



Statens vegvesen

GAZ Workshop

21. November 2011

**Current thinking about environment
regulation and charging in Norway**

State of knowledge NO₂ emission

Pål Rosland* and Ivar Christiansen
Norwegian Public Road Administration

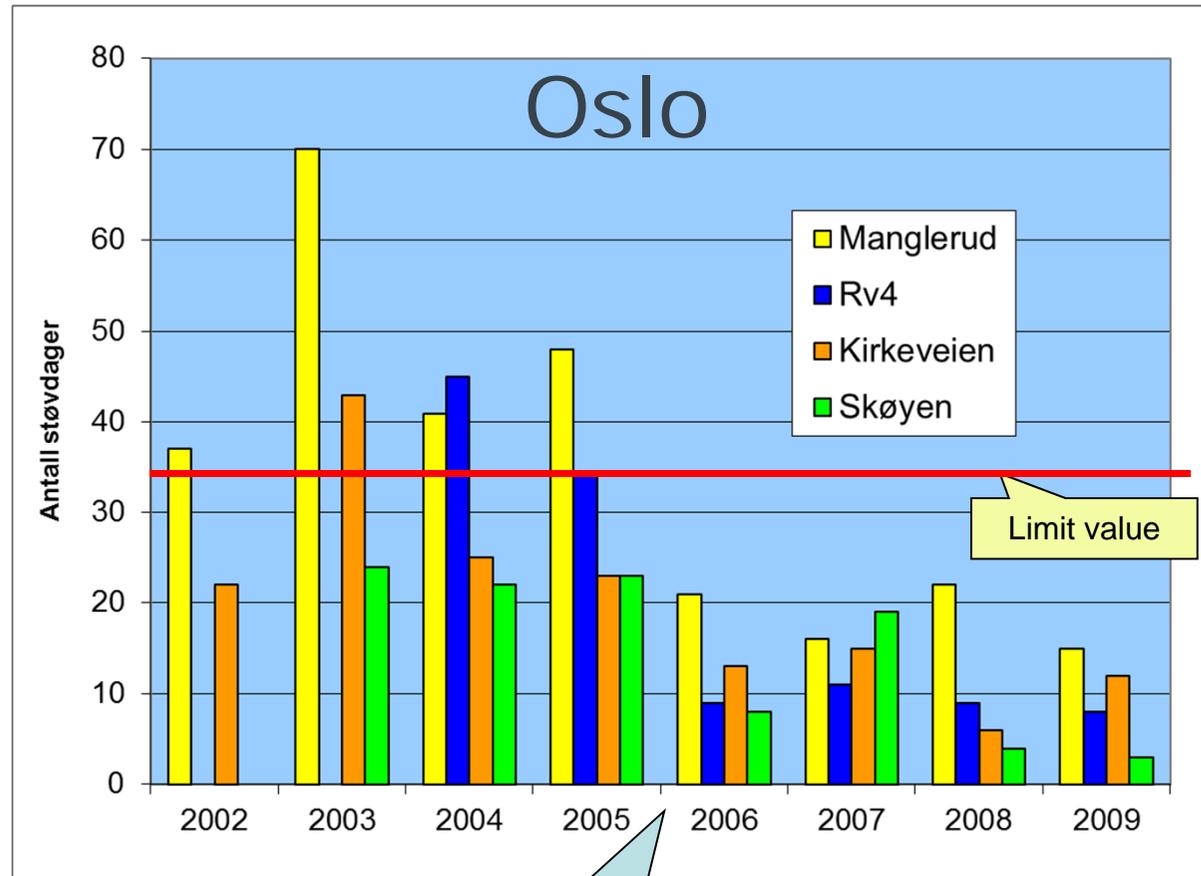
Agenda

- Measures against road dust (Charging studded tires)
- The NO₂-problem (recent study)
- EUs euro classes
(< 3,5 tonne: euro 1-6 and >3,5 tonne: euro I-VI)
- NO₂-emission from vehicles
- Reduced emission = less polluting vehicles
- Low Emission Zone: Ban versus Charging
- Zone versus toll stations (Pre-paying)
- Electronic tag (AutoPASS)
- The Low Emission Zone proposal

PM₁₀

We deal with the dust problem by implementing:

- a) Scheme for charging studded tires
- b) Reducing speed limit from 80 to 60 km/h in wintertime
- c) Frequent sweeping and using magnesium chloride on road



Implementing in 2005 and 2006:
Studded tire scheme, Reduced speed limit (winter) and Dust binding

Studded tire scheme in cities

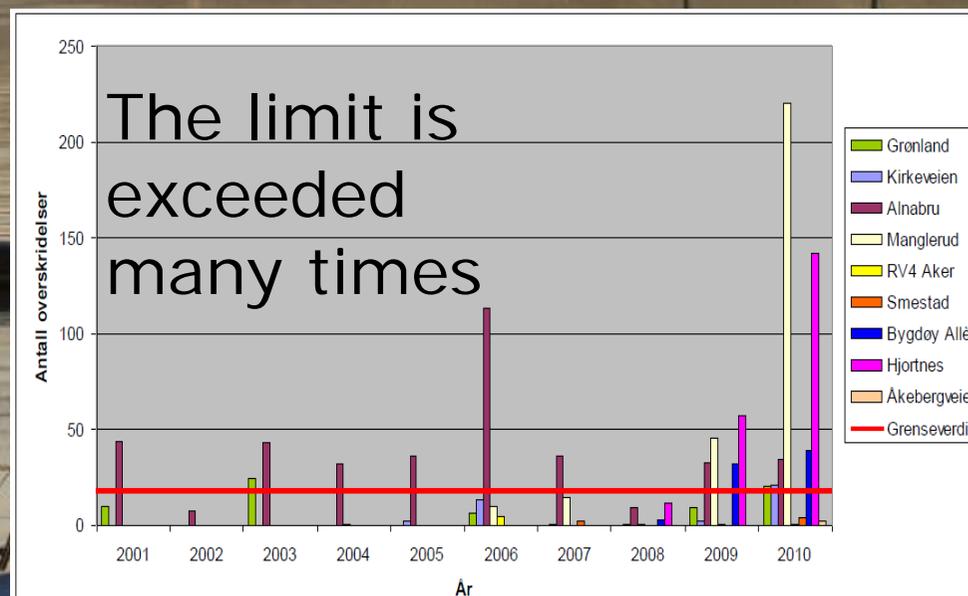
- ✦ Pre-payment
 - *Winter season: 1200 NOK*
 - *Month: 400 NOK*
 - *Day: 30 NOK*
 - *Penalty: 750 NOK*
- ✦ Payment on internet, phone or ticket machines
- ✦ Tag: sticker (oblat) in front window
- ✦ Enforcement by Parking Officers

