Urban air quality and abatement measures in the city of Gothenburg, Sweden

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Transport and Clean Air

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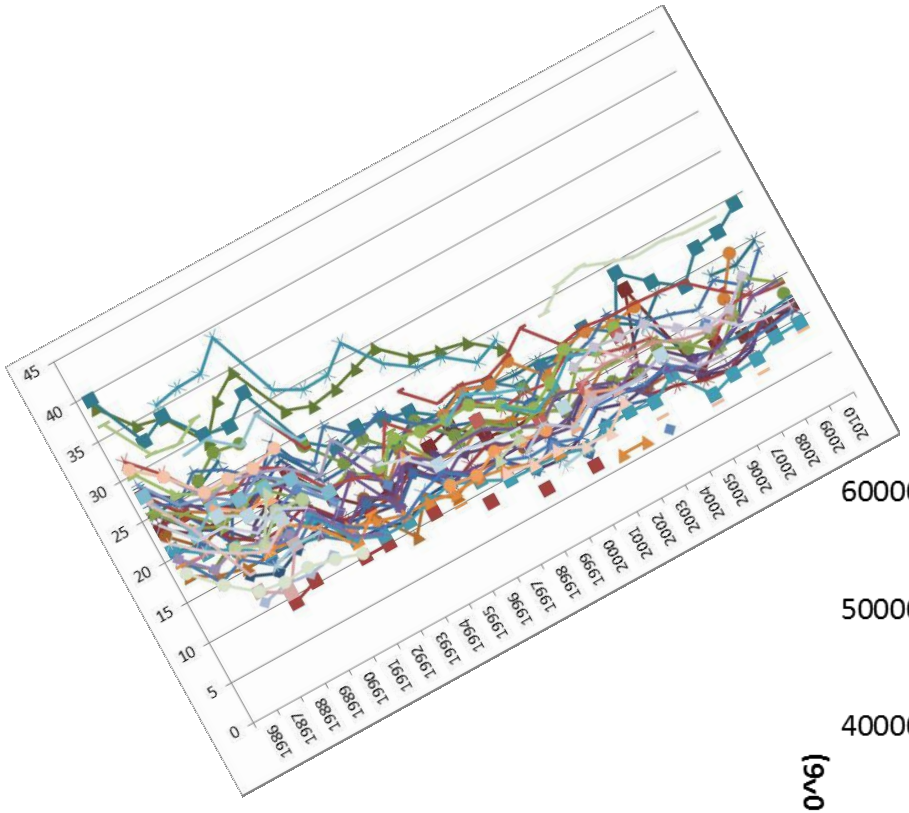
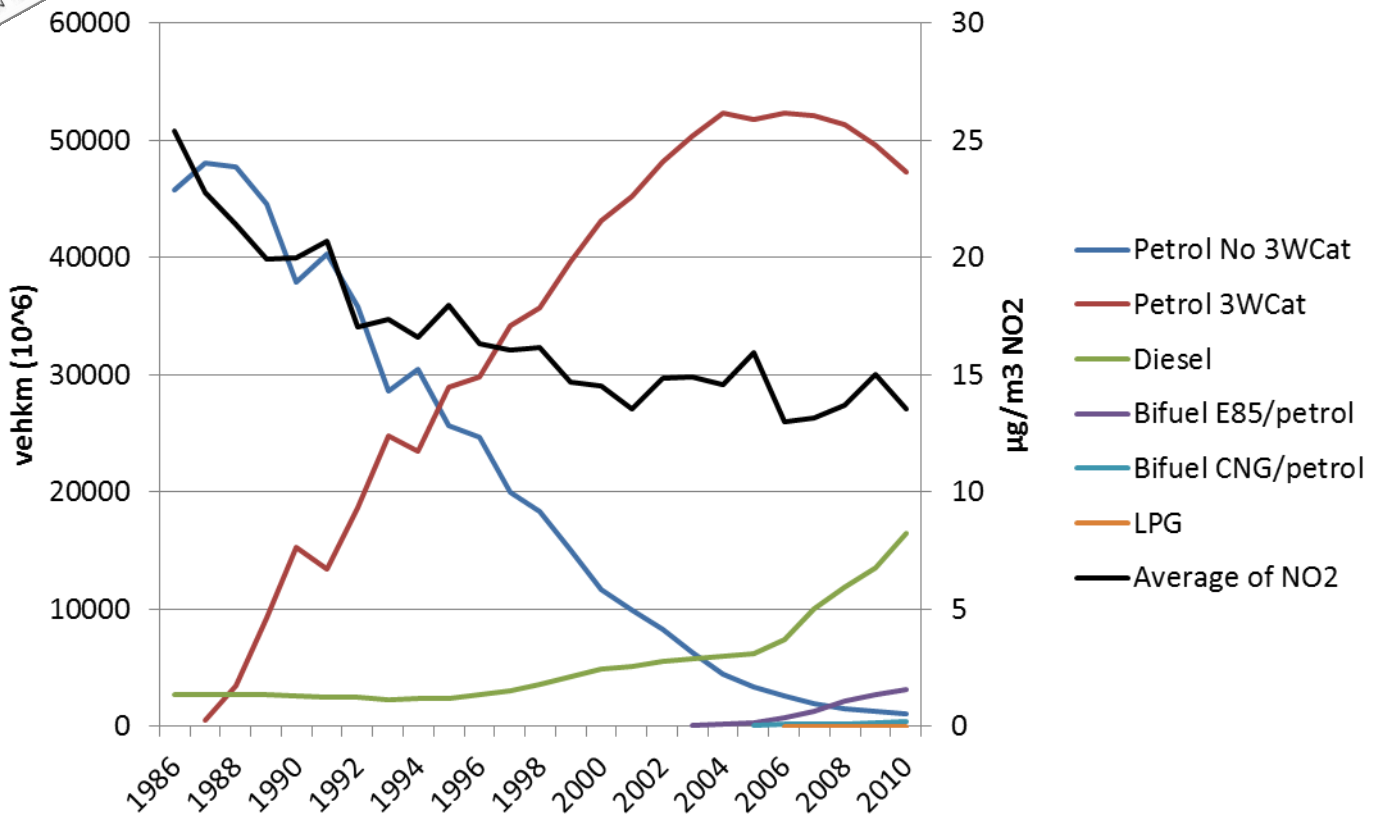
IVL Swedish Environmental Research Institute

