

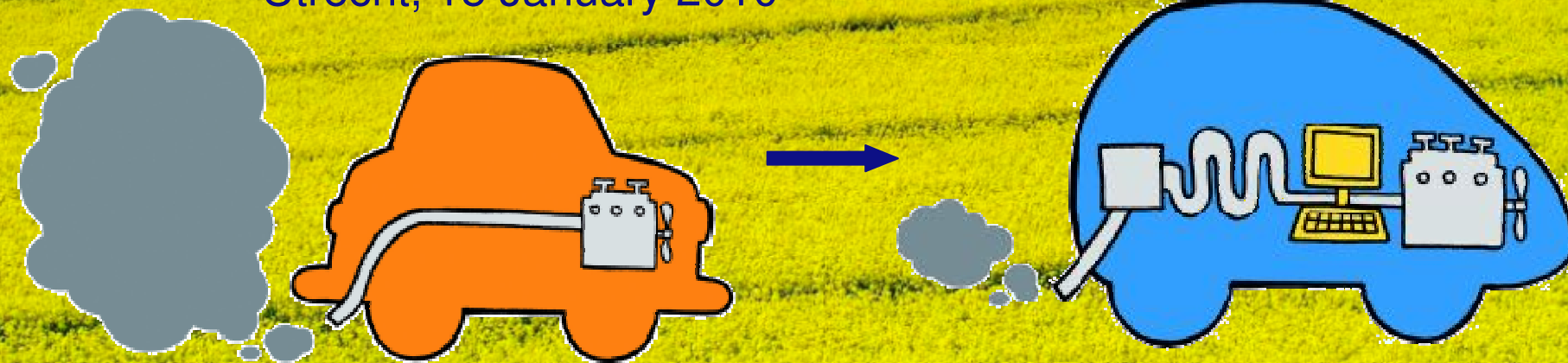
# BOLK 2: Impact of biofuels on pollutant emissions in 2020

TNO & CE Delft  
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**TNO | Kennis voor zaken**



BOLK meeting  
Utrecht, 15 January 2010



## Key message

**Effects on air pollutant emissions in 2020 of 10% biofuel target are very small, provided that the potential risks with high blends of FAME type biodiesel can be controlled or avoided.**

### **Why small:**

- **Closed-loop control for NOx**
- **Low contribution engine out particulates in 2020**

### **Risks with FAME blends:**

- **Performance and durability emission control systems**

# Structure project / contents

- Fuel mix scenarios
- Technical risks / stakeholders consultation
- Emission factors and national level
- Recommendations

# Fuel mix scenarios for 2020

- Main stream and niche fuels: **conclusion of BOLK**

	SI (petrol)	CI (diesel)
Main Stream	Max E10	Max B7 HVO, BTL to increase bio share
Niche	E85 for FFV Natural gas / CBG	B20 – B100 for adapted** (heavy-duty) vehicles

