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# **Energy Recovery from Waste through Integration of Proven Technologies**





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# Thermal Energy



# GREENTECH - ATPS

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**If sufficient thermal energy is added to matter it will transform it into a gas thereafter causing the neutral atoms of the gas to split into positive and negatively charged atoms (ionization)**

**GreenTech Advanced Thermal Process System (ATPS) is a system which avoids ionization but has the capability to control and use thermal energy to destroy waste without burning and in doing so converts organic waste into a gas to be used as fuel.**



# THERMAL ENERGY IN NATURE



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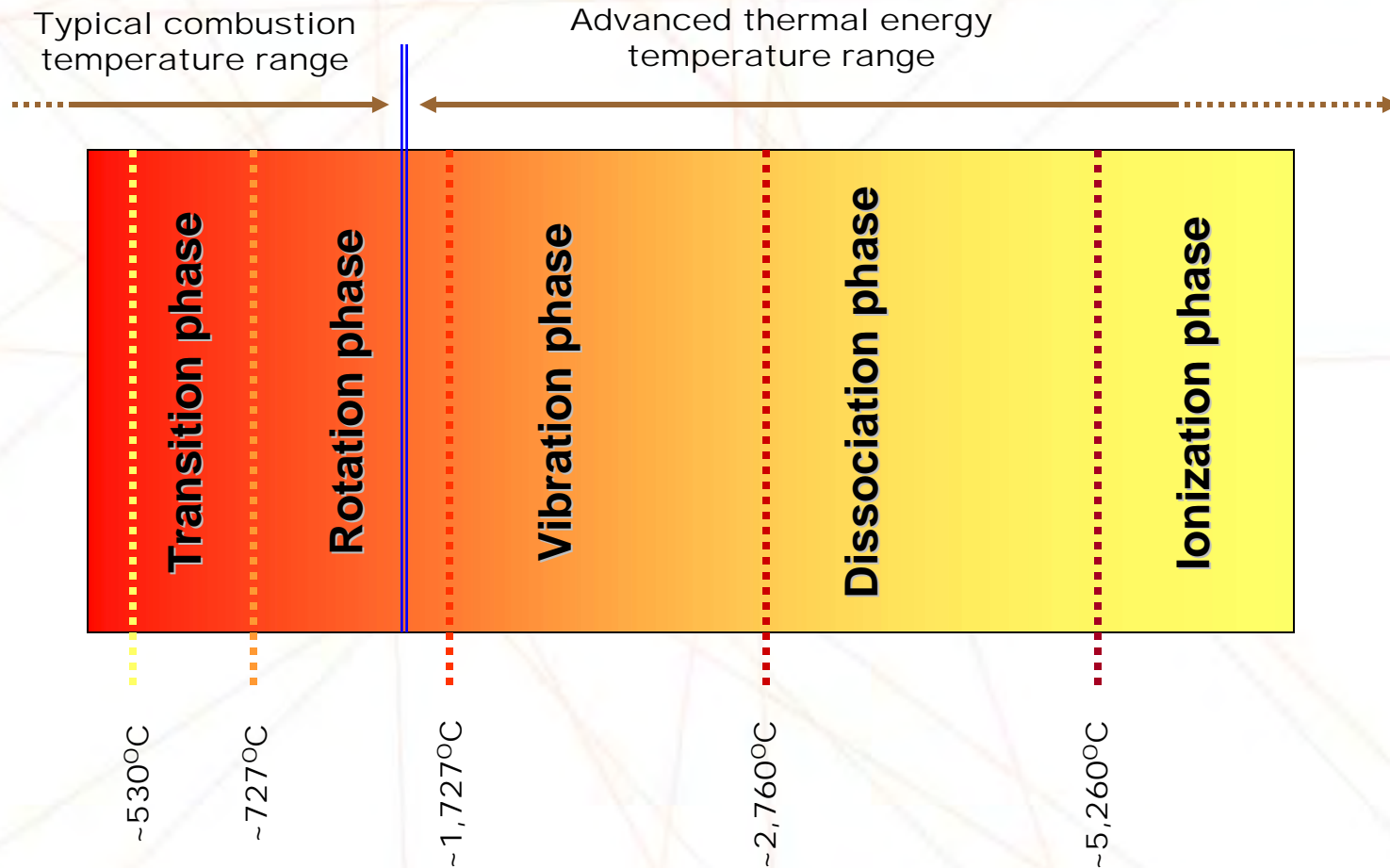




# THE EFFECT OF THERMAL ENERGY ON MOLECULES



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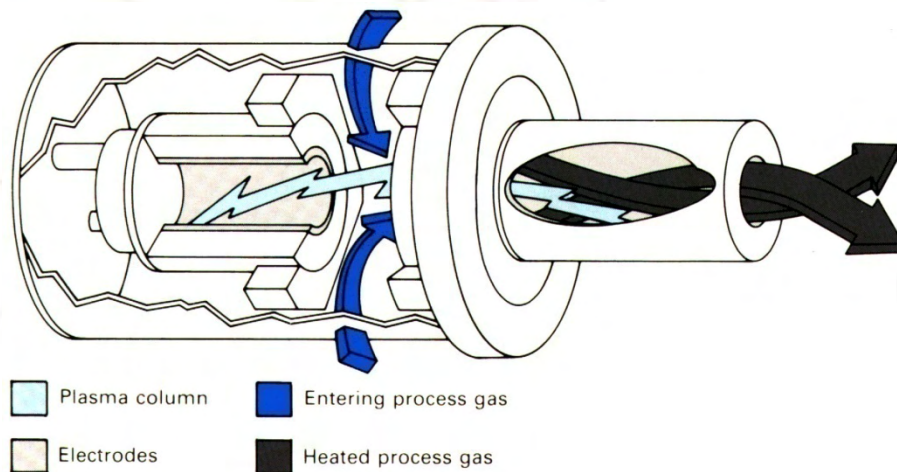




# BASIC PRINCIPLE of THERMAL ENERGY from PLASMA



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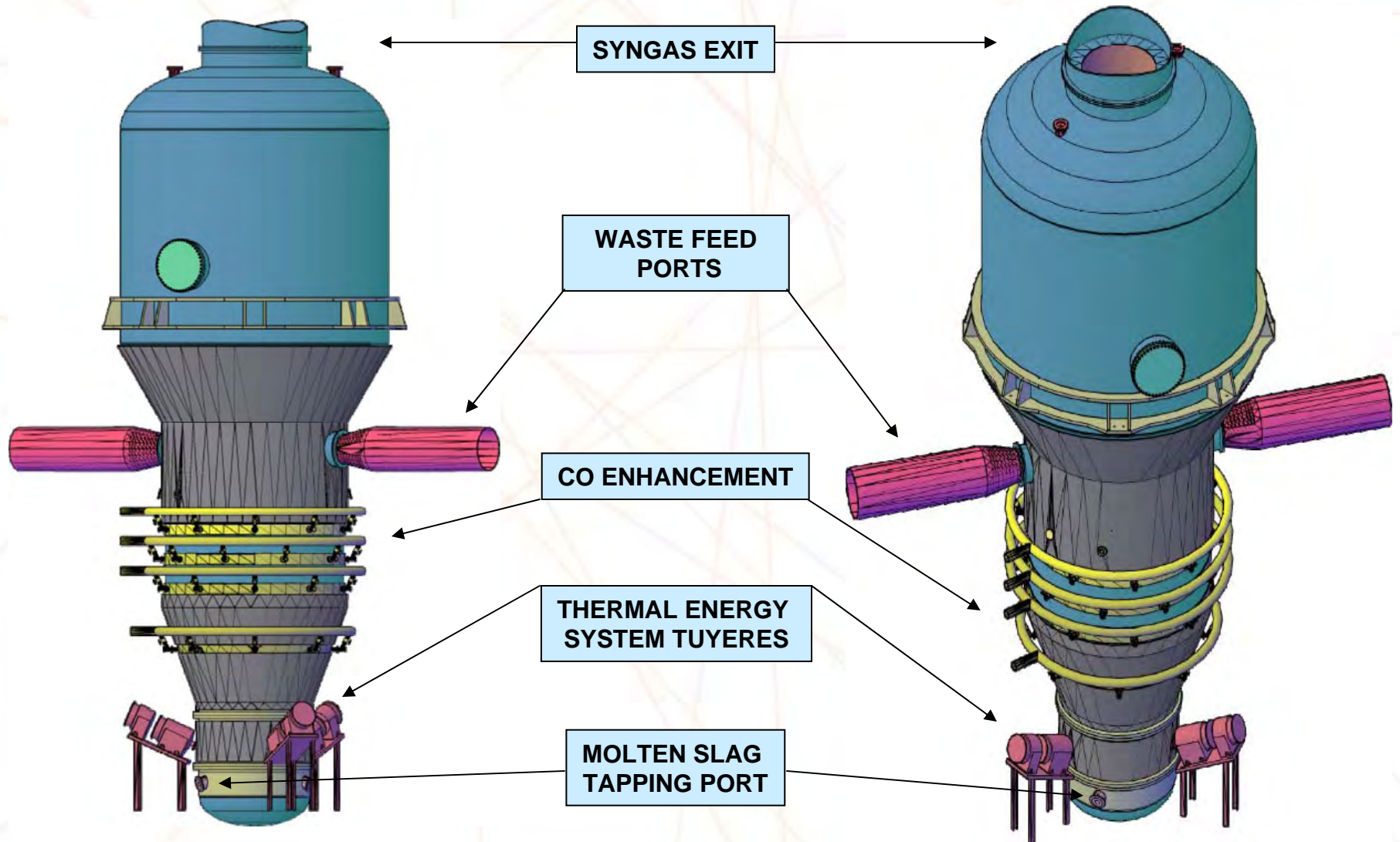




