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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

- THE SITUATION OF THE ELECTRIC POWER EQUIPMENT INDUSTRY IN INDONESIA

Country case study
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This paper was prepared by Mr. Djurzan Hamid, as consultant to UNIDO.

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Preface

This document has been prepared by Mr. Djurzan Hamid, Indonesia, as consultant to UNIDO. For the definition of common terms of reference for case studies an Expert Group Meeting was convened in UNIDO Headquarters in Vienna in December 1983.

In the course of the preparatory work for the Second Consultation Meeting on Capital Goods to be held in Stockholm in June 1985, eleven country case studies were carried out by national experts. These case studies provided input to two UNIDO studies on the electric power equipment industry in developing countries, entitled "Electric power equipment production in developing countries: options and strategies. An analysis of eleven country case studies" (UNIDO/IS.507) and "Electric power equipment production in developing countries: a typology and elements of strategy" (UNIDO/IS.509).

This country case study is presented as documentation of the sources used for the above-mentioned sectoral working paper and sectoral study.

Contents

Contents

Tables

EXPLANATORY NOTES

References to dollars ($) are to United States dollars, unless otherwise stated.

A comma (,) is used to distinguish thousands and millions.

A full stop (.) is used to indicate decimals.

A slash between dates (e.g., 1980/81) indicates a crop year, financial year or academic year.

Use of a hyphen between dates (e.g., 1960-1965) indicates the full period involved, including the beginning and end years.

Metric tons have been used throughout.

The following forms have been used in tables:

Three dots (...) indicate that data are not available or are not separately reported.

A dash (-) indicates that the amount is nil or negligible.

A blank indicates that the item is not applicable.

Totals may not add up precisely because of rounding.

Besides the common abbreviations, symbols and terms and those accepted by the International System of Units (SI), the following abbreviations and contractions have been used in this report:

AC	Alternating current
DC	Direct current
GDP	Gross domestic product
GW	Gigawatt
hp	Horsepower
kW	Kilowatt
kWh	Kilowatt hour
kV	Kilovolt
kVA	Kilovolt-ampere
MVA	Manufacturing value added
MW	Megawatt
R and D	Research and Development

1. INTRODUCTION

The total domestic production of primary energy increased by just over 160 percent between 1972 and 1982. The biggest increase was for natural gas which increased by about 750 per cent over the same period and electricity which increased by 600 per cent. Coal increased by just over 240 per cent.

By 1992-93 it is projected that conventional thermal sources (steam/coal/geothermal/diesel) will account for about 74 per cent of total installed capacity, while hydropower will contribute 22 per cent and gas turbines 4 per cent.

Based on Government Decree No. 67/1961 all electricity generating companies were merged into one agency, 'The State Electricity Company', PLN. Based on Presidential Decree No. 15/1978, the Directorate General of Power was established as a new unit in the Department of Mines and Energy. Government Decree No. 36/1979 states that in areas not yet electrified by PLN, cooperatives and private companies are allowed to operate.

The production of electric power in Indonesia has grown rapidly due to the large increase in demand by industry particularly since 1968, the beginning of Indonesia's First Five Year Plan (Repelita I). At the same time this has meant a rapid increase in maintenance activities carried out domestically, in spare parts, and in manpower. As a result of government policies to increase local content, domestic production capabilities have gradually increased. Local content ratios, however, are relatively low.

Foreign contractors and consultants play an important role in the electrical power industry particularly in the areas of design, management and coordination, and supervision.

Most local firms find difficulty in competing with imports. Furthermore, there are no substantial exports of electrical power equipment. While the total number of foreign expatriates employed in the electrical power industry is small, they tend to occupy the top positions in terms of skill and responsibility.

The electrical power equipment industry in Indonesia began with the first Five Year Plan (Repelita I), 1969 to 1974. During this period construction companies, workshops and factories began accumulating experience in producing and repairing certain items of electrical power equipment such as small turbines for mini hydro powerstations, electrical panels etc. In the period of the Second Five Year Plan (1974-79) there were some manufacturers who began to produce products such as small electric motors, cables, transformers and to assemble diesel motors. By the end of the Third Development Plan (1979-84) there were a number of manufacturers producing various types of electrical power equipment, primarily for low and medium voltage use.

Foreign technology is imported in a variety of ways including licensing agreements, and joint venture arrangements. However, there are no direct subsidiaries of foreign companies operating in this sector in Indonesia.

As a result of the current relatively low level of domestic technological capabilities, local producers find difficulty in winning contracts from the State Electricity Company (PLN). However, it is government policy to attempt to increase local content ratios. This is being done, inter alia, by encouraging foreign suppliers to sub-contract locally, and by accepting local products even where the price and quality are somewhat unfavourable compared to imported equivalents. However, the standard of local subcontracting is still relatively low.

In order to strengthen local industries subsidies are in some instances given by government. Furthermore, since 1979 the monopoly by PLN in the electricity sector has been broken and the participation of private companies and cooperatives is allowed in some areas. In addition government purchases will give priority to locally produced items where feasible.

2. GENERAL INFORMATION

2.1 Historical development of agencies involved in generation, transmission and distribution of electric energy periods:

2.1.1 Before the Second World War (Dutch Occupation Period)

- At the end of the 19th century there were no public utilities. In this decade there were only private producers in products such as: sugar, tea, cooking oil factories, mining (coal oil and tin).

- Public utilities were supplied by NV NIGM (Naamloze Vencotschap Nederlands Indische Gas Matschappij), but it only operated in certain places/factories and big cities.

- According to the Ordinance no. 190/1890 dated 13 September 1890, there were two companies:

a) NV NIGM, operating in Jakarta and
b) NV ANIEM, operating in Surabaya

- At the beginning of the 20th century, the Dutch organized local/regional power/electric companies.

According to Ordinance no. 419/1927 Lanas Water Krachtbedrijven (LWK) was appointed to control hydro power generation in West Java and steam generation in Jakarta. This agency was under the Department of Transportation and Irrigation (Verkeer en Water Staats).

In this period the companies which supplied public utilities were:

a) NV GEBEO, operating in West Java
b) NV OGEM, operating in Jakarta and Palembang
c) NV SEM, operating in Solo and surroundings
d) GEM, operating in Madiun and surroundings
e) NV NJGM, operating in Jakarta and Cirebon
f) NV ANIEM, operating in East Java, Central Java (except Solo), Pontianak and Banjarmasin.

2.1.2 During the Second World War (Japan's Occupation Period)

There is insufficient iformation/data available caused by unfavourable conditions:

a) 1940 - 1941, Asia-Pacific War

During this period there were many good positions in the electric company which was run by the Dutch who were later replaced by Indonesians.

b) 1942 - 1945, Japan's Occupation Period

The top positions in the electric company that were occupied by the Dutch were taken over by the Japanese. During the Dutch occupation period there were many electric enterprises but when Japan occupied Indonesia, the electric enterprises were merged into one agency. The operating area was divided into 2 territories, which were:

(i) The Island of Java, under Army control

For Java Island, it was divided into 3 (three) provinces:

- West Java, supplied by Seibu Jawa Denki Jigyo Kosha
- Central Java, supplied by Tynbu Jawa Denki Jigyo Kosha
- East Java, supplied by Tobu Jawa Denki Yigjo Kosha

Later these companies were merged into one company under the name of Jawa Denki Jigosha, and civil persons replaced military persons in the key positions. It covered all Java Island.

(ii) Outside Java, under Navy control

2.1.3 After the independence of the Republic of Indonesia

Based on the Government Decree (Penetapan Pemerintah) no. 1/SD, 27 October 1945, the Department of Electricity and Gas of the Republic of Indonesia was established (Jawatan Listrik dan Gas Republik Indonesia). At this time almost all of the Indonesian people favoured Government nationalization of all the Dutch companies.

1950 - 1960. The Presidential Decree (Keputusan Presiden) no. 163/1953, 31 Ocotber 1953 states: "All the Dutch companies must be nationalized when the concessions have expired", such as : Balikpapan (1953), Jakarta-Tangerang-Kebayoran (1954), Central & East Java (1954).

1961. The State Electricity Company (PLN). Based on the Government Decree No. 67/1961 all electric companies were merged into one agency. This was the State Electricity Company (PLN).

