



2018

**Biofuels from Landfill &
Waste Water Plant**

(17th October)



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Vision

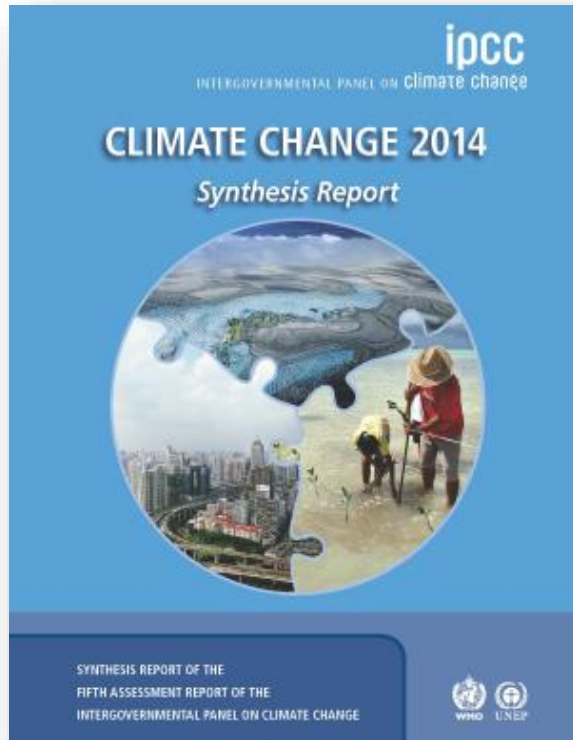
In line with Scania Global sustainable vision of being a leader in the shift towards a sustainable transport system; our vision is to create, educate and build the foundation of the sustainability strategy within Scania SA, which augments the existing product offering with alternative fuels, that positions Scania as the environmental leader in Southern Africa.

Our Vision is to assist, guide and influence, customers, local, regional and national government, statutory bodies, NGO around the importance of environmental stewardship, for the mutual benefit of society.

Our vision is to successfully facilitate the establishment of long term suppliers base for our customers, that comply with European fuel quality standards, that have shared objectives which are ambitious and achievable.

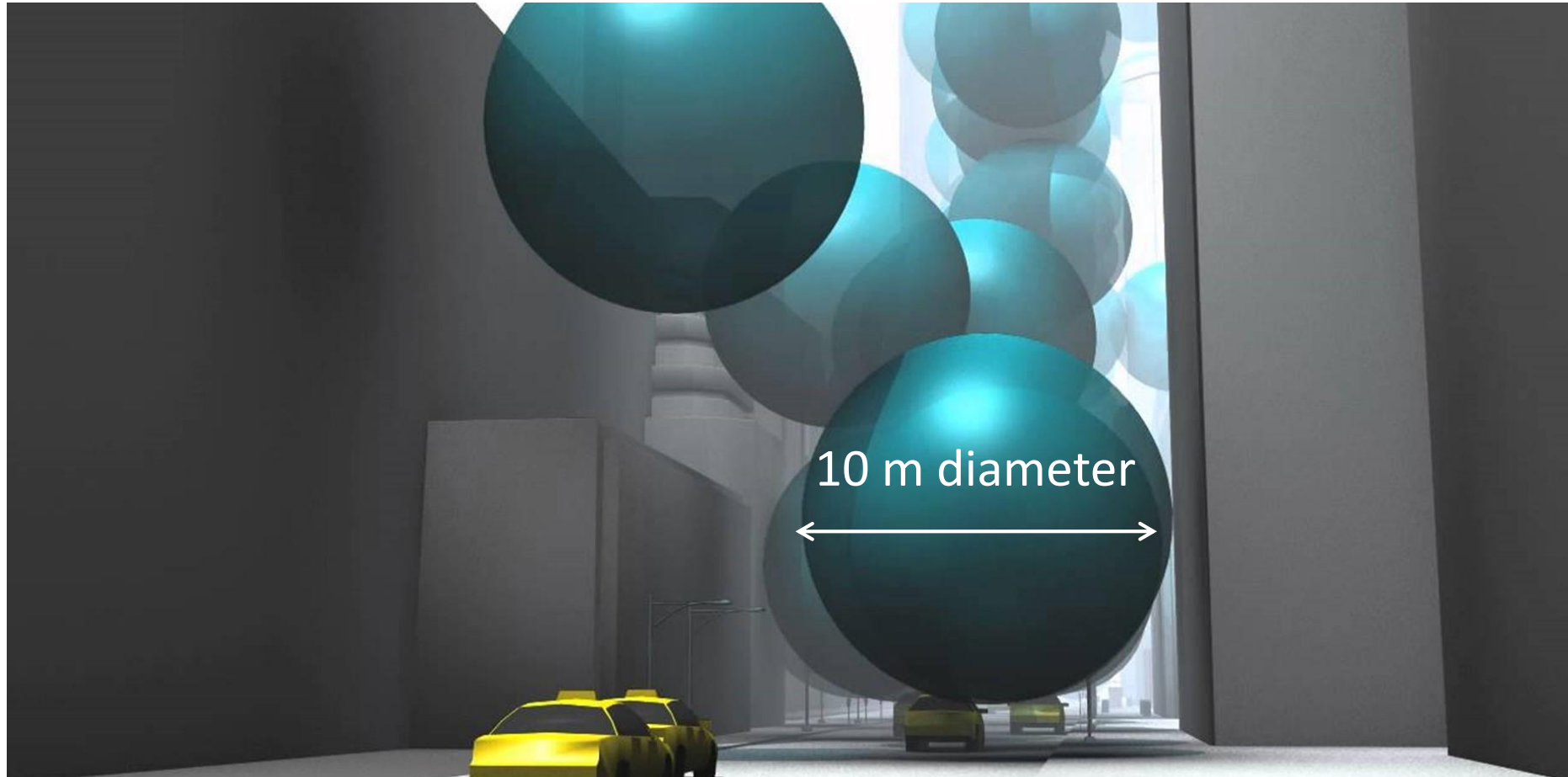


Global warming (*Paris Agreement and IPCC's hard facts*)