# GreenTech Gasification Reactor Configuration



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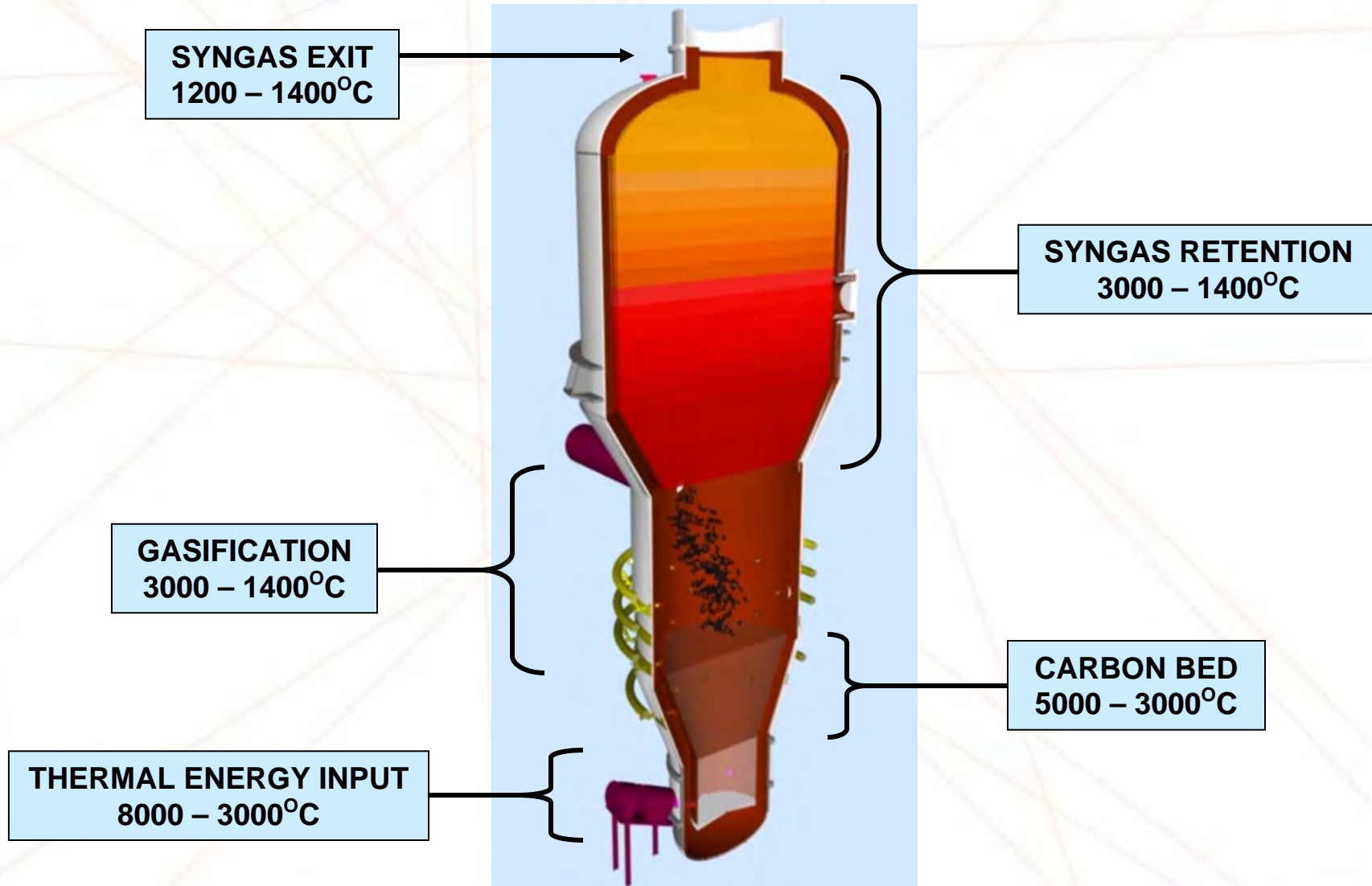




# Typical Operating Temperature Profile



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# GREENTECH ATPS Vs INCINERATOR BURNING

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- **Higher Energy Recovery**
- **No Chemical Treatment or Solidification of Slag**
- **Final and Permanent solution**
- **Significantly Greater Volume Reduction**
- **Smaller Overall Plant Footprint**
- **Greater Flexibility of Waste Streams**
- **Emissions less than permitted levels**
- **Lower cost and shorter construction time**





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# TECHNOLOGY VALIDATION



# Technology - Independent Validation and Track Record



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- The use of Plasma as a thermal energy source was first adopted by NASA in their space program to simulate heat of re-entry into earth's atmosphere.
  - Plasma technology as source of “thermal energy ” has been applied worldwide since 1960s. It's now widely adopted for converting waste to energy.
  - Gasification of waste is currently used by many companies worldwide however, GreenTech has developed the process further by enhancing and capturing the energy available.
  - GreenTech WtE process is the use of plasma through “integration of proven technologies”.



# Technology - Independent Validation and Track Record



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Toyohashi, Japan Mitsui R1 2002 120,000 TPY



Kazusa, Japan Nippon Steel 2002 60,000 TPY



Kawaguchi, Japan Ebara 2002 125,000 TPY



Aomori, Japan Ebara 2001 135,000 TPY





# Technology - Independent Validation and Track Record



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Utashinai, Japan City of Utashinai 2002 65,000 TPY



Yoshi, Japan Hitachi 1999 10,000 TPY



Kakogawa, Japan City of Kakogawa 2003 10,000 TPY



Imizu, Japan City of Imizu 2002 4,000 TPY





# Technology - Independent Validation and Track Record



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Maizuru, Japan City of Maizuru 2002 14,000 TPY



Shimonoseki, Japan City 2002 14,000 TPY



Mihama, Japan City of Mihama 2002 10,200 TPY



Kinuura, Japan IHI 1995 87,600 TPY





# Technology - Independent Validation and Track Record



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Izuka, Japan FUJI 2005 3,650 TPY



Cenon, France City of Bordeaux 2000 590 TPY



Morcex, France INERTAM 2001 70 TPD



Ottawa, Canada Plasco 2005 30,000 TPY





# Technology - Independent Validation and Track Record



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- 
- Concept and feasibility study validated by **Solena Group, Washington. USA.**
  - Overall Process Technology validated by:
  - **Stopford Projects Limited, UK.** “These advanced thermal technologies are potentially more flexible and less destructive, than more conventional waste to energy plants such as mass burn incinerators giving more scope for this type of treatment to allow greater recovery of products from waste. Plasma gasification does not produce hazardous bottom ash and fly ash. It is fuelled by the free waste and is powered by electricity and can be turned off with a flip of switch. Plasma gasification systems do not need to be brought up to temperature over 24 or 36 hours burning expensive fuel oil as does mass burn incineration. It requires little maintenance and unlike traditional power plants do not need to be shut down for weeks at a time for cleaning and maintenance while waste-streams back up”.
  - **Fides International Consultants, Luxemburg.** “The innovative integrated technology for waste elimination and energy recovery developed by GET is a trend setter in the green energy market. The vision of GET goes beyond the usage of syngas as a fuel and will become a contributor in the transition of hydrocarbon based economy to hydrogen based economy”.