Its operational area was divided according to the location:

* PLN-D (Jakarta area, ex OGEM/NIGM)
* PLN-S (Surabaya area, ex ANIEM)
* PLN-B (Bandung area ex GEBEO)

1972. Based on the Government Decree no. 18/1972, the electric power industry is in the hands of the Government, operated through PLN. This decree dealt with: status, general considerations, the scope of working, responsibilities etc.

1978. The Directorate General of Power. Based on the Presidential Decree no. 15/1978, 19 June 1978, the Directorate General of Power was established. It is a new unit in the Department of Mines and Energy. As a follow-up the Decree of the Minister of Mines and Energy no. 734/1978 was issued on 7 December 1978. This Ministerial Decree organizes the task of the Directorate General of Power which carries out the main tasks of the Department in the field of energy based on the policy of the Minister of Mines and Energy.

1979. The Government Decree no. 36/1979 states that in areas not yet electrified by PLN, cooperatives and private companies are allowed to operate.

2.2 Specific information on the National Electric Power System

2.2.1 Maintenance activities

a) Maintenance management is carried out in a professional way for power plants, transmission/distribution lines as well as in substations such as:

- Separation of operator and mechanic jobs, especially for the big power plants.
- Budget oriented system: job order and cost center.
- Scheduling for major/minor overhaul and routine preventive maintenance jobs.
- Information systems.

b) Each power plant is provided with workshops to facilitate repair. The workshop facilities usually depend on the amount of power generated and the number of units in each plant.

c) Availability of spare parts is controlled by management inventory control systems i.e.:

- Classification of spareparts:
  * general spare parts: spark plug, ball bearing etc.
  * special spare parts: rotor, crank shaft etc.
- Consideration of ordering and delivery time (domestic product/workshop made or import)
- Consideration of the optimal stock.

2.2.2 Role of foreign technical experts

Foreign technical experts are needed only for particular cases such as:

- Maintenance during the time of the guaranteed period.
- Difficulties with the particular equipment.
- Foreign technical experts' jobs are to concentrate more on supervision.

2.2.3 Technical training

Technical training activities cover operation and maintenance and are carried out locally; in particular cases overseas training is possible.

- Local training: all the instructors are from the local company; in particular cases, such as services for purchased new equipment, training is given by foreign instructors.

- Overseas training: to prepare qualified personnel for handling new power plants (usually for the big unit power plants with sophisticated accessories).

The development of power industries in Indonesia has grown very fast due to rapidly increasing demand by industry, especially since 1968 i.e. at the beginning of Indonesia's First Five Year Development Plan (Repelita I).

It is clear that the fast growth in the power industries is accompanied by rapidly increasing maintenance activities. The increasing maintenance activities had caused a demand increase for spare parts as well as for manpower.

In Indonesia the increasing demand for spare parts affects the growth of domestic related industries in the power sector. Furthermore, users need spare parts not only at low price but also in good quality. This condition forces domestic industries to be competitive with imported products. Government has a policy to increase local content for all products. So with the guidance of government, domestic production capabilities have gradually increased. There is no single foreign country that dominates the supply of technology to Indonesia. There are many technologies from many countries which enter Indonesia's industry. Especially in the power sector, the government has implemented national standards as well as international standards.

3. DOMESTIC PRODUCTION OF ELECTRIC POWER EQUIPMENT

3.1 Macro economic data for the electric power equipment industry

a) Gross production. At present there are many electric power equipment producers in Indonesia. According to APPI's data (the Electric Panel Manufacturer Association of Indonesia) in 1980, table 1 shows the production of electric power equipment which has been produced by local manufacturers and their production capacity estimate per year.

b) Manufacturing added value. The type of processing production is varied i.e. from assembly only, semi-assembly and full production. For example, the local transformer industries still depend largely on imported components; in other words they still are involved largely in assembly work.

Unfortunately there are no available data on manufacturing value added.

c) Exports and imports. Domestic demand for electric power equipment has been growing rapidly, especially since the beginning of Repelita I. Despite the marked increase in domestic production, Indonesian imports of electric power equipment have been rising steadily. As an example, table 2 shows Indonesian imports of transformers between 1977 and 1981. The trend reflects not only the substantial growth of Indonesian demands but also the high competitive edge of foreign-made over local products.

So far there is no export market for domestic production; they only supply the domestic market.

d) Employment. There are three types of companies: i.e. foreign, domestic and private investment. So the composition of employees consists of foreign and local people. The few foreign employees are usually in top management positions or are instructors.

According to the latest data, the total number of workers in this field is around 3,270.

Table 1. Local production of electric power equipment

NUMBER	TYPE OF EQUIPMENT	PRODUCTION CAPACITY PER YEAR AS OF 1981	DESCRIPTION
1.	Bare Copper Conductor	64.120,18 km	
2.	Aluminium Conductor	136.363,64 km	
3.	Trafo Kiosk	1.250 units	
4.	M.V. Distribution Transformer	5.000 units	D.T. 1 Ø , 3 Ø , auto trafo
5.	M.V. Isolating Switch	1.000 units	
6.	M.V. Switch Boards	7.400 units	
7.	Step Up/Down L.V. Power Transformer	100.300 units	
8.	Assembling Diesel Generator Set	500 units	25 - 280 kVA
9.	Small Power Transformer & Input/Output Trafo.	10.750 units	ordered by T.V & Radio Manufactures
10.	Current Transformer	53.000 units	76/5 A - 2.000/5 A
11.	Voltage Regulator/Voltage Stabilizer	200 units	1 - 100 kVA
12.	Porcelaine Insulators	2.500.000 units	
13.	Porcelaine Fuse Base and Fuse Cap	900.000 units	Diazed, NH/HT, Buispatroon (open type)
14.	L.V. Switch & Disconnecting Switches	17.500 units	
15.	L.V. Switch Board & Generator Control Panel.	13.890 units	

Table 1. Local production of electric power equipment (continued)

NUMBER	TYPE OF EQUIPMENT	PRODUCTION CAPACITY PER YEAR AS OF 1981	DESCRIPTION
16.	Steel Poles	26.160 units	
17.	Bakelite Busbar Support	1.100.000 units	
18.	Bakelite Junction Box	375.000 units	
19.	Bus Duct and Cable Tray	22.400 units	
20.	Metallic Paper Condensor	600.000 units	
21.	Metal Box for kWh - meter	15.000 units	
22.	Generator, Weeding Machines	9.330 units	0,5 - 500 kVA
23.	Bakelite fuse boxes	50.000 units	
24.	Champ	-	
25.	Bakelite Connector Block	28.000 units	
26.	Lamp Fxture Outdoor & Indoor use	56.500 units	
27.	Lamp	6.500.000 units	
28.	Ballast for Fluorescent Lamps and other Discharge Lamp	2.162.000 units	
29.	Cable Luxs	30 ton	25 - 300 mm^2
30.	Low Voltage Electric Cables	7.042,25 Km	
31.	Enamel Wire	4.000 ton	

Source: APPI (The Electric Panel Manufacturer Association of Indonesia)

Table 2. Indonesian imports of transformers

Year	Total (unit)	Value (thousand $US)
1977	123,887	14,287
1978	352,114	14,491
1979	142,575	12,247
1980	354,687	31,279
1981	436,666	55,315

Source: Central Bureau of Statistic.

3.2 Historical development of the electric power equipment industry

It could be said that the electric power equipment industry in Indonesia began with Repelita I, from 1969 to 1974.

During the period of Repelita I, construction workshops and factories started getting experience in producing/repairing some electric power equipment such as small turbines for mini hydro power station, electric panels and polis with their traverse etc.

Then in the Second Five Year Development Plan (1974-1979) there were some electric power equipment manufacturers who began to produce products such as small electric motors, cables, electric panels, transformers and assemble diesel motors.

By the end of the Third Five Year Development Plan (1979-1984), there were many manufacturers of electric power equipment existing in Indonesia as can be seen in Annex tables 17-22.

3.3 Mastering of technology

(a) Assessment of the indigenous development of technology at industry and national levels through:

(i) Training: experience showed that training plays a very important role in developing indigenous technology. All large and medium industries have training facilities to increase the skill-capability of their employees.

(ii) Adaptation: adaptation of new technology is not always practicable, there are constraints regarding facilities and finance.

(iii) Research and development: there is no real research and development in Indonesia in this area. Testing and modification work only is undertaken.

(b) The import of technology.

(i) Licensing: most of the manufacturing processes are licensed; this explains why research and development is not done. It seems that in the next decade, the import of technology by licensing will still be important.