- ✦ Bergen and Oslo: 15 % studded tires
- ✦ Norway countryside: 50 % studded tires

The NO₂-problem

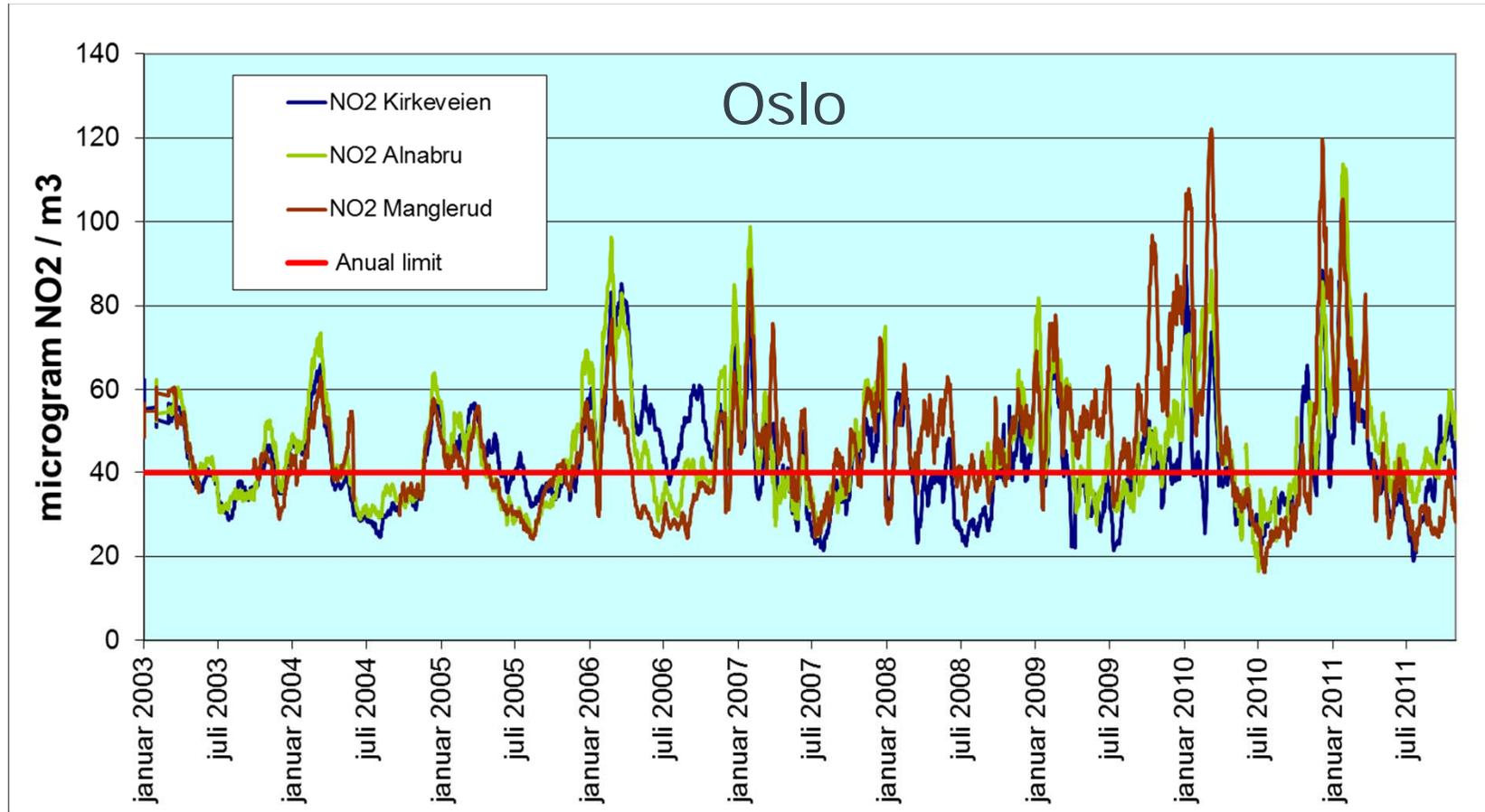
Inversion wintertime makes NO₂-pollution very high

