



Kota Tangerang

Limbah untuk Pembangkit Tenaga Energi

Limbah Energi untuk

19 Juli 2017



Hanvit Power



KDHEC

Korea District Heating Engineering Co.,LTD.



HANVIT Power Inc.

Jadwal acara (Agenda)

- **Ulasan Proyek**
(Project Overview)
- **Kriteria dan Teknologi Desain**
(Design Criteria and Technology)
- **Tata Letak Tanaman untuk Tanaman**
(Plant Layout for Reference Plant)
- **Strategi Pelaksanaan Proyek**
(Project Execution Strategy)
- **Analisis resiko dan Dokumen referensi**
(Risk Analysis and Reference Documents)

Ulasan Proyek (Project Overview)

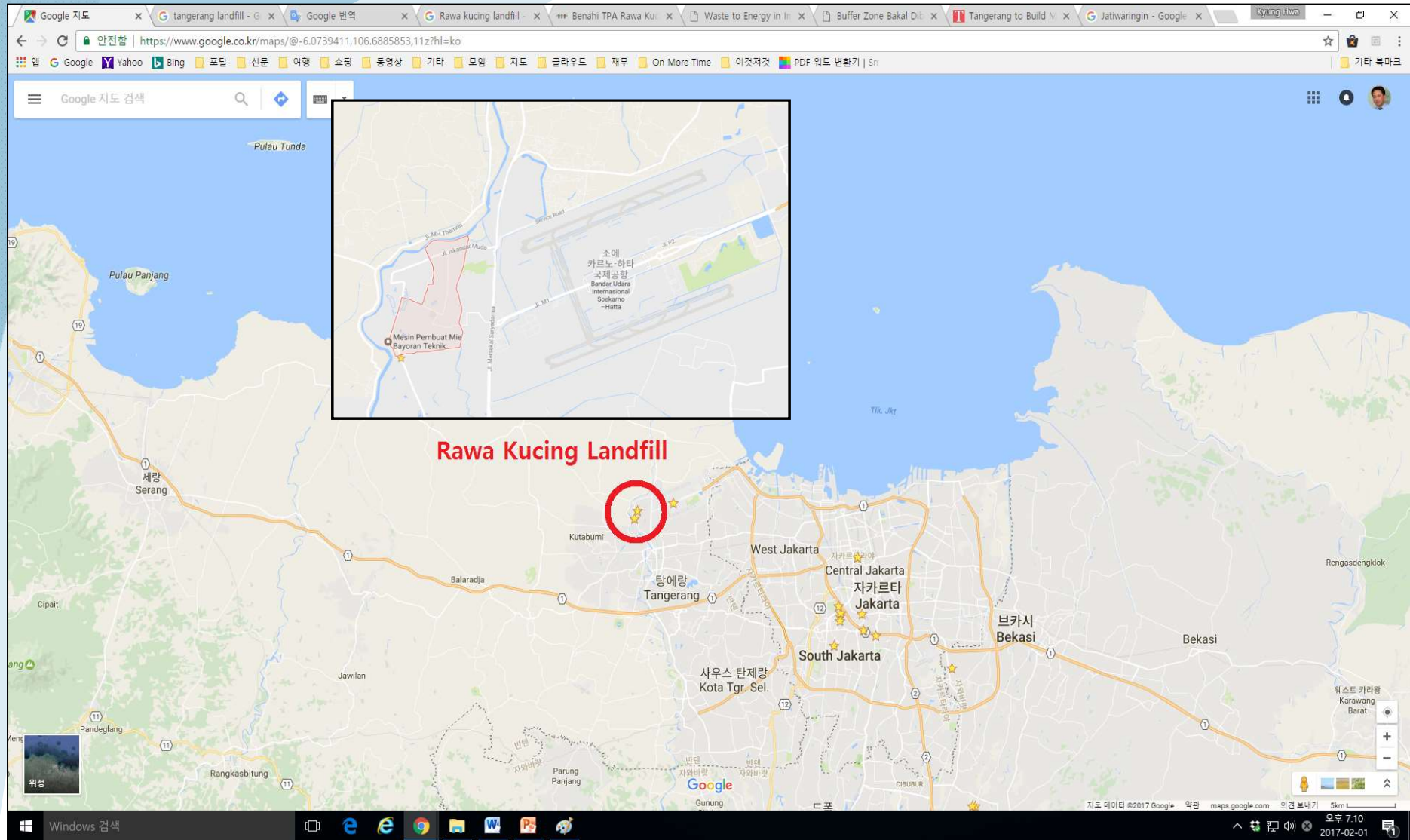
Tujuan Proyek (Aims of Project)

- **Tempat pembuangan limbah Kota Tangerang menggelitik bom untuk kota metropolitan dan besar**
(Waste dumping sites of Tangerang City is tickling bombs for metropolitan and big cities)
 - Rawa Kucing landfill approx. 20Ha filled (by 2013) from 34.8 Ha
 - Has No Rainfall, Leachate, Treatment and Gas Management
- **Teknologi Limbah untuk Energi menjadi lebih dan lebih disukai, sebagai jalan keluar untuk mengurangi beban limbah sembari menghasilkan manfaat bagi kebutuhan manusia (energi)**
(Waste to Energy technology becomes more and more in favored, as a way out to reduce burden of waste while resulting benefit to human needs (energy))
- **Pemerintah pusat dan daerah telah menyadari pentingnya ini, dan memprakarsai program dengan skema KPS untuk mempercepat pelaksanaan WTE kota Tangerang**
(Central and local government have recognized this importance, and initiated programs with PPP scheme to speed up implementation of WTE of Tangerang city)

Ulasan Proyek (Project Overview)

Nama Proyek (Project Name)	Kota Tangerang Proyek Limbah untuk Energi (Tangerang City Waste to Energy Project)
Jenis Proyek (Project Type)	PPP (Public Private Partnership) Kemitraan Publik Swasta
Lokasi Proyek (Project Location)	Rawa Kucing Landfill
Kapasitas Tanaman (Plant Capacity)	[Pengolahan limbah (Waste Treatment)] ● Kapasitas Sistem Pengolahan Limbah : 1,000 tpd (Capacity of Waste Pre-treatment System) ● Kapasitas untuk tanaman WTE setelah sistem pra perawatan: 600 tpd (Capacity for WTE plant after pre-treatment system) [Pembangkitan Tenaga Listrik (Electric Power Generation)] ● Pembangkit listrik bruto : 17.5 MWe (Gross Power) ● Pembangkitan tenaga listrik bersih : 14.0 MWe (Net Power) ● Gunakan Internal power : 3.5 Mwe (Internal Use)
Periode Proyek (Project Period)	35 bulan dari CED sampai Penyelesaian Commissioning (35 month from CED to Completion of Commissioning)

Peta Lokasi Lokasi (Site Location Map)



Dumping Ground untuk Kota (Dumping Ground for City)



Kriteria desain dan Teknologi (Design Criteria & Technology)

Nilai Panas untuk MSW (Heat Value for MSW)

Kriteria Desain untuk Nilai Kalorif (Design Criteria for Calorific Value)

- 1,800 kcal/kg

Classification		High quality	Standard quality	Low quality
Chemical composition (wt%)	C	17.43	23.00	18.09
	H	6.24	2.50	2.70
	O	20.80	11.40	11.28
	N	0.20	0.20	0.44
	S	0.13	0.10	0.20
	Cl	0.70	0.30	0.40
Total		45.50	37.50	33.11
Three components (wt%)	Water	36.40	46.50	55.49
	Combustibles	45.50	37.50	33.11
	Ash	18.10	16.00	11.40
Low calorific value (kcal/kg)		2,100	1,800	1,400
Waste density (ton/m ³)		0.22	0.22	0.22

Ref.: Feasibility Study & Basic Design Report for South Tangerang, 2015.12

Simulasi Pembangkitan Listrik (Power Generation Simulation)

Kriteria Desain untuk Nilai Kalorif (Design Criteria)

Barang (Item)	Awal(Initial)	Efisiensi Pre Treatment	Setelah Pre Treatment (After Pre Treatment)
Limbah (Waste) (ton/day)	1,000	- 40%	600
Nilai kalor (Kcal/kg)	1,800	+ 30%	2,400

Simulasi Pembangkitan Listrik (Generation Simulation)

No.	Barang (Item)	Insinerator	FBC Ketel	Satuan(Unit)	Remark
1	Efisiensi Tanaman (Plant Efficiency)	15%	25%	%	
2	Pembangkitan Tenaga Bruto (Gross)	10,465	17,442	KWe	
3	Penggunaan internal (Internal Use)	2,093	3,488	KWe	20%
4	Pembangkitan Listrik Bersih (Net)	8,372	13,953	KWe	
5	Internal Rate of Return (IRR)	5.36	12.32	%	
Boiler Selection			0		

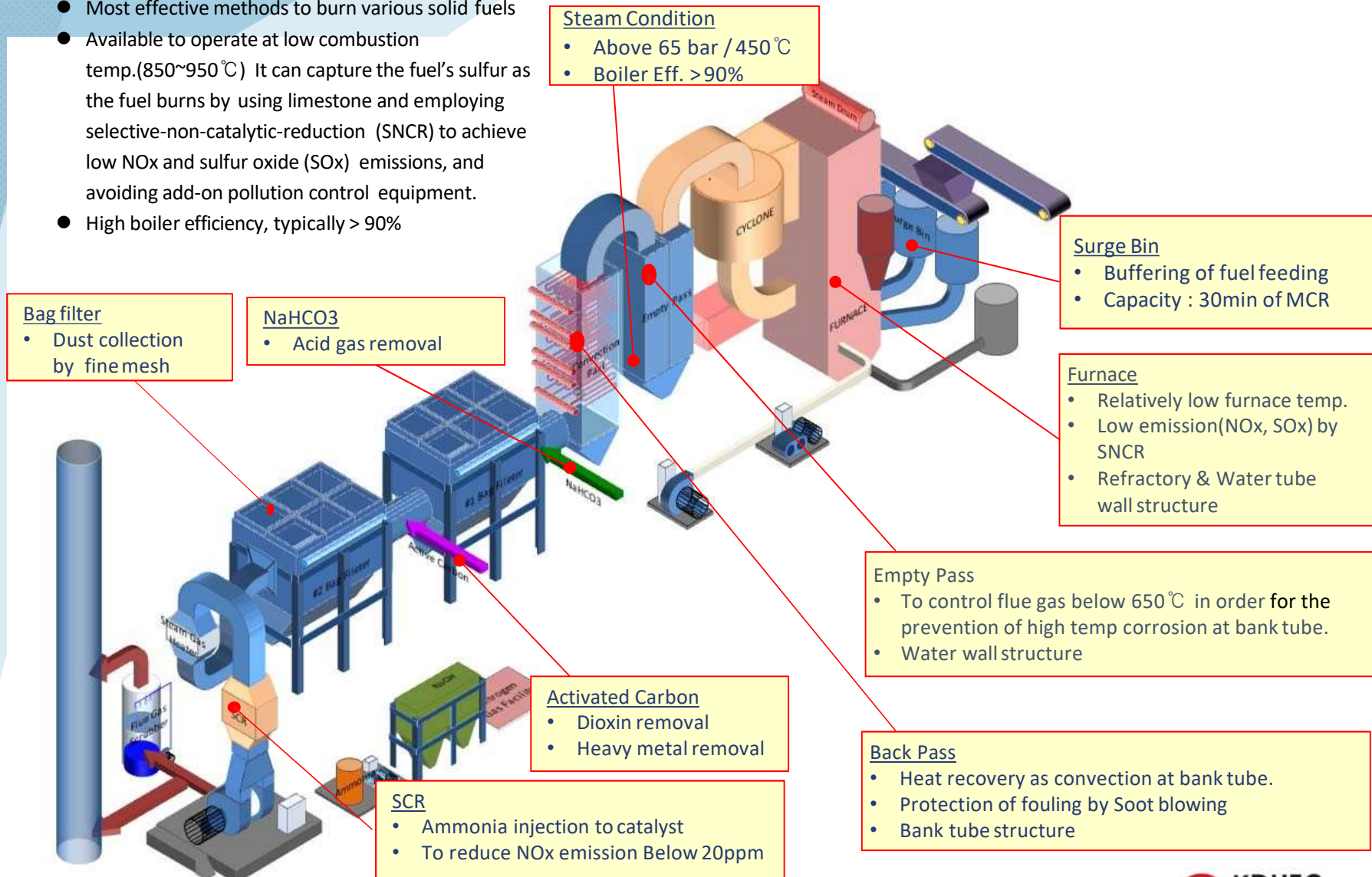
Kriteria Desain - Emisi Udara (Design Criteria – Air Emission)

