ISO 50001 Energy Management System
Case Study

2020 Republic of China (Taiwan)

Far EasTone Telecommunications

The best practitioner for energy management--the energy consumption of the headquarter has decreased for 9 consecutive years, with a cumulative energy efficiency ratio of 48%.

Far EasTone Telecom Headquarters (Office/IDC)

Case Study Snapshot	
Industry	Telecommunications
Product/Service	Telecommunication products sales service, telecommunications and IDC (international data center) operation service and office operation.
Location	Taiwan, R.O.C.
Energy management system	ISO 50001
Energy performance improvement period, in years	9 years (Y2011~Y2019)
Energy Performance Improvement (%) over improvement period	11%
Total energy cost savings over improvement period	$USD 2,700,000
Cost to implement EnMS	$USD 1,162,000
Total Energy Savings over improvement period	109,064 (GJ)
Total CO_2-e emission reduction over improvement period	6,900 (Metric tons)

Organization Profile & Business Case

Far EasTone (FET) is the third-largest telecommunications company in Taiwan. It provides high-quality mobile and fixed communication network services and has about 7.177 million customers with a market share of about 24.5%. Since its establishment, FET has strived to close the gap between people to achieve the objective of "Closing the Distance." To follow the international sustainable trend and correspond to the United Nations Sustainable Development Goals (SDGs), FET establishes the "Sustainability Strategic Blueprint for 2018-2025," aiming at strengthening social tolerance and contributing to the environment and sustainability with its advantages of information and communications.

Energy Strategy - FET understands that in the course of business operation, risks and opportunities to the ecological environment and energy supply may be brought. Therefore, we have introduced energy and environmental management system, exerting industrial influence from the perspective of the life cycle of telecom services. Together with our customers, suppliers, and contractors, we improve energy performance, promote pollution prevention, reduce greenhouse gas emissions, and slow or adapt to climate change.

As technology advances in each generation, the telecom industry's power density has grown exponentially. Since the release of ISO50001 in Y2011, we have quickly integrated the existing energy management system (EnMS) and set strategic goals to become the world's first telecom company with headquarters and equipment room both passing external verification. Also, we expanded and updated the EnMS in 2016 and 2018

(Figure. 1) to constantly improve energy efficiency and maintain our energy advantages in the highly competitive telecom market.

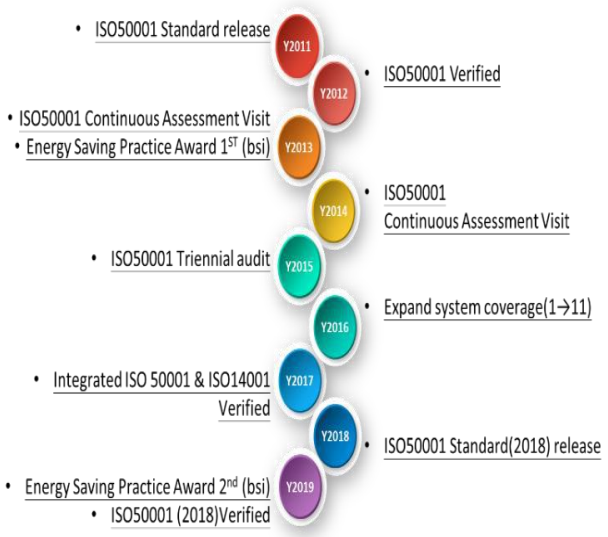

Figure. 1 Establishing process of FET EnMS

"Changing the energy is the new economy and innovation is the driving force"

—Chee, General Manager

Business Benefits

The global mobile communications network consumes 1.5 trillion MWH per year, which is equivalent to about 10% of the total global power generation. The telecom industry plays a pivotal role in making mobile communication networks more energy-efficient. The EnMS is an important part of our environmental sustainability as well as the key foundation for improving energy efficiency and reducing operating costs.

