

# E4D - Ethanol for diesel

## IFP International Consortium Study (2007-2009)

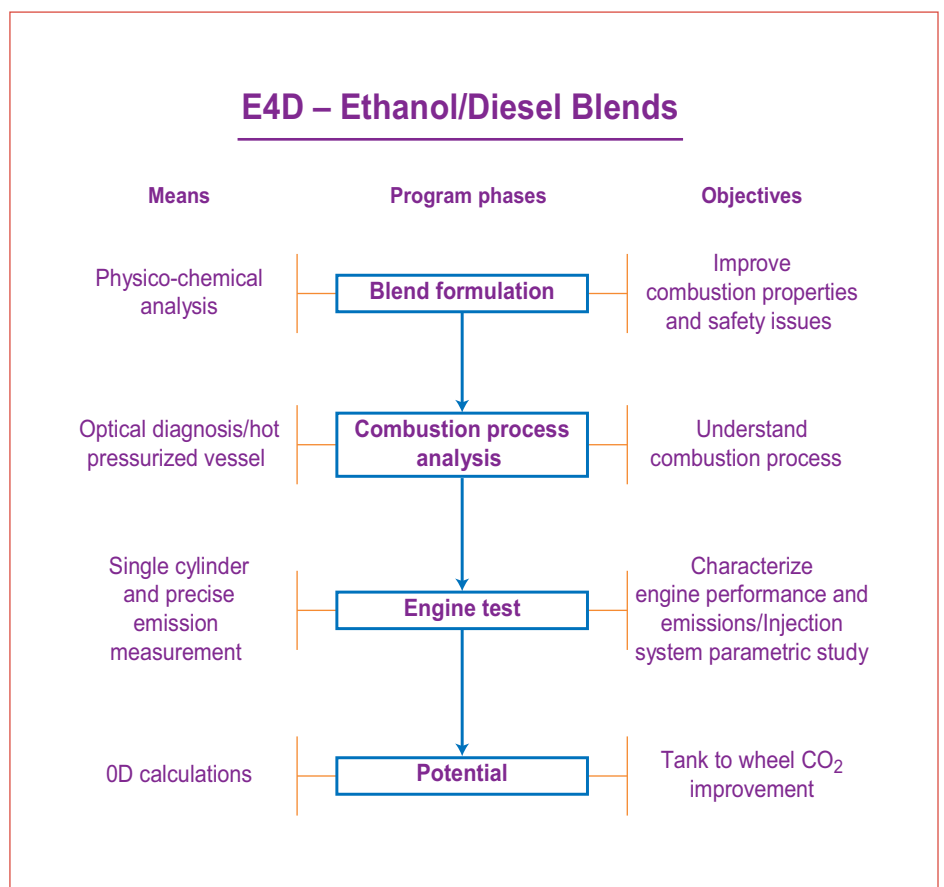
### Four ways to use ethanol in a diesel engine

#### Towards short-term solutions to reduce CO<sub>2</sub> emissions and decrease fuel dependency

The commitment by Kyoto protocol signatories to reduce greenhouse gas emissions has led to growing interest in using fuels produced from biomass, most notably ethanol, for spark-ignition engines, and biodiesel, for diesel engines. These fuels may be used either in blends or pure.

Another concern is to decrease dependency on fossil fuels. Diesel passenger cars constitute a growing market in Europe, and demand for diesel fuel is met by imported petroleum. Biodiesel can replace a share of the imports. Ethanol, on the other hand, by stretching the quantity of gasoline available, which is already in excess, aggravates the imbalance in the global European refining pool.

One promising solution would be to use ethanol in diesel engines, helping to achieve compliance with increasingly stringent regulations.



## Objectives of the research program

The objective of this Consortium is further investigation of ways to use ethanol as a base fuel in diesel engines.

Given the importance of the topic, the potential of this application, and the lack of data, much work must still be done to clarify the impact of such fuels on the combustion process and on emissions and to optimize engine behavior.

Several approaches could be studied:

- ethanol/diesel blends,
- neat ethanol - raw ethanol with or without additives;
- ethanol to diesel; synthetic diesel fuel produced by a chemical transformation of ethanol;
- dual fuel system - for some operating conditions, ethanol and diesel fuel are introduced simultaneously into the combustion chamber.

The research program will focus on ethanol/diesel blends for light-duty and heavy-duty engines, with a wide fuel matrix, including, if possible or available, tests of several injection system designs, brands, or technologies.

## Main work

To study the impact of adding ethanol to a standard diesel fuel, IFP proposes a 3-year program:

- study and investigation of the combustion process:
  - blend formulation;
  - combustion process analysis;
- testing of ethanol-diesel blends including:
  - design and manufacture of heavy-duty single-cylinder engine;
  - fuel matrix screening;
  - optimization of engine set-up;
  - characterization of emissions;
  - testing of injection system characteristics.

## Main results expected

- a better understanding of the behavior of blends containing ethanol;
- establishment of the potential of an ethanol/diesel blend in terms of exhaust gas emissions, fuel consumption, and performance and proposal of lines of progress;
- completion of the engine test, yielding results concerning engine performance, emissions, and the impact of injection system design.

*The information contained in this document is not contractual*

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