

“Cleaner racing in Finland”



**E85 Bioethanol in Finnish Formula
Ford Championship series –
Development of environmental
friendly motorsport**

- The project was carried out as a co-operation with Mäkelä Racing Team and Oulu University of Applied Sciences
- Finnish foundation of Henry Ford and Formula Ford Finland were the major supporters for the project.

Features of E85 Biofuel

- E85 biofuel contains 77-85 % bioethanol, which is a renewable biofuel. The rest part is petrol.
- With E85 it is possible to use higher compression ratio and ignition advance to achieve higher output from the engine.

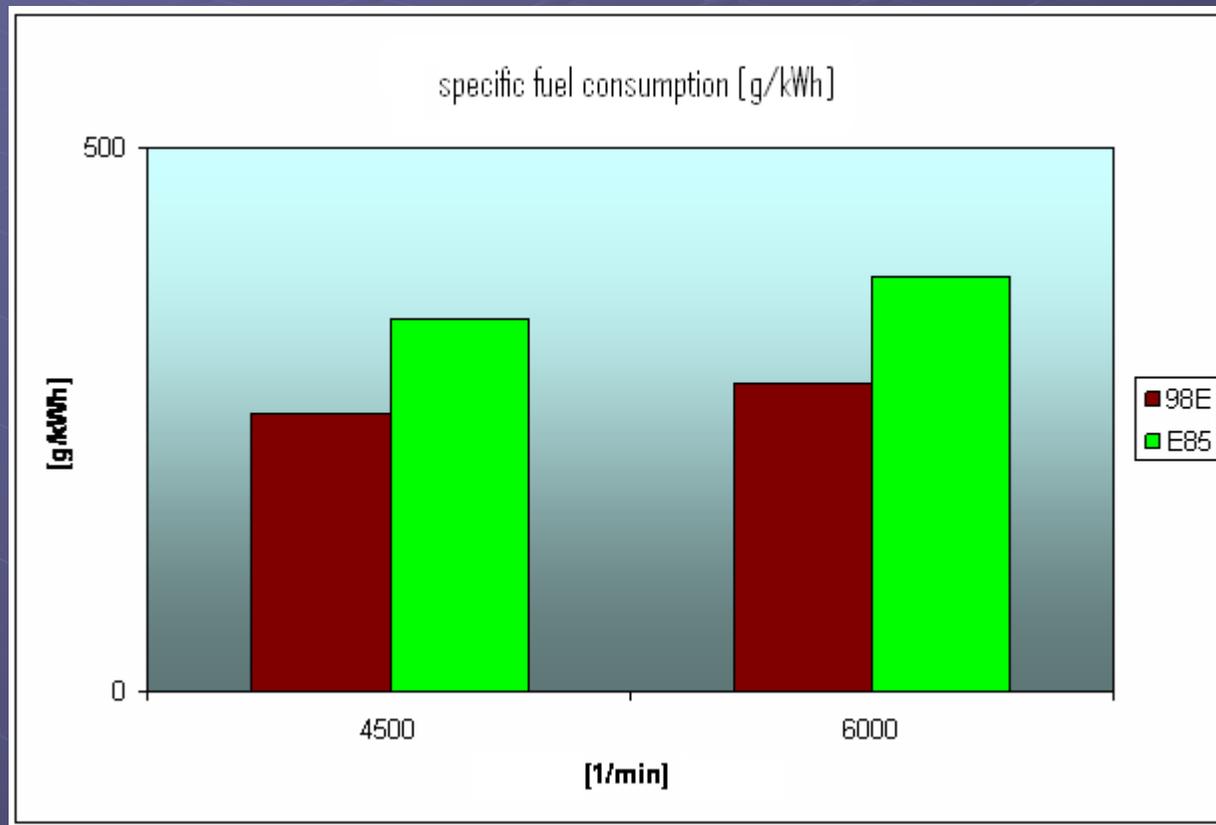
Features of E85 Biofuel

- E85 biofuel contains a large amount of oxygen. Therefore the amount of fuel injected into the cylinder must be enlarged to maintain the correct air/fuel ratio.
- 1 kilogram of 98E petrol needs 14,7 kg of air for optimum combustion. 1 kilogram of E85 biofuel needs approximately 10 kg of air for optimum combustion.

Features of E85 Biofuel

- With E85 biofuel the specific fuel consumption of the engine is approximately 20 % higher compared to 98E petrol.

