# CHAPTER 5 PROJECT DESCRIPTION

## 5.1 INTRODUCTION

The proposal to construct and operate 55MW Gas Fired Power Plant, Slag Metal Recovery Plant, Billet Plant and Coking Plant by Eastern Steel is to complete its Phase 1 development. The Project components is to allow for better and smooth operation, other supporting facilities to be built are Production Office, Worker Quarter and Administrative Building.

## 5.2 PROJECT CONCEPT

### 5.2.1 Approved Conceptual Integrated Iron and Steel Mill Development

The Integrated Iron and Steel Mill (IISM) will be developed in 2 main phases: **Phase 1** and **Future Phase**, of which shall comprise of all the processing and supporting facilities and functions for primary steel production and up to the forming and finishing products. Phase 1 is planned for maximum production capacity of 1.57 mil MT/year of iron and steel products, and most of the major iron and steel making components are in operation since 2015. The Future Phase will have an overall production capacity of 5 mil MT/year for iron and steel products including the downstream steel products such as coils, wire, plates and others, and this will be developed at later stage as shown in **Table 1-1**.

The overall IISM operation, namely the integrated iron and steel mill operation, can be divided into 3 main sections based on the stage processes involved as described in **Table 5-1**. The overall production process shown in **Figure 5-1**.

**Table 5-1 Main Section of IISM**

| No. | Main Section | Brief Description |
|---|---|---|
| 1. | Iron Making Plant (IMP)<br>• Sinter Plant<br>• Blast Furnace | To convert ore to liquid iron.<br>Sintering process is to agglomerate fine-grained raw materials into a coarse-grained iron ore sinter, which is ready to be charged to the Blast Furnace.<br>In the Blast Furnace, pig iron will be produced. During the iron making process, the Blast Furnace is fed with the iron ore, coke and small quantities of fluxes (minerals, such as limestone, which are used to collect impurities). Air which is heated to about 1200°C is blown into the furnace through nozzles in the lower section. The air causes the coke to burn, producing carbon monoxide which reacts with the iron ore, as well as heat to melt the iron. Finally, the tap hole at the bottom of the furnace is opened and pig iron |

| No. | Main Section | Brief Description |
|---|---|---|
| | | (hot metal) and slag (impurities) are drained off. |
| 2. | Steel Making Plant (SMP)<br>• Steel Converter<br>• Ladle Furnace<br>• Continuous Caster (Slab/ Round/ Rectangular/ Billet) | To convert pig iron to liquid steel (or molten steel) and latter cast into desired primary products namely steel blooms, steel slabs and steel billets.<br>In the Steel Converter, the pig iron is refined with oxygen or air, lowering the carbon proportion and providing enough process heat to maintain the steel liquid. Other processes undertaken include desulphurization to remove excess of sulphur, oxygen lancing to remove excess of carbon, and removal of other impurities using a flux material.<br>The finished steel is transferred to a Ladle Furnace (LF) where the steel will be further refined. Adjustment to the required chemical composition of the steel is made with addition of appropriate amounts of ferroalloy and other materials. Impurities are also removed using flux material.<br>It will then send to a Continuous Caster to form semi-finished steel products which normally cast in the form of blooms, slabs and billets for downstream production activities. |
| 3. | Forming & Finishing Mill<br>• Hot Rolling Mill<br>• Cold Rolling Mill<br>• Galvanizing Plant<br>• Pre-Painting Plant<br>• Plate Mill<br>• Section Mill<br>• Bar Mill<br>• Wire Rod Mill<br>• Seamless Pipe Mill | Future Phase. Further processed of the primary steel products into finished products.<br>Long products including billets, bars, beams, iron bar, rebars and wire rods are mainly used in the construction and civil engineering industries.<br>Flat products such as steel slabs, hot rolled coil (HRC) and cold rolled coil (CRC) are mainly used as raw materials for downstream applications in the automotive, oil and gas, machinery and equipment as well as other manufacturing sectors. |

Apart from that, the IISM will be supported by other supporting facilities as follows:

- Raw Material Storage Yard
- Coking Plant
- Pellet Plant
- Oxygen Plant
- Gas Fired Power Plant
- Slag Metal Recovery Plant
- Utilities Plant
- Wastewater Treatment Plant, and
- Conveyor system (for internal transportation of raw materials and products in the plant)
- Production Office, Worker Quarter and Administrative Building

As of to-date, the components that has been developed under Phase 1 in Y2012 and currently in operation are:

- Sinter Plant,
- Blast Furnace,
- Steel Converter,
- Ladle Furnace,
- Continuous Caster (Slab),
- Continuous Caster (Round/ Rectangular),
- Oxygen Plant, and
- Raw Material Storage Yard.

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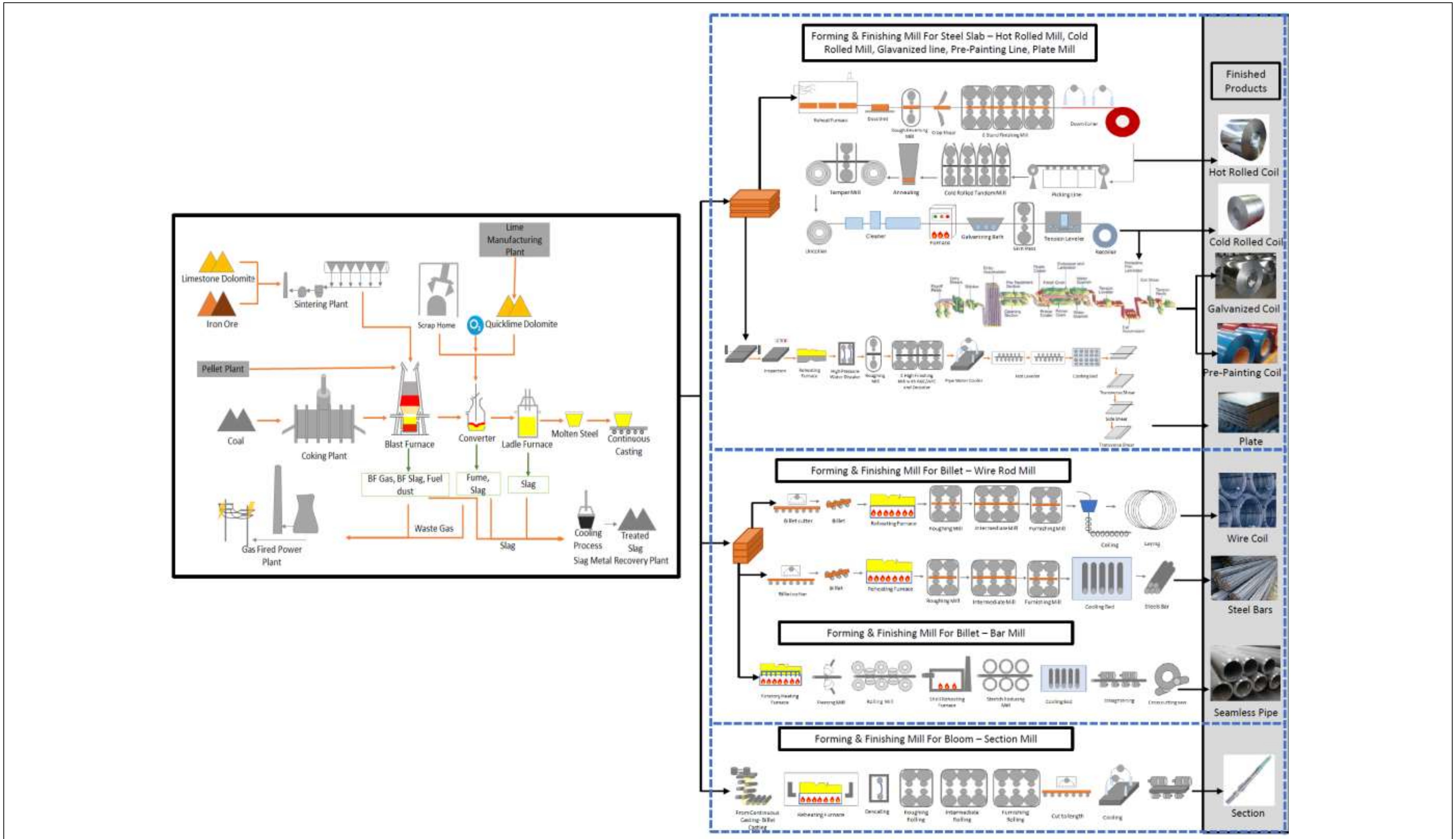


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**Figure 5-1 Overall Process Flowchart for Iron and Steel Mill (IISM)**

### 5.2.2 Proposed Project

Proposed Project in this EIA study refers to the development of 55MW Gas Fired Power Plant and New Plant Components namely Slag Metal Recovery Plant, Billet Plant, Coking Oven and Supporting Facilities: Production Office, Worker Quarters and Administrative Building. These will be built within the existing premise in the Phase 1 area, except for the Supporting Facility which will be built on the Future Phase area (**Figure 1-1**). With these proposed new Project components, it will enhance and optimise the overall IISM operation efficiency. In terms of overall process and production flow, there is no changes to the existing process flow (**Figure 5-1**). **Figure 5-2** shows the proposed new components for the operation.

**Table 5-2** provide brief description of each project components.

**Table 5-2 Project Components Briefs**

| No. | Components | Brief Description |
|---|---|---|
| 1. | Proposed 55MW Gas Fired Power Plant | To utilize the waste gas as fuel to generate electricity. Based on the current operation, the waste gases from the Blast Furnace and the Steel Converter will be treated in the air pollution control system prior released into the atmosphere.<br><br>Since the calorific value (CV) of these gases is high enough to be used in the Power Plant to generate electricity hence these residual gases will be tapped and diverted to Power Plant to generate electricity. With this approach, about 172,000 $m^3$/day of the Blast Furnace Gas (BF Gas) and Converter Gas (CG) will be reused and reduce the waste gas emission. |
| 2. | Proposed Slag Metal Recovery Plant | To construct and operate 300,000 MT/year Steel Slag Metal Recovery Plant next to the existing Steel Making Plant (SMP). The slag metal recovery process is based on hydrolysis characteristics of free calcium oxide (f-CaO) and free magnesia (f-MgO) in steel slags. In which, the hot steel slag will be cooled down by spraying water in the cooling device (namely pyrolyzation devices) and then separated out the metal and non-metal slag by using magnetic separator.<br><br>With the proposed Slag Metal Recovery Plant, 300,000 MT/year slags (from converter slags and steel ladle casting slags) which originally will be disposed will be recovered as much as possible the metal substance and returning into the sintering process. While the remaining |

| No. | Components | Brief Description |
|---|---|---|
| | | non-metal slag will be sold as by-product. It can be used as road base course material and as an aggregate for asphalt concrete.<br><br>The plant will be equipped with four (4) kits of cooling device and supporting electrical automation control and water treatment system. The water treatment process is only involved physical sedimentation process and the water will be recycled back to supply water for the cooling device. |
| 3. | Proposed Billet Plant | To construct and operate a six-strand billet caster in the existing SMP and continuous casting workshop. The caster can produce 1 mil MT/year of continuous casting billets. |
| 4. | Coking Plant (Approved Component in EIA Y2010) | To produce coke which is an important raw material and fuel for iron and steel making process and for sintering process. The coking process requires heating the coal in the absence of air to drive off the volatile compounds. The coke produced is hard but porous inside. The coke production can be divided into four main stages which are coal preparation, coking process, coke quenching and gas purification. The gas purification process consists of 2 cleaning steps; Desphurization System and dust removal by Baghouse.<br><br>The original approved Phase 1 capacity is 0.7 mil MT/year and 2.3 mil MT/year for future capacity (or the ultimate capacity). As for this EIA study, it is planned to construct 0.8 mil MT/year now and 2.2 mil MT/year in future. |
| 5. | Proposed Supporting Facilities: Production Office, Worker Quarters and Administrative Building | A Production Office with total floor area 4609.46 $m^2$ will be built at site, it will be located between the existing Oxygen Plant and CO Gas holder area. About 250 number of workers is estimated in occupy this building. At the same time, a Worker Quarters and Administrative Building is proposed within the existing premise towards the eastern boundary with total area 34.41 acres. The proposed quarters will consist of 1440 units for about 1,944 persons. For these new supporting facilities, proper sewage treatment plant (STP) will be provided; -<br>• STP with 149 PE design capacity at Production Office<br>• STP with 2500 PE design capacity at Worker Quarter |

## 5.3 PROJECT LOCATION

The Proposed Project will be developed within the existing IISM located on Lot 6294 and partially of Lot 60131 and Lot 60129 of Teluk Kalung Industrial Estate, Kemaman, Terengganu.

Total overall IISM facility occupies approximately 1,208 ac. of land. Phase 1 of the development covers an area of 358 ac. Whilst the remaining 850 ac. of land is designated for Future Phases. The Global Positioning System (GPS) coordinates for IISM plant boundaries are listed in **Table 5-3**.

**Table 5-3 Project Boundaries Coordinate**

| No | Latitude | Longitude |
|---|---|---|
| 1 | N4$^0$ 16' 54.24" | E103$^0$ 26' 2.63" |
| 2 | N4$^0$ 16' 58.35" | E103$^0$ 25' 34.84" |
| 3 | N4$^0$ 16' 58.35" | E103$^0$ 25' 11.83" |
| 4 | N4$^0$ 17' 15.03" | E103$^0$ 25' 11.88" |
| 5 | N4$^0$ 17' 15.03" | E103$^0$ 25' 0.80" |
| 6 | N4$^0$ 17' 24.5" | E103$^0$ 25' 02.3" |
| 7 | N4$^0$ 17' 32.3" | E103$^0$ 25' 11.2" |
| 8 | N4$^0$ 17' 46.8" | E103$^0$ 25' 10.0" |
| 9 | N4$^0$ 17' 47.8" | E103$^0$ 25' 01.2" |
| 10 | N4$^0$ 18' 20.4" | E103$^0$ 25' 01.2" |
| 11 | N4$^0$ 18' 32.5" | E103$^0$ 25' 26.9" |
| 12 | N4$^0$ 18' 32.5" | E103$^0$ 26' 16.8" |
| 13 | N4$^0$ 17' 50.6" | E103$^0$ 26' 16.8" |
| 14 | N4$^0$ 17' 35.6" | E103$^0$ 26' 09.8" |
| 15 | N4$^0$ 17' 26.38" | E103$^0$ 26' 05.65" |
| 16 | N4$^0$ 17' 11.22" | E103$^0$ 26' 03.74" |

*Source: Eastern Steel, 2019*

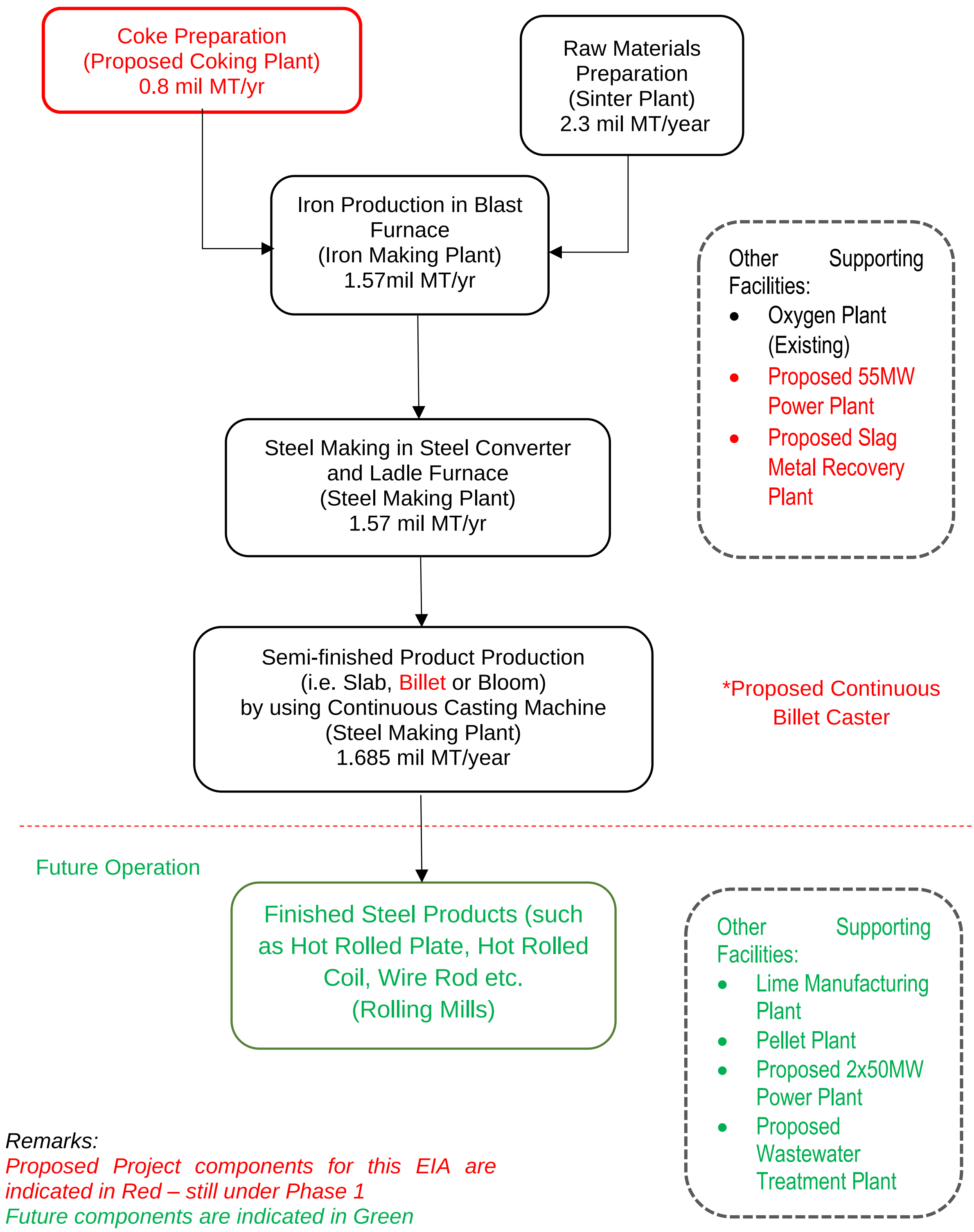


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**Figure 5-2 Proposed New Project Components into Existing Operation (Phase 1)**

## 5.4 PROJECT LAYOUT

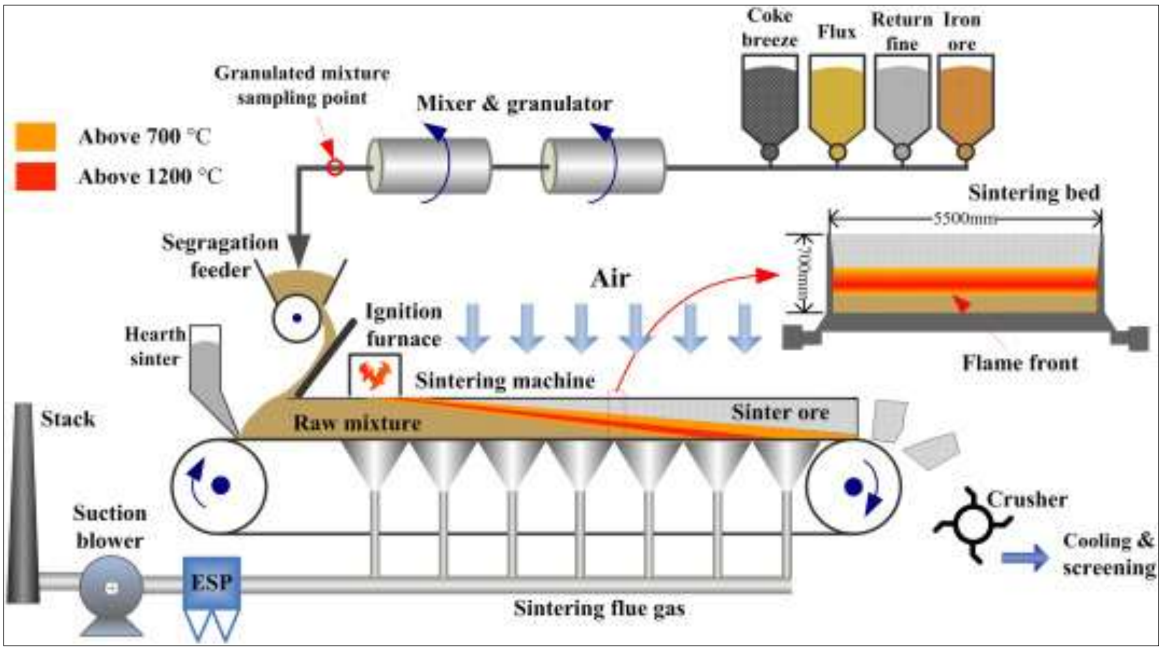
An overall layout for the existing and proposed IISM operation is shown in **Figure 5-3** and **Figure 5-4** to **Figure 5-10** shows the details layout of Proposed 55MW Gas Fired Power Plant, Billet Plant, Coking Plant, Slag Metal Recovery Plant and others proposed supporting facilities.

## 5.5 PROCESS DESCRIPTION

### 5.5.1 Existing Operation

#### 5.5.1.1 Sinter Plant

The Sinter Plant is where raw materials are being prepared in the form of sinter for used in the Blast Furnace. The production process involves the fusion of raw materials such as iron ore fines, coke, coke breeze, limestone, dolomite, calcium lime and return ore (materials returned from the production process) by the sintering process, which involves heating of the material mix to near melting to form a hard clinker or sinter. Simplified process diagram is as shown in **Chart 5-1**.




*Note: For illustration purpose only*

**Chart 5-1 Typical Diagram for Sintering Process**

#### 5.5.1.2 Blast Furnace

Sinter and iron ore pellets are the main feed materials for iron making in the Blast Furnace (BF). High heat from the combustion of coke and coal, provide high heat to cause chemical reduction of iron oxide into iron and melting to form molten iron (hot metal). Refer **Chart 5-2**. Reaction taking place in the Blast Furnace are:

(A) Zone of combustion:

The coke (essentially impure carbon) burns in the blast of hot air to form carbon dioxide - a strongly exothermic reaction. This reaction is the main source of heat in the furnace:

$C + O_2 \longrightarrow CO_2 + Heat$

$C + CO_2 \longrightarrow 2CO$

(B) Zone of reduction of ore:

$Fe_2O_3 + 3CO \longrightarrow 2 Fe + 3CO_2$

$Fe_2O_3 + 3C \longrightarrow 2 Fe + 3CO$

$FeO + CO \longrightarrow Fe + CO_2$

(C) Zone of slag formation:

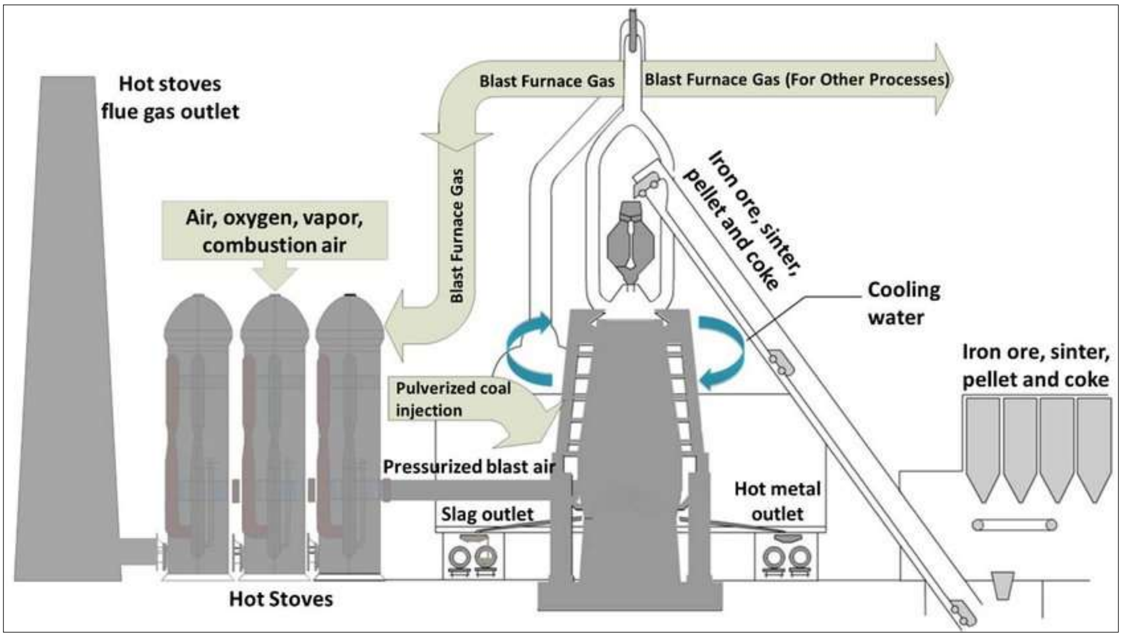
Limestone is added in the furnace and decompose to form Calcium Oxide (CaO). CaO is a basic oxide and will reacts with acidic oxides such as silicon dioxide ($SiO_2$) present in the rock. CaO reacts with $SiO_2$ to produce calcium silicate ($CaSiO_3$), which will melt and run down through the furnace to form a layer on top of the molten iron. It can be tapped off from time to time as slag.

