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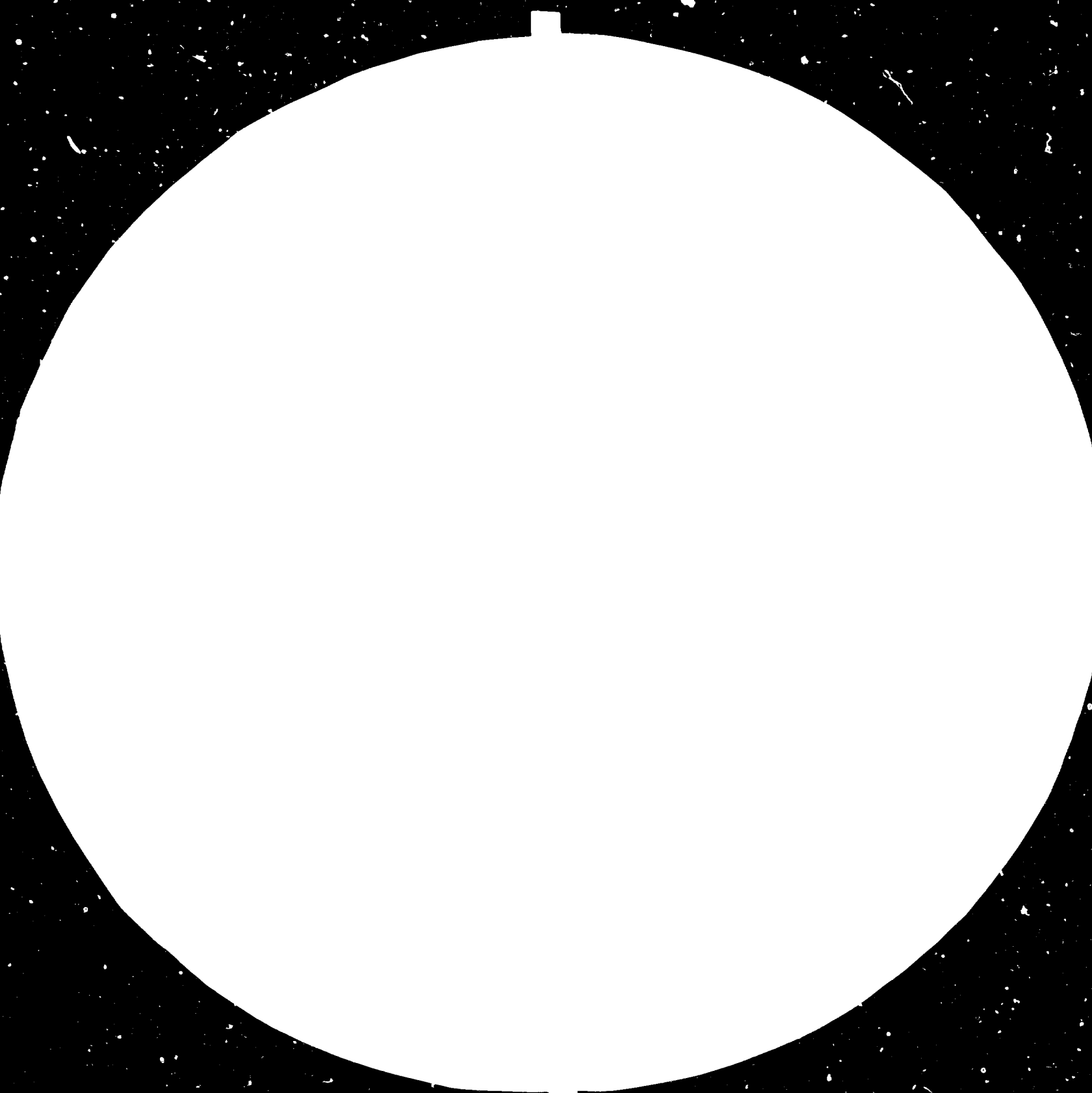
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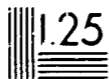
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Expert Group Meeting on the Energy-related  
Equipment and Technology  
Vienna, 19-21 December 1983

REPORT\* (Meeting on energy-related  
equipment and technology).

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1. As a preparation for the Second Consultation on the Capital Goods Industry with Special Emphasis on the Energy-related Equipment and Technology, an Expert Group Meeting on Energy-related Equipment and Technology was held in Vienna from 19 to 21 December 1983.

2. The meeting was opened with an introductory statement by the Head of the Sectoral Studies Branch of UNIDO. He described the purpose and objective of the meeting which was to prepare terms of reference for a set of country case studies, as a contribution to the Second Consultation.

3. The secretariat introduced an ad-hoc information document prepared by a small Expert Group Meeting on Energy-related equipment and Technology convened in Vienna, From 10 to 12 October 1983. This document included draft terms of reference for the country case studies.

