

2009 Prize of Director General of Agency for Natural Resources and Energy

Voluntary energy-saving Audits for small-middle firms by the association of local companies

Shinshu Energy-saving Patrol Unit

1. Background and Needs

Loads the industries impose on global warming are significant (especially, energy segment), and it is essential to concretely and promptly advance the improvement and revolutionary activities against it. Though the industries are holding lectures and case presentations to promote energy conservation, those activities alone are not enough to concretely and speedily execute practical and concrete measures.

With the above background, when Seiko Epson compiled its energy-saving technologies as a casebook and distributed it to local firms in the Suwa district to contribute to Seiko Epson's energy-saving technologies for the prevention of global warming and the development of local communities, Seiko Epson received many requests to execute energy-saving audits at the jobsites of those local firms. Therefore, since 2000, Seiko Epson has extended beyond its energy-saving patrol unit, which was in operation within Seiko Epson and has been voluntarily providing energy-saving audits as " Suwa Local Energy-saving Patrol Unit " for small-middle firms in the Suwa district in association with local firms, the Nagano Prefectural Top Managements' Association Suwa Branch, and the Nagano Prefectural Environment Protection Association Suwa Branch.

Furthermore in 2005, Seiko Epson extended its energy-saving audits to a larger activity that is supported by Nagano Prefecture, the Nagano Prefectural Environment Protection Association, and the Nagano Prefectural Top Managements' Association. Then, Seiko Epson extended its activities throughout Nagano Prefecture and restarted its activities as " Shinshu Energy-saving Patrol Unit " targeting all corporations and facilities. In 2006, Seiko Epson compiled the energy-saving technologies and know-how from " Shinshu Energy-saving Patrol Unit " and published the second edition as a casebook.

These energy-saving activities by Shinshu Energy-saving Patrol Unit have contributed significantly to the prevention of global warming and the reductions in the expenses of corporations.



2. Contents of Activity

Objective

- | | |
|------------------------------------|---|
| 1. Prevention of global warming | Reduction in CO ₂ emission |
| 2. Deal with reduction in resource | Efficient use of energy |
| 3. Strengthen corporation power | Reduce expense, increase profit, improve customer service |

Vision (Target)

As a preventive measure for global warming, Nagano Prefecture aims to reduce CO₂ emissions by 6% by 2012 in comparison with 1990 and more than 50% by 2050 as a long term target. To contribute to the achievement of the prefecture's CO₂ reduction target and the reduction in expenses of corporations via energy-saving activities, we aim to strengthen the power of corporations in Nagano Prefecture through energy-saving activities.

With the principle of “ cooperation than competition ” in energy-saving activities, we intend to continually support CO₂ reduction activities.

Nagano Prefecture's CO₂ reduction target

“We aim to reduce CO₂ more than 50% by 2050 compared with 1990.”

Characteristics of activity

1. This is a voluntary activity by members dispatched from corporations within Nagano Prefecture and it is developing all over the prefecture. This activity is drawing attention as this kind of activity is rarely seen in Japan.
2. Energy-saving audit is a voluntary activity, which is carried out free of charge. Therefore, very small-small-middle firms can easily apply for it.
3. Members are dispatched from firms that received energy-saving audits, which makes the activity sustainable.
4. By disclosing the energy-saving information owned by a firm that dispatches members (like energy-saving casebook) and horizontally developing it among members (like members education) to share useful information, we aim to improve the width and quality of the audit.
5. The Energy-saving Patrol Unit consists of members who have high expertise in energy conservation, such as experts in energy management or electricity chief engineers.
Qualifications: energy manager, pollution control manager, boiler engineer, electrical worker, high pressure gas handler, dangerous object handler, electricity chief engineer, sanitation supervisor, etc.
6. Proposals based on audit include how to proceed with energy conservation and cover from down-to-earth recommendations that cost relatively little to recommendations that may cost somewhat for investment. Besides, we clearly indicate the expected effect of energy saving volume and monetary amount as well as the estimated pay-back period of investment in order to make improvements easily put into practice.
7. We provide education and seminars for members two to three times per year to increase members' skills, and we also hold lectures on energy conservation to promote dissemination of energy conservation.
8. Office operations are done by participating firms, and the association among those firms is well reserved.
9. We have been steadily continued the activities for 10 years, and the number of audits exceed 200. Lately, we have been receiving many requests for interviews and lectures from outside Nagano Prefecture. Our substantial contribution is very high, especially to a

