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UNITED NATIONS
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US/IND/92/124 - "Preparatory Assistance for the Establishment of the Lignite Fuel and Energy Research Institute"

i, 27 p. tabl. diagr.

Tamil Nadu, India
8-10 March 1993

REPORT*

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* This document has not been edited.

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C O N T E N T S

This report was prepared by Department for Programme and Project Development.

This document has not been edited.

1. INTRODUCTION

Neyveli Lignite Corporation (NLC), Tamil Nadu, intends to upgrade the services of its Centre for Applied Research and Development (CARD) and convert it into a nation-wide R&D centre to service the utilization of all lignite deposits. A preparatory assistance project US/IND/92/124 was approved to assess the relevance of the request for UNIDO support and to draft a project document.

The Programme and Project Appraisal Section (APP) was requested to apply the Objectives-oriented Project Planning (OOPP) method to the formulation of the project. This was done through the conduct of an appraisal workshop (OOPP 3) at the project site as an integral part of the preparatory assistance mission.

The UNIDO consultant, Mr. R. Manfred, was briefed on OOPP methodology by APP before he left for India on 12 February 1993. While compiling information, assessing the present capabilities of CARD and the needs for their services he identified potential participants to the workshop from among the users of CARD analytical, monitoring and R&D services and assisted NLC in consolidating a list of the parties to be invited to the workshop. When the moderator of the workshop arrived the invitations to the selected participants had been already distributed; apart from the main users from within the NLC group (mines, power plants, the fertilizer plant and the carbonization plant) the list contained also representatives of the private industries (cement, chemical), cooperation agencies and some Government bodies.

The workshop (8-10 March 1993) was attended by 23 participants (see Annex 1). Though the private industry (from rather remote locations) did not attend the workshop (due to travel costs), there were several non-NLC participants present at the workshop who contributed significantly to the formulation of the project. The users of CARD services from within the NLC group were also very active in identifying problems to be addressed by R&D and in discussing priorities.

In view of the advanced stage of the preparation of the project proposal by the consultant, his well established contacts with CARD and the users of its services and the reflection of this feedback in his proposal it was possible to compress the planning stage of the workshop so that its total duration could be shortened to 3 days. Shortening of the workshop made it also possible to comply with the Ministry of Coal's request to present them the outcome of the workshop in New Delhi before the termination of the mission by the consultant. After the workshop the project was also presented to the management of NLC.

The following text describes the main components of the workshop.

2. PRESENTATION OF THE METHODOLOGY

After a short inauguration of the workshop by the top management of NLC (Director Mr. Sen Gupta) the participants were briefed on basic principles of project design, the OOPP methodology and the associated terminology. The principle of project ownership and the responsibility of the participants for the formulation of the project were emphasized.

3. VERIFICATION OF THE PROBLEM AREA

The project will support the utilization of the lignite resources in India. The participants were handed two pages from the consultant's draft project document justifying the utilization of the lignite resources for energy generation by comparing it with other options of energy supply. In order to verify that lignite utilization for energy generation (as the main form of lignite utilization at present) is desirable the participants were asked to

- comment on the description of the subsector contained in the relevant section of the draft project document;
- complement and support the justification by additional quantitative analysis/indicators, if available.

Some participants from NLC promised to provide additional data on the busbar costs of electricity generation from bituminous coal in other regions of India. This information confirmed competitiveness of the lignite; it was later included in the draft project document.

The option of generating electricity from imported bituminous coal (for example from Australia) could not be quantified but it was generally considered as not competitive and not complying with the Government policy of utilization of national resources.

Having justified the development of the lignite sector four potential problem ares were proposed for the deliberations of the workshop:

1) Lignite sector in India
2) Lignite sector in Tamil Nadu
3) R&D in the lignite sector in India
4) R&D in the lignite sector in Tamil Nadu

It was agreed that the problem area for the workshop was "R&D in the lignite sector in India".

In spite of this delineation some participants sometimes tended to present problems of the lignite sector not related to R&D; reference to the agreed upon problem area helped to keep the discussion focussed on relevant issues.

4. PARTICIPATION ANALYSIS

The participation analysis revealed that CARD had been serving a very broad spectrum of users both within the NLC group and outside NLC; it had established working contacts with many agencies and organizations. As CARD is the sole centre for applied R&D in the lignite sector it was possible to assume that parties engaged in working contacts with CARD were also the main parties concerned by the problem area. They are listed and categorized in Annex 2.

The most frequent users of CARD services are the NLC plants; all of them were present with the exception of NLC/mines the representative of which was present for one day only. CARD staff described in detail what types of analytical and monitoring services were provided to individual parties not represented at the workshop (see Annex 3); the description will be reflected in the draft project document.

During the participation analysis, the level of commercialization of CARD services was also discussed. It was estimated that the income of CARD from sales of their services represented approx. 25% of their annual budget. It was clarified which parties were charged for the services of CARD (see Annex 2). It should be noted, however, that the commercial contacts within NLC are only recorded in the book-accounting system without any actual cash flow.

The parties present at the workshop were asked to formulate their expectations as regards future services of CARD, bearing in mind its possible upgrading by a technical cooperation project. Summary of these expectations as presented by the parties is in Annex 4. The expectations can be grouped in two categories:

(i) those related to solution of production problems (slagging and clinkering in the power stations, quality of briquetting, extraction of chemicals, recovery of chemicals etc.)

(ii) those related to the solution of environmental problems (fly ash, leaching of ash water, land reclamation, waste water used for irrigation/agricultural purposes, compliance with environmental standards by NLC, etc.)

The discussion of expectations represented a bridge to the problem analysis.

5. PROBLEM ANALYSIS

To start the discussion the consultant mentioned a few problems related to the quality and coverage of R&D services which he identified during his mission. The participants then identified a considerable number of R&D related problems on cards and displayed them on the board; most of them described the present deficiencies of CARD and explained why the present

services could not meet fully the needs of the industry, townships and Government agencies. The CARD management accepted the rather critical statements made by the CARD staff themselves.

In the second step the discussion focussed on the effects of the problems concerning inadequate R&D related services; very often they were closely related to the expectations of the users of services. As a final step the cause-effect relationships were consolidated and a problem tree established (see Annex 5).

6. OBJECTIVES ANALYSIS

The problems were converted into objectives in working groups. Sometimes the process was misunderstood and the working group presented activities to solve a certain problem, but in general this step was rather short in spite of the fact that additional objectives were identified and included in the objectives tree, such as "state-of art information on advanced mining technologies is available"; correspondingly the problem tree was adjusted retrospectively. Some problems were not suitable for conversion into objectives, such as "high contents of marcasite in the unprocessed lignite"; they were not included in the objectives tree (see Annex 6).

