Cleaning the air with Chemistry

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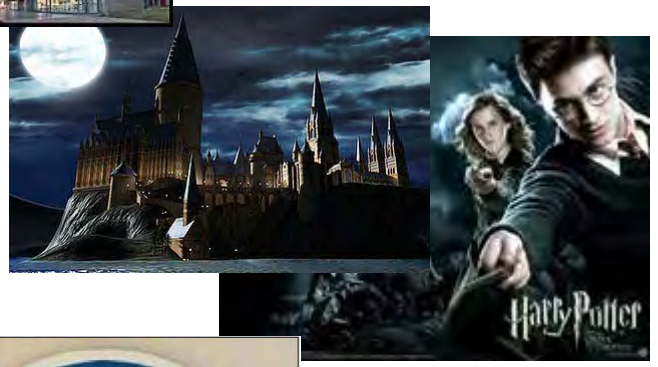
SCI Belgrave Square, London, 26th April 2017

Introduction

- Geographical path…

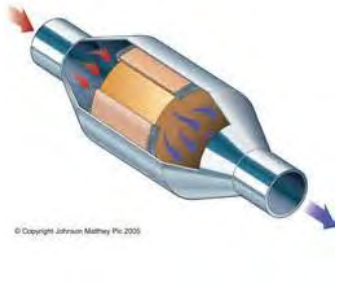
Sunderland



York

Durham

Royston



Johnson Matthey

UK top 100 company

£10.7 billion revenue for year end March 2016

> 12000 employees, operating in around 30 countries

Leading global market positions in all its major businesses

Business split into sectors:

- Clean Air
- Efficient Natural Resources
- Health
- New Markets

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Cleaning the air…What is clean?

- What do we think of when we talk about clean or dirty air?

- Pollution (industrial / personal)
- Dust (natural / man-made)
- Greenhouse gases

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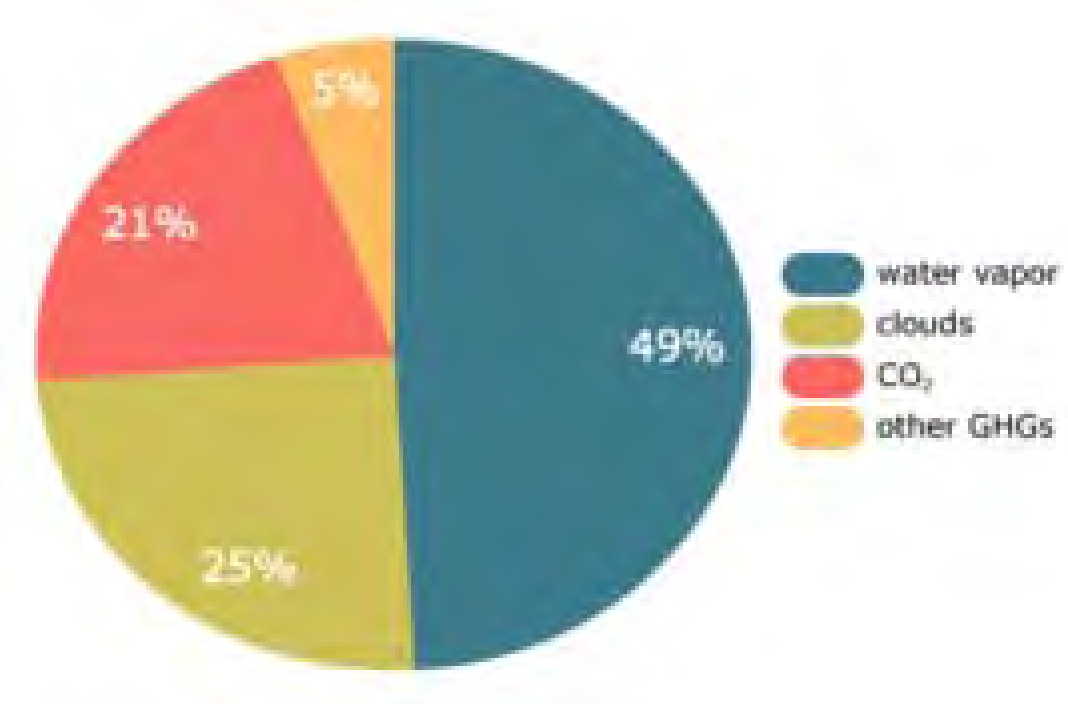
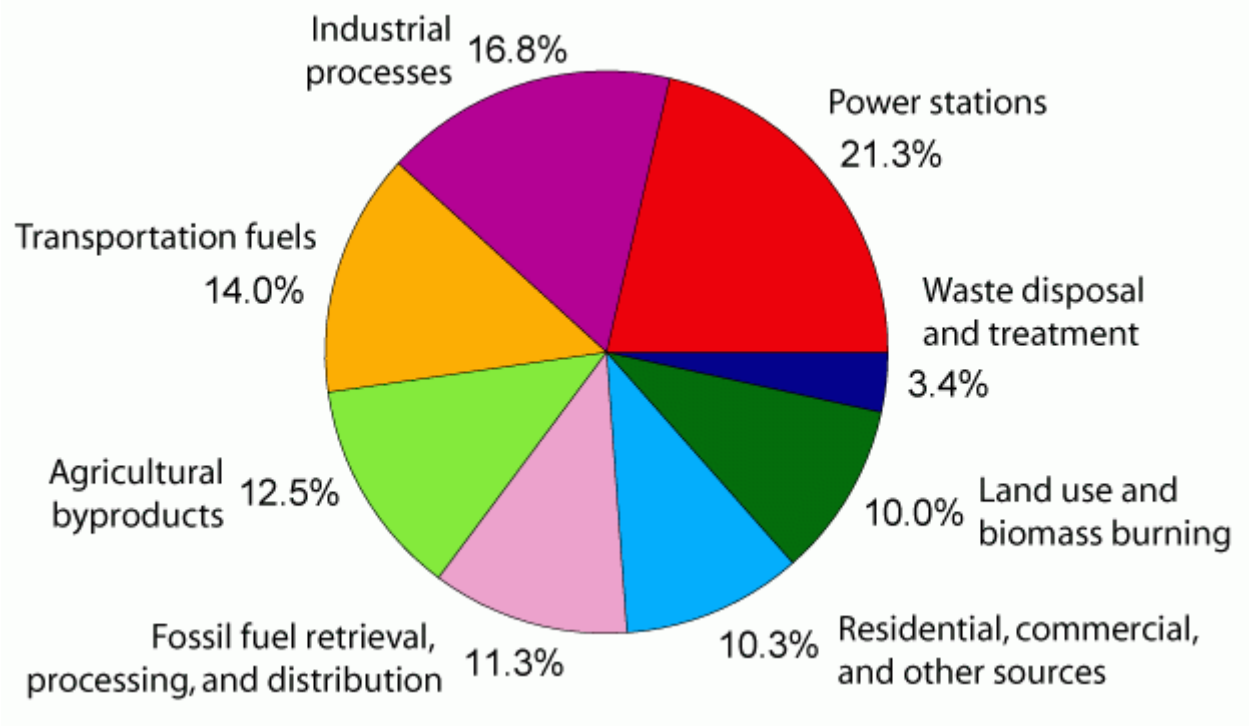
Greenhouse gases



