

**GUIDELINES FOR THE PREPARATION
OF
FEASIBILITY REPORT FOR**

INDUSTRY AND MINING PROJECTS

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PROJECT APPRAISAL DIVISION

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PREFACE

The quality of appraisal, investment decision and success of the projects depend largely on the quality and content of the Feasibility Report (FR). It is in this context that the Planning Commission had earlier issued guidelines for the preparation of FR in 1966 and later in January, 1975. The 1975 version of the guidelines relates to the industrial projects but the same has been in use for other sectors as well to the extent possible.

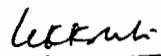
Despite the emphasis on proper feasibility study, a number of cases of time and cost over-run have been encountered in the projects almost in all sectors of the economy. The issue was also considered by the Committee on Public Undertakings (COPU) 1981-82 (Seventh Lok Sabha). In the light of the shortcomings observed in the quality of FR submitted by the project authorities, the Committee desired that on the basis of the experience gained and feed-back on implementation obtained, revised guidelines for preparation of FRs should be issued to ensure reliable project formulation. Following the above recommendations, Working Groups for formulation of revised sector-specific guidelines were set up by the Planning Commission for seven sectors/subsectors, namely, Coal, Power, Cement, Paper, Engineering, Metallurgical and Process Industries.

Based on the drafts developed by these Working Groups, comments received from concerned Ministries/Organisations and discussions held with them, these Guidelines have been prepared. In these Guidelines, the term Detailed Feasibility Report (DFR) has been used in place of FR, mainly to emphasise the need for detailed information to enable proper appraisal of the investment proposal. The Guidelines mainly outline the information required for proper formulation and appraisal of projects. Any procedures and criteria/parameters as may be specified by the Government from time to time have also to be taken into consideration while formulating and appraising projects.

While efforts have been made to incorporate various improvements in the guidelines, these cannot be taken as the final word on the subject as project formulation is a dynamic process and depends on the state of knowledge which gets enriched with time. Any suggestions to improve these guidelines are, therefore, welcome.

New Delhi.

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CHAPTER 1

INTRODUCTION

1.1 Every Five Year Plan lays down certain basic objectives and targets for growth, development, consumption, investment and resources to be mobilised. The macro or national targets are broken into sectoral investments and growth. The plans for each sector consist of programmes/projects and schemes. A complete system of project management must ensure the following aspects:

- a) formulation/selection of the most sound and viable projects;
- b) proper implementation of the projects selected; and
- c) proper management of the completed projects.

1.2 The main stages of the project cycle can be considered in the following phases:

- a) **Preliminary establishment of the need to be achieved through the implementation of a project;**
- b) **Project identification and formulation** which involves examination of various alternatives or options to meet the desired needs / goals; and selection of one or more options for preparation of the Detailed Feasibility Report;
- c) **Preparation of a Detailed Feasibility Report (DFR):** DFR is a document which contains detailed information on the technical, market, organisational, managerial and environmental aspects and on financial and economic viabilities;
- d) **Appraisal of Detailed Feasibility Report(DFR) from the following aspects:**
 - i) **Technical Analysis** to determine whether the specifications of technical parameters chosen are realistic and optimal;
 - ii) **Commercial Analysis** to determine demand/supply gap and whether the product specifications, marketing plan and delivery system are soundly conceived;
 - iii) **Organisational aspects** to determine whether the organisation has the managerial capability to implement and operate the project;
 - iv) **Environmental aspects** to ensure that the environment related aspects like rehabilitation, resettlement etc., as may be required as per environmental guidelines have been fully covered in the project cost;
 - v) **Financial Analysis** to determine whether financial costs and returns are properly estimated and whether the project funding is ensured and whether the project is financially viable;
 - vi) **Economic Analysis** to determine whether a project is worth while from the point of view of economy as a whole.
- e) **Investment decision** to be taken keeping in view the competing claims of other projects and in the context of the provisions available in the Five year and Annual Plans;
- f) **Implementation** which involves implementation planning, preparation of a Detailed Project Report (DPR), detailed designs and drawings, specifications, tendering/contracting, getting various clearances, execution of various activities leading to commissioning of the project and monitoring throughout, and

g) **Operation** (when the project outputs/goods or services are actually generated) and **ex-post Evaluation** to find out whether the objectives intended were realised and whether the project was properly designed and effectively carried out.

1.3 Detailed Feasibility Report (DFR) is the basic document which provides information needed for the purpose of appraisal of the project irrespective of whether it is a proposal for setting up of a new plant/facility or expansion and / modernisation of an existing plant/facility. The quality of appraisal / investment decision largely depends upon the quality of DFR. The purpose of these Guidelines is to specify the information that is required on all the important aspects / parameters of the projects and the way in which the data should be presented.

Investment Approval Procedure :

1.4 All Central public sector projects above a specified cost level require recommendation by the Public Investment Board (PIB) prior to consideration by the Cabinet. Projects in all sectors (except Railways, Atomic Energy , Space, Non Conventional Energy, Science and Technology and Electronics) have to be considered by the PIB. (In the case of scientific departments such as Electronics, Science and Technology, the PIB is headed by the respective Secretaries). In the case of telecommunication sector projects, it has been the practice that any project breaking new ground for the first time would be considered in a normal PIB headed by Secretary Expenditure. Subsequently, repeat projects of similar nature would be considered by the special PIB headed by Secretary, Telecommunications.

1.5 The steps required to be undertaken for investment approval are as follows:

- i) Stage-I approval by the Committee of PIB. This approval authorises the project authorities to incur expenditure for preparation of DFR and undertaking some preliminary activities such as site investigation, tying up the required know-how and technology, identifying the list and sources of equipment, calling for budgetary quotations, starting work relating to basic engineering so as to ensure a greater degree of reliability in regard to the cost estimates and time schedule for preparation of DFR.
- ii) Preparation and circulation of draft PIB Memo and DFR.
- iii) Inter-ministerial Group (IMG) or pre-PIB meetings convened by the Financial Adviser in the Administrative Ministry/Department.
- iv) Obtaining clearances from Ministry of Environment and Forests, Central Electricity Authority etc.
- v) Circulation of final PIB memo by the Administrative Ministry/Department.
- vi) Preparation of appraisal note by the Project Appraisal Division (PAD).
- vii) Consideration by PIB and its recommendations to Cabinet (CCEA).
- viii) Preparation and circulation of Note for Cabinet (CCEA).
- ix) Consideration and investment approval by Cabinet (CCEA).
- x) Issue of sanction letter by the Ministry/Department.

1.6 Chapter-2 of the guidelines describes the information required to be presented in a proposal in the form of a Pre- or Preliminary Feasibility Report (PFR) for the Stage-I clearance. The studies and investigations required to be carried out in respect of various sectors for preparation of Detailed Feasibility Report (DFR) before Stage-II i.e., investment clearance, are given in Chapter-3. Chapter-4 deals with the presentation of DFR while Chapter-5 describes the information required for submission of the Revised Cost Estimates (RCE).

1.7 While these guidelines are generally applicable to all Industrial Projects, specific information requirements for the following Sectors are given separately in chapters 2,3,4 & 5 :

- i) Cement
- ii) Paper
- iii) Engineering Industry
- iv) Metal and other Mining/Non-ferrous metallurgy
- v) Iron & Steel/Ferrous Metallurgy and
- vi) Process Industries.

CHAPTER 2

PROPOSAL FOR STAGE-I CLEARANCE

2.1 The information to be presented in proposal (Pre-or Preliminary Feasibility Report - PFR) for Stage-I clearance is indicated below:

i) **Brief outline/salient features of the proposal:** Besides the broad description, the salient features of the proposal may be given as per the Format indicated at PFR-1.

ii) **Need and justification of the project based on technical necessity and/or demand supply analysis of the product.** The issues that need to be discussed here pertain to identification of the basic objective(s) or need which is sought to be fulfilled by the implementation of the proposed project and the importance accorded to the stated objective(s) in the Plan. The need for the project should be justified from a broad assessment of demand and supply as per the format indicated at PFR-2. The basis and the assumptions underlying the demand supply projections should be spelt out in detail. In case of export oriented units, international demand and supply scenario must be backed by analysis of trade statistics and projections/authoritative forecasts made by reputed experts giving basis of their forecasts. Justification for technical necessity must be supported by adequate details in quantitative terms about the benefits likely to accrue in meeting the objectives of the project.

iii) **Identification and analysis of broader alternatives available for meeting the objective (s) or need.** It may sometimes be possible to rule out some of the alternatives on summary considerations but such considerations, however trivial these may appear, should be briefly indicated. The quantitative and qualitative criteria for determining the inter-se priority of the alternatives should be brought out clearly. It may be clarified that the kind of alternatives to be dealt with here are 'broad' or 'macro' level alternatives which are substitutes of the particular proposal 'in toto'. It is expected that the comparative analysis of alternatives would be based on a realistic set of assumptions. Thus, if a proposal seeks approval in Stage-I for any one of these alternatives, it is expected that the proposal would contain sufficient information on the analysis of other alternatives as well as the basis of estimates made use of in the analysis. However, if sufficient information in regard to all the alternatives is not available, it is expected that the proposal for Stage-I clearance would be broadened to cover studies and investigations relating to all other alternatives.

iv) **Location, technology, feedstock, capacity of the plant and product mix proposed** should be given for each of the techno-economically feasible alternatives identified.

v) **Broad itemwise estimate of the capital cost together with the basis and yearwise phasing of capital expenditure** for all the alternatives considered as per the format indicated at PFR-3.

vi) **Broad itemwise estimate of the annual operation and maintenance cost and financial and economic benefits from the project** together with the underlying basis / assumptions for each of the alternatives considered as per the format indicated at PFR-3.

vii) **Linkages of raw materials and details of infrastructural facilities,** utilities such as land, water, power, transport and environmental quality of the region.

viii) **Economic and financial viability analyses** of the project including determination of IRR, NPV, cost of production/ generation, Domestic Resource Cost (DRC), break-even point, pay back period etc. The data required for viability analysis for each of the alternatives may be reported as per PFR-4.

ix) **Complete list of activities**, studies /investigations etc proposed to be carried out for preparation of DFR.

x) **For location specific projects**, the clearance for site and acquisition of land required, if any, could be considered in Stage-I itself. The environmental and forest clearance for studies and investigations and for site, wherever required, should preferably be obtained before Stage-I clearance. While the requirements of environment appraisal agencies are to be met separately, the PFR should contain the following information:

a) quantification of characteristics of effluent emissions and wastes from different technology options.

b) Land use of proposed site, soil conditions with respect to microbes and leachability, distance from sanctuaries etc., base line information on meteorology, noise level, existing flora and fauna etc.

xi) Estimate of cost and time- frame involved for studies and investigations proposed and preparation of DFR. The details of the cost of studies, source of financing, plan provision may be indicated as per PFR-5.

2.2 The above is general outline for preparation of PFR. Certain sector specific information required to be collated and included in the PFR is described in the following paragraphs:

2.3 CEMENT INDUSTRY PROJECTS :

2.3.1 Demand-supply Analysis :

The broad assessment of demand-supply would be at both the national and regional level to determine the need for locating the cement/clinker plant at specific locations and to decide upon the alternative scales of operation.

2.3.2 Location and Site Conditions :

The cement plant is normally located near a limestone deposit and the selection of site should normally be made at this stage. This is true up to the clinker stage since beyond this stage other options may be available to set up grinding units near consuming centres or near slag/fly ash facility if inter- grinding with slag or fly ash is feasible/contemplated. Such possibilities concerning location of sites should have been studied in all aspects before selecting specific site(s) for the clinker plant suitable with respect to limestone deposits as well as the grinding units. Suitable site plans giving preliminary location of plant and quarry, accessibility and transport links etc. in the regional context may be furnished.

2.3.3 Limestone Availability & Quality :

2.3.3.1 PFR has to indicate preliminary assessment of limestone requirement considering its quality and contemplated scales of operation depending on the objective to be achieved. The requisite source for meeting these requirements would have to be located. The deposit should have been adequately explored either by GSI/State Directorates of Geology & Mining and/or other agencies or by the project authority itself before the proposal for cement plant is mooted since not only the prospecting and exploration is time consuming, it is also necessary to know the extent of reserves and its adequacy for the life of the plant. The quality of limestone should also have been adequately tested in terms of specifications of cement grade limestone not only to have a preliminary idea of raw mix designs but also whether minor constituents present in the limestone would have detrimental effects on plant and equipment. The project authority should collect the information from various agencies and present the results in format PFR-6.

2.3.3.2 PFR should give a brief description of the Geology (lithology, shape, size and structure) of the limestone deposit and the regional geological setting preferably illustrated by geological map giving details about the amount of exploration/ prospecting carried out till date and identifying the agencies doing the exploration work. Type of testwork carried out, if any, to determine the suitability of the limestone for cement manufacture should also be indicated. Quantity, quality and category of geological reserves (as per the norms defined by CRI in publication SP-9-81 entitled "Norms for Proving Limestone Deposits for Cement Manufacture" or the GSI Miscellaneous Publication No. 58 entitled "Standardisation of Terminology & Classification of Ore Reserves") in the prospecting/mining leasehold based on integration of geological and exploration data available in the literature/exploration agencies, and if possible, mineable reserves envisaging a preliminary mining scheme. The data could be presented on the geological map itself and one or two typical level plans and sections. The expected life of reserves at contemplated rates of exploitation may also be indicated. It should also outline the programme of detailed exploration testwork that would be required to be done to finalise the mine plan and other basic engineering parameters for the Stage-II proposal. The principles enunciated in regard to mining of cement grade limestone may also apply to mining of non- metallic minerals used as flux materials, refractory and fertiliser raw materials etc., generally mined by opencast methods.

2.3.4 Infrastructural Requirements :

A broad assessment of transport requirements for coal, cement and slag/fly ash movement (in case relevant), likely linkages to sources of coal/slag etc. and mode of transport available should be made for various alternatives. Similarly, assessment of demand and availability of power should also be made.

2.3.5 Technology :

All available technologies should be shortlisted and sufficient data collected about them to allow a comparative techno-economic analysis.

2.3.6 Basic Engineering :

Project specification should include specification of kiln size and choice between integrated versus split location specifying other parameters whether intergrinding of slag/fly ash is contemplated/feasible or not. In case suitable location for siting the plant is fair distance away from the limestone deposit, preliminary assessment about suitable mode of transporting the limestone should be made.

2.3.7 Environmental Clearance :

As mining of limestone deposits is location specific, required data on environmental aspects should be collected to obtain site clearance from the Ministry of Environment and Forests separately for the quarry and the plant areas.

2.3.8 The information on various aspects discussed above is to be given in the Formats PFR-6 & 7.

2.4 PAPER INDUSTRY PROJECTS :

2.4.1 Demand-supply Analysis :

A broad assessment of demand-supply of the product-mix (various types of paper, paper board or newsprint/pulp) would be at both the national and regional level to determine the need for creating additional capacity for paper/newsprint pulp (conventional or deinked) in the region.

2.4.2 Location & Site Conditions :

The location of a paper project should be broadly decided taking into account the availability of agro/forest-based inputs such as bamboo, soft/hardwood, bagasse, reed/grass, rice bran, etc. and other infrastructural facilities such as power, soft water, proximity to the rail/road systems and the like. Taking these factors into account various suitable sites in the broad regional location need to be identified for comparative assessment of these locational alternatives based upon the information collected about availability of land, water and power supply, other critical inputs & chemicals, relative extent of the rehabilitation problem and in case significant bagasse raw material mix is planned, availability of bagasse from sugar mills and the problems connected with supply of coal in lieu of bagasse should be indicated.

2.4.3 Availability & Quality of Raw Materials & Chemicals :

2.4.3.1 All available information from the State Government and other agencies with regard to availability of forest based raw materials in terms of quantity and quality and the willingness of owners to spare the raw materials for sustained use over the life of the project should be collated and presented for each of the locational and plant capacity alternatives. Similarly, if bagasse is to form a significant part of the raw material, its availability should be ensured from a preliminary study about likely availability based on number of sugar mills, their crushing capacity and willingness of owners to spare the bagasse in required quantities for each of the alternatives. Availability of used newspapers from domestic/international market would have to be ensured if deinked pulp (DIP) plant is to be set up/forms significant proportion of the furnish. Alternatives of setting up "mother" pulping plant at a centralised location based on DIP technology versus smaller sized plants required at each paper mill may also be discussed.

2.4.3.2 The availability of forest-based raw materials should be assessed from the analysis of data furnished by the Forest Department of the State Government (It is presumed that the Forest Department would have conducted a systematic survey of forest resources in the respective catchment area, regularly updating the inventory of forest based resources) giving vital information on growing stocks, accessibility, rate of increment, etc.

2.4.3.3 Information on bench scale testing, if any done on the raw materials for obtaining appropriate suitable furnish composition, particularly in the case of newsprint, should be indicated especially if bagasse is considered as an important component of raw material mix along with requirement of imported softwood chemical pulp, if needed to obtain sufficient tear strength and other properties of newsprint.

2.4.4 Infrastructural Requirements :

Broad assessment of requirements and availability of important infrastructural facilities such as water, power, transport facilities including forest roads, railways should be made for various alternatives.

2.4.5 Technology :

All available technologies should be shortlisted particularly in the case of newsprint production in case significant bagasse raw material base is contemplated and sufficient data, based on bench scale testing, should be assembled in order to narrow down the choice to a few appropriate technologies for further detailed studies.

2.4.6 Basic Engineering :

Specifications of the project should include broad details in regard to major units of the paper plant, and whether captive/chlorine/caustic soda/lime plant as well as captive power plant would need to be established or not.

2.4.7 Environmental Clearance :

Since the basic raw material, to a significant extent even in the case of bagasse-based plants, is forest-based involving heavy transport movement, the location largely dictated by nearness to such resources, adequate data on environmental aspects may be collated to obtain site clearance from the Ministry of Environment and Forests, particularly from the angle of carrying capacity of the site location for air, water and solid waste as well as chemical pollution load. It may also be mentioned whether part of the raw material could be obtained through social forestry projects in the neighbourhood of proposed location.

2.5 ENGINEERING INDUSTRIES PROJECTS (CAPITAL GOODS, INTERMEDIATE GOODS, CONSUMER GOODS INDUSTRIES) :

2.5.1 Demand-supply Analysis :

Preliminary analysis of demand and supply at the macro- level should be made which, in the case of capital goods industries, may be based on technology forecasts for end products including an analysis of current levels of imports and the likely competition from well established foreign suppliers as well as average level of capacity utilisation attained in the industry in the recent past. Demand forecasts, in the case of intermediate goods industries, may be made with reference to the growth of the end use consuming industries. The demand for consumer goods industries may have to take into account the changing tastes and performance of consumers, their purchasing power, product life, replacement requirements, substitution effects, etc.

2.5.2 Product/Sales-mix :

Because of specific importance of end uses, consumer preferences, technology requirements and substitution effects having direct bearing on capacity creation for various facilities, it is necessary to have a broad framework of the likely product/sales-mix that would help in formulating a balanced and optimum mix of fixed assets that would ultimately maximise capacity utilisation.

2.5.3 Ancillarisation/Phased Manufacturing Programme (PMP)/Vendor Development :

A broad idea of level of ancillarisation prevalent in the industry nationally as well as internationally and the likely modification in this pattern keeping in view peculiarities of the local situation should be given. If there are obligations or plans to carry out PMP these should be highlighted. The need, possibilities and extent of Vendor Development Programme, if required, may also be brought out.

2.5.4 Prototype/Product Development :

2.5.4.1 If development of prototypes is necessary before finalisation of production plans for a certain product such as automobile, machine tools etc., it needs to be stated whether the prototypes have already been developed and tested or are still to be developed/tested and necessary/required certification from safety and performance level has been obtained from competent authority. Prototype development would of course be unnecessary in those cases where technology tie up is made for a tested product but certification/homologation may still be required. In case prototypes

are still to be developed, the cost and time frame required for this activity would have to be indicated.

2.5.4.2 For certain industries, especially consumer goods product development and its acceptance in the market would often be necessary to ensure proper marketing of the product and thus could be crucial to the success of a product. The need, possibilities and extent of product development already carried out/ still to be carried out in such cases would need to be clearly spelt out.

2.5.5 Technology :

A broad description of the various technologies available should be given to allow comparative technoeconomic analysis of the various alternatives.

2.5.6 Location & Site Conditions :

All information relevant for determining the optimality of a particular location favoured for siting the plant must be obtained.

2.5.7 Infrastructural Requirements :

Requirement of important infrastructural facilities such as power, water and transportation facilities should be assessed and indicated in PFR. Since the choice of manufacturing processes and the need to instal captive power generation depends upon power availability, its broad assessment is a pre-requisite for comparative analysis of various macro-alternatives.

2.5.8 Basic Engineering :

Project specifications should include broad details about the specific choice among various macro-alternatives based on the following:

- a) Tentative plan of civil works, technology, topography of project location.
- b) Plant layout.
- c) Material handling arrangements.
- d) Essential infrastructural requirements and availability.

2.6 METAL & OTHER MINING/NON-FERROUS METALLURGY PROJECTS :

2.6.1 Demand-supply Analysis :

2.6.1.1 Broad assessment of demand-supply balance at the national level for the ores/concentrates and metal as well as field-wise mine/concentrator and smelter capacities, their linkages and long-term commitment of import/export of ores and concentrates, if any, should be presented as per format at PFR-8. Future outlook on availability and consumption and emerging trends in the use of metal, substitution possibility as well as trading of ores, concentrates and metals including price behaviour in the international market need to be assessed based on authoritative forecasts. Since international trading in ores/concentrates/ metal(s) in terms of comparative advantage is distinctly possible, assessment of strategic/critical demand levels needs to be made so as to ensure this demand satisfaction through domestic sources (if adequate ore reserves are available) or stockpiling policy.

2.6.1.2 Development of new mine capacities alone would be justified if there is excess of smelter capacity over mine production or if there are possibilities of exports of ROM ore/concentrates, resource base of the country permitting and vice versa. In the case of overall metal demand-supply gap, creation of new smelter capacities and/or integrated mine smelter projects would be justified

whenever additional ore reserves are discovered/established after duly considering trade offs between creation of smelting capacity and toll smelting abroad/processing of concentrates offshore etc. Since the smelting capacities need to be established for minimum economic size, certain mismatches in concentrator-smelter capacities resulting in trading in concentrates/toll smelting may be inevitable.

2.6.1.3 PFR should, therefore, highlight the need for establishing of new mine/concentrator/smelter/refinery capacities keeping in view the overall resource base of the country for the metal(s) under consideration, characteristics of ores available for mining, infrastructural facilities available, future outlook of the ores/concentrates/metal(s) in the international market as well as optimality of mine capacity based on availability of reserves, choice of mining method etc. and the minimum economic size of smelter/refinery/metallurgical plant. Suitable comparison with international sizes and norms may also be made. It should also bring out whether strategic/critical demands of the economy are being met or not.

2.6.2 Technological Necessity :

Some additional metallurgical test work may throw up possibilities of recovering by-product metals/minerals or new process technologies to improve productivity are developed and adoption of these would have to be justified mainly in terms of technological necessity.

2.6.3 Location & Site Conditions :

While the mining segment is location specific, trade offs exist for location of metallurgical segment ranging from integrated mining-smelting complex, split location, linkage of concentrates to operating smelting plants as well as offshore treatment/toll smelting of concentrates. Such possibilities concerning location of sites for different segments should have been studied in all aspects before selecting specific options giving full justification for the choice and data presented for evaluation. Suitable site plans giving location of mine/concentrator and selected location of smelting plant, their accessibility, transport links etc. in the regional context should be furnished.

2.6.4 Establishment of Ore Reserves/Quality of Concentrates and Metal Recoveries :

2.6.4.1 Sufficient exploration and metallurgical testwork on the ore body to be developed should have been conducted through systematic exploration programme involving drilling and exploratory mining (if required) during prefeasibility studies based on the concept of sequential evaluation to establish the reserve potential in terms of quantity and grade and its mineability and treatment fairly reliably with demonstrated reserves (proved and probable) constituting 70-75% of the total reserves and basic characteristics of orebody delineated in terms of geometry (shape, size, depth extent), average grade, chemistry and mineralogy of ores, seepage conditions, roof/floor conditions, mineability and the likely quality of concentrates. The proposal is to be based on integration, evaluation and assessment of all exploratory data and bench scale beneficiation/ metallurgical testwork on representative drill core or bulk samples from the ore body already done by various agencies such as GSI/State Directorates of Geology and Mining/ MEC or the exploiting agencies themselves. This assessment preferably based on external third party appraisal by consultants/body of experts should form the basis for establishing basic parameters for drawing up alternative mine designs and process flow schemes for choosing the techno-economically most optimal and feasible alternative in terms of mining method, either for open cast or underground options, process flow sheet for the concentrator and the metallurgical plant. This preliminary assessment of beneficiation and smelting schemes is necessary to have knowledge about the quality of concentrate (assessed both by bulk chemistry and/or mineralogical studies) and process recoveries at beneficiation and smelting stages for the product and coproduct/ byproduct of metals

for different alternatives to enable assessment of output of concentrates/metals from the ROM ore for each of the mining and processing alternatives and their techno-economic merit. The preliminary assessment of the projected metal production cost should be compared, if possible, with industry cost curves for the metal(s) under consideration to allow judgement of level of prices at which the project is likely to be viable and become internationally competitive.

2.6.4.2 Whereas the mine and the mill (concentrator, if required), and even roaster or calcining plant in case needed, have necessarily to be set up near the ore deposit, relative economic choice of locating the smelter/metallurgical treatment plant and other downstream units should have been studied taking into account the cost implications of each location.

2.6.4.3 PFR should give a brief description of the Geology (lithology, structure, complexity and geometry) of the ore body, the type of ore deposit, the presence of various ore types and the regional geological setting preferably illustrated by suitable geological maps, also indicating the geophysical/geochemical anomalies, if any located. Details about the amount/type of exploration and surveys carried out till date and identifying the agencies doing the exploration work should be given. Chemistry and mineralogy of the ore and results of metallurgical testwork, if any, conducted to indicate the quality and recoveries of concentrates to be produced as well as smelting recoveries should be highlighted. Data could be presented on the geological map and one or two typical level plans and sections indicating the probable location of planned mine openings/entries and those already made. Reserve estimates by categories (as per the norms defined in the GSI miscellaneous Publication No.58 entitled "Standardisation of Terminology and Classification of Ore Reserves" published in June 1981 and any amendments that may be carried out in this document from time to time) in terms of quantity and grade based on the integration of geological and exploration data available with different agencies should be indicated for different cut-off grades so that the techno-economic merits of different options of mining methods both open cast and underground and the design philosophy and criteria could be evaluated if not already done during prefeasibility studies that might have been carried out. Based on the results of bench scale metallurgical testwork, the likely NPV value of ore in terms of metal content for various feasible alternatives of mining, metallurgical treatment and plant capacities could be determined to narrow down the choice to select few alternatives to be investigated in the stage II proposal. It should also outline the programme of further exploration/testwork that is needed to be done to finalise the mine design and other basic engineering parameters for the stage II proposal clearly indicating the adequacy or otherwise of the exploration, metallurgical and geomechanical test work already done in this regard.

2.6.4.4 The principles enunciated above in regard to metal mining may also be applicable to mining of non-metallic minerals such as pyrites etc., which are generally mined by underground methods as well as to the mining of minerals catering to the requirements of ferrous metallurgy projects such as iron ore, ferrous minerals like manganese, chromium etc.

2.6.5 Infrastructural Requirements :

A broad assessment of transport requirements for movement of products (concentrates, metals) and capacities/mode of transport available should be made for various alternatives. Similarly, assessment of demand and availability of power, particularly for the metallurgical treatment plant should also be made which could have determining influence on choice of process as well as need for captive power generation. Availability of water identifying the sources, variation in actual flows over a period of time in case of surface water and assessment of ground water potential should have been established based on the data available with State Irrigation Departments/Central Ground Water Board etc.

