GENESIS
FERTILIZERS

AMMONIA AND UREA PROJECT

Supply chain for the project aligned to Front-End Loading (FEL)

Overview for each phase and deliverables.

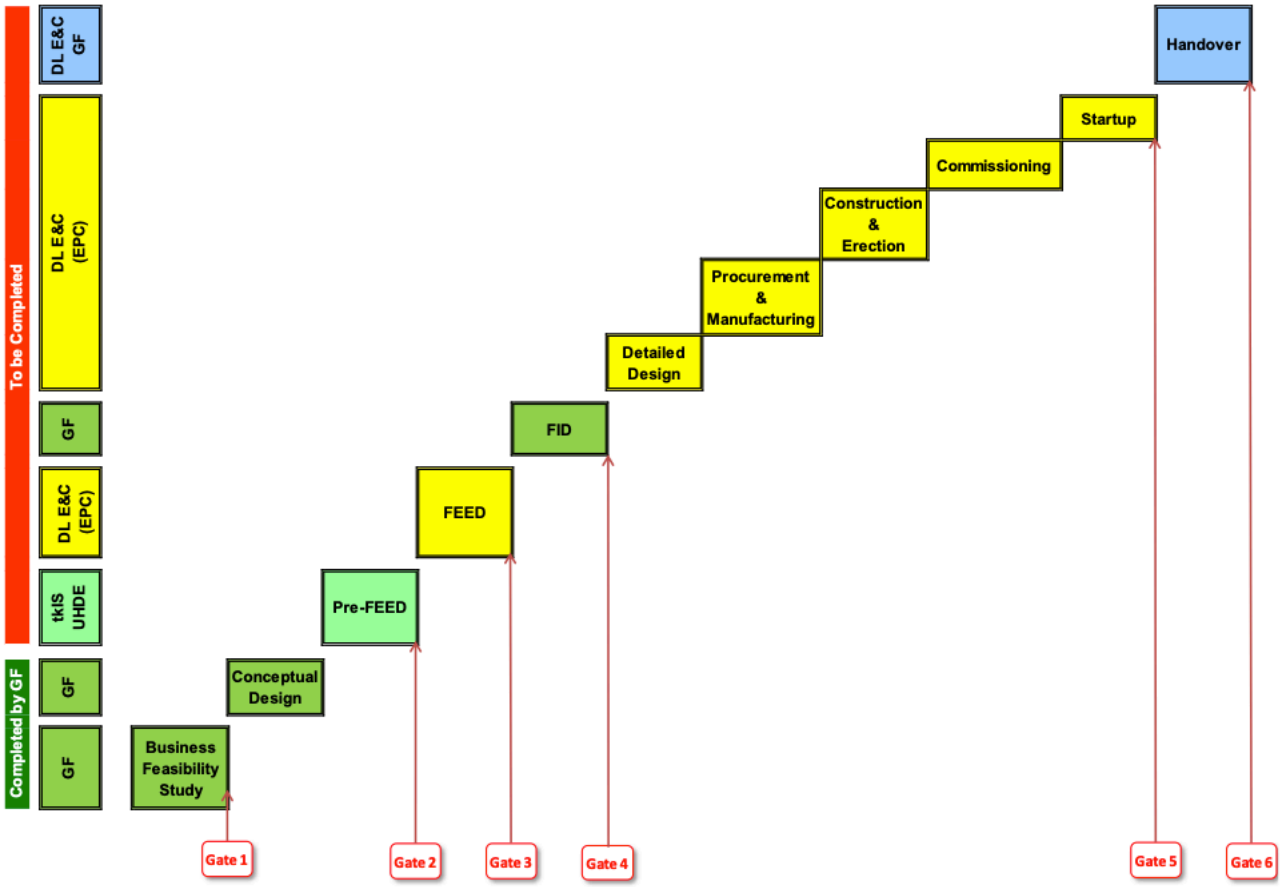
GF Engineering Team

March 22, 2024. Rev. 1

GENESIS
FERTILIZERS

Supply Chain for Projects

Overview on classic phased-gated structure approach aligned to IPA – Independent Project Analysis.



