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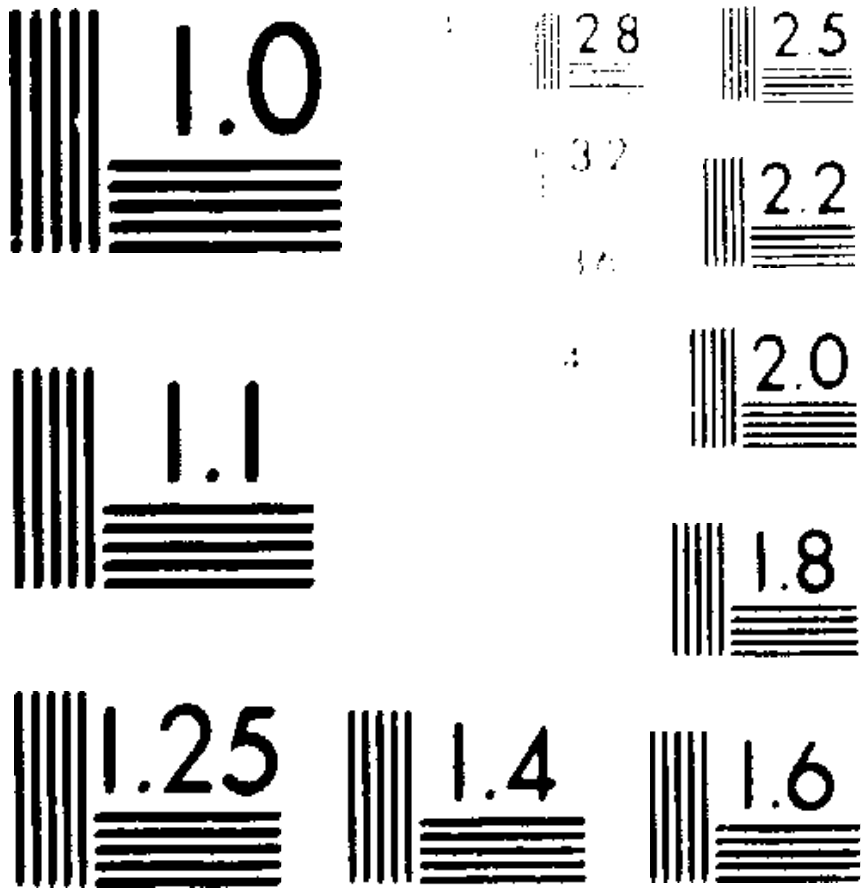
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LNETI – LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL

GABINETE DE PLANEAMENTO

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19 March 1980

THE NATIONAL INDUSTRIAL ENGINEERING AND TECHNOLOGY LABORATORY (LNETI) AND ITS SERVICES TO INDUSTRY.

PORTUGAL.

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Project findings and recommendations

Terminal report prepared for
the Government of Portugal

by

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1. SUMMARY

The report presents the expert's findings and recommendations regarding the relationship of the National Industrial Engineering and Technology Laboratory (LNETI), Ministry of Industry and Energy, Government of Portugal, to industry of Portugal particularly in the light of that country's entry into the European Economic Community in 1985.

These findings are based on a three-week field mission during which the expert intensivly studied LNETI, its organizational structure, plant and equipment, interrelationship with other institutes, relationship with other Governmental Bodies and with industry. He also made a series of visits to relevant bodies of the Government and to industries, and through dialogue with their staff and that of industry associations gained addicional information about industry's needs and LNETI - industry relationship.

On the basis of the studies and discussions, recommendations are suggested for strengthening LNETI's organization so that it may improve its capabilities in research for industry.Then recommendations are given for measures for developing and improving links between the Laboratory and Portuguese industry in order to assist in the promotion of LNETI's services to industry so that the technological content of industry's processes and products may be enhanced and its competitive position improved.

This is followed by an outline for a programme of activities for the unit within LNETI most directly concerned with the

promotion and sale of its services and for possible Government action to implement the programme.

In conclusion, suggestions are given how, possibly through international action, the work of that unit might most efficaciously be strengthened and expanded.

2. INTRODUCTION

2.1 Project Background

The project has been carried out on behalf of the United Nations Industrial Development Organization acting on behalf of the United Nations Development Programme. To quote partially from the project job description, "As Portugal is expected to enter the European Economic Community in 1985, it has become necessary for the country to harmonize its policies and activities relating to quality control, quality certification, certification of conformity with standards, standardization and metrology with those of the Common Market countries. It is also vitally important to develop and organize in the most efficient manner the activities relating to industrial research and technology currently being carried on by a large number of analytical and testing laboratories and research institutes. These institutes, for the most part, undertake research and also give technical assistance and advice to industrial enterprises. Such activities are organized on a sectorial basis. The institutes also provide vital technological support for national activities relating to quality control, standardization and metrology".

A new organic law on the duties and structure of the Ministry of Industry and Energy (formely, Ministry of Industry and Technology) provides that, inter alia, there will be a division concerned with research services and that those services shall be carried out by the National Industrial Engineering and Technology Laboratory (LNETI). The general

structure of LNETI is given in the Government law (decreto--lei) 360/79 of 1st September 1979. The decreto-lei sets forth the organs and services of LNETI, financial arrangements , staff, etc.. Separate regulations, to be issued in the near future, will presente in greater refinement the programmes, policies, staffing, etc., of each of the major units of LNETI Among other things such laws and regulations, as applied to LNETI as well as to other bodies of the Governement, provide the Government with an overview of the objectives, programmes, staffing, financing - in other words, the framework within which each of such bodies should operate.

2.2 Summary Outline of Official Arrangements

The expert was recruited on 6th November 1979 under a Special Service Agreement with the United Nations Industrial Development Organization but because of unforeseen delays could not take on his assignment until 23th February 1980. After a two-day briefing period at the Organization's Headquarters in Vienna, the expert arrived on the project site, Lisbon, 27th February 1980. He concluded his field work 19th March 1980, following which two days were spent in Vienna for presentation of the report and debriefing.

A programme of visits to, and consultations with officials of units of LNETI, Governmental bodies and industries, prepared by the Directorate of International Services of LNETI, was given to the expert (Appendix 5.1). In view of the three-week field work time restriction, the programme was well planned and fully useful.

2.3 Objectives of the Project

It must be pointed out that whereas the project job description was issued 6th July 1979, some of the objectives set forth in it have had to be modified or dropped in the light of the subsequent enactment of decreto-lei 360/79 and the rapid changes occuring within LNETI since then. Further, one objective, that concerning quality control and standardization, has only marginally been dealt with in view of the recent recruitment of a United Nations Industrial Development Organization expert in this area.

Instead, emphasis has been placed on studying relations between LNETI and industry as well as the interrelationship with other Governmental bodies which concern themselves with assistance to industry in one form or the other. Further, attention has been focused on the organizational structure of LNETI, its on-going and planned research programmes, staff, plant and equipment, since these have direct bearing on the kind and quality of services rendered on behalf of industry, and certain recommendations are made accordingly which, if implemented, should enhance LNETI's capabilities to meet the needs of industry. Further, measures have been investigated, for promoting and developing sale of LNETI's services to industry, including improvement in linkage between the two, with appropriate recommendations.

3. FINDINGS

3.1 General Comments

LNETI's position within the Ministry of Industry and Energy is given in the organization chart, Appendix 5.2, which the Laboratory's own organization is set forth in the chart, Appendix 5.3. Further, the work of individual units of LNETI is detailed in Appendix 5.4.

However, an abbreviated presentation of LNETI's services may be useful here.

The LNETI Services are:

- Services of R & D and Technical Assistance
- Services of Scientific and Technical Support
- Administrative Services

The Services of R & D and Technical Assistance are:

- Institutes
- Departments

The Departments are autonomous technical and scientific bodies which develop activities in specific areas within Industrial and Energetical sectors.

The Institutes result from grouping Departments which have related activities within the sectors mentioned before.

There are two Institutes in LNETI

- Institute of Energy

  and

- Institute of Industrial Technology

The Institute of Energy comprises the following Departments:

- Department of Conventional Energies
- Department of Renewable Energies
- Department of Nuclear Energy and Engineering
- Department of Nuclear Sciences and Techniques

The Institute of Industrial Technology is composed of the following Departments:

- Central Department of Industrial Studies and Analyses
- Department of Technology of Food Industries
- Department of Technology of Chemical Industries
- Department of Metallurgy and Metlomechanics
- Department of Electronics and Electrical Equipment

Scientific and Technical Services

- Technical Training Center
- Technical Information Center for Industry
- Planning Office of Engineering and Industrial Technology
- Department of Pre-Investment, Promotion and Commercialization
- Informatic Center

Services of Technical Support

- Direction of External Relations Services
- Direction of Finances and Patrimony Services
- Direction of Officinal Services
- Plant Division
- Direction of Administrative Services

On reporting on the findings, it must firstly, and strongly, be stressed that there is full recognition of the fact that LNETI only recently constituted, of necessity is in a transitory state - in organization, management, staff, programme of work, etc.

Thus it would be inappropriate to present, in critical form, comments on factors which by the nature of fluidity of conditions, internally within LNETI as well as externally, may well resolve themselves as the organization presses forward in the execution of actions to gain the aims and goals under which it has been established.

Recognition must also be given to the overriding factor of current national constraints which, obviously, directly affect the strength of the three legs of an institute: staff, equipment and facilities, and research projects.

Neverhteless, it may be useful at least to touch on those areas, with the thought that the comments may be useful to the Government, generally, and LNETI, specifically, in any action they may take at the appropriate time.

As another general comment it is not the intention to present an in-depth evaluation, with recommendation, of each and every unit of LNETI for that is well beyond the time restriction of the project. Nor, for that matter, is it the intention to detail analysis of LNETI/industry-by-industry relationships for that not only demands not only a very substantial expenditure of in-field time but also techno-economic capabilities beyond the grasp of an individual expert.

Rather, the report attempts to highlight those areas of organization and operation within LNETI which could lead themselves to improvements either now or with time in the interest of the organization becoming a more effective instrument in assisting Portuguese industry to become more technically competitive internally, and, especially in view of Portugal's impending entry into the European Economic Community, externally.

With respect to the las comment, there are numerous advantages for a greater science-and-technology oriented industry, including a lessening of dependence on importation of external technology--licenses, know-how, equipment, etc.; an increase in competitiveness in international markets through higher technology content of industry's export products; an increased ability to adapt foreign technology to suit local conditions and, thus, strenghten the local products competitive edge vis-a-vis imports.

Further, as LNETI strengthens its own technical capabilities , in experience, staff and equipment, it could be a future focal point for R & D carried out on behalf of foreign enterprises, especially in view of the fact that its scientific brain power costs would be more than competitive with of more advanced industrialized countries.

3.2 Organizational Structure

In introducing this aspect of LNETI, stress is laid again on awareness of the constraints under which the organization is operating and, also, of the fact taht it is in a state of transition. Further, the early enactment of Government regulations surrounding the several units of LNETI will do much to resolve a certain hiatus confronting them.

However, it would be remiss not to make the following comments on the organizational structure

3.2.1 Management

At present the structure calls for one Vice-President.Considering the staff size and diversity of operations of LNETI, it would seem essential that the President's hand be strengthened - and

tasks lightened - by installing at least two, preferable three, Vice Presidents: one for the technological group, in this instance the industrial technology institute and the energy institute, who would be primarly concerned with the day-to-day technical operation of these units; one for administration , which would encompass personnel, purchasing, legal, financial, building and equipment maintenance units; and preferably, one for commercial services, which might include industrial liaison, technical information, economic and market assessment, contrats, promotion and publicity units.

In any case it would seem highly important that the present, one man, Vice-President slot be filled as soon as possible so as to great extent as possible relieve the President of day--to-day operational pressures and permit him to devote as much time as possible on formulation of policies relating to overall R & D goals, personnel motivation and the like, as well as, to external relations, within the Ministry and outside of it , wether other Governmental bodies or indsutry, during this critical embryonic period.

3.2.2 Intitute of Energy

A general impression is that within the Institute the structure could be further refined by dividing the Department of Nuclear Sciences and Techniques into a Physics Department and Chemistry Department. The present Department's size and diversity of disciplines present a picture of an unwieldy and unnecessarily complex structure. The new Department of Physics would then contain the divisons of nuclear and atomic physics, neutron , plasma physics, and energy physics. The Department of Chemistry

would encompass the divsions of radiochemistry, transuranium elements and other remaining units. Such division would permit a more selective approach, in the order of disciplines, to the specialized needs of industry.

It might be appropriate to suggest that while under the reorganization the Department of Electronics and Electronical Equipment now rests within the Institute of Industrial Technology, which eventually will be located in Lumiar, it would seem advisable that at least a minimal electronic laboratory service be maintained at Sacavém, the site of the Institute of Energy, considering the on-going needs of that institute and the considerable physical distance that will separate the two institutes.

In any case, the position of Director of the Institute of Energy, now vacant, should be filled as soon as praticable.It continued vacancy can only compound problems of project and staff control and development of relationship with industry.

3.2.3 Institute of Industrial Technology

It was difficult to obtain a first-hand overview, primarly because of the multitude of diverse units, widely scattered throughout Lisbon, involved. The move of the Department of Food Industries Technology to new, albeit temporary quarters will do much to consolidate one important sector of the Institute and to improve its physical image vis-a-vis industrial clients. Pressure for the consolidation should continue to be exerted so that the move from the present, totally inadequate site will be made within this year.

Further, several units of this Institute give an effect of

diffusion of effort in attempting to undertake such great a variety of technical subjects as to raise the sincere question whether they can effectively tackle these with present staff and equipment without danger of being "jack of all trades,master of none". An in-depth review of these units might be illuminating and lead to a tighter, more streamlined operation attuned to a narrower but more effective service to industry.

In any case, until the central site at Lumiar is able to accept the numerous, scathered units of the Institute, the problems of communication, interplay of disciplines, management, project control , and efficacious relationship with industry will remain serious.

