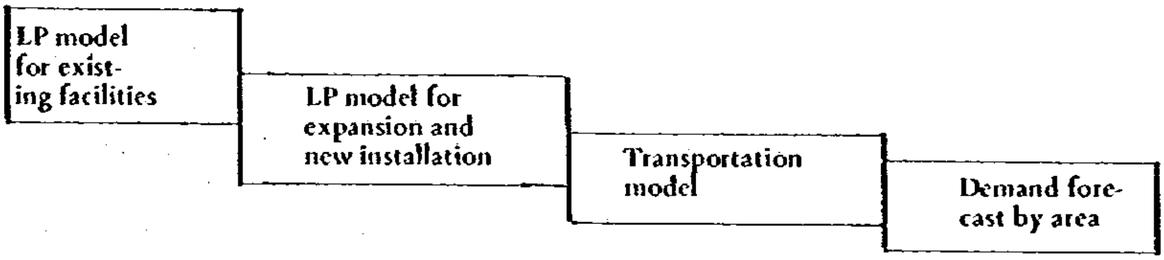
If the optimal location is selected, the transportation cost is an indispensable factor for either the expansion or new installation plan. The general idea of the LP model to be used for long term installation plan is as follows:



For the selection of the facilities required for the expansion and new installation, it is necessary to include not only the operational expense the fixed cost portion of the installation. When we include the fixed cost portion, a technique called "local separable" is often introduced in the construction of the LP model to represent scale merit which can be generally realized in the installation investment. In some instances the scale merit is disregarded and fixed unit cost is used. In any event, by the inclusion of fixed cost portion into the LP model, the solution of the model shows selection of the facilities for expansion and new installation (e.g. capacities of reformer, catalytic cracker, hydrocracker, hydro desulfurizer, etc.), required to satisfy the estimated demand. At the same time necessary amount of investment is obtained. If transportation costs of crude oil to the proposed sites for new installation and transportation costs of oil products from the proposed sites to consumption area are incorporated into the model, and estimated demand by area is given as constraint, the solution of the LP model will indicate the best site, types and capacities of facilities to be installed, investment amount required, etc.

For Pertamina it will be of use to develop the LP model as was mentioned above for the long term installation plan. The LP model will be useful as a tool for drafting the future expansion and new installation plan. Therefore we suggest it as future subject undertake the model.

3–4 Possible Field of Technical Cooperation and Concrete Methods

The utilization of computers in the Japanese oil refining industry covers, as mentioned in chapter 3–2, a very wide variety of fields. Even if limiting the utilization of computers for planning works of refining and transportation, it can be said that in Japan the computers are utilized in very wider fields and are more intensively used than in Pertamina. Pertamina is the only integrated oil company in Indonesia and it is not difficult to surmise that planning works at Pertamina will become more and more important. Therefore, from this standpoint, the possible fields of Japanese technical cooperation to be extended to Indonesia will be very wide. But complete technical cooperation which covers everything will be impossible not only for the cooperation side, time-wise and expense-wise but also not favorable for the receiving side. The receiving side should prepare the background so that technology transfer can be easily feasible and it is important for the receiving side to keep self-development effort. If not, the results gained by the technology transfer will not be conveyed at all.

From the above viewpoint and judgment based on the result of the survey in Indonesia, the following 4 items are mentioned in chapter 3–3, i.e.:

a. Middle term forecast demand forecast utilizing the data bank
b. Construction of data bank for marine transportation
c. Inclusion of transportation cost into LP model
d. Development of long term installation planning model

Those four items have close relationship with the energy data bank and can be regarded as tools for the drafting of refining, and transportation plan at Pertamina; and therefore, they are suggested as technical cooperation items.

All of the above items require data to a certain extent. It cannot be said that at present moment Pertamina has sufficient data for all of these items, but Pertamina is on the way of establishing data; and therefore, it cannot be expected that the tools for drafting the plan by the technical cooperation from next fiscal year onwards will be immediately accomplished.

It will take time to establish data and it is impossible now to make a judgment when highly reliable data accumulation will be accomplished. Therefore it is impossible to draw a blueprint regarding the technology transfer which includes time schedule of the technical cooperation for these items.

But at least the technical cooperation as regards methodology will be possible through the dispatch of experts or acceptance of trainees. By knowing methodology, it will be possible and very important for Pertamina to commence its development on its own.

a. Middle term demand forecast by utilizing data bank

This subject should be regarded as one of the basic application field of the energy data bank. Energy data bank naturally includes time series data and by combining data bank system and scientific techniques, the demand forecast by the time series analysis will be obtained.

It will be a proper approach to develop a model which selects an equation with minimum standard deviation from the following types of equations, applying these equations against the past trend.

$y = ax + b$
$y = ax^2 + bx + c$
$y = \ln x$
$y = ax_1 + bx_2$
— — — — — — —
— — — — — — —

As referred to in item a. of chapter 3–3, the whole demand can be forecasted by adding accumulated forecast demand for large scale plants. To forecast demand by time series analysis as above for those consumers accumulating method is difficult to apply. By utilizing the monthly time series data, demand forecast taking seasonal flucturations into account will also be possible. The above will be an effective measure until the time will come when various statistical data are established including unit consumption, production trend by each industry, etc. Even if more complicated methods become to be applied, the above time series analysis will still remain to be a valuable method at least partially. Needless to say, it is impossible to reflect the economic and political changes which may be enforced in future by the time series analysis. Therefore this emthod is valuable for a comparatively short term demand forecast where these fluctuations are not considered important.

b. Construction of data bank for marine transportation

Pertamina has already undertaken the construction of data bank concerning marine transportation, i.e. in the process of accumulating data on tanker performance. Technical cooperation for the construction of this data bank might not be necessary. However, if Pertamina requests the technical cooperation, or if Pertamina should develop on its own, it is expected that the following explanation would serve as a reference or a guidance, to construct data bank system and to prepare transportation cost tariff.

The data necessary to prepare the transportation cost tariff are data for transportation route, voyage time data, volume and kind of cargo, and cost data. One round trip can be defined as from arrival at a certain loading port going to the unloading port and to arrival at the next loading port. The distance corresponding to a round trip will be available from the distance table. Voyage time data will be available from tanker performance data. Depending on the analysis to be performed by using the voyage time data, the details of the voyage time data to be collected will differ; and therefore the details of the tanker performance data to be collected will differ accordingly. If an attempt is made to analyze the cause of the laytime with the aim of a more efficient tanker performance, it will be necessary to collect a detailed data on laytime based on each cause. In such case, detailed laytime record by each cause, such as waiting of open-berth, waiting for production of products, waiting for tide, shelter due to bad weather, holidays, waiting till dawn if loading or unloading at night is prohibited, etc. will be necessary. If an attempt is made to analyze laytime with the aim to improve the loading/unloading time, it will be necessary to collect data of the loading time and unloading time for each product. Furthermore if an analysis is attempted regarding transportation loss, it will be necessary to collect data for loading volume and unloading volume for each product for each voyage.

If the objective is simply to obtain a mean transportation cost, collection of detailed data for the laytime, transportation loss, etc. will not be necessary. The arrival time at a certain loading port and via the unloading port and the arrival time at the next loading port will be sufficient as voyage time records. Transportation cost of the voyage can be calculated by adding time charterage or equipment, bunker cost and port charges corresponding to the round trip. Unit cost of transportation in terms of Rp/Bk1 will be arrived at by dividing transportation cost by the volume transported.

If the tanker is a time charter, the data for off-hire will also be necessary. In the case of own vessel, it will be necessary to convert vessel's cost to monthly or annual time charterage or alike, considering the life, depreciation, interest, repair cost, insurance, labor cost, ship stores expenses, etc. For the above conversion, the calculation method in line with the Pertamina's accounting method should be applied. For the fuel cost and port charges, the average value in the past may be sufficient and it will not be necessary to apply the exact value for respective voyages. Name of vessel, loading port, unloading port and product can be coded. The reference table of these codes, distance, table, charterage, fuel consumption, port charges may be stored in the Master File. (Refer to Fig. 3.4.1) The transportation cost of each voyage obtained as above, can be classified by route and by type of vessel and average transportation cost by route and by type of vessel can be obtained. From the same information for the above transportation cost calculation, not only the transportation cost, but also the distribution pattern of product from a loading port, the receiving pattern of product at an unloading port can be obtained.

If the main objective is to obtain the transportation cost and analysis of the tanker operation, the necessary input data will be as follows:

(Route and voyage time data)

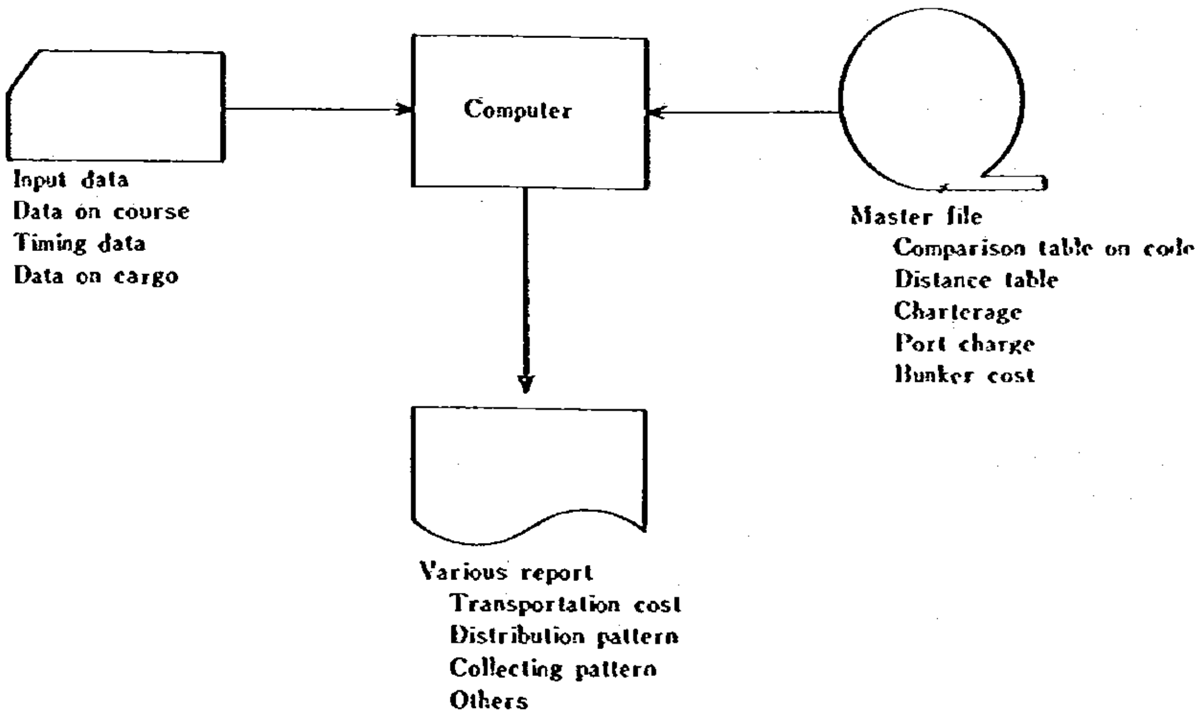
name of vessel (code)
loading port (code) – plural ports will be allowed.

arrival time	year	month	day	hour	minute
loading commencement time	”	”	”	”	”
loading completion time	”	”	”	”	”
departure time	”	”	”	”	”

unloading port (code) – plural ports will be allowed.

arrival time	year	month	day	hour	minute
unloading commencement time	”	”	”	”	”
unloading completion time	”	”	”	”	”
departure time	”	”	”	”	”

Fig. 3-4-2 Data Filing System on Marine Transportation



loading port (code)
arrival time

Off-hire	from	year	month	day	hour	minute
	to	"	"	"	"	"

(Data on Cargo)

name of product	(code)
loading port	(code)
unloading port	(code)
volume	

Remarks: Data on cargo shall be provided if any one product, loading and unloading ports varies.

c. Inclusion of transportation cost into the LP Model

The inclusion of transportation cost into LP model naturally cannot be done before the transportation cost is established to a certain extent. In an occasion to incorporate transportation cost into LP model, the following explanation will serve as a reference by providing the readers with the general idea of the transportation model.

There will be many kinds of transportation models from very simple one to quite sophisticated model. A model with intermediate complexity would best suit for the time being.

Figure 3.4.3 illustrates an example of simplified transportation model. A model of this type uses representative transportation costs for all of the possible combinations of supply sources, sales areas and products. In order to get representative transportation costs it will be necessary to calculate average actual transportation cost from each supply source to each sales area, or to estimate expected lower transportation cost in case more economical transportation system is planned in the future.

Construction of this type of transportation model is easy since the model has simple structure as is shown on Fig. 3.4.2. and Fig. 3.4.3, but calculation of an representative cost of transportation will require much work. But once this representative transportation cost is calculated, it can be applied to the combined model now used at the head office of Pertamina, resulting in completion of the practical combined LP model consisting of refining operation and transportation activities.

An example of more complicated transportation model is shown on Fig. 3.4.4. This type model includes all the combination of possible supply sources and seafed depots. It will be necessary to set a limitation regarding tonnage availability for each vessel size category, taking into account the fleet composition. In general, several kinds of oil products are transported by one trip, for example, in the case of clean products, gasoline, kerosene and diesel oil, are often loaded on the same ship at one trip transport. Therefore, in constructing transportation model of this kind, attention should be paid to the fact that various kinds of oil products can be transported by one trip of a vessel.

In the model of this type, a matrix can be made on each and every vessel as shown on Fig. 3.4.5. and it is also possible to construct a matrix for a group of vessels categorized by size. When fleet is small the former matrix structure will be of use and if large the latter will be effective.

It is not technically impossible to operate the complicated transportation model in combination with the refinery LP model.

Fig. 3-4-3 Example of Simple Transportation

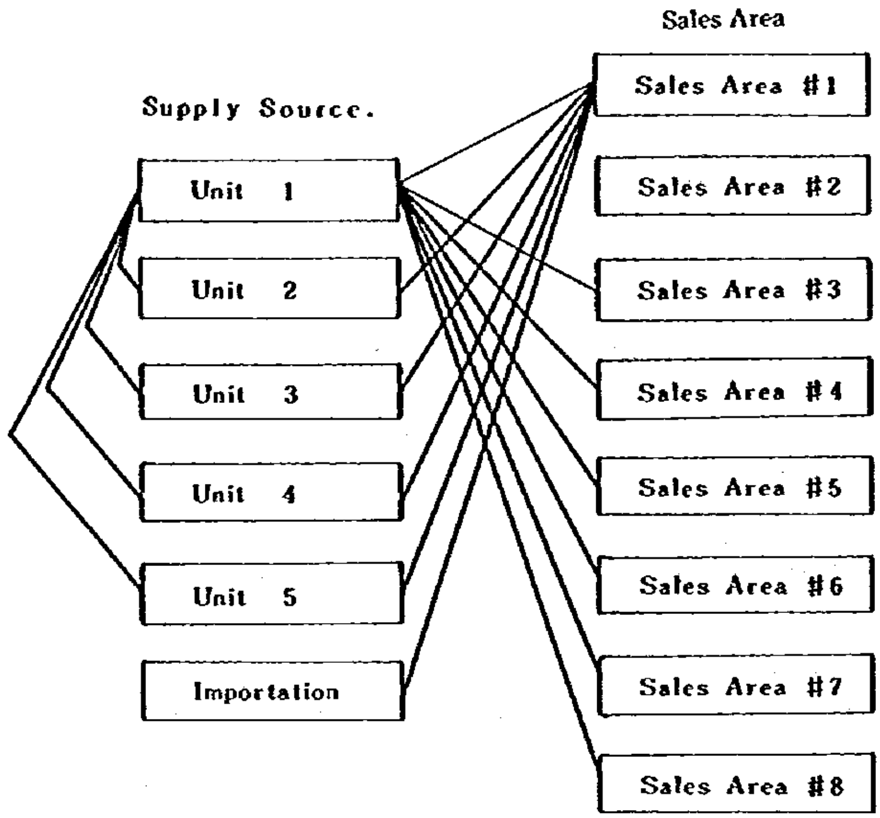


Fig. 3-4-4 Matrix Expression

X	X	X	Y	Y	I	I	
T	T	T	T	T	I	I	
O	O	O	O	O	I	I	
Y	A	B	A	B	I	I	
I	J	J	J	J	I	I	
fxyi	fxaj	fxbj	fyaj	fybj	–	–	= objective function

Note: – Mark of column, for example – XTOAJ expresses the volume fo product J transported from Refinery Unit "X" to Sales Area "A".

– Objective function is the minimization of transportation cost, and fxaj, for example, expresses the representative transportation cost of product J from Refinery Unit "X" to Sales Area "A".

Fig. 3-3-4 Example of Complicated Transportation Model

X	X	Y	Y	X	X	Y	Y	1	1	
T	T	T	T	T	T	T	T	1	1	
O	O	O	O	O	O	O	O	1	1	
A	B	A	B	A	B	A	B	1	1	
M	M	M	M	N						
M	M	M	M	N	N	N	N	1	1	
fxam	fxbm	fyam	fybm	fxan	fxbn	fyan	fybn			= objective function
dxam	dxbm	dyam	dybm							= annual working days of vessel "M"
				dxan	dxbn	dyan	dybn			= annual working days of vessel "N"
Cm		Cm		Cn		Cn				= demand of Seafed Depot "A"
	Cm		Cm		Cn		Cn			= demand of Seafed Depot "B"
Cm	Cm			Cn	Cn					= production of Refinery Unit "X"
		Cm	Cm			Cn	Cn			= production of Refinery Unit "Y"

Note:

- Column mark, for example, XTOAM represents the number of voyages of Vessel "M" from Refinery Unit "X" to Seafed Depot "A". If the matrix is constructed for each and every vessel as this example the column should take a positive integer. If the tonnage to be included in the model is large and if analysis is desired to evaluate whether the composition of fleet is appropriate or not, column is not necessarily a positive integer. Figure with fraction would suffice in such occasion.
- Objective function will be the minimization of transportation cost. Coefficient, for example, fxam shows the transportation cost from Refinery Unit "X" to Seafed Depot "A" by Vessel "M".
- Annual working days of a vessel is the available days for operation, i.e. calendar days less periodic repair and other non-working days. When actually solving a model, it is better to take a range with a certain limit. The coefficient, e.g. dxam shows the required voyage days for a round trip of a vessel "M" from Refinery Unit "X" to Seafed Depot "A".
- Cm and Cn show the cargo carrying capacity of the vessel "M", vessel "N", respectively. If full loading is impossible due to the draft limitation, this coefficient has to be adjusted. In this case the transportation will naturally become high and should be reflected on fxam.

