A numerical study is performed to investigate the effect of non-gray radiation on mixed convection in a vertical two sided lid driven square cavity filled with air-H_2O-CO_2 gas mixture. The vertical moving walls of the enclosure are maintained at two different but uniform temperatures. The horizontal walls are thermally insulated and considered as adiabatic walls. The governing differential equations are solved by a finite-volume method and the SIMPLE algorithm was adopted to solve the pressure–velocity coupling. The radiative transfer equation (RTE) is solved by the discrete ordinates method (DOM). The spectral line weighted sum of gray gases model (SLW) is used to account for non-gray radiation properties. Simulations are performed in configurations where thermal and shear forces induce cooperating buoyancy forces. Streamlines, isotherms, and Nusselt number are analyzed for three different values of Richardson's number (from 0.1 to 10) and by considering three different medium (transparent medium, gray medium using the Planck mean absorption coefficient, and non-gray medium assumption)