- Some gases are natural some are man-made
- What creates these gases?

Combustion

What processes are responsible?



The Reality…

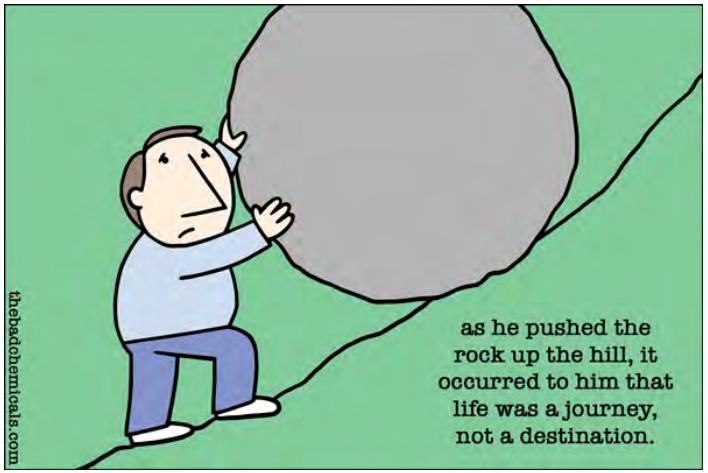
+ impurities

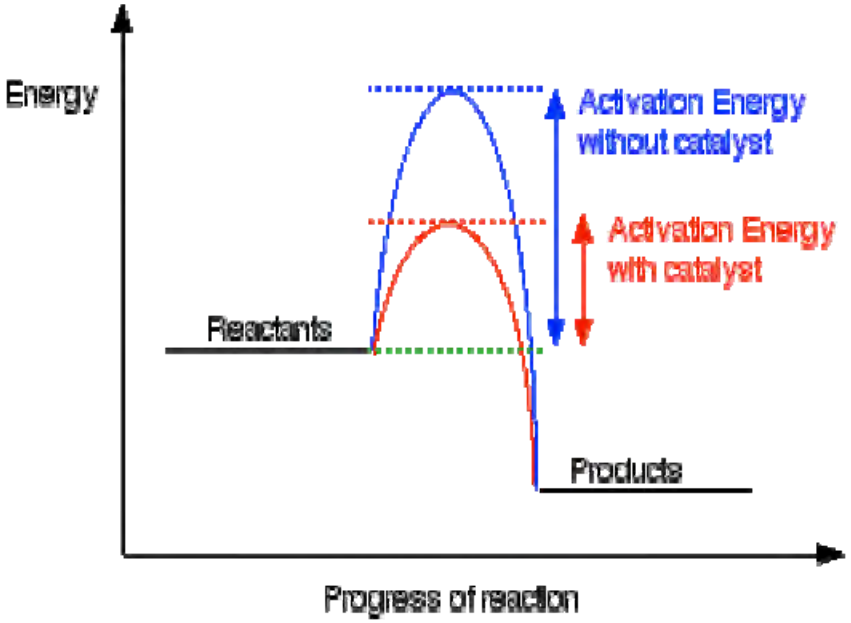
Nitrogen oxides,
sulphur oxides
unburnt
hydrocarbons

+ other parts of air

What can we do?

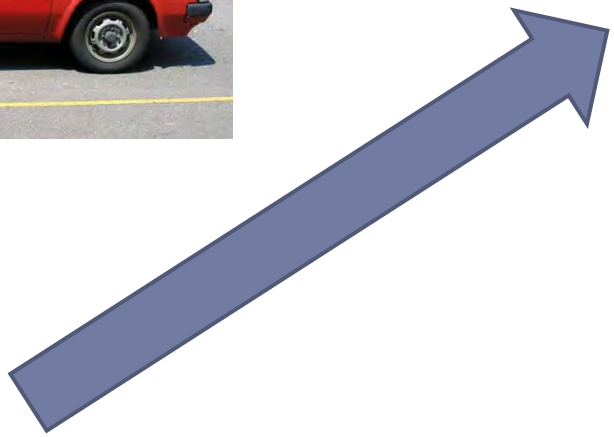
- Catalysts!