  But effective use of complicated transportation model may be realized when it is used for case studies of the variation of the controlled tonnage as a tool for drafting the charter plan. The underlying of the above is that, in general, it is not necessary to use a complicated transportation model for a refinery/transportation combined model.

d. Development of Long Term Installation Plan Model

The concept and value of the long term installation planning model are already mentioned in Item d of chapter 3–3. Construction of the model is not difficult if the RPMS (Refinery Petrochemical Management System), planned to be introduced at Pertamina, is used. Therefore even if the technical cooperation is requested on this subject, it is considered that only the supply of know-how on analysis and interpretation of results would suffice.

In order to implement the above 4 items, cooperation by Japan will be appropriate.

Re item a: To provide guidance for the development of model for time series analysis and its operation.

Re item b: To provide advice when Pertamina faces with difficulty, since Pertamina is already independently promoting.

Re item c: To provide guidance for development and operation of transportation model and its linkage to Refinery LP Model.

Re item d: To provide advice to Pertamina if they face difficulty.

It is concluded that for each of the above items a guidance and advice through the dispatch of experts on a comparatively short period will be sufficient.

4. Computer System

4–1 Present State of Computer Utilization in Pertamina

In this section two things are described. The one is the result of our investigation regarding the present state, capacity and man power of Pertamina's computer system which is scheduled to be utilized at present for the realization of the Energy Data Bank as the first stage. The other is to check concretely what kind of works are necessary to execute the works mentioned in the foregoing chapter. This check shall be done from the viewpoint of computer system and on the basis of the result of our investigation mentioned above.

Accordingly, what is meant by computer here is Pertamina's computer at its head office in Jakarta. Similarly, computer software in this section means software either usable now, or planned to be introduced and possibly to be introduced.

Furthermore, there are some problems which are to be solved now, if possible, but, for the purpose of the establishment of Energy Data Bank, must be put off as the issue to be solved in the later days owing to various restrictions prevailing now. We shall refer later to the reason why it is difficult to take up the problem now.

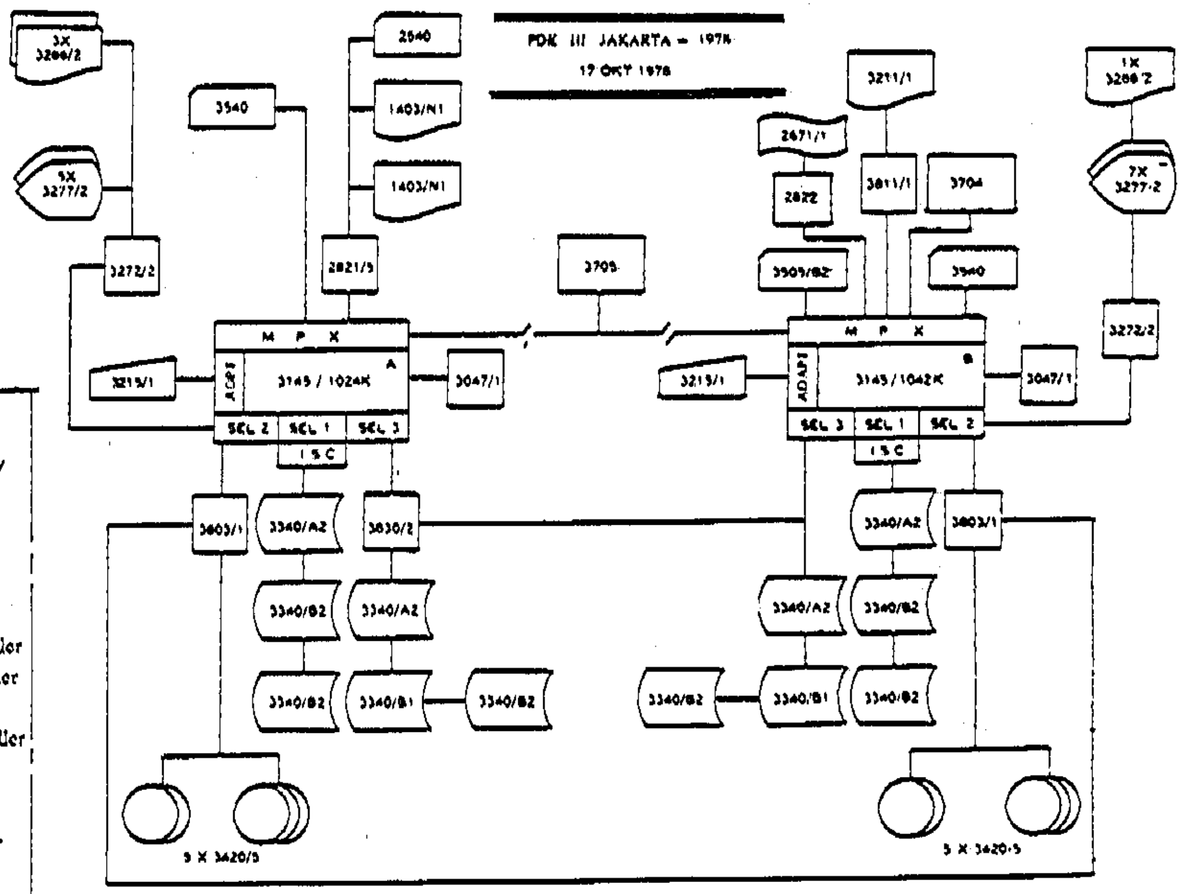
4–1–1 The Present State of Hardware and its Evaluation

The Fig. 4-1-1 shows the configuration of Pertamina's computer hardware at Jakarta. This is a rather large-scale system, a duplex system mainly consisting of two sets of IBM 370/145 (memory size, each 1,024 K bytes). The number and capacity of each unit are as shown in the Table 4-1-1. The system is characterized by that: considerably large capacity of external storage is equipped in the form of magnetic disks and magnetic tape unit, of which 6 sets are shared file. Moreover, peripheral unit consists of CRT display, XY plotter, etc., data input is basically done by means of disket, while the input by card plays only a supplementary role.

As seen in the above, the machine configuration is enough, or rather too sufficient for an average computer user. Its capacity is considered to be enough for the initial stage, however, according to the development of computer utilization, some extension, such as increase in the capacity of user catalog file may become necessary.

For the reference, here is shown the Table 4-1-2 which contrasts the corresponding output capacity between IBM 370 computer and FACOM M series as an example of Japanese computer.

Fig. 4-1-1 Configuration of Pertamina's Computer



3145	Arithmetic Unit Internal Memory
3340	Magnetic Disk Memory
3540	Disket Reader
3420/5	Magnetic Tape Unit
1403/N1	Line Printer
3505/B2......	Card Reader
2671	Paper Tape Reader
3830	Magnetic Disk Controller
3272	Input/Output Controller
3277	CRT
3803	Magnetic Tape Controller
3286 3211 3811	Line Printer
2821	Line Printer Controller
2822	Paper Tape Controller
3215	Key Board Printer

Table 4-1-1 Hardware units list of Pertamina's head office computer

code address	name	number	function
3145	Arithmetic Unit Internal Memory	2 (1024 K bytes)	basic cycle time ...... 202.5 ~ 315.0 ns * memory cycle time .... 540 ns (read) 607.5 ns (write) access time .... 109 ns memory capacity ..... 1024 K bytes
3340	Magnetic Disk Unit	10	Data transfer speed .... 885 K bytes/sec capacity .... 69.88 ~ 559.04 mega byte access time .... 25 miri sec rotational delay time .. 10.1 mil sec
3540	Disket I/O Unit	2	3600 diskets read / 1 minute 3200 diskets write / 1 minute (1898 records / 1 disket) **
3420/5	Magnetic Tape Memory	10	Read/write speed ..... 120 ~ 320 K bytes/sec (1600 bpi, 9 track) Rewind time .... 45 sec/2400 feet reel
1403/N1	Line Printer	2	Print speed .... 1400 line/1 minute
3505/B2	Card Reader	1	Read speed .... 1200 cards/1 minute
2671	Paper tape reader	1	Read speed .... 1000 characters/1 minute
3211	Line Printer	1	Print speed .... 2200 line/minute
2540	Card read-punch	1	

* ns .... 10^{-9} sec
** disket record .... 128 characters/1 record

Table 4-1-2 Comparative table of IBM and FACOM

IBM 370 series			FACOM M series		
type	CPU cycle time	memory cycle time	type	CPU cycle time	memory cycle time
115	480 ns	480 ns			
125	480	480			
135	275~1485	770 read 935 write			
138	275~1485	880 read 935 write	130	240	720 ns
145	202.5~315	540 read 607.5 write	140	210	630
148	180~270	405 read 540 write	160 S	170	510
158	115	1035 read 920 write			
168	80	320	160	40	360
			180 II	60	350
			190	30	375

CPU cycle time in the Table 4-1-2 denotes Input/Output time of arithmetic register necessary for the execution of instructions, while memory cycle time indicates read-out and write-in time of memory.

Next, let us take up the question as to what kind of hardware is needed for the time being so as to make in motion the Energy Data Bank System (EDB System) under consideration.

EDS System here means such a system that gathers groups of information related to the whole energy supply-demand, retrieves vast and accurate information complying with the diversified needs in the various field and further gets an integrated information system in order to make all sorts of statistical data meeting all kinds of purpose. Therefore, unlike what is commonly said, its purpose does not necessary like in to utilize it for the so-called Data Base System of General Purpose and Data Management System (e.g. IMS, TOTAL etc. as mentioned later more particularly) only.

Hardware system necessary for EDB system depends often upon the operational availability or the function of software, however, the following three is necessary as a rule, namely –

1) high speed mass storage
2) arithmetic and logic unit of middle grade
3) operating system (OS), to which terminals can be connected.

Seen Pertamina's hardware system from this viewpoint (Table 4-1-1), it is sufficiently provided with the function to incorporate the above-mentioned information system in it.

However, necessary capacity of hardware depends not only upon the quantity of data, but also upon the fact to what extent the system is furnished with high grade software. When we look at the Pertamina hardware system at present, the system is not enough to realize the on-line system which is one of the powerful means for the centralized management of diversified information as well as its organic and multi-purpose utilization, because its peripheral units are suitable for batch typed ones.

In order to use various terminal units freely for the functional and full utilization of computer, there must be fully equipped telephone line network, and well prepared terminal units together with controller for such terminal units.

As mentioned later, in case where the introduction of a full-fledged Data Management System and On-line System are planned in the future, it will be necessary to extend the hardware system corresponding to meet such a purpose.

4–1–2 The Present State of Software and its Evaluation

Here will be evaluated the content of the software according to the software list submitted of Pertamina. Generally speaking, its software is classified into two large groups as seen in the Fig. 4-1-2, i.e. control program group learning mainly to hardware and process programs for the user.

According to this classification, Pertamina's software is divided into what is shown in the Table 4-1-3, which indicates that Pertamina's software consists mainly of general information management system (IMS) with double-barreled capacity of batch processing and conversational processing. At the same time, so far as scientific and technical computing is concerned, Pertamina's software system relies on SSP (Scientific Subroutine Process) and also adopts various kinds of applications. Judging from the above, Pertamina's software can be said as considerably well prepared.

The outline of the software will be explained one after another in the following description.

(1) System Control Program (Control Program)

This is a software belonging to the category which is generally called Operating System (OS). This is one of the most basic software system essential for the due functioning of computer. All the other softwares, such as language processor, Data Management System and other application softwares do function as a sort of subroutine under this System Control Program. Pertamina's system has the following ones as control program.

a. OS/VS1 and DOS/VS

(i) OS/VS1 (Virtual Memory Operating System/1)

This is an improved version of OS/MFT (Multi-programming of fixed number task in the OS of system/360) which is the basic OS of IBM 360 and 370 series. It is a system control program (SCP) enabling to execute maximum 15 individual jobs independently in parallel. Its characteristic function is to have virtual storage (VS), job entry subsystem (JES), virtual storage access method (VSAM) and virtual transmission access method (VTAM) etc.

(ii) DOS/VS (Virtual Storage Disk Operating System)

This is an operating system for batch process work.

b. Virtual Machine (VM)/370

This is a 370 series version of CP-67 CMS (Control Program of system/360) and consists of the following 4 component factors:

Fig. 4-1-2 Software Clacification

Control Program
①Supervison Program
②Data Management Program
③Job Management Program

Process Program
①Language Processor
②Service Program
③User's Program

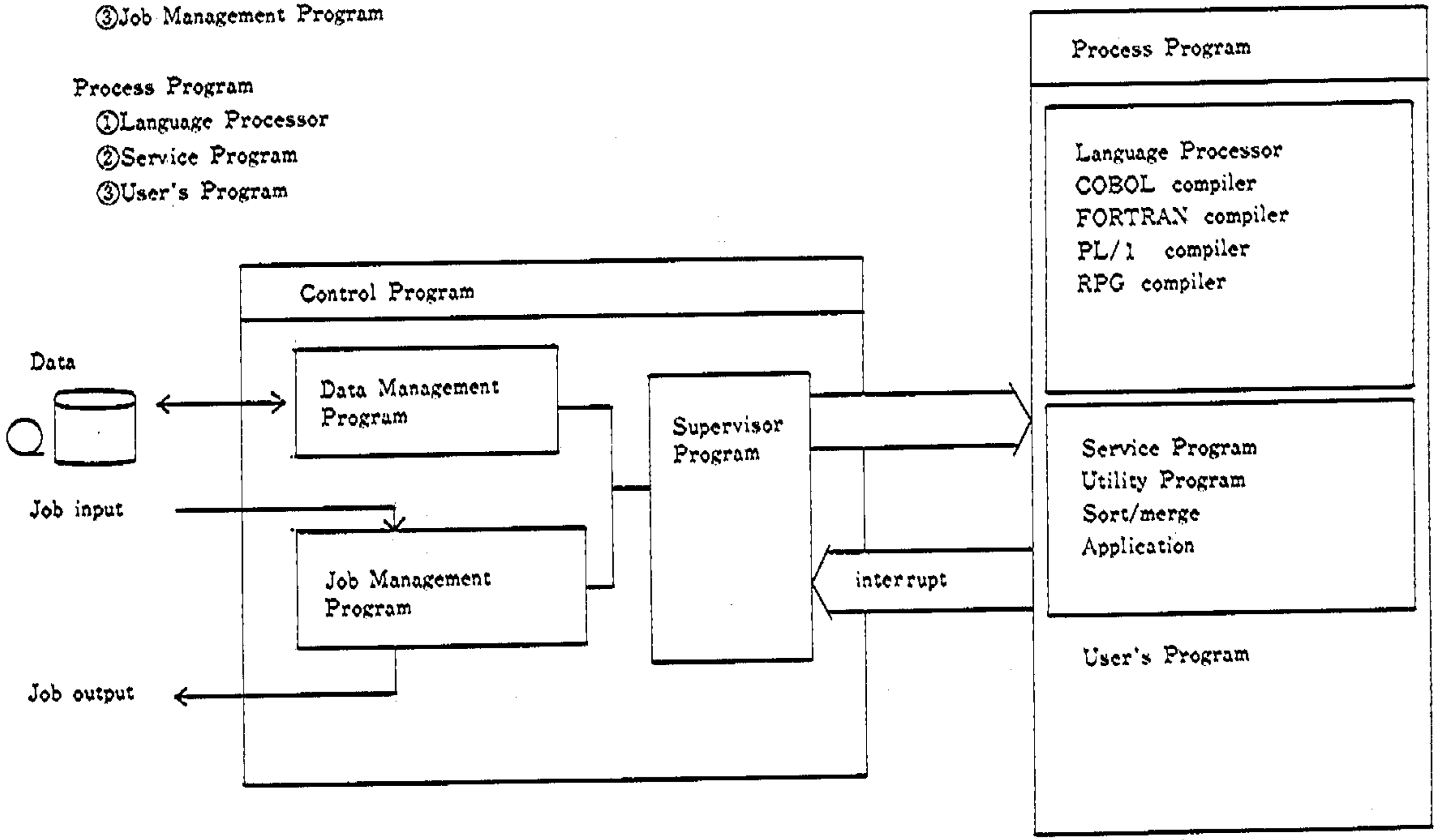


Table 4-1-3 Softwares list in Pertamina

System Control Program 1 OS/VS 1, DOS/VS 2 Virtual memory (VM/370) 3 CMS
Language Processor (language translator, basic software) 1 ANS COBOL, FORTRAN IV 2 PL/1 3 APLSV
Application Software (service program) 1 Data Management System (General Purpose Software) IMS (Information Management System) CICS DMS II (Data Management System) SORT/MERGE HCS (Health Care Support) RPG (Report Program Generator) 2 Simulation Language (General Purpose Software) MPSX (Mathematical Programming System Extend) GPSSV (General Purpose Simulation System V) GPPS (Continuous Process Plant Scheduling System) 3 Application Software of Scientific Technique SSP (Scientific Subroutine Package) 4 User Application (Special Purpose Software) APPLY RESSTM MMS'–GENERAL LEADER UCC–ONE, TEN, FIFTEEN PANVALET NOVEL EASY TRIEVE FILETAB

1 Control Program (CP)
2 Conversational Monitor System (CMS)
3 Remote Spooling Communication Subsystem (RSCS)
4 Interactive Problem Control System (IPCS)

c. CMS (Conversational Monitor System)

This is a software servicing a time-sharing function of conversational mode in the wide range for the user. CMS user must implement and manage the file and can do compile, test and execution of the user program.

(2) Language Processor (Language Translation Program)

This is a software to translate the program language (compiler, etc.) used for the general programming (description of software) into machine language used internally inside the computer. The following ones are prepared as language processors:

a. ANS COBOL

This is a language for business machine which is used most often in Pertamina.

b. FORTRAN IV

This is an acronym of IBM Mathematical Formula Translating System and a language used most widely in scientific and technical computing on account of its brevity, easiness in writing and high efficiency.

c. PL/I (Programming Language One)

This is a language developped by joint effort of IBM and SHARE (IBM's user group) as a language for general purpose program. Although this is a most advanced language, it is not so often utilized as the above two (a. b.), but is used only in the limited case in Pertamina, too.

d. APLSV (Abbreviation of A Programming Language)

APL is a language devised to express numeric and logic relationship clearly and concisely, and used in conversational mode. APLSV is provided with a monitor which can be operated under the OS/VS of system/370. Although it is not clear to what extent APL is utilized now at Pertamina, yet attention is first directed to what degree its display terminals are used.

(3) Application Software (Service Program)

a. Data Management System (General Purpose Software)

This will be described by us in detail later in the section 4-2-3. It is a software for the storage and process of data, that is, a software devised especially to facilitate easy input/output, and easy retrieval-correction-addition of data so that massive and sophisticated data may be dealt.

