

エネルギーAudit (各工場への説明内容)

General Procedure of Energy Diagnosis

Recognition of Current Condition

Identification of Current Problems

Formulation & Preparation of ED

Factory Audit (Diagnosis)

Identification of Problems requiring Countermeasures

Assessment & Recommendation of Countermeasure

Recognition of Current Condition

Observation of Factory

Answer to Questionnaire

Inspection of Data & Documents

Discussion with Factory Members

Outline of Factory & Production Facilities

Operating Conditions

Energy Consumption & Unit Consumption

Energy Flow Chart

Flowsheet for Major Products

Energy Prices

Major Energy Consuming Facilities, Electric Power Station

Identification of Current Problems

Review, Scrutiny and Arrangement of Data, Information and Records

Discussion with Factory Members

Problems in Energy with Major Energy Consuming Facilities

Energy Consumption

Formulation & Preparation of Factory Diagnosis

Review & Analysis of Premises

Formulation of Detailed Plan

Measurement, Field Investigation, Personnel Allocation, Schedule etc.

Necessary Preparatory Work

Discussion with Factory Members

Confirmation of Preparation

Equipment, Power Supply, Adjustment with Production Plan

Factory Audit (Diagnosis)

Measurement and Analysis

Installation & Calibration of Equipment

Analysis of Samples

Monitoring of Operating Conditions

Collection of Records of Measurement & Operation

Field Investigation

Drawings, Detailed Structure & Size

Identifying Problems by observing operation

Relevant Data, Information and Record

Identification of Problems requiring Countermeasures

Review, Analysis of Result of measurement & field Inspection

Identification of Problems and Judgment of Necessary Improvement

Items for Improvement

Explanation and Confirmation with Factory Members

Recommendation of Countermeasures

Calculation and Analysis of Effect of Energy Saving

Explanation and Selection of Proper Countermeasures

Estimation and Prediction of Cost and Effect of the improvement

Reporting

ENERGY CONSERVATION

Many countries in the world have been promoting economic development to escape from poverty or enjoy more affluent life. Increasing energy consumption in both developed and developing countries with rapid economic growth bring shortage of energy supply and the global environment issues eventually.

Many countries in the world has been suffering the shortage of energy because of local unbalance between energy supply and demand (especially petroleum).

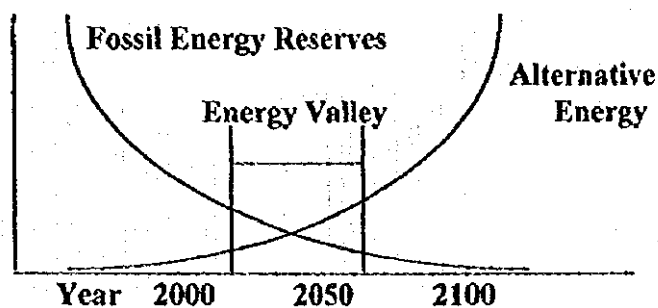
Nowadays, effective energy supply and rational use of energy have become more important as well as global environment issues caused by economic development, not only in developing countries and oil producing countries but also in developed countries for further improvement.

1. Why energy conservation?

Rapid economic development requires vast amount of fossil fuels such as petroleum, coal and gas. Recoverable period of petroleum and gas resources is estimated to be only about 50 years in current pace of consumption. This situation forces the necessity to hasten the development of alternative energy at latest until the middle of 21st century. However we are afraid of serious energy shortage in near future, because the commercialization of alternative energy needs at least 20-30 year period.

On the other hand, the recoverable year of coal resource is estimated to be more than 200 years but it has technological and environmental problems to be solved. So-called clean coal technology under current developing situations seems to require quite long time to realize the commercial utilization.

The first half of 21st century faces to more serious energy crisis than previous ones, as the result of above demand increase, shortage of resource, and delay of development of alternative energy and clean coal energy. Consequently the energy conservation is highly expected as the most directly contributing measure to avoid such crisis by the saving and improvement of efficiency, harmonizing with the global environment.