Costs and Performance of Energy-saving Measures –The Energy Management Committee draws up an action plan based on the annual target and quarterly tracks the implementation results. The successful cases over the years have produced huge benefits and effectively improved energy efficiency. The total cost of energy efficiency investment is USD12,280,000 in 2017-2019, saving a total of 87,420 MWH, of which 15% (13,000 MWH) improvement in energy efficiency related to the equipment room. FET has applied a number of innovative improvement measures to reduce the impacts due to the increasing power density, such as desiccant adsorption technology, which can recycle the exhaust cooling energy and reduce the cooling load of the outdoor air (OA) by 22%, while the hot and cold aisle airflow management project greatly improved the cooling efficiency of the equipment room (Figure. 2).

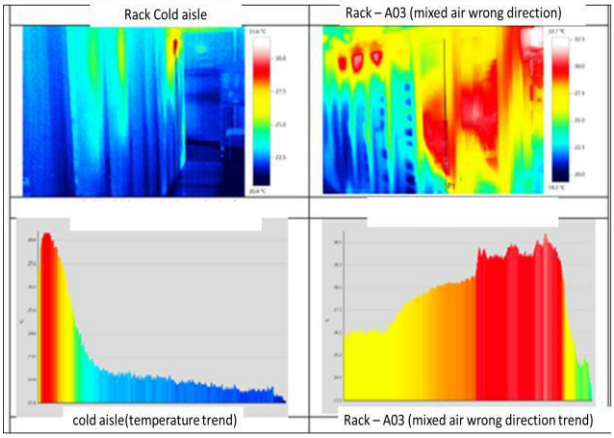

Figure. 2 Data Center's Computational Fluid Dynamics

Benefits of Multiple Sites Approach - The energy use in the telecom industry varies and belongs to different departments. EnMS makes management more consistent. We have planned different training courses, allowing the organization to develop suitable performance indicators, compete fairly, and pursue higher energy efficiency. According to the trend of energy use, after a single site implements the system, the usage continues to decline. Yet, it will gradually level off after the fifth year. After multiple sites have participated, we have brainstormed and come up with better improvements (Figure. 3).

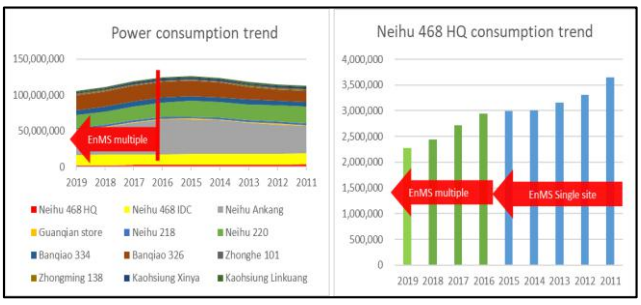

Figure. 3 Run Chart of Energy Use

Experiences Gained from Implementing ISO 50001 -The biggest benefit of ISO50001 is that energy efficiency is deeply embedded in daily decision-making, developed with sustainability, and continuously improved. People are the main variables in implementing the system and the key factor for successful execution. ISO50001 can gradually change corporate culture. Energy efficiency can be improved in the PDCA management cycle and innovation. The biggest challenge in the process is to continuously meet the operation requirements. The core network of telecommunications and the International Data Center (IDC) must operate 24/7/365. We highly encourage innovation and experimentation after risk assessment. Rewards are given to the participating teams, and annually, two members of each successful project accept the chairman's reward and a bonus of USD3,333. Each manager's performance has a fixed percentage linked to environmental sustainability, thereby making environment and energy management regular work.

Other Environmental Benefits - The telecom industry has strong advantages of digital information and communications. To keep improving energy efficiency, EnMS is gradually integrated with the core capabilities of enterprises and we have developed relevant products. The most representative ones include the smart energy management platform, which integrates IoT and AI, and the establishment of an energy-renewing subsidiary--Prime EcoPower Co. The platform has been installed in various electric field domains. Also, the newly established energy-renewing subsidiary has installed the internal solar power generation systems and begun to undertake the construction of solar power plants, assisting the government in promoting energy transition.