(i) IMS/VS (Information Management System)

IMS is a software, in which two functions of DC (data communcation) and DB (data base) are incorporated an bloc. Particularly, DB is constituted with one more physical data base. It is a system, wherein on the basis of a single or plural physical data bases is set another logical data base in the form of physical-logical linkage. The physical data base is composed in the form of hierarchical tree structure, of various segment units, each divided into several fields. In the physical data base there are parent, child, or twin relationship among each segment according to its physical structure. Similarly as above, also in the logical data base, logical parent, child, or twin relationship between each segment is defined on the basis of pointer linkage. As a result, in spite of its basic hierarchical tree structure, a network structure of data is possible as a whole, enabling realization of high-grade data integration. Thus, the excellent point of IMS data structure system lies in that it can deal with network data structure and do service, separating evidently the function difining data base as a whole from the function defining logical data structure which is visible to the individual user's eyes.

At Pertamina's Computer Division, now are under development the Medical Data System and Shipping Data System utilizing IMS.

(ii) DMS II (Data Management System II)

The features of DMS II can be described as follows:

* COBOL, ANGOL and PL/I are usable as host language.
* Bugs do not be generated in the disks regarding the accumulation of DB pudating.
* Throughput is almost constant from beginning to end.
* Multi-DB, Multi-programming and Multi-processing are optional.
* There is no need of paying attention to the difference between on-line processing and batch processing.

(iii) SORT/MERGE

This is a system to file and edit a data file by means of some key worlds.

(iv) HCS (Health Care Support)

This is a Hospital Management System, and is utilized under the OS of CICS/VS or DL/1-ANS COBOL. The typical examples of its utilization are the entry registration system of new patients and system of sickled reservation, etc.

(v) RPG (Report Program Generator)

This is a program used for file updating and report writing. As to the file updating, it drafts programs necessary for updating of basic file, while, in respect of report writing, it gives commands indicating in what form printing should be made, how many lines should be printed in a page, and what should be done in a certain column. It is a generator to draft necessary programs through the process as mentioned above.

b. Simulation Language (General Purpose Software)

These are program packages which do various computing for the scientific business management by using mathematic models. Pertamina has developed and been using many kinds of such languages that are ramified according to the methods of scientific business management and algorithm etc. actually used. In order to make the best use of these softwares, the prerequisite is the participation of experts who understand well the basic methods and have undergone the training of mathematic models. Add to these, it is required to gather and edit data which are the basis of model drafting.

(i) MPSX (Mathematical Programming System Extended)

This is a Linear Programming application system developed by IBM.

(ii) GPSS V (General Purpose Simulation System V)

This is a General Purpose Simulation Language which facilitate modeling by the expression of activities and phenomena in block diagram.

(iii) CPPS (Continuous Process Plant Scheduling System)

This is a simualtor for the check of scheduling system used for continuous process plant. Conversational Mode is available, too.

(iv) RPMS (Refinery Process Mathematical System)

This is a program package consisting of Matrix Generator for the refinery LP model, and Refinery Data Bank.

At present, some technical experts and engineers are dispatched from Pertamina to Bonner and Moor which developed this system, and they get trained there.

c. Application for scientific/technical computation

(i) SSP (Scientific Subroutine Package)

This is a group of scientific/technical computation programs developed and serviced by IBM, in which about 250 subprograms are included. Pertamina uses now this in its extended form. New packages which were developed on the basis of the above package are said to be used at Pertamina for the statistical and analytical purpose.

d. User Application (programs made by users for problem process; Special Purpose Software)

(i) UCC one (Tape Management Software)

This is a Magnetic Tape information process system developed by UCC (University Computing Company). It is furnished with a unique form of standard report writing.

(ii) UCC Ten (Data Dictionary Manager)

This is a subsystem for IMS user and equipped with a function of expression and definition of Data, having 3270 formats, such as data base expression, data set group, segments and fields.

(iii) UCC Fifteen (Job Recovery System)

This is a palliative system for the trouble shooting in O.S.

(iv) PANVALET

This is a program to do management and recovery process at the time of error generating in all the programs, regardless of source programs or object programs. PANVALENT, developed by Pansophic Systems, Inc., does report regarding the detailed information about itself as well as the situation of library surrounding it.

(v) EASYTRIEV

This is a system using free formats for information retrieval and file management (developed by Pansophic Systems, Inc.)

(vi) FILETAB

This is a report writer system which is installed at 500 places in 17 countries (developed by Software International Corp.)

4–1–3 The Present State of Man Power and its Evaluation

As shown in the organization Table 4-1-4, Pertamina's computer personnel numbers 180 persons in all which are clearly divided into two groups, i.e. one in charge of system design and the other in charge of program. Of system design people, 11 persons are related to simulation and with the experience of about 5 years, while 21 persons engaged in business computing have the experience of 5~7 years.

There are not so many people with the experience of 10 years or more, but the line-up is expected to be filled up with more specialists, as time goes on. Most people in charge of system design are said to have experience in programming in the past, while the present persons in charge of programming are experienced 5~6 years in average.

So far as we could know by the investigation this time, the present state of Man Power as mentioned above is fully sufficient to cope with the ordinary projects, unless they are of very large scale or specially difficult ones.

Table 4-1-4 Member of Pertamina Computer Divison.

EXPERIENCE / FUNCTION	Over 1	9	8	7	6	5	4	3	2	1	Total
1. Management.	3	1									4
2. Administration.	2		2	2	4		2				12
3. Procedure.	2			1							3
4. System Development.											
4.1. Scientific.	2	1		2		6					11
4.2. Commercial.	3	2	3	6		4	2		1		21
5. Programmer.			2	3		6	4		18		33
6. System Programmer.		1	1	2	2	2	3		3		14
7. Data Base Adm.	1			1		1			4		7
8. Data Controller.	9		3	1	1						14
9. Computer Operator.	2		2	1	2	1	5	3	5		21
10. Key Puncher.	3		8	4	7	7	9	1	1		40
* TOTAL.	27	5	21	23	16	27	25	4	32		180

4-2 Some Concrete Steps for the Establishment of Energy Data Bank

A methodology will be described below concretely as to the establishment of Energy Data Bank which can be utilized by Pertamina and MIGAS.

4-2-1 The Concept of Concrete Step

The activity needed for the establishment of Energy Data Bank will be, at least, as follows:

1) Gathering and arrangement of the existent basic data
2) Tabulation of the past records of energy consumption
3) Tabulation of Energy Balance Table
4) Forecast of Middle-term demand

In order to accomplish the above work, several know-hows are necessary. We consider it our target in the first year to transfer such technical know-hows to Pertamina and MIGAS, and to brush up the resultant. As there is time limit, even the accomplishment of the above target in itself is even so difficult, however, our activity will not deserve the name "Establishment of Energy Data Bank", unless we can attain this minimum target, at least.

We have defined the step thus far as the Step 1, in which the development of computer software will be restricted only to those of easy nature and with the minimum scale. The prime goal here will be the smooth output of the result.

Only in the stage when the above becomes possible, the following items will be the activity to be taken up in the next step, i.e. –

1) Widening of the sphere, in which data are gathered.
2) Utilization of application system of higher grade.
3) Development of Data Management System.
4) Utilization of Data by on-line system.

These activities are considered to be the future assignment to be taken up after the first step is finished. Accordingly, the process, in which these activities are examined and put into practice, shall be called Step 2. Furthermore, the computer software to be developed in the Step 2 will have to be centered on Data Management System and its utilization by on-line system.

Although these problems at the Step 2 are not taken up in the first year, yet consideration regarding the concept of Data Management System will have, at least, be done in the first year.

The reason why the IMS owned by Pertamina is not used at the Step 1 will be explained later.

When we express this concept in a Figure, it will be as shown in the Fig. 4-2-1.

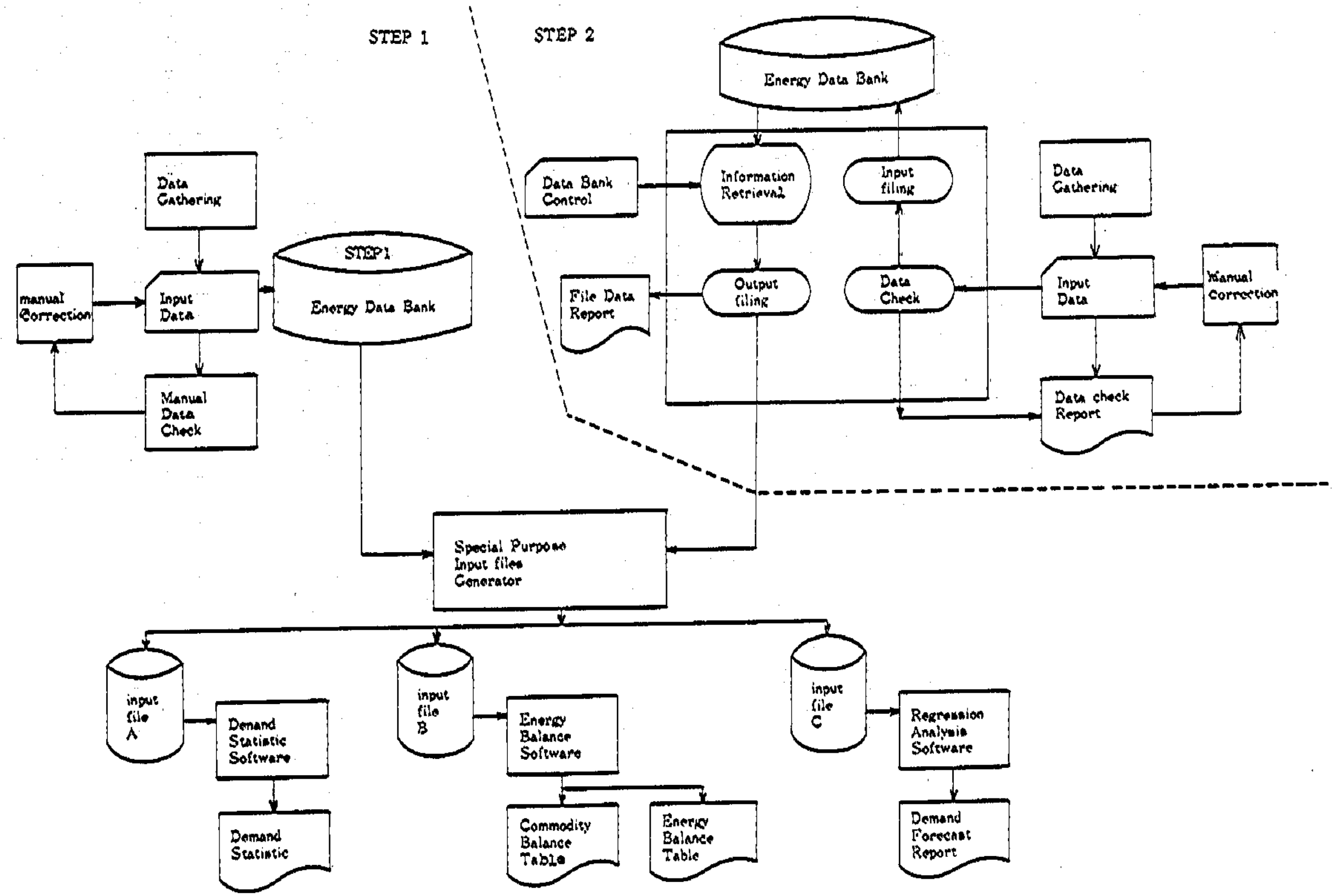
As clarified in this investigation, the computer system and introduced software at Pertamina are considerably high levelled, which the staff engaged in the computer jobs (180 persons) is already in a level worthy of praise, both quatitatively and qualitatively.

Therefore, when the basic know-how is obtained regarding the method of utilization of data in the Step 1, it will become possible to develop higher application technique at the Step 2 and software necessary for them.

The content to be done in the Step 2 is to establish Data Management System. Although there is already IMS which is a software developed by Pertamina as its DMS, yet it is still in a stage that IMS is about to be utilized for the establishment of Shipping, Medical and other Data Bank. Therefore, utilization of this IMS shall not be done at the present stage (Step 1). Furthermore, in the light of the above situation it is considered to introduce higher application program and do system design on the basis of the Energy Data Bank. It is anticipated to require at least 4 ~ 5 years until the stage as mentioned above is realized, and at the same time, it is the option on the part of MIGAS and Pertamina to decide the content to be adopted.

The Fig. 4-2-1 is a flow chart showing the Data between the aforementioned Step and Software as well as its control. In this figure the left side part of the dotted line is the flow of the Step 1, while the right side belongs to the Step 2. Moreover, the squarely boxed part in the Step 2 expresses the Data Management System which is to be accomplished utilizing either IMS or a software newly developed for the Energy Data Bank.

Fig. 4-2-1 . Structure of Energy Data Bank System



4-2-2 Contents of Step 1

Even if Energy Data Bank must be established as soon as possible, it is not advisable to introduce or develop abruptly a system on a large scale, because there are many difficulties anticipated as a matter of fact. Accordingly, a gradual building method in the step by step way is the most practical approach to success.

The first thing to be done is to gather energy related data available now as much as possible and input them into card (here input to disk, because key to disk is used at Pertamina presently). In the stage of Step 1 check and edition must be done manually.

Next becomes necessary the conversion software which converts the Written Input Data into Input File A, B, and C. The Input file A is a file, in which principal Energy Data are arranged in time series and filed in such a form that can be read by Domestic Statistic Software which compiles the statistic report. Input file B is so arranged that it is easy to identify the kind of Energy Data and the division (to be described later), to which the Energy Data belongs. The input file B is made in the form that can be read by the Energy Balance Software which compiles Commodity Balance Table and Energy Balance Table. Input file C is a file, in which Energy Demand data and Economic Frame data are arranged in time series. Input file C is made in the form that can be read by regression analysis software which makes the forecasts of future demands by means of regression analysis.

The software which consists of these files is what corresponds to the portion "special purpose input file generator" described in the Fifure 4-2-2. Here is done data check to some extent. This software is probably enough, if its scale is 5000 steps or so on the FORTRAN basis.

The following problems are anticipated to occur in the stage when this input files generator is operated:

1) Input data are quantitatively so poor as to make Commodity Balance Table and Energy Balance Table.

2) Contrary to 1), unnecessary data may exist too much.

3) Output table of input data check becomes too much.

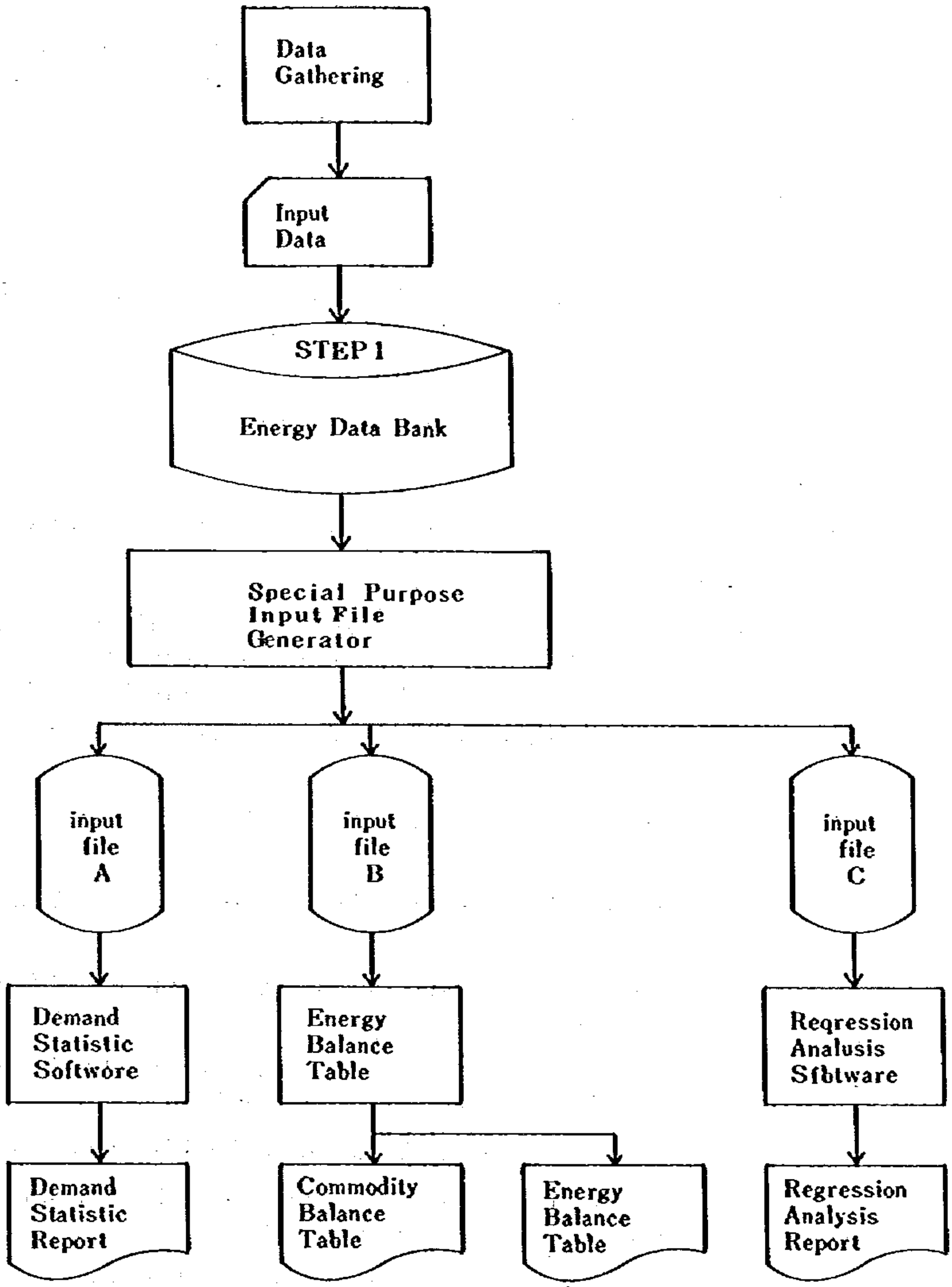
4) Many Input Data errors may come out owing to the deficient Data gathering mechanism.

When such a problem as 1) or 2) breaks out, gathered Data must be rearranged, and necessary data should be supplemented or input to feed back to the Data gathering. Considering thus, input data are advisably to be treated manually, unless and until the concept of Energy Data Bank is fixed in Indonesia.

Therefore, the questions — what kind of Data should be used concretely and what form should be adopted to make Energy Data Bank — are to be decided in consideration of the needs on the Indonesian side and O.A.R.S. now under planning at MIGAS as well as Data gathering organizations inside Pertamina.

Thus, it is essential to make input file A.B.C. and to develop software necessary for the effective utilization of Energy Data Bank Computer Software to be developed at the Step 1 is special input file generator, and Demand Statistics Software, Energy Balance Software and Regression Analysis Software, the latter 3 being necessary for the utilization of Data.