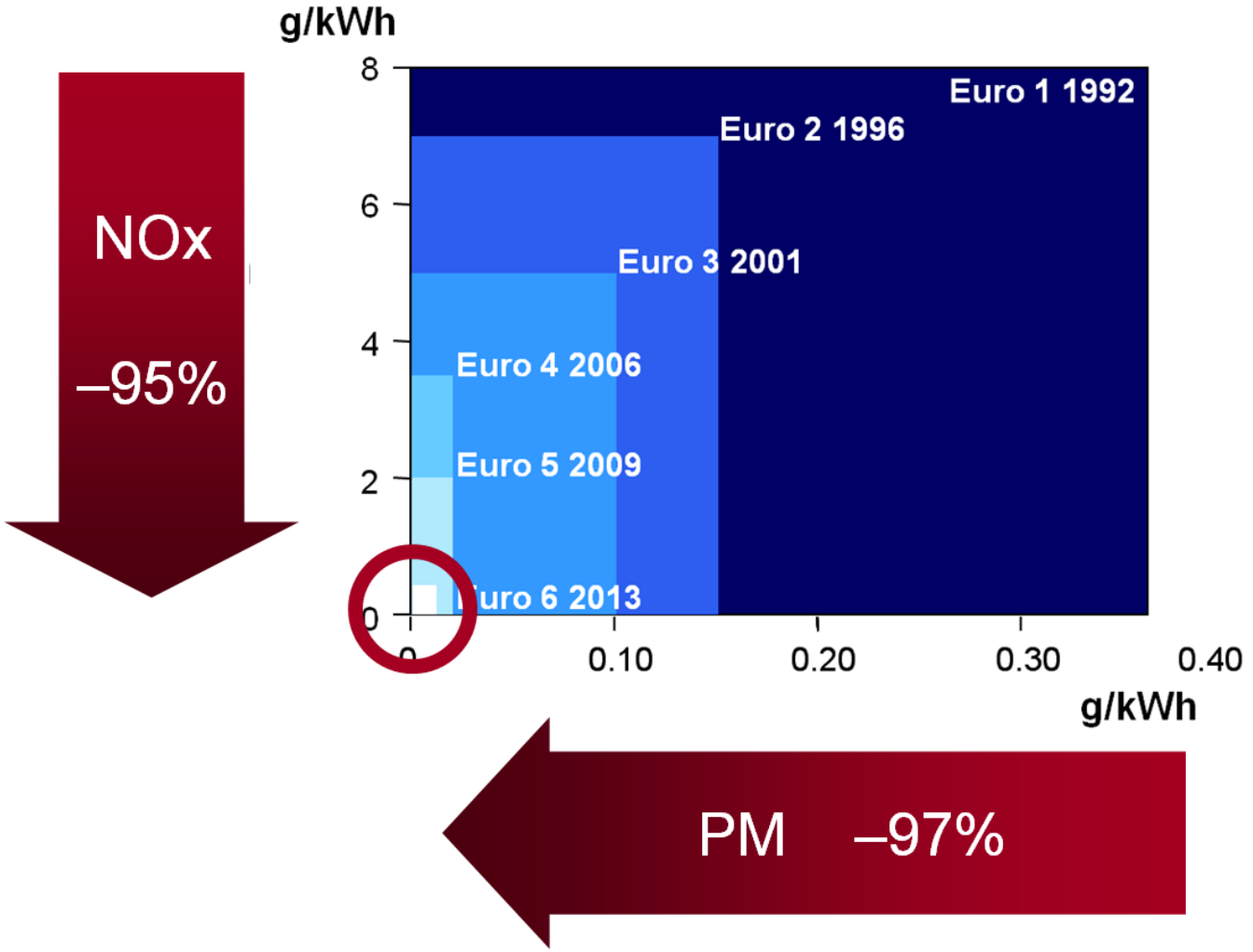
- Sweden's leading organisation for applied environmental research
- independent, non-profit research institute, owned by a foundation jointly established in 1966 by the Swedish Government and Swedish industry
- around 200 employees
- six major theme areas: Climate and energy, Sustainable building, Air and transport, Sustainable production, Resource-efficient products and waste, and Water
- responsible for the national air quality networks on behalf of the Swedish EPA
- runs an urban air quality network in cooperation with small and medium sized municipalities
- data host for the national air quality database