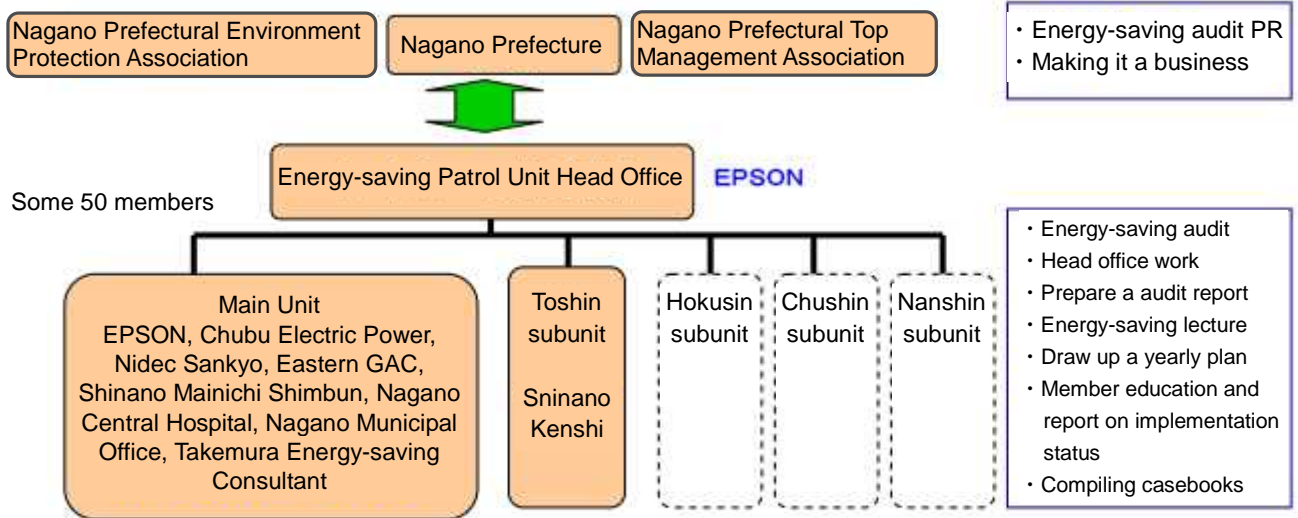
reduction in environmental loads.

10. This is a reliable activity supported by Nagano Prefecture, Nagano Prefectural Environment Protection Association, and the Nagano Prefectural Top Managements' Association.

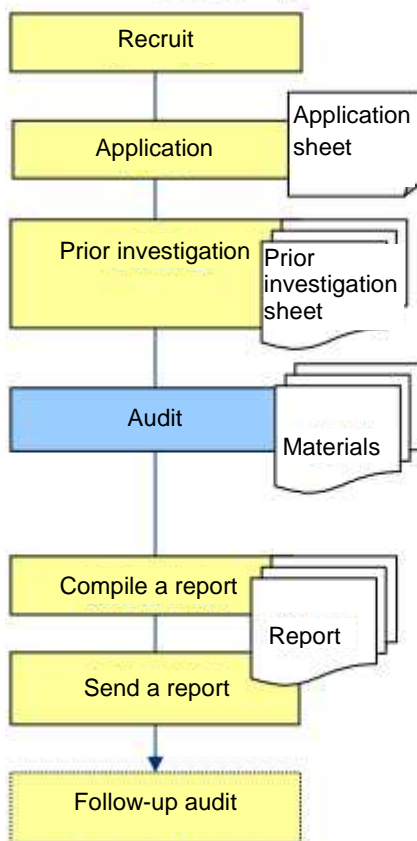
Organizational Structure and Operation

Since Suwa District Energy-saving Patrol Unit was formed in 2000, we have been implementing the activities for nine years, and the total number of audits we provided has exceeded 200. However, there are still many companies (6,300 manufacturers with four or more employees) and facilities in Nagano Prefecture. So, to further advance energy-saving activities, we have established an organization that is advocated and supported by Nagano Prefecture, Nagano Prefectural Environment Protection Association, and Nagano Prefectural Top Management Association, making the activities sustainable. We divided Nagano Prefecture into several districts and assigned voluntary lead companies by district to launch a subunit. Thus, we are utilizing locality to promote activities.

