

# Three Way Catalyst Retrofit

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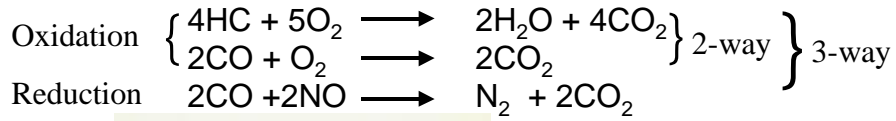
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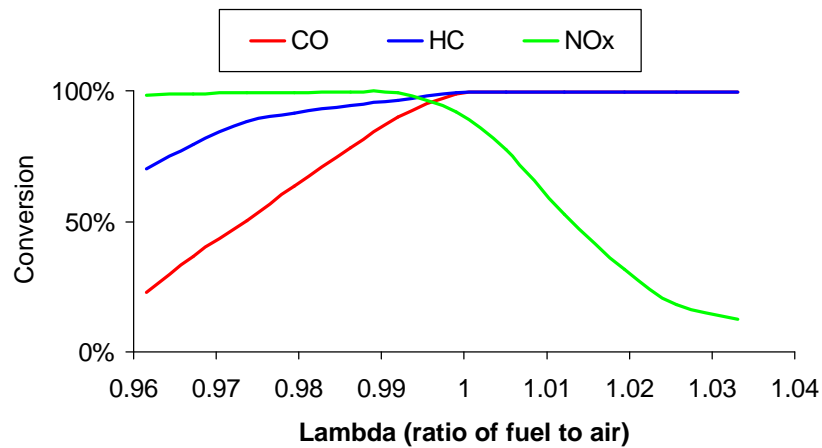
## Definition of TWC Retrofit

- TWC = Three Way Catalyst



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## Three Way Emissions Control



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## Definition of TWC Retrofit

- Retrofit kit for retrospective (aftermarket) fitment to an in-use vehicle



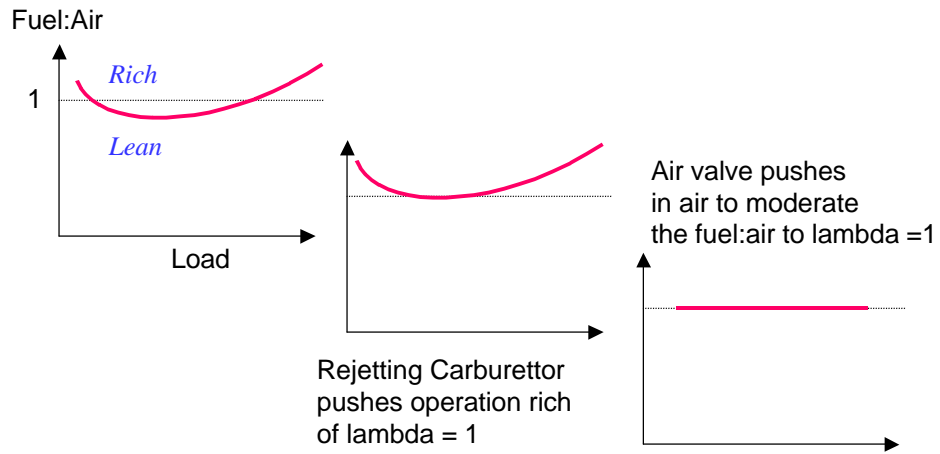
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## Background

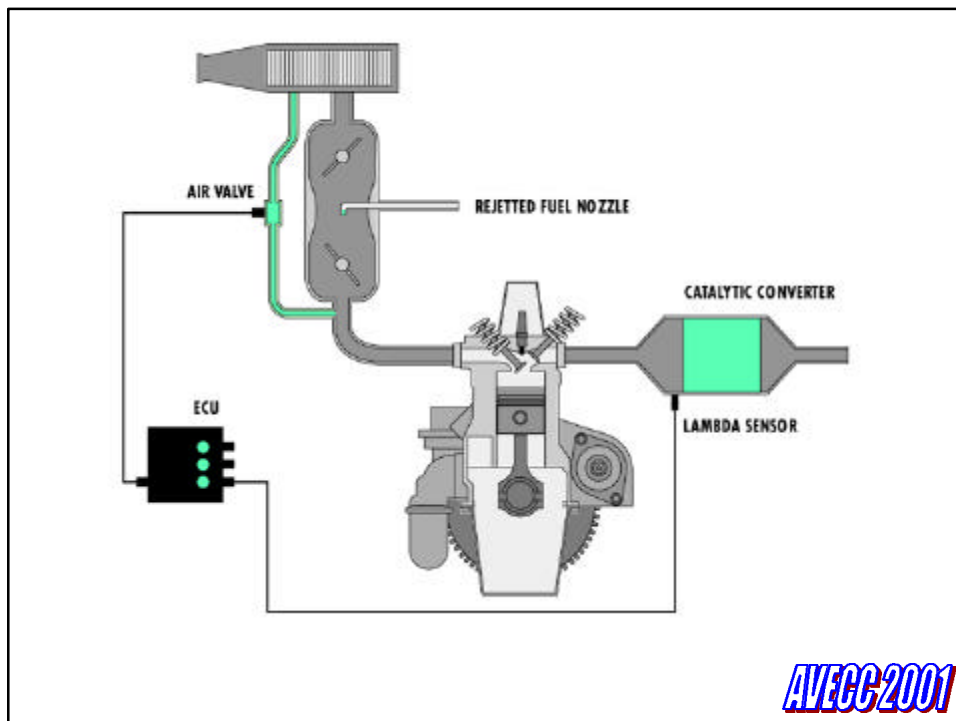
- Germany
  - Practical example of a national but voluntary retrofit scheme
  - Alternative to accelerated scrappage
- China
  - Highly regulated scheme tackling local air quality