No.	Contamination	Unit	Gol Standard	Remark
1	Total Partikulat	mg/Nm ³	120	100
2	Sulfur Dioksida (SO ₂)	mg/Nm ³	210	150
3	Oksida Nitrogen (NO _x)	mg/Nm ³	470	100
4	Hidrogen Klorida (HCl)	mg/Nm ³	10	
5	Merkuri (Hg)	mg/Nm ³	3	
6	Karbon Monoksida (CO)	mg/Nm ³	625	250
7	Hidrogen Florida (HF)	mg/Nm ³	2	
8	Dioksin & Furan	ng/Nm ³	0.1	

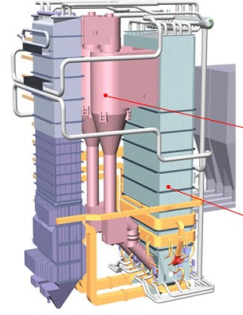
Ref: Regulation : Permen KLHK no 70/2016 : Air Emission; ISCET 2017, Korea, 2017 06 06-15

Beredar Fluidized Bed Combustor (Circulating Fluidized Bed Combustor)

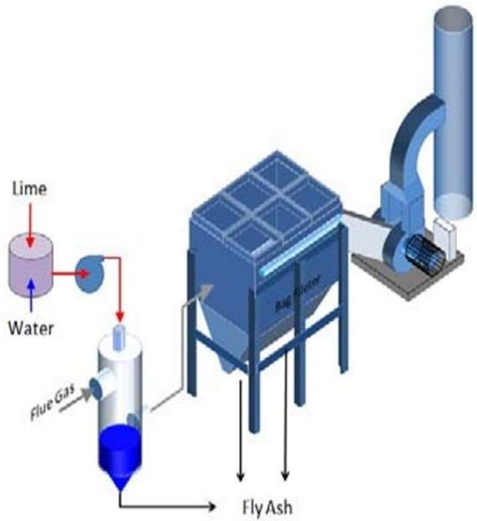
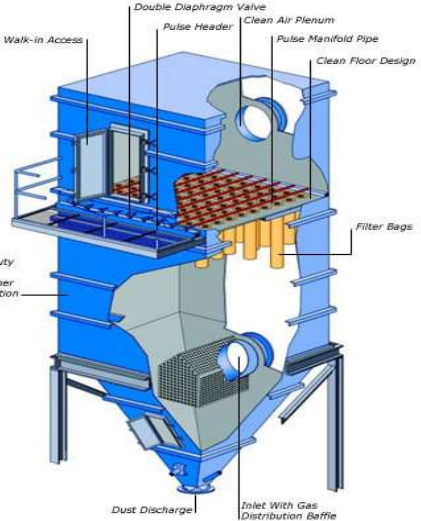
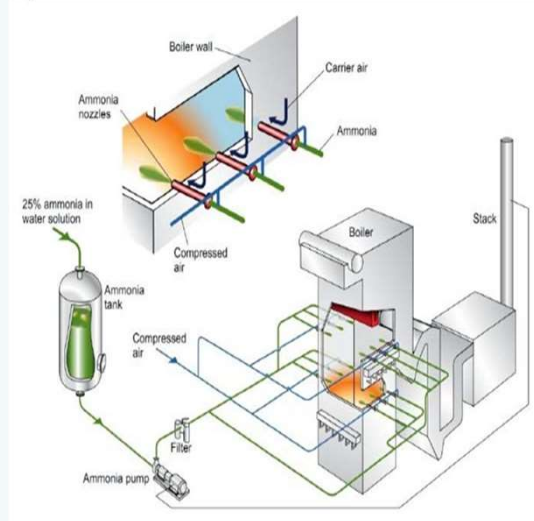
- Most effective methods to burn various solid fuels
- Available to operate at low combustion temp.(850~950℃) It can capture the fuel's sulfur as the fuel burns by using limestone and employing selective-non-catalytic-reduction (SNCR) to achieve low NOx and sulfur oxide (SOx) emissions, and avoiding add-on pollution control equipment.
- High boiler efficiency, typically > 90%



Perbandingan Jenis Parut & FBC (Comparison Grate & FBC Type)

Barang (Item)	Jenis parut (Grate type)	Tipe FBC (FBC type)
Gambar (Picture)		
Fitur teknis (Technical feature)	• Massa menyala pada parutan yang bergerak (Mass burning on the moving grate) • Pengeringan, pembakaran, setelah proses pembakaran (Drying, combustion, after-combustion process) • Tidak perlu pretreatment (No need of Pretreatment)	• Pembakaran Serbuk Fluida (Fluidized Bed Combustion) • Fleksibilitas bahan bakar (mixed fuel firing) (Fuel flexibility (mixed fuel firing) • Emisi rendah (Low emissions) • Pretreatment Mekanik yang dibutuhkan (Mechanical Pretreatment Required)
Suhu Tungku (Furnace Temp.)	950~1050°C	850~950°C
Bahan bakar (Useable Fuel)	• Bulk MSW • 1000~3500 kcal/kg	• Coal, SRF(RDF), Biomass, etc. • 1600~8000 kcal/kg
kuantitas gas buang (Flue Gas Quantity)	100	88 (based on Grate type 100)
Efisiensi Tanaman (Plant Efficiency)	10~15%	20~25%
Biaya Konstruksi (Construction Cost)	200,000 USD/ton	220,000~250,000 USD/ton

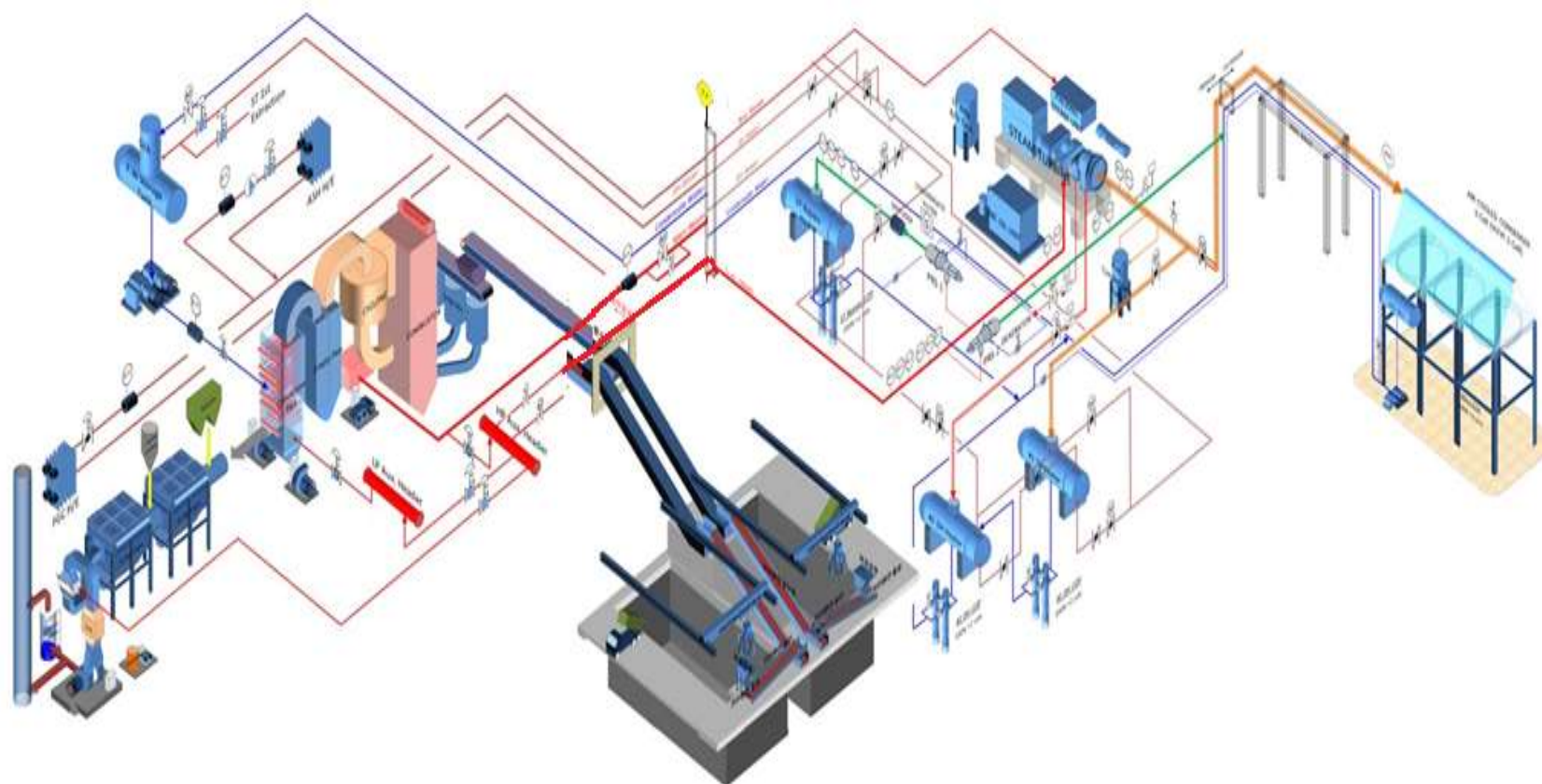
Sistem Pengolahan Gas Flue (Flue Gas Treatment System)

Barang	Asam (Acid)	De-Dust	De-Nox
Mengetik	SDR (Semi-dry Reactor)	Bag Filter	SNCR (Selective Catalytic Reduction)
Gambar (Picture)			
fitur (Features)	• Larutkan penyerap ke dalam air dan semprotkan ke gas buang gas buang melalui semprotan (Dissolve the absorbent in water and inject it into the exhaust flue gas through a spray device) • Biaya investasi awal yang relatif rendah (Relatively low initial investment cost) • Limbah generasi meningkat (Waste generation increase) • Biaya O & M tinggi (High O&M cost)	• Penghapusan butiran padat secara efektif seperti debu (Effective removal of solid granules such as dust) • Kebutuhan perawatan berkala seperti penggantian tas (Periodic maintenance necessity such as replacement of bag) • Pulsasi fenomena akibat pembersihan (Pulsation phenomenon due to purge) • Efek pelepasan tambahan oleh cake permukaan kain reagen kimia (Additional removal effect by fabric surface cake of chemical reagent)	• Injeksi langsung ke Cyclone and Burner dengan Amionia Dissolution dan Urea Water (Direct injection to the Cyclone and Burner with Ammonia Dissolution and Urea Water) • Struktur Sederhana & tidak ada ruang tambahan (Simple Structure & no additional space) • Biaya relatif rendah untuk instalasi & operasi (Relatively low cost for installation & Operation)

