Technology Fact Sheet

Direct Injection for internal combustion engines[i]
/http://climatetechwiki.org/technology/ice_improvements/

General description

Direct fuel injection is a technique that allows gasoline and diesel engines to run more fuel efficient, that is, to burn less fuel. Direct injection techniques are already commonly used in modern diesel engines and are becoming more and more established for gasoline engines. Direct injection engines can lower the CO_2 emission of the vehicle by about 15% with low extra costs compared to other techniques leading to similar CO_2 emission reduction. However, still two thirds of all gasoline powered internal combustion engine vehicles which are sold worldwide are equipped with an internal combustion engine with indirect injection. Direct injection in diesel engines leads to small reductions in NO_x and particulate matter emissions which affect local air quality. However, direct injection in gasoline engines can lead to a small, cca. 6% increase of NO_x and particulate emissions(Gable, 2008).

Direct injection means injecting fuel, under high pressure, directly into the engine's cylinders (Leonhard, 2008). The direct injection process gives precise control over the timing and the amount of fuel which is injected. This precise control allows the motor management system to only inject relative large amounts of fuel when this is required, for example to accelerate the vehicle.

Direct injection modifies the motor's fuel injection system, but does not require any additional changes in car design or transport infrastructure. Direct injection engines need more robust components, because they process fuel at significantly higher pressures than indirect injection systems. The injectors must be able to withstand the higher heat and pressure of combustion inside the cylinder. (source: climatetechwiki.org).

Implementation

Direct injection is fully developed for diesel engines, where it has been used for a considerable time (Bosch, 2004). For gasoline powered cars the technology is not yet widely implemented, although it is already being used in some vehicles. The abbreviation GDI, Gasoline Direct Injection, is commonly used. However, still two thirds of all gasoline powered internal combustion engine vehicles which are sold worldwide are equipped with an IC engine with indirect injection (Leonhard, 2008). It is assumed that by 2030 gasoline powered internal combustion engine will account for 100% of the total number of gasoline powered vehicles, with emissions in compliance with Euro-5 standards (1000 mg / km).

Implementation barriers

GHG emissions reduction (megaton CO_2 equivalent) – 177 thousand tons CO_2 in 2030.

Impact on development priorities:

a) *social*

b) *economic*

- increased energy security of the country;
- improved balance of payments.

c) *environmental*

d) *other*

Investment

Direct injection engines are by about 5% more expensive than a conventional engine. The investments range of several hundreds of dollars, and contribute to reduction of CO_2 emission by up to 15% (Sharpe and Smokers, 2009). For the purpose of analysis an additional investment of $ 1,000 / vehicle was considered, the total purchase price of the car increasing from $ 20-21 thousand. Given the application of this technology to all gasoline powered cars, and given the estimated total number of cars by 2030 is 490,000, the total investment is estimated at $ 10.290 million.

Operation and maintenance costs – were considered at 10% of the annual investment costs, or $ 300 / year, and given the total number of cars, the cost is $ 147 million.

GHG reduction cost – 11.35 $/ton CO_2.

Technology lifetime – 7 years.

Other

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[i] This fact sheet has been extracted from TNA Report - Technology Needs Assessment for climate change mitigation - Republic of Moldova. You can access the complete report from the TNA project website **http://tech-action.org/**