Industrial Training

The Maharaja Sayajirao University, Baroda
Faculty of Technology And Engineering
Chemical Engineering Department

introduction

- Subject

1) Nitric acid
2) EPC (Integrated Engineering and Procurement and Construction)
3) Process Plant Utilities
4) Process Safety

- # Weak Nitric Acid

MAJOR TOPICS TO COVER

1) History
2) WNA or DNA properties
3) Uses
4) Licensors
5) Block diagram & Main processsteps
6) Types of designs & selection
7) Importance of parameters
8) Main equipment & design features
9) Environment
10) Safety

History of Nitric Acid

- First mention goes back to 12th century AD. Referredas

"strong water"

MilneroxidisedNH3tonitricoxideovermanganesedioxidein1789

- C.F.Kuhlmann1838patentedFirstcatalyticoxidationofNH3onplatinumSponge
- Birkeland-Eyde1903 Direct oxidation of N2 with Chfrom

Air in electric arc

Ostwald and Brauer (1901to1904):Pilot plants cale experiments

- W.Ostwald1905OxidationofNH3asindustrialprocess

firstplanttoproduce300kgofnitricacidperdaywascommissionedatGerthe,

nearBochum,in1906usingcrimpedplatinumstripswoundintoacoil.

- 1908 reached ten fold capacity.
- 1909 kaiser filedn patent for the use of platinum in the form of a gauge woven wire 0.06 mm diameter with 1050 apertures/cm2
- Until early 1920s limitation due to ammonia purity and good material of construction
- Ongoing improvement to date (energy efficiencies , capacities)

Properties

- Why weak

1) Chemical Formula:HNO3
2) Specific gravity ;: (@ degC)
3) Molecular Weight:63
4) Boiling Point :120deg C atm pr

1) TH

TECHNOLOGY SUPPLIERS

1) THYSSEN KRUPP INDUDTRIAL , SOLUTION (former UHDE)
2) GRAND PARROISE , France, TECHNIP, Stamicarbon ,Wealtherly ,

etc.

now KBR, Chinese Technologies also available.

At least 15 prprietary nitric acid process are available

MFG in INDIA:

RCF,GNFC,DFPCL,DN,AIL,NFL

TECHNOLOGY SUPPLIERS

- High pressure

American Du POINT: conv pr.-8 bar,900-950 deg c, higher gas flow, pt loss 250 to 400mg/MT100% Na bsis

European unhade, stamicarbon :900 deg C,

Lower gas flow , pt ;loss 180 to 200 mg/ton

Mediumpressure

845 to 880c,pu=t losses 85 to 125/ ton,

Low pressure Atm Plants:

800c , pt losses 50 to 125 mg/ ton

Catalyst:

- Platinum + Rhodium
- Form, packs & structure , catchment, PT filters,Catalyst refurbishing,
- Catalyst poisons.
- Composition mechanically properties , reactivity , cost, efficiency optimization,(wire, dia, weight/ compostition packs) .multi (DEGUSSA): High efficiency, FTC – HERAUS, etc

- 0

Reaction condition: 890 deg c plant pr.
NH3/AIR ratio@10.5-12 vol, effects of parameters & process care

Catalyst fitting & arrangement
catalyst basket
Temperature measurement

WASTE HEAT BOILER

- Eliminate refractory lining. Kepp all parts of coller to allow maximum cs use for minimum ss grade is used In hooter parts.
- Manufracturers
- Shell & tuebe to coiled tubes with la mont headers
- foerced circulation

Main steps in nitric acid process Aammonia oxidiation

2) Oxidation (process path)