4. After the general discussion of the recommendations of the First Consultation on the Capital Goods Industry and the preparatory work for the Second Consultation, the participants made a review of the ad-hoc information document and agreed on the detailed terms of reference for country case studies (see Annex A).

5. The list of participants appears in Annex B.

TERMS OF REFERENCE FOR COUNTRY CASE STUDIES  
ON THE ELECTRIC POWER EQUIPMENT

1. Selection of equipment

Case studies will mainly cover the following equipment (cf. SITC, Rev. 2, UN/ST/ESA/SER.M/34/REV.2) - see also Annex I:

Division 71 : Power generating machinery and equipment (excluding nuclear reactors)

711: Boilers, other boiler house equipment, steam turbines.

714: Gas turbines

716: Electric motors and generators

718: Other power generating machinery (including water turbines)

Division 77 : Electrical machinery, apparatus and appliances

771: Electrical power machinery (transformers, static converters, inductors, etc.)

772: Switchgear

773: Equipment for distributing electricity (excluding low voltage domestic installations and apparatus)

Note: Transmission towers and poles and associated parts (such as insulators, fittings, etc.) are also included.

2. General and statistical information (for the description of terms and energy conversion factors see Annex II and III, respectively):

a) Domestic production of primary energy (coal, other solid fuels, crude oil, natural gas, hydroelectricity, nuclear electricity and geothermal electricity) and their utilization rate (in Terajoules, TJ, for the last ten years, if available; see sample table in Annex IV);

b) Past and present data, planned future projections for electrical energy generation and consumption (installed capacity in MW for hydro, conventional thermal, nuclear and geothermal power stations; electricity generation in GWh; generation per installed capacity in GWh/MW; consumption by industry and construction, transport, and household; ownership of generation plants, public and self-producer; see sample table in Annex IV)

c) Historical development of agencies and/or bodies (governmental, private, regional) involved in generation, transmission and distribution of electric energy (including specialized planning and financing institutions).

d) Plans for development of electric power generation, transmission and distribution (large-scale projects and rural electrification; with special emphasis on micro and mini hydro electric generation).

3. Specific information on the national electric power system

a) Existing electric power generation plants, transmission and distribution systems (type, capacity, local content and foreign supplier, see sample table in Annex IV).

b) Maintenance activities:

- i. Maintenance facilities, spare part supply and repair and maintenance management.
- ii. The role of foreign technical assistance in repair and maintenance activities.
- iii. Training for repair and maintenance, including the role of foreign technical assistance.
- iv. Role of repair and maintenance activities in the creation of domestic production capabilities and its impact on the mastering of technologies.

c) The role of domestic and foreign engineering companies and/or consultancy services in planning, carrying out the feasibility studies and supervising the erection of the power system.

d) Information on the domestic civil works capabilities and their utilization in the electric power system projects.

4. Domestic production of electric power equipment

a) Macro-economic data for the electric power equipment industry including estimated 1983 figures (at current and constant prices - US\$ if available):

- i. Gross production (also quantity data if available);
- ii. Manufacturing value added;
- iii. Exports and imports;
- iv. Employment.

b) Historical development of the electric power equipment industry (the progression in the locally manufactured equipment, the organization of production facilities, licencing agreements, the role of state in the development of this industry, etc.).

c) Types and quantity of existing electric power generation, transmission and distribution equipment which were domestically manufactured (volume, value, manufacturer, local content, technology sources; see sample table in Annex V).

d) Organization of production: Total number of electric power equipment manufacturers and for each main producer:

- i. Name, address and date of foundation
- ii. Size (annual turn-over and employment)
- iii. Capital formation (domestic-private or public, joint venture and subsidiary)
- iv. Technology sources
- v. Main products and their local content.
- vi. Subcontracting policies and the problems with subcontractors.
- vii. Diversification (either a specialized company producing only electric power equipment or a multi-purpose unit also manufacturing other capital goods)



e) Mastering of technology:

i. Assessment and evaluation of the indigenous development of technology at industry and national levels through:

- Training
- Adaptation
- Research and development (with special emphasis on the mastering of design and development processes)

(Including the role of foreign technical assistance from developed and/or other developing countries in the above mentioned activities.)

ii. Assessment and evaluation of the import of technology through:

- Licencing (parties involved, conditions, related national legislation, etc.)
- Joint ventures with foreign companies
- Subsidiaries of foreign companies

f) Constraints on the domestic production of electric power equipment and measures that have been and are being taken to remove these constraints:

- Markets
- Financing
- Infrastructure
- Manpower
- Technical and technological barriers
- Lack of negotiating skills (e.g. licensing, transfer of technology agreements, etc.)
- Other constraints

5. Linkages with the other capital goods industries (for a list of capital goods, see Annex V)

a) Supply of raw materials (in particular steel, copper and aluminium) and intermediate products to the electric power equipment industry.

b) Availability of services of basic facilities (casting, forging, etc.) for the electric power equipment production.

c) Experience of the multi-purpose production and assessment of future possibilities (the possibility of utilising the capabilities to manufacture the electric power machinery for the production of other capital goods, and vice versa).