(ii) Joint venture with foreign companies: Indonesia's electric power equipment industry is relatively young. Since this industry is capital and technology intensive, the Government realized that there must be mutual co-operation with other countries to develop the domestic industry. Indonesia's policy on capital investment is carried out by the Investment Co-ordinating Board (BKPM). As a result of this policy many joint ventures with foreign companies have been formed.

(iii) Subsidiaries of foreign company: there are no direct subsidiaries of foreign companies.

3.4 Constraints on the domestic production of electric power equipment and measures to counteract these

3.4.1 Markets

The electrical power equipment industry operates at low scales, below capacity, depends largely on imported components and is not yet able to compete with imports in terms of both quality and price. These disadvantages make it virtually impossible for domestic producers to win procurement contracts from PLN (The State Electricity Company which is naturally the largest single user). PLN's development projects are funded by foreign aid and its contracts are put out to international tender. However, the Government has a policy to increase local content as well as the participation of domestic firms in electricity development such as:

- Local content requirements are one of the conditions in the procurement contract.
- The foreign supplier should have a domestic counterpart.
- State enterprise is allowed to make an exception for domestic products for tender purposes, even when the domestic price is higher than the import price.

The Junior Ministry of Increasing Participation of Domestic Production is responsible for the implementation of these policies.

3.4.2 Financing

Most of these industries have massive capital and high technology requirements. Since Repelita I (started in 1969), the Government has allowed foreign investors to invest their capital in developing the industrial sector. Other efforts of the Government to finance these industries include:

- Joint ventures with other companies from developed countries.
- Loans of short and long term on a commercial basis.
- Soft loans/grants from international bodies as well as developed countries such as: ADB, World Bank, US Aid etc.

3.4.3 Technical and technological barriers

Usually domestic electric power equipment is lower in quality and more expensive than imported products. Technical problems are caused by:

- Using conventional methods of production.
- Using low efficiency machines (use of single purpose machinery results in higher efficiency; but it is expensive).
- No research and development activities are undertaken.
- Using varying standards.

Measures have been taken by the Government to remove these technical constraints such as giving guidance through training, licensing, sub-contracting policy, standardization etc.

3.4.4 Manpower

The manpower problems of such industry relate to finding qualified/professional engineers and skilled workers. To counteract this problem, the Government has provided training and vocational schools/courses.

4. LINKAGES WITH OTHER CAPITAL GOODS INDUSTRIES

The development of basic materials in Indonesia was rather slow compared with other industry. In the first decade of the industrial era in Indonesia, imported raw material such as steel, aluminium, etc. played an important role in supplying domestic demand. Accordingly, local content of domestic products was very low.

But with the opening of several basic and intermediate industries, such as steel and aluminium smelter, and chemicals, the local content gradually increased. Generally, the electric power equipment sector is not supplied with pure raw materials, such as powder or pellets.

In the first stage pure raw materials (particularly steel, copper and aluminium) are processed to form intermediate products in one of the metal industries.

These intermediate products may be steel wire, steel sheet, copper wire, aluminium extrusion form, which are used as an input to produce electric power equipment, such as telecommunication/power cables, aluminium corrugated metal, or steel poles etc.

A sub-contracting system has been implemented in domestic industry in Indonesia. In the beginning sub-contracting was unsatisfactory since the quality of the subcontracting industry (usually low capitalized home industry) did not meet the requirements. By the guidance of the Government through training, standardization, soft loans/credit etc. the problems of the sub-contracting industry can gradually be overcome.

However, high-technology intermediate products are still imported.

Accordingly, the electrical power industry still depends largely on imported components: these industries are still largely involved in assembly work.

Basic facilities (casting, forging, etc.) for the electric power equipment industry are provided by other industries (metal industry), such as foundry manufacturers, that produce moulds, dies, etc.

5. POLICIES AND STRATEGIES

5.1 National energy and industrial policies

(a) National energy policies. The objective of the Indonesian energy policies is:

- Reservation of energy to supply domestic demand.
- Reservation of energy for export.
- To develop other energy sources taking account of environmental factors.

To achieve these objectives, the Government has given guidance as follows:

- Intensification in exploration of new energy resources.
- Conservation in the use of energy.
- Diversification in the use of energy.
- Indexation in the use of energy.

(b) National industrial policies.

- Emphasizing the use of domestic products.
- Increasing the local content of domestic products.
- Intensification of non-oil domestic products for export.
- Giving priority to the development of base/upstream as well as intermediate industry such as steel/aluminium smelter, rolled steel, construction steel etc.
- Intensification in transfers of technology through: technical assistance, training, licensing etc.
- Developing underlicensed industry to increase value added as well as the transfer of technology.

5.2 The role of the Government

(a) State enterprises.

- Subsidies are in some cases provided by the Government. Guidance for the state enterprises is carried out by the ministry concerned.

- Since 1979, through the Government Decree No. 36, the electric power industry is not monopolized by PLN. Participation of private companies and co-operatives in this area is possible and strongly recommended.

(b) Protection against imported products.

- For some particular products, imports are possible only when there is excess demand.
- High taxes are imposed on imports where similar items are produced by domestic manufacturers.
- Implementation of standards on a national level.

(c) Training.

- It is suggested that technical assistance be obtained from international organization such as: ADB, USAID, Japan Aid, Colombo Pan etc.

- Cooperation with the region as well as with developed countries such as ASEAN, USA, Japan, Australia, etc.

(d) Government purchasing.

Priority should be given to domestic products even where their price is higher than the import price.

5.3 Past and present experience of and future opportunities for co-operation with other developing countries on bilateral and/or multilateral bases

Technical assistance (including training)

The need for technical assistance from developed countries, for instance, is as follows:

- to obtain expert assistance;
- to obtain transfer of technology;
- to get proper training, including training facilities and good trainees.

Co-operation can usually be increased by the training of local counterparts, but there may be disadvantages such as:

- where there is no clear job description;
- where there is no adequate co-operation;
- transfer of technology should be emphasized.

Future opportunities:

- to give a clear job description between the foreign and local counterparts;
- to create an atmosphere of co-operation;
- transfer of technology being emphasized.

6. MEASURES TO BE TAKEN TO INCREASE THE DOMESTIC PRODUCTION OF ELECTRIC POWER EQUIPMENT AND TO IMPROVE LINKAGES WITH OTHER CAPITAL GOODS INDUSTRIES

- Establishing joint ventures with reputable foreign companies.
- Improving local participation.
- Improving human motivation.
- Giving special attention to small-scale industries.
- Up-grading and properly training workers.
- Giving wider job opportunities.
- Immproving small industries by research and development in processing, promotion and materials.
- Standardization, especially for sub-contracting and developing the intermediate industries to complete the linkages in the industrial system.

Statistical data on the electric power
industry in Indonesia

Table A.1. Domestic production of primary energy (in Terajoule - TJ)

Energy source / Year	Coal		Other solid energy		Crude Petroleum		Natural gas		Electricity (Hydro, Conventional Thermal, Geothermal)		Total ***	
	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%
1972	5 253	0.20	-		2.321.892	89.00	150.729	5.83	8 996.4	0.35	2586870	100
1973	4 361.7	0,13	-		2 867.706	90.60	182.891	5.77	10 557	0.33	3165426	100
1974 *	4 576.5	0.11	-		2 945 789	93.23	208 202	6.59	12 042.7	0.38	3270610	100
1975 *	6 048.8	0.14	-		2 799 139	92.23	228 701	7.53	13 572.7	0.45	3347462	100
1976 *	5 653	0.13	-		3 230 372	90.78	321 201	9.02	14 543	0.41	3671769	100
1977 **	5 503	0.13	-		3 610 772	86.36	558 517	13.36	16 398	0.39	4291190	100
1978 **	6 239	0.14	-		3 502 440	80.30	844 226	19.36	19 440	0.45	4472345	100
1979 **	6 590	0.15	-		3 407 071	76.52	1 027 786	23.08	23 965.2	0.54	4565412	100
1980 **	7 555	0.16	-		3 392 954	75.46	1 085 586	24.15	29 070	0.65	4615165	100
1981 **	8 944	0.19	-		3 433 001	74.36	1 156 980	25.06	35 028	0.76	4733953	100
1982 **	12 778	0.31	-		2 865 539	70.52	1 144 839	28.18	48 409.2	1.00	4171565	100

Conversion factors (terajoules/1 000 MT)