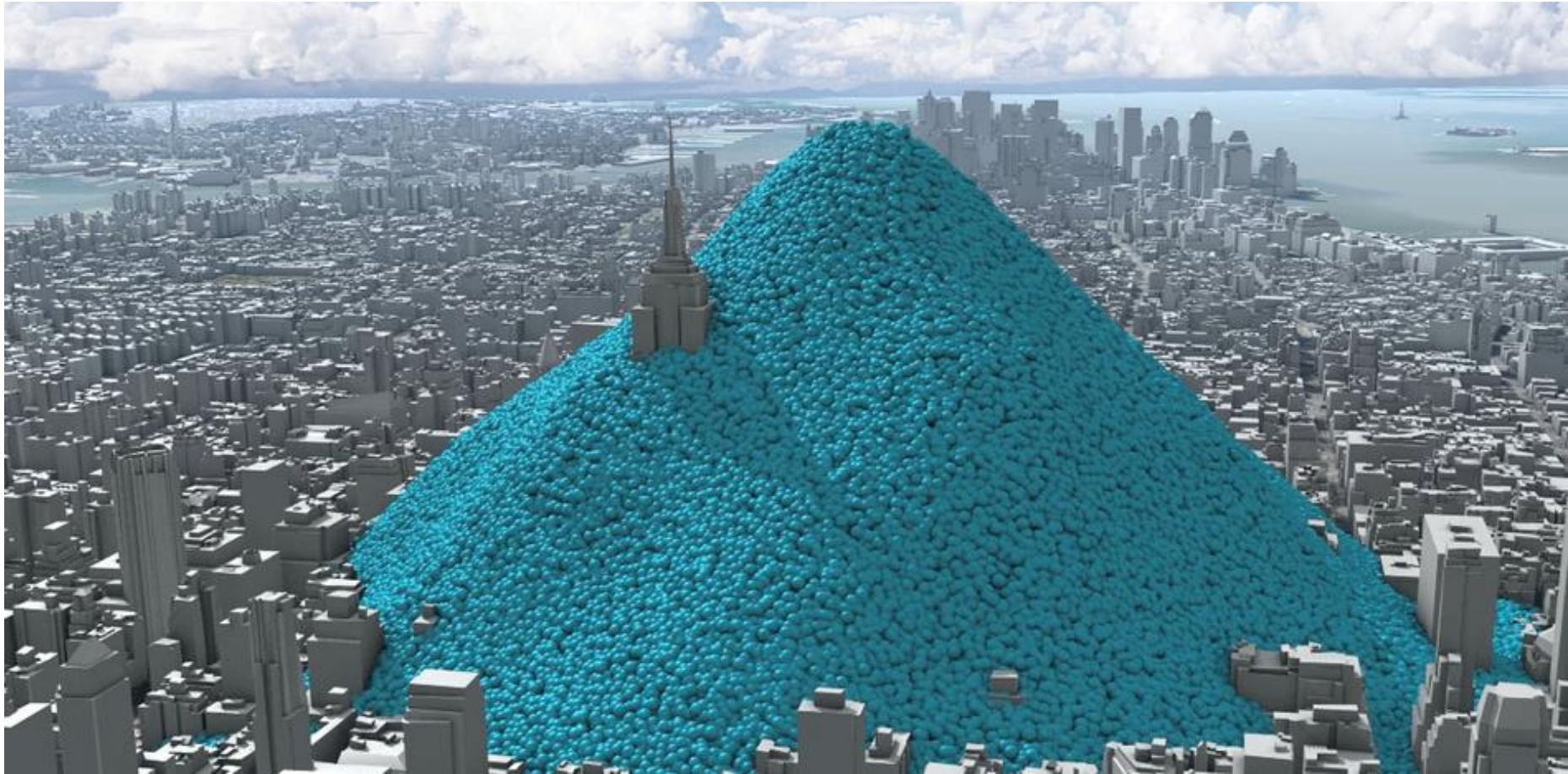


- 1,5 °C
- The window for action is rapidly closing.
- Any further investment in fossil energy infrastructure will cause devastating lock-in effects.
- 196 countries that have signed the accord.

What is one Metric ton of CO₂?



One day of CO₂ emissions within New York



Air quality

Alternative Fuels..

**..clean up the air
and save lives**

Heavy trucks and buses cause
over 50% of
particle emissions.

Leapfrog from poor diesel
qualities straight to
Euro 5 and Euro 6





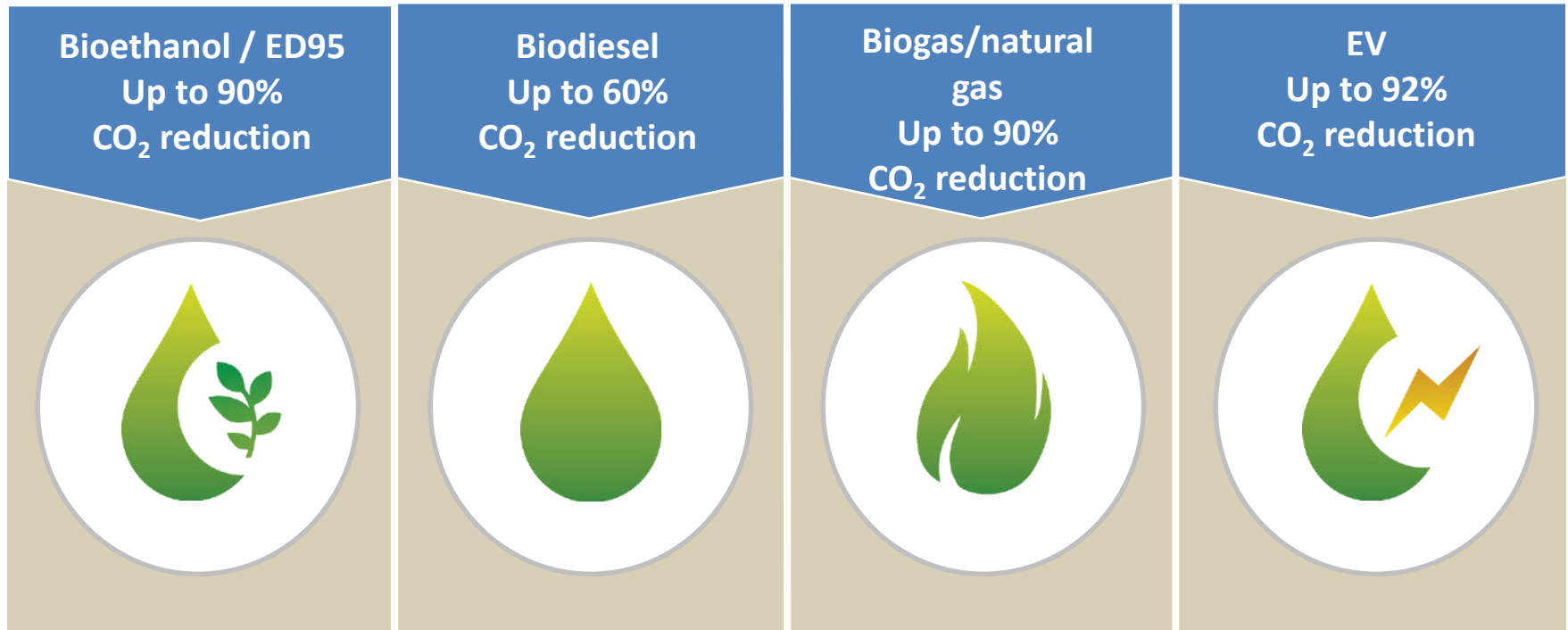
Did you know?



- Last 10 years produced more plastic than the previous 100 years.
- 50 percent of the plastic we use, is only used once.
- Enough plastic is thrown away each year to circle the earth four times..
- Only 5% of the plastics we produce is recovered.
- Plastic accounts for 10% of the total waste we generate.
- Plastic production accounts for 8% the world's oil production.
- It takes 1-1,000 years for plastic to degrade.
- The Floating mass of plastic in the Pacific is the size of South Africa.
- Virtually every piece of plastic that was ever made still exists.
- Plastic chemicals are absorbed into the body.



International CO₂ Reduction Table



- 90 % of World's biofuel
- Local and global fuel
- Many feedstocks
- Sustainable volume production
- 3rd party verification
- Average CO₂ reduction 90 % (EU)

