

# **LA FIN DU DIESEL ET DE L'ESSENCE À BRUXELLES EN 2030: UTOPIE ?**

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COMBUSTIBLES ET CARBURANTS (BRAFCO)



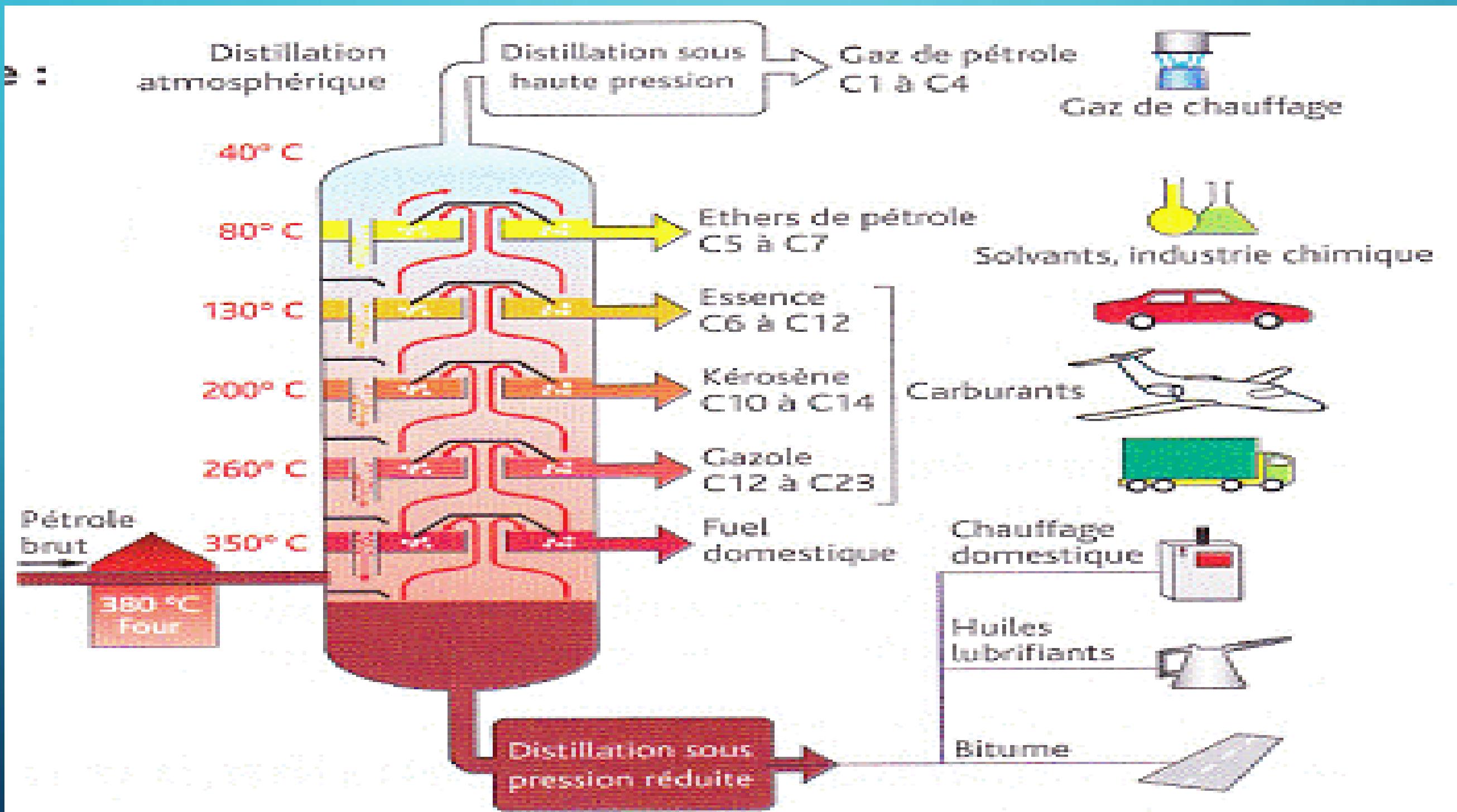
HIER



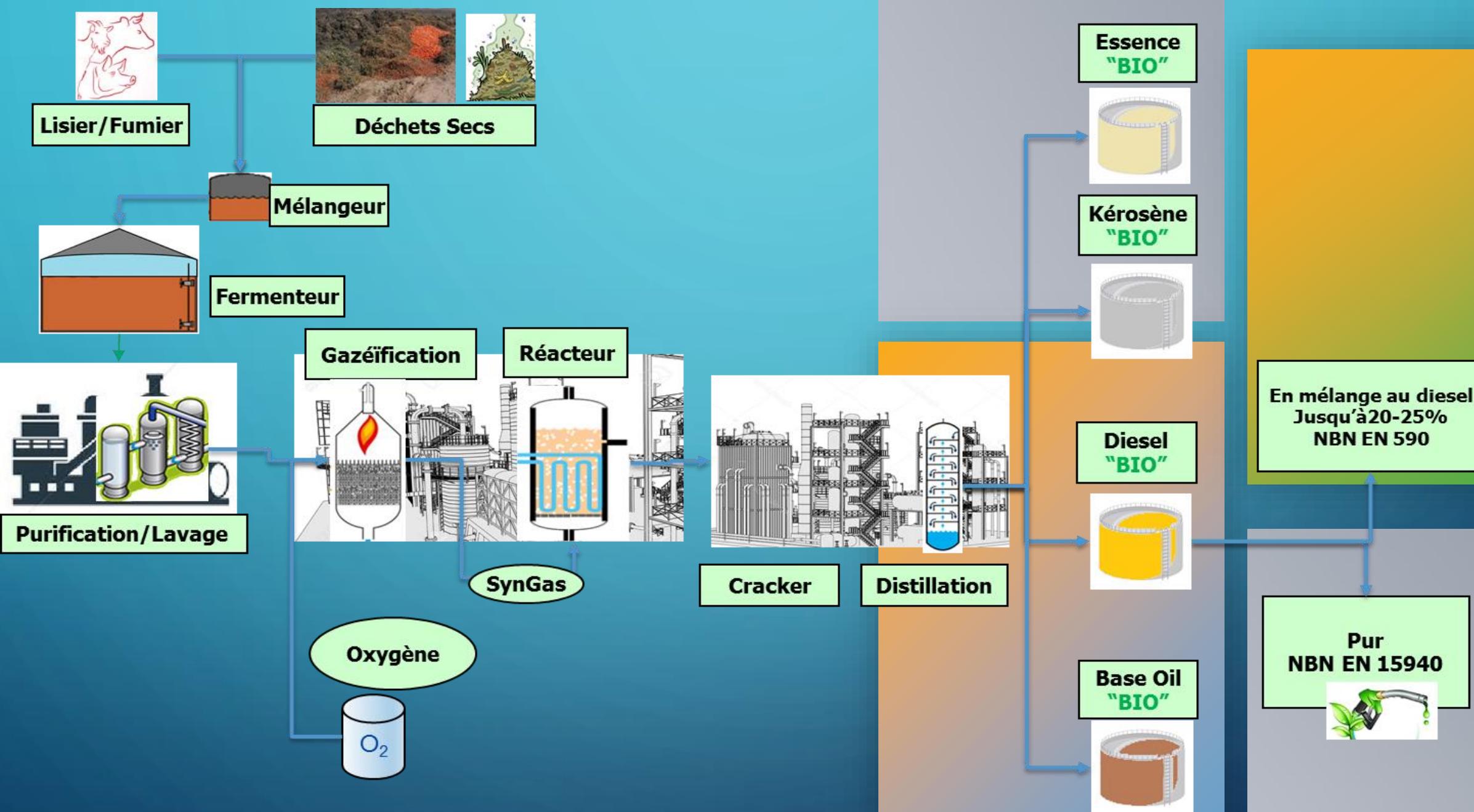