Hard Coal = 29.3076

1000 MSCF = 1.029 TJ
(Natural Gas)

1 000 BOE = 5.870 TJ
(Crude Petroleum)

Conventional thermal = Steam, Diesel & Gas Turbine

1 GWh = 3.6 TJ

* Data from the Central Bureau of Statistics

** Data from the Directorate General of Power

*** Included other solid energy (estimated figure)

Table A.2. Electric energy production and consumption

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
INSTALLED CAPACITY (MW)											
Public and self-producer total	1964	2096	2311	2580 *	3198	3833	4788	5219 **	5689 **	6202 **	6760 **
- Hydro	-	-	-	-	-	-	-	-	489	508	722
- Conventional thermal	-	-	-	-	-	-	-	-	-	-	-
- Nuclear	-	-	-	-	-	-	-	-	-	-	-
- Geothermal	-	-	-	-	-	-	-	-	-	-	-
Public total	664	796	921.6	1107	1376	1862	2288.4	2536	2555	3032	3406
- Hydro	183.9	278.6	278.6	321	321	322	351	378	379	398	437
- Conventional thermal *	480.1	517.4	642.9	785	1055	1540	1937	2158	2176	2634	2939
- Nuclear	-	-	-	-	-	-	-	-	-	-	-
- Geothermal	-	-	-	-	-	-	-	-	-	-	-
GENERATION/PRODUCTION (GWH)											
Public and self-producer total(gross)	5291	6079	7303	8501	9393	10.183	11429	12948	14453	16125	16896.5
- Hydro	-	-	-	-	-	-	-	-	-	-	-
- Conventional thermal*	-	-	-	-	-	-	-	-	-	-	-
- Nuclear	-	-	-	-	-	-	-	-	-	-	-
- Geothermal	-	-	-	-	-	-	-	-	-	7	78
Public total (PLN + purchase)	1913	2256	3345.2	3770	4125	4740	7910	7003	8412	10138	11844
- Hydro	686	903	1793.9	1960	1778	1785	2188	2230	2100	2504	1887
- onventional thermal*	1227	1353	1551.3	1810	2347	2955	3534	4773	6312	7633	7879
- Nuclear	-	-	-	-	-	-	-	-	-	-	-
- Geothermal	-	-	-	-	-	-			-	-	78
Net production	5291	6079	7303	8501	9393	10183	11429	12948	14453	16125	-
Transmision and distribution losses	606	757	870	966	1011	1159	1325	1609	1878	2114	2640
Imports	-	-	-	-	-	-	-	-	-	-	-
Exports	-	-	-	-	-	-	-	-	-	-	-
CONSUMPTION (GWH)											
Total (net production + Imports - Export - transmission and distribution losses	4685	5322	6433	7535	8382	9024	10054	11339	12575	14011	14256.5
Industry and construction	312.5	534.8	715.3	880	978	1142	1443	1910	1722	2240	2996
Transport	-	-	-	-	-	-	-	-	-	-	-
Household and other consumers	1580.5	1640.2	1660	1923	2103	2385	2843	3433	4839	5605	6077

Source : P L N (State Electricity Enterprise)

* Conventional thermal (Steam, Diesel and Gas Turbine)

Table A.3. Electric energy production (projection)

PLANNED FUTURE PROJECTIONS [+)]

Production	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93
1. Gross Generation (GWh)	14135	17037	20977	24452	28656	34924	41293	48293	56252	65609
2. Losses Transmission & Distribution (GWh)	2358	2707	3097	3216	3750	4354	4995	5861	6826	7918
3. Station Use (GWh)	617	624	1035	1203	1416	2146	2773	3210	3742	4579
4. Sales (GWh)	11151	14706	16846	20033	23890	28425	33426	39222	45684	53090
Installed Capacity (MW)										
1. Hydro	664	664	1020	1393	1551	1680	2037	2091	3335	3525
2. Conventional Thermal (Steam/ Steam Coal/Geothermal/Diesel	2757	3627	3572	4439	5067	5982	7144	8409	10255	11918
3. Gas Turbine	695	954	954	954	954	954	954	849	814	709
Total (MW)	4116	5245	5546	6786	7572	8616	10195	12149	14404	16132

[+)] PLN's only (State Electricity Enterprise)
Java & Outside Java

Source : PLN (Public Electricity Enterprise)

Table A.4. Plan for development of electric power generation

ELECTRIC POWER STATION	YEAR : 1984/1985 upto-1989/1990		YEAR : 1991/1992 up to 1996/1997	
	Installed capacity (MW)	%	Installed capacity (MW)	%
1. Hydro Electric Power Station	2 012.5	22.0	3 864	25.1
2. Diesel Electric Power Station	1 893.0	20,6	2 508	16.3
3. Gas Turbine Power Station	996,4	10,9	272.4	1.8
4. Geothermal Power Station	250.0	2,7	940	6.1
5. Coal fire Power Station	1 830.0	20.0	5 555	36.0
6. Oil fire Power Station	2 186.0	23,8	2 266	14.7
T O T A L	9 167.9 *)	100,0	15 405.4 *)	100.0

Source : P L N (State Electricity Enterprise)

*) Including the estimate of retirement of several old Power Plant during this period.

Table A.5. Plan for development of electric transmission and substation (1983/84 - 1988/89)

DESCRIPTION	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Transmission Lines 500 kV (kilometer circuits)	-	741	-	536	105	240
Transmission Lines 150 kV (kilometer circuits)	900	739	1 544	1 571	965	1 246
Transmission Lines 70 kV (kilometer circuits)	152	345	233	256	331	431
Substation (MVA)	573	1 152	1 114	3 661	627	1 516

Source : P L N (State Electricity Enterprise)

Table A.6. Plan for development of electric distribution

DESCRIPTION	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
New Consumer	614 976	659 772	767 938	845 989	928 459	1 074 302
Medium Voltage Circuits (kilometer circuits)	3 690	4 289	4 992	5 499	6 035	6 983
Low Voltage Circuits (kilometer circuits)	7 380	8 577	9 983	10 998	12 070	13 966
Distribution Transformer (MVA)	615	660	768	846	928	1 074

Source : P L N (State Electricity Enterprise)

Table A.7. Plan for development of rural electrification

ITEM	84/85	85/86	86/87	87/88	88/89	TOTAL
1. ENERGY USAGE (GWH)						
a.FROM DISTR. LINE	129	273	440	632	834	2308
b.FROM DIESEL GEN. SET	22	48	77	110	147	404
c.FROM MICROHYDRO	-	10	22	36	65	133
T O T A L	151	331	539	778	1046	2845
2. LOAD FACTOR (%)	30	30	30	30	30	30
3. PEAK LOAD (MW)						
a.FROM DISTR. LINE	58	122	197	283	373	-
b.FROM DIESEL GEN. SET	10	21	34	49	66	-
c.FROM MICROHYDRO	-	5	10	11	29	-
T O T A L	68	148	241	348	468	-
4. ADDITIONAL GEN. (MW)						
a.FROM DIESEL GEN. SET	20	22	26	30	34	132
b.FROM MICROHYDRO	0,2	13,7	1.88	11,9	28,0	55,7
5. ADDITIONAL DISTR. TRANSF. (MVA)						
a.FOR DISTR.SYSTEM	109	120	141	161	169	700
b.FOR DIESEL GEN. SYSTEM	19	21	24	28	32	124
c.FOR MICROHYDRO SYSTEM	-	9	9	11	24	53
T O T A L	128	150	174	200	225	877
6. ADDITIONAL MEDIUM VOLTAGE NETWORK (KM)						
a.FOR DISTR. SYSTEM	3060	3150	3360	3615	3615	16800
b.FOR DIESEL GEN. SYSTEM	540	555	600	645	660	3000
c.FOR MICROHYDRO SYSTEM	-	195	240	240	525	1200
T O T A L	3600	3900	4200	4500	4800	21000
7. ADDITIONAL LOW VOLTAGE NETWORK (KM)						
a.FOR DISTR. SYSTEM	3060	3150	3360	3615	3615	16800
b.FOR DIESEL GEN. SYSTEM	540	555	600	645	660	300
c.FOR MICROHYDRO SYSTEM	-	195	240	240	525	1200
T O T A L	3600	3900	4200	4500	4800	210000

Source : P L N (State Electricity Enterprise)

Table A.8. Existing electric power equipment - Conventional thermal

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)		LOCAL CONTENT %	FOREIGN SUPPLIER
1971	2 X 12.5	Boiler & boiler equipment	B		Durodakovic, Yugoslavia.
		Turbine	T		Yugoturbina, Yugoslavia.
		Generator	G		Rade Koncar, Yugoslavia.
		Sub - Station	S		Rade Koncar, Yugoslavia.
		Control & Instrumentation	C		Durag, Germany.
1972	2 X 50		B		Mitsubishi, Japan.
			T , G , S		Mitsubishi, Japan.
			C		Shimadzu, Japan.
1974	2 X 12.5		B		Durodakovic, Yugoslavia.
			T		Yugoturbina, Yugoslavia.
			G , S		Rade Koncar, Yugoslavia.
			C		Durag, Germany.
1978	2 X 50		B		Mitsubishi, Japan.
			T , G , S		Mitsubishi, Japan.
			C		Shimadzu, Japan
	2 X 53.1		B		Foster Wheeler, USA.
			T , G , S		General Electric, USA.
			C		Bailey, USA.

