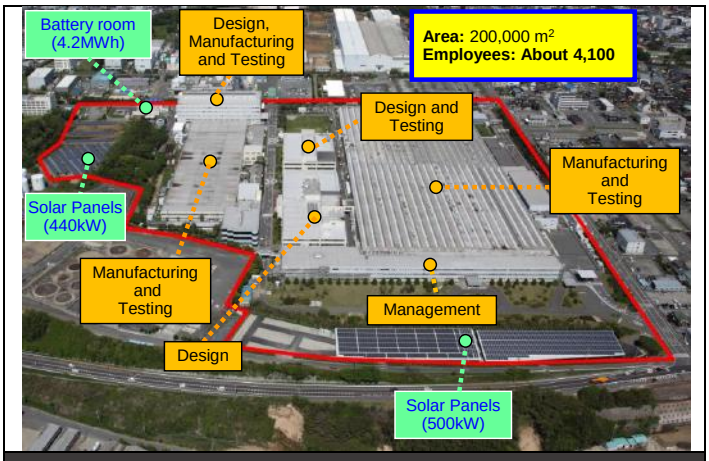
Global Energy Management System Implementation: Case Study

Japan

Hitachi, Ltd. Infrastructure Systems Company Omika Works

Omika Works improved 15% of energy performances. In addition, the number of visitors to Omika Works about this example was about 2,100 in 2011 and was 2.0 times of it in 2014. Therefore, we contributed to interest degree improvement of Omika Works.



Whole view of Omika Works

Business Benefits Achieved

We reduced 23 % of the contract electricity, 15 % of CO_2 emissions and 5 million yen/month of electricity costs by means of visualizing the electric power, making the basic unit of it including the smart next-generation factory plan and promotion of the improvement measure of the energy use efficiency by EnMS.

Omika Works is the central base of Hitachi, Ltd. Infrastructure Systems Company which promotes a social innovation business of an energy, an aquatic environments, a mobility, and an industry. We have 4,100 employees and site area is 200,000 ㎡.

It led to the improvement of the solicitation power to customers by carrying out our smart next-generation factory plan and the showcase of our energy performance improvement activity example using ISO50001.

We think that our case example was helpful to the following.

a) Creation of an order opportunity for the energy solution business by introduction to customers of the energy performance improvement activity example using ISO50001

b) Motivator to employees by assuming ISO50001 a flagship and communalization of the action plan of an energy performance indicator

c) Securing of transparency of the activity result by the ISO50001 certification acquisition

Case Study Snapshot	
Industry	electric machinery/equipment manufacturing industry
Location	5-2-1, Omika-cho, Hitachi-shi, Ibaraki, Japan
Energy Management System	ISO 50001
Product/Service	Design and manufacture of information and control systems
Energy Performance Improvement (%)	15 %
Annual energy cost savings	60 Million yen
Cost to implement	Not included
Payback period	Not Included

Through this example, we judge it to have led to the following businesses which contribute to orders.

a) 2013 machine manufacturer: Large scale energy management system and MES(Manufacturing Execution System) cooperation system

b) 2014 pharmaceutical products manufacturer: Consulting for all company energy

c) 2014 chemistry manufacturer: All company energy management systems and others
d) 2014 machine manufacturer: Basic factory energy management system(Smart Factory)
e) 2015 machine manufacturer: Consulting for all company energy and environmental system
f) 2015 machine manufacturer: Energy management system for a new factory

In addition to the above, we have over 40 cases which will be ordered.

****Energy Performance Improvement (%) (EPI %)**

- Baseline Period Energy Consumption : CO_2 emissions at 2010 : 11,748 t-CO_2/year
- Reporting Period Energy Consumption : CO_2 emissions at 2014 : 9,966 t-CO_2/year

EPI % = (11,748 – 9,966) / 11,748 = 15 %

Company Profile

Omika Works is the central base of social innovation business as a mother factory doing design and manufacturing of information and control systems in conjunction with a various society infrastructure.

Business Case for Energy Management

Energy's role in corporate strategy

Hitachi, Ltd. Infrastructure Systems Company contributes to the making of safe, reliable and comfortable social infrastructure on the concept of "fusion of information and control". Infrastructure Systems Company is providing one-stop total solution including the core components of facilities and equipment, plant engineering, service, and promoting social innovation business in order to develop a next-generation infrastructure system globally for realization of the future low-carbon society and sustainable society. Omika Works located in Hitachi city, Ibaraki Prefecture is the central base of this business as a mother factory designing and manufacturing of information and control systems related to a various society infrastructure.

