Project Details:

**Size OR Magnitude of Operation**

As a part of expansion, APIIPPL is planning to expand the capacity of Induction Furnace, Modernizing the existing the existing Rolling Mill and proposing new Rolling Mill. Following is production capacity and plant configuration:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>UNIT</th>
<th>EXISTING CAPACITY</th>
<th>PROPOSED EXPANSION</th>
<th>AFTER EXPANSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sponge Iron Plant</td>
<td>2,10,000 TPA</td>
<td>---</td>
<td>2,10,000 TPA</td>
</tr>
<tr>
<td>2.</td>
<td>Power Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(25 MW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FBC based</td>
<td>7 MW</td>
<td>---</td>
<td>7 MW</td>
</tr>
<tr>
<td></td>
<td>WHRB based</td>
<td>18 MW</td>
<td>---</td>
<td>18 MW</td>
</tr>
<tr>
<td>3.</td>
<td>Induction Furnace</td>
<td>86,400 TPA</td>
<td>2,13,600 TPA</td>
<td>3,00,000 TPA</td>
</tr>
<tr>
<td>4.</td>
<td>Rolling Mill</td>
<td>1,45,250 TPA</td>
<td>to 2,10,000 TPA</td>
<td>to 2,10,000 TPA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&amp; 90,000 TPA</td>
<td>&amp; 90,000 TPA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(New Rolling Mill)</td>
<td>(New Rolling Mill)</td>
</tr>
</tbody>
</table>

**Manufacturing Process:**

**Steel Melting Shop**

Semi-finished steel in the form of Steel Ingots & Billets is manufactures through Induction Furnace with Concast that works on the principle of induction melting of scrap/ Pig Iron with the help of electric power. An alternating electromagnetic field induces eddy current in the metal so that the electrical energy converts into heat whose quantity depends on the resistively of the charge. If the charge consists of the metal scrap, chips other metal rejections then the eddy currents arise between separate pieces of charge because high contact resistance. So small charge pieces required increase frequency of current that feeds the induction heater in
order to speed up melting of the charge. Induction furnaces operate on current of commercial frequencies (50 Hz) or on current of higher frequencies from 500 to 2000 Hz. Induction furnaces are beneficial in steel making for low melting loss.

An Induction furnace constitutes a single larger primary coil made of water-cooled copper tube. The working voltage impressed across the terminals of the coil. These furnaces have a great much application for melting of iron, Steel and Nonferrous. This type of furnace has a rammed lining. The ramming mantel silica mass contains should more than 96% silica and minimum of Al$_2$O$_3$ & Fe$_2$O$_3$. Before ramming the material a steel template kept inside the furnace and rammed the material between the template and the insulated coil of the induction heater. To minimize the consumption of electric power and cut down the melting period the crucible wall must be as thin as possible. During running the furnace one must keep watch on the state of lining because it operates under most unfavorable condition. The inside of crucible lining is in contact with liquid metal while its outside surface contacts the water-cooled induction.

**Charging:**

The pieces of scrap should be kept on the bottom gently to avoiding impacts into a compact heap. The scrap pieces / Pig Iron should be in small size that provide good compacting of the batch without leaving spacing between the charge and crucible wall. This offer an advantage of quick melting of the charge with a minimum power spent in the stage for the heat.

The zone of a highest temperature during the meet lies in the power part of the crucible therefore it is practical to place first high melting scrap on the crucible bottom. Large and high melting pieces should stand parallel and close to the crucible was while low melting components should be in the middle of the large crucible. Small capacity furnaces are loaded manually and the large capacity furnaces with the aid of buckets.
Melting: -

At the beginning of the melting the furnace works for 5 to 10 minutes on low power until the surge of current fed from the generator disappear. The furnace power is then brought up to a maximum. The charge melts with the crucible held closed. When the charge approaches the fluid stages then the solid pieces are pressed backed with a crow bar. The furnaces is then loaded to its capacity by adding small size of scrap as soon as the charge melted, the stag is formed to protect the metal from oxidation and to avoid reduce the melting loss. If the slag generate in excess it should be skimmed off periodically, at the last to deoxidized the metal with Ferromanganese, Silico-manganese and Ferro-silicon. Now the metal is ready tap for either in ingot or billet casting.

Casting in Ingot mould: -

For casting ingot the metal temperature should be around 1560ºC/ 1570 ºC in ladle. Liquid metal tap from furnace to ladle by the help of crane then the ladle in the centered on the trumpet metal flows from the ladle bottom and filled the ingot mould. Thus the ingot is ready.