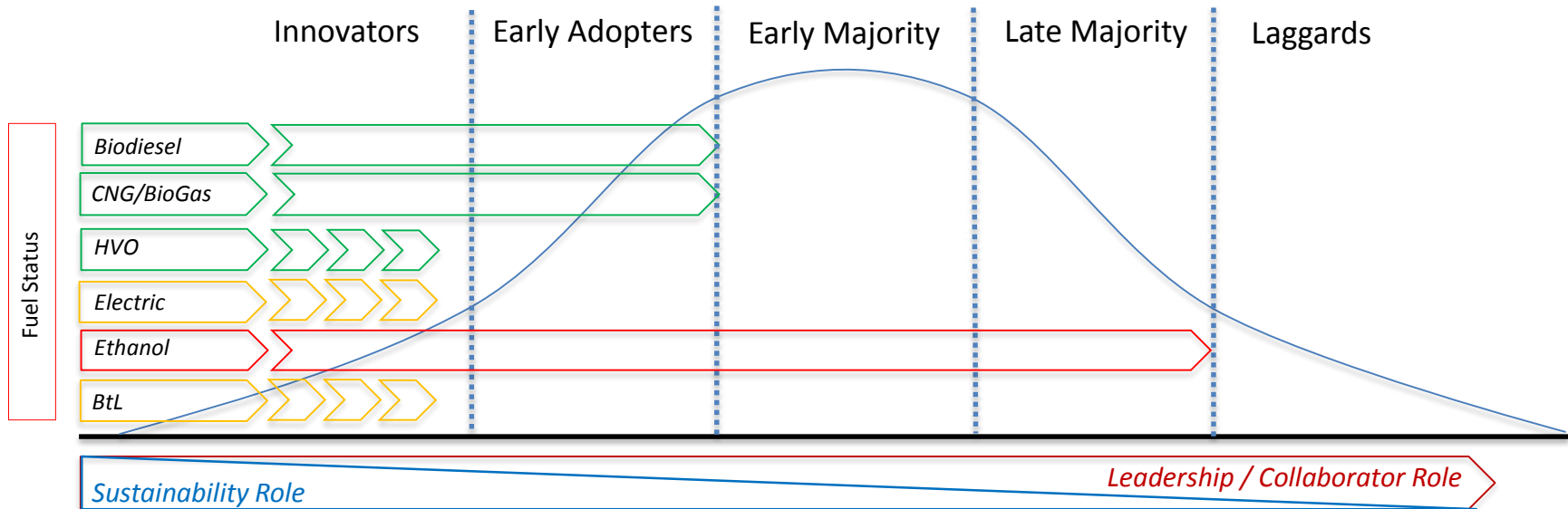
- Many feedstocks
- Similar to diesel
- Fuel quality important
- Not for infrequent use
- Average CO₂ reduction 60 % (EU)

- Local waste to fuel
- Good for local fleets
- Can be combined with CNG
- Expensive infrastructure
- Average CO₂ reduction
Bio-Gas 90 % (EU)
CNG 30 % (EU)

- Limited vehicle range
- Evolving battery tech.
- Hybrid included
- Expensive infrastructure
- Average CO₂ reduction
Solar 92 % (EU)
Electricity 30 % (EU)