Plan

Since Y2005, we have found the increase in power density of telecom equipment is inevitable. To avoid unnecessary waste, we have established a preliminary energy management mechanism and set phase goals every three years after the release of ISO50001 in Y2011 (Figure. 4), quickly adjusting our documents and passing external verification. With the rapid progress of telecom technology, the current 4G mobile communications core network power density has grown 12 times compared to the past. We continue to expand the EnMS and adopt a risk-oriented thinking model to reduce costs, thus increasing the strategic responsibility of senior executives to assess the effectiveness of current control measures. The introducing principle of multiple sites EnMS depends on energy consumption and operational types, decreasing system setup complexity and improving execution efficiency. Now the major buildings have been covered in the EnMS. Under the same management system, it will be easy to extend the system to the Group's affiliates.

	phase	subject
Phase 0	Y2005~Y2010	Energy saving you have the power
Phase 1	Y2011~Y2013	high efficiency first
Phase 2	Y2014~Y2016	let's Go Green
Phase 3	Y2017~Y2019	Go Smart GoEco

Figure. 4 Phase Goals in Every Three Years

Energy review is the highlight of the project, while energy efficiency and major energy equipment identification are important references for resource allocation. Energy reviews include consumption ratio, years of use, and operating periods, and levels A to C are established accordingly. Level A and B cases are first to undergo major energy performance improvement assessment. Orders are placed based on financial viability, operational impact, technology maturity, and energy-saving effect, and the committee will adopt either action plans or operation control after referring to the variables.

Energy Baseline and Indicators - Based on the characteristics of the telecom industry and the development goals of the organization, we set a three-year cycle management model and the last year of each phase is served as the baseline for the new cycle. The current EnPIs by consumption types are shown in Figure. 5.

Consumption Type	EnPI	Description	Check frequency
Office	EUI	Energy Use Intensity, Energy consumption per square meter of the property	Quarterly
IDC/ Telcom room	PUE	Power Usage Effectiveness , total power consumed by the data center divided by the power used by the computing servers.	Quarterly
Base station	Traffic/kWh	Power consumption per unit of	Quarterly
Retail	kWh/site	Average power consumption per store	Quarterly

Figure. 5 Energy Performance Indicators (EnPIs)

We use absolute contraction approach (SBTi-tool, Draft 1.0 (17, Apr. 2019) to calculate the target of S1+S2, which is aligned to the IPCC AR5 scenario and we aim to reduce the emission of S1+S2 by 1.45% per year and reduce 20.3% by 2030. The set target was audited by the SBTI, making FET the third telecom company in Asia to pass this international review. To fulfill the commitment of reducing greenhouse gas emissions, we plan to set smart and green energy as future strategic goals. Also, in the next decade, we will focus on the three core technologies, including the AI energy management platform, the IoT and hybrid energy base station, and microgrid energy storage systems and develop new energy-saving methods to improve energy efficiency and reduce the reliance on traditional petrochemical fuels.

"EnMS allows us to foresee risks and opportunities and lets the processes speak, so we can get things right the first time."

—Olivia Chow, Chairperson of Environment and Energy Management Committee

Do, Check, Act

The Commitment of the Organization and Senior Management - FET Environment and Energy Committee (Figure. 6) is the highest organization for executing energy management. We integrate the ISO system and conduct climate change risk management and the environmental and energy strategies and operations of ISO50001 / ISO14064-1 / ISO14001 / CDP / DJSI. The policies are signed by the president and announced on the internal and external company websites. Relevant documents of the system are incorporated into corporate governance and undergo internal and external audits twice a year to ensure the procedures are effective and properly implemented. The committee coordinates different sites. We communicate via visual management platforms., and all the information and communication records are stored in a shared database. We make the most use of the telecom industry's advantages and tools to improve transparency and reduce communication difficulties.

