

**10. REPORT ON THE TECHNOLOGY TRANSFER
THROUGH OJT**



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10.1 Purpose

The purpose is to conduct technology transfer related to the concrete methods (the technique of auditing the use of energy in factories/buildings, the technique of working out plans for the improvement of energy conservation in factories/buildings, and the technique of evaluating energy conservation promotion plans submitted by factories/buildings) which the counterpart will require when the Government of Thailand enforces various regulations relevant to the Energy Conservation Promotion Act.

10.2 Period

From July 3 to September 15 1994 (75 days)

10.3 Factories to be studied

(1) **Steelmaking factory**

- 1) Name: Y Co., Ltd.
- 2) Address: in Bangkok
- 3) Type: Steelmaking and rolling of shape steel
- 4) Main product names and production amount

Billet: 120,000 ton/year
Angle steel: 60,000 ton/year
Channel steel: 48,000 ton/year

- 5) No. of employees: 441

(2) **Paper and pulp mill**

- 1) Name: Z Co., Ltd.
- 2) Address: in Bangkok
- 3) Type: Papermaking

4) Main product names and production amount

Printing paper and paper for books: 26,000 ton/year

Cardboard: 15,000 ton/year

5) No. of employees: 400

10.4 Description

Technology transfer was conducted in the following procedure.

(1) Explanation of a check list

A check list of the factories to be studied prepared by the study members was explained to the counterpart (DEDP) staffs to make them understand the points to be noted on energy use audit.

(2) Meeting with the factory side

DEDP explained the main purpose and the details of the study to the manager and the engineers of the factory to be studied on the basis of the check list.

The three parties including the study members, DEDP and the factory decided on the measurement items regarding the equipment to be studied, and asked the factory side to newly install a measurement hole.

(3) Selection of measuring instruments

The study team had DEDP select measuring instruments based on the check list, the equipment to be studied and the measurement items, and the study members confirmed them.

(4) Factory study

Interviews, inspection of account books, etc. were conducted on the basis of the check list mainly led by DEDP.

The study team had DEDP install and adjust the devices for study using the workshop data materials for the tertiary field study, and thereafter the study members made confirmation thereof.

DEDP collected data, and the study members checked them and provided guidance to DEDP with regard to the method of handling the abnormal value.

Moreover the study team instructed DEDP to check the measurement data according to the data of the factory operation status.

(5) Guidance on the method of preparing the report on the results of factory energy use audit

Three experts each in heat management technology, electricity management technology and education of staff stayed approx. 1.5 more months at the site after the factory study in order to provide instructions to DEDP in analysis of the following items and preparation of the report thereon.

1) Steelmaking factory

① Outline of the factory

② Energy management situation

③ Shape steel rolling equipment
Billet continuous type reheating furnace

Heat balance

Problems in the use of heat energy, the countermeasures and energy conservation effects

④ Equipment utilizing electricity

Electric energy consumption situation.

Problems in the use of electric power, countermeasures and energy conservation effects

⑤ Collection of data on energy conservation effects and their summary

2) Paper and pulp mill

① Outline of the factory

② Energy management situation

③ Printing paper manufacturing equipment, paper machine

Production and maintenance system

Problems in the use of heat energy in the raw material process, countermeasures and energy conservation effects

Changes in temperature of circulating white water, and energy conservation effects

Problems in the use of heat energy in the paper machine process, countermeasures and energy conservation effects

④ **Boiler and equipment utilizing steam**

Heat balance

Heat insulation of equipment utilizing steam and prevention of steam leakage

⑤ **Equipment utilizing electricity**

Electric energy consumption situation

Problems in the use of electricity, countermeasures and energy conservation effects

⑥ **Collection of data on energy conservation effects, and its summary.**

(6) **Presentation to the factory side**

Under the guidance of the Japanese side, presentation to the factory to be studied was conducted on the basis of the report on the results of energy conservation audit prepared by DEDP.