Bergen,
January 2010



The NO₂-problem

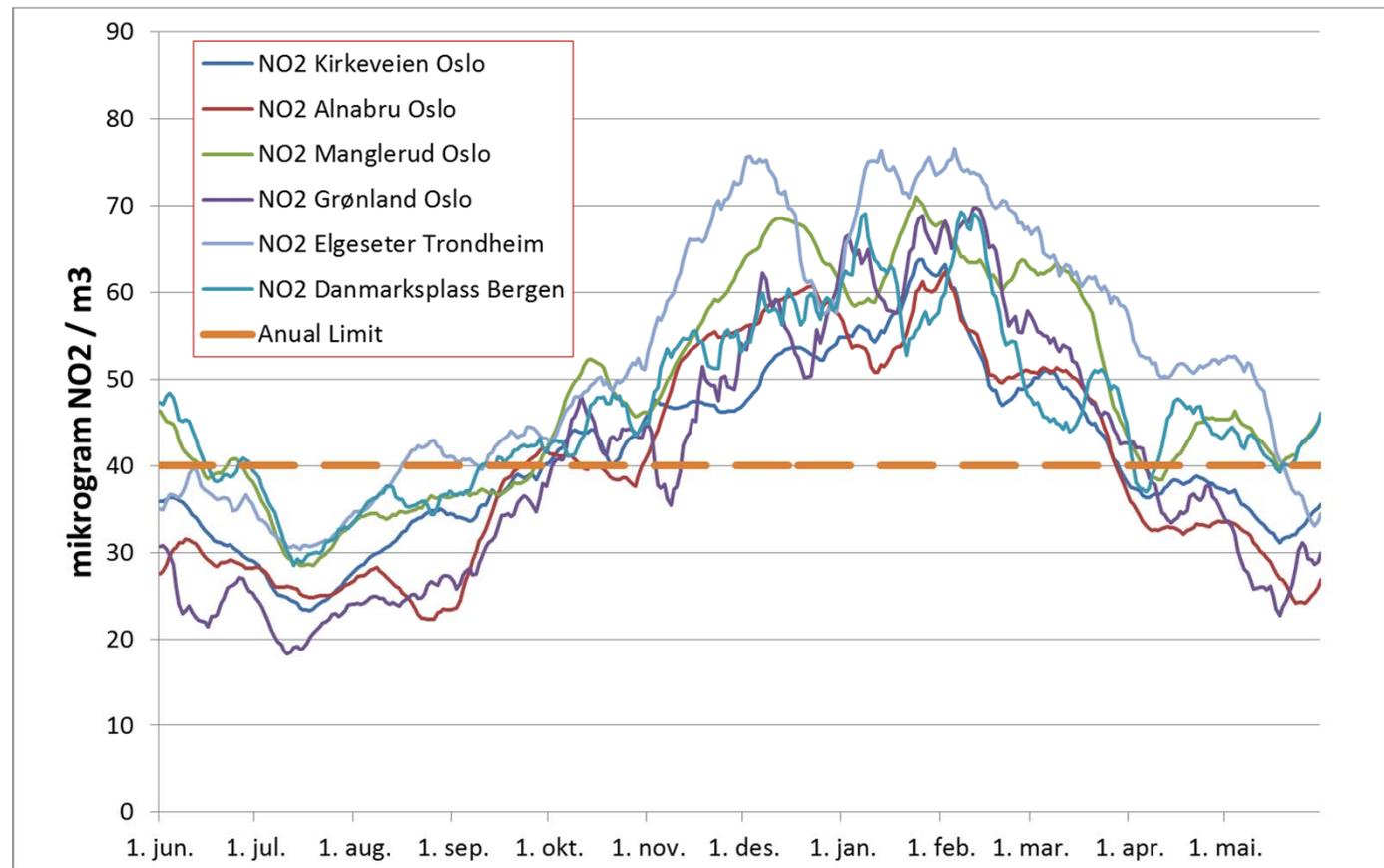
The NO₂-problem has increased since 2006



The NO₂-problem

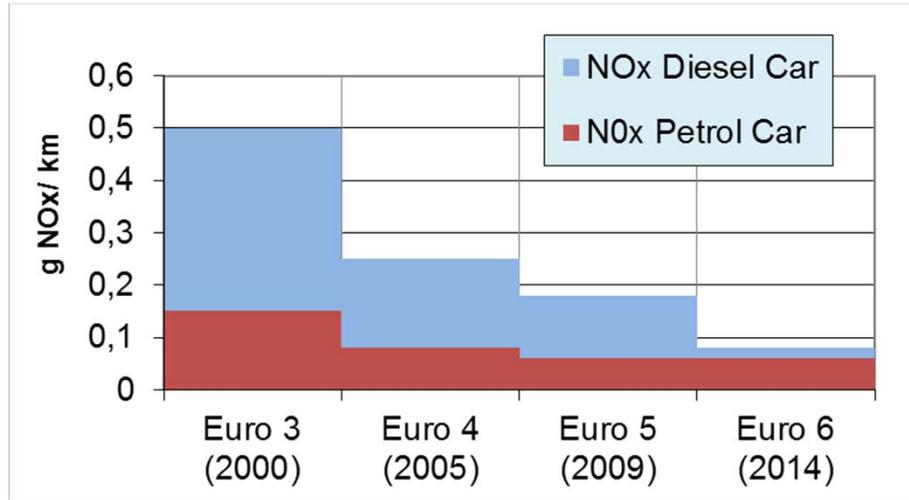
The NO₂-problem vary with the season:
Average level from June to June (2006-2011)