6. Policies and strategies

a) National energy and industrial policies (importance given to the national capital goods industry in general and electric power equipment industry in particular, in planning, in foreign currency allocations, in implementation of investment programmes, etc.).

b) The role of government (state enterprises, incentives, protection, training, government purchasing and market manipulations through legislation, etc.).

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

- Technical and economic institutional framework
- Sale/purchase of equipment with favorable terms
- Export/import of technology
- Technical assistance (including training)
- Exchange of technical and commercial information
- Joint projects
- Other areas of mutual interest.

7. Measures to be taken to increase the domestic production of electric power equipment and to improve linkages with other capital goods industries.

(Including action oriented recommendations for developing the electric power equipment industry; roles of public and private sector; bilateral, regional and international co-operation; role of international organizations, etc.)

8. Other energy-related technologies: Domestic production of energy-related equipment other than electric power equipment.

RELATED GROUPS OF SITC DIVISIONS 71 AND 77

Group	Subgroup	Item	Corresponding BTN heading or subheading	Related heading of SITC, Revised	BCC Category
SECTION 7. MACHINERY AND TRANSPORT EQUIPMENT					
DIVISION 71. POWER GENERATING MACHINERY AND EQUIPMENT					
711		Steam and other vapour generating boilers, super-heated water boilers, and auxiliary plant for use therewith; and parts thereof, n.e.s. <u>109/</u>		{711.1 711.2	
	711.1	Steam and other vapour generating boilers (excluding central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers	84.01A	(110/)	41
	711.2	Auxiliary plant for use with boilers of heading 711.1 (e.g., economizers, superheaters, soot removers, gas recoverers and the like); condensers for vapour engines and power units	84.02A	(111/)	41
	711.9	Parts, n.e.s. of the boilers and auxiliary plant falling within headings 711.1 and 711.2			
		711.91 Parts, n.e.s. of the boilers falling within heading 711.1	84.01B	(110/)	42
		711.99 Parts, n.e.s. of the apparatus and appliances falling within heading 711.2	84.02B	(111/)	42
712		Steam and other vapour power units, not incorporating boilers; steam engines (including mobile engines, but not steam tractors falling within heading 722 or mechanically propelled road rollers) with self-contained boilers; and parts thereof, n.e.s. <u>109/</u>		711.5	
	712.6	Steam and other vapour power units, not incorporating boilers; steam engines (including mobile engines, but not steam tractors falling within heading 722 or mechanically propelled road rollers) with self-contained boilers			41
		712.60[a] Steam engines (including mobile engines, but not steam tractors falling within heading 722 or mechanically propelled road rollers) with self-contained boilers	[84.04]	711.51	
		712.60[b] Steam and other vapour power units, not incorporating boilers	84.05A		
	712.9	Parts, n.e.s. of the power units and engines falling within heading 712.6	84.05B	711.52	42
714		Engines and motors, non-electric (other than those of groups 712, 715 and 718); parts, n.e.s. of the engines and motors of group 714 and item 718.88		(109/)	
	714.4	Reaction engines	84.08A	(112/)	53
	714.8	Gas turbines, n.e.s.			
		714.81 Turbo-propellers	84.08B	(112/)	53
		714.82 Other gas turbines, n.e.s.	84.08C	(113/)	53
	714.9	Parts, n.e.s. of the engines and motors of group 714 and item 718.88			
		714.91 Parts, n.e.s. of reaction engines or turbo-propellers	84.08E	(112/)	53
		714.99 Parts, n.e.s. of the engines and motors of headings 714.88 and 718.88	84.08F	(114/)	53
716		Rotating electric plant and parts thereof, n.e.s.		(115/), (116/)	
	716.1	Motors and generators, direct current	85.01A		41
	716.2	Electric motors and generators (other than direct current) and generating sets			
		716.21 Electric motors (including universal (A.C./D.C.) motors), other than direct current	85.01B		41
		716.22 Generators, alternating current	85.01C		41
		716.23 Generating sets with internal combustion piston engines	85.01D		41
		716.3 Rotary converters	85.01E		41
		716.9 Parts, n.e.s., of rotating electric plant	85.01F		42
718		Other power generating machinery and parts thereof, n.e.s.		(109/)	
	718.7	Nuclear reactors, and parts thereof, n.e.s.	84.59A	711.7	41
	718.8	Engines and motors, n.e.s. (wind engines, hot air engines, water wheels and water turbines)			
		718.81 Water turbines	84.07A		41
		718.82 Other hydraulic engines and motors (including water wheels)	84.07B	(117/)	41
		718.83 Other engines and motors, n.e.s.	84.08D	(118/)	41
		718.89 Regulators for and parts, n.e.s. of the engines and motors falling within headings 718.81 and 718.82	84.07C	(117/)	42