(continued)

Table A.8. Existing electric power equipment - Conventional thermal (continued)

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)	LOCAL CONTENT %	FOREIGN SUPPLIER
1979	3 x 100	B		Deutch Babcock & Wilcox, West Germany.
		T , G		Mitsubishi, Japan.
		S		Merlin Getlin, France.
		C		Bailey, USA.
1981	1 X 200	B		Mitsubishi, Japan.
		T , G , S		Mitsubishi, Japan.
		C		Babcock Bristol, England.
1982	1 X 200	B		Mitsubishi, Japan.
		T , G , S		Mitsubishi, Japan.
		C		Babcock Bristol, England.

Source : P L N (State Electricity Enterprise)

Table A.9. Existing electric power equipment - Gas turbine

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)	LOCAL CONTENT %	FOREIGN SUPPLIER
1974	2 X 20.1	Compressor - turbine T		Alsthorn, France
		Generator G		Alsthorn, France
		Sub - Station S		Alsthorn, France
		Control & Instrumentation C		General Electric, USA.
	1 X 21.8	T		John Brown, England.
		G		Brush, England.
		S		Powels, England.
	1 X 27.4	C		General Electric, USA.
		T , G , S , C		Westinghouse, USA.
1975	1 X 27.5	T , S , C		Westinghouse, USA.
		G		ACEC, USA.
	1 X 21.8	T		John Brown, England.
		G		Brush El, England.
		S		Bonar Long, England.
		C		General Electric, USA.
1976	6 X 20.1	T , G , S		Alsthorn, France.
		C		General Electric, USA.
	1 X 21.5	T		John Borwn, England.
		G		Brush El, England.
		S		Bonar Long, England.

Table A.9. Existing electric power equipment - Gas turbine (continued)

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)	LOCAL CONTENT %	FOREIGN SUPPLIER
1976	1 X 21.5	C		General Electric, USA.
	4 X 31.9	T , G , S , C		Westinghouse, USA.
	3 X 14.4	T , G , S , C		Westinghouse Can, Canada.
1977	2 X 20.1	T , G , S C		Alsthorn, France. General Electric, USA.
	4 X 73.5	T , G , S , C		General Electric, USA.
	1 X 14.5	T , G , S , C		Westinghouse Can, Canada.
1978	2 X 20.1	T , G , S C		Alsthorn, France. General Electric, USA.
	1 X 14.5	T , G , S , C		Westinghouse Can, Canada.

Source: PLN (State Electricity Enterprise)

Table A.10. Existing electric power equipment - Hydro electric

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)		LOCAL CONTENT %	FOREIGN SUPPLIER
1970	1 X 4.500	Fabricated part	P		Charmilles, Swiss.
		Turbine	T		Charmilles, Swiss.
		Generator	G		B B C , Swiss.
		Sub - Station	S		Siemens, West Germany.
		Control & Instrumentation	C		Coloremag, West Germany.
	1 X 60	P , T		100	Barata, Indonesia.
		G , S , C			Unelec, France.
1971	1 X 90	P , T			G. Gilkes, England.
		G , S , C			Mac Farlane, England.
1972	1 X 80	P , T			G. Gilkes, England.
		G , S , C			Mac Farlane, England.
1973	2 X 10.000	P , T			Fuji, Japan.
		G , C			Fuji Electric, Japan.
		S			Tahasha, Japan.
	2 X 35.000	P , T , G , S , C			Teshiba, Japan.
	1 X 540	P , T , G , S , C			Sponjene Breuska, Chekoslovakia
	1 X 4.500	P . T			Ebara, Japan.
		G , S , C			Meidensha, Japan.

(continued)

Table A.10. Existing electric power equipment - Hydro electric (continued)

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)	LOCAL CONTENT %	FOREIGN SUPPLIER
1974	1 X 120	P , T G , S , C		G. Gilkes, England. Mac Farlane, England.
	1 X 120	P , T G , S , C	100	Barata, Indonesia. Jyoty, India.
1976	1 X 80	P , T G S , C		G. Gilkes, England. Brush El, England. English Electric, England.
	2 X 3.500	P , T G , S , C		Ebara, Japan. Meidensha, Japan.
	1 X 35.000	P , T , G , S , C		Toshiba, Japan.
1977	1 X 90	P , T G , S , C	100	Barata, Indonesia. Jyoty, India
	1 X 120	P , T G , S , C		G. Gilkes, England. Mawdaley, England.
	1 X 160	P , T G „ S , C	100	Barata, Indonesia. Dip. Ing, Inggris.

(continued)

Table A.10. Existing electric power equipment - Hydro electric (continued)

COMMISSIONING DATE	PLANT SIZE MW	EQUIPMENT (IMPORTED)	LOCAL CONTENT %	FOREIGN SUPPLIER
1978	2 X 27.000	P , T G , S , C		Toshiba, Japan. Meidensha, Japan.
	1 X 210	P , T G , S , C	100	Barata, Indonesia. Siemens, West Germany.
1979	1 X 120	P , T G , S , C	100	Barata, Indonesia. Jyoty, India.
1980	1 X 1.000	P , T G , S , C		Neyrpic, France. Unelec, France.
	1 X 10.000	P , T G , S C		Fuji, Japan. Fuji Electric, Japan. Takaoka, Japan.
	1 X 180	P , T G , S , C	100	Barata, Indonesia. Siemens, West Germany.
1981	1 X 3.500	P , T G , S , C		Ebara, Japan. Meidensha, Japan.
	1 X 5.400	P , T G , S , C		Andritz, Swiss. B B C , Swiss.

Source: PLN (State Electricity Enterprise)

Table A.11. Existing electric power equipment - Transmission

Commissioning date, year	kV	kms	Equipment (imported)	Power, MVA	Local Content, %
1970	70	56.5	Tower, Conductor T.C) Insulator, Fittings I.F)	-	-
	150	11	T,C,I,F.	-	-
1971	70	37.9	T,C,I,F.	-	-
	150	14	T,C,I,F.	-	-
1972	70	38.5	T,C,I,F.	-	-
	150	33	T,C,I,F.	-	-
1973	70	112.6	T,C,I,F.	-	-
	150	108.6	T,C,I,F.	-	-
1974	70	35.4	T,C,I,F.	-	-
	150	48.4	T,C,I,F.	-	-
1975	150	89	T,C,I,F.	-	-
1976	150	578	T,C,I,F,	-	-

(continued)

Table A.12. Existing electric power equipment - Distribution/Substation

Commissioning date, year	Voltage kV	Equipment (imported)	power, unit/MVA	Local content, %
1970	150	Transformer T.) Switch gear S.) Measurement & control M.) Cable C.)	-	-
	70	T, S, M, C.	1/40	-
1971	150	T, S, M, C.	2/12	-
	70	T, S, M, C.	7/71.5	-
1972	150	T, S, M, C.	2/40	-
	70	T, S, M, C.	2/11.5	-
1973	150	T, S, M, C.	2/40	-
	70	T, S, M, C.	3/21	-
1974	150	T, S, M, C.	2/108	-
	70	T, S, M, C.	3/63	-
1975	150	T, S, M, C.	7/120	-
	70	T, S, M, C.	4/27	
1976	150	T, S, M, C.	18/347	-
	70	T, S, M, C.	1/50	-

(continued)

Table A.12. Existing electric power equipment - Distribution/Substation (continued)

