JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF TRADE, DIRECTORATE OF METROLOGY
REPUBLIC OF INDONESIA

THE STUDY
ON
THE DEVELOPMENT OF LEGAL METROLOGY SYSTEM
IN
THE REPUBLIC OF INDONESIA
(SUMMARY)

NOVEMBER, 1994

JAPAN QUALITY ASSURANCE ORGANIZATION

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PREFACE

In response to the request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a study on the Development of Legal Metrology System in the Republic of Indonesia and entrusted the Study to the Japan International cooperation Agency (JICA).

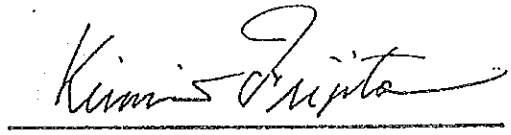
JICA sent to the Republic of Indonesia a study team headed by Mr. Ryuichi Sasaki of Japan Quality Assurance Organization, three times between August 1993 and September 1994.

The team held discussions with the officials concerned of the Indonesian Government, and conducted field surveys at the study area. After the team returned to Japan, Further studies were made ad the report was prepared.

I do hope that this report will contribute to the promotion of the program ad enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Indonesian Government for their close cooperation extended to the team.

October 1994

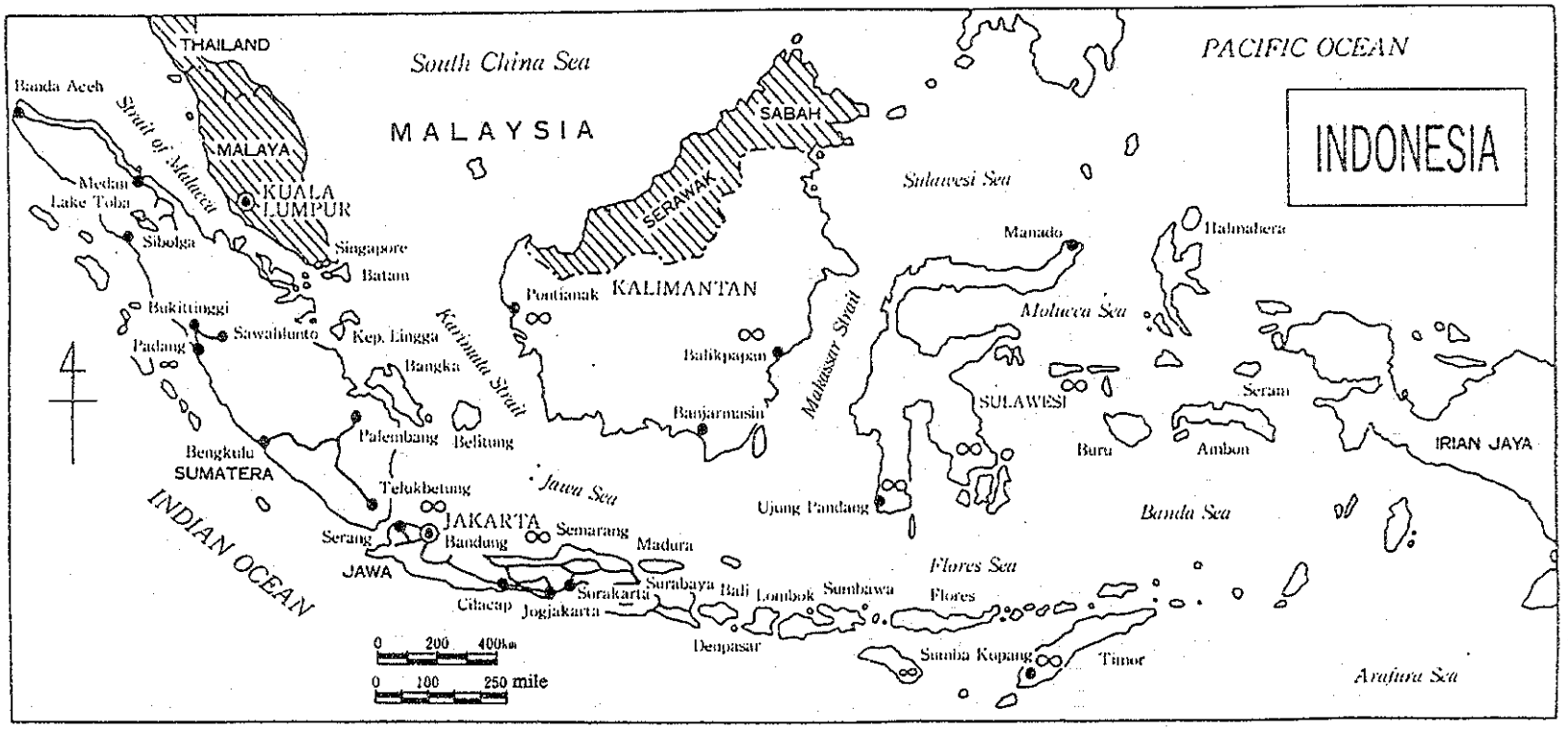


Kimiro Fujita

President

Japan International Cooperation Agency

Indonesia Location Map



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LIST OF ABBREVIATIONS

ANSI	American National Standards Institute
APMP	Asia Pacific Metrology Programme
ASEAN	Association of Southeast Asian Nations
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Board, Indonesia)
BKPM	Badan Koordinasi Penanaman Molal (Investment Coordinating Board)
BPS	Biro Pusat Statistik (Central Bureau of Statistics)
B. I	Bank Indonesia
DOA	Department of Agriculture, Indonesia
DOM	Directorate of Metrology, Department of Trade, Indonesia
DOMA	Department of Manpower Affairs, Indonesia
DOM & E	Department of Mining & Energy, Indonesia
DOF	Department of Forestry, Indonesia
DOH	Department of Health, Indonesia
DOI	Department of Industry, Indonesia
DOPW	Department of Public Works, Indonesia
DOT	Department of Trade, Indonesia
DSN	Dewan Standardisasi, Nasional (Standardization Council of Indonesia)
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
ILAC	International Laboratory Accreditation Conference
ISO	International Organization for Standardization
JETRO	Japan External Trade Organization
JIS	Japan Industry Standards
JNK	Jaringan Nasional Kalibrasi (National Calibration Natwork)

MOI	Ministry of Industry, Indonesia
NDIO	National Development Information Office, Indonesia Instrumentation and Metrology-Indonesia Institute of Science
NIEs	Newly Industrializing Economies
OIML	International Organization of Legal Metrology
PDAM	Regional Company of Water Supply
PLN	Perusahaan Listrik Negara (Regional Company of Electric Supply)
PUSLITBANG KIM-LIPI	Pusat Penelitian dan Pengembangan Kalibrasi Instrumentasi Metrologi—Lembaga Ilmu Pengetahuan Indonesia (Research and Development Center for Calibration, Instrumentation and Metrology Indonesian Institute of Science)
SLI	Standar Listrik Indonesia (Indonesia Electric Standards)

FOREWORD

The present report compiles the findings of the Study for the Legal Metrology Promotion Programme in the Republic of Indonesia (the Study) conducted by the Japan International Cooperation Agency (JICA) at the request of the Government of Indonesia (Department of Trade) to prepare a master plan for the development of the legal metrology system in the Republic of Indonesia.

In conducting the Study and preparing the report, a series of close consultations took place with the DOM, the Indonesian counterpart for the Study, in terms of the study procedure and schedule and the Study was conducted with the full cooperation of Indonesian government organizations, including the DOM, Department of Trade, Department of Industry, BAPPENAS and KIM-LIPI.

The scope of the Study was not limited to the legal metrology system but included related fields which are essential parts of the system's development. The study items were largely classified into the following 5 categories.

(1) Economy and Industry

(2) Legal Metrology (Legal Regulations on Metrology)

(3) National Metrological Standards

(4) Verification System and Its Conditions

(5) Industrial Metrology System and Traceability System

Field surveys were conducted between August 25 and September 29, 1993 and between February 9 and March 1, 1994. In addition, the draft final report was explained to the Indonesian side between September 11 and September 22, 1994.

In principle, the field surveys involved direct visits to the DOM, local verification laboratories controlled by the local offices of the Department of Trade, other government agencies, universities, private enterprises and factories, etc. The surveys were conducted in more than 10 cities in addition to Jakarta and Bandung, the two cities in which the main work was conducted. With the cooperation of the DOM, a questionnaire was sent to those local verification laboratories which the survey team was unable to visit to ensure the maximum gathering of relevant information and data.

Despite such problems as a shortage of statistical data and the lack of a verification equipment register, etc., the field surveys progressed well. The successful presentation of a master plan based on the current conditions of the legal metrology system in Indonesia in the report would not have been possible without the active assistance and work of all the people related to the Study. We would particularly like to express our gratitude to those listed below.

Mr. G. M. Putera	DOM Director
H.M. Hamin Ruba'i, SH	DOM Head of Sub Directorate of Metorological Facilities
Mr. Hari Prawoko	
Mr. Oke Nurwan	
Mr. Cecep Mufti	
Mr. Timan	

The names of the Japanese Study Team members are also listed below for convenience in the case of any future enquiry regarding the report.

Mr. Ryuichi Sasaki	Team Leader	Japan Quality Assurance Organization (JQA)
Mr. Shuichi Watanabe	Physical Quantities (A)	Nagano Seisakusho, Ltd.
Mr. Kazutoshi Shinnou	Physical Quantities (A)	Nagano Seisakusho, Ltd.
Mr. Makoto Katayama	Physical Quantities (B)	JQA
Mr. Takashi Sugiyama	Electrical Quantities (A)	JQA
Mr. Toru Higuchi	Electrical Quantities (A)	JQA
Mr. Kiyohide Yonesu	Electrical Quantities (B)	Japan Electric Meter Inspection Corporation
Mr. Hiroshi Nakatsuka	Industrial Metrology (A)	JQA
Mr. Izumi Sakaya	Industrial Metrology (B)	Engineering Consulting Firms' Association
Mr. Tsutomu Matsuno	General Coordination	JQA
Mr. Shin Kojima	General Coordination	JQA

CHAPTER 1

BACKGROUND AND OBJECTIVE OF THE STUDY

CHAPTER 1

BACKGROUND AND OBJECTIVE OF THE STUDY

1.1 Background of the Study

The Republic of Indonesia has witnessed the rapid development of commercial and industrial activities and is now finding it urgently necessary to improve and consolidate the areas listed below to modernise the institutional arrangements for metrology and measurement and the verification and calibration service facilities, all of which comprise the vital base for the development of commerce and industry. Modernisation is also required to upgrade Indonesia's metrology system to the international level.

(1) Inspection and verification system based on the measurement law

(2) Training facilities to upgrade metrological inspectors and researchers

(3) Facilities of the central metrological research institute and local verification laboratories

Under these circumstances, the Government of Indonesia requested the Government of Japan to conduct a development study on the above. In response to this request, JICA sent the Project Finding Team to Indonesia in May, 1992 which subsequently concluded through consultations with the Indonesian side that it would be necessary to improve and consolidate the manpower, research ability and measuring instruments in the field of measurement in general and legal metrology in particular in Indonesia. Following this conclusion, a formal request for the development study for the present Study was made by the Government of Indonesia and the Fact Finding Team and Preliminary Study Team were sent to Indonesia in January, 1993 and March, 1993 respectively. During the field survey in the latter period, the Scope of Work for the Study was discussed and signed by both the Japanese and Indonesian sides.

1.2 Objective of the Study

The objective of the Study is the preparation of a feasible, concrete plan (master plan) to consolidate the functions of the legal metrology system in Indonesia.

1.3 Scope and Subjects of the Study

The industrial demand for consolidation of the metrological administration in Indonesia is increasing. In fact, the REPELITA V incorporates domestic trade policies designed to gradually implement various projects with the following objectives.

(1) Stabilisation of the domestic market

(2) Improvement of the competitiveness of domestic products

(3) Promotion of further market transparency

(4) Research and development of Indonesia's trade capability

(5) Provision of appropriate guidance on business activities, including marketing, and consumer protection

(6) Development of the trade infrastructure

(7) Support for improvement of the conditions of the export infrastructure

In the field of metrology, the REPELITA V calls for a qualitative improvement of the functions of metrological offices. The Study for the Legal Metrology Promotion Programme in the Republic of Indonesia intends to clarify the current conditions of the subject issues while requesting the full cooperation of the Government of Indonesia for the gathering of information and data relating to the Study itself, the REPELITA VI (fiscal 1994/1995 - fiscal 1998/1999) and the plans/programmes of government departments and agencies related to the REPELITA VI. The objective of the Study is to prepare a master plan to promote and enforce an appropriate legal metrology system centering on the DOM as described in the Scope of Work. As the Scope of Work refers to the necessity to include a staff training plan and a facility/equipment upgrading plan in the master plan to be prepared, the following scope and subjects of the Study have been adopted.

(1) Current conditions of commercial and industrial activities and the relevant administrative policies/measures, including development plans/projects

(2) Legal regulations relating to legal metrology

(3) Related legal regulations and conditions of commercial metrology (verification system)

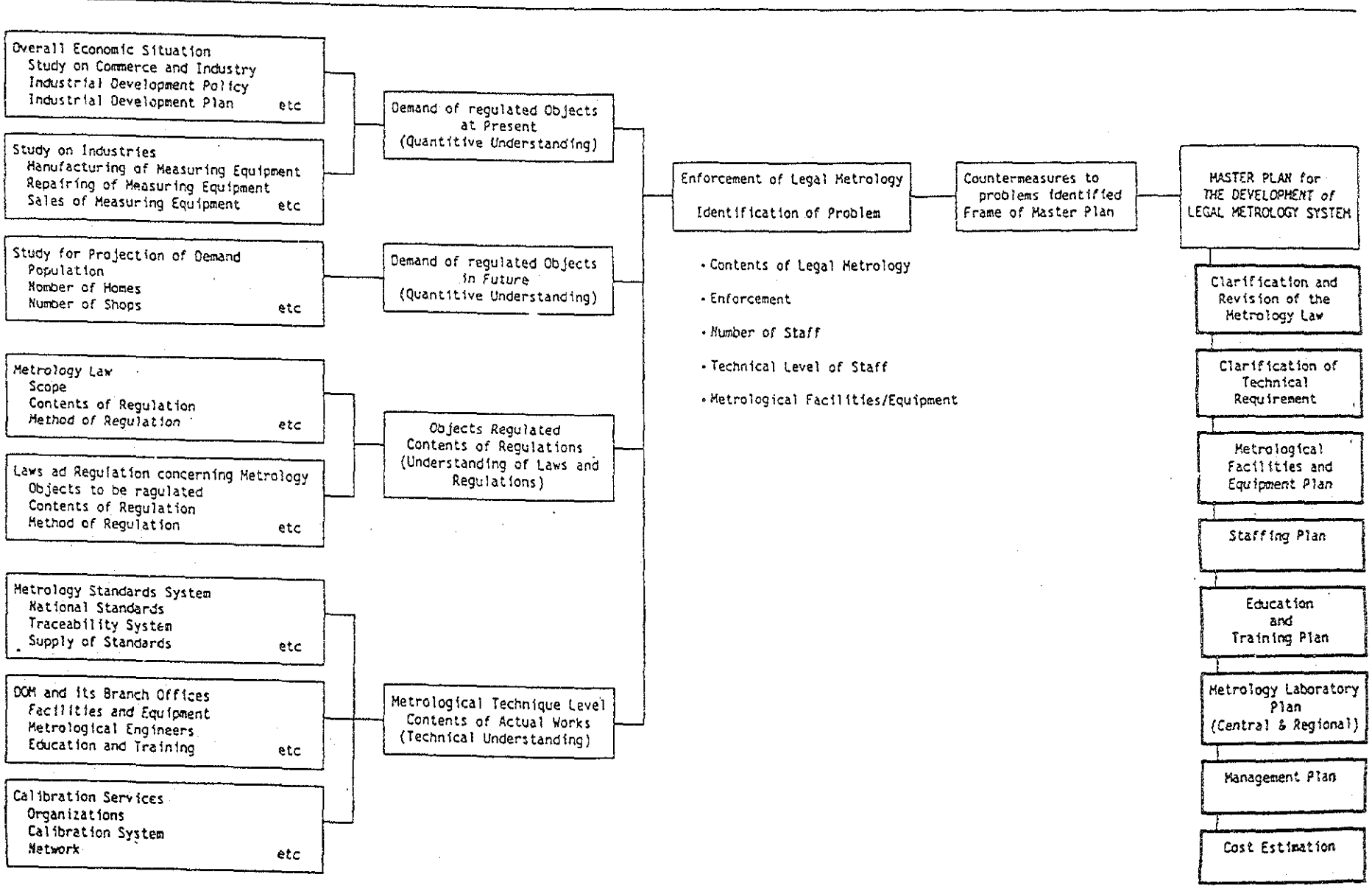
(4) National standards and the traceability system

(5) Industrial metrology (including the provision of a calibration service)

(6) Current conditions and future plan of the DOM

(7) Related issues

FLOWCHART OF THE STUDY



CHAPTER 2

CURRENT SOCIAL AND ECONOMIC CONDITIONS AND DEVELOPMENT PLANS IN INDONESIA

CHAPTER 2

CURRENT SOCIAL AND ECONOMIC CONDITIONS AND DEVELOPMENT PLANS IN INDONESIA

2.1 Current Social and Economic Conditions and Industrial Development Tasks

2.1.1 Country Data on Indonesia

(1) Land and Geography

1) Land

Indonesia is an island country consisting of as many as around 17,500 islands. It stretches from Southern Thailand on the Malay Peninsula to the northeastern part of Australia. Lying across the equator, it stretches more than 5,000km in the east-west direction and more than 1,700km in the north-south direction. It has a total land area of approximately 1.91 million km^2 and is 5.19 times larger than Japan. Indonesia is divided into 27 provinces and special districts. The locations of the provincial capitals are given in Table 2-1.