Oslo
Bergen
Trondheim

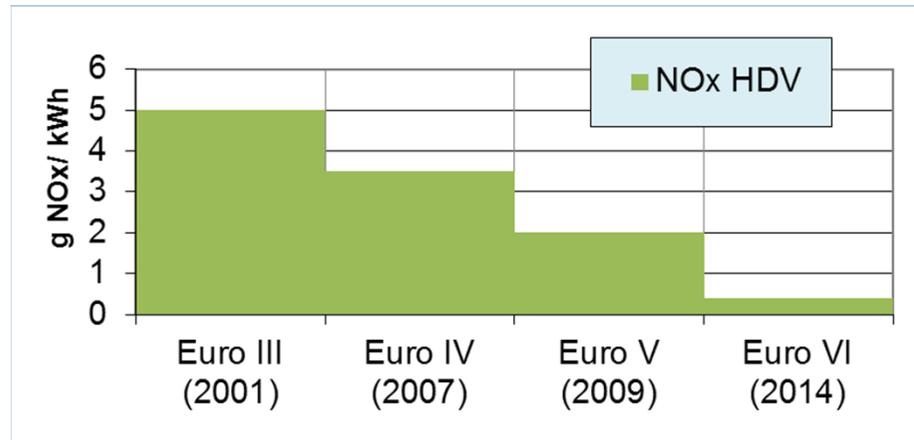


EU's euro classes – NO_x limits

Petrol cars
Diesel cars



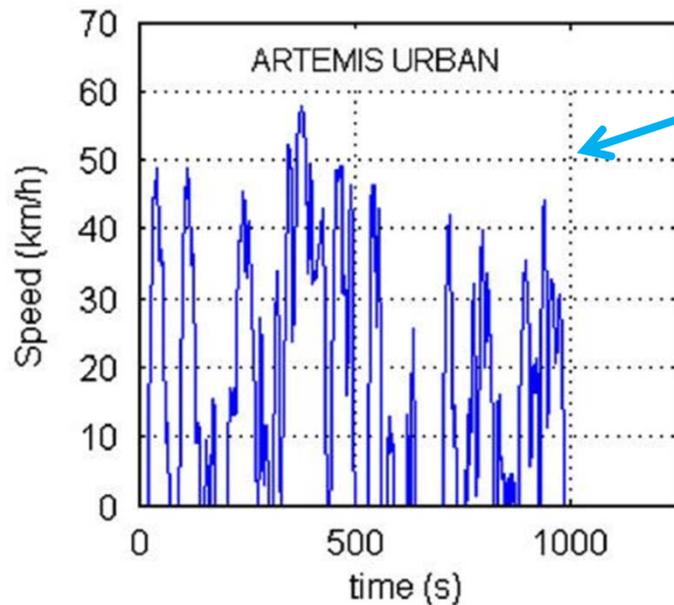
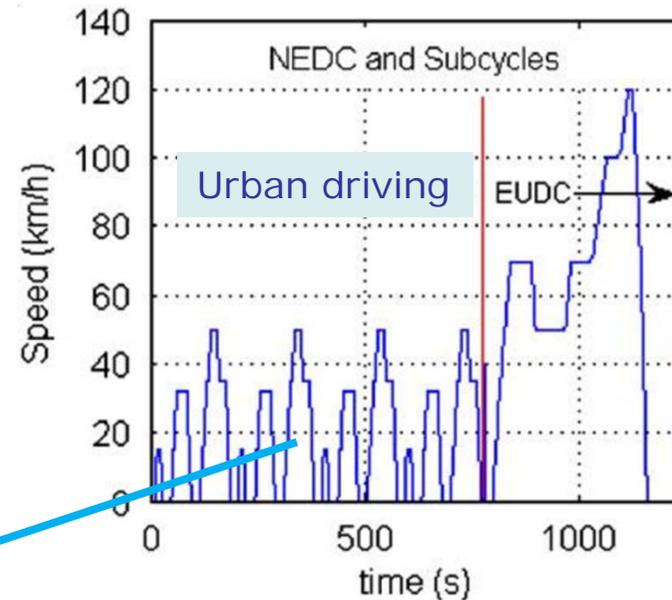
Heavy duty vehicles
10X



EU's euro classes – NO_x limits

In order to clarify that the emission requirements given by the EU are met, the vehicle have to be tested in a defined driving cycle (NEDC).

The test cycle NEDC is not representative for urban driving.



In order to clarify the real NO_x-emission EU has to establish a new test cycle. It is likely that ARTEMIS will be the candidate.

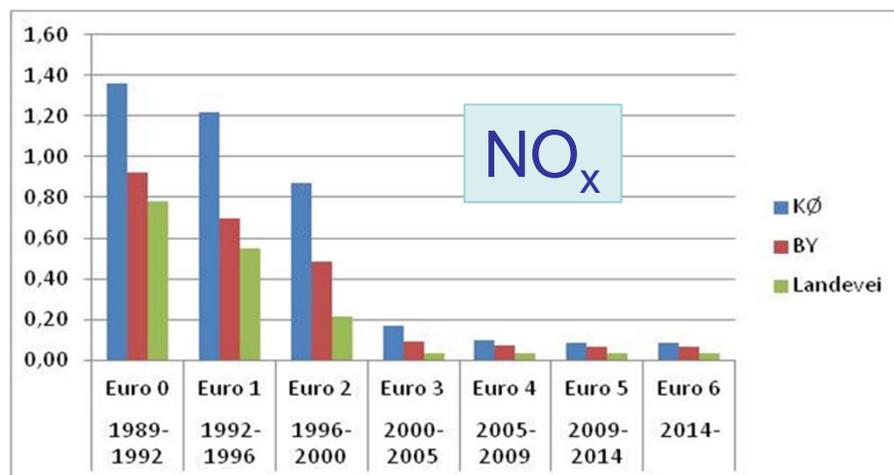
ARTEMIS Urban is quite different from NEDC's Urban driving

Petrol cars – real NO_x-emission

HBEFA has a widely used model for calculating actual emissions from vehicles. Actual tests have verified that HBEFA match well for all euro classes up to five.

Estimated NO_x-emission
form different euro classes.