7. MAIN PROJECT ELEMENTS

The participants were acquainted with the structure and logic of the Project Planning Matrix and with the design requirements for institution (capability)-building projects, particularly as regards the description of the Outputs in the form of "service modules". The Purpose (Immediate Objective) and the Goal (Development Objective) were transferred to the PPM from the objectives tree (see Annex 7). As regards the Outputs the situation was more complicated. A certain structure of the upgraded institution was already proposed by the consultant in his draft project document. To facilitate the planning process the draft document was distributed at this point among the participants; subsequently the functions/services of each Output (sections of the institute) as proposed by the consultant were confronted with the objectives identified in the objectives tree. As a result the consultant's proposal was complemented so that the final scope of services to be provided by the institute increased considerably. As regards the other descriptive components of the service modules the discussion centered particularly on the specification of staff in each section; the users of the services of each section were specified in more detail. There were hardly any comments/changes as regards the proposed equipment and there was no discussion on the premises as they were generally considered to be adequate.

The Activities of the project (to strengthen/establish the capabilities/sections) were prepared by the consultant for most Outputs/sections; they were reviewed by the participants and complemented to reflect the additional functions/services

proposed by them. The Activities for Output 5 were elaborated in a working group and -- after some discussion in the plenary -- also included in the PPM.

As a result of the participants' deliberations at the workshop the consultant together with the backstopping officer adjusted the UNIDO inputs and recalculated the individual and total costs. It became apparent that with the total UNIDO budget close to $ 2 million the project was beyond the realistic scope as regards the potential for donor funding. It was, therefore, decided to recommend to the participants to scale down the scope of the project by focussing on the most important objectives only.

8. SCOPING OF THE PROJECT

Having accepted the necessity to scale down the project the participants first listed all services/functions for which the capabilities were supposed to be developed and, based on the majority opinion, categorized them into two groups according to urgency/priority. In the second step the data on inputs and their costs were distributed; the break down of the inputs made it possible to relate individual costs (expert services, fellowships, equipment etc.) to individual services. Four working groups were formed to prepare, present and justify adjustments in the scope of the project. By comparing the four proposals it became apparent that all of them opted for exclusion from the project of such costly and/or uncertain (in terms of satisfactory results) functions as fluidized bed combustion and microbiological carbonization. They also opted for exclusion of the CAD function though the development of this capability was not very expensive and was supported strongly by the consultant. Most of them were in favour of maintaining the environmental services but it was agreed that the development of the modelling capability should be excluded; instead it was assumed that arrangements will be made with outside agencies/universities to use their models for the simulation and prediction of air and water dispersion.

The main differences related to the lignite treatment functions. The conflicting views were at the end reconciled by the proposal to keep in the project the lignite beneficiation function (particularly the removal of marcasite) and exclude the lignite dewatering function while maintaining under Activities and Inputs a study tour to acquaint the staff with diverse dewatering technologies applied in the world. This awareness raising will help the institute to decide on the follow up outside the scope of the project, if need be.

With the above mentioned adjustments the scope of the project was reduced to less than $ 1.3 millions.

9. ASSUMPTIONS

Some of the objectives which were excluded from the project were included as assumptions ("PBC tests are carried out under a separate project", "Dewatering technology is transferred", "Potential technologies of microbiological carbonization are investigated"). Other assumptions were identified from among those cards which were "kept aside" during the objectives analysis because they were not related to R&D ("Electronic repair and maintenance unit is established"). Additional assumptions were identified in the discussion (see Annex 7).

To influence the occurence of some assumptions the project maintained some supportive activities (such as the study tour to get acquainted with the dewatering technologies).

As usual, for some participants the determination of the "level" of the assumptions seemed to be difficult.

10. INDICATORS

The Indicators for the Purpose and the Goal were relatively easy to propose. To prove the achievement of the Purpose it was proposed to select a few R&D tasks/projects which should be carried out thanks to the upgraded capability of the institute and completed shortly after the termination of the project. In fact additional indicators of this type can be proposed at the next stage of project planning (after the project approval, once the Work Plan is elaborated in detail).

The Indicator for the Goal helps in interpreting the Goal; however, as it must allow considerable time for the impact to take place it is beyond the actual possibility of verification.

The Indicators for the Outputs were more difficult to formulate as the concept of verifying a capability (either established or strengthened) was quite difficult for some participants to comprehend. Finally it was agreed that the Indicators can be interpreted as milestones in carrying out the most important institution/capability building activities. A few examples were proposed, discussed and included in the PPM; more realistic indicators should be defined at the stage of Work Plan preparation.

11. EVALUATION

The participants were asked to express in writing their opinions on the following elements of the workshop:

- duration
- effectiveness of the method
- possibility to participate
- moderator
- resource person
- logistical support

The duration was generally considered adequate, comments on all other issues were positive; only one participant was not satisfied with the possibility to participate in the workshop. Particularly highly appraised was the consultant.

12. A METHODOLOGICAL REMARK

The process of identification and formulation of problems as well as the scoping of the project demonstrated that the participants generated ideas and took decisions on the basis of their own experience, educational background, information at hand, etc. In case of a project upgrading or developing R&D capabilities this experience alone may not be sufficient; what is also needed is the awareness of the potential benefits which may be achieved by the application of more advanced techniques or technologies. The awareness raising function of the resource person in this context is of key importance.

On the other hand the scrutiny of the proposals by the priority criteria of the project beneficiaries diminishes the probability of transferring foreign models and schemes without due consideration of local conditions. "Divergent views" on some issues between the resource person and the participants may emerge. (In the case of this project they related to "CAD application" and "microbiological gasification".) To comply with the principles of project ownership it seems desirable to respect the views and priorities of local parties and not to impose any solution on them.