Here,too, the early appointment of the Institute's director is essential to the smooth, rapid transition from a very diverse group of disciplines to a cohesive whole which more effectively can undertake industry's problems.

3.2.4 Planning Office of Engineering and Industrial Technology

Turning to the support services, it is felt that the experiment with a Planning Office of Engineering and Industrial Technology is a worhtwhile one. As outlined by the several staff, the programme of work can do much to harmonize the numerous activities of LNETI, if carried through as delineated and if the full cooperation of the various units, which the Planning Office is to serve, is obtained.

Such harmonization is absolutely necessary if staff, equipment, and research programmes are to be effectively applied,technically and financially, to the technological improvement of the industry of Portugal.

Although seemingly unadvoidable, it is regretable that such planning functions arose somewhat late in the development of the separate programmes for 1980 of the several units of LNETI. This may lead to some difficulties in future programming exercises which entail on-going projects that contain elements not in accord with ideal planning.

It might be well here to point up the questions raised elsewhere within LNETI as to purpose and functions of the Planning Office. It would appear not only desirable but essential that some "educational" effort be exerted through the lower levels of LNETI to explain the role of the Office and its importance in playing an intimate part in the formulation of programmes suited to the needs of industry.

3.2.5 Department of Pre-Investment, Promotion and Commercialization.

The Department by its very name has a vital position in LNETI--Industry relationship. The Department should act as a principal link between the Laboratory and industry, thus enabling the former to "market" its services more effectively.

To carry out this function, essential to the growth of the Laboratory, the Department should be staffed with an appropriate number of industrial liaison officers. These officers would be involved in economic and market assessment of those industries with which LNETI is doing, or whishes to do, business; in determining the problems of potential clients to which technological solutions might be applied; in arranging assistance from LNETI in resolving those problems; in helping to assess LNETI's proposed or on-going research efforts in order to determine if the results are commercially applicable and exploitable; and in

other ways assist the technical units in bringing their capabilities to the attention of potential, industrial clients. (Needless to say, while the liaison officer can help to gain entrée to industry, at the stage of detailed technical exposition the appropriate scientific discipline must be brought into the discussions,with the industrial client).

Obviously, the present staff size of the Department is quite inadequate for any broad approach to industry as sketched above. LNETI should as rapidly as possible expand the manpower, preferably with engineering economists who also are "sales minded". Otherwise, the Department will continue to play a very marginal role in LNETI's attempts to penetrate the industrial market.

3.2.6 Technical Information Center for Industry

It is obvious that it is essential that there be close coordination between the Center and other information units or the like of the Ministry of Industry and Energy or outside of it.For example the Institute for the Support of Small and Medium Enterprises (I.A.P.M.E.I.) looks forward to such coordination in view of its own efforts in the information field.

The general impression gained is that at present there is a substancial duplication of technical information activities between several bodies of the Ministry which, aside from the undesirable duplication of effort and correlated expenditure in staff time and material (books, journals, films, etc.) might lead to confusion on industry's parts as to the proper source of the information sought.

The Center should ensure that its own role in the dessimination of information is clearly delineated to other bodies concerned

with technical information and that, in turn, there is a full picture of the latter's functions and capabilities so that,as deemed appropriate, cross-referencing may be provided to industrial clients.

3.2.7 Technical Training Center

Until recently, the Center concerned itself with training in industrial management. While important, it is clear that the Center has a broader canvas on which to present its services. In fact, a beginning has been made also to provide technical training, including that for in-house staff, latter this year. Further, new centers will be created in Lisbon and Porto with the help of the World Bank on their physical and human facilities. Too, close harmonization is being developed with I.A.P.M.E.I., which has an important training aspect of its own for enter - preneurs and others from small and medium enterprises. However, the Center is confronted with the fact that the quality of its staff and "teachers" suffers because of the difficulty of competing with the compensation offered by industry. If the Center is to be successful in its important purpose, it has to attract a combination teacher-consultant-researcher. It appears, though, that a new compensation status would need to be created to attract such personnel,let alone stop the present "brain drain" to industry.

3.2.8 Organizational Structure as a whole

It can be seen that the organizational structure of certain other units of LNETI has not been touched upon. This,however, is due to a conclusion reached to concentrate on those units

directly involved in technical facets of LNETI.

It is felt that a sound step forward has already been taken by the Government in the creation of LNETI. If the progressive view is taken that, however, this is only the first step, and that an organism such as LNETI is a dynamic one, then it can be stressed that, with time and experience, an up-to-date look be take at the structure to ascertain whether it meets the requirements of the industry which is to serve.

3.3 Plant and Equipment

3.3.1 Sacavém vs. Lumiar Site

Though now an academic point, it would be a failure not to comment that it would have been more advisable to juxtaposition the Insitute of Industrial Technology at the Sacavém site of the Institute of Energy. Such consolidation would have reduced the physical site development time for the former by several years, with all the advantages occuring therefrom, since the Lumiar site will not be ready for some years to come.

The single laboratory site would have had several other advantages: sharing of common services (utilities, shops, cafeteria); centralization of library and other supporting services; better, more ready administration of interrelated programmes; improved research project control; and most importantly, person-to-person communication of the various disciplines represented within LNETI.

Physical as well as perhaps emotional factors may have been involved in the final decision. Yet there is an impression that, over the years, the physical separation of the two institutes

will increase disparity in purpose and programme, especially with regard to industrial objectives.

3.3.2 Department of Food Industries Technology

As mentioned earlier, the Department will within the year move to new, though temporary quarters. The immeasurably better facilities not only will greatly enhance the working conditions for the staff but also provide a very improved picture of the Department's physical capacity to potential industrial clients.

3.3.3 Equipment

The quality of equipment within various units of LNETI ranges from excellent to poor. In certain sections, such as testing and quality control, too much of the equipment available to the technical staff borders on the obsolete.

In the light of the complexity and diversity of technological problems confronting the scientist, it is important that the tools with which he works meet the technical requirements of today. Yet, the fact remains that current budgetary constraints make it nearly impossible to acquisition additional equipment let alone replace the old.

This situation, of course, emphasizes all the more the need of consolidation of research effort, to lessen duplication of equipment and ensure maximum equipment time use. Further, improvisation, through in-house shop construction and the like, may resolve some of the more immediate needs.

Also, the approach may be suggested that has been successfully used elsewhere, namely, to encourage specific industries to donate certain of the major items of equipment, especially

in instances where pilot plant work on their behalf is involved.

3.3.4 Printed Matter

It is obvious that the same budgetary problem faces LNETI in the acquisition of books, journals and the like, all which, like equipment has spiralled in cost. Yet a library - or a technical information center - dares not fall behind in keeping abreast of international technical developments if LNETI is to be up-to-date and viable in its services to industry. Thus special care must be taken not to assign printed material acquisition a secondary role in any budgetary exercises.

3.3.5 Physical Impression on Industry

It is axiomatic that first impressions are importants. Thus if an industrial visitor to a laboratory sees a technical facility, poorly equipped and maintained, and in which building and equipment does not at least equal his plant, his initial reaction may be that the quality of research itself offered him will be of a lower order than he would accept.

Adequate working space in utilitarian buildings ("monuments" are not needed), with up-to-date though not necessarly overly sophisticated equipment appropriate to scientific disciplines involved will do much to enhance the impression that the laboratory is ready and capable to undertake efficaciously the research task at hand. Of course, this does nor deny that caliber of staff remains a key element in the development of the final product, a successful research project .

3.4 Staff

The purpose of this project was not to make an in-deph evaluation

of the staff of LNETI.

However, since so obviously staff perfomance has a direct relationship to the level and quality of services rendered to industry, and LNETI's recent creation has meant a redirection an reorientation of staff with all that this implies, some comments may be useful.

3.4.1 Relationship at the Staff to the New Organization

Perhaps the most prevalent impression received - though it must be emphasized, based on a small sample - was that the staff, especially at lower levels, was rather uncertain about the policy of LNETI and the on-going progress of reorganization. It appears that this uncertainty in turn has led to incertainty in the individual's mind as to his position within the structure. As voiced on several occasions, the staff believed it was working in a limbo it did not know its place wihtin his section, nor its section place within the Department, let alone within LNETI. Nor did the staff feel comfortable about reorganization plans because it did not know, or appreciate its contribution to them.

Further, there appears somewhat of a lack of understanding what units outside the staff member's own immediate disciplines are and what functions they perform in the system as whole. This knowledge gap seems to be especially true with regard to technical staff and their question about supporting service units.

It understood that there are periodic meetings of management with staff. It is not clear, however, whether informations developed there actually reaches the lower levels of staff, viz., below heads of departments. Perhaps an expanded effort in disseminating

such informationwidely throughout the organization, and at the same time encouraging "feed-back" from staff to management , could do much to lessen disquietude during these early critical months of reorganization.

3.4.2 Job Security

Obviously, the staff is aware that there have been severe , overall budget cuts within the Government, with parallel reductica in staff.Which appreciative that these are a reflection of the general , national economic constraints, the individual staff member naturally is concerned about job security. Such concern tends to make employment with industry or other non-governmental bodies that much more attractive, aside from the consideration that industry's compensation pattern would weigh heavily in the decision scale.

Again, the transitory nature of the current situation must be borne in mind, but it would seem that reassurance of the staff on the matter of job security would be useful.

3.4.3 Compensation

It is clear that salary is the particularly tangible reward for a staff members performance within his organization. Idealy , the salary structure should be such that it not only encourages retention of staff but also improves accession of new, highly qualified personnel. This , of course, implies that the strucure should appoach that of industry. (It need not necessarily equal industry's salaries, since other factors, such working athmosphere, job satisfaction, co-working with peers, professional prestige, also are considerations to a researcher).

The present salary structure within LNETI is less than adequate when viewed against industry's. Of course, the current budgetary constrainsts, confronting all segments of Government, are such that the problem cannot be resolved presently.

The problem is further amplified by the fact that there has been a recent increase in compensation of university staff whose previous salaries more or less equalled that of LNETI staff with comparable training and experience.

It might be useful if general proposals and alternative plans of compensations were drawn which, at the appropriate time could be submitted to the relevant Governmental bodies for their review and consideration. Such compensation structure should take into account the realistic fact that if LNETI is to both hold and attract technically specialized and qualified staff , its salaries must be attractive, even if they fall outside "normal" Government pay scales. Such arrangements are not at all unusual in other countries, and are recognized as essential if the scientific-technological arm of the Government is to be an effective force in indsutrial development.

3. Working Conditions

Brief mention may be made that, aside from adequate compensation , the working conditions - physical plant, equipment,supporting services - must be attractive if the best research effort is to be attained, and staff both attracted and held. These have been referred to earlier, in other contexts, and need not to be touched upon again.

3.4.5 Attendance at Foreign, technical Meetings

There are other motivating forces that can be encouraged and developed by LNETI in the interest of staff sactisfaction.Among these is availability of adequate financing to permit attendance at foreign technical meetings - symposia, seminars, workshops, among others. This would allow the researcher to exchange information in this particular discipline on a person-to-person basis, present technical findings to an international audience, learn directly and timely the latest advances in his field of science, and permit establishment of long-term, personal linkage with professionals abroad.

Presently, the funds available for such participation, important in increasing the staff's performance, are quite restricted. Consideration should be given to increase this segment of LNETI's budget in future presentations to the Government.

3.4.6 Foreign Study

Another encouragement for staff motivation be funds, whether from budget, scholarships, fellowships or grants, which would offer possibilities for foreign study to complement or supplement the researcher's present technical capabilities, with benifits occuring to both LNETI and its industrial clients. LNETI ' s management coud fruitfully pursue possibilities of funding outside its own budget.

3.4.7 Internal Training

There should be provisions for internal training, through local lecturers, discussions groups, and the like; through training by counter part staff provided by foreign organizations, the United Nations system or by other multinational bodies: LNETI's

Technical Training Center can play a critical part in this effort.

Such provisions can be especially beneficial since they indicate LNETI's interest in professional growth and staff morale. While these efforts have, in part, already been iniciated, furtherance and expansion of them should be encouraged.

3.5 LNETI's Interrelationship with other Institutes

It may be interesting to present a few, brief comments on LNETI's possible interrelationship with other institutes, with the view that these may encourage a more detailed exploration as to the usefulness of such relations.

3.5.1 Universities

Since universities are usally the main source of technical staff for research institutes and of theorical knowledge, the relationship of LNETI with the technical universities of Portugal is of importance. Such linkage now exists in an informal manner and should be encouraged, especially in sharing of equipment and specialized manpower.

3.5.2 Foreign Research Institutes

Generally, an interrelationship with a similar, foreign research institute has the purpose of exchanging information, extending technical assistance or receiving it, exchanging staff, or jointly undertaking multidisciplinary research projects.

There are numerous examples of fruitful linkages, but the following may be illustrative:

- Singapore Institute of Standards and Industrial Research and the Universities of Wisconsin (U.S.A.) as well as the Department of Scientific Research of New Zealand.
- The Marmara Scientific and Technical Research Institute (Turkey) and the Central Organization for Applied Scientific Research (The Netherlands).
- The Federal Institute of Industrial Research (Nigeria) and the Tropical Products Institute (U.K.).

It is not known whether such "twinning" now exists between LNETI and a foreign institute. It might be intersting for LNETI to explore this possibility, perhaps through WAITRO (World Association of Industrial and Technological Research Organization) with which no doubt LNETI management is familiar. The institute-to--institute relationship could be a considerable advantage in encouraging industry to seek the services of LNETI.

3.6 LNETI's Relationship with other Governmental Bodies

Consultation visits were make to a number of Governmental bodies within the Ministry of Industry and Energy as well as outside of it, to learn about their functions and programmes, particularly as these might relate to those of LNETI. Particular attention was given to these areas which might seem duplicate or overlap those with whi h LNETI is concerned, with the view that full harmonization and coordination of Governmental efforts on behalf of the development of the industry of Portugal would lead to a more effective use of manpower and physical resources available to the Government for the problems of industry. A sampling is given below.