Fig. 4-2-2 Concept of Energy Supply-Demand Data Bank System in Step 1



At the Step 1 these Softwares shall be developed in close cooperation with Indonesian side. Working procedure of these Softwares will be explained one by one.

(a) Demand Statistics Software

Out of the original data (input file A), this Software outputs, in time series, the past records of the Energy demand classified according to the each industrial field. This past records table of demand will become data showing what kind of energy was selected in the each industry and how the consumption records in the past underwent a change.

The tabulation includes the following two tables.

1) Original Unit Table

This serves to calculate and tabulate, from the original data, the quantity of various energies consumed by the each and every industry by means of Original Unit.

2) Conversion Table

This serves to convert various energies into calorific value (heating value).

(b) Energy Balance Software

This Software Package serves to make two kinds of Commodity Balance Table as mentioned below.

1) Commodity Balance Table

This aims to clarify the supply-demand relationship of Energy, i.e. the supplying situation (what kind of Energy Sources [now, oil and natural gas only] was supplied in what form) and the demanding situation (in what industries it was consumed) in a certain period (annually, quarterly, etc.)

The output formula will be as shown in the Table 2-2 in the second chapter. We shall explain it here briefly.

If we show the nature of the each supply-demand item briefly, its outline will be summarized as below:

(1) Production .... Past records of production of various energies were transferred from the original data.

(2) Import .... Past records of import of various energies were transferred from the original data.

(3) Export .... Past records of export of various energies were transferred from the original data, including bunker oil consumption.

(4) Bunker oil .... Production of heavy oil for bunker, transferred from the original data.

(5) Inventory adjustment .... Adjustment of inventory difference between the beginning and end of the year, each marked with ± respectively.

(6) Total Domestic Consumption .... This is the total of all the energies consumed domestically and equals to the sum of converted energy consumption and domestic final consumption.

⑦ Statistic Difference .... This is an adjustment item to keep the balance of supply and demand of each energy. Here is included energy loss owing to radiation or discharge into air of electric power heat, natural gas, coke oven gas and blast furnace gas, etc. Quality conversion by means of naphtha reforming is included also. ± is marked respectively at each place.

⑧~⑫ Total consumption of converted energy .... This is the past records of various energies converted and consumed as the sencondary and/or tertiary energy.

⑬ (⑭~㉗) Total Domestic Final Consumption .... This is the total final energy consumed domestically in the mining industry and people's daily life. Here is not included the consumption of converted energy. (⑧~⑫)

㉘ Non-energy .... Here is summed up other oil products only that are consumed for other purpose than energy. Other energies are added up in each industry.

㉙ Statistical amendment .... In the original statistics was investigated the difference between the total consumption in the supply-demand balance in the various energies and sales records by means of sampling survey. In this matrix this difference is distributed in proportion to the consumption by each industry.

Table 4-2-2 Energy Balance Table

Kinds of energy / item	coal	oil	other
① Production			
② Import			
③ Export			
④ Bunker oil			
⑤ Inventory Adjustment			
⑥ Total Domestic Difference			
⑦ Statistic Difference			
⑧~⑫ Total Consumption of Converted Energy			
⑬~㉗ Total Domestic Final Consumption			
㉘ Non Energy			
㉙ Quantity Revision			

The kind of Tabulation

1 Original Unit Table .... This is tabulated according to the schema unit of the various energies.

2 Conversion Table .... This is calorific conversion figures classified according to heating value (as per separate sheet) of various energies.

3 Table of the component ratio of the final consumption .... This is the component ratio, making total energy consumption as a denominator and multiplied by 10,000.

4 Table of the component ratio of the each energy .... This is the component ratio, making the total consumption of each energy as a denominator and multiplied by 100.

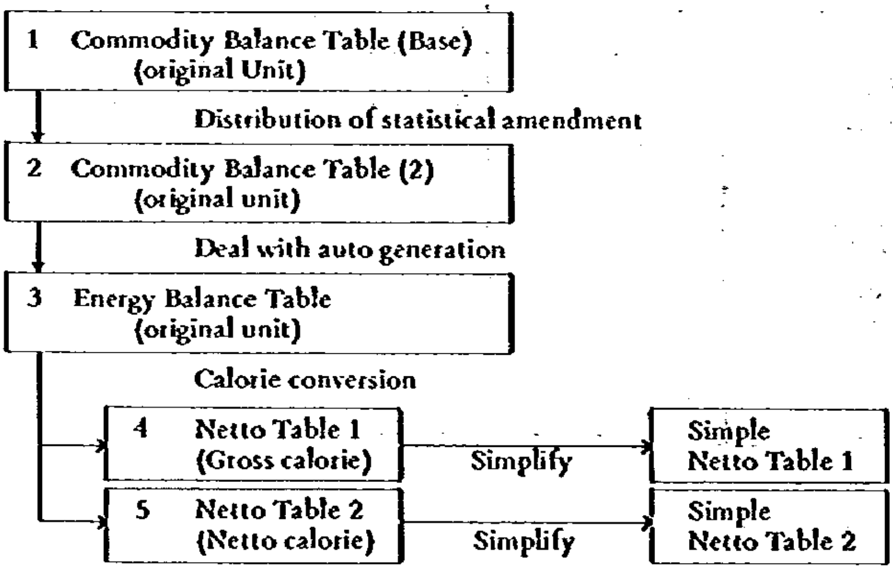
5 Table of the component ratio according to the industries .... This is the component ratio, making the total consumption of each industry as a denominator and multiplied by 100.

2) Energy Balance Table

The purpose of Energy Balance Table lies in to tabulate a Table in the form in conformity to the international standard – i.e. Input-Output Table of Energy which is supplied and demanded in a certain period, and furthermore, by means of such a tabulation, to establish a uniform and consistent Energy supply-demand plan.

The procedure shall be started at the Original Unit Table and then followed in the order as shown in the Figure 4-2-3.

Fig. 4-2-3 Energy Balance Table Flow



(c) Regression Analysis Software

This is a method, in which a certain dependent variable given as quantitative data is explained as a linear function of some independent variables. This method is derived from the method of least square or maximum likelihood method. This regression analysis is a method to be considered quite naturally, so long as one wants to adopt a so-called scientific approach for the solution of any problem whether its field is related to natural science, social science, or cultural science. In short, it is a method used most extensively and frequently among statistical methods.

The above method is used here for the supply-demand forecast of oil products. That is, this analysis is done by substituting demand of each oil product for dependent variable and substituting economic factors for independent variable. Furthermore, the scale of the Energy demand in the future is forecast by doing calorific conversion.

The application Software for the above will be enough, if Pertamina makes the best use of SSP, to which use the personnel at the Computer Division is accustomed.

The point at issue is how long it is required until the Data sufficient enough to sustain regression analysis are gathered.

Here is shown an example in Japan in the form of a concrete equation.

log (Energy demand in the manufacturing industry)

$$= 4.8 + 0.98 \log (\text{production index}) - 0.19 \log (\text{Energy price/GNP deflator})$$

log (oil demand)

$$= 3.86 + 0.93 \log (\text{production index}) - \log (\text{oil price/GNP deflator})$$

4-2-3 An Examination on the Future Problems (Step 2)

Data Bank is, in a word, literally a gathering of accumulated Data in itself, but it has a different characteristic than the conventional data file, because, in the case of Data Bank, Data are accumulated in the form, in which plural programs can be commonly utilized.

Accordingly, it is essential to have Software which can manipulate and process this Data Bank freely at will. The Software is, in sum, to be classified into program packages, such as Information Retrieval Systm, File Processor, File Process System, Retrieval System, Report Writing System and Data Base Operating System, together with Accounting System and Inventory Control System. In general, these software shall be properly defined as DMS (Data Management System). DMS's function is, after all, to rear and maintain Data Bank and make the information from the Data Bank into a Report. In other words, two functions of DMS are the updating of Data Bank and inquiry-system. As for the former function the main point is to define the significance, do assessment, and consider application of DMS within the reach of the Data Bank and in the environment, in which DMS is utilized. In the meantime, as to the latter (inquiry system) the main point at issue is related to the expression, structure and operation of Data, seen from the side of computer technology. When a new report based on the updated Data is required, what is the difference in the procedure between the commonly used one and the method utilizing DMS? It is contrasted in the following Figure 4-2-4.

Fig. 4-2-4 Comparison of the general procedure with the method utilizing DMS

General Procedure	DMS
(1) Analysts do analysis of the flow of input/output and design data form. ↓	(1) Analysts do analysis of the flow of input/output and design data form. (Data input/output becomes freer than the general procedure.
(2) Programmers or analysts write a program for file making, extend this program further for the maintenance of its file and write more programs. ↓	↓
(3) Programmers or analysts write a program to make out required report. ↓	↓
(4) Data are gathered and formatted. Also programs are debugged. ↓	(2) Data are gathered and formatted. ↓
(5) Files are made and stored in tapes or disks. ↓	↓
(6) Report writing is put into practice.	(3) By the use of Data Management System (DMS), files are reared and report is written.

Generalized DMS serves to facilitate both programming and its debugging. The more important feature of DMS is, for instance, that the maintenance and execution of a regular program can easily be continued, even when a skilled person in charge of data process is replaced by other inexperienced person.

On the other hand, there are some difficulties, too, in respect of DMS. Although this is chiefly in the case of DMS sold in the market, it occurs sometimes, for instance, that equipment configuration of computer is compelled to change after the purchase of a DMS, or that the conversion of Data and Programs necessitates even recheck of data element and report.

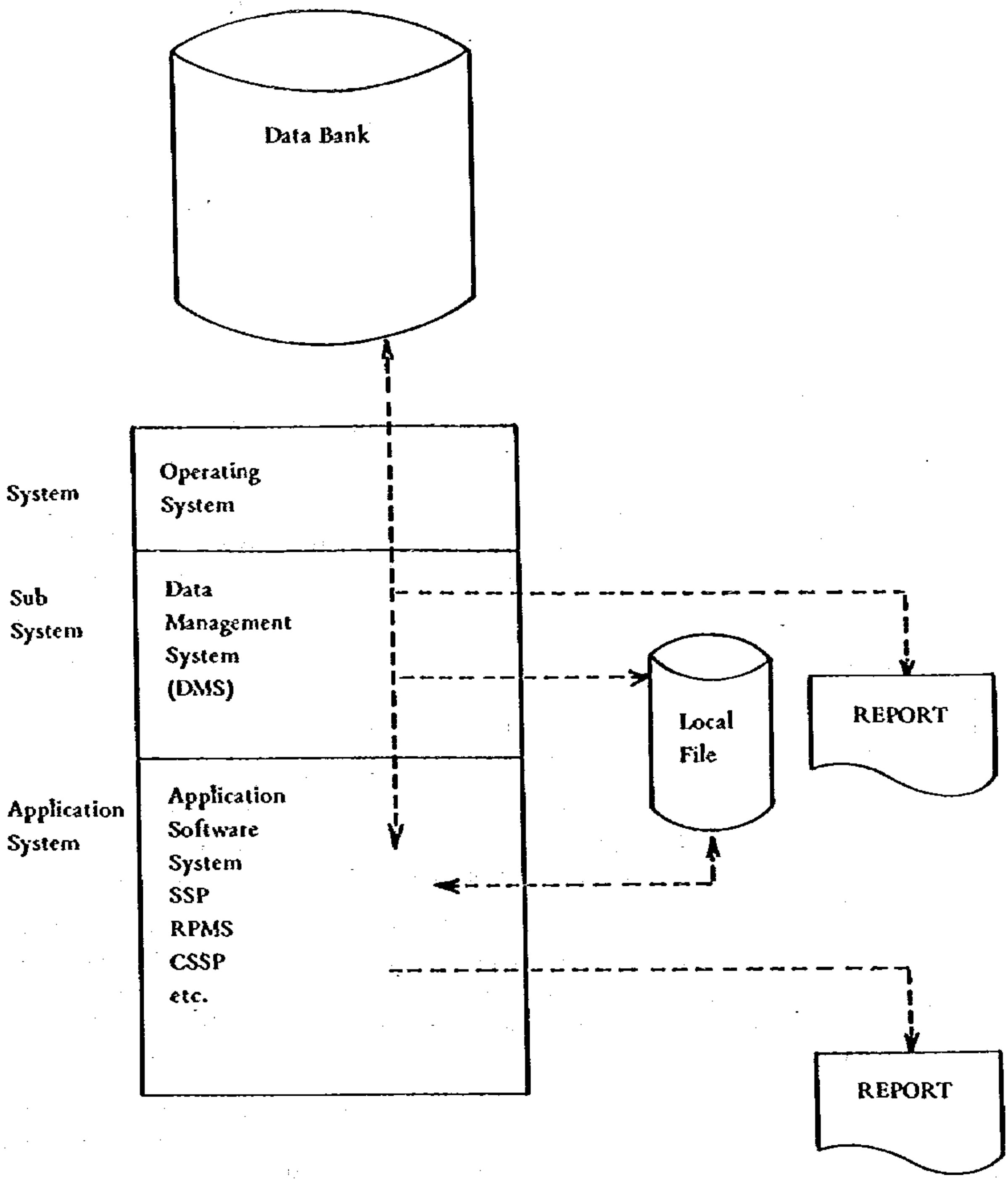
In view of such a bitter case as above, when DMS is applied on Energy Supply-Demand Data Bank in the future, careful check must be done as to what kind of DMS is applied.

The Figure 4-2-5 shows the relationship between the Data Management System and other Application Software/Hardware. DMS is a subsystem under Operating System.

The Computer Division of Pertamina is strongly oriented to IMS, and owns, for the time being, Hardware and Software necessary for the Data Bank.

IMS (Information Management System) is a system developed by IMS Corporation and owned by Pertamina which is going to utilize IMS as shipping information control system. To cite an instance

Fig. 4-2-5 Data Management System and Other Application Software & Hardware



of IMS, the following Hardware is necessary.

(1) The minimum configuration of Central Arithmetic and Processing Unit, and Internal Storage is 256 K byte in the case of batch processing, and 512 K byte in the case of on-line processing. (It is 1,024 K byte at Pertamina.)

(2) At least one Magnetic Disk Unit is necessary as the memory media to be used for Operating System library.

(3) For the operation system of the minimum Data Bank must be added further one disk unit and one tape unit. The reason why the tape unit is included here is because the tape unit is necessary for back-up purpose, i.e. it must be used at the time of reopening or restoration after the Data Bank was damaged, and moreover, because the records of updating must often be preserved for the sake of reference in later days.

Consider thus, Hardware necessary for IMS is, at any rate, equipped enough in Pertamina, unless a full-scale utilization of DMS including on-line (to be described in the later chapter) comes into question.

Certainly, IMS is a Software powerful enough for the maintenance and control of retrieval, data check and Data Bank. However, it will be considerably long years before Pertamina has IMS at its command. The Table 4-2-3 shows the comparison of the features between IMS and TOTAL which is the DMS used in IBM 370 series.

If IMS is used for the work in the first year in order to establish Energy Data Bank, one full month must be spent for the learning of IMS, and furthermore, new files according to the purpose must be made. Also, as a matter fo fact, it would not be possible to prepare mass data, since data volume to be gathered the nceforth is related mainly to oil and natural gas.

If the whole project is, in spite of the condition as mentioned above, promoted in the direction aiming to utilize IMS, that will impede the object of primary importance, i.e. transition of Data Bank application technique, to Pertamina and MIGAS, to say nothing of time and money wasted.

This is the very reason why we insist upon that such DMS as IMS should not be applied in the Step 1, but, instead, Energy Data Bank should, even tentatively, be established, although the interim period (Step 1) shall not pass away idly, but know-how regarding DMS's application should be learned meanwhile and, simultaneously, attention should be paid to the problem as to what kind of DMS (including IMS) should be applied in the future.

At the same time, it must be considered, too, to introduce or develop, of Pertamina's own accord, TOTAL which is a handy type DMS exclusively used for Energy Data Bank. The Energy Data Bank which should be established in the future through the utilization of DMS in some way or other shall include such data as supply-demand balance of each product, refinery information (refinery equipment, yielding rate and operating cost, etc.), and the economic frame in Indonesia (GNP, population and industrial production, etc.)

Simultaneously, it is a natural conclusion to want that this Energy Bank is utilized for the establishment of oil supply-demand model and various other models which should be that mainstay in the

Table 4-2-3 Comparative Table of IMS and TOTAL

Items to be compared	IMS	TOTAL
Developper	IBM and SHARE (IBM's big users)	Independent specialist company
Vendor	IBM	
Object, on which the Software is applied	usable to the program of a very of a very large scale	specially effective in the system smaller than medium scale
Function and specification	rich and with wide option	restricted
Program scale	large	compact
Machine load	as per DB design	small
Manual	huge	small in quantity
Period necessary for learning	a month	4 days
Specialist	difficult	simple
Coding	brief	slightly redundant
How to design a good DB	A prospect for a long term and skill are necessary	simple
Influence of good or bad design	very large	ordinary
Procedure of change or adition to DB	ordinary	simple
Machine load labor	large	simple

future, when such a policy as Energy supply-demand plan will be drafted.

What is shown in the Figure 4-2-6 is a rough sketch of the application system to the approach in abovementioned orientation. Needless to say, this is only one of many thoughts and so second thought may be necessary under the changed situation. Nevertheless, it is more rational to consider in this way, so far as the problem is pursued at the present stage.

Also, in the future, as one of the application of Energy Supply-Demand Data Bank, it must be considered to make oil supply-demand model and do various case study utilizing such models.

Henceforth, energy demand in Indonesia will increase naturally. In order to cope with such a situation, other energy sources than oil (e.g. coal, nuclear power, etc.) must be taken into account, too and furthermore, it must be remembered that policies concerning oil refining and crude oil sales etc. have the tendency of more diversification and complication.

Based on the general purview regarding Energy supply-demand as mentioned above, it is essential to understand in advance what the ideal image of oil supply-demand in Indonesia should be in the future, because this problem is closely connected with the trend of Indonesian economy.

For this purpose, both Energy Data Bank as well as Energy supply-demand forecast method must be established at any cost.

At present, Pertamina engineers in charge of Computer Division are dispatched to Bonner and Moor Corp., U.S. to study application operation and to introduce RPMS, which is an excellent Software package owning Matrix Generator, Report Writer, and Data for oil refining Linear Programming Model.

Being backed by this situation, it will be enough, if an oil supply-demand model is constructed in such a way that LP model is utilized.

As its due procedure, firstly, Refinery Information must be taken out from the file groups of Energy Data bank to formulate a part of oil refining Model.

Next, demand scale based on regression analysis is input, and lastly, the quantity available to supply is input into the oil supply-demand model. Making this model as basic model, analysing function is further added hereto according to the problems proposed, such as qualitative variation of oil supply-demand owing to introduction of substitute energy, and change of deamnd pattern on account of this fact, model construction should be done in compliance with Indonesian own needs.