2) Geography

More than half of Indonesia's national land is covered by forests and the land is characterised by widely distributed volcanic mountain ranges. Some of the mountains in Sumatera and Irian Jaya are more than 3,000m high.

3) Climate

Indonesia has distinctive rainy and dry seasons and a tropical climate with high temperatures and high humidity is dominant throughout the country.

(2) Population

The official population census in 1990 put the population of Indonesia at 179 million, ranking 4th in the world after China, India and the US. The population is overwhelmingly concentrated on such fertile islands as Java, Madura and Bali where the population density is more than 1,000/km^2.

The subject population for the period between REPELITA V and REPELITA X is estimated to be as follows.

REPELITA V	:	189.1 million
REPELITA VI	:	204.4 million
REPELITA VII	:	219.4 million
REPELITA VIII	:	233.6 million
REPELITA IX	:	246.5 million
REPELITA X	:	258.1 million

REPELITA VI hopes to create 11.9 million new jobs to achieve average annual economic growth of 6.2% and expects the agricultural sector, industrial sector and other sectors to provide 1.9 million, 3 million and 7 million new jobs respectively. This massive increase of new employment is essential to achieve another target of REPELITA VI, i.e. decrease of the unemployment rate from the current 3.2% to 0.8% at the end of the plan period.

2.1.2 Outline of Economy

(1) Economic Growth and Industrial Structure

While the Indonesian economy achieved high annual growth of nearly 8% in the 1970's based on stable oil revenues, the annual growth rate has failed to improve since the late 1980's because of the decrease in oil revenues, in turn caused by low oil prices. Oil and natural gas revenues formerly accounted for 60% of the national revenue and 80% of the export earnings. Realising that such excessive dependence on oil revenues was unhealthy for the country's management, the Indonesian government tried to diversify industries. Review of the national projects became a priority policy in 1982 and new economic policies were adopted with such active structural reforms as the liberalisation of finance, taxation reform and the deregulation of imports.

There was a steady increase of both domestic and foreign investment between 1988 and 1990 and exports of non-oil, non-gas products continued to increase, improving Indonesia's economic strength and stimulating domestic consumption to achieve an annual economic growth rate of 7.4% in fiscal 1989. This favourable economic growth, however, was accompanied by accelerated inflation in 1990 which forced the government to adopt a tight monetary policy.

Exports declined in 1991 compared to 1990 because of the Gulf War and the continued tight monetary policy, showing uncertainty in the future.

Suharto was elected president for the sixth successive time in 1993. The new Suharto administration expressed its intention to achieve economic growth by guiding investment towards industrial development to absorb the large rural working population in the industrial sector while also aiming at curbing inflation, improving the international balance of payments and improving the poor infrastructure, including an inadequate power supply. Table 2-2 shows Indonesia's main economic indices.

The Indonesian economy has been maintaining healthy export growth since 1993 with an expected growth rate of 6.5% for fiscal 1993 and investment is said to be recovering due to the relaxation of the tight monetary policy from the middle of the year. Under these conditions, however, there is concern regarding the acceleration of inflation. Table 2-3 shows the GDP growth rate and rate of inflation from 1992 to 1994.

The annual export growth rate is expected to achieve a further 3% to 15% in fiscal 1994 with continuation of the favourable export performance of non-oil, non-gas products, reflecting the economic recovery of industrialised countries. Government consumption is not expected to record a higher growth rate than the 6% expected for fiscal 1993 although public servants will be awarded another pay increase during the year. Investment is expected to increase to 4.8% as a direct consequence of the relaxation of the inward direct investment regulations in October, 1993. With the expansion of the economy, private consumption is forecast to increase by 4.2%. Imports are also expected to increase by 8.9% with intermediate and capital goods comprising the core items due to the favourable exports and recovery of investment. In all, the expected economic growth rate for fiscal 1994 of 7.1% is relatively high while general prices are expected to increase by 9.7% due to the expansion of the economy and trend of easy money.

Table 2-4 shows the industrial structure at the end of REPELITA V. By the end of REPELITA VI, the respective share of each sector will change from 20.2% to 17.6% for agriculture, from 12.1% to 10% for mining and from 20.8% to 24.1% for the industrial sector. Detailed analysis of changes in the industrial sector reveals that the share of the non-oil, non-gas sector will increase from 17.6% to 21.3% at the expense of the oil and natural gas sector, the share of

which will drop from 3.2% to 2.8%. The share of the construction sector will slightly increase from 6.4% to 7% while the share of the commerce sector will also increase from 17.1% to 17.5%. The combined share of the telecommunications sector and transport sector will increase from 5.9% to 6.4%. The GDP output share of the oil and natural gas sector will suffer a substantial decline from 12.6% to 9.8% with the non-oil, non-gas sector accounting for 90.2% compared to the previous 87.4%.

(2) International Balance of Payments and Trade

Reduction of the current account deficit has been an important item on the agenda of economic development planners in Indonesia for a long time. With the change of the basic policy orientation, exports of non-oil, non-gas products favourably increased to reduce the deficit in the second part of the 1980's. Nevertheless, increased imports have pushed up and kept the deficit amount at a high level in the 1990's. While the external borrowing of both the central government and private sector dropped in 1992, the present level of borrowing still justifies further restraint. The increased earnings of non-oil, non-gas product exports have been offset by the increased imports with the end result of a slight increase of the trade deficit. As the current deficit amount can be controlled, it is important to prevent any increase of the deficit and to maintain its size within 2% of the GDP. To achieve this target, the export growth of non-oil, non-gas products should be encouraged and the level of external borrowing should be restrained while overcoming the adverse effects of the recent oil price decline. The current targets are to lower the ratio of the remaining external debt vis-a-vis the GDP from 57% at the end of REPELITA V to 46% at the end of REPELITA VI and to also lower the DSR (debt service ratio) from 32% to 20% during the same period.

As Table 2-10 shows, the trade balance for fiscal 1994 is expected to show a surplus of 8,822 million US$ based on the high growth rate of 16.3% for non-oil, non-gas product exports although the export earnings of oil are expected to decrease by 4.9% on fiscal 1993. The import value will increase by 14.6% because of the economic recovery and the surge of exports of non-oil, non-gas products. The current account deficit will, however, worsen from 2,820 million US$ in fiscal 1993 to 3,190 million US$ due to the poor performance of the service account.

The standing external debt of the Indonesian government as of December, 1992 is some 48.76 billion US$, most of which consists of loans from the IGGI composed of industrialised countries, international financial organizations and the CGI (renamed IGGI). The government spent 15.09 trillion Rp in fiscal 1992 to repay both interest and principal. The total repayment amount in fiscal 1993 is expected to be 16.71 trillion Rp (approximately 8.15 billion US$). The standing external debt at the end of 1993 jumped up to 73.36 billion US$.

(3) *Regional Characteristics of Economy*

The GRDP (gross regional domestic product) in Indonesia is the largest for Java Island which accounts for approximately 55% (89 trillion Rp) of Indonesia's total GDP. Jakarta, which has a population of some 8 million, produces 18.4 trillion Rp alone, indicating the enormous economic gap between Java Island and other regions. The following classification is based on the characteristics and industrial structure of each region.

a. Java: densely populated area

- Population density of more than 500 persons/km^2
- GRDP of 400,000 Rp/km^2
- Well developed agriculture (rice cultivation)
- Well developed manufacturing industry
- Good infrastructure
- Good level of social services and industrial conditions
- GRDP per capita of 600,000-800,000 Rp

b. Sumatera: large plantation area

- Population density of 70-100 persons/km^2
- GRDP of 50,000-130,000 Rp/km^2
- Plantation dominated agriculture
- GRDP per capita of 500,000-900,000 Rp
- Relatively good infrastructure

c. Sumatera: oil field area

- Population density of 50-60 persons/km^2

- GRDP of 720,000 Rp/km^2 excluding oil and natural gas outputs
- GRDP of 890,000 Rp/km^2 in South Sumatera
- Natural resources, mainly oil, providing good income sources

d. Sulawesi/Nusa Tenggara: self-sufficient agricultural area
   - Population density of 50-80 persons/km^2
   - Extremely low GRDP/km^2 (approximately one-tenth and one-fifth of that of the Java and Sumatera plantation area respectively)
   - Very low level of all economic indicators

e. Kalimantan/Irian Jaya: undeveloped area
   - Sparse population with a population density of 25 persons/km^2
   - Small GRDP of 40,000-180,000 Rp/km^2
   - Undeveloped in every sense

Table 2-6 shows the industrial conditions and development possibility of each region.

2.2 Official Medium-Term Economic Development Plans and Their Tasks

2.2.1 Priority Programmes and Results of REPELITA V

(1) Outline and Targets of REPELITA V

Since it was first inaugurated in March, 1968, the Suharto administration has been implementing a series of national development plans (REPELITA). REPELITA I (from 1969/70 to 1973/74), formulated on the basis of the PJP I, was the first of these national development plans and REPELITA V is now approaching the end of its period.

The development target of REPELITA V is increased exports by the non-oil, non-gas sector which is a drastic switch of priority from oil and natural gas exports designed to change Indonesia's industrial structure. The private sector is expected to finance most of the necessary investment in the non-oil, non-gas sector. Particular emphasis is given to investment in the manufacturing sector with a target average growth rate of 8.5%/year being adopted for this sector.

The successful outcome of the policy to change from development led by the oil and natural gas sector to development led by the non-oil, non-gas sector is considered essential to achieve the stable growth of the Indonesian economy in the coming years. As the national economy currently lacks sufficient purchasing power to achieve economic growth through increased domestic demand, increase of the exports of the non-oil, non-gas sector is extremely important.

REPELITA V sets an average annual economic growth rate goal of 5%. The provisional figures so far based on the calender year are 7.5% for 1989, 7.4% for 1990, 6.2% for 1991 and 5.8% for 1992. The original estimate for fiscal 1993 is above 6%.

(2) Results

The economic growth rate under REPELITA V in the 4 years upto 1992 maintained a very high level. The GDP growth rate for 1992 was 6.3% while the average rate for the 4 years was 7% which was well above the target rate. This rapid growth has inevitably resulted in changes of the economic structure and the creation of a basis for the future economy and the public are benefiting from this economic development in the form of increased employment and increased income, etc.

Careful analysis of the results of the individual policies which have been implemented reveals that there has been active investment due to deregulation and administrative reform. The finalised investment amount upto fiscal 1992 already exceeds the target amount for the entire REPELITA V period. Such vigorous investment has, in fact, overheated the economy, pushing up interest rates and accelerating inflation. The tight monetary policy adopted by the government, however, has successfully cooled down economic activities to a more acceptable level. Ordinary revenue showed a marked increase from 23 trillion Rp in fiscal 1988, the final year of REPELITA IV, to 47.5 trillion Rp in fiscal 1992. Government savings increased by approximately 8 times in the same period to 13.4 trillion Rp in fiscal 1992. The foreign currency reserves remained healthy and stable at 12 billion US$ in fiscal 1992, equivalent to 5.5 months of the export value. The current account deficit in fiscal 1992 was drastically reduced to 2.9 billion US$ from 4.4 billion US$ the previous year. The export value is also said to have increased by 15.5% in fiscal 1992 due to the substantial export increase of the non-oil, non-gas sector.

2.2.2 Priority Programmes and Targets of REPELITA VI

(1) Outline of REPELITA VI

The PJP II which commences in April, 1994 aims at achieving an average annual economic growth rate of approximately 6.2% and at increasing the GDP per capita to 1,000 US$ in 5 years. The 2nd 25 Year Long-Term Plan which commences at the same time anticipates an average annual growth rate of 7% to quadruple the current GDP per capita to overtake Asian NIEs.

(2) Targets

REPELITA VI aims at achieving an average annual economic growth rate of 6.2% throughout the plan period with the actual rate varying from 5% to 6.5% depending on the year. By sector, agriculture is expected to achieve an average annual growth rate of just under 3.5%. The expected annual growth rate for the manufacturing sector is 9% with the non-oil, non-gas sector and service sector achieving an annual growth rate of 10% and 6.5% respectively. If these targets are successfully achieved, it is estimated that the GDP per capita at the end of the REPELITA VI period will exceed the 1,000 US$ level.

(3) Improved Economic Efficiency

REPELITA VI emphasises improved economic efficiency as a condition to achieve a growth rate of 6.2%. The expected contribution ratio by production element throughout the plan period is expected to decline in the case of capital and labour but to increase in the case of productivity, suggesting a future economic structure where the production output will increase despite proportionally less input of capital and labour.

(4) Required Investment Amount

As shown in Table 2-7, total investment of 660 trillion Rp in both the public and private sectors is expected during the plan period of 5 years.

In terms of the funding sources, as the domestic savings growth rate is expected to overshadow the investment growth rate during the REPELITA VI period, the balance between savings and investment will improve with the end result of a declining dependence on external funding to meet the domestic investment demand.

(5) Fiscal Balance

In regard to the fiscal balance, tax revenues are expected to achieve a high annual growth rate of 17.5% following the good performance during the REPELITA V period. The share of tax revenues in the domestic revenue will increase from 64.5% in fiscal 1993 to 77.8% in the final year of the plan period. The tax revenue size vis-a-vis the GDP of the non-oil, non-gas sector will also increase from 12.5% in fiscal 1993 to 15.6% at the end of the plan period and approaching the level of such neighbouring countries as Malaysia and Thailand. Consequently, the size of government savings, which is the domestic revenue minus current expenditure, will continue to increase and the government savings are expected to pay for 67.7% of the development expenditure at the end of the plan period, a positive increase from the 62.1% in fiscal 1993.

(6) External Balance of Payments

In regard to the external balance of payments, REPELITA VI anticipates an average annual growth rate of some 16.8% (dollar base) for exports throughout the plan period, led by the non-oil, non-gas sector as in the case under REPELITA V (see Table 2-8). The non-oil, non-gas sector's export value in the overall exports is expected to further increase from 75.9% in fiscal 1993 to 87.0% at the end of the plan period. The expected relatively low investment growth shown in Table 2-8 which is lower than that of the REPELITA V period will suppress the import value while improving the current balance. The ratio of the current account deficit in the GDP will decrease from 1.9% in fiscal 1993 to 1.3% at the end of the plan period. The foreign currency reserve level is expected to be constant throughout the plan period and will be equivalent to 5 months of the import value.

2.2.3 Macroeconomic Framework for PJP II (April, 1994 - March, 2019)

(1) Income Level

The PJP II intends to almost quadruple the real GDP per capita (base year: 1989) from the current 676 US$ to 2,631 US$ in 25 years. This target level has been set to ensure sustainable growth while taking the present income level of neighbouring Malaysia (approximately 2,000 US$) into consideration.