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# Principle of the System

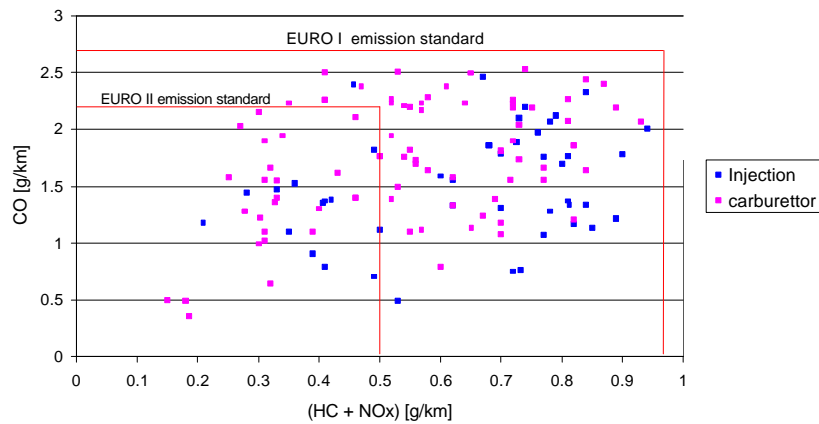


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## Test Results



Source: HJS

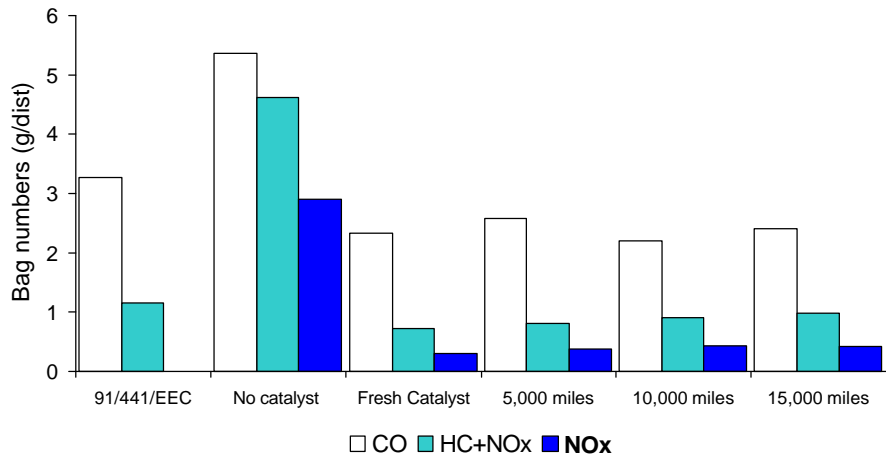
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## Retrofit Durability Trials

- Johnson Matthey tests
  - on HJS closed-loop carburettor TWC Retrofit system
  - Ford Fiesta 1.0 litre engine
  - ageing by road mileage accumulation
  - fuel was pump-grade unleaded gasoline

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## Test Results



Source: Johnson Matthey

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## Real World Testing



Emissions Testing

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## Real World Testing



Driveability

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## Policy Case Study

- UK Cleaner Vehicles Task Force
  - promote environmentally friendly vehicles that people and businesses will want to buy and use
  - improve the environmental performance of the existing vehicle stock