Therefore, technical lectures and suggestions shall be given according to the procedure mentioned as follows:

1) Construction of oil model
2) Study as to what kind of data are necessary
3) Construction of substitute Energy Model
4) Study of premises and results
5) Other ways of application.

Since Pertamina owns abundantly many other Computer Application Softwares than the above, it is more advisable to give suggestions as to their effective operation.

For instance, it is said that Pertamina owns already CMS (Conversational Monitor System) in its O.S. library. Also, it is surmised that Pertamina is scheduled, in the near future, to connect the computer at its head office in Jakarta with terminals at every branch and department. So as to prepare for the situation when on-line system will have to be studied in the future, imust bear in mind that it is necessary for computer to investigate the capacity and situation of telephone lines network in the city of Jakarta.

Furthermore, in order to utilize DMS including online system in full scale, it may become necessary to consider extension of hardware system at the same time.

Fig. 4-2-6 Application System Flow

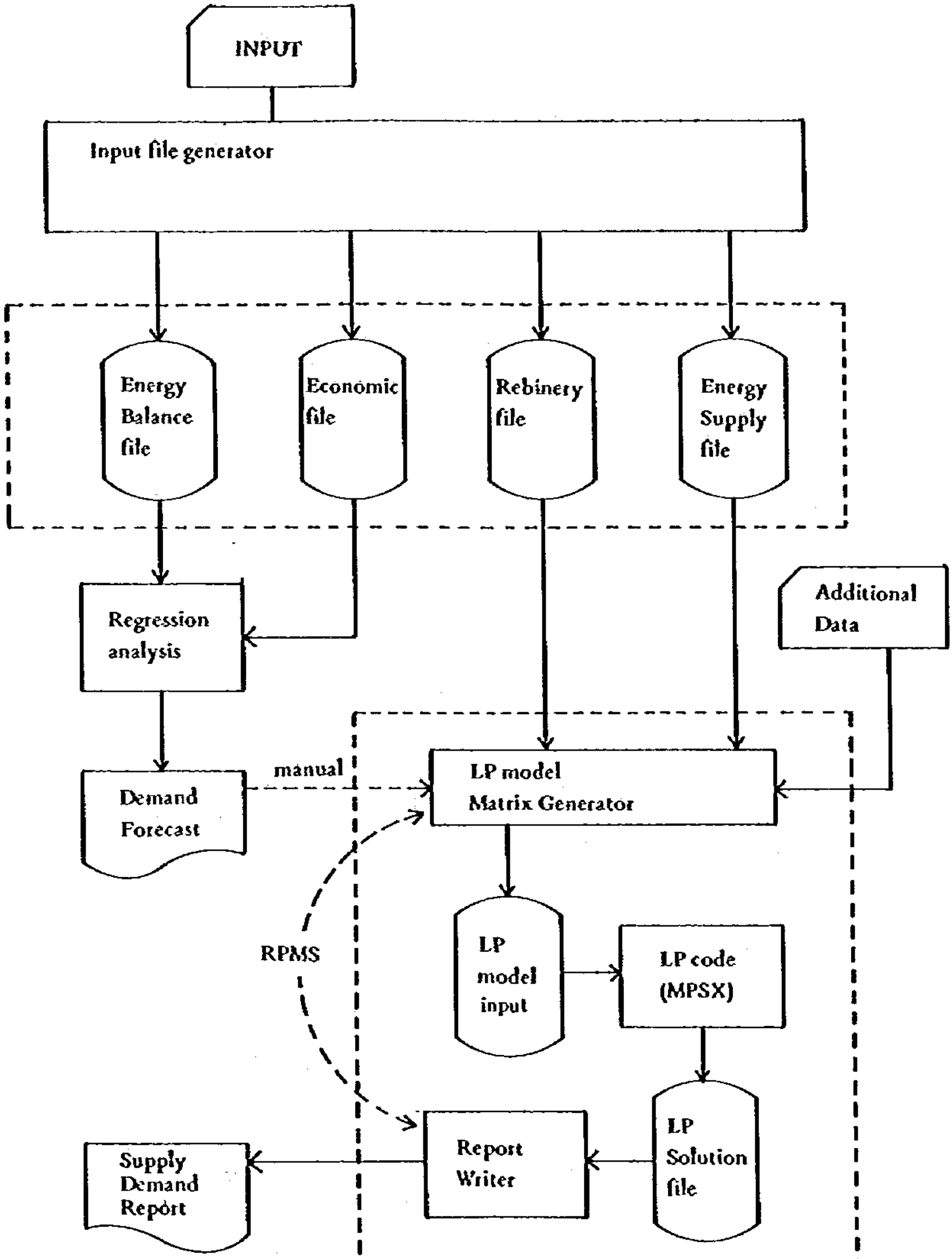


Fig. 5-1-1 Installed Capacity of PLN

PLN OPERATION DIAGRAM

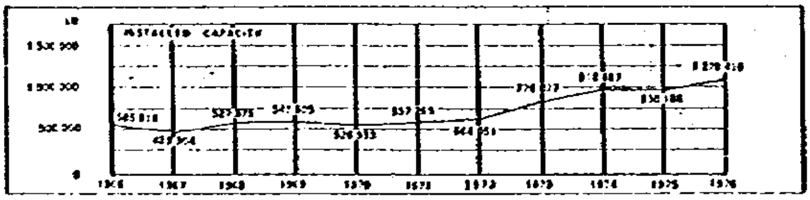


Fig. 5-1-2 Kwh Production of PLN

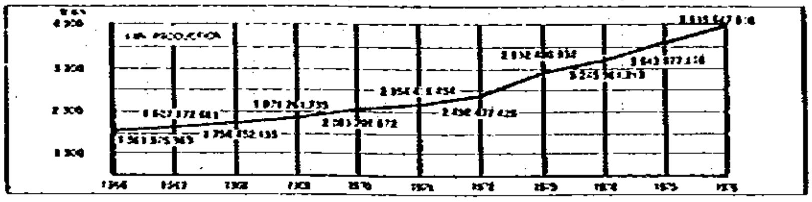


Fig. 5-1-3 Number of Consumers of PLN

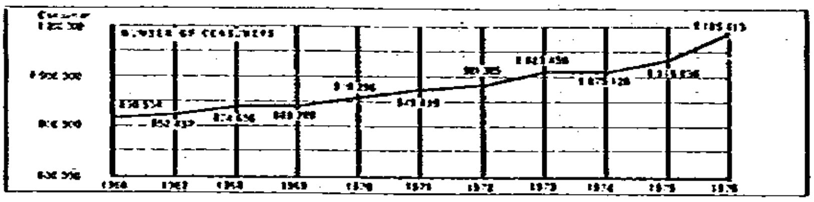
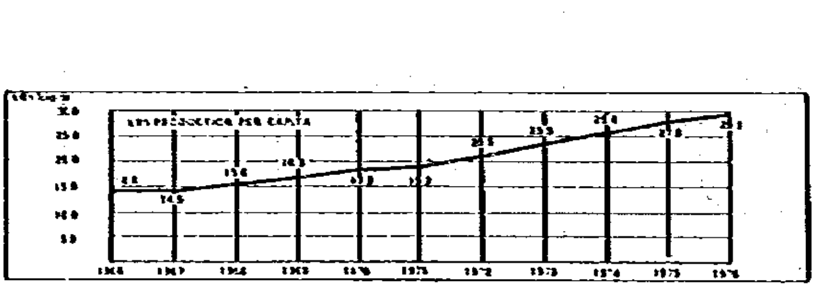


Fig. 5-1-4 Kwh Production Per Capita of PLN



5. Data on Energy Other Than Oil and Gas

5–1 Electric Power Supply Demand Data

5–1–1 Importance of Electric Power

Although the share of electric power is only about 5%* of the final energy consumption in the Republic of Indonesia, the share is expected to grow up to more than 20% in the future as has been shown in the cases of developed countries. Since elecltric power could be generated from energy sources other than oil, promotion of electric demand and supply in the Republic of Indonesia will contribute not to the development of rural electrification and national industrialization but to the national energy policy of oil conservation. Therefore, the demand and supply structure of energy in this country will be influenced by the increasing importance of electric power.

* the World Energy Convention, the Indonesia Nationwide Committee

5–1–2 Data Collection

In regard to the survey and data collection of electric power demand and supply, it is difficult to get complete data. However, each organization such as PLN (the Electric Power Corporation), the Department of Industry, the Central Bureau of Statistics, MIGAS (the Department of Mine and Energy) and PERTAMINA has conducted the survey as required. Though much effort has been made to improve the exchange of information among the above-mentioned organizations, PLN, as the government body in charge of production, distribution and sales of electricity, takes a great interest in this field and actually has been practicing to keep records on monthly basis. Its annual reports are compiled and issued, including information on development programs, facilities installed and activities in production, distribution and sales of electricity in total and by districts, though they are restriced within the PLN coverage. Some key data such as installed capacity, kwh production, kwh sales, the number of consumers etc. of PLN are shown on annual basis in a consistent manner. (See figures 5-1-1, 5-1-2, 5-1-3, and 5-1-4)

There are some difficulties in collecting the data even within the PLN coverage. In case of the data shown in the tables from 5-1-1 to 5-4-1, some comments are made in the following chapter. In establishing the energy data bank including the data on oil, gas and other kinds of energy as well as electric power, it is very important to overcome those difficulties. Especially power system loss and thermal efficiency of power plants are the keys to clarify the interrelationship between primary energy consumption and that of secondary energy such as electric power. It is necessary to collect more accurate data on transmission loss rate and plant efficiency in order to set up a reliable data bank.

But the power systems in Indonesia are so diverse in nature and size that certain figures as load factors and losss rates, do not in most cases, reflect the condition of the power systems on a national basis. As the quality of collected data should be improved immediately in order to assure the significance of any interpretation, the breakdown of information on each system-base is now being conducted in PLN. In order to impoive the general data for PLN purposes, PLN is making preparations for installing computers in the near future. Even if it is just the first step, the practice of keeping records of operational data will be established by the new computer center.

Another problem in the survey of electric power demand and supply is how to collect data outside PLN. There is a considerable amount of individual power generation in this country, but the Central Bureau of Statistics has collected only a part* of its data. It is natural for PLN to be interested in individual power generation, so that it estimates some of the data like installed capacity. Recently the Department of Industry prepares to collect data including energy consumption from industries periodically. By using the oil products sales data collected by Pertamina, the data relating to power generation may be estimated to some extent. All these organizations must cooperate and work together in order to set up the nationwide energy data bank.

* See 5–3–2 General Industrial Statistics

5–1–3 Available Data

The result of the survey of available energy data in regard to electric power is shown in the tables below. (from Table 5.1. to Talbe 5.5) A1 indicates that the reliable data are collected periodically only within PLN coverage. A2 indicates the data are estimated by PLN, the main organization in charge of electric power supply. A3 indicates that there are only the sample data. NA means that no data is available. As for the power system loss rate, PLN calculates it as follows:

$$L\ (\%) = \frac{G - S}{G} \times 100$$

G: gross generated electric energy
S: gross electric energy sold
L: power system loss rate

Under the circumstances of instrumentation in the plants and of electric power sales records, this way of calculation seems to be the best, at least, for the moment. It is necessary, however, for PLN to be equipped with much more instruments of specific types besides those it has at present in order to find out accurate load factor and detailed load curve.

* These data will be needed in the future since they are the energy data to be used in probability or time series data analysis.

5–1–4 Analysis of Data

One of the major purposes of setting up the energy data bank is to analyse input data for making economic plans or development programs. The trend of the rural electrification plan or of the electricity rate system gives a great influence on those plans and programs.

The rural electrification in the Republic of Indonesia is to be promoted on the basis of the following basic concept of the target of the Third Five Year Overall Development Plan (REPELITA III).

The rural electrification plan is materialization of the effort to let the rural community share the benefit of the development. As stipulated in the Cabinet Order No. 18/1972, the purpose of PLN is to take a part in developing the national economy and in improving the Indonesia standard of living under the government policies. In other articles of the orders PLN is required to play an active part just like other sound industries do their commercial activities. The rural electrification must be promoted along that policy.

Table 5-1-1 Data Collection of Power Demand

	National Total	By Districts *1	By Utilities *2	By Classes Users *3	By Installations
Energy Demand (kwh)	A1 A2	A1 A2	A1	A1	A3
Facilities Demand (kw)	A1 A2	A1 A2	A1	–	–
Load Factor (%)	NA	A1	A1	A3	A3
Transmission Loss Rate (%)	NA	A1	A1	–	–
Power System Loss Rate (%)	NA	A1	A1	–	–
Load Curve	NA	A1	A1	A3	A3
Number of Consumers	A1 A2	A1	A1	A1	–

*1 – By PLN Supply Regions (15)
*2 – PLN and the others (private power generation etc.)
*3 – By types of industries

Table 5-1-2 Data Collection of Power Supply

	National Total	By Districts	By Utilities
Hydro Power	A1 A2	A1 A2	A1
Run-off-River Type	A1 A2	A1 A2	A1
Reservoir Type	A1 A2	A1 A2	A1
Pumping-up Type	A1 A2	A1 A2	A1
Thermal Power	A1 A2	A1 A2	A1
Coal Burning Type	A1 A2	A1 A2	A1
Oil Burning Type	A1 A2	A1 A2	A1
Gas Burning Type	A1 A2	A1 A2	A1
New Kings of Energy	A1 A2	A1 A2	A1
Nuclear Power	A1 A2	A1 A2	A1
Geothermal Power	A1 A2	A1 A2	A1
Others	A1 A2	A1 A2	A1

Table 5-1-3 Data Collection of Primary Energy for Electric Power (1)

		National Total	By Districts	By Utilities
Coal	Consumption in Power Plants (ton)	A1 A2	A1	A1
	Average Calories (KCal/ton)	NA	A1	A1
Oil	Consumption in Power Plants (kl)	A1 A2	A1	A1
	Average Calories (KCal/kl)	NA	A1	A1
Gas	Consumption in Power Plants (Nm^3)	A1 A2	A1	A1
	Average Calories ($KCal/Nm^3$)	NA	A1	A1

Table 5-1-4 Data Collection of Thermal Efficiency of Power Plants

	National Total	By Districts	By Utilities	By Plants
Thermal Efficiency of Power Plants	NA	NA	NA	A3

Table 5-1-5 Data Collection of Primary Energy for Electric Power (Future Forecast) (2)

National Total

National Total	1977	1980	1985	1990
Hydro Power				
Potential Water Power *1	A2	A2	A2	A2
Developed Water Power	A1 A2	A1 A2	A1 A2	A1 A2
Coal *2				
Production	A1	A1	A1	A1
Import	A1	A1	A1	A1
Oil *2				
Production	A1	A1	A1	A1
Import	A1	A1	A1	A1
Gas *2				
Production	A1	A1	A1	A1
Import	A1	A1	A1	A1
Nuclear Fuel *2				
Production	A1	A1	A1	A1
Import	A1	A1	A1	A1
Others *2				
Production	A1	A1	A1	A1
Import	A1	A1	A1	A1

*1 – Average Water Fall X Average Height of the Land
*2 – Only for Electric Power Generation

Based on the latest study, the total number of rural areas/villages (desa) in Indonesia is about 57,000, comprising of self-propelling villages (desa swadaya -- 38%), self-sustaining villages (desa swakarya – 55.6%), while 80% of the Indonesian population consist of rural people.

Notwithstanding this fact, the rural electrification target within REPELITA III is only limited in the effort to include all self-supporting villages into the "project area", with the understanding that the distribution networks should cover all such self-supporting villages.

Some of the self-propelling and self-sustaining villages would also be covered in this target, in line with the development of the distribution networks concerned. Having it done not mean that the electrification ratio in self-suppporting villages will reach the 100% figure at the end of REPELITA III.

In regard to the electricity rate system, PLN classifies its consumers into the following 10 groups.

1. Residential (Low voltage)
   - A1 ...... Small-size household consumers with boads limit device (unmetered)
   - A2 ...... Churches, temples, schools, etc.
   - B1 ...... Household consumers (metered)
2. Business (Low voltage)
   - B2 ...... Commercial consumers
   - Special
   - F .... Temporary connections
3. Industrial (Low and medium voltage)
   - C1 ...... Small-scale industries
   - E .... Large-scale industries
4. Others (Low voltage)
   - D .... Street lights
   - C2 ...... Government offices, public enterprises, offices of foreign missions, defence forces.

The annual reports of PLN show the total amount of electric power sales in these groups by supply districts. Although the energy data bank will be used for programming and forecasting the energy system in the future, development plans of electric power will be made and checked by other ways. The annual reports of PLN show those development plans by districts. In regard to the overall installation program based on the demand and supply survey, PLN plans to use the method of analysing probabilites such as system reliadility, forced outage ratio, change of demand, amount of rainfalls, etc.

5–1–5 Forecast of Power Demand

It is well known that PLN has studied several methods for the electric power demand forecast. Some experts from the Japanese power companies have made great contributions in regard to two aspects by introduction of EI Method(*1) used in Japan at present and another method(*2) designed by Mr. Aoki of Electric Power Development Company.

Based on these studies, the present method of the forecast of power demand used by PLN is as follows: Namely, PLN has set up a target level of electric power sales as middle-range (5 – 8 years) forecast after it had made forecasts of the trend in the near future in such fields as the expected volume of electric power purchase by the owners of individual power generation equipments, supply capability of electric power, development plans of electric power system and so on. The target level is continuously evaluated, and the nature of the target itself is assessed. As for the long-range forecast, PLN uses the estimated power demand growth (scenario) in order to determine the general structure of power sources. For instance, an average growth of 14% to 18% on a long-range basis is used in making the long-range plan.

(*1) E1 Method

(1) Forecast of Power Demand of Target Year

After fixing the year five or six years ahead as the target, mainly "piling-up method" is used taking its co-relation with the main economic indicators like GNP into consideration. The economic indicators are based on the economic plan by the government. They can find out the amount of electric light demand by multiplying the number of the households with the average amount of consumption per household. The average amount of consumption is influenced by the rate of popularization of the electric equipments in households. The forecast of the power demand for business is made by the number of demand (kw) and the basic unit (consumed amount by kw). The former is estimated from the relationship with the capital accumulation, Tertiary industry and the latter from actual business activities and areal characteristics. The one for industries is estimated from the number of demand, the consumption rate, consumers' production plans and the relationship with the Index of Industrial Production (IIP). Then they estimate the consumed amount of private generation by checking their production plans, and it is subtructed from the whole amount. The power demand for utilities is estimated in this way.

(2) Short-range Forecast and Middle-range Forecast

In the short-range forecast they usually use the value of the electric power demand and supply plan composed by the Ministry of International Trade and Industry based on the Electric Enterprise Law (Article 29). The estimates in the middle-range forecast are determined by crossing actual results and the value of target year.