3.6.1 Institute for Supporting Small and Medium Industries (I.A.P.M.E.I.)

I.A.P.M.E.I.'s work for small and medium enterprises, involving techno-economic, training and other facets of assistance, has a direct bearing on sectors of LNETI's own programme of work. Considerable will was expressed by the former to coordinate more closely its activities with those of LNETI, especially in training, through the Laboratory's Technical Training Center, information and the Technical Information Center for Industry, and technological support with the Department of Pre-Investment, Promotion and Commecialization acting as a contact point for LNETI.
In turn, I.A.P.M.E.I.'s direct industry relationship , both medium and small, could be valuable, informal adjunct to LNETI's industrial promotional afforts, introducing the latter to a range of industries and making them aware of the services and assistance offered by LNETI.

3.6.2 Directorate General of Quality

This Directorat's very name implies that there are areas of mutual interest between it and LNETI. It is noted that through the Director General close relationship exists which ensures that concerted attention is directed to problems to which both bodies could contibute. It is obvious that LNETI's broad range of quality control - analyses - testing facilities and activities can provide valuable "back-up" services to the Directorate. Furthermore, the Directorates own breadth of contacts with industry can be a valuable assist in LNETI's promotional efforts.

3.6.3 Other Directorates General of the Ministry of Industry and Energy

The various Directorates General of the Ministry, such as those for Light Industries and for Chemical and Metallurgical Industries carry out, on behalf of industry, services, including technical information and techno-economic evaluations, in which LNETI could play a complementary part through its Technical Information Center and its technological branches. In return, the Directorates have a wealth of sectoral information which would be of considerable assistance in LNETI's analysis of the needs of industry.

3.6.4 Foreign Investment Institute of the Ministry of Finance and Planning

This Institute is an especially active Governmental body. It in effect evaluates requests from foreign interests in investment opportunities in Portugal from the view point of their effect on the national economy and in the light of certain legal restrictions on investements concerning, among others, licences, patents, technical know-how, trademarks, models. On the basis of its evaluation and recommendation, the requested approval and financing from the National Bank is decided.

While the Institute has a sound techno-economic staff, it was stressed that technical evaluation problems arise which are outside the capabilities of the staff. It is here that LNETI could play a role. However, since by regulation a decision must be given to the potential investor within 90 days of inquiry; prompt evaluation whether technical or economic, is mandatory long-range technical analysis would be unacceptable.

It is clear that an intimate relationship should be fostered

between the Institute and LNETI.

3.7 Relationship with Industry

Through an intensive schedule of visits to industrial enterprises and associations, and consultations with their staff, a general impression was received of their activities and actual or possible, relationship with LNETI and their views of industry's knowledge of LNETI. The emphasis must be on "general" for the limited project time did not permit full evaluation of each . Further, the range of activities encountered - electronics,fine chemicals, feed stock, machine tools, to name a few - is so broad and diverse that each could demand an in-depth, long-term evaluation project itself. Nevertheless, having said this, the following can be noted.

3.7.1 The industries visited, though they may not necessarily be a representative cross-section of Portuguese Industry, did provide an impression of performance, working conditions, product quality, interest in technical assistance, and the like, as indicated above. They included well established, large, highly successful, technologically capable ones (e.g., cork, detergents) through medium pioneering ones, with high technical content (electronics) to modest beginnings in production and technology (yogurt), down to near failures, with virtually not technological input (pork product processing). They also included discussions with trade associations e.g., for those representing foundries, electronic-electrical industries, dairy industries, that were especially fruitful in providing information on an overview sectorial basis of Industries in Portugal and their place in the overall industrialization of the country and their possible

competitive status in the future European Economic Community, as well as illustrating industry's possible views of R & D, generally, and services of LNETI, more specifically. All of these were supplemented by free dialogue with staff of industries visited.

As generality, when industry does know, avail itself, of the assistance available from LNETI, it is in the area of basic services; eg, testing, standards, quality control, instrumentation, industrial information and documentation, training, while each of these is important in its own right, collectively they do not represent the R & D work which LNETI was established for and which most effectively would further the technological development of Portuguese industry and its products. (Mention must be made, though that in several units of the Laboratory, applied research is being carried out).

3.7.2 Industry's knowledge of LNETI

Whereas most, if not all, of the industries and associations contacted have some knowledge of LNETI and its services, particularly in the areas of testing and quality control, it is only realistic to believe that at this early stage of LNETI's development, industry in Portugal as a whole has very little knowledge of it and even less of its activities and technical services.

3.7.3 Obstacles

While such basic services are indeed essential to industry, and could well serve to introduce the clients to the more R & D based capabilities of LNETI, obstacles remain to hinder

fuller relationship with industry. These obstacles, though certainly not unique in Portugal, must be overcome if LNETI's role in industrial development is to grow. Some of the obstacles though not in order of importance as listed, may include these impressions of LNETI:

- Lack of direct and specific information about objectives and functions.
- Dubiousness about technical manpower and equipment capability in solving the "real" problems facing industry.
- Impression that such a wide range of services is offered that there is specific strength in none.
- Questions by private industry as to the Gvernment relation - ship.
- Slowness of response and delay in performance.
- Uncertainty of the cost/benefit of R & D.
- Feeling that it is an "ivory tower" operation, unrelated to the rough-and-tumble of industrial milieu.
- Doubt about the confidentiality and priority rights of research results.
- Difficulty in technical dialogue (particularly true in the instance of small and medium industries which may lack in- -house technologists).

More could be listed, but none is unsurmountable. It must be born in mind that even today's most advanced industrialized nation was confronted with the same obstacles in its history. The difference is, of course, that in the course of the present unrush of technologies it behooves LNETI, in cooperation with Portuguese industry, to move as promptly and effectively as

possible to overcome such obstacles and provide industry with products and processes of high technological content which will be competitive nationally and internationally.

4. RECOMMENDATIONS

4.1 General

First, some general recommendations are offered with the view of assisting in strengthening LNETI organization so that it may improve its capabilities in research for industry. Then, more specifically, recommendations will be set forth through which linkage with industry could be improved and promotion and sale of LNETI's services could be bettered.

4.2 Organization

The present organizational structure, though a major step forward, should be reviewed periodically in view of the dynamic nature of research and industry's demands on it, and adjusted accordingly.

While the immediate task should be to fill the vice presidency vacancy as quickly as possible so as relieve the President of day-to-day operational problems, the long range aim should focus on the accession of additional vice presidency posts to permit separation of managerial functions into "technical", "administrative" and, "ideally", support services.

The directorship of the Institute of Energy should also be filled as promptty as possible to provide the permanent leadership needed especially during the early days of LNETI.

Consideration should be given to separating the Department of Nuclear Sciences and Techniques into Physics Department and a Chemistry Department to encourage a more cohesive approach by each major discipline to its sector of industry and increasing

manageability of the units.

The directorship of the Institute of Industrial Technology also should be filled as quickly as possible.

Delays should be avoided in the consolidation and move of the Department of Food Industries Technology to its new site.

An in-depth review of others units of the Institute of Industrial Technology should be conducted to determine whether more cohesive, streamlined operations can be developed.

The programming and harmonization work of the Planning Office of Engineering and Industrial Technology should be supported and the Office's functions and services clarified within LNETI as a whole.

The Department of Pre-Investment, Promotion and Commercialization should have the appropriate number and quality of staff if it is to provide the vital linkage with industry. More will be commented on this Department in the industry section of these recommendations.

Close coordination between the Technical Information Center for Industry and other information units or the like within the Government is essential and should be strengthened to assure that industry is best served and to reduce duplication - in staff, material, etc. - to a minumum.

The Technical Training Center should continue to broaden its activities beyond management training, including technical training of in-house staff as well as from industry.

The Center's training programme should take into account that of I.A.P.M.E.I. with the view of harmonizing the two activities for the benefit of staff from small and medium industries.

4.3 Plant and Equipment

In every way the plant situation should be improved as quickly as possible. While the move of the Department of Food Industries Technology to new quarters is a solid step in the right direction, consideration should be given to what other steps, albeit temporary, might be taken to relieve the present, nearly intolerable, situation until such time that the Lumiar site is ready to accept the numerous, city-wide units of the Institute. Though equipment budget constraints are real, if the Laboratory is to grow with general technological developments in industry, it should press for adequate funds to replace obsolete equipment and acquire additional units.

Further consolidation at research effort and sharing of equipment time should be made, coupled with more in-house shop production of certain items.

The possibility of donation of equipment by industrial clients, in connexion with pilot plant activities, for example, should be explored.

Though the same budgetary constraints confront the acquisition of printed matter-books, journals, and the like - their value can not be underestimated if LNETI's staff as well as its industrial clients are to keep abreast of international technological developments and not fall behind, or worse, undertake research projects already resolved elsewhere. Thus, such acquisitions should not be assigned a minor consideration in any budgetary presentation.

4.4 Staff

It would seem useful - especially during this transitory

period - if management would ensure that throughout the organization and at all levels that there is continuing, full understanding of the progress of reorganization and of each individual's position within th scheme of things, to reduce a certain disquiet that now appears to exist.

Management could also see to it that staff becomes more fully aware of the functions and programmes of units outside their one, especially in the instance of the supporting services.

In view of current budgetary constraints, which, among other things, affect staff accessions, it would be helpful if qualified personnel would be reassured about their job security and their long-range position in the growth of LNETI.

Every effort should be made to ensure retention as well as accession of technical staff through an adequate salary structure, even if outside the norm of compensation that now exists within the Government; bearing in mind that as the gap between LNETI and industry structures widens, the loss of the especially qualified personnel will have an extremelly adverse effect on the quality of services LNETI supposelly is to offer. At the least, the present gap between LNETI and University compensations should be eliminated.

Attendance at foreign technical meetings of research staff should be encouraged and financially supported, to permit such staff to broaden their technical horizon and provide them with motivation in performance.

Also foreign study, through various financial means, should be stimulated to complement or supplement the researcher's present technical capabilities.

Internal training, through lectures, study groups, or other means, should be an integral part of staff development as well as an indication of management's interest in professional growth and morale. The Technical Training Center should play an integral part in the training effort.

4.5 Institute Interrelationship

Relationship with universities, particularly those with scientific or engineering content, should be furthered, in the interest applying joint staff-equipment capabilities on industrial problems as appropriate.

It would appear highly useful for LNETI to explore "twinning" arrangements with one or more foreign institute active in similar fields of displince, thus permitting fruitful exchange of staff and information and, when desirable, application of joint research effort on major projects.

4.6 Relationship with Other Governmental Bodies

It is in the area of Governmental body-to-body relationship that LNETI's management could play an especially important role, encouraging the harmonization of similar activities and forwarding in a coherant manner the industrialization aims of the Government.

At a lower staff level, periodic and regular contacts should be maintained and strenghtened between appropriate units of LNETI and other bodies such as I.A.P.M.E.I., Directorate of Quality, other Directorates of the Ministry of Industry, to name several. LNETI should provide valuable "back-up" technical support to those bodies as well as gain greater exposure to

industry's technological needs.

4.7 Relationship with Industry

First and foremost, LNETI should expand its internal review of its own range of activities in the light of the industrial and economic policies of the country and related to the needs of industrial sectors with varying degree of national importance. This recurring monitoring is essential if LNETI is to avoid attempting to conduct too broad a range of services for all of industry without, having real, in-depth competence in any. An over-all look should be given to the various, broad sectors of industry, with the view of selecting those whose activities parellel in-house disciplines. Such evaluation should rank the sectors in order of importance to the national economy and development goals and to their eventual, estimated position within the future Common Market. In this exercise, the information already gained by other bodies of the Ministry, such as the several technical Directorates, or by other Governmental bodies, would be appreciably useful and should be drawn upon. Too, the several technical associations of the country could be helpful in providing statistical data and other basic information useful in measuring rank of importance. Matching real, in-strength capabilities of LNETI against ranked sectors, a selection should be made as to those sectors which would lend themselves most fruitfully and quickly to further, detailed evaluation in regard to their actual and potential R&D needs. In this selection process, management should be strictly realistic as to LNETI's own staff-equipment-experience capacity for entering into possible research projects

with the sectors selected.

The selection process should then be further refined by in--depth surveys of industries within sectors as to their technological demands and potential needs. The surveys should call on a variety of resources for information on these needs and demands: industrial reports, technical information centers, Government data, technical or trade associations, or the industries themselves through personal visits and interviews. In the instance of small and medium industries within a sector, I.A.P.M.E.I. could be particularly helpful.

The end product of the series of surveys should be a listing of industries, by a select number of sectors, which lend themselves best to technical assistance in resolving their problems. The lack of such surveys can misdirect the effort of LNETI and hinder its ability to locate and attract project sponsors who have a real need for its services.

Throughout, the potential impact of R&D on the technological content of process and product of industry, especially as related to its future competitive position in the Common Market, should be weighed and judged against LNETI's present and near-future contribution in technical assistance.

The series of evaluations should be useful to both industry and LNETI. Industry may gain in formation in coherent form that it may not have had before. LNETI may learn where its technical weaknesses and strenghts lie and what action should be taken, in view of potential demand by industry, to improve or modify its R&D capacity accordingly.

The informa' on developed through the surveys should not only be appropriately catalogued but also should be kept current

through periodic, increasingly refined analytical studies. The Technical Information Center should be integrated in this task.

Having identified those industries whose technological needs, actual and potential, parallel the skills and tools available to LNETI, or readily improved or introduced, the next step should be to establish linkage between them and the Laboratory. Such linkage can be developed in a number of ways but should not be initiated until LNETI is certain that it has the requisite capabilities confidently to undertake research work specifically directed to the identified needs of the industry. Nothing can harm the reputation of an institute more than the "over-selling" of its services.

