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ENGLISH

ESTABLISHMENT OF FACTORIES IN DEVELOPING COUNTRIES FOR THE PRODUCTION OF ELECTRICAL DISTRIBUTION TRANSFORMERS *

A Preliminary Guide

prepared by

The Secretariat of UNIDO

in co-operation with
BGEF Ltd., Bangalore, India

* This document has been reproduced without formal editing.

Contents

List of Exhibits

FOREWORD

This brief guide has been prepared for the use of developing countries interested in establishing electrical equipment industries. It may be of interest to policy and decision-making officials; it is also especially designed for officers at the operational level who are responsible for defining and executing projects.

Quantitative and technical data contained herein have been synthesized from various sources and must not be relied upon as to accuracy nor used as a direct basis for commitments. Their purpose is rather to indicate some of the parameters which need to be considered in an actual case, and approximate inter-relationships under an arbitrary set of assumptions. The paper thus represents a rough guide to prospective project developers and project managers. Sources of more precise information and collaboration are identified in Section 7.

Comments on the concept and approach of this document, as well as its content, are invited. Expression of interest in specific topics for future publications of similar nature are also welcome. Please contact:

Factory Establishment and Management Section
Industrial Operations Division
UNIDO
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Vienna - Austria

1. INTRODUCTION AND SUMMARY

Production of electrical distribution transformers provides a convenient way to absorb electrical technology gradually, in stages, upon an existing base of simple metal working skills. For this reason such a project is likely to be the first in the line of electrical machinery, and thus represents a significant step forward in development of a country's industrial sector.

This paper provides preliminary guidance towards establishing a distribution transformer factory. In order to span the requirements of small, medium, and large markets, we have arbitrarily chosen nominal output capacities of 100, 250, and 400 KVA. The following table summarizes basic parameters for these three "model projects", under the assumptions adopted in preparing the guide:[1/]

	Nominal Output Capacity (KVA/annum)		
	100	250	400
Total Investment ($x1000)	1400	2000	2500
Annual Sales Revenue ($x1000)	900	2400	3600
Profitability (% return on equity)	(loss)	13.9%	13.9%
Number of Employees	136	205	272

Naturally, all of the above are subject to local conditions; a special study is needed to determine realistic prospects in a particular market. The following sections explore marketing, technical, and financial issues, i.a., which will need to be considered.

1/ Most of the basic design and manufacturing data used in preparing this report has been kindly provided by BHEP, Ltd., Bangalore, India.

2. THE PRODUCT

2.1 Scope and Description of the Product Line

This report covers the setting up of a unit for manufacturing distribution transformers in the range of 63 KVA to 1600 KVA, up to 33 kV class. The standard distribution transformers are of oil-immersed type. They are manufactured upto 1600 kVA / 33 kV class conforming to VDE 0532, IS:2026 and relevant DIN and International Standards.

Following are the salient constructional features of a typical transformer. The transformer tank is made of sheet steel with corrugated side walls. The active part consists of a core made of cold rolled grain-oriented silicon steel laminations and the windings. Windings are manufactured out of paper covered aluminium or copper conductors. They are made of rectangular or round cross sections depending on the design considerations. The core is held in position by core fixtures made of oil impregnated wood, or steel, depending upon the preferred designs. An off-load tap changer is built in with a vertical shaft for operation. The active portion is fixed to the top cover of the tank. A conservator is also mounted on the top cover. Other necessary accessories such as oil guage, thermometer pocket, valve, bushings and breather etc. are also suitably provided. Please refer to Exhibit 1 for an outline drawing showing a typical physical arrangement.