(3) Forecast of Maxium Power

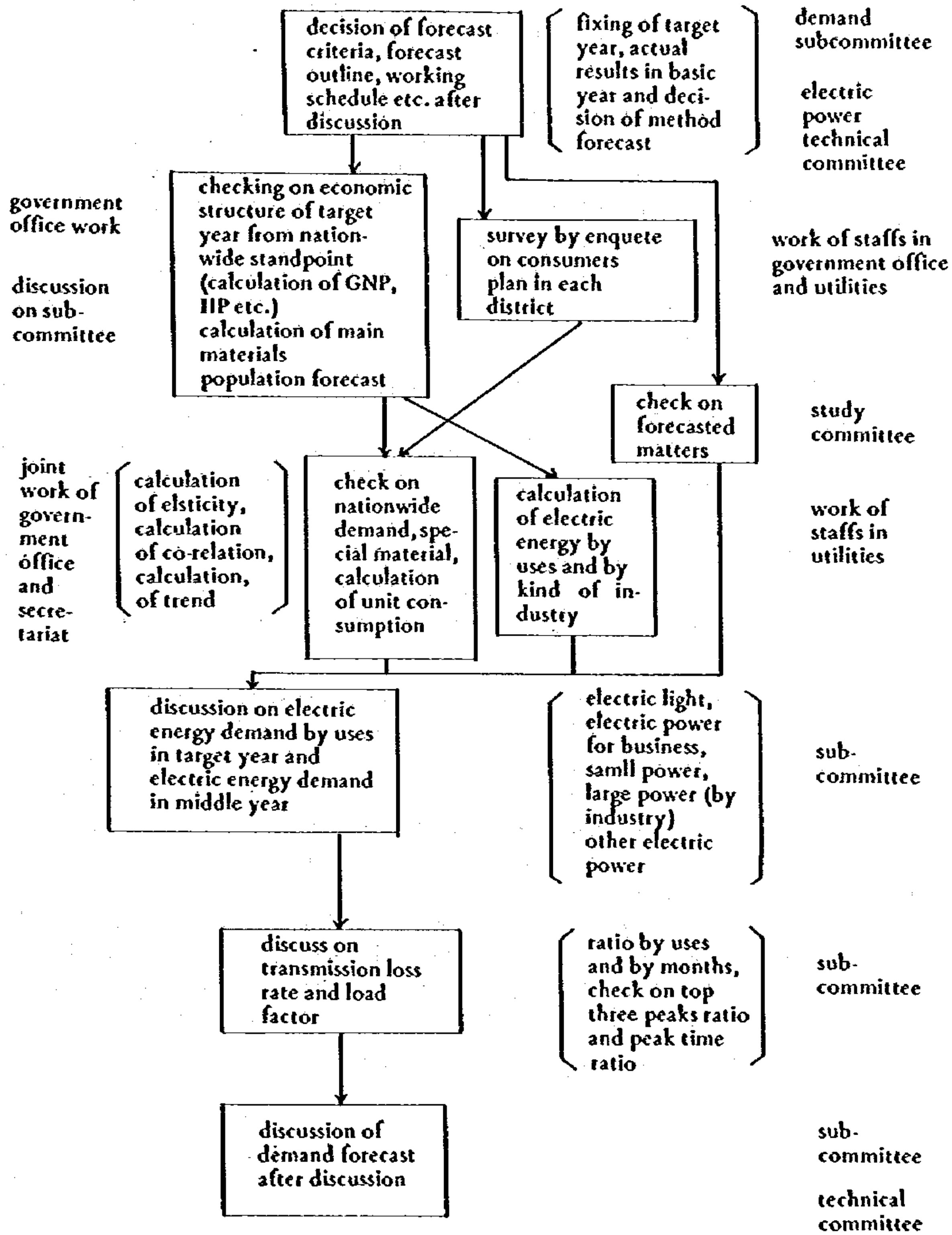
The data taken into consideration in forecasting the maximum electric power are the amouts estimated in 1. and 2., "piling-up method" based on the load survey, "extraction method" and load factor. "piling-up method" is the way to forecast electric energy in a year by months, by days and by hours after it is classified into several purposes.

(4) Long-range Forecast after Target Year

It is classified into electric light use, business use and industrial use including private power generation. Then they take various macro economic indicators, including GNP, into consideration.

This method is illustrated in the following figure 5-1-5.

Fig. 5-1-5 Forecast of Power Demand in Japan (EI Method)



(*2) AOKI METHOD

It has been the general understanding that the amount of consumption of the primary energy or the electric power demand has close relation to GNP. One of the examples is the elasticity against GNP. It seems, however, that they have not found out yet how much the elasticity should be under a certain economic conditions.

Aoki Method designed by Mr. Aoki is based on the findings that the size of GNP per capita and the amount of consumption of the primary energy per capita or the electric power production per capita describe the definite curves in accordance with the particular situations of a country. Those curves are closedly related to the economy, the local and histrorical characters in the consumption of energy, the growth of economy, the amount of consumption of the primary energy, the electric energy demand and the size of GNP. By following those curves, they can forecast the amount of the consumption of the primary energy and the electric energy demand which are in accord with the economic situations of the country.

The problem in this case is the forecast of the size of GNP per capita. The forecast in Aoki Method is based on the findings that the size of GNP per capita is closely related to the growth rate of GNP per capita and that they describe curves particular to each country. GNP per capita and the sizes of growth of several countries are described in Fig 5.6., and GNP per capita and its growth rate in Fig 5.7.

In Fig 5.8. the relation between electric energy per capita and GNP per capita in several countries is described. Fig 5.9. is the demand path chart based on the above figures. They can make the long-range forecast of electric power demand by describing curves specific to each country using these figures.

When we use Aoki Method we must pay attention to the following points. The first is to make precise forecast of population. This method can be applied to all the countries in the world as it is based on the size of GNP per capita. Therefore population of the country plays an important role in the calculation of the primary energy or the gross amount of the consumption of electric power. The second point is that this method is established on the premise that each country will endeavour to make "reasonable development" in its economy which does not cause a confusion in the balance of the international economy. In most cases the economic forecast is not a mere forecast. It is a kind of plan and policy making of the country as a whole. The consumption of the primary energy and the electric power demand are the results of economic activities based on those plans. Even if forcasts on the economy and the energy or the electric power are made following the same kind of curve in in this method, they are not the same, since one is the planning and the other is the forecast.

This method has been used in more than forty countries since 1971.

Fig. 5-1-6 Per Capita GNP and Size of Growth (Aoki method)

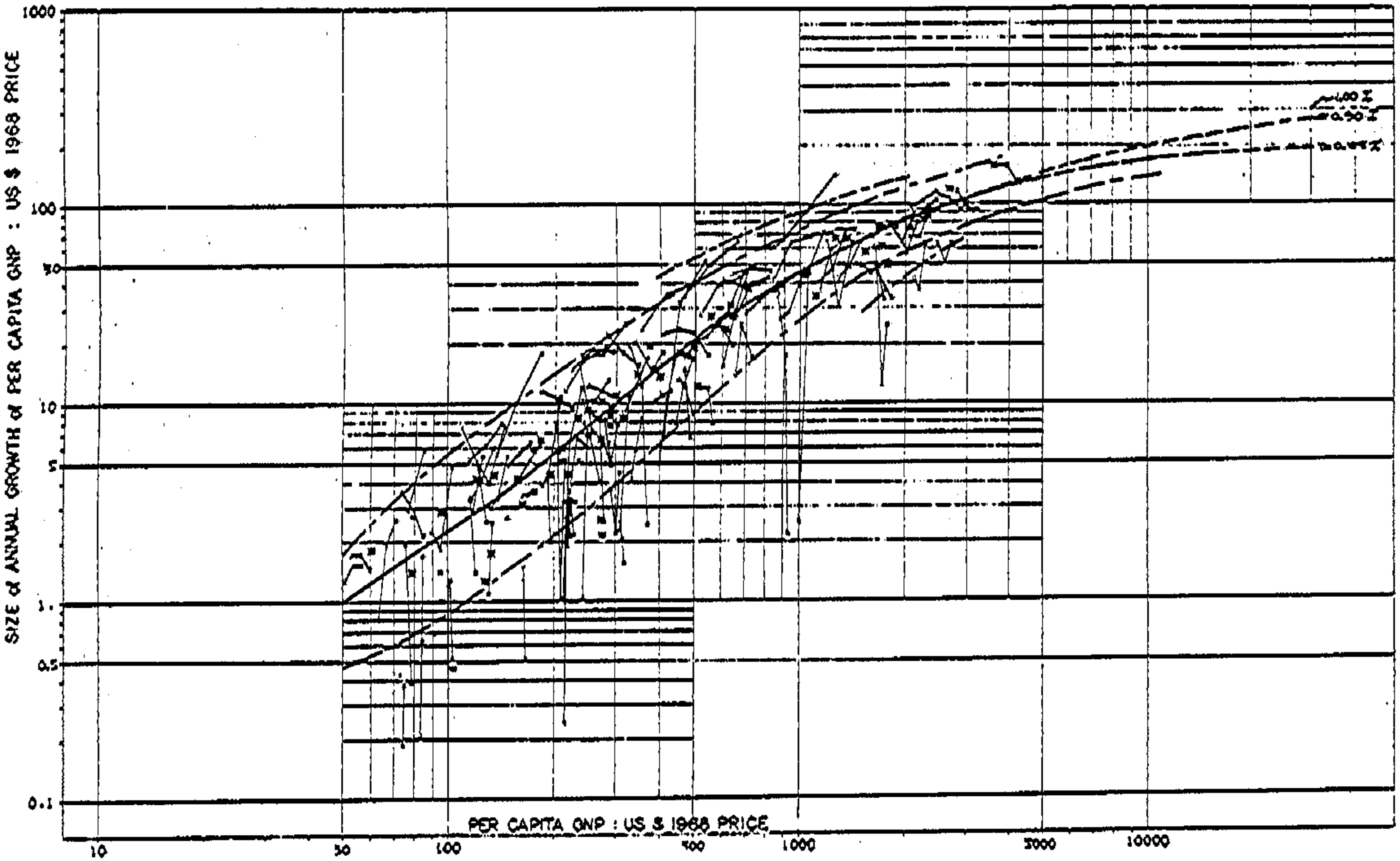


Fig. 5-1-7 Per Capita GNP and its Growth Rate – Long range (Aoki method)
(computed from Fig. 5-1-6 PerCapita GNP and Size of Growth)

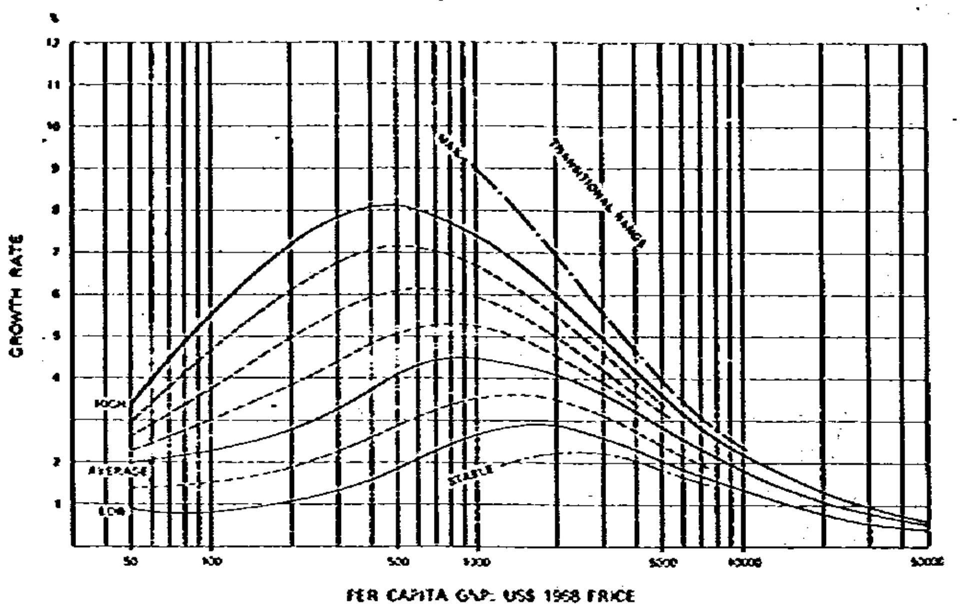


Fig. 5-1-8 Per Capita Electric Energy and GNP (Aoki method)

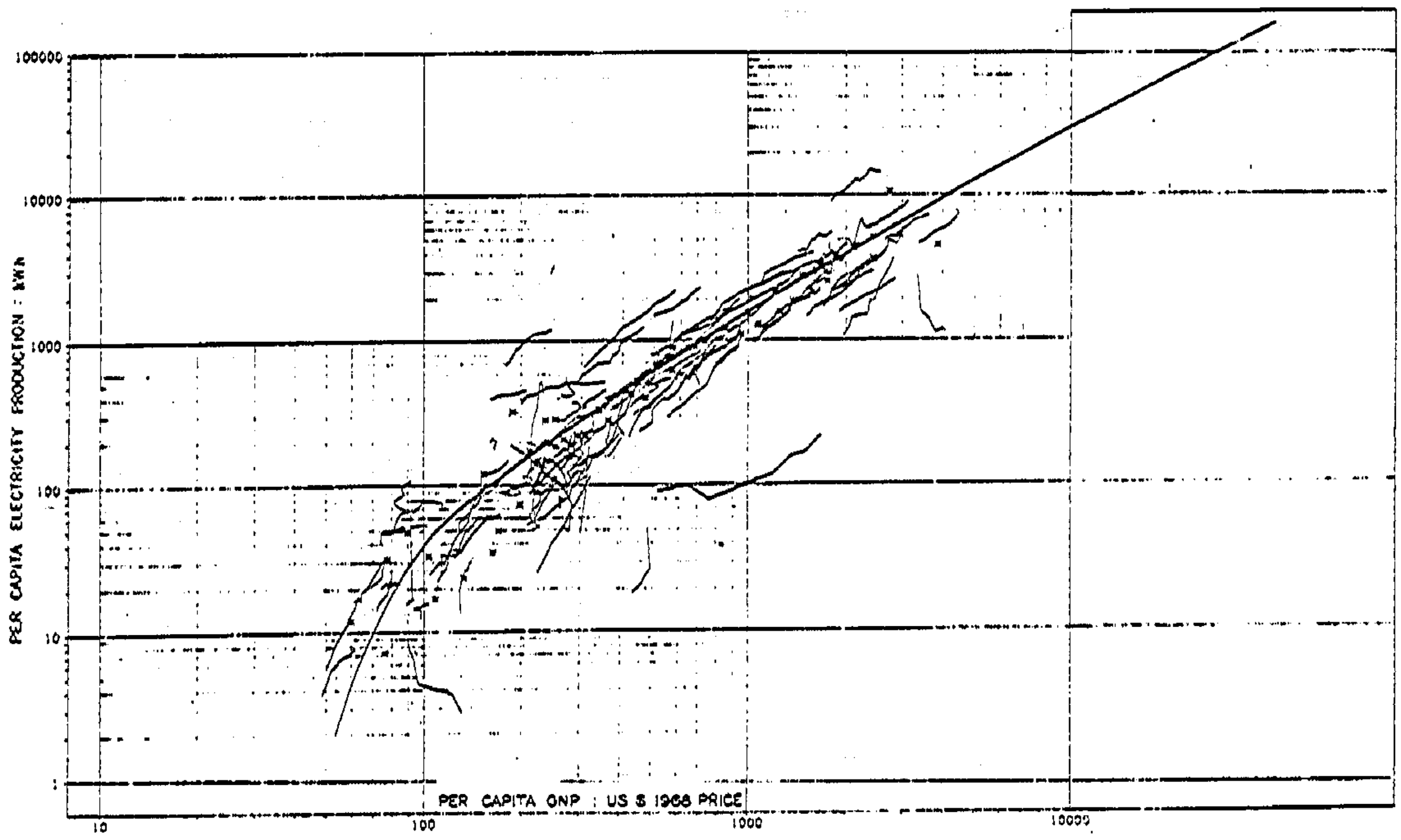
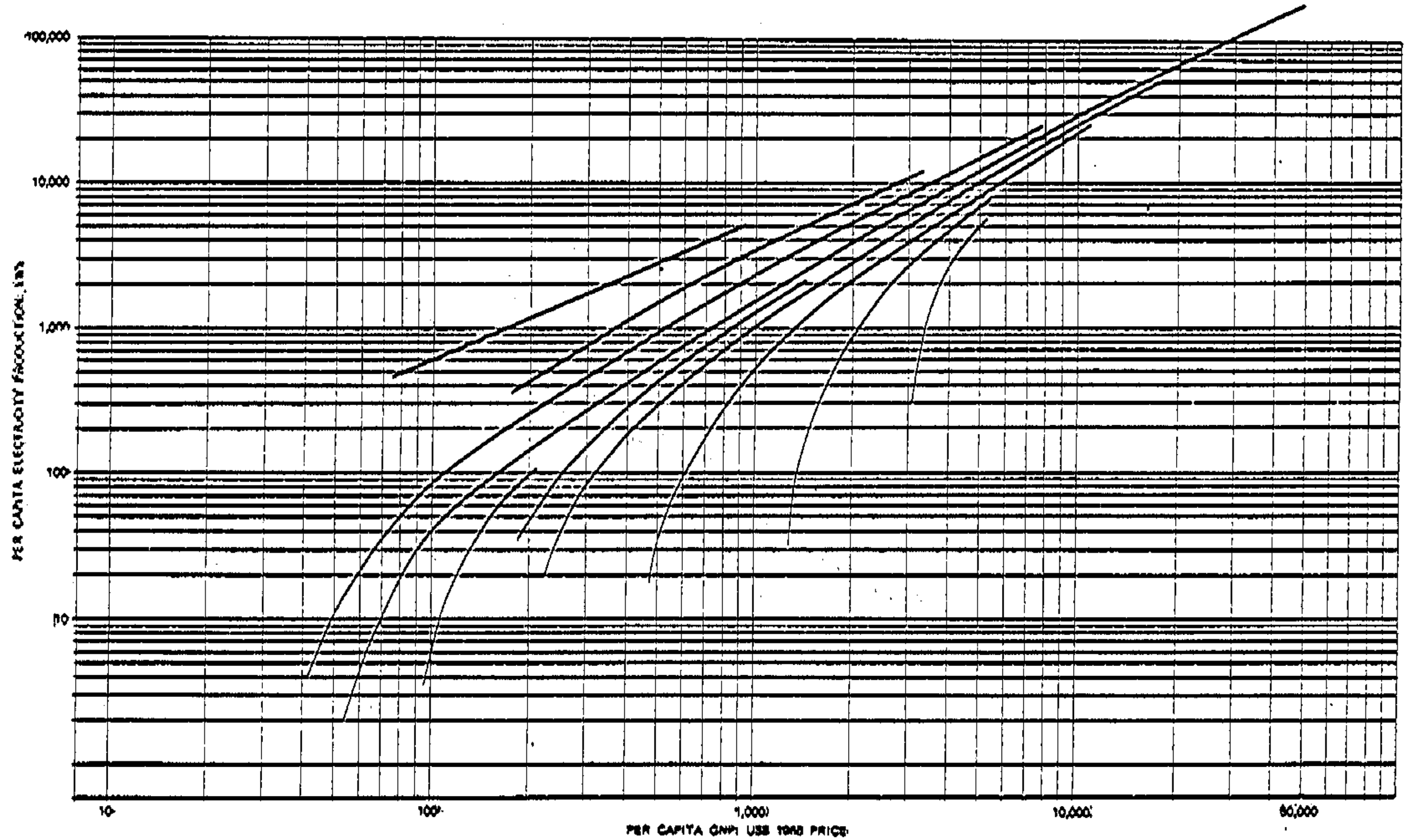


Fig. 5-1-9 Demand Path Chart of Electricity (Aoki method)



5–2 Coal Supply-Demand Data

5–2–1 Importance of Coal

Among the primary dnergy consumption in the Republic of Indonesia, coal has a share of 4% (333 k tec*) in 1965, 2% (161 k tec) in 1970 and 1% (265 k tec) in 1976. The share has kept decreasing as those of oil and natural gas have kept increasing. (See Table 5.6) The oil Crisis in 1973, however, put coal in the limelight again in all over the world. Although the Republidc of Indonesia is one of the oil producing nations, coal is expected to play an important role im the future for the stable supply of energy and the conversation of oil. It is necessary to foresee the importance of coal in the energy demand-supply structure in the future Indonesia for the energy policies and for the forecast of energy demand and supply.