# Technology - Independent Validation and Track Record



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- **Russian Academy of Sciences, Institute for Electro-Physics and Electric Power.** “Calculations and experiments prove that plasma methods of waste and coal treatment are economically beneficial and ecologically friendly. Plasma generators operating on water vapour are the most promising for treatment of organic-containing waste for syngas production”.
- Concept Engineering Design validated by **Simon Carves Limited, UK.**
- Front End Engineering Design undertaken by **Stopford Projects Limited, UK** (completed)
- Detailed engineering design undertaken by **Stopford Projects Limited, UK** (work in progress)
- Gasification Vessel Design and CO Enhancement validated by **Physical Simulation Engineering Ltd** and **Stopford Projects Limited UK.**
- Individual processes are proven technologies undertaken by companies with strong track record including: **Fairport, UK** (Waste Receiving, Sorting and RDF Production), **Europlasma, FR** (Plasma Torches and Reactor Design), **La Gas Integral, FR** (Gas Processing), **Peter Brotherhood, UK** (Gas Compression), **General Electric, USA** (MV Power Generation), **Caterpillar, USA** (LV Power Generation), **Punj Lloyd India** (EPCC Contractors).



# The Process Flow

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**Energy Recovery by Integration  
of Proven Technologies**

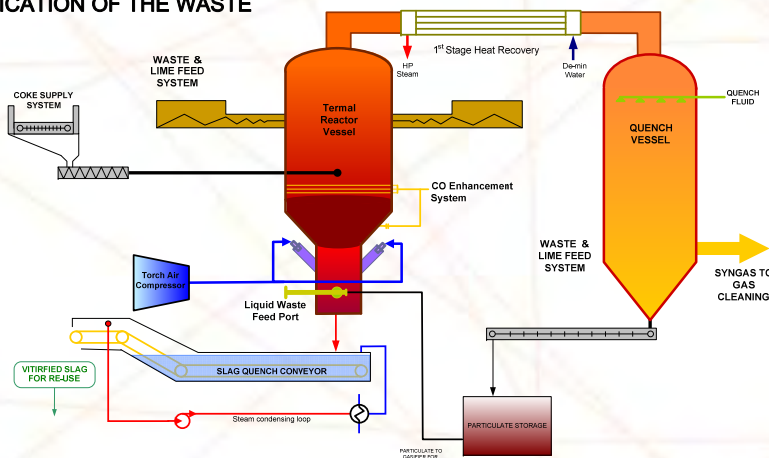


# THE FOUR MAIN STAGES OF A GREENTECH WASTE to ENERGY PLANT

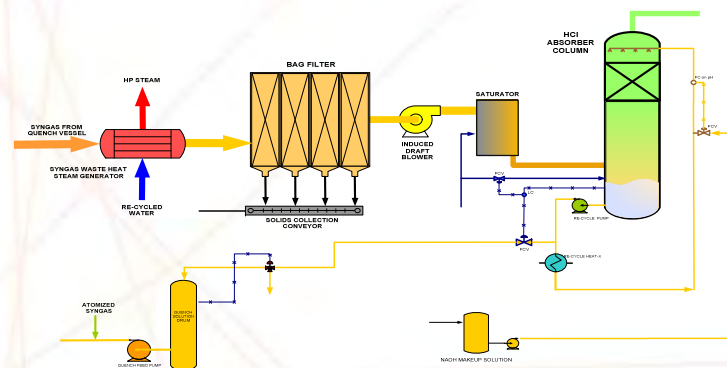


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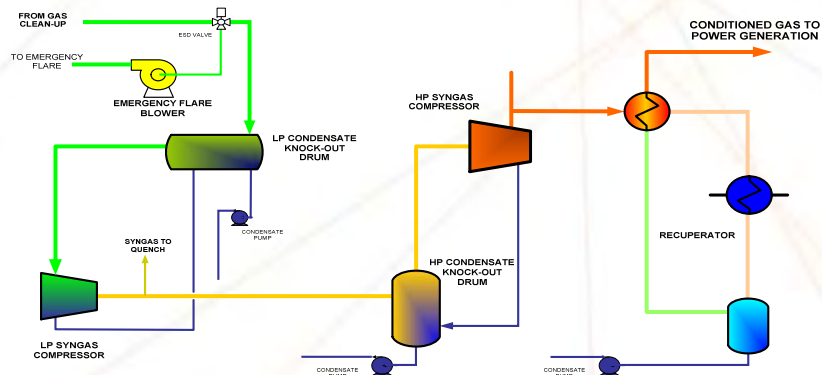
## 1. GASIFICATION OF THE WASTE



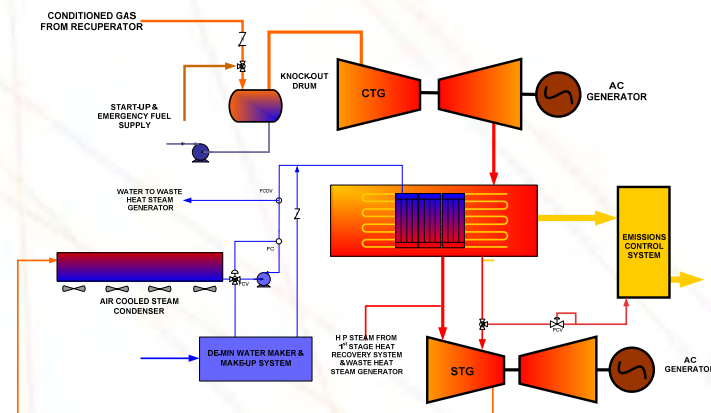
## 2. FILTRATION AND GAS CLEANING



## 3. GAS COMPRESSION & CONDITIONING



## 4. COMBINE CYCLE POWER GENERATION



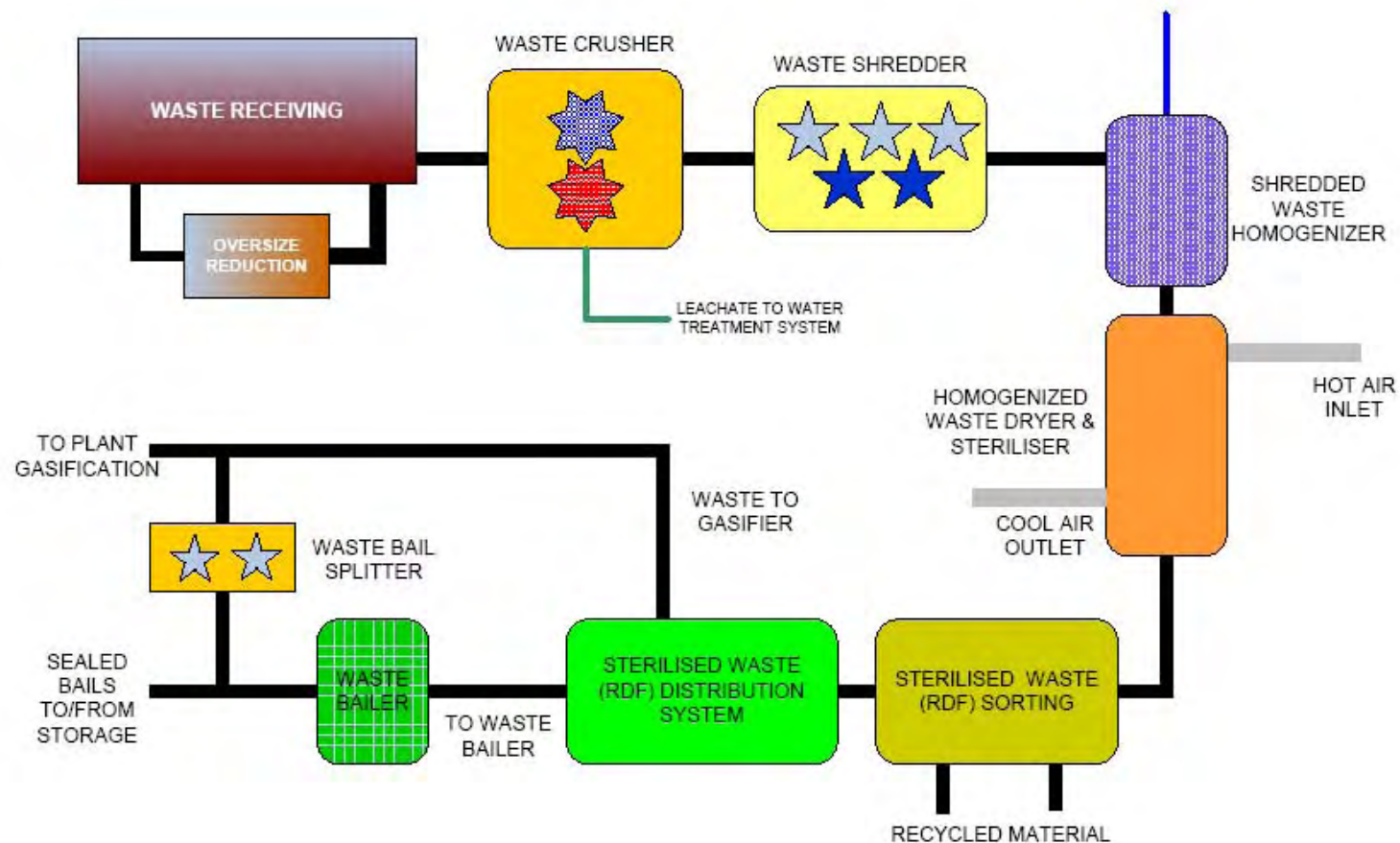


# Stage – One of the Integrated Process



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## Recycle and RDF Processing