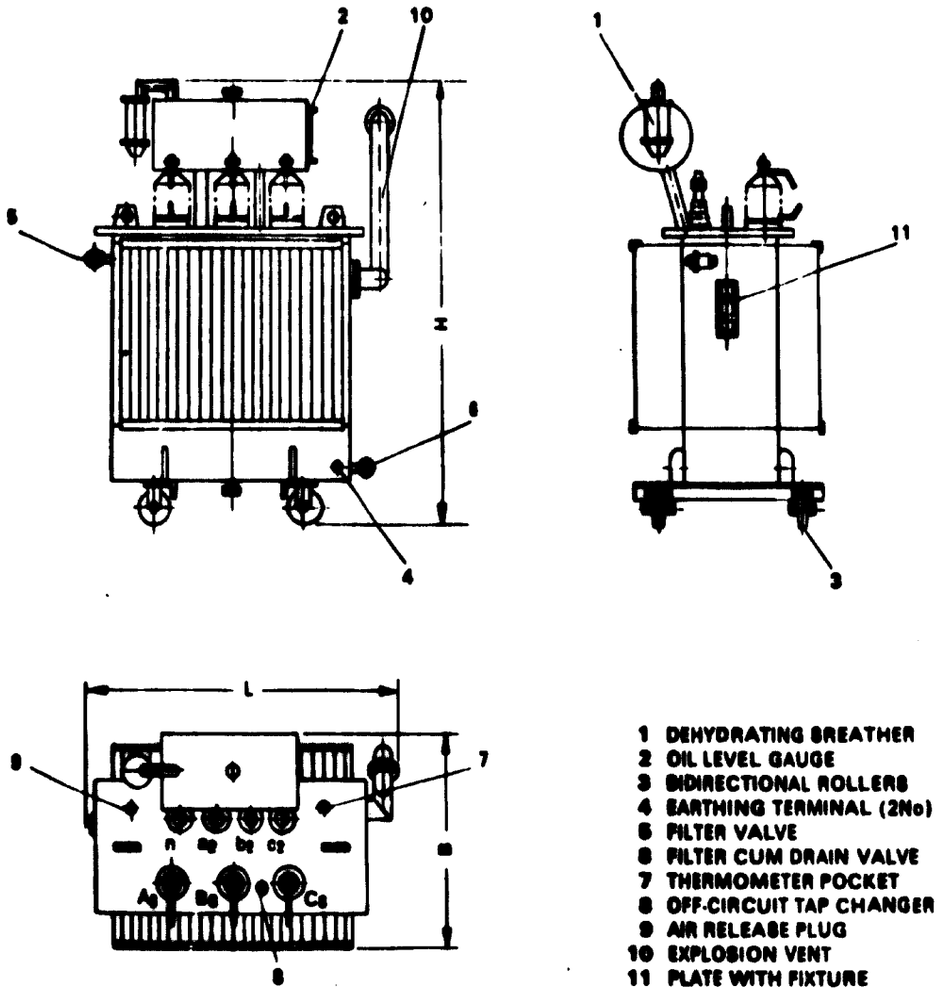
2.2 Importance for Industrial Development

Expansion of a country's electrical power network[1/] is a basic requirement for decentralized industrial development. Hence domestic production of the required equipment is likely to be accorded priority attention if a viable project can be designed. Among the main machinery items - turbines, generators, and transformers - the latter are the simplest and most economically attractive as an initial entry. As mentioned in the preceding section distribution transformer production may proceed in stages based initially upon previously existing metal-mechanic skills. The necessary electrical technology can be limited at the start to assembly and testing techniques, plus repair and maintenance skills.

1/ Refers both to generation and to distribution of electrical power.

EXHIBIT 1 : Typical Outline Drawing of Distribution Transformer

(50 kVA to 200 kVA, 11 kV to 22 kV, 100 kVA to 200 kVA, 33 kV)



1 DEHYDRATING BREATHER
2 OIL LEVEL GAUGE
3 BIDIRECTIONAL ROLLERS
4 EARTHING TERMINAL (2No)
5 FILTER VALVE
6 FILTER CUM DRAIN VALVE
7 THERMOMETER POCKET
8 OFF-CIRCUIT TAP CHANGER
9 AIR RELEASE PLUG
10 EXPLOSION VENT
11 PLATE WITH FIXTURE

BELOW 100KVA CORRUGATIONS ARE PROVIDED ONLY ON LV SIDE

But although gradual, the absorption of electrical machinery technology is of basic importance. It permits the step-by step enlargement of the domestic product range. Such product diversification may include electrical switch gear and electric motors as well as generators and possibly at a later stage turbines and other items.[1/] Since the number of units of larger equipment which can be produced for a local market is limited, it is especially attractive to consider eventually taking advantage of the common technological processes involved by creating an electrical equipment complex under integrated management control.

3. MARKETING, COMMERCIAL AND REGULATORY ASPECTS

3.1 Determining Market Size and Product Mix

On a long term basis the domestic demand for distribution transformers will be on the order of twice the average annual increase in electrical generating capacity.[2/] But since the unit capacities of generating units tend to be very large relative to those of distribution transformers, it is essential to project the demand situation in greater detail. Accordingly, it will be necessary to consider specific future plans of the electric utility company, or companies, for extending distribution lines or increasing the handling capacity of the existing network. The same may be needed separately with respect to the Government's rural electrification programme, depending upon the organizational framework.