Overview on Each Phase and Deliverables

STAGE I - Business Feasibility Study

The business opportunity and its strategic contribution are validated.

Decision support package for Gate 1 authorization

1. Products and Specification
2. Market forecast
3. Sales and Capacity Reconciliation
4. Legal and Environmental Study
5. Initial Screening of Technology
6. Informal Estimates – cost and schedule
7. Bankable Feasibility Study
8. Recommended Resources for Next Phase (people and $)

STAGE II-A – Conceptual Design

It is a document containing the chosen design alternative, descriptive, block diagrams and sufficient information to enable the realization of Pre-FEED.

.

1. Project Scope and Objectives
2. Complex Configuration – Block Diagrams (ISBL and OSBL)
3. Process Description
4. Operation Cases: operational modes aiming to obtain the different desired products.
5. Product Quality and Specification (preliminary)
6. Turndown ranges/limits (preliminary)
7. Project and Operating Cases (preliminary)
8. Technology Licensor Recommendations and Constraints
9. Technology selection

This list of deliverables is usual and typical and might vary according to the complexity of the project and agreements between the client and the engineering services provider.

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

STAGE II-B – Pre-FEED

Pre-FEED is a preliminary FEED. This design package complements the Conceptual Design and is used for a basis to FEED deliverables or Basic Engineering.

Decision support package for Gate 2 authorization.

General Engineering Deliverables (Typical)

1. PFD (ISBL and OSBL). Complex Configuration for Phases I and II.
2. Project Description (entire complex ISBL/OSBL):
    - Project Scope
    - Project and Operating Cases
    - Turndown ranges/limits
    - Technology selection
    - Technology Licensor Recommendations and Constraints
    - Product Quality and Specification
    - Transition from UAS to DEF production (contamination). Long transition period until to remove all the ammonium sulphate.
    - Guidelines for Integration Phases regard to: Heat and Material Balances, Utilities Power Generation and Green Products
    - Project Philosophy: Operability, Expandability, Flexibility and Reliability
    - Control Philosophy: redundancy requirements, main alarms and shutdown, emergency shutdown and panel location (Control Room).
    - Warehouse and storage capacity
    - Interconnection with GF SuperCenter.
    - Expedition of products (big bag, regular bags, bulk, railway, trucks)
    - Loading / Unloading / Storage Facilities Requirements
    - Products storages capacities (NH3, urea, UAS, UAN, DEF)
    - Destination of NH3 “excess”
    - Driver for big compressors (steam or electricity or both)
    - Possibility of sequestration of CO2 and inject in Whitecap pipeline.
    - Winterization and insulating.
    - Electrical Power: supply voltage at BL, high, medium, and low voltage for motor power.
    - Water consumption and battery limit conditions (preliminary).
    - Natural Gas consumption and battery limit conditions (preliminary)

Overview on Each Phase and Deliverables

3. Environmental protection: noise, air emission and liquid effluent.
4. Pressure relief and Flare System
5. Guidelines for Contractor design storage all products.
6. Water Treatment Requirements (guidelines)
   - Wastewater treatment
   - Waste disposal.
   - Storm water containment & treatment.
7. Selection of technologies for Granulation, UAS, UAN and DEF
   - DEF: liquid or granules.
   - DEF: Acid scrubbing in urea process
8. Equipment Design Criteria: equipment that should be design oversized and their respective values.
9. I&E design criteria (guidelines).
10. Heat and Material Balances
11. Table of Inputs consumption (chemicals, catalysts, solvents, etc.).
12. Description of Fire and Gas Detection System (guidelines).
13. Milestone Schedule
14. Design Basis (typical)
15. Scope of Work (SoW) for FEED
16. Invitation to Bid (ITB): FEED and EPC proposal (contractor).

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

According to the UHDE's package, the Pre-FEED deliverables (content) for the GENESIS Project are below.