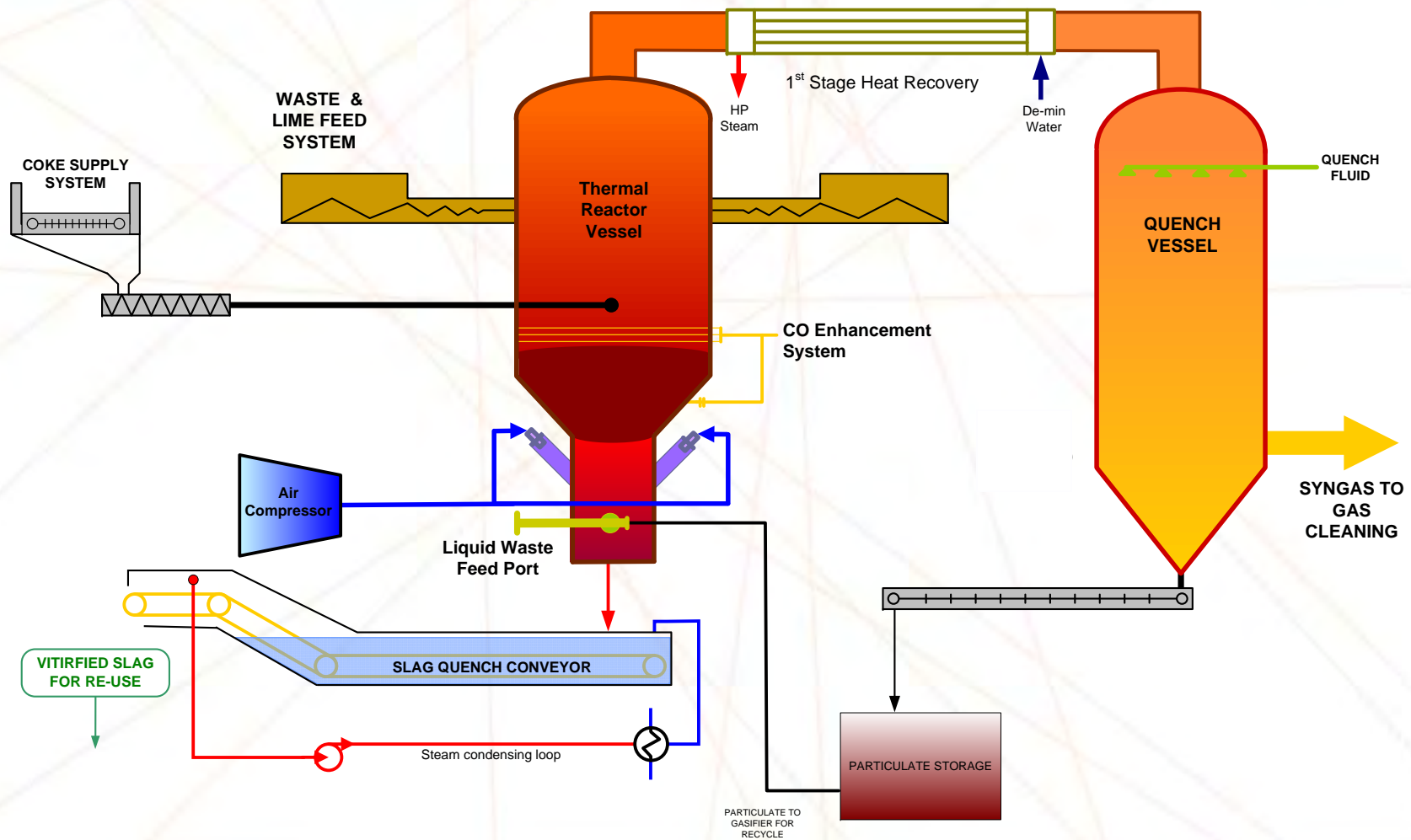


# Stage – Two of the Integrated Process



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## Gasification of the Waste



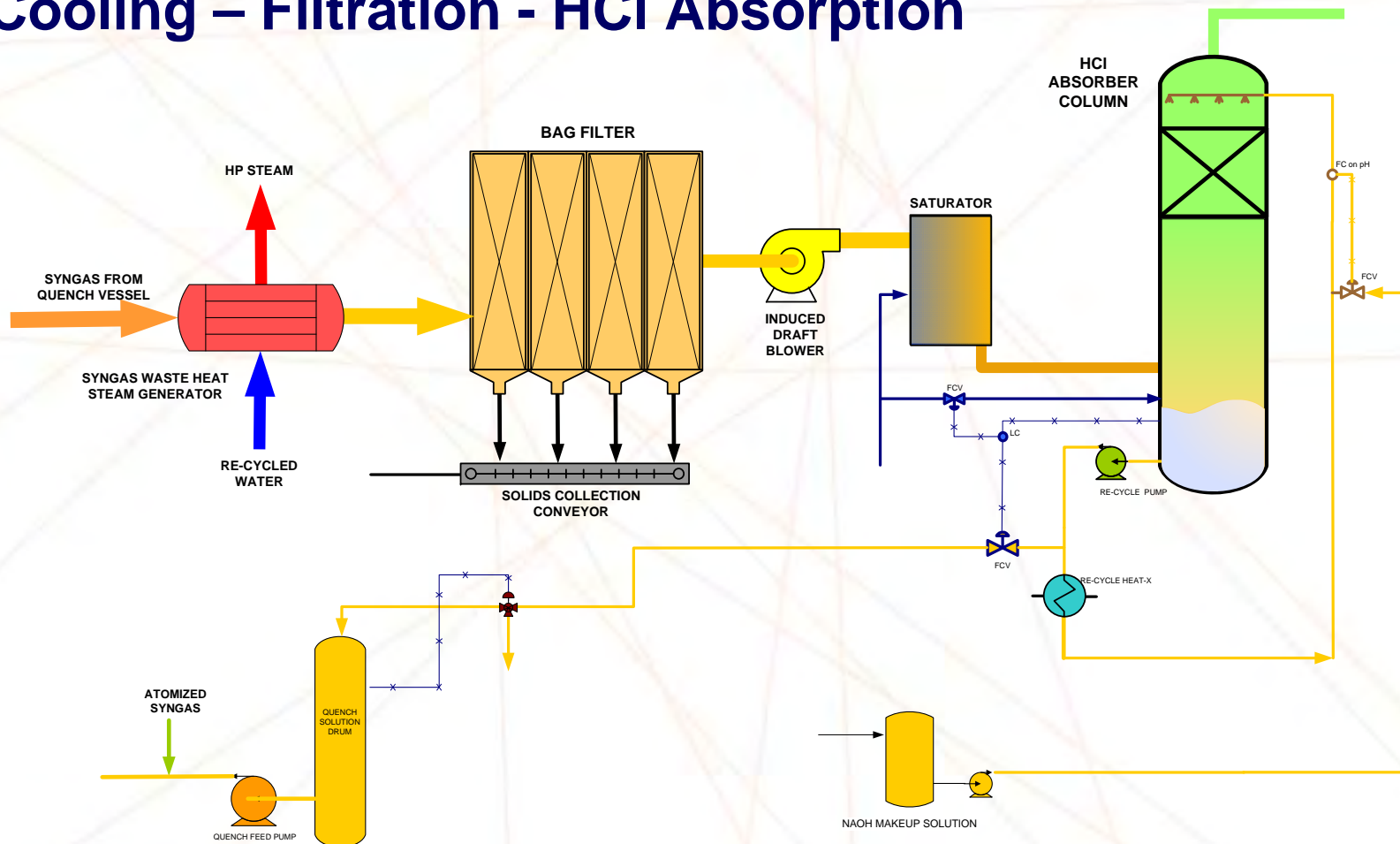


# Stage – Three (a) of the Integrated Process



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## Cooling – Filtration - HCl Absorption