(2) Economic Growth

As Table 2-9 shows, the PJP II intends to achieve an average annual economic growth rate of some 7% throughout the plan period of 25 years with the actual yearly rate gradually increasing from 6.2% during the REPELITA VI period to 8.7% during the REPELITA X period. An annual growth rate of some 7% means doubling of the GDP in 10 years. As the average annual growth rate for the last 25 years has been in the 6% bracket, the planned growth of 7% for the next 25 years is the basis which quantitatively underpins the take-off of the Indonesian economy as planned by the PJP II.

(3) Growth by Sector

The envisaged economic growth will mainly be led by the manufacturing sector. As Table 2-9 shows, the target annual growth rate of the manufacturing sector throughout the plan period is just above 9% which is substantially higher than the 3.5% planned for the agricultural sector. Assuming the successful achievement of the planned growth for each sector, the output of the manufacturing sector will be more than 30% of the GDP at the end of the plan period, achieving a high level of industrialisation rivalling the current level of such Asian NIEs as South Korea (29% in 1990) and Taiwan (34% in 1990).

(4) Workforce

The annual increase ratio of the working population is expected to gradually decline during the PJP II period in line with the decrease of the annual population growth rate (from 1.51% under REPELITA VI to 0.88% under REPELITA X) although the absolute number of the working population will increase by some 69.1 million.

The PJP II plans to absorb this increased working population mainly in the service and manufacturing sectors to reduce the unemployment rate. A big problem will be how to secure employment opportunities for the inadequately employed (those working less than 35 hours/week) who account for 38% of the present employed population.

(5) Fair Distribution

In addition to the basic objective of improving human resources, the PJP II gives priority to the eradication of poverty, the fostering of small businesses and the modernisation of agriculture, all of which will contribute to correcting the

income gap between workers in different sectors. The plan also emphasises the correction of the regional gap through the provision of special development support for the eastern regions and other poor regions. The plan recognises the limitations of an approach which tries to establish quantitative targets for development using such economic indices as the income level and, therefore, stresses on the improvement of such social indices as the infant mortality rate, the mortality rate of pregnant women and the school enrolment rate, etc.

2.3 Current Conditions of and Future Programme for Commerce and Industry

2.3.1 Commerce

(1) Current Conditions

Little data is available to clearly indicate the share of the commerce sector in Indonesia's economy. Although large department stores and modern shopping centres stand side by side in large cities, only a limited number of official statistics on their turnover and profit, etc. are available. In the case of much smaller shops and stalls, sufficient reliable data does not exist. The commerce-related data issued by the Central Bureau of Statistics is the only data on employment and the value-added amount of wholesalers and retailers as part of the national and regional income statistics.

Table 2-10 shows the real growth rate and share of the commerce sector (trade, hotels and restaurants) in the GDP and employment. Both its share in the GNP and employment have been virtually constant since 1988 at around 16% for the former and 15% for the latter.

(2) REPELITA VI

The target annual growth rate for the commerce sector is set at 6.6% during the REPELITA VI period (1994-1999) which is higher than the target GDP growth rate of 6.2%/year but which is lower than the estimated real growth of 7.1% during the REPELITA V period, suggesting a conservative approach by the planner. REPELITA VI also sets a target combined growth rate for the commerce sector and transport sector for each region. A high annual growth rate of more than 10% is predicted for 3 regions, i.e. North Sumatera, Lampung and West Kalimantan (Table 2-11). The document lists the following 8 priority issues for REPELITA VI.

① Market expansion

② Diffusion of information on the domestic market

③ Improvement of the distribution channels

④ Establishment of orderly trade practices

⑤ Consumer protection

⑥ Support for the independence of small traders, informal traders and those handling traditional items

⑦ Qualitative improvement of the commercial facilities and infrastructure with care for the environment

⑧ Vitalisation of the market mechanism

Metrology is referred to under the header of consumer protection. The development of the metrological system and the quantitative and qualitative consolidation of the equipment, facilities and manpower are planned by means of reviewing and improving the existing metrology law and related regulations and expanding the functions of organizations related to legal metrology. An action programme on metrology will be implemented in fiscal 1994 with an estimated budget of slightly more than 2.3 billion Rp.

2.3.2 Industry

(1) History of Industrialisation

Indonesia's stable economic growth since the mid-1980's has mainly been brought about by the industrial sector, particularly the progress of industrialisation culminating in the high export growth of the non-oil, non-gas sector. The growth rate of the industrial sector has always been higher than the growth rate of the general economy, underlining the large contribution by the industrial sector to the development of the Indonesian economy. While the growth of the Indonesian economy was mainly based on import substitution in the period between the late 1960's and early 1980's, export promotion came to the forefront in the mid-1980's. This change of strategy was necessitated by the decline of the oil price and the worsening market conditions for primary products in the midst of a global recession which commenced in 1982. Faced with unprecedented economic difficulties, the Indonesian government looked to the promotion of exports by the industrial sector to reduce the dependence on oil and introduced a series of measures, including relaxation of the import

regulations, financial reform and devaluation, etc., all of which were designed to directly or indirectly promote exports. The successful outcome of these measures was observed with the steady export growth of industrial products in terms of both quantity and variety. The export value of non-oil, non-gas products exceeded the export value of oil and natural gas for the first time in 14 years in 1987 as the incremental portion of the total export value on the previous year was practically dominated by industrial products. The current main export items are plywood, textile products, rubber, timber, aluminium, nickel sheeting, tin, processed food and palm oil.

(2) National Development Plans

REPELITA V initially adopted the following 6 key targets for its industrialisation policy.

① Fostering of export-oriented industries

② Strengthening of the linkage between different industries

③ Employment creation through the encouragement of small-scale industries

④ Promotion of an agricultural product processing industry

⑤ Upgrading and wide diffusion of technologies

⑥ Implementation of various measures to assist industrial development

REPELITA V was formulated in 1988/89 when various deregulation measures were earnestly being implemented and at a time when a rapid export increase of non-oil, non-gas products, led by the manufacturing sector, was seen. There was an increasingly solid basis for the government to actively promote further measures to attract foreign investment as it was becoming more confident of the success of the deregulation policy. REPELITA V is now approaching its end and the performance of REPELITA V in promoting the industrial sector has been a success. In particular, the reduced dependence on oil and natural gas should be highly appreciated.

The industrial sector is considered the driving force for economic growth in REPELITA VI. With a target annual growth rate of 9.4% (10.3% for the non-oil, non-gas sector), the industrial sector will account for 24.1% of the GDP at the end of the plan period in 1999. Even though this target rate is lower than the estimated real growth rate of 10.0% during the REPELITA V period, it is still the highest target on a sector-by-sector basis under REPELITA VI. By

region/province, the target growth rate of the industrial sector is particularly high for Maluku, Irian Jaya and Central Java (Table 2-12).

In the field of employment, the share of the industrial sector is expected to increase to 14.3% of the total employment by the end of the plan period. In order to improve the competitiveness of the industrial sector, REPELITA VI plans to proceed with further deregulation, administrative reform and the withdrawal/reduction of subsidies and protective measures. As industry instead of agriculture is expected to create employment opportunities during the REPELITA VI period, the promotion of high value added and technology-intensive industries is planned to be added to the existing labour-intensive industries and those industries highly dependent on natural resources.

(3) Current Conditions

The role of industry (the word "industry" here means the manufacturing sector, excluding the oil refinery and natural gas liquefaction industries which occupy important places in the national economy) in the Indonesian economy has been becoming increasingly important in recent years. The share of the manufacturing sector in the GDP increased from 8.1% in 1988 to 20.5% in 1992. The number of workers in the manufacturing sector also increased accordingly from 8.1% to 10.5%. The export share of manufacturing products has steadily grown to reach some 58% in 1992 from 48.2% in 1988 (table 2-13).

The main characteristics of the Indonesian manufacturing industry are the dual structure in terms of business size and the uneven geographical concentration of the manufacturing bases. The former, comprising a small number of large factories with relatively high productivity and innumerable small household factories, is quite noticeable. Government statistics use 4 categories for manufacturing factories, i.e. large (100 workers or more), medium (20-99 workers), small (5-19 workers) and household (upto 4 workers). Although large factories only accounted for 0.8% of the 1.52 million factories and 32.7% of workers in the manufacturing sector in 1986, their added value accounted for 82.2% of the total. Meanwhile, household factories accounted for 93.0% of the total number of factories and 52.4% of workers. (No statistics on small and household factories have been released since 1987.)

The geographical characteristics of the manufacturing sector include a high concentration of factories of all sizes in Java and a disproportionate distribution

of large factories involving the development of natural resources (such as plywood, timber, fertiliser and paper factories) in Kalimantan.

It is also worth noting that foreign investment has played a crucial role in the development of the manufacturing sector, as has been the case in other Southeast Asian countries. The approved foreign investment in the manufacturing sector totalled 37.7 billion US$ between 1967 and 1992. A recent trend is the shifting of production bases from Asian NIEs to Indonesia because of wage increases in the former.

Table 2-14 shows the recent production trends of the major manufacturing products. Apart from a substantial increase in the production of household electrical appliances, the growth of textile and yarn production due to a favourable export performance is particularly noticeable.

(4) Trends of Main Industries

The recent trends of those industries related to metrology, such as the electrical/ electronics industry and precision machinery industry, are discussed below together with the oil and petrochemical industry which commands an important position in the economy of Indonesia.

1) Electrical/Electronics Industry

The electrical/electronics industry in Indonesia has achieved remarkable growth with steady domestic, as well as foreign, investment. Domestic investment in this industry totalled 46 million US$ in 1992 while foreign investment totalled as much as 132.35 million US$. The export value of electrical/electronic products in 1992 was 1.1 billion US$ which was double the export value of the previous year. The main export destinations are ASEAN countries, Japan, Western Europe and the Middle East. Most electrical/electronic products manufactured in Indonesia are actually knock-down products for export and the components are exempt from import duties. While diverse products are manufactured, the main items are such household goods as personal computers, radios, audio-cassette players, black and white television sets and telecommunications equipment. Exports of personal computers have been explosive in that products to the value of 100 million US$ were exported in 1992, mainly to the US and Eastern Europe, a staggering fifty-fold increase on the previous year. A large proportion of the foreign investment has been poured into the

computer field, the further expansion of which in the future appears to be assured. One future problem is to increase the local content without losing product quality and price competitiveness.

2) Precision Machinery Industry

There is no category for precision machinery in Indonesia's industrial statistics and the nearest category to precision machinery is probably that of professional, scientific, measuring and control equipment. The output of this category of 48.7 billion Rp (approximately 27 million US$) in 1990 was rather small. As advanced technologies are an essential part of the manufacturing activities in this field, the introduction of technologies from abroad is the key to the future development of local enterprises.

3) Oil and Petrochemical Industry

Although Indonesia is trying to set its economy free from its heavy dependence on oil, oil is still the largest source of foreign currency earnings and revenue. Oil refining is mainly conducted by PURTAMINA which produced 300 million barrels of oil products in 1992. The domestic oil refining capacity exceeds the domestic demand. As the production itinerary does not match the domestic demand, some oil products are actually imported. Following economic growth, the domestic oil demand has been rapidly increasing and it is predicted that Indonesia will become a net oil importer by the end of the century, making expansion of the oil refining capacity essential. The government is actively promoting research on alternative energies.

Within the petrochemical industry, the production of such midstream and down stream items as polypropylene, vinyl chloride resin and synthetic fibres, etc. has been steadily increasing while upstream products, except methanol and ammonia, are imported. In order to improve the supply of upstream products, the construction of an aromatic centre and an olefin centre is in progress in North Sumatera and West Java respectively.

It is planned in the future to replace oil exports with exports of high value added refined oil products and petrochemical products. Meanwhile, PURTAMINA is proceeding with plant modernisation to improve its operation rate.

2.4 Production and Trade Volumes of Measuring Instruments

2.4.1 Trends of Domestic Demand

The domestic demand in the last 3 years (1990-1992) (total of domestic production and imports, disregarding the virtually non-existent exports even though the export volume should, in principle, be deducted from the total), the number of domestic manufacturers and the main exporting countries of the main measuring instruments which are subject to the legal metrology regime are shown in Table 2-21 based on data published by the Directorate of Metrology of the Ministry of Trade.

In general, the manufacture and import of measuring instruments stayed at the same level for the subject 3 years. As the demand for measuring instruments increases in accordance with the development of commerce and industry, it appears reasonable to forecast an increase of the future demand for measuring instruments at the same rate as the target growth rate for commerce and industry (6.6% for commerce and 9.4% for industry) adopted by REPELITA VI or more.

2.4.2 Production and Trade Trends of Main Measuring Instruments

This section describes the production and trade trends of watt-hour meters, gas meters, water meters and taxi meters among those listed in Table 2-15 based on the availability of additional data.

(1) Watt-Hour Meters

In December, 1992, the PLN announced the estimated demand for watt-hour meters upto the turn of the century (Table 2-16). The electrification rate will have reached 70% by 2000 with an estimated demand for 32 million watt-hour meters, double the demand in 1993. The number of customers, i.e. watt-hour meters, as of the end of March, 1992 by region/province and by type of customer is given in Table 2-17.

Although there are 2 types of watt-hour meters, i.e. single phase meters and three phase meters), more than 95% of the domestic demand is for single phase meters. According to the PLN, all single phase meters are manufactured and supplied to the PLN by the following 5 domestic manufacturers, 4 of which are joint ventures with foreign companies. MELCOINDA is the only domestic manufacturer of three phase meters and any supply shortage is met by imports.

- SIGMA BINA
- FUJI DHARMA (joint venture with a Japanese manufacturer)
- METBELOSA (joint venture with a Japanese manufacturer)
- MELCOINDA (joint venture with a Japanese manufacturer)
- MECOINDO (joint venture with a French manufacturer)

The following trade data and values are cited from trade statistics for 1992.

- Imports Quantity : 156,947 units
  Weight : 33,433 kg
  Value : 607,793 US$
  Exporting Countries : Japan, Belgium, Austria
- Exports Quantity : 198,572 units
  Weight : 151,402 kg
  Value : 1,593,692 US$
  Importing Countries : Hong Kong, Taiwan, Philippines, Sri Lanka

(2) Gas Meters

According to the gas statistics, the number of users decreased between 1989 and 1991.

1989	:	24,988
1990	:	22,925
1991	:	16,955

While the exact reason for the above decline is unknown, it can be said that the use of gas is as yet far from popular. 95% of the gas users in 1991 were household users as shown in Table 2-24 and most users are assumed to live in large cities, particularly Jakarta. As there is no domestic manufacturer of gas meters, all gas meters are imported. The technical difficulty of manufacturing gas meters which demand high quality and safety standards than watt-hour meters is the main reason for the lack of domestic manufacturers.

(3) Water Meters

The number of customers, i.e. number of water meters installed, by region/ province in 1991 is given in Table 2-18. The total number of customers was approximately 2.3 million in 1990 with 5.14 million households, some 13% of Indonesia's total households, receiving the supply of drinking water.

(4) Taxi Meters

Most taxi meters are imported from Taiwan although some domestically manufactured taxi meters are in use. The import volume declined in the recent 3 years as the number of registered taxis little changed (Table 2-19). The demand for taxi meters is expected to increase in the future as more regional governments are introducing taxis equipped with meters.