Group	Subgroup	Item	Corresponding BTN heading or subheading	Related heading of SITC, Revised	BEC Category
DIVISION 77. ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES, N.E.S., AND ELECTRICAL PARTS THEREOF (INCLUDING NON-ELECTRICAL COUNTERPARTS, N.E.S. OF ELECTRICAL HOUSEHOLD TYPE EQUIPMENT)					
771		Electric power machinery (other than the rotating electric plant of heading 716), and parts thereof, n.e.s.		(115/), (116/)	
	771.1	Transformers, electrical			
		771.11 Liquid dielectric transformers	85.01G		41
		771.18 Other electric transformers	85.01H		41
	771.2	Other electric power machinery; parts, n.e.s. of the electric power machinery falling within heading 771			
		771.21 Static converters, rectifiers and rectifying apparatus	85.01I		41
		771.22 Inductors	85.01J		41
		771.29 Parts, n.e.s. of the electric power machinery falling within heading 771	85.01K		42
772		Electrical apparatus for making and breaking electrical circuits, for the protection of electrical circuits, or for making connections to or in electrical circuits (e.g., switches, relays, fuses, lightning arresters, surge suppressors, plugs, lampholders and junction boxes); resistors, fixed or variable (including potentiometers), other than heating resistors; printed circuits; switchboards (other than telephone switchboards), and control panels, n.e.s.; parts, n.e.s. of the foregoing apparatus 115/		722.2	
	772.1	Electrical apparatus for making and breaking, for protecting and for making connections to or in electrical circuits (e.g., switches, relays, fuses, lightning arresters, surge suppressors, plugs, lampholders and junction boxes); switchboards (other than telephone switchboards), and control panels, n.e.s.; parts, n.e.s. of the foregoing apparatus	85.19A		42
	772.2	Printed circuits and parts thereof, n.e.s.	85.19B		42
	772.3	Resistors, fixed or variable (including potentiometers), other than heating resistors, and parts thereof, n.e.s.	85.19C		42
773		Equipment for distributing electricity		723	
	773.1	Insulated (including enamelled or anodized) electric wire, cable, bars, strip and the like (including co-axial cable), whether or not fitted with connectors	85.23	723.1	22
	773.2	Electrical insulating equipment		723.2	
		773.21 Electrical conduit tubing and joints therefor, of base metal lined with insulating material	85.27	723.23	22
		773.22 Electrical insulators of glass	85.25A	723.21	42
		773.23 Electrical insulators of ceramic materials	85.25B		42
		773.24 Electrical insulators of other materials	85.25C		22
		773.25 Insulating fittings for electrical machines, appliances or equipment, being fittings wholly of glass apart from any minor components of metal incorporated during moulding solely for purposes of assembly (but not including insulators falling within heading 773.22)	85.26A	723.22	22
		773.26 Insulating fittings for electrical machines, appliances or equipment, being fittings wholly of ceramic materials apart from any minor components of metal incorporated during moulding solely for purposes of assembly (but not including insulators falling within heading 773.23)	85.26B		22
		773.27 Insulating fittings for electrical machines, appliances or equipment, being fittings wholly of other insulating materials apart from any minor components of metal incorporated during moulding solely for purposes of assembly (but not including insulators falling within heading 773.24)	85.26C		22

DESCRIPTION OF TERMS USED IN THE TABLES

CAPACITY: Nominal or nameplate rating of generators.

GROSS PRODUCTION: Total output of power plants, including power used in station operations.

NET PRODUCTION: Output, excluding power used in station operation.

LOSSES IN TRANSMISSION AND DISTRIBUTION: Losses which occur outside the generation plant.

HYDROELECTRICITY: Power generated from falling water, including electricity produced by pumped storage plants .

CONVENTIONAL THERMAL ELECTRICITY: Electricity generated in power plants using conventional fuels (commercial or non-commercial). This includes electricity generated in diesel and gas turbine plants as well as steam plants.

NUCLEAR ELECTRICITY: Electricity generated in power plants which derive their energy from nuclear fuels.

GEOTHERMAL ELECTRICITY: Power generated from volcanic steam.

UTILITIES: Electricity supply systems operated primarily as suppliers of power for public use (as distinguished from industrial and transportation agencies generating primarily for their own use).

CONSUMPTION: Net supply, excluding own use and loss; power delivered to consumers.

CONSUMPTION BY INDUSTRY AND CONSTRUCTION: Excluding consumption by the electricity generating sector.

CONSUMPTION BY TRANSPORT: Excluding the consumption of agricultural sector.