Commissioning date, year	Voltage, kV.	Equipment (imported)	Power, unit/MVA	Local content, %
1977	150	Transformer T.) Switch gear S.) Measurement & control M.) Cable C.)	2/75	-
1978	150	T, S, M, C.	14/560	-
	70	T, S, M, C.	1/15	-
1979	150	T, S, M, C.	15/1,499	-
	70	T, S, M, C.	1/15	-
1980	150	T, S, M, C.	2/600	-
1981	150	T, S, M, C.	3/330	-
1982	150	T, S, M, C.	3/240	-
	70	T, S, M, C.	7/409	-
1983	150	T, S, M, C.	10/316	-
	70	T, S, M, C.	2/123	-

Source : P L N (State Electricity Enterprise)

Table A.12. Existing electric power equipment - Distribution/Substation (continued)

Commissioning date, year	kV	kms	Equipment (imported)	Power, MVA	Local Content, %
1977	150	102	Tower T.) Conductor C.) Insulator I.) Fittings F.)	-	-
1978	150	102	T,C,I,F.	-	-
1979	150	751	T,C,I,F.	-	-
	70	14	T,C,I,F.	-	-
1980	150	303	T,C,I,F.	-	-
1981	150	1.024	T,C,I,F.	-	-
	70	29	T,C,I,F.	-	-
1982	150	159	T,C,1,F.	-	-
	70	645	T,C,I,F.	-	-
1983	150	1.010	T,C,I,F.	-	-
	70	346	T,C,I,F.	-	-

Source : P L N (State Electricity Enterprise)

Table A.13. Role of foreign and domestic contractor/consultant in project construction of hydro-electric power station (below 30 MW)

No.	Type of work	Performed by		
		Foreign	National	Local
I.	INFRA STRUCTURE			
1	Soil Investigation & Survey	1, 4	1,2,3,4,5,7	6, 7
2	Access Road	-	1,2,3,4,5,7	6, 7
3	Base Camp	-	1,2,3,4,5,7	6, 7
4	Office Building	-	1,2,3,4,5,7	6, 7
5	Slope Protection	-	1,2,3,4,5,7	6, 7
6	Drainage	-	1,2,3,4,5,7	6, 7
7	Warehouse	-	1,2,3,4,5,7	6, 7
II.	DAM & SPILLWAY			
1	D a m /weir	1, 4	2,3,5,7	-
2	Spillway	-	-	-
III.	WATERWAY			
1	Intake Structure	1, 4	2,3,5,7	-
2	Pressure Tunnel	1, 4	2,3,5,7	-
3	Surge Tank	1, 4	2,3,5,7	-
4	Penstock Route & Foundation	1, 4	2,3,5,7	-
IV.	POWERHOUSE & TAILRACE			
1	Powerhouse	1, 4	2,3,5,7	-
2	Turbine/Generation Foundation	1, 4	2,3,5,6,7	-
3	Overhead Crane	1, 4	2,3,5,7	-
4	Tailrace	1, 4	2,3,5,7	-
V.	CONTROL BUILDING & SWITCHGEAR			
1	Control-Building	-	2,3,5,6,7	6, 7
2	Switchyard	-	2,3,5,6,7	6, 7
VI.	TRANSMISSION LINE & SUBSTATION			
1	Foundation of T/L	1, 4	2,3,5,6,7	6, 7
2	Sub station Building	1, 4	2,3,5,6,7	6, 7

Legend : 1 - Design
2 - Full responsible
3 - Supervision
4 - Guidance
5 - Management & Coordination
6 - Assisting
7 - Performer

Source : P L N (State Electricity Enterprise)

Table A.14. Role of foreign and domestic contractor/consultant in project construction of hydro-electric power station (above 30 MW)

No.	Type of work	Performed by		
		Foreign	National	Local
I.	INFRA STRUCTURE			
1	Soil Investigation & Survey	1, 3, 4	2, 3, 4, 5, 7	-
2	Access Road	1, 4 *)	1,2,3,4,5,7	6, 7
3	Base Camp	-	1,2,3,4,5,7	6, 7
4	Office Building	-	1,2,3,4,5,7	6, 7
5	Slope Protection	1, 4 *)	1,2,3,4,5,7	6, 7
6	Drainage	-	1,2,3,4,5,7	6, 7
7	Warehouse	-	1,2,3,4,5,7	6, 7
II.	DAM & SPILLWAY			
1	D a m	1,2,3,5,7	6, 7	-
2	Spillway	1,2,3,5,7	6, 7	-
III.	WATERWAY			
1	Intake Structure	1,2,3,5,7	6, 7	-
2	Pressure-Tunnel	1,2,3,5,7	6, 7	-
3	Surge Tank	1,2,3,5,7	6, 7	-
4	Penstock Route & Foundation	1,2,3,5,7	6, 7	-
IV.	POWERHOUSE & TAILRACE			
1	Powerhouse	1,2,3,5,7	6, 7	-
2	Turbine/Generation Foundation	1,2,3,5,7	6, 7	-
3	Overhead Crane	1,2,3,5,7	6, 7	-
4	Tailrace	1,2,3,5,7	6, 7	-
V.	CONTROL BUILDING & SWITCHGEAR			
1	Control Building	1,2,3,5,7	2,3,5,6,7	-
2	Switchyard	1,2,3,5,7	2,3,5,6,7	-
VI.	TRANSMISSION LINE & SUBSTATION			
1	Foundation of T/L	1, 4	2,3,5,6,7	6, 7
2	Sub station Building	1, 4	2,3,5,6,7	6, 7

Legend : 1 - Design
2 - Full responsible
3 - Supervision
4 - Guidance
5 - Management & Coordinating
6 - Assisting
7 - Performer

Source: P L N (State Electricity Enterprise)

Table A.15. Role of foreign and domestic contractor/consultant in project construction of gas turbine electric power station

NO.	Type of work	PERFORMED BY		
		Foreign	National	Local
I.	INFRASTRUCTURE			
1.	Soil Investigation	1,2.	6.	-
2.	Access Road	-	-	2,3,7.
3.	Office Building	-	2,3,7.	6
4.	Drainage	-	-	2,3,7.
5.	Ware House	-	-	2,3,7.
6.	Land Cleaning.	-	-	2,3,7.
7.	Site Filling.	-	-	2,3,7.
8.	Housing	-	-	2,3,7.
9.	Road location	-	-	2,3,7.
10.	Road lightning	-	-	2,3,7.
11.	Boundary	-	-	2,3,7.
12.	Fence	-	-	2,3,7.
II.	POWER HOUSE. :			
1.	Civil Work	1,2,3,4,5.	6,7.	-
2.	Turbine/Generator	1,2,3,4,5.	6,7.	-
3.	Daily Tank	1,2,3,4,5.	6,7.	-
4.	Storage Tank	-	2,3,7,5	6.
III.	SUB STATION :			
1.	Control Building	3,4.	-	2,7.
2.	Switchyard	1,2,3,4,5.	6,7.	-

Legend :

1 - Design
2 - Full responsible
3 - Supervision
4 - Guidance
5 - Management & Coordinating
6 - Assisting
7 - Performer

Source : PLN (State Electricity Enterprise)

Table A.16. Capabilities of domestic civil works in the electric power system project

NO.	Type of work	PERFORMED		
		Foreign	National	Local
I.	INFRASTRUCTURE			
1.	Soil Investigation & Survey.	-	1,2,3,7.	-
2.	Access Road	-	-	2,3,7,5.
3.	Base Camp	-	-	2,3,7,5.
4.	Office Building	-	-	2,3,7,5.
5.	Shore/Slope Protection	-	2,3,4,5,7.	2,3,7,5.
6.	Drainage	-	2,3,4,5,7.	2,3,7,5.
7.	Ware House	-	-	2,3,7,5.
8.	Land Clearing	-	-	2,3,7,5.
9.	Site Filling.	1.	2,3,4,7.	2,3,4,5,6,7.
10.	Site Development Housing - Colony	1.	2,3,4,7.	-
11.	Housing	-	-	2,3,7,5.
12.	Instalasi Penerangan Jalan.	-	-	2,3,7,5.
13.	Road location	-	-	2,3,7,5.
14.	Plat Form	-	-	2,3,7,5.
15.	Boundary fence	-	-	2,3,7,5.
16.	Land Scaping	-	-	2,3,7,5.
17.	Handling Material/Pengangkutan	-	-	2,3,7,5.
18.	Water Treatment	-	1,2,3,5,7.	6.
19.	Water piping	1. -	1,2,3,5,7.	6.
II.	MARINE WORKS			
1.	Intake Canal	1	2,3,5,7.	6.
2.	J e t t y	1	2,3,4,5,7.	6.
3.	Navigation Aids	1	2,3,5,7.	-
4.	Cooling Water Discharge Canal	1	2,3,5,7.	6.
5.	Coal Storage Reclamation	1	1,2,3,4,5,7.	6.
	(continued)			