Table 2-1 First Class Autonomous Bodies 27 Provinces and Territories Capital City

	Provincel Territory		Capital City
1.	Dacrah Iatimewa Ache (DAERAH ISTIMEWA)		BANDA ACHE
2.	Sumatera Utara	*	MEDAN
3.	Sumatera Barat		DADANG
4.	Riau		PAKAN BARU
5.	Sumatera Selatan	*	PALEMBANG
6.	Jambi		JANBI
7.	Bengkulu		BENGUKULU
8.	Lampung		TANJUNG KARANG
9.	Jawa Barat		GANDUNG
10.	DKI Jakarta (DAERAN KHUSUS IBUKOTA)	*	JAKARTA
11.	DI Yogyakarta (DAERAH ISTIHENA)	*	JOGYAKARTA
12.	Jawa Tengah	*	SEMARANG
13.	Jawa Timur		SURABAYA
14.	Kalimantan Barat		PONTIANAK
15.	Kalimantan Tengah		PALANGKA PAYA
16.	Kalimantan Selatan		BANJARMASIN
17.	Kalimantan Timur		SANARIUDA
18.	Sulawesi Utara		MENADO
19.	Sulawesi Tengah		PALU
20.	Sulawesi Tenggara		KENDARI
21.	Sulawesi Selatan		UJUNG PANDANG
22.	Nusa Tenggara Barat		MATARAN
23.	Nusa Tenggara Timur		KUPANG
24.	Maluku	*	AMBON
25.	Bali	*	DENPASAR
26.	Irian Jaya		JAYAPURA
27.	Timor Timur		DILLY

Note: Including persons with o permanent residence

Table 2-2 Indonesia's Main Economic Indicators

(Unit: US$100m)

	Population (millions)	GDP Growth Rate (%)	GDP per Capita	Exports (Non-oil)	Imports	Economic Revenues and Expenditure	Foreign Debt	D.S.R. %
1983	158	3.4	494	211 (50)	164	-42	300	20.1
1984	162	6.0	505	219 (59)	139	-20	319	21.3
1985	165	2.3	512	186 (59)	103	-18	367	29.5
1986	168	3.9	459	148 (65)	107	-40	431	35.9
1987	172	3.6	424	171 (86)	124	-17	525	38.5
1988	176	5.7	450	192 (115)	133	-19	528	42.7
1989	179	7.4	530	229 (140)	163	-13	546	35.2
1990	183	7.4	598	168 (149)	215	-32	679	21.1
1991	188	6.6	607	294 (180)	246	-42	725	33.0
1992	-	6.1	NA	399 (233)	270	-33	800*	-

Population: REPELITA V Goal 1.9% Growth (192.9 million by 1993)
GDP Growth: REPELITA V Goal Approx. 5.0% (Yearly Average)
Current Balance/DSR: REPELITA V Goal 25% (1993)

Source: Bank of Indonesia, Financial Statistics Economic Indicators, World Bank,
World Bank: World Debt Tables 1992/93

Table 2-3 Number and Growth Rate Population by Province

Province	Population			Population Growth Rate	
	1971	1980	1990	1971-1981	1980-1990
1. Dacrah Iatimewa Aceh	2,009	2,611	3,416	2.93	2.72
2. Sumatera Utara	6,622	8,361	10,256	2.60	2.06
3. Sumatera Barat	2,793	3,407	4,000	2.21	1.62
4. Riau	1,642	2,169	3,304	3.11	4.30
5. Jambi	1,006	1,446	2,021	4.07	3.40
6. Sumatera Selatan	3,441	4,630	6,313	3.32	3.15
7. Bengkulu	519	768	1,179	4.39	4.38
8. Lampung	2,777	4,625	6,018	5.77	2.67
9. DKI Jakarta	4,579	6,503	8,259	3.93	2.42
10. Jawa Barat	21,624	27,453	35,384	2.66	2.57
11. Jawa Tengah	21,877	25,373	28,521	1.64	1.18
12. DI Yogyakarta	2,489	2,751	2,913	1.10	0.57
13. Jawa Timur	25,517	29,189	32,504	1.49	1.08
14. Bali	2,120	2,470	2,778	1.69	1.18
15. Nusa Tenggara Barat	2,203	2,725	3,370	2.36	2.15
16. Nusa Tenggar Timur	2,295	2,737	3,269	1.95	1.79
17. Timor Timur	-	555	748	-	3.02
18. Kalimantan Barat	2,020	2,486	3,229	2.31	2.65
19. Kalimantan Tengah	702	954	1,396	3.43	3.88
20. Kalimantan Selatan	1,699	2,065	2,598	2.16	2.32
21. Kalimantan Timur	734	1,218	1,877	5.73	4.42
22. Sulawesi Utara	1,718	2,115	2,478	2.31	1.60
23. Sulawesi Tengah	914	1,290	1,711	3.86	2.87
24. Sulawesi Tenggara	5,181	6,062	6,982	1.74	1.42
25. Sulawesi Tenggara	714	942	1,350	3.09	3.66
26. Maluku	1,090	1,411	1,856	2.88	2.78
27. Irian Jaya	923	1,174	1,649	2.67	3.46
INDONESIA	119,208	147,490	179,379	2.32	1.98

Note: Including persons with no permament residence.
Source: STATISTIK 1992

Table 2-4 Gross Domestic Product (Ratios) / Composition by Industry Sector

No.	Industry Sector	Estimated Values Repelita V Final Year 1993/94	1998/99
1.	Agriculture	20.2	17.6
2.	Mining	12.1	10.1
3.	Industry	20.8	24.1
	a. Non-oil • Gas	17.6	21.3
	b. Oil • Gas	3.2	2.8
4.	Construction	6.4	7.0
5.	Commerce	17.1	17.5
6.	Transport and Communications	5.9	6.4
7.	Others	17.5	17.4
	GDP	100.0	100.0
	GDP Arising form Oil • Gas	12.6	9.8
	GDP Arising form Non-oil • Gas	87.4	90.2

1989/90 Fixed Prices

Source: BAPPENAS, 'Rencana Pembangunan Jangka Panjang Tahun Ke II dan Pembangunan Lima Tahun Ke VI'

Table 2-6 Conditions for Promotion of Regional Industries and Direction to Development Viewed by Region

Type	Province	Direction of Development	Major Problems	Necessary incentives and base for promotion
A Jawa Density Populated Type	Jakarta Jawa Barat Jawa Tengah DI Yogyakarta Jawa Timur Bali	• Further development of manufacturing industries and diversification of industry types • Development of labour-intensive industries	• Absorption of the labour force	<Private sector base> • Promotion of liberalisation • Improvement of investment environment
B Sumatra Large-scale Agriculture Type	Sumatera Utara Lampung Sumatera Barat Sulawesi Utara Nusa Tenggara Barat Kalimantan Selatan Sulawesi Selatan	• Development of agricultural products processing industries (Primary products, food processing, others) • Development of forestry-related industries	• Securing of market competitiveness and high added value • Diversification of industrial fields • Consideration towards protection of resources	<Private sector base> • Activisation of private sector businesses • Improvemt of the investment environment
C Sumatra Oil Development Type	Ache Riau Sumatera Selatan Kalimantan Timur	• Further development of resource deveopment industries (oil, natural gas, mining development) • Fostering of subsidiary industries.	• Organic connections between large-scale projects and local industries	<Government + private sector businesses> • Improvement of the investment (especially subsidiary industries)
D Sulawesi, Nusa and Tengala Subsistence Agriculture Type	Bengkulu Jambi Sulawesi Tenggara Nusa Tenggara Timur Timor Timur	• Promotion of local industries (especially those products which make use of local materials)	• Opening up of new industrial fields • Improvement of social welfare and purchasing power	<Government + private sector businesses> • Infrastructure precedence from the government
E Kalimantan, Irian Jaya Undeveloped Type	Maluku Kalimantan Barat Sulawesi Selatan Kalimantan Tengah Irian Jaya	• Development of resource development industries (Especially forestry and timber, fisheries, mining development)	• Consideration towards protecting resources • Organic connections between large-scale projects and local industries	<Government + private sector businesses> • Infrastructure precedence from the govemtment

Source: Asian Economic Research Institute

Table 2-7

No.	Item	Unit	Estimated values Repelita V Final Year	Repelita VI	
			1993/94	1994/95	1998/99
1	2	3	4	5	6
C					
1	Total Investment	Rp trilyun	93.4	102.1	660.1 ***)
	Private	Rp trilyun	68.2	74.7	484.2 ***)
	Government	Rp trilyun	25.2	27.4	175.9 ***)
2	Raisig of funds	Rp trilyun	93.4	102.1	660.1 ***)
	a. Domestic	Rp trilyun	87.5	95.2	622.8 ***)
	Private	Rp trilyun	64.5	67.3	453.4 ***)
	Government (Gross)	Rp trilyun	26.0	27.9	169.4 ***)
	b. Foreign Funds (Net)	Rp trilyun	5.9	6.9	37.3 ***)

Source: BAPPENAS,'Rencana Pembangunan Jangka Panjang Tahun Ke II dan Pembangunan Lima Tahun Ke VI'

Table 2-8

NO.	Item	Unit	Expected Ualue Repelita V Final Year	Repelita VI	
			1993/94	1994/95	1994/95 s/d 1998/99
1	2	3	4	5	6
VI	National Finance	Rp. milyar			
1	Total Revenues	Rp. milyar	52,769.0	59,737.1	382,048.6
2	Revenues from Non-oil • Gas	Rp. milyar	37,641.4	46,885.9	310,861.5
3	Tax Revenues	%	33,848.7	40,074.4	278,657.4
4	Growth in Tax Revenues	%	16.2	18.4	17.3
5	Tax Revenues as a Percentage of National Finances	%	64.5	71.3	77.8 **)
6	Percentage of Tax Revenues Relating to Non-oil • Gas	%	12.5	13.1	15.6 **)
7	Percentage of Current Expenditure Accounted for by Debt Repayments	%	45.1	42.4	32.8 **)
8	Percentage of Development Revenues Accounted for Government Saving		62.1	63.5	67.7 **)
VII					
1	Non-oil • Gas Exports	US$ juta	28.880	33.589	62.784 **)
2	Exports of Manufactures	US$ juta	24.764	29.109	56.150
3	Growth in Non-oil • Gas Exports	%	16.3	16.3	16.8 *)
4	Growth in Exports of Manufactures	%	17.8	17.5	17.8
5	Percentage of Total Value of Exports Accounted for by Non-oil • Gas Exports	%	75.9	78.5	87.0 **)

Source: BAPPENAS, 'Rencana Pembangunan Jangka Panjang Tahun Ke II dan Pemabngunan Lima Tahun Ke VI'

No.	Item	Unit	Estimated Values Repelita V Final Year	Repelita V	
			1993/94	1994/95	1994/95 s/d 1998/99
1	2	3	4	5	6
6	Non-oil • gas exports as a percentage of GDP	%	19.9	21.4	25.6 *)
7	Current expenditure deficit as a percentage of GDP	%	1.9	2.0	1.3 **)
8	Foreign currency reserves	bln impor	5.1	4.8	5.3 *)
9	Debt service ratio	%	32.5	30.4	20.2 **)
	a. Government	%	21.1	19.0	20.2 **)
	b. Private	%	11.4	11.4	1.3 **)
VII	National foreign debt	US$			
1	Debt outstanding	milyar	83.2	84.3	95.8 **)
2	Debt outstanding as a percentage of GDP	%	57.2	53.7	45.9 **)

Source: BAPPENAS, 'Rencana Pembangunan Jangka Panjang Tahun Ke II dan Pembangunan Lima Tahun Ke VI'

Table 2-9

No.	Item	Unit	Estimated Values	PJP II				
			Repelita V Final Year 1993/94	VI 1994-1998	VII 1999-2003	VIII 2004-2008	IX 2009-2013	X 2014-2018
1	2	3	4	5	6	7	8	9
	GDP							
	a. GDP Growth Rate	% per tahun	6.6	6.2	6.6	7.1	7.8	8.7
	(1) Agriculture	% per tahun	2.4	3.4	3.5	3.5	3.5	3.5
	(2) a. Oil • Gas	% per tahun	10.0	9.4	9.4	9.4	9.1	8.7
	b. Non-oil • Gas	% per tahun	11.0	10.3	10.2	10.0	9.5	9.0
	(3) Others	% per tahun	7.2	6.0	6.3	6.8	8.0	9.5
	b. GDP per Capita	1000 rupiah	1.188	1.487	1.908	2.525	3.483	5.046
	(1989/90 prices)	US$	676	775	995	1.317	1.816	2.631
	c. Composition of Production							
	(1) Agriculture	%	20.2	17.6	15.2	12.8	10.5	8.2
	(2) a. Oil • Gas	%	20.8	24.1	27.4	30.5	32.4	32.5
	b. Non-oil • Gas	%	17.6	21.3	25.1	28.7	31.0	31.5
	(3) Others	%	59.0	58.3	57.4	56.7	57.1	59.4

Source: BAPPENAS, 'Rencana Pembangunan Jangka Panjang Tahun Ke II dan Pembangunan Lima Tahun Ke VI'

Table 2-10 Real Growth Rate, GDP Share and Employment Share of Commerce Sector

(Unit:%)

	1987	1988	1989	1990	1991	1992
Real Growth Rate	7.1	9.1	10.7	7.1	5.4	7.4
GDP Share	15.2	15.7	16.1	16.1	15.9	16.1
Employment Share	-	15.3	14.6	14.6	15.0	15.0

Source: Statistical Yearbook of Indonesia

Table 2-11 Target Growth Rate for Commerce/Transport Sector by Region/Province

(Unit: %)

Region / Province	Target Growth Rate 1994-1999	Share in GRDP	
		1993	1998
1. Aceh	7.5	9.7	12.9
2. Sumatera Utara (North)	10.4	23.9	26.2
3. Sumatera Barat (West)	7.3	31.0	32.1
4. Riau	6.4	10.0	12.0
5. Jambi	8.6	28.1	29.8
6. Sumatera Seletan (South)	7.5	25.0	25.8
7. Bengkulu	9.1	23.5	25.4
8. Lampung	10.0	22.3	25.0
9. Jakarta	6.9	27.7	26.3
10. Java Barat	5.7	24.1	24.2
11. Java Tengah (Central)	6.8	21.9	22.1
12. Yogyakarta	6.7	25.7	27.5
13. Java Timur (East)	6.0	26.6	26.4
14. Kalimantan Barat	10.2	29.0	31.2
15. Kalimantan Tengah	8.2	27.4	28.8
16. Kalimantan Selatan	8.6	30.9	32.3
17. Kalimantan Timur	7.9	16.3	18.9
18. Sulawesi Utara	7.7	24.9	26.9
19. Sulawesi Tengah	6.7	21.2	22.2
20. Sulawesi Selatan	8.5	26.3	28.5
21. Sulawesi Timur Selatan	7.3	18.8	19.5
22. Bali	7.1	31.5	33.1
23. Nusa Tenggara Barat	7.9	23.7	25.9
24. Nusa Tenggara Timur	6.7	21.3	22.9
25. Maluku	9.5	23.7	25.0
26. Irian Jaya	8.2	11.0	11.4
27. Timor Timur	6.9	17.8	17.8
National Average	6.6	17.1	17.5

Note : Figures are combined for the commerce and transport sectors.
Source : BAPPENAS, "Rencana Pembangunan Jangka Panjang Tahum De II dan Pembangunan Lima Tahun Ke VI"

Table 2-12 Real Growth Rate, GDP Share and Employment Share of Commerce Sector

(Unit:%)

	1987	1988	1989	1990	1991	1992
Real Growth Rate	7.1	9.1	10.7	7.1	5.4	7.4
GDP Share	15.2	15.7	16.1	16.1	15.9	16.1
Employment Share	-	15.3	14.6	14.6	15.0	15.0

Source: Statistical Yearbook of Indonesia

Table 2-13 Real Growth Rate, GDP Share and Employment Share of Manufacturing Sector

(Unit: %)

	1987	1988	1989	1990	1991	1992
Real Growth Rate	10.6	12.0	9.2	12.5	9.6	9.7
GDP Share	17.2	18.2	18.5	19.4	19.9	20.5
Employment Share	-	8.1	8.8	10.1	10.4	10.5
Export Share	38.9	48.2	49.8	46.2	51.7	57.7

Source: Statistical Yearbook of Indonesia

Table 2-14 Production Trends of Main Manufacturing Products

Fiscal Year Ending March 31	1989	1990	1991	1992	1993*
Textiles (million meters)	3,503	4,494	5,028	5,342	5,564
Yarn (1,000 bales)	2,712	3,405	3,573	4,140	4,474
Leather (1,000 tons)	21	26	28	29	31
Fertiliser (TSP + ZA) (1,000 tons)	1,752	1,888	1,881	1,687	1,460
Fertiliser-					
Urea (1,000 tons)	4,246	4,892	5,131	4,881	4,946
Ammonia (1,000 tons)	357	369	303	332	340
Cement (1,000 tons)	13,343	14,201	15,890	16,255	17,902
Automobile Tyres (1,000 units)	6,396	7,377	8,220	8,209	8,772
Motorcycle Tyres (1,000 units)	4,870	5,490	5,890	7,682	7,923
Coconut Oil (1,000 tons)	448	486	490	540	553
Refined Palm and Coconut Oil (1,000 tons)	728	847	969	981	1,398
Margarine (1,000 tons)	34	38	44	50	59
Cigarettes (million units)	17.6+	30.3	34.8	52.8	63.6
Clove Cigarettes (million units)	124.2	130.4	139.3	125	135.9
Detergent (1,000 tons)	175	193	213	234	257
Crumb Rubber (1,000 tons)	961	1,027	1,037	1,079	1,079
PVC Pipes (1,000 tons)	60	62	75	90	99
Paint (1,000 tons)	73	80	116	154	162
Plywood (1,000 m^3)	6,900	7,700	8,400	8,500	9,000
Sawn Wood (1,000 m^3)	10,300	10,900	11,100	10,500	10,000
Wire Steel (1,000 tons)	131	143	156	171	-
Sponge Iron (1,000 tons)	985	1,210	1,357	1,355	1,320
Concrete Iron and Steel (1,000 tons)	944	1,300	1,325	1,192	1,300
Steel Slabs (1,000 tons)	722	800	904	963	1,007
Diesel Engines (1,000 units)	32,424	44,345	49,660	51,800	54,000
Tractors (units)	202	65	220	436	396
Hand Tractors (units)	2,490	5,533	6,330	10,000	9,350
Forklifts (units)	513	425	1,248	803	675
Automobiles (1,000 units)	167	175	271	261	196
Motorcycles (1,000 units)	260	281	410	436	457
Televisions (1,000 units)	522	797	1,082	1,581	1,797
Radios/Cassette Players (1,000 units)	1,536	2,339	3,092	3,788	5,018
Refrigerators (1,000 units)	104	138	159	213	230
Dry Batteries (million units)	1,017	1,077	1,158	1,224	1,442