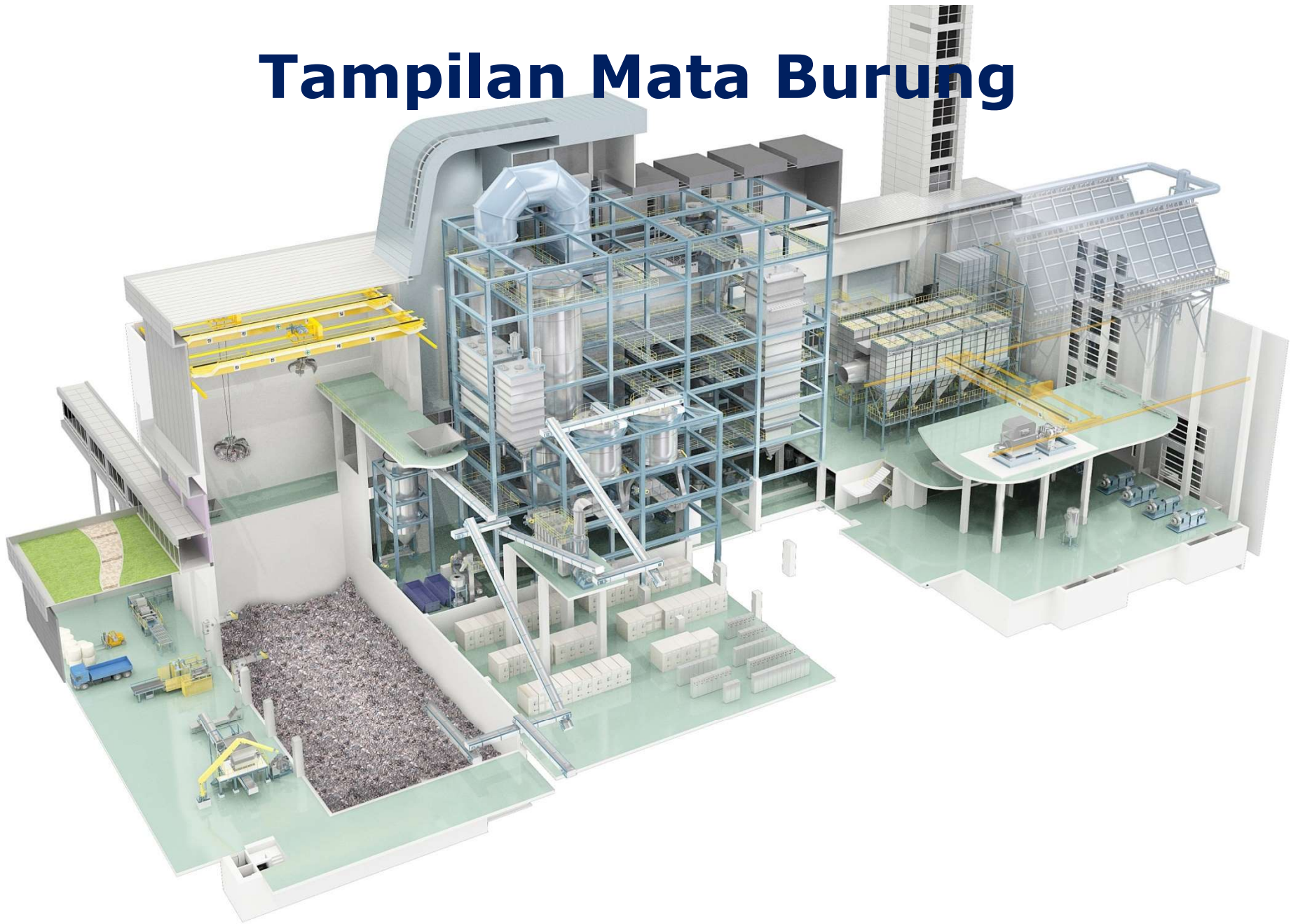
Tata Letak Tanaman untuk Tanaman Referensi (Plant Layout for Reference Plant)

Referensi Desain Tanaman (NAJU) (Reference Plant Design)

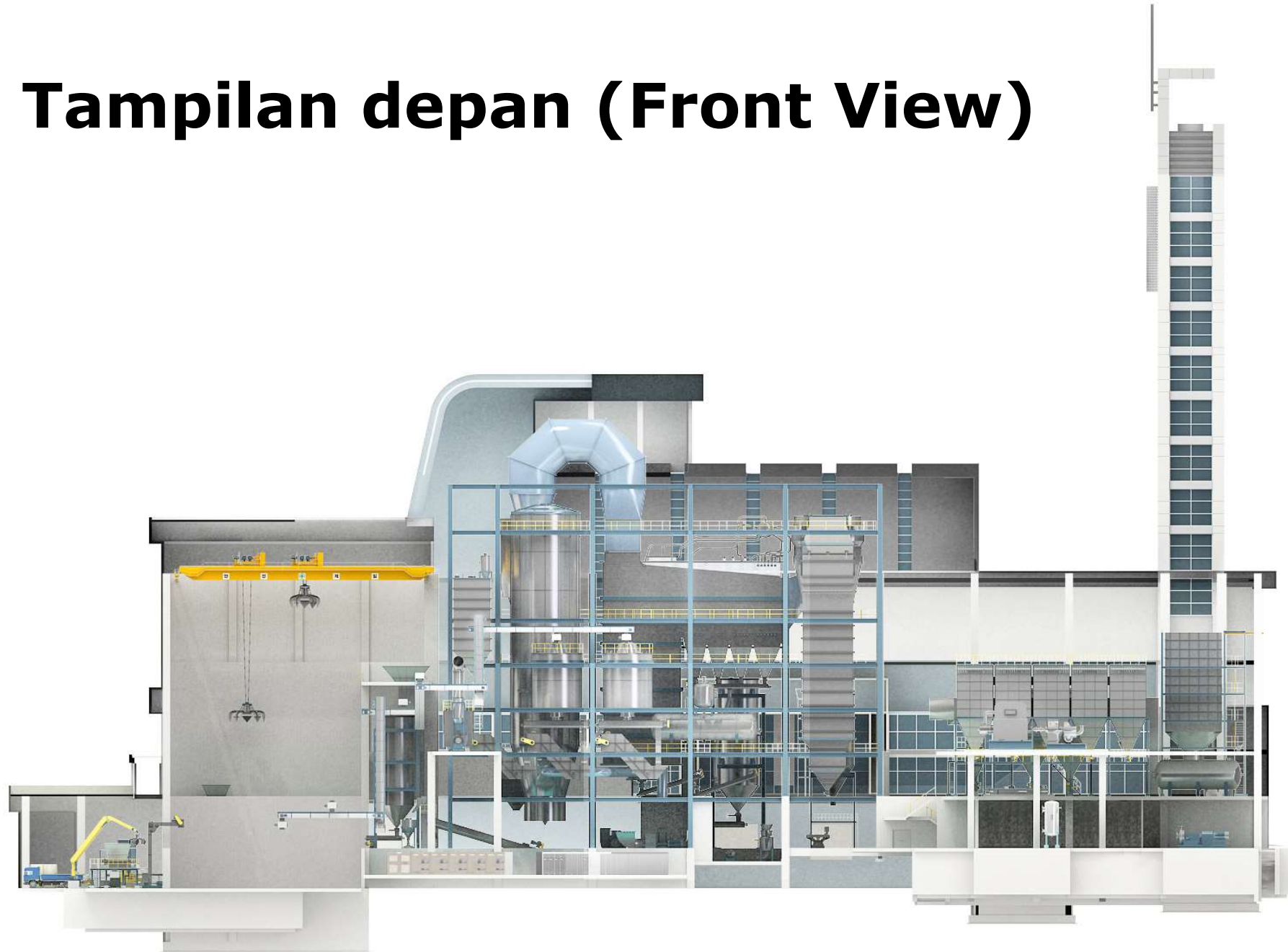
- **Kapasitas Tanaman (Plant Capacity) : 19.6MWe**
- **Peralatan Utama (Main Equipment)**
 - **CFBC Ketel (Boiler) : Hansol SeenTec; Korea**
 - **Turbin (Turbine) : Kawasaki Heavy Industries ; Japan**