AUJOURD'HUI et  
DEMAIN



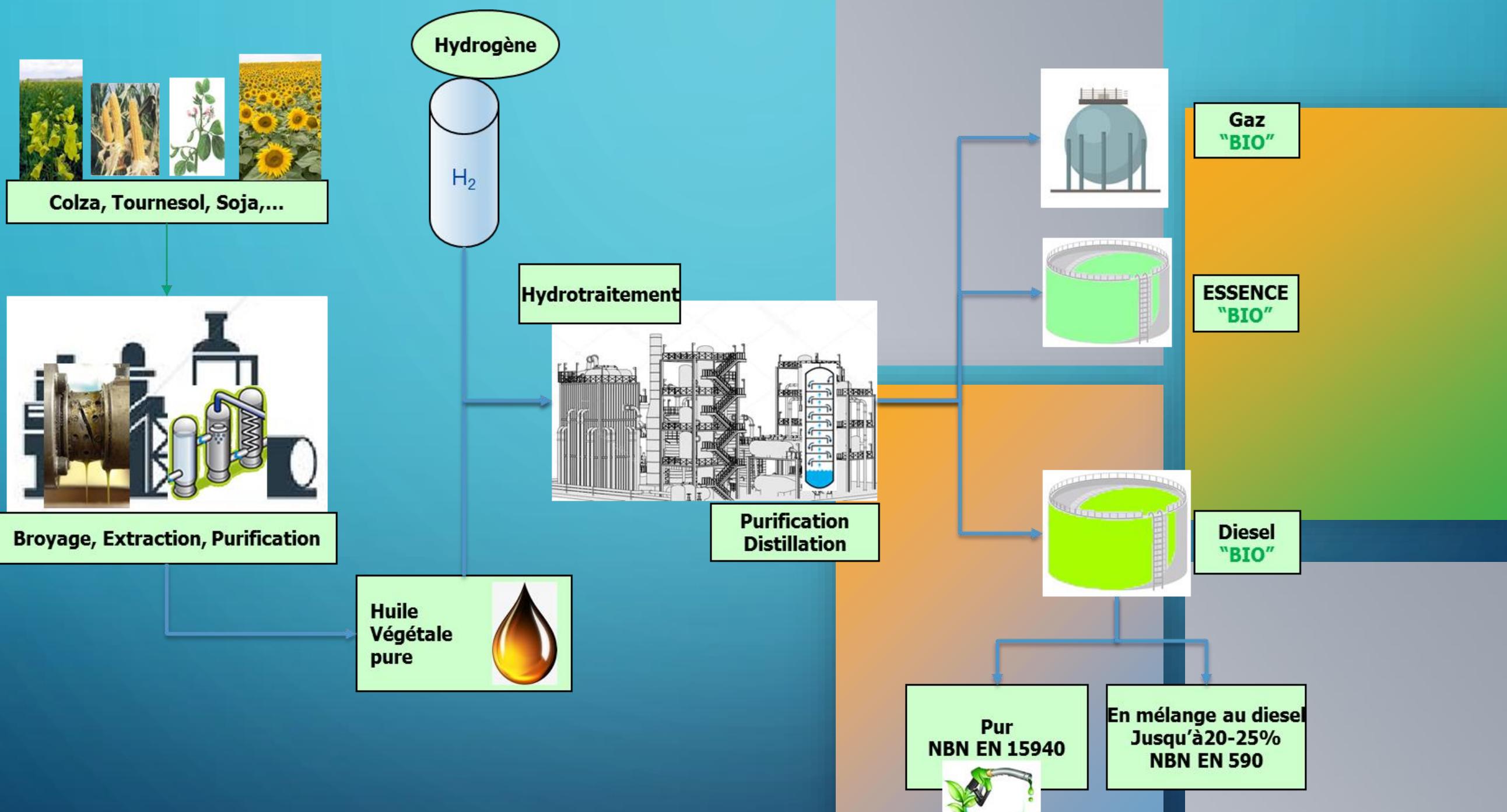
# PRODUCTION CLASSIQUE D'ESSENCE ET DIESEL



