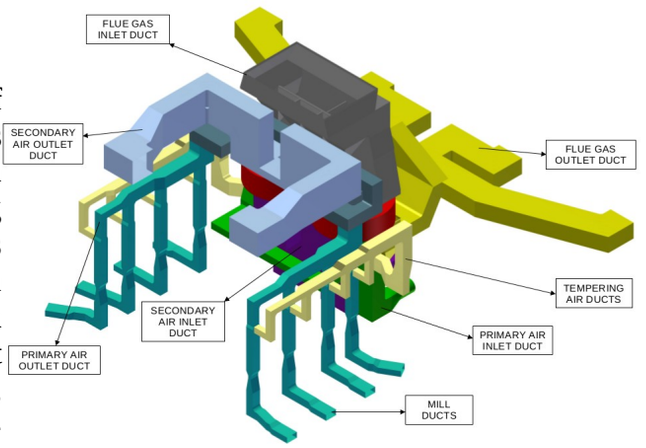
DUCT OPTIMIZATION USING CFD FOR THERMAL POWER

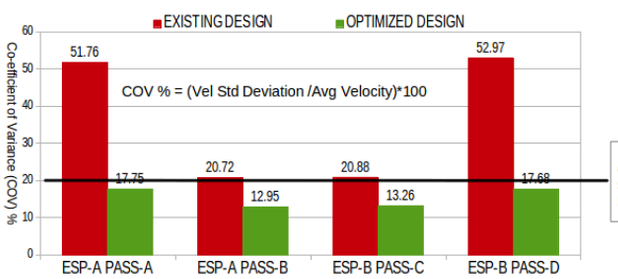
Objectives:

- To achieve uniform pressure, velocity and temperature distribution across vital power-plant components, like Air Pre-Heaters (APH), Gas-Gas Heaters (GGH), Electro-Static Precipitators (ESP) and Selective Catalytic Reduction (SCR), thereby maximizing their design efficiency.
- To significantly reduce the pressure drop across all the process duct systems including Flue gas (FG), Primary air (PA), Secondary air (SA) ducts and thereby saving annual auxiliary operating costs of thermal power plants.

CFD as an Duct optimization tool:

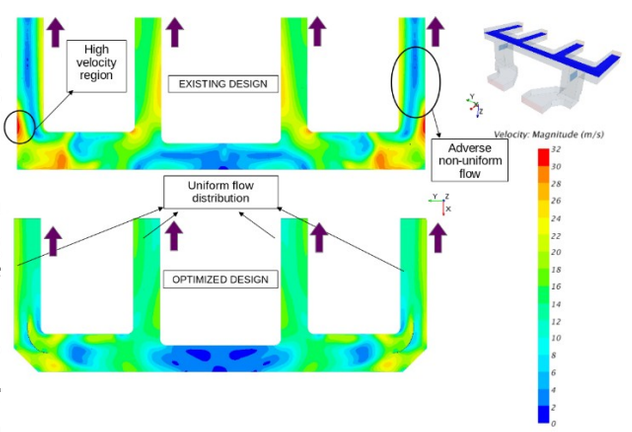


With the remarkable progress achieved in the field of computer technology, Computational Fluid Dynamics (CFD) would be an useful low-cost optimization tool for internal flows through duct/pipe networks. Using CFD models, pressure, velocity and temperatures fields are visualized through the existing ducts for a particular operating point. As a result of sudden geometry changes like sharp bends and abrupt expansion/contraction in the existing geometry, problematic areas such as flow recirculation and non-uniform velocity zones are identified. These abrupt geometry changes not only contribute to the excessive pressure drop in the duct system but also affect the downstream flow distribution. Therefore, in order to streamline the flow through the ducts, certain geometry modifications such as deflector plates, guide vanes, chamfer vanes are introduced. Based on customer preference, external duct geometry can also be modified for much better improvements in the flow. Multiple optimization cycles are carried out in order to arrive at a final optimized design, which has the minimum possible pressure drop for the duct system and uniform velocity distribution upstream of different power plant components. Special attention is given to the fact that the recommended geometry modifications are feasible for manufacturing and erection.



ICAC- gas velocity distribution standard (EP-7) states **COV of 20%** and below is suggested for ESP

Benefits after CFD optimization:



- Duct optimization analysis maximizes the performance of different power plant components such as APH, GGH, ESP, SCR, which in turn increases the overall efficiency of boiler.
- With the reduction in the overall duct system pressure drop, it is possible to considerably cutting down on the annual auxiliary operating costs of thermal power plants.
- Environmental guidelines specific to Thermal PP can be better adhered to for all the different power plant components by performing duct optimization analysis. For example, ICAC-EP-7 standard for clean air norms for ESP inlets can be met.

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