2. Targeted field of energy conservation

From the point of energy consumption, end-users of energy could be categorized as industrial, transporting, residential and commercial sectors. The efforts of energy conservation is essential and important in every sector because every these sectors consume quite big amount of energy around the world.

Energy conservation in industry sector makes its products internationally competitive, harmonized with cost reduction, high and stable quality and improved productivity, leading to the success of economic development. Furthermore, industrial products of high efficiency such as residential and commercial apparatus and vehicles contribute to the energy conservation in transporting, residential and commerce sectors.

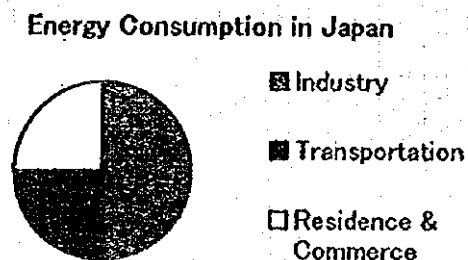
From the realistic point of view, energy conservation sometimes leads to raise the problem of environmental pollution. And environmental consideration controversially leads to high energy consumption.

So rational use of energy should include harmonizing the controversial themes of energy conservation and environment protection.



3. Energy conservation in industrial sector

Structure of energy consumption in three main sectors in Japan is showed on the following graph. Industrial sector represents about 50% of total consumption. So energy conservation in industrial sector seems to be more influential than other sectors.



Number of factory, vehicles and house/building in Japan is showed on the following table.

Targeted number in each sector	
Manufacturing Factory	400,000
Vehicles	40,000,000
Residence/ Building	40,000,000

4. Energy conservation in industrial sector

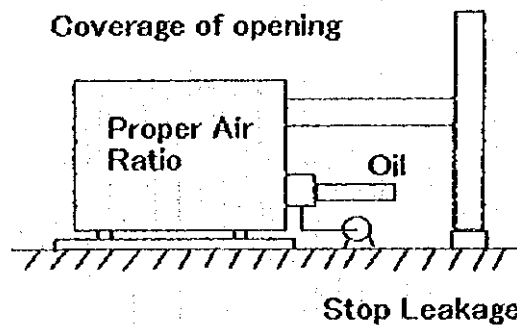
The method of energy conservation in manufacturing process could be categorized to three consequential steps of different degree of difficulty. These are proper management of facilities, minor modification and major modification of manufacturing process respectively.

4.1 First step (Proper management of facilities : Without new investment)

The first step of energy conservation in the factory should be focused mainly on reviewing energy management and repairing damaged parts of facilities.

Item of example :

- 1) Repairing damage and leakage
- 2) Prevention of non-load operation
- 3) Rationalization of fuel combustion (Proper air control)
- 4) Rationalization of heating, cooling and heat transfer
(Proper control of operating temperature)



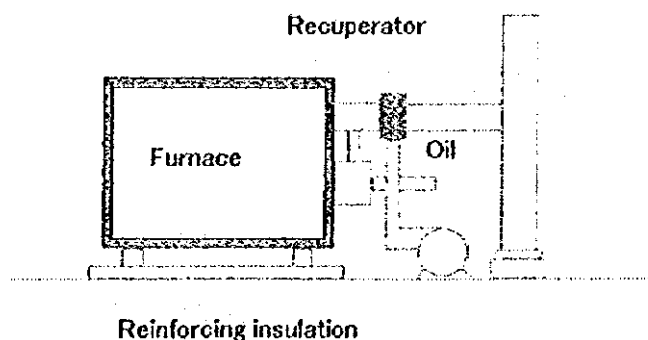
4.2 Second step (Minor modification, minor investment)

After implementing the first step, second step such as energy recovery Item of example are as follows.

Minor investment is expected to be recovered shortly.

