COAL COMBUSTION USING CFD FOR THERMAL POWER

Design Objectives:

In a pulverized coal fired power plant, the main design objectives are as follows,

- To improve the technology for the control of environmental pollutants such as NO_X, SO_X and unburnt carbon in fly ash in order to satisfy the emission norms
- To increase the overall thermal combustion efficiency of coal-fired utility boilers inorder to limit the global warming effects caused due to excessive CO_2 emission and thereby extending the boiler lifetime.

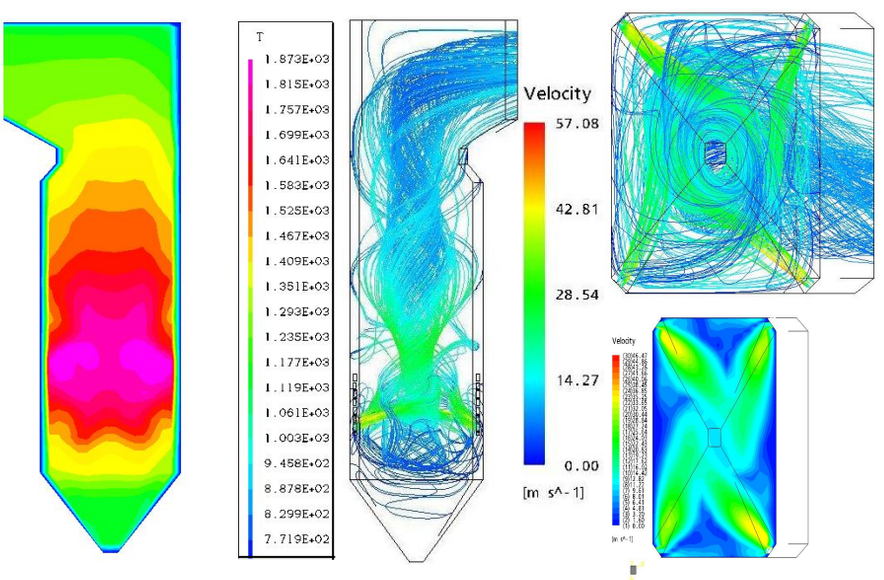
Advantages of using CFD as an Engineering tool:

The use of Computational Fluid Dynamics (CFD) provides boiler equipment performance predictions in the form of detailed 3D distributions of the flow field, gas species, and temperature throughout a boiler, which is almost impossible to infer from experience, traditional performance predictions (based on simple semi-empirical correlations), or field measurements alone. Design optimization is more likely when CFD modeling results are used in conjunction with experience, traditional performance predictions, and field measurements and thereby bridging the gap between previous experience and development of new design invovation. Therefore, CFD models are strongly expected to be a useful low-cost optimization tool for trouble-shooting operational problems for the existing boilers and expediting the design and development of efficient and clean combustion furnaces for future large utility thermal power plant.

Modeling Coal combustion using CFD for Burners/Furnaces/Boilers:

A coal combusion CFD simulation model comprises of a combination of sub-models which numerically solves fluid flow, turbulence, radiative and convective heat transfer, lagrangian particle tracking, chemical reactions, devolatilization, char-oxidation and species transport in a coupled fashion, thereby helps to gain deeper understanding of the complex physical, chemical and thermal processes taking place inside a coal fired utility boiler. Moreover, It facilitates the investigation of the below listed process and design parameters on the furnace wall heat transfer conditions, overall combustion efficiency, emission of pollutants and boiler lifetime.

- Different coal mixes and particle size distributions,
- Boiler load (full and part) conditions,
- Overall furnace geometry (furnace shape, burners arrangement, firing mode, optimization of OFA air ports),
- Retro-fitting new burner design on existing boilers
- Fuel and air inlet velocity distributions and flame-wall interaction phenomena,
- Identify areas of high probability of deposit build-up (slagging and fouling)



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