



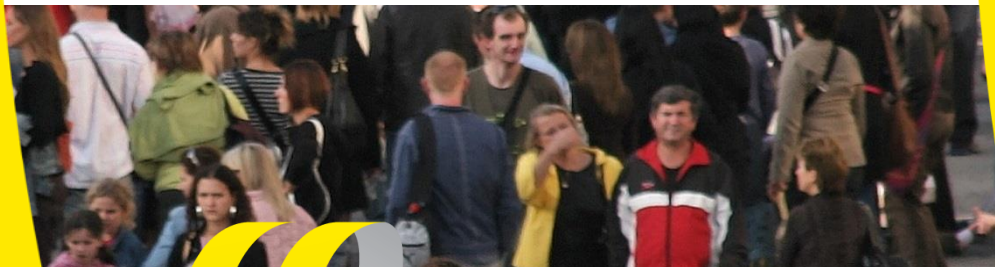
# Potential of electrical trailer cooling during rest periods



Co-financed by the European Union

Trans-European Transport Network (TEN-T)

Analysis of emission and costs



**CE Delft**



# CE Delft

- Independent research and consultancy since 1978
- Transport, energy and resources
- Know-how on economics, technology and policy issues
- 40 Employees, based in Delft, the Netherlands
- Not-for-profit

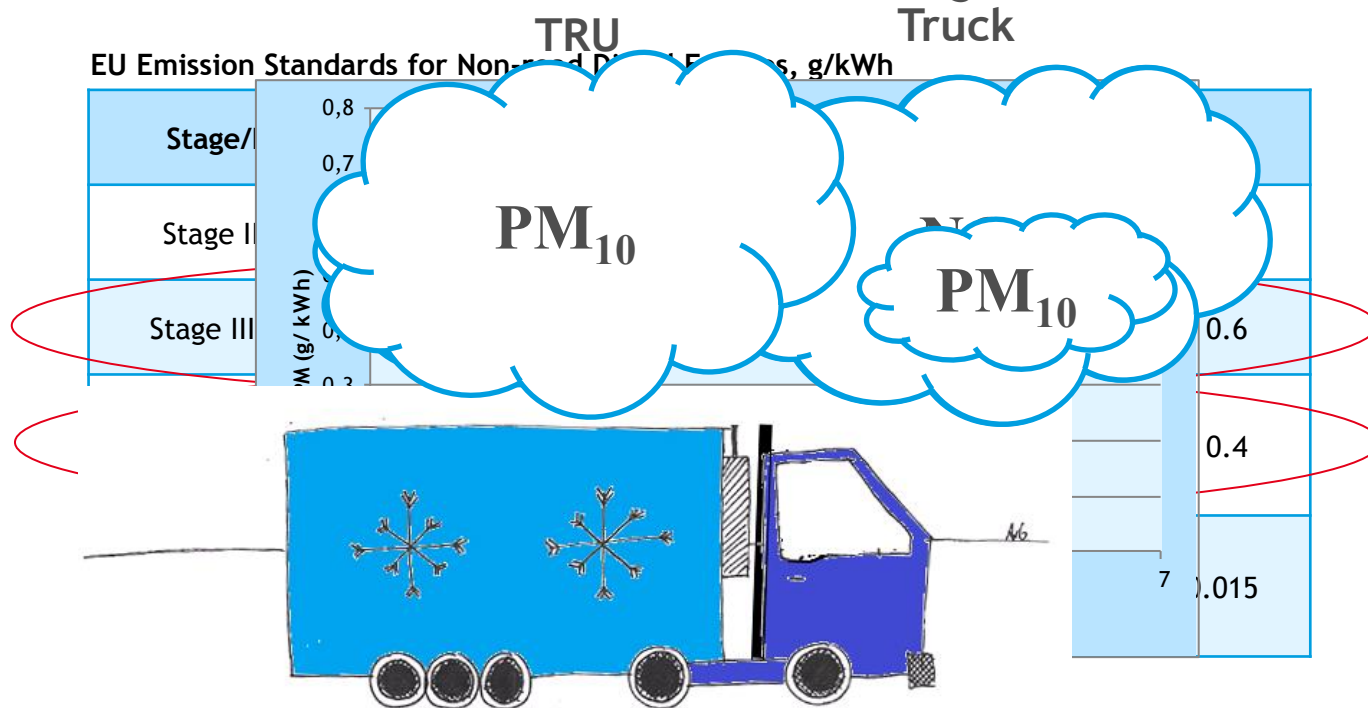
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# Introduction

- Problem: High air polluting emissions of Transport Refrigeration Units (TRU).
  - No EU emission Limits for Non road diesel engines <18kW



# Introduction

- Problem: High Emission of Transport Refrigeration Units (TRU)
  - No EU emission Limits for Nonroad diesel engines <19kW
- Solution provided by NomadPower: electrical power supply network at parking places to allow for electrical cooling during (overnight) rest periods.

