



## Emission Indices of current Flight Gas Turbines compared with EURO IV Diesel Car Emission Standard

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The best method to compare the quality of combustion processes is to compare the the emission indices (EI).

$$EI = \text{mg pollutant} / \text{kg burned fuel}$$

### Euro IV diesel car:

- 25mg particulate matter / km
- assumed fuel consumption 5 kg diesel / 100 km
- allowed emission index for EURO IV diesel cars:

$$EI = 500 \text{ mg soot} / \text{kg diesel}$$

$$\text{or } 5 \text{ mg soot} / \text{passenger km}$$

### Current medium to large passenger aircraft

$$EI = \sim 35 \text{ mg soot} / \text{kg fuel (cruise condition)}$$

Example: 150 seat passenger aircraft

Cruise fuel consumption: 2700 kg / hour

Average speed : 800 km / hour

Soot emission: ~ 100 g / hour or 125mg / km

$$\text{or } 0,8 \text{ mg soot} / \text{passenger km}$$

The combustion process in gas turbines is much better than in diesel piston engines. In diesel engines there is always ignition and extinguishing of the flame. This results in „high emissions“.

In gas turbines there is a continually burning flame. Emission Indices are low without any aftertreatment.

Emission Indices of flight gas turbines are lower than the allowed emission indices of EURO IV diesel cars



### Emission Indices

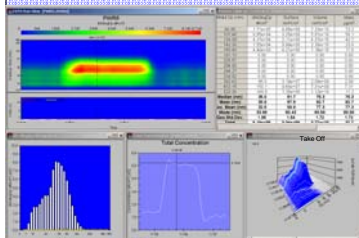
PW 545A (Cessna Citation)



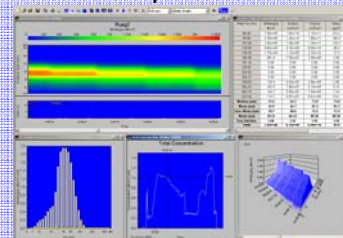
Makila 1A1 (Helicopter engine)



PW 545A – take off



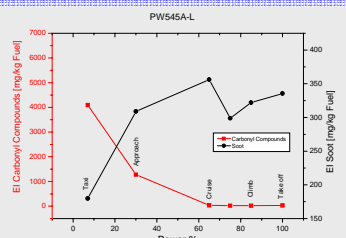
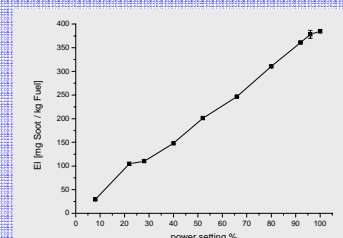
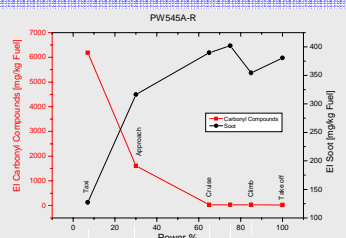
MAKILA 1A1 – power 8% - 100%



mass / kg fuel

$$EI_{\text{soot}} = 25 \text{ mg} - 400 \text{ mg soot}$$

$$EI_{\text{al}} = 0 \text{ mg} - 6250 \text{ mg aldehyde}$$



particle # / kg fuel

$$EI = 2 \times 10^{15} - 7 \times 10^{15}$$