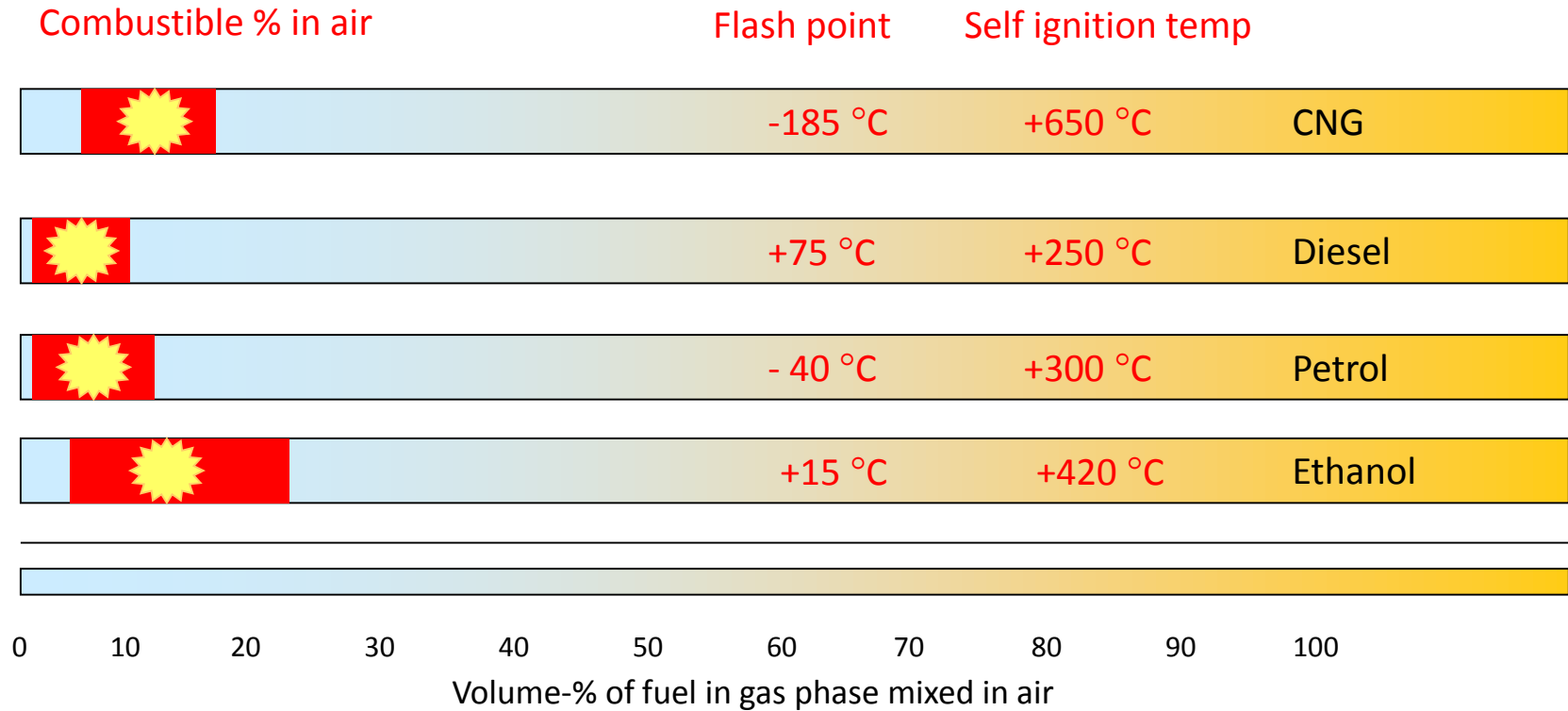


Sustainability Technology Implementation Cycle

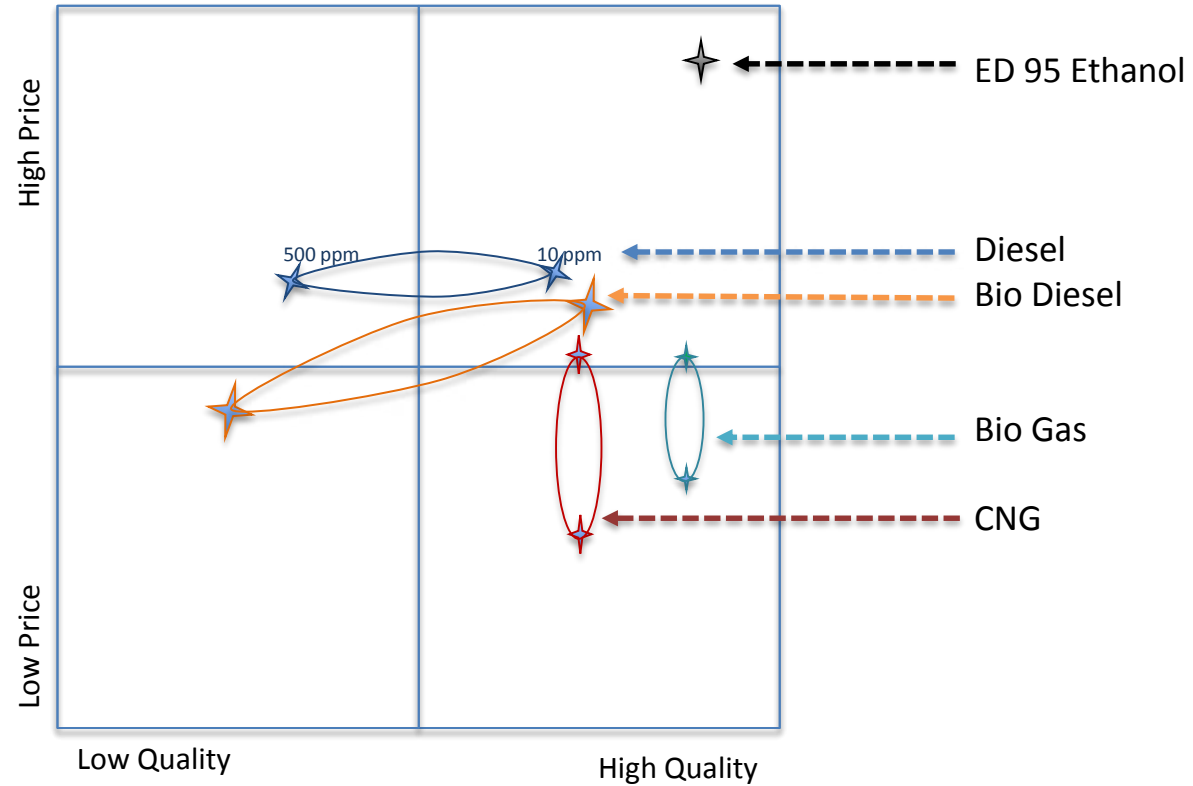




Flammability of Different Fuels



Fuels Positioning Matrix





Selected BioFuels Energy Content Comparison - Cost

| | EV | CNG/CBG LNG/LBG | BioDiesel HVO/BtL | Diesel 500/50/10 | Ethanol |
|------------------|----------------|--------------------|----------------------|---------------------|-------------------|
| Units / 100km | 15 kWh | 40 Litres | 41 Litres | 38 Litres | 64 Litres |
| Price / Unit | R 1.50/ kWh | R 8.00/ Litres | R 12.50/ Litres | 15.50/ Litre | R 13.50/ Litre |
| Cost / 100km | R 195.00 | R 320.00 | R 512.50 | R 589.00 | R 864.00 |

Vehicle – Inner city distribution

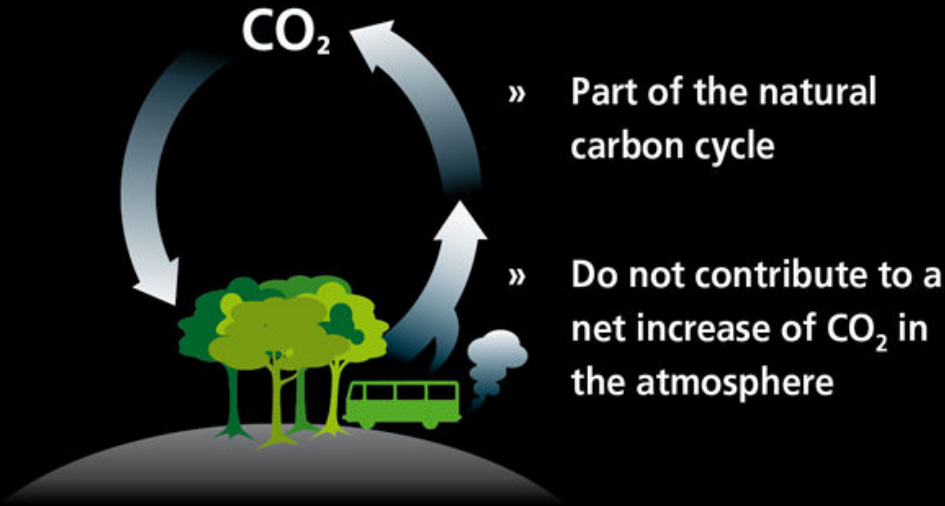
Biofuels to Natural gasses



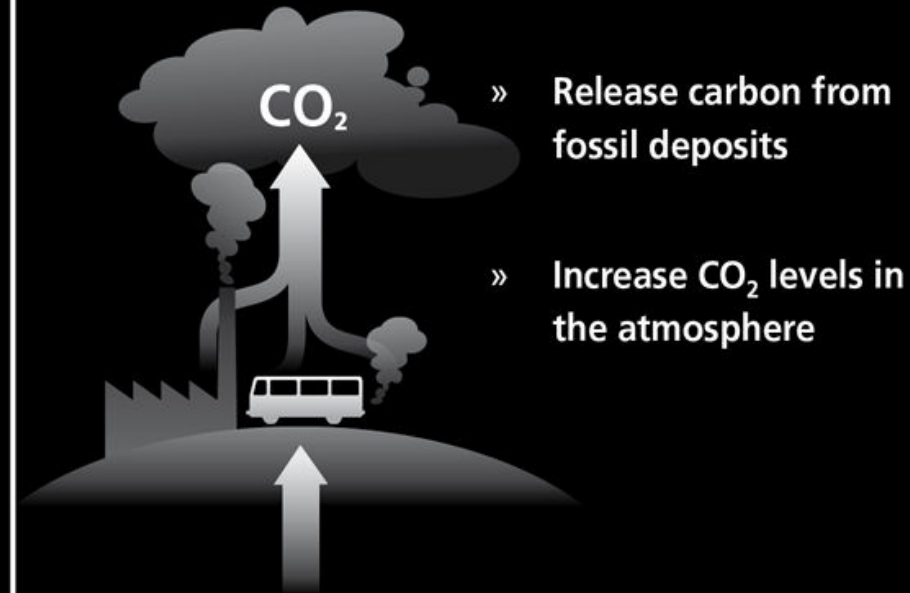
Biofuels

Natural gas

RENEWABLE FUELS



FOSSIL FUELS

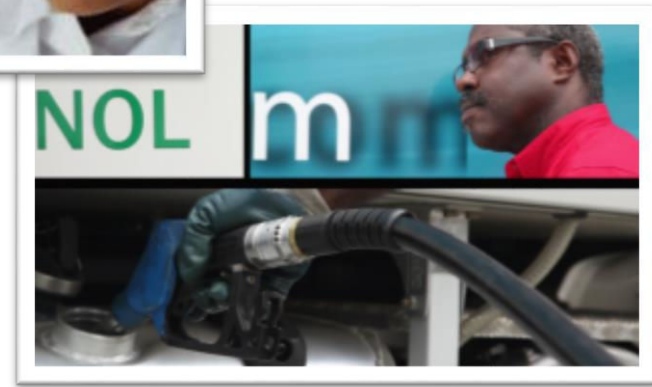
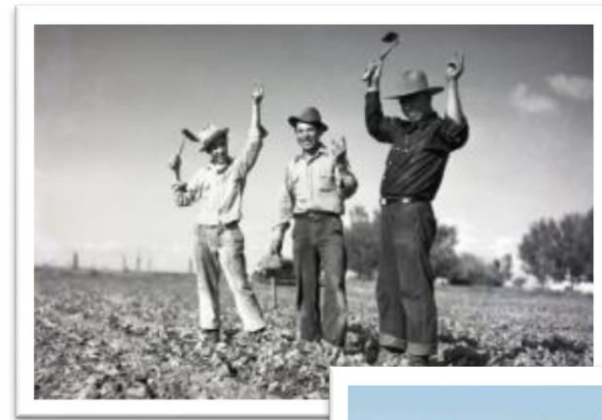


Job creation

Biofuel production
create up to...

...a 100 times
more jobs

per unit of energy
produced, than the
traditional oil industry!