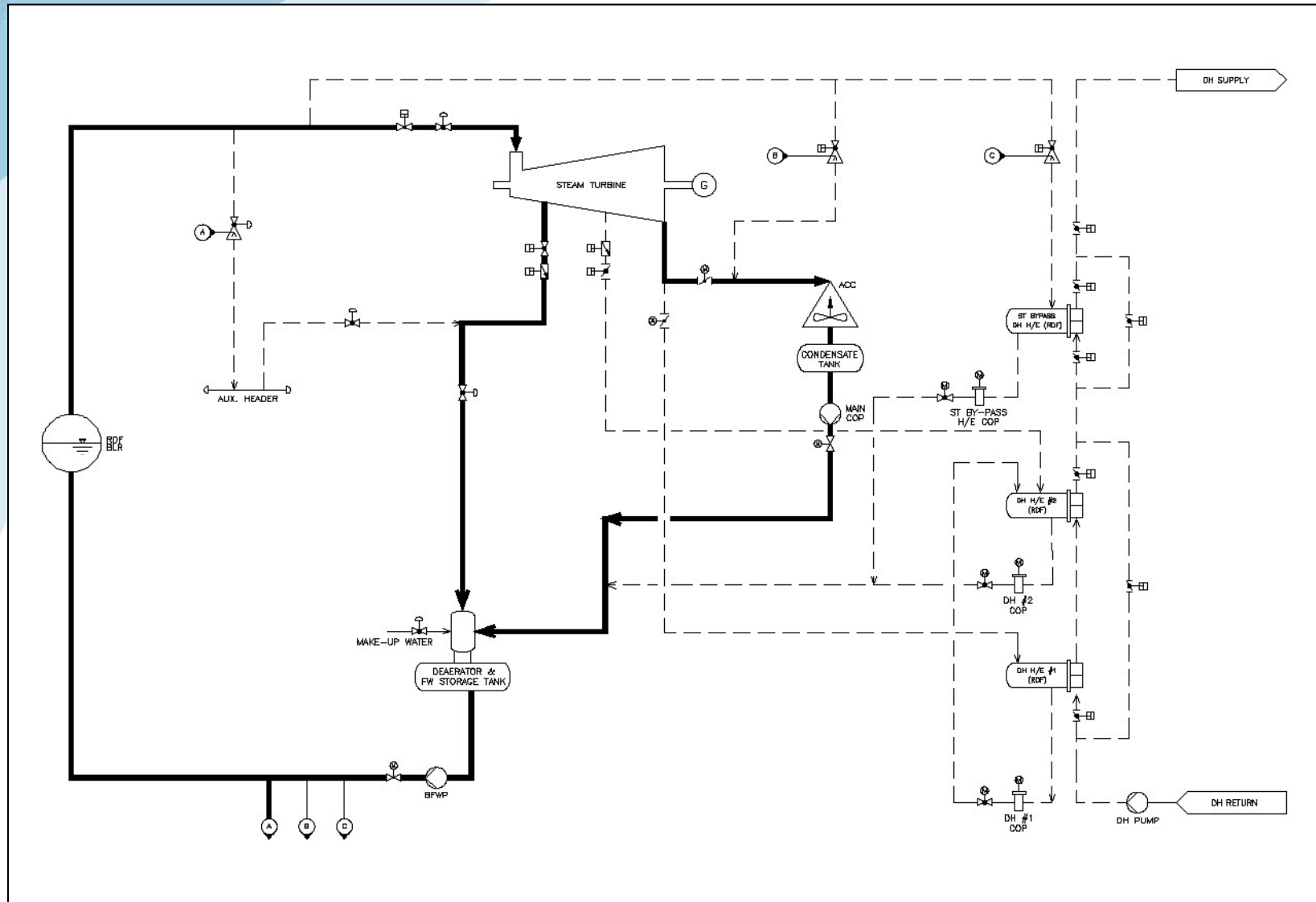
Tampilan Mata Burung



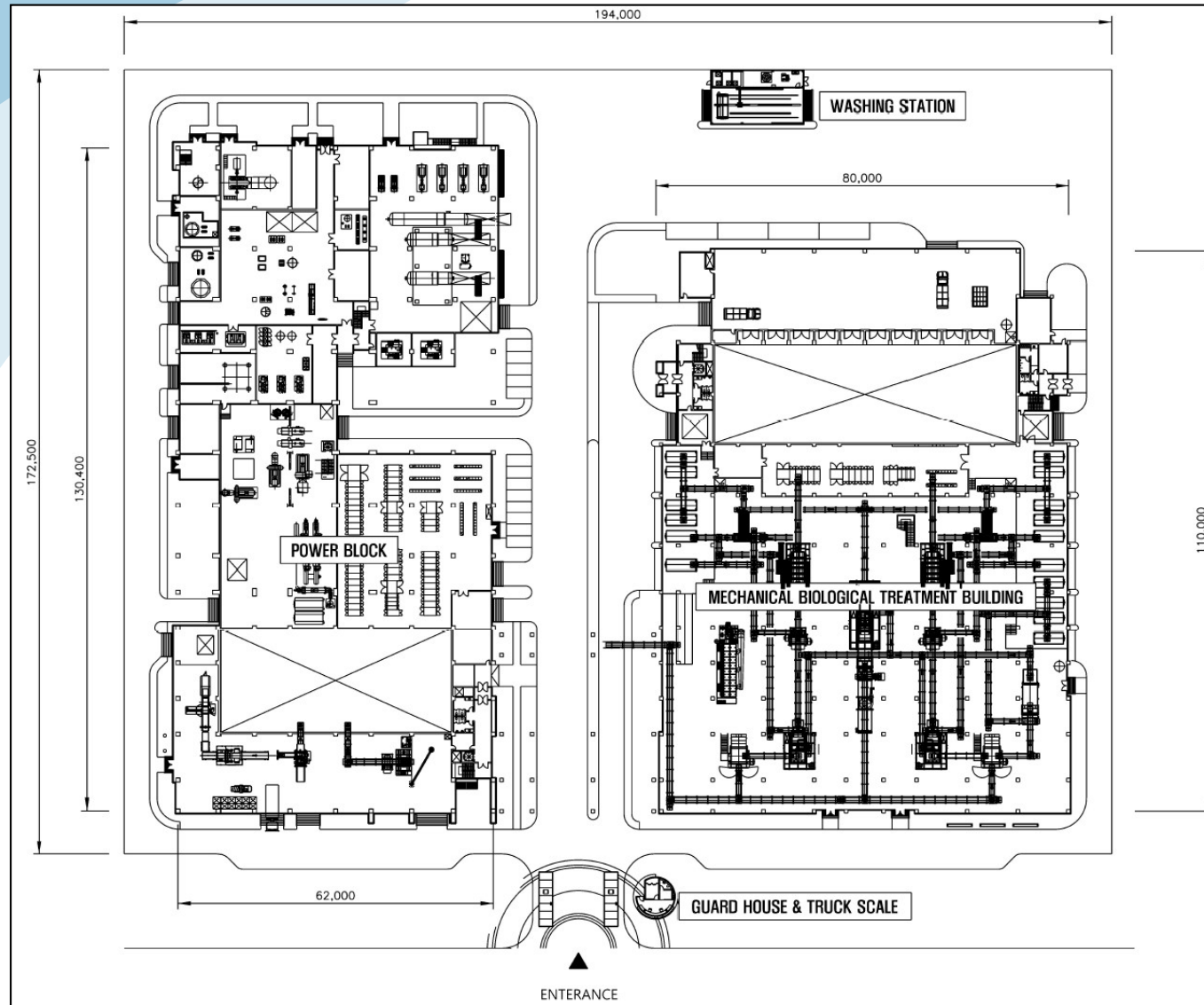
Tampilan depan (Front View)

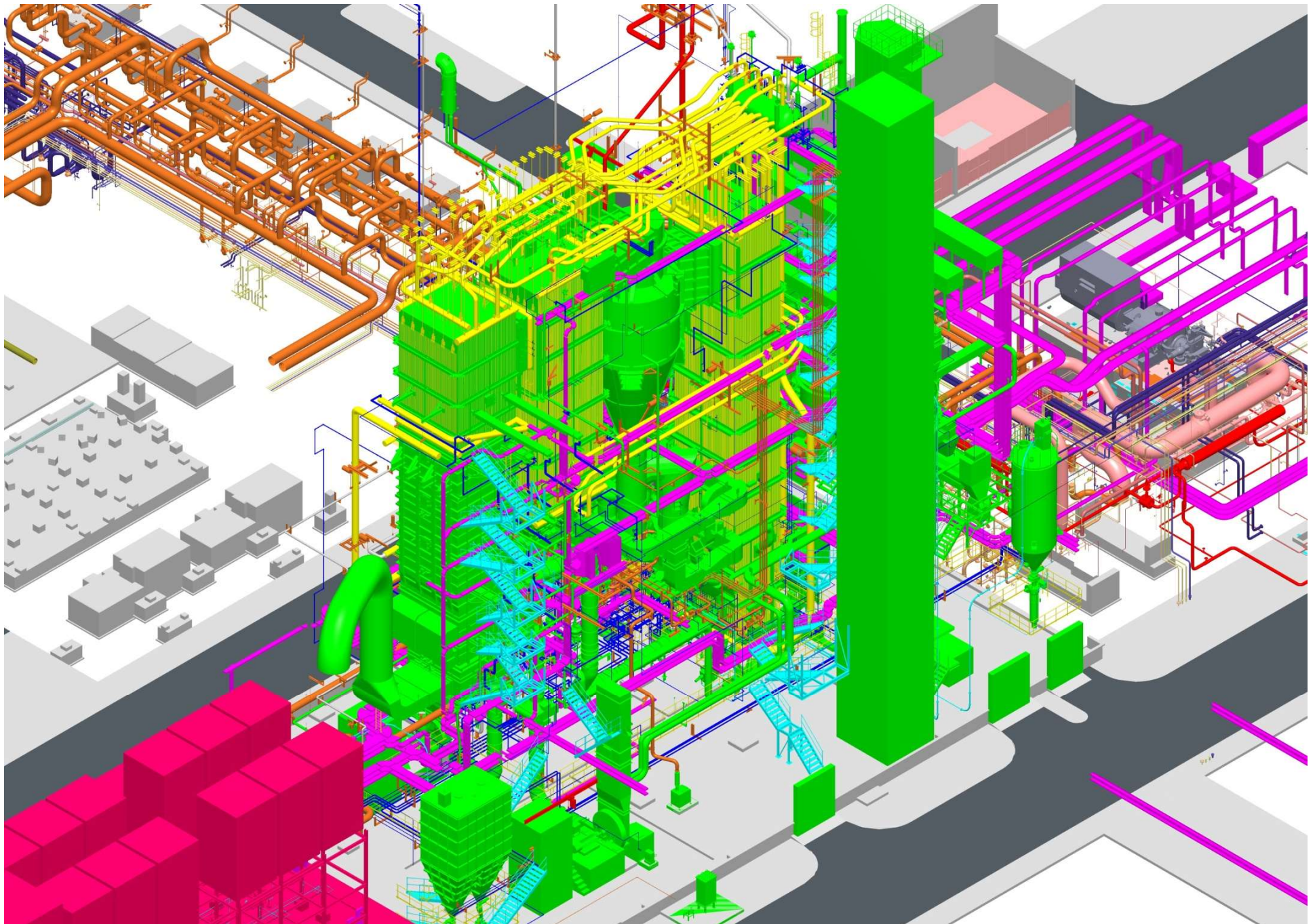


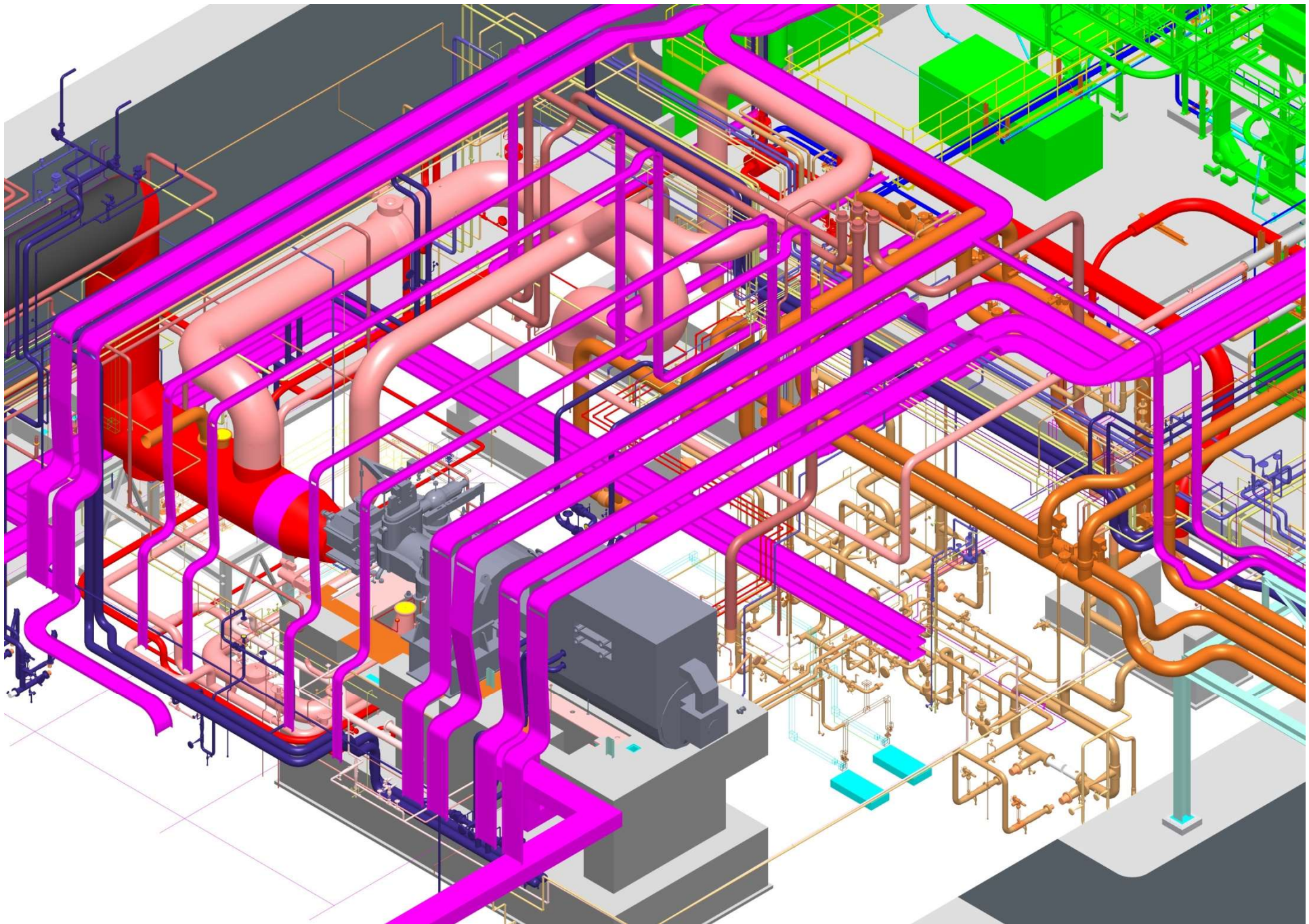
P & ID Desain



Desain Arrangement Umum (General Arrangement Design)







Sistem Pra-Pengobatan (Pre-Treatment System)