Organization Chart of Energy-saving Patrol Unit



Audit flow chart



Recruit PR (Nagano Prefecture, Nagano Prefectural Environment Protection Association)

Application (FAX application), Request an applied firm to pre-investigate

Prior investigation Prepare on the day after writing, Table-1 energy management system, consumption volume by energy type, major facility capacity/number of units, air-con method, manufacturing facility, contracted utility/type, power ratio daily load curve, demand, energy-saving activity history/plan, room temperature management, illuminance management, raising energy-related human resource (education/qualification, enlightenment)

Audit

1. Document, interviews
2. Factory, establishment site audit/measurement, lighting, air-con, building, layout, manufacturing facility, receiving converting power facility, air-con equipment, pump, fan
3. Comments

Send a report (within 2 weeks) Table-2,3

Compile and send within 2 weeks from implementation
Check audit results, proposal contents, improvement plan, economic effects, environmental effects, investment recovery, measurement results, effect calculation material

Table-1

Prior investigation sheet for energy saving audit

For us to do an effective audit, please fill out the sheet within your knowledge prior to the audit and hand it over to us on the day of the audit.

1) Energy management organization and administrative status

Energy management organization chart (outline)

Internal rules/administrative rules on energy-saving activity promotion

• Existent • Non-existent

Internal education/training system on energy-saving activity promotion

• Existent • Non-existent

External education training dispatch system on energy-saving activity

• Existent • Non-existent

Number of internal people qualified for “ Energy manager ”

()

Number of internal people training for “ Energy manager ”

()

2) Usage of Various Types of Energies

By energy type	Purchased power	Fuel					
		A Heavy oil	Kerosene	LPG	LNG	City gas	Other
Unit	KWh	kL	kL	ton	ton	m ³	
Average unit price	Yen/KWh	1,000 yen/kL	1,000 yen/kL	1,000 yen/ton	1,000 yen/ton	1,000 yen/m ³	
Calorific value	2350 Kcal/KWh	9350 Kcal/L	8800 Kcal/L	12000 Kcal/ kg	13000 Kcal/ kg	9800 Kcal/m ³	
Crude oil equivalent coefficient	0.000254 kL/KWh	1.01 kL/kL	0.95 kL/kL	1.30 kL/ton	1.41 kL/ton	1.06 kL/1,000 m ³	
CO ₂ emission coefficient	4.81 tCO ₂ /10,000 kWh	2.71 tCO ₂ /kL	2.50 tCO ₂ /kL	3.00 tCO ₂ /ton	2.70 tCO ₂ /ton	2.0 tCO ₂ /1,000 m ³	
Yearly consumption	10,000 kWh/Year	KL/year	KL/year	ton/year	ton/year	1,000 m ³ /year	
Yearly cost	10,000 yen/year	10,000 yen/year	10,000 yen/year	10,000 yen/year	10,000 yen/year	10,000 yen/year	
Total yearly cost	10,000 yen/ year						
Yearly sales	10,000 yen/ year						
Energy ratio	%(Total yearly cost/ Yearly sales)						

Yearly consumption (crude oil equivalent)	kL/Year	kL/Year	kL/Year	kL/Year	kL/Year	kL/Year	kL/Year
Total crude oil equivalent	kL/Year						
Ratio of power vs. fuel	%	%					
Yearly CO ₂ emission	t-CO ₂ /Year	t-CO ₂ /Year	t-CO ₂ /Year	t-CO ₂ /Year	t-CO ₂ /Year	t-CO ₂ /Year	kgCO ₂ /Year
Total CO ₂ emission	t-CO ₂ /Year						