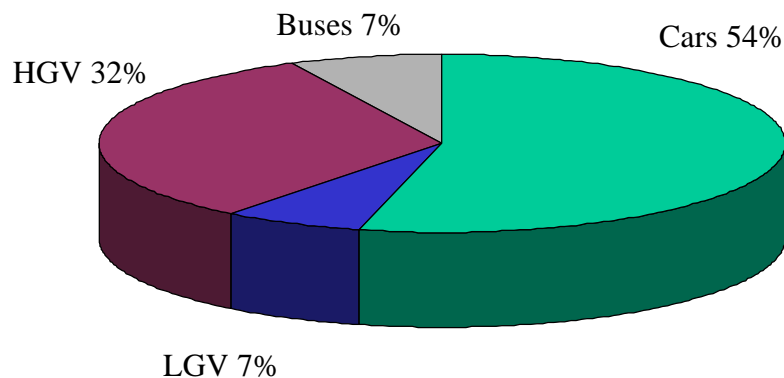
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## Air Quality Objectives

- UK problems are with urban PM and NO<sub>x</sub> (NO<sub>2</sub>)
  - Even allowing for tighter emissions legislation, air quality standards will not be met
  - Need an improvement in emissions from the existing fleet

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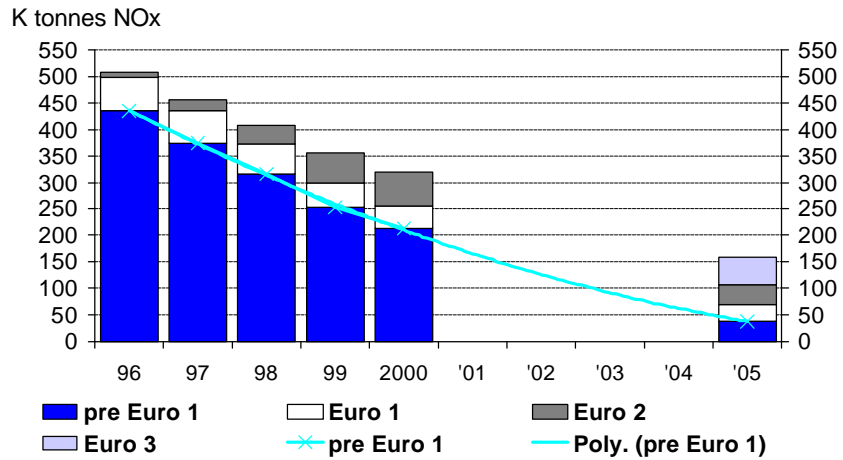
## Transport NO<sub>x</sub> Sources



Total inventory 795 ktonnes NO<sub>x</sub>, 45% petrol vehicles, 55% diesel  
UK estimates, 1998, Source: NETCEN

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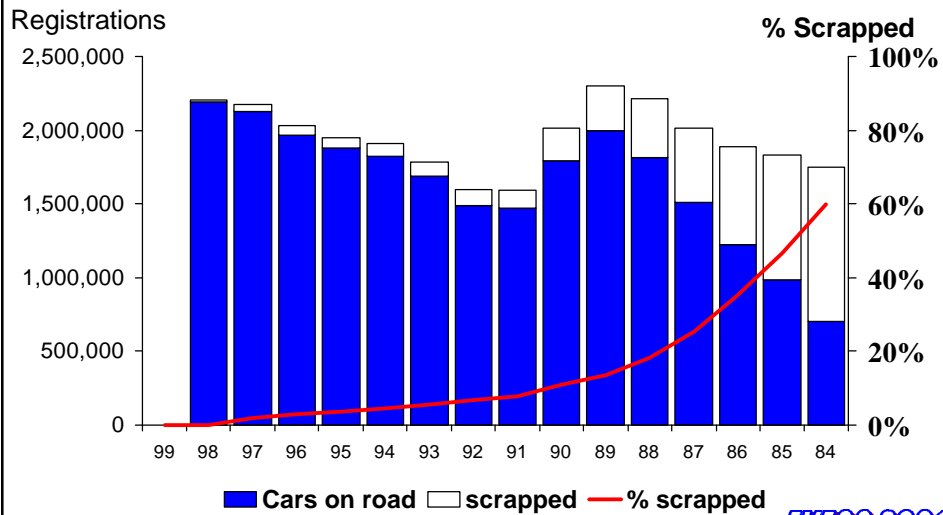
## Most NOx from Pre-Euro 1 Cars



