INRETS INSTITUT NATIONAL DE RECHERCHE SUR LES TRANSPORTS ET LEUR SÉCURITÉ

The challenges of air pollution in the transport sector from the French case

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1. Evolution of: - Air quality
   - Emissions
2. Technological and mobility stakes
3. Research issues

Evolution of the concentrations

- Long records
  - 50 years for SO_2, black smoke
  - 15 years for the other pollutants (less for O_3)
- SO_2 decreasing by a factor 20 since 50's
- CO, COV decreasing by a factor 4 / 10 years
- Black smoke decreasing by 5 till 1990, and then stable
- NO_2 quite constant during 90's, then decreasing (urban peaks)
- CO_2 increasing
- O_3: constant average, increasing median, due to geographical extension

Evolution of air pollution

- Most of the concentrations are decreasing
- *But it does not correspond to the public concern*
  - the population thinks that air pollution increases (in France)
- Environmental perception based on
  - personal perception of its stakes
  - perception of the physical environment by sight, smell
  - additional intellectual elements (scientific & technical information, news)
  - and mainly structured by the long-term view (sustainable development)
- *Air pollution considered as environmental problem deteriorated*

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R005-116/3.5

Traffic evolution in the EU during the 90s

- Doubling period for passenger traffic (p.km)
  - 37 years for road traffic
  - 12 years for air traffic
- Doubling period for good traffic (t.km)
  - 27 years
  - 21 years for road traffic only

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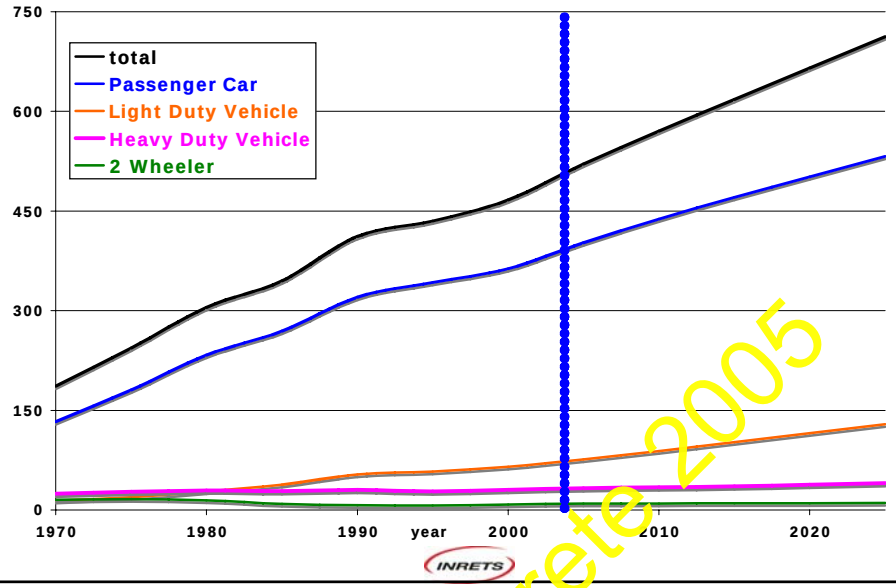
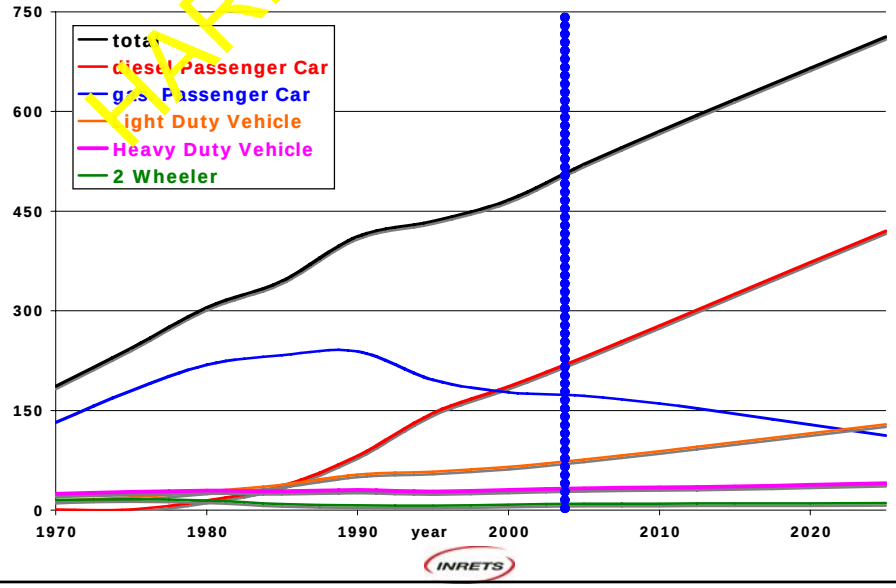
Road traffic in France 1970 - 2025