The above assumes that the project can obtain access to relevant future plans of the concerned institutions. If this is not immediately possible, Governmental assistance may be available. (Please see Section 3.4).

1/ Wire and cables as well as pole line hardware insulators and lightning arrestors are examples.

2/ This assumes that the national electric power system is self-contained. Suitable adjustments must be made if there is a net in-flow or out-flow caused by exchanges with other countries.

In any case it should be possible to estimate the past usage of distribution transformers from import statistics, if there is no presently existing domestic manufacturing capacity. This will serve as a rough check and stimulate questions in case future projections seem to be radically different. Needless to say it is also important to determine current price levels for the various ratings.

For planning purposes it will also be necessary to estimate an approximate "product mix", i.e. the breakdown of expected sales among the various transformer ratings. This report assumes the following mix, for each of the three nominal capacities being examined:

Capacity in kVA	100 KVA		250 KVA		400 KVA	
	Nos	KVA	Nos	KVA	Nos	KVA
63	365	23	890	56	1460	92
100	370	37	930	93	1480	148
200	60	12	150	30	240	48
500	16	8	40	20	64	32
1000	12	12	30	30	48	48
1600	5	8	13	21	20	32
TOTAL:	828	100	2053	250	3312	400

3.2 Marketing and Distribution

In most countries the electrical utility company (or companies) is the main customer for distribution transformers. Depending upon local practice, industries and commercial buildings, i.a., may individually be permitted or required to install their own units. Depending upon the resulting degree of market concentration, the project developer will have to work out suitable market strategy.

3.3. Supply Arrangements

If transformers have been hitherto obtained exclusively through import, it is likely to be essential for the project's success to ensure that a smooth switchover to local supply can be organized. Because of the considerable scale economies involved, it is desirable to capture as much of the market as is technically and economically within reach. Thus early and intensive consultations with the prime customer(s) and with Government officials are called for. It would be financially very risky to commit an investment without having the market assured, possibly through a long term supply agreement. It would surely be advisable to consider offering a seat on the board of directors to the chief executive of the utility company as a demonstration that close collaboration is intended.

If transformer manufacturing capacity already exists within the country the question of potential market share becomes more complex. Competitive intelligence will have to be gathered and assessed in order to determine whether a new unit can win enough support to be viable.

The question of producing transformers mostly for stock or mostly against long term requirements orders, with the customer in effect carrying the inventory of finished goods, is one of considerable financial importance. For that reason it needs to be covered in any relevant sales agreements and deserves judicious treatment. It probably is self-evident that there is little reason to employ a distributor if marketing is primarilly handled through such agreements.

3.4 Possible Government Role

The project sponsor will probably wish to take advantage of whatever Government incentives apply. In addition to any initial tax benefits, he will surely be looking at provisions which afford a measure of protection to his "infant" industry. The range of such measures may include protection against imports as well as against possible future establishment of competing domestic producers.

In the former case the most common provisions are import duties and varieties of licensing, quota systems, or outright banning. The pros and cons of each such measure from the national point of view are well known. In the case of a single principal utility customer, the Government may indeed wish to participate in "mating dance" proceedings as an observer. The Government intervention would be designed to protect national interests since these are by no means guaranteed to be fully served via straight commercial negotiations.