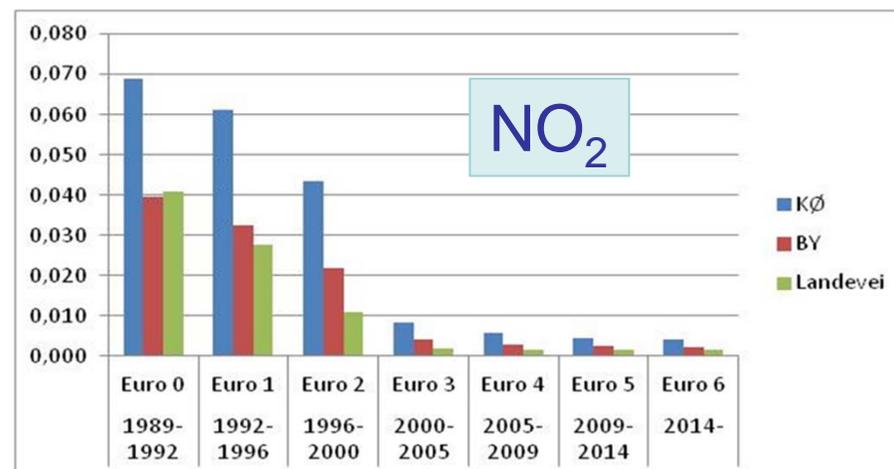
Made by HBEFA



Estimated NO₂-emission
form different euro classes

Made by HBEFA

NO₂ ≈ 5% of NO_x

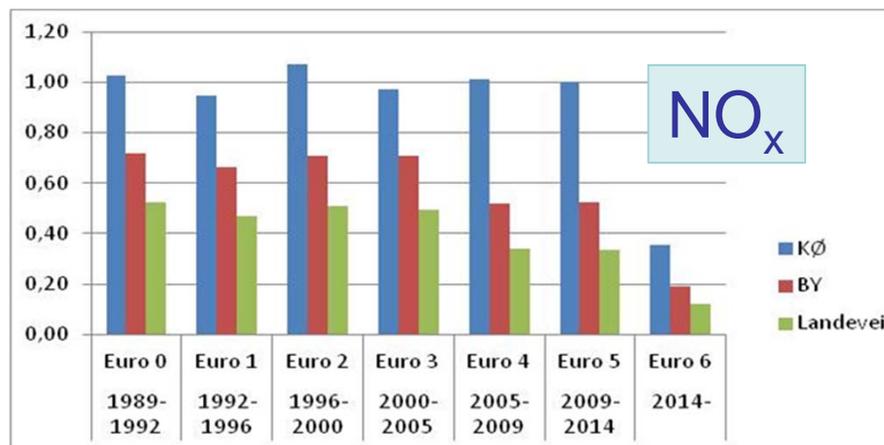


Diesel cars – real NO_x-emission

HBEFA has a widely used model for calculating actual emissions from vehicles. Actual tests have verified that HBEFA match well for all euro classes up to five.

Estimated NO_x-emission
form different euro classes.

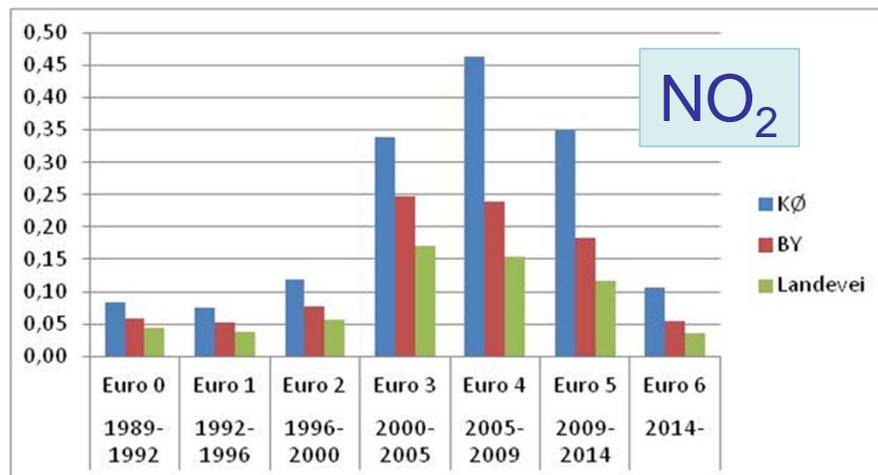
Made by HBEFA



Estimated NO₂-emission
form different euro classes

Made by HBEFA

**Urban driving with Euro 5:
NO₂ ≈ 1/3 of NO_x**

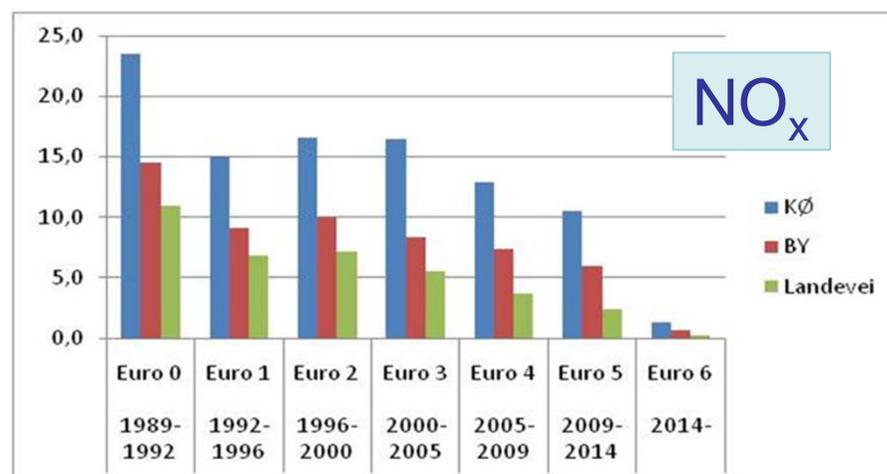


HDV – real NO_x-emission

HBEFA has a widely used model for calculating actual emissions from vehicles. Actual tests have verified that HBEFA match well for all euro classes up to five.

Estimated NO_x-emission form different euro classes.

