# Effects of the Piston Bowl Re-entrant Angle on the Performance, In-cylinder Fluid Flow and Emissions of Dual Fuel HCCI Engines

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***Abstract***
**A numerical analysis is done to investigate the influence of the piston bowl Re-entrant Angle on the working of a CI (Compression Ignition) engine in Homogeneous Charge Compression Ignition (HCCI) mode of combustion with dual fuels (n-dodecane + ethanol) using ECFM-3Z (Three Zone-Extended Coherent Flame Combustion Model, Compression Ignition). This model has been validated with the existing literature. The design of piston bowl is an essential factor that affects the mixing of fuels with air, combustion and emission formation processes. The analysis was done considering re-entrant angle of piston bowl between $14^0$ and $26^0$ while remaining parameters associated with the engine (like maximum diameter of the bowl, injection rate and timing, Compression Ratio etc.,) are unchanged. It is observed that the Piston Bowl Re-entrant angle had shown significant influence on in-cylinder motion of charge, combustion, emission formation of the Dual Fuel HCCI engine. Re-entrant angle $14^0$ had shown an optimal result of lowest NOx emissions with highest Piston Work comparatively for the chosen engine specifications.**
***Keywords:*** HCCI engine; Re-entrant Angle; Bowl-in-Piston; NOx emissions