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THE MANUFACTURE OF BASIC INDUSTRIAL EQUIPMENT IN ARGENTINA

III. Generation and transmission of electric power

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THE MANUFACTURE OF BASIC INDUSTRIAL EQUIPMENT IN ARGENTINA

III

GENERATION AND TRANSMISSION OF ELECTRIC POWER

Summary and conclusions

Probable demand for equipment for the generation, transmission and distribution of electric power is estimated below, together with raw material requirements for the manufacture of such equipment, with a view to establishing provisionally the domestic industry's possible contribution to the satisfaction of these needs and analysing some of the problems arising in connexion with the programming of investment in that sector.

The estimate of probable demand for equipment is based on recent studies (one financed by the United Nations Special Fund and carried out under the joint direction of the Argentine Government and the International Bank for Reconstruction and Development (IBRD),[1/] and another prepared by Agua y Energía Eléctrica[2/]), which have not yet been officially approved, and therefore do not constitute plans in the proper sense of the term. It is thought, however, that in the next ten years - the period covered by these studies - the projects to be constructed will be substantially in line with the recommendations they contain. Some of the longer-term aspects of the question nevertheless still moot points.

The recommendations put forward by the consultants acting under the joint direction of the Argentine Government and IBRD, taken in conjunction with two hydro-electric projects recommended by Agua y Energía Eléctrica, plus provincial plans and schemes under way in areas not covered

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1/ Tippets, Abbott, MacCarthy, Stretton, Kennedy and Donkin, Estudio de problemas eléctricos argentinos, Buenos Aires, 1960.

2/ Agua y Energía Eléctrica, Consideraciones sobre el problema eléctrico argentino. Proposiciones básicas, Buenos Aires, 1961.

/by the

by the basic studies, lead to the conclusion that in the ten-year period 1961-70 the additional installed capacity will represent 2 586 million kW, of which 2 172 million (84 per cent) will be thermal and 414 million (16 per cent) hydro-electric. Details of the power plants, with specifications of units and type of generation, will be found in table 3.

In order to evaluate the foregoing programme from the standpoint of the present study and to measure how far the limitation of the studies to 1970 complicates decisions to invest in the equipment industry, projections of electric power production are discussed in section 1. These represent a minimum hypothesis. If the results obtained, and the extrapolated figures up to 1975, are compared with possibilities for the generation of hydro power, it is clear that hydro-electricity might attain great importance (see section 2).

If a whole series of possible hydro plants, as listed in table 5, is considered with a view to establishing not so much a programme of engineering works as the degree to which this resource has been investigated in relation to foreseeable demand, the conclusion may be drawn that, in accordance with a minimum hypothesis, generation of hydro power might well increase by 5 866 million kWh between 1970 and 1975, and total production of energy for public utility purposes by 6 717 million kWh.

If the maximum hypothesis for hydro power generation is considered, the increase in question might reach 8 310 million kWh. The fact that this figure exceeds total output by a little over 20 per cent is anomalous only in appearance, since these projections are based on a conservative assumption.

In view of the circumstances described, domestic industry has constructed generating units with an approximate capacity of as much as 10 000 kW, and if the facilities of various establishments were combined, a figure as high as 40 000 kVA might be reached. Production of prime movers, however, is confined to the manufacture of low and medium-capacity stationary Diesel motors. Although two plants are licensed to construct hydraulic turbines, no units of any significant capacity have been produced, nor are there any projects afoot for the manufacture of steam or gas turbines.

/Consequently, there

Consequently, there are only very limited prospects of the domestic industry's playing a major part in the supply of generating equipment for public utility systems in 1961-70, as contemplated in the recommendations cited, mainly on the basis of large thermal power stations. What is more, even if the existing possibilities of increasing the capacity of domestically-constructed generating units were successfully exploited, the procedures adopted for extending contracts - which show a leaning towards the type of contract that provides for installation of the prime mover and the generator as a single unit - would place the industry at a disadvantage vis-à-vis foreign competition, irrespective of the problems deriving from costs differences, which are analysed separately in the final section of this chapter.

The programming of investment for the manufacture of thermo-electric prime movers, with the idea of placing the industry in a position to make a larger contribution to the supply of equipment by the end of the sixties and early seventies, is affected by the uncertainty as to whether, after that date, public utility systems will still be expanded on a predominantly thermal basis, or whether an important role will be played by hydro power generation.

Studies now in process of completion, relating to the development of the River Uruguay at Salto Grande and of the Limay-Neuquén system with the Chocón-Cerros Colorados complex, may possibly settle the question of supplies for the coastal region (Litoral) up to 1975. In 1960, 63.5 per cent of the installed capacity was to be found in that area, and the situation is likely to remain unchanged in the future. For subsequent periods, and in relation to the country as a whole, far-reaching programmes would have to be considered, with due regard to the general problem in respect of fuel saving, area development and over-all investment in the economy.

The total investment required for the expansion of generating capacity up to 1970 (excluding large-scale hydro-electric projects which would have to be started before 1970 in order to go into operation during the five-year period 1971-75) amounts to approximately 390 million dollars.