2.6.6 Basic Engineering :

2.6.6.1 The following elements of project should have been specified:

- a) Size of the mine and broad mine plan and technoeconomic indices.
- b) Location of downstream facilities, if required.
- c) Size of concentrator/mill and smelter/metallurgical treatment plants (roaster calcination plants etc.) and technoeconomic indices.
- d) Broad specification of process and flow sheets.
- e) Material balances.

2.6.6.2 The information on various aspects discussed above is to be given in the Format PFR-9.

2.7 IRON & STEEL/FERROUS METALLURGY PROJECTS :

2.7.1 Demand-Supply Analysis :

Broad assessment of demand and supply would be at the national and regional levels by quality (mild, alloy and special steels) and product categories (semis - blooms, billets, slabs; flat products - sheets, plates, coils, hot/cold rolled; long products - wire rods, bars & rods; shaped products-structurals, pipes & tubes, railway material; pig iron for foundaries, etc) to determine the optimal capacity, product mix, the choice of iron/steel making route and location of the plant/capacity expansion of existing plants. This assessment would be in terms of aggregate demand-supply in case of ferro-alloys proposals. In the case of sponge iron units the availability of steel scrap and its substitutability by sponge iron would also have to be determined.

2.7.2 Technological Necessity :

Health study of the existing plants may reveal necessity of initiating debottlenecking/rehabilitation or replacements of certain units/shops or the need for modernisation of the whole plant which may or may not involve any substantial capacity expansion. Development of new cost effective technologies resulting in reduced energy consumption and/or pollution abatement can justify technological upgradation proposals. Changing sales-mix may necessitate balancing of product-mix to improve profitability.

2.7.3 Product/Sales-mix :

Broad framework of likely product/sales-mix in terms of quality, size and specifications would be necessary to formulate a balanced and optimum mix of facilities that would ultimately maximise capacity utilisation.

2.7.4 Technology :

A broad description of various technically feasible and cost effective technologies available should be given to allow comparative techno-economic analysis of the various alternatives.

2.7.5 Location & Site Conditions :

2.7.5.1 All information relevant for determining the optimality of a particular location for siting the plant such as nearness to ports, captive or non-captive sources of basic raw materials (such as iron ore, coking and non-coking coals, flux materials of required specifications for integrated iron and steel plants, scrap/sponge iron and power availability for EAF route of steel making, ferrous

minerals like manganese, chromium etc., in case of ferro-alloys), rail and road transport and communication links, perennial sources of water supply etc. must be obtained. Suitable site plans indicating accessibility, transport links in the regional context and identifying sources of raw materials etc. for the various alternatives under consideration should be incorporated in the PFR.

2.7.5.2 As the integrated steel plants have an extensive areal extent and once established should have a fairly long lease of life it would be pertinent that the site selected should have been explored for any subsurface mineral occurrences and in case fairly large deposits of any valuable mineral exist the relative merits of mining the deposit and erecting a steel plant at the site needs to be evaluated.

2.7.6 Availability of Raw Materials and Fuel :

2.7.6.1 As the steel plants normally require large quantities of ores and fuel, the possible sources of supply must be identified within a reasonable range mainly because large time lags are involved in developing these sources. PFR should give details about the reserves, the degree of reliability, status of geotechnical investigations and likely time in which these sources can be developed either captively or non-captively. Some of the ores and coking coal may have to be beneficiated or washed. The status of project preparation in regard to washeries and beneficiation plants would need to be indicated. The alternative sources and possibilities of imports would also have to be kept in view in case of any hitch in developing identified sources. Since the quality of coking coal is by and large poor with high ash content, it has now become a practice to meet a part of coking coal requirements through imports. A broad idea of coal blend and possible sources of import of coking coal should be identified. The quality requirements of low silica limestone is becoming increasingly stringent and sources of supply for the same should also be identified.

2.7.6.2 The quantitative requirements and specifications of various raw materials should be worked out based on preliminary material flows for the various technological, locational and sizing alternatives. The site selection should be based on optimisation models using operations research tools as large quantities of raw materials and finished goods have to be transported.

2.7.6.3 As captive generation of power is a must in a steel plant, possible sources of supply of non-coking coal should have also been identified.

2.7.7 Infrastructural Requirements :

Because of the very large requirements of infrastructural facilities like water from a perennial source, power and transport links including port development, these should be assessed and indicated together with the likely availability and shortfalls, if any, and the measures to meet the shortfalls should also be highlighted for comparative analysis of various macro-alternatives.

2.7.8 Linked Projects :

With strong backward and forward linkages, ferrous metallurgical plants often depend upon linked projects for their smooth integrated development. These projects should be identified so that appropriate measures could be taken for their proper planning and synchronisation with the metallurgical plant.

2.7.9 Environmental Aspects :

Since the requirements of land for the metallurgical plant are fairly large with strong infrastructural and raw material links, some of which may be planned to be procured captively,

it would be pertinent to obtain site clearances for the captive mines as well as the plant areas separately.

2.7.10 Basic Engineering :

Project specifications should include broad details about the specific choice among various macro-alternatives based on the following:

- a) Tentative plan of civil works, technology, topography of project location.
- b) Tentative plant layout.
- c) Broad specification of material and process flows.
- d) Material handling arrangements, both at captive sources of supplies as well as at the plant site.
- e) Essential infrastructural requirements and availability.

2.8. Process Industries Projects :

2.8.1 Demand-supply Analysis :

A broad assessment of demand-supply of the product at the national and regional level and areas where the product would be absorbed needs to be made, particularly in the case of fertilizer projects (such as single super phosphate, diammonium phosphate-DAP or nitrophosphates), oil refining/gas refining projects, insecticide/pesticide projects. In the case of petrochemical and organic chemicals including dye stuff, the projections of demand may be based on analysis of trends and growth in consuming/end using industries. Assessment of demand for drugs and pharmaceuticals has to be based on population growth, targets for reducing the morbidity and mortality rates etc. In order to take advantage of economies of scale as well as meeting the requirements of minimum economic size, the possibilities of exports based on assessment of international trade, availability and consumption should also be studied. If a new product is to be introduced in the market, a preliminary market survey would be necessary.

2.8.2 Technological Necessity :

Most of the process industry plants involve handling and processing of corrosive chemicals. Health study is thus very pertinent in case the old plant fails to achieve rated capacities. Even in the case of modernisation/technological upgradation and capacity expansion proposals, health study of existing units should be carried out so as to ensure optimum capacity utilisation after the project is implemented.

2.8.3 Location & Site Conditions :

The location of process industry projects should be decided on the basis of relative technoeconomics of siting the plant near the consumption centres or near the source of feedstock taking into account the cost of transporting the feedstock through road/rail/pipeline etc. to the plant site or the product to the consuming centres. Comparative assessment of these locational alternatives should be based upon the survey of prospective locations to assess the availability of land, infrastructural facilities, the possibilities of effluent disposal and other environmental factors besides the availability/movement of feedstock and other critical inputs, chemicals and catalysts.

2.8.4 Raw Material Availability :

The source, composition and quality of feedstocks, quantity available and identification of likely projects involving transport of feedstock (if plant is to be located away from source) and/or possibility of its imports have to be assessed in order to decide the merits of various macro-alternatives. Availability of other critical inputs, chemicals and catalysts also needs to be evaluated.

2.8.5 Technology/Process Options :

Sufficient information should be collected about all alternative technologies to allow comparative techno-economic analysis and assess the requirements of feedstock and chemicals etc., for each alternative. All available processes should be surveyed to identify a short list for more detailed studies and investigations for stage II proposal. Implications of various processes in terms of energy costs, level of pollution and environmental hazards should be specially evaluated in carrying out the relative techno-economics of various alternatives. Relative economics of alternative feedstocks would also have to be studied wherever such choice is available.

2.8.6 Infrastructural Requirements :

Broad assessment of requirements and availability of important infrastructural facilities such as water, power, and transport facilities should be made for various alternative processes, technologies and locations to arrive at appropriate choice of alternative as well as to assess the need for captive generation, preferably based on cogeneration principle if there are large requirements of steam.

2.8.7 Basic Engineering :

The following should be specified for process industry projects at the first stage:

- a) Feedstock to be used
- b) Process route
- c) Broad product-mix
- d) Location
- e) Size of major facilities
- f) Infrastructural requirements.

SALIENT FEATURES OF THE PROPOSAL

A. Identification Characteristics:

1. Name of the project:
2. Location (District/State)
3. Implementation Agency
4. Department/Ministry sponsoring the project
5. Sector
6. Objectives/nature of project (Grassroot/expansion/
replacement/ rehabilitation/modernisation).

B. Physical Characteristics of the project:

(Units to be specified)

1. a) Installed capacity proposed
b) Production at ___ % capacity utilisation.
2. Principal raw materials and energy requirement
at the proposed capacity utilisation.
 - a)
 - b)
3. Linkages of raw materials /utilities
4. Linkages of finished product
5. Technology requirements
 - a) Indigenous
 - b) Foreign
6. Additional Employment generation
(No. of posts)

C. Details about First stage clearance proposal:

1. Cost of studies and investigations/DFR preparation
2. Time frame
3. Financing pattern
4. Plan provision

(contd.)

D. Financial & Economic parameters (Units to be specified):

1. Total Capital cost
2. Foreign exchange component
3. Interest during construction (incl. in D-1)
4. Exchange rate
5. Basis and degree of reliability of cost estimates
6. Annual operation and maintenance cost
7. Sales turn over
8. Proposed funding arrangement for indigenous cost and FE

E. Likely Gestation period:

(from date of sanction)

F. Likely Year of full capacity utilisation:

(after date of commissioning)

G. Expected life of project:

H. Evaluation Indices:

1. Financial IRR/NPV at specified discount rate.
2. Economic IRR/NPV at specified discount rate.
3. Domestic Resource Cost
4. Break Even Point
5. Payback period.

ANALYSIS OF DEMAND AND SUPPLY

Unit of measurement:

Base date (month & Year):

*

Name of Product.....

Year Year Year Year

1. Demand

2. Supply

a) Capacity available with the public
sector undertaking

. Existing

. Under implementation

Total (a)

b) Capacity available with other organisations

(public / private / joint sector)

. Existing

. Under implementation

Total (b)

c) Likely production from 2 (a)

d) Likely production from 2 (b)

e) Total production (c+d)

(contd.)

3. Gap between demand and supply [1-2(e)]
 4. Capacity approved/licensed but implementation not yet started
 5. Capacity proposed as per present proposal
-

* Separate statements may be furnished for each major product in case the project involves production of more than one product.

- Note:
- i) Projections should be given for the base year, year of commissioning of the project and terminal years of the current as well as next five year Plans.
 - ii) The basis of the projections should be spelt out clearly.
 - iii) Where relevant and available, plant wise break-up may be given for capacity/production.

ITEMWISE BREAKUP OF CAPITAL COST, OPERATION & MAINTENANCE COST AND VALUE OF OUTPUT

Unit of measurement :

Base date (month & Year):

Exchange rate:

Item	Unit	Qty.	Market Price	Financial Cost			Economic Cost	
				IC	FC	Taxes & duties in IC	Economic Cost	
							IC	FC
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

A. Capital Cost

- 1. Land, buildings & Civil construction
- 2. Plant & Machinery [1]
- 3. Environment related cost
- 4. Others

Total

B. Operation & Maintenance cost at full production @

- 1. Raw materials
- 2. Repair & Maintenance
- 3. Energy
- 4. Wages [2]
- 5. Environment related expenses
- 6. Others

Total

(contd.)

Name of Product	Unit	Qty.	Market prices	Value of output		
				Financial	Economic IC	FC
1	2	3	4	5	6	7

C. Total Value of Output at full production

- 1.
- 2.
- 3.

Total

* In case a number of Foreign Currencies are involved the amount and the exchange rate assumed may be specified separately.

@ In case project involves more than one product, the O & M cost would need to be furnished separately for each major product.

For all traded and tradable items the economic cost would be fob / cif prices and internal transportation cost. For non-traded/tradable items, this will be social opportunity cost/ economic cost of production/market price excluding taxes, duties and subsidies and any other transfer payments.

Note : IC indicates the indigenous component and
FC the Foreign component.

[1 : includes cost of pollution control, pollution monitoring facility, green belt development, afforestation and rehabilitation.

[2 : includes expenses on maintenance of pollution control equipment, green belt etc.

CASHFLOW STATEMENT FOR CALCULATION OF INTERNAL RATE OF RETURN**(Separate statements for financial and economic rates of return for different alternatives)**

Alternative

Base date (month & Year):

Exchange rate:

(Rs. crores)

YEAR	CASH OUT FLOW									CASH INFLOW/ Value of output			
	Capital Cost			O & M Cost			Total			IC	FC	Taxes and duties in IC	
	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC				
1	2	3	4	5	6	7	8	9	10	11	12	13	
1.													
2.													
3.													
.													
.													
N													
Total													
NPV _____, Financial IRR _____, Economic IRR _____, DRC _____													

Note: i) Interest during construction (IDC) will be excluded from cols. 2 and 3. Depreciation will be excluded from col. 5. Interest on Working Capital will, however, be included in col.5.

ii) Recovery of salvage value is to be shown in N+1th year. Replacement cost of capital nature, if any, not included in the annual O&M cost should be shown in the capital cost column against the appropriate years.

iii) For economic analysis the capital and operation and maintenance cost should be taken at their economic values (as given in DFR 1.3) and after using premium/shadow prices for foreign exchange, labour etc., as may be specified by the Government from time to time.

BREAK UP OF COST FOR STUDIES, INVESTIGATIONS AND PREPARATION OF DFR

Unit of measurement:

Base date (month & Year):

Exchange rate :

Item	Amount (Rs lakhs/crores)		
	IC	FC	Total
1. Soil & other investigations, surveys			
2. Environmental Impact Assessment (EIA)			
3. Acquisition of land (in hectares) (if any)			
4. Basic engineering(if any)			
5. Employment of consultants for preparation of DFR			
6. Process knowhow fees			
Total:			

(Rs. crores)

Source of funding for studies & investigations & preparation of DFR	Budgetary Resources	Extra Budgetary Resources		
		Internal Resources	Direct Credit	Borrowings
IC				
FC				

Plan Provision	Amount (Rs. crores)
Five Year Plan	
Annual Plan for	

Note: IC = Indigenous Component

FC = Foreign Exchange Component

AVAILABILITY/QUALITY OF CEMENT GRADE LIMESTONE

(For Cement Projects)

1. Type of Limestone Deposit: Geologically Simple/Complex/Intricate.

(CRI Classification)

- Leasehold/freehold
- Type of Lease & Prospecting/mining
- Types of Limestone bands

2. Details about the prospecting/exploration work:

- a) Surveying
- b) Surface Geological Mapping (Nature of outcrops)
- c) Pitting and Trenching (if any)
- d) Drilling (Agency-wise)

	Core drilling	DTH drilling	Others
--	---------------	--------------	--------

 - Drilling Pattern & density
 - Meterage & number of holes
 - Depth to which limestone explored
 - Core recovery
 - Whether sludge samples collected
- e) Exploratory mining (if any)
- f) Sampling (Agency-wise)
- g) Whether any other minerals of potential value present besides cement grade limestone?

3. Block-wise Reserves

Q uantity

Grade (%)

(CRI Norms/GSI

Standard Terminology)

CaO	MgO	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	LOI	

a) Geological -(In situ grade)

- Proved (measured), if any
- Probable(Indicated)
- Sub-total: Demonstrated
- Possible (inferred)

(contd)

- b) Mineable (Demonstrated)
(ROM grade)
 - c) Degree of reliability
of reserves
 - d) Minor Constituents
(Below/above specified
limits)
4. Testwork carried out, if any:
 5. Preliminary estimates of LSF,
Silica and Iron Moduli -
 - Whether or not additives
required?
 6. Overburden/Waste rock volume:
 7. Mining Method envisaged:
 8. Preliminary Stripping Ratio:
 9. Proposed exploitation rate:
 10. Life of Demonstrated reserves
at contemplated exploitation rate:
 11. Planned Programme of exploration/prospecting/testwork:
 - a) To be carried out before Stage II approval :
 - Exploration
 - Testwork
 - b) To be carried out before commissioning
and during operational mining:

**DATA ON LOCATION, SITE CONDITIONS AND INFRASTRUCTURE
REQUIREMENTS FOR THE PROPOSED ALTERNATIVE
(For Cement Projects)**

1. Type of Project: Portland Cement, slag/fly ash cement.
2. Locational Characteristics:
 - a) Likely mode of implementation: Integrated/split location
 - b) Likely location of -
 - Clinker plant/quarry
 - Cement grinding unit
 - Slag grinding unit (if required)
3. Baseline data on

Clinker Plant	Cement Grinding Unit
	(If split location)

 - land use
 - water use
 - salient demographic features
4. Accessibility & Transport links
5. Infrastructure and Raw material requirements:
 - Quantity and grade of coal required
 - Likely sources of coal
 - Transport requirements
 - Power requirements
 - Whether captive generation envisaged

ANALYSIS OF MINE/CONCENTRATOR/SMELTER/REFINERY CAPACITIES

A. ORE-CONCENTRATE BALANCE (Mine field-wise)

(For the last 5 years and projected for terminal years of current and next five year plans)

I. CONCENTRATOR CAPACITY (Public/private/joint sector)

(in terms of throughput and grade of concentrate)

	Year		Year		Year	
	Q	G	Q	G	Q	G

a) Existing Plants

b) Plants under
implementation

c) Plant under
appraisal

Total capacity(throughput)

Average capacity utilisation

Actual/projected production
of concentrate

II. MINE CAPACITY

(in terms of ROM ore per day)

a) Existing Mines

b) Mines under implementation

c) Mines under appraisal

Total capacity:

Actual/projected annual production
of ROM ore:

Export of ROM ore (if any):

Net available for treatment:

(contd.)

Number & type of concentrates produced:

Average recovery in the concentrates

(for each metal in the ore):

Average concentration ratio

(for each metal in the ore):

Actual/projected production

of concentrate(s):

III. Details about mismatches in mine-concentrator

capacities (if any):

B. SMELTER-CONCENTRATOR BALANCE (Metal-wise)

(for the last 5 years and projected for terminal

years of current & next five year Plans)

(Similar information may be furnished in case of roaster/ calcination plant)

I. SMELTER CAPACITY(Plant-wise)

(Public/Private/Joint Sector)

Year

Year

Year

a) Existing smelters

b) Smelters under implementation

c) Smelter(s) under appraisal

Total capacity (crude metal)

Average capacity utilisation:

Actual/projected production of crude metal:

Average recovery of metal in smelter:

Total concentrate used/required:

Imports of concentrate (if any):

Net requirement of indigenous concentrate:

II. CONCENTRATOR CAPACITY (Plant-wise)*

(in terms of metal content)

a) Existing plants

b) Plants under implementation

(contd.)

c) Plant under appraisal

Total Concentrate capacity:

Actual/projected production of concentrate:

Export of concentrates:

Toll smelting of concentrates(if any):

Net available for treatment:

III. Details about smelter-concentrator linkages including

distances involved and mismatch in capacities:

C. SMELTING-REFINING BALANCE

I. Refining Capacity (Plant-wise)

a) Existing plants:

b) Plants under implementation
other than under appraisal:

c) Plant under appraisal:

Total capacity (refined metal):

Average capacity utilisation:

Actual/projected production of refined metal:

Average yield:

Total crude metal used/required:

II. AVAILABILITY OF CRUDE METAL

a) Actual/projected production
of crude metal (as per smelter
concentrator balance:)

b) Crude metal not required to
be refined:

c) Net crude metal to be refined:

III. Details about refinery-smelter linkages and

mismatch in capacities:

* For aluminium metal the relevant item is alumina plant capacity.

**GEOTECHNICAL PARAMETERS OF METAL, MINING/
& OTHER NON-FERROUS METALLURGY PROJECTS**

1. Type of Ore Deposit: Stratiform/massive/disseminated/ vein type etc.
 - Geological parameters: Strike length/depth/average width/shape/complexity etc.
 - Leasehold/freehold
 - Type of lease (Prospecting/mining)
 - Ore types and their distribution in the deposit
2. Details about Exploration Work: (Review of work done on the deposit by various agencies)
 - a) Geological/Geophysical/Geochemical Surveys -
 - Airborne
 - Ground surveys
 - b) Details of anomalies, if any.
 - c) Surface geological mapping
 - d) Surveying
 - e) Pitting & Trenching (if any)
 - f) Drilling (Agency-wise and campaign-wise)

	Core drilling	DTH drilling	Others
- Drilling pattern & density			
- Meterage & number of tools			
- Depth to which deposit explored			
- Whether open or closed at depth			
- Core recovery			
- Sludge samples collected			
- Borehole deviations (if any) measured			
 - g) Exploratory Mining (if any)
 - h) Details of sampling (Agency-wise) including check sampling, if any.

(contd.)

3. Salient features of the Mine:

PFR - 9(contd.)

a) Estimation of Geological Reserves

Quantities of Ore (region/area/block/benchwise)	Estimating Agencies		
	1	2	3
i) Blocked (positive)			
ii) Proved (Measured)			
iii) Probable (Indicated)			
Sub-total : Demonstrated			
Possible (Inferred)			
Total:			

b) Bulk density

c) Method of Reserve estimation used

d) Cut-off grades assumed:

i) Geological/natural/assay

ii) Economic

e) In situ grade (metal wise): (Arithmetic/geometric mean)

f) Degree of reliability of ore reserves

(based on conventional/geostatistical analysis)

g) Proposed mining method(s)

- Underground - Probable stoping method

- Open cast - Probable stripping ratio/

overburden/waste rock removal

h) Mineable reserves

i) ROM grade (Metal-wise)

j) Mine Capacity

k) Capacity build up

l) Life of the Reserves

m) Grade of Concentrate(s)

n) Annual production of concentrate(s) at full capacity

o) Recovery of concentrate(s)

(contd.)

- p) Smelter/Roaster/Calcination plant recoveries
- q) Annual Production of Metal(s)/roasted/calced products at full capacity
- r) Details of metallurgical testwork(roasting/calcedination/ other metallurgical) done (if any):
 - Laboratory Scale/Bench Scale/Pilot Plant Scale.
 - Chemical & Mineralogical analysis of -
 - i) Ore
 - ii) Concentrate(s)/roasted/calced products
 - iii) Metal Distribution
 - iv) Beneficial/deleterious constituents present in concentrate/ roasted/calced products.

4. Salient features of the Mill(Concentrator/Beneficiation Plant)

a) Where will the ore be treated?

- Existing mill
- New mill

b) Details about Ore Milling:

	If treated in	
	Existing Mill	New Mill
A. Capacity of Mill		
B. Supply of Ore		
i) from existing and approved mines		
ii) from unapproved mines other than mine under appraisal		
iii) from mine under appraisal		
Total supply:		

5. Salient features of the smelter (Metallurgical Plant):

- a) Where will the concentrate(s)/ore be treated (roasted/ calced/smelted)
 - existing smelter/metallurgical plant (name the linked smelter/plant)
 - toll smelted abroad
 - exported (quantities)

(contd.)

b) Details about the smelter(s)/metallurgical plant:

	If treated in	
	Existing Smelter/ plant	New Smelter/ plant
A. Capacity of the plant(s)		
B. Supply of concentrates		
i) from existing and approved mines/mills		
ii) from unapproved mines/mills other than mine/mill under appraisal		
iii) from mine/mill under appraisal		
Total supply:		
C. What is the minimum economic size of smelter/ roaster/ calcination plant ?		
D. Whether import/export/toll smelting required to avoid mismatches in smelter/concentrator capacities?		

6. Salient features of the Refinery

- a) Where will the crude metal be refined?
 - existing refineries
 - new refinery

b) Details about refining plant:

	Existing refinery	New refinery
A. Capacity of Plant(s)		
B. Supply of crude metal		
a) from existing and approved smelters		
b) from unapproved smelters other than smelter under appraisal		
c) from smelter under appraisal		
Total supply:		

(contd.)

7. Details about downstream units (if any):

a) whether production facilities beyond

primary refined metal required:

i) continuous casting - billets/strips/sheets

ii) Rolling - hot rolling/cold rolling coils

- wire bars

- structurals

iii) Extrusions

iv) Die casting

b) If so, details about existing capacities/

capacity under implementation and

under appraisal:

8. Planned Programme of exploration/testwork:

a) To be carried out before stage II approval:

- Exploration

- drilling

- mine development

- Metallurgical testing

b) To be carried out before commissioning

and during operational mining:

CHAPTER 3

STUDIES AND INVESTIGATIONS

3.1. INTRODUCTION

3.1.1 The adequacy of feasibility report for acceptance of a project in principle or the DFR as a basis for investment decision is largely determined by the thoroughness of the studies and investigations that forms the basis for the preparation of the feasibility report/DFR.

3.1.2 It is understood that at the time of first stage clearance, either by the Committee of PIB or by the respective Ministries under their delegated powers, all the technically feasible macro alternatives, i.e., alternatives to the proposal, in regard to location, size, capacity, technology, product-mix, process, feedstock etc., in achieving the objective would have been adequately examined in choosing a particular macro alternative. At the time of stage II clearance, therefore, only the micro alternatives i.e., alternatives within the proposal relating to a few components in the project in terms of technology, process, product-mix, scale of operation and other techno-economic parameters of project design and linkages would be considered.

3.1.3 The studies and investigations required for a second stage clearance have to be thorough enough to ensure that major changes in project design (plant size, configuration of equipment, mine size and method of quarrying limestone etc., for a cement plant, for example) and consequent variance in cost estimation do not occur once the investment decision is taken.

3.1.4 The scope of studies and investigations would depend not only on the project type (green field site and/or grassroot plant, capacity expansion, modernisation, technological upgradation/debottlenecking etc., as an integrated plant or as some unit(s) in the integrated plant) but also on the degree of integration and complexity. Much wider scope and more exhaustive studies and investigations would be necessary for green field site/grass-root plants and projects marked by higher degree of integration and/or complexity particularly in regard to demand- supply analysis, marketing plan, site investigations, infrastructural requirement and basic engineering. In the case of expansion and modernisation/debottlenecking projects the emphasis may shift to performance of the existing plant and technologies, analysis of the operations "with" and "without" the proposed modernisation/expansion instead of site investigations/ vendor development so vitally important in greenfield/grass root plants. Certain industries would also require specific types of investigations such as availability/quality of raw materials, ancillarisation/PMP, estimation of reserves, beneficiation, metallurgical and other technological assessment, etc. Studies and investigations discussed below are of a broad indicative nature, the actual depth, detail and scope would depend on the nature and scope of project and technology selected.

Sector Specific Studies & Investigations required to be carried out before Stage-II Clearance.

3.2. CEMENT INDUSTRY PROJECTS :

3.2.1 Limestone is the basic raw material of a cement plant normally mined captively and its location thus determines the ultimate siting of the cement plant. The cost of cement production depends to a large extent on the limestone raising cost besides the cost of coal and power. However, the capacity of the plant is governed by the economies of scale, the demand- supply pattern and the cost of distribution and selling etc.

3.2.2 Studies and investigations required for the formulation of cement projects, pertain mainly to the following:

- a) Market survey and demand-supply analysis at the local, regional and national level.
- b) Locational analysis.
- c) Product-mix analysis.
- d) Geotechnical investigations of limestone deposit(s).
 - delineation of shape, size and extent of deposit(s).
 - technological assessment of suitability for limestone manufacture.
 - Assessment of availability and quality of slag/fly ash and/or other additives to cement.
- e) Mining method and equipment configuration.
- f) Capacity Analysis.
- g) Technology & Process Selection.
- h) Other surveys and studies -
 - Land Acquisition.
 - Railway siding and line capacity survey.
 - Infrastructural facilities.
 - Environment Management Plan for Limestone quarry/cement (clinker) plant.

These are discussed in the following paragraphs:

Demand-Supply Analysis :

3.2.3 Detailed assessment of marketing plan in the context of national and regional demand scenarios should be supplemented by market surveys, if necessary, explicitly bringing out the costs of marketing and distribution , particularly in the competitive environment for the non-levy cement. The choice of single or split location for clinker/grinder units made at the time of first stage clearance should be reconfirmed based on these studies.