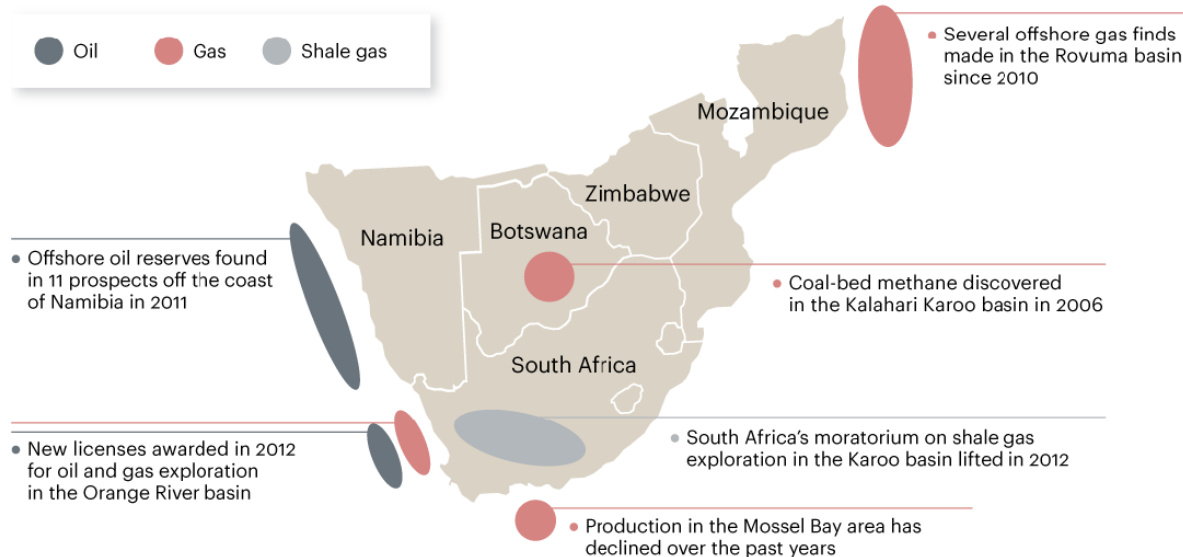




Major Gas Reserves Africa

Figure 1

Recent developments in Southern African oil and gas



Source: A.T. Kearney analysis

Major Gas Reserves in (tcf)

- Mozambique – 195
- Botswana – Unknown (*Coal based*)
- Karoo Basin – 200 (*Shale Gas*)
- Mossel Bay – (*only 2 years left*)
- Orange River Basin – Unknown

Crude oil

- Orange River Basin – Unknown
- Namibia Coast – 11 Billion Barrels

Alternative Fuel Solutions



Alternative Fueling Solution

Bio Diesel

HVO

Natural Gas/Bio Gas

- CNG (*Compressed Natural Gas*)
- LNG (*Liquid Natural Gas*)

The Critical issues not mentioned are:

Finding the correct supply **partner** in regards to fuel and infrastructure

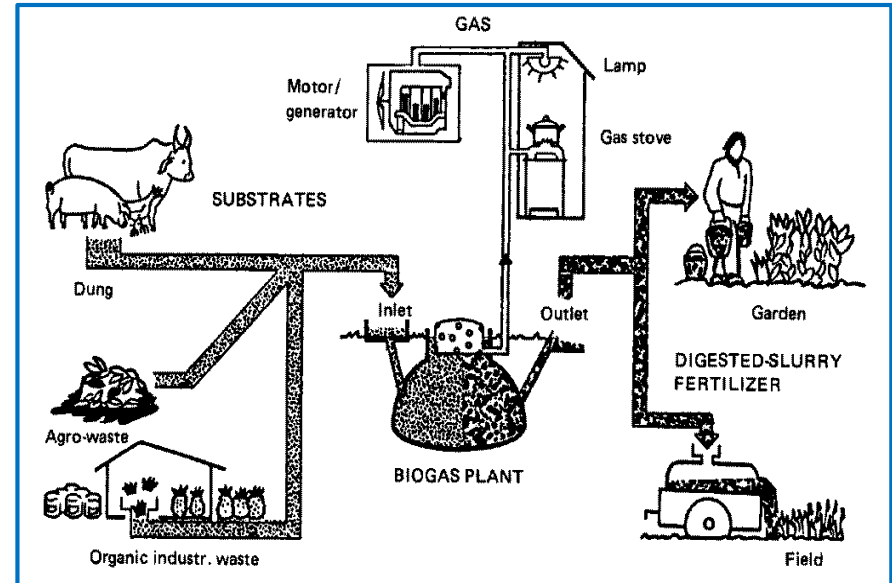
Medium to long term strategic intent

Guaranteed consistence and product quality

Local, regional and national distribution foot print.

CNG/CBG (methane) possible sources in SA

- 824 waste water treatment plant in SA (210 have bio-digester capabilities) (+/-9 generating methane for gensets)
- +/- 186 Land fill(tender business) (6 running gensets)

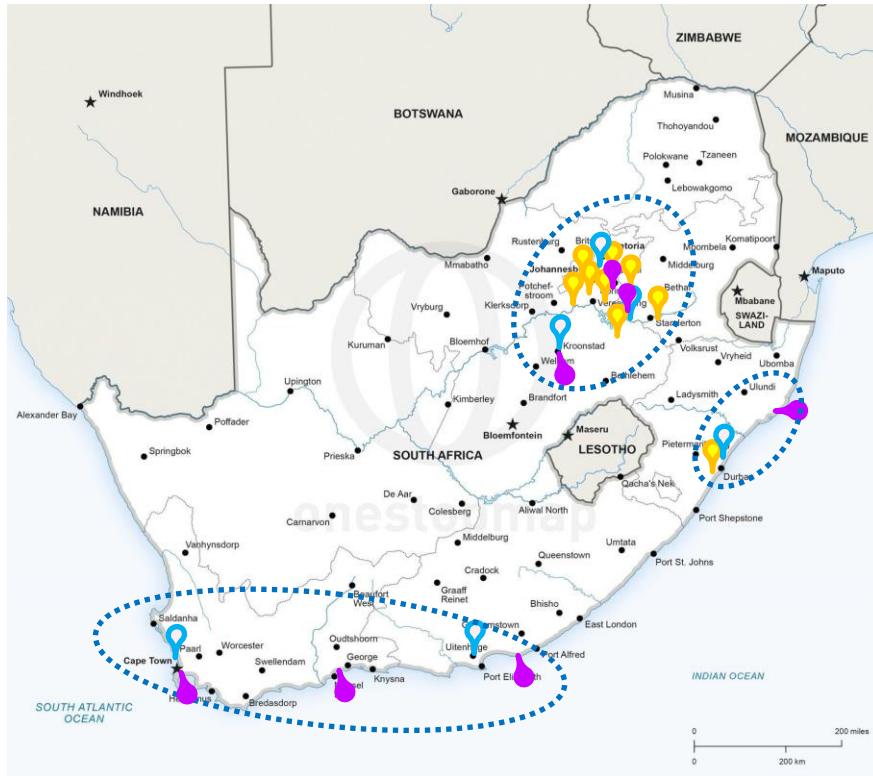


Problems

- Technical Skills not taught at colleges
- Plants seen as liabilities not assists
- Financial status of municipalities
(PPP agreements could work - 10 year window)



CNG/BioGas/LNG Supply Point National



CNG (<16)

- 4 main suppliers CNG.
- CNG/Nova Gas has 8 filling stations in Gauteng.
- Spring light Gas has 1 in Natal.
- Renergen supply CNG out of the Virginia gas fields.
- All 3 sell Sasol CNG has with a methane content of 92%
- All 3 plan to increase footprint by 2 new site a year.
- All 3 have the capability of supplying virtual station.
- The capital invested per company < R 250 million



BioGas

- 8 large scale biodigestors in SA.
- Barriers to enter are high.
- The methane content is between 92 to 97%
- Sign MOU with suitable long term suppliers.