/Of this

Of this sum, 296 million dollars represent expenditure on equipment (including prime movers, generators, step-up transformers and auxiliary installations); and the possible contribution of domestic industry is estimated at 65 million dollars, corresponding to certain types of small generators and auxiliary installations such as switchboard panels, etc.

The situation is very different as regards both transmission, in which 125 million dollars - including 76.5 million for equipment (pylons) - will have to be invested during 1961-70, and distribution, for which a total investment of 272 million dollars - half of it for equipment - will be needed.

Domestic production of transformers and of insulating and supplementary material should be able to meet equipment requirements almost in their entirety. The initiation of domestic manufacture of flat steel products on a large scale would also enable import substitution to be effected in respect of a high proportion of raw material, so that imports would be confined to copper and silicon iron, with the consequent reduction of foreign exchange expenditure.

Here it is the costs problem that is of basic importance; and among the factors by which it is adversely affected is the irregular nature of demand, attributable to financial difficulties and to the lack of specific plans permitting a satisfactory level of utilization of the facilities installed.

Were the hydro-electricity alternative decided upon for supplying the Litoral region, the foregoing figures would have to be increased by the 110 million dollars that would have to be spent on the requisite transmission lines, construction of which would have to be begun and in the case of Salto Grande perhaps completed in the late sixties, as shown in the relevant section.

Analysis of the problems relating to know-how and standards reveals the need for joint action on the part of manufacturers and consumers, in co-operation with the Instituto Argentino de Racionalización de Materiales, so that standards more detailed than those currently adapted may be formulated in the light of economic considerations, and a standardization may thus be achieved which at present is wanting.

/1. Probable demand

1. Probable demand for electric power

Table 1 presents an outline of the installed capacity and electricity production situation in 1960, with respect both to the public utility services and to self-generation in each of the six zones covered by the studies mentioned in the foregoing section. These zones comprise only 12.1 per cent of the total area of the country, but they contain 68.3 per cent of its population (according to the 1960 census), and in the year in question they consumed 87 per cent of the output of electricity.

The high proportion of self-generation, which in the country as a whole accounts for a little over 23 per cent of the electricity supply, mainly reflects the inability of the public utility systems to meet demand, and the consequent proliferation of plants with, in most cases, a low installed capacity. Even if these plants were operated in optimum conditions of efficiency, their mere existence is bound to lead to uneconomic utilization of equipment and fuels, and to complicate fuel distribution and transport.

The estimates of probable demand for electric power prepared by the consultants whose services were engaged in 1959 to carry out a study under the joint direction of the Argentine Government and IBRD relate to the six major market areas shown in table 1, where consumption is highest at the present time, and which will probably continue to be the leading centres of demand in the future. These estimates, prepared for each area on the basis of an analysis of the various types of load and development possibilities, were revised early in 1961 by the State enterprise known as Agua y Energía Eléctrica; some of the figures were increased, but the general picture remained fundamentally unaltered.

The estimates for 1965 and 1970 given in table 2 were based on this second study. The projections formulated by Agua y Energía Eléctrica were reproduced for 1965, and it was assumed that in 1970 the rate of development would be the same as in the last two years considered by the enterprise referred to, i.e. 1967 and 1968.

/Table 1

Table 1

ARGENTINA: INSTALLED CAPACITY AND PRODUCTION OF ELECTRIC ENERGY, 1960

Area	Installed capacity						Production of electric energy						Per-capita consumption (kWh)
	Public supply system		Self-generation		Total		Public supply system		Self-generation		Total		
	Thousands of kW	Percentage	Thousands of kW	Percentage	Thousands of kW	Percentage	Millions of kWh	Percentage	Millions of kWh	Percentage	Millions of kWh	Percentage	
Litoral	1 477	64.1	589	62.0	2 066	63.5	6 050.3	77.1	1 393.4	58.2	7 443.7	72.7	745
Córdoba	125	5.4	21	2.2	146	4.4	524.4	6.7	58.9	2.5	583.3	5.7	391
Cuyo	162 a/	7.0	43	4.5	205	6.3	373.8	4.8	109.7	4.6	483.5	4.7	439
Tucumán	28	1.2	40	4.2	68	2.1	114.4	1.5	88.6	3.7	203.0	2.0	290
Corrientes-Chaco	18	0.8	7	0.7	25	0.8	102.1	1.3	14.6	0.6	116.7	1.1	450
Río Negro	8	0.5	1	-	9	0.3	74.9	0.9	2.4	0.1	77.3	0.8	677
Rest of country	487	21.1	249	26.2	736	22.7	610.0	7.7	727.4	30.4	1 337.4	13.0	211
Total	2 305	100.0	950	100.0	3 255	100.0	7 850.0	100.0	2 395.0	100.0	10 244.9	100.0	510

Source: Distribution by areas was estimated by ECLA on the basis of official statistics by administrative divisions. For per capita consumption, the provisional findings of the 1960 Census were used.