* Through December, 1992
Source: Central Bureau of Statistics

Table 2-15 Production and Trade Volumes of Measuring Instruments

Instrument	Year	Production Volume (A)	Import Volume (B)	Domestic Demand (A)+(B)	Number of Domestic Manufacturers	Main Sources of Supply
Balance	1990	287,146	4,480	291,626	176	1. Japan
	1991	260,192	4,636	264,828		2. Taiwan
	1992	299,659	5,577	305,236		3. Germany
Weight	1990	937,705	0	937,705	40	
	1991	860,437	0	860,437		
	1992	954,197	0	954,197		
Graduated Scale	1990	32,424	0	32,424	9	
	1991	20,779	0	20,779		
	1992	23,216	0	23,216		
Tape Measure	1990	0	65	65		1. Japan
	1991	0	76	76		2. England
	1992	0	105	105		
Dry Can	1990	243,419	0	243,419	38	
	1991	226,115	0	226,115		
	1992	272,860	0	272,860		
Wet Can	1990	618,256	0	618,256	38	
	1991	510,574	0	510,574		
	1992	608,894	0	608,894		
Tank Lorry	1990	1,580	0	1,580	63	
	1991	2,358	0	2,358		
	1992	2,268	0	2,268		
Water Meter	1990	155,143	61,907	217,050	4	1. South Korea
	1991	197,778	65,505	263,283		2. France
	1992	193,584	55,622	249,206		3. Taiwan
Taxi Meter	1990	0	6,648	6,648	5	1. Taiwan
	1991	5	3,808	3,814		
	1992	21	2,184	2,205		
Gasoline Meter	1990	0	923	923	1	1. Japan
	1991	0	857	857		2. US
	1992	0	989	989		3. England
Watt-Hour Meter	1990	1,200,000	na	na	5	
	1991	1,200,000	na	na		
	1992	1,200,000	na	na		
Gas Meter	1990	0	8	8		1. US
	1991	0	227	227		2. France
	1992	0	27	27		
Storage Tank	1990	380	0	380	21	
	1991	96	0	96		
	1992	147	0	147		
Standard Volume	1990	90	2	92	6	1. USA
	1991	60	7	67		
	1992	162	6	168		

Source: Directorate of Metrology, Ministry of Trade

Table 2-16 Estimated Number of Watthour Meters Required in Indonesia (from PLN's Report in December, 1992)

February 20, 1993 by Melbelosa

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Population	(in units of 1,000)	179,322	182,615	186,352	189,917	193,459	196,990	200,492	204,023	207,538	211,048	214,528
Electrification Rate	(%)	29.9	31.9	36.4	40.0	43.8	47.9	52.1	56.6	61.3	66.0	70.8
① Domestic Customers	(in units of 1,000)	10,723	11,651	13,566	15,193	16,947	18,872	20,891	23,095	25,444	27,858	30,377
② Commercial Customers	(in units of 1,000)	407	439	533	589	647	709	774	943	915	968	1,061
③ Public Customers	(in units of 1,000)	281	306	358	401	446	496	548	604	664	725	787
④ Industrial Customers	(in units of 1,000)	30	37	47	55	51	67	78	88	98	109	120
Total Number of Customers	(in units of 1,000)	11,441	12,432	14,505	16,238	18,092	20,143	22,292	24,731	27,122	29,660	32,345

Number of Customers and Increase of Watthour Meters Converted from Above Table

Single-Phase Meter Customers (in units of 1,000)	10,930	11,874	13,834	15,490	17,275	19,233	21,288	23,560	25,918	28,366	30,932
Yearly Increase of Single-Phase Meters (in units of 1,000)		944	1,960	1,656	1,785	1,958	2,055	2,271	2,358	2,448	2,566
Three-Phase Meter Customers (in units of 1,000)	512	558	671	748	817	910	1,004	1,171	1,204	1,294	1,414
Yearly Increase of Three-Phase Meters (in units of 1,000)		47	113	76	69	93	94	167	32	90	120

① Total population × 5 x electrification rate. All the customers given in ① are single-phase meter customers. 30% of ② plus ③ single-phase meter customers. 70% of ② plus ③ are three-phase meter customers. All the customers shown in ④ are three-phase meter customers.

Source: Interim Report

Table 2-17 Number of Electricity Customers by Type of Customers

Province / PLN Operational Unit	Residential	Industrial	Commercial	Domestic	Govt. Office Buildings	Public Street Lighting	Total	%
Region I (ID Ache)	177,008	531	16,142	5,874	1,953	129	201,637	1.63
Region II (North Sumatera)	726,595	2,825	25,350	12,251	3,811	386	771,318	5.22
Region III	388,025	787	23,051	10,018	3,578	346	425,316	3.43
- West Sumatera	252,238	414	9,282	7,254	2,179	289	271,660	2.19
- Riau	135,787	359	13,779	2,764	1,399	57	154,155	1.24
Region IV	532,371	1,153	28,359	10,033	4,476	280	576,687	4.65
- South Sumatera	278,378	496	13,018	4,557	1,953	151	293,563	2.41
- Jambi	64,650	253	5,017	1,282	742	29	71,953	0.58
- Lampung	121,686	292	7,681	2,630	1,017	57	133,263	1.07
- Bengkulu	67,657	107	2,753	1,589	784	33	72,903	0.59
Region V (West Kalimantan)	133,383	403	14,350	2,924	1,647	91	152,798	1.23
Region VI	386,555	1,080	19,587	9,545	4,269	665	421,701	3.40
- Central Kalimantan	52,457	221	4,059	1,503	1,093	65	59,409	0.48
- South Kalimantan	196,185	808	6,885	5,802	1,809	188	211,157	1.70
- East Kalimantan	137,913	351	8,653	2,440	1,367	411	151,135	1.22
Region VII	293,403	594	10,255	5,708	2,705	290	313,985	2.54
- North Sulawesi	219,135	377	6,004	5,182	1,722	245	232,555	1.55
- Central Sulawesi	74,268	217	4,281	1,526	983	44	81,299	0.66
Region VIII	517,998	1,057	17,252	7,443	4,119	219	548,108	4.42
- South Sulawesi	470,807	954	14,942	5,525	3,332	198	496,866	4.01
- Southeast Sulawesi	47,091	103	2,320	818	787	23	51,242	0.41
Region IX (Maluku)	98,091	181	4,344	2,219	1,196	87	104,118	0.84
Region X (Irian Jaya)	54,541	158	5,994	1,963	1,719	191	64,888	0.52
Region XI	534,274	1,861	20,728	14,481	5,000	609	878,953	4.86
- Bali	291,165	1,335	12,247	8,251	1,651	359	315,008	2.54
- West Nusa Tenggara	157,482	250	4,468	4,094	1,293	153	166,740	1.35
- East Nusa Tenggara	71,320	247	3,543	1,557	1,309	44	78,235	0.63
- East Timor	14,307	29	1,385	489	747	53	15,970	0.14
Outside Java	3,840,444	10,840	185,452	83,484	34,473	3,293	4,157,755	33.54
Dist. of East Java	2,054,714	5,952	52,921	41,282	8,557	1,598	2,175,034	17.55
Dist. of Central Java	2,011,998	4,158	60,199	47,608	11,842	2,087	2,137,892	17.25
Central Java	1,730,823	3,587	52,701	41,013	10,309	1,733	1,840,156	14.84
DI Yogyakarta	281,175	571	7,498	8,595	1,533	354	297,725	2.40
Dist. of West Java	2,226,925	7,282	56,855	40,554	7,472	905	2,339,993	18.88
Dist. of Jaya and Tanggerang	1,472,878	8,089	82,185	18,947	3,488	434	1,685,031	12.79
Java	7,775,515	25,501	252,160	148,391	31,359	5,024	8,238,950	66.46
Indonesia	11,515,959	36,141	437,612	231,855	65,832	8,317	12,395,715	100.00
(%)	93.71	0.29	3.53	1.87	0.53	0.07	100.00	

Source: PLN Statistics 1991/92

Table 2-18 Number of Water Supply Customers by Province in 1991

Province	Households	Tourism Objects and Hotels	Hospitals and Social Institutions	Places of Worship	Public	Industrial Estates	Government	Others	Total
1. DI. Aceh	28,026	133	184	198	43	2,841	787	37	32,249
2. Sumatera Utara	173,769	4,214	1,234	886	732	19,747	2,464	96	203,142
3. Sumatera Barat	54,671	304	599	683	494	3,041	820	672	61,284
4. Riau	23,403	220	341	211	36	4,956	816	135	30,118
5. Jambi	22,472	80	180	367	67	2,563	224	3	25,956
6. Sumatera Selatan	74,728	578	822	213	373	6,080	682	37	83,513
7. Bengkulu	13,254	41	74	141	78	334	337	-	14,259
8. Lampung	26,939	30	163	219	484	1,888	274	333	30,330
9. DKI Jakarta									
10. Jawa Barat	525,473	6,659	5,489	3,669	4,108	37,238	4,170	533	587,339
11. Jawa Tengah	209,610	414	1,865	1,647	4,758	16,507	3,319	1,297	239,417
12. DI. Yogyakarta	29,361	19	28	400	334	1,309	880	-	32,417
13. Jawa Timur	339,179	13,189	7,144	2,381	4,065	13,073	4,717	770	384,519
14. Bali	53,443	368	585	300	1,204	5,909	1,361	7	63,177
15. Nusa Tenggara Barat	25,601	27	340	178	718	1,040	456	3	28,363
16. Nusa Tanggara Timur	22,539	105	486	166	352	1,972	622	277	26,519
17. Timor Timor	3,759	4	16	19	82	396	183	16	4,475
18. Kalimantan Barat	78,039	1,398	372	513	568	15,422	1,513	19	97,844
19. Kalimantan Tengah	16,810	59	69	102	143	421	418	6	18,028
20. Kalimantan Selatan	55,992	537	684	456	756	1,895	740	250	61,310
21. Kalimantan Timur	49,218	181	248	407	532	3,255	413	28	54,282
22. Sulawesi Utara	63,128	94	754	557	797	3,431	1,676	232	70,669
23. Sulawesi Tengah	16,677	16	143	83	337	1,238	188	14	18,696
24. Sulawesi Selatan	74,982	585	351	449	2,163	4,860	1,037	283	84,710
25. Sulawesi Tenggara	12,998	66	50	95	67	576	345	3	14,200
26. Malaku	14,198	45	12	104	193	1,122	551	9	16,234
27. Irian Jaya	21,145	69	116	175	91	901	532	41	23,070
Indonesia	2,029,414	29,435	22,349	14,619	23,576	152,015	29,525	5,101	2,306,034

Source: BPS Water Supply Statistics, 1991

Table 2-19 Number of Taxis by Region/Province

	1990	1991	1992
1. Ache	-	-	-
2. North Sumatera	-	158	600
3. West Sumatera	-	48	151
4. Riau	-	-	-
5. Jambi	-	-	-
6. South Sumatera	-	-	11
7. Bengkulu	-	-	-
8. Lampung	-	-	-
9. Jakarta	18,278	18,023	13,125
10. West Java	388	1,033	1,357
11. Central Java	301	489	503
12. Yogyakarta	171	536	511
13. East Java	2,578	3,212	1,961
14. West Kalimantan	-	-	-
15. Central Kalimantan	-	-	-
16. South Kalimantan	-	-	-
17. East Kalimantan	-	-	45
18. North Sulawesi	-	-	107
19. Central Sulawesi	-	-	-
20. South Sulawesi	-	94	96
21. Southeast Sulawesi	-	-	-
22. Bali	-	120	103
23. West Nusa Tenggara	-	-	-
24. East Nusa Tenggara	-	-	-
25. Maluku	-	-	-
26. Irian Jaya	-	-	-
27. East Timor	-	-	-
Total	21,716	23,713	18,570

CHAPTER 3

CURRENT STATE AND PENDING PROBLEMS OF LEGAL METROLOGY IN INDONESIA

CHAPTER 3

CURRENT STATE AND PENDING PROBLEMS OF LEGAL METROLOGY IN INDONESIA

3.1 General

The metrology system is the essential technical basis for the orderly management of a country and its supportive role in modern socioeconomic activities is becoming increasingly more important. It is not only in industrialised countries but also in developing countries that the metrology system plays a part in all aspects of social and economic life in combination with the technical regulations stipulated by various laws.

The ultimate objective of the firm establishment of the metrology system is to ensure economic and cultural development in national life through the establishment and management of a uniform and rational basis for industrial technologies and economic activities. All countries enforce various regulations on metrology as concrete measures designed to maintain fair trade practices, to ensure health and safety and to protect the environment. Industrial and economic development necessarily expands the scope of the metrology system and there are increasing instances of measurement results playing a crucial role.

With the recent progress of borderless economic activities coupled with active trade and cultural exchanges between countries around the world, standardisation of the components of metrology systems from the global point of view has become essential, stimulating international action by the OIML and other organizations. There is, in fact, strong willingness throughout the world community to establish a world metrology system in order to create a worldwide common basis for further economic development and cultural progress.

3.1.1 Basic Concept of Metrology System

Metrology is not simply measurement but is defined as measurement based on officially upheld standards. Under the metrology system, measurement must be conducted in accordance with standard measurement units which are stipulated by law or national standards. All industrialised countries today have their own legal

metrology system which general reflects the national character, history and culture. The basic concept of the metrology system from the macroscopic legal point of view is typified by the German system which is a preventive system presupposing the guarantee of measurement accuracy for a specific period of time. In contrast, the US and UK, etc. have adopted a repressive system under which users are held responsible for the maintenance of metrological accuracy as part of their social responsibility. Although the main emphasis slightly varies from country to country, the legal regulations on metrology in most countries are a combination of the preventive and repressive systems. Regulations are generally classified as structural regulations on measuring instruments and regulations on their scope of use.

3.1.2 Current Legal Arrangements of Metrology System in Indonesia

The metrology system in Indonesia is supported by the Law on Legal Metrology (the Law), related government decrees (some of which are presidential decrees) and ministerial decrees. The Director of the DOM has the legal authority to determine technical issues relating to the implementation of verification through his own decrees, completing the reasonable legal arrangements for Indonesia's metrology system. The Indonesia law and regulations relating to legal metrology are listed below. It is worth noting that the National Standardisation Council has the legal authority to establish a metrological traceability system in the field of industrial metrology based on the Law and backed by government and presidential decrees.