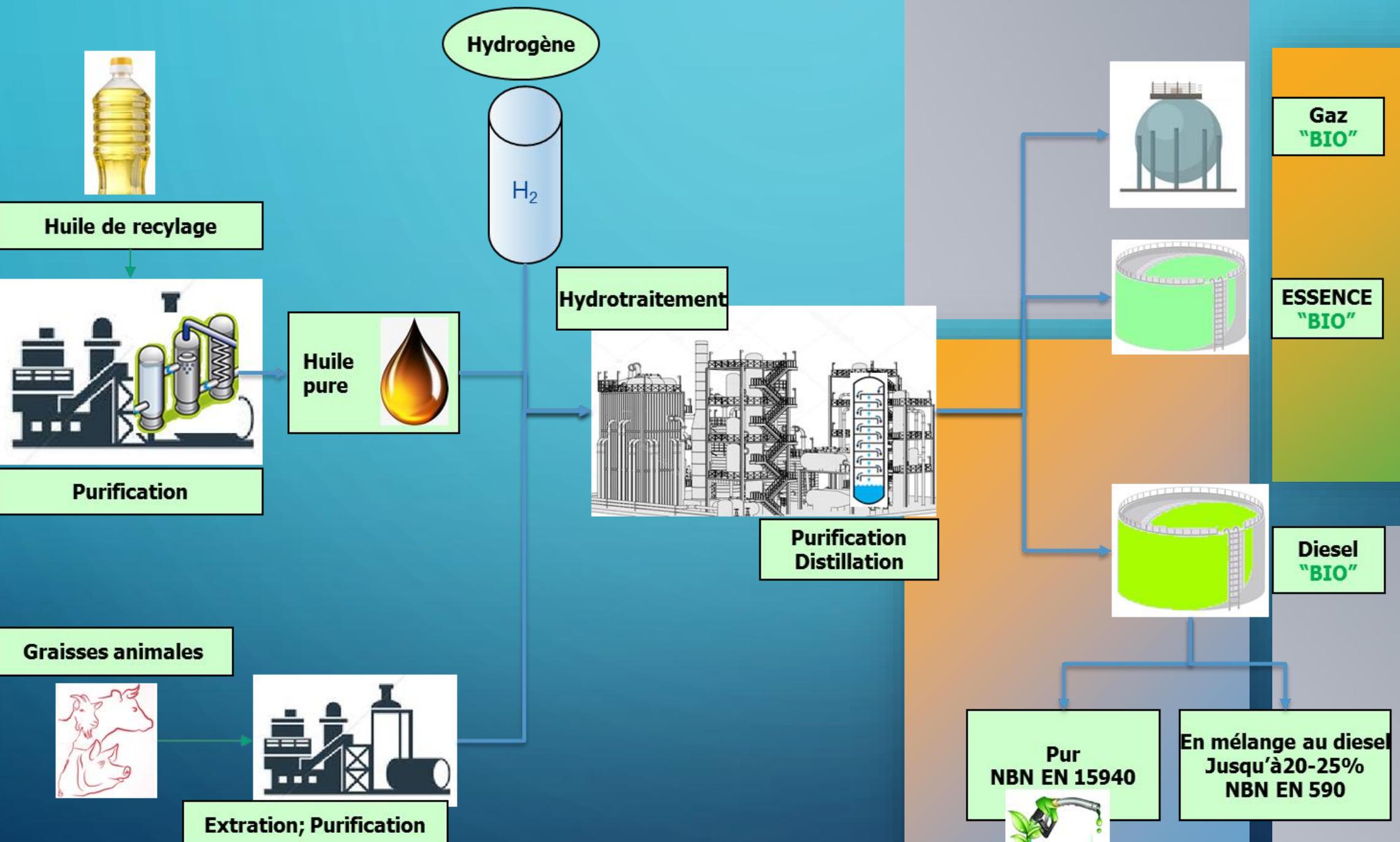
# BTL : BIOMASS TO LIQUID



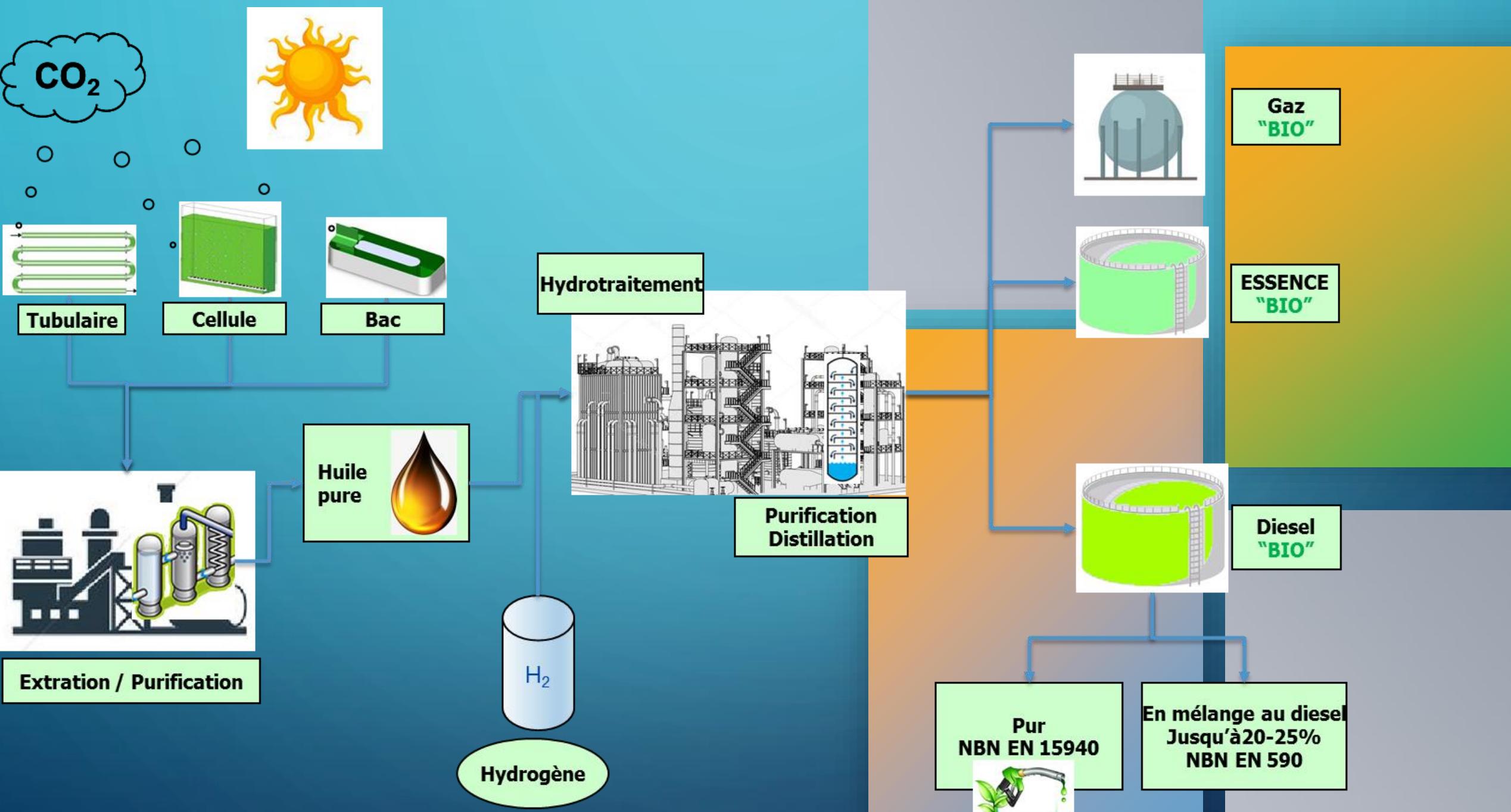
# HVO : HYDROTREATED VEGETABLE OIL



# HO : HYDROTREATED OIL



# HAO : HYDROTREATED ALGAE OIL



# VOORDELEN & NADELEN



## • Voordelen