Note: Sum totals may show discrepancies on account of rounding of figures.

a/ Capacity not fully utilized.

/Table 2

Table 2

ARGENTINA: ESTIMATED CONSUMPTION OF ELECTRIC ENERGY (TOTAL AND HYDRO-ELECTRIC) IN 1965, 1970 AND 1975

(Millions of kWh)

Area	1960		1965		1970			1975		
	Total including thermal energy	Hydro-electric energy	Total including thermal energy	Hydro-electric energy	Total including thermal energy	Hydro-electric energy		Total including thermal energy	Hydro-electric energy	
						Minimum	Maximum		Minimum	Maximum
Litoral	6 050.3	...	8 900.0	...	13 200	...	...	18 520	4 530a/	5 890
Córdoba	524.4	411.2	980.0	535	1 530	535	642	2 145	642	642
Cuyo	373.8	286.1	700.0	376	1 116	826	976b/	1 566	976	2 546c/
Tucumán	114.4	80.5	240.0	156.5	396	156.5	370d/	556	370	470
Corrientes-Chaco	102.1	...	150.0	...	233	...	...	327	...	100
Río Negro	74.9	62.1	145.0	109	194	109	324e/	272	974e/	974e/
Total	7 239.9	839.9	11 115.0	1 176	16 669	1 626	2 312	23 386	7 492	10 622

Source: ECLA, on the basis of official statistics.

a/ Chocón and Salto Grande.

b/ Interconnexion to Córdoba.

c/ Complete equipment for Mendoza and transmission to Córdoba.

d/ Connexion to Salta (or reception from Salta the construction of Cabra Corral).

e/ Transmitting to Bahía Blanca (outside the area).

/The result

The result obtained (16 669 million kWh) represents a total increase of 130 per cent in relation to production in 1960. If this same percentage increase were applied throughout the country - that is, taking into account the public supply systems not included in the six major areas - the public utility systems' total output of electricity in 1970 would work out at 18 055 million kWh.

In order to assess fuel consumption, the National Power Authority estimates for 1970 an approximate aggregate output of electric energy amounting to 22 600 million kWh, including self-generation. If the latter is estimated by subtraction of one of the foregoing totals from the other, by 1970 it should amount to 4 545 million kWh, i.e., 20 per cent - a somewhat lower proportion than in 1960, but still considerable.

The projection formulated by the Power Authority corresponds to an average annual rate of increase of 8.2 per cent. This rate is 7 per cent higher than the average for other countries where there are no restrictions on demand, but it still falls below that predictable in a case of accelerated development, like that of Brazil, where the estimated annual increment is as much as 10 per cent.

The present situation of most of the public utility systems is critical. As they are overloaded, the maintenance of the distribution voltage cannot be guaranteed, and they operate virtually without reserves, with the result that the restriction of demand has very serious effects on productive activity. This unsatisfied demand will seek any and every available means of supply. It is for this reason that the fairly rapid aggregate rate of increase adopted by the Power Authority is considered acceptable. This is also why the detailed projections of demand used as a basis for the study of possible expansion plans for the public systems are actually extremely low, and self-generation will have to continue satisfying a considerable proportion of consumption.

/2. Programme of

2. Programme of electricity generation projects

The plans at present under discussion for meeting public electricity supply requirements envisage an expansion of generating capacity in 1961-70 based principally on large thermal power plants. This can be seen in table 3, which was prepared in the light of the recommendations of the consultants acting under the joint direction of the Argentine Government and IBRD, and also takes into account two hydro-electric projects recommended by Agua y Energía Eléctrica, another six already under way in the rest of the country, and those included in provincial plans. This programme represents an installed capacity increment totalling 2 586 million kW, of which 2 172 million (84 per cent) would be thermal and 414 million (16 per cent) hydro. The total investment involved would be approximately 390 million dollars, of which 295 million would be spent on equipment.

Whatever the conclusion reached as to the desirability of opting specifically for thermal or hydro production, it obviously cannot affect the situation to any great extent within the present decade. In the first place, most of the projects listed in table 3 are under way, or contracts have already been negotiated for the engineering work or the equipment they involve, the only exceptions being those shown in table 4. Secondly, even if it were decided to expand hydro-electric generation still further, the execution of projects of this kind takes too long for any fundamental change to be expected before 1970. This point is illustrated in table 2, which includes for the year 1970, under the heading "maximum", a column giving the hypothetical hydro-electric output which would be obtained if the existing works and those already under way (recorded in the column headed "minimum") were supplemented by those for which projects have been completed and which, according to estimates, could enter operation by the year in question. Although the aggregate increase in hydro-electric generating capacity in the public supply systems of the six leading market areas would thus total 61 per cent, such an expansion would imply only a rise from 10 to 16.1 per cent, and would have no very great effect on fuel saving or on the composition of demand for prime movers.