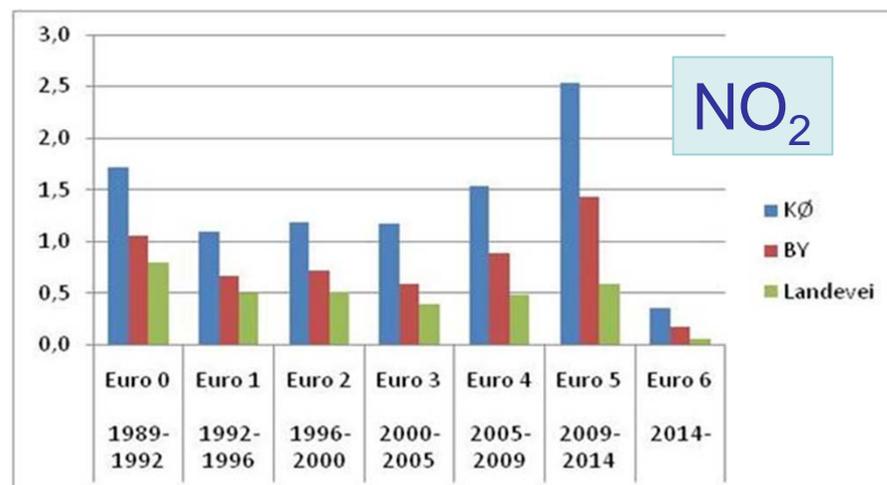
Made by HBEFA



Estimated NO₂-emission form different euro classes

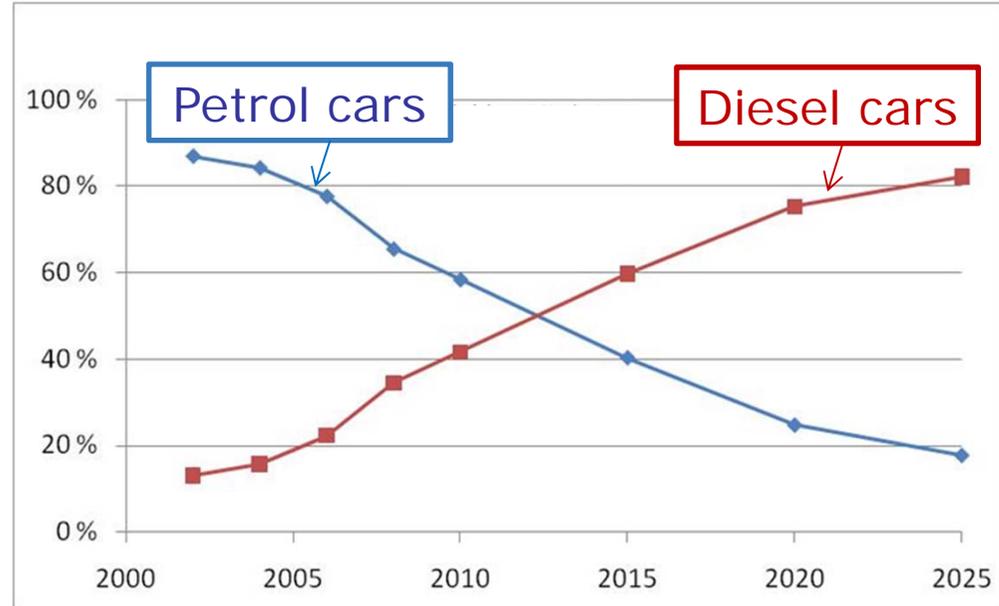
Made by HBEFA

**Urban driving with Euro V:
NO₂ ≈ 25% of NO_x**



Petrol cars versus Diesel cars

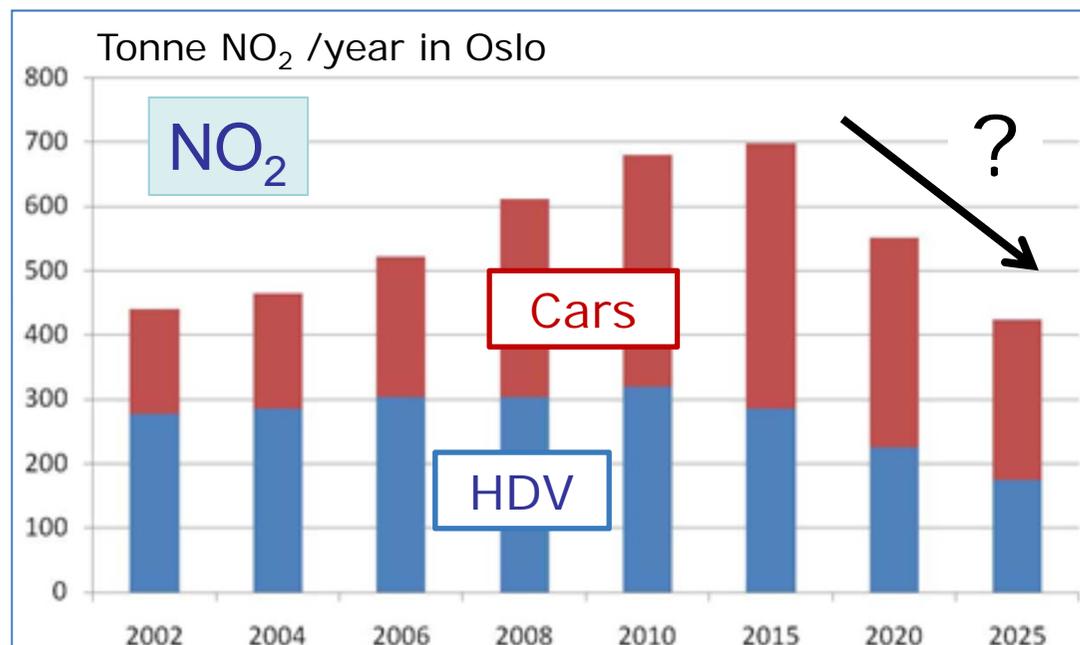
The Norwegian people prefers to buy diesel cars.
In 2025 we can expect 80 per cent diesel cars.



Estimated NO₂-emission up to 2025

Norwegian Institute of Air Research (NILU) has estimated the NO₂-emission up to 2025, based on HBEFA-emission factors.

NILU's assumption is that HBEFA is correct. It is likely that many vehicles will not meet ARTEMIS requirement - just the NEDC requirement. NILU's estimate may be to optimistic.



Less emission = less polluting vehicles

- ✦ Ex: Bus, diesel cars and petrol cars: all average of euro 3-5
- ✦ 1 bus has same NO₂-emission as 4 diesel cars
- ✦ 1 bus has same NO₂-emission as 300 petrol cars
(Ref. Norwegian Institute of Air Research)
- ✦ Reducing the amount of diesel cars and diesel buses/ lorries is much more efficient than reducing the amount of petrol cars.
- ✦ Accelerating the introduction of euro 6/VI diesel vehicles and reducing euro 3-5/III-V diesel vehicles is probably efficient

Low Emission Zone: Ban versus Charging

- ✦ LEZ traffic regulation is based on either ban or charging
- ✦ Both schemes require extensive control
- ✦ Both schemes need a kind of tag or sticker
- ✦ Ban can't affect all, because of the needs of exemption. Exemption would undermine the effect. Who should get the exemption?
- ✦ Charging can affect all, depending on the price.
- ✦ Charging creates a revenue for strategic use

LEZ: Zone versus entry tolling

Zone:

In a zone all traffic is charged



Tolling:

Only traffic passing specific points can be charged



LEZ: Electronic tag

Manuel control is costly. Electronic systems are much more efficient.

Electronic systems:

ANPR: Requires manual assistance to interpret the images



vegvesen.no

AutoPASS (DSRC): The tag is an like an electronic number plate. An existing electronic infrastructure which is accurate and reliable.



Statens vegvesen

The Low Emission Zone proposal (?)