Description	Content
Process Engineering Deliverables	
Process Design Basis	The Design Basis contains information on: Plant capacity, Design scope and battery limit, Feed stock specification, Product specification, Utilities specification, Climatic information received by Owner or Uhde's assumptions otherwise.
Block Flow Diagram for Process Plants	The Block Flow Diagram contains, separately for Phase 1 and Phase 2: Inlet streams to the units (feedstock, utilities), Outlet streams of the units (product, utilities). Note: water, steam and electric power consumption and productions figures are included
Process Description for Process Plants	The Process Description contains: - General description of process, - Essential operating conditions and - Chemical reactions.
Steam Balance Production	Included in Block Flow Diagram
Production and Consumption Figures and Emissions for Process Plants	Production and Consumption Figures and Emissions of the units (list summarizing the Block Flow Diagram figures), separately for Phase 1 and Phase 2. The figures will be shown for normal operation based on all used process required fluids defined in the basis of design.
Equipment Name Only List for Process Plants	The Equipment Name Only List contains: TON (Technical Organization Number), Designation of components and equipment, Quantities (operation I stand-by).
CO_2 Footprint	Information on direct and indirect CO_2 emissions from the Process Plants and from utility import, as far as known, separately for Phase 1 and Phase 2 as listed below.
Description of Changes by Integration of renewable Electricity and/or Hydrogen	Description of changes in the plant by integration of renewable electricity and/or H2, e.g. tie-ins and piping modifications.

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

Deliverables from Technologies Licensors

Each technology licensor will provide its own Process Design Package (PDP) and deliverables.

In terms of NH3, NA, AN, UAS, DEF and UAN, PDP's content is like STAMICARBON.

Here's a typical document list from STAMICARBON (urea product).

1. Design Basis – BoD
2. Process description
3. Material balance
4. Process flow sheet
5. Steam and condensate balance
6. Flow sheet Steam and Condensate
7. Cooling water balance
8. Flow sheet Cooling water
9. Process and Instrumentation Diagrams (P&ID's)
10. Equipment List (names only)
11. Equipment process data sheets
12. Datasheets for pressure safety valves
13. Mechanical, Process and Process Control General specifications
14. Instrument index
15. Data sheets instrumentation (including Control Valves)
16. Logic diagrams
17. Setting list
18. Functional control diagrams – FCD's
19. Safety allocation forms – SAF's

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

STAGE III – FEED

Develop a basic design, further detail the scope defined in the Conceptual Desing (Pre-FEED), the cost, schedule, and execution plan of the project in preparation for execution.

Develop documentation required for FID approval (CAPEX - economics updated) and proceed to the Execution Phase (EPC).

The following is a typical list of deliverables from DL E&C (EPC) for FEED with some comments from GF.

DIVISION	TITLE	
COMMON	1	Government Approval Review
	2	Progress report (monthly)
	3	Project Control (changes, schedule, cost, payments, etc.)
	4	Document Control
	5	Painting & Insulation Specification (equip. / piping / steel structure / etc)
	6	Plot Plan
PROCESS	1	Bedd (Basic Engineering Design Data)
	2	Design Basis
	3	Design Criteria
	4	Process Description
	5	Process Flow Diagram (PFD)
	6	Process Heat and Material Balance
	7	Utility Flow Diagram (UFD) APPROVED FOR DESIGN (DE-TAILING ENG.)
	8	Equipment List
	9	Equipment Data Sheet READY FOR PURCHASE
	10	P&ID APPROVED FOR DESIGN, FROZEN (DETAILING ENG.)
	11	Flare Load Summary

GENESIS
FERTILIZERS

Overview on Each Phase and Deliverables

PROCESS	12	Battery Limit Summary
	13	Utility Summary
	14	Effluent Summary
	15	Catalyst & Chemical Summary
	16	DCS Logic Description
	17	ESD Interlock Description / C&E Diagram
	18	Flare Design Philosophy
	19	Vent/Drain Philosophy
	20	Effluent Philosophy
	21	Isolation Philosophy
	22	Sparing Philosophy
PIPING	1	Preliminary Plot Plan
	2	Line Designation Table (Line List) WITH INSULATION & PAINTING REQUIREMENTS
	3	Piping Material Class Specifications & Class Index
	4	Engineering Specifications
	5	3D Modeling (Equipment Layout and Critical Lines only) BORE DIAMETER ≥ 2" (?)
	6	Piping Interface Table
	7	1st Material take-off for Capex (for Internal) (Covering 70% of Final MTO)