Casting in B.C.M: -

Steel for making billet, the temperature of liquid metal from furnace to ladle, the final metal temperature in ladle should be 80ºC. superheat from liquidious. Liquid metal is storage in tundish through ladle then the tundish metal passes from the various section of mould jacket that is as per requirement (100 X 100 mm, 125 X 125 mm, 160 X 160 mm, 200 X 200 mm) this is a continuous process, length of billet of is cut as par requirement. Process flow chart is enclosed.

Plant facilities for Continuous Casting Machine

Billet caster:

The billet caster shall be complete with ladle stand, mould assembly, strand guide segments and supports withdrawal and straightening system, mould cooling system, Cut
off equipment including length measuring device, Marking machine etc. Requisite dummy bar and facilities for Dummy bar disconnecting and a dummy bar receiver will be included.

**Auxiliary equipment:**

The auxiliary facilities required for the Billet caster will be included. This will include operating platform, cooling bed, ventilation system for spray chambers, equipment for collection and disposal of crop-ends, Repair and assembly facilities for moulds, and segments, Tundishes, Tundish preparation facilities including tundish drying station, Hydraulic system and Centralized lubrication system, scale handling system.

**Electrical Equipment:**

The electrical equipment for the caster will include the drives, HT switchgear, LT switchgear, control desks, cabling and accessories.

**Instrumental and automation:**

A modern DCS process automation system shall be provided for control of process function, sequencing and interlocking and to execute safely controls. Specific features shall include mould level control, computer aided quality control, and process field instruments comprising measuring units, transmitters, load cells, actuators, Programmable controllers and PCs and communication system.

**Plant facilities for Ladle Furnace**

The LF installation will be single station system with provision for arc heating, inert gas stirring, and addition of ferroalloys and additives. The LF will be complete with transformer, Ladle stirring system Aluminum wire feeder, Carbon injecting device, additives storage and addition system, Sampling and temperature measuring device. A fume extraction and cleaning system consisting of bag filters, ID fan and chimney with the related ductwork will be provided.
**Auxiliary equipment:**

The auxiliary facilities required for the LF will be included the transfer cars, slag handling facility, hydraulic and lubrication systems, Electro nipping station.

**Rolling Mill Unit:**


**Reheating furnace**

A pusher type furnace has been envisaged for the heating of billets. The furnace will be end charging and side discharging. It will have single row as well as double row charging facility. In priority rolling mill will be operated on hot charging basis i.e. ingots/ billets will be directly rolled in rolling mill without heating. In case heating will be required then the Producer gas will be utilized as primary fuel and Furnace oil will be utilized as secondary as well as auxiliary fuel in pusher type of re-heating furnace of rolling mill. The furnace combustion system will comprise of air blowers, coal/ FO storage, supply and preheating system and other associated facilities. The product of combustion will leave the furnace at charging end and exhausted through underground flue tunnel and passed through a metallic tubular recuperator before finally let off to a self-supporting steel chimney of sufficient height. A set of instrument will be used for smooth operation of the furnace.
Bar and round mill

A cross country type mill has been envisaged for the plant. The stands have been grouped into roughing, intermediate and finishing groups. Roughing group will have 4 (four) stands, intermediate group will have 8 (eight) stands and finishing mill will have 8 (eight) stands. Roughing group of stands will be driven by one motor. 4 nos. of intermediate stands will be driven by two motors and balance 4 nos. will be driven by a separate motor. Each stand of finishing group will be driven by single motor. Necessary guides and troughs will be provided at entry and exit of mill stands.

One wire rod out let has been provided in the mill. The wire rod line will have 4 stand block driven by a single motor through gear box. Coil forming and handling of coil is provided.

Automated tilting, drop type tilter and feeding arrangement will be provided in roughing group of stands. Repeaters have been provided in roughing / intermediate stands as necessary.

Design provision has been made for introduction of slit rolling facility in future to roll 8 mm, 10 mm & 12 mm rebars in two strands. The rebars discharged from the mill will pass through a water cooling system comprising cooling pipes with high pressure water nozzles for rapid water quenching. At the cooling pipes the bar skin temperature will be reduced to about 600ºC. The core of the bar still remains hot. This entrapped heat tempers the bar. This thermo-mechanical treatment of the bars increases tensile strength without adversely effecting weldability and elongation properties. This process eliminates requirement of cold twisting of bars for production of rebars.

A dividing shear, to cut the products to cooling bed length, will be located immediately after the water cooling system. This shear will divide all products to cooling bed lengths. Rake type cooling beds have been envisaged to receive the rolled product. Cooling bed will be provided with incoming and outgoing roller tables. One cold shear has been provided to cut the bars coming out of cooling bed into commercial length of 6 to 12 m. The bar products will be formed into bundles and will be strapped by strapping machine manually.
The finished products will be removed by overhead EOT crane and stored in the storage area or dispatched through road vehicles.