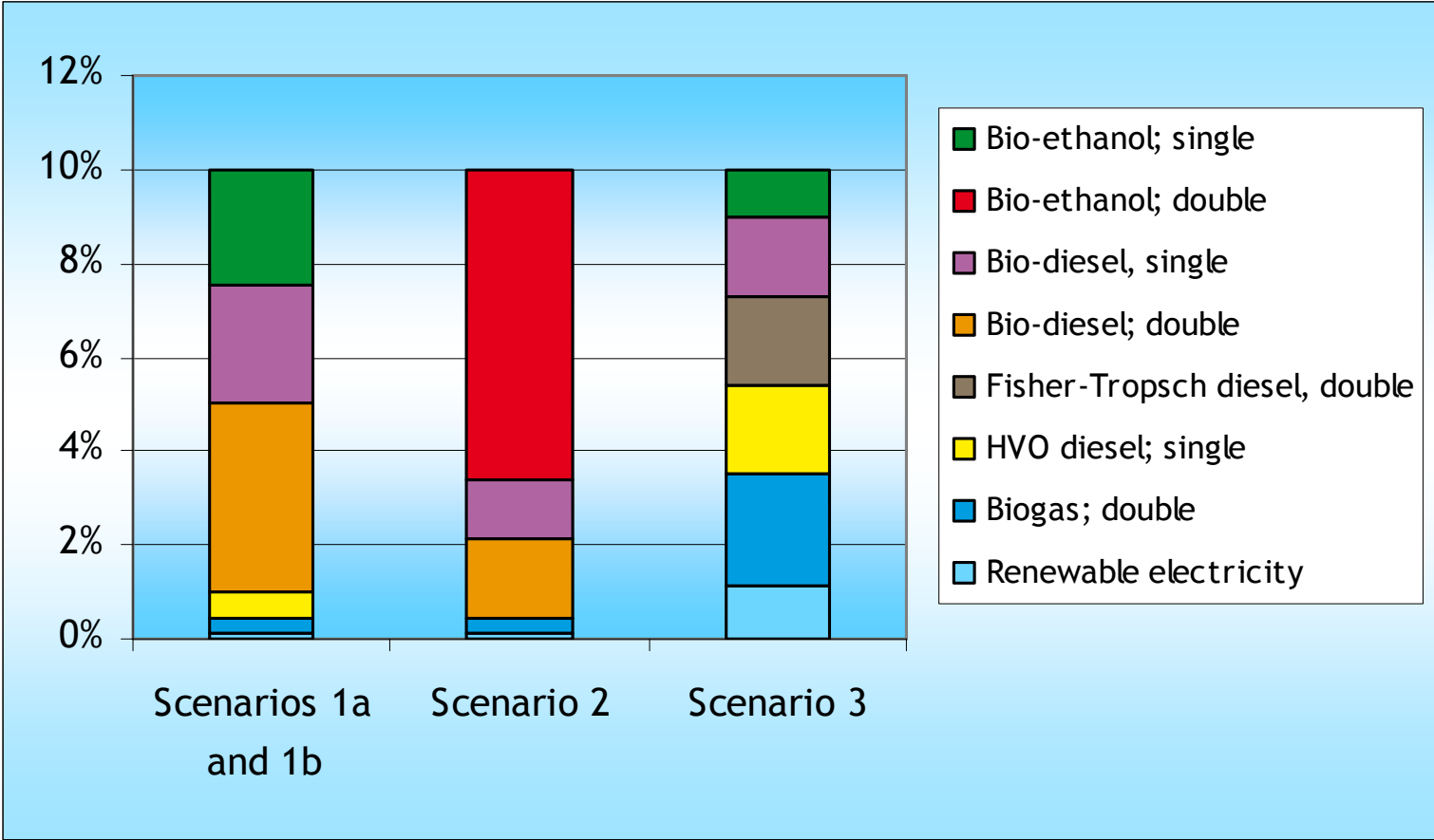
\*\* B30 and B100 chosen for scenario 1

# Fuel mix scenario's for 2020

- 1. Focus on single (& double) counting biodiesel and ethanol.*  
Bulk fuels are B7 and E10  
High blend for heavy-duty vehicles:
  - B30 (scenario 1a): 10% market share
  - B100 (scenario 1b): 2.3% market share
- 2. Focus on double counting ethanol and biodiesel.*  
2% market share by energy of E85 for passenger cars and biodiesel only in low blend (<B5)
- 3. Focus on air quality.*  
5.6% market share by energy of natural gas/biogas for passenger cars  
bulk diesel with low blend biodiesel, HVO and BTL  
Largest share of plug in hybrids and electric  
(4.2% by energy, 660.000 vehicles)

# Fuel mix scenario's for 2020




## Contribution of various fuels to 10% RED target



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## Technical risks / stakeholders consultation

- E10 and B7 will most likely be implemented as standard fuels for the emissions legislation Euro 6 / VI 
- E85: implemented in legislation (Euro 5 phase B) 
  - Same requirements as for petrol
  - No significant technical problems expected
- Technical issues with high blends biodiesel (FAME) 
  - Durability risks of emission control systems
  - Emissions change (possible NOx increase)

# Technical compatibility / stakeholders consultation

## Biodiesel (FAME) in diesel engine

Engine wear issue (biodiesel fulfilling EN14214)	Concern L (low), M (medium), H (high)	
	B30	B100
Fuel injection system wear / injector fouling	L, H, H, H, H	M, M, H, H, H
EGR system fouling, EGR valve sticking	L, H, H, H, H	M, M, H, H, H
Catalyst face plugging	L, M, M, H, H	M, M, H, H, H
(SCR) catalyst deactivation	L, M, M, H, H	M, H, H, H, H
DPF failures	L, M, M, H, H	M, M, H, H, H
Other emissions related issues: - OBD impact and high NOx - damage body work of truck near exhaust pipe	M, H H	H, H H
Other failures -Corrosion, Sticking, Lacquering -Lubricant dilution -Fuel system clogging in winter	H H H	H H H

Biodiesel can seriously affect the durability and performance of emission control systems !