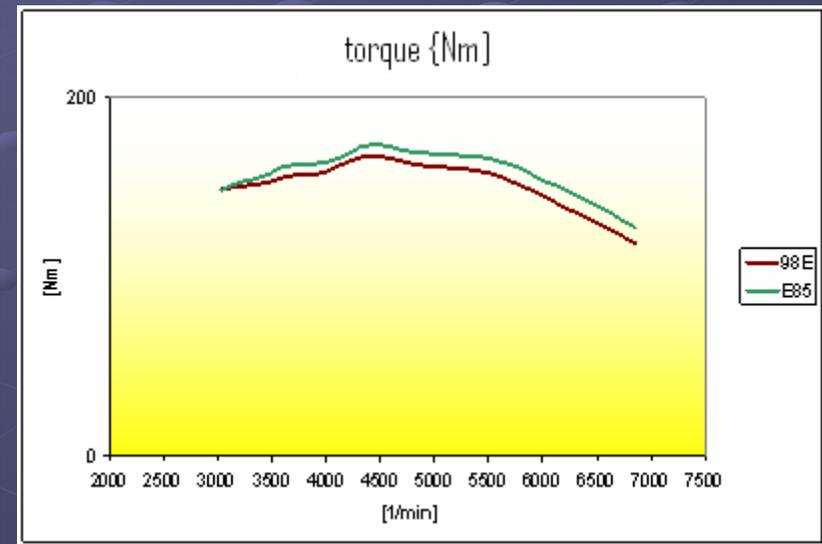
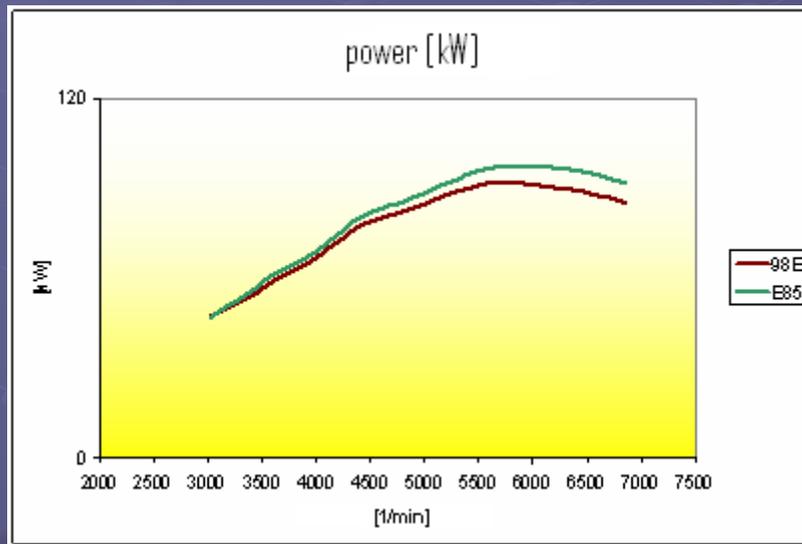
Features of E85 Biofuel



Features of E85 Biofuel

- In Formula Ford Zetec- engine the amount of intake air is restricted.
- Because the higher oxygen concentration of E85 biofuel the output of the engine is increased without a need of any mechanical changes.

Features of E85 Biofuel



Features of E85 Biofuel

- The future vision is to develop and manufacture biofuels from biowaste.
- With this kind of biofuels the balance of CO₂ emissions is nearly zero.

Actions for changing Formula Ford Zetec- engine to run with E85 biofuel

- Increasing the fuel rail pressure up to 400 kPa by replacing the original fuel pressure regulator.



Actions for changing Formula Ford Zetec- engine to run with E85 biofuel

- Engine management unit specially mapped for E85 biofuel (Motec M4)



Actions for changing Formula Ford Zetec- engine to run with E85 biofuel

- Adapter to original wiring harness for replacing the original ECU.