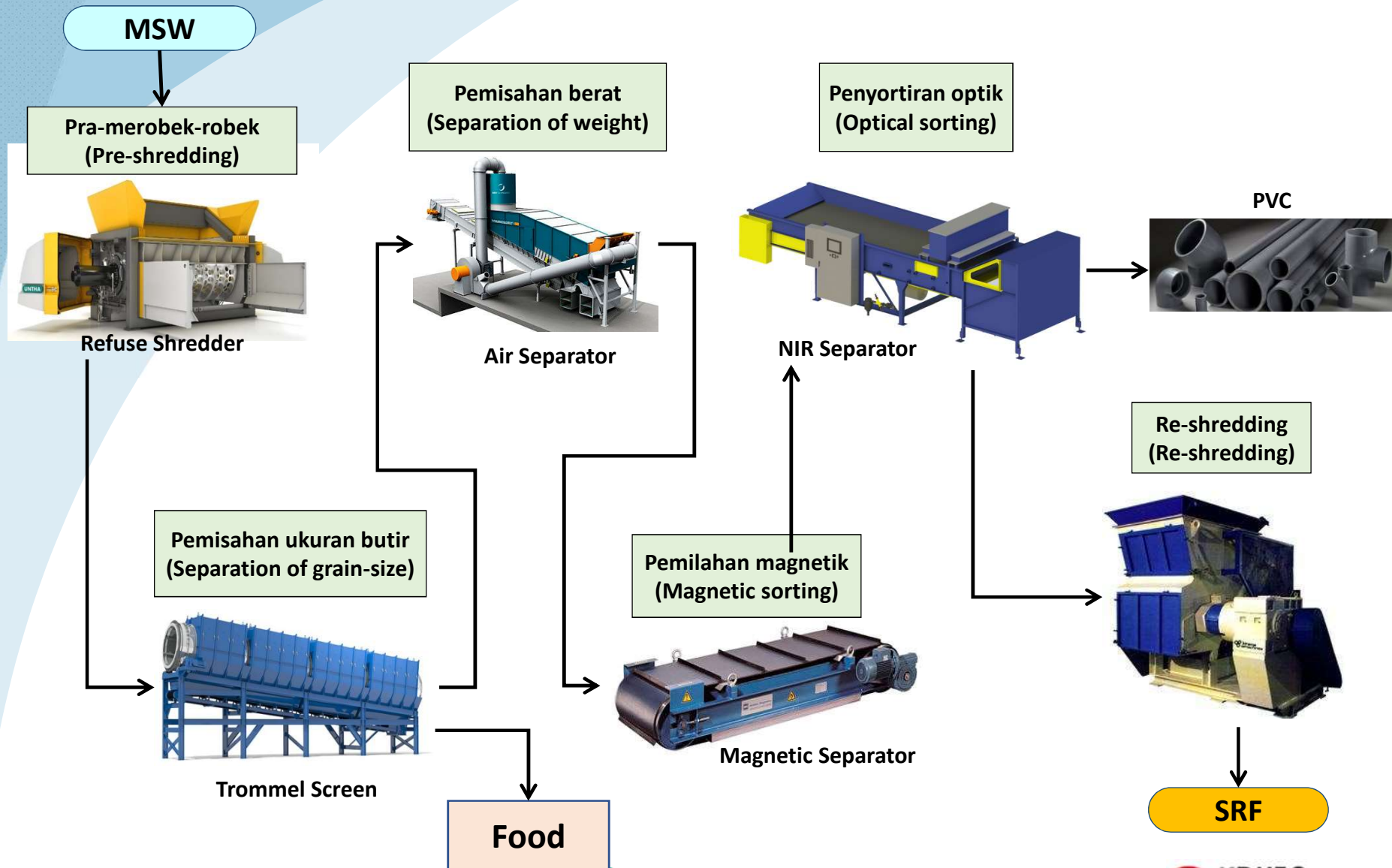
Untuk CFBC Boiler, Pemilahan mekanis diperlukan (For CFBC Boiler, mechanical sorting is required)

- Pemisahan magnetik (Magnetic separation)
- Pemisahan densitas (Density separation)
- Manual pick-up dari bahan daur ulang (Manual pick-up of the recyclable materials)

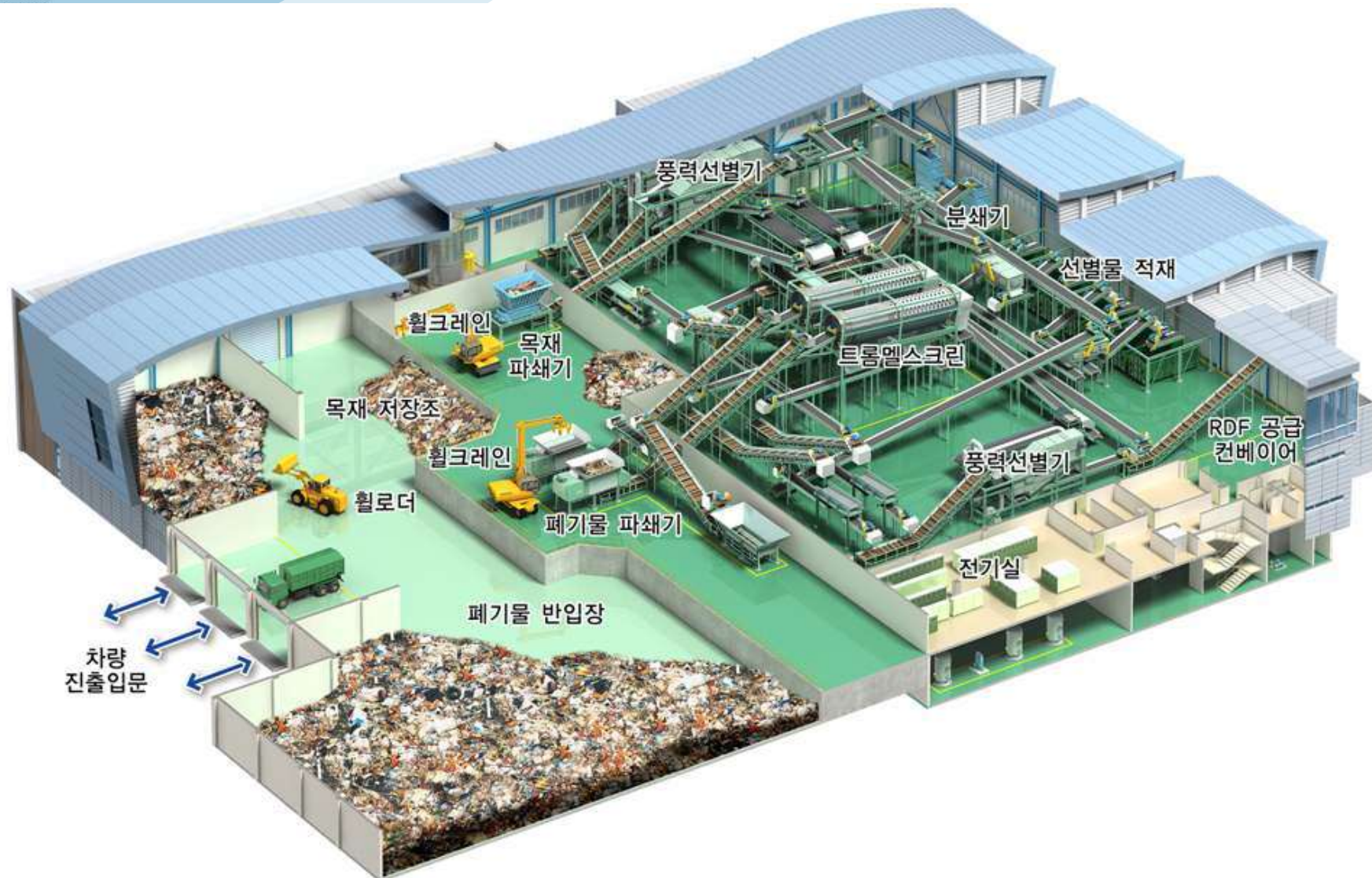
Manfaat (Benefit)

- Mengurangi volume limbah (Reduce the wastes volume)
- Kurangi sifatnya yang berbahaya (Reduce its hazardous nature)
- Peningkatan Properti Fuel (Improvement of Fuel Properties)
 - Nilai kalor (Calorific Value)/Pemisahan Bahan Bakar (Segregation of Combustibles)
- Pemulihan dari Bahan daur ulang (Recovery of the Recyclable Materials)

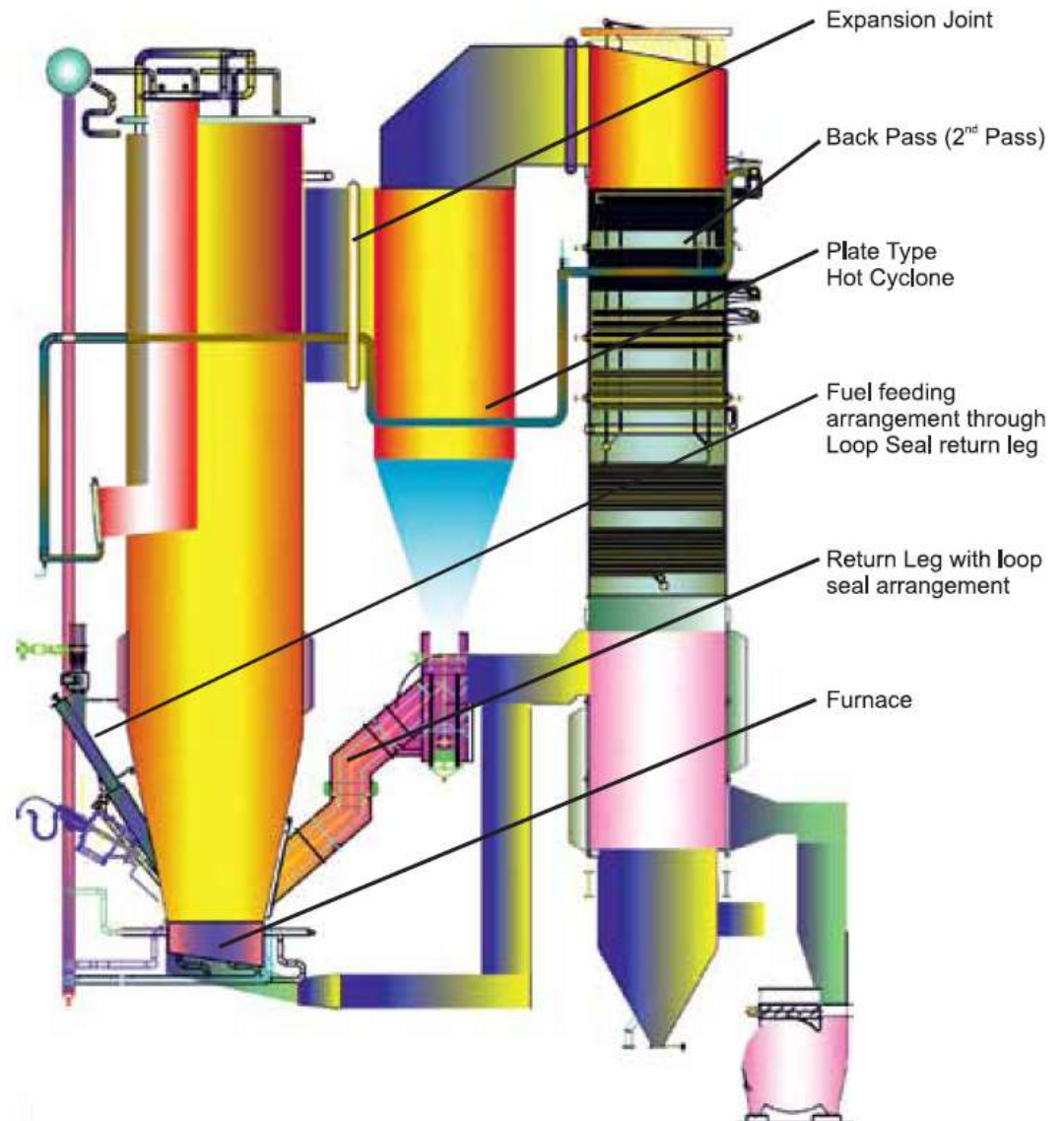
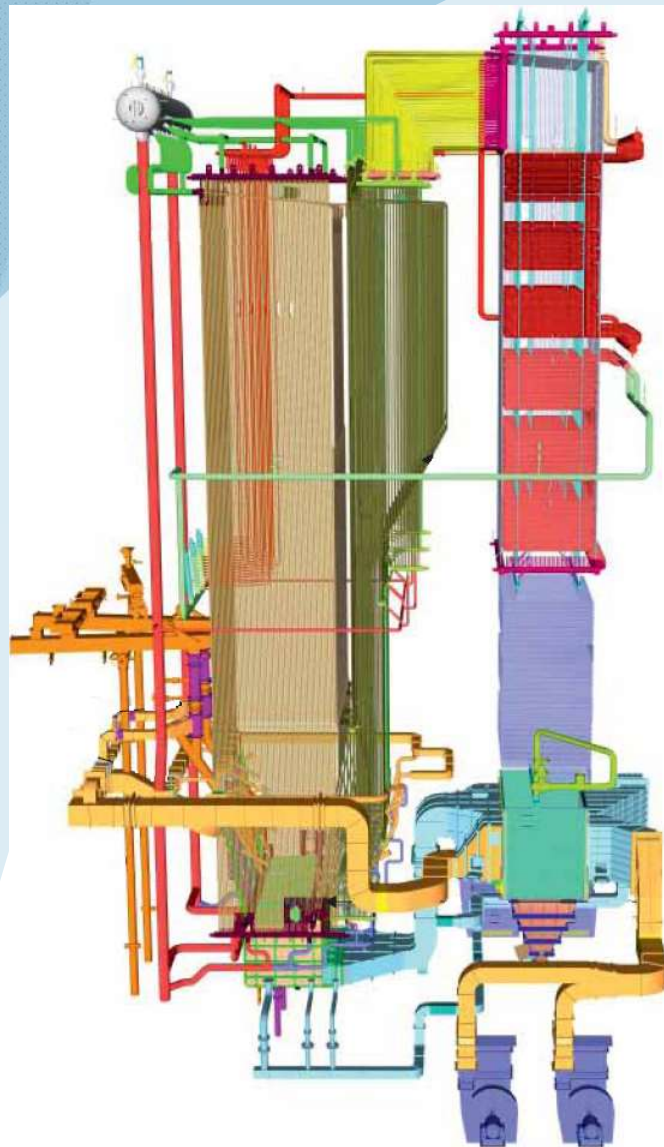
Pre-Treatment Proses Sistem (Pre-Treatment System Process)



