Utrecht University

National Institute for Public Health and the Environment (RIVM)
Ministry of Health, Welfare and Sport
The Netherlands

Air quality has benefited from European emission reductions

Guus Velders

Rob Maas, Paul Ruyssenaars, Gerben Geilenkirchen (PBL), Frank de Leeuw, Norbert Ligterink (TNO), Wilco de Vries, Joost Wesseling

RIVM en Universiteit Utrecht

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Take home message

Since 1980, many measures have been taken in EU to improve air quality

Large avoided concentration increases of SO_2, NO_2 and $PM_{2.5}$

- $PM_{2.5}$ could have increased: 59 µg/m^3 (1980) ➔ 102 µg/m^3 (2015)
- Now about 12 µg/m^3
- More than half from reductions outside the Netherlands

Health benefits for the Netherlands in 2015

- Increase in life expectancy of 6 years
- Avoided monetary health damage € 35 - 77 billion per year

Policy measures in Europe

Air quality limit values in Europe

- 1980: Directive on air quality limit values for SO_2, PM
- 1985: … on air quality limit values for NO_2
- 1996: … on ambient air quality assessment
- 1999: … on limit values various compounds
- 2008: … on ambient air quality and cleaner air

Emission reduction measures

- 1970: EU CO and HC emissions of motor vehicles
- 1988: CLRTAP/Sofia protocol on NO_x emissions
- 1988: EU SO_2 emissions large combustion plants
- 1991-on: EU Euro standards for emissions of cars and trucks
- 1999/2012: CLRTAP/Gothenburg protocol on NO_x, SO_2, VOC, NH_3 emissions
- 2001: EU NEC emission ceilings directive
- 2008: IMO for sea shipping emissions NO_x and SO_2
- 2010: EU directive on industrial emissions
- …

National air quality collaboration programme

Colleboration between

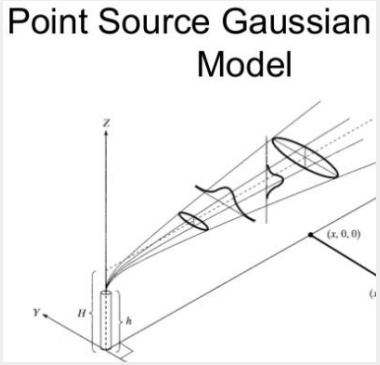
- National government
  - Background concentrations
  - Models
  - Measurements
- Local authorities: cities
  - Local inputs for models