/Table 3

Table 3

ARGENTINA: GENERATING PLANT SITUATION, 1961-69

(All values in terms of installed MW)

Area	Plant	Type	1961	1962	1963	1964	1965	1966	1967	1968	1969
Greater Buenos Aires Litoral	San Nicolás a/	Thermal	30								
	Pedro Mendoza b/	Thermal	12								
	Sorrento-Rosario c/	Thermal		38							
	Calchines-Santa Fe	Thermal			1x30		1x30				
	Puerto Nuevo	Thermal	1x140d/	1x120e/				1x180	1x180		
	Nuevo Puerto	Thermal								1x200	1x200
	Dock Sud	Thermal		1x120d/	3x120e/		1x120f/				
Córdoba	Río Tercero No.3	Hydro			3x12 d/						
	Deán Funes	Thermal	1x33d/							1x33	
	Villa María	Thermal			2x33						
Mendoza	Blanco Encalada	Thermal	1x5.0d/	1x5.0d/							
	Ullún	Hydro				2x21.4g/					
	Nihuil No.2	Hydro					4x21.3d/				
	Valle Grande h/										
	Nuevas instalaciones	Thermal								1x15	1x15
	Nihuil No.3	Hydro								2x20	
	Agua del Toro i/	Hydro									2x56
Tucumán	Escaba	Hydro	2.1 j/								
	Sarmiento	Thermal	1x6 d/								
	Las Vásquez	Thermal			2x10d/	1x10d/			1x10		
Upper Río Negro Valley	Romero	Hydro	2x3.12d/								
	Céspedes	Hydro		2x2.8d/							
	Allen	Thermal	1x1.0d/	4x1.0d/	1x2.0		1x2.0		1x2.0	1x2.0	
Resistencia-Corrientes	Resistencia	Thermal	4.9								
	Barranqueras	Thermal				2x10d/	1x10d/				
	Corrientes	Thermal									1x10
Rest of country	Corralito (Salta)	Hydro		15							
	F. Ameghine (Chubut)	Hydro					68				
	Mar del Plata	Thermal						1x30			
	Concepción del Uruguay	Thermal							1x15		
	Bahía Blanca	Thermal				1x25					
	Necochea	Thermal		1x33	1x33						

Sources: IBRD, Estudio de problemas eléctricos argentinos, (op. cit.); and Agua y Energía eléctrica (State enterprice), consideraciones acerca del problema eléctrico argentino (op. cit.)

a/ Reconditioning of San Nicolás power station.
b/ Reconditioning of Pedro Mendoza power station.
c/ Installation of new boiler only.
d/ Installations contracted for.
e/ Transfer to Puerto Nuevo of a 120-MW unit ordered for Dock Sud.
f/ Additional 120 MW unit to replace that transferred to Puerto Nuevo.
g/ Consultants' estimate.
h/ Equalizing reservoir.
i/ Partial installation.
j/ Repair of third transformer.

/Table 4

Table 4

ARGENTINA: GENERATING EQUIPMENT FOR PROJECTED POWER PLANTS NOT YET UNDER CONSTRUCTION OR CONTRACTED FOR

Area	Generators	Prime movers	Step-up transformers
1. Litoral:			
Puerto Nuevo	2 x 180,000 kVA	Steam turbine	
Nuevo Puerto	2 x 200,000 kVA	Steam turbine	
Salto Grande	10 x 70,000 kVA	Kaplan turbines (25-metre head)	15 x 45 single-phase MVA of 13.2 to 380 kV, each connected to two generators
Chocón	10 x 70,000 kVA	Francis turbines (70-metre head)	15 x 45 single-phase MVA (specifications as above)
Calchines	2 x 30,000 kVA	Steam turbine (monobloc)	
3. Cuyo			
Nihuil 3	2 x 20,000 kVA	Francis turbines (70-metre head)	2 x 25 MVA (13.2-123 kV)
Agua del Toro	2 x 56,000 kVA	Francis turbines (210-metre head)	3 x 65 MVA (13.2-132 kV)
5. Corrientes	1 x 10,000 kVA	Steam turbine	

Source: ECLA, on the basis of official statistics.

/Nevertheless, for

Nevertheless, for the future development of the equipment industry special interest attaches to the adoption of a clearly-defined policy, with far-reaching plans enabling market capacity to be assessed in reasonable measure. Only on the basis of such a policy would it be possible to decide upon further investment in highly specialized sectors, such as the production of prime movers.

To give some idea of how the situation may develop, table 2 includes an estimate of demand for electric power in the main public supply systems for the year 1975, based on the continuation up to that year of the trends registered in the late sixties, and supplemented by an estimate of possible total generation of hydro-electricity in accordance with two hypotheses. The column relating to the minimum hypothesis comprises the hydro projects taken into account in the maximum hypothesis for 1970, together with the Chocón and Salto Grande power plants, whose economic feasibility is at present under study,[3/] although actually official pronouncements have already been made in favour of it. The minimum hypothesis for 1975 also provisionally includes a highly important development in the Cuyo area, designed to supply that zone itself and the Córdoba area (River Mendoza), another tapped from the Saltos de Apipé on the Upper Paraná (Corrientes-Chaco zone), and other smaller projects in Tucumán (see table 5).