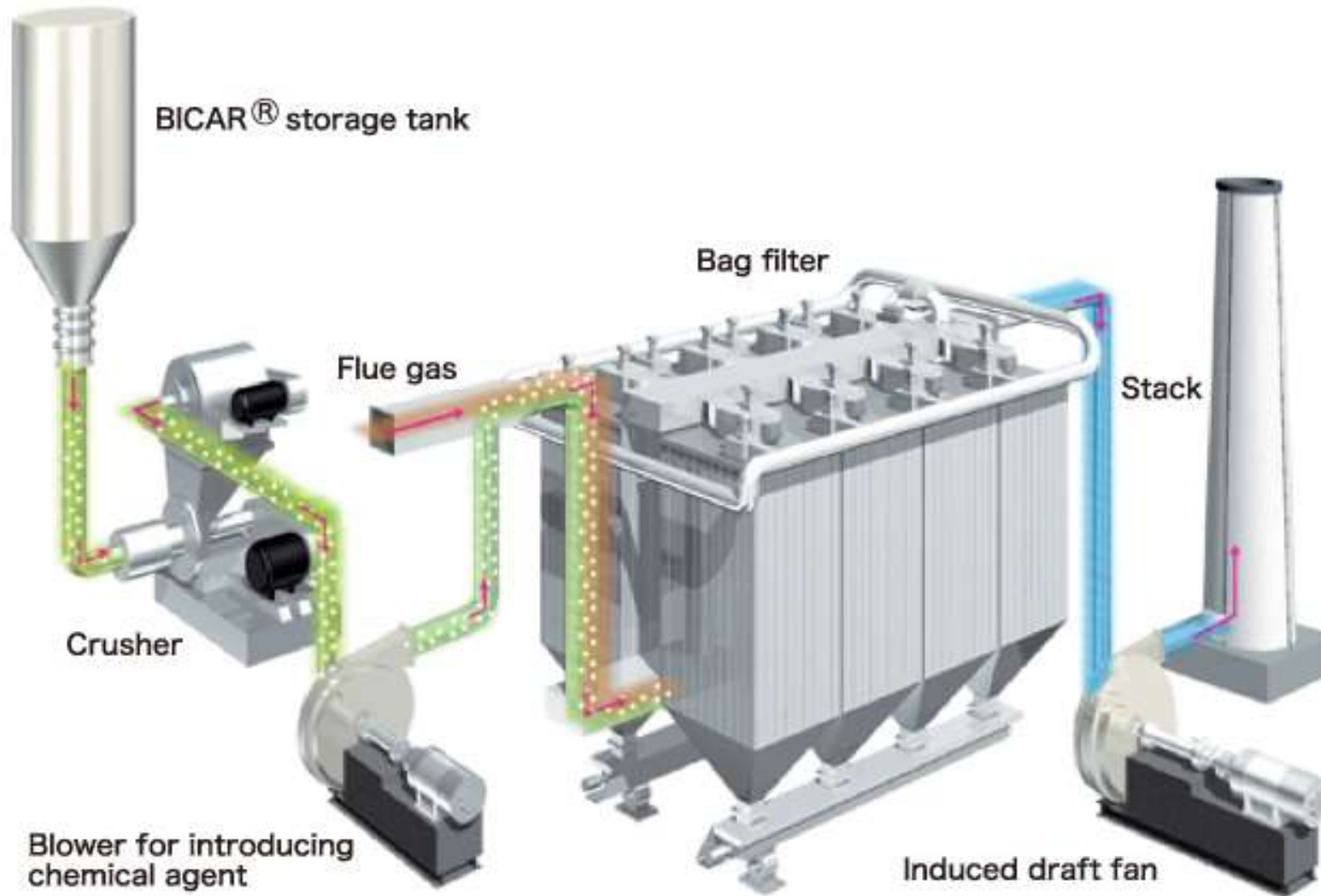
Sistem Pre-Treatment Khas (Typical Pre-Treatment System)



Sistem Boiler (Boiler System) – CFBC



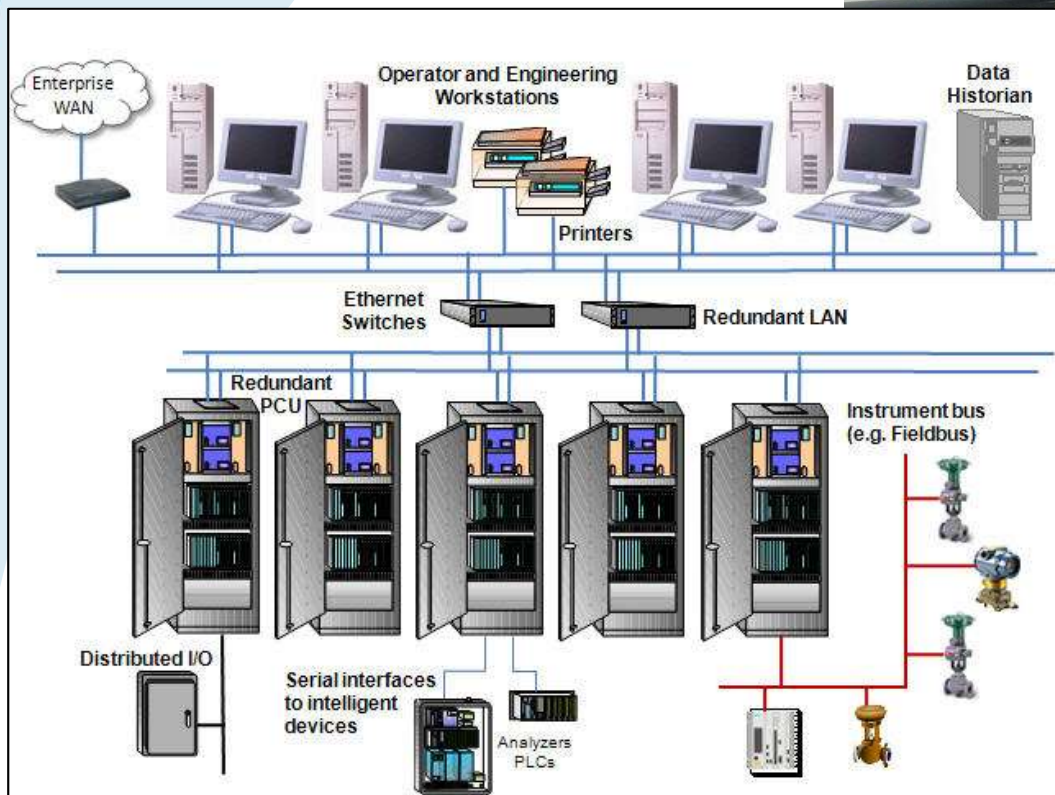
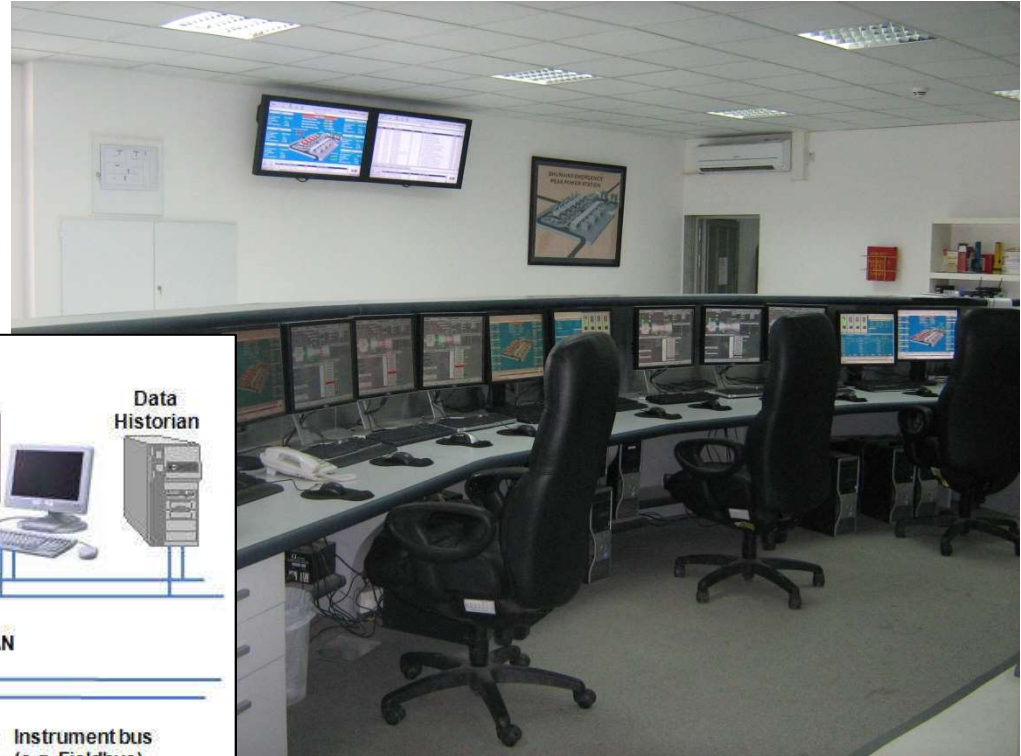
Sistem Pengolahan Gas Flue (Flue Gas Treatment System)



Generator Turbin Uap (Steam Turbine Generator)



Sistem Pengendalian Terdistribusi (DCS)



Beralih Yard, (Switch Yard)



Strategi Pelaksanaan Proyek (Project Execution Strategy)

Hukum & Regulasi (Law & Regulation)