$CaCO_3 \longrightarrow CaO + CO_2$

$CaO + SiO_2 \longrightarrow CaSiO_3$

The hot metal is tapped off and transferred by tanker carrier to the steel making plant for conversion into steel. BF Gas is produced from the iron making process whereby in this process the iron ore is reduced into metallic (pig) iron. The BF Gas will be cleaned by the Dry Method Deduster at the end of Blast Furnace and Hot Stoves of the Iron Making Plant.

The Blast Furnace is equipped with a Top-pressure Recovery Turbine (TRT) system in the downstream of gas-cleaning equipment for a blast furnace. After dust is collected, BF gas is led to the turbine and drives it while expanding from around the furnace top pressure to atmospheric pressure. The power generated by the turbine is transferred to the generator and converted to electric power. In conventional practice, the energy of blast furnace gas was wasted by pressure reduction at a septum valve. With TRT system, it is now recovered as electric power which significantly saving the energy.




*Note: For illustration purpose only*

**Chart 5-2 Typical Diagram for Blast Furnace**

#### 5.5.1.3 Steel Converter

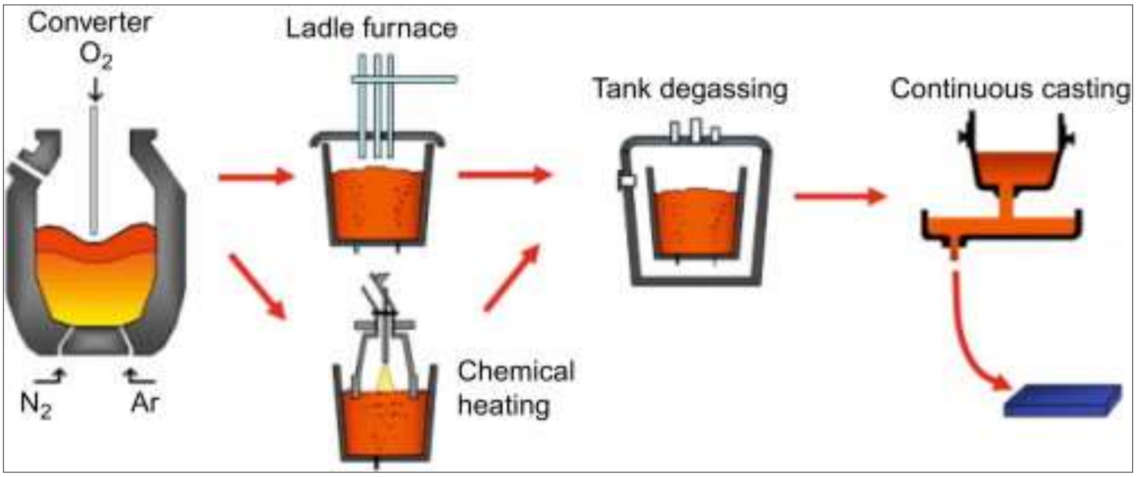
Steel making is undertaken in the Steel Converter (SC) and involves pre-treatment with lime to remove sulphur impurities, mixing, with ferroalloys, steel scrap and pig iron in quantities appropriate to the steel type that is to be produced. Other processes undertaken include desulphurization to remove excess of sulphur, oxygen lancing to remove excess of carbon, and removal of other impurities using a flux material.

#### 5.5.1.4 Ladle Furnace

The finished steel is transferred to a Ladle Furnace (LF) where the steel will be further refined. Adjustment to the required chemical composition of the steel is made with addition of appropriate amounts of ferroalloy and other materials. Impurities are also removed using flux material.

#### 5.5.1.5 Continuous Caster (CC)

Molten steel is then sent to Continuous Caster (CC) where it is formed into semi-finished steel products by means of a mould of desired shape. The steel is normally cast in the form of slab, round and rectangular. These are the raw materials for downstream production activities. **Chart 5-3** shows the semi furnished product production process flow.




*Note: For illustration purpose only*

**Chart 5-3 Typical Diagram for SC, LF and CC Process**

### 5.5.1.6 Oxygen Plant

Oxygen is heavily used in the iron & steel industry where it helps to increase burning temperature by the production of iron and steel; and significantly improve the overall process efficiency. The existing oxygen plant has 2 units of 10,000 $m^3$/hr air separator column with capacity of 240 mil $m^3$/year and will be increased to total capacity of 900 mil $m^3$/year by adding another 5 units in Future Phase. The air separators columns will utilise advanced technology such as molecular sieve adsorption method, turbo-charged turbine expansion machine, neat absorption chamber, selective argon nonhydrogen system and external oxygen compression system.

Ambient air is drawn through an air filter to remove dust and impurity prior to compression to approximately 0.62 MPa (A) with a rate of 88000 $m^3$/hr using a turbo-compressor. The filtered and compressed air go through an air-cooling tower (water medium) to cool down the temperature to 17°C. It then enters the molecular sieve absorber where moisture, $CO_2$, $C_2H_2$ and other impurities content in the air are absorbed. Purified air then channel to two different sections. The first section will enter the bottom part of column after heat exchange while a compressor will compress the other section. It is then sent to cold box and subsequently to the heat exchanger and expansion machine. The liquid form will expand and enter the upper part of the column together with a by-pass impurify nitrogen.

Air from the bottom part column rises and flows through the expanded liquid from the top. The contact between the two will increase the nitrogen content. Nitrogen liquid that is required for return-flow comes from the condensation evaporator where process evaporation of oxygen liquid and condensation of nitrogen liquid takes place.

The operation using non-hydrogen argon system where it terminates the use of argon refining equipment. Thus, the operation is simple and safer transfer reliability. Low-pressure oxygen and low-pressure nitrogen from the cold box of air separator column will enter the oxygen turbine press and nitrogen turbine press respectively. It will then compress to become medium-pressure gases and channelled to storage tank through piping. From the storage tank, oxygen and nitrogen gas will then supply to the plant via piping network after proper pressure adjustment.

The oxygen plant produces oxygen, nitrogen and argon in the form of gas and liquid for consumption at the IISM:

| Product | Purity | Production Quantity ($m^3$/hr) |
|---|---|---|
| Oxygen | 99.6 % $O_2$ | 41,250 |
| Liquid Oxygen | 99.6 % $O_2$ | 500 |
| Nitrogen | ≤10 ppm $O_2$ | 47,500 |
| Liquid Nitrogen | ≤10 ppm $O_2$ | 1,500 |
| Liquid Argon | 99.999% Ar | 1,500 |
| Compressed nitrogen (for oxygen compress uses) | ≤10 ppm $O_2$ | 1,250 |

Note:
1. Liquid product after gas compression, $m^3$ at 0°C and 760mmHg.
2. 1500 $m^3$/h of liquid argon can be compressed to 2.5Mpa (G) argon product and send to cool box.
Source: Eastern Steel, 2019.

### 5.5.2 Proposed Operation

#### 5.5.2.1 55MW Gas Fired Power Plant

The proposed gas fired power plant will be utilising waste gas from the Blast Furnace and Steel Converter. The technology for power generation is a combined-cycle power plant complete with Steam Turbine and Heat Recovery System. Both the BF gas and Converter Gas will be well-mixed to produce a uniformed fuel gas for injection into the 190 ton/h Boiler for steam generation. The resulting steam will run the Steam Turbine Generator for generating 55MW electricity power and feed into the on-site power grid for internal usage.

**Fuel Gas Source**

The main fuel source for the power generation are surplus Blast Furnace Gas (BF Gas) and Converter Gas from the iron and steel production process. Feasibility study has been carried out by Eastern Steel where the fuel composition is summarized in **Table 5-4**. The analysis results showed that both fuel gases have high heating value; 4724.37 KJ/$Nm^3$ (Converter Gas) and 3314.24 KJ/$Nm^3$ (Blast Furnace Gas), which are viable to be used as fuel for the power generation.

**Table 5-4 Fuel Composition**

| Gas Composition | $O_2$ | $N_2$ | $CH_4$ | CO | $CO_2$ | $H_2$ | Heating Value; Q (KJ/Nm$^3$) |
|---|---|---|---|---|---|---|---|
| Converter Gas (%) | 1.45 | 41.06 | 0 | 36.56 | 20.20 | 0.73 | 4724.37 |
| Blast Furnace Gas (%) | 1.24 | 54.04 | 0 | 25.30 | 18.85 | 0.57 | 3314.24 |
| Remarks:<br>• CO gas pressure: the normal pressure of converter gas pipeline connected to the power plant boundary area of converter gas 4~20kPa; gas temperature: 30 to 60 ℃<br>• CO Gas pressure: the normal pressure of blast furnace gas pipeline connected to the power plant boundary zone is around 10 kPa; gas temperature: 20 to 55 ℃ | | | | | | | |

*Source: Eastern Steel, 2018.*

**Energy Balance**

Based on the Feasibility Study (Power Plant Technical Report 2018), the energy balance is as shown in the **Table 5-5**. The information presented here are for both Phase 1 and Future Phase. During the initial start-up stage, with the 600m$^3$ Blast Furnace and 65t Converter, about 30MW power will be generated. Later in future, with addition of 1080 m$^3$ Blast Furnace and another 65t Converter, 55MW power will be generated. For current implementation, Phase 1 will be considered and built. The proposed fuel gas generation and consumption in the IISM is as shown in **Chart 5-4**.

**Table 5-5 Energy Balance**

**Phase 1 (Start-Up)**

| Energy | Production Unit | | Estimated Amount (m³/ton) | Daily Production (ton) | Blast Furnace Gas (m³/h) | Converter Gas (m³/h) | Remark |
|---|---|---|---|---|---|---|---|
| Generation | Iron Making | 600m³ Blast Furnace | 1,570 | 2,400 | 157,000 | 0 | 0.84Mt/a |
| | Steel Making | 65 ton Converter | 150 | 2,400 | 0 | 15,000 | 0.84Mt/a |
| | | | | Total | 157,000 | 15,000 | |
| Usage | **Energy User** | | **Consumption (m³/ton)** | **Daily Production (ton)** | **Blast Furnace Gas (m³/h)** | **Converter Gas (m³/h)** | **Remark** |
| | Lime | Lime Kiln | 0 | 0 | 0 | 0 | Not Included |
| | Iron Making | 100m² Sintering Machine | 50 | 3,714 | 7,700 | 0 | 0.12Mt/a |
| | | Hot Blast Stove | 750 | 2,400 | 71,000 | 0 | |
| | | Blast Furnace PCI | | | 4,000 | 0 | |
| | Steel Making | Ladles Baking | 30 | 2,400 | 3,000 | 4,000 | |
| | | Mixer Furnace | 40 | | | | |
| | Power Plant | 55MW Power Generation | - | - | 71,300 | 11,000 | 29.267 MW |
| | | | | Total | 157,000 | 15,000 | 53.21% |
| | | | | Balance | 0 | 0 | |

Note:
1. Consider blast furnace gas without lime as main production for 55 MW power plant commissioning
2. 55MW power plant generated power load at around 30 MW (29.267 MW), load rate at about 53%.

*Source: Eastern Steel (Power Plant Technical Report), 2018*

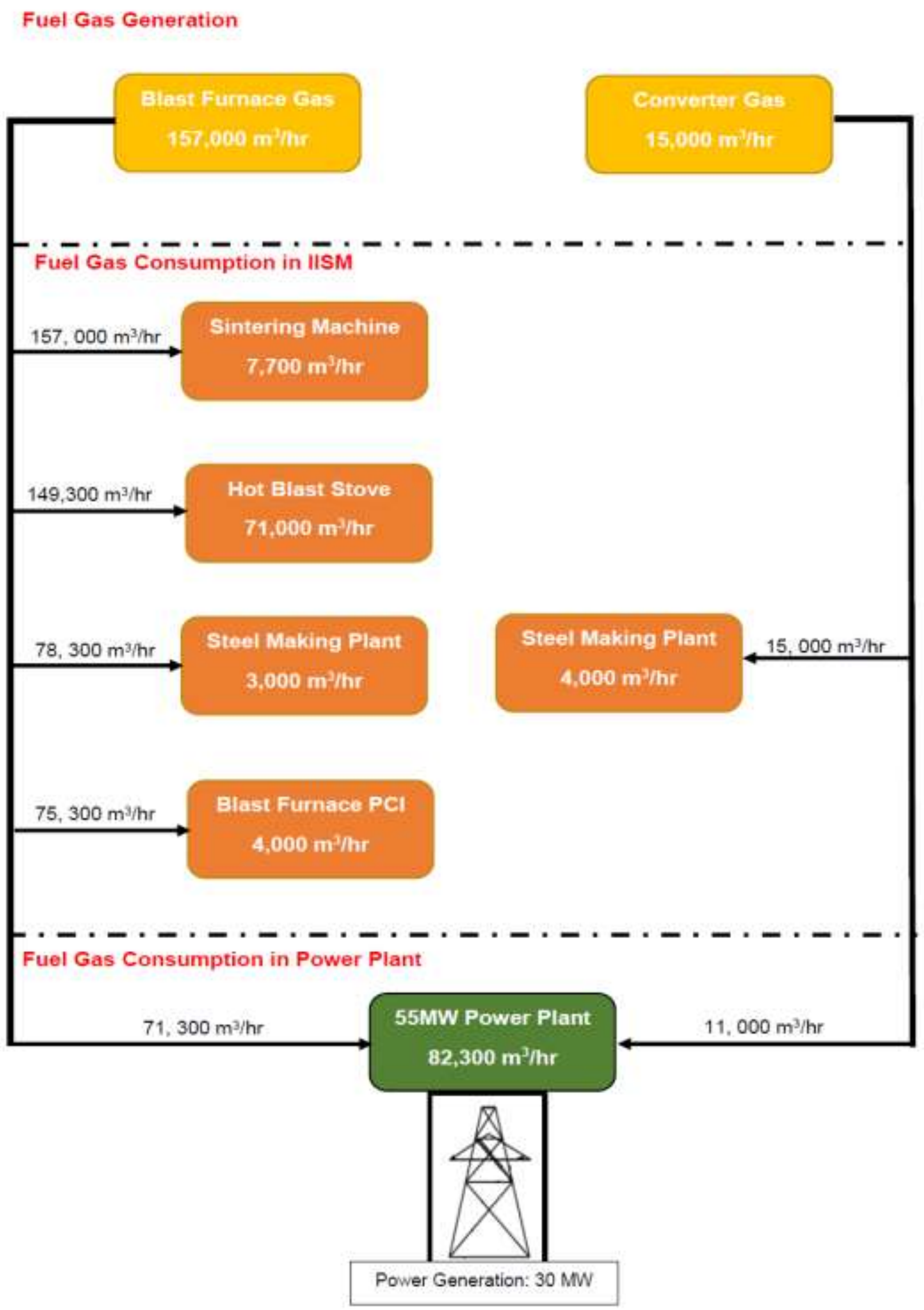
**Future Phase (Fully Operation)**

| Energy | Production Unit | | Estimated Amount (m³/ton) | Daily Production (ton) | Blast Furnace Gas (m³/h) | Converter Gas (m³/h) | Remark |
|---|---|---|---|---|---|---|---|
| Generation | Iron Making | 600m³ Blast Furnace | 1,570 | 6,006 | 392,900 | 0 | 2.0Mt/a |
| | | 1080m³ Blast Furnace | | | | | |
| | Steel Making | 2 unit 65 ton Converter | 150 | 6,126 | 0 | 38,300 | 2.0Mt/a |
| | | | | Total | 392,900 | 38,300 | |
| Usage | **Energy User** | | **Consumption (m³/ton)** | **Daily Production (ton)** | **Blast Furnace Gas (m³/h)** | **Converter Gas (m³/h)** | **Remark** |
| | Lime | Lime Kiln | 663 | 500 | 0 | 13,800 | |
| | Iron Making | 100m² Sintering Machine | 35 | 9,460 | 13,800 | 0 | 3.15Mt/a |
| | | 150m² Sintering Machine | | | | | |
| | | 10m² Shaft Furnace | 230 | 1,791 | 17,200 | 0 | 0.6Mt/a |
| | | Hot Blast Stove | 600 | 6,006 | 146,200 | 0 | |
| | | Blast Furnace PCI | | | 4,000 | 0 | |
| | Steel Making | Ladles Baking | 0 - 40 | 6,126 | 0 | 10,200 | |
| | | (Molten iron, steel ladle and middle ladle heating) | | | | | |
| | | Mixer Furnace | | | | | |
| | Steel Rolling | Heating Furnace | 280 | 5,886 | 68,700 | 0 | |
| | Power Plant | 55MW Power Generation | - | - | 143,000 | 14,300 | 54.817 MW |
| | | | | Total | 392,900 | 38,300 | 99.67% |
| | | | | Balance | 0 | 0 | |

Note:
1. Normal heating furnace shall be considered for steel rolling and BF gas shall be used for the production.
2. Most converter gas shall be used for steel making and the rest shall be sent to the pipeline network of BF gas.
3. The proposed 55MW power generating unit can achieve its full load target.

*Source: Eastern Steel (Power Plant Technical Report), 2018*

**Initial Start-Up Stage**




**Future Phase (Fully Operation)**


**Chart 5-4 Proposed Fuel Gas Generation and Consumption in the IISM**

## Power Generation Process

This is a combined-cycle power plant uses Steam Turbine and Heat Recovery System. Both the BF gas and Converter Gas will be well mixed to become uniformed fuel gas for 190 ton/h Boiler to generate steam. The resulting steam will be used in the Steam Turbine Generator for generating 55MW electricity power which will be tapped into the TNB Grid Network. The overall process flow diagram is shown in **Figure 5-4** and the process description will be presented in this section. While, the layout and sectional view for the Proposed Power Plant are illustrated in **Figure 5-5** and **Figure 5-6**.

BF Gas is produced from the iron making process whereby in this process the iron ore is reduced into metallic (pig) iron. The BF Gas will be cleaned by the Dry Method Deduster at the end of Blast Furnace and Hot Stoves of the Iron Making Plant. Similarly, Converter Gas from the steel making process will be cleaned by the Dry Scrubber and Secondary Dedusting (Bagfilter) before stored at dedicated Converter Gas Holder Tank (50,000m$^3$).

For better high-value fuel for effective power generation, BF Gas and Converter Gas will be mixed in the steel plant before connected to the power plant area via specified fuel gas piping network. Various control valves will be installed in the main fuel gas pipeline network. This fuel gas will be used in firing Boiler for heating hot water, generate steam and electricity.

## Boiler

When reached the Power Plant, the fuel gas will be regulated streaming through an intake valve to a Gas Heater for reheating as well as to exchange heat with the flue gas. The incoming fuel gas will be heated from around 55°C to 150°C; which will then connect to the Burners (equipped with LNG Ignition Device) for the Boiler via 6 diversion branches. Preheating the fuel gas before it is fed to the burners can improve the efficiency. In total, there are 6 unit of Burner (3 nos. at upper layer and 3 nos. at lower layers) at outer wall of the Furnace. Oxygen will also be supplied to the Burner from the Air Intake System for the firing. For the ignition, the LNG Ignition Device will be used for very short duration about 1 hour (during start-up) and burn about 360 Nm$^3$/hr LNG or in total about 360 Nm$^3$.

The performances of the Boiler are as below:

| | |
|---|---|
| Boiler Maximum Continuous Evaporation: | 190 t/h |
| Main Steam Flowrate: | 172.2 t/h (THA) - 190 t/h (BMCR) |
| Main Steam Pressure (at exit point): | 13.7 MPa |
| Main Steam Temperature (at exit point): | 540°C |
| Reheat Steam Flowrate: | 136.4 t/h (THA) -149.7 t/h (BMCR) |
| Reheat Steam Pressure: | 2.4 MPa (BMCR at inlet point) ;<br>2.14 MPa (BMCR at outlet point) |
| Reheat Steam Temperature: | 326.7°C (BMCR at inlet point) ; |

| | |
|---|---|
| | 540°C (at outlet point) |
| Economizer Water Temperature: | 246.8°C (BMCR at inlet point) |
| Air Intake Temperature: | 30°C (Ambient Air) |

**Main Steam and Reheated Steam System**

High pressure saturated steam will be generated in Boiler Drum and to produce high temperature (HT) and high pressure (HP) steam at Superheater. In the Boiler Drum, steam and water mixture coming from the water wall tubes will be separated. It ensures that only steam (no water) will be directed to Turbine. For separation purpose, it contains large number of centrifugal separators and mist arrestors to capture water particles in the steam. Steam from the Drum passes to the Superheater coils placed in the flue gas path. The steam temperature increases from the saturation temperature until the maximum temperature required for its operation. The superheated steam then finally goes to the Steam Turbine to drive the blade for rotating at speed 3000 rpm and 50 Hertz which will generate 11kV electricity. Final superheater steam temperature is 540°C and superheated steam pressure is about 13.7 MPa.

Steam from the exhaust of the first stage Turbine goes back to the Boiler for reheating and will be returned to the second stage. Reheater coils in the flue gas path does the reheating of the returned steam. The reheat steam is at a much lower pressure than the superheated steam, but the final reheated temperature is the same as the superheated steam temperature. Reheating to high temperatures will improves the output and efficiency of the Power Plant.

There are two sets of Forced Draft (FD) Fans, which will take in and pressurize external air, and send it to Air Preheater for preheating. The preheated air will enter Burners at outer wall of the Boiler Furnace via piping. Fuel gas will be fired in the Boiler Furnace to generate high temperature (HT) flue gas, which will pass through Superheater Coils, High Temperature (HT) Superheater, Low Temperature (LT) Superheater, Reheater, Economizer, Air Preheater, Fuel Gas Heater (Heat exchange with fuel gas), and then to Induced Draft (ID) Fans (2 sets), which will release flue gas through a concrete Stack (80m height and internal diameter of 3m) to the atmosphere.

**Boiler Feedwater System**

The feed water is put into the Steam Drum via Feedwater Pump. 2 sets of motorized Feedwater Pump will be provided for the Boiler. In the Steam Drum, the feed water is then turned into steam from the heat of the coils around Superheater. After the steam is used it is then dumped to the main Economizer (or Heat Exchanger). The Economizer will capture the waste heat from boiler stack gases (flue gas) and transfer it to the boiler feedwater. This raises the temperature of the boiler feedwater, lowering the needed energy input, in turn reducing the firing rates needed for the rated boiler output. From the Economizer it is then pumped to the Deaerated Feed Tank. From this tank it then goes back to the Steam Drum to complete its cycle. The feed water is never open to the atmosphere and normally known as a closed system.

**Steam Turbine Condensate Water System**

The steam exhausted from the low-pressure turbines is condensed in the main Condenser and collected in the main Condenser Hot Well. The main Condenser also receives drainage from various system and equipment drains. The condensate that is collected in the Hot Well is removed by the Condensate Pumps. The Condensate Pumps provide the driving force for the condensate flow through the Steam Jet Air Ejector (SJAE) condensers and Steam Packing Exhauster. The SJAE Condensers and the Steam Packing Exhauster heat the condensate flow while cooling their respective process flows. Condensate flow is next directed to the condensate deep-bed Demineralizers which purify the condensate water through ion exchange and filtration. Condensate Booster Pumps take suction from the Demineralizers and maintain the driving force of the condensate flow through strings of low pressure Feedwater Heaters.

The Feedwater Heaters take extraction steam and hot water from the main Turbine and Moisture Separator Reheaters to further raise the condensate temperature. The Feedwater Pumps take suction from the low-pressure Feedwater Heaters and develop system pressure high enough to inject into the reactor pressure vessel. The amount of feedwater flowing to the reactor pressure vessel during normal operations is controlled by varying the speed of the turbine driven reactor feed pumps. During very low power operations the feedwater flow rate is maintained by RFP Start-up Level Control throttle valves. The discharge of the feedwater pumps is directed to the two high pressure feedwater heaters. This final stage of feedwater heating is provided by extraction steam from the high-pressure Turbine.

High temperature and pressure feedwater are directed to two feedwater lines that penetrate the primary containment. These feedwater lines further divide into a total of four reactor pressure vessel feedwater spargers. The feedwater spargers distribute feedwater within the reactor pressure vessel annulus where it is mixed with water rejected by the Steam Separators and Steam Dryers.

The Condensate and Demineralized Makeup Water system consists of a series of storage tanks, transfer pumps, and demineralizers providing reactor grade makeup water to a variety of balance of plant systems. Demineralized water is produced by a series of Demineralized Makeup Water Demineralizers and Transfer Pumps to maintain the Demineralized Water Storage Tank (DWST) full of water. Should the Condensate Storage Tank (CST) level drop below predetermined water levels demineralized water is automatically transferred from the DWST using the Demineralized Water Transfer Pumps. The CST supplies water to the Condensate Transfer Pumps, the Hydraulic System Pumps, and the condenser makeup.