Technological Necessity/Health Study :

3.2.4 The necessity of technological upgradation/modernisation/ debottlenecking/replacement proposals should be based on health study of the plant or on the studies concerning introduction of new technologies to replace outdated and obsolete technologies bringing out the specific advantages of the proposed programme.

Location & Site Conditions :

3.2.5 Detailed topographical survey and soil investigations including load bearing characteristics, hydrology and seismicity of chosen site(s) would be carried out to establish basic parameters for estimating the quantity of earth work, design and type of foundations, design of structures and facilities and to finalise the layout plan. This may require drilling of boreholes upto about 20 M depth or refusal whichever occurs earlier and standard cone penetration test (dynamic and static) be performed at 2 M intervals. Soil should be collected from boreholes for performing standard laboratory tests. Besides plate load tests, field permeability tests (variable and constant head) should be performed. Fluctuations in ground water table should be recorded. Route surveys for the railway siding will also be necessary.

3.2.6 Location of suitable non-mineralised ground or failing which suitable land beyond the final quarry limit (based on life of the quarry) of requisite size and area is essential for duraping of over-burden and waste rock dumps. Identification of such ground near the quarry area is essential not only for scientific and systematic mine planning but also for environmental control through early and simultaneous stabilisation of these dumps as soon as formed to their final shape and size. Land for the proper layout of approach roads assumes importance in hill areas.

3.2.7 For preparation of the mine plan and detailed report, environmental audit as an information base and environmental management plan (EMP) as an integral part of the overall mine plan is an essential pre-requisite. Baseline data on land use, water use, demography, hydrology, air quality and meteorological data for atleast 4 seasons etc., would be required for preparation of comprehensive EIA. For further details reference may be made to the guidelines issued by the Department of Environment.

3.2.8 The area proposed to be acquired for the quarry, plant and offsite facilities would need to be surveyed for establishing ownership, number of displaced persons, rehabilitation measures required etc. as per the guidelines issued by the Ministry of Home Affairs (MHA), if the project is to be set up in tribal areas.

Limestone Availability & Quality :

3.2.9 Major geotechnical investigations must be completed before forwarding stage II proposal either by the project authority or other exploration agencies such as GSI/State Directorate of Geology and Mining/Mineral Exploration Corporation etc. Efforts should be made to collect all previous geo- technical information available with different agencies and integrated with any fresh investigations carried out by the project authority as per the schedule indicated in stage I proposal.

i) The prospecting work carried out should correspond to "Phase III Detailed Exploration" of CRI Norms as described in CRI publication SP-9-81 entitled "Norms for Proving Limestone Deposits for Cement Manufacture".

ii) Depending upon the complexity of the deposit (simple, complex or intricate as per CRI classification) contoured geological and topographic maps on suitable scale (1:4000 for simple, 1:2000 for complex and 1:1000 for intricate deposits) should be presented. Closer spaced drilling on definite section lines or grid pattern should be carried out with spacing and quantum being:

a) Simple deposit - 200 to 300 m (12 to 15 m/mt).

b) Complex deposit - 100 to 200 m (20 to 80 m/mt).

c) Intricate deposit - 50 to 100 m along strike and 50 m

along dip direction (100 to 150 m/mt).

Core drilling may be supplemented by DTH drilling, pitting, trenching and exploratory mining, if warranted by local geomining conditions, to assess the limestone reserves in the demonstrated category (proved and probable) at least to the extent of 70-75% of total mineable reserves required for the life of the project at contemplated scale of operations of which reserves in proved (measured) category should be about 25-35%. Actual spacing and quantum of drilling may be modified based on geostatistical analysis of available exploration data.

iii) Depending upon the degree of lithological homogeneity and dip of the limestone bands the sampling intervals (1 to 5 m) would be decided for preparation of core samples.

Sludge samples are required to be prepared wherever core recovery is poor. Composite samples may be prepared wherever feasible. All samples would be analysed for the six major constituent radicals, namely, CaO, MgO, SiO₂, Al₂O₃, Fe₂O₃, and LOI to enable determination of LSF, iron and silica moduli of the raw mix but in 10% samples minor constituents viz., P₂O₅, SO₃, Cl, Na₂O and K₂O would also be analyzed to determine whether or not these constituents would result in harmful effects on plant and equipment.

iv) Investigations should be thorough enough to delineate the shape, size and extent of limestone deposit and its suitability for cement manufacture. Geological data such as core recoveries and petrographic characteristics should be analyzed to find out whether or not the quality of limestone can be upgraded through simple beneficiation techniques. This is important in those cases where existing plant capacity is sought to be expanded but limestone reserves of required specifications are not sufficient to sustain the project for 20 year life unless additional reserves can be delineated by considering beneficiating grade limestone. This is particularly pertinent in case where only mechanised/semi-mechanised methods are to be deployed.

v) Besides limestone, selected samples of soil, clay, associated overburden and waste rock would also be analyzed for determining their suitability for use as additives. If required deposits of shale, clay, laterite etc., may be located to obtain suitable additive material.

vi) Technological assessment of the limestone deposit should be made by determining compressive strength, bond work index, porosity, mineralogical and petrographic analysis, free silica and raw mix designs etc., by tests on bulk samples.

vii) Assessment of availability and quality of slag/fly ash and/or other additives should also be made.

Establishment of Coal Linkage :

3.2.10 Linkage of coal fields for the proposed plant has to be established based on analysis of-

a) Year-wise coal requirement.

b) Potential of linked coal field in terms of proven reserves of required grade of coal.

c) Characteristic parameters of linked coal block covering moisture content, volatile matter, proximate analysis of coal and its physical and chemical properties.

d) Status of formulation and approval of specific coal mines linked to the cement project, their year-wise production programme and likely availability for the proposed project.

Infrastructural Requirements :

3.2.11 Detailed analysis of transport requirement of the project for movement of coal, cement, slag/fly ash (if relevant), railway line capacity already available and planned for the project as well as status of specific line capacity works on the relevant routes should be presented.

3.2.12 Detailed assessment of likely availability of power at plant site based on the status of generation and transmission projects in the power system should be made. Assessment would thus be made for necessity or otherwise of captive power generation. The route and design for the feeder line would be firmed up.

Basic Engineering :

3.2.13 The basic engineering carried out for Stage II proposal should allow the following to be specified unambiguously -

- a) Mine plan for the limestone deposit indicating the quality of run-of-mine (ROM) limestone.
- b) Mode of movement of limestone and basic design of facilities required - Route alignment of road haulage/ropeway/rail belt conveyors etc.
- c) Layout of the plant, township and quarry.
- d) Sizing and basic design of all major items like raw mill, precalcinator, kiln, cement mill etc.
- e) Basic design of electrical facilities.
- f) Arrangement for coal handling.
- g) Route of railway siding.
- h) Arrangements for packaging and cement despatch.

3.2.14 The information on various aspects discussed above is to be given as per the formats DFR-1.1.1& 1.1.2.

Environment Clearance/Environmental Management Plan (EMP):

3.2.15 Separate clearance for mine and the cement plant facilities would be required for which EIA and EMP would need to be prepared evaluating the hazards/adverse effect of mining limestone and working of cement plant as per the guidelines of the Ministry of Environment & Forests. The requirement of funds under EMP are to be specified and its phasing indicated.

3.3. PULP & PAPER INDUSTRY PROJECTS :

3.3.1 Fibre materials, both forest-based and agro-based are the basic raw materials of Pulp and Paper Industry. The location of the plant and its capacity and configuration, therefore, is determined by the availability of raw materials besides the satisfaction of demand at the regional level to minimise the cost of transportation of raw materials to the plant site and finished products to consumption centres.

3.3.2 Studies and investigations required for the formulation of pulp and paper projects, pertain mainly to the following:

- a) Market survey and demand-supply analysis at the local, regional and national level.
- b) Availability of raw materials.
- c) Location analysis - site selection.
- d) Product-mix analysis.
- e) Availability of inputs and chemicals.
- f) Capacity analysis.
- g) Pilot plant tests on furnish composition.
- h) Technology and Process selection.
- i) Transport & Infrastructure requirements.

j) Other survey and studies:

- Infrastructural facilities.
- Hydrology/Ground water studies for water supply.
- Railway siding and line capacity surveys (if available).
- Land acquisition.
- Environment management Plan for Pulping and Paper units/Integrated plant/transport of bagasse/raw materials by rail/road.

Demand-Supply Analysis :

3.3.3 Detailed assessment of demand-supply of the product-mix should be made at the national and regional level supplemented by market survey of the product i.e., various types of pulp, varieties of paper and paper board planned to be manufactured. Market survey is essential in the case of speciality/high quality paper and paper board to make precise estimation of the past pattern and growth for their consumption for projecting their future requirements with greater reliability.

Technological Necessity :

3.3.4 The necessity of technological upgradation/modernisation/ debottlenecking/replacement proposals should be based on health study of the plant or on the studies concerning introduction of new technologies to replace outdated and obsolete technologies bringing out the specific advantages of the proposed programme.

Site Investigations :

3.3.5 Besides the availability of land, water and power supply influencing the locational choice, other critical inputs and chemicals, infrastructure and required transport facilities to move the raw materials would have to be studied. The facilities for the disposal of effluents, availability of railway siding, highways etc. would also need to be analyzed.

3.3.6 Besides soil investigation fairly substantial geotechnical investigations need to be carried out for proposed site to determine the parameters required to firm up the quantity of earthwork, types of foundations required and design of structures and facilities as already outlined for cement projects to finalise the layout plan.

Availability & Quality of Raw Materials & Chemicals :

3.3.7 An independent survey of the availability of forest based raw materials should be conducted and commitments about it should be obtained from appropriate agencies. The ratio of specific species of forest raw materials (hardwood/bamboo) should be investigated. The quality of forest wood should be examined in the context of the technology proposed to be adopted and the type of paper/paper board to be produced. An independent agency should be entrusted to prepare a report on forest resources which should include industry-oriented management plan as well as logging, harvesting and regeneration plan.

3.3.8 In case bagasse forms a significant part of raw material mix, transport requirements for moving the available material would be firmed up by studying the distances between sugar mills and the proposed project location. The problems of providing coal in lieu of bagasse and the willingness of owners to spare it would have to be studied in depth.

3.3.9 In case deinked pulp (DIP) is to form a significant proportion of the furnish, long term availability of used newspapers/waste paper either from domestic or international sources would have to be studied. In the case of using domestic raw material for DIP, the mechanism for ensuring efficient collection from various sources such as libraries, offices and houses etc., would have to be studied as the used newspapers must not be more than six months old.

3.3.10 Pilot plant testing of the raw materials for designing an appropriate suitable furnish composition, particularly in the case of newsprint, needs to be carried out especially if bagasse is considered a significant component of raw material mix to firm up the design parameters of the pulping plants.

3.3.11 Availability of inputs and chemicals such as caustic soda, chlorine, salt cake, resin, soda ash, lime, alum, etc., in required quantities would have to be ensured. If captive caustic soda/chlorine facilities are planned, the availability of inputs for these plants as well as for the boiler and water treatment plants would also need to be ensured. Quantity and sources of supply of various inputs would need to be specified.

Technology :

3.3.12 The basic sizing decisions and specification of major units such as the pulping plants should be made based on the furnish composition and choice of technology, particularly in the case of newsprint. Process flow sheets and materials balance should be developed based atleast on bench scale tests on furnish composition and quality of paper produced, but preferably on pilot plant tests.

Coal Availability and Quality :

3.3.13 Linkage of coal fields for the proposed plant has to be established based on analysis of -

- a) Year-wise coal requirement.
- b) Potential of linked coal field in terms of proven reserves of required grade of coal.
- c) Characteristic parameters of linked coal block covering moisture content, volatile matter, proximate analysis of coal and its physical and chemical properties.
- d) Status of formulation and approval of specific coal mines linked to the paper project, their year-wise production programme and likely availability for the proposed project.

Infrastructure Requirements :

3.3.14 Important infrastructure requirements need to be studied are:

Water : Being one of most important requirements of a paper project, its availability in adequate quantity and quality at reasonable price has to be ensured. An in-depth water analysis study needs to be conducted and a detailed water supply scheme prepared indicating the source of supply, its quality and treatment facilities required, capital and operating costs etc.

Power : Detailed assessment of power availability would be required keeping in view the regional demand and availability of power/energy. The route and design of the feeder line will have to be established. The necessity of captive power generation will also have to be assessed keeping in view the peak/average power demand of the plant and power situation in the State/region, preferably on combined cycle multi-fuel boiler since steam is also required to be raised to meet plant

requirement and forest wood/bagasse waste/rejects and plant residues can also be incinerated. Energy conservation wherever possible has to be kept in view in assessing the power requirement. **Roads :** For efficient extraction and transportation of forest raw materials a good road network both within the forest areas and from the forest to project site needs to be developed. Proper arterial roads within the forest inter-connecting the major loading points to State/National Highway or the approach roads leading to the project should be developed. Feeder roads/tracks linked to the arterial roads in the forest are also required to be developed. Survey needs to be carried out to plan these networks suitably.

Railways : Rail head near the project site is essential. If it is not existing, the project site may have to be linked to the nearest rail head. Railway siding may have to be provided to facilitate the receipt of raw materials and despatch of finished product.

Township : Guidelines issued by the Government where applicable may be kept in view if the township is required to be developed.

Basic Engineering :

3.3.15 The basic engineering should have proceeded to a stage at which the following can be specified clearly:

- a) Tie up of technology if planned to be imported.
- b) Detailed plan of procuring adequate raw materials and chemicals.
- c) Mode of movement of raw materials and basic design of facilities required.
- d) Layout of plant, sizing and basic design of all major units/sections of the plant.
- e) Electrical line diagram.
- f) Arrangement for pollution control.
- g) Route of railway siding.
- h) Arrangement for power and water supply.

3.4. ENGINEERING INDUSTRIES PROJECTS :

3.4.1 Engineering industries can be broadly classified under three heads:

- a) Capital goods industries (such as machineries of all types, pumps, compressors, well-head platforms, radars, etc.)
- b) Intermediate goods industries (such as refractories, cables, switching equipment, optical fibres, ophthalmic glass etc., components industries, industrial and microelectronics etc.)
- c) Consumer goods industries (such as Photo/X-ray films, automobile, textiles, consumer durables, tyres and tubes, consumer electronics such as radio, TV receivers, VCRs etc.)

3.4.2 While availability of raw materials or consumption centres could be identified as main criteria for location of some engineering industries such as refractories, availability of favourable location (port/water front, appropriate climate, availability of trading network, excellent means of communication, transport links, availability of trained/technical manpower, proximity of an industrial estate/ancillary units, tool rooms, machine and welding shops etc.) determine the location of most of engineering industries. Site selection studies, therefore, are of crucial importance.

3.4.3 Studies and investigations required for the formulation of engineering goods industries, pertain mainly to the following:

- a) Market survey and demand-supply analysis at the local, regional and national levels.
- b) Locational Analysis - site selection.
- c) Product-mix analysis.
- d) Prototype/Product Development Studies.
- e) Technology and process selection.
- f) Capacity analysis.
- g) Transport, communication and infrastructure requirements.
- h) Availability of raw materials and inputs.
- i) Vendor development/ancillarisation studies.
- j) Other surveys and studies -
 - Infrastructural facilities.
 - Railway siding and line capacity surveys.
 - Environment Management Plan.

Demand-Supply Analysis :

3.4.4 Detailed demand-supply analysis of the product(s) proposed to be manufactured have to be carried out to assess realistic demand and supply based on a comprehensive market survey whereby demand pattern over a time frame is established. Capacity creation requirements have to be assessed based on average level of capacity utilisation attained in the industry taking due account of capacity in the pipeline. Technology forecasts (in the case of capital goods industry), growth of end use consuming industries (in the case of intermediate goods industry) and changing tastes and preferences of consumers, their purchasing power, product life, replacement requirements, substitution effects etc., (in the case of consumer goods industries) would need to be taken into account to arrive at the demand projections together with export commitments/possibilities as well as likely imports. Market survey should bring out the competitiveness of the industry in the domestic market against imports.

Technological Necessity :

3.4.5 The necessity of technological upgradation/modernisation/ debottlenecking/replacement proposals should be based on health study of the plant or on the studies concerning introduction of new technologies to replace outdated and obsolete technologies bringing out the specific advantages of the proposed programme.

Product/Sales Mix :

3.4.6 In order to minimise the problem of line balancing due to fluctuations in the demand/order book position and to maintain inventory of finished goods at reasonable level it is necessary that proper analysis of product/sales mix is carried out which would help in formulating balanced and optimum mix of fixed assets.

Ancillarisation vs Inhouse Manufacture/Phased Manufacturing Programme (PMP):

3.4.7 The need to strike a balance between bought out components and inhouse manufacture of parts and components is essential for most of consumer durables and capital goods industries. While the items of proprietary nature whose source of supply is clearly definable on items of standard engineering stores such as nuts, bolts, bearings, etc. which can be easily procured from the trade are normally planned as BOPs, the problem of deciding the extent of inhouse manufacture versus ancillarisation/vendor development to achieve designated Phased Manufacturing Programme gets reduced to such intermediate products like specific castings/forgings/structural parts which could either be manufactured inhouse or bought from vendors/specialised ancillary suppliers. This would depend upon requirements of quality, specifications, developmental efforts put in by the vendors, if any. However, semi-processing facilities would still be required in the plant to handle such ancillarised/bought out items. Detailed engineering studies would be required to be carried out to carefully plan all these details in order to ensure reliability and firmness of cost and other estimates.

Prototype/Product Development Studies :

3.4.8 Usually such studies and investigations, if required, should have been completed even before a project is submitted for stage I clearance. In case such activities were still to be completed at the time of stage I clearance these must be completed before the project is submitted for stage II clearance.

Technology :

3.4.9 Technology and Process selection studies have to be gone into in detail to finalise the materials and utilities requirements, design of assembly lines and in arriving at the basic sizing decisions and specifications of major units. Computer simulation, controlled experimentation or testwork, wherever needed, should form the basis of process selection for any particular industry.

Site Investigations :

3.4.10 Besides soil investigation fairly substantial geotechnical investigations may have to be carried out for the proposed site to determine the parameters required to firm up the quantity of earthwork, types of foundations required and design of structures and facilities, as already outlined for cement projects, to finalize the layout plan.

Infrastructure Requirement :

3.4.11 Important infrastructure requirements need to be studied are:

Power : Detailed assessment of demand and availability of power should be made and need for captive power may be ascertained from analysis of past and projected trends in the availability of grid power on sustained basis. Specific arrangements required by way of feeder lines, substations etc. will have to be studied wherever necessary line route surveys undertaken for firming up the cost estimates.

Transport : The capacities available in the rail/road links, strengthening required, if any, may be ascertained.

Water : Comprehensive assessment of water requirements for the plant, steam generation, town-ship, etc., will need to be made and sources of supply identified.

Input Requirements and Availability :

3.4.12 Availability of critical inputs required for the project in terms of quantity and specifications would have to be ensured either from indigenous sources or imports without difficulties. If any developmental efforts are required in this regard necessary action may have to be initiated in order that optimal capacity utilisation can be attained at the operational stage.

Basic Engineering :

3.4.13 Basic engineering should be sufficiently advanced for an accurate estimation of the following details:

- a) Actual plant layout shopwise.
- b) Detailed material flow diagrams and material handling devices.
- c) Bill of materials for the various capital and operating requirements.
- d) Basic design of various sub-systems.
- e) Line route survey (wherever necessary).

3.5 METAL AND OTHER MINING/NON-FERROUS METALLURGY PROJECTS:

3.5.1 Metal mining projects are concerned with the development of mines for production of ore and/or its beneficiation to produce only the bulk or pure single metal concentrates to be exported/toll smelted abroad/processed offshore or form part of an integrated facility with mine, concentrator and smelter with or without downstream metal refining, semi-fabrication and fabrication facility at a single/split location. Similarly, only the smelting and/or refining/semis/finished metal production may be the subject of study. For several non-ferrous and even non-metallic minerals intermediate stage of roasting/calcining is an important aspect of mineral treatment. Although integrated iron & steel/ferrous metallurgy projects often have captive mines for metal (iron ore, chromium, manganese, tungsten, molybdenum etc.) and flux materials (limestone, dolomite) and fuel (coal), these should normally be treated in the same manner as captive power plants for appraisal of such projects; the studies and investigations required for such projects, however, should be similar to other mining projects. Metallurgical plants such as sponge iron/pellet plants can be set up either independently or integrated with iron ore mining project. These principles would apply equally to mining of non-metallic minerals such as pyrites etc.

3.5.2 Metal mining/metallurgical projects (particularly non-ferrous metals) have several distinctive characteristics setting them apart from other manufacturing industries projects which can have fairly large influence on the conclusions about the investment options for these projects, inherently characterised by riskiness. These are:

- a) Time lag from discovery to production normally spreading beyond 10 years passing through several stages such as reconnaissance survey, detailed exploration, pre-feasibility studies for committing fairly large expenditures for exploration and mineability studies before coming to the stage when decision to proceed with preparation of DFR for commercial exploitation of these resources can be taken.
- b) Finiteness of the exhaustible resource leading to depletion of the asset itself (in several countries depletion allowance is allowed to mining companies as tax deduction as compensation, but not in India, nor the concept of premium arising from this depreciating asset is applied) and hence finite project life, the estimated size of the resource itself having a determining influence on mine capacity. However, the size of reserves itself is often

determined by the price of metal, geological characteristics of ore occurrence and the mining method adopted.

c) Substantial infrastructure costs may be involved in establishing the mining/beneficiation facilities (as ore deposits are usually located in remote areas) as well as for transporting the output to processing/consuming centres.

d) Location specific nature of mining projects which may involve substantial environmental costs. These costs may be equally substantial and perhaps greater in metallurgical treatment plants which need not, however, be location specific.

e) Fairly high capital and energy intensity as well as pollution abatement costs of metallurgical treatment plants may make it advantageous to consider trade off between smelting of concentrates indigenously and their treatment offshore/toll smelting as well as determining the location of metallurgical plant.

f) As majority of these metals as well as the concentrates are freely traded internationally on specific commodity exchanges such as LME and/or by producers themselves together with the high degree of inter metal, metal-plastic/wood/steel substitution possibilities, the resulting price volatility determines the cyclical nature of demand-supply situation leading to frequent production cut down, closure/reopening of mine and/or smelter capacities in the international market. Strategic considerations may dictate adoption of stockpiling policies by certain countries leading to price manipulation, modulating or accentuating the boom-bust cycles which may also be caused by sudden discoveries of new deposits/development of new processes. Although product price behaviour is cyclical, input costs normally follow uniformly increasing trend. Timing of investment is, therefore, crucially important in the success of the venture.

g) Mineralogical and metallurgical characteristics of the ore and its grade strongly influence the recoveries at the beneficiation and smelting stages and hence the viability of a metal mining project. Presence or absence of deleterious/beneficial constituents also have determining influence on the price of the ores and concentrates as well as cost of their metallurgical treatment and maximisation of recovery of metal content of the ores.

3.5.3 It may, therefore, be necessary that several other factors having policy implications, optimisation of resource recoveries, timing of investment and analysis of uncertainty besides the normal investment criteria may have to be taken into account while considering investment options for metal mining projects.

3.5.4 It is also important that geo-technical investigations including geological, geophysical and geochemical surveys and detailed exploration by drilling and/or by exploratory mining must have been sufficiently thorough to establish the reserve potential of the ore deposits with adequate delineation of orebodies in terms of geometry (shape, size, depth extent), chemistry and mineralogy through drilling and/or exploratory mining (if required) and its mineability and amenability to mineral dressing and metallurgical treatment at least on bench scale must have been established to a fairly reliable degree with demonstrated reserves (proved and probable) constituting nearly 70-75% of total reserves even before the project is submitted for first stage clearance.

3.5.5 Pre-feasibility studies establishing the reserves, mineability and amenability to mineral treatment (beneficiation, roasting and/or calcination) are of utmost importance requiring separate financing arrangements. Some of these studies are being conducted by GSI/State Directorates of Geology and Mining as routine activities of these departments. Exploration activities by and large are not appraised or evaluated based on the concept of mine valuation except that the Department of Mines has set up a Standing Ore Economics Committee (SOEC) to sanction expenditures required for promotional activities undertaken by Mineral Exploration Corporation.

The exploiting agencies themselves often undertake exploration-cum-testwork studies either departmentally or contractually through MECL or other agencies.

3.5.6 The mining industry is strictly regulated by the mining laws such as Mines & Minerals Regulation & Development (MMR&D) Act 1957 and as amended in 1986, Mineral Conservation and Development Rules (MCDR) 1958, Mineral Concession Rules (MCR) 1960 and Mines Act 1952. The mining activities are closely monitored and controlled for operational safety by Directorate General of Mine Safety (DGMS). Costly, time consuming and extremely risky business of exploration and development of minerals is by and large the responsibility of the State, except that of non-metallic and minor minerals. The State finances and undertakes this activity with all the attendant risks which has not yet been thrown open to public under the current drive for globalisation of economy whereby the cost of risk capital could have been widely distributed. As a result, despite the rich geological possibilities, the known resource base of the country is deficient for almost all the important minerals except iron ore, bauxite, steam coal (of poor quality) and the like.

3.5.7 Exploitability of well established ore reserves is the key to setting up a mining project although metallurgical plants can be set up based on captive or purchased raw material supplies - the ore or concentrates. The studies and investigations required for the formulation of mining and metallurgical projects mainly pertain to the following:

- a) Market studies and demand-supply analysis at the national level. Outlook in the international market.
- b) Locational analysis for mine and metallurgical plants.
- c) Product-mix analysis for downstream fabrication facilities.
- d) Geotechnical Investigations of Mineral Deposit -
 - i) Geological surveys and investigations:
 - Geological, geophysical, geochemical surveys for locating ore bodies.
 - Detailed exploration: exploratory drilling and exploratory mining for assessing reserves.
 - Identification of exploration guides, controls of mineralisation.
 - Nature of ore boundaries, distribution, shape and disposition of ore zones.
 - Measurement of borehole deviations/bulk density.
 - Check sampling.
 - Estimation of geological and mineable ore reserves.
 - Geostatistical analysis defining confidence levels in respect of quantity and quality of reserves.
 - ii) Petrological and mineralogical studies:
 - Identification of characteristic rock types, ore zones and ore types.
 - Wall rock alteration (if any).
 - Presence of oxidised/activated/secondary enrichment ore minerals.
 - Relative abundance of ore and gangue minerals.

- iii) Mineability studies - Mine Planning and Mine Design Studies:
 - Optimum production capacity and life of reserves.
 - Technology options - Choice of mining method and equipment configuration.
 - Open cast - choice of pit design/ equipment configuration.
 - Underground - choice of stoping method.
- iv) Beneficiation, Roasting and Calcining Studies -
 - Bench scale/pilot plant scale studies.
 - Chemical and mineralogical analysis of ores and concentrates/calcined/roasted products
- v) Geomechanical studies -
 - Sample tests for rock mechanics.
- vi) Metallurgical treatment studies on ores/concentrates.
- e) Technology and Process Selection Studies:
- f) Other surveys and studies:
 - Land acquisition
 - Infrastructure facilities
 - Railway siding and line capacity surveys
 - Environment Management Plan for the mine (including mill) and metallurgical plant.

Demand-Supply Analysis :

3.5.8 Detailed assessment of demand-supply balance at the national level for ores/concentrates and metal as well as field-wise mine/concentrator and smelter capacities, their linkages and long-term commitment of import/export of ores and concentrates, if any, should be presented as per format at DFR-1.1.3. Detailed market survey should be conducted for the metal(s) to be produced to determine the demand pattern both nationally and internationally, to highlight the demand-supply gap. This may be supplemented by future outlook on availability and consumption as well as emerging trends in the use of metal, substitution possibilities and price behaviour in the international market for ores, concentrates and metals based on authoritative forecasts.

3.5.9 Development of new mine, concentrator and/or smelter capacities would be justified only by the surplus/gap in existing mine, concentrator and smelter capacities, discovery and establishment of additional ore reserves etc., and the relative techno-economics of toll smelting/off-shore smelting of indigenous concentrates, development of indigenous mine/smelter capacities versus import of metal once the provision has been made for meeting the strategic and critical demand for the metal(s) as well as possibilities of exporting ores, concentrates and metals.