Law and Regulation for legal Metrology

Low No.2/1981

.Government Decree No.2/1985 → Ministry of Trade
Scope of Verification on Mesuring Equipment

.Government Decree No.26/1983 → Verification Fee

↓

.Government Decree No.10 /1987 → SI Unit

.Government Dcree No.2/1985

1.No.401/1981 → Repairer
2.No.402/1981 → Specied Mesuring Instruments
3.No.403/1981 → Verification Term
4.No.404/1981 → Prepacked Products
5.NO.36/kp/#/88 → Mesuring Equipment should be Verifies
6.No.406/1981 → The Place for Verification of Special Measuring Instrument
7.No.407/1981 → Procedure for desruching of Measuring Instrument
8.NO.409/198 → Proceder for Importing Measuring Instrument
9.Ministiec Decree of Verification Stamps → Isuuued every year

Law and Regulation for Industrial Metrology

Law NO.2/1981

.Government Dcree NO.2/1989 → National Standards

.Presidential Dcree NO.7/1989 → National Standerdization Corncial

↓

This Council Chooses

- National Labratory
- Accreditation of Calibration Centre(±22)

Pres. → Minister of Reseach & Technical(Mr.Habibie)

1st Deputy → Minister of Industry

2st Deputy → Minister of Trade

Secretary → KIM-LIPI

Members:

1.Depart of Industry

2.Depart of Trade

3.Depart of Health

4.Depart of Agriculture

5.Depart of Forestry

6.Depart of Manpower

7.Depart of Public Works

8.Depart of Mining & Energy

9.Depart of Transportation

10.Tachnology Application Council

11.National Atomic Council

List of Director's Decrees for Measuring Instrument

NO.	Item of Measuring Instrument	Number Director's Decree	Remarks
1.	Electronic Weighing Instrument	No.MET-009/MET-1/1347/83. →1983	
2.	Water Meter	No.MET-4005/2793/1990 - 1990	
3.	Tank Lorries	No.MET-4005/4585/1991 - 1991	
4.	Taxi Meters	No.MET-4005/2781/XII/1990 - 1990	
5.	Moisture Meter	No.MET-4005/3548/XII/1990 - 1990	
6.	Electricity Meter (kWh-Meter)	No.MET-4005/3548/VIII/1991 - 1991	
7.	Measuring Instruments Obliged Initial Ver. & Periodical Ver. or Free of Periodical Ver.	No.MET-4005/1919/1992 - 1992	
8.	Spring balance	No.MET-004/2318/1992 - 1992	
9.	Ditto(Devision)	No.MET-004/3104/1992 - 1992	
10.	Flow Meter(Volumetric)	No.MET-4005/720/1993 - 1993	
11.	Storage Tank	No.MET-4005/721/1993 - 1993	
12.	Gas Meter of Rotary Piston	No.MET-4005/722/1993 - 1993	
13.	Compressed Natural Gas Pump	No.MET-4005/723/1993 - 1993	

3.2 Current Conditions and Problems of Legal Metrology System

A weights and measures law is designed to maintain economic order. As the types of measurement required to ensure fair trade are extremely diverse, it is usually the case that the subjects of technical regulations on the inspection and testing of measuring instruments are restricted to those areas which are essential for the protection of general consumers. While it is a question of state sovereignty to what extent legal metrology should cover, the scope of legal metrology has been widening in all countries in accordance with industrial and economic development. The actual regulatory regime has also been becoming more simplified with the introduction of the type approval system and the private sector-based certification system in addition to the more conventional official inspection and testing.

3.2.1 Legal Regulations

The current Indonesian Law on Legal Metrology enforced in 1975 and revised in 1981 generally covers the areas recommended by the OIML, including the national legal metrology system. Probably by coincidence, the recommendations of the OIML were also issued in 1975 and the Indonesian Law on Legal Metrology (the Law) appears to have incorporated those areas which would have been incorporated anyway because of the OIML recommendations prior to the issue of these recommendations. The combined state of the Law, presidential orders, government ordinances, ministerial ordinances and instructions of the DOM Director General when the Law was enforced satisfied the minimum requirements, at least in all areas of the OIML recommendations, despite the constraints imposed by the stage of socioeconomic development and general conditions in Indonesia at the time.

The rapid economic and social development in Indonesia in more recent years has made the Law, related regulations and administrative system for their enforcement rather inadequate. It is now necessary for the competent agencies, i.e. the DOM of the Ministry of Commerce and the KIM-LIPI of the Ministry of Science and Technology, to examine a new administrative structure and the competent agencies for a much more up-to-date measurement law and its enforcement.

3.3 Legal Metrology Implementation System

The implementation of legal metrology is conducted by the DOM, an organization belonging to the Department of Trade, and 47 local verification laboratories belonging to the respective local offices of the Department of Trade.

3.3.1 Role and Organizational Structure of the DOM

(1) Role and Functions

The role and functions of the DOM are stipulated by the Law and are outlined below.

1) *Metrological Administration*

The Director of the DOM issues decrees governing the technical requirements for the implementation of legal metrology in general and the enforcement of the Law in particular to ensure the unified operation of verification.

2) Inspection (Calibration) of Reference Standards

The DOM conducts the regular inspection (for example, every 5 years in the case of standard weights) and calibration of reference standards which are the standards in the possession of the local verification laboratories. The inspection and calibration of working standards are assigned to the laboratories.

Small laboratories find it difficult to appoint a specialist inspector for each type of measuring instrument to be verified due to the limited verification demand for each item. In addition, there are such problems as a shortage of calibration equipment and an inadequate level of calibration accuracy, etc. The control of working standards by these small laboratories is problematic to say the least because of the inadequate technical ability of the staff and inadequate equipment. It is, therefore, necessary to upgrade the metrological engineers and calibration equipment at key laboratories so that the centralised inspection and calibration of working standards can be conducted by these key laboratories.

3) Type Approval Inspection (Testing)

At present, the DOM cannot fully conduct type approval inspection (testing) because of qualitative and quantitative shortages of testing equipment and inspectors.

In regard to watt-hour meters, the type approval test is relatively new and uses facilities owned by watt-hour manufacturers. The test is not yet

widely conducted and it is currently impossible to check all items of which testing is technically required.

4) Technical Guidance for Local Verification Laboratories

The DOM is trying to positively respond to requests made by local verification laboratories for technical guidance. The current system does not allow the active provision of such guidance, however, because of both budgetary constraints and organizational barriers (the laboratories are independent from the DOM).

5) Technical Advice on Personnel Affairs of Local Verification Laboratories

As the local verification laboratories belong to the local administrative offices of the Department of Trade, the DOM does not have direct control over the personnel affairs of the former. However, the DOM does act as a coordinator for personnel movement between laboratories by providing technical advice on the appropriate appointment of verification inspectors and others.

6) Improvement/Renewal of Verification Facilities of Local Verification Laboratories

Twenty percent of the verification revenue earned by the local verification laboratories goes to the DOM for re-distribution to improve/renew the verification facilities of those laboratories in need. However, there is a large gap between the funds available for distribution and the amount requested by the laboratories and it is practically impossible for the DOM to improve the current level of facilities let alone fund their renewal.

(2) Organizational Structure

The DOM belongs to the Directorate General for Domestic Trade of the Department of Trade and is located in Bandung. The DOM consists of 6 divisions, each of which has several sections as described below.

1) Administration Division:
General Affairs; Personnel; Accounting

2) Mass Measurement Division:
Mass Standards; Electronic and Mechanical Measurement; Force and Pressure

3) Flow Measurement Division:
Petroleum Meters; Liquefied Gas Meters; Drinking Water Meters; Electrical and Time Measurement

4) Length and Volume Division:
Length Measurement; Tank Measurement; Taxi Meter Measuring Instruments; Density, Temperature and Viscosity

5) Control and Information Division:
Litigation Procedure and Data Collection; Measuring Instruments; Packed Product Control; Information

Fig. 3-1 and Fig. 3-2 show the organizational structure of the Department of Trade and the DOM respectively.

(3) Building

The total floor area of the DOM building is 4,054 m^2, standing on premises of 9,738 m^2. Half of the floor area is taken up by the Administration Division and the current space for such technical facilities as the metrological standard room and calibration laboratories is rather small vis-a-vis the functions required of these facilities. The layout does not take the function of each room, such as the storage and control of standards, calibration or type approval testing, into account. The provision of auxiliary facilities, including air-conditioning, sound insulation and vibration proofing, etc., is inadequate vis-a-vis the required level for a metrological research institute. Following the relocation of the neighbouring Metrological Training Centre, the current layout of the DOM building must be fundamentally reviewed and large-scale remodelling should be conducted to bring all aspects of the DOM up to the level required of a metrological research institute. Fig. 3-3 shows the present layout of the DOM building.

(4) Measurement Facilities and Equipment

The current measurement facilities (equipment) of the DOM are listed in Table 3-1. These are, however, generally insufficient in terms of both quantity and quality except for some metrological standards. The type approval testing facilities and calibration equipment are particularly inadequate. The procurement and/or renewal of these facilities and equipment as proposed in a later chapter is urgently required. As part of the efforts to upgrade the facilities

of the DOM, it is desirable to transfer still usable equipment in terms of accuracy from the DOM to the local verification laboratories to replace the deteriorated equipment of the latter.

(5) Manpower

As of 1993, the DOM has total manpower of 144, of which 87 work in the administration division. The technical staff number of 57 is too small to fully conduct all the expected technical functions of the DOM and should be increased to approximately 70. The breakdown of the technical staff members in terms of qualifications is as follows.

①	Inspectors	32
②	Assistant Inspectors	2
③	Controller	1
④	Technical Assistants	22

3.3.2 Role and Organizational Structure of Local Verification Laboratories

There are 47 local verification laboratories throughout Indonesia, of which 27 are division-class laboratories which are located in each of the 27 local provinces while 20 are section-class laboratories which are located in large provinces.

(1) Role and Functions

The expected role and functions of the local verification laboratories are largely classified into the following 4 categories.

1) Verification of Legal Measuring Instruments

The following measuring instruments are currently subject to verification under the legal metrology system.

① Mass (scales and weights)

② Length (linear scales and tape measures, etc.)

③ Watt-hour meters

④ Gasoline meters

⑤ Taxi meters

⑥ Gas meters

⑦ Tank volumes of petrol stations and tank lorries, etc.

⑧ Stop watches, parking meters, phone use meters.

⑨ Flowmeter

⑩ Pressure Ganges.

⑪ Thermometers.

⑫ Hydrometers, viscometers, liquefied gas meters.

Depending on the laboratory size and local characteristics of the subject area, some laboratories do not conduct the verification of some of the items listed above. (For example, there are no taxis equipped with a taxi meter in Ambon.) Most initial verifications are conducted by a small number of local laboratories as the applicants are manufacturers. At present, only 8 cities have a city gas supply and the overall diffusion rate in these cities is quite low. Consequently, the DOM is engaged in the verification of gas meters on only a limited scale because of the low demand and the lack of verification facilities at the local laboratories.

2) PR for Verification and Prosecution of Violaters

The controller (metrology police) visits the owners of those measuring instruments requiring regular verification to make them aware of the need for verification and to check any violation of the Law and related regulations. If necessary, the controller requests the company of the police and proceeds with the prosecution procedure.

3) Control and Calibration of Working Standards

Some laboratories are obliged to request the calibration of working standards to other laboratories because of a lack of the relevant calibration equipment. In general, however, all the laboratories have sufficient calibration equipment for those quantities with a high calibration demand such as mass and length. The storage conditions of the working standards are unsatisfactory due to a lack of air-conditioning and other reasons. Other problems include the relatively low technical ability of the staff, deterioration of the calibration equipment and poor calibration accuracy, damaging the credibility of the calibration results.

4) Calibration of Measuring Instruments On Request

Some large laboratories provide a calibration service in the field of industrial metrology in response to a strong request by industrial circles. The accuracy of the calibration equipment and calibration technologies/ techniques employed are rather questionable, however, and the demand is not fully met.

(2) Organizational Structure

The local verification laboratories belong to the local offices of the Department of Trade and operate as an arm of the local administration. The size of such local offices depends on the size of the local administration. Accordingly, while the general status of a local verification laboratory is equivalent to a division, there are 2 types of laboratories based on the scope of business. When 2 or more laboratories are located in a single province, they have the status of a section and are classified into 2 types based on the scope of business.

Some laboratories are in favour of being integrated to the DOM as lower ranked organizations of the latter to facilitate the uniform operation of the metrological administration. This possibility must be carefully debated as it affects the present administrative arrangements. Given the unique nature of the metrological administration, this possibility exists and warrants further discussion. In Thailand and the Philippines, etc., there is indeed an organizational link between the central metrological research institute and local verification laboratories.

(3) Buildings

As Table 3-2 shows, the buildings currently used to house the local verification laboratories vary from independent laboratory buildings where the functions of a laboratory are duly performed to local office buildings of the Department of Trade which are not functional enough for use as a verification laboratory and further to simple wooden houses which are rented for use as a laboratory.

Given the functions of the local verification laboratories, an independent, permanent building is highly desirable, making the rebuilding or substantial remodelling of the existing buildings necessary at more than half of the laboratories.

Air-conditioning is a minimum requirement for the control of working standards. In addition, there are also elements of possible environmental pollution in the case of the verification of taxi meters and tank lorries, etc. Proper consideration should be given to preventing pollution and ensuring a good working environment when planning any rebuilding or remodelling. Due to the importance of improving the present physical state of the local verification laboratories, an improvement project is proposed in Chapter 6.

(4) Measurement Facilities and Equipment

The verification equipment available for each metrological category is detailed in 3.4 onwards. In general, most of the working standards and verification equipment appear to have been used for a long time and are showing signs of deterioration. In fact, more than half of the equipment has passed its expected life and require renewal, implying a need for large amount of investment. It is, therefore, essential to provide budgetary appropriation in a systematic and continuous manner to renew the working standards and verification equipment at the laboratories to ensure verification accuracy and efficiency. A project to improve this aspect of the local verification laboratories is also proposed in Chapter 6.

The number of vehicles to assist re-verification (collective verification) is inadequate and many of the existing vehicles are old. The new procurement and replacement of vehicles are required to increase the number of collective verifications, in turn required to improve the re-verification detection rate.

The paper work for verification is almost entirely conducted manually at the small and medium size laboratories, causing problems in terms of work efficiency and the effective utilisation of data. The introduction of such essential office equipment as personal computers and copiers, etc. is necessary to modernise and rationalise the clerical work.

(5) Manpower

Based on the increase of the work volume in the last 4 years, the expected improvement of the re-verification detection rate and the expected growth of commerce and industry in Indonesia, the average annual growth rate of the number of measuring instruments in use is estimated to be approximately 8% for the next 10 years, commencing in 1993. By 2002, the verification demand will be some 180% of the present level. It must be noted that this figure does

not include those measuring instruments to be newly added to the list of measuring instruments subject to metrological verification. Assuming an annual productivity improvement of 2% for staff members, including administrative staff, the present manpower strength of the local verification laboratories of 1,456 should be increased 170% to some 2,400 by 2002.

Unfortunately, the present situation does not permit a smooth increase of manpower because of the salary gap between the private sector and public sector and the limited ability to train new inspectors. A reasonable solution is the substantial reform of the legal metrology system, including revision of the Law, so that the total manpower at this level remains around 1,500 9 years from now, but is sufficient. Possible measures to make this possible are discussed below.

1) Introduction of Designated Manufacturer System

   A manufacturer of measuring instruments which has an excellent quality control track record may be allowed to appoint a certified metrological engineer to be responsible for the metrological aspects of manufacturing activities. This control system can then be certified and initial verification can be substituted fro in-house inspection.

2) Introduction of Designated Verification Organization System

   For those measuring instruments of which the verification facilities and equipment require substantial investment and the direct possession of which is limited to only a few, the designation of certain verification organizations to be responsible for the verification of such instruments is highly effective to rationalise the verification regime and to make the best use of equipment investment and the professional knowledge of metrological engineers through their concentration in these organizations. This system is applicable for watt-hour meters, gas meters, water meters and environmental measuring instruments, etc. As the owners of these meters are the electricity board, water board and local governments, it should be feasible for the running cost of the designated verification organizations to be met by the verification fee (imposed on the benefit principle).

3) Designation of Verified Measuring Instrument Users

When an in-house inspection and calibration system for measuring instruments under the control of a certified metrological engineer has been firmly established at a department store, supermarket or large enterprise which uses a large number of measuring instruments, the system can be designated as being exempt from re-verification.

4) Introduction of Designated Metrological Certification Business System

Anyone whose business is the issue of metrological certificates is required to obtain the qualification of a certified metrological engineer while the inspection and calibration of reference standards, the possession of which is a compulsory requirement for such businesses to be designated as such, are conducted by a key local verification laboratory to rationalise the verification process.

3.4 Current State and Problems of Legal Metrology

3.4.1 General

The First and Second Field Survey Teams visited the DOM and its 9 local inspection laboratories and examined the conditions of inspection, availability and conditions of inspection equipment and buildings and qualitative level of inspectors, etc. The Survey Teams also collected data and information relating to the inspection records, number of inspectors and scope of equipment and instruments in possession, etc. at 47 local inspection laboratories and analysed the current conditions of these laboratories.