The main Condenser receives cooling water from the Cooling Tower or Circulating Water System. Circulating water flows through the condenser tubes, condensing the low-pressure turbine exhaust steam surrounding the tubes.

**<u>Demineralized Water Makeup System</u>**

The performance of Boiler and Cooling Tower might be affected by deposit of scales and corrosion. Hence, demineralized water shall be made up for the loss in steam and water system of power plant. Demineralization Water Treatment Plant with capacity of 50 $m^3$/hr will be designed for the demineralize raw water. Where, suspended solids such as sand and silt, the cations and anions which are dissolved salts and minerals need to be removed; excess $CO_2$ from the water need to be degassed; and microorganisms (bacteria) need to be eliminated as much as possible. These can be removed by Reversed Osmosis, Activated Carbon and Electro-Deionization (EDI). Electro-Deionization (EDI) technology will be used to remove residual salts and ionizable aqueous species such as carbon dioxide, silica, ammonia and boron from the water sources. After the treatment, the accepted quality of demineralized water will be used as make up water for the Condenser to mix with condensate water there. **Table 5-6** summarize the demand of make-up water.

**Table 5-6 Make-up Water**

| No. | Make-up Water for Components | Flowrate ($m^3$/hr) |
|---|---|---|
| 1. | Evaporation via Cooling Tower | 103 |
| 2. | Blown-off (mist) via Cooling Tower | 8 |
| 3. | Blowdown from Circulating Water System | 26 |
| 4. | Other Misc. | 15 |
| | Total | 152 |

**<u>Water Circulating System</u>**

The Condenser shall be used to cool exhaust steam by circulating water, for which Cooling Tower and circulating water pump shall be arranged. Circulating water return from the Condenser shall be led to Cooling Tower for cooling purpose. After that, water shall be sent to blowdown water tank, and pressurized by circulating water pump to lower part of the Condenser by circulating water supply pipe, and then to water chamber of the Condenser. After heat exchange in the Condenser, water will be led out from upper part of the Condenser to circulating water return (repeatedly). Raw water will be sourced from the Syarikat Air Terengganu (SATU) to make up steam and water loss in the Cooling Tower. A 100$m^3$ Raw Water Tank will be provided at site. The quantity and quality of water is as tabulated in **Table 5-7**.

**Table 5-7 Circulating Water Flowrate and Quality**

| No. | Components | Water Flowrate ($m^3$/hr) | Required Water Quality |
|---|---|---|---|
| 1. | Turbine condenser cooling circulating water | 9,255 | Temperature ≤35°C<br>Pressure 0.25 MPa<br>Suspended Solid <100 mg/L |
| 2. | Turbine oil cooler cooling water | 120 | |
| 3. | Generator air cooler cooling water | 300 | |
| 4. | Others Misc. | 154 | |
| | **Total** | **9,829** | |

**Power Generation System**

The generator shall be driven by high speed rotation (3000 rpm) of steam turbine to generate power. The generator is equipped with excitation system and output device at output voltage of 11KV. The electric power shall be boosted to 33KV by one set of booster transformer, and to 275/33KV substation of the steel plant, and then to TNB power grid.

In summary, electrical energy generation using steam turbines involves three energy conversions, extracting thermal energy from the fuel and using it to raise steam, converting the thermal energy of the steam into kinetic energy in the turbine and using a rotary generator to convert the turbine's mechanical energy into electrical energy.

**Air Pollution Control**

For the boiler, a 80 m heights stack with internal diameter of 3 m will be constructed for gas emission. Since the proposed power plant is using pre-treated waste gas (Blast Furnace Gas and Converter Gas) as burning fuel and low NOx Burner will be used in firing the Boiler, hence, Eastern Steel is committed that the emission quality will always comply with the Environmental Quality (Clean Air) Regulations 2014, Third Schedule (Regulation 13), Category A Heat and Power Generation for Boilers. The stack emission quality guaranteed by the engineering design team; MCC Capital Engineering & Research Incorporation Limited are as below:

**Table 5-8 Achievable Emission Quality**

| Parameter | Unit | *Stack Emission Quality - Heat and Power Generation for Boilers | Monitoring Requirement |
|---|---|---|---|
| Oxygen ($O_2$) Reference | % | 3% | 3% |
| Dust as Total PM | mg/Nm$^3$ | 5 | Periodic or Quarterly |

| Parameter | Unit | *Stack Emission Quality - Heat and Power Generation for Boilers | Monitoring Requirement |
|---|---|---|---|
| NOx as $NO_2$ | | 350 | **Continuous Monitoring (CEMS) |
| SOx as $SO_2$ | | ***10 | Not Available |
| CO | | 50 | **Continuous Monitoring (CEMS) |

Note:

1. The emission shall be calculated in term of mass of pollutant per volume of the waste gases expressed as $mg/m^3$ at standard conditions for temperature and pressure for dry gas (volume at 273K, 101.3 kPa).
2. *Stack Emission Quality will comply with the Environmental Quality (Clean Air) Regulations 2014, Third Schedule (Regulation 13), Category A. Heat and Power Generation for Boilers. The oxygen reference ($O_2$) for Gaseous Fuels is 3%.
3. **Averaging time for continuous monitoring is 30 minutes.
4. ***$SO_2$ emission limit as proposed in the Best Available Techniques Guidance Document On Power Generation issued by DOE Malaysia.

The detailed engineering design specification will be provided by the professional engineer via Written Notification to DOE not less than thirty days before the commencement of the system.

**Water Pollution Control**

Wastewater to be generated are:

- Intermittent effluent discharge from Boiler Drum (Intermittent Blowdown (IBD) Flash Tank): about 3 $m^3/h$, which mainly is concentrated salt with no toxic substance. The IBD Flash Tank is to remove sludge from the Boiler. To maintain the pH level of boiler water, phosphate dosing is done in drum.
- Intermittent discharge from Demineralisation Water Treatment Plant: about 120 $m^3/h$, which is mainly backwashed water of the equipment with high suspended matter and no toxic substances.
- Continues discharge from Water Circulating System (from the Boiler Drum to the Continuous Blowdown (CBD) Flash Tank): 40 $m^3/h$, which is mainly concentrated water in the Cooling Tower, contain salt and suspended matter and no toxic substance.
- Other discharge from sullage and sewage will be treated in the sewage treatment plant: 5.5 $m^3$/day.

All the effluent discharged will be connected to the existing Retention Pond within the IISM. Where, further cooling and sedimentation process will take place prior to release into Sg. Teluk Kalung. In addition, the plant operator will carry out periodic (daily or weekly) testing on the effluent discharge quality. The final effluent discharge quality will comply with the Environmental Quality (Industrial Effluent) Regulations 2009. Whereby, sewage discharge quality will be complied with the Environmental Quality (Sewage) Regulations, 2009.

**Noise Pollution Control**

Noise control measures have been taking into account during the planning stage by strategically arrangement of the equipment layout, where the main noise sources (such as steam turbines, generator sets, cooling towers, etc.) in the middle of the plant. Besides, engineering control will be applied on the noisy equipment, which will be equipped with an acoustic enclosure and vibration reduction measures to control the noise value (1m from the sound source) within 85dB(A). The requirements of Factories and Machinery (Noise Exposure) Regulations 1989 will be complied.

**Safety Precaution & Environmental Protection Measures**

As a safety precaution measure, nitrogen gas purging system will be equipped and carbon monoxide (CO) gas detectors will be strategically installed at high risk areas within the power plant such as Boiler and Control Room. The safe level shall not more than 0.3 mg/kg CO. If not, when there is a leak detected, alarm will be activated, and all the people shall be evacuated follow the evacuation route.

Comprehensive training will be provided for boiler operators. Strict implementation of operating procedures, implementation of certification, especially boiler ignition, start-up, shutdown maintenance, etc. these must be strictly in accordance with the operating procedures.

In addition, CEMS will be installed at the stack to ensure the CO and $NO_2$ are always comply with the Environmental Quality (Clean Air) Regulations 2014. Meanwhile, periodic (every 3 month) monitoring shall be conducted for the stack emission.

#### 5.5.2.2 Slag Metal Recovery Plant

The proposed Slag Metal Recovery Plant with capacity of 300,000 MT/year is located next to existing SMP. Steel slag metal recovery line is used to recover metal from the converter slags. It is a simple process involve only cooling of slag metal by using water and physical separation in later stage. No chemical is added.

Process main components to be constructed are four (4) kits of cooling devices and supporting electrical automation control and water recycling treatment system. **Figure 5-7** show the layout of the Slag Metal Recovery Plant. At every once time, maximum two (2) cooling devices will be work simultaneously while the rest in standby mode. The principal of this process is based on hydrolysis characteristics of free calcium oxide (f-CaO) and free magnesia (f-MgO) in steel slags.

When steel making slag generated from steel making plant, it will arrive the slag span via the cross train. The slag ladle will be transported to the steel slag metal recovery plant, then lifted using crane and will be poured into the cooling device and measures shall be taken once one ladle is poured to prevent hardening. After the device is full, the cover will be closed. The automation system will be controlled the water spray, steam exhaust and hydrolysis process take place. Pyrolytic steel slags will be removed by excavator and then loaded into the truck transport to the storage area where physical metal separation taking place by using Magnetic Separator.

With the proposed Slag Metal Recovery Plant, 300,000 MT/year slags (from converter slags and steel ladle casting slags) which originally will be disposed will be recovered as much as possible the metal substance and returning into the sintering process. While the remaining non-metal slag will be sold as by-product. It can be used as road base course material and as an aggregate for asphalt concrete.

Since water is the main requirement for the cooling of slag, water recycling treatment system will be built at site. The system will have design maximum water consumption of 150 $m^3$/hr with water pressure 0.35-0.40 MPa. Due to evaporation loss, top-up water is required (about 70.93 $m^3$/hr). At site, the water level in the holding tank will be maintain at 0.7 m. Water consumption for each cooling is 30 $m^3$/hr - 60 $m^3$/hr (max.). Water feed return is considered based on 30%. This returned water is relatively clean and only need to remove suspended solid (SS). The SS can be removed in the sedimentation pond. Cooling water will be recycled following the water saving principle. Technically, no water discharge from the system. Sludge will be accumulated over the time and this need to be dewatering by using filter press and returned into sintering process. Hence, no waste will be generated.

#### 5.5.2.3 Billet Plant

Billet Caster refers to the process to produce the continuous casting billets which means the same process as in Continues Caster (CC). Molten steel from the Steel Converter is sent to CC where it is formed into semi-finished steel products by means of a mould of desired shape. The steel is normally cast in the form billets as raw materials for downstream production activities. For this expansion of Billet Plant, one set of six-strand billet caster and auxiliary facilities will be additionally equipped in Steel Making Plant and Continuous Casting workshop. The caster can produce 1 mil MT/year of continuous casting billets. **Chart 5-5** shows the operational flowchart for the Proposed Billet Caster and **Figure 5-8** show the arrangement of the Billet Plant.

The technical specification of the Caster is tabulated in **Table 5-9**, while **Table 5-10** summarizes the product specification.

**Table 5-9 Main Technical Parameters of Billet Caster**

| Items | Technical Parameter |
| --- | --- |
| Model of caster | Full-arc billet caster |
| Strand number | 6 strands |
| Gap between strands | ~1350 mm |
| Basic arc radius | 8m |

| Items | Technical Parameter |
|---|---|
| Casting cross section (mm) | 150×150, 120×120 |
| Cut to length (m) | 6~12 |
| Ladle turntable | Type: butterfly shape, with single lifting and independent weighing systems. The revolving angle is not limited, and the ladle covering device is equipped. |
| Protective casting | Ladle long nozzle protection + argon sealing<br>Sizing nozzle (immersion type nozzle of tundish is reserved) |
| Working capacity of tundish | ~32.0t, height of working liquid level: ~800mm<br>~34.0t, height of overflow liquid level: ~900mm |
| Cart type of tundish | Semi-gantry type |
| Support of tundish | With hydraulic lifting and weighing system and transverse trimming function |
| Control of steel flow of tundish: | Automatic control of stopper is reserved. |
| Mould: | Continuous taper tube type mould. Length of copper pipe: 900mm |
| Automatic control of liquid level of mould: | Detection of radioactive source + control of casting speed (control of stopper is reserved) |
| Electromagnetic stirring: | External type mould is reserved for electromagnetic stirring. |
| Oscillation of mould: | Semi-plate spring type electromechanical oscillation (at inner arc side) |
| Secondary cooling: | Include 4 areas, wherein areas 1~2: full water; areas 3~4: mist cooling |
| Withdrawal and straightening machine | Single-stand tongs type withdrawal and straightening machine |
| Cutting type: | High-speed flame cutting |
| Type of dummy bar: | Rigid dummy bar |
| Pre-cutting roller | Free roll + pinch roll |
| Delivery table | Post-cutting flow separating central drive roller + whole-length roll |
| Billet discharging type | Tilting gear, bidirectional transverse billet shifter, electric stepping type turnover cooling bed, casting billet collecting bed, accident billet storage bench, conveying roll (to next bay), and reserved hot conveying roller |

Source: Eastern Steel, 2019.

**Table 5-10 Billet Product Specification**

| Specification | Product Grade (Plain carbon structural steel and low alloy steel) | |
|---|---|---|
| | 150x150 Billet | 120x120 Billet |
| Thickness of billet (mm) | 150 | 120 |
| Width of billet (mm) | 150 | 120 |
| Unit weight (kg/m) | 171 | 109.44 |
| Cut to length (m) | 6~12 | 6~12 |
| Cut length weight (kg) | 1026~2052 | 657~1313 |
| Average capacity of ladle (t) | 70 | 70 |
| Strand number of caster | 6 | 6 |
| Average casting speed (m/min) | 2~2.3 | 3.1~3.6 |
| Steel passing amount (kg/min) per strand | 342~393 | 339~394 |
| Hourly output of caster (t) | 123~142 | 122~142 |
| Average casting time (min) | 34~30 | 34~30 |

Source: Eastern Steel, 2019.

The main process features of the caster are: -

a) Automatic monitoring of mould liquid level

Maintaining of stable liquid level in the casting process is the perquisite of obtaining optimum billet surface/interior in the casting process. The fluctuating of liquid level may be minimized by the methods of automatic control of liquid level and casting speed-control loop, and the working conditions of operators can be improved, so as to eliminate the steel leakage accidents due to disturbance on persons. The automatic detection of liquid level and the automatic control of liquid level of stopper are also reserved.

b) Large-capacity T-shaped tundish

The T-shaped tundish adopting optimized design is internally designed with optimum flow field distribution and is also convenient for the building of slag retaining wall and weir. The steel liquid in tundish shall be designed with enough depth, so as to ensure the enough floating-up time of inclusions in hot metal, and also ensure the stable liquid level of hot metal in tundish.

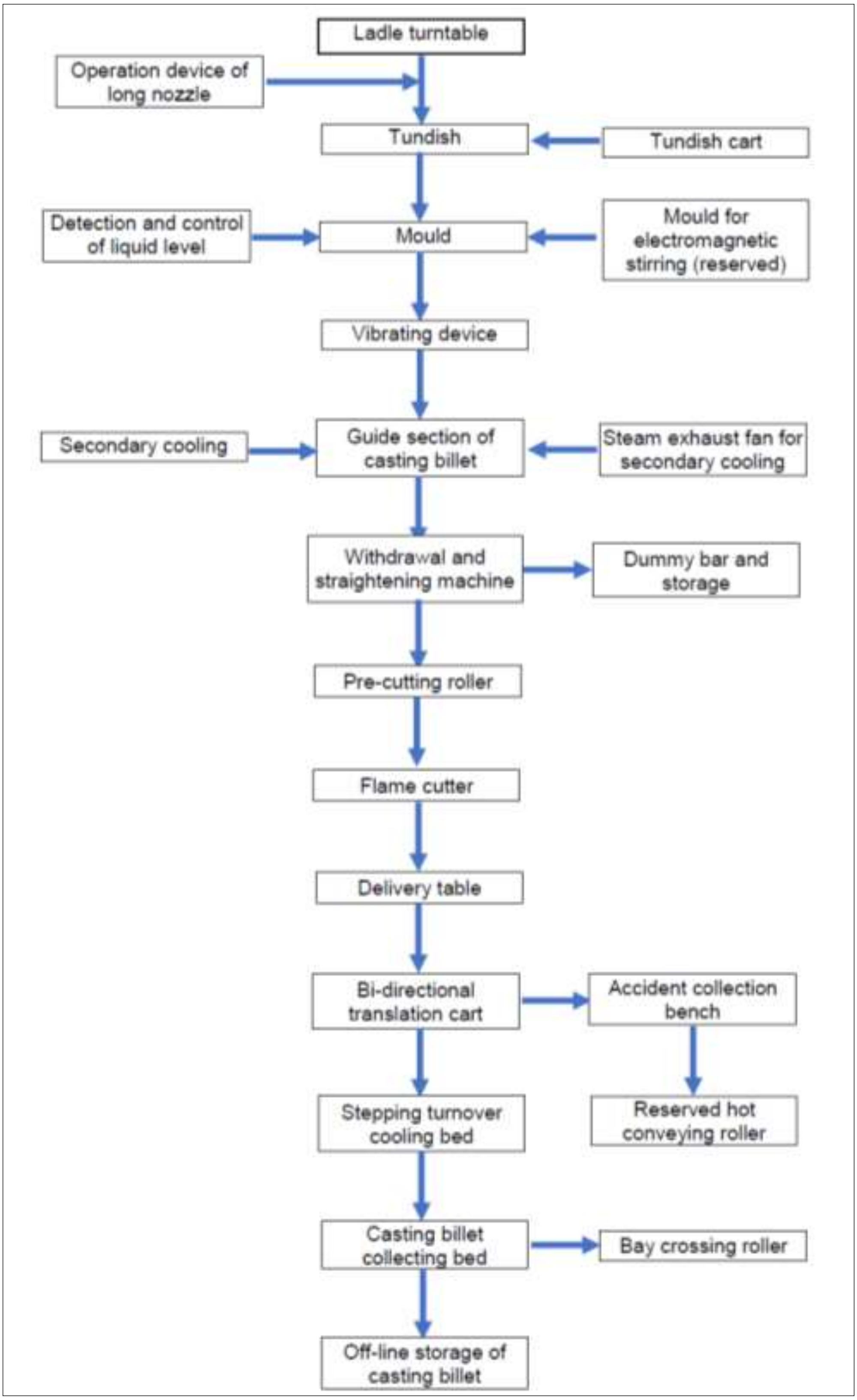



**Chart 5-5 Proposed Billet Caster Operation Flowchart**

c) Secondary cooling

At the same time, the secondary cooling is controlled by areas, and the casting billet is uniformly cooled by casting speed control model in the casting process; the temperature rise is low, to reduce the forming of cracks.

d) Protective casting

There is one long nozzle between hot metal ladle and tundish, which is sealed by argon gas. When plain carbon steel is produced, the part between tundish and mould is cast in an open way. When high-quality steel is produced, the immersion type nozzle is adopted.

e) Improving of electric automation control level

The electric automation of caster adopts primary basic automation control, and the interface is reserved. Under the condition of not performing secondary basic automation control, the information of weighing of large ladles and tundishs, casting speed, temperature of tundish, etc. may be transferred to the main control room of converter.

#### 5.5.2.4 Coking Plant

The Proposed 0.8 mil MT/year Coking Plant will adopt a cleaner technology. In which, the new Model QRD-2018 Clean Heat Recovery Coke Oven which has been patented in China (Patent No: ZL01270184.X) will be installed. Where, apart from producing coke as important raw material and fuel for Iron and steel making process and for sintering process; the residual waste heat will be recovered for power generation (2 x 50 MW). However, the proposed waste heat recovery for 2 x 50 MW power generation will only carry out in future (Note: Information not available at this moment and will be submitted later when is ready). Hence, for this EIA study, the Coking Plant will not involve the waste heat recovery and power generation component.

For this EIA study, the Coking Plant will be utilised a set of 8 x 18 holes recovery type coke oven with an annual production of 0.8 mil MT of coke per year (DEIA Y2008 approved for ultimate 2.3 mil MT of coke per year). An estimated 1.57 mil MT/year of pulverized coal is required to meet the coke production.

The main purpose of metallurgical coke is as a fuel and reducing agent for blast furnace smelting, and also used as a proppant and a loose agent for the blast furnace column. The quality of metallurgical coke will directly affect the performance of blast furnace smelting. In general, for every tonne of pig iron, 400 kg to 500 kg or more metallurgical coke is needed.

The new Model QRD-2018 Clean Heat Recovery Coke Oven coking coal has a wide application range and can be used with weakly cohesive coal and anthracite coal in combination with other coke coals, and the ratio of the coking coal can be 40-50%. This will be saving coking coal resources. The coke oven uses coke oven gas produced by coking and various materials to burn and heats the carbonization chamber on the top of the furnace, the furnace walls on both sides and the bottom of the furnace, and the coke oven gas and various substances generated in the coke are in the furnace. Burning out can eliminate harmful by-products such as ammonia, naphthalene and sulfur produced by conventional coke ovens, and provide a direct heat source for the coking process. The negative pressure operation in the whole coking process reduces the emission of pollutants in the coking process and coal charging and coking process. At the same time, the coking adopts the pre-tanning fast side loading coal and the flat coke process, which can improve the coke quality and reduce the coke dust. As such, this new model is better in protecting the environment.

Coke oven is an oven for the conversion of coal into coke by heating the coal in the absence of air so as to distil the volatile ingredients. Blended pulverized coal will be transferred to coal storage bunker in the coke oven battery. Charging of coal into the coke oven will form peaked piles. When the charging process is almost done, the levelling door at the top of the oven door on the pusher side ("chuck door") is opened. The levelling bar from the pusher is moved back and forth across the peaked coal piles to level them. This levelling process will provide a uniform coking and clear vapour direction for the gases evolved to the gas collection system. The chuck door is then closed.

After the coke oven is charged with coal, the cover of the charging hole is replaced and sealed with a wet clay mixture. Coke oven is ready for thermal distillation process. A set of 8 x 18 holes recovery type coke oven will be utilised in Coking Plant.

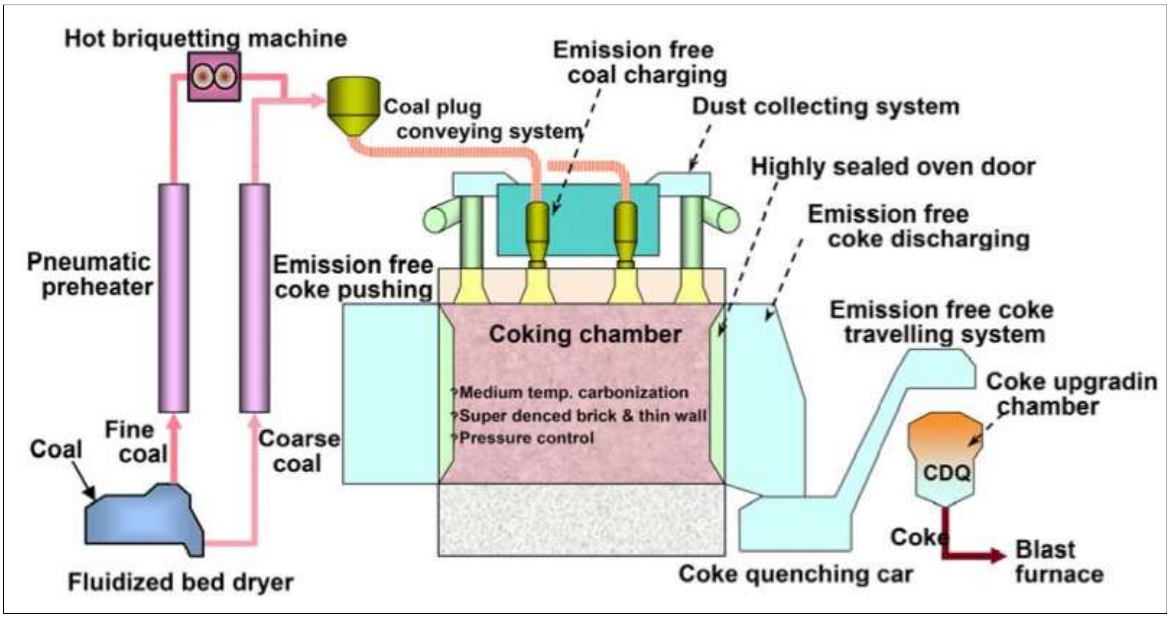
At the end of the coking, doors on both ends of the oven are removed. Coke guide and quenching car are moved into its position. The coke is pushed from the oven by a ram extended from the pusher through a coke guide into the quench car. The quench car will carry the coke into the quench tower for cooling.