List of Participants **Annex 1**

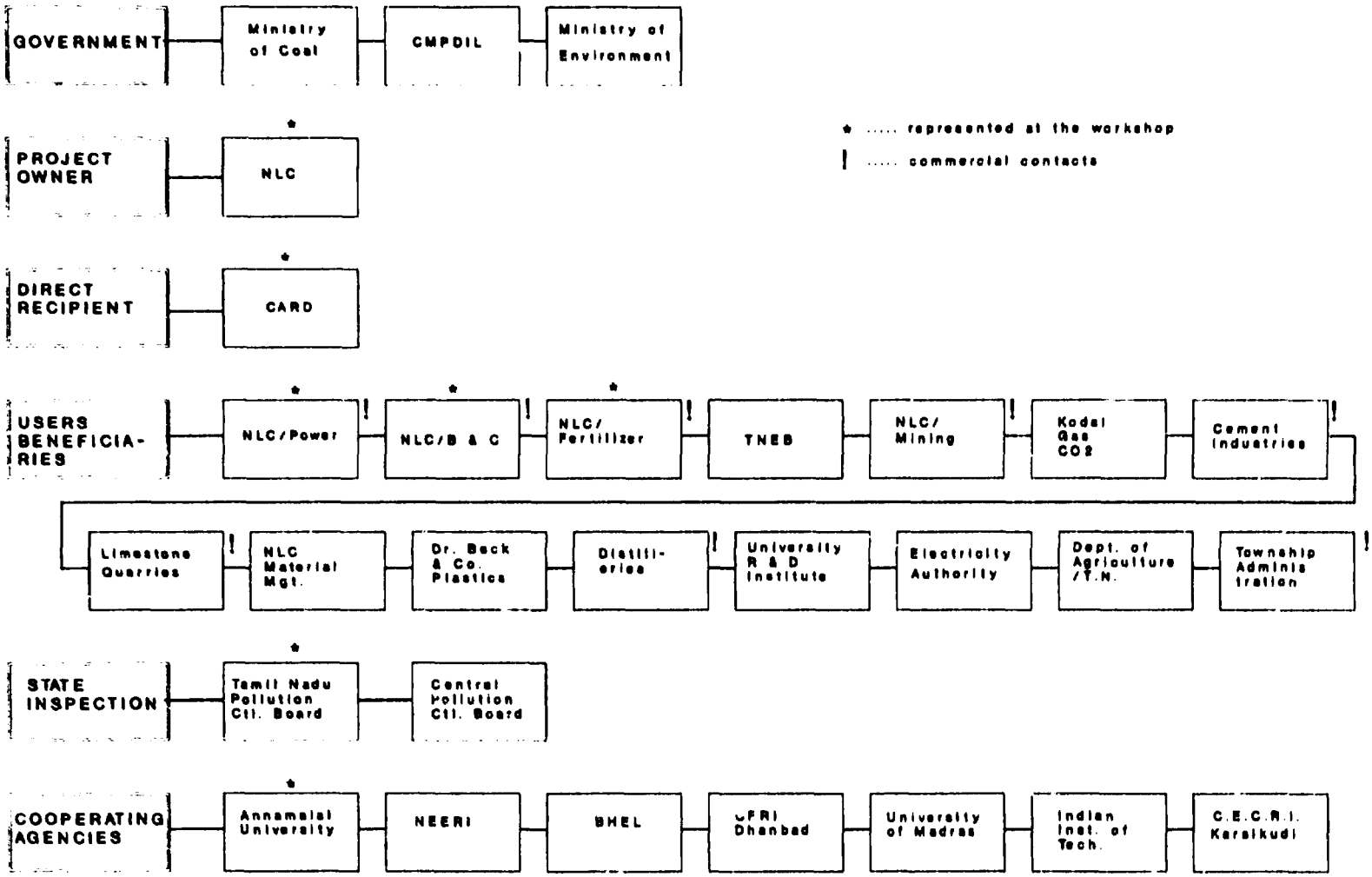
Workshop on

"LIGNITE ENERGY RESEARCH INSTITUTE"

From 08.03.93 to 10.03.93
at
NLC Training Complex, Neyveli.

Sno	Name	Organisation
1.	G.Rengasamy	Tamilnadu Pollution Control board
2.	V.Haridoss	Tamilnadu Pollution Control board
3.	Dr.M.P.Chockalingam	Annamalai University
4.	RM.Alagappan	Annamalai University
5.	Dr.Lada.R.Rajasekaran	Annamalai University
6.	Dr.B.Raghupathy	Annamalai University
7.	S.Venkatasubramanian	NLC/TS-I
8.	R.Kumarasamy	NLC/TS-I
9.	George Jacob	NLC/New Projects
10.	A.Sivakumar	NLC/TS-II
11.	T.K.Venkata subramanian	NLC/B&C
12.	A.Clement	NLC/B&C
13.	M.Sadasivan	NLC/Fertilizer
14.	M.K.Gopalakrishnan Pillai	NLC/CARD
15.	J.Balakrishnan	NLC/CARD
16.	K.C.Radhakrishnan	NLC/CARD
17.	Dr.S.Santhanam	NLC/CARD
18.	V.Manoharan	NLC/CARD
19.	Vincent.J.Mechery	NLC/CARD
20.	M.Velan	NLC/CARD
21.	J.N.Ravi	NLC/CARD
22.	R.Gopal	NLC/CARD
23.	Gopalakrishnamurthi	NLC/CARD

PARTICIPATION ANALYSIS



Annex 3

MONITORING AND ANALYTICAL SERVICES OF CARD: MAIN USERS

1. Chemical and Physical Analysis:

   - NLC industrial units
   - Private and public organizations outside NLC

2. Atmospheric Monitoring:

   - NLC to ensure the quality of air
   - Tamil Nadu Pollution Control Board
     M/o Environment, Central Electricity Authority
   - Central Pollution Control Board (formulation of guidelines)
   - Mining units in NLC
   - Cement industries, quarry owners (e.g. lime stone)
   - Tamil Nadu Agricultural Department (meteorological data)
   - Universities and educational institutions for special theses for graduation

3. Water Monitoring:

   - NLC, to ensure water quality with respect to surface inland discharge, drinking water, ground water
   - Tamil Nadu Electricity Board, as statutory implementation agency for pollution compliance
   - Central Ground Water Board
   - Private agencies; distilleries; new entrepreneurs
   - Universities and institutions for theses preparation as a part of graduation requirement