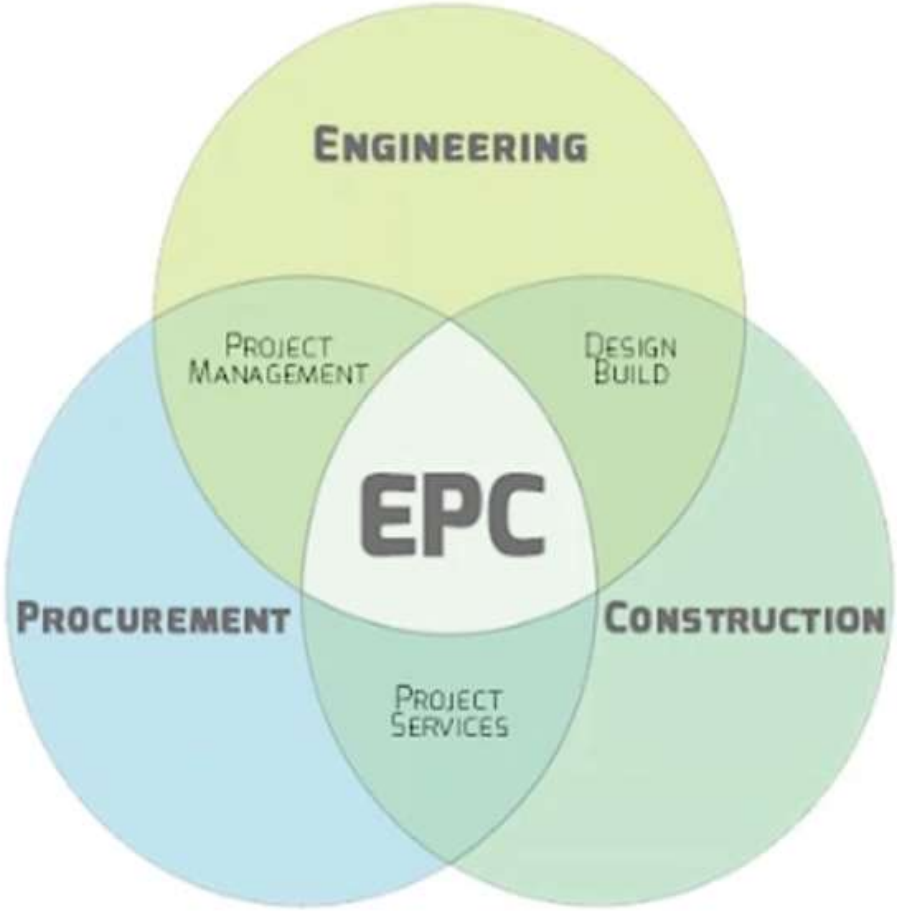
EPC

(Integrated Engineering, Procurement and Construction)

Introduction To EPC

❖ What does EPC mean ?

- Integrated Engineering, Procurement and Construction
- EPC Contractor delivers project on turn-key basis
- Client benefits include:
  - Better risk management
  - Consolidated responsibility
  - Drives ownership of project lifecycle
  - Enhanced management oversight
- Various versions of EPC type of contracts are -
  - T-EPC type which means EPC including supply of Process Technology
  - EPCM which means Engineering, Procurement and Construction Management with Construction by Client/Others.
  - EP which means Engineering and Procurement scope only with Construction by Client/Others.


ENGINEERING
PROJECT MANAGEMENT
DESIGN BUILD
EPC
PROCUREMENT
CONSTRUCTION
PROJECT SERVICES

1) Brief on pre engineering activities

brief on EPC, feasibility , contract award , tender, cost estimination and evaluation

2) Integrated Engineering Activities

feef/ basic, discipline wise , multi discipline integration, use of it, 3d model approach , concurrent engineering,

❖ Brief on EPC

- Current trend of epc
- Key drivers
- Challenges
- Change in scenario
- Life cycle chain

Current trend on EPC business

Today's Global Fast Track projects require EPC contractors to successfully manage & perform projects involving concurrent participation of multiple design centers, Procurement offices & Construction site while still keeping a control on Project Schedule & Costs ‘