1) **Steelmaking factory**

Date: September 8, 1994 (Thursday)

Participants: Japanese side

1. Yukio Nozaki
2. Shousuke Noguchi

DEDP side

1. Mr. Pinyo Tanthumart
2. Mr. Chartree Peampravut
3. Mr. Virat Songngam
4. Mr. Phruttapong Sarakasetrin
5. Mr. Athaphon Hongsamat

Factory side

1. Mr. B General Manager
2. Mr. C Chief Electrical Engineer

2) Paper and pulp mill

Date: September 9, 1994 (Friday)

Participants: Japanese side

1. Yukio Nozaki
2. Akira Koizumi
3. Shosuke Noguchi

DEDP side

1. Mr. Danai Eg-kamol
2. Mr. Kittipong Rattapisutikul
3. Mr. Thamasak Suwanteap
4. Mr. Suthat Tunlitsit
5. Mr. Pittaya Kruakhunpet
6. Mr. Somsiri Sintusak

Factory side

1. Mr. A Chief Engineer
 2. Mr. B Engineer
 3. Mr. C Engineer
 4. Mr. D Engineer
 5. Mr. E Chief of Dep. Stocking Prep.
 6. Mr. F Electrical Engineer
 7. Mr. G Chief of Dep. Paper M/C
- and four others

10.5 Output

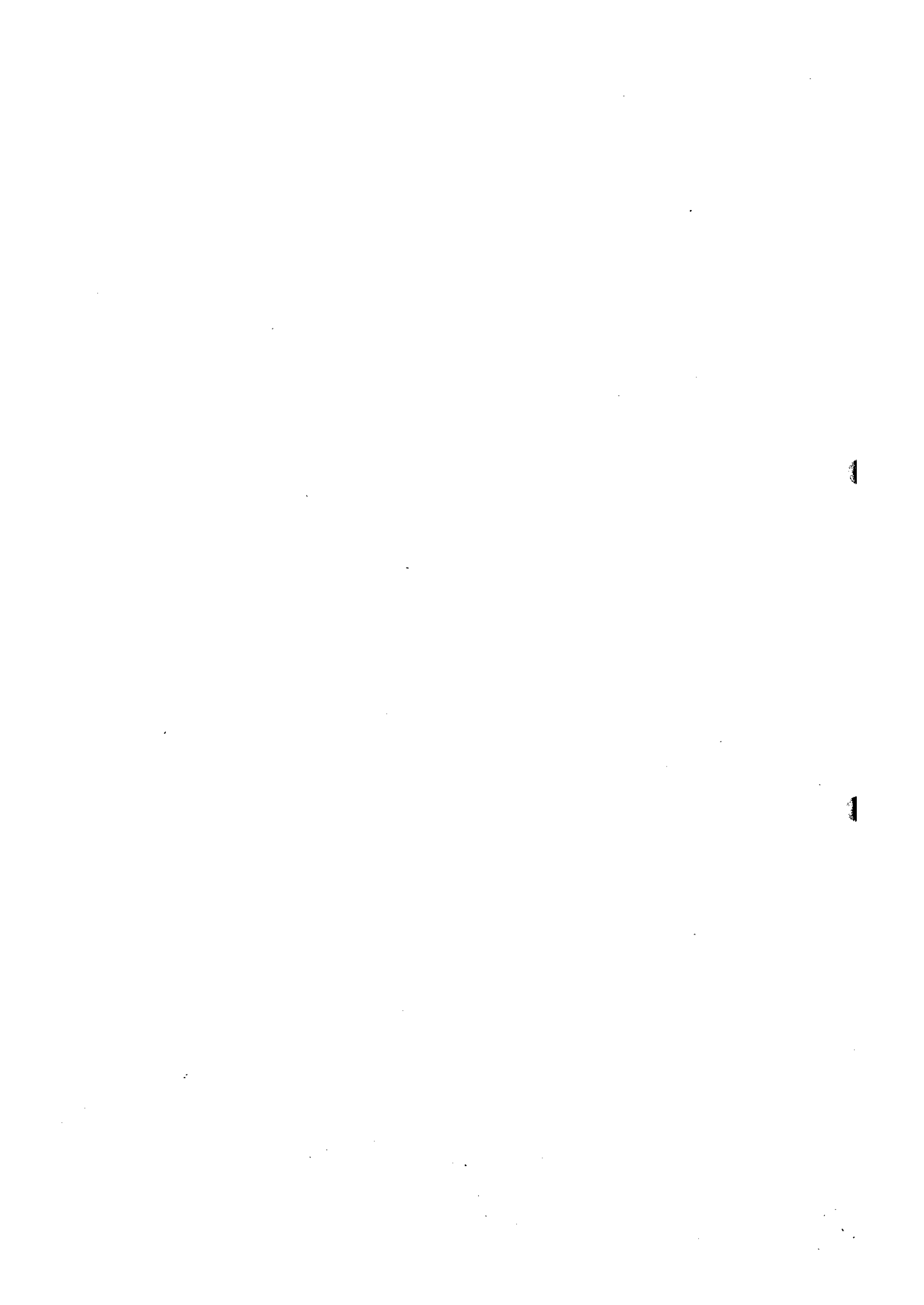
- (1) DEDP acquired the following concrete methods and knowledge regarding energy conservation audit technology.
 - 1) Points to be noted on energy conservation audit
 - 2) Items for interviews
 - 3) Points to be noted on visual observation
 - 4) Selection of measuring points
 - 5) Installation and operation methods of measuring instruments