3.5.10 DFR should highlight the need for establishing new mine/concentrator/smelter/refinery capacities keeping in view the overall resource base of country for the metal(s) under consideration, characteristics of ores available for mining, infrastructural facilities available, future outlook of ores/concentrates/metal(s) in the international market as well as optimality of mine capacity based on availability of ore reserves, choice of mining method etc. and the minimum economic size of

the smelter/refinery/metallurgical plant. Suitable comparisons with international sizes and norms may also be made. It should also bring out whether strategic/critical demand of the economy are being met or not.

Technological Necessity :

3.5.11 Detailed studies would be required to justify the technological necessity of the proposal in terms of additional mine development required to maintain production or of metallurgical testwork, throwing up possibilities of recovery of by-product metals/minerals from the ore, development and testing of new process technologies to improve recoveries/productivity.

Site Investigations :

3.5.12 In the case of mine and mill, a substantial part of geotechnical investigations would normally have already been conducted as integral part of the detailed mineral exploration programme to establish the ore reserves. Additional geotechnical investigations, topographical survey and soil investigations may, however, be required to be conducted for captive power plant and/or metallurgical treatment plant facilities. The investigations should be thorough enough for all segments of the metal mining/metallurgical project to obtain the parameters required for determining the quantity of earthwork, types of foundations required and design of structures as already described for Cement Projects to finalise the layout plan.

Establishment of Ore Reserves/Quality of Concentrates and Metal Recoveries :

3.5.13 The reserves potential of the ore deposit to be developed should have been established in terms of quantity and grade, through systematic exploration programme carried out at the pre-feasibility stages based on the concept of sequential evaluation augmented by the programme indicated at the time of stage I clearance sufficient enough such that the demonstrated reserves constitute 70-75% of the total reserves out of which proved (including blocked, if any) reserves should at least be 25% to 35% depending on the complexity of the deposit. The detailed exploration programme should have several built in checks on the reliability of the data such as impact of core recovery on grade, bias/error in core sampling methods, bias/error in analysis, errors in integration, computation and assessment of ore reserves. Bench scale beneficiation studies on composite batch samples from drill core representing different segments of the deposit should also have been conducted to generate adequate data on recovery, grade and impurities of concentrate(s). Currently established smelting technologies should have been evaluated to ascertain suitability for the treatment of concentrates to yield optimal smelter recoveries, depending upon the quality of concentrates to be treated.

3.5.14 The basic studies to be done at DFR stage consist of detailed mine planning, establishment of mining method commensurate with the rate of exploitation and mechanisation for optimal recovery and carrying out pilot plant beneficiation roasting and/or calcination test on bulk samples to finalise the parameters of process flow sheet. Technology and process selection studies for the metallurgical treatment plant would have to be conducted to finalise the process choice for planning most optimal recoveries from the concentrate(s) to be treated. The required information may be furnished as per format DFR-1.1.4.

Infrastructure Requirements :

3.5.15 Power, transport facilities and water are the major items of infrastructure required for mining/metallurgical projects. The assessment of requirements and costs should be thorough enough to permit planning and designing of the facilities.

Power: Besides detailed assessment of availability and requirements, finalisation of the parameters of captive generation plant, specific arrangements needed by way of feeder lines, sub-stations, etc., would have to be studied and where necessary, line route surveys undertaken.

Transport facilities: The capacities available in road-rail links, the strengthening required, arrangements for handling at the mine, concentrator or smelter should be studied and alternatives analysed.

Water : Detailed studies about availability of water from various sources, river, canal, groundwater, etc., would be conducted to determine the actual flows over the past ten years (for river, canal source), as well as variations in these flows, assessment of groundwater availability (in case this is the prime source) and the need for low flow segmentation.

Establishment of Coal Linkage :

3.5.16 In case captive generation is required, especially for energy intensive metallurgical plants, the linkage of coal fields for the proposed plant has to be established based on the analysis of:

- a) Year-wise coal requirement.
- b) Potential of linked coal field in terms of proven reserves of required grade of coal.
- c) Characteristic parameters of linked coal block covering moisture content, volatile matter, proximate analysis of coal and its physical and chemical properties.
- d) Status of formulation and approval of specific coal mines linked to the power plant, their year-wise production programme and likely availability for the proposed project.

Basic Engineering :

3.5.17 The basic engineering should have proceeded to a stage at which the following could be specified clearly:

- i) Detailed mine plans.
- ii) Detailed process flow sheet, material flow diagrams and material balances.
- iii) Detailed pit design/mine design, estimation of mine development, site preparation works etc.
- iv) Basic design for tailing dam including reclamation of water.
- v) Basic design for mill (concentrator)/roaster/ calcination plants.
- vi) Basic design for smelter/refinery/ fabrication and other facilities.
- vii) Basic handling facilities for ores, concentrates at the mine, mill and smelter.
- viii) Line route & specifications for feeder line for power.
- ix) Basic design of other electrical facilities.
- x) Route for railway siding, roads.
- xi) Basic design of by-product plants, if any.
- xii) Pollution control measures, water recycling systems.
- xiii) Design of water intake and delivery systems.
- xiv) Design of captive power facilities, if any.

3.5.18 The information on various aspects discussed above is to be given as per the Formats DFR-1.1.4 & 1.1.5.

3.6 IRON & STEEL/FERROUS METALLURGY PROJECTS :

3.6.1 Projects in this category have wide diversity in terms of technology, size of the plant (in terms of land area), investments, degree of horizontal and vertical integration ranging from the setting up of blast furnace (BF) - Basic Oxygen Furnace (BOF) route based integrated steel plants, Electric Arc Furnace (EAF) route based mild steel and/or alloy and special steel plants, as well as plants on new emerging technologies such as COREX process, Energy optimisation furnaces etc., pig iron, sponge iron, ferro alloy plants as well as individual shops/components of integrated plants such as coke oven battery, blast furnace, steel melting shop, continuous casting, rolling mills of various types etc. Studies and investigations required would be equally wide ranging and varied. In general, these pertain mainly to the following:

- a) Market studies and demand-supply analysis at the national and regional level.
Outlook in the international market.
- b) Locational analysis
- c) Product-mix analysis
- d) Site investigations
- e) Technology and Process Selection Studies
- f) Capacity analysis
- g) Raw material testing and linkages, blending/sorting and handling.
- h) Transport, communication and infrastructure requirements.
- i) Marketing and distribution network studies
- j) Other surveys and studies -
 - Land acquisition
 - Infrastructure facilities
 - Railway siding and line capacity surveys
 - Environment Management Plan for the plant and captive sources of raw material supplies, separately.

Demand-Supply Analysis :

3.6.2 Detailed analysis of demand-supply of the products at the national and regional levels disaggregated by quality (mild, alloy & special steels) sizes, specifications and product type (semis-blooms, billets, slabs; flat products - sheets, plates, coils, hot/cold rolled; long products - wire rods, bars and rods; shaped products - structurals, pipes & tubes, railway materials etc., pig iron etc.) categories through a comprehensive market survey would have to be done to enable finalisation of capacity, sizing and configuration of equipment. Demand projections should take into account the export possibilities as well as import requirements for certain quality, sizes and specifications for which demand is not large enough to set up facilities.

3.6.3 Future outlook on availability and consumption should be supplemented by analysis of emerging trends on the uses of steel, pig iron/sponge iron or ferro-alloys, substitution possibilities and price behaviour in the domestic and international market especially in the case of flat, shaped

and long products, pig iron/sponge iron/scrap and ferro alloy. These studies are important for projects involving creation of new capacity or expansion of existing facilities.

Technological Necessity :

3.6.4 Health study of the plants to be modernised/ technologically upgraded or replaced should be conducted elaborating the existing condition and problems being faced in achieving rated production/increasing productivity or containing production costs including conservation of energy and improvement of quality and to justify the techno-economic indices assumed before and after project implementation. Since individual shops/plants have a strong backward/forward linkages with other shops/units, the impact of modernisation/replacement/ upgradation of any one unit on other units in backward/forward linked chain should also be studied. Benefits of new cost effective technologies resulting in reduced energy consumption and/or pollution abatement should be analysed for improved profitability.

Product/Sales-Mix :

3.6.5 Because of the wide diversity of products of a steel plant in terms of size of order lot, quality, size, specifications and product types it is imperative that a proper product/sales mix is chosen which would minimise the inventory and quality control costs, optimise the line facilities with optimum production lot and operating rate of rolling mills as well as appropriate balanced capacity of various units with increasing transportation efficiency and maximise profitability of the plant in the given overall demand-supply scenario, product prices and costs of the various elements constituting the product-mix. Adequate flexibility, however, should be provided in the layout such that changes in sales-mix over a period of time could be accommodated as and when required.

Location and Site Investigations :

3.6.6 Besides the nearness to sources of raw materials and efficient transport linkages as well as availability of land, water and power influencing the locational choice, the matching of requirements in terms of quality and specifications with actual availability from sources of supply, the arrangements required for blending, raw material handling and storages required would have to be studied besides analysis of disposal of solid, liquid and gaseous effluents, requirements of inplant transport/traffic as well as route capacity and railway siding etc., would have to be studied.

3.6.7 Besides soil investigations fairly extensive geotechnical investigations would have to be done to firm up the design parameters and quality of earthwork, types of foundations and design of structures and facilities as already outlined for cement projects to finalise the layout plan.

Availability & Quality of Raw Materials :

3.6.8 An independent detailed assessment of availability of major raw materials such as coking and non-coking coals, iron ore (lump and fines), flux materials, refractories (for cokeovens, blast furnace, SMS, continuous casting facilities) would have to be carried out and their quality tested to meet the desired specifications and finalisation of optimal blend for maximising the productivities of coke, sinter, hot metal and crude steel. Status of implementation of captive and non-captive sources of supply would need to be studied for dovetailing and synchronisation with the various plant facilities in a phased manner.

3.6.9 The quality of coking coal would be assessed in terms of ash content, volatile matter and proximate analysis for the prime, medium, blendable coals and imported coals as well as the

quality and strength of coke produced from the designed blends in terms of ash content and M10 value. Similarly, the calorific value and proximate analysis of non-coking coals required for captive power generation and coal dust injection (if planned) would also be studied. The grade and sizing of iron ore fines and quality of sinter produced would be tested and also of the lumps required for blast furnace. The quality of flux and refractory materials such as limestone, dolomite, dead burned magnesite, chromite quartzite, silica etc. required for blast furnace and steel making as well as refractories would be tested to firm up the design parameters of lime/dolo and refractory materials plants. Tests and investigations required to determine the process flow sheets of coke ovens, sinter plant, compatibility of indigenous and imported coking coals and assessment of productivity norms in various shops should be conducted before the materials flow diagrams and process parameters are finalised.

3.6.10 The total requirements of various raw materials and inputs should be assessed through detailed material balance and material flow studies on dry and wet basis not only for planning of procurement of supplies, but also for designing of material handling arrangements as well as inplant traffic flows.

3.6.11 In the case of alloy and special steel plants, the sources, availability and quality of scrap and its sorting characteristics and sponge iron would need to be studied besides the availability of power and ferro alloys.

3.6.12 For sponge iron units, availability of appropriate quality coal or natural gas/LNG is of critical importance besides the high quality DRI (Direct Reduced Iron) grade iron ore fines/natural pellet ore/concentrates/pellets as well as binder materials.

3.6.13 For ferro alloy plants the quality and source of metallurgical grade ferrous and non-ferrous minerals such as low phosphorous manganese, chromium, quartzite/silica sand, titanium, tungsten, molybdenum, nickel, cobalt, niobium etc. of appropriate specifications would need to be ensured.

3.6.14 In case the captive sources of supply form an integral part of the project, the studies and investigations indicated for metal mining projects should be carried out for such projects. Data on sources of supplies and transportation routes should be shown on appropriate maps.

Technology and Process Selection Studies :

3.6.15 Depending upon the quality of raw materials available, detailed technology and process selection studies are of critical importance in achieving productivity norms and techno-economic indices which can produce steel, pig iron or ferro alloys at internationally comparable costs. This would also depend on the equipment sizes and configuration and operating efficiencies of individual shops, training of skilled operators in the state-of-the-art technologies and processes as well as span of the learning curves in mastering new technologies. Critical choices, therefore, should be made based on indepth studies in arriving at process flow sheets, material balances and materials flow diagrams for which detailed energy, fuel and gas balances of different process centres would be necessary. The yield levels for various shops should conform to international norms. Suitable comparisons of plant capacities and techno-economic indices should be made with international sizes and norms.

3.6.16 For the coke oven batteries technological choices are concerned with height of battery, width of coke ovens and type of charge - normally prepared coal charge, PBCC (partially briquetted coal charge), stamp charging, selective crushing of coal and dry quenching of coke produced, either singly or in combination to obtain the maximum strength of coke at minimum costs and

using maximum of inferior grade coals and minimum of imported coals for desired levels of coke strength, reduced pollution load, maximum recovery of byproducts etc., particularly the yield of coke oven gas to optimise the gas and fuel balance of the plant.

3.6.17 For the blast furnace, the variables of interest are the sinter burden, blast temperature, coke rate, ash content of coke - 5 mm iron burden, slag rate, blast humidity etc. which would determine the design of the blast furnace and stoves and the relevant technological choices are concerned with burden distribution, slag granulation, screening of coke and sinter, tapping of hot metal and slag etc., besides coal dust injection, secondary fuel injection, oxygen enrichment etc.

3.6.18 In the area of steel making, technology of open hearth furnace and its variants such as twin hearth furnaces, KORF technology etc., are rapidly becoming obsolete. Oxygen steel making and secondary ladle refining technologies are in vogue. The variables of interest are reduced tap to tap time, increased lining life of the converter, higher liquid steel temperatures etc., and technology choices are mainly concerned with top and/or bottom blowing, movement of steel through various types of ladles and methods of secondary refining.

3.6.19 The era of ingot casting, soaking pits and mother mill for rolling of blooms/billets and slabs has already ended with the introduction of continuous casting technology. Depending upon the product-mix the choice is between bloom/billet caster, slab caster or slab-cum-bloom caster. A new element of technological choice is the trade off between hot rolling mill and thin slab casting, slab sizing etc., vertical versus horizontal casting for long products etc.

3.6.20 Similar technological choices are available for sponge iron and ferro alloy plants which need to be evaluated before particular process is selected for adoption.

3.6.21 Process selection studies must ensure minimum energy consumption through detailed energy balance and gas balances as well as minimum cost of production through detailed material balances.

3.6.22 The basis of process selection studies, whether done through computer simulation, controlled experimentation, pilot plant investigations and the like or only based on literature survey etc., should be clearly highlighted.

Establishment of Coal/Washery Linkages :

3.6.23 Steel plants would require coking coal, mostly washed except perhaps for the blendable coal of suitable grade as reductant. Depending upon the properties these coals are classified as prime, medium and blendable. Each steel plant would, therefore, be linked with different washeries for quantities of different types of coals required in the blend, including washed imported coal, to be charged in the coke ovens. In addition, non-coking coal would be required for captive power plant as well as coal dust injection, if adopted. The linkages of steel plants with washeries and coal fields for non-coking coal has to be established based on the analysis of:-

- a) Year-wise requirement of blendable and washed prime and medium coking coal as well as steam coal for power generation, coal dust injection.(CDI).
- b) Potential of linked coal field for non-coking and blendable coking coal in terms of proven reserves of required grade of coal.
- c) Capacity of linked washeries recovery and grade of washed prime and medium coking coal and linkages to various steel plants.
- d) Characteristic parameters of linked coal block/washeries covering moisture content, volatile matter, proximate analysis of coal and its physical and chemical properties.

e) Status of formulation and approval of specific coal mines/washeries linked to the project and their year-wise production programme and likely availability for the proposed project.

Infrastructural Requirements :

3.6.24 Power, transport facilities, water utilities and township are the major items of infrastructure required for iron & steel/ferrous metallurgy projects. The assessment of requirements and costs should be thorough enough to permit planning and designing of facilities.

Power : Besides detailed assessment of availability and requirements, finalisation of the parameters of captive generation plant, specific arrangements needed by way of feeder lines, substations, etc., would have to be studied and where necessary, line route surveys undertaken.

Transport Facilities : Detailed studies on transport requirements for movement of raw materials and finished goods through road/ rail as well as requirement of port facilities for import of raw materials such as coking coal etc., and export of finished products, if planned, would need to be carried out to finalise the transport plan considering the capacities already available and strengthening required. Inplant traffic requirements both road and rail as well as conveyor belt systems would also have to be studied to ensure smooth operation at the production stage, providing adequate design margins for operational contingencies and bottlenecks.

Water : Detailed studies about availability for perennial sources of supply such as river, canal, groundwater etc. and design of balancing reservoirs required should be carried out. The assessment should be based on actual flow and variability in the flow of water (in case of surface water such as river, canal) and/or potential and availability of ground water (in case this is the prime source) etc.

Utilities : Steel plants require several utilities like oxygen, nitrogen, argon, compressed air, chilled water, demineralised water etc. The requirements should be properly assessed and captive facilities planned if part or all the requirements have to be met inhouse.

Township : Because of very large size of manpower required for integrated steel plant, development of township facilities is of prime importance. Guidelines issued by the Government wherever applicable may be kept in view in development of township.

Linked Projects :

3.6.25 Various linked projects such as development of captive/ noncaptive mines, washeries, transport linkages (Railways, ports, roads etc.) should be identified and their status and costs should be established.

Basic Engineering :

3.6.26 The basic engineering should have proceeded to a stage at which the following can be specified clearly:

- a) Tie up of technology, if planned to be imported for certain units.
- b) Detailed process flow sheets/material flow diagrams and material balances as well as plan of procuring the raw materials and other inputs.
- c) Mode of movement of raw materials and basic design of facilities required for their handling, storage etc., ensuring uniformity in quality and specifications through blending mechanism and facilities.

d) Layout of plant, sizing and basic design of all major units/sections of the plant such as raw material handling systems, coke oven batteries, sinter plants, blast furnaces, steel melting shops, continuous casting facilities, rolling mills, utilities like captive power, oxygen plants, DM water and chilled water facilities, refractory materials plants, lime/dolo kilns etc.

e) Electrical line diagram.

f) Arrangements for effluent disposal, recycling of wastes/pollution abatement.

g) Routes of railway siding.

h) Arrangement for power, water supply and inplant rail/road traffic.

3.7 PROCESS INDUSTRIES PROJECTS :

3.7.1 Projects included under this category are equally wide ranging covering fertiliser, inorganic and organic heavy chemicals, oil refining, gas processing, petrochemicals, drugs and pharmaceuticals, insecticides, pesticides, etc. The typical feature of such projects is the variety of feedstocks for a particular industry and variety of industries can be set up utilising the same feedstock. Fertiliser plants can be based on coal, fuel oil, naphtha and natural gas. Petrochemical plants can be based on different fractions of natural gas such as C2-C3, C4 and higher fractions, LPG or different cuts of naphtha.

3.7.2 Another typical feature is the minimum economic size of the plants for products of different petrochemical products or fertilizer. Oil refining projects are characterised by varying product slates depending upon the nature and characteristics of the crude being refined and technology chosen for processing (such as hydrocrackers, FCCU, reforms, delayed coker etc.). Similarly, the product yield of gas refining projects would depend upon its composition. The efficiency of operations depend upon the catalyst used.

3.7.3 The studies and investigations required for the formation of Detailed Feasibility Report (DFR) for process industries relate mainly to the following:

a) Demand and supply analysis;

b) Process choice;

c) Raw materials availability;

d) Site conditions;

e) Infrastructure requirements;

f) Basic engineering;

g) Pricing.

Demand And Supply Analysis :

3.7.4 The nature of the market study required for preparing a Detailed Feasibility Report for a chemical process industry will vary from case to case. In certain cases like fertilizers or petroleum products the estimates of demand and potential supply are finalised at an inter-Ministerial level or Working Group level and the specific study required for a DFR relates mainly to the disaggregation of the national picture to the appropriate regional level. In certain other cases like petro-chemicals or organic chemicals a more detailed analysis of recent trends, the growth of end-using industries, the substitution for and other materials, etc, may be required. The analysis should be based on actual market survey carried out for the purpose. If possibility of export of

the product(s) exists, it should be explored and brought out separately. The market study should keep in view the time frame of the project.

3.7.5 The DFR should also consider the overall supply scenario of the products alongwith requisite details viz., firm availability from existing units and their planned expansions, projects under implementation and likely availability of the product(s) from those projects and latest status of licensed/approved projects where implementation is yet to start. A unitwise list of the projects under each category, their status and likely production within the time frame of the project may be furnished for correct assessment of supply position.

3.7.6 Marketing arrangement necessary for the proposed project alongwith the cost implications may also be studied in detail.

Process Choice :

3.7.7 In most chemical process industries a variety of processing schemes are available for a given feedstock or a given end-product. This is also an area where there are frequent changes in technology. At the time of first stage clearance all available processes should have been surveyed to identify a short list for more detailed study. The survey should collect sufficient information on costs and processing parameters to allow comparative techno-economic analysis. Energy forms an important component of operating cost in process industries. Hence the implications of energy in the production may be specifically looked into while doing techno-economic comparison. In particular, the relative economics of alternative feedstock may have to be studied whenever this choice exists. At the second stage the process choice will be firm and the investigations arising out of that will be mainly in the form of detailed discussions with the information given by prospective suppliers of know-how. A survey of the actual results, in physical terms, achieved with the process technologies in the short list may also be necessary.

3.7.8 In case there are more than one feedstock available for producing the desired end-product (such as Naphtha, Natural Gas, LPG, etc., for olefins) it would be desirable to undertake a detailed analysis of the State of the Art technologies available for different feedstocks. This will also be one of the considerations while deciding on the particular feedstock to be adopted.

Raw Materials Availability :

3.7.9 Most chemical process industries involve one or two primary feed stocks as raw material. The selection of process and the sizing of the project depends critically on the quantity and quality of the available raw materials. Hence a detailed study of the availability of the basic raw materials will be necessary. This study should cover the following aspects:

- i) Source of the feedstocks;
- ii) Amounts available yearwise;
- iii) Likely imports of feedstocks;
- iv) Composition and quality of feedstocks;
- v) Status of linked projects for supply of feedstock and expected yearwise production programme;
- vi) Status of projects for the transportation of feedstock.

3.7.10 The analysis for a final decision on feedstock should also include investment requirement alongwith FE component, yield pattern, energy consumption, cost of production, possibility of

obtaining by- product/co-products etc. The analysis should be in financial as well as economic terms.

Location and Site Conditions :

3.7.11 Detailed study of site conditions must include a detailed topographical survey and soil investigations to establish basic parameters for estimating the quantity of earthwork, designing of foundations, civil structures and other facilities to finalise the layout plan, Route surveys for the railway siding may also be necessary.

3.7.12 Chemical process plants can often pose major pollution problems. Hence a detailed Environmental Impact Analysis is generally required. This must be done on the basis of the guidelines specified by the Department of Environment. A detailed baseline survey will be required with a minimum of one year data on land use, water use, demography, hydrology, air quality, meteorology, etc.

Infrastructure Requirements :

3.7.13 The major items of infrastructure required for process industries are steam & power, water and transport facilities.

3.7.14 With regard to power, an assessment of power availability is required to determine the choice of process and the need for captive generation. Apart from the detailed assessment of availability, the specific arrangement needed by way of feeder lines, sub-stations etc., will have to be studied and where necessary, line route surveys undertaken.

3.7.15 Co-generation can be important component in chemical process industries, which have a large steam requirement. The economic advantages of alternative schemes of co-generation should be studied and integrated with the analysis of power requirement.

3.7.16 With regard to transport, the capacities available in road-rail links, the strengthening required, and the arrangements for handling should be studied and alternatives analysed.

3.7.17 With regard to water, studies and investigations will be necessary to identify the source, the actual flows over the past ten years (if it is a river or canal), the variation in these over the year of assessment of ground water availability (if this is the source), the need for low flow augmentation, water quality, the location of intake structures, etc. The investigations preceding the first stage should establish the availability of water though the details can be worked out for the second stage clearance.

Basic Engineering :

3.7.18 In the second stage the basic engineering and choice of technology should have preceded sufficiently to allow for the specification of the following:

- Type of project and location
- Annual capacity/ capacities
- Crude charge/feedstock
- Products to be manufactured
- Process flow diagrams/material balance
- Equipment list with data sheets

- Power requirements and preliminary engineering for power supply and distribution
- Water balance and preliminary engineering for water supply and effluent disposal system
- Balance for other utilities
- Tankage requirements
- Product loading and transportation requirements
- Land requirements and plot plan
- Project schedules and construction facilities
- Procurement Plan (imported/indigenous)
- Arrangements for process licensing/basic engineering.

Pricing :

3.7.19 Pricing of feedstock as well as the end-product/by-product may be of importance in case the same are not being already traded. In case the Government has issued certain guidelines for pricing of the feedstock and/or the final product or the by-product the same will be adopted. If there are none, it will be desirable to go into the pricing aspect and formulate a basis for the same. For instance C2-C3 component of natural gas which is now being increasingly adopted as a feedstock for cracker, it will be necessary to frame a basis to facilitate financial analysis of the project.

3.7.20 Certain products may be new to the market and so their pricing also gains special significance. In such a case the CIF price of the imported product may provide a basis. It is possible that the CIF price may not make the project viable and so some duty protection may be necessary. The same will have to be highlighted. For by-product(s) also a similar exercise may be desirable.

CHAPTER 4

DETAILED FEASIBILITY REPORT

4.1 The studies and investigations suggested in Chapter-3 generally carried out after Stage-I approval, often generate several investment options which are worth considering. On the basis of the preliminary analysis of these options, a feasible option is developed into a project and Detailed Feasibility Report (DFR) is prepared for further processing and seeking Government's approval, although brief particulars of other options studied but rejected, are also given in DFR. In this report a detailed description of the project parameters, based on the studies and investigations, is to be given to enable the appraising agencies to evaluate the technical feasibility and financial & economic viability of the proposed project. The information about the project to be provided in DFR should be adequate and reliable.

Geological & Mining Aspects of Mineral/Ore Deposit :

4.1.1 For projects involving mining of mineral deposit either as an integral project of manufacturing industry such as a cement plant or as a captive or non-captive source of supply of basic raw material to another industry such as iron ore, flux materials for a steel plant or projects concerning mining of an ore deposit, the DFR should deal with the following geological and mining aspects.

4.1.2 A brief description of geology (lithology, shape, size, structure and complexity) of the deposit along with the regional geological setting may be given preferably illustrated by suitable geological maps, plans and sections. The details of exploration and exploratory mine development (if any) including geophysical and geochemical surveys (if any) carried out by different agencies and its adequacy for investment decision and further pre-production exploration & development required should be indicated, preferably illustrated by appropriate level plans and sections.

4.1.3 For the mining of mineral deposits the details and method of estimation of ore reserves in terms of quality (chemical and mineralogical) and quantity alongwith details of sampling and testwork carried out to determine its suitability and conformity to the specifications required by the manufacturing industry and the expected life of reserves at contemplated rates of exploitation should be given. In case other useful minerals could be recovered as coproducts from the volume of rock to be excavated, its feasibility and method of recovery should also be discussed.

4.1.4 If the quality of mineral deposits in certain block can be improved through beneficiation to meet the required specifications the same should be discussed alongwith details of testwork at bench scale and pilot plant scale and whether this would have any impact on the mine plan with and without beneficiation. This is particularly important in those cases where the life of reserves without considering the poor quality blocks is inadequate to sustain supplies for the life of the project.

4.1.5 The mining method, mine design and the mining plan to be adopted in exploiting the deposit should be described in detail giving the details about equipment configuration to achieve the contemplated rate of production.

4.1.6 In the case of ore deposits for metal mining the description of geological aspects should give details about the type of ore deposit, occurrence of various ore types besides the lithology, structure, complexity, geometry (shape, size, disposition and depth extent), chemistry and

mineralogy of the ore deposit alongwith the description of geophysical/geochemical anomalies, if any located. Special emphasis needs to be given to ore guides used for exploration, controls of mineralisation identified, petrological and mineralogical characteristics of rock types and ore zones as well as characteristics of wall rock alteration (if any observed), presence of oxidised/activated and secondary (enrichment) minerals, relative abundance of ore and gangue minerals, their relationship and distribution patterns as well as correlation with major structures such as variation across and along strike and depth, the nature of ore boundaries, distribution, shape and disposition of ore zones etc.