……. In Short , Completion of Project

On Time

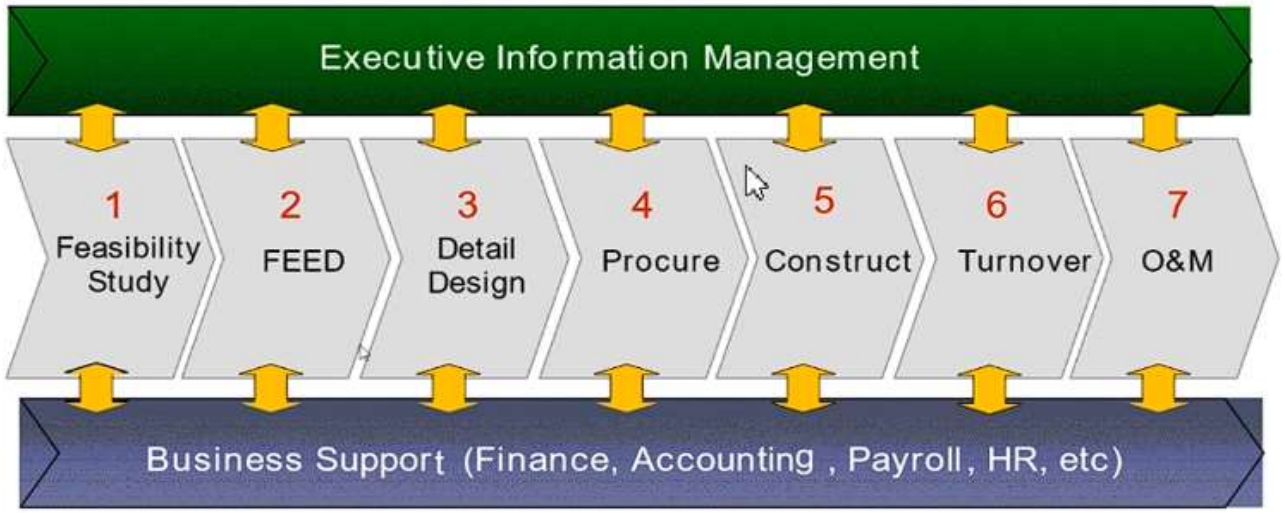
in Budget

With Expected Quality & Performance

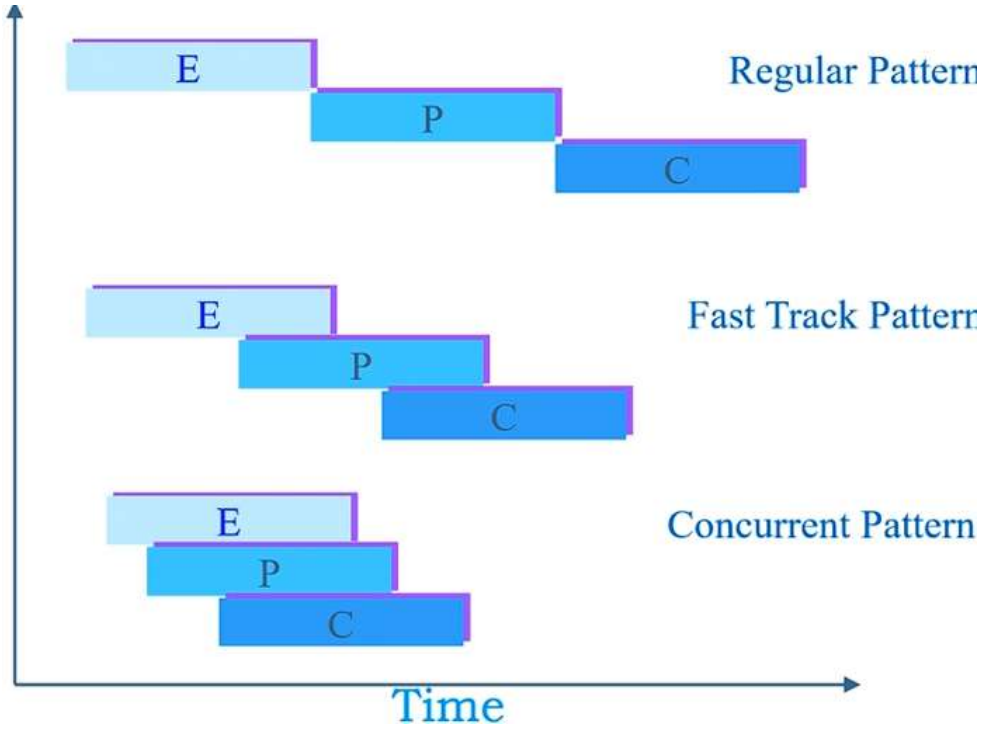
Key Drivers of EPCbusiness

- Scope management
- Project planning &control
- engineering , procurement, cost,data, project, quality, hr ,risk management
- Health safety & environment