Investigate 13 items including above two items

3. Classification as a designated energy management factory segment	9. Capacities of major facilities
4. Major uses of energy	10. Illuminance measurement results
5. Electricity contract	11. Room temperature measurement results (Recommended by government)
6. Trend of yearly power consumption	12. Voltage measurement results at use location
7. Trend of yearly maximum power	13. Energy reduction activity status
8. Trend of maximum power over time	

Table-2

Report 1

Simple Report of Energy-saving Investigation Audit

1. Investigation audit data

Item	Data
Implementation date/time	
Implementation venue	
Audit investigator	

2. Investigation audit results

Economic aspect assessment

Total investment value	Yearly reduction effect sum (electricity, kerosene, LPG)	Simple investment recovery years	(Reference) *4 Reduction rate vs. yearly consumption
600 (10,000 yen)	300 (10,000 yen/y)	2.0 (years)	2.8(%)

Environmental aspect assessment

Reduction (crude oil equivalent)	Reduction (crude oil drum equivalent)	Reduced CO ₂ volume	Forests area contributing to Earth environment protection	Tokyo Dome area equivalent
51 (kL/y)	255 (cans/y)	96 (tons/y)	4.4 (Ha)	1.0

Preconditions for calculation

- *1 Unit price of purchased electricity = 15 yen/KWh (including base fee)
- *2 Unit price of kerosene = 79 (yen/L)
- *3 Unit price of LPG = 112 (yen /kg)
- *4 Yearly energy consumption of crude oil equivalent (Result) = 1,833 (kL/y)
- *5 Yearly energy cost (Result) = 107.68 (million yen/y)

3. Expected improved effects (Rough estimate)

Class	Items to be improved	Invest-ed sum (10,000 yen)	Expected effects *1-3			
			Type of energy	Saved energy (kL/y, KWh/year)	Saved sum (10,000 yen/y)	Recovery (years)
Facility	<p><Building/air-con></p> <ul style="list-style-type: none"> - Shutter simple thermal insulation - North side windows, low thermal insulation part "puchipuchi" simple thermal insulation - Idle machines storage space simple partition - Proper room temperature setting (See casebook) - INV of exhaust fans (See casebook) - Meticulous exhaust control and proper exhaust volume - Cleaning of air conditioner filters - Adoption of energy-saving belts like exhaust fans (See casebook) - Chiller piping thermal insulation <p><Compressor></p> <ul style="list-style-type: none"> - Lowered disgorge pressure of compressor from 7 kg/cm² to 6 kg/cm² (tubes arranged, looped air piping of factory, use of pressuring valve) (See casebook) - Thermal insulation of exhaust duct (See casebook) - Short circuit prevention of air supply/exhaust in compressor room <p><Production machinery></p> <ul style="list-style-type: none"> - Enhancement of simple thermal insulation of drier (See casebook) - Enhancement of thermal insulation of high-temperature duct - Valve squeezing of solution pumps toward INV (See casebook) - Repair of air leakage (See casebook) - Secure idling time of halted M/C and frequently turn off power to save waiting power and frequent exhaust control (See casebook) <p><Lighting></p> <ul style="list-style-type: none"> - Adoption of Hf type when fluorescent lighting malfunctioned 	600	Electricity	200,000 KWh/year	300	2

	- Human sensor for co-use, low-use areas or toilet - Individual switch for office room fluorescent lamp and its thorough use (See casebook) <Others> Proper number of vending machines					
Total of expected results	Total invested sum	600	Total kerosene	0 kL/year	0 yen/ year	
		10,000 yen	Total electricity	200,000 KWh/year	300,000,000 yen/ year	
Total expected effects				300,000,000 yen/ year		
Total crude oil equivalent				51 kL/year		
Energy-saving ratio compared with previous year *4				2.8%		