- 6) Data collection method by means of the study equipment
 - 7) Continuous measurement method
 - 8) Account books required for the study
 - 9) Method of evaluating factory operation data
 - 10) Checking the findings obtained from visual observation against the measured data
 - 11) Safety control in the measuring operation
- (2) DEDP acquired the methods and knowledge required for preparing the report on the results of energy conservation audit
- 1) Arrangement of collection data and accounts/slips
 - 2) Analysis of the collected data
 - 3) Computerized data processing, and graph and diagram preparation methods
 - 4) Identification of problems
 - 5) Drafting of energy conservation measures
 - 6) Estimation of energy conservation effects
 - 7) Appearance of the report (layout, use of diagrams and tables, and sentence expression)

10.6 Future Themes

- (1) Improvement in knowledge of DEDP staff
 - 1) Mastering of the points to be noted on energy conservation audit of various types of industry and the equipment to be studied
 - 2) Accumulation of energy conservation improvement case examples
- (2) Strengthening of guidance and PR for enterprises
 - 1) It is necessary to conduct more PR for the concept that energy conservation is an essential factor for enterprises from viewpoints of strengthening of the competition power on the market as well as the rationalization of management.

- 2) It is necessary to make them understand that the grasping of the current situation forms a prerequisite of the promotion of energy conservation and that the installation of minimum required measuring instruments is essential.



**11. Appended Data Materials
(Members, Counterpart, Timetable, Measuring and
Instruments)**



Members of the Study Team

No	Name	Duty	Description of responsibilities
1	Teruo Nakagawa	Leader (1993)	General management and measurement technology
2	Hiroshi Ishida	Leader (1994)	General management
3	Norio Fukushima	Deputy leader	Assistant leader, liaison negotiation, and evaluation of organization, system and energy
4	Masaaki Takemura	Education of staff (A)	Energy policy, popularization of energy conservation and factory energy management
5	Ayako Sato	Education of staff (B)	National qualification, and factory energy management
6	Mitsuo Iguchi	Education of staff (C)	Factory energy management
7	Hisao Kita	Heat management technology (A)	Heat management technology
8	Akira Koizumi	Heat management technology (A) Education of staff (D)	Heat management technology and factory energy management
9	Hiroshi Murata	Heat management technology (B)	Heat management technology
10	Yukio Nozaki	Heat management technology (C)	Heat management technology
11	Shosuke Noguchi	Electricity management technology (A)	Heat management technology
12	Toshio Sugimoto	Electricity management technology (B)	Heat management technology
13	Kenjiro Yamaguchi	Energy conservation technology for buildings	Energy conservation technology for buildings
14	Kazuo Usui	Database concept design Electricity management technology (C)	Database concept design and electricity management technology
15	Hiroyuki Takayama	Job arrangement	Receiving, unpacking, checking and preparation for use of the equipment to be carried by the study team at the site

List of Counterparts

Members of Department of Energy Development and Promotion

No	Name	Assignment
1	Dr. Prathes Sutabutr	Director General
2	Dr. Itthi Bijayendrayodhin	Deputy Director General
3	Mr. Pramote Iamsiri	Director, Energy Conservation Division
4	Mr. Pravitt Teetakeaw	Chief, Energy Conservation Center
5	Mr. Pramoul Changpong	Chief, Energy Conservation Sector
6	Ms. Amaraporn Achavangkool	Senior Scientist
7	Mr. Danai Akamol	Mechanical Engineer
8	Mr. Artnarong Kuptrabutr	Electrical Engineer
9	Mr. Supachok Kusulsong	Mechanical Engineer
10	Ms. Chinda Suntipharaphoph	Senior Economist
11	Mr. Surapol Sodsoon	Senior Economist
12	Mr. Pinyo Tantumas	Mechanical Technician
13	Mr. Banpot Disakul	Electrical Technician
14	Mr. Chana Chumprayoon	Electrical Technician
15	Mr. Amporn Kulcholrat	Electrical Technician
16	Mr. Pongpat Mungkung	Electrical Engineer
17	Mr. Virat Song-ngam	Electrical Engineer
18	Ms. Somsiri Sinthsak	Chemical Engineer
19	Ms. Phruttapong Sarakasetrin	Electrical Engineer
20	Mr. Kittipong Rattanapisutikul	Mechanical Engineer
21	Mr. Chatree Peamparvut	Mechanical Technician
22	Mr. Somchart Tanglikhosit	Mechanical Technician
23	Mr. Suthat Chobchuen	Electrical Engineer
24	Mr. Thamasak Suwanatep	Electrical Technician
25	Mr. Pittaya Kruakhuanpet	Electrical Technician
26	Mr. Somphot Kongpan	Mechanical Technician
27	Mr. Aithaphon Hongamat	Electrical Engineer