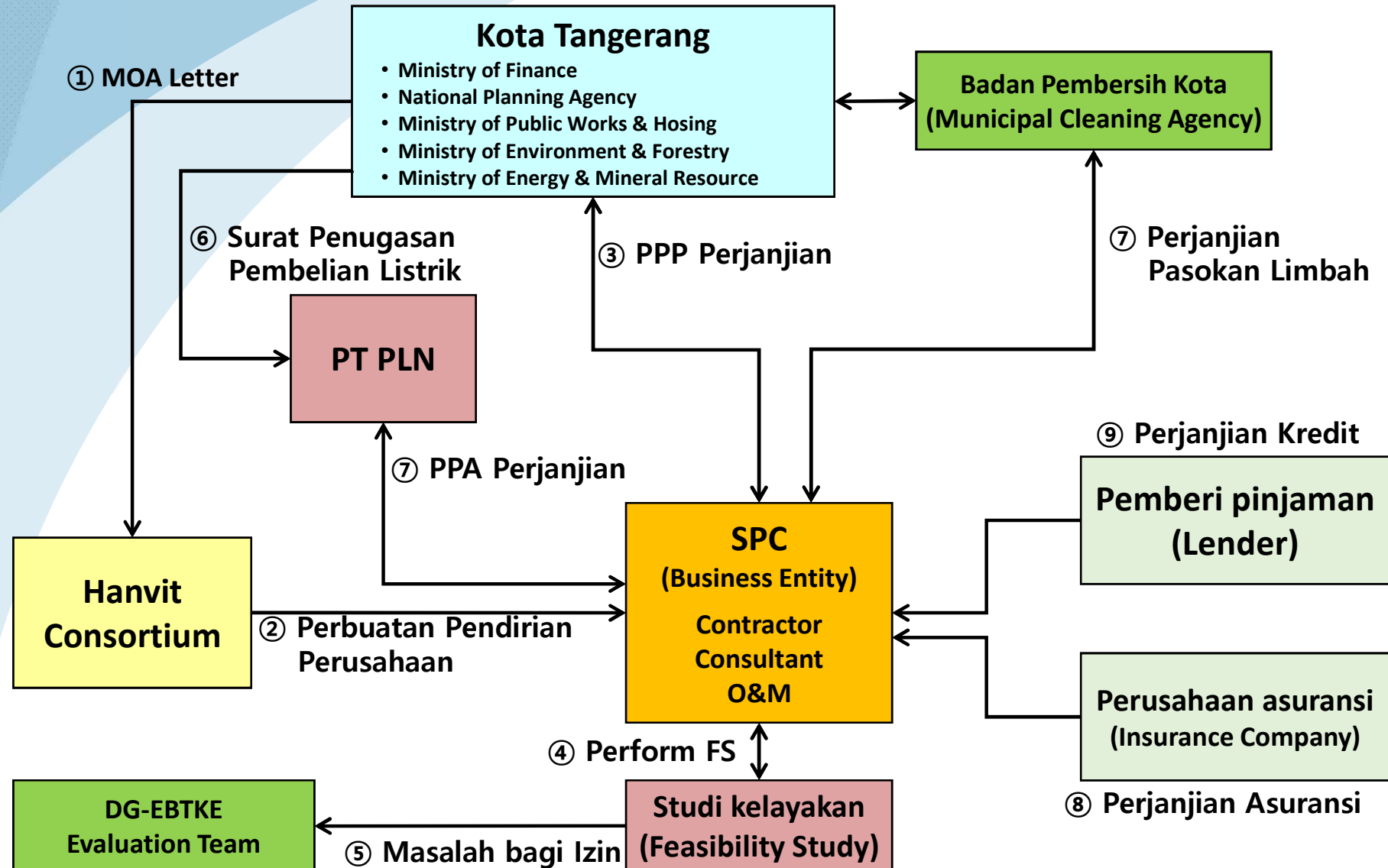
- **PR 38/2015 : PPP Scheme**
- **Law 18/2008 : Waste Management**
- **GR 81/2012 : Household Waste Management**
- **GR 50/2007 : Regional Cooperation.**
- **Law 30/2007 : Energy**
- **Law 30/2009 : Electricity**
- **GR 14/2012 : Electricity Business;**
- **MEMR 44/2015 : Purchase of WTE Electricity by PT. PLN**

PR: Presidential Regulation ,

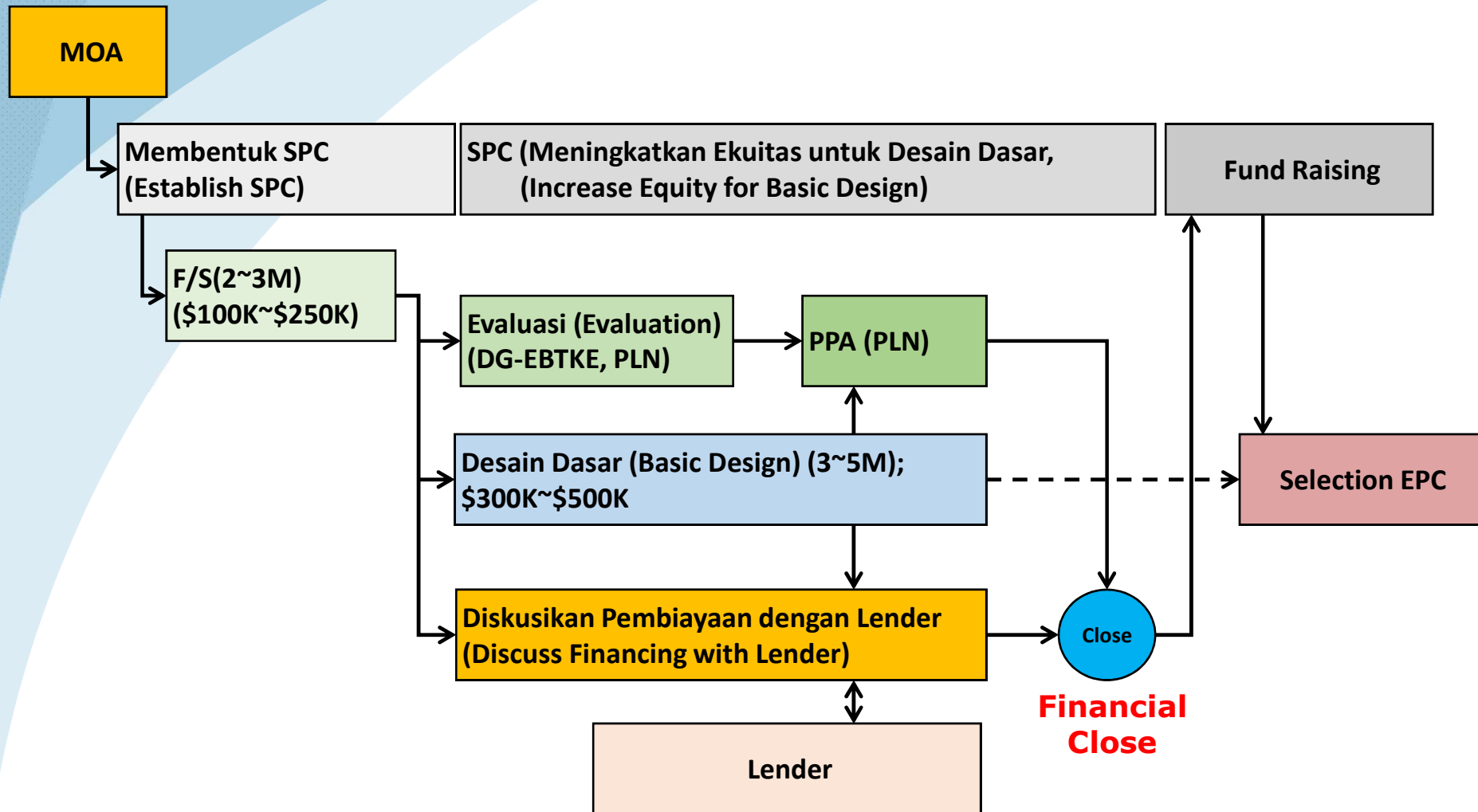
GR: Government Regulation

MEMR : Ministry of Energy and Mineral Resources

PPP Scheme



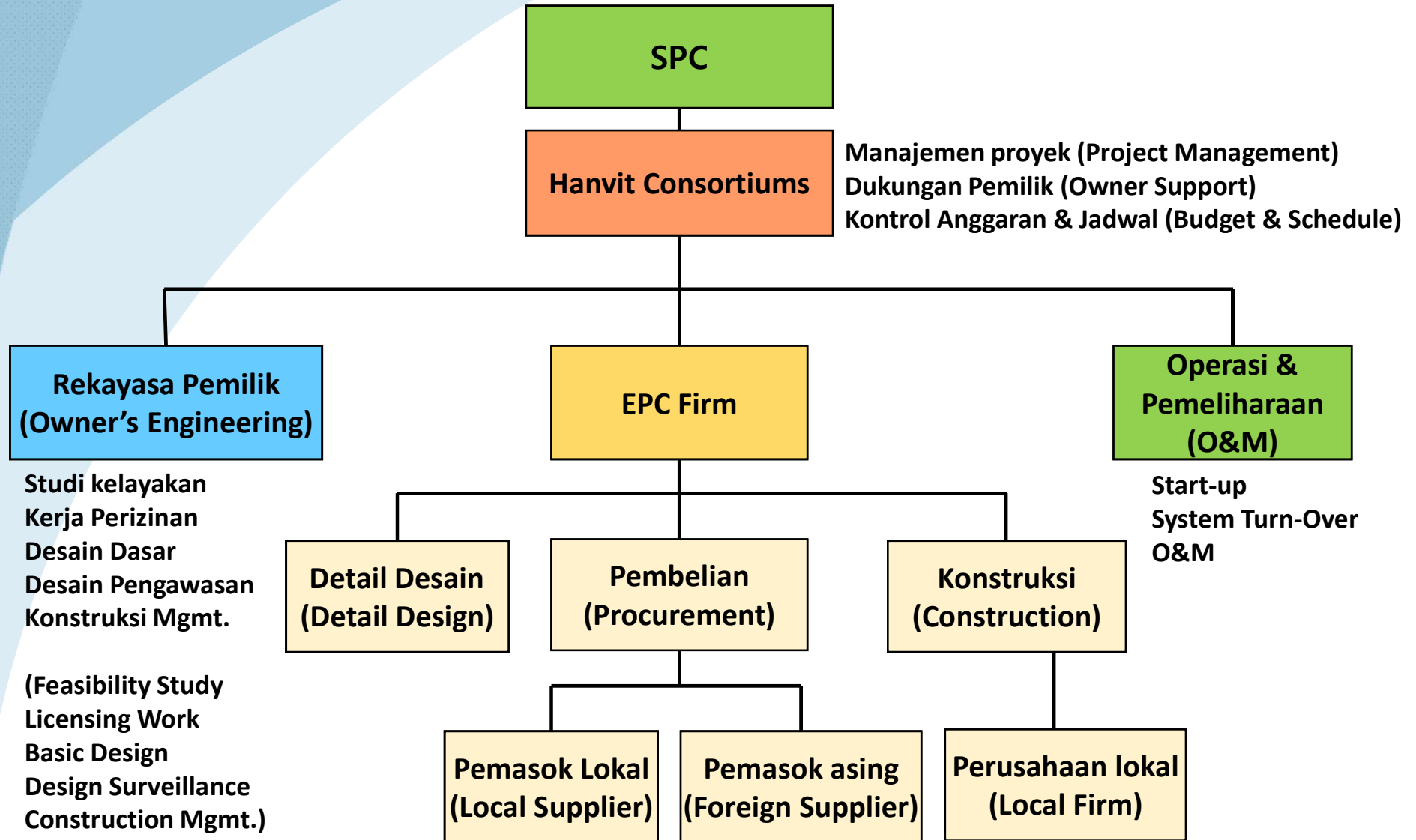
Perizinan dan Mulai proyek Proses (Licensing and Project Start Process)



F/S : Feasibility Study

DG-EBTKE: Directorate General of New and Renewable Energy and Energy Conservation