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# Emission Factors for biofuels blends

$$\boxed{\begin{array}{l} \text{Emission} \\ \text{Factor}_{\text{biofuel}} \end{array}} = \boxed{\begin{array}{l} \text{Emission} \\ \text{Factor}_{\text{convention}} \end{array}} \times \boxed{\begin{array}{l} \text{Standard} \\ \text{Factor}_{\text{biofuel}} \end{array}} \times \boxed{\begin{array}{l} \text{Failure} \\ \text{Factor}_{\text{biofuel}} \end{array}}$$

CAR II

B10 – B100  
E85

B10 – B100

increase or  
decrease

increase  
1% - 5%  
failures

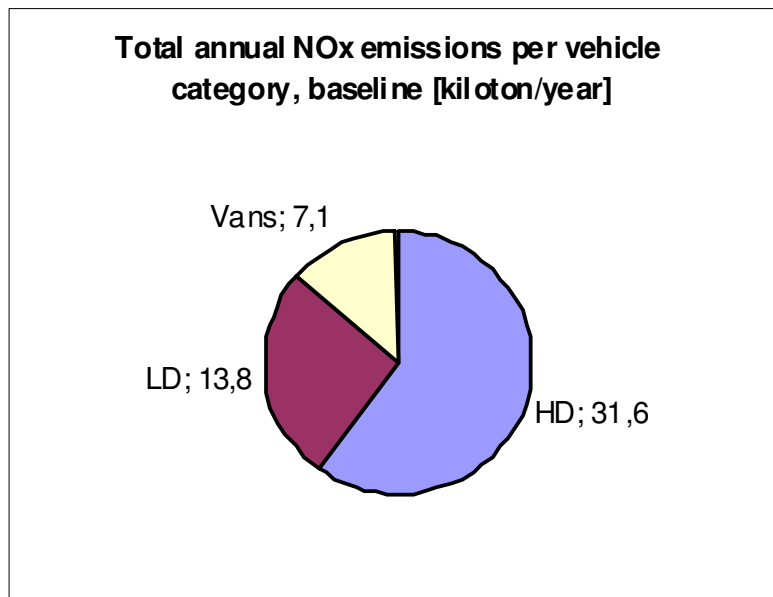
# Emissions on a national level

$$\begin{array}{|c|} \hline \text{Emission factor} \\ \hline \text{g/MJ} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Energy consumption} \\ \hline \text{MJ/year} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Total emissions} \\ \hline \text{g/year (kTon/year)} \\ \hline \end{array}$$

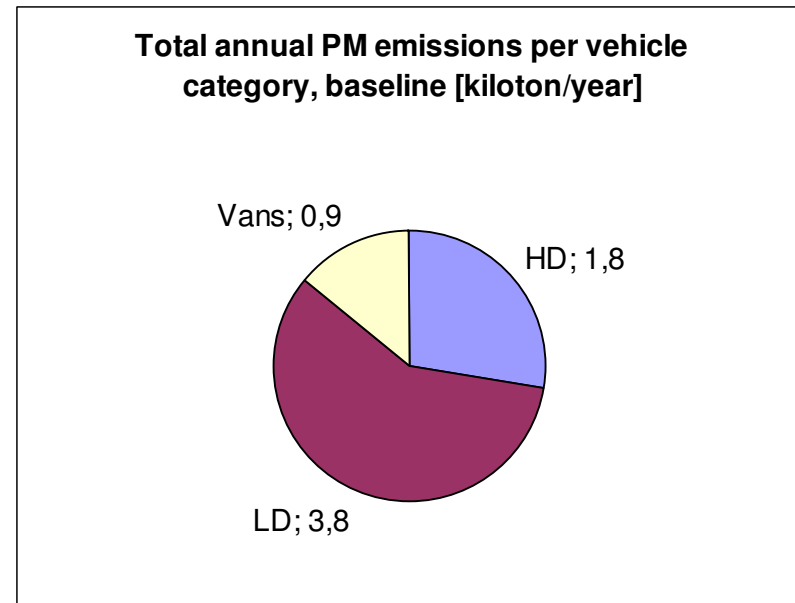
Heavy duty		Vans		Passenger cars		
<div style="border: 1px solid black; padding: 5px; width: fit-content;">Total emissions kTon/year Vehicle category total</div>	+	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Total emissions kTon/year Vehicle category total</div>	+	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Total emissions kTon/year Vehicle category total</div>	=	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Scenario total Annual emissions kTon/year</div>

