

MOTIVATION and ACHIEVEMENT

To retrofit the existing coal-fire power plants with significantly increased efficiency (HHV 50%), reduced emissions, and low capital cost using mild-gasified synthesis gas consisting of high-energy-density volatiles, hydrogen and carbon monoxide.

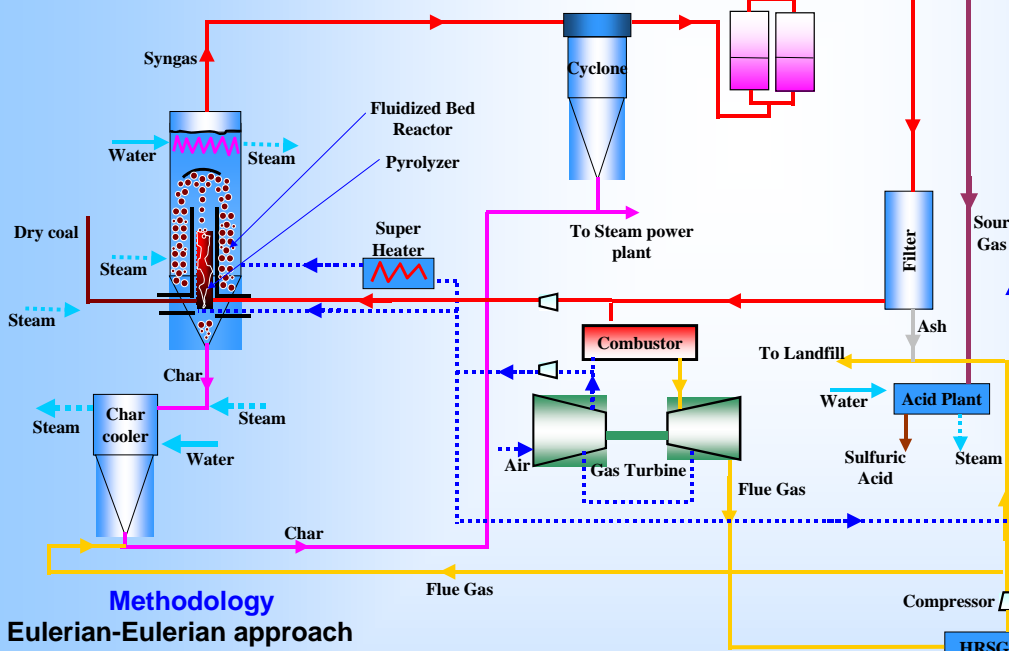
Problem with existing Coal-fired plants

- Combustion of coals
- Low Efficiency (28-30%)



▪ High emissions with Sulfur dioxide (SO_x) and Oxides of Nitrogen (NO_x), Mercury, Small particles.

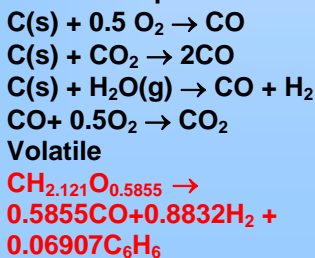
Process flow details



Methodology
Eulerian-Eulerian approach to solve Heterogeneous reaction process

- Reaction Models
- -Eddy-Dissipation
- -Finite Rate

Reaction Equations



Solution concepts

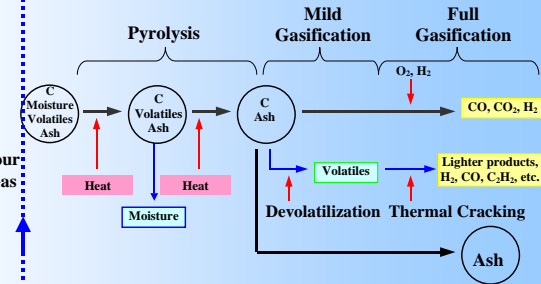
▪ Coal is not combusted, rather the mild-gasified syngas is combusted in gas turbines and the clean char (not coal) is burned in the existing boilers

▪ The syngas is cleaned with warm gas clean up system to remove sulfur and other contaminants before burning syngas in the gas turbine.

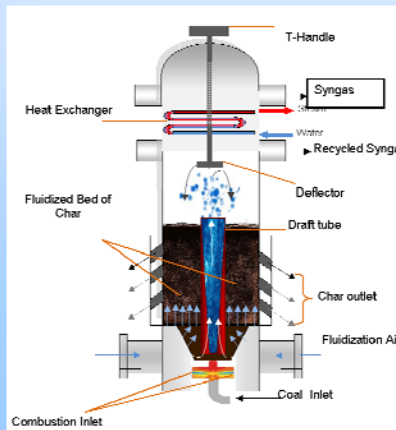
Advantages

- Retrofit existing coal-fired power plants without requiring new green fields
- Preserve the existing boilers and steam power plants to reduce plant costs.
- Significantly enhance efficiency (30% → 50% HHV) Significantly reduced emissions
- Reduced capital cost due to reduced major equipment sizes
- Preserving the high energy density volatiles with about six times more energy than the fully gasified syngas.

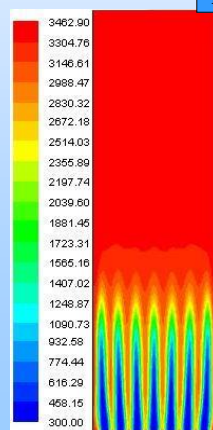
What is Mild Gasification?



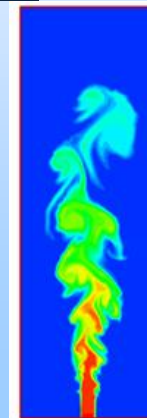
Mild Gasification emphasizes preserving the heavy volatiles without further gasifying fixed carbon or thermally cracking the volatiles into lighter components.



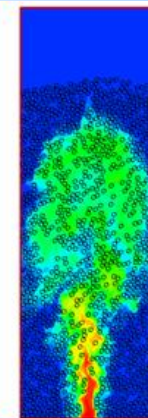
ECCC Mild Gasifier Design



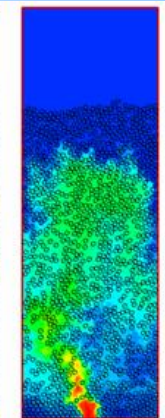
Adiabatic flame temp



Without particles



With light particles



With heavy particles