We could realize solicitation power improvement to customers about the proof of the effect by establishing effectiveness and efficiency of Factory Energy Management System (FEMS) that controls facilities effectively which we maintained by a smart next-generation factory plan and making the showcase of the whole activity of EnMS in a real factory.

Figure 1: Business area

Energy management program

Omika Works is the first kind designated energy management factory in the Energy Conservation Act and have the effort duty of 1% improvement of the electricity consumption basic unit. We show the change of the recent basic unit in table and achieve the duty.

Figure 2: Basic unit trend in the Energy Conservation Act

	2010	2011	2012	2013	2014	5 annual average basic unit change
Sales amount energy consumption rate (kL/M¥)	0.03975	0.03236	0.03970	0.03743	0.03488	–
The anti-last year ratio	–	81.4%	122.7%	94.3%	93.2%	96.8%

Note: The reason of 2012 rate increase is that energy consumption at 2011 largely decreased by Great East Japan Earthquake disaster in 2011.

History of energy reduction approach

In the energy saving activity of conventional ISO14001, we have carried out the activity by deciding action target such as energy saving patrol once a month. But in the activity of ISO50001, it became easy to connect the improvement action by performing management by the numerical value, and we have increased consciousness aiming at accomplishment of our targets.

Based on the electricity data which utilized FEMS, each section devises a plan and carries out the improvement measure along with the plan. After confirmed the electricity information that was provided by visual control of FEMS, each section performs analysis and measures, and reflects them for the plan. We turn PDCA cycle

continuously by adopting ISO50001 effectively and carry out energy use efficiency improvement.
Each section sets a basic unit in accord with the activity of it, raises a concrete energy saving measure for the theme, confirms the deviation between a target and the result and performs an improvement activity every month. If it is a designing section, as an example of the basic unit it sets the electricity consumption per use area or electricity consumption per staff. If it is a production section, as an example of the basic unit, it sets the electricity consumption per production unit number or electricity consumption per working hour.

Keys to Success

A. Get an incentive and understanding to top management
B. Unification use with ISO14001EMS
   a) Minimization of the ISO50001 operational standard by adding ISO5001 correspondence matters to ISO14001 operational standard
   b) Management documents increase suppression by adding EnMS action items to ISO14001 management plan
   c) Burden Reduction of auditors and the audit department by the simultaneous implementation of the EMS and EnMS internal audit
C. FEMS construction
   a) Implementation of PDCA cycle with the realization of the energy performance improvement measure by application and department and with the results by measures execution can be quantitatively determined
   b) Escalation in employees interest about the electricity usage by an intranet exhibition of electricity consumptions

EnMS Development and Implementation

In the light of Great East Japan Earthquake disaster of March 11, 2011 experience, we decided to promote "the smart next-generation factory plan" from June, 2011. It aimed at introducing photovoltaic power generation facilities, battery facilities and peak shift peak cut of the electricity usage which minimizes the influence on operation of our factory, and corresponding reinforcement to BCP (Business Continuity Planning) and further efficiency of the energy use.

In the smart next-generation factory plan, we introduced photovoltaic power generation facilities (940kW) and battery facilities (4.2MWh), attached electricity sensors (ex. smart meters and multi-meters) to every power distribution panels of 7 buildings (from A to G building) in Omika Works, and made electricity consumption visible every electricity usages (illumination, air conditioning, OA apparatus, production facilities, inspection facilities) and every section usages. By such measures, we built FEMS every building including the air conditioning control. In addition, we acquired the certification of the ISO50001 energy management system and established the structure of the PDCA cycle to plan energy performance improvement continuously.

As a result, we achieved 23% reduction at the peak electricity of 2012 in comparison with 2010. (We updated contract electricity from 8,000kW to 5,700kW). We achieved 4 million yen per month by the contract electricity reduction, 1 million yen per electricity fee for monthly use by the photovoltaic power generation and the energy performance improvement activity of EnMS, total cost 5 million yen per month. We could achieve 15% CO_2 discharge reduction which was shown from 11,748 t-CO_2 /year at 2010 to 9,966 t-CO_2 /year at 2014. In addition, in order to keep the adjustment of the evaluation of the activity, we used the CO_2 conversion factor 0.36 kg-CO_2 per kWh before Great East Japan Earthquake disaster.