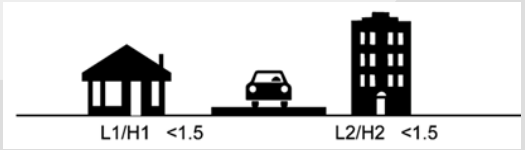
+ Industry / livestock → SRM3

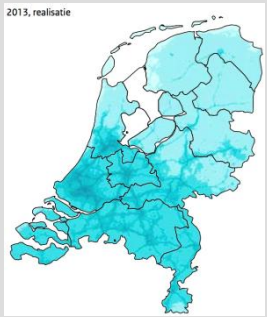
+ Highways → SRM2

+ Local streets→ SRM1

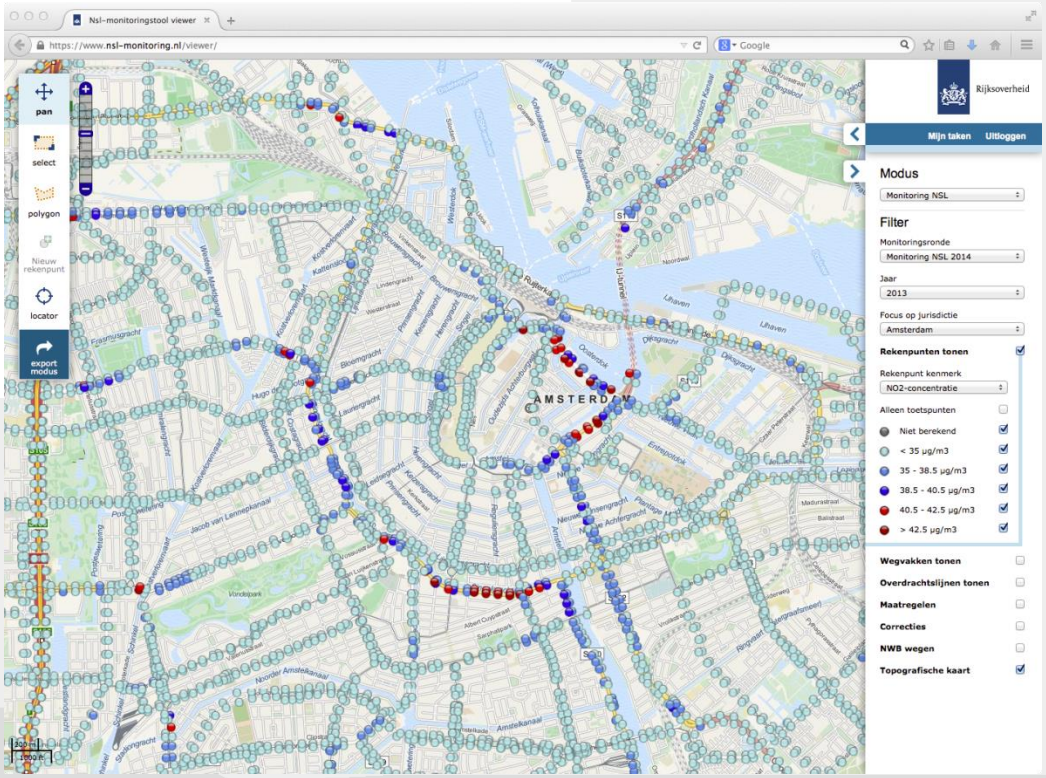
Background







Monitoring tool: Concentrations Amsterdam



Local concentrations the result from

- **European** emissions and measures
- **National** emissions and measures
- **Local** emisions and measures

Scenario study

Baseline scenario

- Reported emissions in NL and rest of Europe

World Avoided scenario

- How the emissions could have increased without policy measures
- Emission factors (kg/activity) unchanged from 1980 on
- Growth according to activity per sector

Model calculations

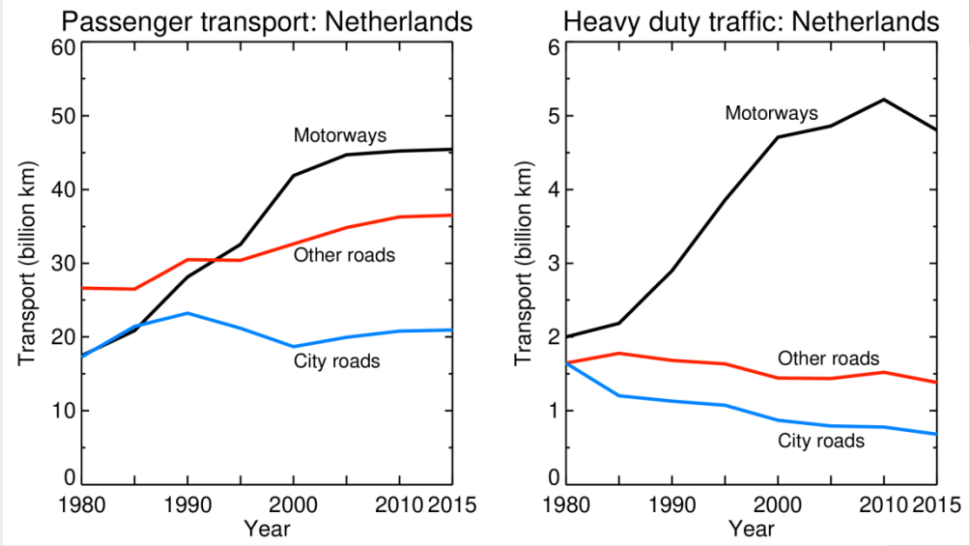
- OPS model ➔ large scale concentration (1x1 km; GCN2017)
- NSL/TREDM ➔ local traffic contributions (8.8 million addresses)