Linkages should be established through one or more of the following: periodic publications, such as annual reports, on LNETI's facilities and experience; industrial visits at management and staff level; technical information dissemination; short-term staff exchanges; introductions through other Government bodies already in contact with the industry; public relations activities, such as press releases, technical publications or radio-TV, to expose particularly significant scientific developments by LNETI; involvement of top managers of LNETI in industry related affairs, such as appearances before technical trade associations, membership on board of directors, presentations at executive-level seminars or working groups.

One particularly useful and visible linkage is through the more routine work for the industry that may already be under way, such as quality control and testing. With the entré already

gained, it should be measurably simpler for LNETI to identify other problems, more R&D - demanding, within the industry served and to "sell" its services more readily, accordingly. Throughout, though, there should be continuing recognition that the most effective way establish and maintain strong linkage with industry is through research projects efficiently and successfully carried out. As the number of such project increases, LNETI will find a more than comparable increase in industry interest in its services.

With the linkage established, a continuing, strong relationship should be formed with the industry so that, virtually automatically, the latter first turns to LNETI when confronted with a technological problem. Preferably, the relationship should be at two levels: executive-to-executive, and technologist-to--technologist, with the former necessary for any official go--ahead on research project start-up.

The relationship is particularly fruitful if LNETI staff would direct a portion of its effort to visits to industry or to encouraging and hosting visitors from industry. In the former instance, LNETI staff would gain invaluable, first-hand insight on industrial activity, problems, and potential areas for research; while in the latter case, industry's representatives would gain a fuller, personal understanding of R&D activities, facilities and staff experience which would increase their knowledge of, and confidence in LNETI.

The unit within LNETI which should be most directly involved in the above activities is the Department of Pre-Investment, Promotion and Commercialization. Consideration might be given to eliminating the rather vague term, "Pre-Investment" from the name of the Department. Thus, it should have the functions

of: initiating and carrying out, in cooperation with appropriate units of LNETI, and with the assistance of other Governmental bodies, techno-economic sectoral and industry studies; establishing and strengthening linkages with industry; evaluating industry's needs and determining LNETI's potential assistance in meeting these; initiating direct contacts between appropriate research staff and the industry with the aim of developing a research project; carrying out a continuing economic assessment of on-going research work to ensure that technically successful results are commercially exploited; periodic assessment of LNETI's programme of work as judged against national industrialization goals, generally, and industry's needs, specifically; encouraging such public relations as appropriate to bring LNETI's work and services to the attention of industry; providing in the specific disciplines represented within the Department, on-the-spot problem solving for industry; referring industry's needs in areas other than research, such as training or technical information, to the appropriate units of LNETI or to alternative sources of assistance; examining LNETI's own, in-house research work for possible exploitation; attending such meetings, national or international, that bear on the Department's interests; investigating and recommending various means through which industry could financially support R&D projects, e.g., through trade association support, or joint industry-government funding; in other ways, assisting in promoting and developing the growth of LNETI.

To best accomplish the above, varied functions, the staff and the budget of the Department should be strengthened. Staff should be employed that preferably has technical and/or

economic training, industry experience, and "sales-minded" personality. A minimum of 4 - 5 would initially be required for the near future, if LNETI wishes forcefully and expeditiously to expand its R&D services to industry and to carry out the other functions recommended above. The budget, too, should reflect the financial requirements, such as frequent travel to industry and public relations efforts, which a substantial increase in the operation of the Department demands. Nevertheless, too rapid an expansion should be avoided. Rather, the Department's expertise should be built upon block-by-block. Finally, it is strongly recommended that consideration should be given to strengthen the capabilities of the Department through the following: provision of a several weeks fellowship, or similar, for its head, to permit a study tour of foreign research institutes with well-established promotional and commercial departments, e.g.. Battelle Memorial Institute, Stanford Research Institute, IIT Research Institute, all of the U.S., to learn, first-hand, from their experiences, suitable methodologies: long-term organizational development assistance, managerial and sectoral, through foreign experts. Such study and assistance programmes might be explored with various multinational organizations such as the United Nations system.

5. APPENDICES

5.1 APPENDIX

Programme of visits to, and consultations with, officials of units of LNETI, Government bodies and industries prepared by Directorate of International Services of LNETI for the UNIDO expert

PROGRAMME FOR MR. PAUL B. W. GOLLONG'S MISSION

28 Feb.-19 Mar. 1980

THURSDAY, 28

10.00 - Directorate of International Services, LNETI
Mrs. Maria do Céu Oliveira - Delivery of Programme and arrangements

11.30 - Steering Committee, LNETI - Mrs. Inês Florêncio
- Philosophy about LNETI-Industry relationship and work of steering Committee

12.30 - Luncheon meeting with Mr. Santos Gonçalves, General Director of Quality , Ministry of Industry and Energy and Mrs. Florêncio and Oliveira

14.00 - Promotion and Commercialization Department, LNETI
Mr. Campos Rodrigues - Ministry of Industry and Energy (MIE), its structure an interconnection with other enterprises and governmental organizations.

FRIDAY, 29

9.30 - Steering Committee, LNETI - Mr. A. Coelho de Carvalho

11.00 - Technical Information Center Industry, LNETI
Mrs. Celeste Tavares

14.00 - Departments of Conventional and Renewable Energy,LNETI
Mr. Lemos Cabral

MONDAY, 3

All day - Department of Nuclear Science and Techniques, LNETI, Sacavém - Mr. Jaime de Oliveira and Mr. Henrique Carvalhinhos

- Department of Electronics and Electrical Equipment, LNETI, Sacavém - Mr. Carlos Veiga

TUESDAY, 4

All day - Planning Office of Engineering and Industrial Technology, LNETI - Mr. Ventura Sampaio, Mr. Neves da Silva and others

WEDNESDAY, 5

8.00 - Department of Technology of Food Industries, LNETI Mr. Vieira de Sá

10.00 - Central Department of Industrial Studies and Analysis, LNETI - Mrs. Vitória Pinheiro

14.00 - Instituto de Apoio às Pequenas e Médias Empresas Industriais (I.A.P.M.E.I.) - it gives technical and financial support to small amd medium enterprises - Mr. Palma Féria

THURSDAY, 6

10.00 - Technical Training Center, LNETI - Mr. Silva Serra, Director, and Mr. J.Pinto dos Santos, Adviser

16.00 - General Directorate for Quality, Ministry of Industry and Energy - Mr. Santos Gonçalves

FRIDAY, 7

10.00 - Studies and Planning Department, Ministry of Industry and Energy - Mr. Marques dos Santos and Mr. Alcântara de Melo, Director for International Economic Relations

16.00 - Direcção Geral das Indústrias Transformadoras Ligeiras, Ministry of Industry and Energy - Mr. Bartolomeu Monteiro

MONDAY, 10

All day - Visit to Oporto with Mr. Campos Rodrigues from LNETI and Prof. Silva e Sá and Prof. Paulo Guedes de Oliveira from Universidade de Engenharia - Oporto

1. Cork Association (Industries and Exporters), Santa Maria das Lamas
2. Amorim Cork Industry Ltd., Mozelos - Mr. Gaspar A.S. Barbosa Malheiro
3. VIMA - Vehicles and Material Handling Ltd., Vila Nova de Gaia - Mr. D. de Paiva, Administrator; A. A. Giesteira de Almeida, Director
4. ADIRA - A. Dias Ramos, Machine Tools, Ldt., Oporto - Antônio Henrique Correia Ramos, Director General, Mr. J. A. Bessa Pacheco, Chief Engineer
5. A.P.F. - Portuguese Foundry Association, Oporto - Mr. Manuel José Botelho Chaves, Secretary General, Mr. A. Casimiro da Costa, Director for Foundry Magazine.

TUESDAY, 11

10.00 - Instituto do Investimento Estrangeiro (Foreign Investment Institute), Ministry for Finance and

Planning - Mr. Vitor Simões, Vice-Director

11.00 - Portuguese Trade Promotion Board - Mr. Carlos Julião, Coordinator

14.30 - CENTREL - General Electronics, SARL, Almada - Mr. José Manuel Campos Pires de Matos Assistant Director General

WEDNESDAY, 12

10.00 - QUATRUM - National Enterprise of Organic Chemicals - Mrs. Ana Maria dos Santos Costa, LNETI; Mr. Manuel Fontes de Mello and Mr. João Barrento, Administrators, QUATRUM

14.30 - Department of Technology of Food Industries, LNETI - Mrs. Sílvia Frazão

THURSDAY, 13

9.00 - RAVAFE (a feed stock enterprise), Freixial - Bucelas - Mrs. Helena Rodigues, LNETI; Mr. Rui da Câmara e Sousa, Technical Director, RAVAFE

14.00 - SONADEL (National Society of Detergents) - Mrs. Maria Leonor Bateira, LNETI; Mr. Antônio Matos Ferreira, Director of Production and Development, SONADEL

FRIDAY, 14

9,00 - Visit to GEL-TERRA - pork processing industry - Cascais
Mr. Soares Melo and Mr. Palminha, LNETI; Mr. Jorge Pablo and Mr. José Atanásio, GEL-TERRA.

14,30 - Biolacta, S.C.A.R.L. - yogourt industry - Mrs. Manuela Barbosa, LNETI; Mr. João Gaspar Gonçalves, Biolacta

16,30 - (name, place of firm and people seen, to be folled in); Mrs. Manuela Barbosa, LNETI.

MONDAY, 17

15,00 - Representatives of National Association of Electronic and Electric Material Industries (ANIMEE) - Mr.Campos Rodrigues, LNETI; Mr. A.L.Abreu Freire, Mr. Miguel Allegre de Magalhães, Economic Advisor, ANIMEE.

TUESDAY, 18

10,30 - Dairy Industries Association
Mr. Mário Morais

Pork Meat Industries Association
Mr. Baron de Cabrier da Silva

Mr. Vieira de Sá, Mrs. Manuela Barborsa, Mrs. Armanda Severo, Mr. Melo Soares and Mr. Campos Rodrigues, LNETI.

15,00 - Meeting with Public Relations - LNETI - Mr. Carlos Barbosa and Mr. Costa Ferreira.

WEDNESDAY, 19

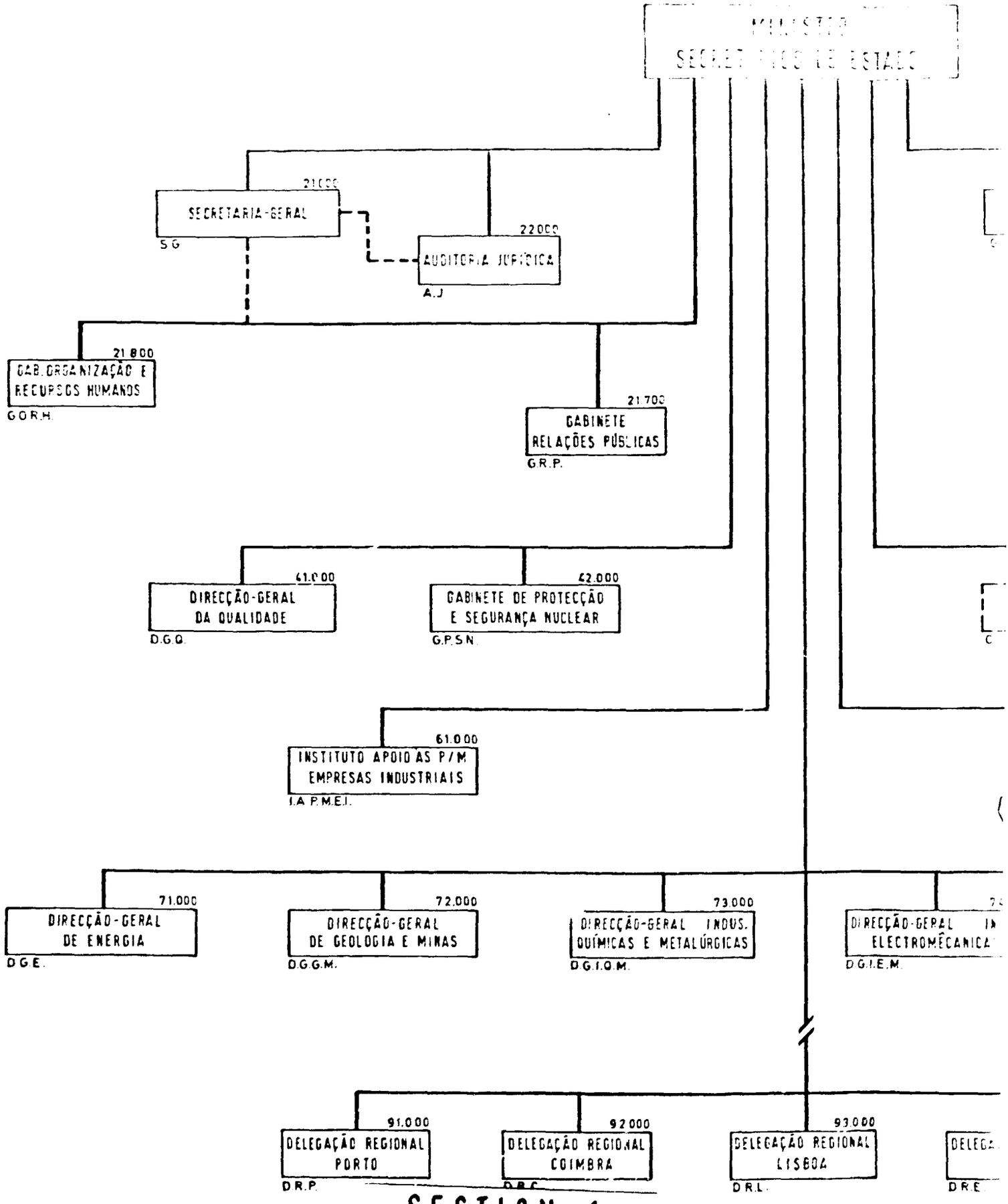
9,30 - Meeting with the President of LNETI, Prof. Veiga Simão.

