Emission Differences between Neat Gasoline and E5 and E85 Gasoline-bioethanol fuel blends for Passenger Cars

11th joint TFEIP/EIONET meeting
10-11 May 2010, Larnaca, Cyprus
Transport expert panel, 10 May 2010

Morten Winther
Aarhus Universitet
Danmarks Miljøundersøgelser
Afdeling for Systemanalyse
Disposition

› Introduction

› Emission factor differences: neat gasoline/bioethanol blends
  › E0 vs E5
  › E0 vs E85

› Conclusion
Introduction

› Background: Literature survey made in the Danish REBECa project investigating the emission consequences of using biofuels in the Danish transport sector.

› Most of the emission measurements of E5 and E85 are relatively new and of European origin
  › The vehicles comply with EU legislative standards
  › European test cycles are used for emission testing
Introduction

› It is an advantage that measurements are obtained for new European vehicles
  › Until now ethanol only plays are marginal role as a road transport fuel
  › Most of the mileage is driven by newer vehicles (Euro 3+)
  › FFV’s (Flexible Fuel Vehicles) running on E85, are modern cars in compliance with new EU emission standards
  › Fine correspondance between Euro layers and calculation models
Introduction

- The use of European test cycles ensures the best consistence between test results and model factors
  - EU NEDC (New European Driving Cycle): Used for emission approval of cars in Europe
  - ARTEMIS Urban, Rural and Highway driving cycles: Real world driving patterns for urban, rural and highway driving developed in the European ARTEMIS project (EU 5th framework programme)
Martini et al. (2007): 1 Euro 3 and 6 Euro 4 cars
- Test cycle EU NEDC; CO, HC, NO\textsubscript{x}, CO\textsubscript{2}, fuel (l/100 km) energy (MJ/100 km)

- Test cycle EU NEDC; CO, HC, NO\textsubscript{x}, CO\textsubscript{2}, fuel (l/100 km)
Conclusions for E0 vs E5

- The average E0 vs E5 emission differences are close to zero.
- The large standard deviation for the E0/E5 results display large measurement differences between individual cars.
- The small average E0-E5 differences are supported by a comprehensive literature review made by Egebäck et al. (2005). In this study no significant differences are found between neat gasoline and E10/E15 blends from measurements made in Australia, Canada, USA, Sweden and UK.
- Consider the data basis for COPERT.
de Serves et al. (2005): 3 Ford Focus 1.6 l. (Euro 4)

Westerholm et al. (2008): Saab 9-5 Biopower (1.8 l.) and Volvo V50 1.8 F (1.8 l.)
  Measurements for E5 vs E85, E5 is the base fuel quality in Sweden
  Test cycles: EU NEDC; ARTEMIS Urban, Rural and Highway
  CO, HC, CH₄, NOₓ, CO₂, fuel (l/100 km) energy (MJ/100 km)
Conclusions for E0 vs E85

› The large standard deviation for the E5/E85 results, display large measurement differences between individual cars.
› More measurements are needed in order to provide a more solid basis for the derived averages.
› E0 vs E5 differences are close to zero, and hence the E5/E85 differences are assumably the same as for E0 vs E85.
› Consider the data basis for COPERT
References


› Winther (2009): Unit transformation functions from energy to volume and general expressions of fuel consumption and emission factor functions for biofuel blends used in the REBECa project (project note, 11 pp)

› Winther (2009): Emission Differences between Neat Gasoline and E5 and E85 Gasoline-bioethanol fuel blends for Passenger Cars (project note, 7 pp)

› Winther (2010): Road transport fuel consumption and emission calculations in the REBECa project (project note, 29 pp)

Thank you for your attention!