4. Material Testing:

   - NLC industrial units
   - Outside private agencies

5. Soil Mechanics:

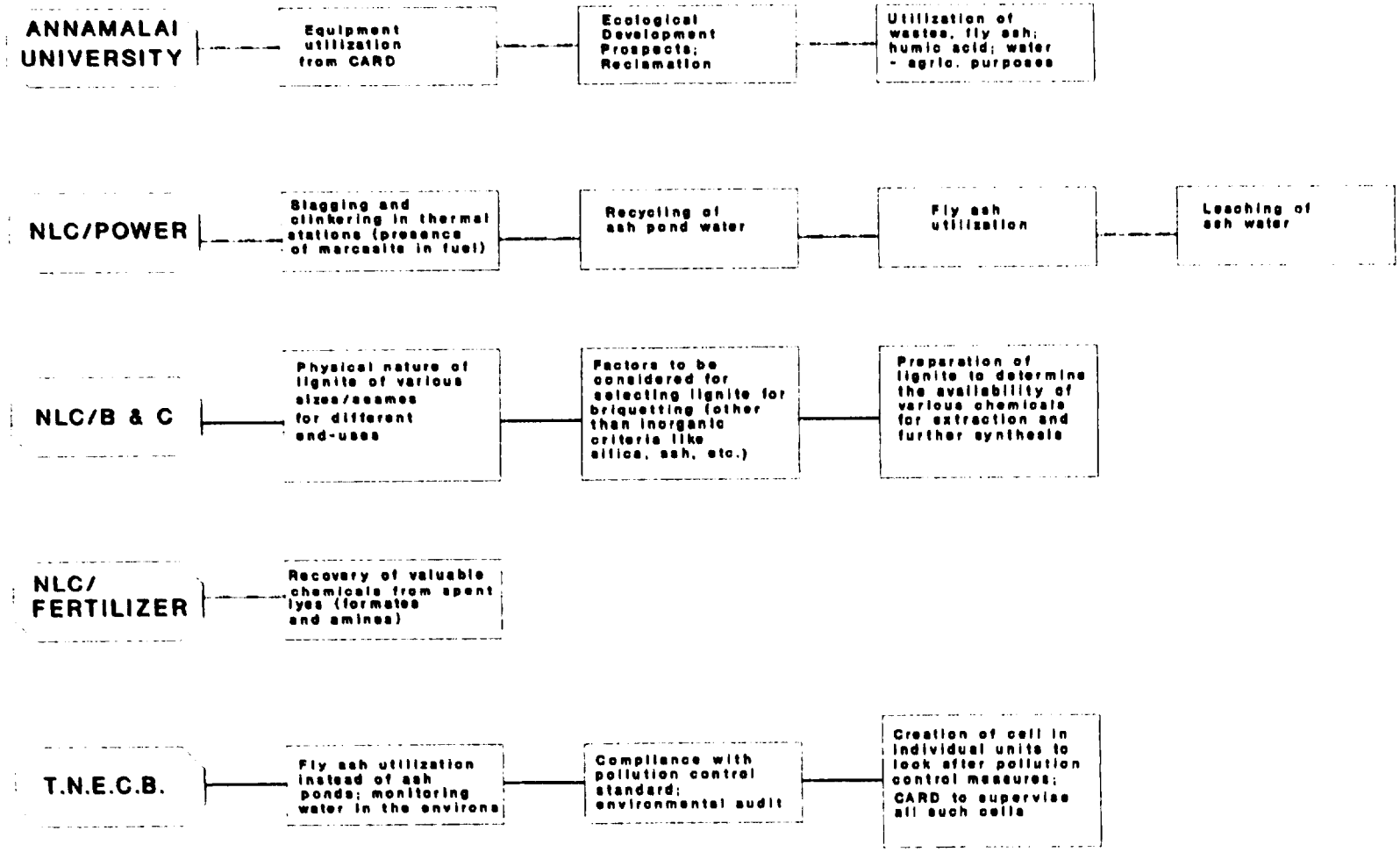
   NLC units

6. Reclamation:

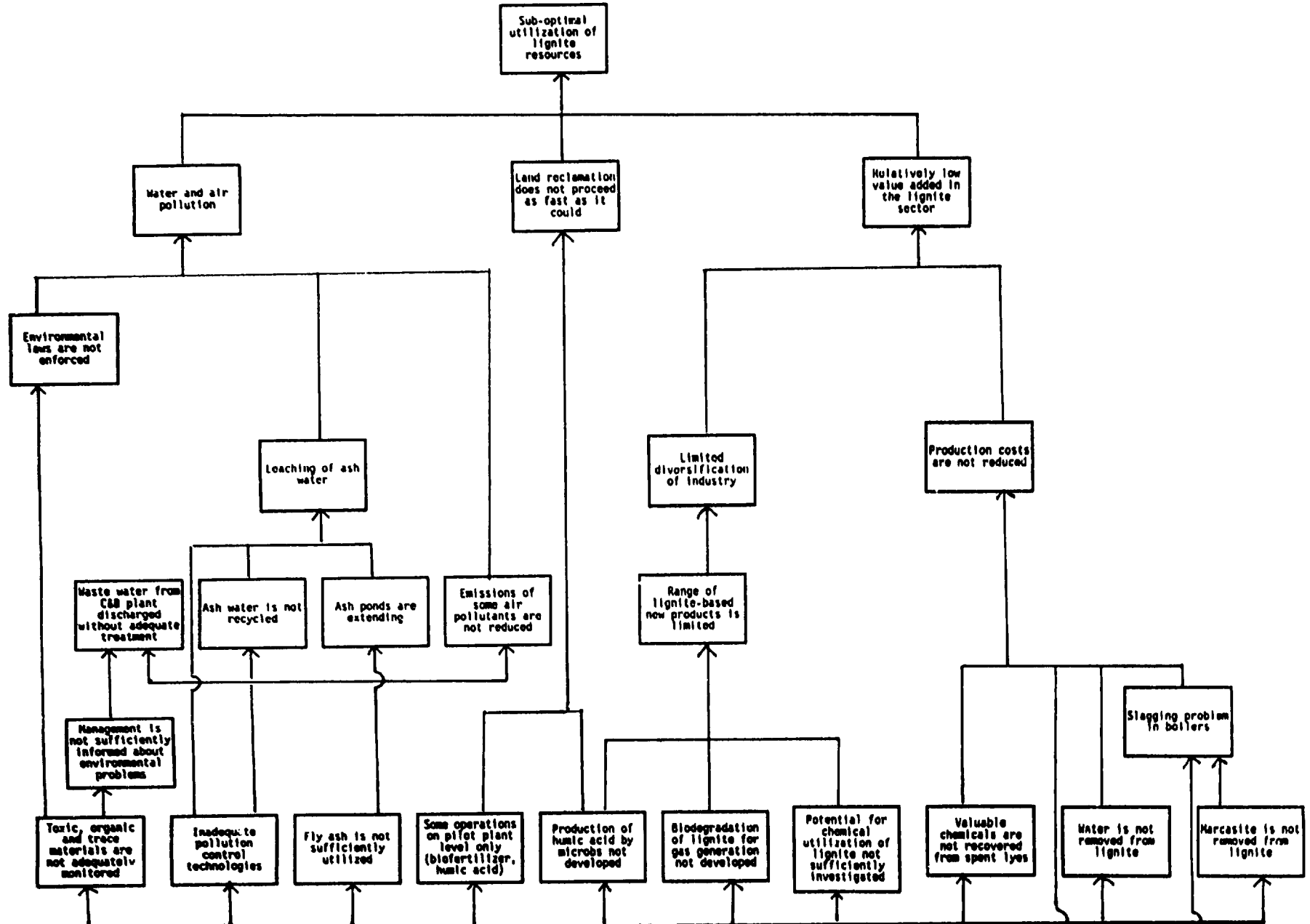
   - NLC in-house R&D
   - NLC and collaborative agencies (in particular Annmalai University)