GENESIS
FERTILIZERS

Overview on Each Phase and Deliverables

INSTRUMENT	1	Design Specifications for Control System
	2	Instrument Data Sheet (Critical Items: PSV, Control Valve, Analyzer, Flow Meter)
	3	Engineering Specifications
	4	N° of Gas Detector or Location Plan
	5	Process Control Systems Power and Utility Requirements Preliminary (Control, Communication and Analyzer Systems)
	6	Overall Instrument Cable and Cable Tray Conceptual Routing Above and Undergrounding
	7	System Configuration & Interface for Package PLC / Control System
	8	Analyzers Shelter Size & Location
	9	Rack Room - Instrumentation Cabinets Lay-Out
	10	Control Systems Block Diagrams
	11	Instrument Index & I/O List
	12	MTO for Capex (for Internal)
		DCS architect
		Control system Cyber security
		SIL level proposed
ROTATING EQUIPMENT	1	Engineering Specifications
	2	RFQ for Long Lead Items (for Internal Capex*)
	3	TBE (Technical Bid Evaluation) for Long Lead Items (for Internal Capex*)

GENESIS
FERTILIZERS

Overview on Each Phase and Deliverables

STATIC EQUIPMENT	1	Heat Exchanger Data Sheet With Thermal Rating
	2	Engineering Specifications (Vessels, H/Ex, Air Cooler, Etc)
	3	Standard Drawings
	4	Equipment Weight Estimation
	5	TBE (Technical Bid Evaluation) for Long Lead Items (for Internal Capex*)
	6	RFQ for Long Lead Items (for Internal Capex*)
	7	MTO (Insulation, Fireproofing, Pf & Ladder) for Internal TIC Estimation
ELECTRICAL	1	Single Line Diagram (overall) APPROVED FOR DESIGN (DETAILING ENG.)
	2	Single Line Diagram (simplified) APPROVED FOR DESIGN (DETAILING ENG.)
	3	Electrical Equipment Layout
	4	Hazardous Area Classification APPROVED FOR DESIGN (DETAILING ENG.)
	5	Hazardous Source Schedule
	6	Electrical Main Cable Route Layout
	7	Block Diagram for Telecommunication System
	8	Design Basis for the Electrical System VOLTAGE LEVELS
	9	Electrical Load List
	10	Engineering Specifications DATA SHEETS FOR SUBSTATION, TRANSFORMER AND ELECT. EQUIP.
	11	Electrical Calculation
	12	Electrical I/O List (Typical: Ecms Or Process Control)

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

ELECTRICAL	13	Electrical Cable Schedule
	14	MTO for Capex (for Internal)
	15	Electrical Equipment List
	16	UPS and Battery charger details and its autonomous time
	17	Lightning system
	18	Fault level proposed
	19	Grounding system
CIVIL	1	Engineering Specifications
		1) Civil Design Criteria
		2) Sewer and Drainage
		3) Road and Paving
		4) Fencing and Gates
	2	Conceptual Road, Paving and Fencing Plan
	3	Conceptual Underground Plan
	4	Storm water management
	5	Conceptual Surface Run-off Drain Plan
	6	MTO - Quantities for Capex (for Interna*L)
	7	Conceptual Drawings for Major Equipment Foundations and Underground Basin Structure and Pipe racks
	8	Standard Drawings
	9	Conceptual Site Preparation Plan (If required)
	10	3D Modeling (30% Basis)
	11	SITE SURVEY (TOPOGRAPHY MAP, SOIL TEST, BEARING CAPACITY, ETC.)