L e g e n d :

1 - Design
2 - Full responsible
3 - Supervision
4 - Guidance
5 - Management & Coordinating
6 - Assisting
7 - Performer

Source : PLN (State Electricity Enterprise)

Table A.16. Capabilities of domestic civil works in the electric power system project
(Continued)

NO.	Type of work	PERFORMED		
		Foreign	National	Local
III.	POWER HOUSE :			
1.	Piling & Ground Improvement	1,3,4.	2,3,5,7.	6.
2.	Main Civil Construction	1,4,3.	1,2,3,5,7.	6.
3.	Circulating Water Ducts	1,4.	2,3,5,7.	6.
4.	Administration Building	1,4.	2,3,5,7.	6.
5.	General Service Building	1,4.	2,3,5,7.	6.
6.	Simulator Building	1,4.	2,3,5,7.	6.
7.	Steel Work & Cladding.	1,3,4,2,5	7.	6.
8.	S t a c k	1,2,3,4,5	7.	6.
9.	Storage Tank	1,2,3,4,5	2,3,5,7.	6.
10.	Ash Valley Development	1,4.	2,3,5,7.	6.
11.	Oil/Water Piping.	1,3,5.	7.	6.
IV.	SUBSTATION :			
1.	Substation Building	1,4.	2,3,5,7,	6.
2.	Switchyard	1,3,4.	2,3,5,7.	6.

L e g e n d :

1 - Design
2 - Full responsible
3 - Supervision
4 - Guidance
5 - Management & Coordinating
6 - Assisting
7 - Performer

Source: PLN (State Electricity Enterprise)

Table A.17. Domestic production of electric power equipment
Diesel engine

NUMBER	MANUFACTURER	LOCATION	PRODUCTION CAPACITY/ YEAR	SPECIFICATION
1.	PT. YANMAR DIESEL LTD	JAKARTA	35.000 units	(5 - 18) HP.
2.	PT. KUBOTA INDONESIA	SEMARANG	30.000 units	(4 - 18) HP.
3.	PT. TRI RATNA DIESEL		10.000 units	(5,5 - 18) HP.
4.	PT. BOMA BISNA INDRA	SURABAYA	8.000 units	(30,5 - 105) HP.
5.	PT. DESINDO ACUNG ENGINEERING WORKS	JAKARTA	5.064 units	(59 - 455) HP.
	T O T A L		88.064 units	

Source: Investment Coordinating Board (BKPM)

Table A.18. Domestic production of electric power equipment
KWH meter

NUMBER	MANUFACTURER	LOCATION	PRODUCTION CAPACITY/YEAR
1.	PT. MELCOINDA		200.000 units
2.	PT. FUJI DHARMA ELECTRIC Co Ltd.		200.000 units
3.	PT. MELTBELOSA		400.000 units
4.	PT. MONSANTO PAN ELECTRONICS		24.000 units
5.	PT. SIGMA TIRTA ENGINEERING		120.000 units

Source: BKPM (Investment Coordinating Board)

Table A.19. Domestic production of electric power equipment
Electric cable/conductor

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION
1.	PT. SUCACO	JAKARTA	NYM; NYA; NYY; NYFGbY; BCC; AAAC; AAC; ACSR; Enamelled wire and XLPE Insulated Power Cable.
2.	PT. KABELINDO MURNI	JAKARTA	NYA; NYM; NYY; NYFGbY; NYRGbY BCC;AAC;ACSR;Enamelled wire.
3.	PT. KABEL METAL INDONESIA	JAKARTA	NYA; NYM; NYY; NYFGbY; NYRGbY BCC; Twisted Cable.
4.	PT. TERANG KITA	CIMANGGIS BOGOR	NYA; NYAF; NYM; NYY; NYFGbY; NYRGbY; BCC; Twisted Cable and XLPE Insulated Power Cable.
5.	PT. INDOTRIJAYA INDUSTRIES	JAKARTA	NYA; NGA; NYM; NYY; AAC.
6.	PT. PUDJI TJAHAJA INDUSTRIAL CORP.	MEDAN	NYA; NYM; NYY.
7.	PT. NIKKATSU ELECTRIC WORKS	BANDUNG	NYA; NYM; NGA.
8.	CV. SINAR MERBASU	SURABAYA	NYA; NYM; NYY; BCC.
9.	PT. JEMBO CABLE COMPANY	TANGERANG	NYA; NYM; NYY; NYFGbY; BCC; NYAF; NYMHY; NYZ.
10.	PT. PULUNG COPPER	BOGOR	NYA; NYM; NYY; BCC.
11.	PT. VOKSEL ELECTRIC	JAKARTA	NYA; NYM; NYY; BCC.
12.	PT. JAYACO MURNI ABADI	JAKARTA	NYA; NYM; NYY.
13.	CV. KAWAT MAS	TANGERANG	NYA; NYM; NYY.
14.	PT. INKABEL JAYA	TANGERANG	NYA; NYM.

TOTAL ANNUAL PRODUCTION

1975	1976	1977	1978	1979
9.200 ton	9.500 ton	12.500 ton	15.720 ton	17.400 ton

1980	1981
19.140 ton	18.634 ton

Source: APPI
(The Electric Panel Manufacturer Association of Indonesia).

Table A.20. Domestic production of electric power equipment
Transformer

NUMBER	MANUFACTURER	LOCATION	PRODUCTION CAPACITY / YEAR	SPECIFICATION
1.	PT. U N I N D O	JAKARTA	10.000 units 5.000 units 20 units	1 Ø average 200 kVA 3 Ø average 35 kVA)* *) (8 - 1.600 kVA) Power Transformer (5 - 60) MVA/150 kV
2.	PT. BAMBANG JAYA	SURABAYA	1.000 units 2.000 units	average 90 kVA average 200 kVA
3.	PT. ASATA UTAMA	JAKARTA	2.000 units	
4.	PT. TRAFINDO PERKASA	TANGERANG	3.000 units	3 Ø (> 100 kVA)
5.	PT. MORAWA ELECTRIC	MEDAN	1.000 units	1 Ø 50 kVA 3 Ø 50 - 160 kVA
6.	PT. SINAR ELEKTRONIKA BARU	JAKARTA	4.000 units	550 kVA
7.	CV. E R K A		300 units	5 - 50 kVA
8.	PT. INTER KALIAREN ELECTRIC WORKS		7.500 units	
9.	PT. FIRST PURA JAYA TEKNIKA	JAKARTA	75 units	5 - 50 kVA

TOTAL ANNUAL PRODUCTION :

1978	1979	1980	1981
1400	1375	2331	3890

Source: APPI (The Electric Panel Manufacturer Association of Indonesia).

Table A.21. Domestic production of electric power equipment
Generator

NUMBER	MANUFACTURER	LOCATION	PRODUCTION CAPACITY/ YEAR	SPECIFICATION
1.	A VAN KATCH NEU - ISENBURG Gmbh & Co KG and Mr. PARYANTO	BANDUNG	720 u	(15 - 350) kW
2.	PT. IMORA MAKMUR	JAKARTA	-	
3.	PT. ELTAB INDONESIA	-	700 u	
4.	CV. E C H O	JAKARTA		
5.	PT. MEWAGE ENGINEERS	JAKARTA	2.500 u	
6.	PT. ADHIASA - SAKTI			
7.	PN. METRIKA		4.000 u	
8.	PT. UNGARAN MULTI ENGINEERING		1.500 u	(up to 15) kW
9.	PT. DENYO INDONESIA		13.650 u	(0,5 - 500 kVA
		T O T A L		

Source: APPI (The Electric Panel Manufacturer Association of Indonesia)

Table A.22. Domestic production of electric power equipment (excluding cable, transformer, diesel engine, KWH meter and generator)

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION	PRODUCTION CAPACITY PER YEAR
1.	PT. ALCO INDUSTRIES	JAKARTA	1. LAMP FIXTURE for indoor and outdoor use. 2. Electric Panel.	
2.	PT. AEG BINA	JAKARTA	1. LV & MV Electric Panel 2. Cable Lux 3. Current Transformer 4. Fuse Holder 5. Knife Switch	600 units 50 tonnes 20.000 units 150.000 units 50.000 units
3.	PT. GINI MEGAH	JAKARTA	1. Switch board Wallmounted 2. Switch board Free Standing 3. Panel Synchrone	200 units 100 units 20 units
4.	PT. MEGA ELTRA	JAKARTA	ELECTRIC PANEL	500 units
5.	PT. ICESA ENGINEERING	JAKARTA	1. LV Switchboard 2. MV Switchboard 3. Lighting Distribution Board.	3.000 units 100 units 5.000 units
6.	PT. INDUSTIRA	JAKARTA	1. LV & MV Panel, Busduct and Floorduct. 2. Lamp Fixture for indoor and outdoor use.	