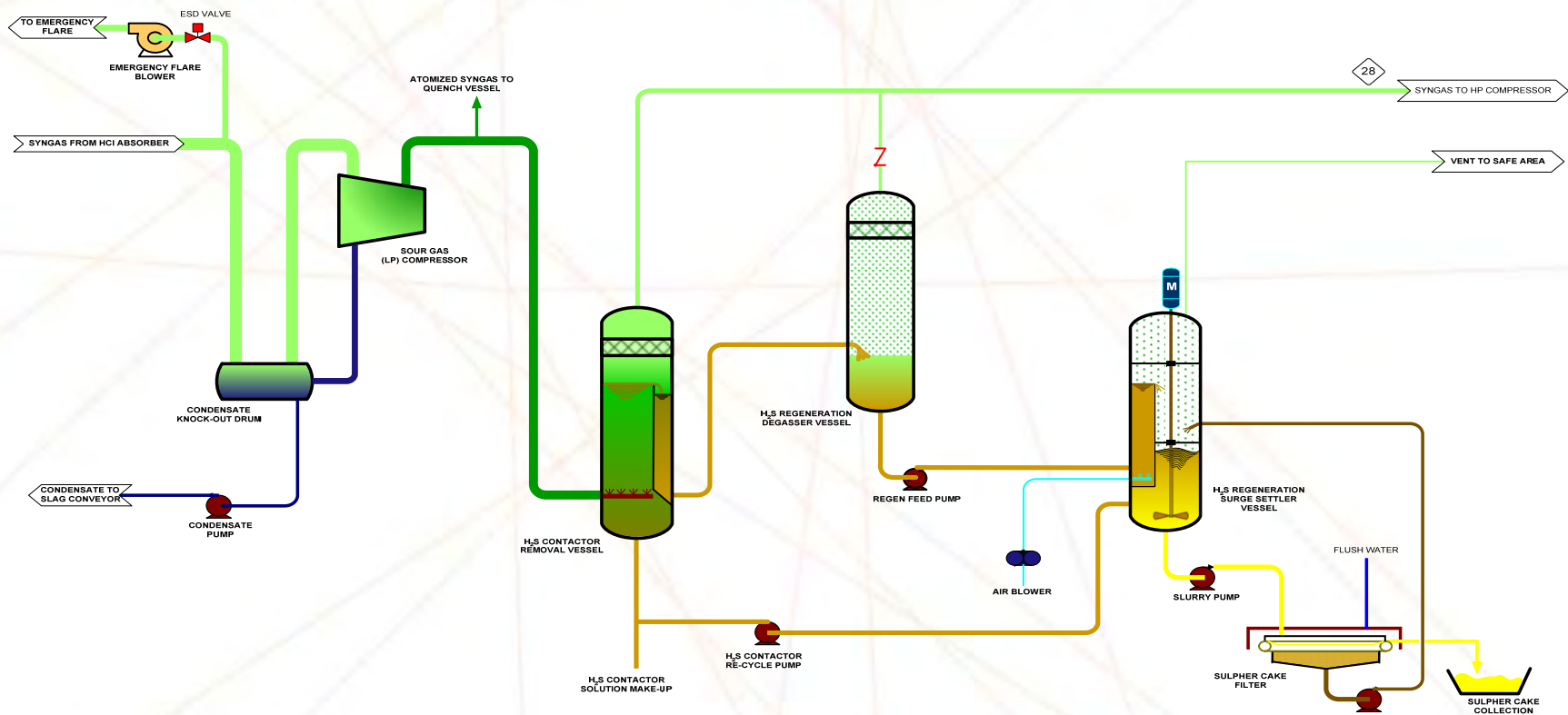


# Stage - Three (b) of the Integrated Process



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## 1st Stage Compression - H<sub>2</sub>S Removal



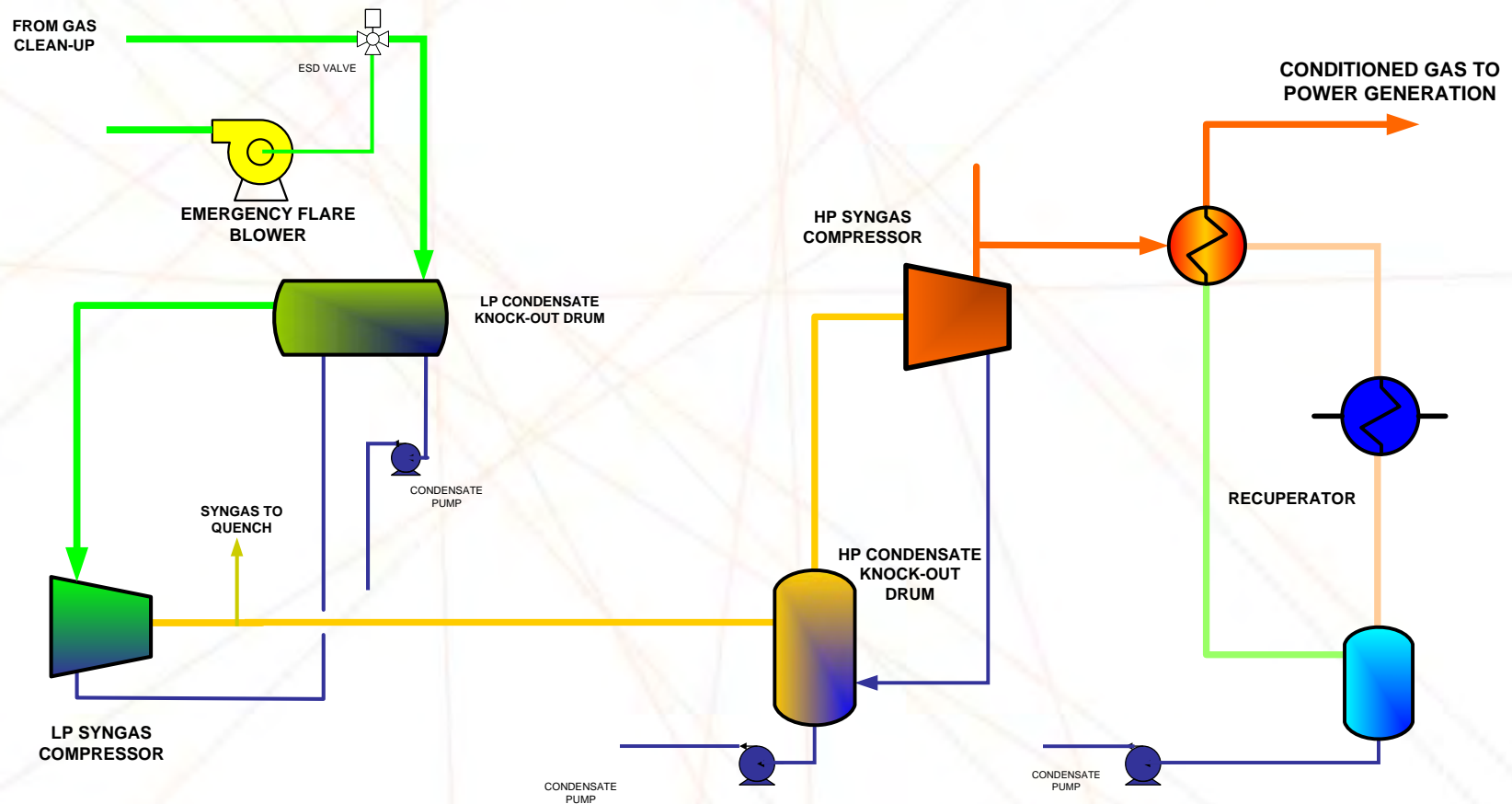


# Stage – Four of the Integrated Process



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## Gas Compression and Conditioning