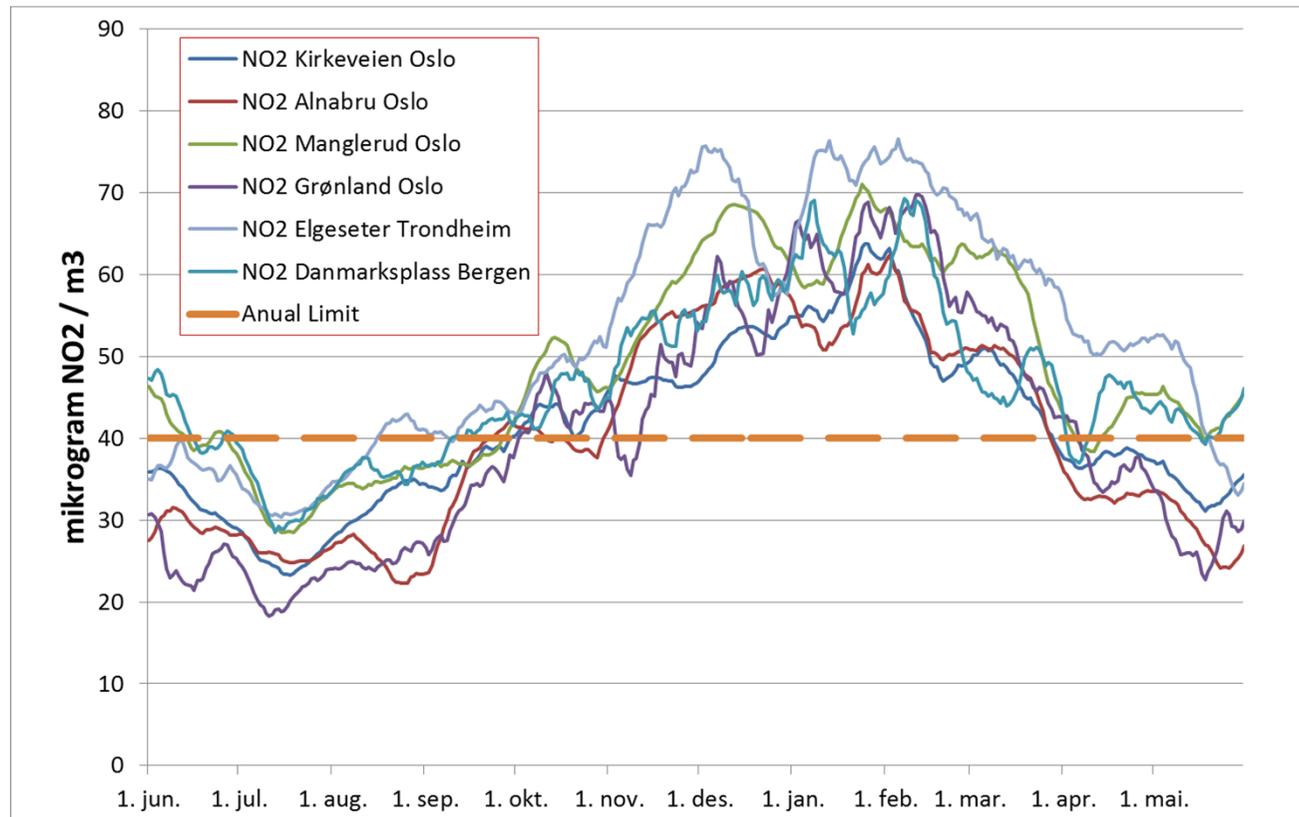
- ✦ A charging system variable with seasons
- ✦ LEZ shall deter the types of vehicles that have high local emissions
- ✦ LEZ shall favour the types of vehicles that have low local emissions
- ✦ Pre-payment and obligatory use of AutoPASS tag.
- ✦ The AutoPASS tolling stations may be defined as control stations and complemented by a few extra stations and mobile control equipment
- ✦ The proposal requires a new paragraph in the Norwegian Road Traffic Act, which makes it legal to charge specific vehicle types.

LEZ: Season variable charging system

NO₂ is a winter problem. It is most appropriate to charge when it is the most problems.

Average contamination levels at monitoring stations in three cities.

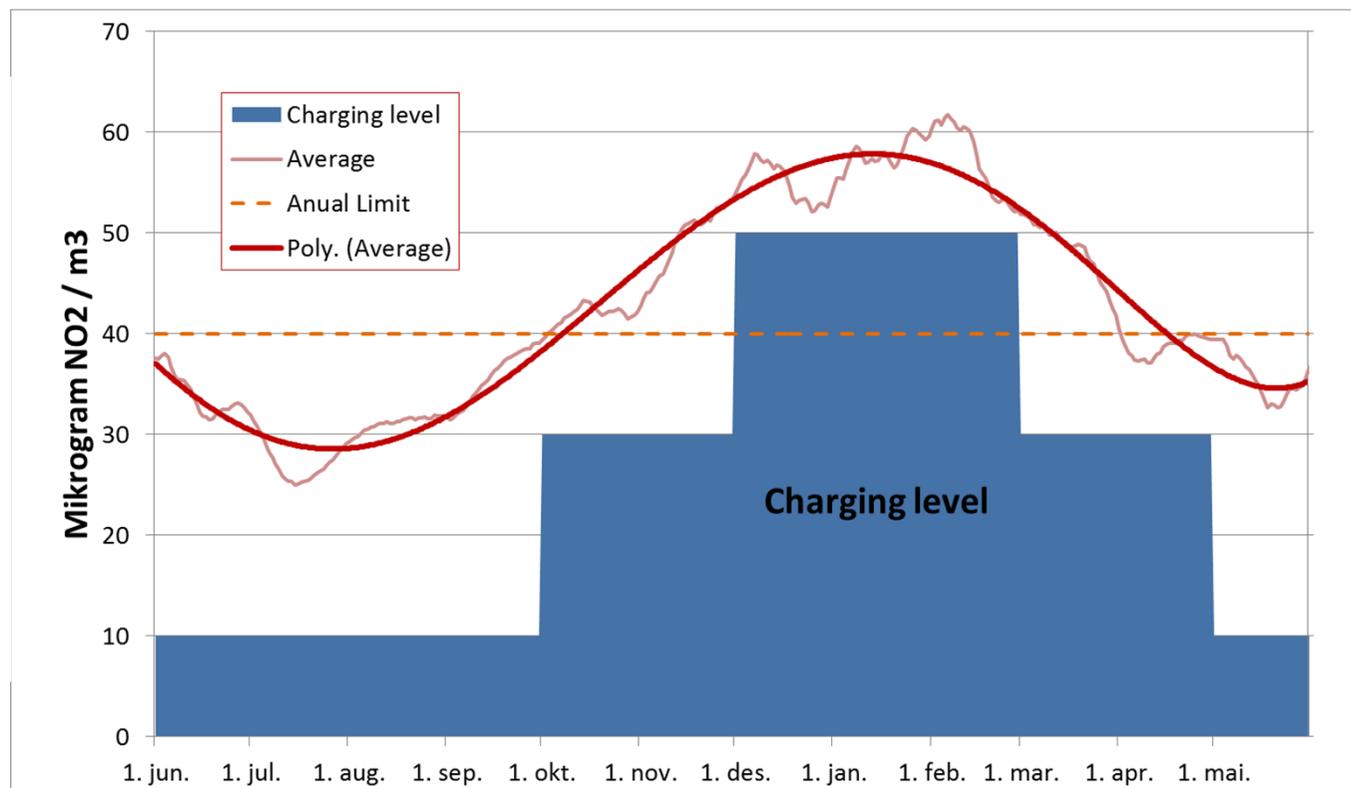
(2006-2011)