Table-3 Report-2

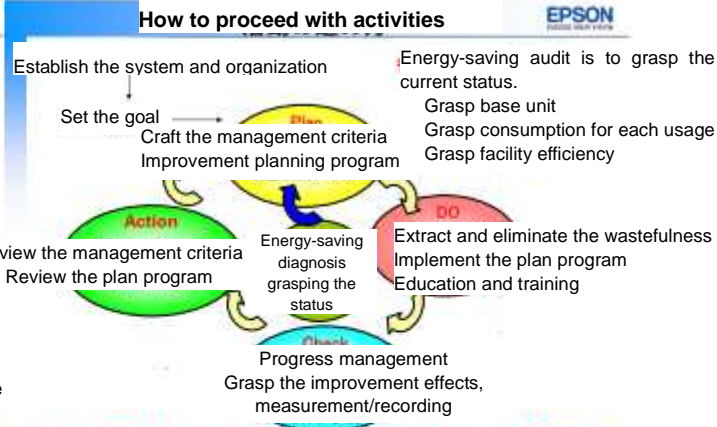
How to find energy-saving themes

Approach
Energy-saving methods by "grasping status" and "reviewing traditional management"
Finding energy-saving themes by "measuring technique" and "analyzing past data"

Point


1. "What?" Improvement method from question mark plus finding by small group activity
2. Grasp the current status in greater detail by "visualization"
3. Can see the issue while pursuing "limit value"
4. Grasp the energy-saving base unit by "facility" and examine the past trend
5. "Knowledge, know-how and mind-set", a prior investigation is effective for "finding energy-saving themes".
6. Extract cases where operations are done with a certain margin and re-examine them.
7. Get Manufacture, Engineering, Quality involved to find measures and promote energy conservation.

How to proceed with activities



It is important to grasp "when", "where", "how much" and "why" energy is consumed.

Photo comment




Lighting management

From whole lighting to local lighting
Manage only necessary place with necessary time and necessary amount.

Adage of a certain company
"Those who control lighting control energy-conservation."

Photo comment



Steam boiler thermal insulation

The boiler itself has the temperature of 89℃ and heat is being dispersed all over the room.
It is possible to reduce fuel 8% by thermal insulation.

Points of energy-saving audit

Energy-saving audits are done from the points below. Firstly we consider the financial status

of a company to be audited. We classify the points into those that can be done without budget and those that can generate big effects though they may need some budget.

Point	Case
1. Can we stop it?	Stop air conditioners in middle term, control number of units
2. Can we decrease it?	Power distribution loss, loop piping
3. Can we lower or raise it?	Temperature/humidity, air pressure, steam pressure
4. Can we squeeze it?	Flow volume, airflow volume, exhaust volume
5. Can we shut it off?	Solar heat circulation, thermal insulation
6. Can we smooth it?	Piping route, filter pressure loss
7. Can we make it severe?	Contracted utility, power ratio, power distribution voltage
8. Can we put them together?	Compressor, transformer, boiler, etc.
9. Can we shift it?	Heat storage, peak power, single-phase load
10. Can we utilize nature?	Free cooling, solar light, purge

Points of activity

Continuity Points No burden Fun Pleasure, happiness to achieve Mission, passion	Upbringing Points Focus on job site To be learned Acquire concrete improvement method	Effect disclosure Points Reduced energy volume Reduced cost Reduced CO2 Proposal requiring small investment
Technological edge Point Energy manager, electricity chief engineer, architect facility engineer, air-con equipment engineer, boiler engineer, knowledge of qualification of machine designer, etc., technology/experience minimally required		
Confidence/trust Point Duty for confidentiality, no desire, keep promises, impartiality, not relevant to energy-saving business, many introductions of energy-saving machines and vendors, immediately delete photos of audit, keep reporting deadline		
Safety audit Point Power generation, transform facility (high voltage), machine room (rotating device), boiler (high temperature), audit at dangerous place like roof or attic (high place), staff with qualifications and experience		

3. Effects

Energy-saving

As a result of the energy-saving audits that lasted nine years from 2000 to 2009, we accomplished more than 200 audits in the prefecture and achieved great effects. See Fig.1