CONSUMPTION BY HOUSEHOLD AND OTHER CONSUMERS: Includes households, agriculture, public lighting and all other sectors.

NET IMPORTS: Total imports minus total exports.

GROSS SUPPLY: Gross production plus net imports.

NET SUPPLY (=gross consumption): Net production plus net imports.

NET CONSUMPTION: Net supply minus transmission and distribution losses

STANDARD CONVERSION FACTORS<sup>\*/</sup>

(Terajoules/1000 metric tonnes - TJ/1000 MT)

Hard coal	29.3076	Naphtha	44.1289
Lignite/brown coal	11.2834	White/industrial spirit	43.2078
Coke-oven coke	26.3768	Gas-diesel oils	42.4960
Gas coke	26.3768	Residual fuel oils	41.4996
Brown coal coke	19.6361	Lubricants	42.1401
Patent fuel briquettes	29.3076	Feedstocks	43.9405
Lignite briquettes	19.6361	Plant condensate	44.3131
Peat	9.5250	Bitumen (asphalt)	41.8000
Fuelwood (9.7 TJ/1000 M <sup>3</sup> )	13.4734	Petroleum waxes	43.3334
Charcoal	28.8888	Petroleum coke	36.4000
Bagasse	7.7221	Other petroleum products	42.4960
Crude petroleum	42.6133	Liquefied petroleum gas	45.5440
Natural gas liquids	45.1923	Refinery gas	(original unit is TJ)
Aviation gasoline	43.9614	Natural gas	(original unit is TJ)
Motor gasoline	43.9614	Gasworks gas	(original unit is TJ)
Natural gasoline	44.8992	Coke-oven gas	(original unit is TJ)
Jet fuel	43.1994	Blast furnace gas	(original unit is TJ)
Kerosene	43.1994	Electricity (1000 Kwh)	3.6048

<sup>\*/</sup> Special conversion factors applicable to a certain country can be utilized provided that it is clearly indicated.

TABLES

- i. Domestic production of primary energy
- ii. Electric energy production and consumption
- iii. Electric energy production (projections)
- iv. Existing electric power equipment
- v. Domestic production of electric power equipment



DOMESTIC PRODUCTION OF PRIMARY ENERGY (in Terajoules - TJ)\*/

Energy source Year	Coal		Other solid fuels		Crude petroleum		Natural gas		Electricity**/		TOTAL	
	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%	TJ	%
1972												100
1973												100
1974												100
1975												100
1976												100
1977												100
1978												100
1979												100
1980												100
1981												100
1982												100
1983												100

\*/ This table is related to para. 2.a.

\*\*/ Only hydro and geothermal electricity, i.e. from domestic primary sources.

ELECTRIC ENERGY PRODUCTION AND CONSUMPTION<sup>\*/</sup>

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
<b>INSTALLED CAPACITY</b>	MW (Megawatts)											
Public and self-producer total												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
Public total												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
<b>PRODUCTION</b>	GWh (Gigawatt-hours)											
Public and self-producer total (gross)												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
Public total												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
Net production												
Transmission and distribution losses												
Imports												
Exports												
<b>CONSUMPTION</b>	GWh (Gigawatt-hours)											
Net consumption (net production + imports - exports - transmission and distribution losses)												
Industry and construction												
Transport												
Household and other consumers												
<b>GENERATION PER INSTALLED CAPACITY</b>	GWh/MW (1000 hours)											

<sup>\*/</sup> This table is related to para 2.b.

ELECTRIC ENERGY PRODUCTION (PROJECTIONS)\*/

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
<b>INSTALLED CAPACITY</b>	<b>MW (Megawatts)</b>											
Total												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
Non-conventional**/												
<b>PRODUCTION</b>	<b>GWh (Gigawatt-hours)</b>											
Total (gross)												
Hydro												
Conventional thermal												
Nuclear												
Geothermal												
Non-conventional**/												
Imports												
Exports												

\*/ This table is related to para 2.b.

\*\*/ Wherever applicable

EXISTING ELECTRIC POWER EQUIPMENT\*/

(only for the equipment commissioned after 1970)

I. Generation Stations\*\*/

Commissioning date	Plant size (MW)	Equipment	Local content (%)	Foreign supplier
HYDRO				
		Fabricated parts Turbine Generator Sub-station Control and instrumentation		
CONVENTIONAL THERMAL				
		Boiler and boiler house equipment Turbine Generator Sub-station Control and instrumentation		
GAS TURBINE				
		Compressor-turbine Generator Sub-station Control and instrumentation		

\*/ This table is related to para 3.a.

\*\*/ If a large number of similar units less than 5 MW has been installed, then the total number of units should be given together with the details of equipment for one sample unit.