4.1.7 Details about the exploration such as the nature and type of exploration including exploratory mine development, if any, measurement of bore hole deviations, estimation of bulk density, state of drill core, nature of sampling and sample preparation, results of check assays and sampling, should be presented, preferably on suitable plans and sections. Bench-wise/level-wise reserve estimates (mineable and geological) by standard categories indicating the methods and parameters used in estimating geological and mineable reserves (including cut-off grades, dilution and mining loss factors) in terms of quantity and grades should be presented in the DFR.

4.1.8 Details of metallurgical testwork including pilot plant test work on bulk/composite samples carried out on the ores and concentrates as well as geomechanical testing on drill core to obtain data for rock mechanics and mine design should be incorporated.

4.1.9 Efficiency and sequencing of mining operations including parameters of mine design and equipment configuration, process flow sheets and design parameters of mill, smelter and fabrication facilities including materials flow diagrams should be described in detail.

4.2 The other information required to be presented in DFR is indicated below:

- i) Demand - Supply position and other information about the sector/industry including market studies
- ii) Policies
- iii) Project in the framework of Corporate and National Plan
- iv) Alternatives
- v) Technical aspects :
 - a) Location/Site
 - b) Production build-up
 - c) Plant size
 - d) Technology
 - e) Feedstocks/raw materials
 - f) Energy Consumption
 - g) Equipment and construction requirements
 - h) Manpower requirements
 - i) Transport and communication requirements
 - j) Utilities
 - k) Linked projects
- vi) Organisational and managerial aspects

vii) Environmental Aspects

viii) Project Cost :

- a) Capital cost requirement
- b) Operating requirements and costs
- c) Total Systems Cost

ix) Financial Analysis

x) Economic Analysis

xi) Sensitivity Analysis.

4.3 Salient features of the project under consideration may be given in format DFR-1.1. The details to be furnished under each of the above items are as follows:

4.4 DEMAND - SUPPLY POSITION AND OTHER INFORMATION ABOUT THE SECTOR/INDUSTRY INCLUDING MARKET STUDIES :

4.4.1 General introduction/functioning of the sector with particular reference to the output/product which is to be produced through the project under consideration should be given.

4.4.2 Several questions need to be dealt with for obtaining complete picture of the industries:

a) Would estimation of demand at national level alone be sufficient to plan for new capacities, their location and sizes or would it have to be disaggregated to regional and local levels? Would a detailed market survey be necessary for developing a marketing plan and distribution networks? Is the development of prototypes, products necessary for ensuring proper marketing ?

b) Are the products of the concerned industry freely traded internationally through commodity exchanges or by the producers directly? What is the structure of international trade for the industry? Is it marked by cartelisation/monopolies ? Does this free trading involve all goods in a backward-forward chain such as ores, concentrates or metals? What are the trade offs in setting up capacities based on imported intermediates/ exporting the primary goods or their offshore processing for such industries?

c) What is the price behaviour of the products (especially linked in backward-forward chain) and the major inputs in the international and domestic markets?

d) What percentage of international trade is the likely demand-supply gap in domestic market, particularly for those products which have poor domestic resource base?

e) Would the total demand-supply estimation or the estimation of strategic/critical demand more relevant to the make or buy decisions for the industry?

f) Is the industry marked by fluctuating prices have strong substitution possibilities?

4.4.3 The end uses to which the project output (product) is at present being put to, such as, power generation and transmission, engineering industries, electroplating, manufacture of alloys, defence application as intermediate product, household consumption etc.

4.4.4 The indigenous demand and availability of the product in the particular and generic forms during the last five years vis-a-vis the total requirement of the economy may be given in tabular form. How the gap between demand and supply in qualitative and quantitative terms is being met? Where the product has also import /export implications, the international demand - supply situation, as relevant, may also be given.

4.4.5 Projected demand and supply positions over the next 10-15 years period, the years when the proposed project is to be commissioned, the terminal years of the current and next Five Year Plan are particularly important and the projections in DFR should be compared with projections in the Plan documents, Working Group Reports, etc. Statement DFR-1.2 is to be used for giving demand supply projections.

4.4.6 The national level demand estimates may be disaggregated to regional and local levels for those industries which require detailed marketing plan and distribution network such as cement, paper and consumer industries. Detailed market surveys would be necessary to develop such a marketing plan. For those industries which are freely traded internationally and their products and intermediates are linked in backward-forward chain such as ores, concentrates and primary metal production of non-ferrous metals and are easily substitutable it would be necessary to assess future outlook on availability and consumption as well as emerging trends in the use of products, substitution possibilities and price behaviour in the international market based on authoritative forecasts.

4.4.7 **Market Studies for Products :** The details of the market studies carried out by the enterprise for estimating the demand for the products over time-frame, likely supply from existing capacity and the steps in the offing to meet the demand supply gap in quantitative and qualitative terms should be given. The survey would acquire additional significance for projects for the production of specialised products. The market analysis should deal with issues like the effect of the choice of the product mix and the impact of concessions on the profitability, location of the market areas, cost of marketing etc. It should be specifically indicated whether it would lead to import substitution or exports, level of imports/exports and international prices during the last three years and those projected in future.

4.4.8 **Market studies for Raw materials:** The details of the market study for the availability of raw materials and feedstock from existing supply sources, imports (including international market situation) and price behaviour during the last 3 years and that projected in future, should be given. Any new capacity/ supply sources under implementation or likely to be implemented may also be given. If any negotiations have been undertaken or agreements have been reached for assured supply of raw materials, these may be specifically mentioned, giving the details.

4.5 **POLICIES:**

4.5.1 The developments of the particular industry/sector under consideration in the national and international field and how the policies have kept pace with the changing requirements.

4.5.2 Whether the import of the product is covered under an open general licence or covered under the import trade control policy? Whether the product is allowed for import on restricted basis and if so, to what extent and with whose approval? Whether the product is canalised for indigenous supplies?

4.5.3 What are the customs duties payable on the imported product under consideration? Is there any countervailing customs duty? What is the excise duty on the indigenously produced product and income tax on expatriate services? What is the level of Central Sales Tax and the range of the local sales tax, works contract tax and electricity duty on captive power generation in the various states? How much will the product cost to the ultimate users?

4.5.4 Narrate the pricing policy adopted by the public enterprise for this product. Are there any statutory regulations? Is there any attempt to match the local price with that of the landed cost of the imported product? Is there any Bureau of Industrial Costs and Prices (BICP) formula regulating its selling price? Is there any institutional arrangement for determining the selling price or are the prices allowed to find their level in keeping with the free market forces? How do the international (cif/fob) prices vary? Is there any periodic pattern in the fluctuation of international prices?

4.5.5 Is there any Government Policy/view on the choice of technology? If so, details may be furnished in this regard. How far the project under consideration meets with these requirements?

4.5.6 Is there any government policy/view on the location of a project of this nature? If so, to what extent the project under consideration complies with these requirements.

4.5.7 Government's policy on role of Public Sector in this field.

4.6 PROJECT IN THE FRAMEWORK OF CORPORATE AND NATIONAL PLAN:

4.6.1 **Background:** A brief background para on the project forming part of the Corporate Plan of the enterprise and how it dovetails into the National Plan.

4.6.2 **Objectives and Inter-se Priorities:** What are the various projects under consideration at present in the enterprise and their objectives? What are the other projects considered in the sector? A summary of the salient features of these projects may be furnished. How will these projects be ranked in terms of inter-se priorities, should there be any resource constraints?

4.6.3 **Timing of Investment:** Is it the opportune time to start a project of this nature? This would need to be examined in the context of the saturation prevailing in the industry, demand supply analysis and other relevant factors such as opportunities for supplies to overseas market.

4.6.4 **Plan Provision:** The total Five Year and Annual Plan provision for the sector, the enterprise, the likely sources of funds and commitments already entered into and whether the available uncommitted segment will be adequate for funding the project to the extent of its requirements? The Five Year and Annual Plan provisions for the project should also be specified. Would the project be implemented through the internal resources and/or extra budgetary resources such as loans from financial institutions, supplier's credits, fixed (term) deposits from public, debentures, bonds etc., or budgetary support would be required for equity and/or loans? Detailed financing plan for implementing the project should be an integral part of DFR.

4.6.5 **External Aid:** If the project is to be externally aided, the extent and nature of assistance and the details of the aid / assisting agency may be indicated. Whether the project has already been posed to the external agency? If so, with what commitments? What will be the terms and conditions of the aid/assistance?

4.6.6 **Track Record of Public Enterprise:** How has been the track record of the public enterprise in implementing the projects? In this connection the following information may be furnished for assessing the performance of the public enterprises in the field.

- a) Running projects (in production);
- b) Projects under implementation;
- c) The benefits (original projections vs actual attainments) achieved from the projects implemented by the enterprise in the past;

- d) Problems faced during implementation; and
- e) Remedial measures taken or proposed to be taken for overcoming the shortfalls/problems.

4.6.7 The information required to deal with the items listed in paras 4.6.4 and 4.6.5 may be indicated after obtaining necessary information from the Administrative Ministry.

4.7 EXAMINATION OF ALTERNATIVES:

4.7.1 While the analysis of macro alternatives would have been made at the time of Stage-I clearance (as applicable), a detailed analysis of micro alternatives studied at the time of DFR needs to be discussed here.

4.7.2 The salient features of such alternatives may be furnished and the basis for the choice of a particular alternative finally chosen may be indicated. Some of the relevant aspects are the choice of technology, plant size, location, feedstock, equipment, availability of infrastructure, technical manpower and the like. The salient features of the alternatives may be given in the text of DFR but the information on results of analysis is to be presented in formats DFR-1.3 & 1.4.

4.8 TECHNICAL ASPECTS:

a) Location / Site:

4.8.1 The choice of location of the project would depend on the nature & type of project considered. In case of location specific projects, the clearance of the site and land acquisition involved, if any, should have been considered in Stage-I itself and necessary environmental and other clearances for site obtained. In other cases, the alternative locations considered together with the cost implications and the basis of the final choice made would need to be spelt out in details. Appropriate site plan/layout on suitable scale indicating location of different shops/facilities/plants, storages, infrastructural facilities, transport links, township, green belt etc., making the location project site explicit in the regional context.

4.8.2 Besides description of physical features of the site, terrain, soil condition, extent of site preparation and development needed, its geological, geohydrological, meteorological and seismic features, availability of civil and construction materials and the extent to which the existing infrastructure can be utilised/needs to be strengthened, the following pertinent questions need to be dealt with in respect of site conditions:

- i) The availability, cost of acquisition of land required for plant and township (present and future requirements). Whether the cost of rehabilitation and other compensation measures have been duly examined and arrived at as per the guidelines laid down by the Central (Ministry of Home Affairs, BPE, etc.) and State Governments?
- ii) Suitability of site for building purpose, the seismic zone in which the site is located and whether the seismicity has any financial implications in the design of structures; if so, it would need to be quantified.
- iii) Have any mineral occurrence been reported either surface or sub-surface at the site or in the neighbourhood? If so, have any exploration been carried out and extent of reserves indicated? The presence or absence of potential mineralisation underneath the surface may be confirmed from GSI/IBM and/or other exploiting agencies. Are there any trade offs involved in winning the mineral/setting up the proposed plant?

iv) Has the area experienced any unusual flooding in recent past? If so, what additional protective measures may be required to avoid flooding of the plant such as boundary wall, raised plinth levels etc.

v) Have the soil characteristics and water table levels been adequately studied? What costs may have to be incurred due to additional protective measures such as unproved/deeper foundations etc., that may be necessary, particularly for heavy engineering projects, forging/ press shops etc.?

vi) If the site is located in a hilly terrain what measures may be required to prevent soil erosion/land slides in the neighbourhood?

vii) If the site is in the range of the border with a neighbouring country, whether the approval of the Ministry of Defence has been obtained from the security angle?

viii) Are any legal or environment related hurdles anticipated in the acquisition of land? If the lands are under cultivation, will the loss of foodgrains be substantial?

ix) Has the availability of water, power and other utilities been ensured by the concerned State Government(s)? What is the likelihood of these being fulfilled on the basis of independent studies? Is it possible to pool water and power resources with other industries in the region?

x) The extent to which existing infrastructure, if available, is to be utilised.

xi) The state of labour relations prevalent in the region at present and in the recent past.

xii) Is the site located in the backward area declared by the concerned State Government/Central Government? If certain concessions of capital or revenue nature are available from State Government, the extent of such concessions may have to be quantified.

xiii) Has the site/location been selected on the basis of some over-riding consideration(s)? If so, its economic implications should be indicated.

xiv) The availability of trading network at the location which could be relied upon to supply standard general engineering store items.

xv) Is the site located near Industrial Estate/proximity of ancillary units for optimising the make or buy decisions through a balanced subcontracting programme?

xvi) The availability of a sufficient number of tool rooms, machine shops, welding shops, electrical repair shops etc. in the region.

xvii) Is the site located in the neighbourhood of Polytechnics/ITIs etc., which can provide necessary skilled labour locally from the region itself?

b) Production build-up:

4.8.3 The production build-up may be assumed taking into account a realistic and attainable level of capacity utilisation based on the marketing and production problems, effect of preliminary runs, learning curves etc. It should also identify the type of problems that could arise during production build-up stage, particularly with respect to possible equipment failures, raw-material problems etc. It should bring out the experience of other similar projects established in the country vis-a-vis their anticipations.

c) Plant Size:

4.8.4 The basis of the plant size proposed should be scientifically established. It should be based on the product mix demanded by the end-users as revealed by the disaggregated demand supply analysis and availability of infrastructure facilities. The size chosen may be compared with

international sizes and norms, and with minimum economic size, if the same has already been established for plants in the sector. In the case of mineral based projects, the plant capacity may have to be established taking the mineable reserves available, life of the project and other techno-economic parameters etc.

4.8.5 The justification and basis of sizes may be given not only for the main plant and its sections/units/shops but also for auxiliary plant services such as cooling water, DM water plant, oxygen/nitrogen/argon plants, steam/power generation based on cogeneration principle etc. In the case of expansion of existing units, the requirements of the total plant after expansion should be kept in view and possibilities of integration of new facilities with the existing facilities fully examined.

d) Technology:

4.8.6 The project authorities would have shortlisted all the available technologies at the Stage-I. They would have collected sufficient information about various alternative technologies to allow a comparative techno-economic analysis. The DFR should contain a detailed analysis of various alternative technologies (based on the method suggested in Chapter-2) to arrive at the technology appropriate for the project in question. If the project is going to utilise an indigenous technology, the details of the institution which developed the technology, the organisation that has made commercial application of that technology and the experience of other users of that technology should be presented.

4.8.7 In case the technology is to be imported, the reasons for selecting that technology vis-a-vis other competing technologies will have to be indicated. The DFR should also describe the vintage of technology and anticipated development in the field which might make the technology obsolete in the near future. The commercial standing of the foreign collaborator, the market share controlled by them both in their own country and world wide, their track record in transferring the technology to other countries, should also be indicated. The assessment of the foreign collaborator could also be obtained from a third country and mentioned in the DFR. If the same technology has been imported by some other project, that should be mentioned alongwith the experience of that plant. If the selected technology is closely held/and or response from the foreign collaborator is not coming, the details thereof should be highlighted. A summary of the technology agreement signed and the scope of this agreement should be clearly indicated in the DFR.

4.8.8 In addition to the above the following questions need to be dealt with for giving a detailed description of the technological option adopted in the DFR:

- a) Is this the most suitable technology for the product/ raw materials to be used?
- b) Is the chosen technology state-of-the art upto date or conventional/obsolete? Have new technologies already emerged in the advanced countries? How soon will these be adopted on commercial scale in India?
- c) Name the successful plants in India and abroad using this technology. If there are none in India, how has indigenous application been proved?
- d) From where will the requirement of knowhow be procured? Has this knowhow been procured earlier? If so by whom?
- e) If already procured what is the justification for procuring it again? Can it be procured from some unit whose license period is over without getting into legal problems?
- f) Outline plan for outright transfer and absorption of the technology. Is any collaboration required? If so, give details about nature of collaboration, financial and managerial

participation, royalty and technical fees payable, restrictions on export and on the future use of technical knowhow, arrangements for updating it and facilities for access of design and development activities of the collaborator etc. The details about technology absorption plan needs to be spelt out.

g) Whether the technology transfer includes adequate provisions for availing of the training facilities for the Indian Engineers/technicians abroad in the collaborator's works and necessary experts for the erection, testing and commissioning services?

h) Whether the procurement of imported scope of plant and equipment has to be made compulsorily only through the services of collaborator and no direct ordering can be made without getting into problems of performance guarantees for such equipment?

i) Does the agreement provide adequate guarantee for the realisation of plant capacities on a sustained basis over a length of time and compensation/remedies for non-fulfilment of performance guarantee?

j) Has the collaborator arranged/assisted for financing the FE component of funds for meeting the cost of imported scope of supplies? In such cases whether such prices are padded vis-a-vis open market purchase prices? If so, to what extent?

k) Whether the foreign collaborator's support may be required for the import of components which are not proposed to be indigenised even after the period of collaboration and what safeguards are being undertaken to ensure their timely availability and at reasonable costs?

l) What efforts/provisions are proposed to be kept in the project to further develop this technology indigenously so as to keep pace with developments in that technology?

m) Are there any proposals for establishing R&D facilities as part of the project? Is the R&D programme part of the NCST science and technology Plan? Scope of such R&D work may be defined.

n) Whether the indigenously available technology has been considered for adoption and evaluated carefully? Has it been taken up for commercial exploitation in any of the existing industrial undertakings and if so, with what reported degree of success? If laboratory/bench scale indigenously developed technology is being considered, have the capabilities for upscaling the designs been carefully evaluated? Are necessary consultancy organisations available in this field?

4.8.9 Complete details of materials flow and process flow sheets as well as material balances suitably illustrated by charts, line or block diagrams should be given in the DFR. For expansion/modernisation proposals these details both before and after the implementation of the project are required to be given.

4.8.10 The emphasis should be on selection of clean and state-of-the art technology rather than choosing cheaper technology involving significant pollution abatement cost. The analysis of alternative technologies should also study their impact in terms of international protocols.

e) Feedstocks/Raw Materials:

4.8.11 The requirements of major raw materials/feedstocks and inputs must be identified and their technical aspects studied. Technical risks in availability of raw materials/feedstocks must be evaluated and alternative plans developed to ensure smooth running of the plants once the proposal is implemented.

4.8.12 Even though some of the inputs may not form major component of the cost but are critical for production, sources of supplies of such critical inputs, if any, must be identified and the reliabilities of such supplies should be ensured.

4.8.13 Technical specifications and quantities of various feedstocks/raw materials should be specified which are needed to generate the proposed output. These quantities should be related to the production build-up.

f) Energy Consumption:

4.8.14 In case of projects which are of power/energy intensive nature, it is necessary to bear in mind that the scheme is designed and handled with utmost care from the point of view of energy economy. In view of this, it is necessary to specify the energy audit system to be followed in the project. The DFR should deal explicitly with the question of energy economy and how the energy consumption would compare with other plants in India/abroad.

g) Equipment and Construction Requirements:

4.8.15 The DFR should contain a complete list of capital equipment (by type and size) of the main units of the proposed plant, requirements of buildings and structures by type and size and a broad plant layout. It should give justification for the choice of size and specifications proposed for important items of equipment and plant structures.

4.8.16 The DFR should also indicate the possible source of supply of capital equipment, construction services, engineering services, etc. This is particularly important in the case of imported items. For imported items which are of high value or are critical to operation of plant, alternative sources of supplies should be indicated in order of preference.

4.8.17 The level of township satisfaction which has been assumed in the project cost may be indicated together with the details of the various types of houses which are proposed to be constructed as laid down by the Bureau of Public Enterprises (BPE). The precise location of the project and township and the distance between them may also be indicated on suitable maps. If the project authorities are planning to seek a separate sanction for the township at a later date, the years in which they may come up for such a sanction together with the likely requirement of funds in those years may have to be foreseen at the investment decision making stage itself as per the instructions in vogue.

4.8.18 **Choice of equipment:** The DFR should also deal with the analysis underlying the choice of equipment and specifications of the construction requirements. The type of questions that should be dealt with here are as follows:

- i) How has the capacity of the plant as a whole been determined? Will the plant be worked on a single, double or triple shifts?
- ii) Which plants/sections of the project could be made labour intensive?
- iii) What is the extent of in-built capacity for expansion?
- iv) Have standby units been provided for? What assumptions have been made about maintenance, shutdowns and idle time for different items of equipment?
- v) If the different items of equipment are not fully balanced, which are the items with substantial amount of excess capacity and what is the reason for such excess capacity?
- vi) On what basis have the construction specifications for factory buildings and other on-site facilities been determined?
- vii) How has the economic life of the project been established?
- viii) What is the housing satisfaction standard adopted for the purpose of township planning? What are the township densities which have been adopted?

ix) Has the possibility of the purchase of second-hand equipment/leasing arrangements to reduce capital costs been considered? If so, pertinent details of such arrangements may be furnished.

4.8.19 Construction methodology and technology: The DFR should outline the construction methodology and technology to be used, including capital vs labour intensive options considered, construction equipment to be used, use of new materials planned, innovations in methodology, quality assurance of construction labour, improvements planned over present construction methodologies / technologies and their likely input / benefit on project construction time and cost.

h) Manpower Requirements:

4.8.20 The DFR should indicate the unitwise and category-wise requirement of personnel for the project and plan for induction of different categories of personnel. It should also indicate the arrangement proposed for training in-plant and outside. If the project involves redundancies, it should indicate plans for redeployment of the staff rendered surplus. The DFR should indicate the steps envisaged for avoiding retrenchment or redeployment of construction staff after completion of construction, wherever necessary.

4.8.21 The DFR should also indicate the organisation structure envisaged for the project after it goes into production, and the time schedule for filling up of key posts, particularly that of the Chief Executive. It should also indicate the arrangements contemplated for ensuring continuity in top management.

i) Transport and Communication Requirements:

4.8.22 The projected requirement of the various transportation facilities typewise such as, rail, road, etc., may be specified in the DFR alongwith the problems, if any, in meeting the projected requirements. In particular the DFR must specify:

i) The transport routes and modes that will be used to carry important raw materials and outputs with details about the quantities to be moved, the available capacity on the route, the additional investments that may be required, the alternatives considered etc.

ii) Whether there will be any constraints on the movement of over-dimensional consignments (ODCs)? If so, the arrangements that are envisaged for this purpose.

iii) The terminal facilities like sidings and sheds that will be required to facilitate the movement.

iv) Whether adequate port capacity exists if imports or exports by sea or coastal shipping movement are involved ?

4.8.23 If the project is expected to generate substantial demand for tele-communication requirements such as, telephone/ telex exchanges etc., arising from the largeness of the project, this may have to be indicated in the DFR and associated cost should be treated as a part of the capital cost.

j) Utilities:

4.8.24 Details for utilities such as water, power etc., separately for meeting construction requirements and for operating the plant, including quantities, quality aspects, sources, transmission / transportation, commitments obtained etc., should be specified.

k) Linked Projects:

4.8.25 Many of the projects have backward (input side) and forward (output side) linkages. If the project under consideration has such special linkages in the forward or backward directions, the same will have to be specified with the progress in the implementation of such projects so that all of them put together work as a smooth integrated system.

4.9 ORGANISATIONAL AND MANAGERIAL ASPECTS:

A) Implementation Plan:

4.9.1 The DFR should indicate the activity-wise phasing of construction preferably in the form of a bar chart or a master control network (PERT/CPM) diagram. Quantitative information on the phasing of material and labour requirement during the construction period should be specified, besides indicating the timing of deliveries of imported and indigenous equipment. It should also contain a copy of the Master Control Network (PERT/CPM based) or if not possible, a bar chart. The physical phasing given in the bar chart/network should be consistent with the phasing of expenditure given in the section on the capital costs.

4.9.2 As the completion and commissioning of the project is dependent on the availability of infrastructural facilities like water and power supply and railway siding, completion of which is handled by other agencies, the phasing of construction activities of these inter-related facilities or linked projects should also be given so as to present an integral view of all the linkages.

4.9.3 The DFR should also deal with the types of problems that may affect the phasing of the construction. These may include the difficulties involved in procurement of construction material and power and other utilities and availability of construction equipment and manpower. Other difficulties may arise in the movement of oversized consignments and special requirement of skill for onsite fabrication. A detailed resource-based implementation plan should integrate project activity work, quantities, time, sequencing, and match the requirements for manpower, materials, equipment, utilities etc., with the constraints of availability in each time period.

B) State of preparedness:

4.9.4 The following information may have to be furnished by the project authorities to illustrate their preparedness for the implementation of the project under consideration:

i) Studies and investigations:

4.9.5 How far the required studies and investigations have been completed leading to, in general, a better prepared project? (Survey of India topographic maps-million sheets, quarter inch and one inch sheets or orthophoto maps, should be used in preparing maps for illustration or location of plants, facilities, transport facilities. Photo interpretation of aerial photographs, Satellite photographs, satellite imagery studies carried out by NRSA may also be used in carrying out studies and investigations).

ii) Mode of implementation:

4.9.6 Whether the project will be implemented departmentally, through a number of contractors/packages or through a single turn-key contractor? If so, whether the turn-key packages have been chosen as homogeneous parts for facilitating easy supervision, monitoring, fixing responsibility for non-attainment of performance, targets and even carrying out a disaggregated cost-benefit analysis wherever possible/required. Whether consultants are to be engaged for supervision/moni-

toring of implementation ? The mode of selection, role and responsibility of the consultants in project implementation must be clearly defined.

4.9.7 If the project is to be implemented by the departmental personnel, whether adequate number of key personnel of required experience and calibre are available ? If fresh recruitment is to be resorted to, whether it will be possible to get such requisite manpower within the stipulated time ? Whether the present recruitment rules and procedures would permit the same?

4.9.8 If the project is to be implemented by hiring the services of a turn-key contractor, the standing of the contractor, his track record in the implementation of similar projects, major works on hand, capability to mobilise the requisite resources at a required time so that the project does not slip may be explained.

iii) Technology transfer:

4.9.9 Whether the technology tie up has been established with a foreign collaborator and if so, what is the status of transfer of the required technology? Will the project require the services of expatriate specialists during the construction period? If so, their requirements may be quantified in man- months, categorywise.

4.9.10 What is the progress in the acquisition of basic engineering and performing detailed engineering work in connection with the project?

4.9.11 How far the material resources have been estimated and the tender documents made ready so that the notice inviting tenders could be released as soon as the investment decision is taken?

iv) Infrastructural backup:

4.9.12 Whether the following infrastructural facilities have been acquired / tied up?

a) Allotment of land and problems associated therewith;

b) Whether the project site is well connected by the road/highway of the required width? If not, what steps are being taken to acquire/augment this facility;

c) Whether there is a need for a railway siding during the construction stage, for easy movement of plant and equipment upto the site by rail? If so, what steps have been taken to ensure that the siding will be available in time;

d) In case the project is heavily dependent on a port for the import of capital goods, recurring import of raw materials or export of finished products, what steps have been taken to augment them;

e) Will the requirements of water during construction period be met? Does it involve any laying of pipe-line to bring the required quantity of water from a nearby river/stream etc? Will it be adequate to run the plant/meet the requirement of township after the plant is commissioned? Whether a storage dam would need to be constructed to obtain the required quantities of water ? If the ground water is the primary source and whether its potential has been estimated through geo-hydrological investigation and by whom?

f) Whether the temporary power connection has been obtained from the SEB concerned for the purpose of erection of plant and equipment, construction etc? How will the requirement of power be met after commissioning? Has the concerned Electricity Board given the commitment? How much of captive generation is planned for sustaining the demand from the category-I loads and insulate the critical equipment from the qualitative and quantitative shortfalls?

g) Whether any temporary housing/warehousing have been provided wherever circumstances warrant the same?

h) In the case of large engineering projects the requirements of tele-communication may have to be assessed i.e. for setting up of a telephone exchange/ telex/FAX facilities etc. If the demand will be of a sizeable nature, the cost of such facilities may have to be included within the capital cost structure of the project under consideration as advised by the Telecommunication Department.