Item of example :

- 1) Recovery of waste heat (Preheating of combustion air)
- 2) Prevention of radiation heat loss (Strengthen the insulation)
- 3) Power generation by efficient heat transformation (Co-generation)
- 4) Prevention of electrical resistance loss (Improvement of power factor)
- 5) Rationalization of transforming electricity to power and heat
(Control of rotating speed)



4.3 Third step (Major modification of manufacturing process)

The third step adopts drastic modification of whole manufacturing process and sometimes requires vast investment, leading to great energy conservation. For example, iron & steel industry successfully changed their process from complicated ingot casting & slab method to continuous casting method.

Ingot casting & slab method

Melt → Cool → Heat → Roll → Slab

Continuous casting method

Melt → Slab

5. Result of energy conservation in developing countries

Following table shows the result of energy conservation in developing countries for fifteen years.

Step	Items	Rate of energy conservation	Fund
One	Proper management of facilities	12%	Not necessary
Two	Minor modification	5%	Minor investment
Three	Major modification	13%	Major investment
	Total	30%	

6.1 Support of dissemination activities

Japanese experts are dispatched to a counterparts organization in developing country. They support dissemination for information and awareness.

(1) Holding seminar

For managers, Japanese experts introduce effect of energy conservation such as strong production for trade and contribution for environment issue. Furthermore, Japanese expert introduce managing and financing information such as promoting organization in factory and enough small investment. For engineers, Japanese expert introduce concrete promotion measures such as energy conservation technology, successful cases and evaluation method for investment.

Main theme of seminar are shown on table 4.

Table 4 Main Theme of Seminar

No	Main Theme of Seminar
1	Policy of energy conservation in Japan
2	Energy conservation in factory
3	Energy conservation in building
4	Heat technology of energy conservation
5	Electric technology of energy conservation
6	Energy Conservation technology in industrial sectors (Steel, Paper, Glass, Cement, Textile, Food, Chemical,.....)
7	New technology of energy conservation

(2) Distribution of pamphlet

We support distribution of information on energy conservation by pamphlet and other materials for managers, engineers and the people, then awareness of energy conservation is improved.

6.2 Study on a feasibility of energy conservation in industry

It is necessary to know a detail situation of energy use of every sector in industry to promote energy conservation in industry field. Many countries have a statistical data of energy supply for country level but there is not a detail data for each sector.

(1) Factory energy audit

Japanese expert team study a detail energy situation of factories with energy audit bus to know situation of energy use in industry field of developing country under cooperation with local counterpart.

Recommendations of energy conservation are not only forecasting of energy

conservation in industry but also a data managing method of energy conservation and a prediction of effect for the country.

Energy conservation projects of factory energy audit are executed as follows. (Table 5)

Table 5 Energy Conservation Project

No	Country	Period of Cooperation
1	Thailand	1982-1985,1993-1995
2	Malaysia	1983
3	China	1985-1986
4	Argentine	1987-1989
5	Hungary	1991-1992
6	Bulgaria	1992-1994

(2) Technology transfer

Auditing technologies of energy conservation transfer to local engineers on the job training at detail study by Japanese experts team with energy audit bus.

6.3 Cooperation for planning of regulation and incentive by the Government

It is very important to prepare regulation and incentive by the clear policy for quick and efficient promotion because the target of energy conservation is many and wide energy user.

Japanese experts study energy policy and economic/industry situation in developing country. Then they give advises to make plans for regulatory measure of energy conservation based on the following Japanese experiences.

(1) Energy conservation Law

In Japan, the energy conservation Law enacted at 1979 as regulation measure. Energy intensive factories are designated, report of energy consumption in each factory are obligated and national qualification of energy manager are regulated by the Law.

Ministerial guidelines of energy conservation for factory, building and apparatus are announced to promote energy conservation by the Government.

(2) Taxation system for investment promotion of energy conservation

For incentive measure in Japan, there is a measure of tax reduction by taxation system of energy investment promotion from 1979.

(3) Financial assistance system of energy conservation

Another incentive measure in Japan is special low interest loan system by the Law of energy conservation assistance which enacted at 1993.