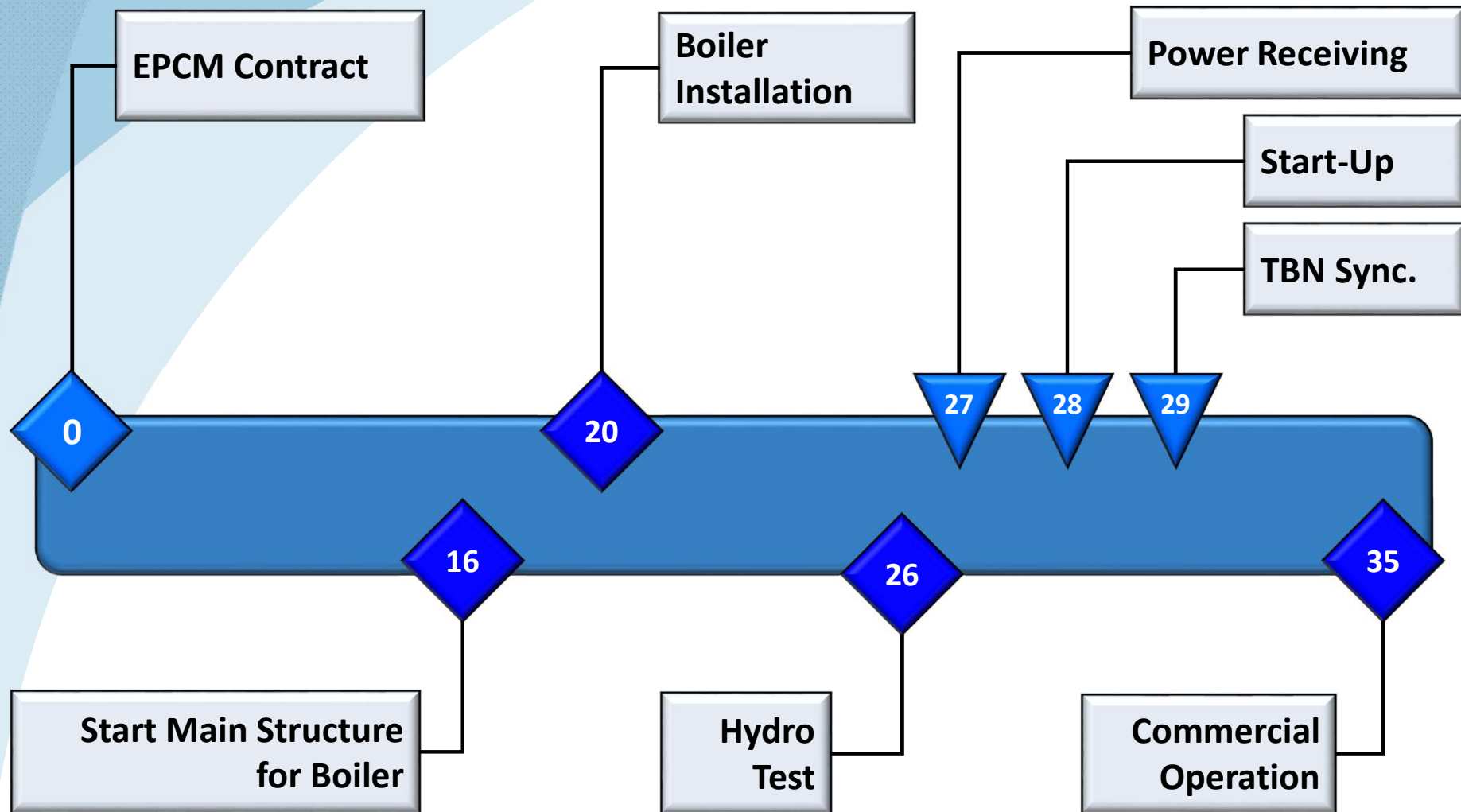
Project Organization



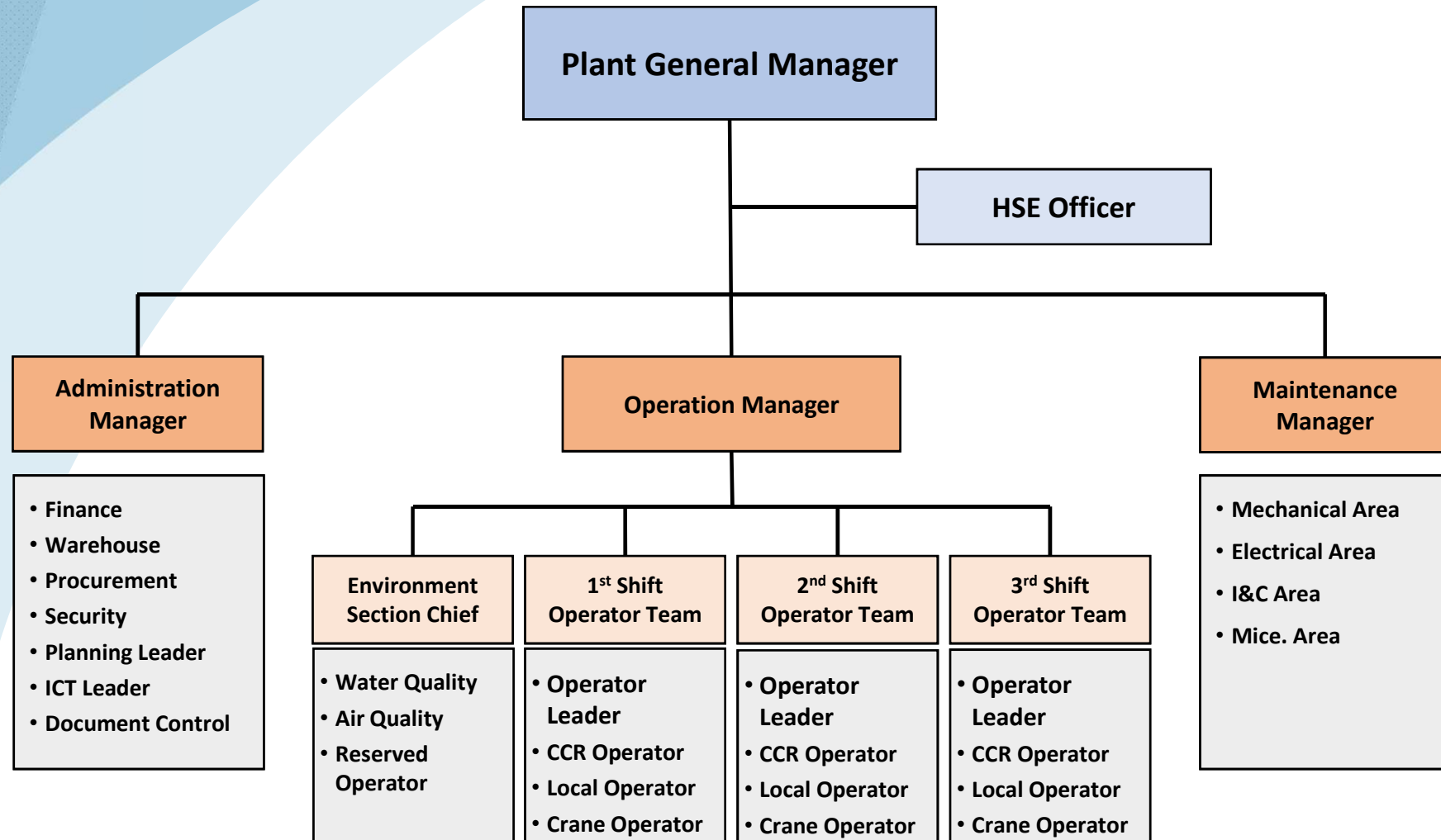
Mayor Kerja & Jadwal Proyek (Major Work & Project Schedule)

Activity	1st Year												2nd Year												3rd Year													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
Engineering & PMC																																						
Boiler & Incinerator System																																						
Flue Gas Treatment System																																						
Turbine & Accessory																																						
Pre-Treatment System																																						
BOP & Auxiliary System																																						
Electrical & I&C System																																						
Start-up & Commissioning																																						

Tonggak konstruksi (35month) Construction Milestone



O & M Organisasi & Rencana Staffing (O&M Organization & Staffing Plan)



Analisis risiko dan referensi Dokumen (Risk Analysis & Reference Documents)

List of Risk

- **Perubahan Hukum & Peraturan selama Proyek (Change of Law & Regulation during Project)**
- **Akuisisi tanah (Land Acquisition)**
- **Perizinan dan Konstruksi Izin Kerja (Licensing and Construction Permit Work)**
- **Pasokan Bahan Bakar - Kualitas & Kuantitas (Fuel Supply – Quality & Quantity)**
- **Jadwal Konstruksi (Construction Schedule)**
- **Kinerja Pembangkit Listrik (Performance of Power Plant)**
- **Force Majeure - Natural Force Majeure (불가항력)**
- **Jaminan finansial (Financial Guarantee)**
- **Durasi Operasi Start-up (Duration of Start-up Operation)**
- **Jaminan COD (Guarantee of COD)**

Key Factor for Successful Project

- Kuantitas & Kualitas sampah harus terjamin, jadi, setelah menyortir kita menggunakan 600 tpd sebagai bahan bakar untuk pembangkit listrik

(The **Quantity & Quality of waste** should be guaranteed, so, after sorting we use 600 tpd as fuel for power generation)

- Tarif listrik USD 0.1877 harus dijamin.

(The electricity power tariff **USD 0.1877** should be guaranteed)

- Berdasarkan analisis finis awal, proyek secara ekonomi lemah, sehingga diperlukan tambahan biaya tip

(Based on preliminary financial analysis, project has economically feeble, so, additional **tipping fee** are required)

- Perolehan Tanah merupakan isu yang sangat penting bagi investor asing, sehingga dibutuhkan untuk mengakuisisi tanah oleh City dan menyewakannya ke SPC.

(Acquisition of Land is very critical issue for foreign investor, so, it is required to acquire the land by City and rent to SPC.)

Key Factor for Successful Project (cont'd)

- **Air tanaman harus disediakan oleh kota ke batas tanaman WTE.**
(The water shall be provided by city to the boundary of WTE plant)
 - **Make Up Water: 350ton / day (dalam take), 200ton / day (Discharge)**
- **Desain dan pekerjaan konstruksi untuk saluran transmisi dengan PLN tidak termasuk anggaran SPC, saluran transmisi harus terhubung dengan PLN di halaman switch pabrik MSW.**
(The design and construction work for transmission line with PLN are not include SPC budget, transmission line should connected with PLN at switch yard of MSW plant.)
- **Sebagian besar pekerjaan perizinan akan dilakukan oleh SPC, dukungan aktif kota diperlukan.**
(Most of licensing work will be performed by SPC, the active support of city are required.)
- **Berbagai dokumen jaminan diminta untuk didiskusikan dengan pemberi pinjaman keuangan, dukungan aktif kota untuk dokumen jaminan diperlukan.**
(The various guarantee document are required to discuss with financial lender, the active support of city for the guarantee documents are required.)

Reference Document

- **Pre-Feasibility Study for Solid Waste Management in City of Tangerang, CDIA, (2013)**
- **Feasibility Study & Basic Design Report (Final Draft), South Tangerang, 20154.12**
- **KERANGKA ACUAN ANALISIS DAMPAK LINGKUNGAN HIDP (KA-ANDAL) REHABILITASI DAN PENGEMBANGAN TEMPAT PEMROSESAN AKHIR SAMPAH (TPA) RAWA KUCING, (2012,5) (“Rawa Kucing 폐기물 처리장 개발 및 복구환경 영향평가 분석 기준 조건”)**
- **Waste to Energy Guidebook, “EU-Indonesia Trade, (2015)**
- **Waste to Energy in Indonesia Challenges and Opportunities, InSWA, (2015.5)**
- **Waste to Energy Development in Indonesia, World Waste to Energy City Summit, (2016.5)**
- **Scoping Study for SWM in Indonesia (2011)**
- **Study on the Waste Treatment Facility BOT Project in DKI Jakarta, The Ministry of Economy, Trade and Industry (2012.2)**

Law & Regulation on EIA

Law

- Government Regulation No.27/1999: Process of the conduct of Environmental Impact Assessment (EIA/AMDAL) (“AMDAL: Analisis Mengenai Dampak Lingkungan”)
- Law No.32/2009 concerning Environmental Protection and Management

Decree the Minister of State for Environment

- Decree of the Minister of State for Environment No. 11/2006 about Types of Business or Activity Compulsory Equipped with Environmental Impact Analysis
- Decree of the Minister of State for Environment No.2/2000 on Guidance on the Evaluation of the EIA (AMDAL) Document
- Decree of the Minister of State for Environment No.8/2000 on Guidance on Public Participation and Information Disclosure of the EIA Process.
- Decree of the Minister of State for Environment No.9/2000 on Guidelines for Preparation of Environmental Impacts
- Decree of the Minister of State for Environment No.40/2000 on Guidance on the Working Procedure of the EIA Commission.
- Decree of the Minister of State for Environment No.41/2000 on Guidance on the Establishment of Commission for the EIA Evaluation in Regency/City

TERIMA
KASIH!