Project phases and life cycle chain



❖ Current scenario on EPC business



Key challenges in EPC business

- Interface of contract documents
- Difference in the estimated & actual scope of work
- Delay by the equipment vendors & long item suppliers of piping, instruments & electrical
- Difference in the estimated material & actual material requirement
- fluctuating commodity prices and improvement in labour rates
- Deployment of sufficient manpower by sub contractors
- Management of performance guarantees

- Requirement for customers is

1) the technical and cost information (from licensor)

2) Execute “ the feasibility study “

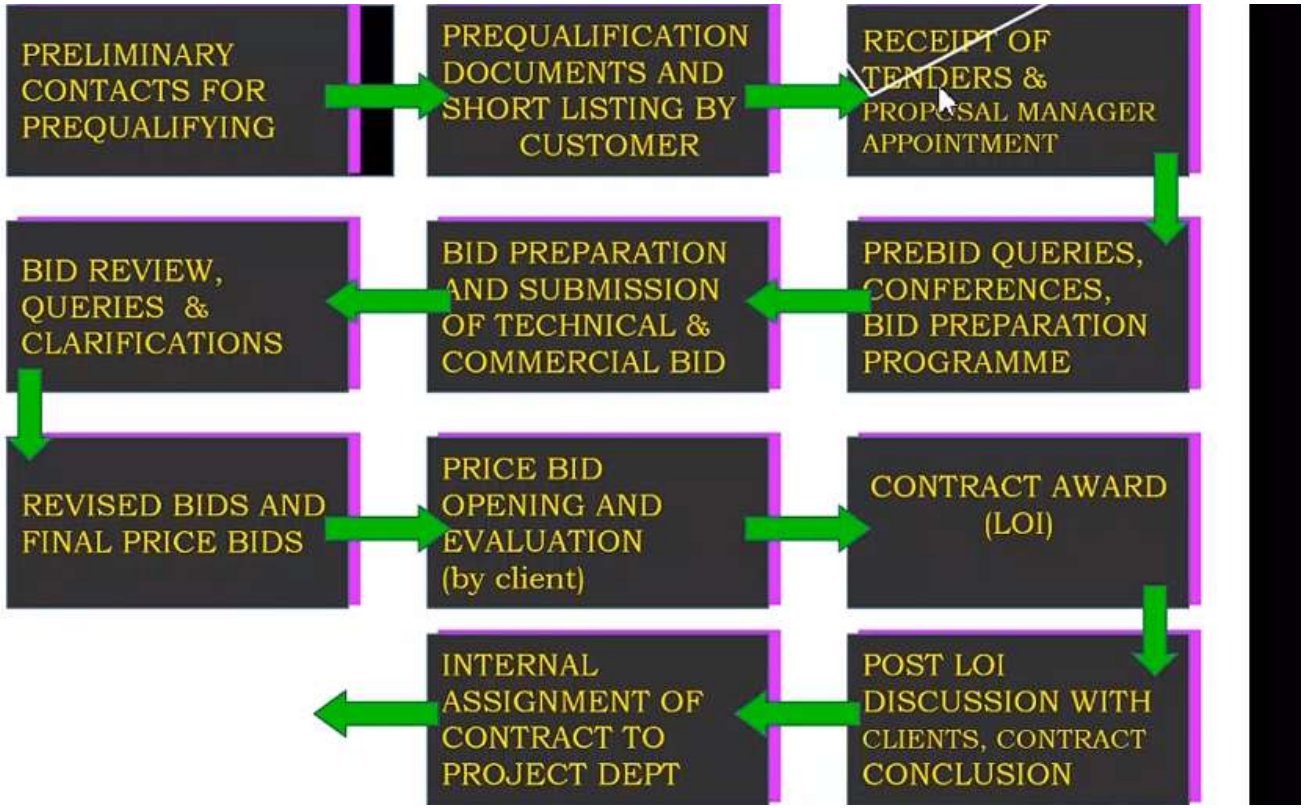
Which must essentially answer the following questions :

- ✓ from where can I purchase the raw materials and utilities? At what price ?
- ✓In which market should I sell the products / at what price ?
- ✓What investment must I forsee ? From where and at what cost can I obtain the financial means ?
- ✓What economic return can I forsee for the investment ? At what of risk ?