Figure 3 : Smart next-generation Factory plan

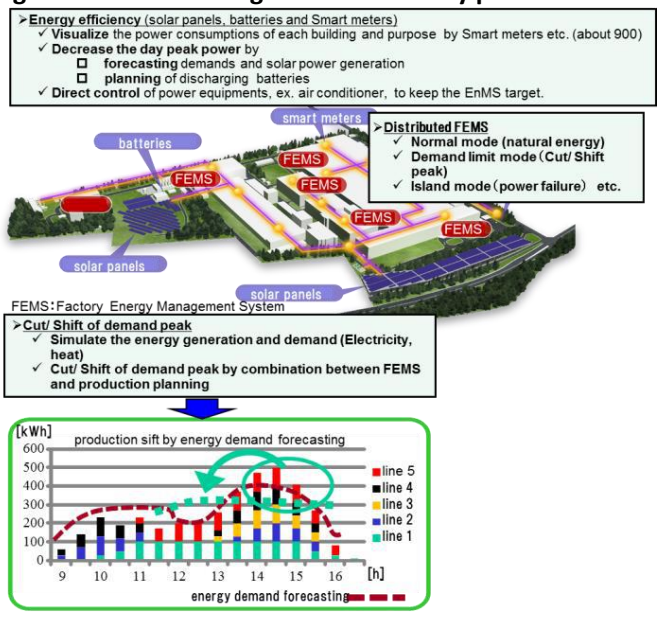


Figure 4 : EnMS PDCA by visualization

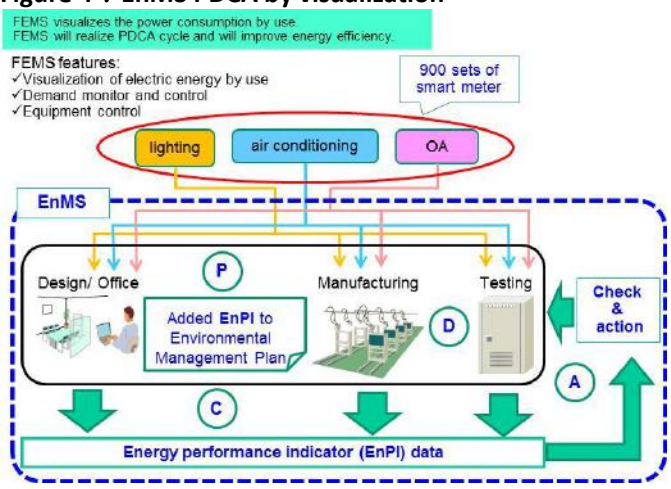
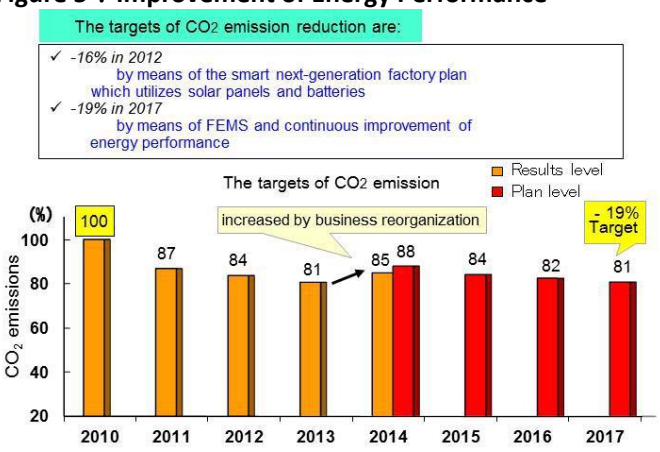
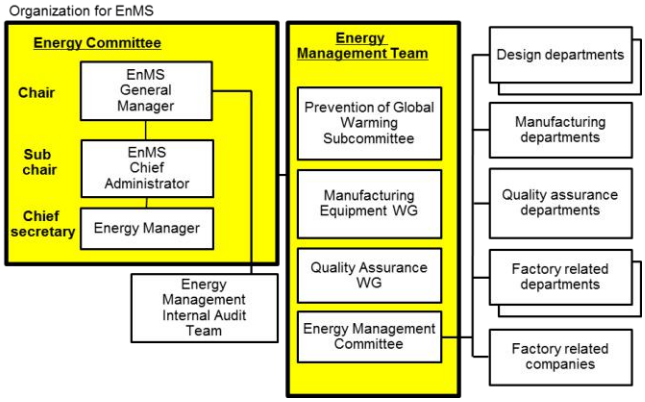