LNG

- The coastal site have been identified.
- Environmental Impact Study still to be done.
- Timing of projects (2020)
- Capex range < R 2 billion/site
- 5 new LNG points in SA

Sustainability for Southern Africa





Scania Euro 6 engines

| Volume | Max power | Max torque | Fuel | | Technology |
|------------------|---------------|----------------|------------|---------------|------------------------|
| 7 litres | 280 hp | 1100 Nm | Diesel | | EGR + SCR |
| 9 litres | 250 hp | 1250 Nm | Diesel | | EGR + SCR |
| 9 litres | 280 hp | 1400 Nm | Diesel | | EGR + SCR |
| 9 litres | 280 hp | 1200 Nm | Ethanol | ED95 | SCR |
| 9 litres | 280 hp | 1350 Nm | CNG | Biogas | Otto, 3-way cat |
| 9 litres | 340 hp | 1500 Nm | CNG | Biogas | Otto, 3-way cat |
| 9 litres | 320 hp | 1600 Nm | Diesel | Biodiesel | SCR |
| 9 litres | 360 hp | 1700 Nm | Diesel | Biodiesel | SCR |
| 13 litres | 410 hp | 2000 Nm | CNG | Biogas | Otto, 3-way cat |
| 13 litres | 410 hp | 2150 Nm | Diesel | | SCR |
| 13 litres | 450 hp | 2350 Nm | Diesel | Biodiesel | EGR + SCR |
| 13 litres | 490 hp | 2550 Nm | Diesel | Biodiesel | EGR + SCR |



Scania Euro 6 gas engines *(Current 9 litre)*

Otto engine with outstanding efficiency

| | |
|--------|-----------------------------|
| Gas | 40% thermal peak efficiency |
| Diesel | 43% thermal peak efficiency |

Scania modular system – Scania quality

Less than 40 parts differ from diesel engine
Excellent service and spare part availability

All city and regional purposes

280 hp (Bus, Truck, 1350 Nm)
320 hp (Bus, 1500 Nm)
340 hp (Truck, 1600 Nm)
Diesel torque levels

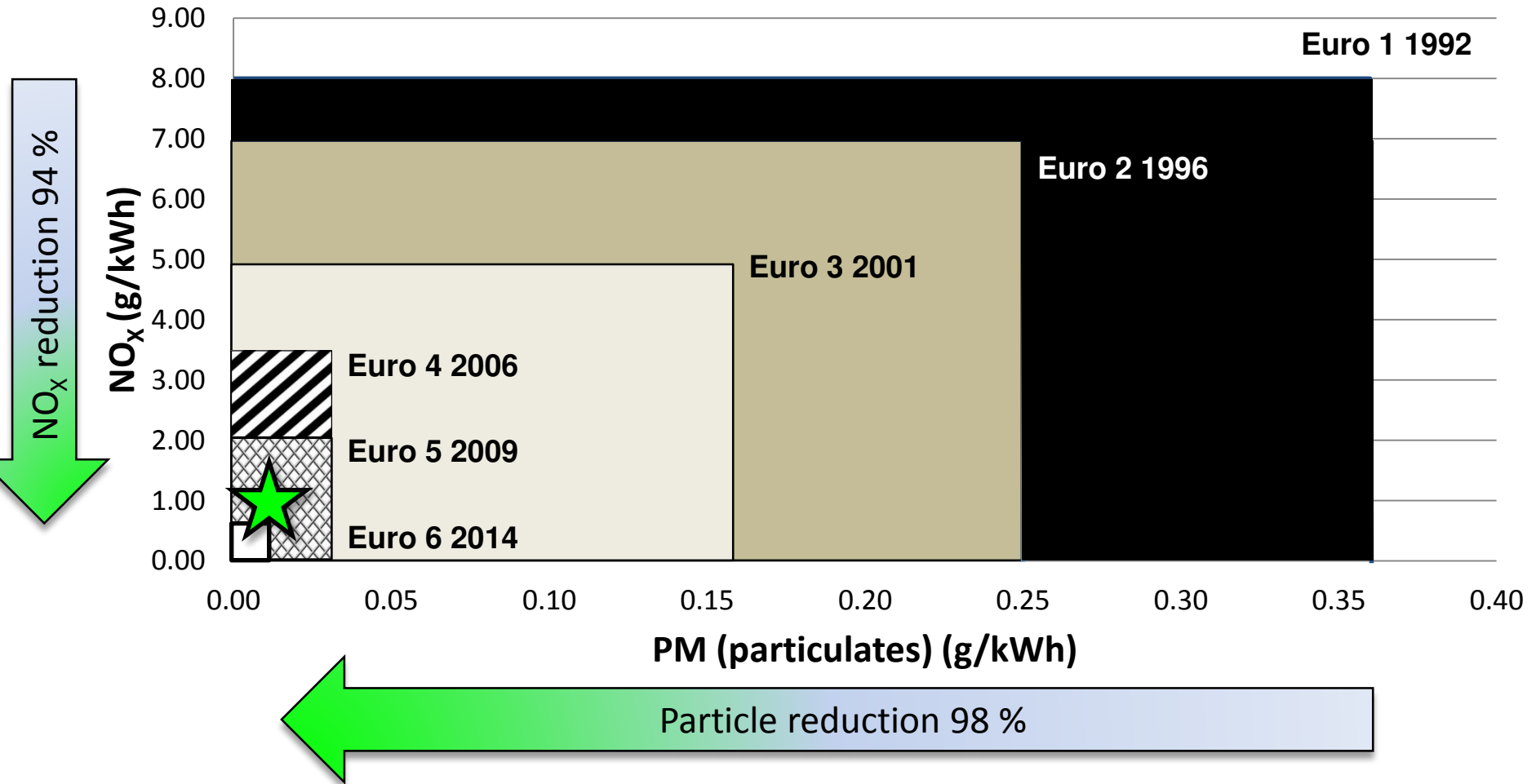
Other features

Less sensitive to gas quality
100% operability on 2 000 m+
Operates on both CNG and LNG
No complex after-treatment/SCR/AdBlue necessary
Only 3-way catalyst necessary to reach Euro 6
Up to 90% CO₂ cuts with biogas (~10-20% with CNG)