GENESIS
FERTILIZERS

Overview on Each Phase and Deliverables

ARCHITECTURE & STRUCTURE	1	Engineering Specifications
		1) General (Purpose & Scope of Work)
		2) Material Specifications
		3) Structural Design Loads
		4) Structural Steel Design Criteria
		5) Reinforced Concrete Design Criteria
	2	Non-Process Building Conceptual Drawings (Administration Bldg., Cafeteria, Fire Station, Guard House, Warehouse, Workshop etc)
		1) Architectural Conceptual Drawing (Plan, Elevation, Section)
	3	Standard Drawings (Stair, Handrail, Ladder)
	4	MTO - Quantities (only Pile, Conc. Structural Steel) for Capex (for Internal)
	5	3D Modeling (30% Basis)
	6	FIREPROOFING SPECIFICATION
	7	Pipe racks
	8	Requirements of Blast proof control room and operator booth

GENESIS
FERTILIZERS

Overview on Each Phase and Deliverables

ENVIRONMENT	1	Design Basis (for Environment Facilities)
	2	Project Specific Procedures Related To Environment Engineering
	3	Process Description (for Environment Facilities)
	4	Process Flow Diagram (for Environment Facilities)
	5	Process Heat and Material Balance (for Environment Facilities)
	6	Equipment List (for Environment Facilities)
	7	Equipment Data Sheet (for Environment Facilities)
	8	P&ID (for Environment Facilities)
	9	Battery Limit Summary (for Environment Facilities)
	10	Utility Summary (for Environment Facilities)
	11	Chemical Summary (for Environment Facilities)
	12	DCS Logic Description (for Environment Facilities)
	13	ESD Interlock Description / C&E Diagram (for Environment Facilities)
	14	PROVIDE INFORMATION FOR UPDATE ENVIROMENTAL STUDY (BY OWNER/OTHER)
DESIGN HSE	1	Design HSE Plan
	2	Safety Study Procedures (Hazop, Sil, Etc.)
	3	Hazop Study Report
HVAC	1	Design Basis for Hvac System
	2	Preliminary Air Flow Diagram / Piping and Instrumentation Diagram
	3	Preliminary HVAC Load Calculation
	4	MTO for Capex (for Internal)

GENESIS FERTILIZERS

Overview on Each Phase and Deliverables

Fire Fighting	1	Design Basis for Fire Fighting System
	2	Fireproofing Philosophy
	3	Data Sheets (F/W Pumps, F/W Storage Tank)
	4	Preliminary P&Id for Fire Fighting (Outdoor) & F/W Pump System
	5	Preliminary U/G Fire Water Piping Layout
	6	Preliminary F/W Hydraulic Calculation Report
	7	MTO for Capex (for Internal)
	8	Control room and IT server Building fire suppression system
LAB	1	Laboratory Equipment List
	2	Laboratory Tests Requirements

STAGE IV – FID

The Final Investment Decision (FID) is final decision at Gate 4 and occurs at the end of the Front-End Engineering Design (FEED) phase.

FID basically consists of the moment when a project's owner confirm that the project has the technical, operational, commercial, and financial conditions to advance to implementation phase (execution).

FID's requirements covering Tasks, Deliverables and Documentation for Project Genesis Sanction are being considered according to Govt of Alberta's criteria.

This scope of work is being led by Genesis / CFO for future Director Board's decision.

STAGE V – DETAILED DESIGN

At this stage - which is part of EPC contractor - all sufficient and necessary documents will be generated for civil construction and electromechanical erection works, for all technical disciplines that make up the scope of the project.

In addition to these, the necessary documents will be prepared and issued for general materials and equipment procurement.

Deliverables List is classic and varies depending on each EPC contractor and the client's specific requirements.

Overview on Each Phase and Deliverables

STAGE VI – PROCUREMENT & MANUFACTURING

At this stage - which is part of EPC contractor - all materials, equipment and services needed for civil construction and electromechanical erection are purchased.

EPC's procurement is a multi-step process that covers everything from vendor selection to approval of each project component, all the way through to delivery and installation.

Into this process there is an important activity that is to follow up and inspect in workshop supplier those pre-selected critical items.

STAGE VII – CONSTRUCTION & ERECTION

In the construction and electromechanical erection phase, the plans and designs developed during the engineering phase are executed.

The EPC contractor is responsible for managing construction and erection crews, contractors, and subcontractors to ensure that the project is built according to specifications, safety standards, quality, and timelines.

Throughout the entire construction phase, the EPC contractor oversees both their work crews and subcontractors, while also providing the project owner with regular updates on construction progress, challenges, and any deviations from the devised plan.

