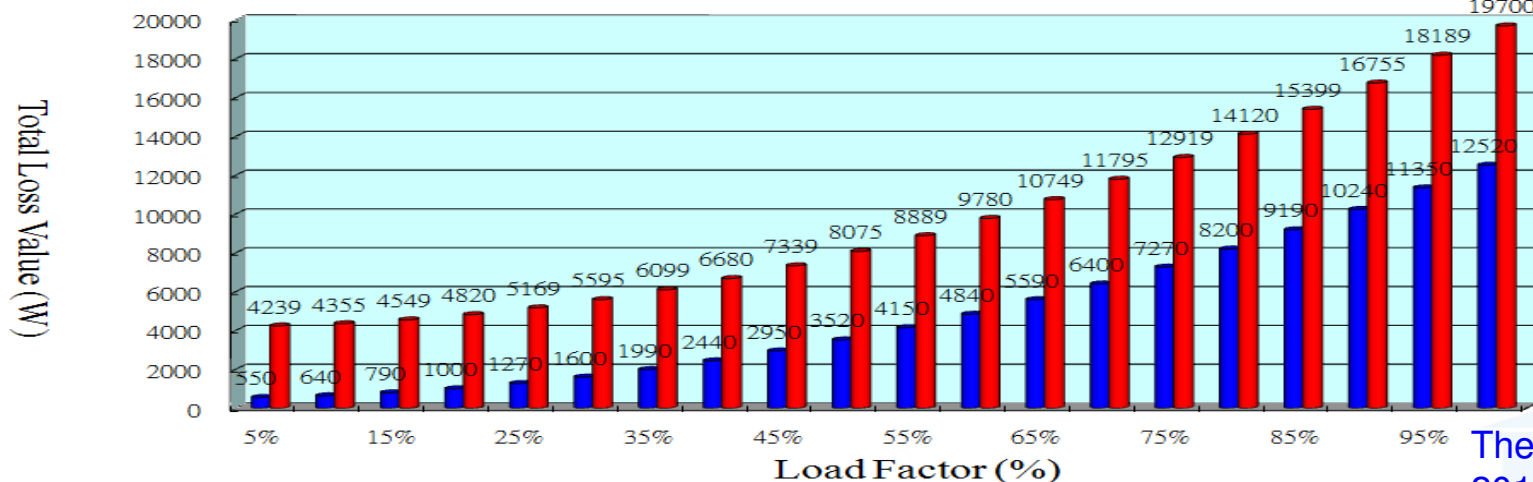
SiFe(SiFe Transformer)：2,000kVA

AMT(Amorphous Transformer)：1,250kVA

25% ROI

36,502 kWh annual saving

292,515 PHP annual saving

Table of Total Loss

The unload loss of AMT transformer is only 20% of the SiFe transformer

Legend: ■ AMT ■ SiFe

Y-axis: Total Loss Value (W) — 0, 2000, 4000, 6000, 8000, 10000, 12000, 14000, 16000, 18000, 20000

X-axis: Load Factor (%) — 5%, 15%, 25%, 35%, 45%, 55%, 65%, 75%, 85%, 95%

AMT values: 550, 640, 790, 1000, 1270, 1600, 1990, 2440, 2950, 3520, 4150, 4840, 5590, 6400, 7270, 8200, 9190, 10240, 11350, 12520

SiFe values: 4239, 4355, 4549, 4820, 5169, 5595, 6099, 6680, 7339, 8075, 8889, 9780, 10749, 11795, 12919, 14120, 15399, 16755, 18189, 19700

The improvement has started since 2015-10

6. IEMS - Insnergy Provides 4+1 Energy Solutions

Global Services
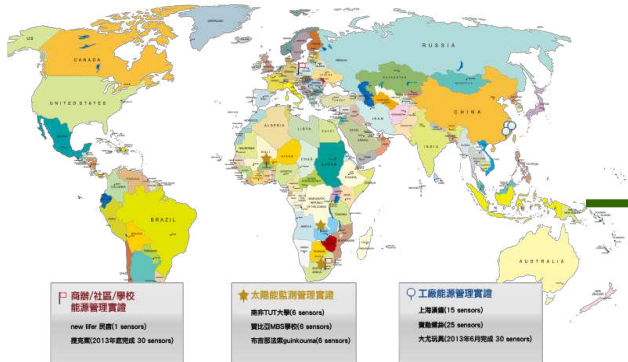
In-Snergy

Green IOT Applications
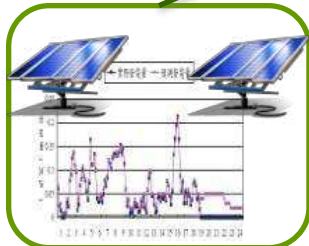
Liza	Ectuary	iFamily	In-Light
Renewable and Solar Energy Solutions	Enterprise Energy Management Solutions	Smart/Green Home Solutions	Smart Lighting Management Solutions

In-Snergy (Internet Smart energy):

- Green IOT(Internet of Things) Platform
- Internet-based cloud technology offers always-on 24 hours a day year-round service in monitoring and optimizing electricity usage environment to raise power usage efficiency and help to ensure comfortable outdoor and indoor environments

- Simple, adaptable, ready-to-use energy monitoring and management solution, applicable in various environments

- A scalable cloud platform, that is easily installed to offer the desired features based on end-customers' needs

- Capable to interact with and manage large-scale sensor equipment

- Based on Open data communication interface (JSON/ SOAP) that can easily integrate with commercially available sensor devices, electric meters, and others

Customers of Insnergy

Located in Taiwan, China, USA, Africa, Europe, Asia

Up-to-date our worldwide clients are categorized as:

- **Enterprise—300+**
- **Home users—3,000+**
- **Street lights—2,800+**
- **Solar users—12+**

South Africa
Namibia

Czech Republic
Romania
The Philippines

Thank You