* 1,000 tons equivalent coal

5–2–2 Exploitation and Utilization of Coal

It is needless to say that they do not plan coal exploitation without forecasted demand. The demand for coal in INdonesia is expected to make a jump in the years after 1983 from 265,000 tons in 1976 as shown in Table 5.7. In the longer-range forecast shown in Table 5.9., the Energy Balance Table, about 100,000,000 tons of coal* is to be supplied in Indonesia in 2000. It will have a share of 53% of the energy supply. Most of the coal is to be used by the coal fired power plants which are planning to be built. The power plant is expected to reach 3,600 MW during 10 years from 1983 to 1992. It shows clearly that one of the purposes of the energy policy in Indonesia is to increase the supply of electric power based on the exploitation of coal.

The plans of P.N. BATUBARA (the Coal Corporation) for the demand enlargement of coal at present are as follows. The first is the construction program of the above-mentioned coal fired power plant. The second is the construction program of the new industrial center in the soutn Sumatra, and the third is the export plan to Thailand, Malaysia, and Singapore. A part of the first plan is shown in Table 5.8. As for the second, the center is planned to be constructed during years from 1980 to 1985 in Pandjung district to strengthen the industrial, infrastructure aby promoting chemical industries and providing harbor facilities.

On the other hand the plans for the supply of coal are centered on the exploitation of mines in the south Sumatra including Bukit-Assam and Ombilin and in the east Kalimanatan district. P.N. BATUBARA thinks that there will be the huge amount of coal deposit enough to meet the demand. Besides these districts are not far from the above-mentioned countries where coal is planned to be exported. It is confirmed that 15,000 million tons of coal deposits in Shell Mining Area in Bukit-Assam, the greatest mining area in the south Sumatra. Also 100 million tons of coal of good quality deposits in the mining area there possesses by the P.N. BATUBARA. The heating value of the coal there is 6,000 kcal/kg, the ash element is below 0.5% and water 16%.

The production plan of this area is shown in Table 5.8. While the production target is 275,000 tons in 1981, the end of the first period, it makes a remarkable jump to 1,500,000 tons in 1983 when the coal fired plant is expected to start its operation. It increases to 2,500, 000 tons in 1992. P.N. BATUBARA makes the long-range forecast of the balance of demand and supply of coal as shown in Fig. 5.10. The present overall amount of supply plus the amount increased in Bukit-Assam will be

Table 5-2-1 Structure of Primary Energy in Indonesia

(The equivalent in coal – 1,000 tons)

	Oil	Natural gas	LPG	Coal	Hydraulic power	Total
1965	6,835 (87)	565 (7)	–	333 (4)	109 (2)	7,842 (100)
1970	8,656 (88)	880 (9)	1 (0)	161 (2)	154 (1)	9,852 (100)
1976	18,420 (90)	1,499 (8)	53 (0)	265 (1)	224 (1)	20,461 (100)

( ) – %

Source: The Estimate of Energy Requirements for The Five Year Development Plan 3rd Phase (1977–6–16)

Table 5-2-2 Forecast of Primary Energy Supply and Demand

(The equivalent in coal – 1,000 tons)

	1977	78	79	80	81	82	83	84
							(100 MW)	(600 MW)
Electric Power	–	–	–	–	–	–	180	1,080
Railways	78	78	100	100	100	90	80	65
Industries	50	200	330	530	550	630	655	680
Heating	85	120	120	120	120	120	120	120
Others	70	70	70	70	70	70	70	70
Total	283	468	620	820	845	910	1,105	2,015

Source: From the same estimate as that in Table 5-2-6.

Table 5-2-3 Production Plan in Bukit-Assam (Batubara)

First Period

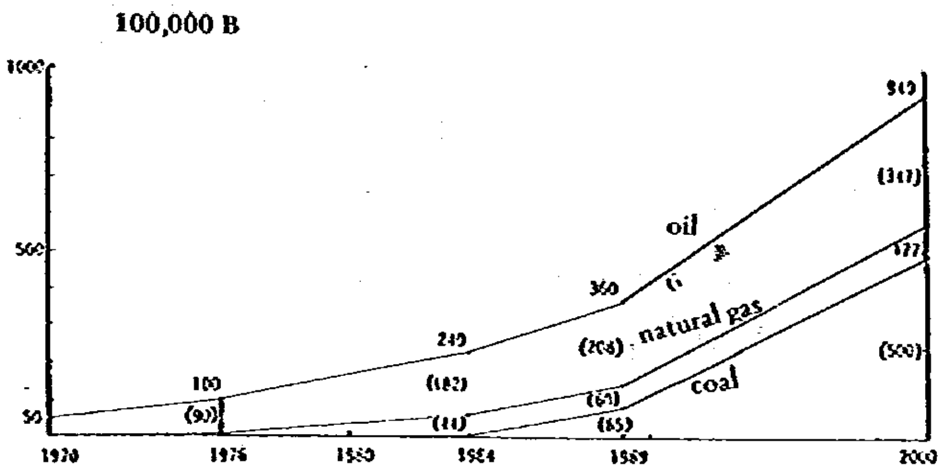
Year	Production amount (1,000 tons)		
	Steam coal	Coking coal	Total
1977	105	27	132
1978	125	50	175
1979	175	50	225
1980	195	50	245
1981	225	50	275

Second Period

Year	Production target (1,000 ton)	Forecasted demand (1,000 ton)	Power plant program (MW X number)
1982	500	500	
1983	1,500	1,500	(100 X 1) *
1984	2,000	2,000	(300 X 2) *
1985	2,500	3,200	325 X 2
—	—	—	—
1988	2,500	6,400	375 X 2
—	—	—	—
1991	2,500	8,500	500 X 1
1992	2,500	12,800	500 X 2

* – REPELITA III

Fig. 5-2-1 Coal Utilization Plan in Indonesia



Hydraulic power and geothermal power have been omitted because of their small scale.

Source: The same estimate as that in Table 5-2-1.

Table 5-2-4 Long-range Energy Balance in Indonesia

(The equivalent in oil – 1,000,000B)

	1976 (actual results)	1984 (final year of 3rd 5-year plan)	1989 (final year of 4th 5-year plan)	2000	Memo
Oil	90 (90%) (247,000B/day)	182 (76%) (490,000B/day)	208 (58%) (560,000B/day)	347 (37%) (950,000B/day)	Average growth of production in 1966/76 – 12.5%
Natural gas	8 (8%) (110MMcf/day)	44 (18%) (610MMcf/day)	60 (16%) (860MMcf/day)	77 (8%)	26,000,000,000,000 cf Recoverable Reserves
Coal	1 (1%) 265,000 ton)	10 (4%) (2,000,000 ton)	85 (24%) (17,000,000 ton)	500 (53%) (100,000,000 ton)	Estimated deposits in South Sumatra is 10,000,000,000 tons (50,000,000,000B). Huge deposits have been located in Kalimantan
Hydraulic Power	1 (1%) (450MW) *	4 (2%) (1,250MW)	6.5 (2%) (2,150MW)	15 (2%) (5,000MW)	* – 6/1 of whole generation facilities (2700MW) o 30,000MW is possible, but locations are bad.
Geothermal power	–	–	0.5 (0) (200MW)	1 (0) (400MW)	More than 8,000MW is possible in good locations.
Nuclear power	–	–	NA	NA	It will rival coal in future. but there is no definite plan.
Solar energy	–	–	–	NA	It may be utilized for residence in 2,000.
Total	100 (100%)	240 (100%)	360 (100%)	940 (100%)	(Firewoods are valuable as fuel in local districts.)
Growth rate of energy demand	(1970/76) 13.21	(1976/84) 11.60	(1984/89) 8.45	9.11	
Economy growth rate	8.31	8.47	6.45	NA	
Elasticity	1.59	1.37	1.31	NA	

Source: From the Energy Game-An Indonesian Version nearly enough to meet the demand by 1984. After that year the production increase is expected in the East Kalimantan and Ombilin while the amount of production in Bukit-Assam remains as 2,500,000 tons. Therefore the supply amount will be 15 million tons at least and 22 million at most by 1933. It will be enough to meet the demand of about 20 million tons, the forecast amount of demand in 1990, or thereabout.

5–2–3 Data Collection and Analysis

P.N. BATUBARA makes and promotes plans concerning coals as one of the concerning coals as one of the government organizations. Also it is engaged in the rpoduction of coal, management of mines and transportation and sales of coal, too. Therefore it can give almost all the information on coal.

In fact the task force in charge of collecting and arranging the date has been organized in P.N. BATUBARA. The experienced staff from the sections of mining, transportation, sales and power plant have task force meetings once in a month to exchange the data. As a result almost all the data including the gross amount of coal consumption a year have been arranged. It is incomplete, however, as the amount consumed in railways is not included in the gross. Another problem is the delay in processing the data. As for the demand forecast, members from board of directors in P.N. BATUBARA, industrial companies, transportation companies and so forth hold meetings once in three months for discussion. The data collected and arranged in these regular meetings are considered reliable as a whole in regard of consistency and continuity. Therefore the data on coal given by P.N. BATUBARA will be useful and indispensable to the setting up of the energy data banks whose activities should cover all the economic situations in Indonesia.

Besides it is certain that the data given by P.N. BATUBARA will have an influence upon the future energy policy of Indonesia. As said before, the present policy is to economize oil and to raise its price in the international market. For that purpose the government plans to develop and utilize coal for the present and nuclear power, geothermal power, solar energy and so forht in the future. As the second important energy source, coal will influence the economic situations in Indonesia for the coming decade or more years. Therefore it is necessary for the energy data bank to have the accurate grasp of the economicsituations concerning coal.

P.N. BATUBARA in turn is much interested in setting up of the energy data bank. Authorities concerned want to take a part in setting it up and to share its benefit in exchange for submitting the data on coal to it. For P.N. BATUBARA the use of the data bank will give the remarkable effect in compiling coal policies, development programs and demand fore casts.

* A part of it will be replaced by atomic energy.

5–3 General Industry Statistics

5–3–1 Industrial Statistics Concerning Energy

General industrial statistics which are necessary for setting up of the energy data bank can be classified into two groups. The first group are those showing the actual state of energy consumption in each sector of industries. The second are macro economic indexes. Both of them are important, for industries are the main consumers of energy and the energy situations are closely related to the economic trend.

Staitstics included in the first group are "unit consumption" which shows the amount of energy consumption per unit production, "thermal efficiency" which shows the process of energy transformation, the gross production of industrial materials of various kinds, the gross amount of energy consumption in each field of industries etc. which are the basis of these indexes calcualtion. Those included in the second are GNP, (GDP), IIP, price index and population censuses. In the following report much attention has been paid to the first group.

5–3–2 Data Collection and Analysis

The Department of Industry, PERTAMINA, PLN and other organizations collect data on general industrial statistics when they need them. CBS (the Central Bureau of Statistics) arranges those data in reports and publishes them.

The census of large-scale and medium-scale industires with more than 20 employees is conducted every year. Since 1974 all industries have been included in the census, Industries with more than 100 employees are classified as large-scale, those with more than 20 are medium-scale, those with more than 5 are small-scale and those with less than 5 are household industries. The way of classification of industries is based on "Industrial Sectionalization International Code Concerning Overall Economic Acitivities" legistrated in 1968, but classification is more minute in some parts. In the census they try to prevent sampling errors by attaching importance to continuity. In the census conducted in 1976 the primary agricultural industries like tea, gum and tobacco are omitted because of difficulty in separate data collection. Assembly factories of motors and motorcycles, too, are omitted as the collected data were not enough.

Items included in the census conducted in 1976 are the number of establishments, the number of persons engaged, employment costs, the value of transactions in fixed capital, input costs, value of output and value added. It is shown in Table 5-3-1. by industry groups. Table 5-3-2 shows the amount of electricity produced, purchased and sold by types of industry. This statistics is important as the survey of electricity outside of PLN. Table 5-3-3. shows the amount of consumption of raw materials by types of industry. The amount of consumption of fuel oil and lubricating oil by types of industry and their prices are shown in Table 5-3-4.

As the important element of 5-year Plan for Arrangement of Statistics for by CBS, industrial statistics was taken in 1964. The recent one is based on the data on 12 months from August of 1974 to July of 1975. The purpose of the census is to learn the structure and characteristics of each industry in Indonesia by finding out kinds of industries, their distributoon, number of workers, capitals, amount of production etc. The census covered large-scale industries, middle-scale ones, small-scale ones, household industries, oil industries, mining industries, electric industries, gas industries and water supply services. The census of large-scale industries and middle-scale ones coverd the whole Indonesia and the number of establishments in it reached almost 9,000. As for small-scale industries and household ones, the sampling census is conducted every 5 years. It covers 27 provinces, 300 countries and 3,000 villages.

Two forms were used in the census. One of them is suitable for large-scale industries and middle-scale ones, and the other for small-scale ones. Items of the data collected from the former are; number of establishments, time of starting operation, power equipment used, number of employee, the number of working labour by day, paid wages, goods in stock, consumption amount of raw materials, input costs, value of output, value added and the rate of contribution to the gross production amount in the country. The actual state of electricity generation and alaes is shown in Table 5-3-5, and that of consumption of fuels and lubricants in Table 5-3-6. The data collected from the latter form are numbers of establishments, industries and the number of working labour day, value of output and value added. Statistics concerning electricity and gas based on the census were arranged and published. Table 5.16 and Table 5.17 included in them show the amount of fuel consumed in the generation of eelectric power and that of electricity generated and purchased. PLN, however, is the only source of these two tables. It is desired that the overall data including that of private power generation will be collected.

At present, CBS uses a computer, ICL 1903, in processing and analysing those statistics. It plans to install a bigger type of computer by the credit form the Japanese government in order to process the data more speedily and efficiently. In 1971 it started to form the inter-industry relations I-O table in cooperation with Asian Economy Research Institute in Japan. The table based on the statistics taken in 1975 is going to be published in February of 1979 after obtaining approvals from the organizations concerned. While the table of the energy section of 1971 was calssified into 15 departments and 175 items, that of 1975 is more minutely classified to 179 items. The next I-0 table will be the one based on the statistics to be collected in 1980. Also they are planning to form the trade I-0 table connecting the domestic tables of Japan and Indonesia as an new experiment.

In conclusion relatively numerous and reliable statistics are collected and stored in CBS. Data in CBS, however, may not be able to use as the input data of the energy bank without some improvement. First they must be rearranged consistently. Also it is necessary to complete the statistics of samll-scale industries and of general household including non-commercialized energy. If the statistics of "unit consumption", that is, energy consumption per unit production, and thermal efficiency on the basis of the above statistics are completed, they will be very useful to the energy data bank.

Table 5-3-1 Annual Survey of Large and Medium Mfg. Establishments – 1976

Number of establishments, number of persons eangaged, employment costs, value of transactions in fixed capital, input costs, value of output and value added.