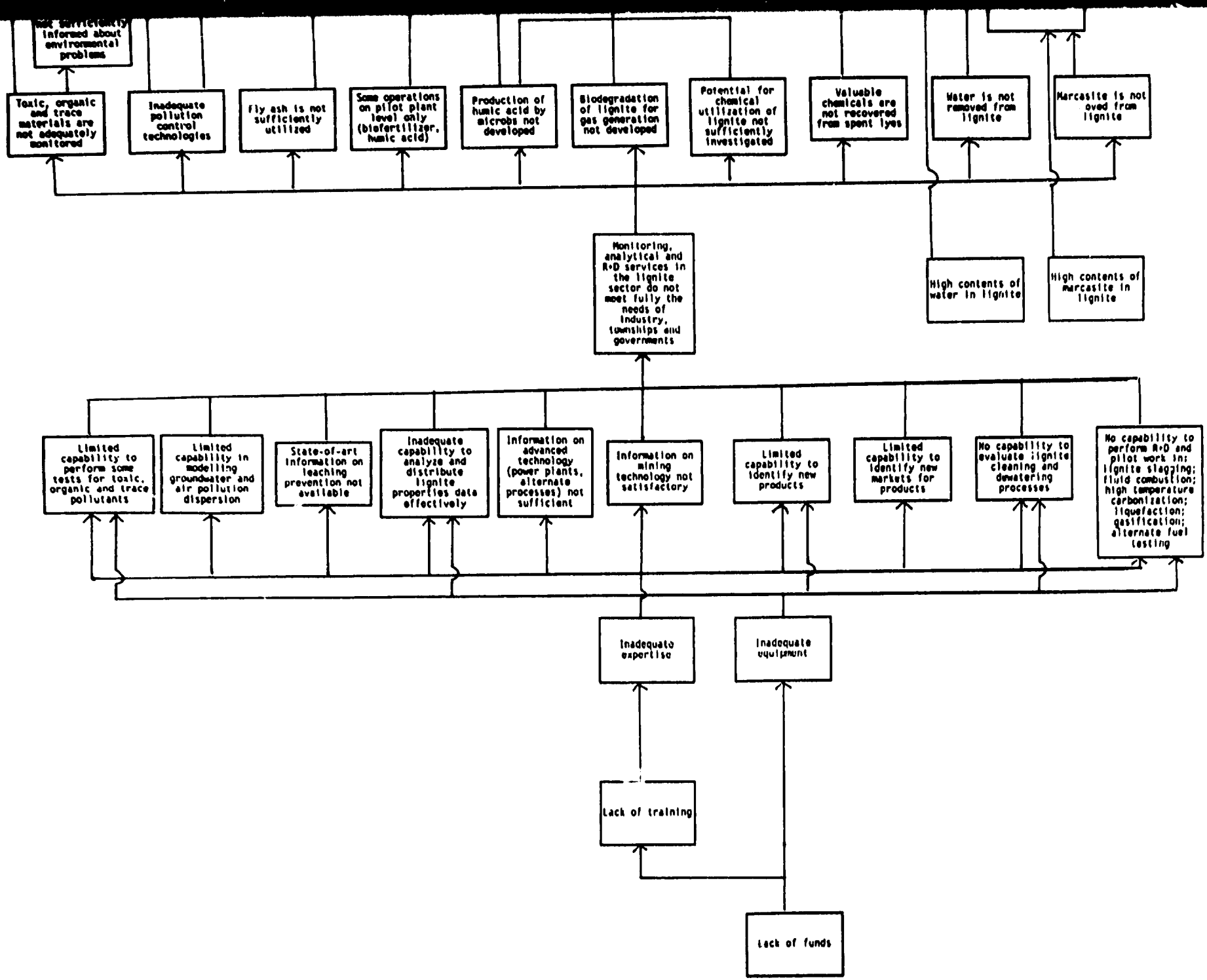
Annex 4

EXPECTATIONS



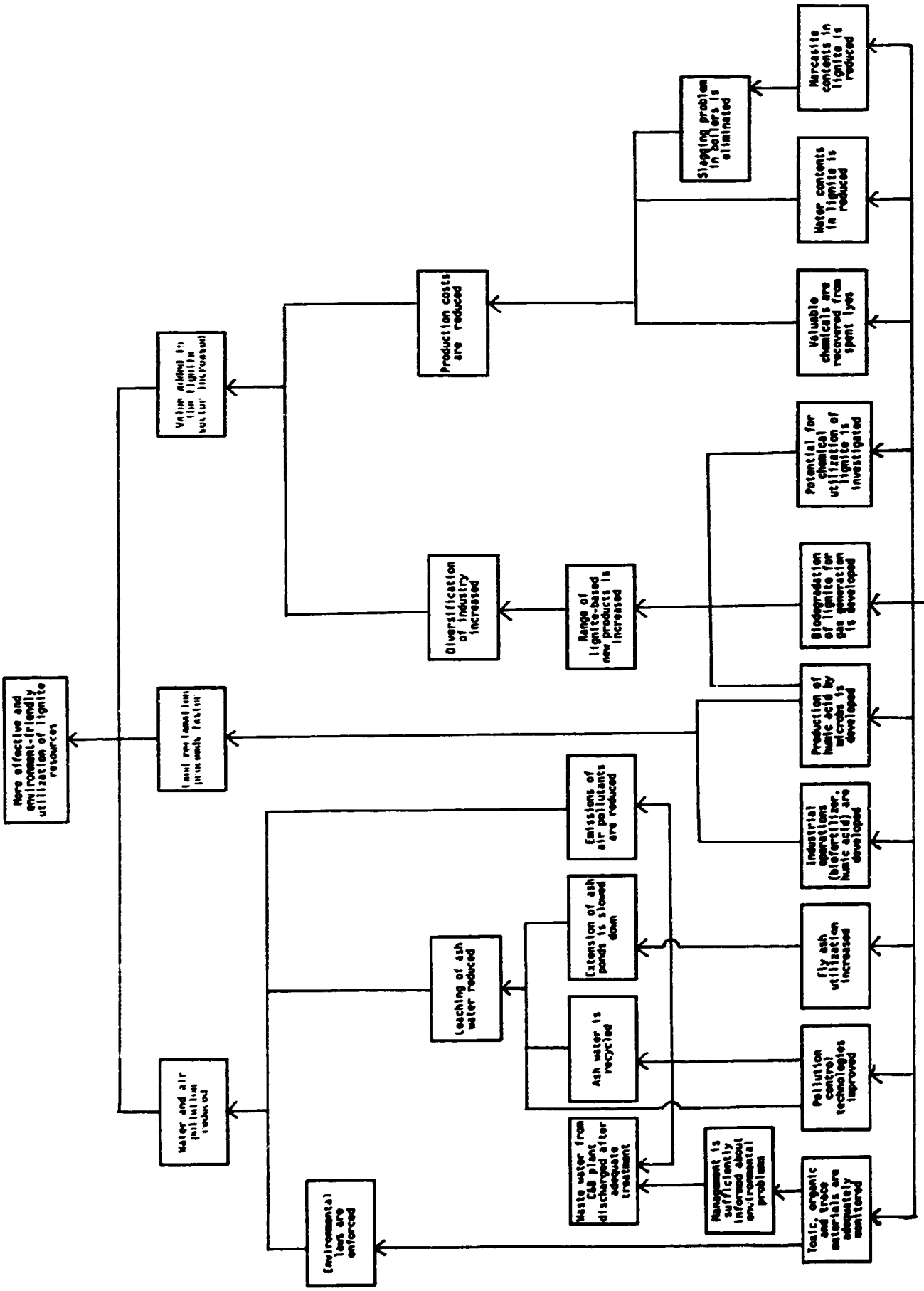
P R O B L E M T R E E



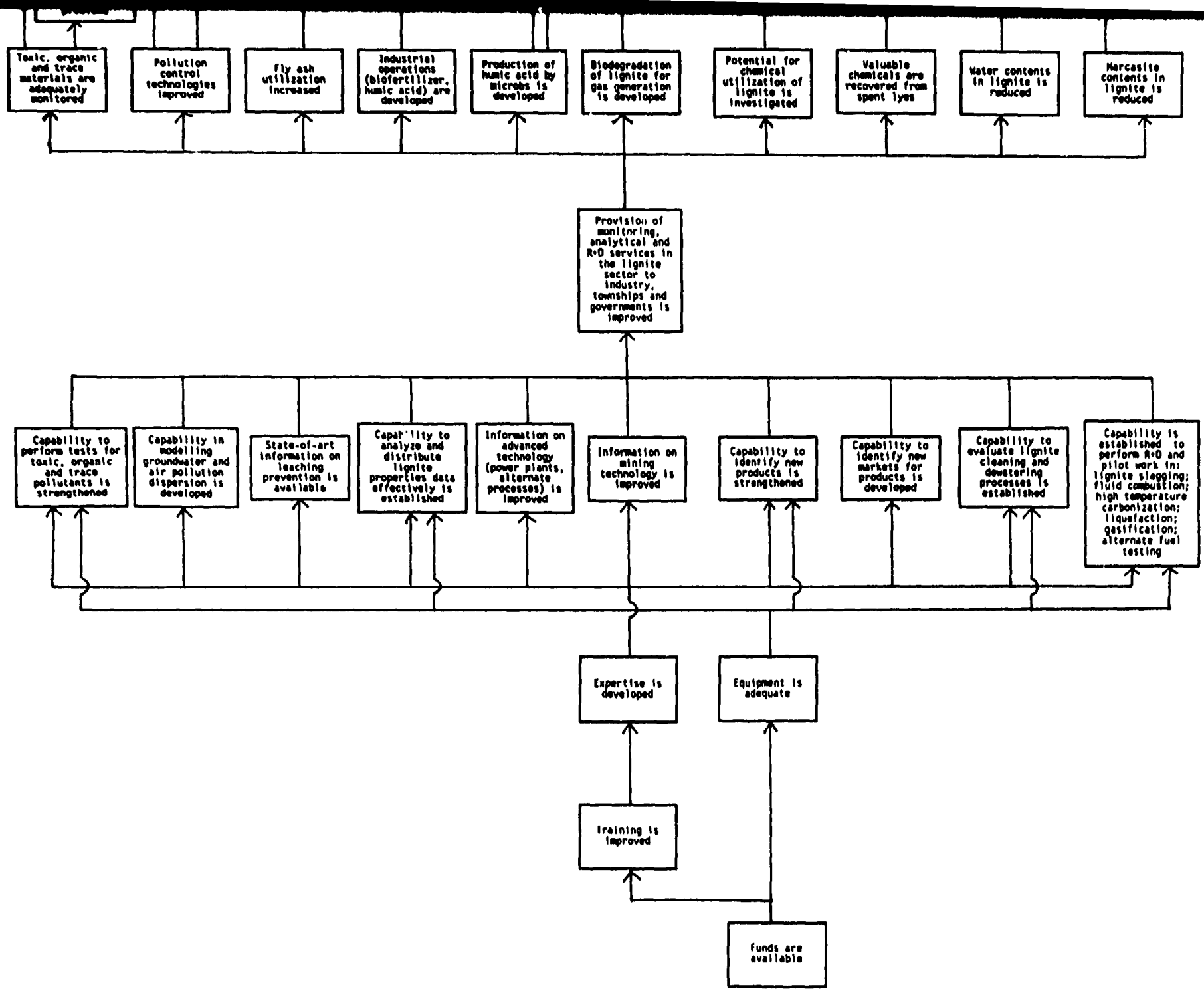

not sufficiently informed about environmental problems
Toxic, organic and trace materials are not adequately monitored
Inadequate pollution control technologies
Fly ash is not sufficiently utilized
Some operations on pilot plant level only (biofertilizer, humic acid)
Production of humic acid by microbs not developed
Biodegradation of lignite for gas generation not developed
Potential for chemical utilization of lignite not sufficiently investigated
Valuable chemicals are not recovered from spent lyes
Water is not removed from lignite
Marcasite is not oved from lignite
Monitoring, analytical and R+D services in the lignite sector do not meet fully the needs of industry, townships and governments
High contents of water in lignite
High contents of marcasite in lignite
Limited capability to perform some tests for toxic, organic and trace pollutants
Limited capability in modelling groundwater and air pollution dispersion
State-of-art information on leaching prevention not available
Inadequate capability to analyze and distribute lignite properties data effectively
Information on advanced technology (power plants, alternate processes) not sufficient
Information on mining technology not satisfactory
Limited capability to identify new products
Limited capability to identify new markets for products
No capability to evaluate lignite cleaning and dewatering processes
No capability to perform R+D and pilot work in: lignite slagging; fluid combustion; high temperature carbonization; liquefaction; gasification; alternate fuel testing
Inadequate expertise
Inadequate equipment
Lack of training
Lack of funds