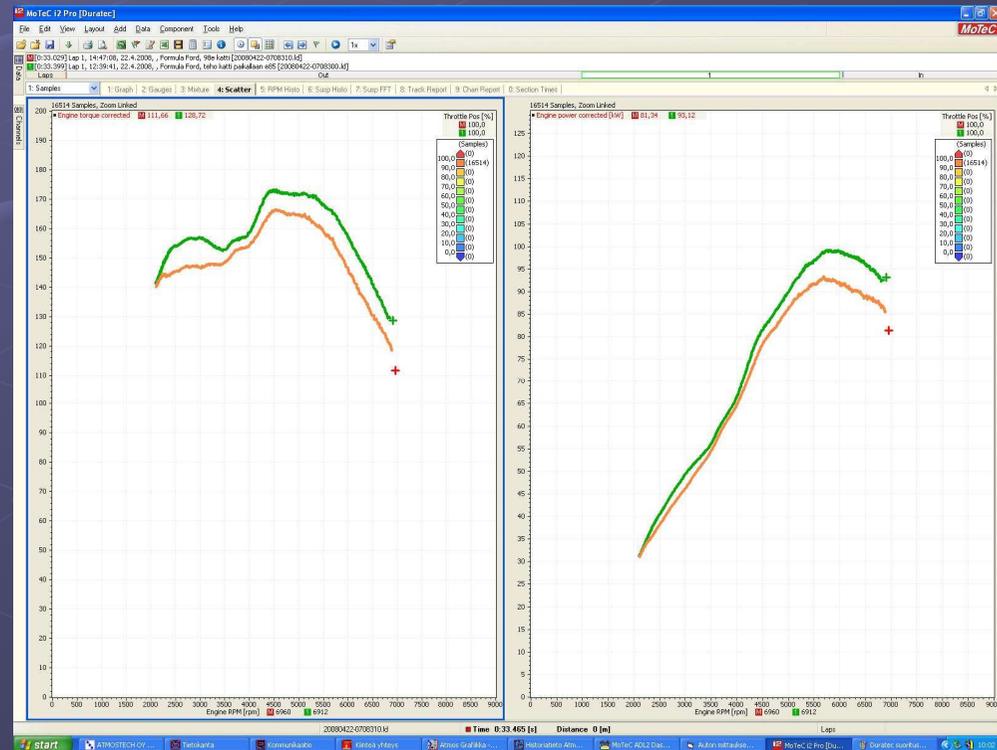


Zetec- engine assembled in engine dyno.



Zetec- engine output comparison with different fuels

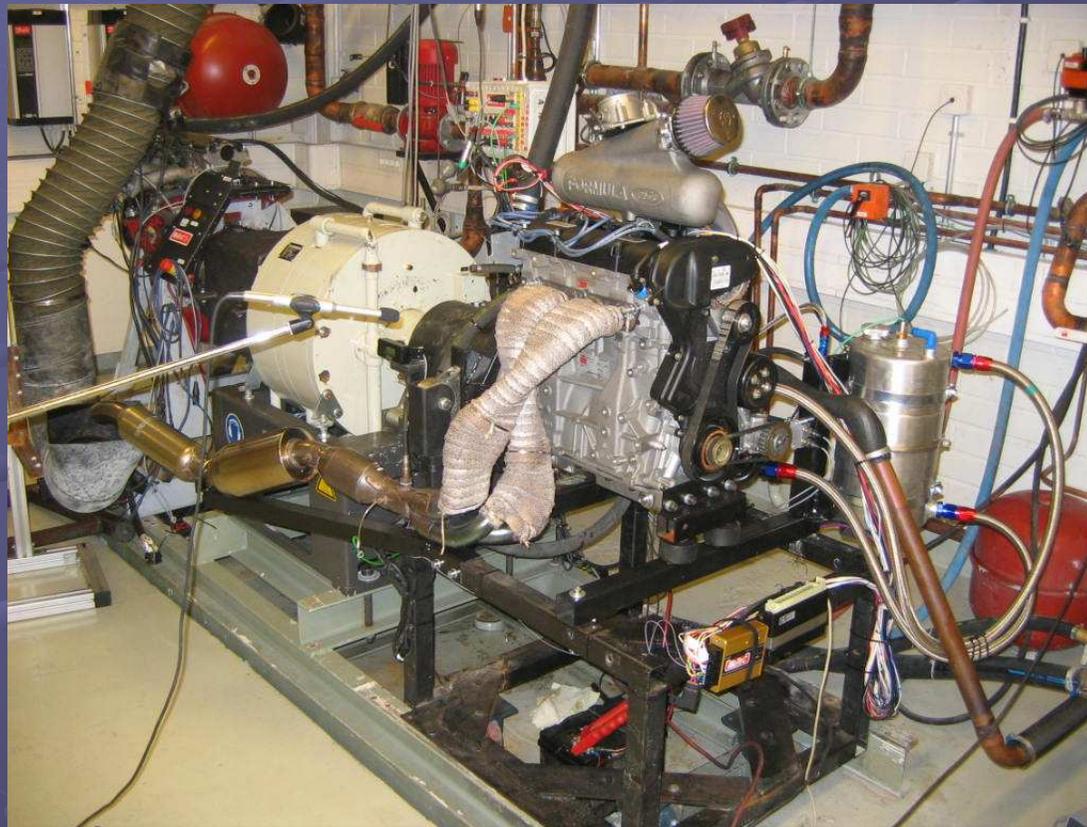
- 98E petrol:
 - 92 kW / 5600 1/min
 - 166 Nm / 4500 1/min
- E85 Biofuel:
 - 99 kW / 5600 1/min
 - 173 Nm / 4500 1/min