Trend of NO_2 in Swedish cities





European emission standards – heavy duty vehicles



City of Gothenburg

~ 550 000 inhabitants

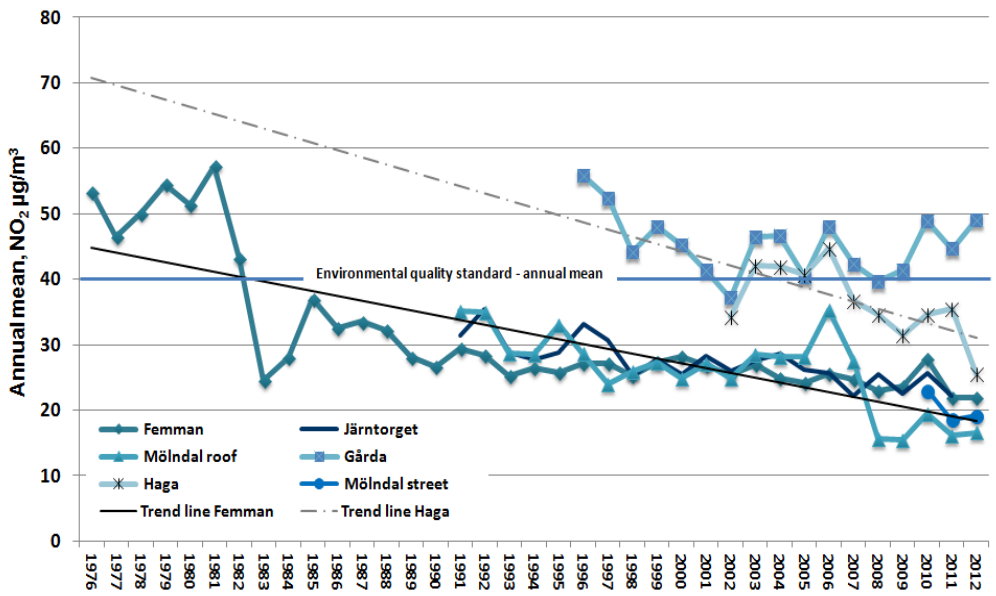
Port of Gothenburg is the largest port in Scandinavia

> EU limit values for NO_2 and PM_{10}

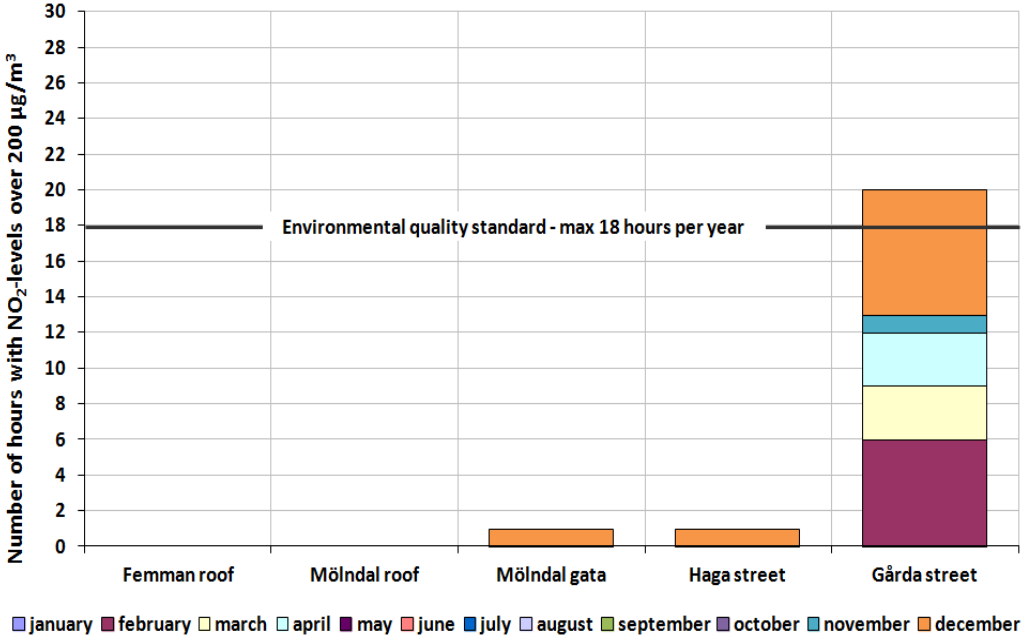
Air quality plans for NO_2 (2004) and PM_{10} (2006)