per vehicle type

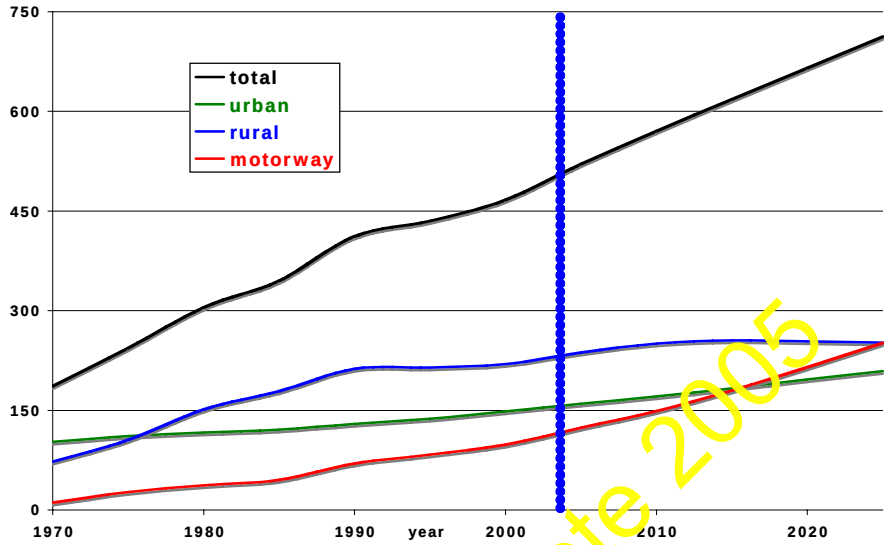


Road traffic in France 1970 - 2025

per vehicle and fuel type



Road traffic in France 1970 - 2025
per road type



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National emission inventory: method

- Road emission model: Copert III
- Improvements by taking into account of
  - air-conditioning: large increase of emission factors when running
  - *but refrigerating gases not taking into account*
  - constructors' commitment: specific CO_2 emission of new cars should decrease 190 => 120 g/km from 1995 to 2012
  - particulate filters: 90 to 99.9 % efficiency on PM

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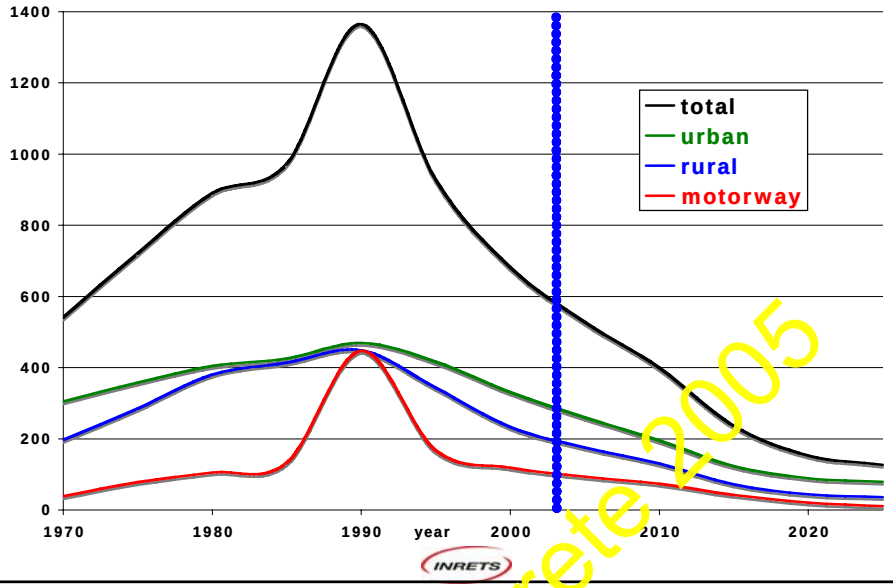
NOx emission for road traffic (1970 - 2025, France)