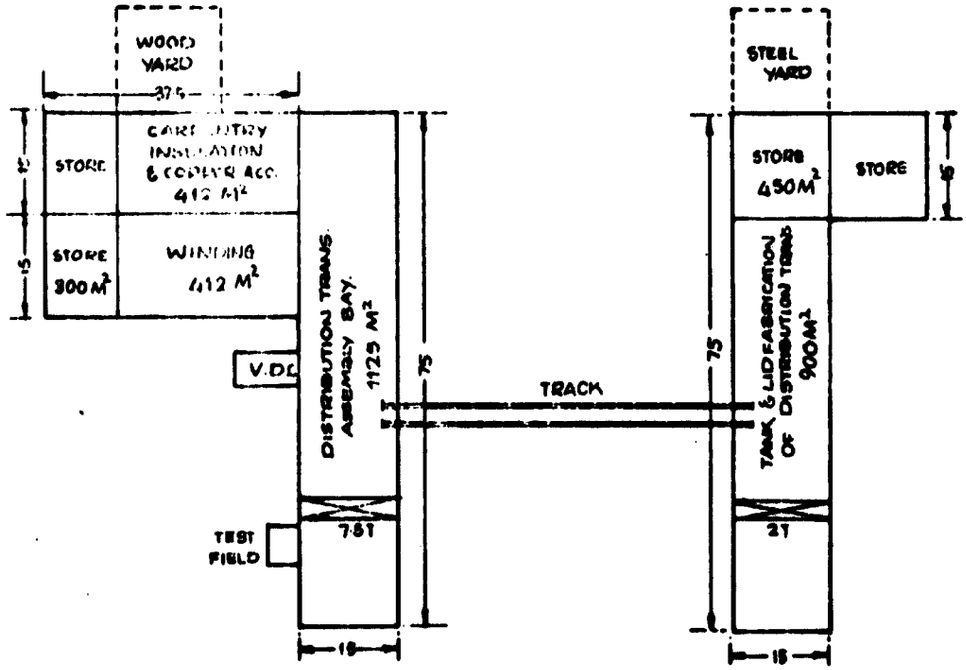
Prospective national benefits presumably include a number of jobs and substantial savings in foreign exchange outlays. It would be unfortunate if the utility company were unwilling to cooperate towards making maximum use of a new domestic manufacturing facility. Genuine cooperation might be expected to take the form of providing maximum advance notice of transformer requirements and doing all possible to meet system needs via basic standard transformer ratings, without special features which create problems for the manufacturer. There may also be ways in which technical personnel of the utility can directly assist the new manufacturer in becoming established.

4. THE FACTORY

4.1 Technical Description of the Factory

Project facilities have been planned to make the unit as self sufficient as possible. The general layout of shops for different manufacturing activities is indicated in the sketch given as Exhibit 2.

EXHIBIT 2 : General Layout of Distribution Transformer Plant
(250 MVa Capacity)



ADMINISTRATIVE BUILDING 450 M²

TOTAL WORKING AREA : 3600 SQ.M.
ADMINISTRATIVE BUILDING: 450 SQ.M.
V.D.C: VACUUM DRYING CHAMBER
OVER HEAD CRANE

Sufficient provision has also been made for administrative building, social bays, canteen etc.

For the purpose of assessing the requirements of plant and machinery the manufacturing activity is divided into two distinct parts, one is the sheet metal fabrication and machine shop and the other is carpentry, insulation, copper accessories, winding and final assembly activities. The machinery requirements is based on a single working shift, with certain exceptions to reduce capital investment.

The following paragraphs describe the functions of the main shops areas:

SHEET METAL FABRICATION SHOP

The majority of work in the fabrication shop involves gas cutting, shearing, punching, both gas and arc welding, rolling, drilling, shot blasting and painting operations. The major components to be fabricated are tank, lid, conservators, corrugations and other accessories. An overhead crane of sufficient capacity is also provided for handling heavy parts.

MACHINE SHOP

The machine shop is equipped for turning, milling, drilling and tapping operations. Provision is also made for essential tool grinding operations. The parts to be manufactured in the machine shop are bushing components such as terminal bolts and other copper and brass parts. The machine shop can also be used for occasional maintenance work.

CARPENTRY

Facilities are provided for manufacturing parts made out of wood, hard paper and press board. Parts manufactured here are core fixtures, core foot, pressure pieces, clamps, sticks, etc. A wood seasoning and impregnating plant has also been provided.

INSULATION SHOP

Facilities are provided for performing punching, bending, shearing and insulating operations. The press board parts manufactured here are yoke insulation, dovetail pieces, tubes, outcoming leads etc.

COPPER ACCESSORIES

Facilities for shearing, punching, bending and brazing operations on copper, brass and aluminium parts are provided. The parts manufactured are outcoming leads, connection pieces etc.

WINDING SHOP

The winding machines have been provided on a two shift basis. Different types of winding such as roundwire, flat wire helical and continuous windings with tappings can be wound on these machines. A double column hydraulic coil press is also provided for coil pressing. A jib crane is also provided for handling heavy coils.

ASSEMBLY SHOP

Assembly shop is provided with facilities for vacuum drying and oil filling facilities for transformers up to a capacity of 1600 kVA/33 kV. Oil filtering facilities are also provided. One overhead travelling crane of sufficient capacity is provided for assembly and despatch activities.

TEST FIELD

Test field equipment is provided for testing transformers up to a capacity of 1600 kVA/33 kV. All the routine and type tests can be performed with the equipment provided.