Sources: SMMT, AID

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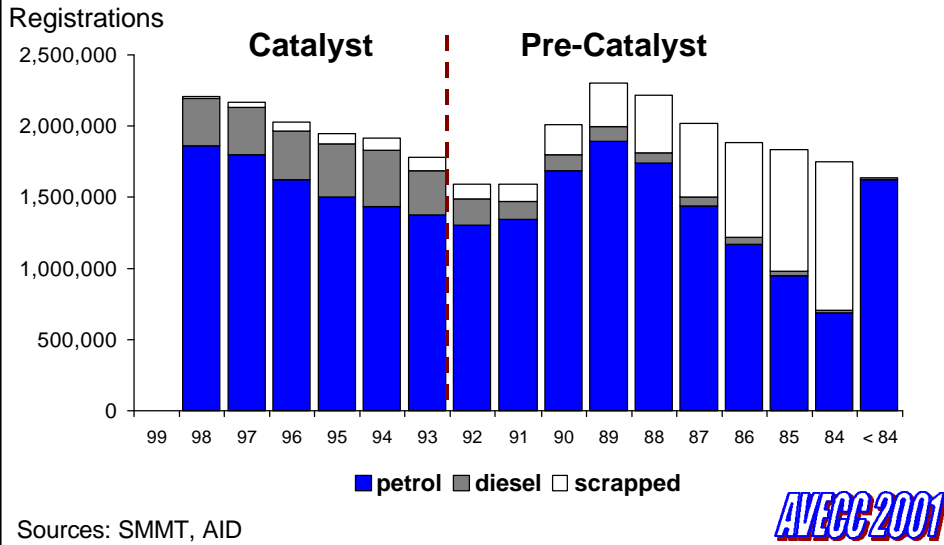
## UK Car Census



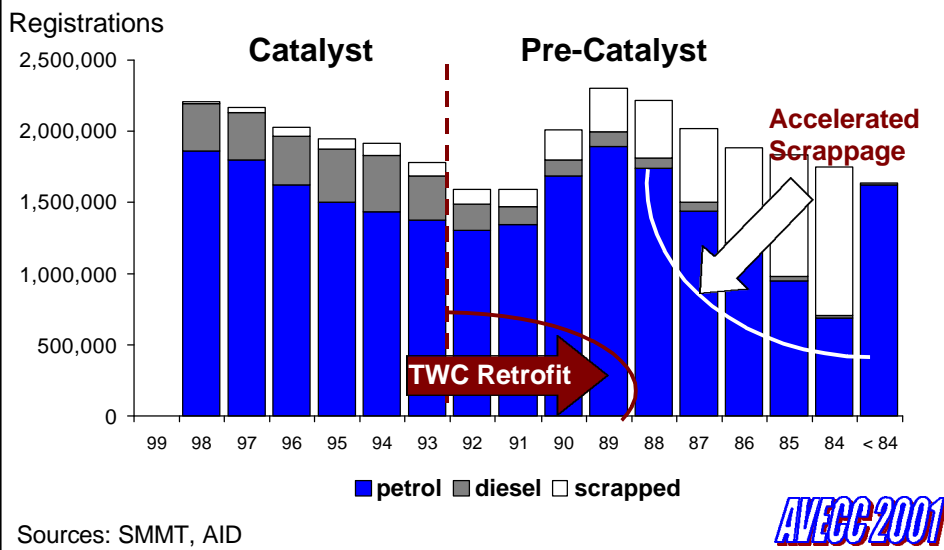
Sources: SMMT, AID

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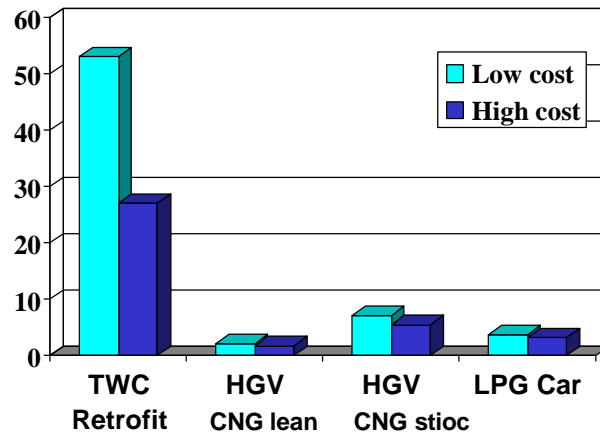
# Census by Emissions Control



# .... or Scrappage



## Benefit-Cost Ratio



Source: Cleaner Vehicles Task Force Technology & Testing Report 2000

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## NOx Reduction Options

- Accelerated scrappage
- Cut vehicle mileage (fuel tax)
- Stringent testing regimes
  
- TWC Retrofit
- Incentives for alternative fuels

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## Implementation Issues

- Regulatory regime
  - Certification and in-service testing
- Willingness to pay
  - Cost of technology and likely budget
- Scope of scheme
  - Local or national, voluntary or compulsory, incentive or tax

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## Conclusions

- TWC Retrofit is viable upgrade option giving > 70% NO<sub>x</sub> reduction
- Is attractive (Benefit:cost) compared with other policy options.
- Can be implemented nationally or locally
- Central difficulty is how to incentivise?

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