Concentrations and associated avoided health effects

Drivers for traffic

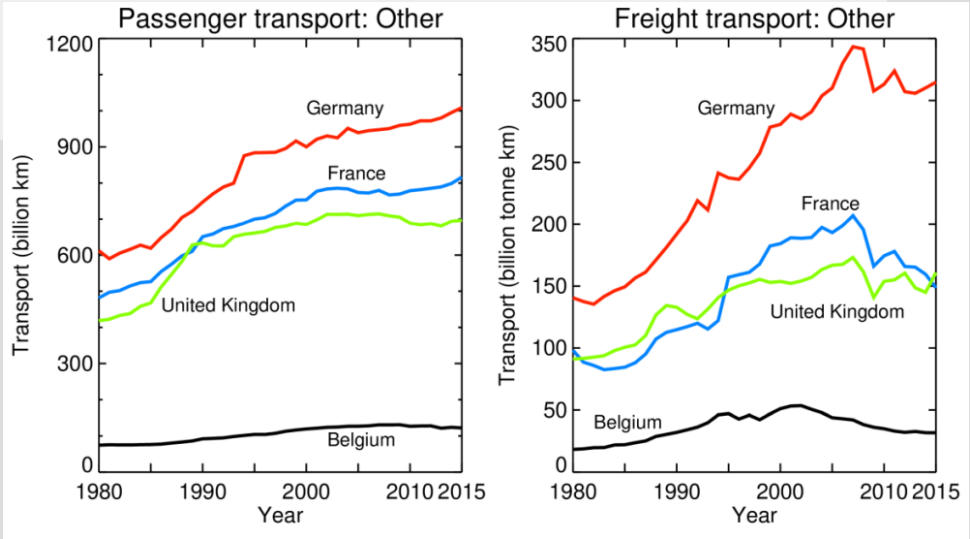
For Netherlands

- Transport in billion km driven
  - Passenger cars
  - Light duty vehicles
  - Heavy duty transport
- Large increase in transport motorways
- Very large increases light duty transport



For other countries

- Passenger transport in billion km driven
- Freight transport in billion tonne km