EXISTING ELECTRIC POWER EQUIPMENT (continued)

(only for the equipment commissioned after 1970)

II. Transmission

Commissioning date	Voltage (kV)	Rating (MVA)	km/tons/ units <sup>***</sup> /	Equipment	Local content (%)
SUB-STATION					
			- - -	Transformer Switchgear Measurement & control	
TRANSMISSION LINE					
				Tower Conductor Insulator Fittings	
CABLE					
				Cable	

III. Distribution

Voltage (kV)	Rating (MVA)	Total number of units for each voltage and rating range	km/tons/ units <sup>***</sup> /	Equipment	Local content (%)
SUB-STATION					
			- - -	Transformer Switchgear Measurement & control	
TRANSMISSION LINE					
				Tower Conductor Insulator Fittings	
CABLE					
				Cable	

<sup>\*\*\*</sup>/ The preferred unit of measurement is metric tonnes. However, the others (km or number of units) can also be used depending upon the availability of statistical data.

DOMESTIC PRODUCTION OF ELECTRIC POWER EQUIPMENT\*

Type of equipment	Specification (power and voltage for electromechanical equipment)	Annual production (number of units for electromechanical equipment and tons for others)	Local content in % (as of 1983 or latest data available)	Local Manufacturer	Source of technology
		1972 73 74 75 76 77 78 79 80 81 82 83			

\*/ This table is related to para 4.c.

