Industrial Scale Decarbonization of a Blast Furnace through Carbon Capture along with Clean Hydrogen Production

While global CO_2 emissions are set to reach around 40.5 GTPA by 2022, the steel industry alone contributes 7-10% of the total emission. The CO_2-intensive BF-BOF route of steel production is pre-dominant and will continue for some time. Decarbonization of BF-BOF is limited by the economics of multi-point post-combustion capture and technology to replace coal. Dastur has designed a novel solution integrating gas conditioning unit, carbon capture unit, and combined heat and power (CHP) plant. Gas conditioning unit helps to increase CO_2 concentration to >30% and to capture >85% of available CO_2 from a single source, enabling carbon capture technology to work efficiently with the lowest $/Te. Additionally, H_2 can be recovered from the H_2-rich fuel gas stream at a marginal cost of <0.5 $/kg$H_2$. Since CO_2 concentration is >30%, a wide range of technologies (from steam-based amine to all-electric PSA/Cryogenic) can be deployed depending on CO_2 purity requirement, net CO_2 reduction target, electricity, and steam cost. Even steam and power sourcing options could differ depending on available waste recovery options in existing steel plant operations. Additionally, the deployment of carbon capture along with H_2 recovery can enable a circular green economy through utilization of CO_2 /H_2 in downstream industries like aggregates, methanol based chemicals, Enhanced Oil Recovery, etc. The incentives and support from governments can accelerate decarbonization of steel further. This paper discusses the key design aspects, policy support and techno-economics of different options.