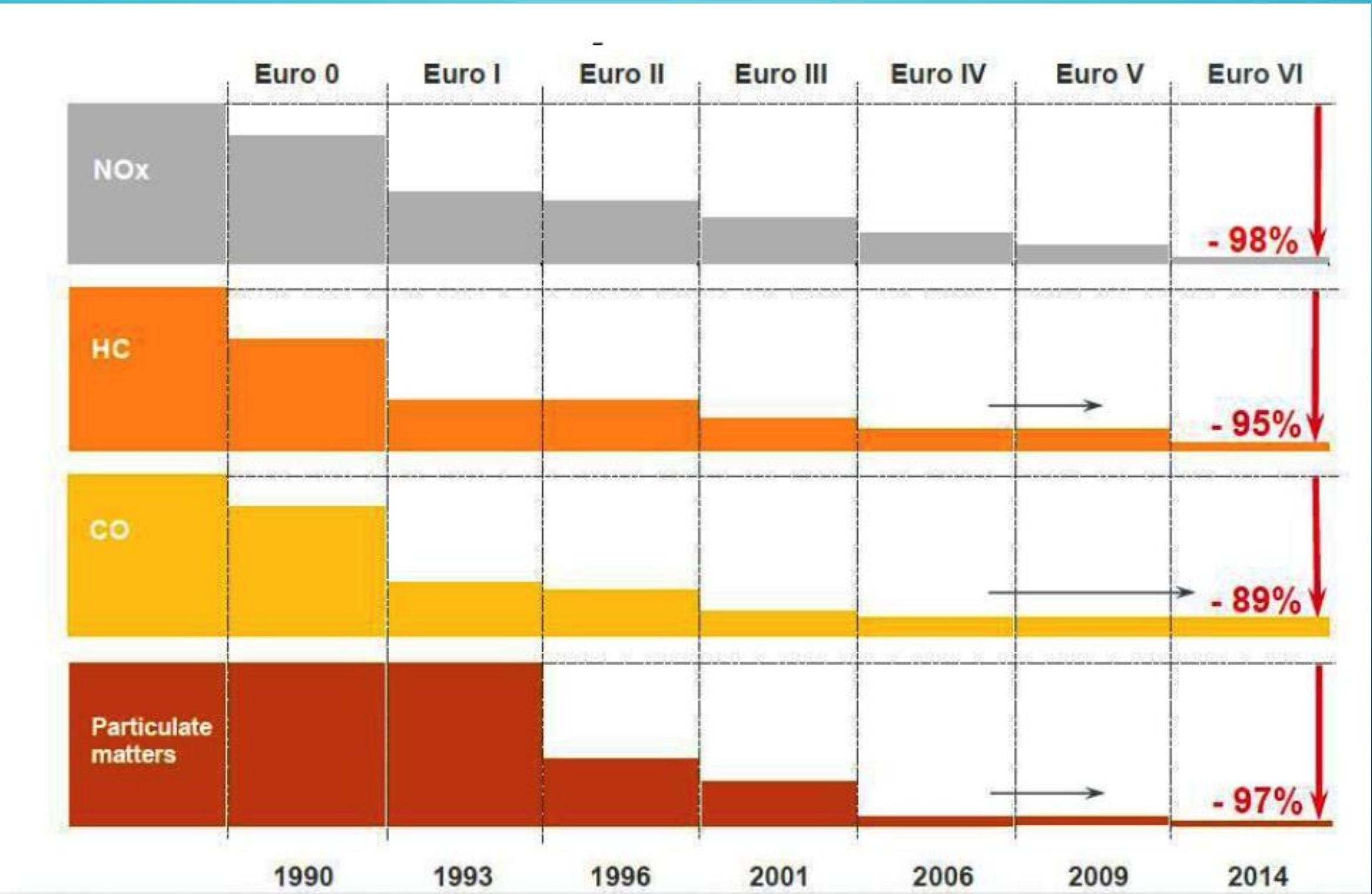
- **Gelijk of hoger cetaangetal (klasse A)**
- **Geen polycyclische aromaten**
- **Vermindering van de gereglementeerde emissies : Nox (zelfs gelijkaardig), CO, HC, Deeltjes & CO<sub>2</sub>**
- **Stabieler dan biodiesel (FAME)**
- **Goed koel te houden**
- **Vereist niet absoluut noodzakelijk een specifieke motor**
- **Perfect te mengelen met fossiele diesel (gelijkaardige molecule → verzadigde koolwaterstoffen)**
- **Homologatie op de laatste Euro VI-motoren**