To judge from this analysis of the prospects, the maximum hypothesis for 1975 implies an increase of 8 310 million kWh in hydro-electric generating capacity over the maximum hypothesis for 1970, while in the case of the minimum hypotheses for the same years the corresponding difference is 5 866 million kWh. In both instances, the expansion is commensurate with the increment in total demand during the same period, which a conservative estimate places at 6 717 million kWh.

3/ The technical-economic and financial study of the Chocón-Cerros Colorados complex which is being carried out by the ITALCONSULT-SOFRELEC consortium and financed by an Inter-American Development Bank loan will probably be completed by mid-1962. The Salto Grande Comisión Técnica Mixta (formed by the Argentine and Uruguayan Governments) requested the firm of SOFRELEC to undertake the study and preparation of the final project; the study is already finished, and the project is expected to be ready by the end of 1962. If an immediate start were made on the construction of the Salto Grande power plant, the first generating unit might go into operation in 1969 and the whole power plant by 1972.

/Table 5

Table 5

ARGENTINA: ADDITIONAL HYDRO-ELECTRIC ENERGY GENERATED IN PUBLIC PLANTS, 1965, 1970 AND 1975

(Millions of kWh)

	1965	1970		1975	
		Minimum	Maximum	Minimum	Maximum
Litoral:				2 920	
Salto Grande a/				2 920	
Córdoba:					
La Viña	18				
San Roque	63				
Río III No.3	53				
Río III No.4			22		
Río III No.5			20		
La Viña No. 2 y 3			65		
	124		107		
Cuyo:					
Ullún	90	90			
Nihuil No. 2		360			
Nihuil No. 3			150		
Agua del Toro					380
Uspallata					410
Potrerillos					220
Salto de Potrerillos					560
	90	450	150		1 570
Tucumán-Santiago del Estero:					
Los Quiroga	6				
Pueblo Viejo	70				
Angostura No.1 b/			132		
Angostura No. 2 b/			37		
Río Hondo			45		
Angostura No. 3					40
El Cadillal					60
	76		214		100
Corrientes-Chaco:					100
Apipé branch c/					100
Río Negro:					
Julián Romero	25				
Céspedes	22				
Complejo Chocón-Cerros Colorados d/				2 960	4 320
	47			2 960	4 320

Source: Various official publications.

a/ Including net energy amounting to 2 220 GWh delivered to the Buenos Aires-Litoral distribution system and 700 GWh for local consumption, calculated on the basis of the Argentina part only. However, the agreement between Argentina and Uruguay, provides for the transfer of energy from the Uruguayan part of the system and this is taken into account in the transmission line project.

b/ Or some other equivalent of the Aconquija project.

c/ Power plant considered in the lateral canal project. The entire development, at present under study, would enable much higher figures to be reached.

d/ Including, for the minimum 1975 hypothesis, only the El Chocón power plant, with a net energy delivery of 2 310 GWh to the Buenos Aires-Litoral distribution system, and 650 GWh for consumption within the area and transmission to Bahía Blanca. In the case of the maximum hypothesis, the Cerros Colorado development is added.

/This is

This is mainly due to the concentration of demand in the Litoral, which means that the decision to draw upon hydro-electric sources of supply suffices in itself to change the situation basically, converting the generation of hydro power from a purely ancillary to a decisive factor in the expansion of the public supply systems.

Hence there is a good deal of uncertainty as regards the projection of demand for prime movers and generators, and the composition of this demand may alter substantially as a result of the decisions adopted in connexion with the development of hydro power.

3. Transmission lines and distribution systems

Table 6 indicates the lengths of the transmission circuits, by sectors, as envisaged in the report prepared by the consultants to the Argentine Government and IBRD for implementation in the next decade. The table also includes (column headed 380 kV) the transmission lines from Chocón and Salto Grande to Buenos Aires, which are due to be installed during the same period. The totals do not cover the Mendoza-San Luis-Córdoba transmission system which is needed for the Agua del Toro power plant, or the Córdoba-Litoral interconnexion, which is desirable in the interests of balancing the systems and enabling generation reserves to be better utilized and distributed.

The total investment required for these transmission lines would be about 225 million dollars, of which 135 million would be spent on equipment. Work on a series of projects representing an aggregate investment of 97.5 million dollars, i.e. 43.3 per cent, is already being carried out in some cases, and in others was either scheduled to begin or the contracts were to be negotiated in 1961. The corresponding distribution systems would account for 272 million dollars, including 136 million for equipment.

Transmission and distribution together represent a total investment of 497 million dollars. This is approximately the amount needed to build the generating plants, which including Chocón and Salto Grande would cost 551 million dollars. Even if it were eventually decided that it would

/Table 6

Table 6

ARGENTINA: LENGTHS OF TRANSMISSION CIRCUITS

Area	380 kV	132 kV	66 kV
Litoral	1 514	876	263
Córdoba	-	438	673
Cuyo	-	336	108
Tucumán	-	28	-
Río Negro	-	-	188
Total	1 514	1 678	1 232

Source: ECLA, on the basis of official statistics.