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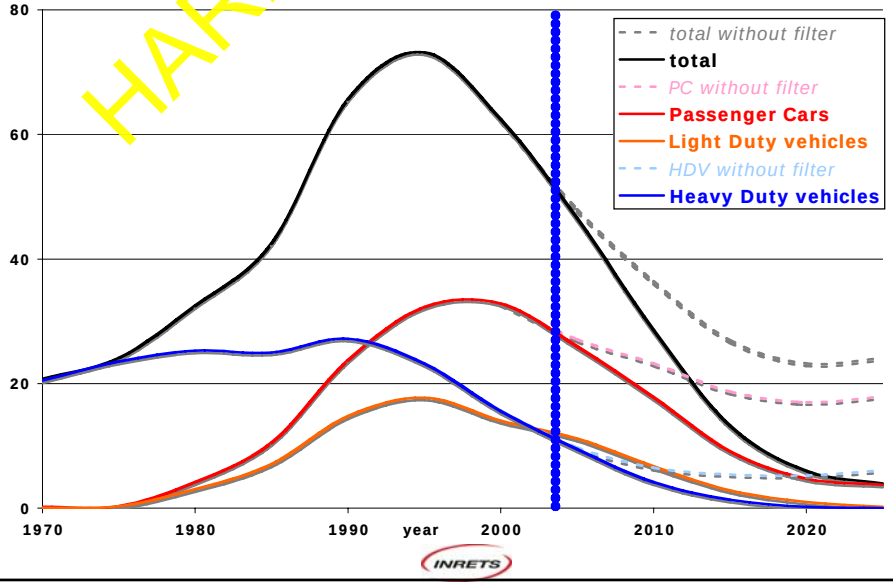
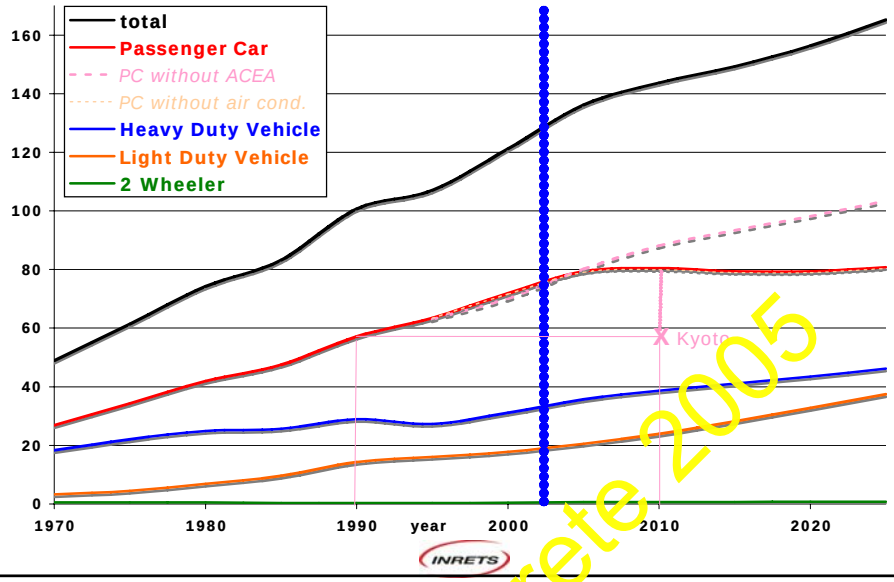
PM emission for road traffic (1970 - 2025, France)



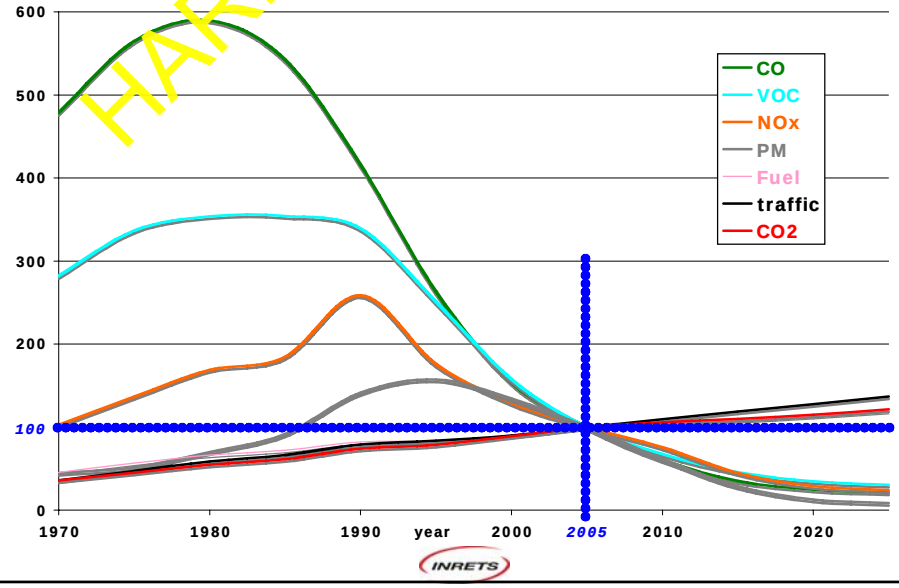
R105-111/2.13.2

CO_2 emission for road traffic (1970 - 2025, France)