Local emissions

Go directly to Euro 6 with clean biofuels





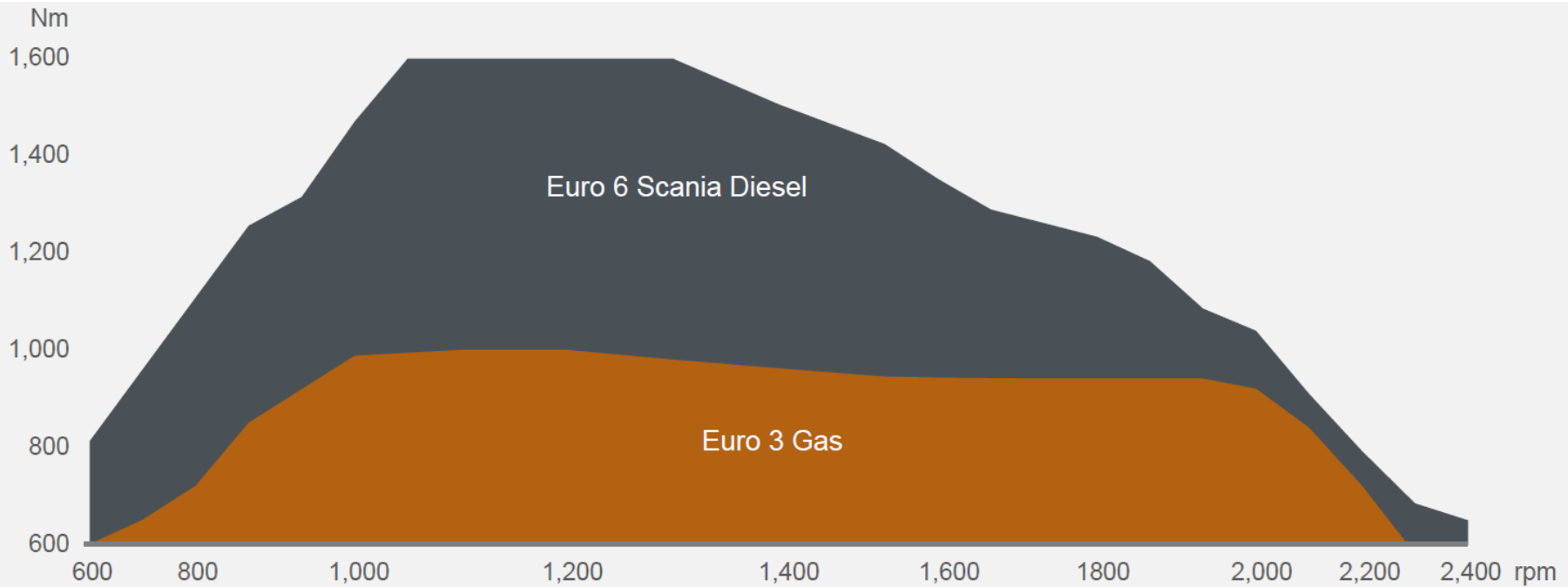
Euro Emissions Specification

| Level | Implementa- tion year | CO {g/kWh} | HC {g/kWh} | Nox {g/kWh} | PM {g/kWh} |
|--------|--------------------------|---------------|---------------|----------------|---------------|
| Euro 1 | 1992 | 4.5 | 1.1 | 8.0 | 0.36 |
| Euro 2 | 1996 | 4.0 | 1.1 | 7.0 | 0.25 |
| Euro 3 | 2001 | 2.1 | 0.66 | 5.0 | 0.1 |
| Euro 4 | 2006 | 1.5 | 0.46 | 3.5 | 0.02 |
| Euro 5 | 2009 | 1.5 | 0.46 | 2.0 | 0.02 |
| Euro 6 | 2014 | 1.5 | 0.13 | 0.4 | 0.01 |

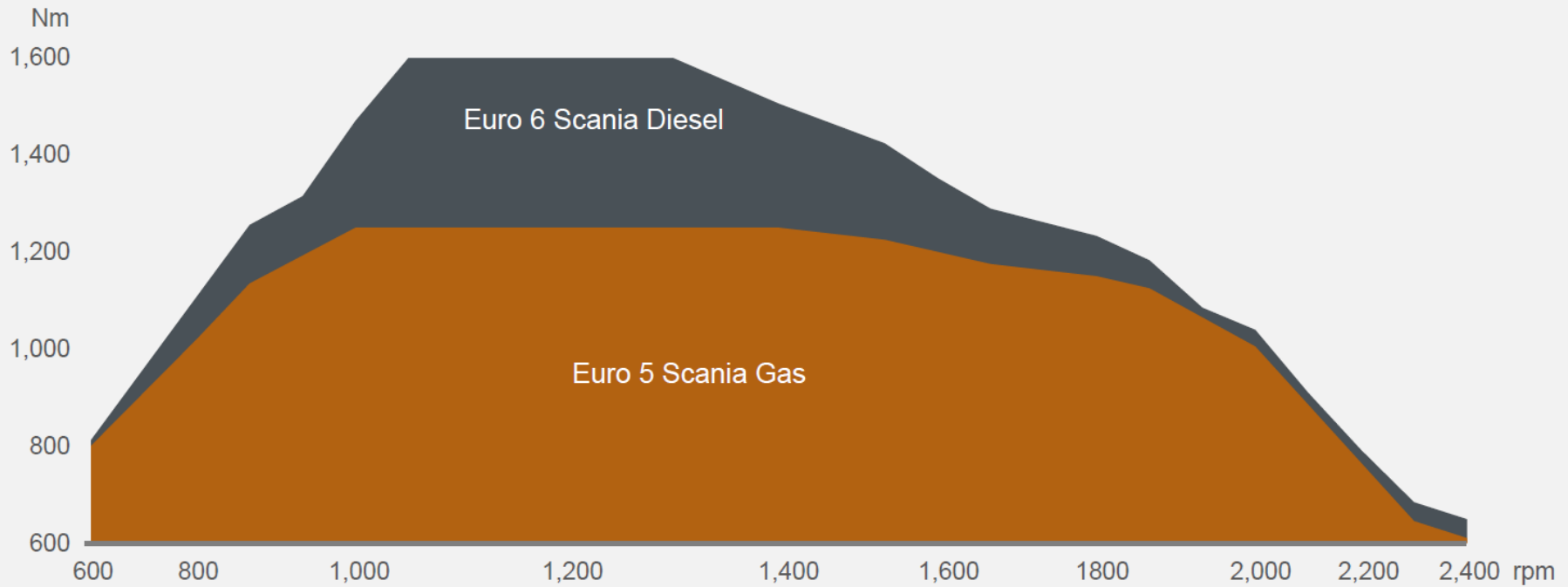
CO = Carbon Monoxide | NOx = Oxides of Nitrogen | HC = Hydrocarbons | PM = Particulate matter