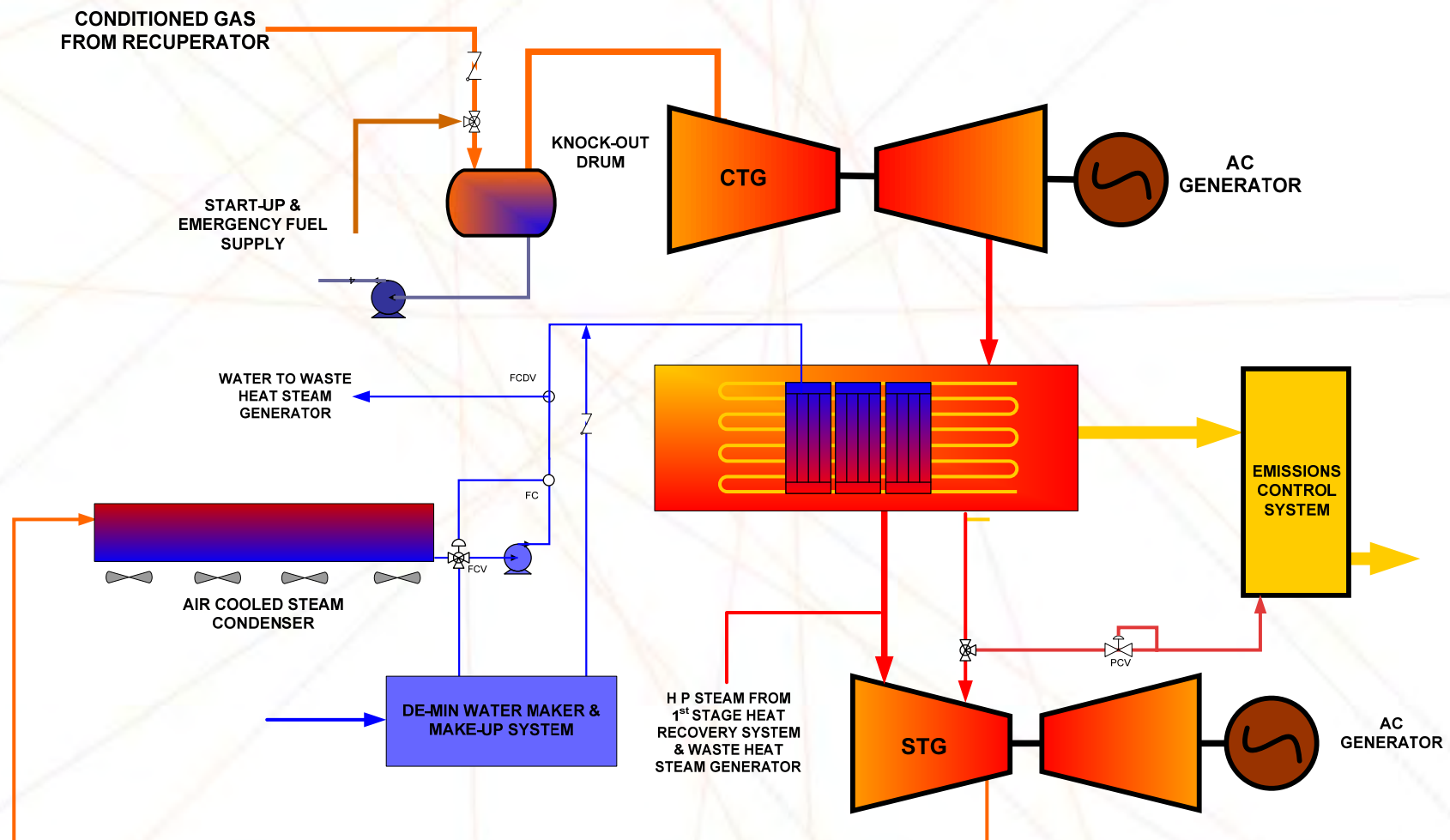


# Stage – Five of the Integrated Process



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## Combine Cycle Power Generation





# UTILITY & SAFETY SYSTEMS



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PLANT AIR, NITROGEN &  
OXYGEN PRODUCTION



PLANT POWER GENERATION &  
DISTRIBUTION



PLANT COOLING &  
CONDENSING SYSTEMS



PLANT CCR, DCS & DATA  
ACQUISITION



GAS & FIRE DETECTION  
FIRE FIGHTING SYSTEMS



DE-MINERALISED WATER  
SYSTEM



WATER & EFFLUENT  
TREATMENT





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# **COLOMBO RENEWABLE ENERGY PROJECT**





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# MANAGEMENT & ENGINEERING



# Summary of Work

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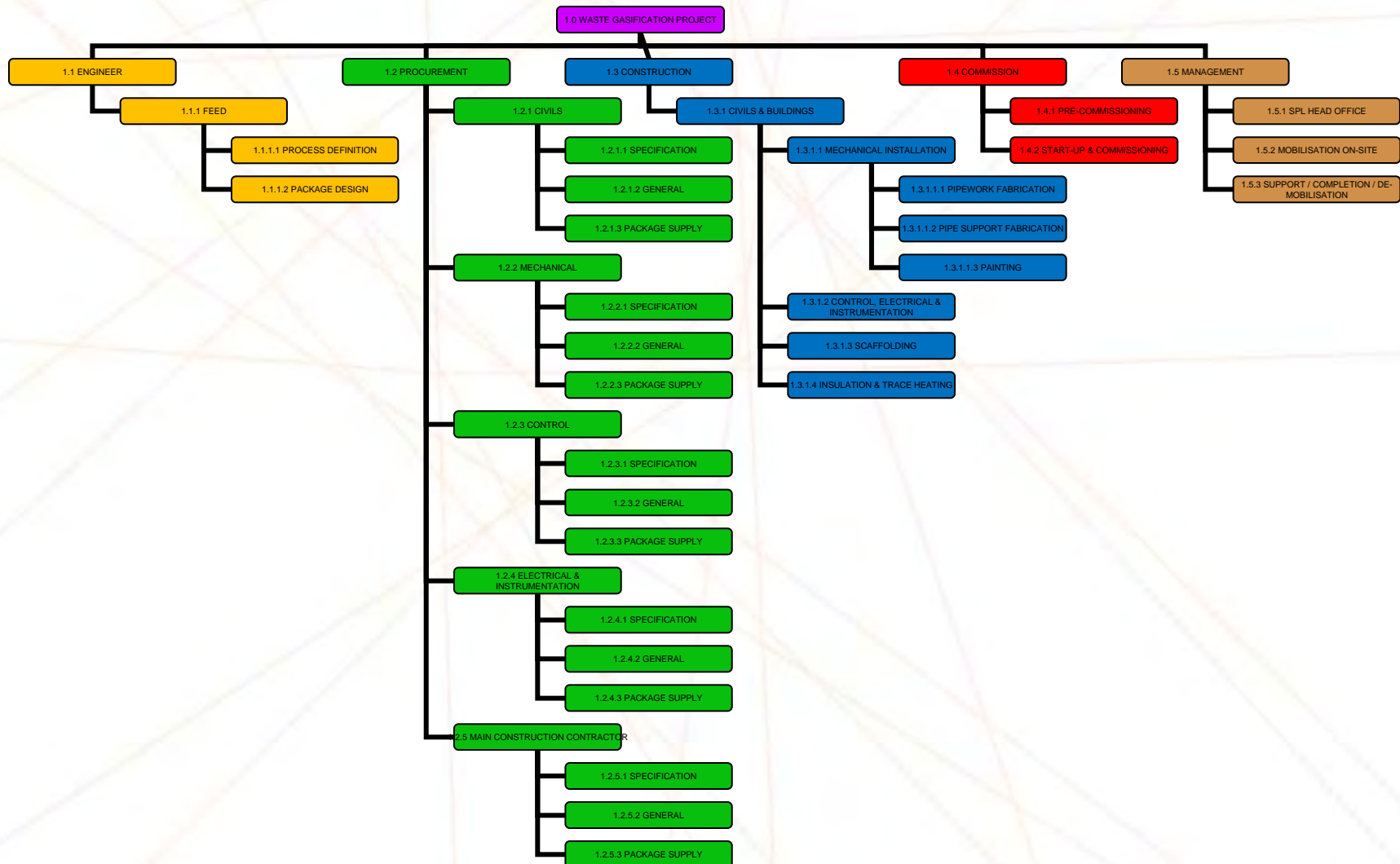
- ➡ Waste Stream Characterisation and Detailed Analysis
- ➡ FEED (Front End Engineering and Design) Study
- ➡ Detailed Engineering
- ➡ LLE (Long Lead Equipment) Definition and Specification
- ➡ Project Execution Strategy