MATERIAL TESTING LABORATORY

Facilities are provided for mechanical, electrical testing and chemical analysis of materials. Some of the equipment provided in the transformer test field is not provided in the laboratory to avoid duplication.

POWER, WATER, GAS AND COMPRESSED AIR FACILITIES

Provision has been made for an 11 kV outdoor structure at the receiving end. From the 11 kV structure underground cables are drawn to the sub-station. The sub-station with necessary transformers and switchgears is to be located near the factory building. Power distribution equipment is provided in sufficient capacity to cater to different activities of the factory.

Provision has also been made for providing water supply and sanitary facilities to the factory. The following items are foreseen - (a) bore-well (b) cover-head tank and (c) distribution system etc.

Provision has also been made for providing compressed air and gas system where-ever required.

4.2 Material and Utilities Inputs

The principal materials required for producing distribution transformers are the following :

- Steel core laminations
- Paper covered copper/aluminium wire
- Insulators
- Off-load tap changers
- Breathers
- Die-cast aluminium and brass components
- Sheet steel
- Transformer oil

The following table, Exhibit 3, provides estimates of quantities and cost of the principal materials for each of the three nominal plant sizes. From the figures it may be seen that the largest cost items are the winding materials, the steel core and the insulating oil. There are some variations possible depending upon the choice between copper and aluminium conductors, but the range is limited to a few percentage points. [1]

Similarly, Exhibit 4 provides physical estimates of principal utility requirements.

1/ The next stage of reducing the high materials cost would be further backwards integration in preparing the conductors used in winding coils. This would entail at least the paper-winding step and next the stage of wire-drawing from rod.

EXHIBIT 3 : Raw Material Inputs [1]

Material	100 MVA Tons	100 MVA $x1000	250 MVA Tons	250 MVA $x1000	400 MVA Tons	400 MVA $x1000	Unit Cost $ per kg
Copper [2]	14.7	64	37.3	163	58.9	258	4.38
Aluminium [2]	47.0	182	117	454	188	729	3.88
Laminations	159	318	397	794	636	1272	2.0
Transformer Oil	119	134	297	336	477	539	1.13
Construction Steel	120	49	299	122	479	196	0.41
Insulation Paper	1.5	5	3.8	12	6.1	19	3.13
Press Board	4.4	7	10.9	18	17.5	29	1.63
Wood	19.5	5	49.7	12	78.5	20	0.25
	485	764	1212	1911	1941	3062	
Adjusted for operation at 80% capacity		611		1529		2450	
Plus 5% allowance for other materials such as tap changers bushings, etc.		31		76		122	
Total material at 80% capacity		642		1605		2572	

1/ All quantitities are approximate averages based on standard ratings in the product mix given in section 3.1., and on operations at 100% of rated capacity.

2/ Based on use of aluminium windings up to 200 KVA and copper on higher ratings. Alternatively copper can be used throught the range but the total weight is then about one third greater. The high unit cost result from at 60% import duty in India and the fact that the conductors are purchased already insulated with paper wrappings.

EXHIBIT 4 : Utilities Requirements for Distribution Transformer Plant

	Capacity in MVA per Annum		
Utilities	100	250	400
Electrical Energy (x 1000/Kwh/mo)	50	101	148
Maximum Demand (KW)	179	311	390
Compressed Air (m^3/hr)	280	400	418
Water (x 1000 litres/day)	14	23	30

4.3 Manpower and Skill Requirements

Estimates have been made of skill and manpower requirements for both factory and office personnel. These estimates are summarized in Exhibit 5, together with cost projections (which are based upon Indian salary levels). With certain exceptions the operation is based on single-shift production.

EXHIBIT 5 : Manpower Inputs

Class of Employees	100 MVA No.	100 MVA $x1000	250 MVA No.	250 MVA $x1000	400 MVA No.	400 MVA $x1000	Total avg. Compensation $/yr[1/]
Skilled Workers	21	32	35	53	51	77	1500
Semi-skilled Workers	59	71	96	115	121	145	1200
Unskilled Workers	16	16	24	24	40	40	1000
Office and Professional Staff	36	61	46	78	56	95	1700
Executives	4	22	4	22	4	22	5500
TOTALS :	136	201	205	292	272	379	

The staffing levels have been designed to support 100% of nominal capacity to be conservative, the same figures are used in the financial analysis for operation at 80% of capacity.

1/ Including incentives, housing, social benefits, as applicable.