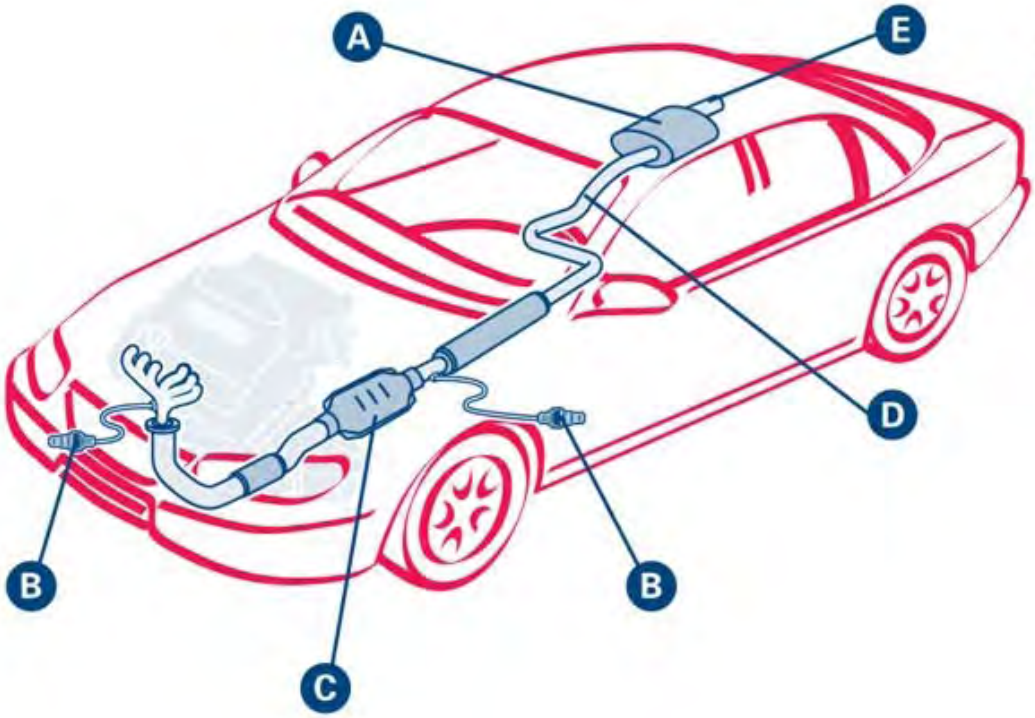


Catalytic Converter

- Where do we find them?



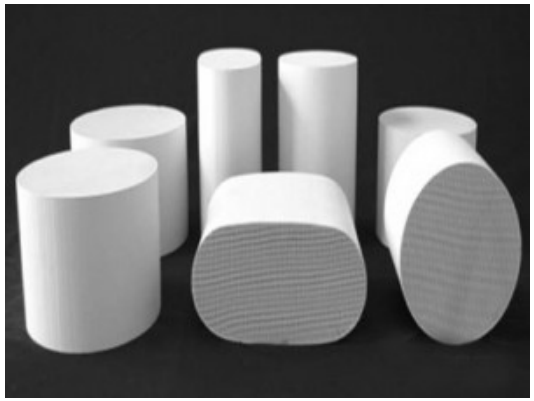
Catalytic Converter

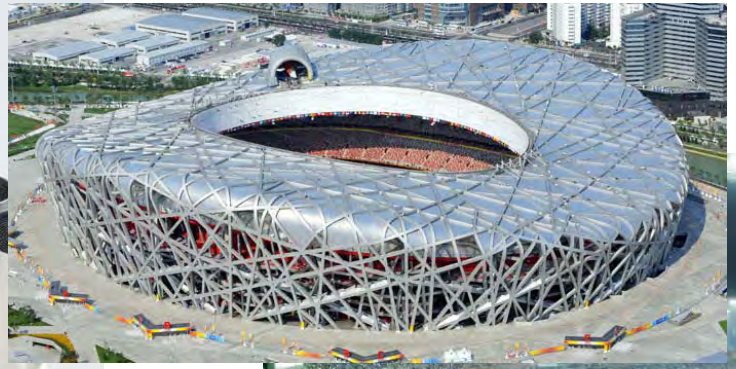


Your car's exhaust system consists of:

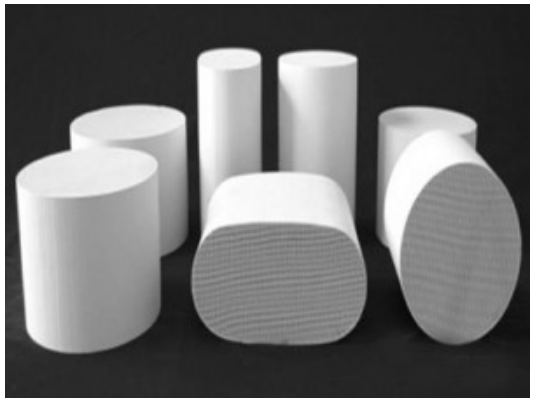
A. One or more mufflers
B. One or more oxygen (O2) sensors
C. One or more catalytic converters
D. Exhaust pipe
E. Tail pipe