NO_2 levels in Gothenburg

Annual means

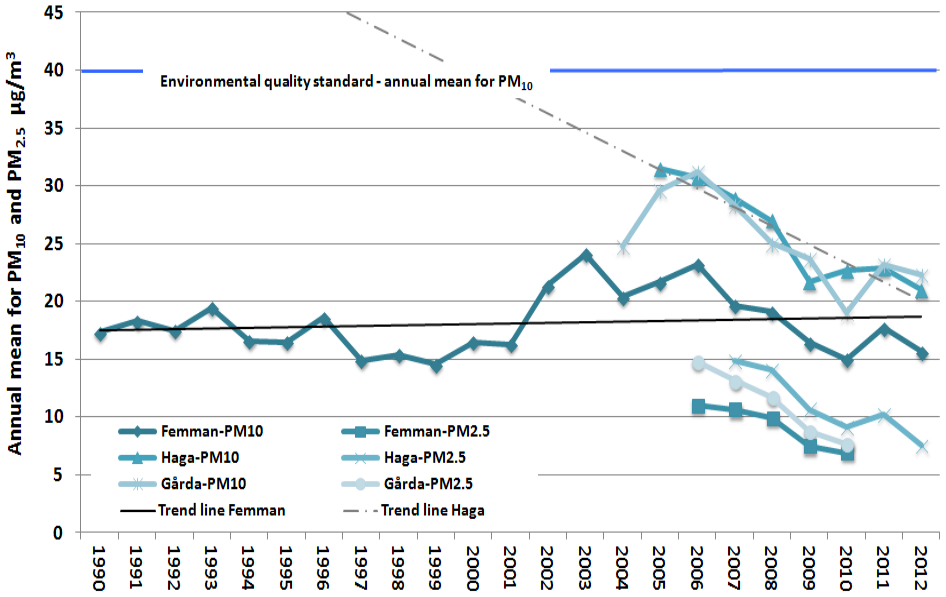


Number of hours > 200 µg/m^3, 2012

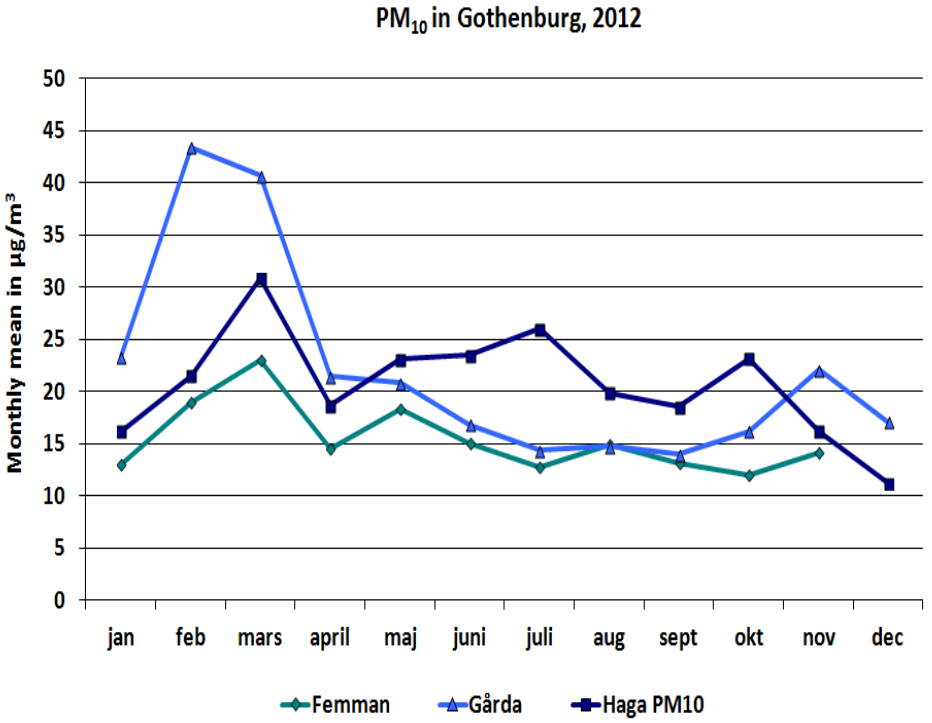


PM_{10} levels in Gothenburg

Annual means



Monthly means of PM_{10}, 2012



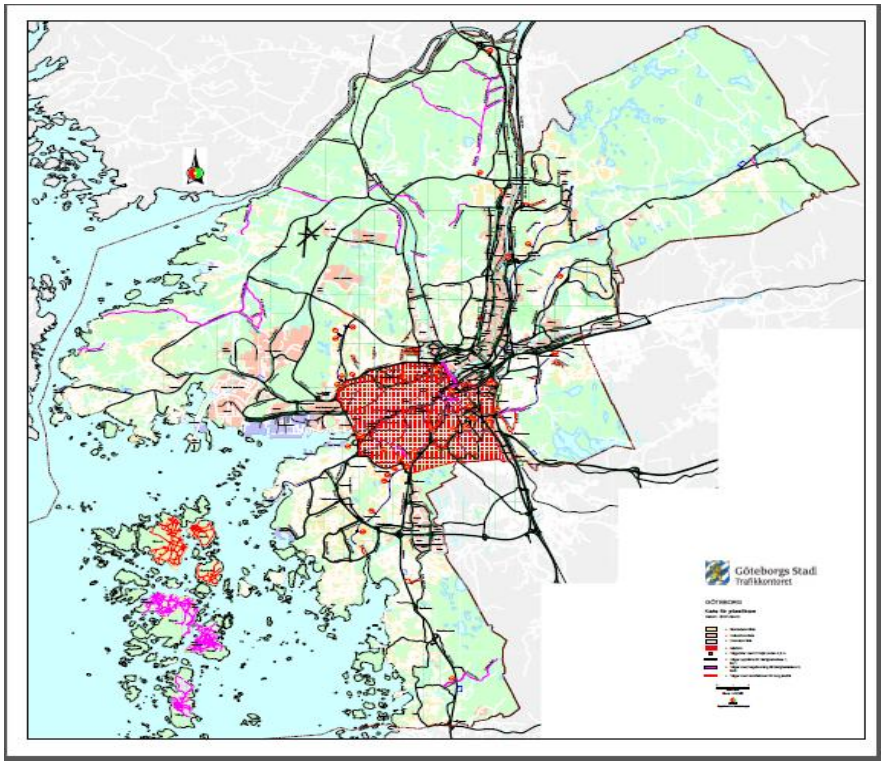
Local abatement measures in Gothenburg

- **Environmental zone within the city centre**
- **Reduced number of studded tires**
- **Reduced speed**
- Cleaning with water
- Sweeping
- Water drenching
- **Dust-binding agents**
- **Congestion charge**

Environmental zone

Regulation of heavy duty vehicles

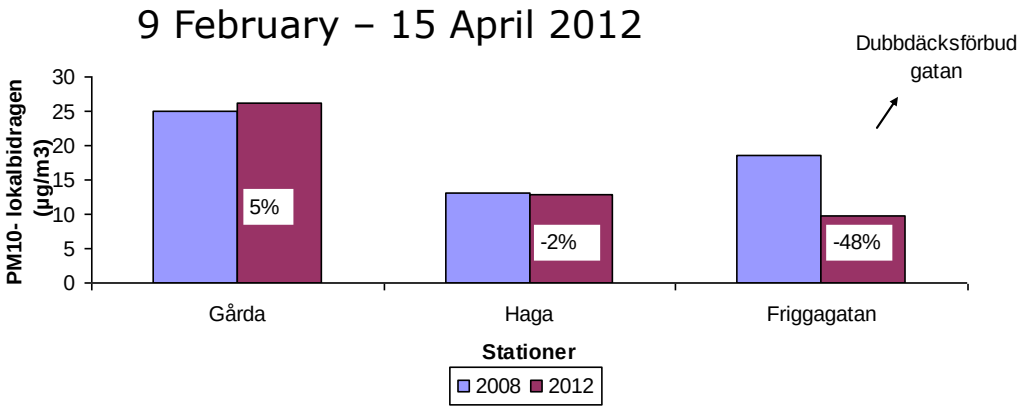
- Euro IV allowed until 2016
- Euro V allowed until 2020
- Old vehicles can be adjusted to meet new, stricter requirements
- Regulated emissions of CO, HC, NO_X and PM