4.4 Quality Control Requirements

Distribution transformers are normally manufactured in accordance with VDE 0532, IS: 2026, relevant DIN and other international standards. Quality control and assurance are provided by careful testing of raw materials, by mechanical inspection and by mechanical and electrical testing at various stages of manufacture. To this end, provision has been made, i.a., for a materials testing laboratory (physical and chemical) and for a test field. The latter is equipped for short circuit, open circuit, impedance, high voltage, induced voltage and temperature rise tests.

4.5 Plant Investment

For each of the three nominal capacities, detailed equipment lists and costings have been prepared. Based on these estimates, Exhibit 6 presents a summary for the principal investment categories. Provision is also made for a 10% contingency fund.

For illustrative purposes we have assumed that required working capital will equal two months' turnover. This figure of course, depends heavily upon commercial arrangements worked out with customers and suppliers.

EXHIBIT 6 : Estimated Investment ($x1000)

	100 MVA	250 MVA	400 MVA
Basic Plant and Equipment	627	717	924
Testing, Transport & Utilities	175	237	287
Tooling, Jigs and Fixtures	44	54	65
Office Equipment	18	29	35
Land and Buildings	279	404	475
Contingencies @ 10%	80	96	130
TOTAL FIXED INVESTMENT	1223	1537	1916
WORKING CAPITAL 1/	150	400	600
TOTAL INVESTMENT	1373	1937	2516

1/ Based on assumption of two-months' turnover.

5. TRANSFER OF TECHNOLOGY AND MANAGEMENT SKILLS

5.1 Need for Collaboration

Thie project invclves relatively complex, moderately sophisticated products. It would thus be very difficult for anyone except a highly experienced management team to begin manufacturing them without outside help. There is probably no substitute for the relevant commercial, manufacturing and testing experience, even if detailed design data could be freely obtained. If this principle is accepted the next questions are : (1) what kind of collaboration is needed, and (2) how it can be obtained economically.

5.2 Possible Phasing of Implementation

The exhibite in this report have been prepared aesuming that a complete new plant ie built complete in one stage. In practice it appeare more prudent to eelect one of eeveral alternative phasing arrangemente. Phasing offere advantagee such as reduced initial investment and the poesibility of beginning with leee complicated processes while the workforce is undergoing training. The principal phaeing alternatives are :

(1) Begin with full range of processes but reduced output capacity, and gradually build up production volume.

(2) Begin with aesembly only based on "CKD" kits purchased from overeeas, and gradually add production proceeeee to inoreaee value added.

(3) A variation of (1) or (2) or a combination.

The deoieion in thie regard probably depende upon existing skille whioh are readily available. For example, if adequate metal fabrioation experience exiete then probably it ie ueeful to coneider importing ready-made oores and windings and aeeembling them into locally-made traneformer tanke.

5.3 Nature of Collaboration Agreements

Although it ie theoretically poesible to "go-it-alone", the ohances of technical succeee would eeem to be enhanced through eome form of liceneing or joint venture arrangement, particularly if a progressively phased aseembly/manufacture approach ie eelected. Naturally, eelection of a collaborator is basic to euoceee of the project. Selection ehould take place at a relatively early stage in project development einoe the identity of the collaborator will determine many detaile of plant and proceee deeign, as well ae of the project economice.

Some criteria to consider in selection, in addition to financial arrangements are the quality of the proposed provisions for operational assistance and for training local people at all levels; the degree of responsibility for product quality which the collaborator will accept; and the package of restrictions which he seeks to impose - such as on design changes, use of locally purchased goods and services, export sales, etc. It may be obvious that a true mutual understanding and acceptance of the two parties' objectives (and probably also of those of the host Government) will contribute greatly to long range success.[1/]

A typical package of services which might be offered by a prospective collaborator might be the following:

- Assistance in project planning.
- Provision of all technical data, design and testing specifications, manufacturing know-how.
- Provision of tools, jigs and fixtures or of drawings (for alternative source procurement).
- Assistance in selection and training of personnel.
- Assistance in plant operation and in sales promotion.
- Assistance in after-sales service.

In exchange for such services, some form of lump-sum and a fee based on production or sales would be negotiated. A viable agreement might be more detailed and specific in itemizing services and related costs, and in specifying targets for preparing local people to take over the functions themselves.

[1/] Please see The International Transfer of Industrial Management Skills, UNIDO/IOD.106

6. TENTATIVE FINANCIAL ANALYSIS

In view of the several uncertainties, including alternative phasing arrangements, it is impossible to estimate financial results fully without analysing local conditions. But for illustration and eventual comparison, we have assembled the data presented in the several previous exhibits into a pro-forma income statement (please see exhibit 7).