Timetable of the Field Study

1) Primary field study

- | | |
|---------|---|
| Members | ① Terou Nakagawa (Leader) |
| | ② Norio Fukushima (Deputy leader) |
| | ③ Masaaki Takemura (Staff education) |
| | ④ Ayako Sato (Staff education) |
| | ⑤ Hisao Kita (Heat management technology) |
| | ⑥ Shosuke Noguchi (Electricity management technology) |

No	Date	Day of the week	Itinerary
1	August 5, 1993	Thursday	Departure from Tokyo, Arrival at Bangkok
2	August 6	Friday	Courtesy visit to JICA Bangkok Office, Embassy of Japan, and JETRO Bangkok, Meeting with Department of Energy Development and Promotion (DEDP)
3	August 7	Saturday	Preparation for study
4	August 8	Sunday	ditto
5	August 9	Monday	Explanation of the inception report
6	August 10	Tuesday	Study (DEDP)
7	August 11	Wednesday	Study (DEDP, The Energy Conservation of Thailand (ECCT))
8	August 12	Thursday	Preparation for study
9	August 13	Friday	Study (DEDP Energy Training Center)
10	August 14	Saturday	Preparation for study
11	August 15	Sunday	ditto
12	August 16	Monday	Study (National Energy Policy Office (NEPO))
13	August 17	Tuesday	Study (h Building (Hotel), e Building (Bank))
14	August 18	Wednesday	Study (The Industrial Finance Corporation of Thailand (IFCT))
15	August 19	Thursday	Study (c Building (Department store), f Building (Hospital))
16	August 20	Friday	Study (Thai Industrial Standard Institute (TISI), Ministry of Industry (MOI))
17	August 21	Saturday	Preparation for study
18	August 22	Sunday	ditto
19	August 23	Monday	Study (A Factory (Glass), C Factory (Iron & Steel))
20	August 24	Tuesday	Study (Electricity Generating Authority of Thailand (EGAT), DEDP)
21	August 25	Wednesday	Study (Ministry of Finance (MOF), National Economic and Social Development Board (NESDB), I Factory (Dyeing))
22	August 26	Thursday	Study (The Federation of Thai Industries (FTI), King Mongkut's Institute of Technology Thonburi, Technological Promotion Association (Thai-Japan) (TPA))
23	August 27	Friday	Study (Ministry of Interior (MOI), Chulalongkorn University)
24	August 28	Saturday	Preparation for study
25	August 29	Sunday	ditto

No	Date	Day of the week	Itinerary
26	August 30, 1993	Monday	Study (D Factory (Cannery), DEDP)
27	August 31	Tuesday	Preparation of a progress report
28	September 1	Wednesday	ditto
29	September 2	Thursday	Signing of the progress report, Report to JICA and Embassy of Japan
30	September 3	Friday	Departure from Bangkok, Arrival at Tokyo

2) Secondary filed study

Members	①	Terou Nakagawa	(Leader)
	②	Norio Fukushima	(Deputy leader)
	③	Ayako Sato	(Staff education)
	④	Akira Koizumi	(Heat management technology)
	⑤	Hiroshi Murata	(Heat management technology)
	⑥	Kazuo Usui	(Database, Electricity management technology)
	⑦	Kenjiro Yamaguchi	(Building)