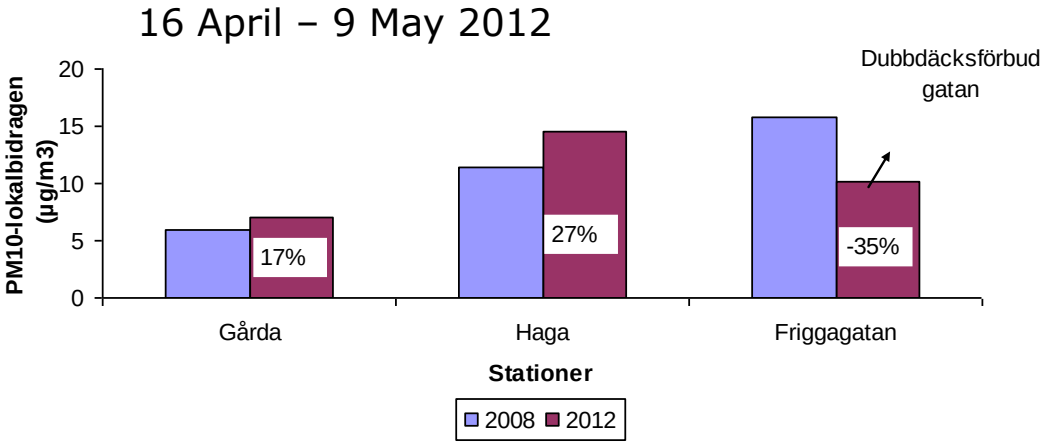


Reduced number of studded tires

- Studded tires reduction approx. 60% → 20% in Friggagatan between 2008 and 2012
- Estimated decrease ~13% of local PM_{10} contribution to the 90 percentile of daily mean values
- Other factors
  - Meteorological variations
  - Different local ventilation conditions due to reconstruction
  - Different vehicle mileage
  - Different dust-binding measures

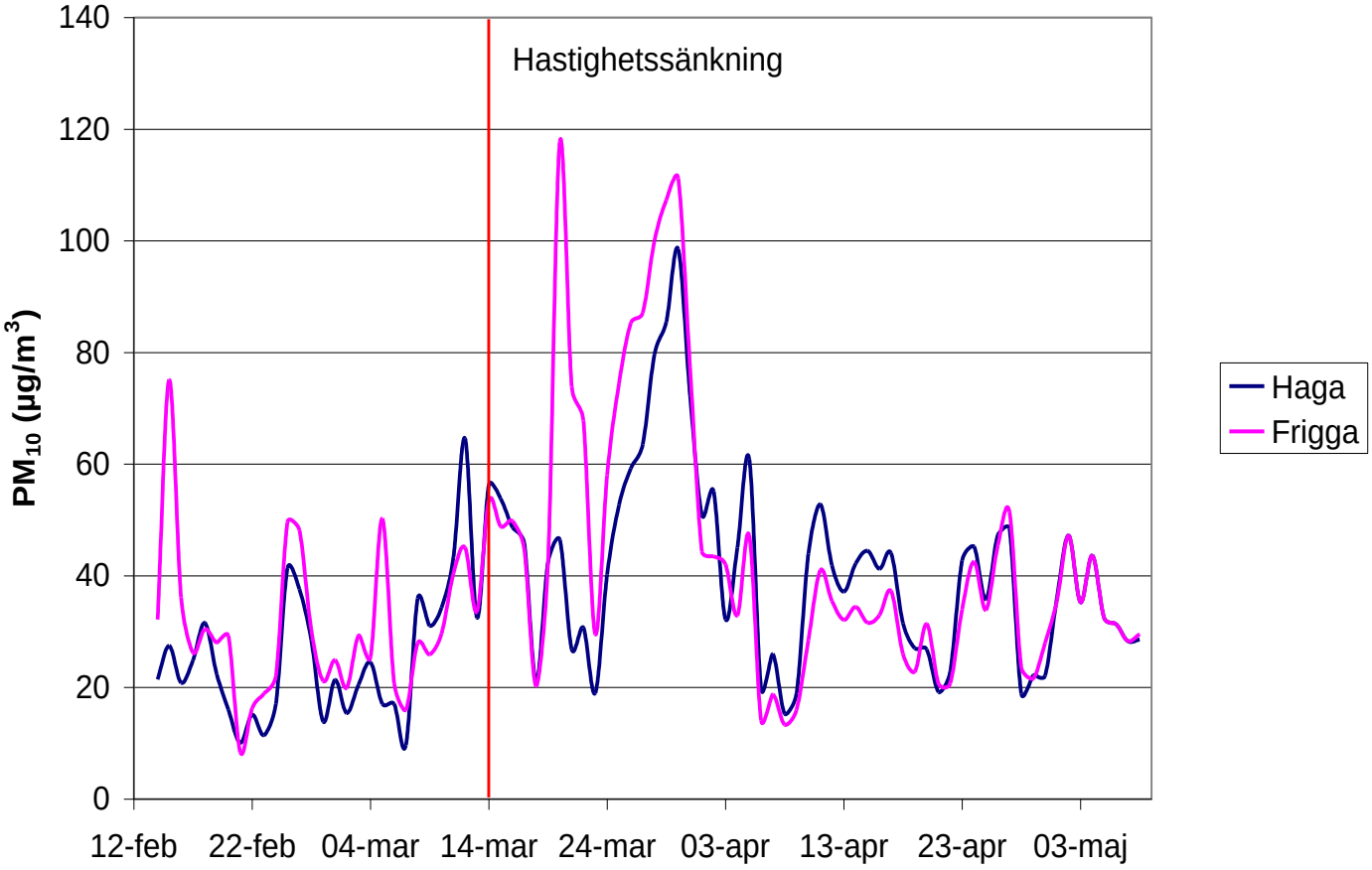
Local contribution to PM_{10}
90 percentile of daily mean value