5.2 APPENDIX

Organization chart of Ministry of Industry and Energy, showing relationship of LNETI to other bodies of the Ministry 1/

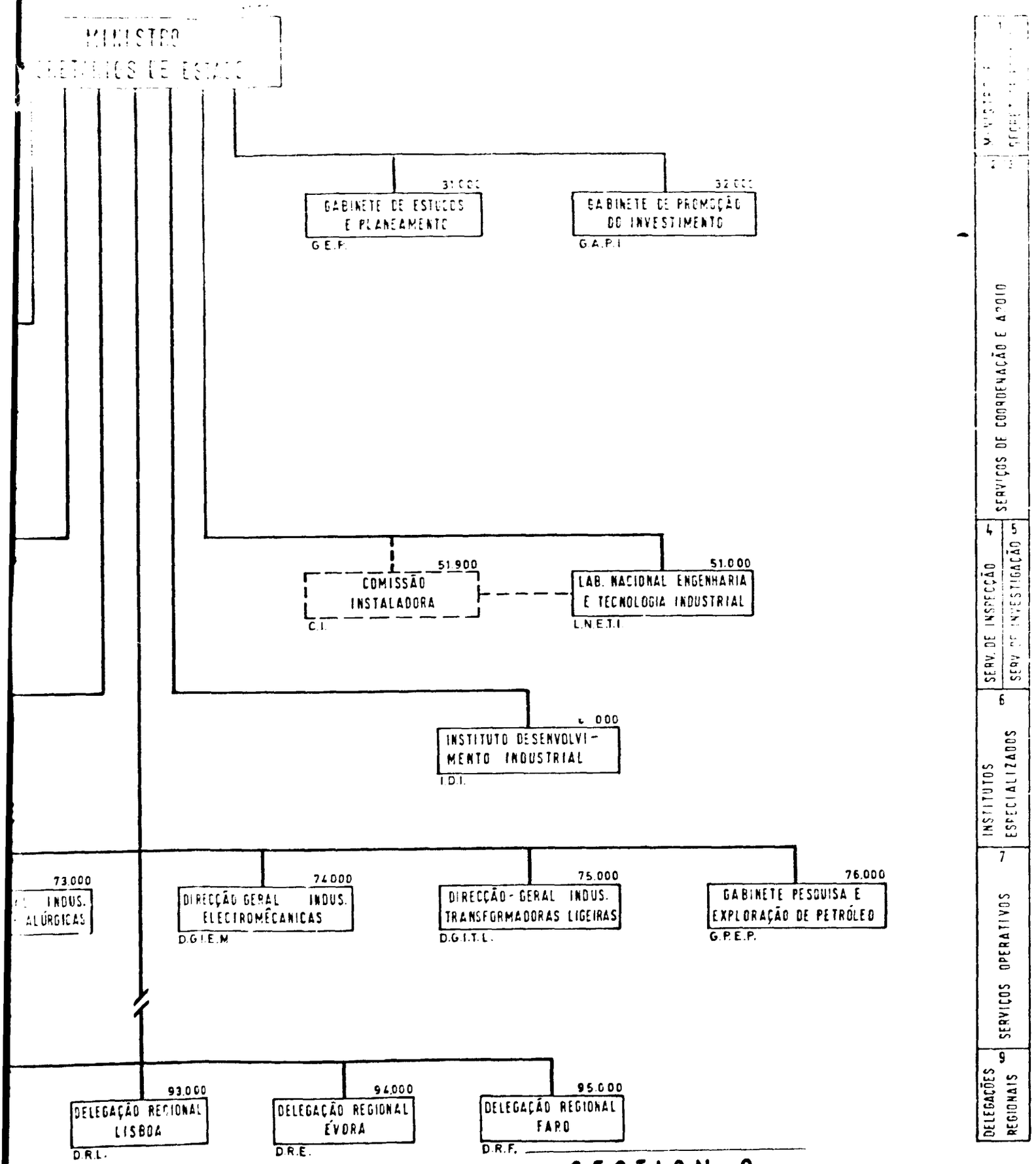
1/ Since the issuance of the chart, April 1979, the Ministry's former name, "Ministry of Industry and Technology," was changed as indicated

MINISTÉRIO DA INDUSTRIA E T



SECTION 1

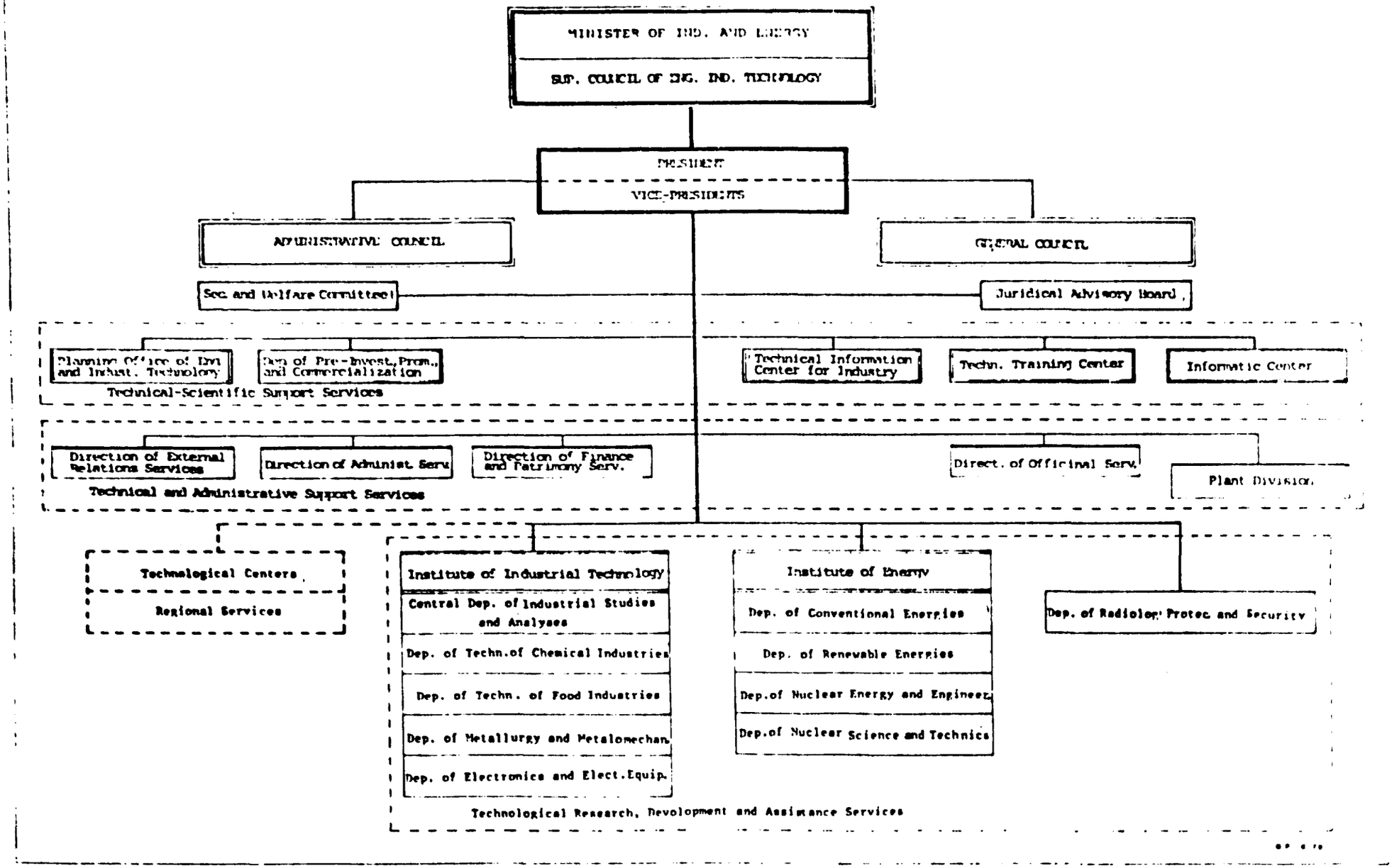
INDÚSTRIA E TECNOLOGIA



SECTION 2

5.3 APPENDIX

Organization chart of LNETI. Since its issuance the number of Vice-Presidents has been reduced to one. Further, the Informatic (Computer) Center has not yet been established


MINISTER OF IND. AND ENERGY
SUP. COUNCIL OF ENG. IND. TECHNOLOGY
PRESIDENT
VICE-PRESIDENTS
ADMINISTRATIVE COUNCIL
GENERAL COUNCIL
Soc. and Welfare Committee
Juridical Advisory Board
Planning Office of Invt and Indust. Technology
Dep. of Pre-Invest., Prom., and Commercialization
Technical-Scientific Support Services
Technical Information Center for Industry
Techn. Training Center
Informatic Center
Direction of External Relations Services
Direction of Administ. Serv.
Direction of Finance and Patrimony Serv.
Technical and Administrative Support Services
Direct. of Officinal Serv.
Plant Division
Technological Centers
Regional Services
Institute of Industrial Technology
Central Dep. of Industrial Studies and Analyses
Dep. of Techn.of Chemical Industries
Dep. of Techn. of Food Industries
Dep. of Metallurgy and Metalomechan.
Dep. of Electronics and Elect.Equip.
Institute of Energy
Dep. of Conventional Energies
Dep. of Renewable Energies
Dep.of Nuclear Energy and Engineer.
Dep.of Nuclear Science and Technics
Dep. of Radiolog. Protec. and Security
Technological Research, Development and Assistance Services

5.4 APPENDIX

Listing of activities of units of LNETI, as prepared by the Planning Office of Engineering and Industrial Technology for the expert

- Technical Information Center for Industry
- Technical Training Center

INSTITUTE OF INDUSTRIAL TECHNOLOGY

- Central Department of Industrial Studies and Analyses
- Department of Technology of Chemical Industries
- Department of Technology of Food Industries
- Department of Metallurgy and Metalomechanics
- Department of Electronics and Electrical Equipment

INSTITUTE OF ENERGY

- Department of Conventional Energies
- Department of Renewable Energies
- Department of Nuclear Energy and Engineering
- Department of Nuclear Sciences and Technics

- Department of Radiological Protection and Security

MINISTERIO DA INDUSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL – LNETI

TECHNICAL INFORMATION CENTER FOR INDUSTRY

A.

- CENTRAL INFORMATION SERVICE
  - Central Library Division
  - Information and Documentation Division
  - Patent Division
  - Documental Informatics Division
- SECTORIAL INFORMATION SERVICE
  - Technical Information in the Technological Area Division
  - Technical Information in the Energy Area Division
- EDITORIAL SERVICE
  - Technical Support Division
  - General Support Division

A.1 OBJECTIVES

- To organize the national technical information system for industry, together with specialized services in the Ministry of Industry by gathering, treating and organizing documents, books, publications and audio-visual means.
- To coordinate the connection of the national technical information system for industry with other national and international information nets.
- To divulge the knowledge deriving from the activities of LNETI with interest for the industrial development and the ones contained in the patents of invention by the industrial enterprises and entities of the Ministry of Industry.
- To organise the editorial of LNETI and to guide its activities.

A.2 IDENTIFICATION OF FUNCTIONS

- Acquisition, recording, cataloguing of publications and respective domestic diffusion: bibliographies, bibliographic bulletins,
- Reproduction (copy) and divulging of scientific and technical articles,
- Technical Information. Sellective Diffusion,
- Service Question/Answer and guidance towards information sources,
- Technical translations (to and from),
- Treatment of Portuguese and French patent texts,
- Retrospective search of patents and search on the state of the technique
- Sellective diffusion of Patents,
- Enlargement and up-dating of mecanographic files,
- Organization of files covering different fields of the Ministry of Industry,
- Data Bank of enterprises/products
- Listing and labelling for the diffusion of documentation
- Publishing activity-typesetting, printing, reprography,

A.3 FORESEEN ACTIVITIES

- Automatization of documentation,
- Organization of the information net-work of LNETI,
- Organization of the information net-work for industry,
- Connection to international net-works,
- Publishing of periodicals, papers, etc., on Information

B. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	18	15
OTHERS	79	30
TOTAL	97	45

There is a certain identification between the projects the Department intends to develop in 1980 and its functions and activities.

MINISTERIO DA INDUSTRIA E TECNOLOGIA

Working Paper

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Gabinete de Planeamento

TECHNICAL TRAINING CENTER

A.

- Service of Industrial Management
- Service of Technologies
- Service of Região Norte (North Country/side)
- World Bank Group

The Technical Training Center has a technical-scientific role in planning, coordinating, supporting and holding training activities in the fields of Industrial Management and Technologies.

A.1 OBJECTIVES:

- To hold courses, conferences, seminars and other meetings in the fields of: Industrial Management and Technologies.
- To provide the development of technics connected to Industrial production.
- To promote post-graduate courses and training periods for monitors.
- To promote Research & Development activities.

A.2 PROJECTS :

In 1980 the Technical Training Center will develop the following projects:

Support and Direction for maitenance of the Center and its services

This project includes activities as :

- Planning and Programmation
- Information System
- Tele-enterprise
- Audiovisual
- Auxiliary Services

Industrial Management Training
(mainly connected to the service of Industrial Management)

It includes training courses on the subjects :

- Basic Direction — Programmes
- Direction Development
- Updating Programmes
- Foremenship training
- Requested training
- Internal training (addressed to the personnel of the Departments of LNETI)

Technological Training (connected to the Service of Technologies)

It includes training courses on the subjects :

- Food Industries
- Corrosion
- Metallurgy and Metalomecanics
- Electronics and Electrical Equipment
- Nuclear Sciencesand Techniques
- Renewable Energies
- Radiological Protection and Security
- Wood
- Quality
- Metrology
- Requested training
- Internal training (addressed to the personnel of the Departments of LNETI)

World Bank Project

The World Bank Group is developing the World Bank Project,

which has as objectives to give technical and financial assistance to the :

- Building of the new Plant of the T.T.C.
- Implementation of the T.T.C. activities mainly in the Industrial Management field.
- Training of Monitors (giving awards)
- Acquisition of Equipment.

B. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	9	6
OTHERS	14	8
TOTAL	23	14

INSTITUTE OF INDUSTRIAL TECHNOLOGY

MINISTÉRIO DA INDUSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Gabinete de Planeamento

CENTRAL DEPARTMENT OF INDUSTRIAL STUDIES AND ANALYSES

A.

- Service of Analyses and Essays
- Service of Experimental Development of Analytical Methods
- Service of Study and Control of Industrial Effluents
- Service of Corrosion and Protection of Materials

A.1 Objectives

- to make analyses and tests of the products
- to make research and to develop methods of chemical, physical and instrumental analyses.
- to assist and give technological support in the fields of control and treatment of manufacturing effluents, corrosion and protection of materials and use of industrial residues.

A.2 Description of Functions

- training
- information
- technical support and assistance to Industry
- quality control

Experimental Development of Analytical Methods

(Analytical support to Industry and to official and public services)

- metals, metallic alloys, uranium concentrates slag and metalic residues
- ceramics, refractories, cements, glass and raw materials

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Development of Analytical Technics

- spectrophotometry VIS, UV and IV
- optical emission spectrography
- X Ray fluorescence spectrometry
- atomic absorption and flame emission spectrometry
- electrochemical methods of analysis (polorography, electro-analysis, etc.)
- Conventional methods of analysis (complexometry, gavimetry, solumetry)
- spectrofluorimetry
- organic, elementar and functional micro-analysis

Study and Control of Industrial Effluents

- characterization of liquid effluents
- analytical support to industry and to governmental departments in the control and characterization of industrial water supplies and of industrial effluents
- study of analytical methods in order to allow the increase of the above-mentioned support

Corrosion and Protection of Materials

Corrosion

- agressiveness and treatment of water for boilers
- material selection
- corrosion diagnosis

Protection

- metallic coating
  - metallic packing
- non-metallic coating
  - selection and specification
  - metallic packing — special incidence in paint coating
- cathodic protection
  - study phase

A.3 Foreseen Activities

Within the analytical field we consider the improvement of the following laboratories:

- Laboratory of Preparation of Samples to make a great number of samples of any type of materials for analytical purposes
- Laboratory of Spectrometry to give analytical support to the characterization and treatment of industrial effluents and to the corrosion and protection of materials.

Study and Control of Industrial Effluents

- development of the present activities
- study and development of new analytical methods to which there are not adequate equipment and techniques.
- cooperation in the normalization of analytical methods concerned with the characterization of water supplies and residuals.

Organization of the Sectors:

- liquid effluents
- gassy effluents
- residual recovery

Corrosion and Protection of Materials

- Development of the present activities, start and development of the following ones:

- electrochemical essays in: material selection , located corrosion, study of coating and inhibitors
- inhibitors: study, selection and recovery of inhibitors
- corrosion: maritime, biological and by inflamation gas
- control and inspection - Non-destructive essays (X-Ray, supersonic waves,chemical analysis, etc.) corrosion "in loco" (test tubes and methods of electrical resistance)

Protection of Materials

Development of the present activities, namely:

Metallic coating

- study of problems within industrial plants of galvanoplasty and plating
- preparation of surface

Non-metallic coating

- opinions on protection projects
- homologation of products
- studies on plastic coatings, hot pastes.
- protection of navy construction

B. PROJECTS

The Department intends to undertake the following projects, subdivided into subprojects:

Technical and Technological Assistance

- Quality Control and Normalization

  Objective: to support the industrial activity and to promote the quality of the products

- Advisory and Expertise

  Objective: to solve specific problems and trouble spots of industry and state institutions

- Analytical Support
- Information treatment and diffusion
- Promotion of courses and training periods for Industry and Teaching Institutions.
- Technical-scientific Meetings

- Participation in Working Groups

  Objective: to give support to industrial projects, promoted by other organizations.

Research and Development

Main objectives: Acquisition of knowledge to a better development of the activities included in the above-mentioned project.

- Analytical Methods
- Industrial Effluents
- Corrosion and Protection of Materials

Training

- Training of Internal Staff
  (As a reply to the needs of the Department)

  Objective: to provide the development of the former projects.

- External Training

  Objective: to answer the requests of Industry and other private and public organizations, universities and other institutions.

Organization and Infrastructures

- Organization
- Infrastructures

The good running of the Departament will depend on the conditions which will be developed in the next five years. That is, the possible physical concentration in one single campus of all labs presently located in five geographical different places.

This will make possible a whole exploitation of the infraestructures, equipment and human resources that the Department already has.

C. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	45	5
OTHERS	83	26
TOTAL	128	31

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DEPARTMENT OF TECHNOLOGY OF CHEMICAL INDUSTRIES

A.

- Service of Chemical Transforming Industries
  - General Technological Assistance Division
  - Cork and Wood Division
  - Ceramics and Glass Division
- Service of Natural Products Industries
  - Chemical Products Division
  - General Technological Assistance Division

A.1 Objectives:

The Department of Technology of Chemical Industries is integrated in the Institute of Industrial Technology.

The functions of this Department are: research, development and experimental work related to the technology transfer and assistance and, technological support to the natural products and chemical transforming industries.

A.2 Description of Activities:

Service of Chemical Transforming Industries

General Technological Assistance Division

- Studies of identification and composition of rubber components keeping in mind a decrease in the imports of finished products.
- Collaboration in the study of the policy to be applied to the tyre Industry (retreaded and new) trying to improve the products'quality, through the description of the correct manufacture processes. To support the textile industries either showing measures for

the improvement of quality level or studying and identifying polimers and additives.

Cork and Wood Division

- Technical Assistance, formative and informative to the wood industrials.
- Physical and mechanical characterization of local manufactured pannels.
- Technological studies on the processing of corks, drying and equilibrium states.

Ceramics and Glass Division

- Technical assistance and technological support to the manufacturers and consumers of China Tableware, refractories and glass.
- Applied research to the study of specific problems existing in these areas.
- Intense collaboration in the international refractories normalization and support to the Technical Comissions of National normalization of Glass and "China"Tableware.

Foreseen(5 years)

General Technological Assistance Division

- Study of new Technologies and conversion of others.
- Development of its present activities.
- Development of the staff training activities.
  Applied research to the study of the specific problems in the field of: raw materials, paints and decorating glasses, new refractories, new glass formulations.

Service of Natural Products Industries

Chemical Products Division

- Study of industrialization of spontaneous domestic flora for the obtention of essential oils and other aromatic products.
- Study of corollary industries such as detergens, soaps and cosmetics.
- Assistance to the industrials in that field.

Cork and Wood Division

- Studies of quality specifications of raw and finished materials.

Chemical Products Division

- Beginning of the isolation of active principles with use in the pharmaceutical industry.
  It will be attempted to increase the working field concerning cultivated aromatic plants.

General Technological Assistance Division

- Studies on pigments, dye stuffs and other paint additives. The possibility of its synthesis will be considered. The main idea in these studies is to increase "added value" to the goods.

B. PROJECTS:

The Department intends to undertake the following projects in 1980 :

Direction and Support

Objective:

Maintenance of the human, material and equipment resources, needed

to the everyday work of the Department.

Studies on the Extraction of Aromatics Products by Several Wavs

Objective:

To apply new technics of steam distillation and solvent extraction.

At the moment, Portugal is the second world exporter of yallow tree essential oil. Our country has also good perspectives of acquiring an important position in the extraction of other essential oils. The aim of these studies is to advise IPE to develop a project of aromatic plants industrialization.

Study of Rock-Salt Purification and Cristalization Technology

Objective:

To study the use of the rock-salt in the pharmaceutical industry and in the preparation of compounds for chemical analysis, apart from its use in food industry and nourishment.

As a result it is expected the setting of a pilot-plant for the extraction and cristalization of rock-salt and for research on contaminators (mercury and cadmium).

Study of the Technology and of Raw-Materials for the Production of Alcohols

Objective:

To obtain methanol using the yallow tree waste as raw materials.

Works on the profitability of a methanol production plant using vegetable waste

The use of methanol as a starting material in plastic and sinthetic fibres industries is also being considered.

It has been made a first contact with the Department of Conventional Energies, to study the possibility of partial substitution of the fuel oil by methanol.

Studies on the Technology of Cork Produtcs

Objective:

Technological support to this industry through the determination of drying conditions, dimensional stability humidity curves, expansion and retraction coefficients of the corks.

Physical and Mechanical Characterization of Local Manufactured Pannels

Objective:

- To set up criteria for quality standars, to support the exportation of local manufactured pannels.

- To collect bibliographic data on wood preservation and treatment, glues, resins, paints and varnishes and to plan a laboratory for essay and quality control.

Essays and Characterization Techniques of Raw-Materials in the Manufacture of Glass, Ceramics and Refractories

Study of Macau Tableware

Objective:

Technological support to this Industry specially to the Industrials of tableware in Macau.

This project arose from the difficulties in exportation of Macau tableware due to its lead high level content.

The painting and glassing procedures of this tableware will be studied in loco.

Personnel Training

Objective:

Personnel training not only for internal tasks but also for Industry.

It is also foreseen the preparation of technical personnel not only through internal training courses but also by giving grants for studies abroad.

C. Human Resources

	EXISTINC	TO ADMIT
PROFESSIONALS	13	2
OTHERS	23	3
TOTAL	36	5

MINISTERIO DA INDUSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Gabinete de Planeamento

DEPARTMENT OF TECHNOLOGY OF FOOD INDUSTRIES

A.

Industrial Development Service
- Dairy Industry Division
- Meat Industry Division
- General Technological Industry Division

Laboratorial Assistance to Industry Service
- Food Microbiology
- Food Chemistry
- Bood Biochemistry

A.1 Objectives

The Department of Technology of Food Industries, DTIA, is a department of the Institute of Industrial Technology belonging to LNETI.

The objectives of this Department are the research and development the experimental analysis related to the technology transfers, the technological assistance and support to the sectors of the Food Industries as well as the accomplishment of technological micro - biological and biochemical studies of the respective food products.

A.2 Description of functions:

Industrial Department Service:

Dairy Industry

1 - Tecnhical and technological assistance to the Dairy Industry aiming at the quality control, new technologies and the study of new products.

2 - Applied research in cheese technology and coagulative enzymes.

3 - Experimental development

4 - Technical and technological training for the Dairy Industry workers, at all levels, either by training periods or by courses.

Meat Industry

1 - Technological assistance to the Meat Transforming Industry, for the solution of production problems and study of new products.

2 - Applied research in order to find new technologies and modify the existing ones.

3 - Experimental development ..

4 - Technological training mainly directed to the Meat Industry workers, at all function levels, either by the promotion of courses or training periods.

General Technology

1 - Technical and technological assitance in the field of vegetables and cooked meals industries, fermentation industries animals feeding and new products.

2 - Applied research aiming at the complete profit of raw materials looking for new technologies in the field of vegetables, cooked meals and fermentation industries.

3 - Experimental development

4 - Technological training of the workers of the above mentioned industries, at all function levels, either by courses or training periods.

Food Microbiology

1 - Technical assistance to the Food Industries including the Animal Feeding Industries.
2 - Laboratorial assistance aiming above all the protection and promotion of industrial quality.
3 - Training of technical staff at enterprise level either by training periods or courses and other quick means of knowledge transmition.
4 - Applied research in the field of analytical methodology and consequent collaboration with the Department responsible for the standardization.

Food Chemistry

The same of the Food Microbiology

Food Biochemistry

1 - Applied research aiming to contribute for the identification of biochemical parameters that will allow the interpretation of the phenomena coming from the technological processes.
2 - Training of the staff of this division.

Foreseen Activities

They intend to continue the works mentioned before.

HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	27	15
OTHERS	33	20
TOTAL	60	35

C.Projects

The Department intends to undertake the following projects in 1980:

Support and Direction Project

Objectives

To maintain the Department's services.

Study of the Traditional Portuguese Sausage

Objectives

To make a list of all kinds of sausages, to gather the domestic "receipts" and to study their industrial production at the pilot-workshop of the Department to make the projects

of quality standardization.

Characterization of Animal, Vegetable origin by-products and of National origin to granulate Food Compounds and Production of new Proteins.

Objectives

To characterize the use of animal, vegetable origin by--products and mineral ones in order with their economic valuation; to reduce the needs of food products for animals

To reduce the imports of products necessary to the accomplishment of some technologies.

Studies in order to Industrialize the Production of Cheese

Objectives

To make a list of all kinds of cheese, to gather the domestic "receipts" and to study their industrial production at the pilot-workshops of the Department . To make the projects of quality standardization.

Technological Studies of Meat Transforming, Fish-tins and Technology of Vegetables Products Transforming

Objectives

To improve the techniques of production in these areas.

Thistle's industrialization

Objectives

To continue the studies of possible thistle's industrialization (this plant is used in cheese's production).

Establishment of structures to the Technical and Laboratorial Support of the Food Industry

Development of the Micotoxines Study in Animal Production

Objectives

To make an approach of the micotoxines' problems in order to contribute to their control preventing the serious economic damages caused by contaminated food.

To study the micotoxines that are specially relevant in animal production.

Quick Methods for the Detection and Identification of Bacteria in Food Products.

DEPARTMENT OF METALLURGY AND METALOMECHANICS

A.

- Service of Extractive Metallurgy
  - Physical Concentration Division
  - Hydrometallurgy Division
  - Pyro and Electrometallurgy Division
- Service of Technology of Foundry and Melting
  - Sand and Moulding Division
  - Iron Metals Division
  - Non Iron Metals Division
- Service of Technology of Materials
  - Pulverometallurgy Division
  - Thermal Treatments Division
  - Mechanical Treatments Division

A.1 OBJECTIVES:

The Department of Metallurgy and Metalomechanics has to promote and accomplish research and development within Metallurgical and Science Technology in order to achieve the folowing objectives:

a) To profit and to increase the value of the mining and mineral resources of the country;

b) To absorb, adapt and develop technologies which led to the creation of new metallurgical industries and similars, mainly those connected with the national resources;

c) Technical and scientific support to the import of technology concerning material production;

d) Technical and technological assistance to the national metallurgical industry and similars and consequently to promote, establish and control the quality;

e) Technical and scientific support to public and private organisms in the field of extraction, production and utilization of metallic materials and others;

f) To colloborate and promote activities aiming the training, reconvertion and improvement of the technical staff of the country.

