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RECOMMENDED PRACTICE FOR FEASIBILITIES STUDIES

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

The feasibility study for a chemical process design investigates both the technical and economic feasibility of the proposed project. The technical part of the feasibility study considers the alternative processes, and the equipment that constitutes the chemical plant in each case. This Project Engineering Standard helps to explore the commonly encountered problems during the feasibility studies of an industrial investment projects.

DEFINITIONS AND TERMINOLOGY

Administrative Expense - The overhead cost due to general direction of the Company, above the plant manager level. Generally includes top management salaries, and the costs of legal, central purchasing, traffic, accounting, and other staff functions.

Break-Even Point - The percentage of capacity at which incomes of a Company or facility just cover all fixed and variable costs. Depreciation is normally included.

Consultant Fee - The charge for the use of the Consultants (or Contractor's) organization for the period and to the extent specified in the contract.

Cost Index (Price Index) - A number which relates the cost of an item at a specific time to the corresponding cost at some arbitrarily specified time in the past.

Depreciation Costs - The allocation of the cost of fixed capital assets less salvage (if any), over the estimated useful life of the plant, in systematic and rational manner.

Direct Cost - The manufacturing expenses which may be affected by production rate. Direct costs are generally assignable to a specific product or process area usually including:

- Input material.
- Operating, supervision, clerical payroll.
- Fringe benefits.
- Maintenance.
- Utilities.
- Catalysts, chemicals, operating supplies.
- Miscellaneous.

Discounted Cash Flow(DCF) - The rate of compound interest at which the Company's outstanding investment is repaid by proceeds for project.

Expansion - Any increase in the capacity of a plant facility or Unit, usually by added investment. Scope of its possible application extends from the elimination of problem areas to the complete replacement of an existing facility with a larger one.

Indirect Cost - In a project, all costs other than direct costs, such as material, labor, which do not become a final part of the installation, but which are required for the orderly completion of the installation and may include, but not be limited to starting costs, Contractor fees, insurance, taxes etc.

Interest Rate - The rate earned by money expressed as a constant percentage of the unpaid balance at the end of the previous accounting period.

Labor Cost - The salary plus all fringe benefits of construction craftsmen and general labor on construct projects and labor crews in manufacturing or processing areas which can be definitely assigned to one product or process area or cost center.

Overhead Cost - A cost or expense inherent in the performing of an operation, i.e., engineering, construction, operating or manufacturing, which can not be charged to or identified with a part of the work, product, or asset, and therefore, must be allocated on some arbitrary basis believed to be equitable, or handled as a business expense independent of the volume of production.

Present Value - The discounted value of a series of cash flows at any arbitrary point in time. Also, the system of comparing proposed investments which involves discounting at a known interest rate, in order to choose the alternative having the highest present value per unit of investment.

Profitability - A measure of the excess of income over expenditure during a given period of time.

Working Capital - The funds in addition to fixed capital and land investment which a company must contribute to the project (excluding start-up expense) to get the project started and meet subsequent obligations as they come due. Working capital is normally assumed recovered at the end of the project without loss.

SYMBOLS AND ABBREVIATIONS

SYMBOL/ABBREVIATION	DESCRIPTION
a	*Discount Factor.*
ARR	Annual Rate of Return.
CIF	Cost, Insurance and Freight.
CF_n	Nominal value of a future cash flow.
CTO	Coefficient of Turnover,(CTO = 360/MDC).
CF_p	The value at present time.
DCF	Discounted Cash Flow.
F	Found (or Capital), paid for a project.
FOB	Free On Board.
I	Increment of found in a definite time.
ir=IRR	Internal Rate of Return.
K	Total investment cost (fixed assets and working capital).
LPG	Liquefied Petroleum Gas.
MDC	Minimum Days of Coverage.
n	Number of years.
NCF_n	Annual Net Cash Flow of a Project.
NCU	National Currency Units.
NPV	Net Present Value.

NV	Negative NPV (at the highest discount rate).
OGP	Oil, Gas and Petrochemicals.
PV	Positive NPV (at lowest discount rate).
R	Interest rate.
R	Annual rate of return (in present).
SRI	Stanford Research Institution.
UBC	Unified Building Code.

UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

FEASIBILITY STUDIES

General

This Engineering Standard comprises several stages as following:

- Opportunity Studies — The identification of investment opportunities
- Pre-Feasibility Studies — Analysis of project alternatives and preliminary project selection as well as project preparation
- Feasibility Studies — Final project selection and project appraisal investment decisions

Opportunity Studies

General

1. Identification of investment opportunities should be made at the starting-point in a series of investment-related activities. Information on the newly identified and viable investment opportunities should be obtained.