Drivers for other sectors

Electricity production

- Non-nuclear in TeraWatt hour

Households

- Population

Industry

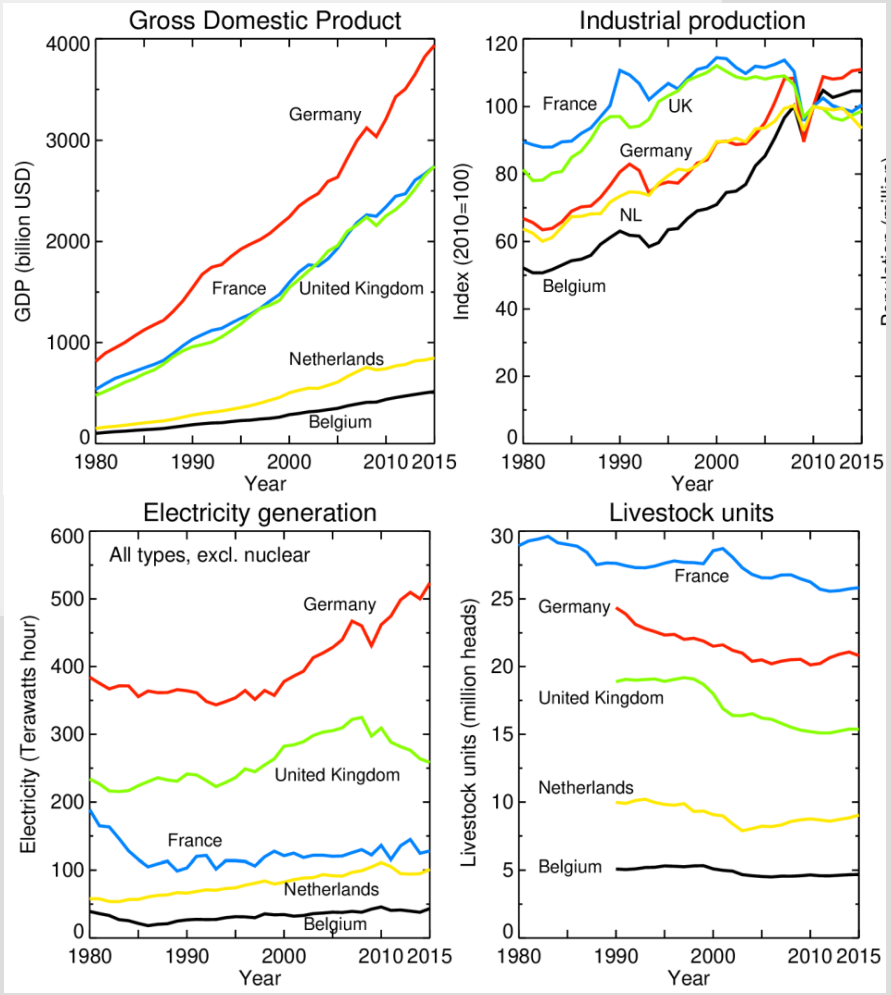
- Industrial production index

Agriculture

- Livestock index

Other (e.g. non-road traffic)