C) Marketing Plan:

4.9.13 Details of marketing plan may be given including any promotional efforts needed, demonstration facilities required; distances of major demand centres, infrastructural (such as transportation) arrangements, marketing organisation (whether own or on contract/license basis), the details about prototypes development, testing and certification, if necessary, product development activities carried out to ensure proper marketing of the product to be launched.

D) Other Clearances Required for Project Implementaion:

4.9.14 List of clearances that may be required for implementing a project and the agencies empowered to accord the clearance should be given, with detailed time planning for the same.

4.10 ENVIRONMENTAL ASPECTS:

4.10.1 The project will have to be cleared from the ecological and environmental point of view by the Ministry of Environment and Forests of the Government of India as well as the Environmental Control Boards of the respective State Governments. In view of this, the individual requirements of these organisations will have to be foreseen and complied with. The environmental impact of the project and the measures envisaged to prevent environmental deterioration and hazards should be fully discussed in the DFR together with the cost implication. The environmental clearance should be obtained before the project is submitted for Stage-II clearance and relevant costs of environment related aspects separately may be mentioned in the cost estimates.

4.10.2 Information on the following items is required for the above purpose:

- a) Site Plan indicating location of different plants, storages, township and green belt.
- b) Emissions, water balance, solid and liquid waste generation and disposal, including their recycle, occupational health associated with the project, risk analysis in the case of hazardous industry, disaster management plan, green belt development plan, afforestation programme, in case of industries using forest lands/resources.
- c) Rehabilitation plan.
- d) Pollution Control systems proposed and their efficiency.
- e) Permission from the State and Central Pollution Control Board and State Department of Environment.
- f) Permission from Regional Planning Bodies.

4.11 PROJECT COST:

a) Capital Cost Requirement:

4.11.1 For the purpose of appraisal, capital costs are essentially those costs which are incurred before the commencement of commercial production. Apart from the expenditure on fixed assets, costs incurred for items like labour training, test production etc., which may not appear to be

expenditure on capital items, should for the purpose of appraisal be treated as capital costs. A summary of capital cost to be furnished is set out at DFR-2. The basis of the capital cost estimate is to be presented as per the format.

4.11.2 While several sets of alternatives may be available for consideration at the Stage-I level, they may get reduced to a few only at the Stage-II based on substantial amount of basic data generated from the various detailed and in-depth studies.

4.11.3 In most cases it may be necessary to prepare information on more than one alternative based on the different assumptions such as, maximum procurement of imported supplies with a view to reducing the gestation period or maximum procurement of indigenous supplies with a view to curtailing foreign exchange requirements. In these cases, the time schedules will vary and accordingly the capital cost phasing (local costs and foreign exchange costs should be shown separately) required to be given vide formats DFR-1.3 and 1.4 will also have to be furnished separately for the different alternatives under consideration. The capital cost phasing should also correspond to the scope of the project as defined in paras on project description.

4.11.4 The capital cost estimates of the project will have to be prepared after carrying out the detailed studies/investigations as laid down in the Chapter-3 of these Guidelines. While the studies and investigations will give the broad project parameters, it is equally important to firm up the estimates with other critical details such as, scope of supplies from indigenous and imported sources, in-house/departmental construction vs turnkey execution, proper estimation of the auxiliary/ancillary/ off-site facilities, administration, and supervision required during the construction period, contingencies and the like.

4.11.5 The project authorities should indicate in the Format DFR-2, the degree of reliability of the capital cost estimates componentwise.

4.11.6 As per present PIB procedures, no built-in provisions for forward escalation in the capital cost estimates are allowed. Hence, the cost estimates should correspond to a fairly recent base date, not more than six months old. The base date (month /year) should be clearly indicated. All cif/fob prices for traded/tradeable products/raw materials/feedstocks etc., for economic analysis should be average of last three years in international currency, converted into rupees at the current exchange rate. Where possible and relevant, maximum & minimum prices in last three years and outlook of prices in the international market based on authoritative forecasts, may also be given.

4.11.7 The project authorities should also adhere to the norms approved by the PIB regarding the admissible level of contingencies, or any other provision to be made in the cost.

4.11.8 If the project involves replacement and renewals in a particular segment before the end of the economic life of the project, such costs should be duly indicated in the respective years in which they are expected to occur.

4.11.9 The cost on account of environmental safeguards including pollution abatement, rehabilitation, afforestation etc., would need to be estimated with the help of concerned authorities and the cost involved may be shown in the capital cost estimates, as a separate item (DFR-2.7).

4.11.10 Format DFR-2.8 has been designed with a view to collect information about the working capital requirements. Based on this, the margin money for the working capital required for the project and forming a part of the capital cost estimate will have to be determined for the purpose of sanction for the investment. While the entire requirement of working capital should also be

reflected in the separate column, for the purpose of viability analysis the margin money (as a part of capital cost) and interest payments on borrowed working capital are taken as cash outflows.

4.11.11 The information on the capitalised interest (on loan portion only) during construction should be furnished in detail (DFR-2.9) with the necessary back up calculations.

4.11.12 The DFR should also deal with the capital cost phasing of the project taking into account the various critical activities, requirements of resources, terms and conditions at which these resources could be mobilised, and arrive at the yearly requirements of funds for execution of the project.

4.11.13 In all cases, the primary data on the basis of which the estimates have been made should be given in subsidiary annexures indicating the physical units and the unit rates used. Where provisions have been made on a lumpsum basis, the same should be clearly spelt out.

b) Operating Requirement and Costs:

4.11.14 For the purpose of project appraisal, revenue expenditure which is incurred after the project commences commercial production may be treated as operating costs. A series of formats (DFR - 3.1) have been designed to collect information about the operating costs in the form required for the financial and economic analysis.

4.11.15 In the summary table at Format DFR-3.1 the items of costs have been divided into two categories 'A' and 'B' in terms of variable and fixed elements. These operating costs should also correspond to the same reference base (quarter/year) to which the capital costs are related. No provision for forward escalations is admissible as per the current PIB procedure in the operating costs as well.

4.11.16 Variable costs at category 'A' comprise the items such as, raw materials, intermediates and boughtout finished items (if applicable), stores & spares, fuels, utilities and some components of the overheads. The details of the norms of consumption, total annual requirements and the unit rates for the various inputs, etc., are to be specified in this summary table. It is also to include break-up of the costs in terms of the Indigenous Component (IC) and Foreign Component (FC).

4.11.17 The fixed costs at category 'B' comprise items such as, labour and supervision, fixed overheads, repairs and maintenance etc. The depreciation is also to be indicated in this Format. The formula and the method used for the depreciation will need to be specified in the DFR. Similarly, amortization of current assets, deferred revenue expenditure, interest payments on the long terms loans and the short term loans may be furnished separately alongwith the basis of such calculations. The total cost of production comprising the variable and fixed elements will be taken over further to Format DFR-4.2 for the purpose of making the profitability projections.

4.11.18 Each industry/enterprise may also develop a uniform code for the various costs. But, once they are formed it is desirable to adhere to the same in the various DFRs prepared by the enterprise.

4.11.19 The information at Format DFR-3.2 is required to be furnished for the stable level of capacity utilisation (which is to be specified at the top of the table) for a full year for the project. In the same manner calculations may also be required to be given yearwise for the project till the stable level of capacity utilisation is attained assuming an appropriate production build-up.

4.11.20 The basis on which the operating requirements and costs have been estimated should be presented in the DFR.

4.11.21 Format DFR-3.3 has been designed to collect data on labour requirements and labour costs. The coding of labour by category suggested in this table could be modified to suit the requirements of each enterprise. However, as far as possible, the modifications should take the form of an addition of sub-categories rather than a complete change in the classifications suggested here.

c) Total System Cost

4.11.22 This includes the costs which are incurred in the creation of the required complementary facilities by the other organisations which are not owned by the enterprise. But, nevertheless, these are required for the smooth construction/ operation of the project. Some of these costs could be for the following facilities:

- * Water supply
- * Power supply
- * Port facilities
- * Railway lines/yards/rolling stock
- * Projects for the supply of inputs having vertical linkages such as, heavy forgings/castings for a T.G. Set, semi-conductor modules for digital watches, T.V. Picture tube shells for the manufacture of T.V. sets and the like.
- * Linked mining projects such as iron ore, coking and non-coking coal, limestone/dolomite mines for integrated iron and steel plants or pellet plants for sponge iron plants, the same for steel producers based on EAF route etc.

4.11.23 As regards the system-projects, the following details may be furnished:

- * Name of the project / enterprise owning the project;
- * Agency likely to provide/create new facilities;
- * Basis of capital cost estimation with annual phasing of cost, foreign exchange requirements in the capital cost, date of completion of the project and contractual commitments, if already entered into.
- * Whether these are already approved /yet to be approved/ in regular production in operation.

4.12 FINANCIAL ANALYSIS:

4.12.1 In financial analysis it is necessary to assess the financial health of the organisations with and without the project, manner of funding and financial viability. The first is analysed with the help of projected profit and loss/balance sheet statements with and without the project (DFR 4.1 & 4.2).

4.12.2 The second part of financial analysis is to indicate yearwise capital fund planning i.e., sources of fund to meet the yearwise requirements, separately for Indian cost and foreign exchange, subdivided into internal resources, market borrowings, suppliers' credits, multilateral/bilateral funding, other sources and budgetary support. The degree of FE neutrality of the project and the number of years required to achieve 100% FE neutrality (where applicable) should be indicated. The sources of funds, alongwith amounts, terms (interest, repayment period etc.) should be clearly indicated (Format DFR 4.3).

4.12.3 The purpose of third part of financial analysis is to assess the financial soundness of a project. There are different indicators for assessing the financial soundness of a project such as, Net Present Value (NPV), Internal Rate of Return (IRR), Breakeven Point (BEP), Pay back period, capital output ratio etc. These are complementary, rather than alternatives. Each indicator has its own strong and weak points. For a proper idea of the financial soundness of the project, it is necessary to assess it from different aspects. Besides the above indicators, it would be necessary to work out the ability of the enterprise to meet year by year cash liabilities in order to assess budgetary implications as a result of the implementation of the project and the financial position of the undertaking 'With' and 'Without' the project (DFR-4.4).

4.12.4 In case of projects where the revenue earnings are based on administered prices, the calculation of IRR may not serve any meaningful purpose. In such cases, the cost of production/generation/storage would need to be worked out to assess the implicit subsidy involved.

4.12.5 For projects where quantification of benefits is difficult such as, sound broadcasting, TV, health, education projects etc., the practice in vogue is to follow the cost minimisation/cost effective approach, and work out the cost per unit of satisfaction.

4.13 ECONOMIC ANALYSIS:

4.13.1 The purpose of economic analysis is to determine whether the project is worthwhile from the point of view of entire economy. Most of the data required for economic analysis are covered elsewhere in the guidelines in the sections on capital requirements and costs and operating requirements and costs. In addition, data would be required on the level of import and export alongwith the average import/export prices and also data on the impact of the project on foreign trade.

4.13.2 Normally, the following analysis should be carried out:

- i) Economic IRR with and without premium on foreign exchange and other shadow prices. (As may be prescribed by the government).
- ii) Net Present Value (with and without premium on foreign exchange and other shadow prices) where selection is to be made from among the mutually exclusive projects or the least cost option is to be selected. The discount rate is to be used as prescribed by the Government.
- iii) Domestic Resource Cost i.e., the rupee cost of earning/ saving foreign exchange. No premium on foreign exchange rate is used in this calculation.
- iv) Net foreign exchange earned or saved over the entire life of the project.

4.13.3 The economic analysis has to be carried out on incremental basis, i.e. taking all costs and benefits "with" the project minus "without" the project; not "after" and "before". In other words if the existing situation is expected to deteriorate or improve without the project, such change has to be taken into consideration. The results are presented in DFR-4.5.

4.13.4 The meaningful economic analysis should take account of indirect costs and benefits - quantifiable as well as non quantifiable. Several costs which were earlier external to the project are being internalised, e.g. the cost of rehabilitation of the population to be shifted from the site, cost on the anti-pollution measures etc., form part of the capital cost of the project. In case there are any costs or benefits which are not quantifiable, these should be clearly discussed. Even if the cost of anti pollution measures have been internalised it should clearly discuss the consequences such as, emission of pollutants into the atmosphere, disposal of toxic wastes into the water courses,

the number of people (occupation wise) to be shifted from the project site and to be rehabilitated elsewhere. There are many other indirect consequences, costs as well as benefits, which should be discussed. These may include property damage, loss of amenities, damage to the landscape etc., The major components of environmental cost are damage cost and abatement cost. The damage costs are those which society faces because of actual damage to the environment and largely paid by the public. The abatement costs are those for controlling the causes of environmental damage which are internalised, but could in the long run be passed on to others through higher prices, government subsidies or tax incentives. There may be genuine difficulty in estimating these costs, especially the damage cost. The impact assessment, if carried out properly, would enable the decision makers to make the analysis as rational as possible. At least, the various causes and effects should be itemised as distinctly as possible and presented in the form of impact matrices.

4.13.5 In economic analysis, it is absolutely essential to avoid double counting and undue credit should not be taken for the benefits which would accrue to the society even without the project. One indirect benefit often advanced to justify the project is the growth of ancillary industries. This may refer either to output using industries or input supplying industries. The benefits accruing from a growth in output using industries could have been secured by imports even without the project, though, it is possible that the easy and cheaper availability gives additional impetus. Similarly, the input supplying industry could have exported their output. The availability effects will be of consequence mainly in respect of non-traded goods. The benefits from traded inputs are in most cases reflected in the project prices and in transport costs.

4.13.6 The credit, however, should be taken where an existing industry supplying an input has excess capacity and increase in the demand for that input results in decline in cost which will, of course, accrue to the main project. But this will benefit to the supplying industry as well. Such benefits should be listed as far as possible. It is, therefore, essential to know which supplying industry has excess capacity or not.

4.14 SENSITIVITY ANALYSIS:

4.14.1 It is assumed that the DFR is prepared on the basis of, as far as possible, realistic assumption of demand-supply gap/ or meeting technological necessity/export possibility, capital cost estimates, gestation period, operating cost estimates, production build-up, turnover, economic life, etc. But, the project is in the nature of a venture which means exposure to chance and some of the assumptions/estimates may go wrong. Experience shows that in several areas assumptions have often gone wrong. It is, therefore, necessary to carry out sensitivity analysis to indicate the project's financial profitability and economic viability or cost of production when there are changes in the estimates of key parameters. The extent of changes in the key parameters should be based on the past experience relating to the Sector. The results are to be presented in DFR 4.6.

SALIENT FEATURES OF THE PROPOSAL

A. Identification Characteristics:

1. Name of the project:
2. Location (District/State)
3. Implementation Agency
4. Department/Ministry sponsoring the project
5. Sector
6. Objectives/nature of project (Grassroot/expansion/
replacement/ rehabilitation/modernisation).

B. Physical Characteristics

1. a) Installed capacity proposed
b) Production at ___% capacity utilisation.
c) Details about unit/section/shopwise capacities.
d) Production of products, by products and coproducts.
2. Principal raw materials and energy requirement
at the proposed capacity utilisation of ___% .
a)
b)
c)
3. Linkages of raw materials /utilities
4. Linkages of finished product
5. Technology requirements
a) Indigenous
b) Foreign
6. Additional Employment generation (No. of posts)
7. Major facilities planned, their capacities and sizing etc.

(contd.)

C. Financial & Economic characteristics:

1. Total capital cost (Rs. Crores)
2. Foreign exchange component (Rs. Crores)
3. Exchange Rate:
4. Interest during construction (Rs. crores) (included in C-1)
5. Degree of reliability of cost estimates.
6. Funding arrangement for Indigenous cost (IC) and FE
7. Total system cost (Rs. crores)
8. Base date of capital cost (month/year)
9. Annual operation and maintenance cost (at _____ % cap. ut.) [Rs. crores]
10. Sales turn over (at _____ % capacity utilisation.) [Rs. crores]

D. Evaluation Indices:

1. Viability

	IRR(%)	NPV *	Domestic Resource Cost (Rs./US \$)	Cost per unit *
	1	2	3	4

(i) Financial

(ii) Economic **

* This has to be worked out at the discount rate specified by the Government.

** With premium on foreign exchange and other shadow prices as specified by the Government.

2. Break-even point at _____ % capacity utilisation.
3. Year in which the cumulative cash flow turns positive/payback period.

E. Implementation period & life:

1. From the date of sanction to mechanical completion _____ years _____ months.
2. From the date of sanction to commissioning _____ years _____ months.
3. From commissioning to full capacity utilisation _____ years _____ months.
4. Expected economic life of the project.

**AVAILABILITY/QUALITY OF LIMESTONE AND ITS TECHNOLOGICAL
ASSESSMENT FOR CEMENT MANUFACTURE**

1. Type of Limestone Deposit: Geologically Simple/Complex/Intricate.

(CRI Classification)

- Type of Lease

2. Details about the prospecting/exploration work:

a) Surveying

b) Surface Geological Mapping (Nature of outcrops):

c) Pitting and Trenching (if any):

d) Drilling (Agency-wise) Core drilling DTH drilling Others

- Drilling Pattern & Density
- Meterage & number of holes
- Depth to which limestone explored
- Core recovery
- Whether sludge samples collected?

e) Exploratory mining (if any)

f) Sampling (Agency-wise)

- Limestone
- Possible additive materials

(Overburden/waste rock shale/clay/laterite etc.)

g) Whether any minerals of potential value present besides cement grade limestone?

3. Block-wise Reserves

Quantity

In situ Grade (%)

(CRI Norms/GSI

Standard Terminology)

CaO MgO SiO₂ Al₂O₃ Fe₂O₃ LOI

a) Geological - (In situ grade)

- Proved (measured),
- Probable (Indicated)
- Sub-total: Demonstrated
- Possible (inferred)

(contd.)

- b) Benchwise Mineable Reserves (ROM grade)
 - e) Degree of reliability of reserves
 - d) Minor Constituents (Below/above specified limits):
4. Results of Geostatistical analysis of exploration data (if any):
5. Bench-wise Mineable Reserves -
- Block A
 - Bench 1
 - Bench 2
 - Bench 3
 - Block B
 - Bench 1
 - Bench 2
 - Bench 3
- Total:
6. Details of Mining Method - Manual/Semi-mechanised/Mechanised
- a) Overburden/waste rock
 - b) Stripping Ratio
 - c) Exploitation rate
 - d) Life of Demonstrated Reserves
 - e) Cost of limestone raising
7. Details of Beneficiation tests (if required):
- Bench scale
 - Pilot plant scale
 - Quality of limestone before
and after beneficiation
 - Recoveries
 - Cost of limestone beneficiation

(contd.)

8. Details of Technological Assessment (Bulk sample tests):

- a) Compressive strength
- b) Bond work index
- c) Porosity
- d) Mineralogical and Petrographic analysis
- e) Raw Mix Design
 - Silica modulus
 - Iron modulus
 - LSF
- f) Type of additives required.

**DATA ON LOCATION, SITE CONDITIONS AND
INFRASTRUCTURAL REQUIREMENTS
(for Cement Projects)**

1. Type of Project: Portland/slag/fly ash cement
2. Locational Characteristics: (For expansion/modernisation proposals, information may be furnished on total and incremental basis)
 - a) Whether integrated or split location
 - b) Details of location and area proposed to be acquired for -
 - Quarry, including overburden/waste dumps
 - Clinker plant
 - Cement grinding unit
 - Township(s)
 - Slag grinding Unit (if required)
 - c) Whether sited on mineralised/non-mineralised ground:
 - If sited on mineralised ground, how far from quarry limits is?
 - Clinker Plant
 - Overburden/Waste dumps
 - Township/Offsite facilities
 - d) Nature of terrain; Hilly/flood prone/low lying/other (specify):
 - e) Geological/Geohydrological/Meteorological and seismic features of site/location having impact on civil works/ structures:
 - f) Ownership pattern of land:
 - g) Measures required for flood protection/ seismicity (if applicable):
 - h) Measures required for prevention of soil erosion/land slides etc. (if applicable):

(contd.)

- i) Defence Ministry's approval:
 - If required: obtained/not obtained.
 - j) Whether located in backward area?
 - If so, give details of concessions.
 - k) Status of labour relation in the area.
 - l) Whether any legal problems anticipated in land acquisition:
 - m) Availability and cost of land acquisition:
 - n) Whether route survey for railway siding conducted:
3. Baseline data (before and after project implementation) on:
- Land use
 - Water use
 - Salient demographic features
 - Fauna & Flora/terrestrial and aquatic ecology
 - Hydrological data/water quality
 - Meteorological data/Air quality(for atleast 4 seasons)
 - Noise
4. Accessibility and Transport links:
5. Rehabilitation Measures required:
- Number of persons to be displaced:
 - Number of Tribals:
 - Others:
 - Cost of rehabilitation:
6. Results of soil investigation:
- a) Types of soils
 - b) Load bearing capacity (if applicable):
 - c) Types of foundations required
 - (unpiled/piled/bored piles/others)

(contd.)

7. Details about availability of slag/fly ash:
 - Source(s)
 - Quantities
 - Whether slag grinding required
8. Details of Coal Linkage:
 - a) Colliery/seam to which linked
 - b) Coal requirement
 - c) Grade of coal
 - Specified
 - Available
 - d) Reserves of coal linked
 - e) Proximate analysis of coal -
 - Fixed Carbon
 - Volatile Matter
 - Moisture Content
 - Calorific Value
 - f) Status of implementation of linked coal project
 - g) Arrangements for coal handling.
9. Other input requirements/sources of supply:
 - Gypsum
 - Others
10. Transport Requirement/Availability:
 - a) Annual movement of -
 - Coal
 - Cement
 - Slag/fly ash
 - b) Existing line capacity
 - c) Line capacity planned

(contd.)

11. Power Requirement/Availability

- a) Requirement
- b) Availability from SEB/Regional grid
- c) Captive generation required.

ANALYSIS OF MINE/CONCENTRATOR/SMELTER/REFINERY CAPACITIES

A. ORE-CONCENTRATE BALANCE (Mine field-wise):

(for the last 5 years and projected for terminal years of current and next five year plans)

I. CONCENTRATOR CAPACITY (Public/private/joint sector)

(in terms of throughput and grade of concentrate)

	Year		Year		Year	
	-----		-----		-----	
	Q	G	Q	G	Q	G
a) Existing Plants						
b) Plants under implementation						
c) Plant under appraisal						
Total capacity(throughput)						
Average capacity utilisation						
Actual/projected production of concentrate						

II. MINE CAPACITY

(in terms of ROM ore per day)

- a) Existing Mines
- b) Mines under implementation
- c) Mines under appraisal

Total capacity:

Actual/projected annual production of ROM ore:

Export of ROM ore (if any):

Net available for treatment:

Number & type of concentrates produced:

Average recovery in the concentrates

(for each metal in the ore):

(contd.)

Average concentration ratio

(for each metal in the ore):

Actual/projected production of concentrate(s):

III. Details about mismatches in mine-concentrator capacities (if any):

B. SMELTER-CONCENTRATOR BALANCE (Metal-wise)

(for the last 5 years and projected for terminal years of current & next five year plans)

I. SMELTER CAPACITY(Plant-wise)

(Public/Private/Joint Sector)

Year Year Year

a) Existing smelters

b) Smelters under implementation

c) Smelters under appraisal

Total capacity (crude metal)

Average capacity utilisation:

Actual/projected production of crude metal:

Average recovery of metal in smelter:

Total concentrate used/required:

Imports of concentrate (if any):

Net requirement of indigenous concentrate:

II. CONCENTRATOR CAPACITY (Plant-wise)*

(in terms of metal content)

a) Existing plants

b) Plants under implementation

c) Plant under appraisal

Total Concentrate capacity:

Actual/projected production of concentrate:

Export of concentrates:

Toll smelting of concentrates(if any):

Net available for treatment:

(contd.)

III. Details about smelter-concentrator linkages including distances involved and mismatch in capacities:

C. SMELTING-REFINING BALANCE

I. Refining Capacity (Plant-wise)

- a) Existing plants:
- b) Plants under implementation
other than under appraisal:
- c) Plant under appraisal:

Total capacity (refined metal):

Average capacity utilisation:

Actual/projected production of refined metal:

Average yield:

Total crude metal used/required:

II. AVAILABILITY OF CRUDE METAL

- a) Actual/projected production of crude metal
(as per smelter concentrator balance) :
- b) Crude metal not required to be refined:
- c) Net crude metal to be refined:

III. Details about refinery-smelter linkages and mismatch in capacities:

* For aluminium metal the relevant item is alumina plant capacity.

GEOTECHNICAL PARAMETERS OF METAL AND OTHER MINING/NON-FERROUS METALLURGICAL PROJECTS

1. Type of Ore Deposit: Stratiform/massive/disseminated/vein type etc.
 - Geological parameters: strike length/depth/average width/shape/complexity etc.
 - Ore types in the deposit.

2. Details about Exploration Work: (Review of work done on the deposit by various agencies)
 - a) Geological/Geophysical/Geochemical Surveys -
 - Airborne
 - Ground surveys
 - b) Type of Anomalies, if discovered
 - c) Surface geological mapping
 - d) Surveying
 - e) Pitting & Trenching (if any)
 - f) Drilling (Agency-wise and campaign-wise)

	Core drilling	DTH drilling	Others
- Drilling pattern & density			
- Meterage & number of holes			
- Depth to which deposit explored			
- Whether open or closed at depth			
- Core recovery			
- Whether sludge samples collected			
 - g) Exploratory Mining (if any)
 - h) Details of sampling (Agency-wise) including check sampling, if any:

(contd.)

3. Salient features of the mine:

a) Estimation of Geological Reserves

Quantity of Ore

Estimating Agencies

(region/area/blockwise)

- i) Blocked (positive)
- ii) Proved (measured)
- iii) Probable (Indicated)

Sub-total : Demonstrated

Possible (Inferred)

Total:

b) Bulk density:

c) Method of Reserve estimation used:

d) Cut-off grades assumed:

- i) Geological/natural/assay
- ii) Economic

e) In situ grade (metal wise); Arithmetic/Geometric Mean

f) Degree of reliability of ore reserves (based on conventional/geostatistical analysis):

g) Confidence limits on:-

- tonnage of ore reserves
- grade of deposit (metal-wise)

h) Mining method: Technology options:

- Underground: stoping method(s) mine entries and haulage of men and material
- Open cast:
- Any other (solution mining/hydraulic mining etc.)

i) Mineable reserves

j) ROM grade

k) Dilution & Mining loss factors

l) Optimum production capacity and life of reserves

(contd.)

- m) Sequencing of mining operations
- n) Efficiency of mining operations
- o) Details about Mine Design:
 - (i) Opencast:Shovel dumper/rope shovel/hydraulic excavator etc.
 - Stripping ratio
 - Bench height
 - Overburden/waste rock volume
 - Other parameters
 - (ii) Underground:-Cut & fill/open/shrinkage stoping/ vertical crater retreat/block caving/room & pillar/any other (please specify):
 - Vertical/inclined shaft(s)/declines/
spiral ramps as mine entries, haulage of men and materials.
 - Mine development
 - Shaft: Depth..... Nos.....
 - Ventillation/haulage
 - Declines/inclines
 - Other mine entries
 - Level development
(drivage, X-cuts/raises etc.)
 - Other parameters
- p) Grade of Concentrate(s)
- q) Annual production of concentrate(s)
at full capacity
- r) Recovery of concentrate(s)
- s) Smelter/Roaster/Calcination Plant Recoveries
- t) Annual Production of Metal(s)/roasted/calcined products
at full capacity

(contd.)