Economic assessment

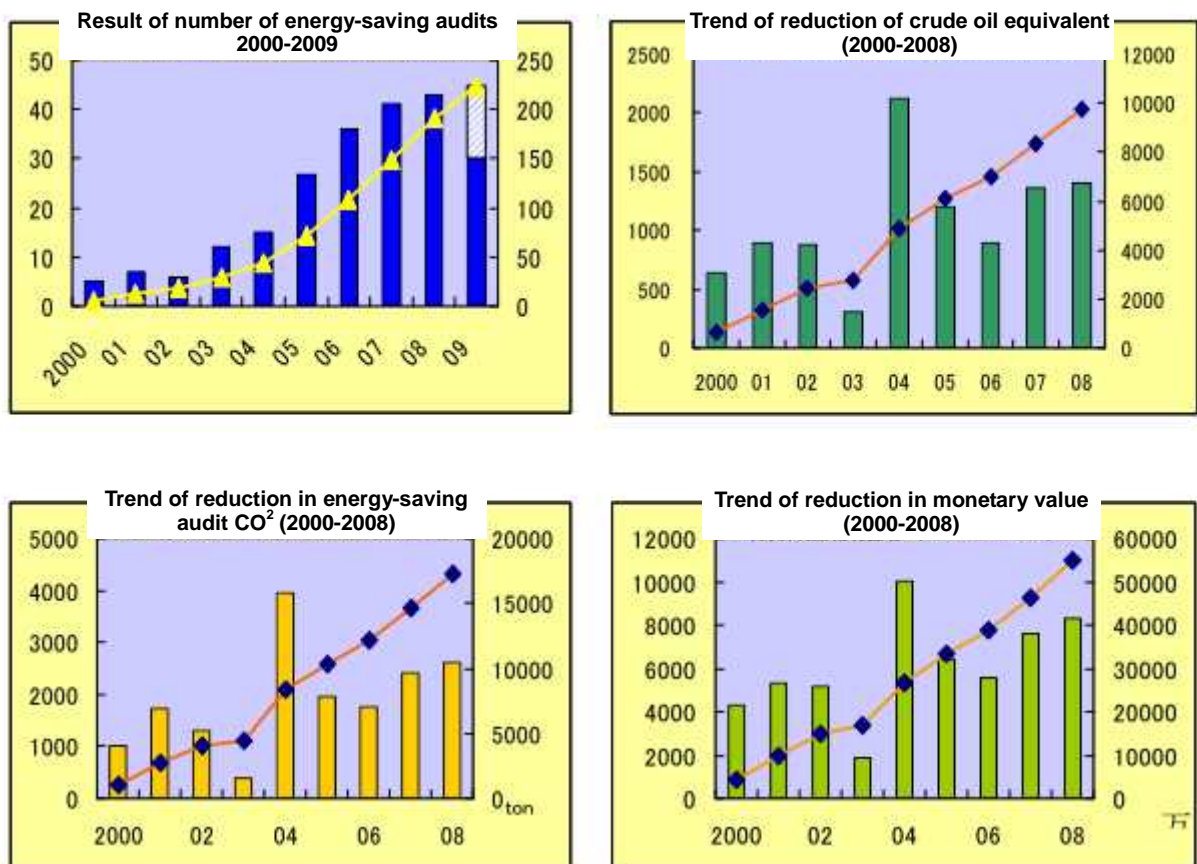
- Simple investment payback years: About three years (average)
- Energy-saving efficiency: 9.2% (average)
- Reduced cost: 560 million yen (simply accumulated) *

Environmental assessment

- Reduction effect of 10,700 kL of crude oil equivalent (Fig.2)
- Reduction of 19,000 tons of CO₂ (Fig.3)

* Just in case the proposal based on the energy-saving audit is implemented

Fig. 1 Graph of Results



Case: Individual light switches



Case of head office: 4469 units	Yearly reduction	Simple investment recovery period
Invested: 8,950,000 yen	6,170,000 yen/y	1.45 years

Case: Thermal insulation of steam tubing/machines



Facility invested sum (one location)	Yearly reduced sum (one location)	Simple investment payback period
Egg-shape valve: 20,000 yen	17,000 yen/y	1.2 years