CAPITAL GOODS ACCORDING TO ISIC DIVISION 38

<p>381</p> <p>3811</p> <p>3812</p> <p>3813</p> <p>3819</p>	<p><u>Manufacture of Fabricated Metal Products, Machinery and Equipment</u></p> <p>Manufacture of fabricated metal products, except machinery and equipment</p> <p>Manufacture of cutlery, hand tools and general hardware</p> <p>The manufacture of table, kitchen and other cutlery; hand and edge tools such as axes and hatchets, chisels and files, hammers, shovels, rakes, hoes; and other hand agricultural and garden tools, hand saws and plumbers', Masons', mechanics' and cabinetmakers' precision hand tools; hardware such as fireplace equipment, brackets, lock and key sets, and other builders' and furniture hardware, coasters, clamps, and marine and luggage vehicle hardware. Included are blacksmith shops, excluded are the production of silverware and plated ware, classified in group 3501 (Manufacture of jewellery and related articles) and the manufacture of cutting dies and power-driven hand tools, which are classified in the appropriate group of major group 382 (Manufacture of machinery and equipment except electrical).</p> <p>Manufacture of furniture and fixtures primarily of metal</p> <p>The manufacture, alteration and repair of furniture and fixtures consisting primarily of metal, for household, office, public building, professional use, and restaurants. The production of upholstered or padded furniture having metal frames is classified in group 3520 (Manufacture of furniture and fixtures, except primarily of metal).</p> <p>Manufacture of structural metal products</p> <p>Manufacture of structural components, steel or other metal, of bridges, tanks, smoke stacks and buildings; metal doors and screens, window frames and sashes, metal staircases and other architectural metal work; metal sections for ships and barges; boiler steel products; and sheet metal components of buildings, substations and light tanks. The assembly and installation at the site of pre-fabricated components into bridges, tanks, boilers, central air conditioning and other steel-metal systems by the manufacturer of these components which can not be separately reported, is to be included in this group, along with the main manufacturing activity.</p> <p>Manufacture of fabricated metal products except machinery and equipment not elsewhere classified</p> <p>The manufacture of fabricated metal products such as metal cans from tin-plate, zinc-plate, or enamelled sheet metal; metal shipping containers, barrels, drums, kegs and keels; metal stampings; screw machine products, safes and vaults; fabricated wire and cable products from purchased wire rods, excluding insulated wire and cable; steel springs; bolts, nuts, washers, rivets and collapsible tubes, except in primary rolling or drawing mills; punches, stamps and other press tools, non-electrically operated; iron and metal sanitary ware and plumbing brass goods; valves and pipe fittings; small metal ware; and all other fabricated metal products not elsewhere classified. This group includes industries such as those engaged in</p>	<p>enamelling, japanning and lacquering, and galvanizing, blasting and polishing metal products. The manufacture of specialized parts of automobiles, aircraft and ships is classified in the appropriate group of major group 384 (Manufacture of transport equipment). The manufacture of machinery parts except those mentioned in this group are classified as follows: general purpose parts for machinery (group 3829); specialized parts of machinery and equipment (appropriate group of major groups 382 through 385).</p> <p>382 Manufacture of machinery except electrical</p> <p>3821 Manufacture of engines and turbines</p> <p>The manufacture, re-building, and repair of steam and gas engines and steam, gas and hydraulic turbines; and of petrol, diesel and other internal combustion engines. The manufacture of complete steam, gas and hydraulic turbine-generator sets, and of complete engine-generator sets, is classified in group 3531 (Manufacture of electrical industrial machinery and apparatus). The manufacture of turbines or engines by establishments primarily engaged in fabricating a given type of transport equipment and establishments primarily engaged in producing specialized turbines or engines for a given type of transport equipment, are classified in the appropriate group of major group 384 (Manufacture of transport equipment).</p> <p>3822 Manufacture of agricultural machinery and equipment</p> <p>The manufacture and repair of agricultural machinery and equipment for use in the preparation and maintenance of the soil, in planting and harvesting of the crop, in preparing crops for market on the farm, or in dairy farming and live-stock raising; for use in performing other farm operations and processes, such as planting, seeding, fertilizing, cultivating, harvesting; ploughs, harrows, stalk cutters, silking machines, farm tractors, etc.. Excluded is the manufacture of agricultural hand tools, such as rakes, hoes, clippers, hand lawn mowers, which is classified in group 3811 (Manufacture of cutlery, hand tools and general hardware).</p> <p>3823 Manufacture of metal and wood working machinery</p> <p>The manufacture, alteration and repair of wood-working and metal-working machinery, such as machinery for sawmills, planing mills, furniture makers and veneer workers; lathes, boring, drilling, milling, grinding, shearing and shaping machines; power saws and sanders; drop forges and other forging machines; rolling mills, presses and drawing machines; extruding, rolling and non-electrical welding machines; and machine tool cutters, dies and dies. The manufacture of attachments and accessories for wood-working and metal-working machines is included. Excluded is the manufacture of electric welding equipment (classified in group 3531), and hand tools for wood and metal working that are not power driven (classified in group 3811).</p> <p>3824 Manufacture of special industrial machinery and equipment except metal and wood working machinery</p> <p>The manufacture, alteration and repair of special industrial machinery and equipment except metal-working and wood-working machinery, such as food machinery, textile machinery, paper industry machinery, printing-trade machinery and equipment, chemical industry machinery and equipment, oil refining machinery and equipment, cement-making and other cement machinery, heavy machinery and equipment used by construction and mining industries. The manufacture of material handling machinery, such as lifting and rolling machines, cranes, conveyors, industrial trucks is classified in group 3829 (Machinery and equipment, except electrical, n.e.c.).</p>
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Division	Major Group	Group
	3825	Manufacture of office, computing and accounting machinery  The manufacture, renovation and repair of office machines and equipment, such as calculating machines, adding machines, accounting machines; punched-card system machines and equipment; digital and analog computers and associated electronic data processing equipment and accessories; cash registers; typewriters; weighing machines except when scientific apparatus for laboratories; duplicating machines except photo-copying machines; and other office machines.
	3829	Machinery and equipment except electrical not elsewhere classified  The manufacture, renovation and repair of machinery and equipment, except electrical machinery, not elsewhere classified, such as pumps, air and gas compressors; blowers, air conditioning and ventilating machinery; fire sprinklers; refrigerators and equipment; mechanical power transmission equipment; lifting and hoisting machinery, cranes, elevators, moving stairways, industrial trucks, tractors, trailers, and stackers; sewing machines; small arms and accessories, heavy ordnance and artillery; industrial process furnaces and ovens; automatic merchandising machines; washing, laundry, dry-cleaning and pressing machines; cooking ranges and ovens; and other service industry machines. Included are manufacture of general purpose parts of machinery, such as ball and roller bearings, piston rings, valves; and shops engaged in manufacturing, rebuilding or repairing various kinds of machinery and equipment and associated parts and accessories on a job or order basis for others.
	383	Manufacture of electrical machinery, apparatus, appliances and supplies
	3831	Manufacture of electrical industrial machinery and apparatus  The manufacture, renovation and repair of electric motors; generators and complete turbine-generator and engine-generator sets; transformers; switch gear and switchboard apparatus; rectifiers; other electrical transmission and distribution equipment; electrical industrial control devices such as motor starters and controllers, electronic timing and positioning devices, electromagnetic clutches and brakes; electrical welding apparatus; and other electrical industrial apparatus.
	3832	Manufacture of radio, television and communication equipment and apparatus  The manufacture of radio and television receiving sets, sound recording and recording equipment including public address systems, gramophone dictating machines and tape recorders; gramophone records and records; telegraph equipment; radio and television transmitting, signalling, and detection equipment and apparatus; radar equipment and installations; parts and supplies specially used for electronic apparatus classified in this group; semi-conductor and related sensitive semi-conductor devices; fixed and variable electronic capacitors and condensers; radiographic, fluoroscopic and other X-ray apparatus and tubes.
	3833	Manufacture of electrical appliances and housewares  The manufacture of electrical appliances and housewares, such as electric space heaters; blankets; and heating pads; hot plates, broilers, roasters, toasters and food mixers; ironers and mangles; vacuum cleaners and floor waxers and polishers; hair driers, toothbrushes, electric hair clippers, shavers and hot water heaters. Excluded is the manufacture of electric lighting equipment, which is classified in group 3829.
	3839	Manufacture of electrical apparatus and supplies not elsewhere classified  The manufacture of other electrical apparatus,