For this system, Coke Dry Quenching (CDQ) will be installed. CDQ is a heat recovery system to quench red hot coke from a coke oven to a temperature appropriate for transportation. It is an energy saving system in which, during quenching process, sensible heat of the red-hot coke is recovered and utilized for power generation or as steam. The advantages of CDQ are:

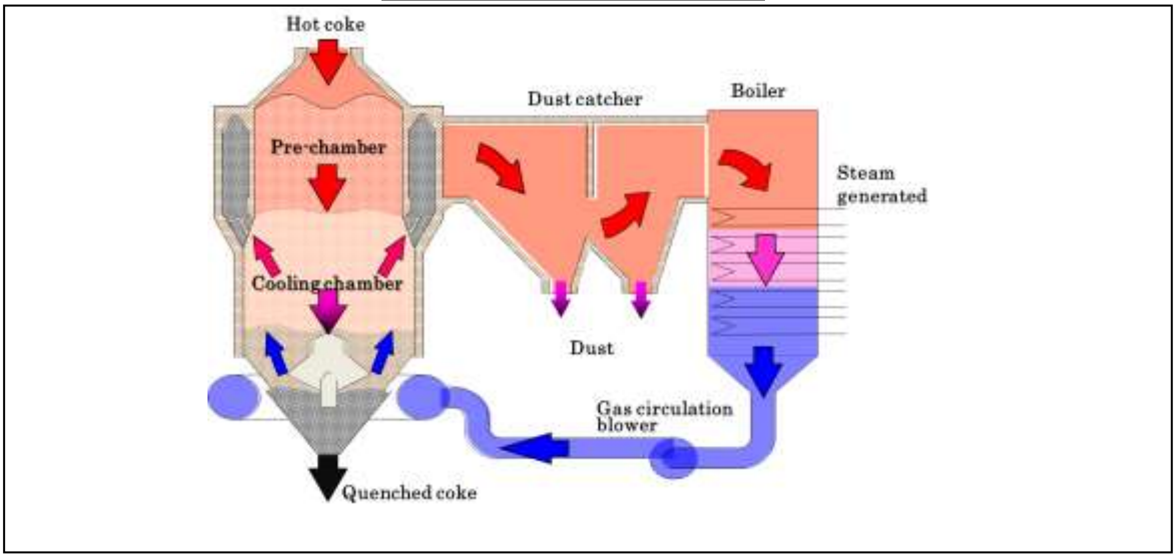
- It is a gradual coke quenching system which can improves coke strength and coke size distribution in the process of descending coke packed bed resulting in a cost reduction with raw materials for Coke Oven.
- The CDQ coke has lower moisture content (0.1 to 0.3%) than Coke Wet Quenching coke (2 to 5 %), as such the coke ratio of Blast Furnace can be reduced.
- Combustible component and coke dust in circulating gas are burned by blowing air into the gas, and so the temperature of the circulating gas can be raised. Thus, steam generated by the waste heat boiler can be increased.

Since the quenching process is adopted, and a baffle dust removing device is assembled on the quenching tower, the waste gas emission will be cleaned before released. In future, the waste gas will be used in the 2 x 50MW Power Generation, in which the exhaust gas purification adopts semi-dry desulfurization and dust removal process.

**Coking Process**




**Coke Dry Quenching (CDQ)**




*Note: For illustration purpose only*

**Chart 5-6 Typical Diagram for Coking Process & CDQ**

The layout is illustrated in **Figure 5-9**. In summary, the operation of the Coking Plant can be divided into 3 main components; namely Coking Section, Waste Heat Power Generation Facility (Future Operation) and Air Pollution Control System. The detailed description for each section is as described in the following:

| No. | Main Components | Description |
|---|---|---|
| **A** | **Coking Section** | |
| 1. | Coal Preparation | Coal storage, coal receiving, coal proportioning and blending, crushing<br><br>The imported coal will be stored at the designated coal storage area. For the Project, 3600 $m^2$ (0.36 ha) will be allocated for coal storage area. It can store up to 78,000 MT coal for 20 days supply.<br><br>For the preparation of coal, different types of coking coal in the coal storage yard are pushed into the coal pit by the loader. Hard coal such as anthracite should be pulverized at primary crushing machine (Model PCFK 1820 200t/h) and then regrind with other coal types in a certain proportion before sent to secondary crushing machine room. Where, the coal will be hammering by PCFK 1820 counter-attack hammer with 300 t/hr. (2 units: 1 standby)<br><br>Weighed feeding electronic belt scale is installed under the coal pit of coal blending, and the amount of coal and coal blending ratio are computerized control. A dust collector is provided at the coal pit for controlling dust emission.<br><br>An electromagnetic iron remover is equipped at top inlet of the crushing machine where the belt conveyor is conveying to remove metal impurities such as iron in the coal. At the secondary crushing machine, the clean coal is crushed to less than <3 mm, accounting for more than 90%, to meet the requirements of tamping coke coal.<br><br>Coking coal of acceptable particle size is then sent to the coke oven coal tower by a belt conveyor for use in the coking process. |
| 2. | Coking Process | Patented Model QRD-2018 Coke Oven (Patent No: ZL01270184.X) will be constructed and installed (such as coke oven body, gas collection pipe, chimney, coal tower, tamping station, coal loading, push coke etc.).<br><br>Coking system consist of 8 coke ovens and 2 unit of 900 tonne coal tower; each coke oven has 18 holes. For every 2 set of coke ovens (2 x 18 holes), 1 waste heat boiler will be provided. Hence, in total 4 waste heat boilers and 2 x 50 MW steam turbine generator will be installed. The 8 coke ovens share 2 chimneys with a height of 70m, arranged on one side of the coke oven, and a set of dry |

| No. | Main Components | Description |
|---|---|---|
| | | quenching system (CDQ) at one end of the coke oven. The quenching tower is 36m high.<br><br>The coke oven coking coal has a wide application range and can be used with weakly cohesive coal and anthracite coal in combination with other coke coals, and the ratio of the coking coal can be 40-50%, saving coking coal resources.<br><br>The coke oven uses coke oven gas produced by coking process and various materials to burn and heats the carbonization chamber on the top of the coke oven, the coke oven wall on both sides and its bottom. The coke oven gas and various substances generated in the coke are confined in the coke oven. High temperature burning in this coke oven model can eliminate harmful by-products such as ammonia, naphthalene and sulphur produced by conventional type coke oven, and provide a direct heat source for the coking process. In addition, the negative pressure operation in the whole coking process reduce the possibility of emission of pollutants from the coking process and coal charging process. At the same time, the coking adopts the pre-tanning fast side loading coal and the flat coke process, which can improve the coke quality and reduce the coke dust for better environment protection. |
| 3. | Coke Dry Quenching (CDQ) | In the Coke Dry Quenching process, coke is cooled using an inert gas such as nitrogen gas as cooling medium in dry cooling plant, instead of cooling by sprayed water which results in high $CO_2$ emissions and thermal energy loss. This process allows the recovery of the thermal energy in the quenching gas which can then be used to produce steam and electricity, for the preheating of coking coal.<br><br>In addition, by adopting the dry quenching method, it saves water (around 0.5–1.0 $m^3$ per ton of gross coke) hence no water pollution issue is anticipated. This technology is known to produce stable coke quality and energy efficiency.<br><br>Coke particle diameters range from fine dust to a maximum size of 150 mm of maximum lumps. To cool coke particles as uniformly as possible in the furnace, they should be charged into the furnace with a proper particle size distribution in both circumferential and radial |

| No. | Main Components | Description |
|---|---|---|
| | | directions. A rotating coke bucket that rotates and collects the coke particles discharged from the coke oven is adopted to make uniform the particle size distribution in the circumferential direction.<br><br>The dust emission volume from CDQ is less than 3 g/t-coke, besides, new type charging equipment, which is covered with the screen. The inside dust is suctioned to the de-dusting facility. Therefore, it achieves further reduction of dust emission from the CDQ. |
| 4. | Sieve Coke (Screening Process) | Loading of coke, conveying, screening, storage and transportation<br><br>The screening coke section is mainly consisting facilities such as drying coke, elevated stand, transfer station and sieve coke building. It is used to complete the classification, storage and transportation of coke (or coke after the dry quenching process) that will be dried on the drying rack.<br><br>The coke produced by the coke oven is placed on the drying rack after being quenched, scraped into the belt conveyor by the scraper, and then sent to the screen coke building by the belt conveyor. The coke after coke quenching is also fed to the coke belt conveyor by a belt conveyor.<br><br>The coke is sieved in a sieve coke building through a single layer of coke grate sieve, and the sieve material (>80 mm coke) passes through the coke cutter and enters the lower double-layer vibrating screen together with the sieve material, and is divided into >20 mm. 8 to 20 mm and <8 mm three. The sieved coke enters the buffer tank of the sieve coke building. The buffer bin should also consider the storage of large coke (>80mm). The coke of 20-80 and 8~20mm can also be sent to the blast furnace and other sections through the belt conveyor. The coke in the buffer tank can be loaded by truck.<br><br>There are two sets of single-layer sieving screens, cutting coke machine and double-layer vibrating screens in the sieve coke building. At any one time, one in operation while the other in standby mode. The equipment is equipped with a closed dust cover and a sieve funnel for easy maintenance. |
| **B** | **Waste Heat Power Generation Facility (Future Operation)** | |

| No. | Main Components | Description |
| --- | --- | --- |
| 5. | Waste Heat Boiler | Hydrogen gas content in the coke oven gas generated from the coking process is more than 50%, which will become steam after combustion. The coke oven gas temperature is about 1000 - 1150°C, and the heat is recovered by the waste heat boiler to produce steam for steam turbine generator to generate electricity.<br><br>Each waste heat boiler will be equipped with one set of desulfurization and dust removal system. |
| 6. | Power Generation System | 2 x 50 MW steam turbine generator room, deaeration pump station, desalination pump station, electricity substation etc.<br><br>Projected ~758,105,700 kWh of electricity will be generated in a year. In which, 112,091,943 kWh will be used internally for the Proposed Coking Plant and the remaining of 646,013,757 kWh will supply for the other plants in IISM. |
| **C** | **Air Pollution Control System** | |
| 7. | Desulphurization | Flue gas treatment process after waste heat boiler will adopt the semi-dry desulphurization technique. Mainly to remove/ capture the sulphur dioxide from the waste gas by using gypsum so that acidic gases such as $SO_2$, $SO_3$ and HF react to form by-products such as $CaSO_3$ and $CaSO_4$. Hence, no $SO_2$ emission or only minimal $SO_2$ residue emission. After the Desulphurization treatment, the flue gas will be further treated in the dust collector before released through a stack.<br><br>Subsequently, desulphurization gypsum or FGD gypsum will be generated. About 19,890 Tonne/year of FGD gypsum is to be generated. This FGD gypsum is a by-product, which can be used in making building material and used by other industries such as cement retarder, desulfurization gypsum building products, model making, medical food additives, sulfuric acid production, paper filler, paint filler, etc. |
| 8. | Dust removal | Coal dust removal, push coke dust removal, screen storage coke building dust removal, coal preparation and screening coke transfer station dust removal, dust removal in one crushing machine room, dust removal in secondary crushing machine room, dust removal after flue gas desulfurization of waste heat boiler. |

**Air Pollution Control Measures**

For coal transfer station, the crushing room coal transfer path is designed in an enclosed building to avoid dust from escaping to the environment. In order to eliminate the dust which is produced during the crushing process, dust trap is established at the coal crusher exit point and the conveyer transfer point. The dust will enter the explosion-proof pulse bag dust removal system for removal to less than 30 mg/m$^3$. There are several conditions used to control the dust emission to the environment during coke oven operation as follow:

- Coke oven battery – Uses spring and cut resistance, thick frame and protection layer block which provide complete strength and effective fire protection.
- Burning of cleaned COG and cleaned BF gas - Flue gas containing $SO_2$ and $NO_2$ will be emitted through 36 m chimney. Coke Oven Gas will be treated via Desulphurization process and followed by Baghouse. Gas emission will comply to the Environmental Quality (Clean Air) Regulations 2014, where Total PM not more than 10 mg/m$^3$, $NO_2$ not more than 500 mg/m$^3$ and Sulphur compound not more than 800 mg/m$^3$. CEMS will be installed at the stack to ensure the Total PM is always comply with the Environmental Quality (Clean Air) Regulations 2014.
- Since the COG has high calorific value, it will be used as fuel gas for the Waste Heat Boiler. 2 unit of boilers will be installed to generate heat and steam for generating electricity via steam turbine. This steam turbine power generator system component will be installed later. For the boiler emission, it will be designed to comply with the Environmental Quality (Clean Air) Regulations 2014, where $NO_2$, CO and Total PM will less than 350 mg/m$^3$, 50 mg/m$^3$ and 5 mg/m$^3$. Where $SO_2$ will meet the BAT requirement of 10 mg/m$^3$.
- In summary,
  - one (1) unit of Desulphurization and Baghouse System will be installed at Coke Oven
  - two (2) unit of Waste Heat Boiler will be installed at Boiler House
  - one (1) unit of dust collector will be installed at Crushing Room 1
  - one (1) unit of dust collector will be installed at Crushing Room 2
  - one (1) unit of dust collector will be installed at Quenching Tower
  - one (1) unit of dust collector will be installed at Coke Screen House

**Advantages of Model QRD-2018 Coke Oven**

1. Main Features:
   a. Is an innovative clean coke oven technology based on summarizing of all the experience knowhow in China and other countries.
   b. Suitable for producing coke and power generation
   c. Has wide coking range, can be used for weakly cohesive coal, anthracite coal coking
   d. High coke quality and large block size
   e. The production process uses advanced hydraulic tamping with side loading coal and flat joint coke technology.

f. Operating under negative pressure condition in the production process which does not leak smoke and does not produce wastewater with chemical contamination of phenol cyanide. Combine the production processes with environmental protection measures to meet the requirements of cleaner production.
g. Production consumes less water, less electricity, and has the characteristics of energy saving
h. The fume/volatiles produced by coking are completely burned inside the coke oven, recovering heat for power generation or heating.
i. Easy to operate and easy to manage
j. Less coke oven investment, low power consumption, low coke cost, significant economic benefits, good environmental and social benefits

2. Coke oven structure characteristics:
   a. The top of the furnace adopts an arch structure that is provided with an adjustable primary air inlet. The air volume is controlled to maintain a proper coking temperature and reduce the reaction between coal and air. Minimize coke burnout and control coke burnout below 1.5%.
   b. The refractory bricks on the top of the furnace are made of silicon bricks, high-strength insulating clay bricks, heat-insulating bricks and fiber coatings. It ensures that the coke oven can maintain good tightness and heat preservation effect after long-term use, which not only reduce coking time, but also increase coke oven gas collector pipe flue gas temperature. These energy saving measures can increase power generation.
   c. The combustion chamber is located at the bottom of the carbonization chamber and is in the form of an interconnected serpentine structure. The bottom of the design is insulated by heat-insulating bricks. The temperature inside the heat-dissipating port of the coke oven is <200 °C, which reduces the heat dissipation of the coke oven, increases the temperature of the flue gas, and increases the amount of waste heat generated.
   d. The main wall of the carbonization chamber is evenly distributed with various fire passages, and a suction adjusting device is provided, and the whole coke oven is operated under negative pressure. The bricks at the descending fire channel and the four-fold arching point are all arc-shaped, the flow of the flue gas is more stable, and the heating is more uniform. A compressed air purge port is provided at the top of the main wall of the descending fire tunnel to solve the problem of carbon deposition after long-term production of the coke oven.
   e. The latest technology coke oven door adopts vermicular graphite iron RUT-340, to replace the air inlet at the upper door, which is beneficial to reduce the air intake via upper door and reduce the burning loss of coking coal.
   f. The coke oven is provided with iron protection device, including column, upper horizontal tie bar, lower horizontal tie bar, longitudinal pull bar, spring, protection plate.
   g. Coke oven equipped with hydraulic tamping station, coal-loading push-cart car, flat-joint coke car, dry quenching technology, etc.

h. Suction at the coke oven hole and heating temperature can be automatically adjusted by PLC control.
i. For the production of metallurgical coke and construction conditions, the main body of the coke oven is made of silica brick and clay refractory brick.

**Raw Material & Coke Product**

The quantity of main raw materials required is tabulated in **Table 5-11**. **Table 5-12** shows the list of coke products produced and its quality is in **Table 5-13**.

**Table 5-11 Quantity of Main Raw Materials Required**

| No. | Main Raw Materials | Quantity (Tonne/year) |
|---|---|---|
| 1. | Coal (Clean) | 1,104,156 |
| a. | Anthracite | 331,246 |
| b. | Gas Coal | 220,832 |
| c. | Coking Coal | 220,832 |
| d. | Others Type | 331,246 |
| 2. | Lime [$Ca(OH)_2$ 99.8%] | 10,665 |

**Table 5-12 Coke Products**

| No. | Coke Product | Quantity (Tonne/year) |
|---|---|---|
| 1. | > 80 mm Coke | 239,400 |
| 2. | 20 ~ 80 mm Coke | 494,766 |
| 3. | 8 ~ 20 mm Coke | 31,920 |
| 4. | < 20 mm Coke Powder | 31,920 |
| | Total Coke (Dry) | 798,006 |

**Table 5-13 Coke Product Quality**

| No. | Parameters | Quality Index |
|---|---|---|
| 1. | Secondary metallurgical coke ash (Ad) | < 13.5% |
| 2. | Sulphur ($S_{t,d}$) | < 0.80% |
| 3. | Anti-fragility Strength ($M_{25}$) | >93% |
| 4. | Abrasion resistance ($M_{10}$) | <6.5% |
| 5. | Reactive CRI | ≤ 25% |
| 6. | Post-Reaction Strength (CSR) | ≥ 65% |
| 7. | Volatility ($V_{daf}$) | < 1.5% |

### 5.5.3 Proposed Supporting Facilities

#### 5.5.3.1 Production Office

This main operational office known as Production Office will be built at Integrated Iron and steel plant. The Production office will be consisting with 5 floors office. The total floor area for this office is 4609.46 $m^2$. About 250 workers are estimated to occupy this building. A small sewerage treatment plant with 149 PE designed is proposed to be built in this production area. The layout of Production Office is illustrated in **Figure 5-10**.

#### 5.5.3.2 Worker Quarters and Administrative Building

Eastern Steel has proposed to develop worker quarters and administrative building at a part of its land at Lot 60129 Teluk Kalung Industrial Area, Kemaman, Terengganu as shown in overall IISM layout and **Figure 5-11** shows the detailed layout of the proposed living quarter building. The proposed worker quarters will only be occupied by Eastern Steel workers from local. No family will occupy this worker quarter. Total land area for these facilities is about 34.41 acres. The proposed quarters and administrative building are planned to be developed in two (2) phases, Phase 1 and Phase 2. The first phase of the construction consists of one (1) block senior hostel, four (4) block hostel, one (1) block amenity block, one (1) block canteen, one (1) block admin building and one (1) block sport centre (open type). While in Phase 2, another two (2) block of senior hostel and five (5) block hostel as well as parking area will be built. 2500 PE of sewage treatment plant is proposed to be built for this quarter building and 100m of buffer zone will be provided between Living Quarter Building and IISM Future Plant Components.

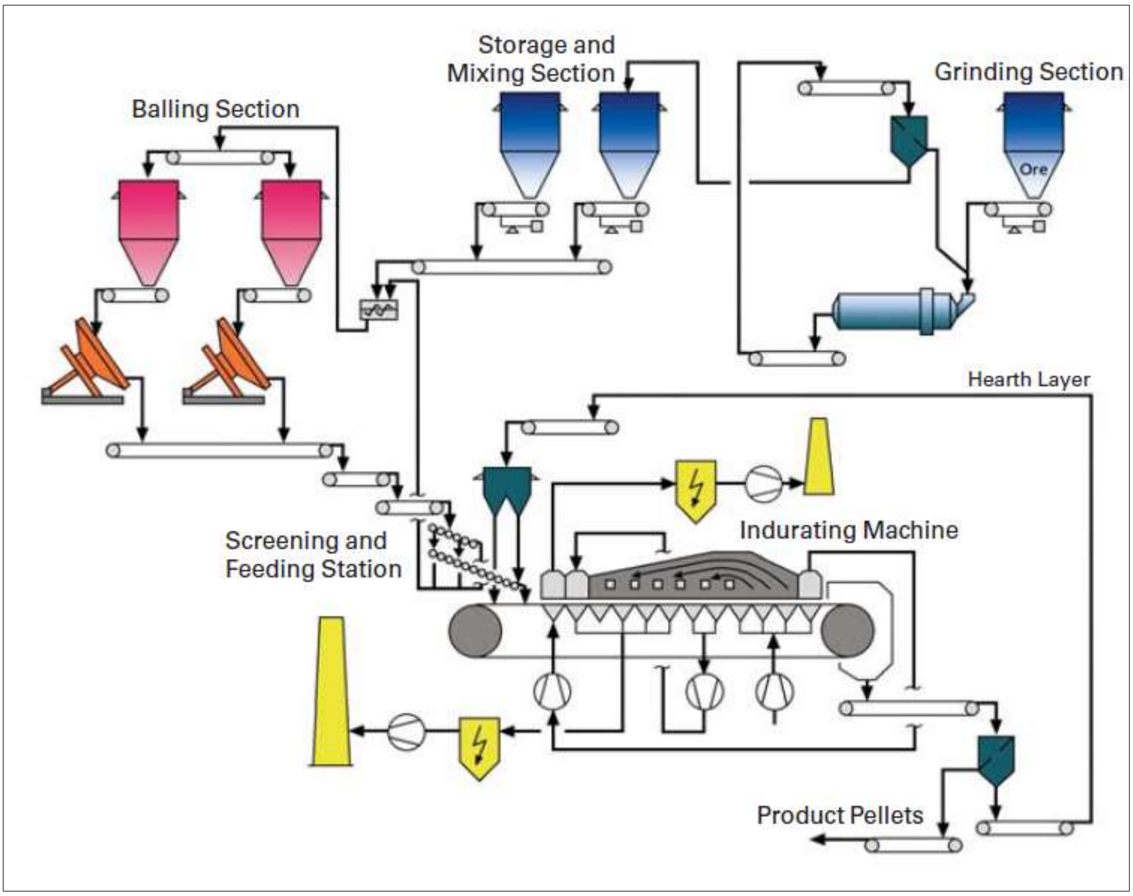
Prior to development of worker quarter and administrative building, Eastern Steel has obtained the approval conditions from Majlis Mesyuarat Kerajaan Negeri Terengganu through letter number UPEN.TR.145/04/686 JLD.5 (42) dated 1st August 2018 and supporting letter from Department of Labour, Terengganu dated 6 May 2019 (**Appendix B**).

### 5.5.4 Future Phase Operation

During this study, Pellet Plant and Rolling Mill still yet to developed. Pellet Plant is an upstream activity for preparation of raw material for Blast Furnace. While, Rolling Mill is downstream activity to further process steel slabs and billets by rolling and finishing operations to produce steel products such as plates, hot rolled coils, cold rolled coils, galvanized coils, pre-painted coil, sections, bars, wire rods and seamless pipes.

#### 5.5.4.1 Pellet Plant

Preparation of iron ore into pellets suitable for use in the Blast Furnace is a process, undertaken in a Pellet Plant. The process involves the binding of fine-grained iron ore with a binder material (often day or bentonite) and rolling of the mix into balls. The balls then pass through a furnace where they are indurated (hardened) and become pellets (measuring diameter, 9.55 to 16.0 mm) for use in the BF.