Catalytic Converter





Catalytic Converter

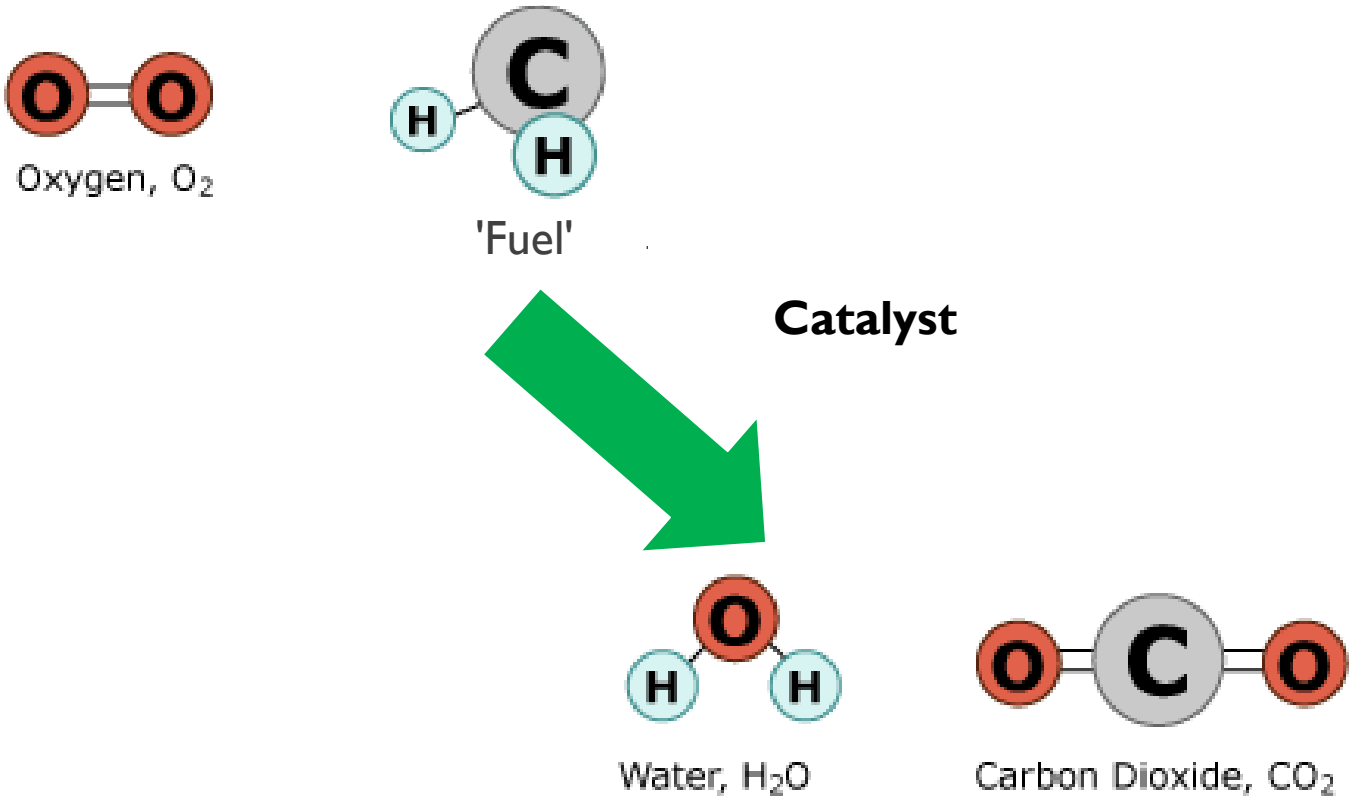


Precious Metals

How do Catalytic Converters work?

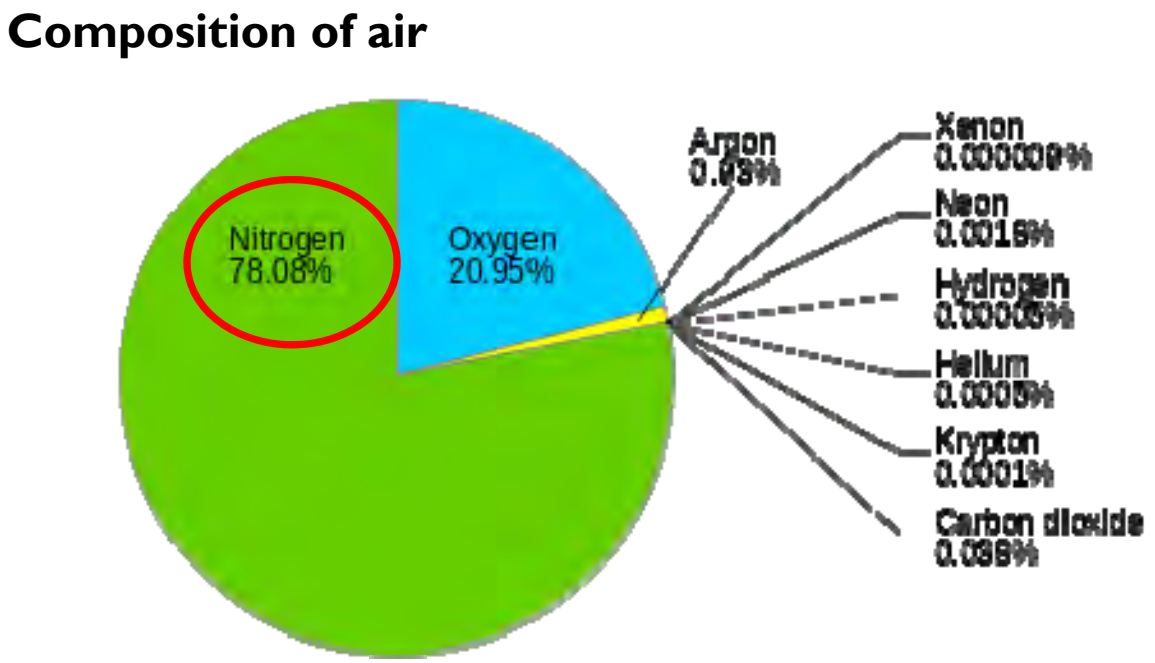
- Volunteers!