Division	Major Group	Group
	384	Manufacture of transport equipment
	3841	Ship building and repairing  Shipyards and boatyards engaged in building, repair and specialized painting and calking of all types of ships, barges, lighters, and boats, except rubber boats; specialized marine engine and ship parts manufactures; the conversion and alteration and breaking-up of ships. The fabrication of floating oil rigs is classified in group 3824 (Manufacture of special industrial machinery and equipment except metal and wood working machinery).
	3842	Manufacture of railroad equipment  The building and re-building of locomotives of any type or gauge, and railroad and tramway cars for freight and passenger service; the production of specialized parts for locomotive, railroad and tramway cars. Included are the separately reported establishments of railway and tramway companies primarily engaged in the re-building, repair and alteration of locomotives and cars. The manufacture of electrical signalling equipment for railways and tramways is classified in group 3832 (Manufacture of radio, television and communication equipment and apparatus).
	3843	Manufacture of motor vehicles  The manufacture, assembly, re-building and major alteration of complete motor vehicles such as passenger automobiles, commercial vans and buses, lorries and truck trailers, universal carriers, special purpose motor vehicles (ambulances, taxicabs, etc.) trailers and pickup coaches; vehicle-draw caravans; motorized sleds; specialized manufacture of motor vehicle parts and accessories such as engines, brakes, clutches, axles, gears, transmissions, wheels and frames. This group does not include the manufacture of tires and tubes (group 3553); automobile glass (group 3520); electrical equipment (appropriate group of major group 383) or agricultural, road building and industrial tractors, and fork-lift and industrial trucks (appropriate group of major group 382).
	3844	Manufacture of motorcycles and bicycles  The manufacture, assembly, re-building and major alteration of motorcycles, scooters, bicycles, tri-cycles, pedicabs, and specialized parts such as rotors, saddles, seat posts, frames, gears and handle bars.
	3845	Manufacture of aircraft  The manufacture, assembly, re-building, alteration and repair of aeroplanes; gliders, aircraft parts such as engines, propellers, pontoons and under-carriages; space vehicles and specialized parts; and hovercraft and specialized parts. The manufacture of aeronautical electrical equipment is classified in the appropriate group of major group 383 (Manufacture of electrical machinery, apparatus, appliances and supplies); the production of aeronautical measuring instruments is classified in group 3831 (Manufacture of professional and scientific equipment and measuring and controlling instruments); the fabrication and assembly of missiles and rockets is classified in group 3829 (Manufacture of machinery and equipment except electrical not elsewhere classified).

accessories and supplies not elsewhere classified, such as insulated wires and cables; storage and primary batteries, wet and dry; electric lamps and tubes; fixtures and lamp sockets and receptacles; snap switches, conductor connectors, and other current-carrying wiring devices; conduits and fittings; electrical insulators and insulation materials except porcelain and glass insulators, which are classified in group 3810 (Manufacture of pottery, china and earthenware) and 3820 (Manufacture of glass and glass products), respectively.



<u>Divi-</u> <u>sion</u>	<u>Major</u> <u>Group</u>	<u>Group</u>
		<b>384</b> Manufacture of transport equipment not elsewhere classified
		The manufacture of transport equipment, not elsewhere classified, such as animal-drawn wagons, carts and sleighs; hand-drawn pushcarts, wheelbarrows and baby carriages.
		<b>385</b> Manufacture of professional and scientific, and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods
		<b>3851</b> Manufacture of professional and scientific, and measuring and controlling equipment, not elsewhere classified
		The manufacture, renovation and repair of laboratory and scientific instruments and of measuring and controlling equipment not elsewhere classified; the fabrication and assembly of cyclotrons, betatrons and other accelerators; and the production of surgical, medical and dental equipment, instruments and supplies and of orthopedic and prosthetic appliances. The manufacture of optical instruments for scientific and medical use is classified in group 3852; the fabrication and assembly of radar equipment, X-ray and electric therapeutic apparatus is classified in the appropriate group of major group 385; the production of non-laboratory weighing instruments is classified in group 3825; the manufacture of measuring and dispensing pumps is classified in group 3829; and the fabrication of electrical industrial control devices is included in group 3831.
		<b>3852</b> Manufacture of photographic and optical goods
		The manufacture of optical instruments and lenses, ophthalmic goods, photographic and photocopying equipment and supplies. Included is the manufacture of optical instruments for scientific and medical use. The production of photo-chemical materials and sensitized film, plates and paper is classified in group 3829 (Manufacture of chemical products n.e.c.).
		<b>3853</b> Manufacture of watches and clocks
		The manufacture of clocks and watches of all kinds; clock and watch parts and cases; and mechanisms for timing devices.

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