2. This information, data and required parameters should be generated, qualified and used as the main instrument to develop a project idea into a proposal. Compilation of necessary information, data and determining parameters followed with detailed analysis is termed as "Opportunity Study".

3. The following objective points should typically be analyzed together with an overall look to investment potential of the company, general interest of other governmental authorities domestic and foreign investors in investment and promotion of the project(s):

    - Natural resources with potential for processing and manufacture such as hydrocarbon resources for chemical and petrochemical industries and crude oil for refinery processing.
    - Possible resources of utilities such as air, steam, fuel, power, water, etc. and their transportation alternates for chemical and petrochemical or refinery plants.
    - The existing industrial pattern that serves as a basis for the proposed new hydrocarbon-based industries.

- Future demand of the products that should have been potentially grown up as a result of increased population or purchasing power or for newly developed consuming goods.
- Imports, in order to identify areas for import substitution.
- Environmental impact.
- Manufacturing sectors successful in other countries with similar economic background and levels of development, capital, labor and natural resources.
- Possible inter-linkage with other industries, indigenous or transnational.
- Possible extension of existing production lines by backward or forward integration, linking for example, a downstream petrochemical industry with a refinery.
- Possibilities for diversification for example from a petrochemical complex into another product manufacturing.
- Possible expansion of existing industrial capacity to attain economies of scale.
- The general investment climate.
- Industrial policies.
- Availability and cost of production factors.
- Export possibilities.

4. Opportunity studies should be taken as a sketchy in nature relying more on aggregate estimates rather than on the detailed analysis. Cost data usually should be taken from comparable existing projects and not from quotations of sources such as Licensors, engineering companies or equipment suppliers.

5. Outline of a general opportunity studies is given under Appendix A. These parameters may be integrated and/or cross checked with those already practiced in the Company's planning and investment promotion departments for the purpose of adequate stimulating of Company's (as investor) response.

6. It should be noted that, the information conveyed in a project opportunity study should not involve any substantial costs in its preparation, as it is intended primarily to highlight the principal investment aspects of a possible industrial proposition.

Pre-Feasibility Studies

General

1. The project idea should be elaborated in a more detailed studies. However, formulation of a feasibility study that enables a definite decision to be made on the project is a costly and time consuming task. Therefore before assigning larger funds for such study, a further assessment of the project idea should be made in a pre-feasibility study.

2. A pre-feasibility study should be viewed as an intermediate stage between a project opportunity study and a detailed feasibility study; the difference being in the degree of detail of the information obtained and the intensity with which project alternatives are discussed.

3. A detailed feasibility study.

4. A detailed review of available alternatives should take place at the stage of pre-feasibility study. In particular, the review should cover the various alternatives identified in the following main fields of study:

   - Project or corporate strategies and scope of the project.
   - Market and marketing concept.
   - Raw materials and supplies.
   - Location, site and environment.
   - Engineering and technology.
   - Organization and overhead costs.
   - Human resources, in particular managerial staff, labor costs, and training requirements and costs.
   - Project implementation schedule and budgeting.

5. The financial and economic impact of each of the above factors should be assessed. Occasionally, a well prepared and comprehensive opportunity study justify by-passing the pre-feasibility study stage. A pre-feasibility study should however be conducted if the economics of the project are doubtful.

Feasibility Studies

General

1. A feasibility study should provide all data necessary for an investment decision. The commercial, technical, financial, economic and environmental prerequisites for an investment project should therefore be defined and critically examined on the basis of alternative solutions already re-viewed in pre-feasibility study.

2. A feasibility study should be carried out only if the necessary financing facilities, as determined by the studies, can be identified with a fair degree of accuracy. Possible project financing should be considered as early as the feasibility study stage, because financing conditions have a direct effect on total costs and thus on the financial feasibility of the project.

Main Objectives

The main objectives to be considered, as the minimum requirement, in feasibility studies of projects are classified and covered in the following chapters:

Chapter I : Executive Summary.

Chapter II : Project Background and Basic Idea.

Chapter III : Market Analysis and Marketing Concept.

Chapter IV : Raw Materials and Supplies.

Chapter V : Location, Site and Environment.

Chapter VI : Engineering and Technology.

Chapter VII : Organization and Overhead Costs.

Chapter VIII : Human Resources.

Chapter IX : Implementation Planning and Budgeting.