*Note: For illustration purpose only*

**Chart 5-7 Typical Diagram for Pelletizing Process**

#### 5.5.4.2 Rolling Mill

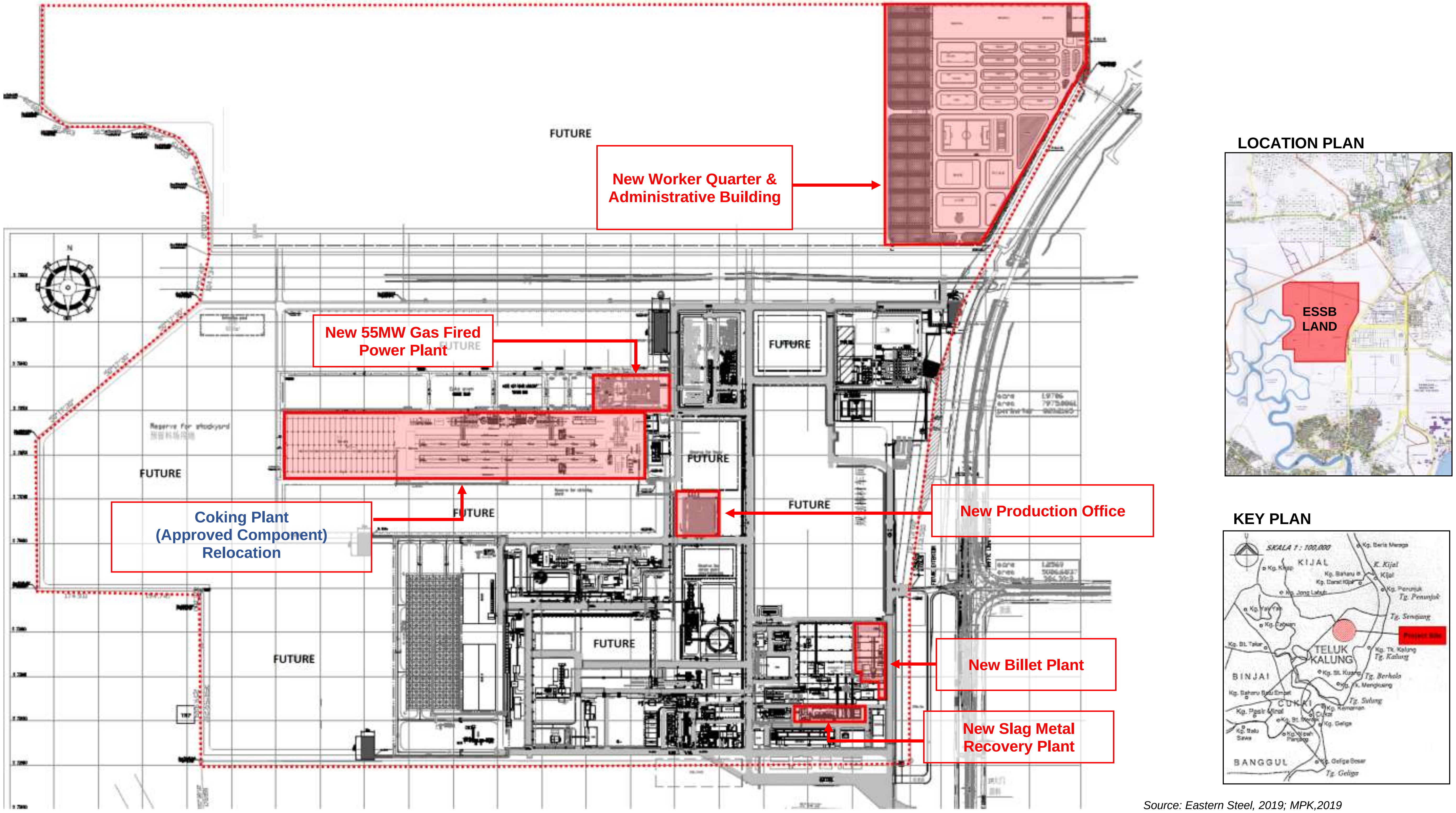
Rolling process is undertaken in the Rolling Mill (RM) where steel slabs or billets are passed between rollers to reduce their thickness or creating thinner cross sections. The process of rolling continues with incremental reduction of thickness or cross sections until the required specifications are achieved. Rolling is first undertaken in a Hot Roll Mill and subsequently at the Cold Roll Mill.

#### 5.5.4.3 Hot Roll Mill (HRM)

Operation in the HRM involve the pre-heating of the starting material to near melting temperature to enable ease of rolling of the steel. Hot rolling of slabs is applied as the first stage of rolling to produce plates or coils, while hot rolling of billets is to produce beams, bars and wire rods.

#### 5.5.4.4 Cold Roll Mill (CRM)

CRM operations are rolling operations undertaken without the input of heat to the steel material. Products of cold rolling include cold roll coils and sheets which are used in other downstream production processes (such as Galvanising Plant and Colour Plant) to produce galvanized or pre-painted sheets or coils. These processes are applied for protection of the steel.




*Source: Eastern Steel, 2019; MPK,2019*

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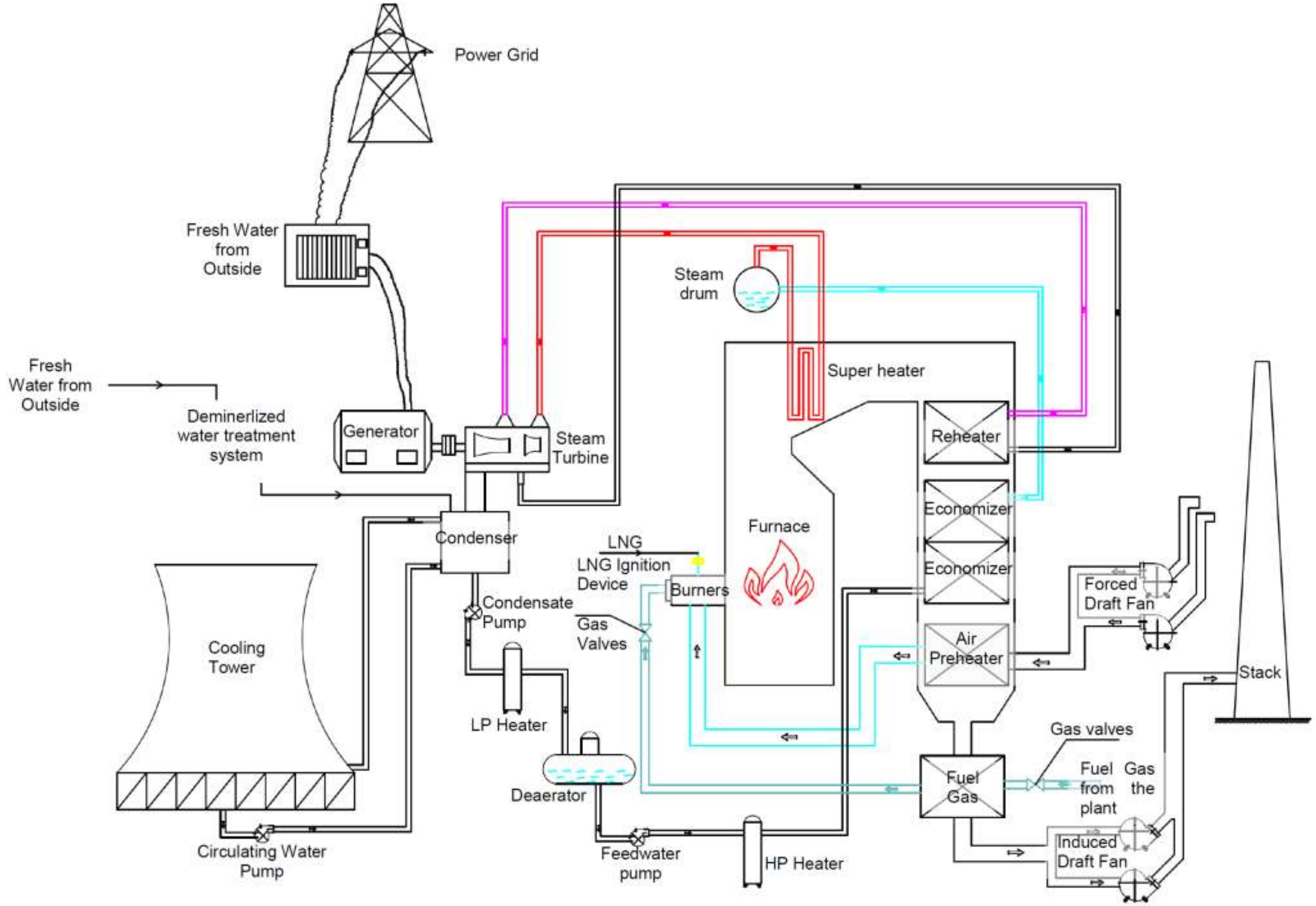
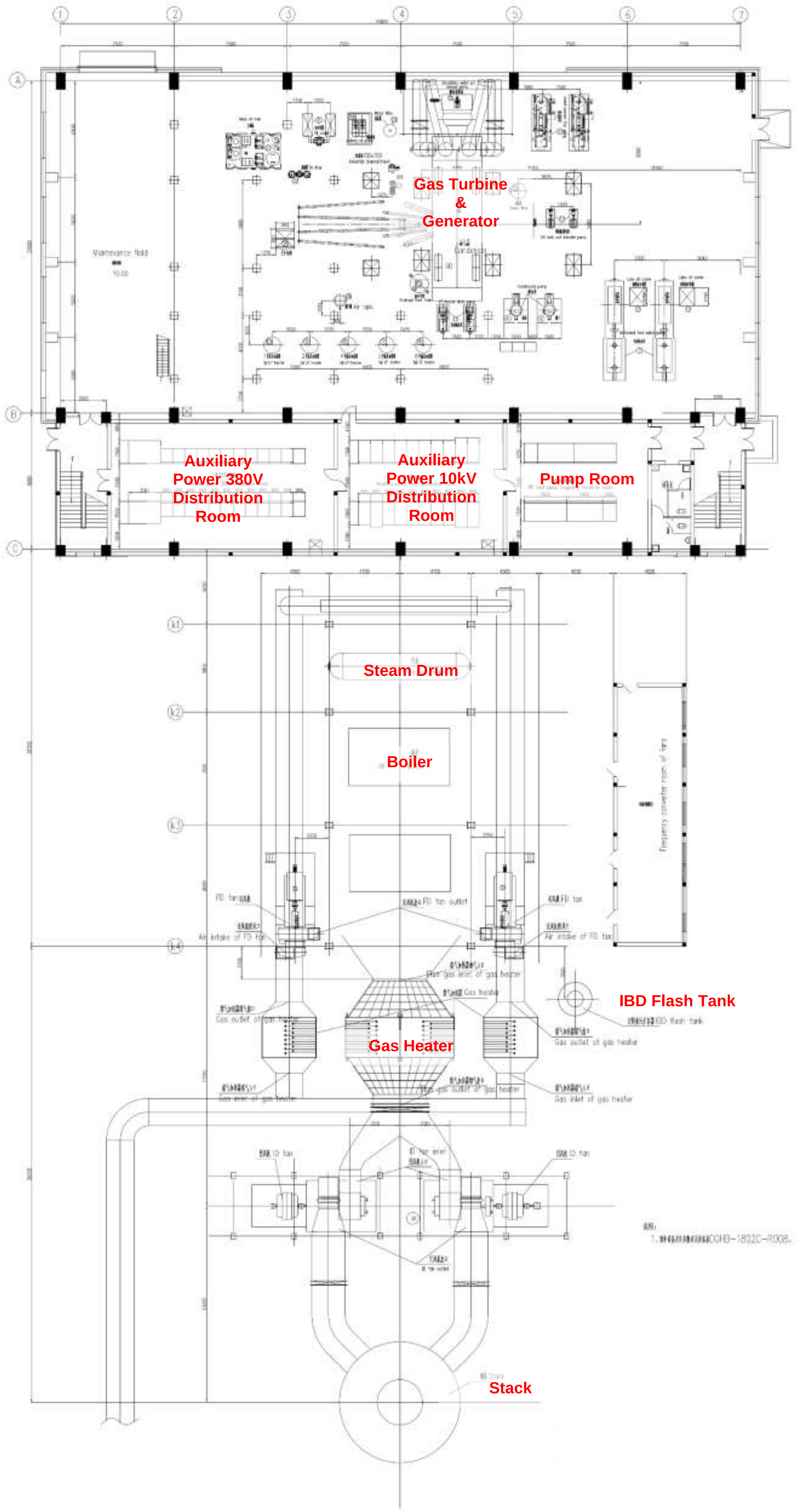
**Figure 5-3 Layout of Proposed Project at Integrated Iron and Steel Mill (IISM)**




Source: Eastern Steel, 2018

**Figure 5-4 55MW Gas Fired Power Plant Flow Diagram**




*Source: Eastern Steel, 2018*

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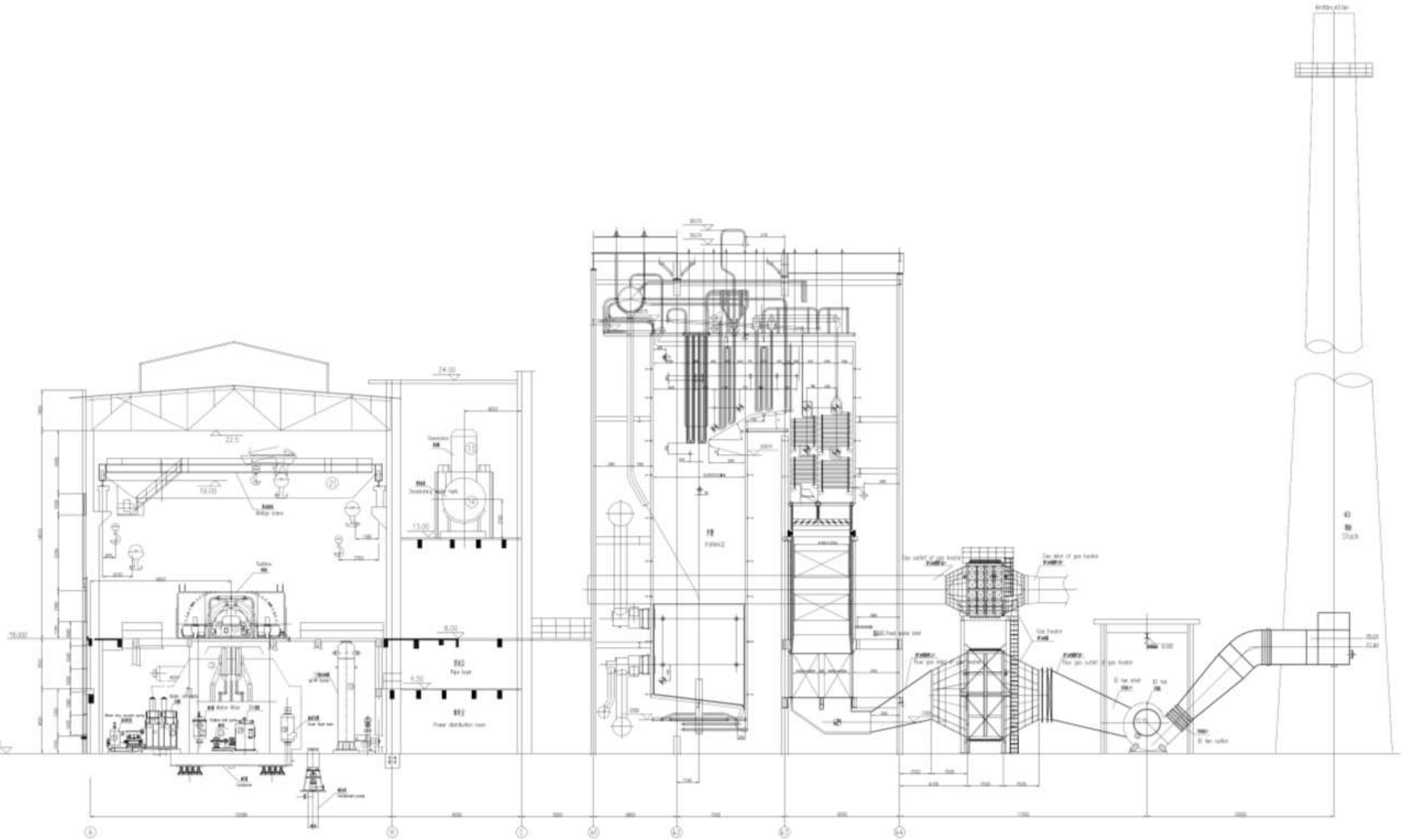
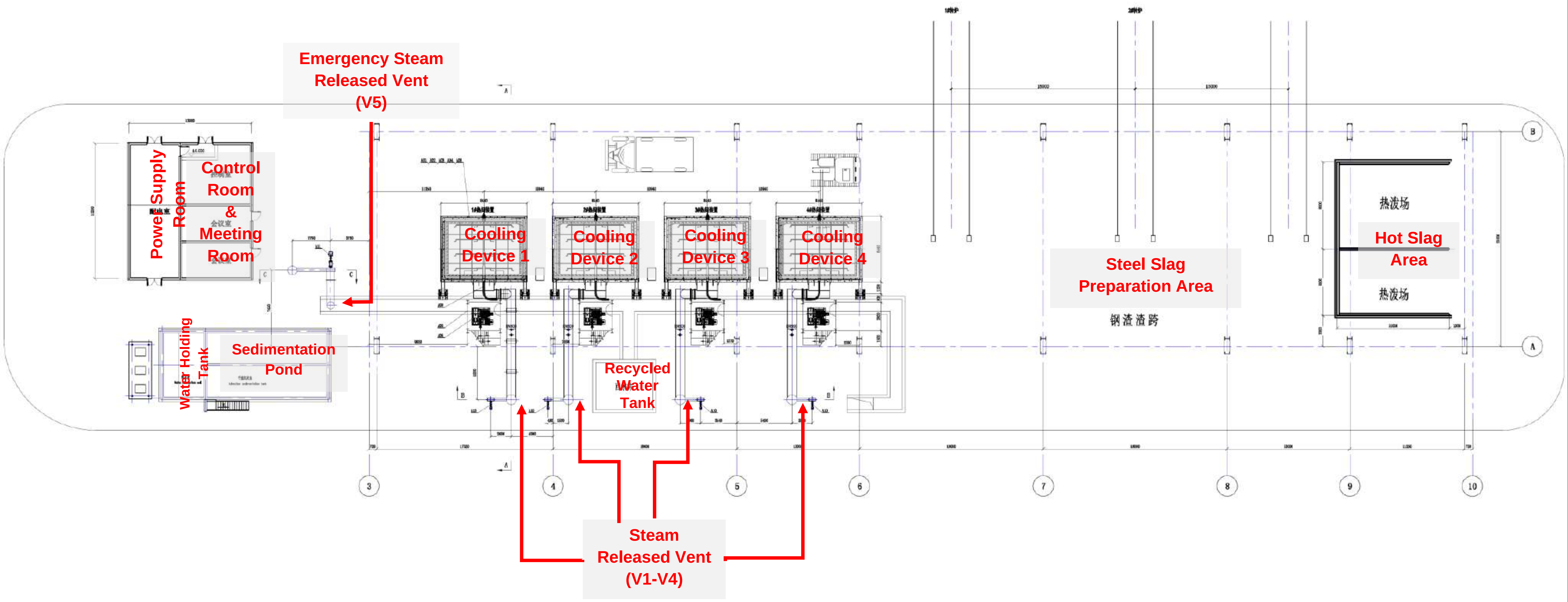
**Figure 5-5 Layout of 55MW Gas Fired Power Plant**



Source: Eastern Steel, 2018.

| | |
|---|---|
| TRi ECOEDGE | **Figure 5-6 Sectional View of 55MW Gas Fired Power Plant** |




*Note: Not to scale*
*Source: Eastern Steel, 2019*

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**Figure 5-7 Layout of Slag Metal Recovery Plant**

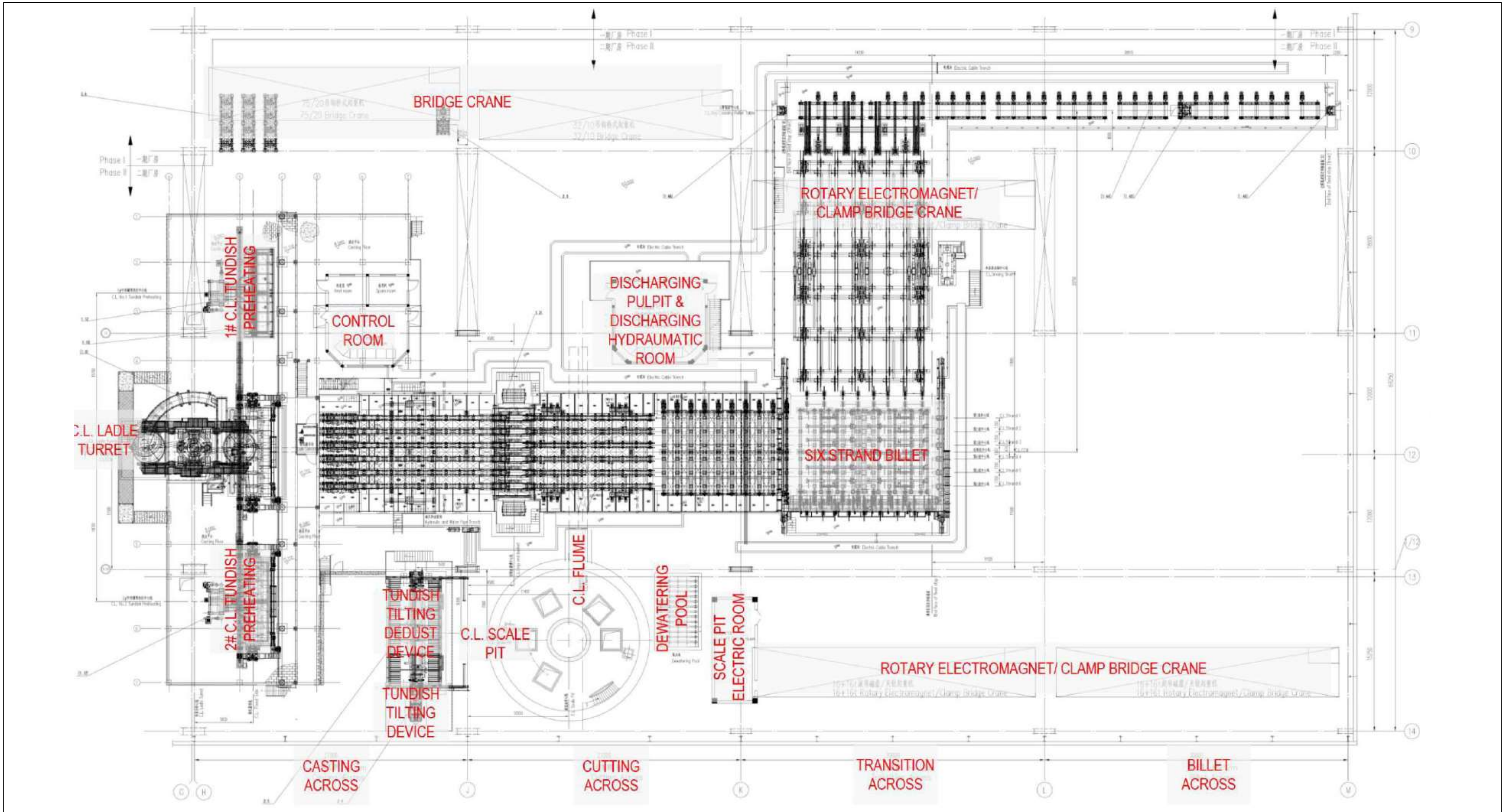


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**Figure 5-8 Layout of Billet Plant**