Lets do some Chemistry

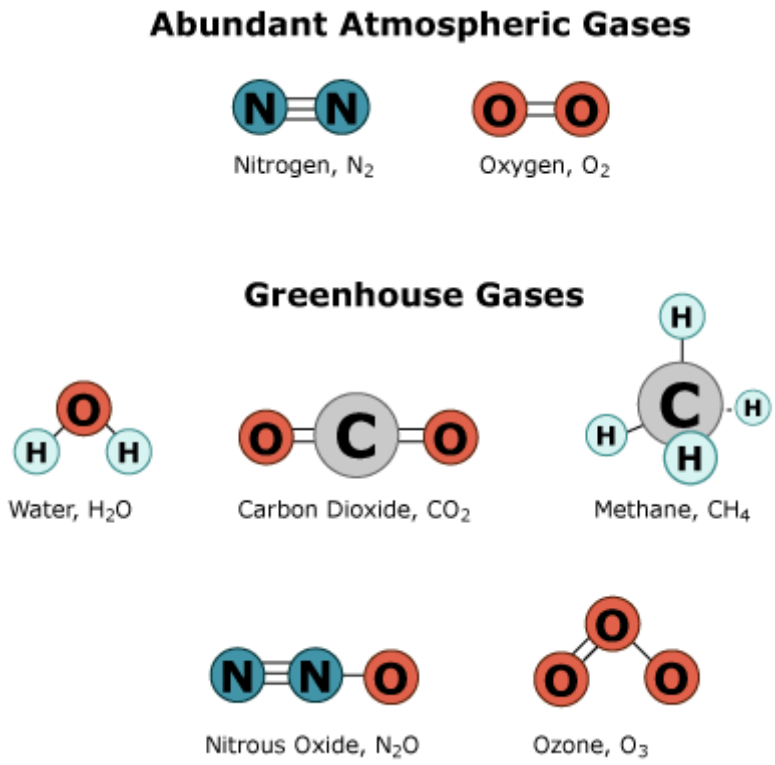


Not that simple…

- Example

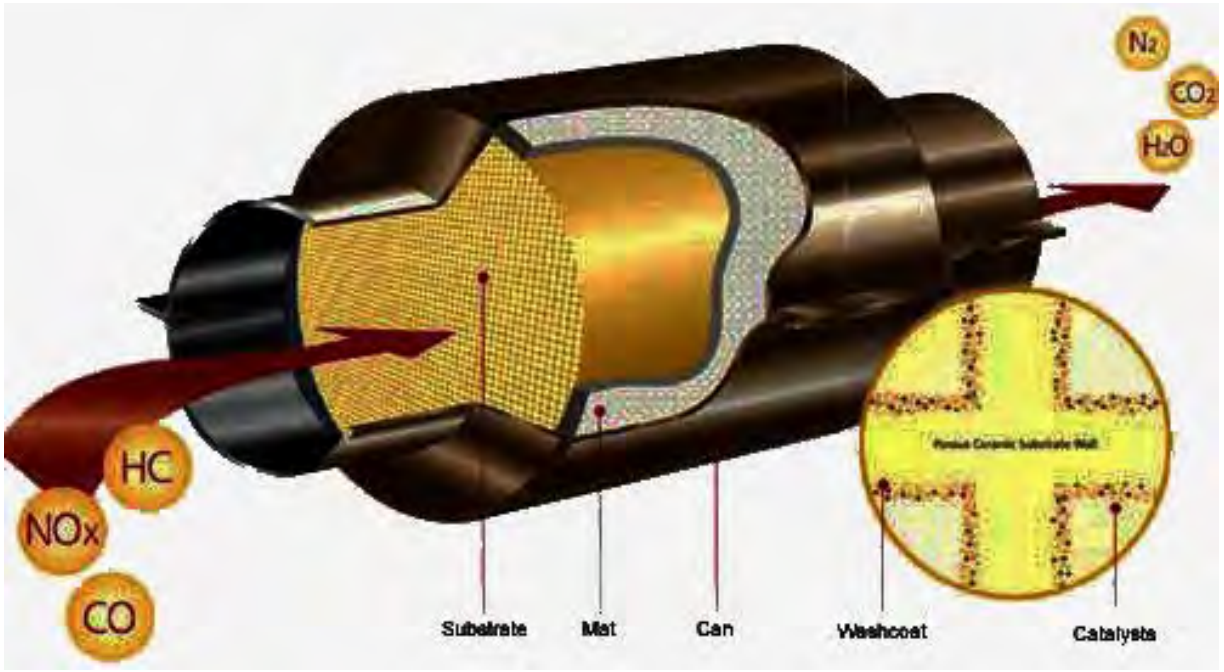


Many potential reactions



and more…

Catalyst in action

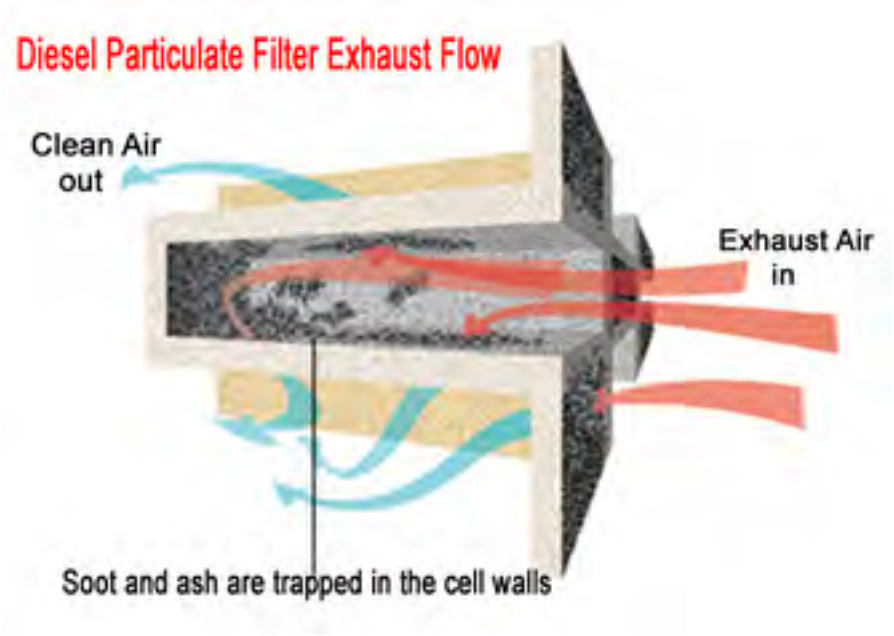


What about the soot?