/not be

not be desirable to harness the hydro resources mentioned, thereby reducing the capital needed for transmission lines by some 100 million dollars, transmission and distribution would still represent a sufficiently large and clear-cut demand potential to justify the execution of manufacturing and investment plans for the industry producing the necessary components.

As the projected transmission and distribution systems chiefly consist of open circuits, there will be a ratio of 3.5 to 1 between the total transformer capacity needed to step up or lower the voltage and the additional capacity to be installed. This will give a total of 8 820 million kVA in the next ten years, even without the Chocón and Salto Grande systems.

4. Equipment manufacturing capacity

The following classification has been adopted for the equipment needed to produce, transmit and distribute electric energy:

Production equipment

Prime movers
Generators
Step-up transformers
Measuring, circuit-breaking and safety equipment
Travelling cranes
Sluice gates and penstocks

Transmission and distribution equipment

Step-down transformers
Disjunctors
Switches and circuit-breakers
Insulators
Pylons for transmission lines

/The step-up

The step-up and step-down transformers are considered together. As regards ancillary equipment, it has proved impossible to make specific estimates owing to the lack of definitive projects.

(a) Prime movers

Two undertakings exist with sufficient capacity to manufacture water turbines: Neyrast S.A., a subsidiary of Neypirc (France) and Construcciones Electromecánicas Especiales (CEE), who hold manufacturer's licences from Ansaldo San Giorgio S.p.A. and Franco Tosi (Italy). Up to now, however, only low-power units have been built.

There are also plants manufacturing stationary Diesel engines that are suitable for power stations of small or medium capacity up to 2 000 h.p., but there is no project for the construction of steam or gas turbines for power plants of large capacity, such as the majority of those envisaged in the studies mentioned in sections 1 and 2.

(b) Generators

The demand for generators and the years marking the conclusion of their installation are given in table 3. Table 4 sets out separately equipment that is not yet under construction or has not been contracted for.

The following are the leading establishments manufacturing generators:

Construcciones Electromecánicas Especiales (CEE), an Argentine company set up eleven years ago with 30-per-cent foreign capital. Its monthly production capacity is 140 tons, or the approximate equivalent, if the capacity of each unit was 10 000 kVA, with normal specifications, of 350 000 kVA per annum. Given the size of the units usually manufactured (150 to 2 000 kVA), this annual capacity drops to 250 000 kVA. The firm holds Ansaldo-San Giorgio licences (up to 25 000 kVA);

SIAM Electromecánica, a newly-formed Argentine company, with an annual production capacity of 150 000 kVA. This is a provisional figure, as the establishment is not yet in full operation and is capable of considerable expansion. It holds licences from Westinghouse and Marelli;

/A third

A third establishment, ELECTROMAC, specializing in low-capacity generators, and holding licences from Siemens. There are also numerous plants manufacturing motors which can produce small generators for self-generation, co-operatives, etc., and actually have done so, although sporadically as a rule.

Among the existing power plants supplied by domestic industry may be mentioned Neuquén, with three generator sets of 3 000 kW, and Concord (Córdoba), with four sets of 2 000 kW, as well as other smaller plants.

The largest generating unit constructed in Argentina is an alternator of 9 600 kVA, 13 200 V and 750 r.p.m., built to particular specifications.

The machining capacity represented by the machine-tool inventory in establishments manufacturing generators is sufficient for units of up to 20 000 kVA to be entirely constructed in the same workshop. With the collaboration of the existing specialist factories which possess adaptable machine tools, generators with an individual capacity of up to 40 000 kVA might be constructed. For the higher capacities within this range, the shafts would have to be imported.

Present prospects for the participation of domestic manufacturers in the expansion plans of the public electricity supply systems are very limited, in view of the size of the generating units contemplated and the lack of domestic production of prime movers (steam, gas and water turbines). This would continue to be the case even if manufacturers operated in association with other workshops in order to increase the capacity of the generating units, since the prevailing tendency is to contract for provision of the prime movers and the generators, as well as for their assembly, at one and the same time, as pointed out in section 7.

In contrast, there is an ample field for domestic production in the manufacture of equipment for self-generation and for small local power plants. In the most densely-populated part of the Litoral (north and centre of the Province of Buenos Aires, and south and centre of the Province of Santa Fé), as well as in the Province of Córdoba, the

/present tendency

present tendency is for electric power to be supplied from large plants by means of transmission and distribution lines. In the rest of the country, distances are so great that many small centres will have to continue obtaining their supplies from low or medium-capacity plants. If, therefore, long-term plans were established which made due provision for the expansion of such services, the domestic production of generators would be able to count on a steady and fairly significant demand.