Speed reduction (50 → 40 km/h)

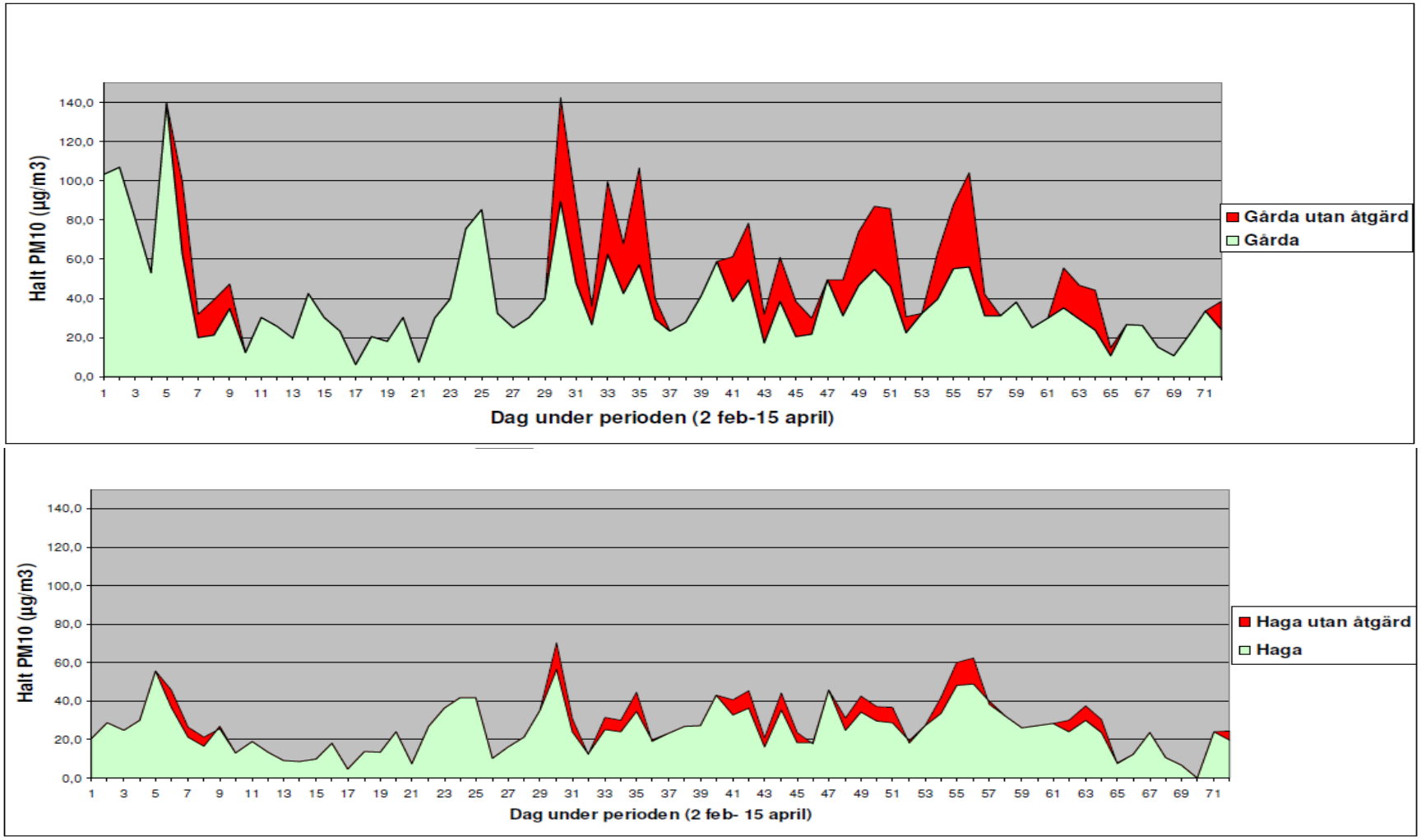
3-5 km/h in reality



No clear results – indicated decrease of 5% for PM_{10} in Friggagatan

Effect of dust-binding measures

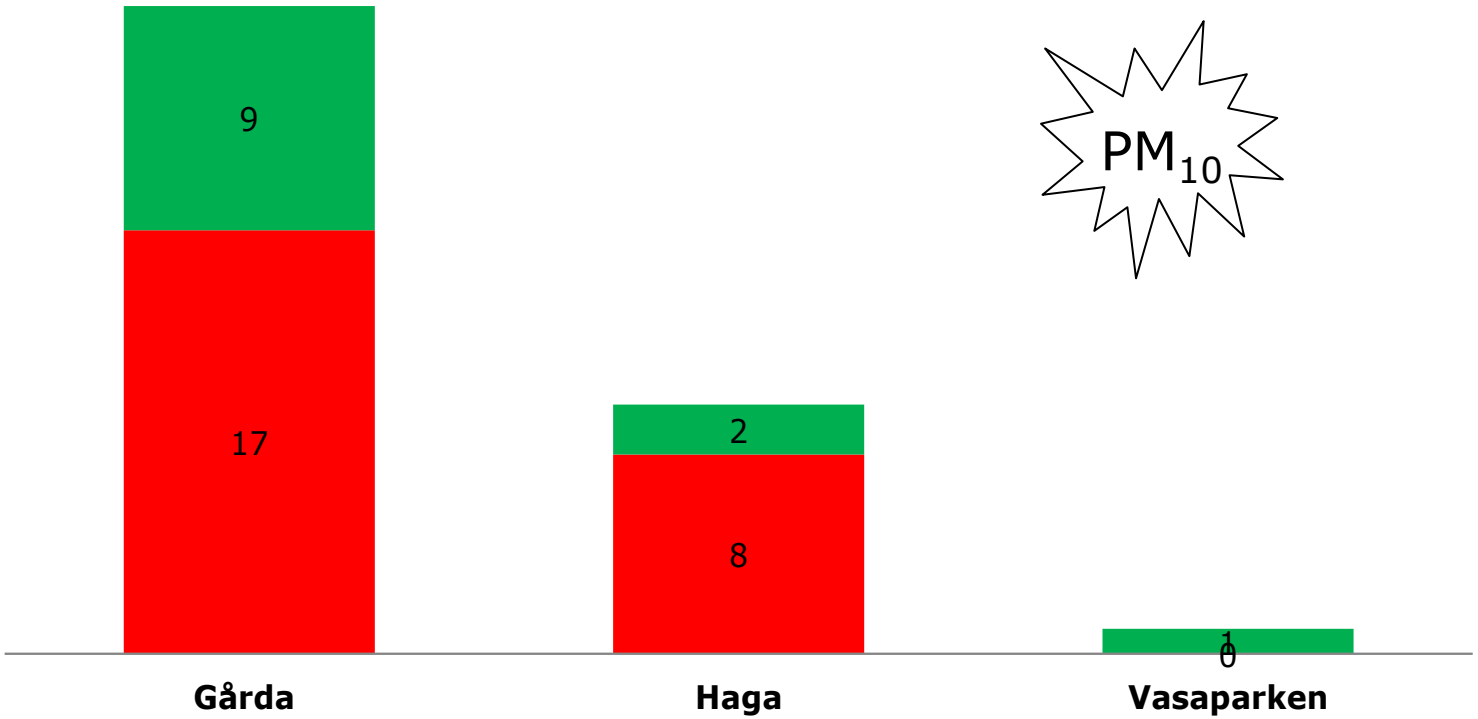
Monitored (green) and simulated (red) concentrations if no measures, Feb–Apr 2012