Figure 5 : Improvement of Energy Performance



As the organization that promotes the ISO50001 energy management system, we made an organization of which an energy committee is a top. In our energy committee, a chairperson is a general manager of Omika Works, a vice chairman is a department manager of First Environment Surveillance Department, and a chief secretary is energy manager. We organized four energy management teams under the energy committee which are constituted of "Prevention of global warming subcommittee" that is the subsystem of "Environment Committee", "Production facilities working group" that is constituted of production section with much energy consumption, "Examination facilities working group" that is constituted of examination section with much energy consumption and "Energy management committee" that is constituted of representatives of all departments including the affiliates in our factory. We hold an energy committee once in two months and plan improvement of the energy saving activity.

Figure 6: Organization for EnMS



Review, analysis, and planning

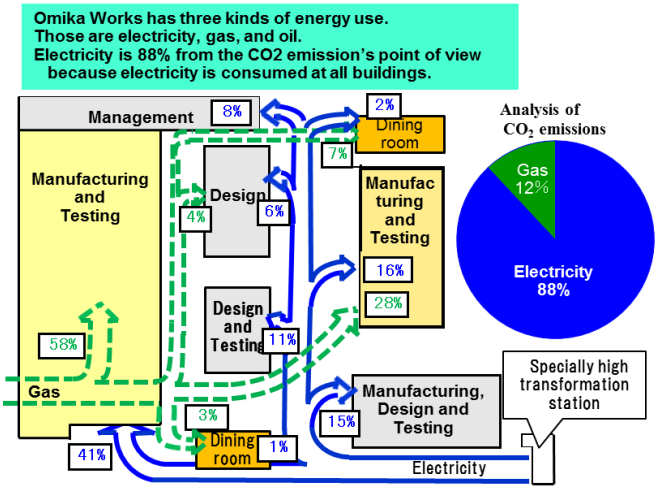
A. Enforcement procedure of the energy review

We show the enforcement procedure of the energy review and each evidence as follows.

a) Identification of the energy source

We made the energy flow chart of Omika Works. We selected electricity to account for 88% of energy use as the object of the energy review according to the section, because the use of city gas is a specific department and union sector (such as cafeteria).

Figure 7 : Analysis of Energy flow at Omika Works



b) Energy review

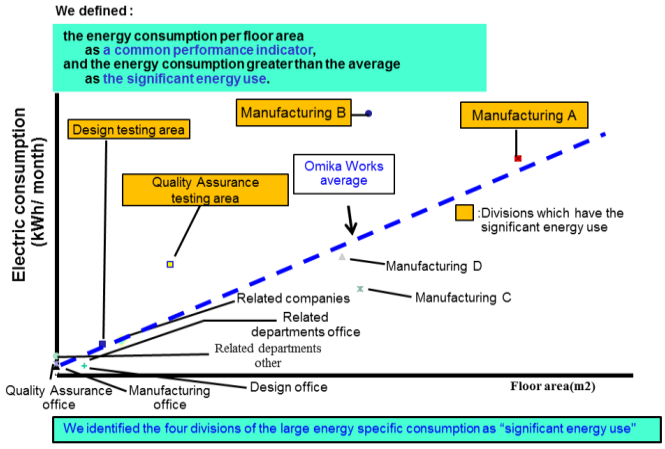
Energy and performance indicators for each activity section (EnPIs) in common, we decided it as the electricity consumption per occupation area of each section.

c) We made an EnPIs graph according to above sections and identified sections which exceed the average of electricity consumption of our factory. Specifically, manufacturing sections and quality assurance sections were identified. As a result, we set up energy

management teams of "Production facilities working group" and "Examination facilities working group" as a cross-sectional organization of Omika Works.

d) We predict the energy consumption in the future of our factory from the target percent improvement of the basic unit (CO_2 discharge per sales amount).