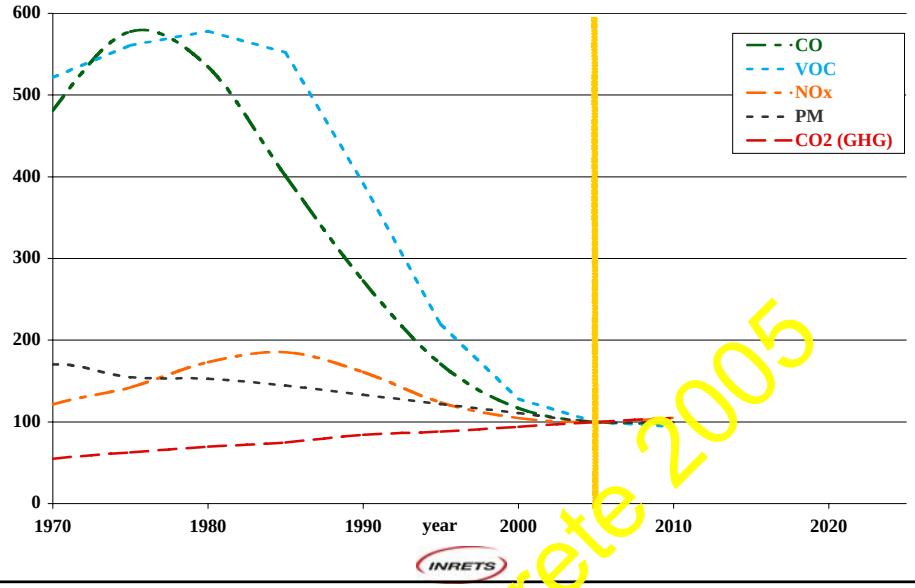
R105-112/2.13.2

Evolution of the road traffic emissions compared to 2005 (France)



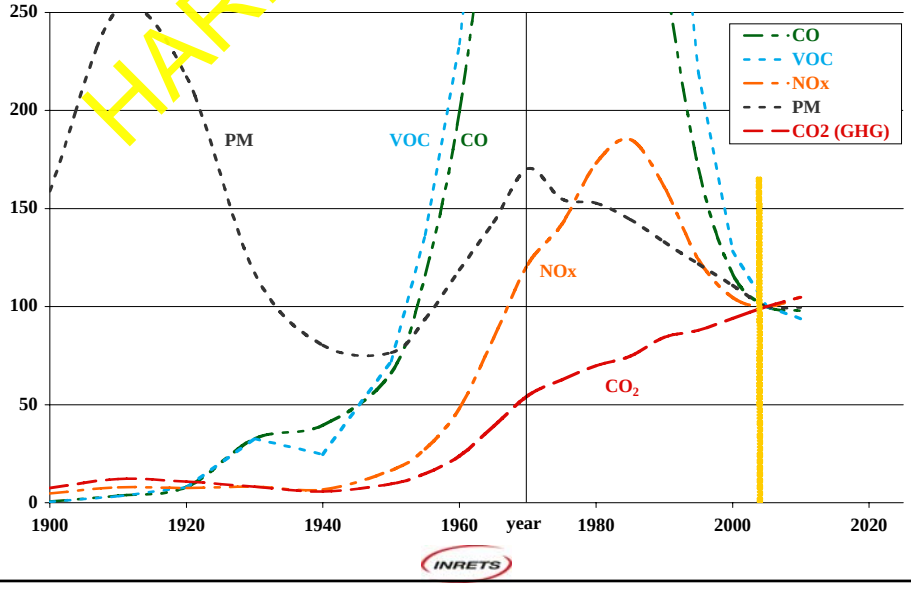
R105-110/2.13.2

Evolution of transport emissions compared to 2005 (Switzerland)