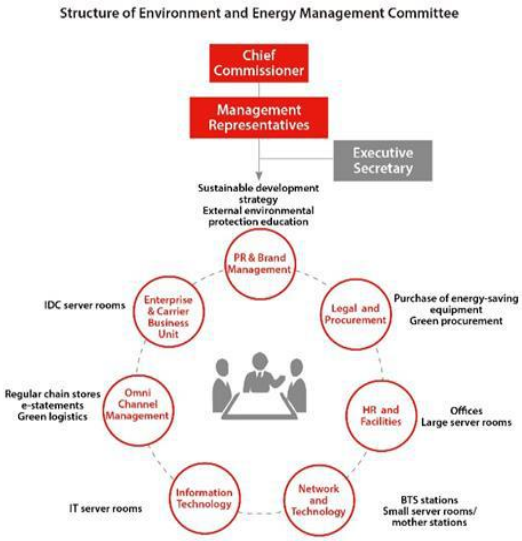

Figure. 6 Organization Chart of FET Environment and Energy Management Committee

Energy Review and Quantitative Data - The main power consumption of FET comes from the base station, the IDC, offices and branches (Figure. 7). The total power consumption in each year is about 5.3 billion kWh. The Environment and Energy Management Committee calls for an annual energy review that identifies significant energy use, and conducts management and reduction through action plans.

Type	consumption ratio
Base station	69%
IDC & Telcom Switch Room	27%
Retail	2%
Office	2%

Figure. 7 Consumption Ratios by Type

Energy Monitoring System - The energy data collection plan is mainly carried out on an instant and extensive

energy monitoring system platform, which can reduce manpower and improve accuracy. In addition to data collection, the platform also has implemented a considerable degree of artificial intelligence. With the parameter model obtained through data analysis, the platform can actively control the air-conditioning equipment to improve energy efficiency, as shown in Figure. 8. Through the Open Platform Communications interface, we can easily connect with supervisory computers at different sites, access to requisite information, and incorporate it into the headquarter's EnMS.

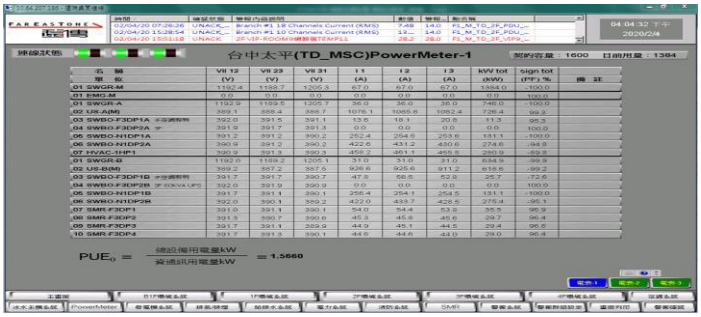

Figure. 8 Energy Monitoring System

Key Activities for Improving Energy Performance - FET has invested in many energy efficiency improvement programs over the years (Figure. 9). We analyze various consumption types, determine priorities through energy reviews, and make the most use of resources. One particularly successful project - the decommissioned and inefficient equipment cleaning action plan - won the best case of the year in the Group. According to McKinsey and Company, utilization of servers in business and enterprise data centers "rarely exceeds 6%" (i.e., they deliver no more than six percent of their maximum computing output on average over the course of the year) and up to 30% of servers are comatose– using electricity but delivering no useful information services. The Environment and Energy Management Committee makes the action plans and formulates a clean-up project. Through investigation, discussion, and implementation, the clean-up of the equipment that delivers zero or low services or that can be integrated but is in power transmission is reduced by a total of 241 KW, saving 2.1 million kWh (21MWH) of electricity a year.

Consumption Type	measures	saving benefits
Office	1. AI Energy Management Platform 2.Adsorption dehumidification system	Medium
IDC/Telcom room	1. Frequency Magnetic Centrifugal Chiller 2.Hot and cold aisle airflow project	High
Base station	1.Free coling project 2.High efficiency power supply replacement	High
Retail	1.Automatic induction switch system 2.Smart Energy Management Platform	Low

Figure. 9 Major Energy-saving Measures of FET by Consumption Types

Implementation of Energy Performance Indicators - With FET's improvement for 9 consecutive years, the latest EnPI (Y2017-Y2019) shows that the four targets of Office, IDC/ Telcom switch room/ base station, and Retail have all been fulfilled, indicating that our system has very significant effects on the improvement of energy efficiency in various industries, as shown in Figure. 10.