(1) Inspection Organizations

There is a total of 47 local inspection laboratories in Indonesia which are responsible for day-to-day inspection work. Their geographical distribution is mainly concentrated in Sumatera and Java as shown below.

Sumatera	10
Java	20
Kalimantan	6
Sulawesi	3

Bali 1

Tenggara 4

Irian Jaya 2

Timor 1

The 9 local inspection laboratories of the DOM which were visited are as follows:

Large-Size Laboratories	: Jakarta, Bandung, Medan and Surabaya
Medium-Size Laboratories	: Surakarta, Denpasar and Palembang
Small-Size Laboratories	: Bojonegoro and Anbon

In addition to these laboratories, the Survey Teams visited manufacturers of measuring instruments and university research institutes to obtain a general picture of the metrology system in Indonesia.

(2) Conditions of Inspection at Local Inspection Laboratories

The surveys at the DOM and its local inspection laboratories found, based on the survey findings on the control of standards, actual inspection work and conditions of re-inspection (equivalent to regular inspection in Japan) using the collective inspection method, that metrological inspection is conducted in fairly strict accordance with the legal regulations. Points worthy of special note are the practice of sealing those measuring instruments which have passed the initial inspection or re-inspection to prevent any subsequent alteration or remodelling of these instruments, the stamping of not only the pass mark but also the laboratory mark and inspector's mark and the fair number of criminal prosecutions regarding violation of the statutory re-inspection and other requirements.

(3) Inspection Records

The initial inspection and re-inspection records for the 3 year period since 1990 are shown in Table 3-4 while the total number of inspection by item is given in Table 3-5. The total inspection volume of approximately 6.5 million pieces/year was fairly stable for these 3 years.

In the case of mass-related inspections, most of the subjects were domestically manufactured instruments except truck scales and electronic balances. All watt-hour meters were domestically manufactured by joint ventures with foreign capital, including Japanese capital. More than 20% of the water meters were imported products while all the taxi meters were imported products.

By instrument category, those instruments relating to mass accounted for the largest proportion. The initial inspection completion rate was almost 100%.

The inspection volume is expected to continuously increase in the future with an increasing demand for such utility service-related meters as watt-hour meters and water meters and also with an improved detection rate for scales and other measuring instruments used.

Analysis of the inspection volume by product type shows the dominant use of wet cans for volume measurement. The inspection volume of wet cans was quite steady in the 3 year period, standing at some 770,000 pieces in 1992. The most numerous metering item inspected in 1992 was watt-hour meters at some 610,000 pieces, followed by water meters at approximately 250,000 and taxi meters at 20,000. The number of inspected watt-hour meters showed an increase of 445% on the previous year and is expected to gradually but steadily grow in the future following the increased installation of watt-hour meters in households due to the progress of electrification.

The total number of initial inspections and re-inspections conducted on main measuring instruments in the 3 years since 1990 is given below.

Year / Item	1990	1991	1992
Length	52,004	44,745	43,558
Mass	5,007,720	5,060,670	5,243,116
- Weights	(3,347,197)	(3,889,235)	(4,017,413)
- SIMPL	(28,536)	(29,148)	(29,096)
- Balances	(1,131,987)	(1,142,287)	(1,196,607)
Volume	1,217,770	1,081,648	1,207,667
- Cans	(1,205,431)	(1,068,444)	(1,193,871)
- Tanks	(11,845)	(12,662)	(12,947)
- Others	(494)	(542)	(849)
Water Meters	220,762	266,262	252,682
Flow Meters	1,621	1,532	1,921
Gasoline meters	8,285	9,206	11,116
Taxi Meters	21,716	23,768	19,781
Watt-Hour Meters	12,621	137,155	610,970

(4) Number of Inspectors

The staff members of the DOM and its local inspection laboratories are classified as inspectors responsible for actual inspection, assistant inspectors, controllers responsible for the enforcement of metrology laws and regulations, technical assistants without the relevant qualifications and administrative staff.

1) DOM

The staff composition of the DOM for the 5 years since 1989 is shown below.

	Inspectors	Assistant Inspectors	Controllers	Technical Assistants	Administrative Staff	Total
1989	29	0	5	25	90	149
1990	30	0	5	26	88	149
1991	31	2	4	26	87	150
1992	31	1	8	24	83	147
1993	32	2	1	22	87	144

The number of inspectors in these 5 years only slightly increased. The relative dominance of the administrative section was quite noticeable with administrative staff accounting for some 60% of the DOM's total manpower. Inspectors at the DOM are not directly involved in the initial inspection or re-inspection of measuring instruments and are responsible for the inspection (calibration) of standards held by the local inspection laboratories, the maintenance and control of standards used for the inspection (calibration) of subordinate standards and type approval tests.

2) Local Inspection Laboratories

The staff composition of the 47 local inspection laboratories for the 5 years since 1989 is shown in Table 3-3. The number of inspectors steadily increased every year with an increase of 60% to 342 in 1993 from 214 in 1989. The total number of staff, however, was almost level in the 4 years between 1989 and 1992 and slightly increased in 1993. The total number of staff in 1993 was 39 more than the 1989 level, a 3% increase in the 5 year period. The manpower strength of the 9 local inspection laboratories surveyed in 1993 is shown below.

	Inspectors	Assistant Inspectors	Controllers	Technical Assistants	Administrative Staff	Total
Jakarta	17	3	10	12	23	65
Surabaya	13	3	10	15	8	49
Medan	12	5	5	9	17	48
Bandung	9	5	7	8	14	43
Surakarta	14	2	8	8	9	41
Denpasar	9	7	1	5	9	31
Palembang	7	5	3	5	7	27
Bojonegoro	4	1	7	3	4	19
Anbon	2	4	1	3	7	17

There was a slight discrepancy in the manpower strength of the different laboratories, as shown by 8 inspectors at Bandung Laboratory, a large-size laboratory, compared to 14 and 9 at Surakarta and Denpasar Laboratories respectively, both of which are medium-size laboratories. It is, however, wrong to draw a hasty conclusion regarding the capability of each laboratory based on the current manpower level as the manpower quality and types of work conducted require clear assessment prior to reaching any conclusion. In general, it is safe to say that the systematic development of manpower, particularly instructors, should be planned to strengthen the local inspection laboratories.

(5) Measuring Instruments

1) Standards

The standards held by the local inspection laboratories are calibrated by the DOM every 5 years and are used to calibrate their own inspection standards every year to maintain the traceability of all standards.

The master standards allocated to all local inspection laboratories include a highly accurate standard linear scale, a Class E2 1kg standard weight, a highly accurate standard balance and standard tanks (for water and tank lorry meters). The larger laboratories are also equipped with inspection facilities for taxi meters and electric meter. Table 3-4 lists the measuring instruments held by each of the 47 local inspection laboratories. Standards which are commonly available at all the laboratories are given below.

① Mass

- Class E2 standard weights: 1mg - 1kg

- Class F1 standard weights: 1mg - 1kg
- Hard Class standard weights: 1kg
- Working standard weights: 1mg - 25kg
- High precision standard balances - Class C: 1kg, 50g, 1,000mg
- Inspection-grade balance - Class A: 15kg
  Class B: 10kg
- Hydrostatic balance: 0.5 kg

② Volume

- Glass volume tubes: 5mℓ - 1,000mℓ
- Volume tubes: 5, 10, 20, 50, 100, 200, 500, 1,000 litres

③ Flow

- Portable electronic secondary standard meter

④ Length

- Class 3 length standards
- Working length standards
- Comparator

As already shown by the actual inspection records, many instruments are related to mass measurement and the range of mass measuring instruments if fairly adequate.

The level of the available standards and inspection facilities varies from one laboratory to another and many are old or deteriorated. The maintenance of standards shows a particularly large discrepancy between laboratories, reflecting the conditions of the buildings, some of which are unsuitable to conduct accurate measurement. One example is that the present technical level of the laboratories, the environment of the standards room and the accuracy of the calibration equipment/instruments make it difficult to guarantee the original accuracy of 10^{-6} of Class E2 and Class F1 weights and high precision balances.

2) Type Approval Test Facilities

While test facilities for gas meters, water meters and watt-hour meters are available, none of the local inspection laboratories have the environmental test facilities required for the type approval test of measuring instruments and these facilities should be introduced in the near future. Other problems are the ambiguity of technical standards for measuring instruments, including the apparent absence of standards on durability and environmental performance, and the necessity to consolidate the inspection system through active research on the future introduction of electronic measuring instruments.

(6) Buildings and Environmental Conditions

The buildings of some of the local inspection laboratories are small and/or deteriorated to the point that the leakage of rain hampers inspection work. Such environmental arrangements as air-conditioning and the maintenance of standards is generally poor at most of the laboratories. It is necessary to check and rectify the problematic aspects of the buildings and to improve the environmental conditions, including temperature control, to ensure the proper maintenance of standards.

(7) Provision of Office Equipment

The provision of office equipment is rather poor at all the laboratories. A common register (large size) is used by all the laboratories to record the inspection results and to notify the date of the next re-inspection to measuring instrument users. All types of work, including checks on inspection applicants and notification of approaching inspection dates, etc., are conducted manually and take up a large part of the working hours.

In addition to the introduction of such OA equipment as computers and facsimiles, user control software should be developed to rationalise the administrative work in order to increase the capacity of each laboratory to deal with the increasing demand for inspection.

(8) Training System

The staff members related to legal metrology are graded as inspectors, assistant inspectors and controllers. In order to qualify as an inspector, it is necessary to undergo a 3 tier training course with each tier consisting of one year's classroom

study and one year's practical training and to pass an examination at the completion of each tier. This training system has succeeded in producing inspectors whose technical abilities little vary from one laboratory to another.

Controllers conduct on-the-spot inspection to detect those measuring instruments without the inspection or re-inspection mark and initiate the criminal prosecution process vis-a-vis offenders. These law enforcement activities are fairly strict and the amount of fines charged and collected is high.

3.4.2 Measuring Instruments Subject to Inspection

(1) Measuring Instrument Categories

Measuring instruments which are controlled by the Law on Legal Metrology in Indonesia are those used for commercial purposes regardless of their size. Consequently, those used for cooking or domestic purposes are not subject to inspection. Measuring instruments subject to inspection at present are roughly classified into the following categories.

- Length measuring instruments
- Mass measuring instruments
- Volume measuring instruments
- Flow measuring instruments
- Taxi meters
- Watt-hour meters, gas meters, water meters
- Petrol (pump) meters
- Pressure gauges
- Thermometers
- Aerometers, viscometers, liquefied gas meters, others

(2) Implementation, Record and Validity of Inspection

As described earlier, the category of mass measuring instruments has the largest number of items subject to inspection among all categories and its initial inspection rate is almost 100%. Re-inspection is extensively conducted, underlining the DOM's positive commitment to promoting the wider application

of the inspection system although problems do exist in terms of the number of inspectors and the level of inspection facilities.

The number of inspections is also fairly high in the case of such volume measuring instruments as various cans and tank lorries, taxi meters and water meters, suggesting active inspection in these categories.

Detailed inspection records by item and by type of inspection for the 3 year period from 1990 to 1992 are given in Table 3-3. The conditions of inspection implementation, inspection records and inspection result validity are described below for the main measuring instruments.

1) *Length Measuring Instruments*

The inspection of length measuring instruments, together with mass and volume measuring instruments, became compulsory in 1928, only a few years after the enactment of the Law on Legal Metrology in 1923. Following a transitional grace period of 10 years, official inspection commenced in 1938.

The subject items are mainly linear scales and tape measures. Scales and level gauges for wood processing are also inspected although the inspection volumes of these items are small.

The inspection volume dropped from 52,000 pieces in 1990 to 44,000 pieces in 1991 and 1992. By geographical area, the inspection of length measuring instruments was mainly conducted in Jakarta and Bogor, implying a concentration of the relevant manufacturers in these two areas. The validity of inspection approval is one year.

The number of completed initial inspections and re-inspections is given below.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	32,424	111	32,535	19,469	52,004
1991	20,779	122	20,901	23,844	44,745
1992	23,216	118	23,334	20,224	43,558

2) Mass Measuring Instruments

Mass measuring instruments are largely classified into weights and balances. The inspection of mass measuring instruments became compulsory into 1928 together with length measuring instruments and inspection commenced in 1938 after a transitional grace period of 10 years.

Most of the balances used for commercial purposes in Indonesia are manual balances, beam scales, and pendulum scales, and electronic scales which are used in Japan or the US are rate. Electronic scales for large supermarkets, truck scales for factories and automatic scales for conveyor belt lines are not yet widely used.

The actual level of initial inspections and re-inspections of mass measuring instruments is given below.

Year	Item	Initial Inspection			Re-Inspection	Total
		Domestic Products	Imported Products	Sub-Total		
1990	Weights	937,705	2	937,707	2,909,490	3,847,197
	Scales	287,416	4,486	291,902	868,621	1,160,523
	Sub-Total	1,225,121	4,488	1,229,609	3,778,111	5,007,720
1991	Weights	860,437	4	860,441	3,028,794	3,889,235
	Scales	260,192	4,616	264,808	906,627	1,171,435
	Sub-Total	1,120,629	4,620	1,125,249	3,935,421	5,060,670
1992	Weights	954,197	0	954,197	3,063,216	4,017,413
	Scales	299,659	5,594	305,253	920,450	1,225,703
	Sub-Total	1,253,856	5,594	1,259,450	3,983,666	5,243,116

The validity of inspection approval is one year for both scales and weights.

3) Volume Measuring Instruments

The inspection of volume measuring instruments commenced in 1938. The main small instruments relating to the measurement of volume include dry cans to measure rice and oil containers and wet cans while medium size and

large instruments include automobiles, such as tank lorries, vehicle transporting containers used for rail or maritime transportation and oil storage tanks.

The number of initial inspections and re-inspections from 1990 to 1992 is given below.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	947,199	2	947,201	270,569	1,217,770
1991	815,589	7	815,596	266,052	1,081,648
1992	972,211	26	972,237	235,430	1,207,667

The validity of inspection approval is one year for all inspections.

4) Flow Meters

The main flow meters are those used to measure the volume of oil flow from a tanker to an oil refinery plant and to measure the volume of oil flow from a storage tank to a tank lorry. The number of initial inspections and re-inspections during the same period is given below.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	0	81	81	1,621	1,702
1991	0	60	60	1,472	1,532
1992	0	160	160	1,753	1,921

The validity of inspection approval is one year.

5) Water Meters

The total number of inspections stood at approximately 221,000 in 1990, 266,000 in 1991 and 253,000 in 1992. With the growing water supply service, the number of water meters in use is also steadily increasing.

By geographical distribution, the Jakarta and Surabaya Laboratories conducted some 70% of the entire water meter inspections, reflecting the availability of the water service in large cities. The number of laboratories with a negligible number of water meter inspections gradually declined

from 25 in 1990 to 20 in 1991 and further to 18 in 1992, indicating the steady development of the water service throughout Indonesia.

The number of initial inspections and re-inspections in the 3 year period is given below. The validity of inspection approval is 5 years.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	155,143	61,907	217,050	3,712	220,762
1991	197,778	65,505	263,283	2,979	266,262
1992	193,584	55,651	249,235	3,447	252,682

6) Gasoline meters

Although the geographical distribution of inspections was not uniform, all 47 local inspection laboratories conducted gasoline meter inspections. Out of the some 11,000 meters inspected in 1992, some 2,000 (15%) were inspected at the Jakarta Laboratory. All those laboratories which conducted more than 500 inspections were located on Java Island at Bandung, Bogor, Surakarta, Surabaya and Jakarta.

The number of initial inspections and re-inspections in the 3 year period is given below.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	0	841	841	7,444	8,285
1991	0	794	794	8,412	9,206
1992	0	885	885	10,231	11,116

Given the one year validity of inspection approval, the re-inspection enforcement ratio appeared to be almost 100%.

7) Taxi Meters

A total of 19 laboratories (approximately 40%) of the 47 laboratories conducted taxi meter inspections during this period.

The geographical distribution of laboratories conducting taxi meter inspections was confined to 6 laboratories on Java Island, including those at

Jakarta, Bandung and Surabaya, in 1990 but expanded to those laboratories in 3 regions, including Sumatera and Bali, in 1991 and further to those in Kalimantan in 1992, indicating a gradual spread of the taxi meter inspection capability throughout the nationwide laboratory network.