## • Nadelen

- **Soortgelijke massa lager dan B7**
- **Vereist een additief om het smeringsvermogen te verbeteren**
- **Duurder, en zelfs veel duurder c.f. algen**
- **Beschikbaarheid van de grondstoffen**

# ZONE DE BASSE ÉMISSION À BRUXELLES

\* Un accès de maximum 8 jours par an et par véhicule est possible via l'achat d'un pass d'une journée.



## Evolution des normes d'homologation Europe Moteurs diesel

### Euro 5

- Depuis septembre 2011

### Euro 6b

- Depuis septembre 2014
- Limites des émissions d'oxydes d'azote fixée à 80 mg/km au lieu de 180 mg/km

### Euro 6d temp

- A partir de septembre 2017
- Mesures en conditions de conduite réelles RDE avec un facteur de conformité de 2.1 (NOx)
- Cycle WLTC au lieu du cycle NEDC

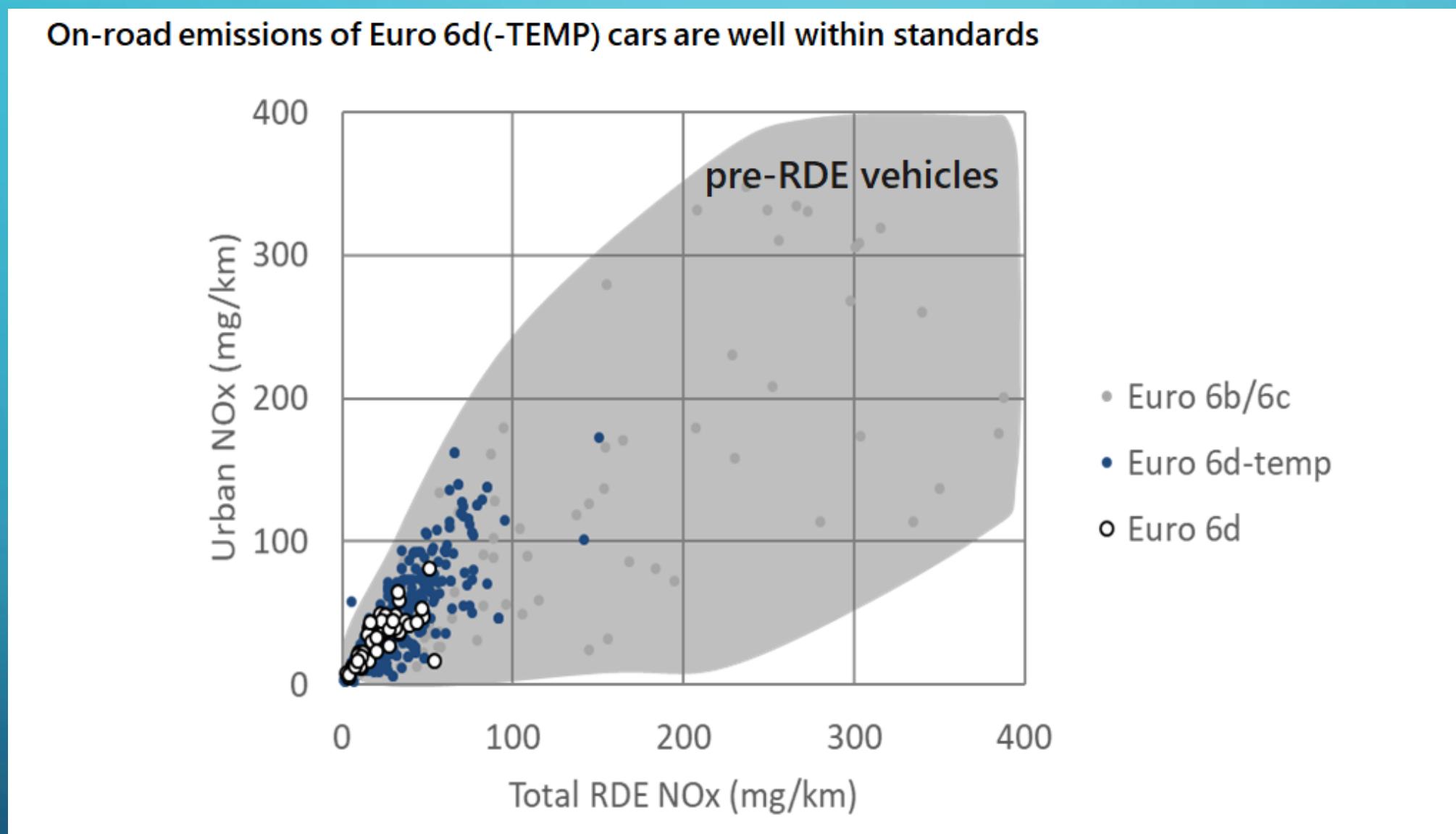
### Euro 6d full

- A partir de Janvier 2020
- Facteur de conformité RDE de 1.5

# WAT IS ER VERANDERD SINDS DIESELGATE?

- In Europa worden nieuw geregistreerde voertuigen voortaan verplicht getest volgens de WLTP-testcyclus (Worldwide Harmonized Light Vehicle Test Procedure) op een testbank, aangevuld met een RDE-test (Real Driving Emissions) op de weg = ervoor zorgen dat nieuwe auto's schoner zijn.
- 2018: EURO 6 Temp-norm en 2020 : EURO 6 d-norm (nog strengere emissievoorwaarden).
- Technologische vooruitgang : « Selective Catalytic Reduction » vermindert schadelijke stoffen met 99 % (fijnstofdeeltjes en Nox).
- De oude generaties dieselvoertuigen verdwijnen.
- De lage emissiezones (LEZ) zijn een doeltreffende manier om de meest vervuilende voertuigen te bannen.
- Strengere en doeltreffendere controles in de technische controlecentra om fraude op te sporen.

**Le test RDE a permis d'améliorer considérablement les émissions de Nox des moteurs diesel: Les émissions sur route des voitures Euro 6d (-TEMP) sont bien dans les normes**



SOURCE: ACEA/JAMA PEMS DATA CONSULTED – 19 NOVEMBER 2019

# BESLUITEN

- JA voor de lage emissiezones (LEZ)
- Le parc de véhicule se renouvelle en 9 ans.
- In 2030 zullen bijna alle in België geregistreerde dieselvoertuigen Euro 6 temp-of Euro 6-voertuigen zijn, die de luchtkwaliteitsnormen zullen naleven.
- Les annonces d'un dieselban à Bruxelles sont donc superflues!
- Het is niet aan de overheid om bepaalde motoren (diesel en benzine) bij voorbaat uit te sluiten of om a priori hypothetische winnaars aan te wijzen (met name elektrische auto's).
- Un véhicule doit être autorisé s'il respecte les normes d'émissions, quelle que soit sa motorisation.