(e) Transformers

There are three major producers of high-voltage transformers, namely:

CEGELEC (Compañía General de Electricidad), an Argentine company established twelve years ago, with 30-per-cent foreign capital. Its annual production capacity is 450 000 kVA, in units of 15 000 kVA, although it is able to manufacture units of up to 40 000 kVA. It holds licences from Cie. Savoisienne and from Delle (both of which are French companies, subsidiaries of the Cie. Générale d'Electricité);

SIAM Electromecánica, which was mentioned above under the head of generators, and operates under the same licences for the manufacture of transformers. Its annual capacity is approximately 300 000 kVA, and here again considerable expansion is feasible;

HAMAG, an Argentine company with a production capacity of 120 000 kVA, which holds Allgemeine Elektricitätsgesellschaft (AEG) licences, and has specialized of late in the production of low-voltage circuit-breakers.

Other smaller firms manufacture transformers, and CEE, which as we have already seen makes generators, is planning to enter this line of production as well. In round figures, and on the assumption that plants are operating at full capacity, total production capacity may be estimated at 1 million kVA per annum.

The unit with the highest capacity and voltage constructed up to now is one of 15 000 kVA, for a step-down transformer station in the province of Mendoza which has already entered operation, with a primary voltage of 132 kV. The specialist factories mentioned above possess facilities to carry out the requisite trials for units with a working voltage of up to 135 000 V.

/Requirements in

Requirements in respect of transformers are so great - representing over 8 million kVA, as previously estimated for the forthcoming decade - that although in many cases step-up transformers are imported together with the generating equipment, there is enough potential demand for this specialized industry to maintain a steady level of activity, especially as part of the distribution facilities at present installed will need replacement. This implies an increase in transformer requirements which has not been estimated but is bound to be significant.

(d) Ancillary equipment

In the factories mentioned and in other smaller establishments, the following items of ancillary equipment are made: instrument transformers (up to 132 000 V), section switches (up to 220 000 V), oil circuit-breakers (up to 35 000 V) and pneumatically operated automatic circuit-breakers (up to 35 000 V).

Several factories make porcelain insulators for high voltages using domestic raw materials. One of these factories, the Fábrica Argentina de Porcelanas Armanino (FAPA), has a laboratory with sufficient trial capacity for up to 1.1 million V on impulse wave, for 750 kV on industrial frequency, and for high and low frequencies for communication lines. In addition, CEGELEC, General Electric and CEE all have special sections for the manufacturing and assembly of switchboards.

5. Materials needed

An estimate of raw materials for transformers and transmission lines, specially calculated in accordance with Verein Deutscher Elektricitätswerke (VDE) standards, is included here.

(a) Materials for transformers

Since most of the transformers for the power plants listed in table 3 are under construction or contracted for, or else will be supplied by the manufacturers of generators, requirements in respect of raw materials are estimated on the basis of a total capacity of 6 300 million kVA. They would seem to be as follows:

/Tons

	Tons
Silicium iron	3 795
Carbon steel	2 208
Copper	759
Miscellaneous, including insulating material	138
Total	6 900

All these materials have to be imported. In addition, about 2 300 tons of oil are needed. Oil produced in Argentina (by Yacimientos Petrolíferos Federales - YPF) is available, and is in current use for voltages of up to 66 kV. However, SEGBA requires that imported Shell oil be used for distribution transformers. Insulating paper (up to 66 kV) and insulators (up to 132 kV) are also manufactured in Argentina.

(b) Materials for transmission lines

	Tons			
	380 kV	132 kV	66 kV	Total
Aluminium	7 448.9	2 709.3	447.2	10 605
Steel for conductors	3 633.6	1 344.9	925.8	5 904
Steel equivalent for pylons	23 467.0	12 585.0	4 896.0	20 896

This estimate is based on the assumption that all pylons would be of steel, although many projects specify reinforced concrete pylons.

Aluminium is at present imported. Although projects for refining-plants exist, in no instance has a start been made as yet on the work of installation.

6. Preparation of projects and standardization

Studies and projects for electric power stations are carried out mainly by the technical workshops of Agua y Energía Eléctrica (State enterprise), the Dirección de Electricidad y Mecánica of the Province of Buenos Aires (DEBA) and the Empresa de Electricidad of the Province of

/Córdoba (EPEC),

Córdoba (EPEC), as well as the Servicios Eléctricos del Gran Buenos Aires (SEGBA) and the Campañia Italo-Argentina de Electricidad (ITALO), which are, respectively, semi-public and private enterprises, operating only in Greater Buenos Aires. It is the practice of these workshops to farm out certain aspects of the designing to national or foreign firms of consultants. The tenders, however, are drawn up or reviewed in the technical shops in question, which ensures ample scope for local technical skills to play their part.

As regards standards, although the Instituto Argentino de Racionalización de Materiales (IRAM) has prepared specifications for material for the electricity industry, in many instances they are insufficiently detailed, and recourse is often had to the standards established in the United States (American Institute of Electrical Engineering - AIEE) or in Europe (Comitato Elettrotecnica Internazionale - CEI, and Verein Deutscher Elektricitätswerke - VDE).

It should be noted that the application of European standards tends to reduce the quantity of materials used, especially in respect of transformers. For example, VDE standards result in a saving of 25 to 30 per cent on weight and up to 12 per cent on costs.

