Air fuel ratio definition

Thermal engines use fuel and oxygen (from air) to produce energy through combustion. To guarantee the combustion process, certain quantities of fuel and air need to be supplied in the combustion chamber. **A complete combustion takes place when all the fuel is burned, in the exhaust gas there will be no quantities of unburnt fuel**.

Air fuel ratio is defined as the ratio of air and fuel of a mixture prepared for combustion. For example, if we have a mixture of methane and air which has an air fuel ratio of 17.5, it means that in the mixture we have 17.5 kg of air and 1 kg of methane.

The ideal (theoretical) air fuel ratio, for a complete combustion, is called stoichiometric air fuel ratio. For a gasoline (petrol) engine, **the stoichiometric air fuel ratio is around 14.7:1.** This means that, in order to burn completely 1 kg of fuel, we need 14.7 kg of air. The combustion is possible even if the AFR is different from stoichiometric. For the combustion process to take place in a gasoline engine, the minimum AFR is around 6:1 and the maximum can go up to 20:1.

When the air fuel ratio is higher than the stoichiometric ratio, the air fuel mixture is called lean. When the air fuel ratio is lower than the stoichiometric ratio, the air fuel mixture is called rich. For example, for a gasoline engine, an AFR of 16.5:1 is lean and 13.7:1 is rich.

Fuels	Stoichiometric air-fuel ratio
Gasoline	14.7:1
Octane	15:1
Hydrogen	34.5
Methane	17
Methanol	6.5:1
Diesel	14.5:1
Ethanol	9:1