LEZ: Season variable charging system

Basis for seasonal variable charging levels:

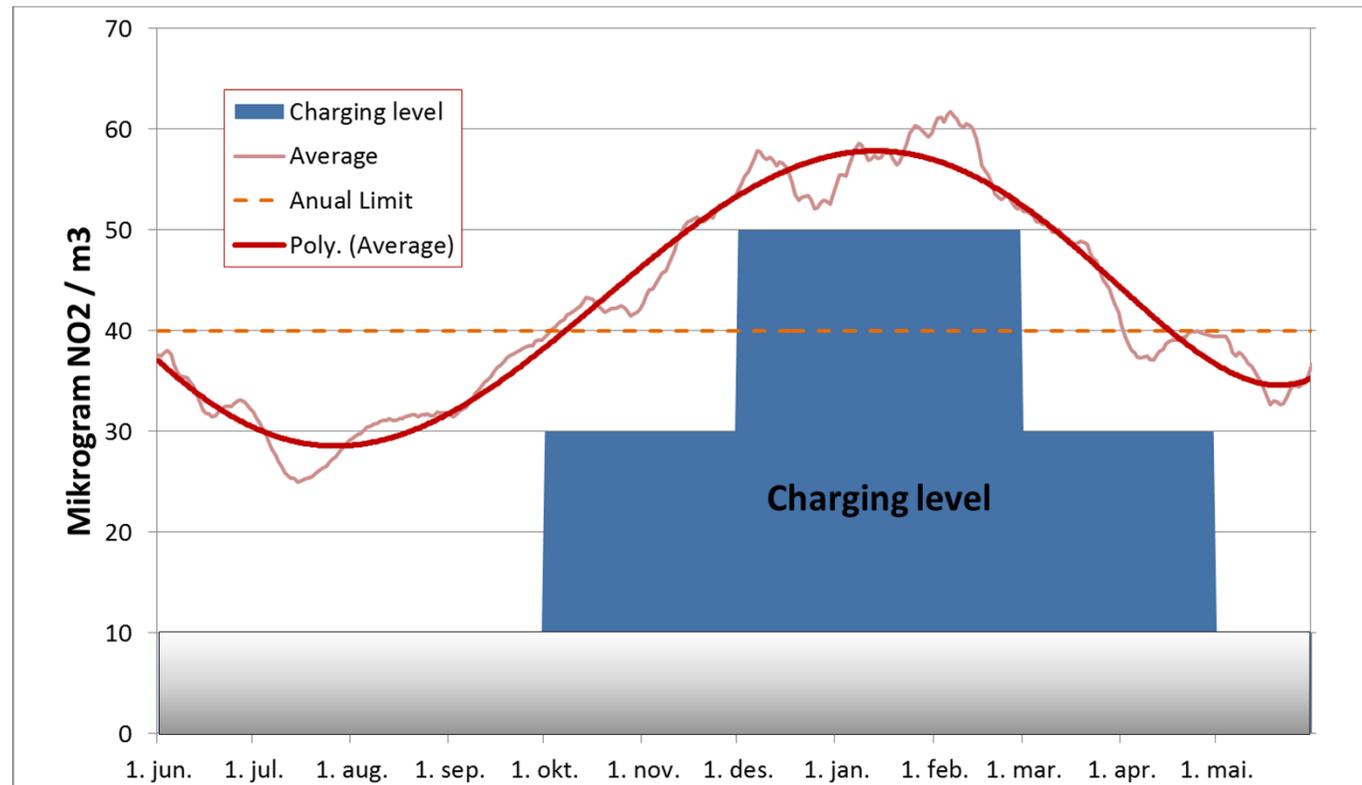
Different price levels during the year. The prices reflect the pollution levels. This scheme is more relevant than paying the same price during the year.



LEZ: season variable charging system

Pairing the tolling ring and LEZ charging system

The tolling system works all year and it repellent all types of vehicles. We therefore propose to take out this contribution so LUS is free of charge in summer time.



Seasonal variation is predictable and easier to adapt to in relation to daily or weekly variations

LEZ and other measures

Charging vehicles with high local emission will likely reduce the amount of this vehicles special in the period it is the most problems.

We believe that over a few years people will adapt. People will choose the transport modes that are favoured. The public can build up the necessary collective capacity.

The measure can be enough to reduce both the annual level and the peak level to a satisfactory level. If not, the local municipality can as a campaign, ban diesel cars those days it is big problem with the air quality. They have the possibility to prohibit this cars by the Road Traffic Act, § 7.

Thank you for the attention!

paal.rosland@vegvesen.no
ivar.christiansen@vegvesen.no