⇒ What are potential environmental benefits of power supply at parking places in long distance transport?



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# Calculation emission reduction potential

Emission electricity consumption

=

Hours per year on resting places

X

Electricity consumption per hour  
(kWh/ hour)

X

Emissions factor electricity  
(gram/ kWh)

—

Emission diesel consumption

=

Hours per year on resting places

X

Diesel consumption per hour  
(litre/ hour)

X

Emission factor diesel  
(gram/ litre)

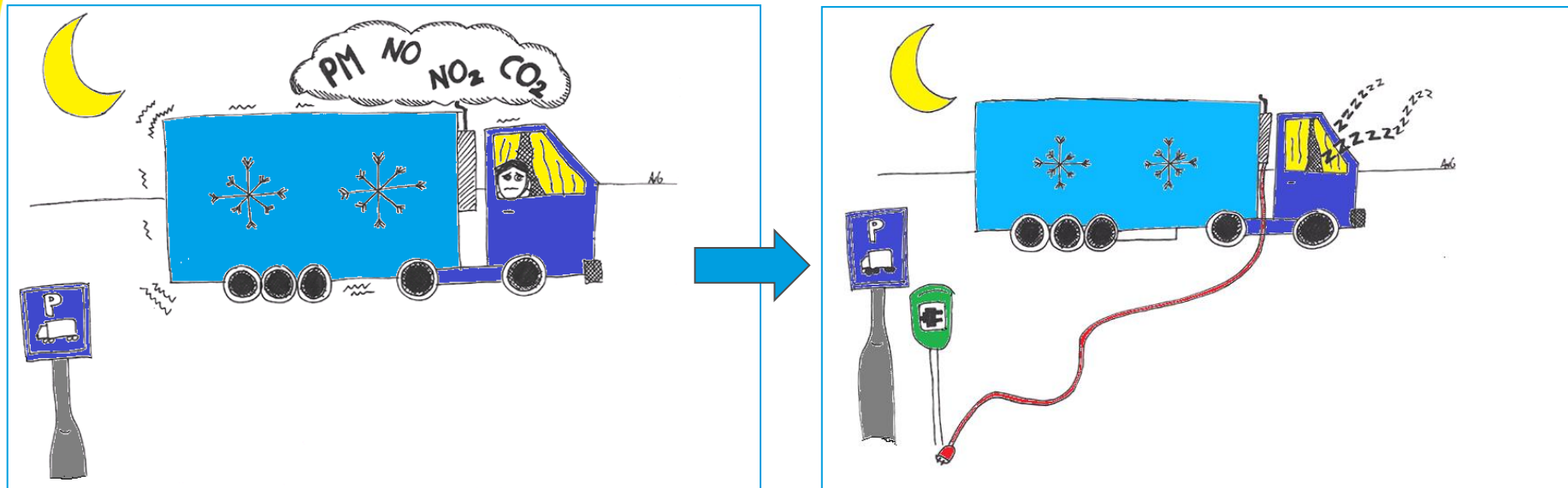
## Method

- Interviews
  - TRU producers
  - TRU users / transport companies
- Literature research
- Calculations
  - Potential for EU28;
  - Several cases for France and Poland

## Results on parameters

- 1500 operating hours per year for TRU in long distance transport, 15-30% of hours on parking places: 225-450 hours per year.
- Fuel consumption at parking places:
  - 2.0-2.5 litre diesel/ net operating hour on average
  - Per gross operating dependent on operation mode, temperature, insulation of trailer, age of system
- 3.2 kWh electricity replaces 1 litre of diesel
- Emission factors Diesel at level of US Tier II or EU Phase III >19 kW
- Emission factors electricity dependent on country: Poland, France
- Fuel savings and maintenance costs savings; electricity costs

# Results



- 8.6 kg CO<sub>2</sub>/ hour
- 48 g NO<sub>x</sub>/hour
- 5.6 g PM<sub>10</sub>/hour

- 2.5 kg CO<sub>2</sub>/ hour     -70%
- 3 g NO<sub>x</sub>/hour         -93%
- 0.2 g PM<sub>10</sub>/hour      -95%