No	Date	Day of the week	Itinerary
1	October 13, 1993	Wednesday	Departure from Tokyo, Arrival at Bangkok
2	October 14	Thursday	Courtesy visit to JICA and JETRO, Meeting with DEDP
3	October 15	Friday	Study (DEDP)
4	October 16	Saturday	Preparation for Study
5	October 17	Sunday	ditto
6	October 18	Monday	Study (DEDP)
7	October 19	Tuesday	Study (DEDP, GTZ)
8	October 20	Wednesday	Study (E Factory (Rice Cleaning), B Factory (Glass))
9	October 21	Thursday	Study (F Factory (Automobile Parts), G Factory (Plastic))
10	October 22	Friday	Study (i Building (Office))
11	October 23	Saturday	Preparation for study
12	October 24	Sunday	ditto
13	October 25	Monday	Study (g Building (Hospital))
14	October 26	Tuesday	Study (J Factory (Chemical), a Building (Department store), b Building (Department Store))
15	October 27	Wednesday	Study (d Building (Bank), h Building (Hotel), TPA, DEDP)
16	October 28	Thursday	Study (Metropolitan Electricity Authority (MEA), IFCT)
17	October 29	Friday	Study (J Factory (Chemical), Head Office, DEDP)
18	October 30	Saturday	Preparation for study, Departure of member Koizumi from Bangkok
19	October 31	Sunday	ditto, Arrival of member Makagawa at Bangkok

No	Date	Day of the week	Itinerary
20	November 1, 1993	Monday	Study (Ministry of Industry (MOI), Ministry of Interior (MOI), DEDP)
21	November 2	Tuesday	Study (K Factory (Tire), DEDP)
22	November 3	Wednesday	Study (ECCT, DEDP)
23	November 4	Thursday	Study (Department of Environment Promotion, DEDP)
24	November 5	Friday	Preparation of a progress report
25	November 6	Saturday	Arrangements of the materials
26	November 7	Sunday	ditto
27	November 8	Monday	Preparation of a progress report
28	November 9	Tuesday	Signing of the progress report, Report to JICA and Embassy of Japan
29	November 10	Wednesday	Departure from Bangkok, Arrival at Tokyo

3) Tertiary field study

- Members
- ① Terou Nakagawa (Leader)
 - ② Norio Fukushima (Deputy leader) (Advance Team)
 - ③ Mitsuo Iguchi (Staff education)
 - ④ Yukio Nozaki (Heat management technology) (Advance Team)
 - ⑤ Toshio Sugimoto (Electricity management technology)
 - ⑥ Kenjiro Yamaguchi (Building)
 - ⑦ Hiroyuki Takayama (Adjustment)

No	Date	Day of the week	Itinerary
1	February 21, 1994	Monday	Departure of member Fukushima and Nozaki from Tokyo, Arrival at Bangkok
2	February 22	Tuesday	Confirmation of Export Package of Equipment
3	February 23	Wednesday	Study (DEDP)
4	February 24	Thursday	ditto
5	February 25	Friday	Preparation for Study
6	February 26	Saturday	ditto
7	February 27	Sunday	ditto
8	February 28	Monday	Study (DEDP)
9	March 1	Tuesday	ditto, Arrival of the main team at Bangkok
10	March 2	Wednesday	Courtesy visit to JICA
11	March 3	Thursday	Study (DEDP)
12	March 4	Friday	Explanation of Interim Report, Arrival of member Takayama at Bangkok, Receiving the equipment
13	March 5	Saturday	Unpacking the equipment
14	March 6	Sunday	Preparation for Study

No	Date	Day of the week	Itinerary
15	March 7, 1994	Monday	Workshop
16	March 8	Tuesday	ditto
17	March 9	Wednesday	ditto
18	March 10	Thursday	ditto
19	March 11	Friday	ditto
20	March 12	Saturday	Preparation for Study
21	March 13	Sunday	ditto
22	March 14	Monday	Workshop
23	March 15	Tuesday	ditto
24	March 16	Wednesday	ditto, Departure of member Takayama from Bangkok
25	March 17	Thursday	ditto
26	March 18	Friday	ditto
27	March 19	Saturday	Preparation for Study
28	March 20	Sunday	ditto
29	March 21	Monday	Workshop
30	March 22	Tuesday	ditto
31	March 23	Wednesday	ditto
32	March 24	Thursday	ditto
33	March 25	Friday	ditto
34	March 26	Saturday	Arrangement of the materials
35	March 27	Sunday	ditto
36	March 28	Monday	Preparation of a progress report
37	March 29	Tuesday	Signing of the progress report, Report to JICA and Embassy of Japan
38	March 30	Wednesday	Departure from Bangkok, Arrival at Tokyo