Figure 8 : Significant energy use



B. Operative procedure of an energy baseline and the energy performance indicators:

We fixed the energy baseline for 1% improvement per year of the electricity basic unit as the standard year 2010. In addition, we carry out the review of the baseline when there is the big change of a production process and facilities. Because we had the reorganization of the production base in April, 2014, and the increase in CO_2 discharge with the electricity consumption was anticipated, we record the change origin. Each section of the EnMS activity unit makes EnPIs which can evaluate reduction activity of the energy consumption appropriately by oneself, and sets the targeted value of the improvement. We add an item of EnPIs of EnMS to the environmental management plan of ISO14001, and reduce the increase in activity plan. In this example, EnPIs is the value that fell below electricity consumption with amount of production in a production section.

Figure 9 : Energy management system action plan

Financing

We had a company president approve facilities investment for a smart next-generation factory plan and Omika Works manager approve the activity for ISO50001 certification acquisition in order to reduce the environmental load with the production activity of Omika Works, especially reduce CO_2 emissions that is contributed to the prevention of global warming, and plan a solicitation power improvement to customers by making and presenting the showcase that constitute a whole system to build and apparatus concerned.

Duration

In ISO50001 management system construction, based on ISO14001 which had already established using, by performing the integrated operation of ISO50001 we could rationalize and early start-up of the management system operation. In addition, we made modifications in a standard for ISO50001 correspondence based on an operative standard of ISO14001 about the operative standards. We carry out unification use of ISO50001 and ISO14001 about the internal audit.

As the promotion organization, at first between a period from January, 2012 to April, we organized an ISO50001 preparations organization in "Prevention of global warming subcommittee" that is the subsystem of "Environment Committee" which moved into action in ISO14001. After that, we got approval by the top management in the end of April and founded "Energy

Committee" and "Energy Management Team" in May, 2012.
Meanwhile, we carried out a domestic inspection and a top management revue, and received certification audit by Japan Audit and Certification Organization for Environment and Quality in June and authenticated it in July. Thus, the EnMS construction period was six months.

Figure 10 ： Integration of EMS and EnMS

Ⅰ. Comparing EMS(ISO 14001) and EnMS(ISO 50001) standard requirements
Ⅱ. Making common operation rules based on the comparing result

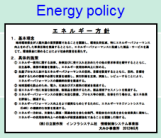
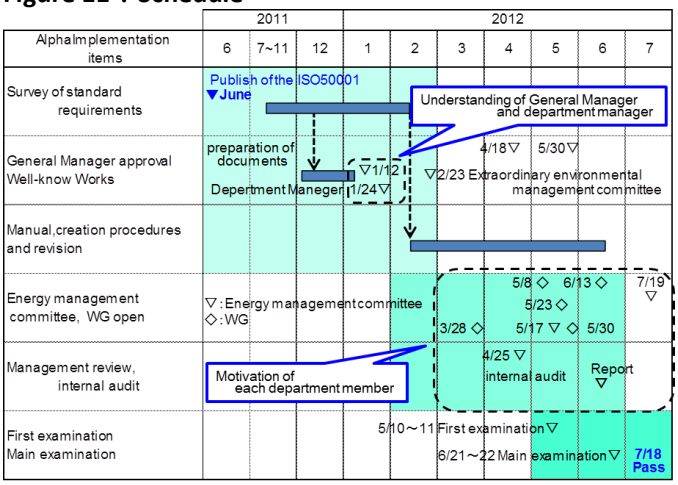
No	requirements	actions for EnMS	remarks
	-	To identify operation rules associated with EMS	✓new 6 rules and 10 revisions ✓Integration of EMS and EnMS operation
1	**Scope**	To describe the name of the department in Omika Works which should be managed ⇒To add a physical boundary	Physical boundary 
4.1	**General requirements**		Energy policy
4.2	**Management responsibility**	To made an EnMS manual	
4.3	**Energy policy**	To define the Energy Policy	
4.4	**Energy planning** ✓*Energy review* ✓*Energy baseline* ✓*Energy performance indicator* ✓*Energy objective, energy target and energy management action plans*	➢**To analyze the energy flow** ➢**To identify the significant energy use** ➢**To simplify the system to add the Energy objectives and Energy target to Environmental Management Plan and Report of EMS**	**set up the common performance indicator of** electric consumption Step 1: calculating the performance indicator per floor area. Step 2: Identify the significant energy use ●Setup the energy management team ●Organize the performance indicator of each department.
4.5	**Implementation and operation**	➢To integrate operation of EMS and EnMS □ Common operation rules □ Common internal audits	✓Adding EnMS terms to education tools for traditional EMS. ✓Internal auditor training (2012/9)
4.6	**Checking**		
4.7	**Management review**	➢To setup Energy Committee	