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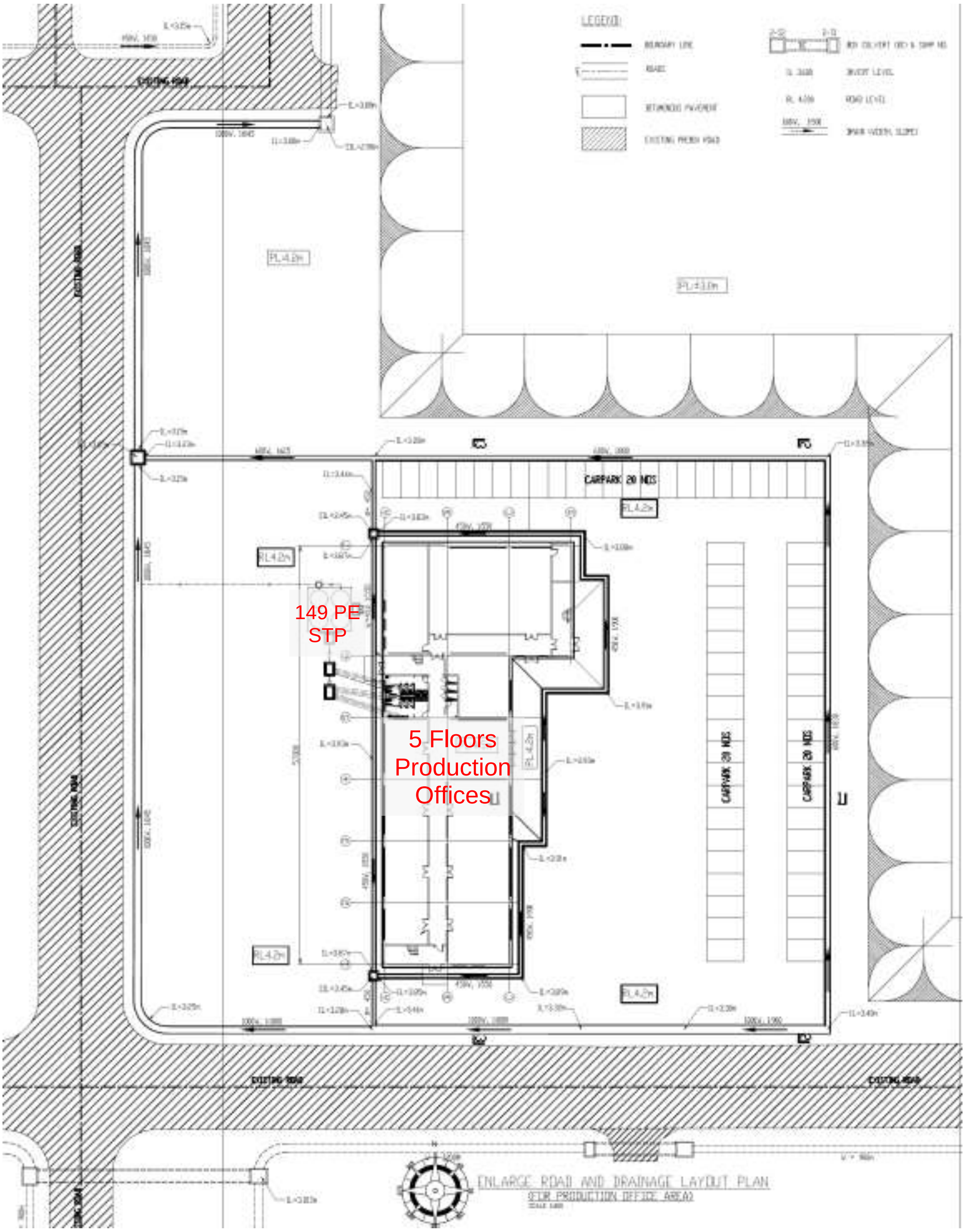
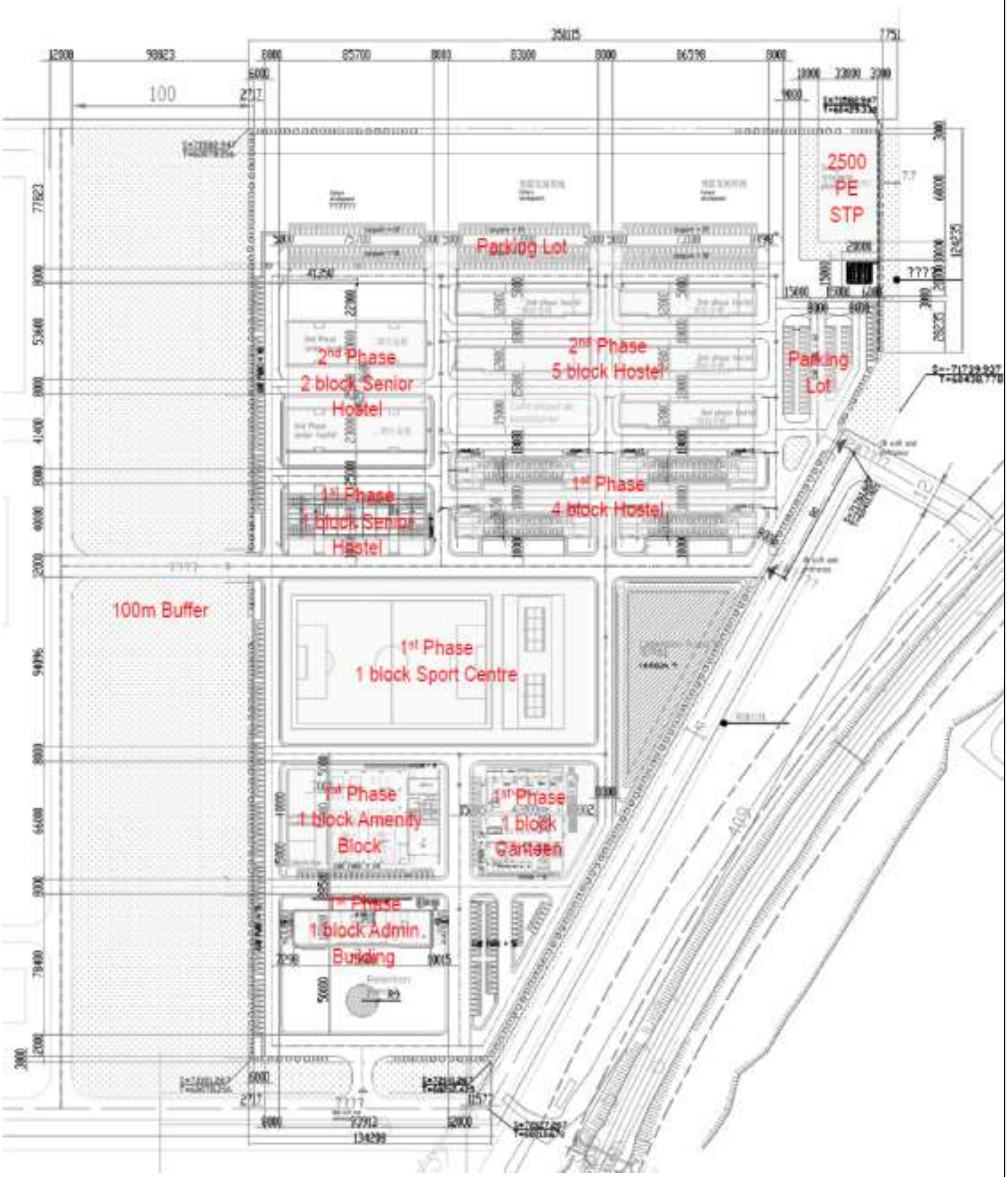
**Figure 5-9 Layout of Coking Plant**




*Source: Eastern Steel, 2019*

**Figure 5-10 Road and Drainage Layout Plan of Production Office**




*Source: Eastern Steel, 2019*

TRi ECOEDGE

**Figure 5-11 General Layout of Worker Quarter and Administrative Building**

## 5.6 RAW MATERIALS AND PRODUCTS

### 5.6.1 Raw Materials Requirement

Most of the raw materials including coal, iron ore and iron pellet for this Phase will be sourced from overseas and imported to the IISM Plant in bulk by ship. Kemaman Port located 5km from the Plant will be the receiving point for these raw materials. Raw materials will be transferred from the port by truck to Raw Materials Storage Yards (RMY) within the Plant. It will be supplemented by local sources.

The RMY is located next to the Sinter Plant for the ease of material transfer for proportioning and preparation for the process. For the future phase, transportation of raw material will be from the port via conveyors. Raw materials will be stored are iron ore, iron fines, limestones fines, Dolomites fines, mixed ores, Anthracite, coal, coke and steel scrap.

Iron ore and scrap metal that will be used as raw material will come from outsources. Raw material that will be received from outsource will be inspected and analysed prior to be used for sintering, iron smelting and steelmaking and the material need to pass through IISM standard stipulates technical requirement.

Iron ore that comes from outsource will be received in batches. Parameters to be analysed from Iron ore are TFe, $SiO_2$, $H_2O$, S, $Al_2O_3$ and crystal water in accordance to the IISM analyse method as per **Table 5-14**. The iron ore material should meet the technical requirements as listed in **Table 5-15**.

**Table 5-14 Iron Ore Analyses Method by IISM**

| Parameter | Analyse Method |
|---|---|
| TFe | GB/T6730.5 |
| SiO2 | GB/T6730.9 |
| H2O | GB/T6730.2 |
| S | C(T)—10—022—B |
| Crystal water | C(T)—10—031—A |
| P | C(T)—10—025—B |
| Particle size | Visual inspection (GB/T2007.7—1987) |

Source: Eastern Steel, 2019

**Table 5-15 Iron Ore Technical Requirements by IISM**

| Process | | Composition (%) | | | | | | | Particle size |
|---|---|---|---|---|---|---|---|---|---|
| | | TFe | $SiO_2$ | $H_2O$ | S | P | $K_2O$ | $Na_2O$ | |
| Sintering | Level 1 | ≥64 | ≤5 | ≤10 | ≤0.25 | ≤0.1 | ≤0.2 | ≤0.2 | 0.5-8mm, <0.5mm≤5%, >8mm≤10% |
| | Level 2 | ≥62 | | | | | | | |
| Iron Making | Level 1 | ≥64 | ≤6 | ≤2.5 | ≤0.1 | ≤0.08 | ≤0.2 | ≤0.2 | 10~ 30mm ≥ 90% |
| | Level 2 | ≥62 | ≤5 | ≤3 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Level 3 | ≥60 | ≤6.5 | ≤5 | | | | | |
| | Level 4 | ≥58 | ≤6.5 | ≤8 | | | | | |
| | Level 1 | ≥56 | ≤6.5 | ≤10 | | | | | |
| Steel Making | | ≥62 | ≤6 | ≤10 | ≤0.1 | ≤0.15 | - | - | 10-30mm ≥ 90% |

*Source: Eastern Steel, 2019.*

Note(s): 1. Water content as the basis for settlement, not as a quality indicator.
2. The moisture content of iron ore is crystallized water content.
3. The content of $TiO_2$ in iron ore is subject to temporary requirements by technical department.

For non-alloy scrap steel, there are three (3) technical requirements as follow:

1. The composition should be in accordance with **Table 5-16**. Besides, the total composition of silicon and manganese will be not greater than 0.6%.

**Table 5-16 Non-alloy Scrap Composition by IISM**

| **Composition** | **C** | **S** | **P** | **Cu** | **Ni** | **Cr** |
|---|---|---|---|---|---|---|
| **Numerical (%)** | ≤2.00 | ≤0.05 | ≤0.05 | ≤0.30 | ≤0.30 | ≤0.30 |

*Source: Eastern Steel, 2019*

2. In addition, non-alloy scrap steel will be divided into four levels according to its dimensions as stipulated in **Table 5-17**.

**Table 5-17 Non-alloy Scrap Level Dimensions by IISM**

| **Level** | **Dimension** | **Single** | **Typical Example** |
|---|---|---|---|
| Special Grade | ≤500mm x 400mm, thickness ≥ 20mm | ≤500 Kg | Steel billet head, steel ingot head, rough billet, gear, rail and channel steel with thickness ≥ 20mm etc. |
| 1 | ≤500mm x 400mm, thickness ≥ 10mm | ≤500 Kg | Steel roll and steel plate with thickness ≥ 10mm, mechanical parts, cutting structural parts, scraps and surface without slag, ladle with impurities not higher than 1% (mass percentage), etc. |
| 2 | ≤500mm x 400mm, 6mm ≤ thickness <10mm | ≤500 Kg | 6 ≤ thickness <10mm steel plate, trim, steel, mechanical parts, cutting structural parts, recast parts, etc. |
| 3 | ≤500mm x 400mm, 3mm ≤ thickness < 6mm | ≤500 Kg | 3mm ≤ thickness < 6mm steel plate, trim, steel, mechanical parts, cutting structural parts and surface without slag, impurities not higher than 2% (mass percentage) of ladle. |

*Source: Eastern Steel, 2019*

3. Non-alloy scrap should not be mixed with following materials as below:

- Iron alloy, alloy scrap and scrap iron
- Mud, cement, sand, oil and concrete
- Other flammable material and explosive materials or weapons such as bombs
- Closed vessels and other etc.
- There should be no complete set of mechanical equipment and structural parts in scrap steel, rubber and plastic products.
- Toxic and hazardous substances, radioactive substance and other chemicals that have an effect on the quality of steel making.
- The rust on the surface and the thickness of the rust on each side shall not be greater than 10% of the thickness of the single piece.

Non-alloy scrap shall be inspected and accepted in batches. The classification, cleanliness and inclusion of each batch of scrap steel will be inspected by visual or tape measurement. While the toxic and radioactive substances may not be inspected on the premise of the supplier's guarantee. The parameters will be test for non-alloy scrap are S, P, and C. The content of Cu, Ni, Cr and other residual elements may not be test without the guarantee of the supplier. The analysed method of non-alloy scrap steel will be in accordance with **Table 5-18**.

**Table 5-18 Non-alloy Scrap Steel Analyses Method by IISM**

| Parameter | Analyse Method |
|---|---|
| S | C(T)—10—022—B |
| C | |
| P | C(T)—10—034—B |

Source: Eastern Steel, 2019

Estimated quantity of raw materials required to meet the Project designed production capacity is summarised in the **Table 5-19**. Pellet Plant will be constructed in near future to produce iron pellet on-site for the steel making, thus reducing the need for importation.

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**Table 5-19 Raw Material Consumption**

| Raw Materials | | Existing IISM Operation | | Proposed IISM Operation | |
|---|---|---|---|---|---|
| | | Consumption (MT/year) | Source | Consumption (MT/year) | Source |
| **Sinter Plant** | Mill Scale | 180,000 | Local/Imported | 180,000 | Local/Imported |
| | Mixed Ore | 16,000 | Local | 16,000 | Local |
| | Anthracite | 40,000 | Local | 40,000 | Local |
| | Iron Ore Fine | 761,726 | Local/Imported | 761,726 | Local/Imported |
| | Coke | - | - | 340,300 | Produced on-site |
| **Blast Furnace** | Sinter | 1,100,000 | Produced on-site | 1,240,000 | Produced on-site |
| | Mg | 2,200.4 | Local | 2,200.4 | Local |
| | Fluorite | 1,056 | Local | 1,056 | Local |
| | Silica | 3,400 | Local | 3,400 | Local |
| | Pellet | 28,623 | Local | 28,623 | Local |
| | Lump Ore | 178,767 | Local | 178,767 | Local |
| | Coke | - | - | 500,000 | Produced on-site |
| **Steel Converter** | Pig Iron | 18,000 | Produced on-site | 532,130 | Produced on-site |

| **Raw Materials** | | **Existing IISM Operation** | | **Proposed IISM Operation** | |
|---|---|---|---|---|---|
| | | **Consumption (MT/year)** | **Source** | **Consumption (MT/year)** | **Source** |
| | Molten Iron | 782,000 | Produced on-site | 1,000,000 | Produced on-site |
| | Iron Filing | 20 | Local | 20 | Local |
| | Steel Slag | 30,000 | Local | 30,000 | Local |
| | Mixed Iron | 8,080 | Local | 8,080 | Local |
| | Mixed Ore | 10,880 | Local | 10,880 | Local |
| | Dolomite | 17,050 | Local | 17,050 | Local |
| | Scrap | 50,000 | Local/Imported | 50,000 | Local/Imported |
| | Limestone | 18,000 | Local | 18,000 | Local |
| **Coking Plant** | Anthracite | - | - | 331,246 | Local |
| | Gas Coal | - | - | 220,832 | Local |
| | Coking Coal | - | - | 220,832 | Local |
| | Others Coal Type | - | - | 331,246 | Local |
| | Lime | - | - | 10,665 | Local |

### 5.6.2 Products

**Table 5-20** shows the summary of the products will be produced by the Eastern Steel for Proposed Project and for Future Phase.

**Table 5-20 Products Produced**

| Product | Mil MT/year | | |
|---|---|---|---|
| | Existing Operation | Proposed Project | Future Phase Operation |
| Hot Metal | 0.7 | 1.57 | 2.98 |
| Steel | 1 | 2 | 5 |
| Final Products | 1 | 1.95 | 5.75 |
| Power Generation | 0 | 55MW | 155MW |

*Source: Eastern Steel, 2019*

## 5.7 MATERIAL FLOW AND BALANCE

For the existing operation, the estimated annual mass balance flow diagram is shown in **Figure 5-12** and **Figure 5-13** for the Proposed Project. The figures also present the wastes types generated, the waste streams produced at process units and production units at the plant as well as summary on the quantities of emissions and pollutants generated.

## 5.8 UTILITY REQUIREMENTS

### 5.8.1 Water Demand and Supply

Water required for the process will be sourced from Teluk Kalung Inground Reservoir owned by Syarikat Air Terengganu Sdn. Bhd. (SATU). Water demand for Phase 1 operations is 13.31 mil $m^3$/year. Thus, upon commencement of Total Phase operation, water demand is projected to be 60.96 mil $m^3$/year. Water is mainly used as cooling water in steel production, as well as for domestic consumption and firefighting system.

The initial water needed will be fresh intake and once the operation commences, process water will be treated and reused for the operations. About 95% of water recovered is anticipated will be recycled. Make-up water is to compensate for water mostly lost through evaporation. Blowdown water will only be occurred if the Plant is shutting down. Breakdown of the water utilisation in the IISM is presented in **Table 5-21** below.

**Table 5-21 Water Utilization in the IISM**

| No. | Plant | Initial Water Demand | | Make-up Water during Operation | |
|---|---|---|---|---|---|
| | | $m^3$/hr | $m^3$/year | $m^3$/hr | $m^3$/year |
| | **Existing Plant** | | | | |
| 1. | Sinter Plant | 9.00 | 3,287 | 6.30 | 2,301 |
| 2. | Blast Furnace | 35.10 | 12,820 | 27.00 | 9,862 |
| 3. | Steel Converter | 21.86 | 7,984 | 17.30 | 6,319 |
| 4. | Continuous Caster | 1892.00 | 691,038 | 18.00 | 6,574 |
| 5. | Auxiliary & Oxygen Plant | 47.55 | 17,367 | 33.30 | 12,163 |
| | **Proposed New Component** | | | | |
| 6. | Slag Metal Recovery Plant | 101.33 | 36,999 | 70.93 | 25,907 |
| 7. | Coking Plant & Power Plant | 22,816.80 | 8,333,731 | 449.50 | 164,176 |

### 5.8.2 Electricity Demand and Supply

The estimated annual power consumption for the whole IISM is about 117,857 kW during Phase 1 and will increase to 625,476 kW when Future Phase is fully implemented. Electricity energy required for operation of all electrically operated equipment and machinery will be obtained from two sources.

The first source is from the national grid via a sub-station that has been constructed within the IISM. The second source will be supplied by the Proposed 55MW Gas Fired Power Plant that will be installed. Electrical energy generation using turbine involves three energy conversions, extracting thermal energy from the fuel and using it to raise steam, converting the thermal energy of the steam into kinetic energy in the turbine and using a rotary generator to convert the turbine's mechanical energy into electrical energy.

### 5.8.3 Diesel Fuel Consumption

Diesel will be used mainly for the vehicles moving within the IISM and some machinery maintenance work. During the Phase 1, three (3) diesel tanks with storage capacity of 20,000 L each will be installed and managed by the Appointed Contractor. It is estimated that approximately 250,000 L per year of diesel will be consumed for the Phase 1 operation.

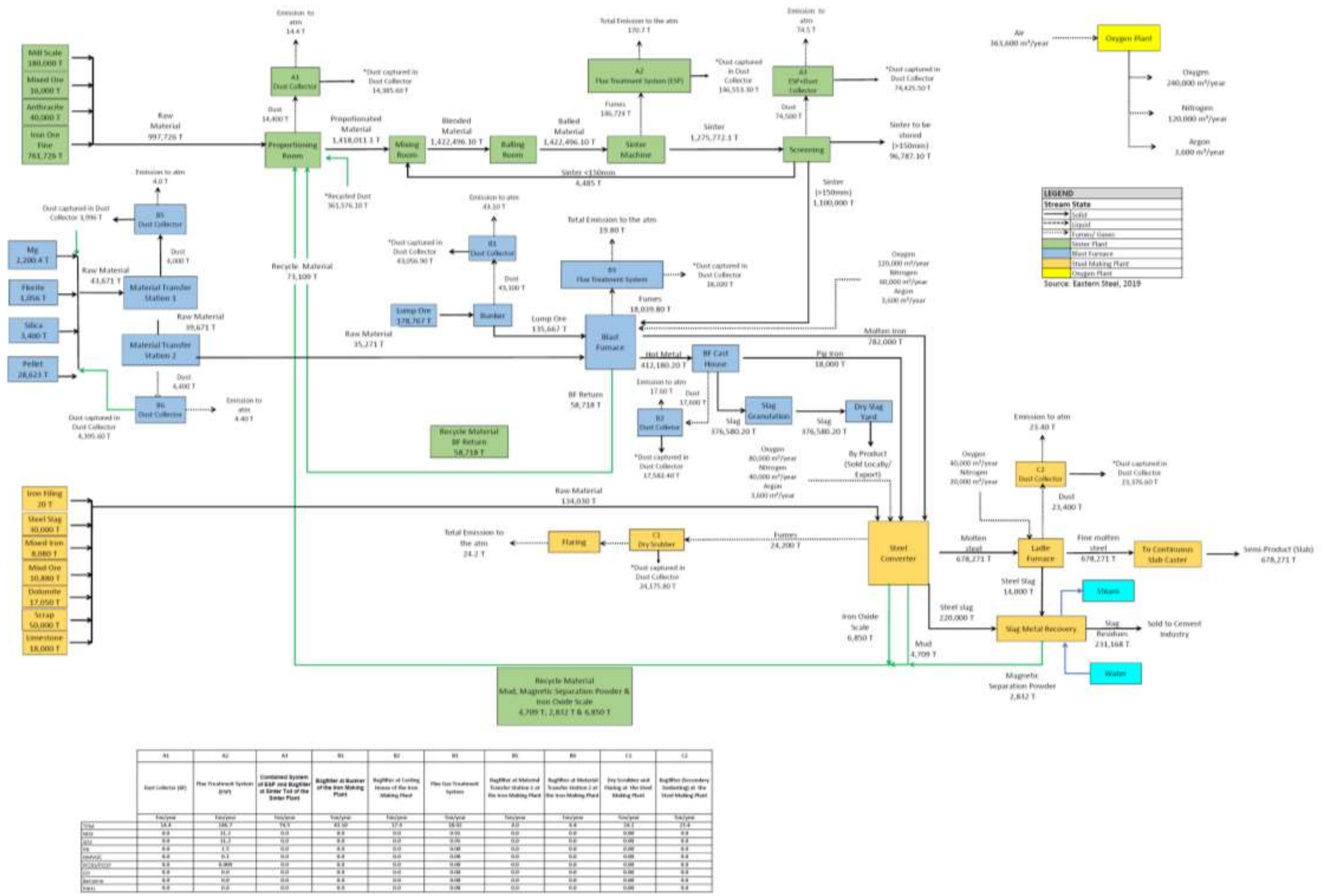
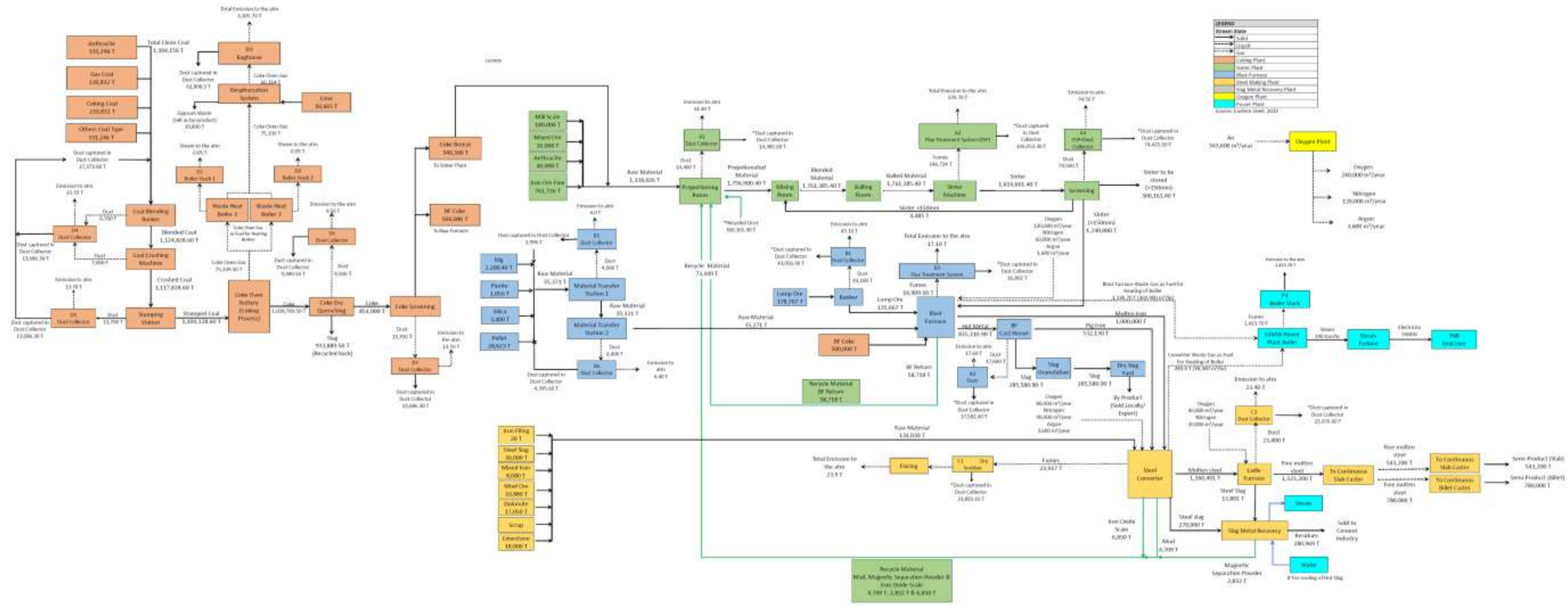



Figure 5-12 Estimates of Mass Balance for Existing IISM Operation



| | A1 | A2 | A3 | B1 | B2 | B3 | B5 | B6 | C1 | C2 | P1 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dust Collector (BF) | Flue Treatment System (ESP) | Combined System of ESP and Bagfilter at Sinter Tail of the | Bagfilter at Bunker of the Iron Making Plant | Bagfilter at Casting House of the Iron Making Plant | Flue Gas Treatment System | Bagfilter at Material Transfer Station 1 at the Iron Making Plant | Bagfilter at Material Transfer Station 2 at the Iron Making Plant | Dry Scrubber and Flaring at the Steel Making Plant | Bagfilter (Secondary Dedusting) at the Steel Making Plant | Power Plant | Waste Heat Boiler Stack 1 | Waste Heat Boiler Stack 2 | Coke Oven Stack (After Desphurization Treatment) | Dust Collector at Crushing Room 1 | Dust Collector at Crushing Room 2 | Dust Collector at Quenching Tower | Dust Collector at Coke Screening Room |
| | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year | Ton/year |
| TPM | 14.4 | 146.7 | 74.5 | 43.10 | 17.6 | 15.68 | 4.0 | 4.4 | 23.9 | 23.4 | 17.03 | 0.05 | 0.05 | 80.6 | 13.7 | 13.7 | 9.5 | 13.7 |
| NO2 | 0.0 | 11.2 | 0.0 | 0.00 | 0.0 | 0.71 | 0.0 | 0.0 | 0.00 | 0.0 | 1192.26 | 0.00 | 0.00 | 1612.5 | 0.00 | 0.00 | 0.00 | 0.00 |
| SO2 | 0.0 | 11.2 | 0.0 | 0.00 | 0.0 | 0.71 | 0.0 | 0.0 | 0.00 | 0.0 | 34.07 | 0.00 | 0.00 | 1612.5 | 0.00 | 0.00 | 0.00 | 0.00 |
| PB | 0.0 | 1.5 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NMVOC | 0.0 | 0.1 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PCDD/PCDF | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CO | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 170.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Benzene | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PAHs | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

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**Figure 5-13 Estimates of Mass Balance for Proposed IISM Operation**

## 5.9 POLLUTION SOURCES AND CONTROL

**Table 5-22** presents an overview of the some of the potential pollution sources and types of emissions expected from carrying out iron and steel operation for the Project. This information has been obtained from existing plant data and from general information about the iron and steel industry globally.