- Gross Domestic Production



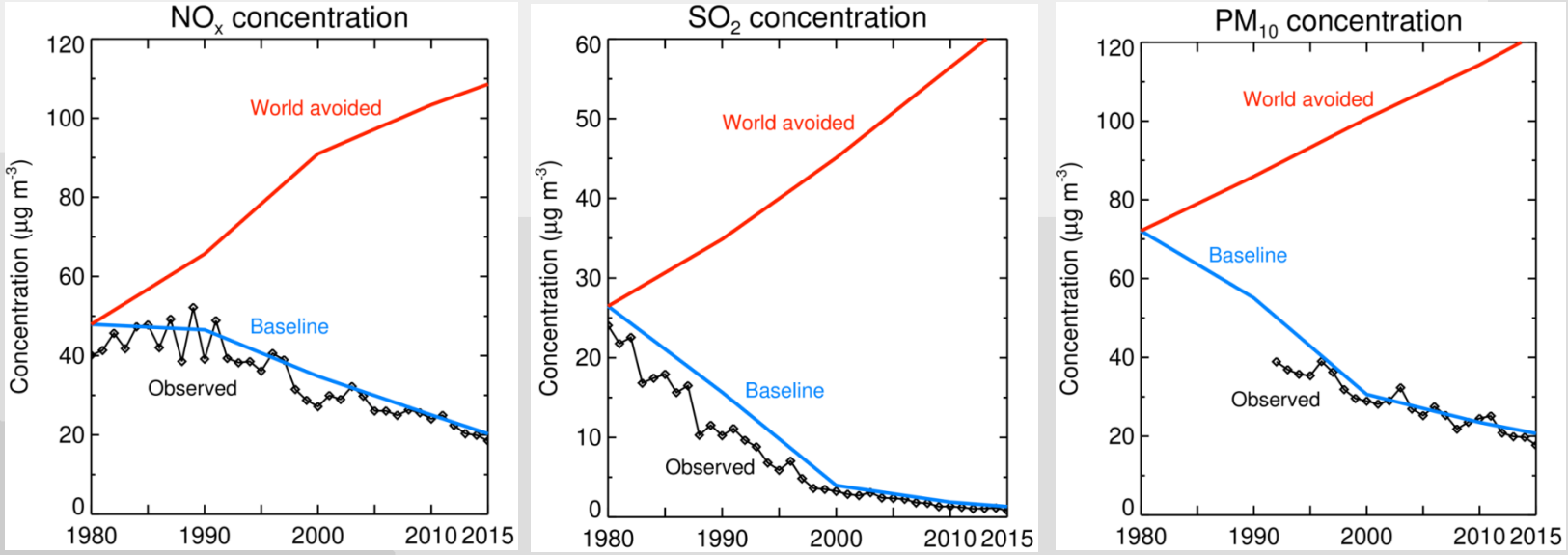
Concentrations NO_x, SO_2, PM

World avoided: increases in NO_x (and NO_2), SO_2, PM_{10}, $PM_{2.5}$

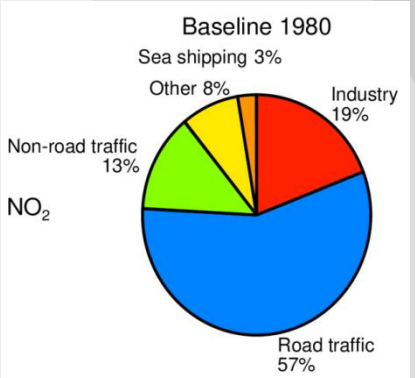
Decreases in Baseline scenario

Good agreement with observations NO_x (and NO_2) and SO_2

Current concentrations in Asian cities: PM_{10} over 200 µg/m^3



Contributions to NO_2 concentration



Emissions of road transport are dominant

- 57% in 1980; 40% in 2015 (baseline)
- Almost half from domestic passenger cars and delivery vans

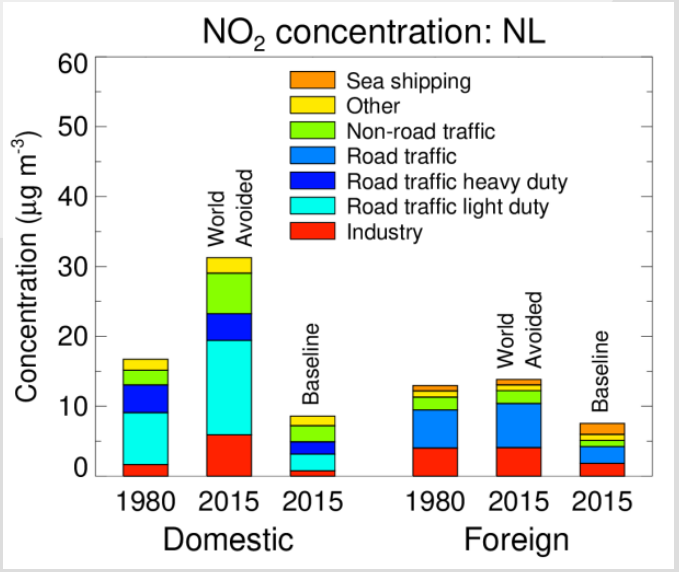
Without measures NO_2 would have increases: 30 ➔ 45 µg/m³

- Decreased to 16 µg/m³ in baseline

➔ 29 µg/m³ avoided:

- Domestic light duty responsible for 11 µg/m³
- Domestic industry: 5 µg/m³
- Foreign road traffic: 4 µg/m³