Industry Group: Manufacture of basic chemicals except fertilizer (Code-35110)

INDOSESIA

Sr. No. (1)	Description (2)	Unit (3)	No./value (4)
I	Number of establishments	no	41
II	Total number of persons engaged:	no	
	1. Paid workers	"	
	a. Production workers	"	2,700
	b. Others	"	1,136
	c. Total (1a + 1b)	"	3,836
	2. Unpaid family workers	"	12
	3. Total (1c + 2)	"	3,848
III	Employment Costs	000 Rp	1,387,564
IV	Value of transactions in fixed capital:	000 Rp	
	1. New purchases	"	1,161,603
	2. Second hand purchases	"	126,591
	3. Construction, major repairs and improvements:		
	a. Undertaken by establishment	"	760,915
	b. Undertaken by others	"	308,092
	4. Total additions (1 + 2 + 3a + 3b)	"	2,357,201
	5. Sale of used imtems	"	6,962
V	Input Costs:	000 Rp	
	1. Raw materials	"	3,769,938
	2. Fuel, electricity and gas	"	1,473,559
	3. Other materials	"	1,029,044
	4. Repairs and industrial services received	"	167,655
	5. Rent of building, machinery and equipment	"	22,862

Sr. No.	Description	Unit	No./Value
(1)	(2)	(3)	(4)
V	6. Non incustrial services received	000 Rp	523.427
	7. Total	000 Rp	6.986. 485
VI	Other expenses	000 Rp	
	1. Gifts and Contributions	000 Rp	16.943
	2. Land rent	000 Rp	2.308
	3. Interest paid	000 Rp	178.593
VII	Value of increase in stocks	000 Rp	197.844
VIII	Value of Gross Output	000 Rp	
	1. Value of goods produced	000 Rp	11.812.100
	2. Value of electricity sold	000 Rp	–
	3. Value of industrial services rendered	000 Rp	1.298
	4. Gross income from resale	000 Rp	23.361
	5. Increase in stock of semi-finished goods	000 Rp	170
	6. Receipt from non-industrial services rendered	000 Rp	356.705
	7. Total		12.193.634
IX	Value added at market prices (VIII. 7 – V. 7)	000 Rp	5.207.149
X	Indirect taxes	000 Rp	547.991
XI	Value added at factor cost (IX – X)	000 Rp	4.659.158

Table 5-3-2 Electricity produced, purchase and sold by industry major group

INDONESIA

Sr. No.	Industry major group code	Own production (M. wh)	Electricity power purchased Quantity (M. wh)	Electricity power purchased Value (000 Rp.)	Electricity power sold Quantity (M. wh)	Electricity power sold Value (000 Rp.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	311	187.411	22.446	546.623	1.967	40.212
2	312	65.205	7.048	167.002	3.021	83.988
3	313	19.396	2.945	70.476	351	9.000
4	314	19.037	7.560	244.715	–	–
5	321	524.928	130.893	3.681,042	7.101	115.808
6	322	1.237	571	14.771	–	–
7	323	3.650	1.342	38.827	–	–
8	324	3.239	414	10.752	–	–
9	331	68.526	5.272	153.056	16	282
10	332	1.511	628	18.648	–	–
11	341	69.207	30.513	668.872	–	–
12	342	15.114	9.898	269.450	–	–
13	351	164.716	14.929	652.124	–	–
14	352	36.167	12.027	291.615	2.321	58.111
15	353	–	–	–	–	–
16	354	–	–	–	–	–
17	355	65.796	4.840	134.646	–	–
18	356	54.849	6.799	125.885	–	–
19	361	6.511	549	15.975	86	612
20	362	22.751	6.466	151.702	–	–
21	363	159.785	79.558	1.244.185	934	20.504
22	364	1.252	232	6.030	11	240
23	369	2.428	80	6.030	–	–
24	371	18.990	29.187	1.600	–	–
25	382	–	–	670.191	–	–
26	381	99.044	19.023	407.587	–	–

Table 5-3-3 Number of establishments, quantity and value of raw materials

Industry group: Manufacture of basic chemicals except fertilizer Code 35110

INDONESIA

Sr. No.	Description	Unit	Quantity	Value (000 Rp)
(1)	(2)	(3)	(4)	(5)
I	Number of establishments	no.	41	x
II	Material used:			
1.	Molasses	ton	128.410	1.606.091
2.	Sulphure	ton	3.437	223.425
3.	Chemicals	x	x	842.063
4.	Salt	ton	7.476	162.325
5.	Lime	ton	3.398	144.399
6.	Etherish oil	ton	68	125.292
7.	Alluminium hydroxida	ton	1.059	97.573
8.	Tapioca flour	ton	1.006	91.740
9.	Black pepper	ton	134	74.696
10.	Alcohol	ton	131	44.473
11.	All kind of papers	ton	82	55.907
12.	Z.A. fertilizer	ton	424	25.285
13.	M. D. F.	1000 ltr/litre	944	23.222
14.	K. O. H.	1000 ltr/litre	63	25.238
15.	Ash sodium	ton	186	20.374
16.	Caustic sodium	ton	89	19.296
17.	Mangaan rock	ton	150	19.476
18.	Barium nitrat	ton	57	17.190
19.	Alluminium powder	ton	55	16.883
20.	Alluminium sulphate	ton	85	16.495
21.	Rice	ton	118	12.399
22.	Aerogeen	1000 ltr/litre	88	7.185
23.	Asam sulphate	ton	48	6.922
24.	Silica sand	ton	419	6.233
25.	Quinine	ton	16	4.844
26.	Fuel oil	ton	85	4.286
27.	Hcl	ton	2.057	4.523
28.	Essence	kg	860	4.119
29.	Sugar	ton	22	3.963
30.	Premium	1000 ltr/litre	54	3.718
31.	Zutavelzuur	ton	27	3.614
32.	Wire	roll	200	3.500
33.	Talpa	1000 ltr/litre	9	3.352
34.	Dextrine	ton	1	2.400
35.	Rottela	1000 ltr/litre	6	2.204
36.	Glyserine	1000 ltr/litre	1	1.981
37.	TSP	ton	10	1.747
38.	Gam	ton	4	1.030
39.	Amonia	ton	2	582
40.	Sirlac	kg	676	437
41.	Apirits	ton	x	144
42.	Others	x	x	69.262
43.	Total	x	x	3.769.938

Table 5-3-4 Quantity of fuel and lubricants used by industry group

INDONESIA

Sr. No.	Industry Group code	Benzine	Fuel oil	Diesel oil	Kerosene	Coal	Cokes	Gas	Others fuel	Lubricating oil
			Liter —	Litre		kg.		m^3	x	Liter-Litre
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	31111	26.700	28.800	—	600	—	—	300	x	108
2.	31112	24.428	876.741	2.500	—	—	—	8.320	x	1.125
3.	31121	87.657	2.502.404	1.249.000	—	—	—	—	x	122.637
4.	31122	223.874	551.841	40.000	4.025	—	—	—	x	2.352
5.	31130	31.000	67.217	210.000	66.900	—	—	—	x	3.784
6.	31140	42.316	46.2136	—	490.327	—	—	—	x	11.373
7.	31151	285.157	8.993.408	5.679.314	223.951	—	—	—	x	197.417
8.	31159	224.432	5.410.929	896.447	13.252	—	—	—	x	30.549
9.	31161/31162	211.369	2.607.576	208.483	81.758	—	—	—	x	87.957

Table 5-3-5 Electricity Generation & Sale, During 1974 by Industry Group

Serial number	Industry Group	Number of establishments generating electricity	Prime movers connected to generator		Generators		Electricity generated (KWH)	Number of establishments	Quantity (KWH)	Value 1000 Rp/Rps)
			Number	Capacity (PK)	Number	Capacity (KP)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
01.	31111	1	—	—	2	3,0	6950	—	—	—
02.	31112	5	5	586,0	6	1255,0	880272	—	—	—
03.	31121	5	12	4236,0	15	2467,4	6915846	—	—	—
04.	31122	5	5	755,0	10	721,5	793110	—	—	—
05.	31130	3	14	526,0	16	386,5	694300	—	—	—
06.	31140	16	23	2174,0	41	11320,0	19437395	—	—	—
07.	31151	62	59	5142,5	93	14850,3	21511612	1	800	20
08.	31152	6	8	4395,5	12	1571,4	4621101	—	—	—
09.	31159	12	26	6178,5	33	4758,4	8149142	—	—	—
10.	31161	30	23	1010,5	32	809,5	1073525	—	—	—
11.	31163	41	75	4595,0	89	3317,5	6922329	—	—	—
12.	31162,31164	2	4	7600,0	13	12525,0	28262181	—	—	—
13.	31169	14	9	448,3	20	4233,8	8774306	—	—	—
14.	31171	19	9	773,6	20	1345,6	2038058	—	—	—
15.	31179	36	22	1595,5	62	4725,6	4121846	1	840	21

Table 5-3-6 Consumption of Fuels and Lubricants During 1974, by Type of Fuel/Lubricant

Serial number	Type of fuel/lubricant	Number of consuming establishments	Number of persons engaged in consuming establishments	Standard unit	Quantity of fuel consumed in standard unit	Value of fuel consumed 1000 Rp/Rps
(1)	(2)	(3)	(4)	(5)	(6)	(7)
01.	GASOLINE	2205	422239	LITRE	661393627	2827025
02.	SOLAR	3085	483965	LITRE	435741798	8363665
03.	H. S. D.	1031	197449	LITRE	396001968	5607695
04.	PARAFFIN	2263	241521	LITRE	37182011	615406
05.	OTHER TYPE OF FUEL-OIL	623	120183	LITRE	200633745	2928513
06.	COAL AND COKE	167	72184	KG	51425593	1179138
07.	GAS	237	50981	M^3	9004956	447767
08.	TYPE OF FUEL	2084	205513	(.........)	--	2072392
09.	LUBRICANTS	3523	482286	LITRE	12271149	2872709

Table 5-3-7 Fuels and Lubricants Consumed in The Generation of Electric Power During 1975/1976

Sr. No.	PLN Region	HSD Quantity (000 LITER)	IDO Quantity (000 LITER)	Residue Quantity (000 LITER)	Lubricants Quantity (000 LITER))
(1)	(2)	(3)	(4)	(5)	(6)
1	PLN. Wilayah I	7.778.839	–	–	95.439
2	PLN. Wilayah II	57.330.946	–	–	316.767
3	PLN. Wilayah III	21.864.507	–	–	232.738
4	PLN. Wilayah IV	21.765.469	1.407.934		253.499
5	PLN. Wilayah V	10.546.975	–	–	220.751
6	PLN. Wilayah VI	8.000.096	–	–	95.775
7	PLN. Wilayah VII	3.259.726	–	–	53.632
8	PLN. Wilayah VIII	8.053.243	–	20.175.276	118.717
9	PLN. Wilayah IX	5.283.928	–	–	86.075
10	PLN. Wilayah X	9.478.701	–	–	169.322
11	PLN. Wilayah XI	15.333.644	–	–	145.584
12	PLN. Wilayah XII	8.205.667	5.659.945	42.240.756	236.618
13	PLN. Wilayah XIII	36.859.284	26.853.389	–	340.762
14	K	103.071.450	7.653.678	198.149.084	186.053
15	Da	547.152	–	–	8.557
16	Db	–	–	–	–
17	PLN. Pusat	–	–	–	–
18	PLN. Bengkel Pusat	–	–	–	–
19	Jumlah-Total	317.379.627	41.574.945	294.724.623	2.560.559

Source : Statistik Pengusahaan P.L.N. 1975/1976.

Table 5-3-8 Electricity Generated and Purchased from Others During 1975/1976

Sr. No.	PLN. Region	KWH generated PLTD-Diesel	P.L.T.U.-Steam	P.L.T.A.-Hydro	P.L.T.G.-Gas Turbine	Sub Jumlah-Sub Total
(0.1)	(0.2)	(1)	(2)	(3)	(4)	(5)
1	PLN. Wilayah I	21.351.049	–	–	–	21.351.049
2	PLN. Wilayah II	65.415.765	–	207.670	67.992.800	133.616.235
3	PLN. Wilayah III	64.945.749	–	1.242.552	–	66.188.301
4	PLN. Wilayah IV	51.290.189	89.694.800	9.436.700	10.472.500	160.894.189
5	PLN. Wilayah V	32.214.157	–	–	–	32.214.157
6	PLN. Wilayah VI	27.107.771	–	41.135.550	–	68.243.321
7	PLN. Wilayah VII	9.345.901	–	35.612.470	–	44.958.371
8	PLN. Wilayah VIII	27.567.986	50.393.500	10.751	–	77.972.237
9	PLN. Wilayah IX	16.258.758	–	–	–	16.258.758
10	PLN. Wilayah X	28.386.460	–	–	–	28.386.460
11	PLN. Wilayah XI	50.997.161	–	709.728	–	51.706.889
12	PLN. Wilayah XII	39.989.944	128.835.000	514.178.421	523.700	683.527.565
13	PLN. Wilayah XIII	88.968.919	–	201.454.925	64.743.000	355.160.844
14	K	26.769.589	628.072.939	383.907.909	204.148.700	1.242.899.128
15	Da	1.245.054	–	4.479.218	–	5.724.272
16	Db	–	–	–	–	–
17	PLN. Pusat	–	–	–	–	–
18	PLN. Bengkel Pusat	–	–	–	–	–
19	Total	551.854.452	896.996.730	1.192.375.894	347.880.700	2.989.107.776

Table 5-3-9 Electricity Generated and Purchased from Others During 1975/1976 (Continued)

Sr. No.	PLN Region	Electricity purchased from others (KWH)	Total (KHW)	Purchased from
(0.1)	(0.2)	(6)	(7)	(8)
1	PLN Wilayah I	1.303.862	22.654.911	P.N. Pertamina
2	PLN Wilayah II	6.021.767	139.638.002	P.N. Pertamina, Pabrik Es Pematang Siantar
3	PLN Wilayah III	972.266	67.160.567	P.T. Semen Padang, P.N. TBO Sawah Lunto
4	PLN Wilayah IV	3.247.841	164.142.030	P.N. TABA Tg. Enim, PJKA Lahat
5	PLN Wilayah V	–	32.214.157	
6	PLN Wilayah VI	1.984.691	70.228.012	P.N. Pertamina
7	PLN Wilayah VII	–	44.958.371	
8	PLN Wilayah VIII	–	77.972.237	
9	PLN Wilayah IX	–	15.258.758	
10	PLN Wilayah X	–	28.368.460	
11	PLN Wilayah XI	–	51.706.889	
12	PLN Wilayah XII	–	683.527.565	
13	PLN Wilayah XIII	–	355.166.844	
14	K	767.655.800	2.010.554.928	P.O. Jatiluhur
15	Da	–	5.724.272	
16	Db	–	–	
17	PLN Pusat	–	–	
18	PLN Bengkel Pusat	–	–	
19	Total	781.186.227	3.770.294.003	

Source : Statistic Pengusahaan P.L.N. 1975/1976.

5–3–3 General Plan of Setting Up of Data Center

The Department of Industry recognized the necessary of the establishment of a information processing and control system as the industry has made a progress as a result of the promotion of the first and second 5-year plans. They formed a task force in order to collect, process and present data and statistics. As a result they decided to set up the Data Processing and Analysis Bureau in February of 1978 with WANG 2200 as its central processing unit. During that time they input the result of the industrial census of 1974 to the computer in cooperation with CBS and P.T. ELNUSA (Electronica Nusantra). Also they presented the purchase plan of computers to BAKOTAN, advisory organization to the government on computers, and sent trainees to JICA (the Japan International Cooperation Agency) and ELNUSA to make them experts.

They recently completed the Master File including about 5,000 industries. The data collection started in 1973, and they plan to arrange the data on 53,000 items. About 30,000 census lists have been collected now and the statistics of about 10,000 items have been input to the computer. As for the data concerning energy, they are planning to find out the actual state of its production, distribution and consumption concerning 46 kinds of products, and the survey lists are under preparation now. In order to improve the information control system, the Department of Industry is trying to materialize tha plan of Data Center in the Department of Industry with the emphasis on the training of computer operators and a purchase of a bigger computer.
The concrete plans are to put the central processing unit in the data processing bureau and to set up terminals in each of 4 Directorat General of Chemical Industry, Metal Industry, Other Industries, and Small Industry.

The Department of Industry strongly desires not only the cooperation of the other organizations but the technology transfer from Japan. Especially the latter is necessary for the training of operators, technique of planning systems and for collecting and arranging of statistical data. They are going to request UNIDO (the United Nations Industrial Development Organization) or Japan to dispatch experts to the Industrial Data Project Section within 1978/1979. It will be useful to increase efficiency of operators. Although these problems cannot be discussed thoroughly in this report, the necessity of the data center must be stressed. In view of the incompleteness of the statistics of end consumption sector, it will be very useful to the forecast of energy deamnd and analysis of energy consumption rate in the field of the Industry.

5–4 Problems and improvement Plans

5–4–1 General Idea of Problems and Improvement Plans

In setting up of the nationwide energy data bank in the Republic of Indonesia, we notice problems in each part of energy statistics other than oil and gas. As a result of analysing those statistics by type of energy or by organizations concerned, the problems can classified into three groups. The first is the problems of statistics themselves. The second is those of the range and the method of data collection, and the third is those of the processing of statisitics or the data.

In the case of the first group, statistics are not good enough to be input computers though they may be related to energy data or may form the basis of energy data. And they do not express the economic situations directly like "unit consumption" or thermal efficiency does. It is necessary for the data bank to clarify the kinds of statistics needed and to establish the way to process the obtainalbe raw data into the form of input data.

In the case of the second group, household statistics, those of non-commercialized energy above all, are insufficient. Also the data on electric power outsides of PLN (private power generation etc.) must be more complete and wide-ranging. To cope with the situation for the present, it is necessary to try to find out what kind of mutual supplements can be possible among the existing data. Improvement of forms of census lists and installation of more measuring equipments in electric facilities are to be desired for the future.

Inthe case of the third group, it is not a mere matter of technics. The problems must be treated from the macroscopic point of view. For example, they must consider how the present data processing method used by computers in CBS, the Department of Industry and PLN can be utilized for setting up of the nationwide energy data bank. The I-O table by CBS formed on the basis of the industrial statistics will be very useful in the bank for demand forecast or for forming the macroscopic economic model. Also P.N BATUBARA can be expected to make a great contribution to the bank in view of its deep interest and willingness to join in it.

5–4–2 Cooperation of Organizations Concerned

"To treat from the macroscopic point of view" mentioned above means that the said problems can be solved by the cooperation of the organizations concerned in the Republic of Indonesia. At the same time the cooperation will make mutual supplement of the existing data possible as a step for the present.

The Department of Industry and CBS have already cooperated with each other in preparing the data center or in conducting industrial censuses. When the data center is completed in the department in the future, the data in it will be utilized by CBS in conducting industrial censuses or in forming I-O tables. As a result the energy data bank will be able to complete the existing insufficient data on final consumption sector and to store macroscopic economic data which are indispensable for demand forecast or making energy policies.

As said before, statistics concerning electric power demand and supply outside PLN are not more than those CBS have taken. So far as the authorized one are concerned, PLN, too, collects the data on private power generation in order to carry out its duty as the organization in charge of electric utilities. Therefore the cooperation of the both parties is necessary for the development of the energy data bank. The next subject is coal. As for the data on its production and distribution, those BATUBARA has seem to be better than those the other organizations have. As for its end use, the data CBS has seem to be better.

It is needless to say that the cooperation of these organizations is indispensable for the development of the energy data bank.

5–4–3 Arrangement of Data and Technical Aid

Of the input data to be put into the Energy Data Bank, the ones concerning primary energy such oil, gas, and coal do not require processing though there may remain the problem of unit conversion.

In the case of secondary energy like electricity, however, its conversion efficiency is very important in order that it is treated on the same level with that of the other kinds of energy. Also the conversion into the energy data–calculation of "unit consumption", for instance–is necessary when we try to get the statistics of end use energy from general industrial statistics. In setting up the energy data bank, the processing of the original raw data is a very important problem as well as enlargement and improvement of data collection. Furthermore, the energy data bank cannot be utilized for making energy plans, analysing energy situations and for forecasting demand unless economic statistics with an emphasis on macroscopic economic index are included in the data.

The importance of the arrangement of statistics must be stressed as the conclusion of the "the Report on the Project of Setting up of the Energy Data Bank in the Republic of Indonesia". In order to improve the way of arranging them, the technical aid of Japan is as necessary as the cooperation of the organizations concerned. The Japanese aid must not be the temporary one just for "the Project". They need it in various fields on the long-term basis. For example, the project of Data Center in the Ministry of Industry, cooperation will have great significance as a part of an effort to improve the situations of statistics and data in that country. Thus, technical assistance to be extended by Japan in order to solve problems described in this chapter, especially in 5–4–1, will not necessarily materialize in the course of "the project" only, but rather should be materialized by various measures which are of longer and wider ranges.