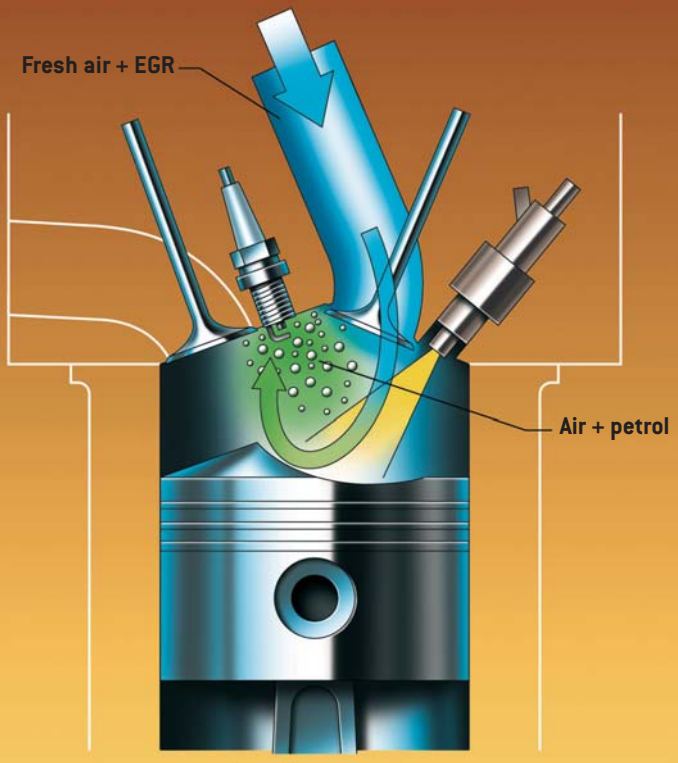
The stratified charge engine

The principle of stratified charge applies to direct injection petrol engines. It involves concentrating spraying of the fuel close to the spark plug rather than throughout the whole of the combustion chamber. This method of operation delivers a **reduction in fuel consumption** that can reach 40% when the engine is running at very low charge.



RENAULT COMMUNICATION

BASIC FACTS

The principle of the stratified charge engine is to deliver a mixture that is sufficiently rich for combustion in the immediate vicinity of the spark plug and in the remainder of the cylinder, a very lean mixture that is so low in fuel that it could not be used in a traditional engine. On an engine with stratified charge, the delivered power is no longer controlled by the quantity of admitted air, but by the quantity of petrol injected, as with a diesel engine.

IN SHORT

By concentrating the spraying of the fuel near the spark plug in a specific zone of the combustion chamber placed near the spark plug, the fuel consumption of the engine is sharply reduced when running at very low charge.

: HOW DOES IT WORK?

One approach consists in dividing the combustion chamber so as to create a pre-combustion chamber where the spark plug is located. The head of the piston is also modified. It contains a spheroid cavity that imparts a swirling movement to the air contained by the cylinder during compression. As a result, during injection, the fuel is only sprayed in the vicinity of the spark plug.

But other strategies are possible. For example, it is also possible to exploit the shape of the admission circuit and use artifices, like "swirl" or "tumble" stages that create turbulent flows at their level.

All the subtlety of engine operation in stratified mode occurs at level of injection. This comprises two principal modes: a lean mode, which corresponds to operation at very low engine load, therefore when there is less call on it, and a "normal" mode, when it runs at full charge and delivers maximum power.

In the first mode, injection takes place at the end of the compression stroke. Because of the swirl effect that the piston cavity creates, the fuel sprayed by the injector is confined near the spark plug. As there is very high pressure in the cylinder at this moment, the injector spray is also quite concentrated. The "directivity" of the spray encourages even greater concentration of the mixture. A very small quantity of fuel is thus enough to obtain optimum mixture richness in the zone close to the spark plug, whereas the remainder of the cylinder contains only very lean mixture. The stratification of air in the cylinder means that even with partial charge it is also possible to obtain a core of mixture surrounded by layers of air and residual gases which limit the transfer of heat to the cylinder walls. This drop in temperature causes the quantity of air in the cylinder to increase by reducing its dilation, delivering the engine additional power. When idling, this process makes it possible to reduce consumption by almost 40% compared to a traditional engine. And this is not the only gain. Functioning with stratified charge also makes it possible to lower the temperature at which the fuel is sprayed. All this leads to a reduction in fuel consumption which is of course reflected by a reduction of engine exhaust emissions.

When engine power is required, injection takes place **in normal mode**, during the admission phase. This makes it possible to achieve a homogeneous mix, as it is the case with traditional injection. Here, contrary to the previous example, when the injection takes place, the pressure in the cylinder is still low. The spray of fuel from the injector is therefore highly divergent, which encourages a homogeneous mix to form.