		Phase 0	Phase 1		Phase 2		Phase 3	
		2005~2010	Y2011~Y2013		Y2014~Y2016		Y2017~Y2019	
Consumption Type	EnPI	saving 1%	Target	Actual	Target	Actual	Target	Actual
Office	EUI	v	15.00%	16.50%	5.00%	8.22%	4.50%	4.65%
IDC/ Telcom room	PUE	v	4.50%	5.84%	5.00%	6.10%	3.00%	3.67%
Base station	Traffic/kWh	NA	NA	NA	1.50%	-1.61%	10.00%	17.17%
Retail	kWh/site	NA	NA	NA	1.50%	1.78%	10.00%	15.98%
"+ "= saving							EnPI renew	

Figure. 10 Implementation of EnPIs

Third-party Verification of Energy Performance Improvement - We value the correctness of energy-saving results and the variables, which are reviewed yearly. When energy performance indicators deviate, the project leader initiates changes. New indicators need to undergo regression analysis and the review of its normality, independence, and homoscedasticity. Also, it can only be changed with the consent of the committee. Relevant energy performance improvement data is confirmed not only through internal audits but also through annual external audits performed by third parties. Important projects are entrusted to Taiwanese consulting institutions such as Taiwan Green Productivity Foundation for measurement and verification (M&V).

Communication and Training - FET value communication with employees or relevant groups. Effective communication can establish transparency in energy management, promote successful operation of the

system, and achieve expected results. We conduct a yearly satisfaction survey of all employees, which shows a 97.74% satisfaction on energy-saving performance (Figure. 11). The scores have increased year by year mainly owing to the effective courses and a gradually established corporate culture. The sense of honor allows employees to make suggestions and fully support the Company's energy-saving projects. The Environment and Energy Management Committee plans three levels of courses annually. The first level requires all employees' participation. The courses apply an e-learning method, and dynamic activities such as the annual Green Carnival are held to attract colleagues. The second level includes facility professional courses, which are attended by professionals who perform energy management. The courses are planned with advanced energy-saving technologies and supplemented by experience sharing. The third level is for members of the Environment and Energy Committee and the courses include global energy trends and energy management strategy. The purpose is to allow the committee members to timely receive the latest information to assist decision-making.

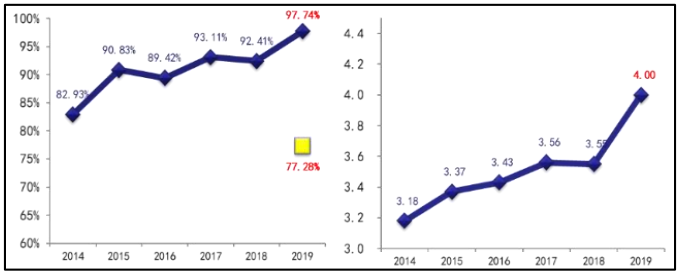

Figure. 11 Energy-saving Satisfaction Run Charts

Transparency

FET has participated in the CDP (Carbon Disclosure Project) since Y2016. Afterwards, we actively disclose information every year such as carbon emissions, regulatory risks, market risks, and risks of loss due to climate change, and explain our adaptation, responsive practices and the results of climate change. In Y2019, FET was selected for the first time on the Dow Jones Sustainability World Index c and listed on the Dow Jones Emerging Markets Index for the fourth consecutive year. Of the 24 selected projects in DJSI, FET received full marks in 7, showing that our outstanding performance in sustainable operations has won international recognition.

Lessons Learned

A. **Avoid adding process documents -** The telecom industry has a higher level of technology penetration than others. Current processes can be adjusted to meet the requirements of standard documents. Avoiding adding new documents can reduce manual work, improve system execution efficiency, and it is easier to scale to many sites.

B. **Strengthen organizational background review -** The capacity and conditions of an organization determine the operating strength of the system. The past action plans could not be implemented due to insufficient resources. Through background reviews, the current financial resource technology maturity and operational impact can be known in advance, which can increase the success rate of the action plan and the resources can be invested effectively.

C. **Link risk management strategies -** EnMS used to focus only on the management and improvement of major energy efficiency. Combining risk management strategies expands the breadth of system management and enables preventive control instead of result management, which helps identify problems in the early stages and take effective measures.