- u) Details of metallurgical testwork (roasting/calcination
/other metallurgical) done:
 - Laboratory scale/Bench scale
 - Pilot plant scale
 - drill core
 - bulk sample
 - Chemical & Mineralogical analysis of -
 - i) Ore
 - ii) Concentrate(s)
 - iii) Metal Distribution
 - iv) Beneficial/deleterious constituents
present in concentrate.
 - v) Details of Geotechnical studies on
drill core/bulk samples:
 - w) Details about Mill Design Parameters:
 - x) Details about smelter design parameters:
 - y) Details about Refinery design parameters:
 - z) Details about fabrication facility
design parameters:
4. Salient features of the Mill (Concentrator/Beneficiation Plant)
- a) Where will the ore be treated?
 - Existing mill
 - New mill

(contd.)

b) Details about Ore Milling:

	If treated in	
	Existing Mill	New Mill
A. Capacity of Mill		
B. Supply of Ore		
i) from existing and approved mines		
ii) from unapproved mines other than mine under appraisal		
iii) from mine under appraisal		
Total supply:		
c) Technology: (Dry/wet beneficiation/jigging/tabling/gravity concentration/cyanidation/floatation/chemical/bacterial leaching):		
d) Process details:		
e) Process flow sheet details:		
f) Details about treatment of lean ores/oxidized ores etc.:		
5. Salient features of the smelter (Metallurgical Plant):		
a) Where will the concentrate(s)/ore be treated(roasted/calcined/smelted)?		
- existing smelter/metallurgical plant (name the linked smelter/plant)		
- toll smelted abroad		
- exported (quantities)		

(contd.)

b) Details about the smelter(s)/metallurgical plant:

- | | If treated in | |
|--|----------------------------|-----------------------|
| | Existing Smelter/
plant | New Smelter/
plant |
| A. Capacity of the plant(s) | | |
| B. Supply of concentrates | | |
| i) from existing and approved mines/mills | | |
| ii) from unapproved mines/mills
other than mine/mill under appraisal | | |
| iii) from mine/mill under appraisal | | |
| Total supply: | | |
| C. What is the minimum economic size of smelter? | | |
| D. Whether import/export/toll smelting required
to avoid mismatches in smelter/concentrator capacities? | | |
| c) Technology: (Pyrometallurgy/hydrometallurgy etc.): | | |
| d) Process details: | | |
| e) Process flowsheet details: | | |
| f) Details about treatment of byproducts
(residues/slimes/cakes etc.): | | |
| 6. Salient features of the Refinery: | | |
| a) Where will the crude metal be refined? | | |
| - existing refineries | | |
| - new refinery | | |

(contd.)

b) Details about refining plant

Existing
refinery

New
refinery

A. Capacity of Plant(s)

B. Supply of crude metal

a) from existing and approved smelters

b) from unapproved smelter other than
smelter under appraisal

c) from smelter under appraisal

Total supply:

c) Technology & Process details:

7. Recovery of By-product Metals/Minerals (if any):

a) whether the recovery of byproduct metals/minerals
in the ore/concentrate/smelter cake/sludge/slimes etc.
is feasible/planned (based on R&D/metallurgical test work)

b) Details of bench scale/pilot plant scale test work.

8. Details about downstream units (if any)

a) whether production facilities beyond primary
refined metal required:

i) continuous casting - billets/strips/sheets

ii) Rolling - hot rolling/cold rolling coils

- wire bars

- structurals

iii) Extrusions

iv) Die casting

b) If so, details about existing capacities/
capacity under implementation and under appraisal.

**DATA ON LOCATION, SITE CONDITIONS &
INFRASTRUCTURAL REQUIREMENTS**

(For Mining/Metallurgy Projects)

1. **Type of Project:** Mine/Mill/Smelter/Refinery/Fabrication Facility/Integrated
2. **Locational Characteristics:** (For expansion/modernisation proposals information may be furnished both on total and incremental basis)
 - a) **Whether integrated or split location:**
 - In case of split location, distances between:
 - Mine & Mill
 - Mill & Smelter
 - Smelter-Refinery
 - Smelter-Fabrication facility
 - b) **Details of location and area proposed to be acquired for:**
 - Mine
 - Overburden/waste dumps
 - Mill
 - Tailing dams
 - Smelter
 - Refinery
 - Fabrication facility
 - Others
 - Township(s)
 - c) **Nature of terrain:** Hilly/flood prone/low lying/others (specify)
 - d) **Geological/Geohydrological/Meteorological/seismic features of site location:**
 - e) **Ownership pattern of land:**
 - f) **Measures required for flood protection/seismicity (if applicable):**
 - g) **Measures required for prevention of soil erosion/land slides etc. (if applicable):**
 - h) **Defence Ministry's approval:**
 - If required: obtained/not obtained. (contd.)

- i) Whether any legal/environmental related problems anticipated in land acquisition:
 - j) Are the concessions available for location of industry in backward area pertinent?
If so, give details:
 - k) Status of labour relations in the area:
 - l) Availability and cost of land acquisition:
 - m) Is rail link feasible? If so, whether route survey for railway siding conducted?
3. Baseline data (before and after project implementation) on:
- Land use
 - Water use
 - Salient demographic features
 - Fauna & Flora/terrestrial and aquatic ecology
 - Hydrological data/water quality
 - Meteorological/Air quality data (for atleast 4 seasons)
 - Noise
4. Accessibility and Transport Links:
5. Rehabilitation Measures required:
- Number of persons to be displaced
 - Number of tribals
 - Others
 - Cost of rehabilitation
6. Results of soil/geotechnical/geomechanical investigations:
- a) Type of soil
 - b) Load bearing capacity
 - c) Types of foundations required
7. Details about availability of inputs/sources of supplies:
- Explosives
 - Reagents/chemicals
 - Stores & spares
 - Others

(contd.)

8. Details about coal linkages for power plant, if any -
 - a) Colliery to which linked
 - b) Coal requirements
 - c) Grade of coal
 - specified
 - available
 - d) Reserves of coal linked
 - e) Proximate analysis of coal
 - f) Status of implementation of linked coal project
 - g) Arrangements for coal handling
9. Transport Requirement/Availability:
 - a) Annual Movement of -
 - Concentrates
 - Metal/metal products
 - Input requirements
 - b) Existing line capacity
 - c) Line capacity planned
10. Power Requirement/Availability:
 - a) Requirement
 - b) Availability from SEB/Regional grid
 - c) Captive generation required

ANALYSIS OF DEMAND AND SUPPLY

(Unit of measurement) :

(Base date: month & year) :

*

Name of Product.....

Year Year Year Year

1. Demand

2. Supply

a) Capacity available with the public sector undertaking

Existing

Under implementation

Total (a)

b) Capacity available with other

organisations (public/private/joint sector)

Existing

Under implementation

Total (b)

c) Likely production from 2(a)

d) Likely production from 2(b)

e) Total production (c+d)

(contd.)

3. Gap between demand and supply [1-2(e)]

4. Projects approved/licensed but
implementation not yet started

5. Capacity proposed as per present proposal

* Separate statements may be furnished for each major product in case the project involves production of more than one product.

Note: i) Projections should be given for the base year, year of commissioning of the project and terminal years of the current as well as next five year Plans.

ii) The basis of the projections should be spelt out clearly.

iii) Where relevant and available, plant wise break-up may be given for capacity/production

**ITEMWISE BREAKUP OF CAPITAL COST, OPERATION & MAINTENANCE COST
AND VALUE OF OUTPUT**

(Separate for each alternative)

Unit of measurement:

Base date (month & year):

Exchange rate * :

Item	Unit	Qty.	Market Price	Financial Cost			Economic** Cost	
				IC	FC	Taxes & Duties in IC	IC	FC
1	2	3	4	5	6	7	8	9

A. Capital Cost

1. Studies & Investigations
2. Land & Civil Works
3. Know-how & Engineering
4. Plant & Equipment
5. Project Management
6. Commissioning Expenditure
7. Environment Related Cost
8. Margin Money for Working Capital
9. Capitalised Interest During Construction

Total (1 - 9)

B. Operation & Maintenance at full production @

1. Raw materials
 - 01
 - 02
2. Fuels & Energy
 - 01
 - 02

(contd.)

3. Utilities

01

02

4. Labour cost

01

02

5. Repair & Maintenance

6. Selling Expenses

7. Other expenses

Total (1 - 7) :

C. Value of Output at full production

Name of product	Unit	Qty.	Market Price	Value of Output	
				Financial	Economic**
1	2	3	4	5	6
01					
02					

Total:					

* In case a number of Foreign Currencies are involved the amount and the exchange rate assumed may be specified separately.

@ In case project involves more than one product, the O & M cost would need to be furnished separately for each major product.

** For all traded and tradable items, the economic cost would be fob / cif prices and internal transportation cost. For non-traded / tradable item, this will be social opportunity cost/economic cost of production/market price excluding taxes, duties and subsidies and any other transfer payments.

Note: IC indicates the Indigenous Component and FC the Foreign Component.

CASHFLOW STATEMENT FOR CALCULATION OF INTERNAL RATE OF RETURN**(Separate statements for financial and economic rates of return for different alternatives)**

Alternative

.....

Base date (month & year) :

Exchange rate :

(Rs. crores)

YEAR	CASH OUT FLOW									CASH INFLOW/ Value of output		
	Capital Cost			O & M cost			Total			IC	FC	Taxes and duties in IC
	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC			
1	2	3	4	5	6	7	8	9	10	11	12	13
1.												
2.												
3.												
.												
.												
.												
N												
Total												
NPV _____, Financial IRR _____ Economic IRR _____ DRC _____												

Note:

i) Interest during construction (IDC) will be excluded from Cols.2 and 3. Depreciation will be excluded from Col.5. Interest on Working Capital will, however be included in Col. 5.

ii) Recovery of salvage value is to be shown in N+1th year. Replacement cost of capital nature, if any, not included in the annual O&M cost should be shown in the capital cost column against the appropriate years.

iii) For economic analysis the capital and operation and maintenance cost should be taken at their economic values (as given in DFR 1.3) and after using premium/shadow prices for foreign exchange, labour etc., as may be specified by the Govt. from time to time.

SUMMARY OF CAPITAL COST

Base date (month & year):
Exchange rate* :

(Rs. crores)

Statement No.	Item	Capital Cost			Basis of estimates	@ Degree of reliability within (+/-).... %
		IC	FC	Total		
1	2	3	4	5	6	7
	2.1					
	2.2					
	2.3					
	2.4					
	2.5					
	2.6					
	2.7					
	2.8					
	2.9					
	A. Total Project Cost (2.1 to 2.9)					
	2.10					
	2.11					
	2.12					
	B. Total system cost:					

* In case the number of foreign currencies involved are more than one, the amount and exchange rate for each of the currencies may be indicated in the footnote.

- @ TQ - Tender Quotation
BQ - Budgetary Quotation
IH - In-House Cost Data
CD - Consultants Data

DETAILS OF THE COST OF THE STUDIES AND INVESTIGATIONS

Base date (month & year):

Exchange Rate:

(Rs. Crores)

Sl. No.	Studies and Investigations	Cost of the Study/ Investigations			Agency*responsible for carrying out the study/ investigations
		IC	FC	Total	
1	2	3	4	5	6
1.					
2.					
3.					
.					
.					
.					
.					
.					
.					

* Indicate whether inhouse or outside agency.

DETAILS OF COST CIVIL WORKS

Base date (month & year):

Exchange Rate :

Sl.No.	Item	Unit	Qty.	Rate (Rs)	Amount (Rs. Crs.)		Remarks
					IC	FC	
1	2	3	4	5	6	7	8

- A. Design, Engineering & Consultancy
- B. Civil & Structural Works for the Plant
- 1.1 Land acquisition:-
- 1.101 Plant
- 1.102 Other purposes
(to be specified)
- 1.2 Preliminary survey, soil investigations etc.
- 1.3 Land Development
- 1.301 Excavation
- 1.302 Levelling
- 1.303 Internal roads and paths
- 1.4 Others (to be specified)
- 1.5 Bulk Services:-
- 1.501 Water Supply
- 1.502 Power Supply
- 1.503 Others (to be specified)

(contd.)

DFR - 2.2(contd.)

Sl.No.	Item	Unit	Qty.	Rate (Rs)	Amount (Rs.Crs.)		Remarks
					IC	FC	
1	2	3	4	5	6	7	8

1.6 Main & Auxiliary Plant**1.601 Main plant structures:**

- i)
- ii)
- iii)

1.602 Auxiliary Plant structures

- i)
- ii)
- iii)

1.603 Miscellaneous structures:-

- i) Administrative buildings
- ii) Others (to be specified)

1.604 On site facilities:-

- i) Roads @
- ii) Railway tracks and siding
- iii) Marshalling Yard
- iv) Communications
- v) Others (to be specified)

1.605 Off site facilities:-

- i) Roads
- ii) Railway link from source of
raw materials to plant
- iii) Marshalling yard

(contd.)

DFR - 2.2(contd.)

Sl.No.	Item	Unit	Qty.	Rate (Rs)	Amount (Rs.Crs.)		Remarks
					IC	FC	
1	2	3	4	5	6	7	8

1.606 Enabling Works

- i) Roads
- ii) Railway Tracks
- iii) Construction Water
- iv) Construction power
- v) Temporary office accommodation
- vi) Temporary residential accommodation
- vii) Construction plant and equipment

Total (1.601 -1.606):

C. Township

D. Supervision

E. Contingency

Total (A - E) :

@ Excluding internal roads and paths already covered under land development.

*

DETAILS OF KNOWHOW, ENGINEERING AND CONSULTANCY

Base date (month & year) :

Exchange Rate :

(Rs. Crores)

1	Licence & Know-how fees		Basic Engg.		Detailed Engg.		Procurement		** Consultancy						Training		Total	
	IC	FC	IC	FC	IC	FC	IC	FC	Site Inve- sti- ga- tion	Monito- ring		Oth- ers		IC	FC	IC	FC	
										IC	FC	IC	FC					
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Plant/ Facility 'A'																		
Plant/ Facility 'B'																		
.																		
.																		
.																		
Total:																		

* Separate tables for different facilities alongwith a summary table

** In-house expenditure should be shown under 'Project Management'.

BREAK UP OF PLANT AND EQUIPMENT COST

Base date (month & year) :

Exchange Rate :

(Rs. Crores)

Sl. No.	Item	Cost of Equipment/supplies				Inland Transport & Insurance	Erection charges		Others (to be specified)		Total	
		cif	Custom Duties & Other Taxes	Indigenous cost	Tax element		IC	FC	IC	FC	IC	FC
1	2	3	4	5	6	7	8	9	10	11	12	

A. Main Plant

1.

2.

3.

4.

etc.

Sub-total (A)

B. Captive Power Plant**C. Auxiliary Plants &**

Facilities

1.

2.

3.

.

.

Sub-total (C)

(contd.)

DFR - 2.4(contd.)

Sl. No.	Item	Cost of Equipment/supplies				Inland Transport & Insurance	Erection charges			Others (to be specified)	Total		
		cif	Custom Duties & Other Taxes	Indigenous cost	Tax element		IC	IC	FC		IC	IC	FC
1	2	3	4	5	6	7	8	9	10	11	12		

D. Other Facilities

1. Railway siding
2. Internal roads
3. Communications
4. Water & sewage
5. Power

Sub-total (D)

E. Initial Spares

F. Contingencies

G. Grand Total (A-F)

A. PROJECT MANAGEMENT EXPENSES

Base date (month & year):

Exchange Rate :

(Rs. Crores)

Sl. No.	Item	Project Management Expenses *			
		IC	FC	Total	Basis
1	2	3	4	5	6
1.	Site Establishments				
2.	HQ Establishment				
3.	Foreign and Domestic travel				
4.	Other expenditure				

* Excluding expenditure covered under 'Knowhow and Engineering payments'.

Note: This format may be completed based on the experience of the project authorities and their consultants as a percentage of plant costs including plant and equipment.

B. CATEGORYWISE MANPOWER DURING CONSTRUCTION

Year	Managerial/ Administra- tive		Technical Skilled				Semi- skilled		Un- skilled		Total	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost
1	2	3	4	5	6	7	8	9	10	11	12	13
1.												
2.												
3.												
.												
Till commissioning												

DETAILS OF COMMISSIONING EXPENDITURE

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Item	Amount		
	IC	FC	Total
1	2	3	4

A. Expenditure on Commissioning

- 1.
- 2.
- 3.

 Total (A):

B. Credit for production during commissioning period**C. Net commissioning expenditure :**

(A - B)

-
1. Duration of trial runs alongwith the cost incurred for carrying out trial production after adjusting the receipts from such trial runs such as saleable products, scrap etc.
 2. The pre-operative training includes the cost of training required to be given to the various categories of work force alongwith the duration of training and Institutes where they are to be imparted, may be indicated. If required, a separate annexure may be used for presenting additional details.

ENVIRONMENT RELATED COSTS

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Sl. No.	Item	Amount			Basis
		IC	FC	Total	
1	2	3	4	5	6

1. Rehabilitation of displaced persons
2. Pollution abatement cost
3. Effluent treatment
4. Compensatory afforestation
5. Pollution monitoring facilities

Total :

* Number of families/persons affected, compensation basis and other details to be given in the footnote.

ASSESSMENT OF WORKING CAPITAL

Base date (month & year):

Exchange Rate:

(Rs. crores)

Sl. No.	Item	Norms of inventory	Unit rate	Total Value	Remarks
1	2	3	4	5	6

1. Raw materials
 - a) Imported
 - b) Indigenous
2. Intermediates
 - a) Imported
 - b) Indigenous
3. Boughtout component
 - a) Imported
 - b) Indigenous
4. Work in progress
5. Finished Goods
6. Debtors
7. Cash and Bank balance
8. Total current assets (1 to 7)
9. Creditors
10. Advances from customers
11. Total current liabilities (9-10)
12. Working Capital gap (8-11)

(contd.)

DFR - 2.8(contd.)

Sl. No.	Item	Norms of inventory	Unit rate	Total Value	Remarks
1	2	3	4	5	6
13.	Margin Money (as per norms)				
14.	Gap for bank finance				
15.	Annual interest on bank financed amount (excl. margin money)				

- Note:-
1. This is required to be furnished yearwise till one year after stable level of production is achieved;
 2. Incremental working capital requirements on annual basis may be shown in a footnote.

**COST OF LINKED PROJECTS INCURRED BY OTHER AGENCIES
(NORMALLY FOR FACILITIES WHICH WILL NOT BE OWNED
BY THE ENTERPRSE)**

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Sl. No.	Project	Total cost	Implementing Agency	Completion date (month/year)
1	2	3	4	5

ESTIMATION OF OPERATING REQUIREMENTS AND COSTS

Base date (month & year):

Exchange Rate:

(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Financial			
				IC	FC	T&DC	Total
1	2	3	4	5	6	7	8

A. Variable Cost

1. Purchased Raw-materials and

semi-finished/finished boughtouts

a)

b)

2. Fuels

a)

b)

3. Utilities

a)

b)

4. Variable Overheads

a)

b)

5. Royalty (and cess in case of mining projects)

6. Others (to be specified)

Total Variable Cost(A):

(contd.)

DFR - 3.1(contd.)

(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Financial			
				IC	FC	T&DC	Total
1	2	3	4	5	6	7	8

B. Fixed Costs**1. Labour & Supervision**

a)

b)

2. Fixed Overheads

a)

b)

3. Repairs & Maintenance**4. Depreciation****5. Interest on Long Term Loans****6. Interest on Working Capital Loans****7. Others (to be specified)****Total Fixed Cost(B):****Total Operating Cost(A + B):**

(contd.)

ESTIMATION OF OPERATING REQUIREMENTS AND COSTS

Base date (month & year):

Exchange Rate:

(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Economic			
				* IC	@ FC	Inland Transport	Total
1	2	3	4	9	10	11	12

A. Variable Cost
**1. Purchased Raw-materials and
semi-finished/finished boughtouts**

a)

b)

2. Fuels

a)

b)

3. Utilities

a)

b)

4. Variable Overheads

a)

b)

5. Royalty**6. Others (to be specified)****Total Variable Cost(A):**

(contd.)

ESTIMATION OF OPERATING REQUIREMENTS AND COSTS

Base date (month & year):

Exchange Rate:

(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Economic			
				* IC	@ FC	Inland Transport	Total
1	2	3	4	9	10	11	12

B. Fixed Costs

1. Labour & Supervision

a)

b)

2. Fixed Overheads

a)

b)

3. Repairs & Maintenance

4. Depreciation

5. Interest on Long Term Loans

6. Interest on Working Capital Loans

7. Others (to be specified)

Total Fixed Cost(B):

Total Operating Cost(A + B):

* For non-traded goods. @ For traded & tradable goods at fob/cif value.

In case any cost item is at subsidised rate, the actual economic cost would be reported.

ESTIMATION OF SALES REVENUE

Base date (month & year):

Exchange Rate:

Products	Unit	Quantity	Unit Rate (Rs.)	Financial (Rs. crores)	* Economic (Rs. crores)
1	2	3	4	5	6
A.					
B.					
C.					
D.					

Financial Revenue is as to be received by the project authority by the sale of output.

* For traded and tradable product the sales revenue in economic terms would need to be calculated on the basis of cif/fob values of the product. For non-traded/tradable product, it will be at social opportunity cost/economic cost of production at ex-factory price, excluding the excise and other duties/subsidies.

REQUIREMENTS OF LABOUR AND COSTS
(At Stable Level of Capacity Utilisation for a Full Year)

Base date (month & year):

Exchange Rate:

(Rs. crores)

Category of Labour	No. of workers	Total wage cost	Costs of P.F. ESIS, gratuity scheme etc.	Average earnings per worker (Rs.)
1	2	3	4	5
1. Production Workers				
01 Unskilled				
02 Semi-skilled				
03 Skilled				
04 Technical				
05 Managerial				
Total:				
2. Workers at Administration and sales				
01 Unskilled				
02 Clerical				
03 Junior Managerial				
04 Senior Managerial				
Total:				
Grand Total:				

PROJECTED BALANCE SHEET

(Rs. Crores)

Item	Year 1	Year 2	Year 3
1	2	3	4

I. Assests

01 Gross block

Less 02 Depreciation and amortisation

03 Net block

04 Capital work in progress

05 Unallocated expenditure during construction

06 Other items in the nature of assets

07 Total net fixed assets (03 - 06)

08 Investments

09 Working Capital/Net Current assets

10 Inventories

101 Raw materials

102 Spare Parts

103 Work in progress

104 Finished goods

105 Other stores

11 Sundry debtors

12 Loans and advances

13 Cash and bank balance/deposits

14 Other assets

15 Total current assets (10 - 14)

(contd.)

DFR-4.1(contd.)

Item	Year 1	Year 2	Year 3
1	2	3	4
Less 16 Current liabilities and provision			
17 Net current assets/working capital			
18 Deferred revenue/preliminary expenditure			
19 Accumulated deficit			
<hr/>			
Grand total :			
<hr/>			
Authorised share capital			
II. Liabilities			
01 Paid up share capital			
011 From Central Government			
012 From others			
02 Loans			
021 Loans from central Government			
022 Loans from foreign parties			
023 Working capital loans from Central Government			
024 Loans from others			
03 Cash credit/advances			
04 Reserves and surplus			
041 Development rebate/Investment allowance reserve			
042 General and other reserves			
043 Specific reserves			
05 Balance from profit/loss			
<hr/>			
Grand Total :			
<hr/>			

Note: The above data may be furnished till one year after production is stabilised.

PROJECTED PROFIT AND LOSS STATEMENT**(Rs. crores)**

Item	Year 1	Year 2	Year 3
1	2	3	4
I. Income			
01 Gross sales/operating income			
Less 02 Commission, rebate and discount			
Less 03 Excise duty			
04 Net sales/operating income			
05 Other income/Misc. receipts			
<hr/>			
Total (04 and 05) :			
<hr/>			
II. Expenses			
06 Purchase of finished goods			
07 Consumption of raw materials, stores and spares			
08 Salaries, wages and welfare benefits			
09 Repairs & maintenance			
10 Power and fuel			
11 Misc. expenditure			
12 Prior period adjustment			
13 Accretion/decretion in a stock of finished goods			
14 Work in progress			
<hr/>			
Total (06 to 14) :			
<hr/>			
III. Gross margin (I - II)			
Less 15 Depreciation			
Less 16 Deferred revenue/preliminary expenditure			

(contd.)

PROJECTED PROFIT AND LOSS STATEMENT

(Rs. crores)

Item	Year 1	Year 2	Year 3
1	2	3	4
IV. Gross profit/loss			
(III - 15 - 16)			
17 Interest			
171 On central Govt loans			
172 On foreign loans			
173 On other loans			
174 On cash credit			
175 On supplier's credit			
176 On bonds & others (specify)			
Less 177 Interest capitalised			
18 Net chargeable interest			
<hr style="border-top: 1px dashed black;"/>			
V. Profit/loss before tax (IV-18)			
Less 19 Tax provision			
VI. Net profit/loss (V-19)			
Less 20 Dividend payment			
VII. Retained profit/loss (VI-20)			

Note: The above data may be furnished till one year after production is stabilised.

SOURCES OF FINANCING OF THE PROJECT

(Rs. crores)

Item	Total	Yearly phasing during implementation		
		Year 1	Year 2	Year 3
1	2	3	4	5
1. Capital cost				
a) IC				
b) FC				
Domestic				
2. Internal resources				
3. Institutional loans				
4. Market borrowings				
5. Supplier's credit				
6. Public equity				
7. Budgetary support				
8. Collaborators contribution				
9. Other sources (specify)				

Total (2 - 9) :				

Foreign				
10. Multilateral loans (specify)				
11. Bilateral loans (specify)				
12. Direct commercial borrowings				
13. Supplier's credit				
14. Collaborators contribution				
15. Others (specify)				

Total (10 - 15) :				

(contd.)

16. Debt equity ratio

(Rs. crores)

Item	Total	Years of operation		
		Year 1	Year 2	Year 3
1	2	3	4	5
FE earnings				
FE component of				
operating cost				

Note: It should be demonstrated as to how FE earnings will meet FE requirement for operation as well as the FE component of capital cost. Where the products are not actually exported, then FOB Value of production of tradable goods may be given.

CASHFLOW STATEMENT FOR CALCULATION OF INTERNAL RATE OF RETURN

Base date (month & Year):

Exchange rate:

(Rs. crores)

YEAR	CASH OUTFLOW									CASH INFLOW/ Value of output		
	Capital Cost			O & M cost			Total			IC	FC	Taxes and duties in IC
	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC			
1	2	3	4	5	6	7	8	9	10	11	12	13
1.												
2.												
3.												
.												
.												
.												
N												
Total												

NPV _____, Financial IRR _____

Note: i) Interest during construction (IDC) will be excluded from cols. 2 & 3. Depreciation will be excluded from col. 5. Interest on Working Capital will, however, be included in col. 5.

ii) Recovery of salvage value is to be shown in N+1th year. Replacement cost of capital nature, if any, not included in the annual O&M cost should be shown in the capital cost column against the appropriate years.

iii) For the alternative proposed, cashflow statements would need to be prepared for "with" and "without" project situations, for working out cost of production (Financial and Economic) on incremental basis.

CASHFLOW STATEMENT FOR ECONOMIC ANALYSIS

(Rs. crores)

Year	Cash outflow *					Cash inflow *			
	(at economic prices)					(at economic prices)			
	Traded/ trad- able items	Other commo di- ties	Skilled labour, manage- ment	Un- skilled labour	Other items	Total	Traded/ trad- able items	Other items	Total
1	2	3	4	5	6	7	8	9	10
1.									
2.									
3.									
.									
.									
.									
.									
N									
Total :									
Premium/ shadow prices used above									
NPV (economic) _____, Economic IRR _____									

* For economic analysis the capital and operation and maintenance cost should be taken at their economic values (as given in DFR 1.3) and after using premium/ shadow prices for foreign exchange, labour, etc., as may be specified by the Govt. from time to time.