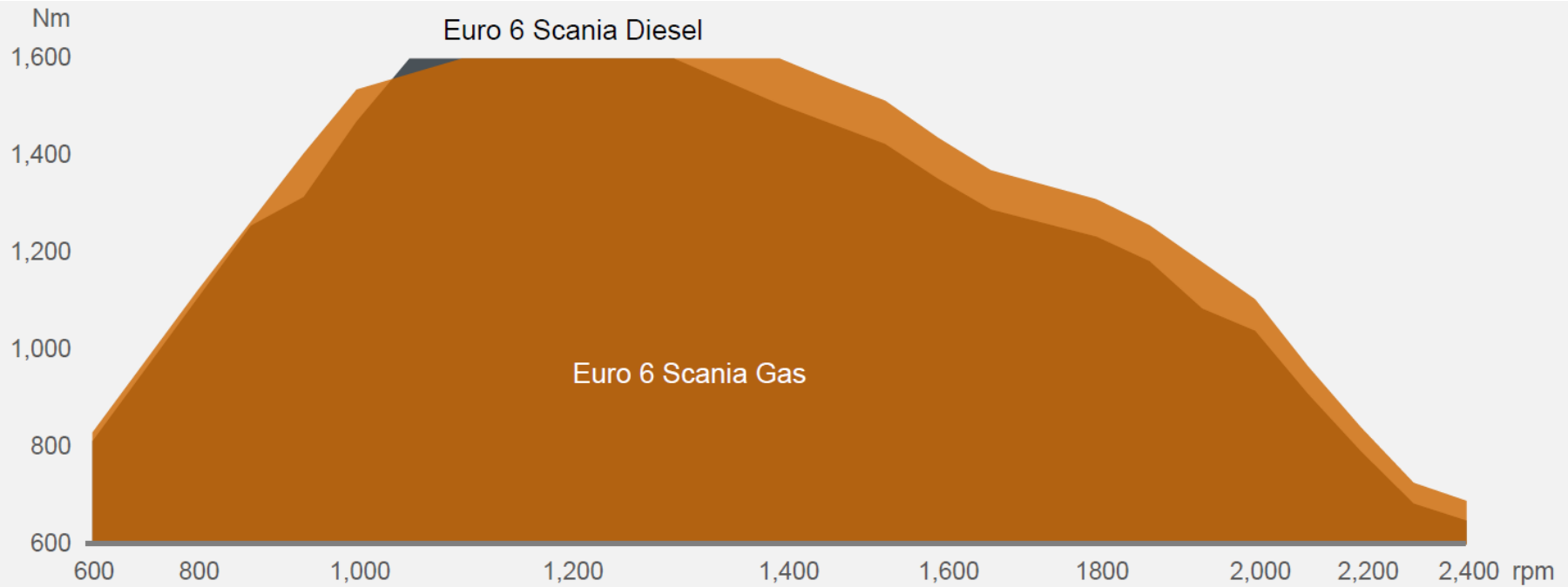
Paradigm shift – torque development



Paradigm shift – torque development



Paradigm shift – torque development



Certified for quiet deliveries

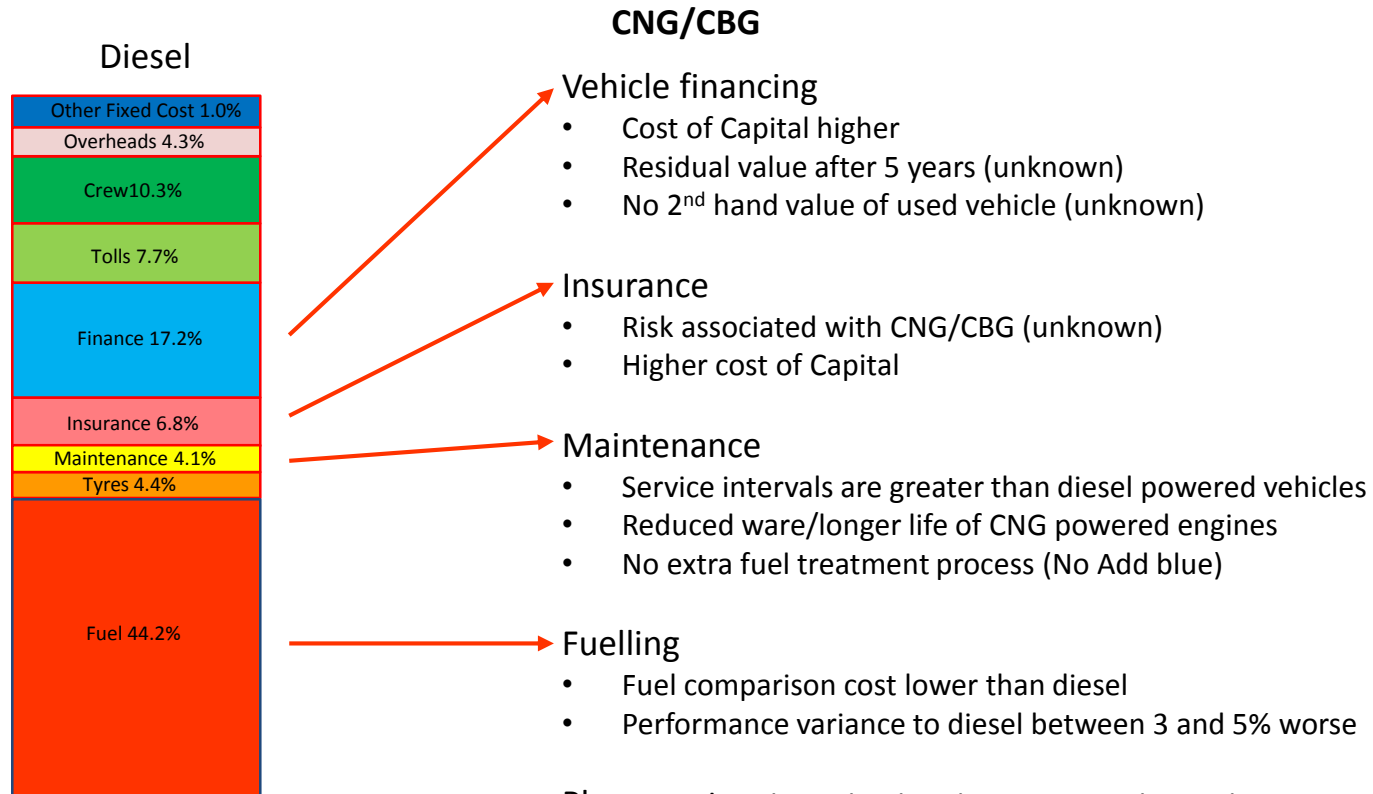


Scania's gas engines have been certified according to the Piek-Keur Quiet TRUCK standard.

The certification has been adopted by several European cities as a prerequisite for night time distribution.

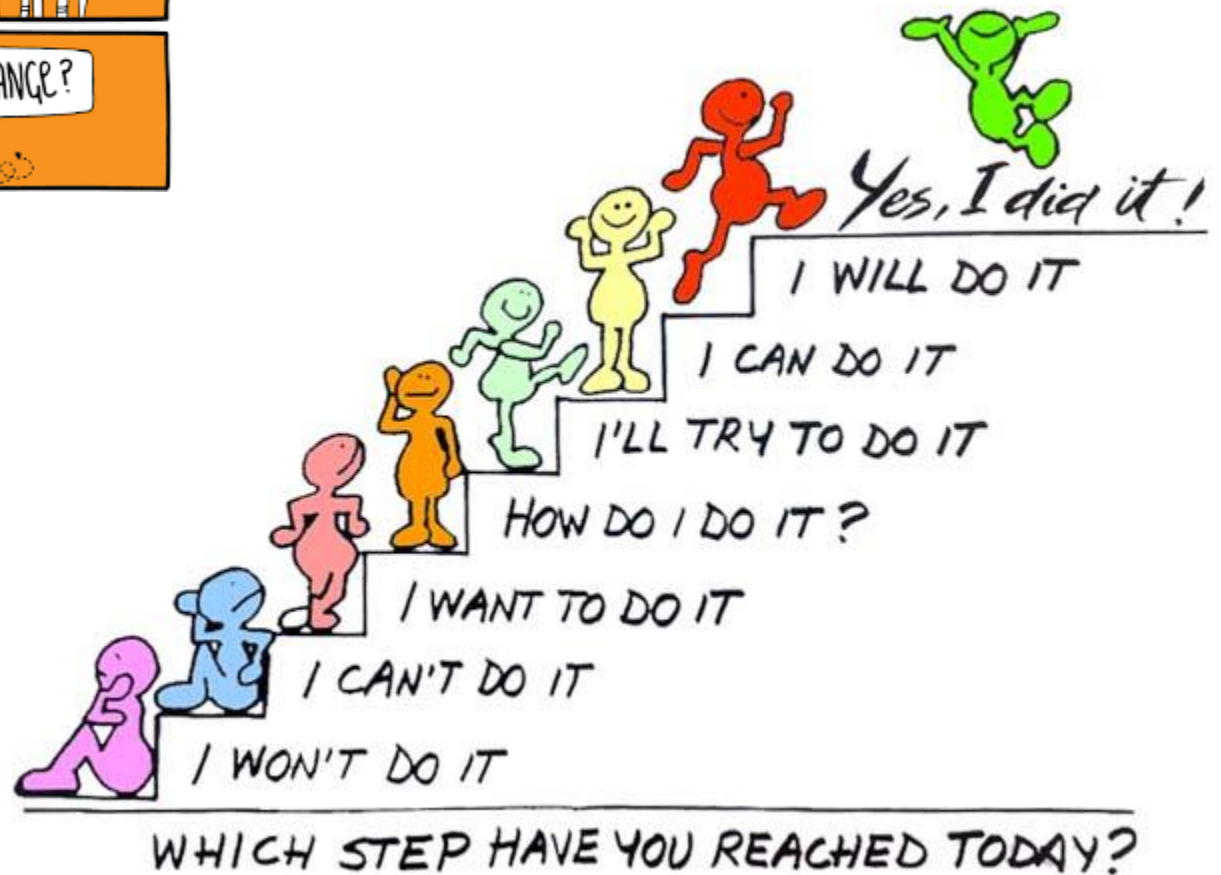


TCO - Diesel Long haul Truck Comparison - To Biofuels Solutions



Please note: *that other key drivers are unchanged*

Change management



CNG/BioGas Success



- Unitrans Passenger, in conjunction with Scania has become the first operator to embark on CNG-powered buses
- First 10 CNG/BioGas buses on the road
- The first 100% CNG distribution truck



Scania Sustainable Offerings – Examples



Questions & Thoughts?

