

Low blend in fossil fuels

**E-diesel and low blend in
gasolin**

Ethanol fuels for heavy-duty diesel vehicles

Pure bioethanol fuel



Ethanol bus fuel

Ethanol fuel for modified heavy-duty diesel engines.

Low blend in diesel



E-diesel

Can be used for all diesel engines.

What are E-diesel fuels?

- E-diesel is a blend of diesel fuel containing up to 15 volume % ethanol and additives, to maintain blend stability and certain fuel properties such as cetane number, corrosion inhibition and lubricity.
- The additives may comprise from 0,2 % to 5,0 % of the blend.
- The most tested compositions of E-diesel are 7-10 % ethanol and 1-2 % additive.

Example of fuel composition from E-diesel tests in Sweden

E-diesel composition		
Ethanol (fuel-grade >99.5%)	10%	(5-15%)*
Additive	2%	(0,2-5%)*
Diesel fuel	88%	(80-95%)*

*) Various compositions tested by different companies in Europe and US.

Source: Akzo Nobel Surface Chemistry AB, Sweden

How are E-diesel fuels made?

- E-diesel is made by splash blending of conventional diesel, fuel-grade ethanol, and additives.
- No special mixing protocol or temperature control is required.

A 124,000 kilometres test on E-diesel

Vehicle

- Scania R114
- Engine: DC1102
- Euro 2, 380 hp
- Weight: 15,000 kg
- Load: 25,000 kg



Source: Akzo Nobel Surface Chemistry AB, Sweden

Will using E-diesel affect the engine?

- The engines, engine bearings and rubber sealing has not shown any negative effect from E-diesel blends.

Inspection of the engine was made by Scania



Source: Akzo Nobel Surface Chemistry AB, Sweden

Precautions when using E-diesel

- Addition of ethanol to diesel fuel lowers its flash point, $<14^{\circ}\text{C}$.
- E-diesel blends, are like gasoline, flammable, and should be handled as such.

Sekab has a new E-diesel concept

- Ethanol derivative 10 % by volume.
- Diesel fuel 90 % by volume.
- No other additives.
- High stability. Stable blend up to 50/50.
- Higher flash point – Sekab low blend can be handle like diesel.

	Sekab Low blend	Diesel, Swedish standard
Cetane number	51	Min 51
Viscosity, 40 °C (cSt)	1,6	1,4 - 4,0
Density, 15 °C (kg/m ³)	815	800 - 820
Flash point (°C)	32 *	Min 55
Cloud point (°C)	-40	Max -16
CFPP (filter), (°C) **	<-35	Max -32
Corrosion, copper	1A	1A
HFRR (lubricity), (µm)	357	Max 460

*) Fire risk classification 2b flash point Min. 30 °C.