The domestic industry is adversely affected by the fact that there are no single standards to serve as a basis for bidding, since this prevents proper standardization, and consequently influences costs. Again, in the study of standards for such a purpose, adequate attention should obviously be devoted not only to technical but also to economic problems. A case in point is the limitation of transformer losses; if the limits set are too narrow, the cost of materials is raised unnecessarily, whereas if they are broader the reduction in the cost of equipment may outweigh the increase in operational expenditure. In this respect, it would be desirable for manufacturers and leading consumers to collaborate with IRAM in the search for a satisfactory solution.

As was previously pointed out, manufacturers have settled know-how problems by means of agreements with foreign firms, in the event of such firms not participating in the enterprises concerned.

/7. Factors affecting

7. Factors affecting the competitive capacity of industry

It is very difficult nowadays for domestic manufacture to compete with imports, owing to substantial differences in costs, which in the case of high-voltage transformers sometimes reach 100 per cent.[4/] For generators the corresponding differences are somewhat smaller. A list of the principal factors adversely affecting the structure of costs is given below.

(a) Import duties

Imported raw materials are subject to heavy import duties ranging from 40 per cent on silicium iron and sheet to 100 to 150 per cent on certain insulating materials for use with high voltages. This situation may improve to some extent when domestic production of flat steel products begins, but there is no sign of any project for the manufacture of silicium iron sheet. In the case of transformers, where the cost of the raw material is greater than that of labour, the incidence of these duties averaged 16 per cent of the selling price at the end of 1961, sometimes rising to 20 and 25 per cent for higher-voltage transformers. In the case of generators, where a higher proportion of the cost is represented by labour, the average incidence of import duties at the same date was estimated at 8 per cent.

Hydraulic turbines for public plants can be imported duty-free. Consequently, establishments licensed to manufacture them would be unable to compete, because of the duties on raw materials.

(b) Irregular nature of demand

The leading customers - national and provincial electricity enterprises and SEGBA - do not space out their orders in such a way that manufacturing plans can be drawn up and efficient plant utilization ensured. The erratic nature of this demand is attributable to the fact that hitherto no long-term plans have existed, and when medium-term plans have been formulated, financial difficulties have prevented their implementation. Consequently, there are sporadic bursts of demand for

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4/ While the cost of domestically-manufactured step-down units of 132/33/13.2 kV and 15 000 kVA was 76 Argentine pesos per kVA, that of imported units with the same characteristics was 36 Argentine pesos per kVA at the beginning of 1961.

/large quantities

large quantities of equipment to deal with emergencies, and long periods when no tenders are invited. This pattern of demand has a significant effect on costs which cannct be quantitatively assessed in the present study.

(c) Bidding procedures

In some cases, bidding procedures also raise the cost of domestically-manufactured equipment. Thus, for example, Agua y Energía Eléctrica invites tenders for the construction of transmission lines, including the provision of material by the bidder. The latter adds a percentage surcharge to the purchase cost of transformers. The difference between the cost of domestically-produced and imported transformers is thus increased to the still greater disadvantage of the Argentine product. To solve the problem, DEBA purchases the material and issues a separate contract for the construction of the line.

The financing problem considerably influences the choice between these two alternatives. The second does not represent a very heavy burden from this standpoint if the project is a small one, but if it is on a very large scale, the accumulation of the materials may mean the freezing of substantial resources for the enterprise inviting tenders, even though there may be a reduction of engineering costs.

Another point to be considered is the question of assembly, which is considerably simplified if a single firm is responsible both for supplying and for installing the equipment. The problem ceases to exist if, as in the case of ENDESA in Chile, the enterprise concerned has a technical organization qualified to handle the work of installation. Otherwise, the most satisfactory procedure, despite the drawbacks indicated, may perhaps be that adopted by Agua y Energía Eléctrica.

Adverse effects are also produced by a procedure which has been adopted of late - that of combining the generating equipment requirements of public utility co-operatives in a single tender. In this instance, the scale of the bidding virtually precludes competition on the part of domestic industry, whereas it would have no difficulty in meeting requirements if they were split up.

/(d) Difficulties in

(d) Difficulties in obtaining bank financing

The restriction of bank credit at present in force makes it impossible to obtain enough financial assistance from the bank. The burden resulting from these restrictions may in some cases represent as much as 10 per cent of costs. Owing to these financing difficulties, it is impossible to put production plans into effect at the time when reasonable estimates of demand warrant their formulation, as in the case of self-generating equipment of certain relatively standard capacities.

(e) Export promotion practices in certain countries

The financing of sales is another factor at present affecting the possibilities of finding buyers for domestic production. Foreign producers, on the other hand, can often resort to government financing institutions which enable them to offer highly advantageous terms of payment.

Other points that must be taken into account in this context include export subsidies - the most concrete and recent example is afforded by Italy, which under the terms of Legislative Decree No. 561 (1959) grants an 8-per-cent subsidy on exports of generators - and the lifting of duties on export sales in the Federal Republic of Germany and in France.