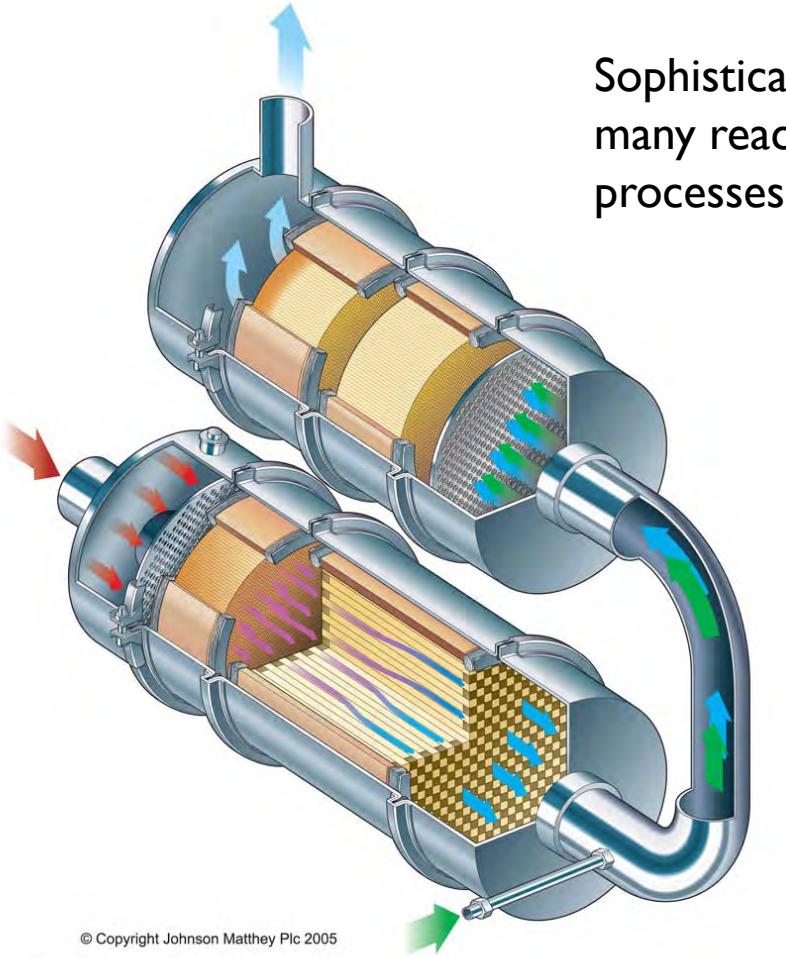
- Filtration

…more volunteers

Soot Filtration

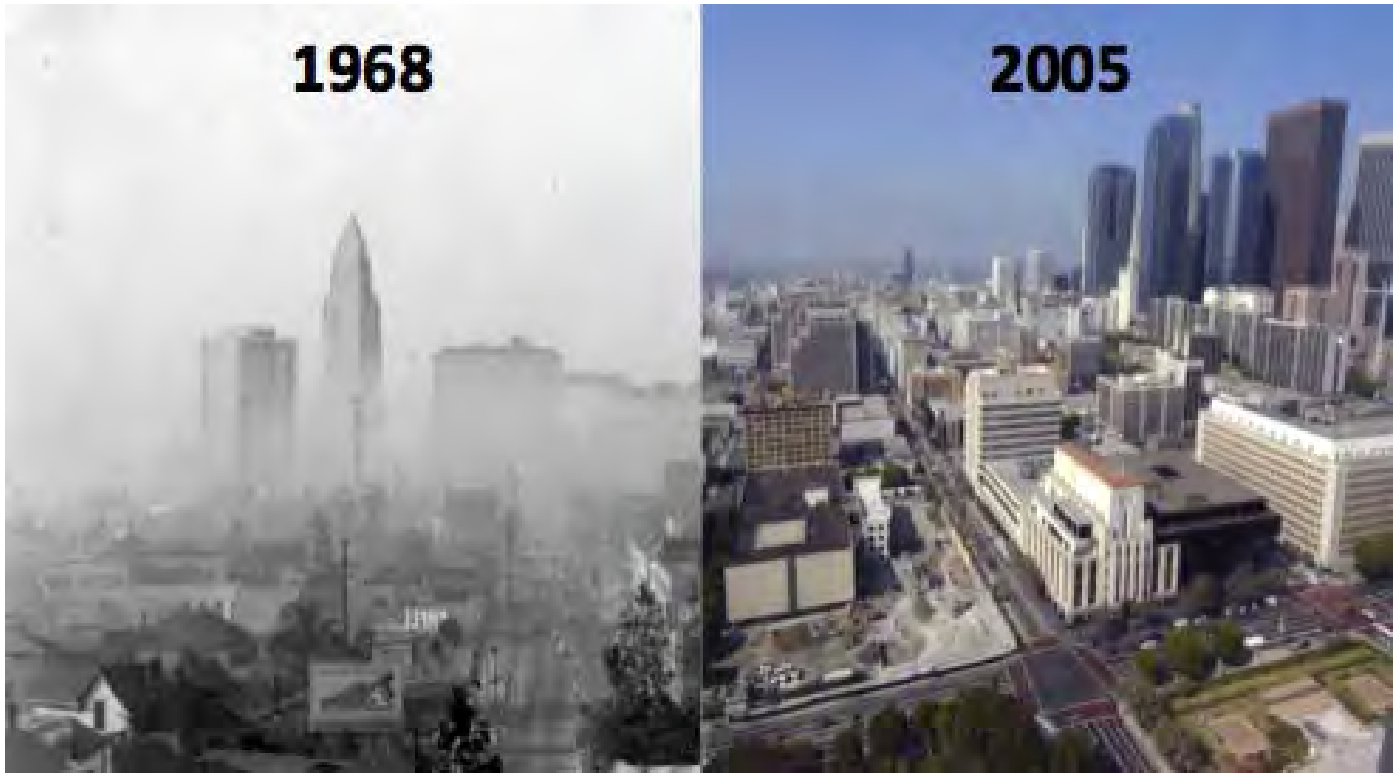


Multi-catalyst system

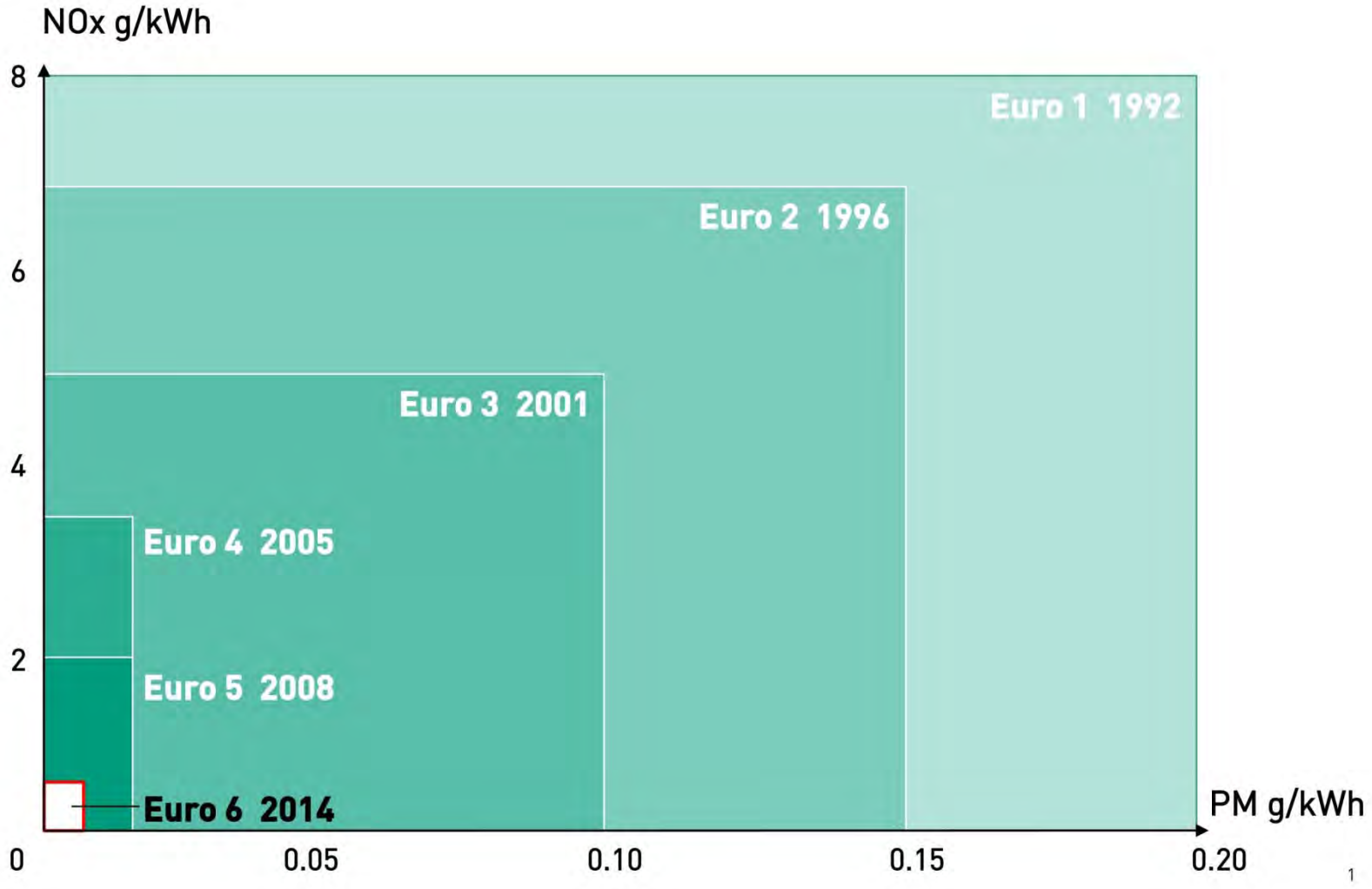


Sophisticated systems with many reactions and processes