# Emissions on a national level

- Baseline emissions level in 2020 [kiloton/year]



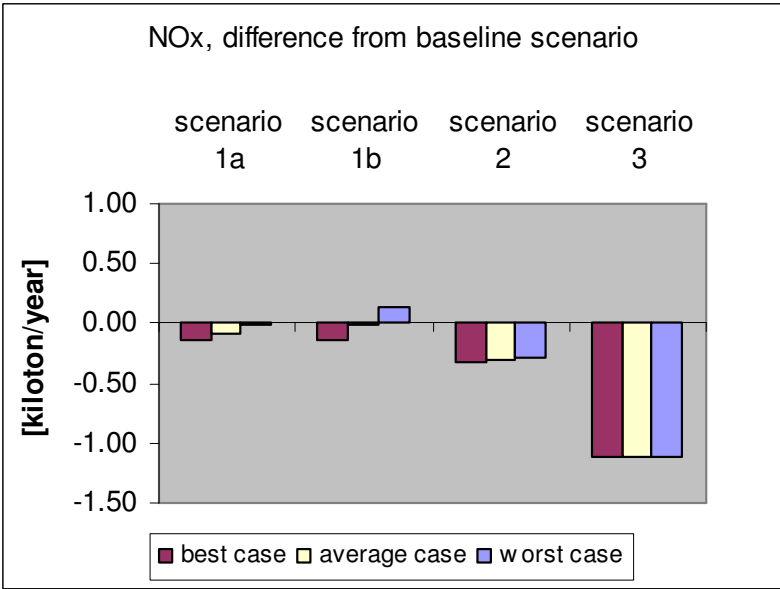
**NOx**  
total 52.5 kton/y



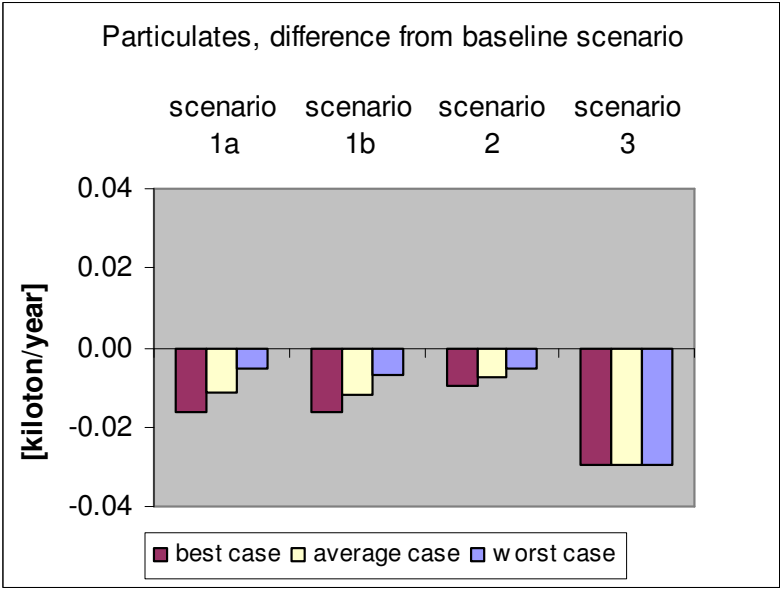
**PM**  
total 6.5 kton/y

# Emissions on a national level

- Influence of biofuel scenarios on emissions [kiloton/year]



NOx  
up to 2% reduction



PM  
up to 0.5% reduction

# Recommendations

- High blend of FAME biodiesel is not recommended, but important to be prepared for:
  - Stimulate and monitor fleets with trucks on high blends
  - Provide technical guidelines and requirements
- Stimulate double counting biofuel because it reduces the need for high blends
- Monitor failure rates and quality of all fuels extensively.  
→ remote emissions sensing of all cars
- Carry out cost-benefit calculations to compare additional fuels costs (of second generation) with additional vehicle costs

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