4) Fourth field study

- Members
- ① Hiroshi Ishida (Leader)
 - ② Norio Fukushima (Deputy leader)
 - ③ Mitsuo Iguchi (Staff education)
 - ④ Akira Koizumi (Staff education)
 - ⑤ Yukio Nozaki (Heat management technology)
 - ⑥ Toshio Sugimoto (Electricity management technology)
 - ⑦ Shosuke Noguchi (Electricity management technology)

No	Date	Day of the week	Itinerary
1	July 3, 1994	Sunday	Departure from Tokyo, Arrival at Bangkok
2	July 4	Monday	Courtesy visit to JICA and Embassy of Japan
3	July 5	Tuesday	Meeting with DEDP
4	July 6	Wednesday	ditto
5	July 7	Thursday	Meeting with the steel factory
6	July 8	Friday	Study of the steel factory
7	July 9	Saturday	Preparation for the study
8	July 10	Sunday	ditto
9	July 11	Monday	Study of the steel factory
10	July 12	Tuesday	ditto
11	July 13	Wednesday	ditto, Arrival of member Koizumi at Bangkok
12	July 14	Thursday	ditto
13	July 15	Friday	Meeting with the paper & pulp factory
14	July 16	Saturday	Preparation for Study
15	July 17	Sunday	ditto, Departure of member Ishida from Bangkok
16	July 18	Monday	Study of the paper & pulp factory
17	July 19	Tuesday	ditto
18	July 20	Wednesday	ditto
19	July 21	Thursday	ditto
20	July 22	Friday	ditto
21	July 23	Saturday	Preparation for Study, Arrival of member Noguchi at Bangkok
22	July 24	Sunday	ditto
23	July 25	Monday	Transfer of duties
24	July 26	Tuesday	ditto
25	July 27	Wednesday	Technology transfer, Departure of member Fukushima, Iguchi, Sugimoto from Bangkok Return home of Deputy leader Fukushima, member Iguchi, and member Sugimoto
26	July 28	Thursday	ditto
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67	September 7	Wednesday	ditto
68	September 8	Thursday	Presentation of the study results of steel-making plants

No	Date	Day of the week	Itinerary
69	September 9	Friday	Presentation of the study results of paper & pulp mills
70	September 10	Saturday	Arrangement of data materials
71	September 11	Sunday	ditto
72	September 12	Monday	Arrangement of factory study results
73	September 13	Tuesday	Summing up of the study
74	September 14	Wednesday	Report to JICA Thai office
75	September 15	Thursday	Departure from Bangkok, Arrival at Tokyo

Equipment List

No	Name	Set (s)
1.	Energy Audit Bus	1
2.	Ultrasonic flowmeter for fuel oil or water	2
3.	High temperature anemometer for gas	1
4.	Steam condensate flow meter	1
5.	Pitot type flow meter	1
6.	Differential pressure transmitter for orifice	1
7.	Oxygen meter for exhaust gas	2
8.	Carbon dioxide and monoxide meter for exhaust gas	1
9.	Pretreatment unit for sampling exhaust gas	1
10.	Sampling tube for exhaust gas	1
11.	Thermometer for surface	2
12.	Thermocouple with compensate cable for gas	1
13.	Suction pyrometer	1
14.	Infrared radiation thermometer (low range)	1
15.	Infrared radiation thermometer (high range)	2
16.	Glass thermometer	3
17.	Hygrometer	5
18.	Infrared thermal video system	1
19.	20 channel recorder with data memory and reader	3
20.	Water SC meter	2
21.	Water pH meter	2
22.	Pressure gauge with transmitter for furnace gas	1
23.	Pressure transmitter for steam	1
24.	Steam trap checker	2
25.	Watt-power factor meter	3
26.	Power meter	1
27.	Tachometer	2
28.	Lux meter	3
29.	Circuit tester	2
30.	Voltage detector	2
31.	Heat resisting gloves	2
32.	Cobalt glass for eye protect	3
33.	Power insulation gloves	2
34.	Extension power cord with tools	1
35.	Stop watch	1

No	Name	Set (s)
36.	Wagon desk for field work	2
37.	Training unit for measurement of temperature and power	1
38.	Training unit for measurement of water flow and power	1
39.	Training unit for measurement of gas pressure and power	1
40.	Transducer (for current)	1
41.	Transducer (for voltage)	1
42.	Computer (for Database)	1

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