- Largest foreign contributions: UK and Belgium



Contributions to $PM_{2.5}$ concentration

Dominant contributions from sources outside Netherlands

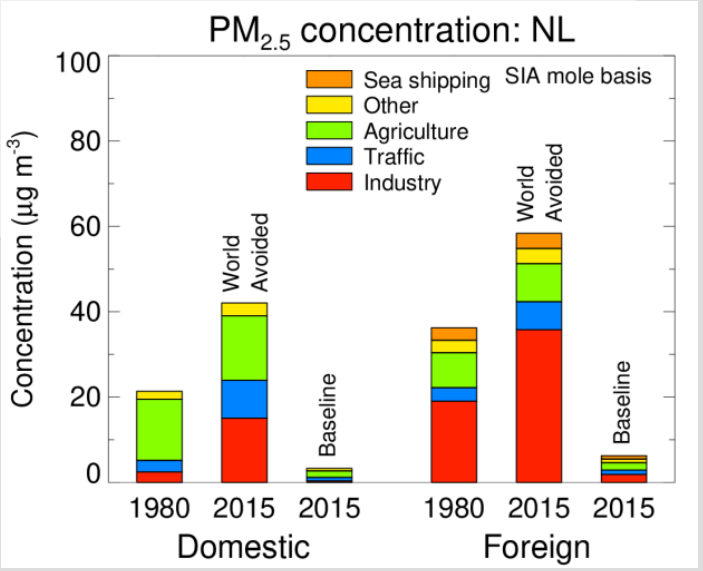
- 40% from domestic sources
- 27% from German sources, 20% from UK, Belgium and France combined
- Dominant sectors: industry and agriculture

Without measures $PM_{2.5}$ would have increases: 59 ➔ 102 µg/m³

- Decreased to 12 µg/m³ in baseline

➔ 90 µg/m³ avoided:

- Foreign industry responsible for 34 µg/m³
- Domestic industry: 15 µg/m³
- Domestic agriculture: 14 µg/m³
- All traffic: 13 µg/m³



Exceedance of limit values

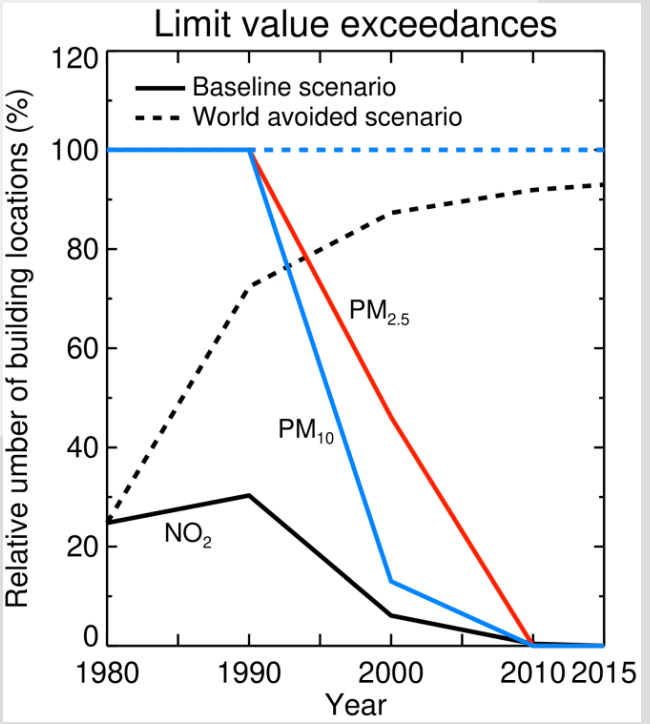
Calculated at 8.8 million locations of buildings (BAG)

NO_2: 40 µg/m³

- Exceedance from 25% to <1% in 2010
- World avoided: >90%

PM_{10} (32 µg/m³) and PM2.5 (25 µg/m³)