Actions for changing Formula Ford Duratec- engine to run with E85 biofuel

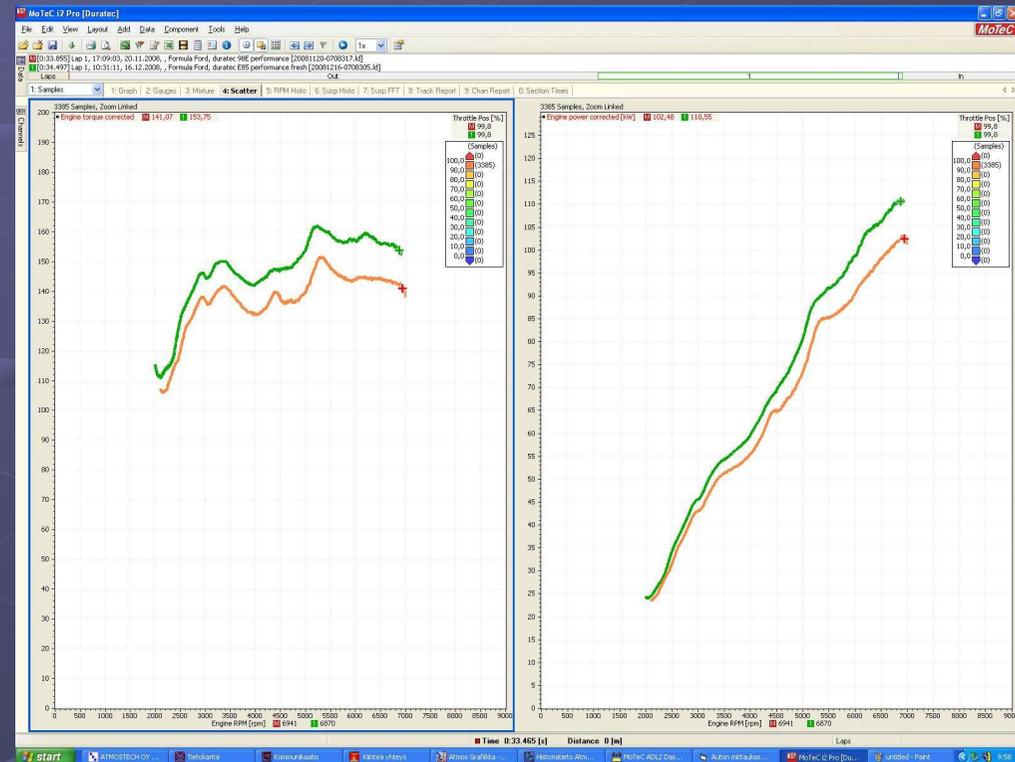
- Replacing original fuel injectors
- Engine management unit specially mapped for E85 biofuel (Motec M4)
- Adapter to original wiring harness for replacing the original ECU.

Duratec- engine assembled in engine dyno.



Duratec- engine output comparison with different fuels

- 98E petrol:
 - 103 kW / 6900 1/min
 - 151 Nm / 5300 1/min
- E85 Biofuel:
 - 111 kW / 6900 1/min
 - 162 Nm / 5300 1/min



Driving simulation in chassis dynamometer

- Before actual track tests the Zetec- engine was tested in chassis dynamometer.



Track tests

- First test run was at Kemora circuit in 7.5.2008



Project exhibition

- "Ethanol formula" on display at ahvenisto circuit Finnish championship opening in 17. – 18.5.2008



Track tests

- Finnish motorsport journalists testing the "Ethanol formula" at Botniaringin circuit in 11.8.2008



Racing with E85 biofuel

- First race with E85 powered formulas at Alastaro circuit in 13. – 14.9.2008



Project exhibition

- Oulu UAS and Mäkelä Racing Team at Oulu exhibition center in 26. -27.9.2008



Project exhibition

- Oulu UAS and Mäkelä Racing team at Oulu University in 12. – 13.11.2008



Supporting the project



Supporting the project



- Milla, Miikka, Jaana and Markku Mäkelä

Supporting the project



- Oulu University of Applied Sciences,
Institute of Technology /
Engine Laboratory.