***) Cold Filter Plugging Point.

Fuel consumption

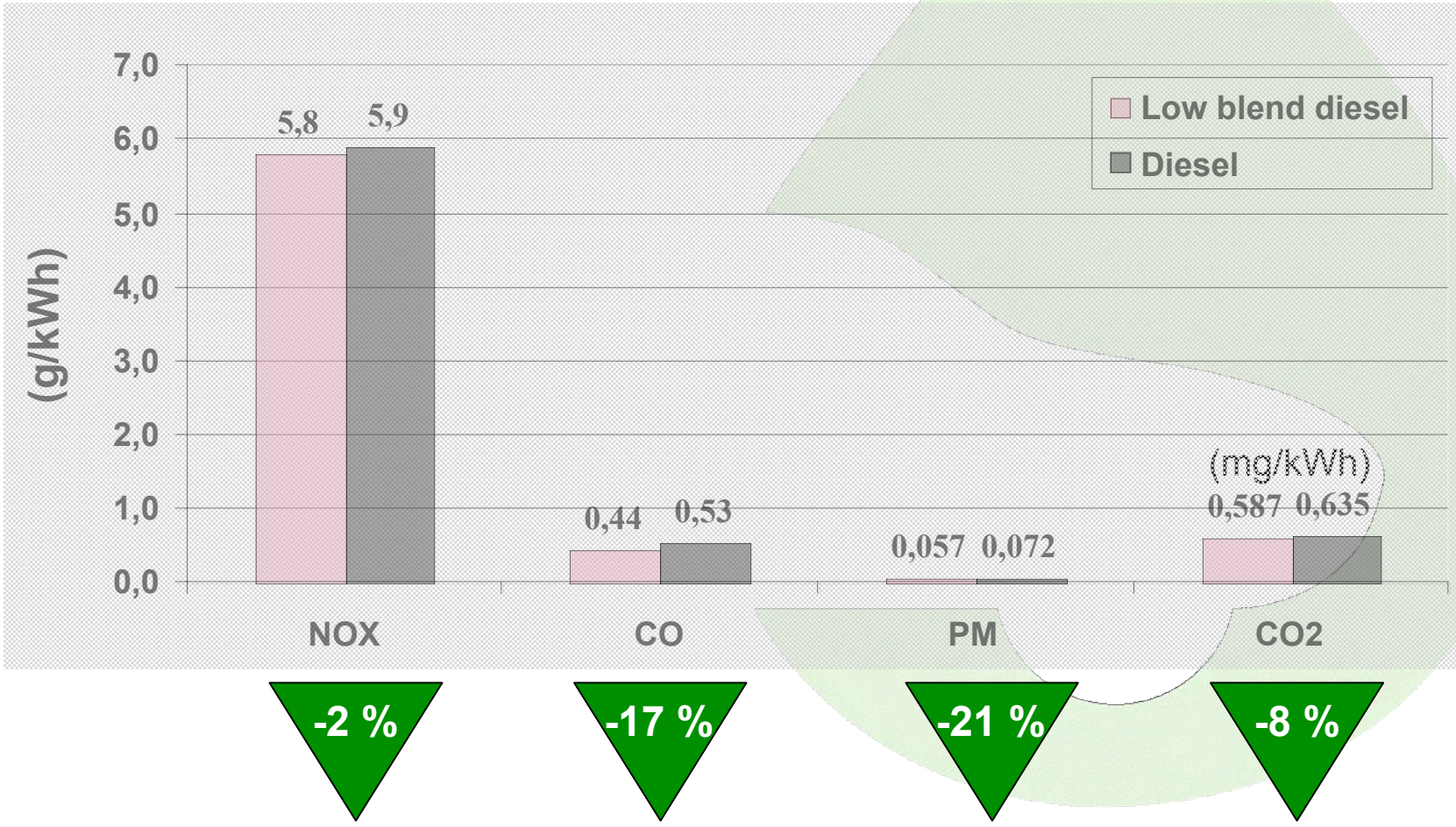
	Diesel	Sekab Low blend	Relative increase
Volvo engine	201,0 g/kWh	206,6 g/kWh	2,8 %

Engine power 3,6 % lower than diesel fuel at maximum load.

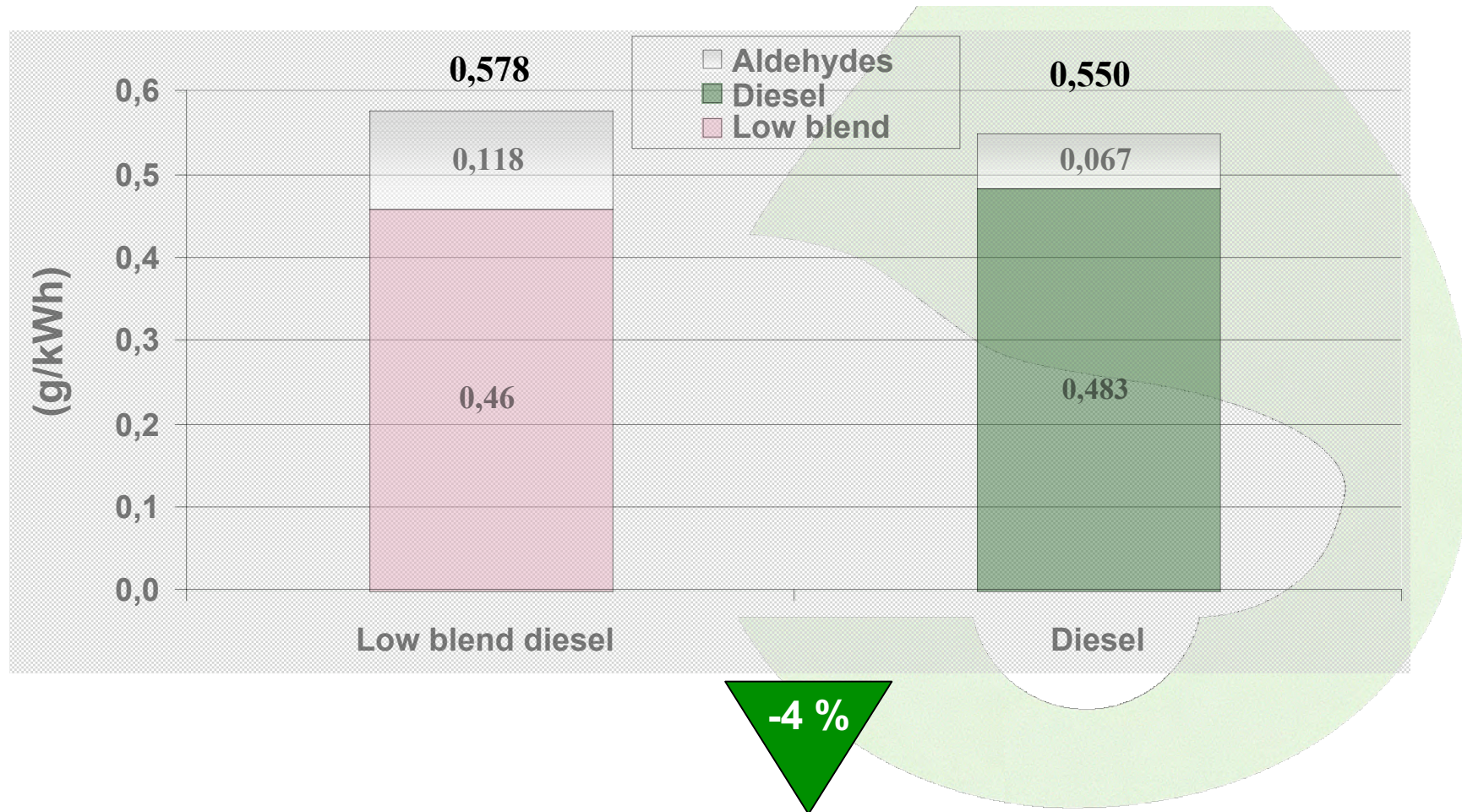
	Diesel	Ethanol derivative	Sekab Low blend
Heating value	43.1 MJ/kg	30 MJ/kg	41,8 MJ/kg