- Objectives of feasibility study are

  - Market study
  - Choice of the location
  - Choice of the technology
  - Project definition
  - Financial economic analysis of the profitbilty

Contract award on business



3) Process plant utilities

- Utility areas : important area of a chemical plant & house aboilers large compressors , refrigeration system , air conditioning systeam , water treatment plants , cooling tower , etc
- Utilities located outside plant limits should not give any wrong impression that utilities are any less important than main process , because it iss the efficient management of utilitites that generate profits .
- It is current normal engineering practice aimed att reducing the consumption of utilities because the production of utilitites whether it is compressed air steam etc requires energy & enrgy is the becoming costlier day by day.

- Effcient utilities management doesn't end at cost cutting but their operating parameters are also important

❖ Elctrical power : it is used for electrical motors of machinery items like pimps blowers , compressers , agitator as well as for lighting.

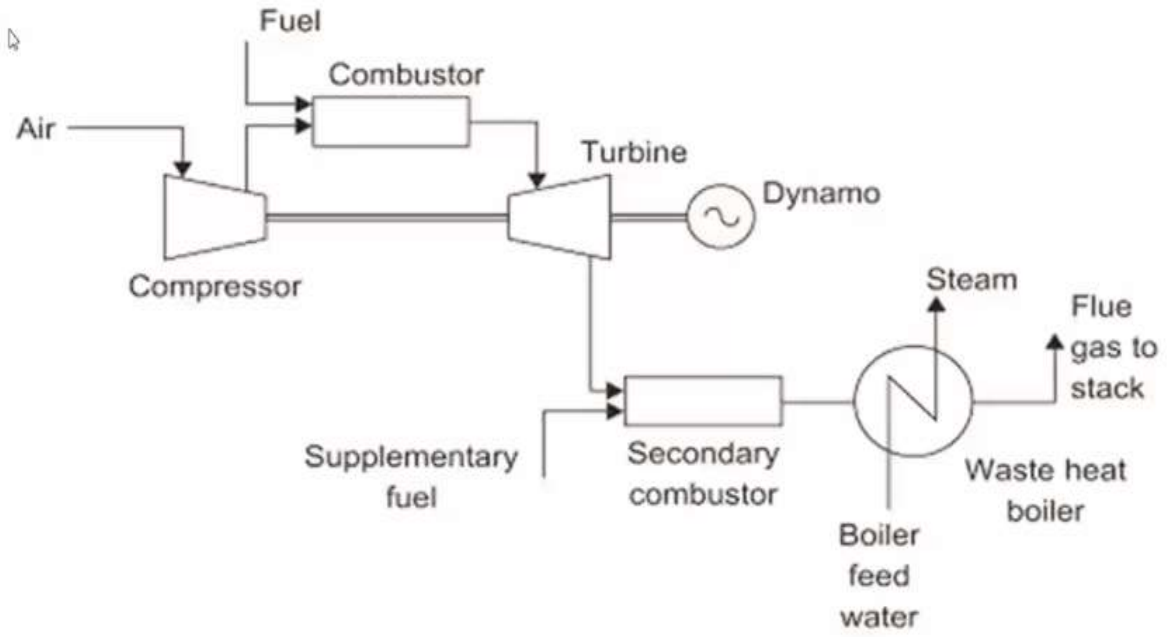
- It is efficient , relaiable & available in wide range of violatege level
- The power demand is the genrally determind by the the energy required for compression pumping air cooling lights anf many others machinery items .
- Genaraly it is used up to 200 hp but for large machineries power used is as high as 10000 hp

❖ Electricity is now used as primary heat utilitiy in large scale chemical plants because :

➢Heat from electricity is two to three times more exepensie than heat from fuels due to the drop in efficiency.