Before and After



Setting the standard



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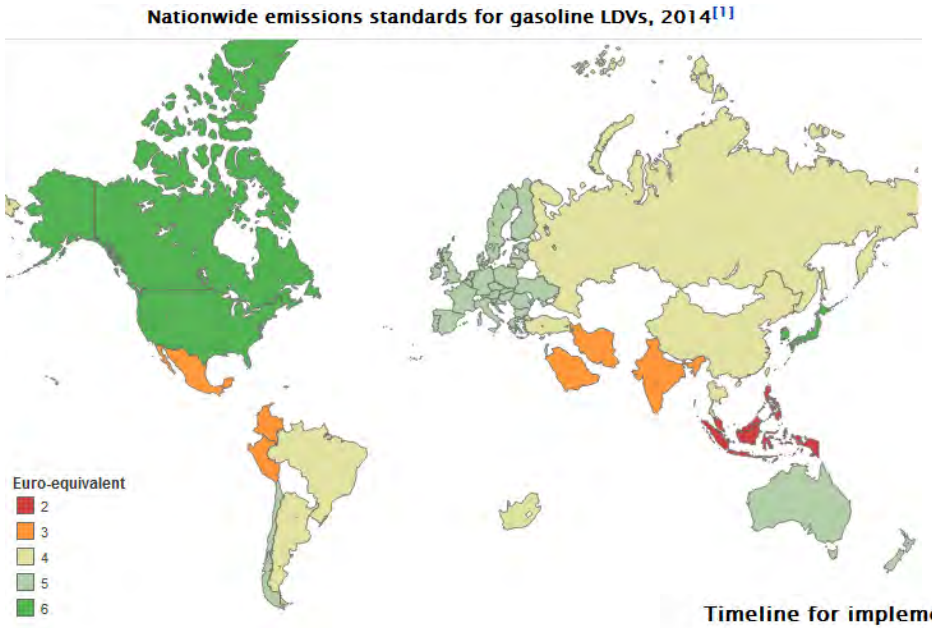
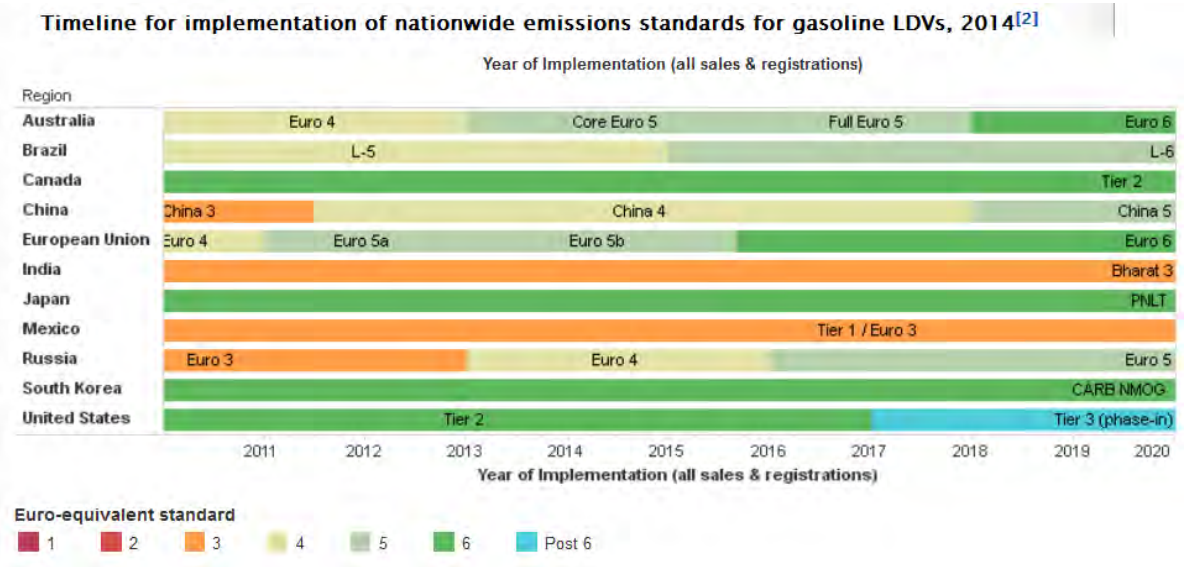
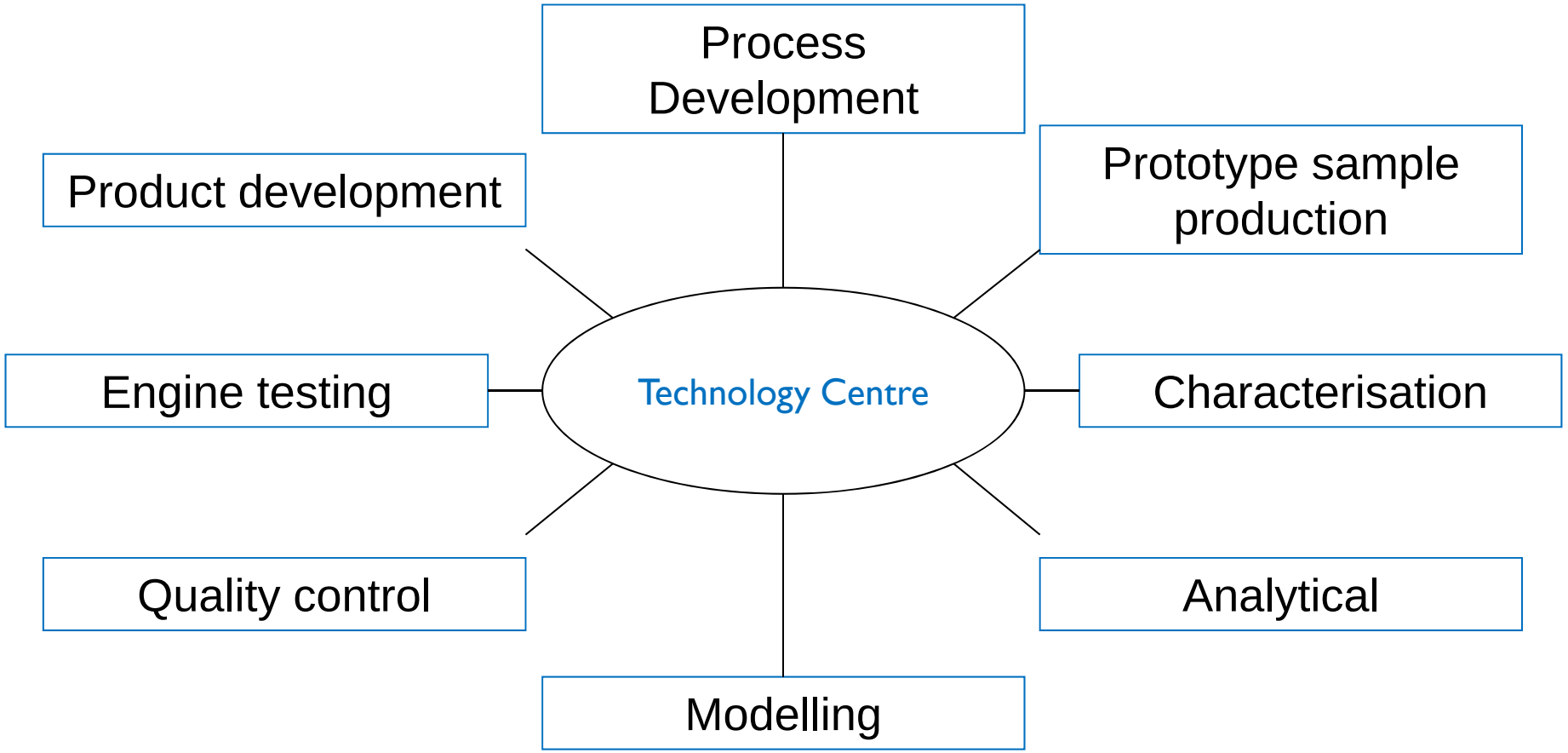