Figure 11 ： Schedule



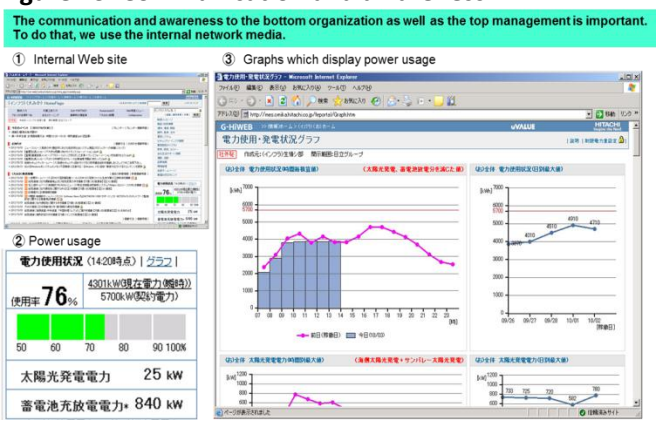
As well-known and understanding to employees, we post energy policy posters to each department and distribute energy policy cards and education documents to employees. In addition, through real-time monitoring of power usage and publication to employees, we connect to the efforts of all participation of power saving.
About the management education, energy manager (national licensee) who is required to install at a first-class energy management appointment factory educate electricity consumption trend on the whole place of Omika Works and the trend of the industry in the "Environment and Energy Management Committee" that we hold once in two months.

About the external and internal communication, we set reference sections, communication sections and records to a document and manage it.

Figure 12: Energy policy card


HITACHI
スローガン：次世代へクリーンな地球を
エ ネ ル ギ ー 方 針
1. 基本理念
地球環境保全が人類共通の重要課題であることを認識し、構造責任低減、特にエネルギーパフォーマンス向上をめざした事業活動を推進するとともに、エネルギーパフォーマンスに配慮した製品・サービスを通じて、環境保全に努めることにより社会的責任を果たす。
2. 具体的施策
(1) エネルギー使用に関する法律、条例並びに受け入れを決めたその他の要求事項を順守するとともに、自主基準、業務手順書を整備し、エネルギー使用効率向上に努める。
(2) 生産プロセスにおけるエネルギーパフォーマンスの目的、目標を設定するとともに、目的、目標を達成するための情報や必要な資源を確保し、実行計画を立案、実施、レビューすることにより、エネルギーパフォーマンスの継続的改善を推進する。
(3) 地球温暖化防止のため、電力、石油及びガス燃料の節減を推進する。
(4) 省エネルギー性に有益な新技術、新製品を提供するため、製品環境アセスメントを推進する。
(5) エネルギーパフォーマンスの改善に有益な設備、プロセス等の新設、改修を行う場合は、省エネ効果を評価し、調達する。
(6) エネルギーパフォーマンス向上をより確実なものとするために、エネルギーマネジメントシステム(EnMS)の継続的な改善を推進する。
(7) エネルギー方針は、文書化し関係・関連会社を含む全部門、管理会社の社員を含む全従業員に周知し、エネルギーの使用効率向上への取組みが経営基盤強化であることを認識し行動する。
2012 年 5 月 30 日
(株)日立製作所 インフラシステム社
情報制御システム事業部 大みか事業所

Figure 13: Communication and awareness



We prepared following facilities and systems sequentially from July, 2011 by a smart next-generation factory plan.

A. A large size real time power monitoring system that indicates the electricity consumption by 7 buildings of Omika Works, amounts of photovoltaic power generations, a battery discharge and charge and the electric energy to receive
   a) Monitors of the usage power consumption to section managers
   b) Published on our intranet homepage: the real time electricity consumption on the whole place of Omika Works, the electric energy that we contract and the proportion

B. Generation, Battery and others facilities which we maintained
   a) Photovoltaic power generation facilities 940kW
   b) Battery facilities 4.2MWh
   c) 900 electric power sensors according to application (air conditioning, illumination, OA apparatus and others) by 7 buildings

C. Development of the FEMS system
   a) Air conditioner automatic control of the prevention of the peak target electricity excess (Instance of the summer: automatic change of the temperature setting, forced outage)
   b) Production control system avoiding the examination peak electricity of large electricity usage products

We perform the operational management with the following procedure manuals which we documented as management operation about the energy.