Annex 6

OBJECTIVES TREE



SECTION 1


Toxic, organic and trace materials are adequately monitored
Pollution control technologies improved
Fly ash utilization increased
Industrial operations (biofertilizer, humic acid) are developed
Production of humic acid by microbs is developed
Biodegradation of lignite for gas generation is developed
Potential for chemical utilization of lignite is investigated
Valuable chemicals are recovered from spent lyes
Water contents in lignite is reduced
Marcasite contents in lignite is reduced
Provision of monitoring, analytical and R+D services in the lignite sector to industry, townships and governments is improved
Capability to perform tests for toxic, organic and trace pollutants is strengthened
Capability in modelling groundwater and air pollution dispersion is developed
State-of-art information on leaching prevention is available
Capability to analyze and distribute lignite properties data effectively is established
Information on advanced technology (power plants, alternate processes) is improved
Information on mining technology is improved
Capability to identify new products is strengthened
Capability to identify new markets for products is developed
Capability to evaluate lignite cleaning and dewatering processes is established
Capability is established to perform R+D and pilot work in: lignite slagging; fluid combustion; high temperature carbonization; liquefaction; gasification; alternate fuel testing
Expertise is developed
Equipment is adequate
Training is improved
Funds are available

SECTION 2

Annex 7

Project Name : Lignite Energy Research Institute
Est. Completion :
Date of Revision:
Design Team : COPP Workshop 8 - 10 March 93

Narrative Summary (NS)	Measureable Indicators (OVI)	Means of Verification (MOV)	Important Assumptions
Goal: 1 More effective and environment-friendly utilization of lignite resources	1.1 Share of lignite processed (not burned in the power stations) increased from ...% in year 0 to ...% in year 8	1.1	(Goal to Supergoal) 1
Purpose: 1 Improved provision of lignite-related analytical, monitoring and R&D services to industry, townships and the Government	1.1 Share of commercialized services of CARD/LERI increased from 25% in year 0 to ...% in year 4 1.2 Production of new commercial by-products from H.T. carbonization implemented in year 5 1.3 Fly ash bricks developed in year 4 1.4 Soil reclamation project extended to other areas by year 5	1.1	(Purpose to Goal) 1 Industry has funds to apply R&D results 2 A central section for integrated pollution control in MLC is established
Outputs: 1 Analysis section strengthened (Description: Appendix 1)	1.1 New test procedures completed (year 2, month 12) 1.2 Computer network established (year 2, month 6) 1.3 Data bank operational (year 2, month 9) 1.4 Available data on Indian coal properties entered in the data bank (End of year 3)	1.1	(Output to Purpose) 1 Electronic repair and maintenance unit is established 2 FBC tests are carried out under another project 3 Dewatering technology is transfered 4 Potential technologies of microbiological carbonization are investigated
2 Technology information section established (Description: Appendix 2)	2.1 Local staff recruited and trained (year 2, month 12) 2.2 Procedures for lignite analysis and display established (year 1. month 12) 2.3 Power plant technology information service operational (year 2, month 9)	2.1	
3 Energy section strengthened (Description: Appendix 3)	3.1 Local staff recruited and trained (year 1, month 12) 3.2 Slag/foul furnace constructed (year 2, month 6) 3.3 Gasification rig constructed (year 2. month 6)	3.1	

Narrative Summary (NS)	Measureable Indicators (OVI)	Means of Verification (MOV)	Important Assumptions
	3.4 High temperature carbonization furnace established (year 1, month 6)		
4 Environment section strengthened (Description: Appendix 4)	4.1 Local staff recruited and trained (year 2, month 6) 4.2 Monitoring plan prepared (year 1, month 12) 4.3 Pollution control technology data file operational (year 2, month 6) 4.4 Information on sump technology available (year 2, month 6)	4.1	
5 Lignite treatment section established (Description: Appendix 5)	5.1 Local staff recruited and trained (year 1, month 12) 5.2 Facilities for beneficiation upgraded (year 2, month 9) 5.3 Pilot plant established (year 3, month 6)	5.1	
6 New product section established (Description: Appendix 6)	6.1 Local staff recruited (year 1, month 6) 6.2 Action plan prepared (year 1, month 12) 6.3 Improvement studies of existing products completed (year 2, month 12) 6.4 Study on biological production of humic acid completed (year 2, month 12)	6.1	
Activities: 1.1 Prepare specifications and procure analytical equipment 1.2 Study tours (2) 1.3 Establish toxics, organics, trace contaminants, new products test procedures 1.4 Recruit data management consultant 1.5 Develop data management program 1.6 Prepare specifications and procure computer	Inputs/Resources: \$ 1000 Experts (BL 11) CTA 150 Control of emissions 120 Solid waste disposal 36 Lignite beneficiation 80 New products 36 Sub-total 422 National Experts (BL 17) Data management 20 Reclamation and Water 20 Sub-total 40 Subcontracts (BL 21) Slagging/fouling furn. 150 Gasification & liquef. 120	1.1	(Activity to Output) 1 Staff trained by the project stays with the institute 2 Staff trained by the project stays with the institute 3 Staff trained by the project stays with the institute 4 Staff trained by the project stays with the institute Simulation models are made available to LERI 5 Staff trained by the project stays with the institute 6 Staff trained by the

Narrative Summary (NS)	Measureable Indicators (OVI)		Means of Verification (MOV)	Important Assumptions
network	Sub-total	270		project stays with the institute
	Fellowships (BL31)			
1.7 Train personal with network	Power plant technology	39		
	Env. control technol.	44		
	Library/computer	14		
1.8 Establish data bank	Sub-total	97		
1.9 Establish data feedback file	Study tours (BL 32)			
	Analysis	13		
	Environmental	26		
2.1 Recruit staff	Lignite treatment	25	2.1	
	Gasification/Liquef.	13		
2.2 Fellowships	Heat products	13		
2.3 Establish procedures for lignite data analysis and display	Sub-total	90		
	Equipment	265		
	BL 15	3		
2.4 Establish power plant technology information service	BL 16	18		
	BL 35	6		
2.5 Establish format for papers	BL 51	20		
2.6 Procure office equipment and literature	TOTAL	1246		
3.1 Recruit and train local staff			3.1	
3.2 Construct slag/foul furnace				
3.3 Test lignite				
3.4 Award subcontract on physical gasification and liquefaction				
3.5 Construct gasification rig				
3.6 Carry out tests in gasification and liquefaction equipment				
3.7 Procure high temperature carbonization furnace				
3.8 Carry out high temperature carbonization tests				
3.9 Prepare lignite slurry and carry out tests with slurry				
4.1 Recruit and train local staff (study tours, fellowships)			4.1	