**Table 5-22 Pollution Sources and Type**

| Type of Pollution | Pollution Source | Pollutants | Pollution Control |
|---|---|---|---|
| Air Emissions | Sinter Plant | Total PM, $SO_2$, $NO_2$, Total Lead, NMVOC | Bagfilter at Dosing House, Electrostatic Precipitator (ESP) at Sinter Head, Combine System of ESP and Bagfilter at Sinter Tail. |
| | Iron Making Plant | Total PM, $SO_2$, $NO_2$ | Bagfilter at Bunker, Bagfilter at Casting House, and Bagfilter of Dry Method Deduster |
| | Material Transfer Station | Total PM | Bagfilter |
| | Steel Making Plant | Total PM | Scrubber and flaring for Steel Converter, Bagfilter of Secondary Dedusting, |
| | Power Plant | TPM, CO and $NO_2$ | Waste Heat Recovery Boiler |
| | Coking Plant | TPM, $NO_2$, and $SO_2$ | Stack of Waste Heat Boiler, Stack of Desulphurization System and Baghouse, and other Dust Collector for fugitive dust control |
| | Vehicular movement | Fugitive dust | Tire cleaning facility, street sweeping |
| Liquid Wastes & Wastewater | Casting & iron and steel processes | Cooling water (low particulates level, O&G) | Cooling water is to be fully recycled. Bleeding off (Blowdown) is needed periodically to maintain quality. Oil and grease will be speeded and collected at various stages and be utilized as second fuel in the furnace. |
| | Worker quarters & office operations | Sewage | Sewage will be treated in sewage treatment plant (STP) or septic tank. |
| | Machinery & equipment operation | Spent lubricant oil | Classified as scheduled waste but are to be sold to recyclers |

| Type of Pollution | Pollution Source | Pollutants | Pollution Control |
|---|---|---|---|
| Noise & Vibration | Steel making & casting operations | Noise (unwanted sound) | Acoustic treatment & noise barrier (as needed) |
| | Operation of induction fans & stack outlet | | |
| | Transportation activities | | |
| | Operation of mechanical equipment (motor, conveyor system, compressor, suction systems | | |
| | Pressure relief, cooling system | | |
| Hazardous Waste | Machinery and other equipment | Lubricating, hydraulic, other mineral oils | Recovery by approved off-site recovery facilities |
| | Other sources and activities | Chemical, paint & oil containers, rags, filters, contaminated soil, lab waste, etc. | Recovery by approved off-site recovery facilities |
| Non-Hazardous Solid Waste | Solid waste consisting of domestic type of waste and general office waste, which is produced mainly from administration building and canteen. | Papers, food wastes, packaging wastes, etc. | The solid waste is disposed at the nearest landfill area at Bukit Takar by appointed contractor. |

### 5.9.1 Air Pollution Control

For the existing operation, air pollution sources for the IISM have been identified and proper control systems have been designed and installed to ensure that the stack emission is complied with the limit as stipulated in the Environmental Quality (Clean Air) Regulations 2014. The type and location of the air pollution control systems (APCS) are as summarized in **Table 5-23**. The existing and proposed new stacks location are indicated in **Figure 5-14.**

**Table 5-23 Air Emission Points and its Pollution Control System**

| Stack ID | Plant | Remark |
|---|---|---|
| **Sinter Plant** | | Existing |
| A1 | Bagfilter at Dosing House | |
| A2 | Electrostatic Precipitator (ESP) at Sinter Head | |
| A3 | Combined System of Electrostatic Precipitator (ESP) & Bagfilter at Sinter Tail | |
| **Iron Making Plant** | | |
| B1 | Bagfilter at Bunker Bunker | |
| B2 | Bagfilter at Casting House | |
| B3 | Bagfilter at Dry Method Deduster | |
| **Material Transfer Station** | | |
| B5 | Bagfilter at Station 1 | |
| B6 | Bagfilter at Station 2 | |
| **Steel Making Plant** | | |
| C1 | Scrubber and Flaring | |
| C2 | Secondary Dedusting | |
| **55MW Gas Fired Power Plant** | | Proposed New |
| P1 | Boiler Stack | |
| **Coking Plant** | | |
| D1 | Waste Heat Boiler Stack 1 | |
| D2 | Waste Heat Boiler Stack 2 | |
| D3 | Desulfurization System and Baghouse Stack | |
| D4 | Dust Collector Crushing Room 1 | |
| D5 | Dust Collector Crushing Room 2 | |
| D6 | Dust Collector Quenching Tower | |
| D7 | Dust Collector Coke Screen House | |

Source: Eastern Steel, 2019

#### 5.9.1.1 Sinter Plant

The waste gas from the sintering process containing pollutants such as dust, $SO_2$, $NO_2$, Lead (Pb), NMVOC and PCDD/PCDF will be cleaned prior discharge. Dust pollutant is generated from materials-handling operations, crushing, screening and proportioning of raw materials and fuels as well as during unloading, cooling, granulating and transfer of finished sinter. Hence, to control air pollution in these areas;

- one (1) unit of bagfilter has been installed at Dosing House
- one (1) unit of electrostatic precipitator (ESP) has been installed at Sinter Head
- one (1) unit of combined system of electrostatic precipitator (ESP) and bagfilter has been installed at Sinter Tail

Closed drafting and dedusting measures will be adopted at all dust generating points. Sealing or enclosure of equipment and areas generating significant smoke and dust will be conducted. These efficient bagfilter and electrostatic precipitator (ESP) will be adopted to ensure the exhausted gas meet with the emission standards stipulated in the Environmental Quality (Clean Air) Regulations 2014.

Besides, Continuous Emission Monitoring System (CEMS) will be installed to monitor the dust (Total PM), $SO_2$ and $NO_2$ emission from the sinter process to ensure emissions are within the allowable limits of 50 mg/m$^3$, 500 mg/m$^3$ and 400 mg/m$^3$.

To minimize dust dispersion, negative pressure will be maintained within these dust generating areas. Dust collected by pollution control system will be sent to the proportioning room where it will be recycled into the sintering process.

#### 5.9.1.2 Iron Making Plant

In the Iron Making Plant, fugitive dust will be generated mainly at the Bunker, Casting House and also from the Blast Furnace (BF) process. Hence, the following air pollution control systems are strategically equipped:

- one (1) unit of bagfilter has been installed at Bunker
- one (1) unit of bagfilter has been installed at Casting House
- one (1) unit of bagfilter (which also known as Dry Method Deduster) has been installed for the Blast Furnace

Waste gas generated from the Blast Furnace process will be treated in a closed loop air pollution control system, which consisting of Gravity Deduster and Dry Method Deduster before flowing into Hot Stoves for generating Hot Blast Gas (with High Heating Value) and reuse in the Blast Furnace.

In general, the Gravity Deduster is a large chamber which have small resistance force and the dust will be separated from the waste gas and settle to the bottom of the chamber relying on gravity when it hit the wall. After this 1st cleaning process, the cleaned waste gas will be filtered in the Dry Method Deduster as 2nd cleaning process. Hence, only after this double cleaning processes, the treated gas will be released through the stack, which will meet with the emission standards stipulated in the Environmental Quality (Clean Air) Regulations 2014.

Besides, Continuous Emission Monitoring System (CEMS) will be installed to monitor the dust (Total PM) emission from the Blast Furnace to ensure emissions are within the allowable limit of 50 mg/m$^3$. Dust collected from air pollution control system will be returned to the Sinter Plant for recycling.

#### 5.9.1.3 Steel Making Plant

Steel making will generate high amount of converter gas (mainly constitutes carbon monoxide and dust) and these converter gas can be recovered as fuel. Prior reuse, the converter gas will need to be cleaned to remove dust. In general, the waste gas emit from the Steel Converter will be captured by a hood on top of the Steel Converter, which then direct to the Primary Deduster or known as Scrubber System. The Scrubber System is consisting of Overflow Venturi Tube, Gravitational Dehydrator, Heavy Mound Venturi Tube and Webby Dehydrator. In which, dust particulates in the waste gas will be removed, where the dust concentration will be reduced to ≤ 50 mg/m$^3$. After the gas treatment process, the cleaned gas will then store in a Gas Holder and will be supplied and reused in the Plant as supplementary energy. Only occasionally, for safety purpose the treated gas needs to release through the Gas Release Tower (Flaring). At the top of the Gas Release Tower the carbon monoxides (CO) in the waste gas will be burned off by ignition.

- one (1) unit of scrubber has been installed
- one (1) unit of bagfilter has been installed at Secondary Dedusting

Besides, Continuous Emission Monitoring System (CEMS) will be installed to monitor the dust (Total PM) emission from the Steel Converter to ensure emissions are within the allowable limit of 50 mg/m$^3$.

The system is also equipped with CO and $O_2$ auto analyzer to make sure the converter gas is collected to more than 80 m$^3$/MT steel which is equivalent to 6690 KJ/m$^3$. Converter gas will be collected when the oxygen concentration is less than 2% and the CO is more than 35%. When the oxygen concentration in the converter gas is more than 2%, the alarm will automatically trigger, and the converter gas will be release by cut over of t-valve.

In addition to this, for removing of fugitive dust at the underground silos, Mixer and Steel Converter, a Secondary Dedusting (Bagfilter) is installed. It has 4200 filter bags which provide total filter area of 13,123 m$^2$.

#### 5.9.1.4 Material Transfer System

Two unit of Bagfilter equipment will be installed at the Material Transfer System to capture any fugitive dust. The collected dust is mainly the raw material which will be used in the process. With these Bagfilter units in placed, the dust emission (≤ 50 mg/m$^3$) will meet with the emission standards stipulated in the Environmental Quality (Clean Air) Regulations 2014.

- one (1) unit of bagfilter has been installed at Bagfilter Station 1
- one (1) unit of bagfilter has been installed at Bagfilter Station 2

#### 5.9.1.5 Proposed 55MW Gas Fired Power Plant

The Proposed 55MW Power Plant is using waste gas (Blast Furnace Gas and Converter Gas) as burning fuel. These fuel gases will be going through the pre-treatment before stored in respective gas holders for the Proposed Power Plant. In addition, low NOx Burner will be used in firing the Boiler. A 80 m height stack with internal diameter of 3 m will be constructed at site for the Waste Heat Boiler.

As a safety precaution measure, nitrogen gas purging system will be equipped and carbon monoxide (CO) gas detectors will be strategically installed at high risk areas within the power plant such as Boiler and Control Room. The safe level shall not more than 0.3 mg/kg CO. If not, when there is a leak detected, alarm will be activated, and all the people shall be evacuated follow the evacuation route.

For the boiler emission, it will be designed to comply with the Environmental Quality (Clean Air) Regulations 2014, where $NO_2$, CO and Total PM will less than 350 mg/$m^3$, 50 mg/$m^3$ and 5 mg/$m^3$. Where $SO_2$ will meet the BAT requirement of 10 mg/$m^3$. In addition, CEMS will be installed at the stack to ensure the CO and $NO_2$ are always comply with the Environmental Quality (Clean Air) Regulations 2014. Meanwhile, periodic (every 3 month) monitoring shall be conducted for the stack emission.

#### 5.9.1.6 Proposed Coking Plant

For coal transfer station, the crushing room coal transfer path is designed in an enclosed building to avoid dust from escaping to the environment. In order to eliminate the dust which is produced during the crushing process, dust trap is established at the coal crusher exit point and the conveyer transfer point. The dust will enter the explosion-proof pulse bag dust removal system for removal to less than 30 mg/$m^3$. There are several conditions used to control the dust emission to the environment during coke oven operation as follow:

- Coke oven battery – Uses spring and cut resistance, thick frame and protection layer block which provide complete strength and effective fire protection.
- Burning of cleaned COG and cleaned BF gas - Flue gas containing $SO_2$ and $NO_2$ will be emitted through 36 m chimney. Coke Oven Gas will be treated via Desulphurization process and followed by Baghouse. Gas emission will comply to the Environmental Quality (Clean Air) Regulations 2014, where Total PM not more than 10 mg/$m^3$, $NO_2$ not more than 500 mg/$m^3$ and Sulphur compound not more than 800 mg/$m^3$. CEMS will be installed at the stack to ensure the Total PM is always comply with the Environmental Quality (Clean Air) Regulations 2014.
- Since the COG has high calorific value, it will be used as fuel gas for the Waste Heat Boiler. 2 unit of boilers will be installed to generate heat and steam for generating electricity via steam turbine. This steam turbine power generator system component will be installed later. For the boiler emission, it will be designed to comply with the Environmental Quality (Clean Air) Regulations 2014, where $NO_2$, CO and Total PM will less than 350 mg/$m^3$, 50 mg/$m^3$ and 5 mg/$m^3$. Where $SO_2$ will meet the BAT requirement of 10 mg/$m^3$.
- In summary,
  - one (1) unit of Desulphurization and Baghouse System will be installed at Coke Oven
  - two (2) unit of Waste Heat Boiler will be installed at Boiler House
  - one (1) unit of dust collector will be installed at Crushing Room 1
  - one (1) unit of dust collector will be installed at Crushing Room 2
  - one (1) unit of dust collector will be installed at Quenching Tower
  - one (1) unit of dust collector will be installed at Coke Screen House

### 5.9.1.7 Proposed Slag Metal Recovery Plant

During steel slag treatment, saturated steam will be produced from cooling of molten slag in cooling devices. Four (4) unit of vent and one (1) unit of emergency vent will be installed for releasing steam.

### 5.9.1.8 Requirement of Emission Limits

Eastern Steel is committed to ensure its operation will fully comply with the Environmental Quality (Clean Air) Regulations 2014 (**Table 5-24**).

**Table 5-22 Clean Air Regulations 2014 Emission Limits**

| Source | Pollutant | Limit Value | Monitoring |
|---|---|---|---|
| **Category A: Heat and Power Generation<br>1. Boilers (Capacity > 10 MWe)** | | | |
| Gaseous fuels | Sum of NO and $NO_2$, expressed as $NO_2$ | 350 mg/m$^3$ | Continuous* |
| | Carbon monoxide (CO) | 50 mg/m$^3$ | Continuous* |
| | Total PM | 5 mg/m$^3$ | Periodic |
| **Category B: Production and Processing of Ferrous Metals (Iron and Steel Mills)** | | | |
| Sinter plants (waste gas from the sintering belt) | Sum of $SO_2$ and $SO_3$, expressed as $SO_2$ | 500 mg/m$^3$ | Continuous* |
| | Sum of NO and $NO_2$, expressed as $NO_2$ | 400 mg/m$^3$ | Continuous* |
| | Total PM | 50 mg/m$^3$ | Continuous* |
| | Total Lead as Pb | 1 mg/m$^3$ | Periodic |
| | NMVOC | 75 mg/m$^3$ | Periodic |
| | PCDD/PCDF | 0.1 ng TEQ/m$^3$ | Periodic |
| Coke ovens (@ 5% $O_2$) | Total PM | 10 mg/m$^3$ | Continuous* |
| | Sum of NO and $NO_2$, expressed as $NO_2$ | 500 mg/m$^3$ | Periodic |
| | Sulphur compounds as S | 800 mg/m$^3$ | Periodic |
| Blast furnace (Regenerator @ 3% $O_2$) | Total PM | 50 mg/m$^3$ | Continuous* |
| Basic oxygen furnace (converter gas) | Total PM | 50 mg/m$^3$ | Continuous* |
| Electrical arc furnaces | Total PM | 50 mg/m$^3$ | Continuous* |
| Rolling mill: Thermal treatment furnace (@ 5% $O_2$) | Sum of NO and $NO_2$, expressed as $NO_2$ | 500 mg/m$^3$ | Periodic |

Note: *Averaging time for continuous monitoring is 30 minutes

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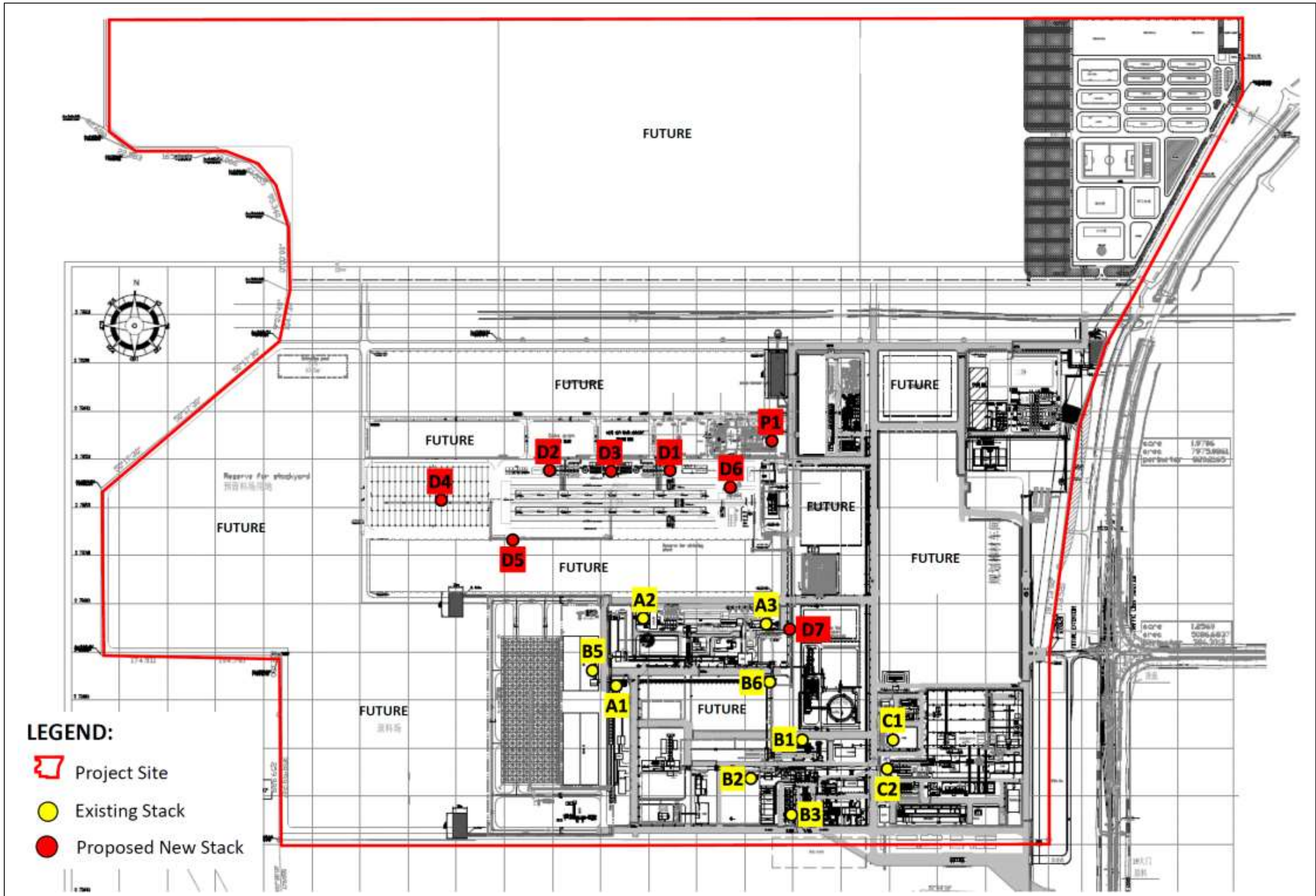


**LEGEND:**

| | |
|---|---|
| **Sinter Plant** | |
| A1 | Bagfilter at Dosing House |
| A2 | Electrostatic Precipitator (ESP) at Sinter Head |
| A3 | Combined System of Electrostatic Precipitator (ESP) & Bagfilter at Sinter Tail |
| **Iron Making Plant** | |
| B1 | Bagfilter at Bunker Bunker |
| B2 | Bagfilter at Casting House |
| B3 | Bagfilter at Dry Method Deduster |
| **Material Transfer Station** | |
| B5 | Bagfilter at Station 1 |
| B6 | Bagfilter at Station 2 |
| **Steel Making Plant** | |
| C1 | Scrubber |
| C2 | Secondary Dedusting |
| **Coking Plant** | |
| D1 | Waste Heat Boiler Stack 1 |
| D2 | Waste Heat Boiler Stack 2 |
| D3 | Desulfurization System and Baghouse Stack |
| D4 | Dust Collector Crushing Room 1 |
| D5 | Dust Collector Crushing Room 2 |
| D6 | Dust Collector Quenching Tower |
| D7 | Dust Collector Coke Screen House |
| **Power Plant** | |
| P1 | Boiler Stack |

*Note: Not to Scale*
*Source: Eastern Steel, 2019*

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**Figure 5-14 Stack Locations at IISM**

### 5.9.2 Water Pollution Control

For this Project, no process wastewater will be produced except for cooling water; and it will be treated accordingly as summarised below (**Table 5-25**).

**Table 5-25 Process Water of IISM**

| System | Source/Location | Treatment Method |
|---|---|---|
| Cooling Water Circulating Treatment System | Mechanical Draft Cooling Tower for<br>• Converter<br>• Ladle Furnace<br>• Continuous Casting Machine<br>• Primary Deduster (or Known as Scrubber)<br>• Secondary Deduster<br>• Air Compressor<br>• Cooling Water Recirculating Softener System<br>• Slag Metal Recovery Plant<br>• Power Plant<br>• Coking Plant | To allow for effective water circulating operation, to reduce raw water (makeup water) usage, of an evaporative cooling tower without formation of scale, chemical treatment of the cooling water is thus required.<br>The treatment involves filtering system and water chemistry control by adding anti corrosion agent, biocides (to control the growth of unwanted microorganisms or biofouling in the cooling water) and etc. |
| Soft Water Circulating Cooling System | Plate Heat Exchanger for<br>• Oxygen Lancing<br>• Material Feeding<br>• Explosion Relief Valve<br>• Crystallizer | To obtain optimal operating of the Soft Water Circulating System, the soft water needs to be controlled by adding anti corrosion agent, biocides (to control the growth of unwanted microorganisms in the cooling water) and etc. |
| Converter Water Circulating System | Gas Emission Treatment by the Primary Deduster (or Known as Scrubber) for Converter at Steel Making Plant (SMP). | A small quantity of water mist from the Primary Deduster (Scrubber) will be treated in Physical Treatment Process. Where, the effluent will be stored in the Water Holding Pond located in SMP. Then, the water will be pumped into Filter Press for dewatering. Where, the filtrate will be stored in a Filtrate Pool and recirculated into the Inclined Sedimentation |

| System | Source/Location | Treatment Method |
|---|---|---|
| | | Tank and process repeated. Filtered sludge cake which still consist of steel will be returned into the sintering process. |
| Continuous Casting Water Circulating System | Treatment of process water at Continuous Casting Machine (CCM) | Wastewater from the CCM will be treated in a Deoiler Cyclone to remove the oil before send to Magnetic Press Sludge Dewatering Machine. After this, the filtrate will be passed through Disk Deoiler in Degreasing Pool for removing the residual oil (if any) and then stored in Water Tank. Where, the filtered water will be recycled and used in the CCM process. |

In principal, there is no discharge from the cooling tower (and heat exchanger) as the water will be recirculated within the system, except for blowdown. Blowdown, or intentional removal of water from the cooling tower is required to prevent over concentration of salts and insoluble airborne debris which will affect the effectiveness of the cooling system. The frequency of blowdown and volume of water to be discharged will be controlled by the trained operator or experienced service personnel. No direct discharge of blowdown water into the river. The blowdown water will be stored at the retention pond. The blowdown quality will be analysed and treated to ensure that it meet the Standard B of the Environmental Quality (Industrial Effluent) Regulations 2009. Hence, the blowdown event and the quality of discharged shall be logged in a Log Book which shall be available for DOE inspection (if any).