- Exceedance from 100% to <1% in 2010
- World Avoided: 100%



Trends in health effects

740 000 DALYs avoided in 2015

- Baseline 560 000 ➔ 135 000 from 1980 to 2015

66 000 attributable death avoided

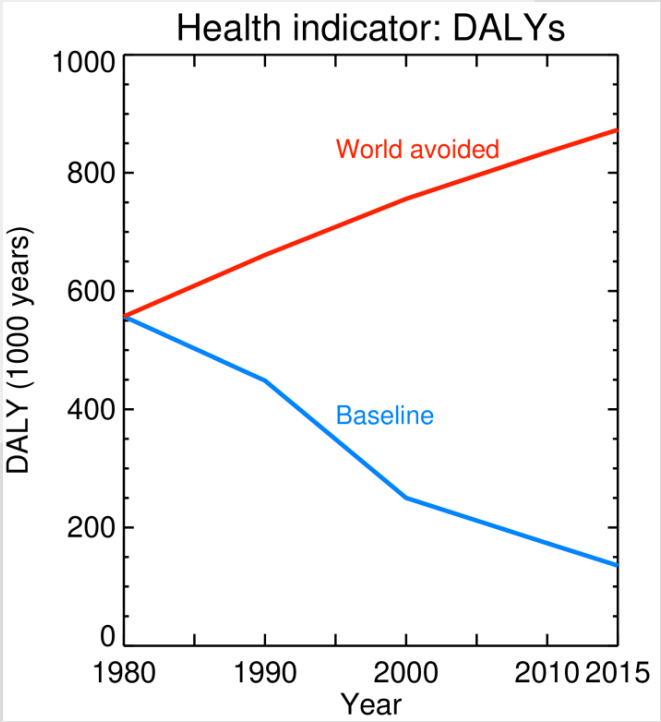
- Baseline 50 000 ➔ 12 000

6 years of loss of life expectancy avoided

- Baseline 4 years ➔ 1 year

€ 35-77 billion per year damage avoided

- Baseline 26-58 ➔ 6-14 billion



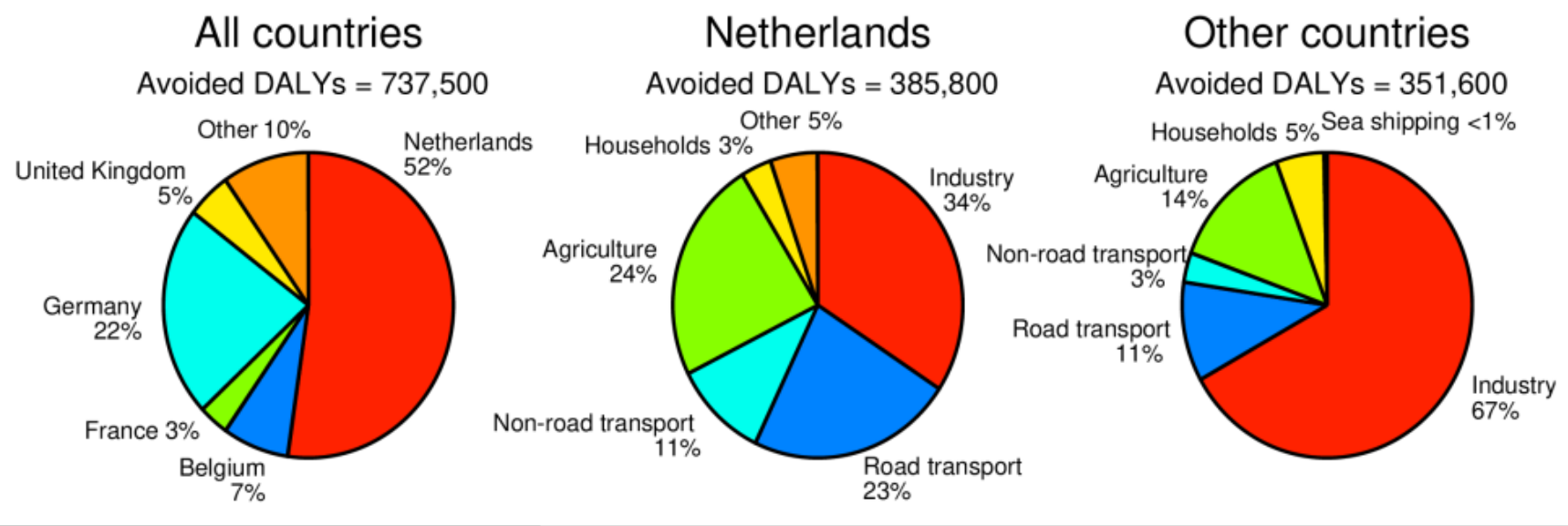
Contributions to avoided health effects

Domestic and foreign sources similar contributions to avoided DALYs

50% avoided DALYs attributable to industry

- Incl. refineries, electricity production
- Sulphate aerosols and SO_2 emissions
- EU directives on large combustion plants, other industry, liquid fuels

24% traffic, 19% agriculture, 4% households etc.