- Noise reduction 4 dB
- No extra costs or even saving of €180,- per year



# Result for EU 28

Potential emission reduction for 234,000 truck-trailers with TRU

- 130-260 million litres of Diesel
- 300-600 kilotonnes CO<sub>2</sub> -



2,700-5,400

- 2400-4700 tonnes NO<sub>x</sub> -
- 280-560 tonnes PM<sub>10</sub> -



5,000-20,000

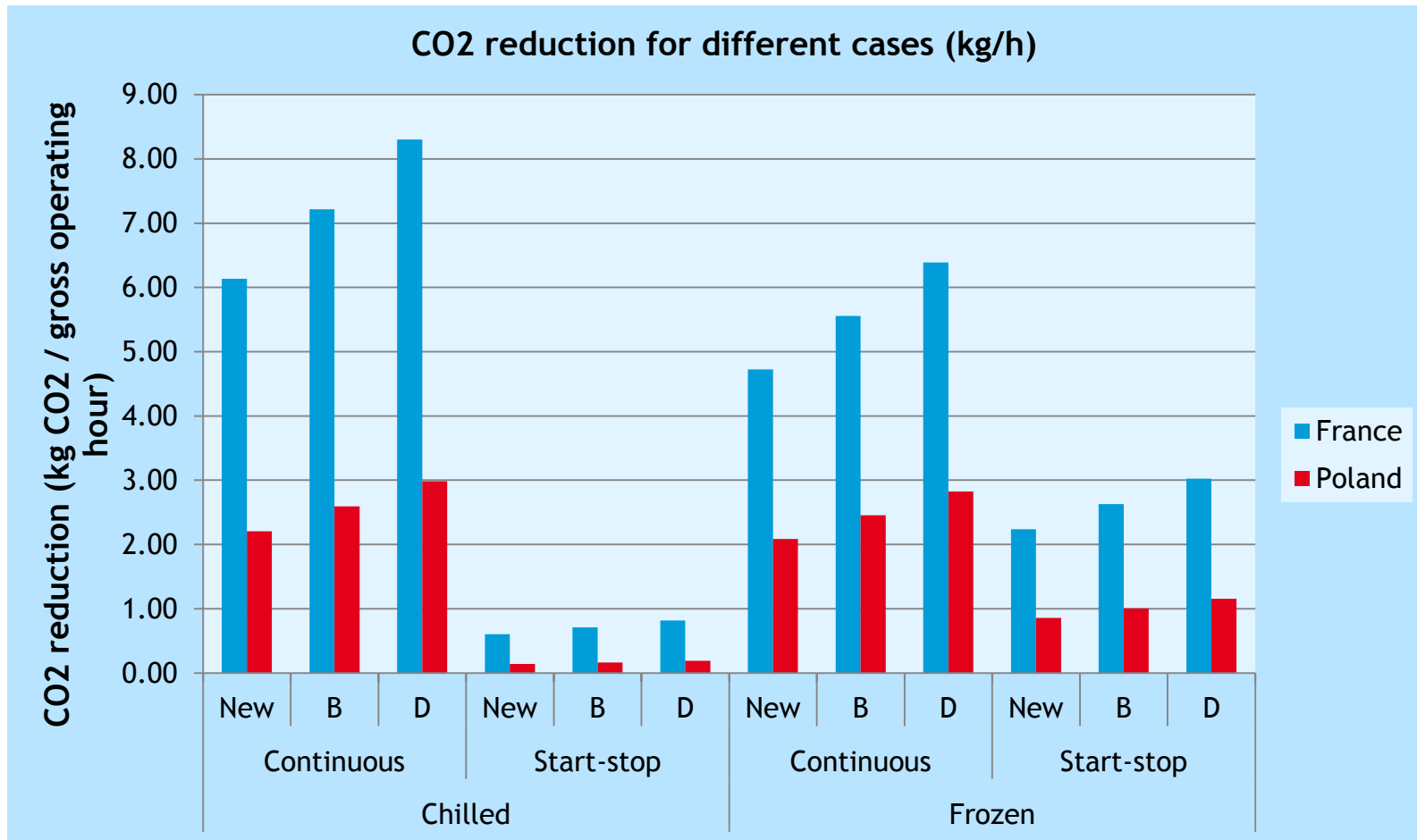


35,000-70,000

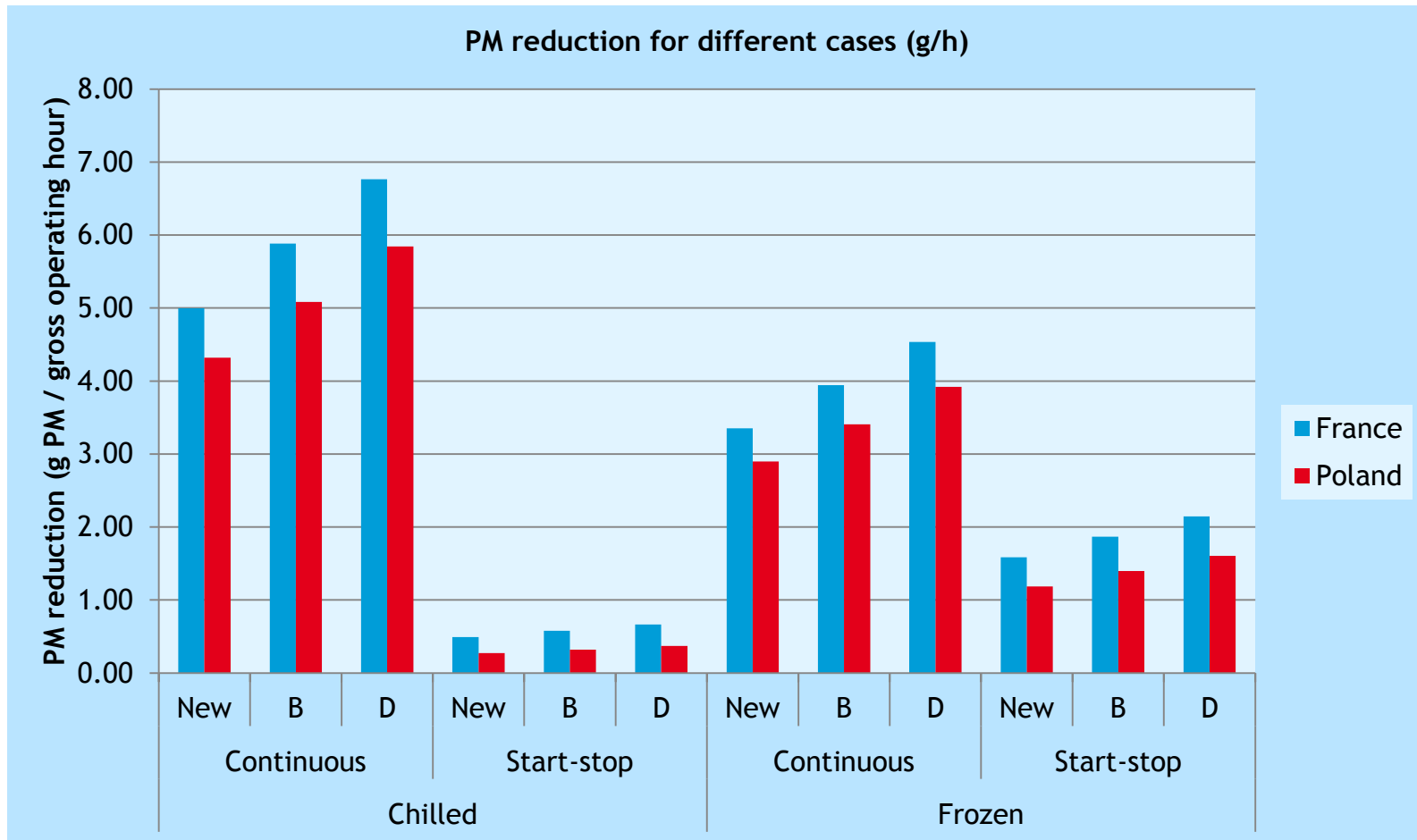
110,000-220,000

220,000-440,000

# Different cases - Different results: CO<sub>2</sub>



# Different cases Different results: PM<sub>10</sub>



# Conclusion

- Emissions of diesel TRUs are relatively high
- Power supply at parking places offers large potential for environmental benefits:
  - ~70% CO<sub>2</sub> reduction,
  - ~90% NO<sub>x</sub> and PM<sub>10</sub> reduction,
  - 4dB noise reduction
- Yearly PM<sub>10</sub> reduction is significant and equals PM<sub>10</sub> emissions of a truck

## Outlook

- Investigate potential for distribution services in urban areas, where air quality is of high importance.

Thank you for your attention!

The report can be downloaded at [www.cedelft.eu](http://www.cedelft.eu)