Narrative Summary (NS)	Measureable Indicators (OVI)	Means of Verification (MOV)	Important Assumptions
4.2 Prepare overall monitoring plan			
4.3 Recruit consultant to provide state-of-art polution control technology data			
4.4 Recruit consultant to provide sump technology			
4.5 Introduce additional monitoring of toxic, organic and trace contaminants			
4.6 Make arrangements for the utilization of simulation models			
4.7 Introduce new land reclamation and effluent treatment R&D projects			
5.1 Recruit local staff		5.1	
5.2 Study tour			
5.3 Recruit the expert			
5.4 Prepare action plan on benificiation, reflection and maceral studies			
5.5 Upgrade the available facilities and conduct experiments			
5.6 Specify and procure pilot plant equipment			
5.7 Scale up to pilot plant and transfer technology			
6.1 Recruit local staff		6.1	
6.2 Recruit marketing expert			
6.3 Prepare action plan			
6.4 Carry out marketing study on existing products			
6.5 Carry out improvement studies of existing products			
6.6 Carry out a study of by-products from high temperature carbonization			

Narrative Summary (NS)	Measureable Indicators (OVI)	Means of Verification (MOV)	Important Assumptions
6.7 Carry out a study of biological production of humic acid			
6.8 Carry out studies on new products			
6.9 Carry out marketing studies on new products			

Output 1: Analysis Section strengthened Appendix 1

Additional functions/services

- Testing of toxic, organic and trace pollutants
- Testing by thermogravimetric, differential thermal and specific surface area analytical techniques
- Testing of new products (liquefaction, gasification, biological products)
- Collecting and recording Indian lignite data.

Staffing

3 Senior Scientists
6 Junior Scientists
12 Analysts

Methodology : New standard analytical procedures will be applied. Organizationally, this will bring all analyses into one group, which provide better and more efficient service. This should not present staff from performing their own analyses, but will permit them to focus on the interpretation and application of data.

Premises : Present laboratory space is adequate.

Equipment (additional) :

a. Computer Network with (1) server
(1) back-up server
(5) workstation
(1) printer

b. Instruments :

- Thermogravimetric analyser
- Differential thermal analyser
- Surface area measurer

Users :

NLC, BHEL, other lignite based power plants, pollution control agencies, department of agriculture, academia.

Funding :

Budget; partly from sale of services.

Appendix 2

Output 2: Technology Information Section established

Function/Services :

- Storage, analysis and distribution of lignite coal properties data.
- Power plant technology information service.
- Coordination of information flow.
- Organization of study tours, fellowships and paper publication.
- Library and transfer data focus.
- Commercialization of LERI services.

Staffing :

1 Data Manager/Librarian
1 Draftsman
1 Plant Engineer
3 Assistants
1 Statistician

Methodology :

Procedure for data analysis and data display will be established in concert with the data management system consultant. A reference file of power plant technology will be established and continuously updated.

A standard format and review procedure for technical papers will be applied.

Premises :

No new facilities are required.

Equipment :

3 Personal Computers
1 Printer
1 Fax
1 Copier

Technical reference books and journals.

Users :

NLC, industry, academia, technical institutes, power plant planners.

Funding :

Budget, partly from sales of services.

Output 3: Energy Section strengthened Appendix 3

Additional functions/services

- Laboratory combustion tests to evaluate slagging/fouling.
- Development of physical lignite gasification processes.
- Development of a high temperature carbonization process.
- Lab tests to evaluate lignite liquefaction process.
- Development and evaluation of lignite slurries.

Staffing :

2 Design Engineers
4 Process Engineers
6 Jr. Engineers
2 Scientists
6 Jr. Chemists.

Methodology :

Advanced analytical procedures will be followed. Available designs/blueprints will be transferred and applied.

Premises :

No new facilities are required.

Equipment :

1 Slagging/fouling furnace
1 Physical gasifier (including particle analyzer)
1 High temperature carbonization furnace
Lab equipment (miscellaneous)

Users :

NLC
Brick/cement industry
Combustible, low heat gas users
Metallurgical industry; foundries

Funding :

Budget; partly from sales

Output 4 : Environmental Section strengthened Appendix 4

Additional function/services :

- Integrated monitoring of all gaseous, liquid and solid effluents (with power plants, mining, carbonization and Fertilizer monitoring)
- Monitoring toxic, organic and trace contaminants.
- A state-of-art environmental control technology information service
- Applying plume dispersal, water dispersal and leaching models
- A knowledge base for ash/slag sump construction; management and leaching control.
- Effluent treatment studies.
- Land reclamation studies.

Staffing :

2 Environmental Engineers/Scientists
6 Jr. Engineers/Jr. Scientists
3 Assistant Engineers/Asst. Scientists

Methodology :

Overall environmental control systemology will be applied. Plume dispersal modeling, total effluent estimation and control planning will be applied. Comparative, objective evaluation of SO2, NOX and particulate emissions control technologies will be obtained from dedicated technical institutes.

Equipment :

Laboratory equipment

Users :

NLC
State and control agencies
Industry
Agriculture

Funding :

Budget; partly from sales of services

Output 5: Lignite Treatment Section established Appendix 5

Function/Services :

- Developing processes for lignite beneficiation
- Reflection and maceral studies

Staffing :

1 Process Engineers
1 Scientist
1 Jr. Engineers
1 Jr. Scientists
3 Assistants

Methodology :

Three promising lignite beneficiation process will be transferred by experts and tested at Neyveli. The most promising method will be developed further and process specifications will be prepared.

Equipment :

Laboratory and pilot plant equipment

Users :

NLC
Commercial boilers

Funding :

Budget

Output 6: New Product Section established Appendix 6

Function/Services :

- Improvement of by-product variety, yield and quality from existing processes (low temperature carbonization, humic acid, flyash)
- Development of new products and by-products from lignite and mining residues (high temperature carbonization, biological humic acid production
- Collection of feedback from users.
- Market studies/analysis function.

Staffing :

2 Sr. Chemists/Scientists
2 Jr. Chemists/Scientists
1 Economist/Marketing expert
2 Assistants

Methodology :

Process procedures and product specifications will be prepared based on the results of marketing and R&D studies.

Equipment :

1 autoclave
1 antrifuge
Laboratory and pilot plant equipment

Users :

Cement Industry
Chemical Industry
Pharmacentrial Industry
Plastics Industry
Fertilizer Industry

Funding :

Budget; partially funded by users.