This very preliminary analysis - based on largely arbitrary assumptions - suggests that special measures would be required to make the smallest unit financially viable. Please note that we have made no effort to evaluate possible savings in foreign exchange, the creation of jobs, and the contribution which such a project would undoubtedly make to increasing national technical and managerial self-reliance. Thus, possibly with certain adjustments, even the smallest project may well be economically desirable from the national point of view.

The two larger units are reasonably profitable at 80% of capacity, given the assumptions. Their break-even point is apparently between 50% and 60% of nominal capacity, because of the high variable cost of material inputs. With concessions, and operating at a high rate of capacity utilization, the figures would be even more attractive.

EXHIBIT 7 : Pro-Forma Income Statement
(₹x1000)

	100 MVA	250 MVA	400 MVA
Sales Revenue[1/]	900	2400	3600
Materials and Supplies[2/]	642	1605	2572
Manpower	201	292	379
Depreciation[3/]	100	123	153
Utilities and Miscellaneous	40	60	80
Sub-total :[4/]	983	2080	3184
Profit before finance charges and income tax	(83)	320	416
Less: finance charges[5/]	69	97	126
Profit before income taxes	(152)	223	290
Less income taxes[6/]	-	89	116
Net profit :	(152)	134	174
Net profit as return on capital	-	13.8%	13.8%
Net profit as return on sales	-	5.6%	5.5%

1/ Based on operation at 80% of capacity

2/ Includes import duties; e.g. 60% on copper and aluminum for windings.

3/ Based on 8% per year for equipment, and 5% for building.

4/ Omits explicit allowance for technology and other possible fees associated with foreign collaboration.

5/ Assumes 50% of investment borrowed at 10% p.a.

6/ Assumes income tax rate of 40%.

7. FOLLOW-UP ACTION APPROACH

7.1 Project Studies

It is strongly suggested that a very specific market study be carried out as a first step toward project development. The brief comments in section 3 may serve as a guide. In addition, special attention should be paid to determining specific unit prices which have been paid recently for particular transformer ratings. To some extent a "dollars per kilogramme" index may be helpful in the market study phase, if used carefully.

Further steps in project development may be determined on examination of market study results. The possibility of a joint project with one or more neighbouring countries may be considered if the local market is severely restricted.

A number of well established firms and organisations could provide the kinds of advice and assistance described in section 5.3. As mentioned, NGEF Limited of India has contributed most of the technical and economic basis for this publication. In addition the Elin-Union Company of Austria assisted in the preparation of an earlier publication. Contact addresses for these two firms (as examples) are given below:

- NGEF Ltd.
  Byappanahalli
  Post Bag 384
  Bangalore 1
  Mysore - INDIA

- ELIN-UNION
  Aktiengesellschaft für
  Elektrische Industrie
  Pensinger Str. 76
  1141 WIEN- Austria

7.2 Technical Co-operation

In addition to the (commercial) collaboration discussed in section 5, the sponsors may wish to have some outside advice at various stages of the project. UNIDO provides such advice and assistance on request of Governments, subject only to financial and programming considerations.

For example UNIDO could assist in carrying out market studies; further advice could be given at the stage of negociating collaboration agreements, management systems etc., according to specific needs. Interest may be communicated through local representatives, or direct to the Factory Establishment and Management Section.

8. BIBLIOGRAPHY

a) On the subject of electrical distribution transformers

- Production of Distribution Transformers in Developing Countries, United Nations Sales No. E.70.II.B.11

- Information on international standards for production of distribution transformers is available from the International Standards Organization, 1, Rue de Varembe, Box 56, 1211 Geneva 20

- Project Reports for Establishing Distribution Transformer Unit in Developing Countries, August 1977, NGEF Ltd. (unpublished)

b) Other UNIDO publications providing similar scope and intended for potential sponsors of industrial projects (selected)

- Establishment of Factories in Developing Countries for the Re-refining of Automotive Lubricating Oil, UNIDO/IOD.III

- Guidelines for the Production and Marketing of Acrylic Sheet in Developing Countries, United Nations Sales No. E.71.II.B.21

- Technical and Economic Aspects of the Oil Palm Fruit Processing Industry, United Nations Sales No. E.74.II.B.10

- A Fertilizer Bulk Blending and Bagging Plant, United Nations Sales No. E.76.II.B.2