The number of initial and re-inspections of taxi meters in the 3 year period from 1990 to 1992 is given below. The validity of inspection approval is one years.

Year	Initial Inspection			Re-Inspection	Total
	Domestic Products	Imported Products	Sub-Total		
1990	0	6,648	6,648	15,068	21,716
1991	5	3,808	3,813	19,955	23,768
1992	21	2,935	2,956	16,825	19,781

8) Watt-Hour Meters

The first initiative to make watt-hour meter inspection compulsory took place in 1949 but did not actually materialise for a long time. A project team was established with the cooperation of the PLN in 1982 to study and examine the feasibility of introducing a compulsory inspection system. A joint ministerial ordinance by the Department of Commerce and the Department of Mining and Energy was promulgated in 1988 and actual inspections commenced in fiscal 1991 by local inspection laboratories.

The inspection records of each laboratory for the 3 year period from 1990 to 1992 are given in Table 3-19. Inspections were conducted at only 5 laboratories in 1991, increasing to 18 in 1992. The number of meters inspection sharply increased from some 13,000 in 1990 to 137,000 in 1991 and further to 611,000 in 1992. Since 1992, it appears that some 10% of the inspection watt-hour meters have been imported meters.

The number of initial inspections of single phase watt-hour meters in Indonesia is 1.5 million. Assuming that imported meters are roughly equivalent to 10% of the number of domestically manufactured meters, the total number of new meters for inspection is estimated to be more than 1.7 million.

The inspection of watt-hour meters is conducted in the following manner.

① Self-heating (10% of rated voltage and base current; power factor 1; 30 minutes)

② Creeping test (application of 110% of rated voltage)

③ Minimum running current test (with rated voltage and a power factor 1; application of 0.5% of base current; applicable to precision watt-hour meters)

④ Error test (with rated voltage and rated frequency)

i) 100% of rated current; power factor 1 and 0.5

ii) 50% of rated current; power factor 1 and 0.5

iii) 5% of rated current; power factor 1

* ii) above will not be applied in the case of single phase watt-hour meters.

⑤ Meter adjustment is conducted for the error test to improve the pass rate.

⑥ Watt-hour meter is conducted for a combination of a meter and current limiter.

3.4.3 National Measurement Standards and Inspection Standards

(1) Standard Quantities

1) Length Measuring Instruments

The KIM-LIPI is responsible for the establishment of national length standards and has established the length standard with an interferometer using a He-Ne stabilised laser based on the definition of a "meter" to establish national traceability. The primary standard linear scale (1m in length) owned by the DOM in the line standard-based legal metrology field is calibrated by the length standard using an interferometer.

2) Mass Measuring Instruments

The DOM owns a one kg prototype and compares it with another prototype owned by the International Bureau of Weights and Measures every 10-15 years. In Indonesia, the primary national standard calibrated by the prototype is used to calibrate secondary one kg standards every 5 years which in turn are used to calibrate tertiary one kg standards owned by the laboratories every 5 years.

3) Volume Measuring Instruments

Volume standards are derived units. In the legal metrology field, the DOM uses standard weights to calibrate liquid volume standards and the standard bell prover for the air volume standard. In the case of large tanks, the volume standard is derived from length.

The standards for the following meters are maintained as derived units from volume, mass and time quantities.

4) Flow Meters

Volume or mass and time

5) Water Meters

Standard volmetric tube or mass

6) Gasoline meters

Volume or mass

7) Taxi Meters

Length and time

(2) Control of Standards

1) Length

With regard to the control conditions for standards at the local inspection laboratories, it must be pointed out that no air-conditioning is provided. The only visible control is that the 1m standard linear scale is kept in a specially designed wooden box, illustrating the generally poor control conditions.

With regard to the inspection of tape measures, the DOM has a 20m standard tape measure and the large laboratories have either a 10m or 20m standard tape measure.

2) Mass

The control conditions for standards depend on the laboratory size. Medium size and large laboratories have an independent storage room with

some degree of air-conditioning to control the room temperature and humidity. Some small laboratories have an independent storage room while others use part of the high accuracy balance calibration room. In either case, there is no air-conditioning and the only noticeable control is to keep the standards in a specially designed wooden box.

While the size of the inspection space varies from one laboratory to another depending on the laboratory size, the balances to calibrate weights and the weights in use are more or less similar at all the laboratories. As all the inspection tools, including balances and weights, are deteriorated, their systematic renewal is necessary.

3) Volume

The 500 litre and 1,000 litre standard tanks used for inspection are calibration using the 20 litre volmetric standard which is calibrated by the DOM to maintain its accuracy.

4) Water Meters

The inspection facilities at the laboratories aim at supply water meters which can be used as standards. The 200 litre standard tank with a glass gauge is calibrated by the 20 litre volmetric standard every 3 years to maintain its accuracy. The present facility size appears to be adequate to supply standard water meters.

5) Gasoline meters

The work standard tank used for inspection is calibrated by the 20 litre standard tank which is in turn calibrated by the 20kg standard weight. As this traceability largely depends on the accuracy of the 20kg standard weight, the accuracy of the 20kg standard weight calibrated by the one kg secondary standard weight of the DOM plays a crucial role.

6) Watt-Hour Meters

The standards for basic electric quantities are maintained by the KIM-LIPI and are supplied to some 20 networked organizations, including the LMK-PLN. Each networked organization assembles the units for practical electric quantities and supplies them to related organizations and offices, etc. The electric standards traceability system at the LMK-PLN is shown in

Fig. 3-5. The standard watt-hour meter (RCS: Rotating Sub-Standard Wha) used for the error test of ordinary watt-hour meters is calibrated by the secondary standard watt-hour meter (standard wha) which in turn is calibrated by an AC/DC comparator traceable to the national standard. The establishment of the watt-hour standard at the LMK-PLN is highly evaluated by the KIM-LIPI together with the high control level (repeatability: ± 0.03 μV) of the voltage standard.

(3) Calibration of Inspection Standards

1) Length Measuring Instruments

The DOM uses the primary standard linear scale and comparator to calibrate the 1m standard linear scales (some with a comparator) owned by the local inspection laboratories to an accuracy of 10^{-5}.

2) Mass Measuring Equipment

The DOM has established the primary standard, which is the highest standard in the national legal metrology system, based on the one kg prototype and uses this primary standard to calibrate secondary standards every 5 years. These secondary standards are, in fact, distributed to the local inspection laboratories as master standards. The laboratories use these master standards to calibrate their own inspection standards every year in order to complete the traceability system for mass in the national legal metrology system. Each laboratory is responsible for calibrating its standard weights by dividing or multiplying the one kg master standard. However, as comparison of the weights calibrated by different laboratories is not conducted, it is quite possible that a reliable level of accuracy is not achieved due to differences between laboratories in terms of the technical level, control conditions of standards and control of the calibration environment.

3) Volume Measuring Instruments

Each laboratory calibrates 5 litre, 10 litre and 20 litre standard tanks with a gauge glass vernier for liquid measurement using the weight method involving standard weights. Using these reference standard tanks, 500 litre and 1,000 litre standard tanks for the inspection of tank lorries and 200 litre standard tanks for the inspection of water meters are calibrated. The 5 litre, 10 litre and 20 litre standard tanks with a gauge glass vernier are calibrated

using the weight method (the standard tank is filled with water and its weight is compared with the standard weight) every 3 years at each laboratory.

4) Water Meters

The standard water meters used for the inspection of ordinary water meters are calibrated by a master meter. This calibration work is jointly conducted at the PDAM laboratories by a laboratory inspector and a PDAM inspector. The large and medium size laboratories have facilities to calibrate standard water meters.

5) Taxi Meters

The standards used for the inspection of taxi meters are calibrated in terms of distance and time in the case of the actual travelling test method and the drum circumference and number of revolutions in the case of the stationary engine running method. In other words, these standards are calibrated by the length standards, time and electric pulse signals.

6) Watt-Hour Meters

The calibration of the standards used for inspection purposes must achieve some kind of traceability to the national standards. The LMK-PLN meets this requirement to a large extent as described so far in this section. Regrading the standard watt-hour meters owned by the PLN's divisional offices as primary standards, those owned by owned by the PLN's section branches as secondary standards and those owned by manufacturers as tertiary standards, these standards are currently calibrated in the following manner. Tertiary standards and primary standards are calibrated every 9 months and 18 months respectively by the mobile LMK-PLN Calibration Group or at the LMK-PLN. These calibration intervals are rather long compared to the 6 months and 12 months in Japan. Secondary standards are calibrated by the standards owned by the divisional offices every 12 months.

3.4.4 Type Approval Test

The type approval test records are shown in Table 3-6. A relatively large number of tests are conducted in the case of such volume measuring instruments as dry/wet cans and tank lorries and also in the case of mass measuring instruments.

The type approval test facilities for gasoline meters at the DOM are of a fairly high standard but were only used once in 1990, indicating problems of the test implementation system.

The 4 tests for water meters and 5 tests for taxi meters do not appear to reflect the reality as the number of corresponding inspections is quite high.

The type approval test of watt-hour meters is conducted by the LMK-PLN and approved by the DOM. As this kind of arrangement is also observed in France and the UK, etc., the present arrangement will continue in the future. As Table 3-27 shows, type approval tests of watt-hour meters consist of 29 test items and the manufacturer is required to submit 7 watt-hour meters to the PLN for type approval purposes. The test data are compared with the SPLN standards and others. When the requirements of such standards are generally met, official type approval is given. The number of type approval tests for watt-hour meters and others conducted by the LMK-PLN in the past 5 years is shown in Fig. 3-10. The simple annual average is 9 tests and approximately 5 tests in the case of single phase watt-hour meters and three phase watt-hour meters respectively.

The DOM has expressed a desire to conduct its own type approval tests. A cautious approach is required in planning such a move in view of the small number of type approval tests currently undertaken, the type approval test system in foreign countries which does not necessarily encourage such a move and the cost of the test facilities as well as manpower development.

Areas for improvement of the current type approval test system include the partially ambiguous test methods and the absence of well-defined manuals, etc. These shortcomings should be rectified together with further consolidation of the test equipment to improve the overall type approval test system in Indonesia to meet the real demand for tests.

CHAPTER 4

CURRENT CONDITIONS AND PENDING PROBLEMS OF INDUSTRIAL METROLOGY

CHAPTER 4

CURRENT CONDITIONS AND PENDING PROBLEMS OF INDUSTRIAL METROLOGY

4.1 Current Conditions of Industrial Metrology

The establishment of measurement standards and the expansion/consolidation of the calibration service for standards and measuring instruments, both of which comprise the technical basis for qualitative improvement of industrial activities and products, are important. A metrology standard organization must have a traceable collection of standards, consisting of the primary standard at the top and secondary and working standards for each type of quantity. The current conditions of industrial metrology in Indonesia are described below, taking the above-described requirements into consideration.

4.1.1 National Metrology Standards

Indonesia has a certification system for measuring instruments calibration laboratories which form the National Measuring Instruments Calibration Network (JNK). While the Metrology Committee of the National Measuring Instruments Standardisation Council (DSN) acts as the Secretariat of the JNK, the KIM-LIPI conducts the essential activities. The KIM-LIPI is responsible for the supervision and coordination of the certification and measurement activities of the certified measuring instruments calibration laboratories and also for the supply of standards to members of the JNK. At present, the JNK has 22 organizations, ranging from private and public enterprises to government organizations.

(1) DSN

The DSN is the supreme organization which decides the development course for metrology standards in Indonesia and was established in 1984 by a relevant Presidential decree. The main roles of the DSN are to coordinate organizations engaged in standardisation activities and to provide the President with advice on policies relating to standardisation.

As shown in Fig. 4-1, the DSN is chaired by the Minister of Research and Technology with the Minister of Industry and the Minister of Trade acting as

Deputy Chairmen. The Deputy Director of the LIPI acts as the Secretary and the members represent the Departments of Industry, Trade, Health, Agriculture, Forestry, Manpower, Mining and Energy, Transportation and Public Works, the Technology Application Council and the National Atomic Council.

There are 6 subordinate committees, including the Calibration Committee which is chaired by a DSN appointee with members representing the Departments of Industry, Trade, Health, Agriculture and Manpower and the Technology Application Council. The actual management of the Metrology Committee is conducted by the LIPI as the Secretary of the DSN. The main fields of work of the DSN are described below and also shown in Fig. 4-2.

1) Issues relating to standardisation by the government and private enterprises, etc.
2) Issues relating to the provision of an information for the government and private enterprises, etc.
3) Issues relating to testing laboratories, calibration centres and the National Calibration Network.
4) Issues relating to the ISO, IEC, ASEAN standards and the national committee on Asia-Pacific standardisation.
5) Issues relating to coordination between the following committees.
   - National Standardisation Policy and Planning Committee
   - Official Indication of Standards Committee
   - Testing Certification Committee
   - International Cooperation and Information on Standardisation Committee
   - Safety Standards Evaluation Committee
   - Calibration Committee

Issues relating to metrology standards are handled by the Calibration Committee.

(2) KIM-LIPI

The KIM-LIPI was first established in 1967 by Presidential Decree No. 128 as the National Institute for Instrumentation - Indonesian Institute of Science. It was relocated in 1986 to the Science and Technology Development Centre in

Cirebon with the procurement of new buildings and equipment to facilitate calibration work as part of the Science and Technology Development Programme. In the same year, the name was changed to the KIM-LIPI (Research and Development Centre for Calibration, Instrumentation and Metrology - Indonesian Institute of Science) by Presidential Decree No. 1. Presidential Decree No. 7 of 1989 made the KIM-LIPI responsible for the technology control of national physical standards as it designated the KIM-LIPI as the national research institute for standards.

The KIM-LIPI controls the national standards for length (interferometer), voltage (standard cell), temperature (triple point of water, lead, silver and gold), luminosity (standard bulb), force upto 1 MN, capacitance, inductance and resistance.

All standards are regularly traced within the regional framework of the Asia-Pacific Metrology Programme as well as with standards controlled by the the PTB (Germany), NML (Australia) and CERLAB (France).

The main domestic work of the KIM-LIPI is research and development on metrology, calibration and instrumentation. Work in relation to metrology standards is conducted by the R & D Division for Calibration and Metrology Systems as shown in Fig. 4-3 which consists of the following 6 laboratories.

- Accoustical Metrology Laboratory
  microphones; noise meters; vibration meters
- Mechanical Metrology Laboratory
  force; pressure; mass; density; viscosity; volumeters
- Electrical Metrology Laboratory
  voltage; radio waves; power; capacity; inductance; resistance; frequency; time
- Temperature Metrology Laboratory
  temperature; relative humidity; moisture meters
- Dimensional Metrology Laboratory
  length; angle; linearity; flatness; surface roughness; circularity
- Optical Metrology Laboratory
  standard bulbs; illumination meters

(3) Metrology Standards Supply System

The metrology standards supply system is established by the 22 organizations belonging to the JNK. These organizations receive standards, mainly related to the 7 basic quantities of temperature, length, current, frequency, photometry and mass, and re-supply standards to private enterprises and others. The relevant traceability system is shown in Fig. 4-4.

4.1.2 Pending Problems

(1) Calibration Organizations

Although 22 organizations are certified by the JNK as metrology standards supply organizations, the domestic metrology standards supply system is still inadequate due to the concentration of most of these organizations on Java island. The establishment of new metrology standards supply organizations in local areas is necessary in response to the development of Indonesian industries in the coming years. At present, however, only university laboratories appear to be capable of metrology standards supply in local areas. A likely solution is the designation of key verification laboratories from among the existing 47 verification laboratories throughout Indonesia to act as metrology standards supply organizations.

(2) Standard Quantities

The KIM-LIPI is currently supplying standards for mainly base units. In the future, it will be required to also supply standards for derived units to meet the growing industrial demand for such units, making the further expansion of the KIM-LIPI necessary.

In view of the increasing seriousness of the adverse impacts of industrial development on the environment, the supply of standards for measuring instruments used for environmental measurement is essential. While the KIM-LIPI has a research section for noise and vibration and supplies standards in these areas, no such system is currently available for chemical quantities. Environmental analysis equipment requires the supply of such chemical substances as standard gases (NOx, SO_2 and CO, etc.) and standard pH liquid, etc. The metrology standards supply system in these areas must also be developed. More direct suggestions are not made here, however, as the present Study does not concern the desirable reform of the KIM-LIPI.