SENSITIVITY ANALYSIS

S. No.	Case	Internal Rate of Return (IRR)		
		Financial	Economic	
			With Premium	Without Premium
1	2	3	4	5
1.	Base case			
2.	Capital cost + 10%			
3.	Capital cost + 20%			
4.	Capital cost + 30%			
5.	Operating cost + 10%			
6.	Operating cost + 20%			
7.	Sales Revenue - 10%			
8.	Sales Revenue - 20%			
9.	Different combinations			

CHAPTER 5

REVISED COST ESTIMATES (RCE)

5.1.1 All projects, requiring Government approval, have to be reappraised and require Government approval again if the increase in Capital Cost exceeds a specified percentage. These revised cost estimates have to be submitted well before incurring the additional expenditure or making commitments. Necessary procedures and instructions required for RCE are laid down by the Government from time to time. This chapter outlines the information to be given in RCE proposals which have to be submitted for this purpose. In many cases, when the Detailed Project Report is prepared after the investment approval, the revised costs become known and often a proposal for revised approval, based on DPR, is submitted. This is also treated as RCE.

5.1.2 The proposal of revised cost estimates (RCE) should be in the nature of a memorandum on 'exceptions'. The primary aim of subjecting RCE to techno-economic appraisal is to focus on the changes which have taken place since the original approval of the proposal and reasons thereof. As far as possible, repetitions of information on the need and justification, technology, location and other parameters should be avoided, if there is no change vis-a-vis the latest sanctioned project.

5.1.3 The information to be presented in RCE cases will compare the revised status with the sanctioned project. In case of first Revised Cost Estimate, the comparison is with the original project sanctioned. In case of second RCE, the comparison will be with the first RCE sanctioned and so on. The RCE formats have been designed on the same lines as DFR formats so as to enable a comparison of the RCE with the DFR estimates as per sanctioned project.

5.1.4 The comparative picture should cover all the important techno-economic parameters such as, the project cost, capacity, completion time, O&M expenditure, financial/economic benefits, financial and economic viabilities as given earlier vis-a-vis those now proposed. In case there are major variations in the parameters like technology, location, size of the plant, funding pattern or in the need and justification of the project from the latest sanctioned project, the project authorities should clearly indicate such change together with the reasons/justifications underlying the proposed changes.

5.1.5 **Project Status:** It is necessary to indicate the latest physical and financial progress achieved. The date upto which the progress is reported should be clearly indicated. Major milestones achieved should also be recorded in the form of a calendar of events. While indicating the financial progress, the project authorities should not simply furnish the latest expenditure incurred on the project, it should also indicate the expenditure committed till the date of report. Apart from achievement of major milestones, the physical progress may give the achievement in percentage terms for each of the components/ contracts of the project separately. The details to be furnished are indicated in the Formats RCE-4.1 & 4.2.

5.1.6 **Cost Over-run:** It is also necessary to indicate the basis on which the sanctioned estimates were framed and how the circumstances changed that basis. Similarly, project authorities should also give the basis underlying the revised estimates proposed. The degree of reliability of the revised estimates must also be indicated together with the reference level of prices.

5.1.7 The cost over-run should be subjected to the standardised variance analysis to segregate the effect of a) cost increases due to fiscal reasons within approved project schedule, (b) cost increases due to fiscal reasons beyond approved project schedule and (c) cost increases due to other reasons. Essentially the physical reasons such as change in scope (process, design),

quantity/volume, additions/deletions, under/ over estimation, omissions etc. should be segregated. The increase in cost for crashing of critical activities in order to avoid delay in project execution may be highlighted separately. The itemwise cost variance analysis should be presented in the Format RCE - 4.3. Detailed reasons/justifications for each variation in the cost proposed should be furnished. The variation in cost due to increase in quantities and/or unit rates should be indicated separately in the format RCE-4.3.

5.1.8 The variation in the annual operation and maintenance cost and the working capital requirement, if any, should also be indicated together with the justification/reasons underlying the change.

5.1.9 **Funding:** The arrangements for funding of RCE as compared to sanctioned project, both for Indigenous cost (IC) and FE, should be outlined.

5.1.10 **Time Over-run:** In analysing the total time over-run the starting point should be taken as the change from the zero date (i.e. the date of sanction). Similarly, the project commissioning should be taken as the final event. If the time over-run is on account of elongation of activities on the critical path, then the list of all such critical activities and reasons for inability to assess accurately their time duration in the sanctioned proposal should be clearly explained. It is also important that the reasons for the inability to adhere to the sanctioned commissioning schedule are clearly brought out in the Format RCE-4.1. Agencies responsible for delay should be identified and responsibility fixed for the delay. The project authorities should also highlight the steps being envisaged to crash some of the critical activities so as to commission the project in the original time profile. A schedule of major milestones on a comparative basis should be provided. **The cost over-run as a result of time over-run should be estimated and indicated separately.**

5.1.11 **Viability Analysis of the Revised Proposal:** The project authorities should also furnish the financial and economic viabilities of the revised cost proposal together with the cashflow statements in support of the above calculations as per formats RCE-4.4 & 4.5.

**SALIENT FEATURES OF THE ORIGINAL VIS-A-VIS
REVISED PROPOSAL**

1. Name of the Project :
2. Department/Ministry :
sponsoring the project
3. Date of sanction of
original proposal

	Latest Sanctioned	RCE	Variation
1	2	3	4

- A. Physical characteristics
 1. a) Installed capacity
(unit to be specified)
 - b) Production at ____%
utilisation proposed
 2. Technology requirement
 - a) Indigenous
 - b) Foreign
 3. Location.
 4. Additional employment
generation (No. of posts)
- B. Financial and Economic characteristics
 1. Total capital cost
(Rs. crores)
 - .Financial
 - .Economic @
 2. FE Component (Rs crores)
 3. Exchange rate used

(contd.)

4. Interest during construction
(Rs. crores) (included in B-1)
5. Margin money (Rs. crores) (included in B-1)
6. Funding arrangement for Indigenous Cost (IC) and FE
7. Total system cost (Rs crores)
8. Annual Operation and maintenance
cost (Rs. crores)(at _____ % capacity utilisation)
9. Annual Revenue / Sales turnover @
(at ____ % capacity utilisation)
10. Base date of the estimates
(month & year)
11. Phasing of expenditure
(Rs. crores)

C. Evaluation Indices

1. Viability

- IRR (%)
- EIRR (%) #
- DRC (Rs / US\$)
- Cost per unit (Rs)*
 - . Financial
 - . Economic

2. Breakeven point

(at _____ % capacity utilisation)

3. Year in which the cumulative cashflow

turns positive

{contd.}

D. Implementation period & life

(month / years)

1. From date of sanction to mechanical completion
 2. From date of sanction to commissioning
 3. From commissioning to full capacity utilisation
 4. Expected economic life of the project.
-

@ For all traded and tradable commodities, the cost and revenue would need to be based at border prices (cif /fob). Internal transportation cost, would need to be added.

* This has to be calculated at the discount rate specified by the Government.

With premium on foreign exchange and other shadow prices as specified by the Government.

ANALYSIS OF DEMAND AND SUPPLY

LS RCE

Unit of measurement:

Base date (month & year):

*

Name of Product.....

Details	Year		Year		Year		Year	
	LS	RCE	LS	RCE	LS	RCE	LS	RCE
	2	3	4	5	6	7	8	9
1								

1. Demand

2. Supply

a) Capacity available

with the public
sector undertaking

Existing

Under implementation

Total (a)

b) Capacity available

with other organisations
(public / private /
joint sector)

Existing

Under implementation

Total (b)

(contd.)

RCE - 1.2(contd.)

Details	Year		Year		Year		Year	
	LS	RCE	LS	RCE	LS	RCE	LS	RCE
	2	3	4	5	6	7	8	9
1								

c) Likely production

from 2 (a)

d) Likely production

from 2 (b)

e) Total production (c+d)

3. Gap between demand

and supply [1-2(e)]

4. Projects approved/licensed but

implementation not yet started

5. Capacity proposed as per

present proposal

LS : Latest Sanctioned , RCE : Revised Cost Estimate

* Separate statements may be furnished for each major product in case the project involves production of more than one product.

Note:

i) Projections should be given for the base year, year of commissioning of the project and terminal years of the current as well as next five year plans.

ii) The basis of the projections should be spelt out clearly.

iii) Where relevant and available, plant wise break-up may be given for capacity/production.

SUMMARY OF CAPITAL COST

LS RCE

Base date (month & year):

Exchange rate* :

(Rs. crores)

Statement No.	Item	Capital Cost						Basis of estimates for RCE	@ Degree of reliability within +/-...%
		LS			RCE				
		IC	FC	Total	IC	FC	Total		
1	2	3	4	5	6	7	8	9	10
2.1	Studies & Investigations								
2.2	Cost of Civil Works								
2.3	Know-how, Engineering & Consultancy								
2.4	Plant & Equipment								
2.5	Project Management								
2.6	Commissioning Expenditure								
2.7	Environment Related cost								
2.8	Margin Money for Working Capital								
2.9	Capitalised Interest During Construction								
	A. Total Project Cost (2.1 to 2.9)								
2.10	Cost of linked projects								
2.11	Cost of unskilled labour included in A (Total)								
	B. Total system cost:								

LS : Latest Sanctioned RCE : Revised Cost Estimate

* In case the number of foreign currencies involved are more than one, the amount and exchange rate for each of the currencies may be indicated in the footnote.

@ TQ - Tender Quotation BQ - Budgetary Quotation

IH - In-House Cost Data CD - Consultants Data

DETAILS OF THE COST OF THE STUDIES AND INVESTIGATIONS

LS RCE

Base date (month & year):

Exchange Rate:

(Rs. Crores)

Sl. No.	Studies and investigations	Cost of the study/ Investigations						* Agency responsible for carrying out the study/ investigations
		LS			RCE			
		IC	FC	Total	IC	FC	Total	
1	2	3	4	5	6	7	8	9
1.								
2.								
3.								

LS : Latest Sanctioned, RCE : Revised Cost Estimate

* Indicate whether inhouse or outside agency.

DETAILS OF COST CIVIL WORKS

LS RCE

Base date (month & year):

Exchange Rate :

Sl. No.	Item	Unit	Qty. (Rs.)		Rate (Rs)		Amount (Rs.Crs)				Remarks
			LS	RCE	LS	RCE	LS		RCE		
1	2	3	4	5	6	7	8	9	10	11	12

- A. Design, Engineering & Consultancy
- B. Civil & Structural Works for the Plant
- 1.1 Land acquisition:-
- 1.101 Plant
- 1.102 Other purposes
(to be specified)
- 1.2 Preliminary survey, soil investigations etc.
- 1.3 Land Development
- 1.301 Excavation
- 1.302 Levelling
- 1.303 Internal roads and paths
- 1.4 Others (to be specified)
- 1.5 Bulk Services:-
- 1.501 Water Supply
- 1.502 Power Supply
- 1.503 Others (to be specified)

(contd.)

Sl. No.	Item	Unit	Qty. (Rs.)		Rate (Rs)		Amount (Rs. Crs)				Remarks
			LS	RCE	LS	RCE	LS		RCE		
							IC	FC	IC	FC	
1	2	3	4	5	6	7	8	9	10	11	12

1.6 Main & Auxiliary Plant

1.601 Main plant structures:

- i)
- ii)
- iii)

1.602 Auxiliary Plant structures

- i)
- ii)
- iii)

1.603 Miscellaneous structures:-

- i) Administrative buildings
- ii) Others (to be specified)

1.604 On site facilities:-

- i) Roads @
- ii) Railway tracks and siding
- iii) Marshalling Yard
- iv) Communications
- v) Others (to be specified)

1.605 Off site facilities:-

- i) Roads
- ii) Railway link from source of raw materials to plant
- iii) Marshalling yard

(contd)

RCE - 2.2(contd.)

Sl. No.	Item	Unit	Qty. (Rs.)		Rate (Rs)		Amount (Rs.Crs)				Remarks
			LS	RCE	LS	RCE	LS		RCE		
							IC	FC	IC	FC	
1	2	3	4	5	6	7	8	9	10	11	12

1.606 Enabling Works

- i) Roads
- ii) Railway Tracks
- iii) Construction Water
- iv) Construction power
- v) Temporary office accommodation
- vi) Temporary residential accommodation
- vii) Construction plant and equipment

Total (1.601-1.606) :

- C. Township
- D. Supervision
- E. Contingency

Total (A - E) :

@ Excluding internal roads and paths already covered under land development.

LS = Latest sanctioned, RCE = Revised cost estimate

*

DETAILS OF KNOWHOW, ENGINEERING AND CONSULTANCY**(Separate statements for latest sanctioned and proposed RCE)**

Base date (month & year) :

Exchange Rate :

(Rs. Crores)

Licence & Know-how fees		Basic Engg.		Detailed Engg.		Procurement		** Consultancy						Train-ning		Total		
								Site Inve sti ga-tion		Monito ring		Oth ers						
IC	FC	IC	FC	IC	FC	IC	FC	IC	FC	IC	FC	IC	FC	IC	FC	IC	FC	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Plant/ Facility 'A'																		
Plant/ Facility 'B'																		
.																		
.																		
.																		
Total:																		

* Separate tables for different facilities alongwith a summary table

** In-house expenditure should be shown under 'Project Management'.

BREAK UP OF PLANT AND EQUIPMENT COST

(Separate statements of latest sanctioned and RCE)

Base date (month & year):

Exchange Rate :

(Rs.Crores)

Sl. No.	Item	Cost of Equipment/supplies				Inland Transport & Insurance	Erection charges		Others (to be specified)		
		cif	Custom Duties &	Indigenous cost			IC	FC	IC	IC	FC
Total		Other Taxes		Tax element in IC	IC	IC	FC	IC	IC	FC	
		FC	IC								
1	2	3	4	5	6	7	8	9	10	11	12

A. Main Plant

1.

2.

3.

4.

etc.

Sub-total(A)

B. Captive Power Plant**C. Auxiliary Plants &**

Facilities

1.

2.

3.

Sub-total(C)

(contd.)

RCE - 2.4(contd.)

(Rs.Crores)

Sl. No.	Item	Cost of Equipment/supplies				Inland Transport & Insurance	Erection charges			Others (to be specified)		
		cif	Custom Duties &	Indigenous cost			IC	FC		IC	IC	FC
Total		FC	IC	IC	Tax element in IC	IC	IC	FC	IC	IC	FC	
1	2	3	4	5	6	7	8	9	10	11	12	

D. Other Facilities

1. Railway siding
2. Internal roads
3. Communications
4. Water & sewage
5. Power

Sub-total(D)

E. Initial Spares

F. Contingencies

G. Grand Total (A-F)

A. PROJECT MANAGEMENT EXPENSES

LS RCE

Base date (month & year):

Exchange Rate :

(Rs. Crores)

Sl. No.	Item	Project			Managment			Expenses*	
		LS			RCE			Basis of RCE	
		IC	FC	Total	IC	FC	Total		
1	2	3	4	5	6	7	8	9	
1.	Site Establishments								
2.	HQ Establishment								
3.	Foreign and Domestic travel								
4.	Other expenditure								

LS : Latest Sanctioned, RCE : Revised Cost Estimate

* Excluding expenditure covered under 'Knowhow and Engineering payments'.

Note: This format may be completed based on the experience of the project authorities and their consultants as a percentage of plant costs including plant and equipment.

B. CATEGORYWISE MANPOWER DURING CONSTRUCTION

(Separate statements for latest sanctioned and proposed RCE)

Year	Managerial/ Administrative		Technical		Skilled		Semi-skilled		Un-skilled		Total	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost
1	2	3	4	5	6	7	8	9	10	11	12	13
1.												
2.												
3.												
Till commissioning												

DETAILS OF COMMISSIONING EXPENDITURE

LS RCE

Base date (month & year):

Exchange Rate :

(Rs. crores)

Items	Amount					
	LS			RCE		
	IC	FC	Total	IC	FC	Total
	2	3	4	5	6	7
1						

A. Expenditure on Commissioning

- 1.
- 2.
- 3.

Total (A):

B. Credit for production during commissioning period

C. Net commissioning expenditure (A - B):

LS : Latest Sanctioned, RCE : Revised Cost Estimate

1. Duration of trial runs alongwith the cost incurred for carrying out trial production after adjusting the receipts from such trial runs such as saleable products, scrap etc.
2. The pre-operative training includes the cost of training required to be given to the various categories of work force alongwith the duration of training and Institutes where they are to be imparted, may be indicated. If required, a separate annexure may be used for presenting additional details.

ENVIRONMENT RELATED COST

LS RCE

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Sl. No.	Item	Amount						Basis of RCE
		LS			RCE			
		IC	FC	Total	IC	FC	Total	
1	2	3	4	5	6	7	8	9

*

1. Rehabilitation of displaced persons
2. Pollution abatement cost
3. Effluent treatment
4. Compensatory afforestation
5. Pollution monitoring facilities

 Total

LS : Latest Sanctioned,

RCE : Revised Cost Estimate

- * Number of families/persons affected, compensation basis and other details to be given in the footnotes.

ASSESSMENT OF WORKING CAPITAL

LS RCE

Base date (month & year):

Exchange Rate:

Sl. No.	Item	Norms of inventory		Unit rate (Rs)		Total value (Rs crores)		Remarks
		LS	RCE	LS	RCE	LS	RCE	
1	2	3	4	5	6	7	8	9

1. Raw materials
 - a) Imported
 - b) Indigenous
2. Intermediates
 - a) Imported
 - b) Indigenous
3. Boughtout component
 - a) Imported
 - b) Indigenous
4. Work in progress
5. Finished Goods
6. Debtors
7. Cash and Bank balance
8. Total current assets (1 to 7)
9. Creditors
10. Advances from customers
11. Total current liabilities (9-10)
12. Working Capital gap (8-11)

(contd.)

RCE - 2.8(contd.)

Sl. No.	Item	Norms of inventory		Unit rate (Rs)		Total value (Rs crores)		Remarrks
		LS	RCE	LS	RCE	LS	RCE	
1	2	3	4	5	6	7	8	9
13.	Margin Money (as per norm)							
14.	Gap for bank finance							
15.	Annual interest on bank financed amount (excl. margin money)							

LS : Latest Sanctioned, RCE : Revised Cost Estimate

Note:- 1. This is required to be furnished yearwise till one year after stable level of production is achieved;

2. Incremental working capital requirements on annual basis may be shown in a footnote.

CAPITALISED INTEREST DURING CONSTRUCTION (IDC)
 (Contents flexible depending upon specific requirements of the project).

LS RCE

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Year	Loan											
	Source		Currency		Amount		Rate of Interest		Period		Total Amount	
	LS	RCE	LS	RCE	LS	RCE	LS	RCE	LS	RCE	LS	RCE
1	2	3	4	5	6	7	8	9	10	11	12	13

 Total

LS : Latest Sanctioned, RCE : Revised Cost Estimate

**COST OF LINKED PROJECTS INCURRED BY OTHER AGENCIES
(NORMALLY FOR FACILITIES WHICH WILL NOT
BE OWNED BY THE ENTERPRISE)**

LS RCE

Base date (month & year) :

Exchange Rate :

Sl. No.	Project	Total Cost		Implementing Agency	Completion Date (month/year)	
		(Rs. crores)			LS	RCE
		LS	RCE			
1	2	3	4	5	6	7

LS : Latest Sanctioned, RCE : Revised Cost Estimate

ESTIMATION OF OPERATING REQUIREMENT AND COSTS**(Separate statements for latest sanctioned & proposed RCE)**

Base date (month & year):

Exchange Rate:
(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Financial			
				IC	FC	T&DC	Total
1	2	3	4	5	6	7	8

A. Variable Cost

1. Purchased Raw-materials and semi-finished/finished boughtouts
 - a)
 - b)
 2. Fuels
 - a)
 - b)
 3. Utilities
 - a)
 - b)
 4. Variable Overheads
 - a)
 - b)
 5. Royalty (and cess in case of mining projects)
 6. Others (to be specified)
- Total Variable Cost (A):

(contd.)

RCE - 3.1(contd.)
(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Financial			
				IC	FC	T&DC	Total
1	2	3	4	5	6	7	8

B. Fixed Costs

1. Labour & Supervision

a)

b)

2. Fixed Overheads

a)

b)

3. Repairs & Maintenance

4. Depreciation

5. Interest on Long Term Loans

6. Interest on Working Capital Loans

7. Others (to be specified)

Total Fixed Cost (B) :

Total Operating Cost (A+B) :

(contd.)

RCE - 3.1 (Contd.)
(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Economic			
				IC *	FC @	Inland Transport	Total
1	2	3	4	9	10	11	12

A. Variable Cost

1. Purchased Raw-materials and semi-finished/finished boughtouts

a)

b)

2. Fuels

a)

b)

3. Utilities

a)

b)

4. Variable Overheads

a)

b)

5. Royalty

6. Others to be specified

Total Variable Cost (A):

(contd.)

RCE - 3.1(contd.)
(Rs. crores)

Item/Details	Consumption Norms	Total requirement (Qty.)	Unit rate	Economicl			
				IC *	FC @	Inland Transport	Total
1	2	3	4	9	10	11	12

B. Fixed Costs

1. Labour & Supervision

a)

b)

2. Fixed Overheads

a)

b)

3. Repairs & Maintenance

4. Depreciation

5. Interest on Long Term Loans

6. Interest on Working Capital Loans

7. Others to be specified

Total Fixed Cost (B) :

Total Operating Cost (A+B) :

* For non-traded goods.

@ For traded & tradable goods at cif value.

In case any cost item is at subsidised rate, the actual economic cost would be reported.

ESTIMATION OF SALES REVENUE

LS RCE

Base date (month & year):

Exchange Rate:

Products	Unit	Quantity		Unit Rate (Rs.)		Financial (Rs. crores)		* Economic (Rs. crores)		
		LS	RCE	LS	RCE	LS	RCE	LS	RCE	
		1	2	3	4	5	6	7	8	9
A.										
B.										
C.										
D.										

LS : Latest Sanctioned, RCE : Revised Cost Estimate

Financial Revenue is as to be received by the project authority by the sale of output.

* For traded and tradable product the sales revenue in economic terms would need to be calculated on the basis of cif/fob values of the product. For non-traded/tradable product, it will be at social opportunity cost / economic cost of production/ ex-factory price, excluding the excise or other duties/subsidies.

REQUIREMENTS OF LABOUR AND COSTS**(At Stable Level of Capacity Utilisation for a Full Year)****[Separate Statement for Latest Sanctioned & proposed RCE]**

Base date (month & year):

Exchange Rate:

(Rs. crores)

Category of Labour	No. of workers	Total wage cost	Costs of P.F. ESIS, gratuity scheme etc.	Average earnings per worker (Rs.)
1	2	3	4	5
1. Production Workers				
01 Unskilled				
02 Semi-skilled				
03 Skilled				
04 Technical				
05 Managerial				
Total:				
2. Workers at Administration and sales				
01 Unskilled				
02 Clerical				
03 Junior Managerial				
04 Senior Managerial				
Total:				
Grand Total:				

PRESENT STATUS OF THE PROJECT

(Progress uptomonth & year)

Sl. No.	Item of work/activity	Date of award of contract		Date of commissioning (month & Year)		Reasons for delay	Progress achieved			
		LS	RCE	LS	RCE		Phys- ical @	Financial *	#	IC FC Total
1	2	3	4	5	6	7	8	9	10	11
1.										
2.										
3.										
.										
.										
.										
.										
.										

LS : Latest Sanctioned, RCE : Revised Cost Estimate

@ In terms of percentage.

* Actual expenditure incurred upto the month and year progress is to be reported in rupee crores.

Exchange rates assumed would need to be specified.

Note : Commissioning refers to start of commercial operation.

DETAILS OF YEARWISE EXPENDITURE TILL(MONTH/YEAR)

Base date (month & year) :

Exchange Rate :

(Rs. crores)

Item	Latest sanctioned cost		Year		Year		Year ...		Balance expenditure	
	IC	FC	IC	FC	IC	FC	IC	FC	IC	FC
1	2	3	4	5	6	7	8	9	10	11

1. Studies & Investigations
2. Cost of Civil Works
3. Know-how , Engineering & Consultancy
4. Plant & Equipment
5. Project Management
6. Commissioning Expenditure
7. Environment Related Cost
8. Margin Money for
Working Capital
9. Capitalised Interest
During Construction
- A. Total Project Cost (1 to 9)
10. Cost of Linked Projects
12. Cost of Unskilled Labour
included in A (Total)
- B. Total System Cost
14. Weighted average *Exchange Rate

In case the number of foreign currencies involved are more than one, the amount and exchange rate for each of the currencies are to be indicated.

* Weight average exchange rate for each year in the past should be given.

ITEMWISE COST VARIANCE ANALYSIS

LS RCE

Base date (month & year) :

Exchange rate :

(Rs. crores)

Sl. No.	Items	LS	RCE	Variation in cost	Variation in cost due to				
					Escalation (based on index)	Exchange rate variation	Change in statutory duties *	Change in customs duties due to Exch. Rate variation	IC
1	2	3	4	5	6	7	8	9	10

A. Cost overrun for fiscal reasons

within approved time schedule:

1.

2.

IDC

Margin money

Total (A)

B. Cost overrun for fiscal reasons

beyond approved time schedule:

1.

2.

IDC

Margin money

Total (B)

(contd.)

ITEMWISE COST VARIANCE ANALYSIS

LS RCE

Base date (month & year) :

Exchange rate :

(Rs. crores)

Sl. No.	Items	Latest sanctioned	RCE proposed	Variation in cost	Variation in cost due to			
					Change in scope		Under/over-estimation	Other reasons (specify)
					Approved items	Additional items		
1	2	3	4	5	11	12	13	14

C. Cost overrun due to other reasons

1.

2.

.

.

IDC

Margin Money

Total (C)

LS : Latest Sanctioned, RCE : Revised Cost Estimate

* Statutory duties	Latest Sanctioned		Revised Cost Proposal	
	Rate	Amount	Rate	Amount
- Excise duty				
- Customs duty				
- Sales tax				
- Others(specify)				

CASHFLOW STATEMENT FOR CALCULATION OF INTERNAL RATE OF RETURN**(Separate statements for the Latest Sanctioned and proposed RCE)**

Base date (Month & Year)

Exchange rate

(Rs. crores)

YEAR	CASH OUTFLOW									CASH INFLOW/ Value of output														
	Capital Cost			O & M cost			Total			IC	FC	Taxes and duties in IC												
	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC	IC	FC	Taxes and duties in IC															
										2	3	4	5	6	7	8	9	10	11	12	13			
1																								
1.																								
2.																								
3.																								
.																								
.																								
.																								
N																								
Total :																								
	NPV _____,						Financial IRR _____																	

Note:

i) Interest during construction (IDC) will be excluded from Cols. 2 & 3. Depreciation will be excluded from Col. 5. Interest on Working Capital will, however, be included in Col. 5.

ii) Recovery of salvage value is to be shown in N+1th year. Replacement cost of capital nature, if any, not included in the annual O&M cost should be shown in the capital cost column against the appropriate years.

CASHFLOW STATEMENT FOR ECONOMIC ANALYSIS
(Separate statements for the Latest Sanctioned and proposed RCE)

Base date (month & year):

Exchange rate:

(Rs. crores)

Year	Cash outflow *					Cash inflow *			
	(at economic prices)					(at economic prices)			
	Traded/ trad- able items	Other commo di- ties	skilled labour, manage- ment	un- skilled labour	other items	Total	Traded/ trad- able items	Other items	Total
1	2	3	4	5	6	7	8	9	10
1.									
2.									
3.									
.									
.									
.									
.									
N									

Total :

Premium/shadow

prices used above

NPV (economic) _____, Economic IRR _____

* For economic analysis the capital and operation and maintenance cost should be taken at their economic values (as given in DFR 1.3) and after using premium/shadow prices for foreign exchange, labour, etc. as may be specified by the Govt. from time to time.

SENSITIVITY ANALYSIS

(Separate statement for the Latest Sanctioned and proposed RCE)

S. No.	Case	Internal Rate of Return (IRR)		
		Financial	Economic	
			With Premium	Without Premium
1	2	3	4	5
1.	Base case			
2.	Capital cost + 10%			
3.	Capital cost + 20%			
4.	Capital cost + 30%			
5.	Operating cost + 10%			
6.	Operating cost + 20%			
7.	Sales Revenue - 10%			
8.	Sales Revenue - 20%			
9.	Different combinations			