- Guidelines for the Establishment and Operation of Vegetable Oil Factories, UNIDO/ID/196

c) Selected UNIDO publications providing specialized functional guidance for establishing new factories

- Guidelines for the Acquisition of Foreign Technology in Developing Countries, (with special reference to technology licence agreements), United Nations Sales No. E.73.II.B.1

- Contract Planning and Organisation, United Nations Sales No. E.74.II.B.4

- Closing the Factory Establishment Gap, UNIDO/ICD.105, 10 August 1977

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- Manual for the Preparation of Industrial Feasibility Studies, UNIDO/ICIS.33

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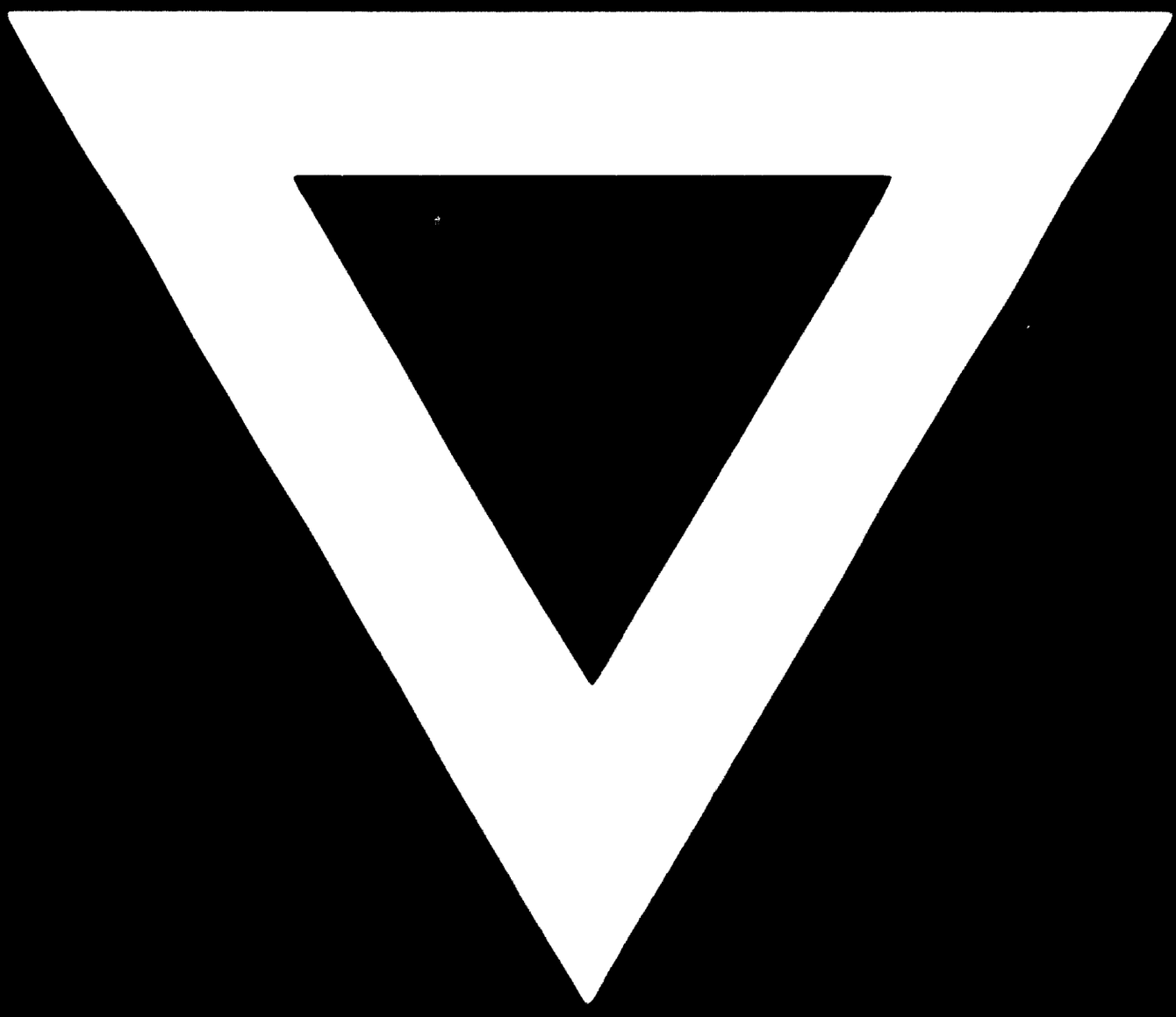

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