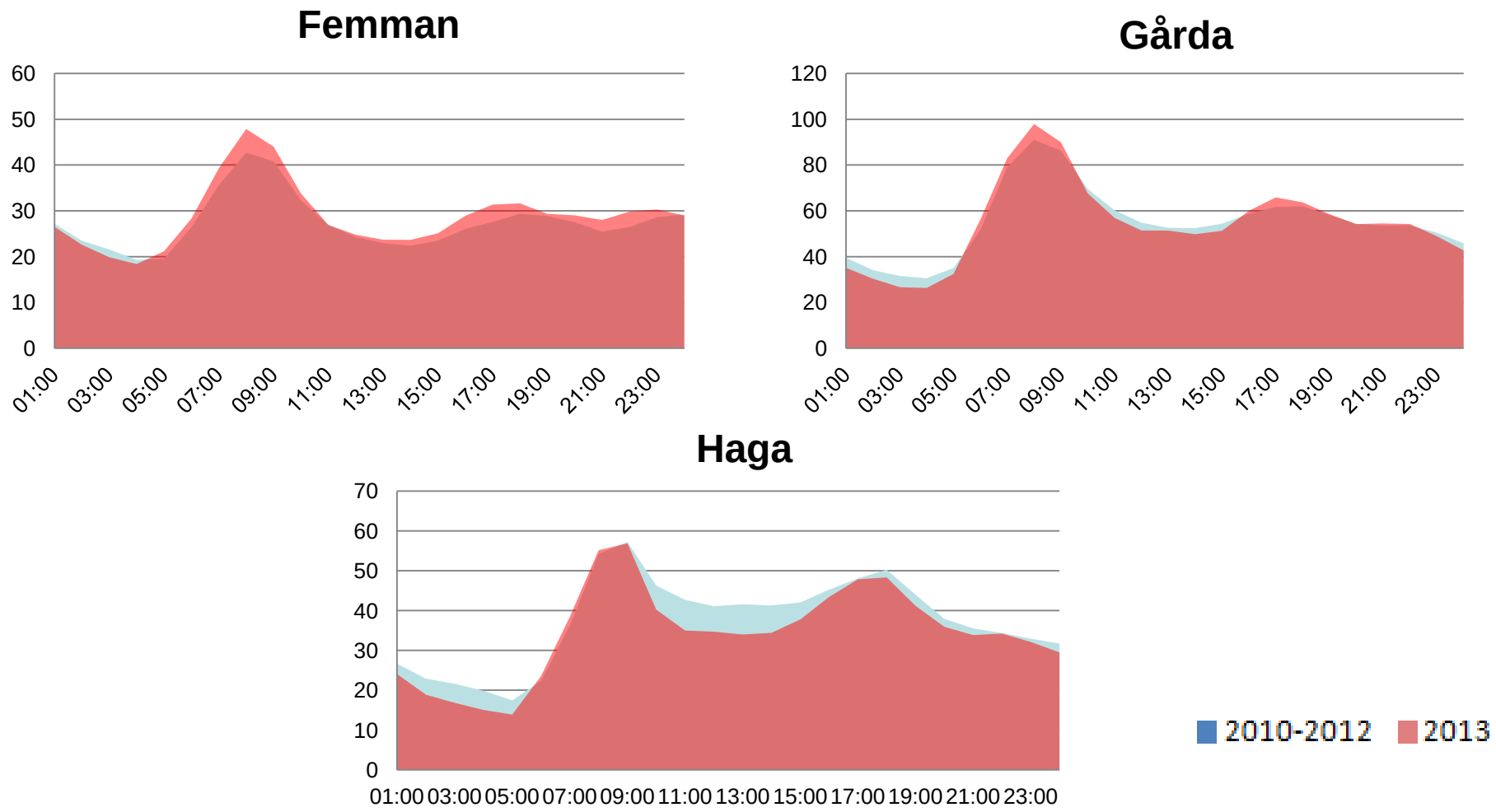
Effect of dust-binding measures 2012

Number of days above the EU limit value

and avoided days of exceedance

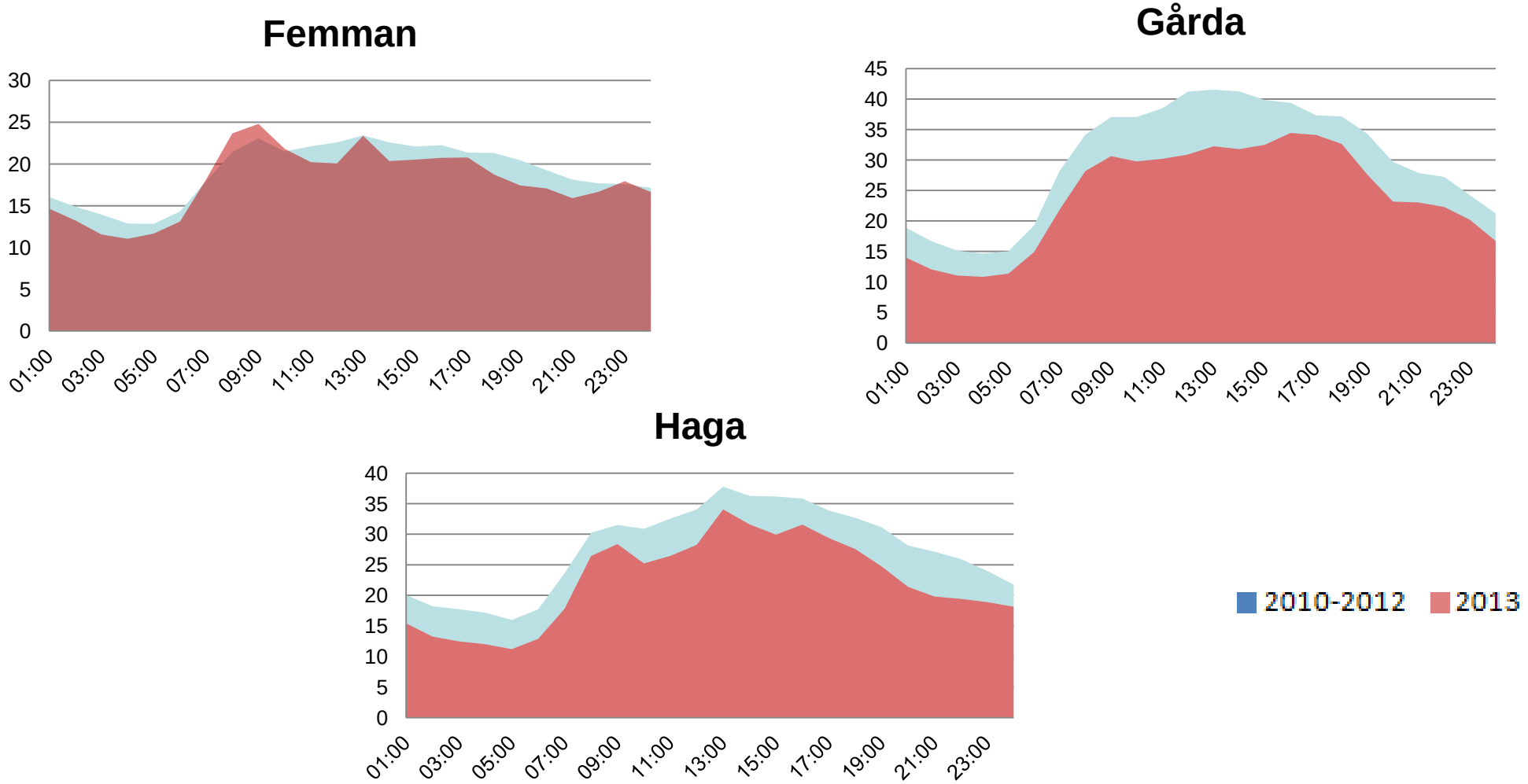


Congestion charge - NO_2 in Gothenburg



Congestion charge - PM_{10} in Gothenburg

Monday - Friday



Conclusions

- NO_2 levels have decreased
  - Introduction of TWC
  - Emission regulations
  - Environmental zone
- PM_{10} measures
  - Dust-binding
    - effective to lower high PM concentrations, the effect remains ~ 2 days
    - during unfavourable conditions and high PM concentrations not enough to keep the levels below the limit value
  - Effects of other measures more uncertain
- Congestion charge
  - Decreased vehicle mileage, decreased NO_X emissions
    - NO_2 concentrations lower at noon, increased levels during rush hours
    - PM_{10} concentrations lower

Thanks for your attention!