Chapter X : Financial Analysis and Investment Appraisal.

Each of these chapters should separately be studied on the basis of specific procedure and guidelines given herein this Specification. For further detail studies of any and all of the scopes covered in these chapters, specific references are given at the end of each chapter.

CHAPTER I – EXECUTIVE SUMMARY

General

1. For convenience of preparation, the feasibility should begin with a brief executive summary, outlining the project data (assessed and assumed) and the conclusions and recommendations which would then be covered in detail in the body of the study.

2. The executive summary should concentrate on and cover all critical aspects of the study, such as the following: the degree of reliability of data on the business environment; project input and output; the margin of error (uncertainty, risk) in forecast of market; supply and technological trends; and project design.

3. The executive summary should have the same structure as the body of the feasibility study, and cover but must not be limited to the following areas:

   a) Summary of the Project Background and History (Chapter II)

      - Name and address of project promoter.
      - Project background.
      - Project (corporate) objective and outline of the proposed basic project strategy, including geographical area and market share (domestic, export), cost leadership, differentiation, market niche.
      - Project location: orientation towards the market or torwards resources (raw materials).
      - Economic and industrial policies supporting the project.

   b) Summary of Market Analysis and Marketing Concept (Chapter III)

      - Summarize results of marketing research: business environment, target market and market segmentation (consumer and product groups), channels of distribution, competition, life cycles (sector, product).
      - List annual data on demand (quantities, prices) and supplies (past, current and future demand and supplies).
      - Explain and justify the marketing strategies for achieving the project objectives and outline the marketing concept.

- Indicate projected marketing costs, elements of the projected sales program and revenues (quantities, prices, market share etc.).
- Describe impacts on: raw materials and supplies, location, the environment, the production program, plant capacity and technology etc.

c) Raw Materials and Supplies (Chapter IV)

- Describe general availability of:
  i. Raw materials
  ii. Processed industrial materials and components
  iii. Factory supplies
  iv. Spare parts
  v. Supplies for social and external needs
- List annual supply requirements of material inputs.
- Summarize availability of critical inputs and possible strategies (supply marketing).

d) Location, Site and Environment (Chapter V)

- Identify and describe location and plant site selected, including:
  i. Ecological and environmental impact
  ii. Socio-economic policies, incentives and constraints
  iii. Infrastructural conditions and environment
- Summarize critical aspects and justify choice of location and site.
- Outline significant costs relating to location and site.

e) Engineering and Technology (Chapter VI)

- Outline of production program and plant capacity
- Describe and justify the technology selected, reviewing its availability and possible significant advantages or disadvantages, as well as the life cycle, transfer (absorption) of technology, training, risk control, costs, legal aspects etc.
- Describe the layout and scope of the project

- Summarize main plant items (equipment etc.), their availability and costs
- Describe required major civil engineering works.

f) Organization and Overhead Costs (Chapter VII)

Describe basic organizational design and management and measures required.

g) Human Resources (Chapter VIII)

- Describe the socio-economic and cultural environment as related to significant project requirements, as well as human resources availability, recruitment and training needs, and the reasons for the employment of foreign experts, to the extent required for the project
- Indicate key persons (skills required) and total employment (numbers and costs).

h) Project Implementation Schedule (Chapter IX)

- Indicate duration of plant erection and installation
- Indicate duration of production start-up and running-in period
- Identify actions critical for timely implementation.

i) Financial Analysis and Investment Appraisal (Chapter X)

- Summary of criteria governing investment appraisal
- Total investment costs
- Major investment data, showing local and foreign components
- Land and site preparation
- Structures and civil engineering works
- Plant machinery and equipment
- auxiliary and service plant equipment
- Incorporated fixed assets
- Pre-production expenditures and capital costs
- Net working capital requirements
- Total costs of products sold

- Operating costs
- Depreciation charges
- Marketing costs
- Finance costs
- Project financing
- Source of finance
- Impact of cost of financing and dept service on project proposal
- Public policy on financing
- Investment appraisal: key data
- Discounted cash flow (internal rate of return, net present value)
- Pay-off period
- Yield generated on total capital invested and on equity capital
- Yield for parties involved, as in joint venture projects
- Significant financial and economic impact on the national economy and environmental implications
- Aspects of uncertainty, including critical variables, risks and possible strategies and means of risk management, probable future scenarios and possible impact on the financial feasibility of the investment project.
- National economic evaluation.
- Conclusions.
- Major advantages of the project.
- Major drawbacks of the projects.
- Chances of implementing the project.