a) Energy management operation procedure manual: We prescribe the procedure to reduce energy for the purpose of prevention of global warming.
b) Energy management standard under the Energy Conservation Act: We prescribe the management standard (ex. decision criteria for the management item, the measurement item, the check item and check frequency) for every energy management facilities intended by the Energy Conservation Act.
c) Illumination facilities management standard under the Energy Conservation Act: We prescribe the management standard of illumination facilities and the appropriate illumination management.
d) Air conditioning management standard under the Energy Conservation Act: We prescribe the management standard of air conditioners and appropriate air conditioning management. The indoor management temperature at the time of the heating operation is less than 20 degrees Celsius and at the time of the cooling operation is more than 28 degrees Celsius.
e) Office appliances management standard under the Energy Conservation Act: We prescribe the management standard of the apparatus for the office work and the appropriate apparatus energy management for the office work. The time which is setting for PC monitor power save is less than ten minutes.

In addition, as work on the review of the newly introduced facilities, we consider changing necessity of energy baseline to target facilities that use over 20kW by the ‘energy consumption check vote’.

Each activity section makes an annual action plan at the beginning of the year and has the Mayor of section approve it. In it, they set target values of the end of the year and every month. They confirm electricity usage results every month that are provided by the FEMS system, and revise action plans as needed.

Action plan

"Prevention of global warming subcommittee", "Production facilities working group" and "Examination facilities working group" which constitute the energy management team and activity sections which constitute "Energy management committee" plan energy performance improvement programs and target values in a beginning of the fiscal year. They input monthly result levels into their plans and inspect them. They issue the corrective action report according to the decision criteria by the result as needed and confirm the cause, the present measure, the permanency measure and the effectiveness of the measure.

Decision criteria
We fill a corrective action in a corrective entry column and carry out the measure, if the total achievement rate prospect at the time of the inspection is 99-71% (101-142% in the reciprocal) of the target value. In addition, when we continuously fill a corrective action in a corrective entry column more than twice in the same item, we issue the corrective action report and carry out the radical measure.
In addition, we also carry out a review of the target value at the time of over-achievement.

Internal audit
As preparations of the internal audit, we educate members of internal audit according to the "education procedure manual of members of internal audit" and we prescribe the way of it in the "procedure manual of the environmental management internal audit". This procedure manual is prescribed according to ISO14001 requirements and is added audit items of ISO50001 requirements.
The audit team consists of one member of chief audit and more than two members of audit, in order to secure objectivity and equitableness of the audit. In addition, we use the internal audit check list in which we listed a check item and the way of confirmation every item standard number of EnMS in order to secure the audit quality.

We reduced the each monthly energy consumption cost about 5 million yen by the peak electricity (contract electricity) of Omika Works reduction from 8,000kW to 5,700kW with our smart next-generation factory plan, by our photovoltaic power generation facilities and by the purchase electricity reduction with our EnMS activity.

The number of visitors to Omika Works about this example was about 2,100 in 2011 and was 1.7 times of it in 2012, 1.9 times of it in 2013 and 2.0 times of it in 2014. Therefore, we think that the showcase of Omika Works produces a desirable result.
In addition, investment and payback period of such as photovoltaic power generation facilities, battery facilities and FEMS is not public.

We were able to prioritize the action plan from the point of view for significant energy use, and carry out an energy performance improvement activity effectively.

Lessons Learned

We performed the following newspaper publication and external lectures after ISO50001 certification registration and contributed to the EnMS recognition improvement in Japan.

- The daily publication industry newspaper (2012.7.30 publication) "Energy-saving international certification acquisition"
- Nikkei industry newspaper (2012.8.2 publication) "The international standard certification acquisition"
- ISO Meeting workshop (October, 2012) in Osaka by Japan Audit and Certification Organization for Environment and Quality sponsorship About the "ISO50001 certification acquisition"
- ISO50001 international workshop example reports (November, 2012) "ISO50001 certification. A case of Omika Works, Hitachi, Ltd" hosted by Ministry of Economy, Trade and Industry
- SO Meeting workshop (April, 2013) in Tokyo by Japan Audit and Certification Organization for Environment and Quality sponsorship About the "ISO50001 certification acquisition"
- 2013 energy and power saving example announcement meeting January, 2014 by General Foundation energy saving center sponsorship "Visualization and making units of electricity and Promotion of energy use efficiency improvement measure by EnMS"
- Japan Accreditation Board example briefing session (March, 2016)