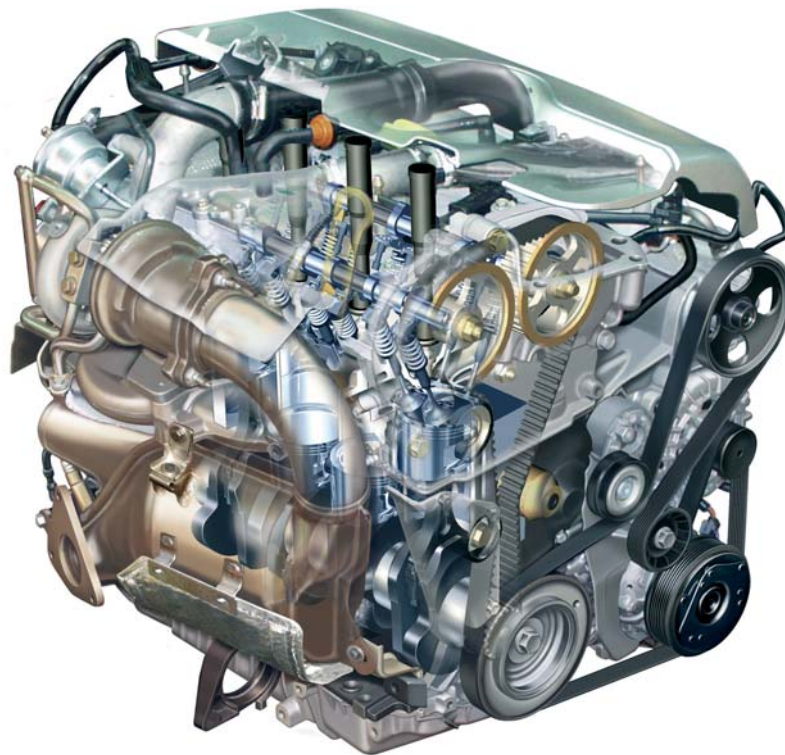




Downsizing

➤ The basic concept of downsizing is to **reduce engine capacity while preserving performance**. This operation directly increases engine efficiency while reducing polluting exhaust emissions.



RENAULT COMMUNICATION

➤ THE BASICS

The higher the cubic capacity of an engine, the larger its size.

This assertion will come as a surprise for no one. Size has a direct impact on performance. Indeed, the greater the size of the moving parts of an engine, and therefore the larger their mass, the higher their inertia. In terms of alternate stroke pistons this results in a great expenditure of energy to reverse the displacement direction with each half-turn of the engine. Moreover, thanks to the low inertia of its moving parts, a small capacity engine can run faster than a bulkier engine. Because the power that an engine delivers is a function of the product of its torque and the number of revolutions, any increase in torque makes it possible to increase power. In addition, internal friction of an engine is directly related to the dimensions of the components that are in contact. Here again, the larger the engine, the larger the surfaces in contact, so the higher the friction and the more energy needlessly lost during running. This energy comes directly from fuel. It follows that any loss of energy results in an increase in fuel consumption. Moreover, it is much more difficult

to have perfect control of combustion of a large volume of mixture. Heterogeneity phenomena may arise. In addition to a loss of engine efficiency, these result in an increase in polluting exhaust emissions. Lastly, the weight of the engine itself penalises vehicle performance and fuel consumption. All of these features are arguments in favour of downsizing.

IN SHORT ➤➤➤

Downsizing consists of reducing the cubic capacity of an engine while maintaining its level of performance. This can be done with a turbocharger and direct injection technology.



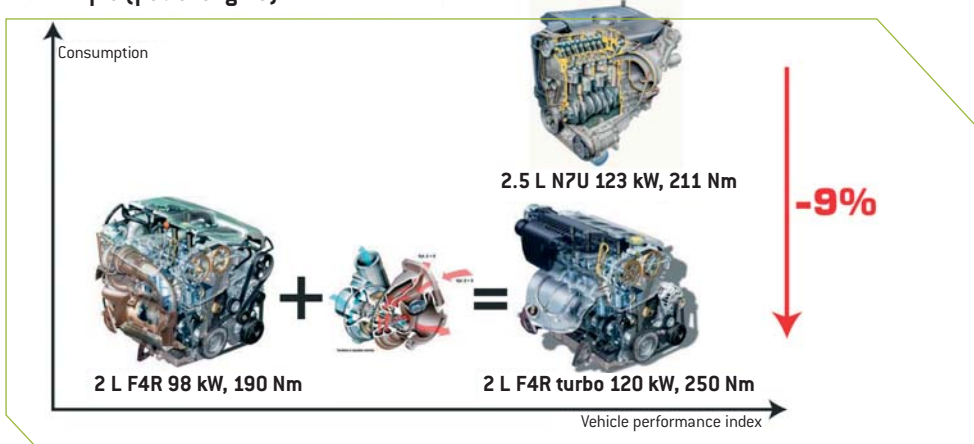
> HOW DOES IT WORK?

In a diesel or petrol engine, it is the explosion or the combustion of the mixture which produces the driving force.

The more of the mixture brought into play, the greater the release of energy. In addition, the higher the rate at which motive phases follow one another, the greater the amount of energy the engine will produce in a given lapse of time. All this, in theory, is equivalent to saying that the greater the cubic capacity of an engine, the faster it will run, and the greater the power it will deliver. However, up to now cubic capacity was synonymous with the quantity of mixture which the engine could accept during each intake stroke, but downsizing has modified this concept. Downsizing favours increasing engine running speed by reducing the inertia of its moving parts, but on the other hand, works against the intake of an acceptable mix volume by the cylin-

ders. However, a turbocharger makes it possible to solve this problem. By increasing the pressure of air on entry to the engine, it makes it possible to apply a higher volume of mixture to each cylinder than it could accept without this pre-compression. Moreover, the conditions under which the mixture explodes, or burns, and its air-fuel proportioning play a role in the amount of energy which this operation releases. Here, direct injection makes it possible to control these conditions very precisely, delivering optimisation of engine output. Thus, a 2.5 L petrol engine capable of delivering power of 123 kW and torque of 211 Nm can be replaced by a 2 L turbo engine. This will deliver 120 kW with torque of 250 Nm, and therefore equivalent performance, while offering a 9% reduction in fuel consumption. This illustrates the principle of the downsizing.

Example (petrol engine)



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