6.4 Cooperation to establish a coordination center between Government and private

A center of promotion of energy conservation is required as core organization in the country. A concrete execution of the policy and understanding of many energy users are necessary for energy conservation because the target of energy conservation are many and wide of energy user.

This center promotes actual energy conservation measures, then this activities are cooperate between the Government and private.

We cooperate to establish a center in developing country based on many Japanese experiences.

The center executes the following activities to many energy users under the umbrella of the Government of developing country.

- 1) Dissemination
- 2) Education
- 3) Technical consultation and guidance
- 4) Publication
- 5) Research

6.5 Cooperation of human resources development

A key of creation of energy conservation promotion system in developing countries is human resources development.

Even if policy and organization are completed, it is impossible to promote energy conservation without human resources to operate them.

Then, we support developing country to be able to promote energy conservation by themselves with cooperation of industrial engineers development by training courses and establishment of a training center.

(1) Holding training course in developing country

Technical training courses of energy conservation are held to develop energy managers and engineers by Japanese experts at developing country. Training items is as follows.

- 1) Energy consumption measuring
- 2) Improvement plan for energy conservation
- 3) Successful case study conservation

(2) Holding training course in Japan

Human resources are developed by training courses with the following items to invite energy managers and engineers from developing countries.

- 1) Policy study for Energy conservation
- 2) Technology study for energy conservation
- 3) Successful cases observation of energy conservation
- 4) Equipment study for energy conservation

5) Improvement measure study for energy conservation

(3) Support to establish a training center by developing country

We have a limitation to human resources development of energy managers and engineers in developing countries by Japanese experts.

It is necessary to establish a training center as a key base and to manage training courses by developing country-side to develop many energy managers and engineers.

We cooperate to management and training items of a training center, which is established by developing country, based on many Japanese experiences.

6.6 Equipment demonstration

It is very effect to show a real equipment as demonstration instead of information for equipment promotion of energy conservation.

Then, there is the following cooperation to donate a real equipment as proof demonstrations by Japan.

(1) Energy audit bus

Many kinds of energy measuring equipment are required to analyze the detail situation of energy use in factories.

Energy audit bus consists of carrying vehicle and energy measuring equipment, and it is quite useful for factory energy audit.

(2) Pilot plant in a training center

Pilot plant for practice training is required at engineer training in a training center.

Engineers study suitable management and effect of energy conservation equipment by pilot plant.

The pilot plants are popular in factory and consists of the followings.

- 1) Boiler and Heat exchanger**
- 2) Combustion furnace**
- 3) Electric oven**
- 4) Electric transformer**

(3) Proof demonstration of energy conservation parts and equipment in factory

Energy conservation improvement is executed for a purpose of proof demonstration to actual operating line in factory.

Effect of energy conservation open to the public of a demonstration equipment.

Date of planning, construction, finance and technology to improvement should open to the public.

各国援助機関の活動状況とエネルギー関連

1996年5月31日 国際協力専門員 佐藤和親氏 調査結果より

カナダ国際開発庁	CIDA	農業 教育・訓練 民間企業育成 民主主義化と良い統治 地方主導
アメリカ国際開発庁	CTZ USAID	中小企業育成 農業 民主化支援 環境・エネルギー・科学 保険 住宅 人的資源・研修・教育 民間セクター・経済活性化
スウェーデン国際開発庁	SIDA	運輸 資源のリサイクリング 交通安全 環境 エネルギー
英国ノウハウ基金 フランス・ポーランド基金 デンマークの援助機関 世界銀行	DINIDA	市場化経済移行支援 経営者訓練 新規企業財政支援 エネルギー関連 社会開発 社会基盤整備 工業 農業
ヨーロッパユニオン	EU-PHARE	調整貸付金 企業リストラクチャリング 民営化
欧州復興開発銀行	EBRD	エネルギーセクター含む全産業 合弁会社への投資 銀行株の買取りと銀行への貸出し 持ち株基金 民営化計画支援
国連開発計画	UNDP	公共投資資金 市場経済化支援