Table A.22. Domestic production of electric power equipment (excluding cable, transformer, diesel engine, KWH meter and generator)
(continued)

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION	PRODUCTION CAPACITY PER YEAR
7.	PT. FIRST PURA JAYA TEHNIKA	JAKARTA	1. Electric Panel	1.200 units
			2. Transformer	300 units
			3. Bakelite Junction Box	180.000 units
			4. N.H. fuse puller	60.000 units
			5. Terminal Board	200.000 units
			6. Busbar holder	300.000 units
8.	PT. SIEMENS INDONESIA	JAKARTA	1. LV Panel	119 units
			2. MV Panel	465 units
			3. Generator Panel	59 units
			4. Busduct	16 units
9.	PT. SINAR ELEKTRONIKA SEB	JAKARTA	1. Step up/down Transformer	
			2. Panel	
			3. Voltage Stabilizer	
			4. Current Transformer	
10.	PT. TATA KOMPONIKA	JAKARTA	1. LV & MV Panel	
			2. Lamp Fixture	
			3. Transformer	
11.	PT. HAZEMEYER HOLEX INDONESIA	BOGOR	1. Electric Panel	
			2. Fuse Box	
			3. LV Air Break Switch	
			4. Isol moulded case CB	

Table A.22. Domestic production of electric power equipment (excluding cable, transformer, diesel engine, KWH meter and generator)
(continued)

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION	PRODUCTION CAPACITY PER YEAR
12.	PT. UNINDO	JAKARTA	1. CSP & non CSP Distribution Transformer (up to 1600 kVA/30kV)	15,000 units
			2. Power Transformer (up to 60 MVA/150 kV)	20 units
			3. MV Cubicle	
13.	PT. TWINK INDONESIA	CIMAHI	1. LARGE ELECTRIC PANEL	500 units
			2. SMAL ELECTRIC PANEL	10.000 units
			3. DISCONNECT SWITCH (up to 20 kV)	3,500 units
			4. FUSE BASE	15,000 units
14.	PT. DIAMOND SARANA ELEKTRIK	TANGERANG	1. CONDENSOR	614.800 units
			2. Fuse Cap 25 A/50 A	526.384 units
			3. Fuse Base 25 A/50 A	613.332 units
15.	PT. MESINDO AGUNG ENGINEERING	JAKARTA	1. Assembling Diesel Gen-Set	5.064 units
			2. Panel of Gen-Set	300 units
16.	PT. ASATA UTAMA ELECTRICAL	JAKARTA	1. Ballast (trafo TL)/Mercury (sodium) Rapid Start High Power Factor.	21.600.000 units
			2. Auto Trafo Single & Three Phase	100 000 units

Table A.22. Domestic production of electric power equipment (excluding cable, transformer, diesel engine, KWH meter and generator)
(continued)

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION	PRODUCTION CAPACITY PER YEAR
17.	PT. NIKKATSU ELECTRIC WORKS	BANDUNG	1. Ballast 2. Electric & Telecommunication cable 3. Step up/down Transformer 4. Slide Regulator.	
18.	PT. DENYO INDONESIA	BEKASI	1. AC GENERATOR (0,5 - 500kVA) 2. Welding Machine (100 - 600 A) 3. Air Compressor (0,5-20 M^3)	13.650 units 1.500 units 200 units
19.	PT. SIBALEC	JOGYAKARTA	LAMP	
20.	PT. OMESA PERKASA	SURABAYA	LV & MV Panel for indoor and outdoor use	700 units
21.	PT. JAYA TEKNIK INDONESIA	JAKARTA	1. LV Panel 2. Cable Tray & Trunking 3. AC Body Unit	
22.	PT. CAHAYA PELANGI ENGINEERING	JAKARTA	1. LV Electric Panel 2. MV Electric Panel 3. HV Electric Panel	
23.	PT. JAYA KENCANA	JAKARTA	ELECTRIC PANEL	
24.	PT. KENCANA SAKTI	JAKARTA	STEEL POLE	

Table A.22. Domestic production of electric power equipment (excluding cable, transformer, diesel engine, KWH meter and generator)
(continued)

NUMBER	MANUFACTURER	LOCATION	TYPE OF PRODUCTION	PRODUCTION CAPACITY PER YEAR
25.	PT. 3 M INDONESIA	BEKASI	1. Electrical Tape LV & MV 2. Springlok, Connector 3. Accessories of cable for jointing and Terminating (up to 35 kV)	
26.	PT. WIJAYA KARYA	SURABAYA,BOYOLALI PURWOKERTO,CIREBON, CIBINONG.	CONCRETEPOLE	
27.	PT. MEGA CONCRETE	SEMARANG	CONCRETEPOLE	
28.	PT. TONGGAK AMPUH	CIBINONG	CONCRETEPOLE	
29.	PT. KOMBET INDONESIA	JATILUHUR	CONCRETEPOLE	
30.	PT. HUME SAKTI	SURABAYA,JAKARTA	CONCRETEPOLE	
31.	PT. FAJAR ELECTRIC WORKS	JAKARTA	FUSE BOX & SWITCH	
32.	PT. BROCO	MEDAN	FUSE BOX & SWITCH	

Source : APPI (The Electric Panel Manufacturer Association of Indonesia)

Table A.23. Domestic production of non-electric energy equipment

No.	Equipment	Company	Production on capacity per year	Specification
1	2	3	4	5
I	E N G I N E			
	Diesel :			
	- Below 30 HP	1. PT. Yanmar Diesel 2. PT. Kubota Indonesia 3. PT. Tri Ratna Diesel 4. CV. Wira Mustika Indah	90.000 Unit	
	- Above 30 HP	1. PT. B.B.I. 2. PT. Mesindo Agung	11.000 Unit 5.000 Unit	Up to 500 HP ; 600 up to 1500 RPM Up to 1000 HP; 1500 RPM
II	P U M P			
	- Water pump	1. PT. New Ruhaak 2. PT. Ebara 3. PT. Karya Hidup Sentosa 4. PT. B.B.I. 5. PT. Dwika 6. PT. Martani 7. PT. Aneka Pompa	28.000 Unit	

Table A.23. Domestic production of non-electric energy equipment (continued)

1	2	3	4	5
III	PIPING & VESSEL			
1.	- Water pipe - Gas pipe - Oil pipe	1. PT.K.H.I. 2. PT. Bakrie Tube Makers 3. PT. Bakrie Pipe Industry 4. PT. Spindo 5. PT. ISTW 6. PT. Aneka Jakarta 7. PT. Ahli Teknik 8. PT. Johan Trading 9. PT. Inastu 10. e.t.c.	336.500 Ton	14-80 inc,API, ASTM, JIS, DIN, DSS, Thicknes : 3-19 mm Ø 1,5 - 6 Inc, SII Ø 4" - 16
2.	- Valve	1. PT. Boma Stork 2. PT. Automotive Accessories Indonesia 3. Representation of FMC Company	by ordered	3000 up to 10.000 PSI - under process
3.	Vessel - Pressure and Unpressure vessel	1. PT. Barata Indonesia 2. PT. Boma Stork 3. PT. Atmindo 4. PT. Super Andalas Steel 5. PT. Hari Subur 6. PT. Sumatera Raya Sari 7. PT. Mc Dermott 8. PT. Avlau 9. e.t.c.	13.000 Ton	Pressure : below 70 kg/cm2

Source : THE MINISTRY OF INDUSTRY