A.2 IDENTIFICATION AND DESCRIPTION OF ACTIVITIES

Service of Extractive Metallurgy

- Physical Concentration Division (foreseen)
  - Assembly of a physical ore concentration laboratory.
  - Physical concentration studies on national ores (Iron from Moncorvo, Tungsten, pyrits and others).

- Hydrometallurgy Division (present)
  - Studies on uranium ore, lixiviation, ionic permutation, extraction with solvents and precipitation in order to support Urgeiriça Factory and the starting of the project for profiting the Nisa's Uranium ore as well.
  - Studies on the uranium recovery from the phosphoric acid. Building up and operation of a pilot plant at Quimigal Factory in order to get technical economical data.

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- Studies on the continuous ionic permutation. Project for building up a pilot installation in order to trace continoushy badly clarified liquids.
- Studies on the integrated profit of Portuguese pyrites. Technical-economic studies on the hidrometallurgical means for pyrites treatment.

- Hydrometallurgy Division (foreseen)
  - Studies on the static and classical lixiviation.
  - Studies on the sedimentation and clarification of pulps.
  - Studies on the ionic permutation.
  - Studies on extraction with solvents.
  - Studies on treatments of solutions - Cementation, precipitation, effluents treatment.

- Pyro and Electrometallurgy (present)
  - Desintegration of hard metal scrap with zinc, followed by destillation.
  - Chlorination of hard metal scrap.
  - Production of cobalt powder within a laboratorial scale, by precipitation of the cobalt oxalate, followed by its decomposition in hydrogen.
  - Technical and economic studies on the pyrometallurgical means in order to exploit Portuguese pyrites.
  - Study of the mechanism of fluidification.
  - Study on cohesives powders.

- Pyro and Electrometallurgy (foreseen)
  - Cobalt powder production in pilot plant.
  - Wc-Co mixed powders production.
  - Electrolytic production of metal powders.
  - Electrolytic attack on slag.

- Thermal and Mechanical Treatments
  - Preparation of sands and mouldings. Melting pots manufacture. Preparation of small loads for melting.

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- Melting and casting - small loads.
- Samples preparation for metalografic observation. Qualitative and quantitative tests.
- Test tubes preparation for mechanical tests.
- Tensile mechanical tests up to 5 TON. at normal and high temperatures.
- Mechanical fatigue experiments up to 10 TON.
- Hardness and collision tests.
- Thermal and mechanical treatments at laboratorial scale.
- Other physical tests (dilatometry, thermogravimetry).
- Determination of structures and identification of phases by X-ray diffraction.

- Pulverometallurgy Division (present)
  - Determination of powder characteristics.
  - Milling, mixture, granulometric separation of powders.
  - Pressing.
  - Vacuum sinterization in reductive atmosphere.
  - Technical-economic studies on sinterized metallic pieces production.
  - Mechanical properties.
  - Other physical properties such as magnetic, electric, etc..

- Pulverometallurgy Division (foreseen)
  - Scanning microscopy and micro-analysis.
  - Chemical vapour deposition.
  - Pilot tests of powder production and metal sinterized pieces.
  - Simulated tests of sinterized pieces.

B. METALLURGY AND METALOMECHANICS PROGRAM

Description:

Research and Development within Extractive Metallurgy, Foundry and Melting Technology, Technology of Materials and Metalomechanics

in order to introduce them in the manufacturing system.

Extraction of Uranium by Continuous Ionic Permutation

Objectives:

To eliminate the previous clarification of the traditional processes of treatment of uranium liquids, caused by lixiviation of ores.

Mechanisms of Fluidification

Objectives:

Perfect knowledge of the fluidification technics specially in the obtention of theorical means to obtain the mixture coeficient of homogeneously fluidificated solids.

Exploitation of Pyrites from Alentejo

Objectives:

Perfect knowledge of the technics which allow to choose the most adequate alternative to the project of profit the pyrites from Alentejo.

Assembly of an Ore Thermal Treatment Laboratory

Objectives:

To have a Lab. able to answer the industry requests in the field of ore thermal treatment (accomplishment of thermal treatment of small series or/and parts as well as studies for improvement and optimization of processes).

Thermal Treatment of Aluminium Alloys of ALMELEC Type

Objectives:

Study of the influence of thermal treatments on the mechanical and electrical properties of ALMELEC aluminium alloy.

Appraisal of the influence of the parameters of the different manufacturing phases on the mechanical and electrical characteristics of the finished product - conductor wire with about 3mm diameter.

Cooperation with Empresa Ferrominas in Moncorvo

Objectives:

This cooperation is mainly based on the aspects of physical concentration of the iron ore aiming the decrease of its percentage in phosphorus.

Production Line of Sinterized Metal Pieces

Objectives:

Study and planning of industrial plants to be established in Portugal.

Assembly of a Mechanical Treatment Laboratory

Objectives:

To study and develop industrial processes for metal manufacture including, laminating, forging, stamping.

Testing the Conditions of Thermal Treatment (Process and Equipment)

Objectives:

To test the conditions of thermal treatment in the production (manufacture) of magnetic plate.

Sinterization of Mixtures of Carbonets with Niquel and Iron

Objetives:

To verify the possibility of using a cheaper connection element in hard metal (niquel, iron and its alloys) instead of cobalt.

Development and Technological Support to Casting

Objectives:

To give support to Metalomechanical Casting Industry concerning the manufacture processes, manufacture of new products and quality control.

This process consists of five phases already in execution: information; elaboration of a technological casting file ; technological support on the field of casting and experimental development.

C. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFISSIONALS	31	—
OTHERS	33	—
TOTAL	64	—

MINISTERIO DA INDUSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Working Paper

Gabriel de Mascarenhas

DEPARTMENT OF ELECTRONICS AND ELECTRICAL EQUIPMENT

A.

- Service of Development and Project
  - Scientific Uses Division
  - Industrial Uses Division
  - Design Office
- Service of Maintenance and Quality Control
  - Maintenance Division
  - Quality, Control and Test Division
- Service of Supply and Production
  - Supply Division
  - Production Division
- Service of Electricity and Electric Equipment

A.1 Functions of the D.E.E.E. (Foreseen Activities - 5 years)

INDUSTRIAL USES

- To accomplish applied research and experimental development in the fields of Electronics and Engineering of Systems aiming its future industrial use.
- To accomplish experimental development in the field of electronic instruments and systems in collaboration with industrial sector or by its own initiative aiming its promotion in selected fields.
- To project and to diffuse of scientific and technical knowledge and to collaborate in the activities of professional training in the fields of its competence.

- To render services of advisory and technical assistance.

- To make experimental analysis related to processes of technological transference.

SCIENTIFIC USES

- To make applied research and experimental development in the field of Electronics and of Engineering of Systems keeping in view the acquisition of knowledge and the mounting of electronic instruments to be used in scientific research.

- To promote studies and projects of electronic instruments integrated in multi-disciplinary programs involving other Departments.

- To project and to mount prototypes of electronic instruments requested by LNETI Services or other similar Laboratories.

- To promote the diffusion of scientific and tecnological knowledge and to collaborate in professional training activities in the field of its competence.

- To render advisory services and technical assistance.

DESIGN OFFICE

- Automatic design of matrixes of printed circuit.

- Design of component implantation, design of electrical and functional panels and of boards incorporating the "design aspects".

- Design of mechanical parts.

- Design of panels and graphics.

- Elaboration of project and production files.

- Publishing technical and scientific articles.

MAINTENANCE

- To accomplish preventive maintenance actions in the ambit of technical assistance of the LNETI services and other external Institutions (services).

- To accomplish projects aiming the alteration and compatibilization of equipment and systems, keeping in view the adaptation or optimization of its technical characteristics.

- To collaborate in the execution of projects and to build prototypes of electronic instruments.

- To acquire and diffuse scientific and technical knowledge and to collaborate in professional training in the field of its competence.

- To render services of advisory and technical assistance.

QUALITY CONTROL AND TEST

- To test the characteristics of the prototypes developed in the Department.

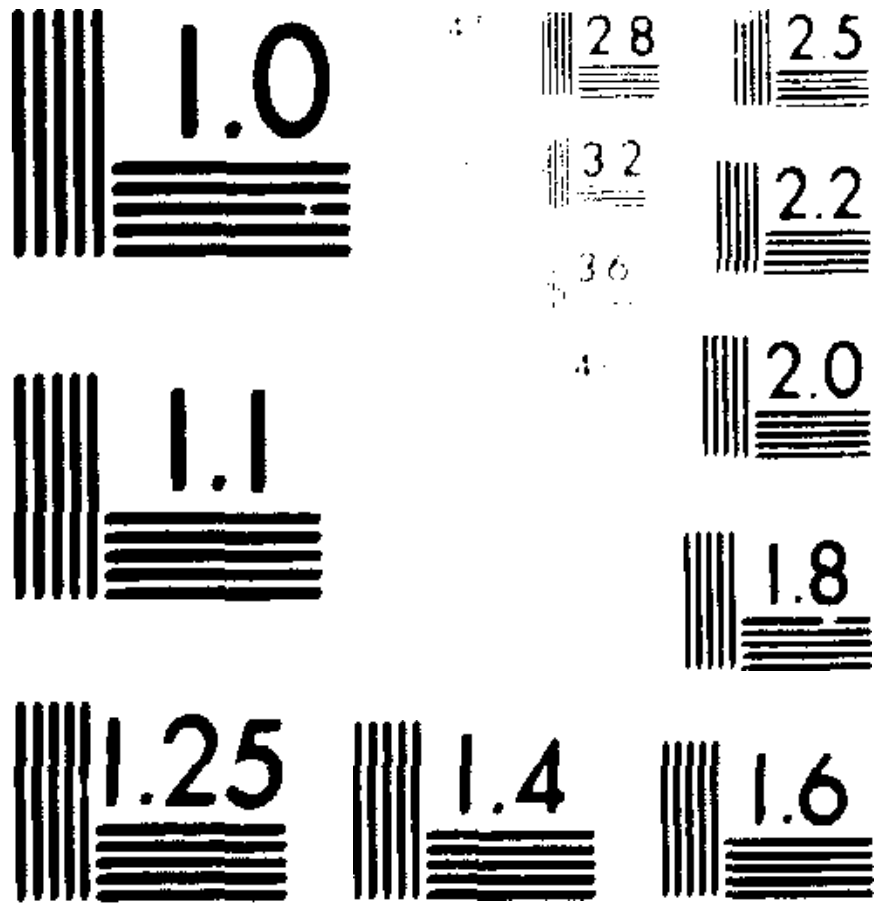
- To test the characteristics of prototypes manufactured by the National Electronic Industry.

- To control the production of samples.

- To verify the imported equipment.

- To give advice regarding the products qualification and manufacturing processes required by the General Directorate of Quality.

- To organize and to run the electronic equipment warehouse of the Department.



SUPPLY

- To assure the stock of selected components necessary to the project development, to the programmed production and to the organized maintenance of electronic equipment.
- To select technical electronic components and raw-materials.

PRODUCTION

- To produce devices and electronical appliances developed and required by the Department.
- To test the manufactured appliances.
- To keep up-to-date the file of the production's records.

B. PROGRAM OF ACTIVITIES FOR 1980

PROJECTS:

Direction and Support

Objectives

To support the activities of the sectors of Development, Project, Technical Assistance and Management in the areas of its competence, namely :

- Documentation and Technical Information Office
- Electronics Design Office
- Administrative Office

R&D in Electronics
- Digital Systems - DS
- Project Assisted by Computer - PAC
- Data Analysis and Processing - DAP

Objectives

DS - To introduce new technologies in the electronic projects associated to the development of digital systems.

- To promote the microprocesser using.

PAC- To supply the Department with the informatic means.

DAP- To control the technics of analysis and processing of information, its use in projects of instrumentation and in treatment and analysis of experimental data.

Scientific Instrumentation
- Radiological Protection - RP
- Modular Nuclear Equipment - MNE
- Biology and Medical Science - BMS

Objectives

RP - To conceive, project and construct a System of Radiological Monitorization.

- To develop portable units to staff and environment monitorization.

MNE - To provide a modular line of nuclear instrumentation.
To study, conceive and accomplish systems of analysis and treatment of data associated to the spectroscopy of radiations.

BMS - To study, develop experimentally and build Electrophysic prototypes with industrial production feasibility.

- To accomplish small series of devices or of systems that answer to hospitalar needs.

Industrial Equipment { Telemeasure and Remote Control - TRC
Industrial Signalling, Measure and Control - ISMC
Industrial Uses of Radiations - IUR

Objectives

TRC - To accomplish a System of Acquirement, Treatment and Presentation of Data and achievement of Actions of Control applied to the automatization of the exploitation of production processes.

ISMC- To project and product industrial equipment of signalling, measure and control in the evaluation, presentation, register and treatment of physical largenesses associated to industrial systems.

- To study and accomplish systems to automatize machines, tools and to control industrial processes.

IUR - To conceive, project and construct equipment for industrial use in which are used radiations. To measure indirectly physical largenesses.

General Electronic Assistance:

a) Maintenance
b) General Electronics
c) Quality Control

Objectives

Maintenance - To keep operational all LNETI's instruments and maintain the equipment of Industry and of Scientific Institutions.

General Electronics - To answer the requests of LNETI's services, other Research Institutions and Industry.

- To accomplish some works in the area of Power Electronics.

- To accomplish didactic electronic instrumentation.

Quality Control - To control the quality of Electronic Equipment

Supply and Production

Objectives

Supply - To keep an up-to-date knowledge on the technological evolution in the area of electronic components; to make tests of specification and of feasibility.

- To study the market conditions of purchases; material, administrative and economic management of stocks.

Production - To produce electronic devices.