#### 5.9.2.1 Sinter Plant

In the Sinter Plant, water is used for cooling purposes and for floor washing. Average water consumption is about 9 $m^3$/hr.

Water is used mostly for cooling of process equipment and does not come into direct contact with the process materials. It remains clean and is recirculated in the cooling system after passing through cooling towers to remove the excess heat. Top-up water is added to replace water lost from the system due to evaporation.

Wastewater generated from floor washing and direct cooling of materials will be drained to an underground pit and pumped to concentration tanks. The wastewater will go through a precipitation process to remove solids and suspended particulates before it is pumped back to be used as recycled water for the sintering process. The recycled water will contain less than 200 mg/L of suspended solid. After few cycles, the concentrated wastewater will be treated prior discharge to the environment.

#### 5.9.2.2 Blast Furnace

Water for the BF process is used for cooling purposes to remove process heat from BF body, hot stove, hydraulic station and pneumatic blowers, etc. and to rinse blast furnace slag. Hot wastewater that is generated from the cooling process will be pumped to the cooling tower and cooled water is returned to suction well for reuse. Suspended solids concentration after cooling is less than 20 mg/L.

Wastewater from slag rinsing contains high amount of SS. The wastewater will undergo precipitation, filtered to reduce the SS to less than 400 mg/L, and recycled back for reuse. No wastewater will be discharge out as the water will be reuse for optimisation.

#### 5.9.2.3 Steel Converter

In the converter process, heated water will be generated from the cooling process this is recycled after cooling. Two types of system will be used, i.e. the clean circulating water system and soft water closed-loop system. The former system uses a cooling tower system while the latter system uses heat exchanger. Cooled water with suspended solids concentration less than 20 mg/L will be stored in a water storage tank before reused in the converter for cooling process. This system is also used for cooling water for the Ladle Furnace and Continuous Casting Facilities.

Wastewater from the air pollution control system for the converter process will be sent to an elevated flume waterway and highly efficient clarifier to reduce the solids concentration to less than 100 mg/L. The cooled water is stored in a water storage prior to reuse in the air pollution control system.

#### 5.9.2.4 Casting

Secondary spray cooling process generates wastewater that needs to be treated. Vortex type sedimentation tank and chemical oil remover will be used to reduce the suspended solids and oil concentration to less than 20 mg/L and 10 mg/L respectively. The treated water then is cooled in a cooling tower prior storage in water storage tank and pump back for recycling.

#### 5.9.2.5 Proposed 55MW Gas Fired Power Plant

The continuous wastewater discharged from the Boiler Drum will be fed into the Continuous Blowdown (CBD) Flash Tank for continuous removal of the concentrated wastewater. The separated secondary steam enters the Deaerator, and the wastewater is connected to the Intermittent Blowdown (IBD) Flash Tank. The IBD Flash Tank is provided to remove sludge from the Boiler. To maintain the pH level of boiler water, phosphate dosing is done in drum. Minimal effluent (~ 26 $m^3$/hr or 0.433 $m^3$/min) will be discharged from the Blowdown Flash Tank and will be cooled down at the Retention Pond at the IISM. The final effluent discharge quality will comply with the Environmental Quality (Industrial Effluent) Regulations 2009.

#### 5.9.2.6 Proposed Coking Plant

Wastewater to be generated mainly from the quenching tower, cooling tower for electric generator, washing of floor and domestic sullage water.

Wastewater from the quenching process will be stored in a pond located under the quenching tower and will be treated by going through the sedimentation process for further removal of SS. After this it will be recycled back to the quenching tower for removal of dust. No effluent is proposed be discharged to the environment. As for the sedimentation sludge, desludging will be done when required. The sludge will be sent to Sinter Plant reused in the sintering process.

#### 5.9.2.7 Proposed Slag Metal Recovery Plant

Water used in cooling device will be mostly evaporated and released as steam. The residual cooling water at the bottom of the cooling device will then automatically flows to the water return tank by gravitational flow. The water will be pumped to the horizontal sedimentation tank through the return water pump, in which water will be further cooled and precipitated and suspended particles will be further precipitated and separated. Treated cooled water will overflows from the sedimentation tank and enters the suction well and will be pumped by water supply pumps together with supplemented water for recycling. No wastewater will be discharge out as the water will be reuse for optimisation.

#### 5.9.2.8 Requirement of Wastewater Discharge Limits

The receiving river water quality shall comply with the Class III limit of the National Water Quality Standard (NWQS). Although the Proposed Project does not produce any effluent, Eastern Steel is committed to ensure any discharge from the IISM will comply with the Standard B Limit, Environmental Quality (Industrial Effluent) Regulation 2009. The Class III limit for NWQS and Standard B limit, Environmental Quality (Industrial Effluent) Regulation 2009 are tabulated in **Table 5-26** and **Table 5-27**, respectively.

**Table 5-26 National Water Quality Standard Class III Limit**

| Parameter | Unit | Class III Limit |
|---|---|---|
| pH | | 5.0 - 9.0 |
| Temperature | °C | - |
| Dissolved Oxygen (DO) | mg/l | 3.0-5.0 |
| Biochemical Oxygen Demand (BOD) | mg/l | 6.0 |
| Chemical Oxygen Demand (COD) | mg/l | 50.0 |
| Total Suspended Solids (TSS) | mg/l | 150.0 |

| Parameter | Unit | Class III Limit |
|---|---|---|
| Mercury (Hg) | mg/l | 0.004 |
| Cadmium (Cd) | mg/l | 0.010 |
| Chromium Hexavalent (Cr6+) | mg/l | 1.4 |
| Chromium Trivalent (Cr3+) | mg/l | 2.5 |
| Arsenic (As) | mg/l | 0.4 |
| Cyanide (CN) | mg/l | 0.6 |
| Lead (Pb) | mg/l | 0.02 |
| Manganese (Mn) | mg/l | 0.1 |
| Nickel (Ni) | mg/l | 0.9 |
| Tin (Sn) | mg/l | 0.004 |
| Zinc (Zn) | mg/l | 0.4 |
| Iron (Fe) | mg/l | 1.0 |
| Silver (Ag) | mg/l | 0.0002 |
| Selenium (Se) | mg/l | 0.3 |
| Fluoride (F) | mg/l | 10.0 |
| Oil and Grease (O&G) | mg/l | N |
| Ammoniacal Nitrogen (AN) | mg/l | 0.9 |
| Total Coliform | Count/ 100ml | 50000.0 |

**Table 5-27 Standard B Limit**

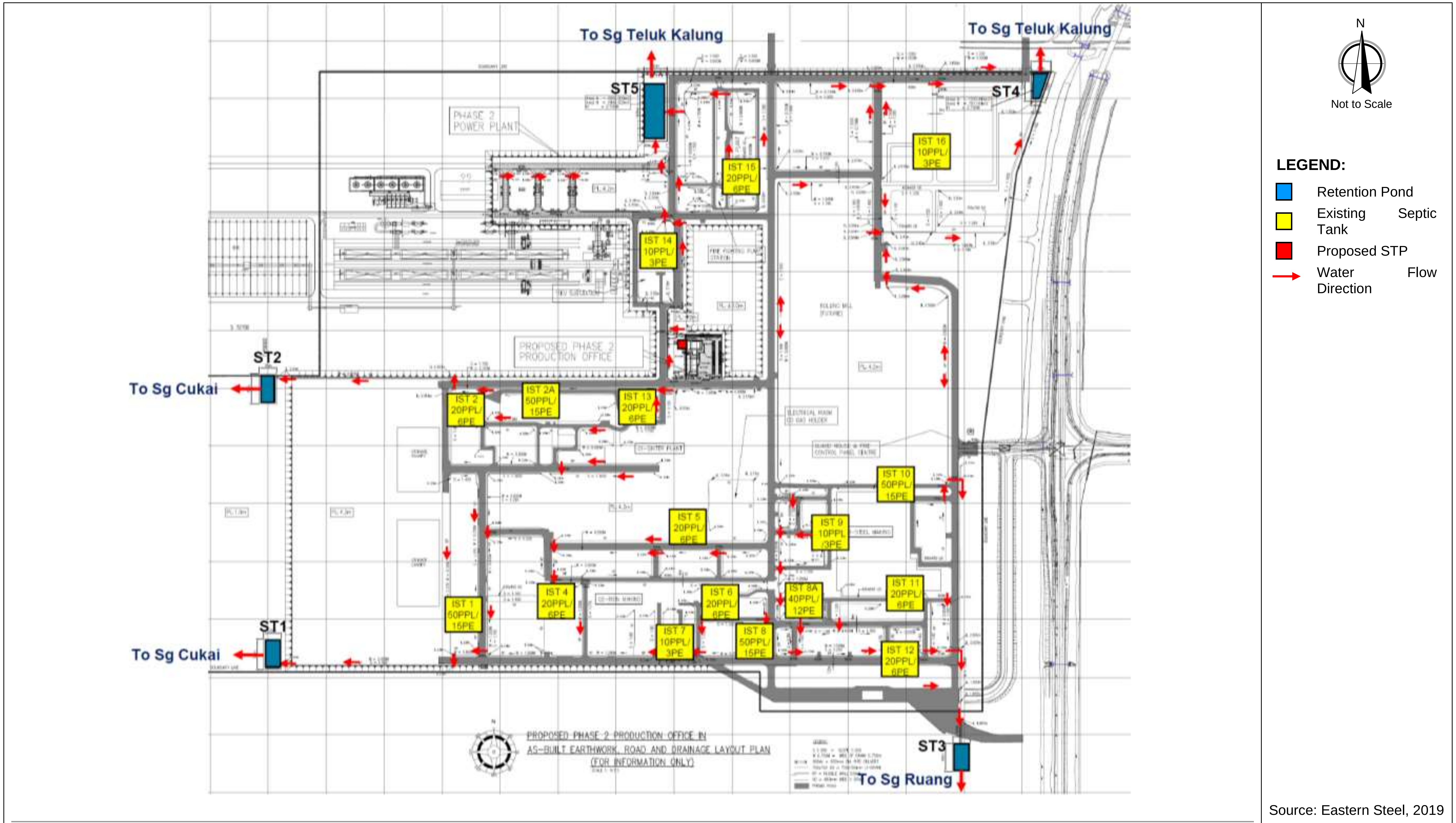
| Parameter | Unit | Standard B Limit |
|---|---|---|
| pH | | 5.5-9.0 |
| Temperature | °C | - |
| Dissolved Oxygen | mg/l | - |
| Biochemical Oxygen Demand (BOD) | mg/l | 50.0 |
| Chemical Oxygen Demand (COD) | mg/l | 200.0 |
| Total Suspended Solids (TSS) | mg/l | 100.0 |
| Mercury (Hg) | mg/l | 0.05 |
| Cadmium (Cd) | mg/l | 0.02 |
| Chromium Hexavalent (Cr6+) | mg/l | 0.050 |
| Chromium Trivalent (Cr3+) | mg/l | 1.0 |
| Arsenic (As) | mg/l | 0.10 |
| Cyanide (CN) | mg/l | 0.10 |
| Lead (Pb) | mg/l | 0.5 |
| Copper (Cu) | mg/l | 1.0 |
| Manganese (Mn) | mg/l | 1.0 |
| Nickel (Ni) | mg/l | 1.0 |

| Parameter | Unit | Standard B Limit |
|---|---|---|
| Tin (Sn) | mg/l | 1.0 |
| Zinc (Zn) | mg/l | 2.0 |
| Boron (B) | mg/l | 4.0 |
| Iron (Fe) | mg/l | 5.0 |
| Silver (Ag) | mg/l | 1.0 |
| Aluminium (Al) | mg/l | 15 |
| Selenium (Se) | mg/l | 0.5 |
| Barium (Ba) | mg/l | 2.0 |
| Fluoride (F) | mg/l | 5.0 |
| Phenol | mg/l | 1.0 |
| Free Chlorine (Cl2) | mg/l | 2.0 |
| Sulfide (S2-) | mg/l | 0.5 |
| Oil and Grease (O&G) | mg/l | 10 |
| Ammoniacal Nitrogen (AN) | mg/l | 20 |
| Color | ADMI | 200 |
| Formaldehyde | mg/l | 2.0 |

#### 5.9.2.9 Sewage Treatment

Currently, sewage will be treated in the existing septic tanks (see **Figure 5-15**). The design of the septic tanks has been granted approval from Indah Water Konsortium Sdn Bhd (IWK) (**Appendix C**). For the Proposed Production Office; and Proposed Worker Quarter and Administrative Building, sewage treatment plant (STP) with design capacity of 149 PE and 2500 PE respectively are to be built. Sewage will be treated and no direct discharge of sewage from the site. For the septic tanks, desludging will be carried out periodically by the IWK Contractor.

For the existing IISM, the drainage system for stormwater and premise parameter drains flows toward the existing 5 Sedimentation/Retention Ponds within the IISM before discharged into Sg. Teluk Kalung or into Sg. Ruang. The road and drainage system of the Proposed Project as shown in **Figure 5-15** and **Figure 5-16**.




Source: Eastern Steel, 2019

TRi EC EDGE

**Figure 5-15 STP Location, Road and Drainage Layout of Proposed Project (Lot 6294)**

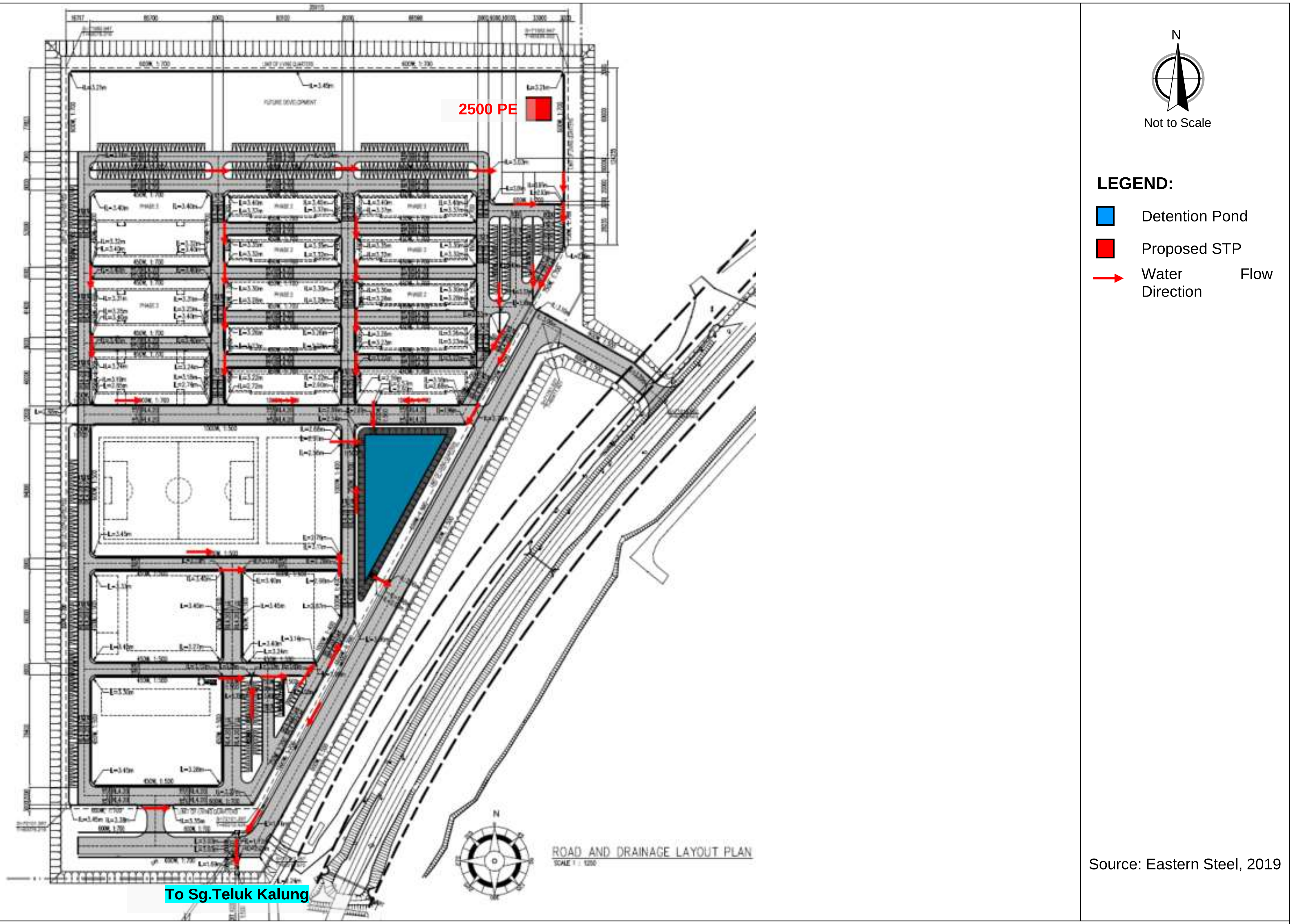



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**Figure 5-16 STP Location, Road and Drainage Layout of Proposed Worker Quarter and Administrative Building**

### 5.9.3 Noise Control

Noise is anticipated from main plant of iron and steel operation as well as transportation activities. High noise levels are anticipated from the operation including scrap and product handing, waste or by-product gas fans, process cooling and draft fans, rotating equipment, dedusting system, furnace charging, fuel burners, cutting activities, wire rod pay-off units and conveyor system. These are mostly found within the buildings housing the facilities.

Outdoor noise sources will be from the raw material and auxiliary building areas and from vehicles movement within the Project site. Besides, noise is also generated from the stack outlet where flue gas is released into the atmosphere.

Noise control through acoustic treatment or the use of noise barriers has been designed for specific noise sources where noise levels are at levels which exceed safe levels for worker safety. Alternatively, the use of safety equipment or gear is a requirement for workers operating in noisy areas.

Noise safety measures are intended more for worker safety rather than the public as there are no permanent residential property to be found within 1 km from the boundary of the Project. The former is to meet the requirements recommended under the Factories and Machinery (Noise Exposure) Regulations 1989. Measures will also be applied to ensure that boundary noise levels as stipulated under the Planning Guidelines for Environmental Noise Limits and Control of the DOE (2004) will be met.

### 5.9.4 Waste Management

Most of the waste residue from IISM will be recycled or reused to obtain added value from various types of by-products. Waste materials may include slag from BF, dust from BF gas, by-products of air pollution control system and sludge from sedimentation ponds. **Table 5-28** below describes the solid wastes generated from each component of the plant and the method to manage it.

Waste materials prior disposal or recycles will be stored at designated area located at the Project site. The wastes which are classified as scheduled waste will be stored in suitable containers/ bags and labelled accordingly. These bags will be stored in the waste storage area before removed by licensed contractor for disposal at licensed premises.

**Table 5-28 Waste Management for IISM Operation (Phase 1)**

| WASTE | | DISPOSAL METHOD |
|---|---|---|
| 1 | Molten BF Slag | To be sold to cement plant, as the raw materials of cement. |
| 2 | Dried BF Slag | To be crushed and part of it is recycle and the rests to be sold together with molten slag. |

| WASTE | | | DISPOSAL METHOD |
|---|---|---|---|
| 3 | Steel Slag (contain molten iron slag from pre-treatment) | | The molten iron slag is sent to hammer workshop and slag treatment plant for recovery.<br>Ladle slag is processed by means of rotary drum or water spraying treatment to recover ferrous metal.<br>The recycled scrap can be used as feedstock for steel making production, as sintering fluxes and raw materials for cement production, while the fine particles are used for land filling or backfill constructions material. |
| 4 | Ferrous dust & slurry collected | Raw material stockyard | To be recycled and reused in the stockyard. |
| | | Sintering process | To be recycled and reused in sintering process. |
| | | BF dedusting | To be sent to Sintering Plant as sintering mixtures. |
| | | Converter Dust | To be sent to Sintering Plant as sintering mixtures. |
| | | Iron Oxide Scale from Con-casting | To be sent to Sintering Plant as sintering mixtures. |
| | | Lime Manufacturing Plant | To be sent to Sintering Plant as sintering mixtures. |
| | | Pellet Plant | To be sent to Sintering Plant as sintering mixtures. |
| | | Coking Plant | To be recycled or reuse as secondary fuel material |
| | | Rolling Mills | To be sent to Sintering Plant as sintering mixtures. |
| 5 | Industrial Wastes | | Most of the industrial wastes are spent refractories, which can be used as wrought materials for refractory production after being classified, the rests can be used for road laying, backfill construction etc. |
| 6 | Mud | | Mud from steel making plant to be sent to Mud Treatment then to be reused as raw material. |
| 7 | Waste oil from Con-casting water treatment | | Waste oil is mainly collected by the oil removal from oily water. The waste oil will be recycled by the licensed contractor at licensed premises. |
| 8 | Steel Scrap | Continuous Casting | To be recycled back into steel making process |
| | | Rolling Mills | To be recycled back into steel making process |

Source: Eastern Steel, 2018.

#### 5.9.4.1 Industrial Solid Waste

Solid waste consisting of domestic type of waste and general office waste, which is produced mainly from administration building and canteen. Eastern Steel has adopting

3R: Reduce, Reuse and Recycle. Hence, only minimal amount of waste is generated (about 300 kg/month) and will be disposed at the nearest landfill area at Bukit Takar by appointed contractor. Other valuable items will be sold.

#### 5.9.4.2 Scheduled Wastes

Scheduled wastes generated by the existing operation and anticipated quantities with the new components of Project are as follows:

**Table 5-29 Scheduled Wastes Generation Type, Quantities and Management Method**

| SW Code | SW Type Currently Generated and Declared | Quantity (Tonne/Month) | | Management Method |
|---|---|---|---|---|
| | | Existing Operation | Future Operation | |
| SW305 | Spent lubricant oil | 0.1 | 0.2 | Disposal or Recycle/Recover at prescribed premises for Scheduled Waste |
| SW306 | Spent hydraulic oil | 1.6 | 3.2 | Disposal or Recycle/Recover at prescribed premises for Scheduled Waste |
| SW409 | Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled waste | 1.1 | 2.2 | Disposal or Recycle/Recover at prescribed premises for Scheduled Waste |

Source: Eastern Steel, 2019
Note: SW Inventory declared to DOE, via e-SWIS

The used oil drums or used chemicals containers are returned back to the suppliers and vendors for reuse. In the event these are not able to be reused, it will be disposed as used oil drums or chemical containers (SW 409) and handled as the requirements of the Environmental Quality (Scheduled Wastes) Regulations 2005.

## 5.10 PROJECT DEVELOPMENT PHASE

The project has been planned to start its operation in stages as shown in the **Chart 5-8**.

## Chart 5-8 Eastern Steel Project Schedule

| Item \ Year-Month | 2019 | | | | | | | | | | | | 2020 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Term of Reference (TOR) | | | | | | | | | | | | | | | | | | | |
| Environmental Impact Assessment | | | | | | | | | | | | | | | | | | | |
| Design Preparation | | | | | | | | | | | | | | | | | | | |
| Construction Design for Overall Project | | | | | | | | | | | | | | | | | | | |
| Proposed Slag Treatment Plant | Modification & Installation | | | | | | | | | | | | | | | | | | |
| Proposed Billet Plant | Modification & Installation | | | | | | | | | | | | | | | | | | |
| Coking Plant | Earthwork Activity | | | | | | Construction | | | | | | | Testing & Commissioning | | | | | |
| Proposed 55MW Gas Fired Power Plant | Earthwork Activity | | | | Construction | | | | | | Testing & Commissioning | | | | | | | | |
| Proposed Supporting Components: Production Office | | | | Earthwork Activity | | | | Construction | | | | | | | | | | | |
| Proposed Supporting Components: Worker Quarters and Administrative Building | | | | | | | | | | | | | | | Earthwork Activity | | Construction | | |

Source: Eastern Steel, 2019