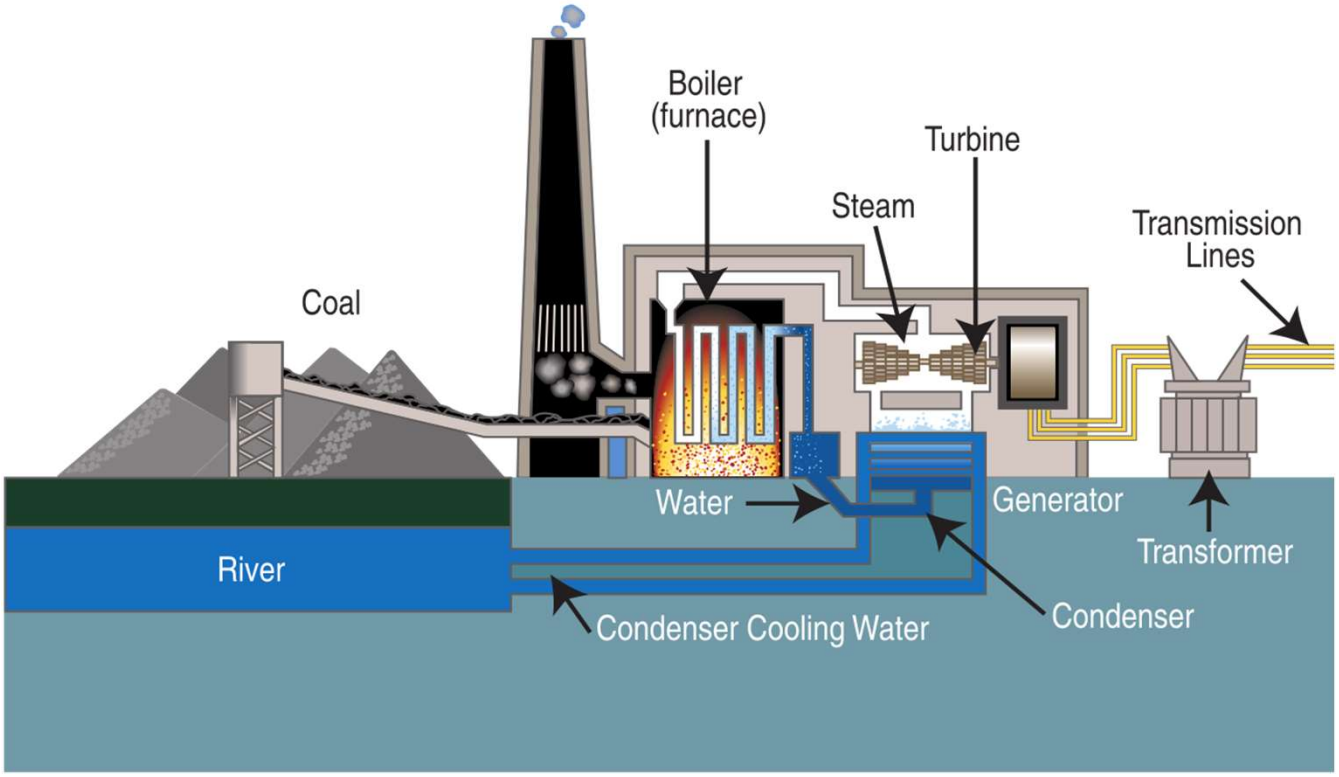
- Electrical heating units are expensive, require high maintenance, and must comply with strict safety regulations.
- Electrical heating units are unsafe compared to steam heating units. In steam systems, the flow of steam controls the temperature, whereas in electrical heating units, temperature is controlled by temperature controllers, which can fail or burn out.

Cogeneration



- Gas turbine cogeneration with a heat recovery steam boiler

Conventional coal fired power generation plant



Heating: why heating is required

- Heating is required for Distillation, Chemical Reaction, Reactors, Condensers, Crystallizers and other equipment.
- Generally Steam at different pressures, Condensate, Hot Air, Hot Nitrogen, Fired heaters, Hot Oil (Heat Transfer oils e.g. Dowtherm, Essotherm, Marlotherm. Servotherm etc), Molten salt ar^ used
- Heating is also supplied to maintain temperature of fluids in piping and equipment by provision of Heat Tracers which are either steam tracers or electrical tracer.
- For heating of vessels, vessels can be Jacketted / Provision of Limpet Coil / Dimple Jacket or in some cases Steam or Electrical Tracing