# EPCCM Work Breakdown Structure



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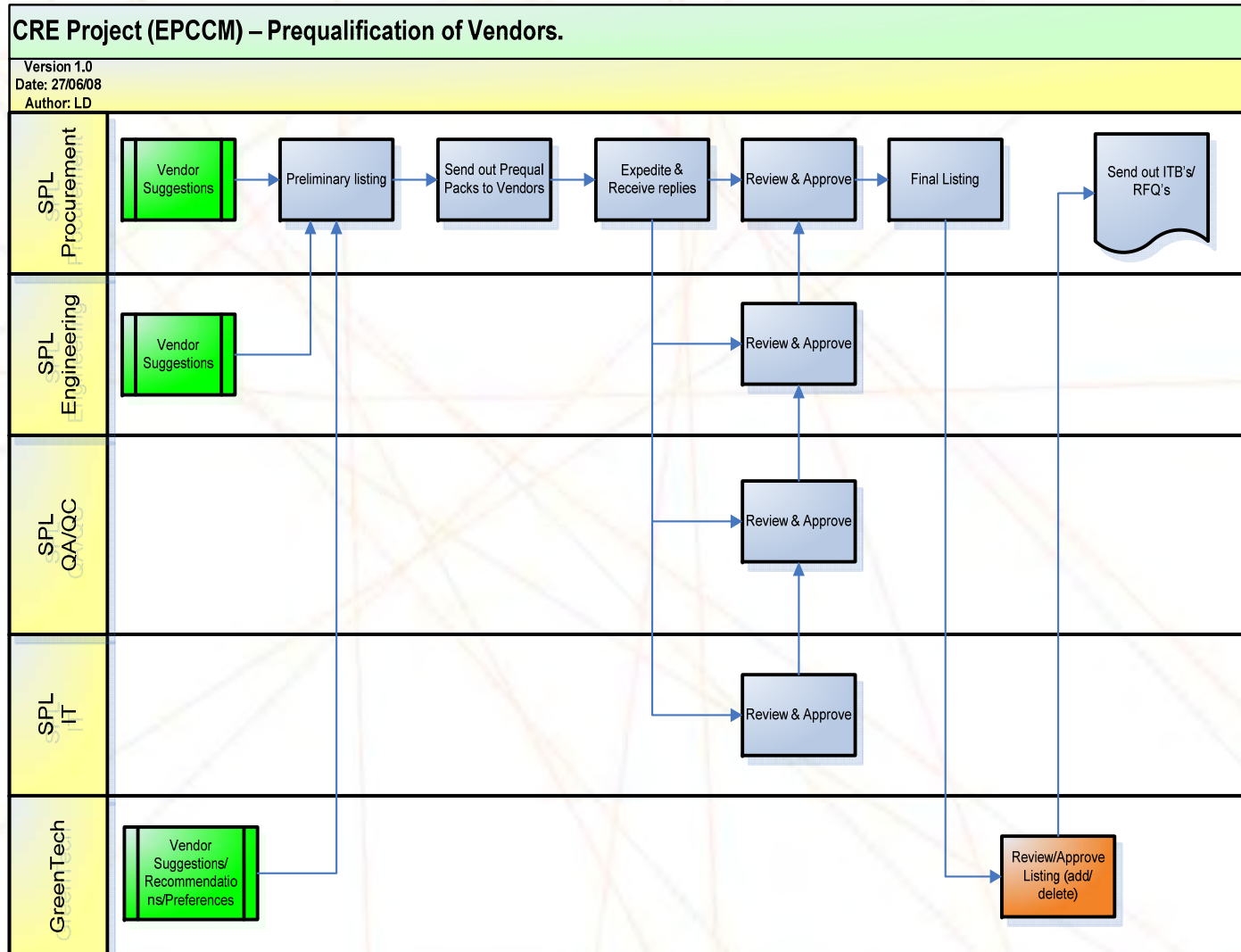




# LLE Vendor Pre-qualification



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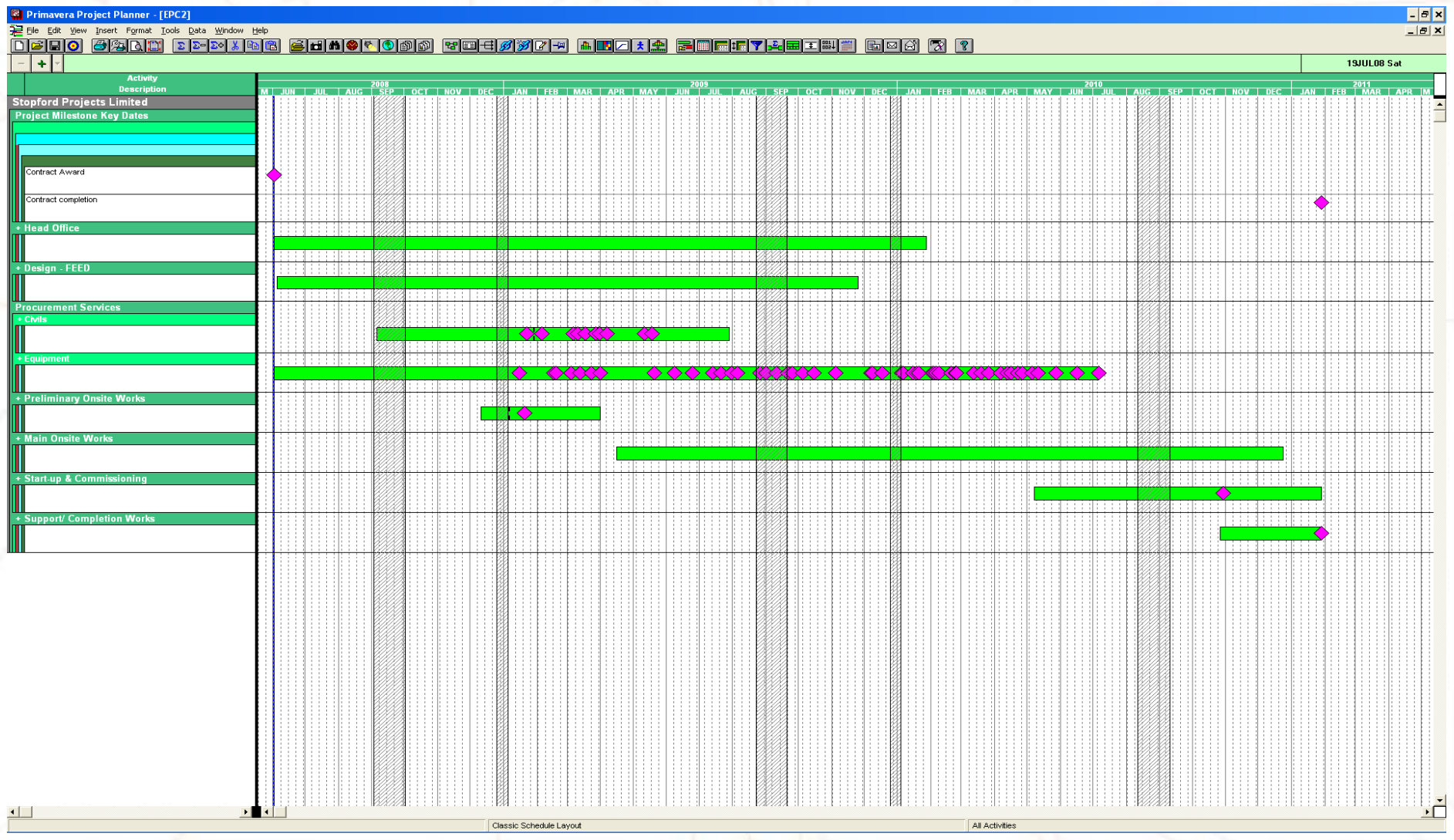




# Level One Schedule



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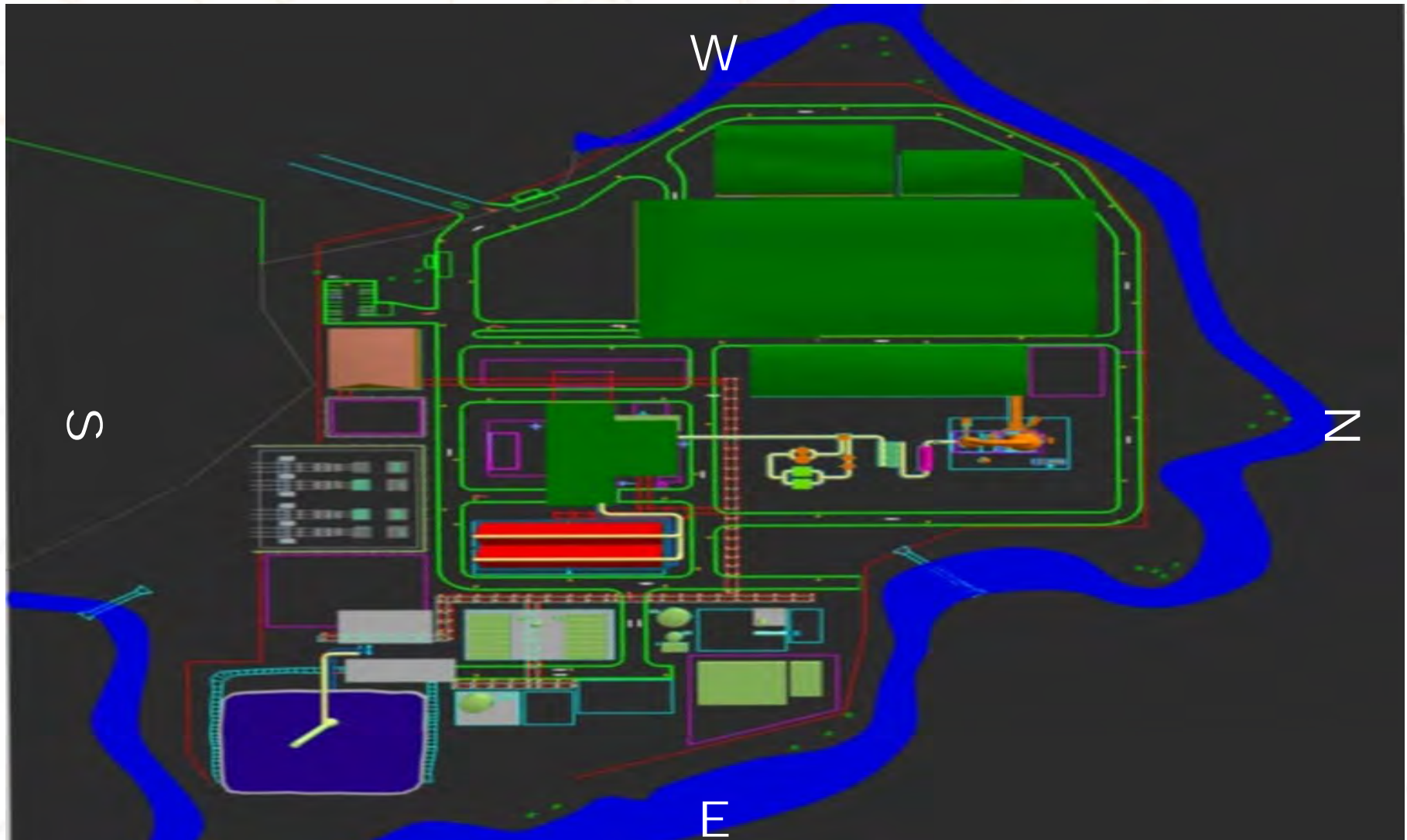
# **COLOMBO RENEWABLE ENERGY PLANT LAYOUT**