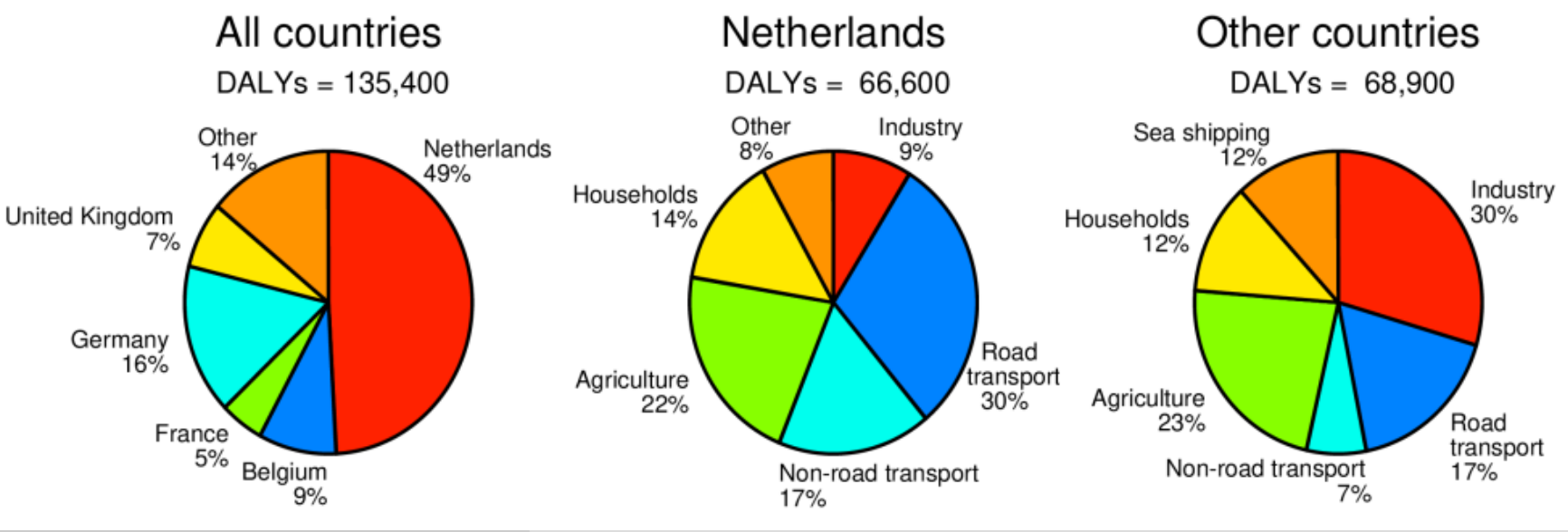
Health effects in 2015

Contributions attributable to various sectors, domestic and foreign

- Largest road transport, agriculture, industry

Domestic sectors: 49%

Foreign sectors: 51%



Conclusions

Since 1980, air quality has improved considerably in the Netherlands

Large avoided concentration increases of SO_2, NO_2 and $PM_{2.5}$

- $PM_{2.5}$ could have increased from 59 µg/m^3 (1980) ➔ 102 µg/m^3 (2015)
  (now on average 12 µg/m^3)
- More than half from reductions abroad

Health benefits for the Netherlands in 2015

- 66 000 avoided attributable deaths per years
- Increase in life expectancy of 6 years
- Avoided monetary health damage € 35 - 77 billion per year

Questions?

Dank u wel

Thank you

Gracias

Danke

Merci

Diolch yn fawr

Спасибо

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