Back to Johnson Matthey…

Clean Air Sector UK Locations

Roles within technology centre



Relevant degree / PhD Skills

Knowledge of Chemistry

- Catalysis
- Surface Chemistry

Industrial Experience (MChem)

Project work

Time management

Teamwork

Leadership

Presentation skills

Computer Skills

- Data Analysis
- Excel

Further developing skills

Technical Knowledge

- Aftertreatment chemistry specifics
- Challenges of technology scale-up
- Engine technology

Commercial Awareness

Communication Skills

- Phone & web conferences
- Interaction with colleagues with a variety of backgrounds
- Chemical engineering, Mechanical engineering, Statistics, Commercial

Why I like my job

Applies my chemical knowledge

Commercial edge to the work

Wide range of customers and projects

Variety in day-to-day activities

Rewarding work

- ‘Making the world a better place’

Location

- Cambridge (20mins), London (45mins)

Why I like my job

Career Development Opportunities

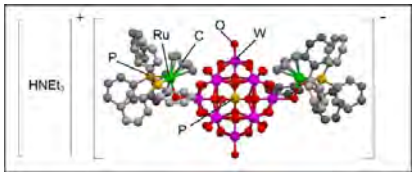
- Multiple groups looking at different technologies and markets
- Opportunities to progress into management
- Option to move from technical to commercial role

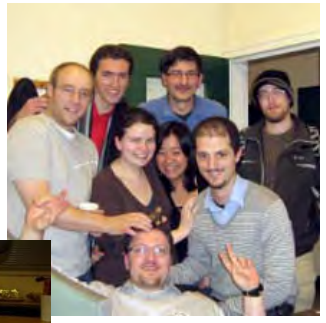
Opportunities to travel

- Macedonia – Skopje
- South Africa – Germiston
- Argentina – Pilar
- Mexico – Querétaro
- Russia – Krasnoyarsk
- Asia – Japan, China, Korea, India, Malayasia

Personal success foundation

- Happy
- Healthy
- Peace of Mind
- Prosperous
- Secure
- Friends
- Good family relationships





Sustainability
Johnson Matthey

Good Luck

Any Questions?

http://www.matthey.com/

What can we do?

1

Check your revs - change up before 2,500rpm (petrol) and 2,000rpm (diesel).

2

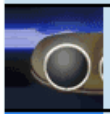
Anticipate road conditions and drive smoothly, avoiding sharp acceleration and heavy braking. This saves fuel and reduces accident rates.

3

Use air conditioning sparingly as it significantly increases fuel consumption.

4

The most efficient speed depends upon the car in question but is typically around 45 - 50mph. Faster speed will greatly increase your fuel consumption.



5

Drive away immediately when starting from cold - idling to heat the engine wastes fuel and causes rapid engine wear.

6

Accessories such as roof racks, bike carriers, and roof boxes significantly affect your car's aerodynamics and reduce fuel efficiency, so remember to remove them when not in use.

7

Avoid short journeys - a cold engine uses almost twice as much fuel and catalytic converters can take five miles to become effective.

8

Plan your journeys to avoid congestion, road works and getting lost.

9

Check your tyre pressure regularly - under-inflated tyres are dangerous and can increase fuel consumption by up to 3%.

10

If you're stuck in a jam, switch the engine off if you expect to be there for more than a minute or two. Cutting the engine will save fuel and reduce emissions.