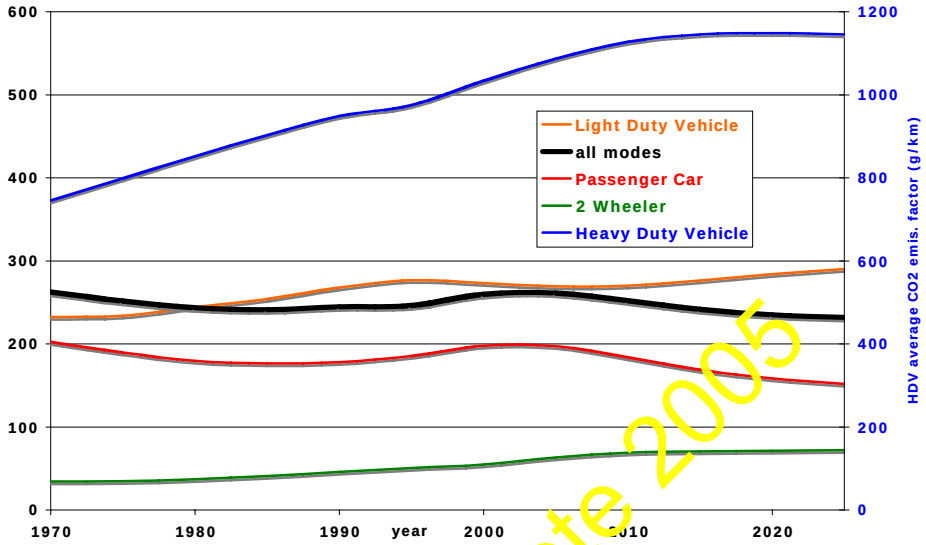
RJ03-1042.1.3.2

Evolution of the transport emissions compared to 2005 (Switzerland)



RJ03-1052.1.3.2

Evolution of the average road CO_2 emission factors (France, 1970 - 2025)



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Evolution: conclusion

- Very positive evolution for CO & HC
  - (3W catalyst, diesel)
- Positive evolution for NOx & particles
  - (3W catatalyst, diesel, particulate trap)
  - evolution NO_2 ?
- Nevertheless emissions much higher than 50 years ago
- Negative evolution for CO_2
  - linear traffic increase
  - very slow decrease of the unit fuel consumption
  - increasing specific fuel consumption for HDV, LDV and 2 Wheelers

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Technology stakes

- Fuel susbstitution
  - Diesel / gasoline: -10-20% CO_2
  - LPG or NGV / gasoline: -11 % CO_2, -50% NOx
- Particulate traps (99 to 99.9% efficiency): must equip all diesel vehicles
- Gasoline direct injection: -10-15% CO_2? PM increase
- Supercharging for gasoline vehicles reduces engine volume and consumption
- Hybrid vehicles: -30% (urban) => -0% (motorway) for CO_2
- Fuel cells: -30% CO_2 (well to wheel: life cycle): better than other in the future?

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Mobility stakes

- 40% effort by technology, 60% by mobility (OECD)
- Mobility: sustainable transport modes, management of the transport demand
- Does transport demand exist?
- Or is it an effect of the infrastructure supply?
- Taken into account of the environment
  - common: Environmental Impact Assessment (EIA): does not change the main aspects of the project
  - rare: Strategic Environmental Assessment (SEA): can cancel a project
  - strong political will necessary

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R003-110/4.7

Research issues (1/2)

- The air pollution problematic changes
- The present applied research will be used 10-15 years later
- Privilege the challenging pollutants, impacts and tools of the future
- But prudence to leave other subjects due to uncertainties

- Pollutants
  1. GHG, CO_2, fossil fuels
  2. NOx and smog precursors
- Impacts
  1. Greenhouse: more pollutants, impact acc. location
  2. Sensitive pollution (odours, smoke, soiling): very few studies, big concern
  3. Photochemical smog
  4. Synergies between impacts
- Tools

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R105-121/4.7

Research issues (2/2)

- Pollutants
- Impacts
- Tools
  - emission tools:
    - macroscopic ones with life cycle assessment approach: production, utilisation & destruction of infrastructures, vehicles and energy
    - socio-economic aspects essential to manage the traffic evolution
  - decision making tools
    - go beyond the analytical approach to answer simply but seriously to simple questions
    - by aggregating pollutants and impacts, by a systemic approach of air pollution from sensitive pollution to greenhouse effect
    - or by a systemic approach of the environment, including safety
    - include psycho-sociological approaches of the nuisance perception, study the political mechanisms involved in political decision

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R105-122/4.7

Conclusions

- The past evolution of the air quality, the future evolution of the emissions and the public concern allow us to see the main challenges in terms of pollutants and impacts
- Some clear challenges: GHG, systemic approach, sustainable transport
- *A lot of uncertainties*: smog, a number of unregulated pollutants, new concerns as GH in the past?
  - ➔ Be careful
- Research orientation
  - Try to answer the present questions
  - *and the (unknown) future questions: Absolute need to enlarge fundamental research*
  - *at the same time increase our knowledge without any other objective*
- Based on EU situation: do not extrapolate…

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R105-1234-7