The heating value for Low blend is 3 % lower in comparison to diesel.

Emissions and CO₂



HC-emissioner



Summary of low blend in diesel

- Bioethanol derivative is soluble in diesel oil up to 50 %. No extra additives is needed.
- Higher flash point than conventional E-diesel, which means the fuel can be handle as standard diesel fuel.
- Low blend with ethanol, E-diesel, needs an extra solubilizer additive.
- The fuel properties fulfils the fuel standard qualities with reference to lubricity, corrosion and cetane number.
- Low blend in diesel does not damage sealings or engine parts.
- Reduction in exhaust gas emissions for nitrogen oxides, particulates and carbon monoxide.
- Reduction of carbon dioxide with about 8 %.

Low blend of ethanol in petrol



Low blend in Sweden

- In Sweden E10 was sold by OKQ8 from 1997 to 2000.
- From 2000 E5 was introduced. Today all petrol sold in Sweden contain 5 % ethanol.
- Some other countries which have introduced E5 or E10: US, Australia, Thailand and India.

Composition of ethanol in petrol

E5 and E10	
Ethanol (Fuel-grade >99.5%)	5 and 10 %
Petrol	95 and 90 %

Low blend of ethanol in petrol

- Anhydrous ethanol is typically blended up to 10 volume % in petrol for use in unmodified engines.
- In fuel blends up to 10 %, conventional petrol vehicles can be operated under full manufacturer warranty.
- Low percentage ethanol blends are dispensed in many service stations worldwide.
- Anhydrous ethanol has been used up to 25 % in petrol blends in Brazil for more than 30 years.

Recommendations for low blend of ethanol in petrol

BioAlcohol Fuel Foundation 1999-09-01

<u>Car manufacture</u>	<u>Percentage of ethanol</u>	<u>Model</u>
• Alfa Romeo	5,0 %	
• Audi	5,5 %	
• BMW	5,5 %	All models
• Chevrolet	10 %	1997-
• Citroen	10 %	1998-
• Fiat	5,0 %	
• Ford	10 %	1998-
• Honda	10 %	All models
• Hyundai	5,0 %	
• Mazda	10 %	1987-
• Mitsubishi	10-15 %	1989-
• Opel	10 %	All models
• Renault	15 %	All models
• Saab	10 %	1998-
• SEAT	5,5 %	All models
• Skoda	5,5 %	All models
• Suzuki	10 %	All models
• Toyota	10 %	1998-
• Volkswagen	5,5 %	All models
• Volvo	10 %	1998-

Source: Car agents for Sweden and OKQ8

Low blend of ethanol in petrol

- Ethanol in petrol is an efficient way to increase volume of fuel ethanol.
- Low blend does not provide any technical development.
- E5 contains 5 vol% ethanol, which meets the EN228 petrol specification.
- E10 need a change of the fuel standard specification for petrol.
- Low blends with 10 % and more will provide effect on reduced CO₂.

The End

Thank you!