STAGE VIII – COMMISSIONING

The main objective of Commissioning is to ensure the transfer of the industrial plant from the Contractor to the Owner in an orderly and safe manner, guaranteeing its Operability, in terms of performance, reliability and traceability of information.

In practice, the commissioning process consists of the integrated application of a set of engineering techniques and procedures to verify, inspect, and test each physical component of the project, from individual ones, such as parts, instruments, and equipment, to more complex ones, such as modules, subsystems, and systems.

Pre-Commissioning is normally known as a set of tests activities that are carried out under "cold condition", it means, with "de-energized systems".

On the other hand, under "hot condition", or "energized systems", commissioning is also called "pre-operation".

STAGE IX – STARTUP

After completion of commissioning, the operation cycle (O&M) begins through the start-up of the equipment and production units that make up the industrial complex.

Normally this process occurs in stages and gradually until the complete operation of the complex. Normally, the EPC Contractor do this job side by side with Owner/Client.

Overview on Each Phase and Deliverables

STAGE X – HANDOVER

Handover milestone is when the project's completed scope of work gets handed off from Contractor to the deliverable owner.

It's not just about Contractor passing off the project to the owner, but also about supporting that owner for a length of time as previously agreed.

This milestone defines the starting of guaranteed time provided to owner by Contractor and Technologies Licensor.

Appendix A – Definitions for Terms and Abbreviations

A

AS – Ammonium sulphate (crystal)

AN – Ammonium nitrate (compound for UAN)

B

BL – Battery Limit: concept in the design, construction, and operation. Defines the physical boundaries of the plant and the areas where the primary process equipment and supporting facilities are located.

BP – Belle Plaine

C

CO_2 – Carbon dioxide (feedstock for urea synthesis)

CAD – Canada

CAPEX - Capital expenditure (funds used to undertake the project)

D

DL EC - Daelim Engineering & Construction E&C (FEED and EPC provider)

DEF – Diesel Exhaust Fluid (urea solution in demineralized water used for control of the emission of nitrogen oxides NO_x from vehicles).

E

EPC – Engineering, Procurement and Construction. Model of contract which contractor assumes full responsibility for all stages of the project, from design to construction and final delivery.

F

FID - Final Investment Decision

FEL – Front-End Loading (methodology for defining the capital project scope)

FEED – Front-End Engineering Design (basic design with cost estimate – CAPEX)

Overview on Each Phase and Deliverables

G

GH – Green hydrogen (hydrogen made from sustainable sources).

Gate - The gates work as transition points in which the project may go to the next phase, return for better definition, or canceled.

GF – Genesis Fertilizers LP (owner)

H

HSE - Health, Safety and Environment

HVAC - Heating, Ventilating and Air Conditioning

I

I&E – Instrumentation and Electric (activities and services related to this technical discipline)

ITB – Invitation to Bid (formal solicitation extended by a project owner to contractors to submit a bid)

ISBL – Inside Battery Limits: physical boundaries of the plant where the primary process units and equipment are located that make the final product.

N

NH_3 – Ammonia (feedstock for urea synthesis and ammonium nitrate)

NG – Natural gas (feedstock for ammonia synthesis / fuel for reformer and boiler)

NA – Nitric acid (feedstock for ammonium nitrate)

O

OPEX - Operating Expenditure (incurred costs throughout the life of the facility)

O&M - Operations and Maintenance (performance of day-to-day activities)

OSBL - Outside Battery Limits: physical boundaries where secondary process units and equipment - meaning, support facilities - are located).

P

PDP – Process Design Package (set of technology licensor documents)

PSM – Process Safety Management

S

STAMI – Stamicarbon (Technology Licensor for urea synthesis)

SK – Saskatchewan

T

tkFT – thyssenkrupp Fertilizer Technology (Technology Licensor for Urea and Urea Ammonium Sulphate Granulation)

U

UHDE - thyssenkrupp UHDE GmbH (Technology Licensor for NH_3-NA- AN-UAN-UAS production)

Urea – nitrogen-based fertilizer (fertilizer granules)

UAS - Urea Ammonium Sulphate (fertilizer granules)

UAN – Urea Ammonium Nitrate (fertilizer liquid)