# Plan View



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# Plan from North East



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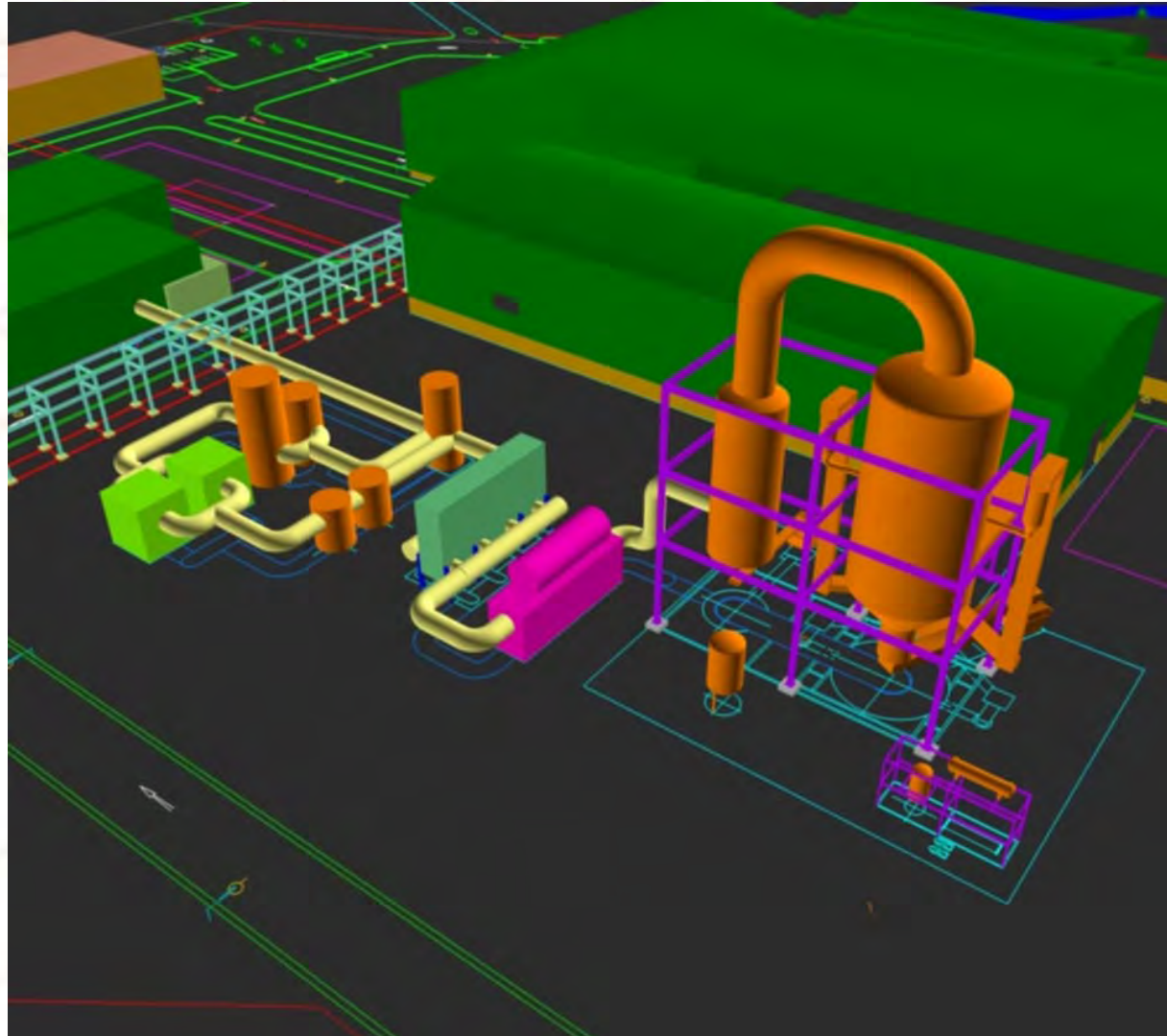




# View from East



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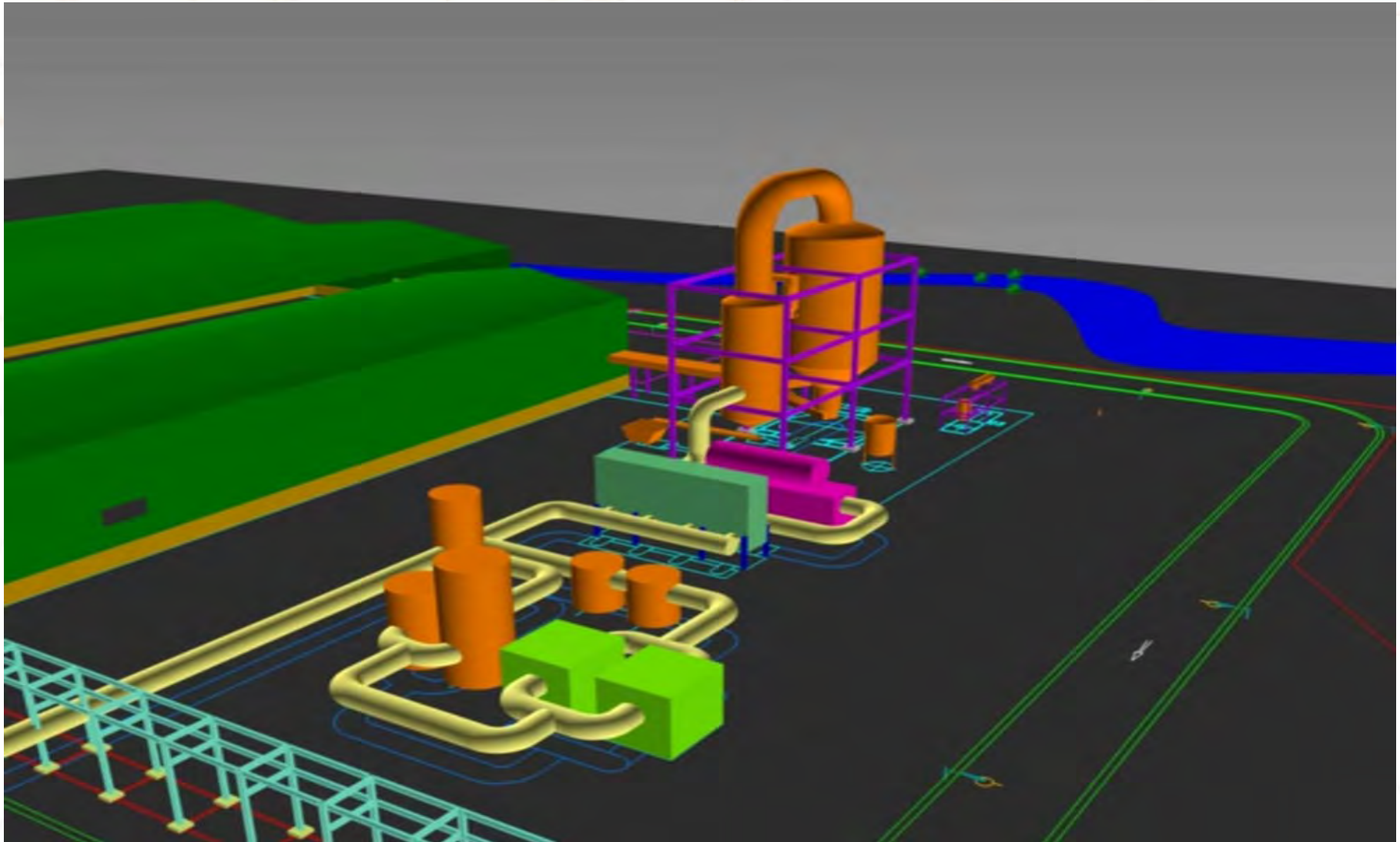




# View from South



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# Plan from South



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