- To achieve services internally requested.
- To follow the technological evolution in the area of electronic equipment production.

C. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	21	2
OTHERS	18	5
TOTAL	39	7

INSTITUTE OF ENERGY

DEPARTMENT OF CONVENTIONAL ENERGIES

A.

- Service of Conservation of Energy
  - Division of Support to Industry
  - Division of Experimental Development
  - Division of Instrumentation and Control
- Service of Alternative Fuel
  - Division of Development of Products
  - Division of Development of Processes
  - Division of Analytical Support

A.1 PURPOSES:

- To study, to research and to promote technological development in order to get a rational utilization of oils and its substitution by alternative combustibles.

- To perform the energetical analysis of industrial processes as well as the energetical utilization of residues (waste).

- To assure support to industry aiming technological innovation, conservation and reduction of internal consumption.

- To prosecute the studies and processes of development of equipment and materials concerning the combustion, transport , storage and utilization of thermic energy (including problems related to geothermal energy).

A.2 OBJECTIVES:

- Reduction of combustible consumption, without damaging the users.

A.3 ACTIVITIES:

- Studies concerning the quality control of petrol and fuel.
- Analysis to determine the physical and chemical characteristics of combustibles under D.G.C. guidance.
- Essays of engines in bench in order to determinate of its characteristics curves aiming its homologation.
- Contacts with the glass industry for manufacturing purposes in order to study the burning conditions in oven.
- Organization of a seminar on combustion for glass industry technicians.
- Tests of a steam generator with the production of 250km/hour.
- Development of a calculus system for the resolution of "Heat equation" used in energetical balance.

A.4 FORESEEN ACTIVITIES:

- Studies of Alternative Combustibles.
- Recovery of energy by capturing oil wastes in tanker's cisterns.

B. PROJECTS :

The Department intends to undertake the following projects:

- Direction and Support
- Recovery of Energy from Industrial plants
- Studies of additives for liquid combustible
- Studies on Alternative Fuel.

C - HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	6	16
OTHERS	12	4
TOTAL	18	20

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MINISTÉRIO DA INDÚSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

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DEPARTMENT OF RENEWABLE ENERGIES

A.

- Service of Solar Energy
  - Division of Thermal Uses
  - Division of Thermodinamic Uses
  - Division of Testing
- Service of New Sources of Energy
  - Division of Wind Energy
  - Division of Tidal Energy
  - Division of Other Energies (Geothermal, Tidal, etc.)

A.1 OBJECTIVES:

This Department has the purpose of working in the fields of research,development and experimental uses of the new sources of Energy in the "non-nuclear area" such as : - solar energy; -wind energy ; - tidal energy ; - geothermal energy trying to reduce the energetical dependence and to develop the Portuguese technology in the areas already mentioned.

A.2 ACTIVITIES:

The present activities included in this program are the following ones :

- Uses of solar energy at low temperatures for thermal utilization;
- Evaluation of market conditions for this kind of utilization, as well as, studies regarding its industrialization;

- Improvement of a method for quantification of solar energy resources and its geographical distribution in our country;
- Elaboration of computer programs in order to plan plants and flat plate solar energy collectors;
- Project and construction of a testing bank for flat plate solar collectors;
- Tests of flat plate solar collectors for industry;
- Assistance to official and private institutions concerning the project of plants using solar energy;
- Prosecution of the technological development of flat plate solar collectors in order to select the most promising types;
- Construction of space heating systems for drying fruits in Alpiarça and in Agronomical Highschool of Lisbon;

A.3 FORESEEN ACTIVITIES:

- Conclusion of the construction of a testing bank for flat plate solar collectors using artificial illumination.
- Construction of a prototype for steam production in cooperation with CNRS of France.
- Tests with a refrigerator using Ammonium and Sodium thiocyanate

A.4 LONG TERM ACTIVITIES:

- Studies, project and construction of a central tower for electricity generation.
- Prosecution of applied research in the fields of wind and tidal energy.

This program includes the following projects:

1. Direction and support

2. Industrial and domestic uses
3. Pilot plants for Solar Energy uses in stove
4. Solar refrigerators
5. Radiant properties of materials
6. Construction and test of a steam plant
7. Central tower for electrical uses

A.5 COOPERATION WITH PORTUGUESE INSTITUTIONS

There is a large cooperation with many official and private institutions.

A.6 EXTERNAL COOPERATION

ERDA (U.S.A.)
IFCE (French Institute of Fuels and Energy)
CNRS (France)

They have established contacts with the following countries through their Embassies.

- Australia
- Federal Republic of Germany
- Canada
- Brazil

B. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFISSIONALS	8	7
OTHERS	11	2
TOTAL	19	9

MINISTÉRIO DA INDUSTRIA E TECNOLOGIA Working Paper

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Gabinete de Planeamento

DEPARTMENT OF NUCLEAR ENERGY AND ENGINEERING

A.

- Service of Exploitation of the Portuguese Research Reactor (P.R.R.) :
  - Operation Division
  - Irradiation and Testing Division
- Experimental Service of Physics of Reactors :
  - Nuclear Studies Division
  - Thermal and Mechanical Studies Division
- Service of Computation of Reactors :
  - Methods of Computation Division
  - Analysis of Reactors Division

A.1 OBJECTIVES :

- This Department has to promote research and development in the engineering area and to make studies to obtain nuclear energy from different sources. It also has to promote the permanent training of its staff

A.2 HUMAN RESOURCES :

	EXISTING	TO ADMIT
PROFISSIONALS	5	6
OTHERS	13	4
TOTAL	18	10

B. Present situation :

The main guidelines of the department are :

1 - Exploitation of the P.R.R. as radiation source

2 - Applied research in the area of the Physics of Nuclear Reactors,using the P.R.R. as object of study.

The first guideline is, at the present,the best equipped in human resources and has the following main activities :

a) - Operation of the P.R.R. aiming the research, radioisotopes production, radioactives sources and use of nuclear technics.

b) - Equipment of the P.R.R. aiming its regular and safe exploitation.

c) - Radiometry of the P.R.R. study of the field of radiations in the reactor's core and its neighbourhood.

d) - Support the users in the planning and accomplishment of their experiments.

The second aim is to develop a project on " Noise analyses in the P.R.R. ", trying to develop a technic of analysis and fluctuation of different kinds,which may allow the vigilance of the working of nuclear centrals and other industrial systems as well.

Short and long run

- To invest in radioisotopes production, in uses of the technics of analysis by activation with neutrons and in the use of neutron beams.
- To promote the use of P.R.R. through an agressive external policy in order to establish research contracts, with other national and international institutions.
- To admit and to train technical staff.

- To prosecute the development of the technics of noise analysis in reactors, and vibrations analyses in industrial systems.
- To promote the training of specialists in Physics, in Engineering of Nuclear Reactors and of reactor operators.
- To promote and support training, aiming the use of the P.R.R.

C. PROGRAM OF NUCLEAR ENERGY AND ENGINEERING :

- To accomplish R&D in the areas of Physics and Engineering of Nuclear Reactors, aiming the safety and exploitation of Nuclear Centrals.
- To admit and to train staff.
- To support and to promote trainings, aiming the use of the P.R.R.
- To prosecute the development of the technics and Noise Analysis in Reactors.
- To study the field of radiation of the P.R.R. core and its neighbourhood.

Projects of the program :

- Direction and support
- Working of the P.R.R.
- Noise Analysis in the P.R.R.
- Radiometry in the P.R.R.

Direction and support :

Objectives: To support the Department with the human, material and financial means necessary to the accomplishment of its objectives.

Working of the P.R.R. :

Objectives: To keep operational the P.R.R., aiming the

research and the production of radioisotopes.

Noise Analyses in the P.R.R. :

Objectives: To develop vigilance methods of work of Nuclear Centrals and of complex industrial plants, through the analyses of flutuation.

Radiometry in the P.R.R. :

Objectives: To study the radiation field in the P.R.R. core and in its neighbourhood.

DEPARTMENT OF NUCLEAR SCIENCES AND TECHNICS

A.

- Service of Nuclear Atomics Physics
- Service of Neutrons Physics and Nuclear Instrumentation
- Service of Plasma Optics and Physics
- Service of Production and using of Radioisotopes:
  - Production Division
  - Nuclear Medicine DIvision
- Service of Radiology :
  - Radiobiology Division
  - Radioagronomy Division
- Service of Chemistry of Nuclear Combustible and Transmanians Elements
- Service of Chemistry and Physics of the Solid State.

A.1 OBJECTIVES:

-To promote and develop research and using of the Nuclear Sciences and Technics for pacific goals.

-To promote staff training.

A.2 IDENTIFICATION AND DESCRIPTION OF ACTIVITIES

- To accomplish Research in Inorganic Chemistry Nuclear and Atomic Physics,Plasma Optics and Physics, Neutrons Physics and Nuclear Instrumentation,Biochemistry and Nuclear Medicine to publish technical magazines, to hold meetings and congresses on these matters.

- To develop nuclear methods and instruments and optical technics for industrial using.

- To supply specialized services, namely in Meteorology and analyses, using physical methods.
- To promote the production and using of radionuclides and radiations
- To assist the industry with consultations, technology transfer processes and acquisition of very specialized services.
- To provide staff training, mainly professional, promoting the cooperation with the universities and Research Centers.

NUCLEAR SCIENCES AND TECHNICS PROGRAM

- To develop Nuclear Energy for pacific uses, through the establishment and improvement of the necessary technical infrastructures, as well as nuclear protection and safety.
- To promote the development, of technical and specialized instrumentation used in the nuclear sector.
- To favour the incorporation of menwork and national raw-materials in equipments and plants connected with the pacific uses of the Nuclear Energy.
- To promote de staff training in collaboration with the universities.

B. PROJECTS OF THE PROGRAM

- Direction and support
- Analyses by Neutrons Activation and spectrometry of X-Ray fluorescence
- Dinamization of the Nuclear Medicine in the LNETI and development of methodologies.
- Using of radiochemistry methods in geochemistry

- R&D activities in Chemistry field.
- Electric and magnetic properties of metallic and organometallic materials
- Radiation effects in biological tissues.

R & D ON VAN DER GRAAFF ACCELERATOR

OBJECTIVES:

- Fundamental free research in nuclear atomic physics, as well as in research to the measurement of nuclear and atomic constants and material parameters
- Experimental development and using of analytical technics

ANALYSIS BY ACTIVATION WITH NEUTRONS AND SPECTROMETRY OF FLUORESCENCE OF THE X-RAY

OBJECTIVES:

- To classify roman cerâmics by activation with thermal neutrons
- To study the spectrometry of fluorescence of X-Ray methods in bronze analysis
- To analyse the basalts by activation with thermal neutrons.

DINAMIZATION OF NUCLEAR MEDICINE IN LNETI AN DEVELOPMENT OF METHODOLOGIES AS WELL

OBJECTIVES:

- To develop and dinamize the methodology of the Nuclear Medical Science in LNETI.

USING OF RADIOCHEMISTRY METHODS IN GEOCHEMISTRY

OBJECTIVES:

- Development in the area of Geochemistry and Archeology

R & D IN CHEMISTRY OF ACTIVITIES AREA

OBJECTIVES:

- To set up the necessary intrastructures for chemical works and determination of cristaline structures of compounds of actinides.

ELECTRIC AND MAGNETIC PROPERTIES OF METTALIC AND ORGANOMETTALIC MATERIALS

OBJECTIVES:

- To get organic and organomettalic materials with high electrical condutivities or even with metallic behaviour

RADIATION EFFECTS IN BIOLOGICAL TISSUES

OBJECTIVES:

- To study the effects of the radiations in biological tissues.

C. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	46	5
OTHERS	39	5
TOTAL	85	10

MINISTÉRIO DA INDUSTRIA E TECNOLOGIA

LABORATÓRIO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL — LNETI

Gabinete de Planeamento

Working Paper

DEPARTMENT OF RADIOLOGICAL PROTECTION AND SECURITY

A.

- Service of Radiological Protection
  - Division of Radioactive Plants
  - Division of Nuclear Plants
- Service of Environmental Radioactivity
  - Division of Environmental Control
  - Division of Radioecology
  - Division of Standardization and Methods
- Service of Operational Radiological Protection
  - Division of Physic and Radiobiology
  - Division of Radiation Dosimetry
  - Operacional Division

A.1 OBJECTIVES:

The functions of this Department are research and development on radiological protection and safety of nuclear plants and people in order to prosecute the following general objectives:

1) To keep environmental radioactivity at security levels on the whole country especially in the areas near the nuclear power plants, uranium mines, etc.
2) To provide technical assistance to public and private organisms connected with radioactivity sources.
3) To develop methods in order to control radioactive pollution.
4) To treat and to store radioactive wastes.

A.2 ACTIVITIES:

- Regulation, licensing and inspection of nuclear power plants.
- Control of radioactive pollution of rain, drinkable water (especially thermal water) and food.
- Control of the radioactive pollution in rivers and sea water.
- Analysis of radiation exposures in uranium mines and surrounding areas.
- Research on biological and medical principles of radiological protection.
- Improvement of methods of ionizing radiation dosimetry.
- Promotion of the radiological protection for workers and nuclear plants in Sacavém.
- Treatment and storage of radioactive wastes.
- Analysis of the risk of radiation damage in normal operation and under incident conditions Intervention in accidents.
- Tests of radiological quality.

A.3 EXTERNAL COOPERATION

- International Atomic Energy Agency
- European Nuclear Energy Agency (OCDE)
- Nuclear Energy Organizations from Spain and France

A.4 LOCAL COOPERATION

- Commission of Protection against ionizing radiation.
- Service of Nuclear Protection and Security.
- Nuclear power plants group for coodination of licensing activities.
- National Environment Commission
- National Uranium Enterprise.
- E.D.P. (Electricity of Portugal)
- Portuguese Mineral Water (Luso)

B. HUMAN RESOURCES

	EXISTING	TO ADMIT
PROFESSIONALS	25	9
OTHERS	28	20
TOTAL	53	29