**La mixité énergétique dans le transport et l'évolution  
technologique définiront la mobilité de demain**



**Thank You For Your Attention**

# What future for the internal combustion engines?

Pollutant emissions

Local: PM and NOx

Greenhouse gas emissions

Global: CO<sub>2</sub>

Key advantages

Availability, Range

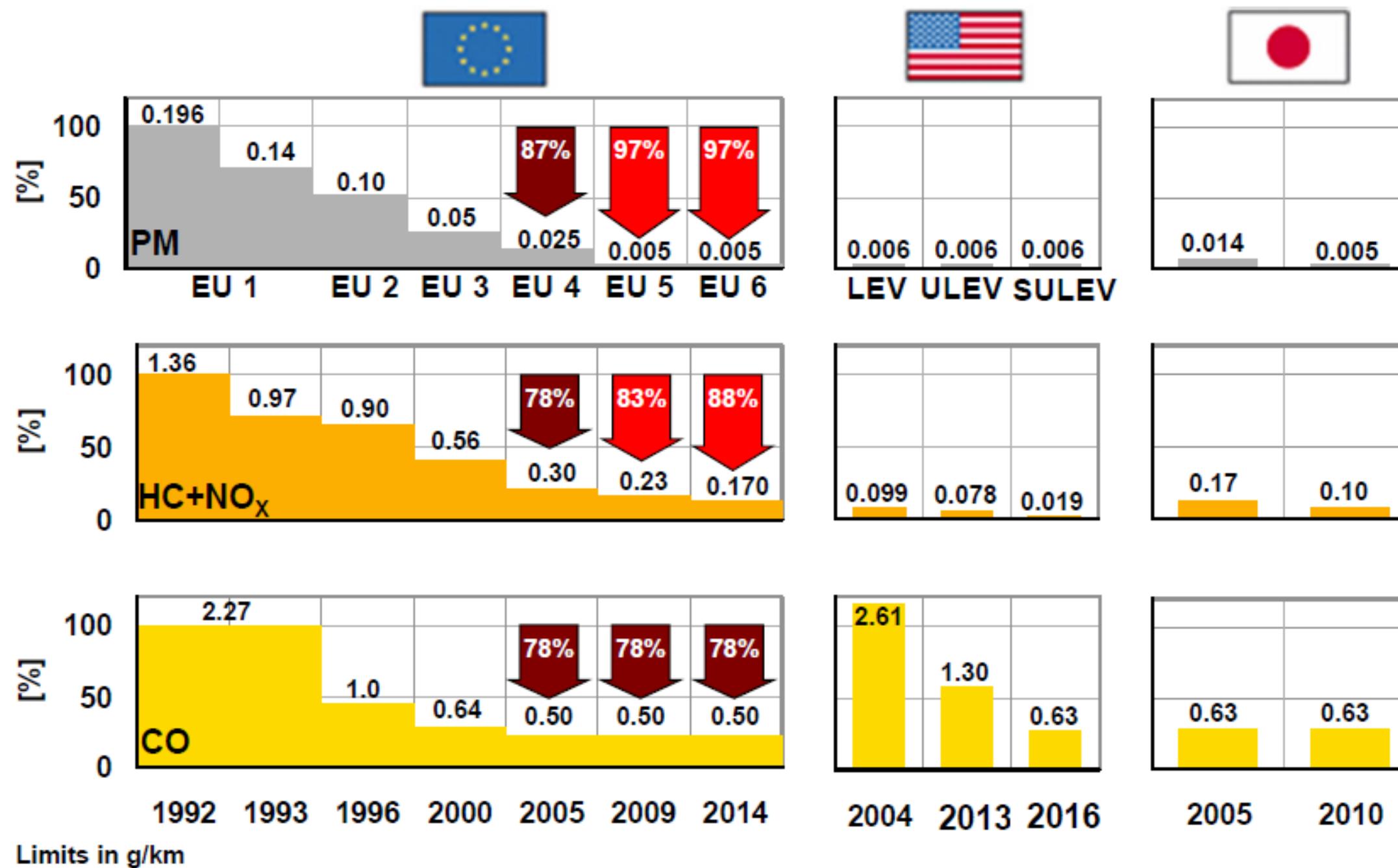
H. Jeanmart & F. Contino

**Pollutant emissions**  
Local: PM and NOx

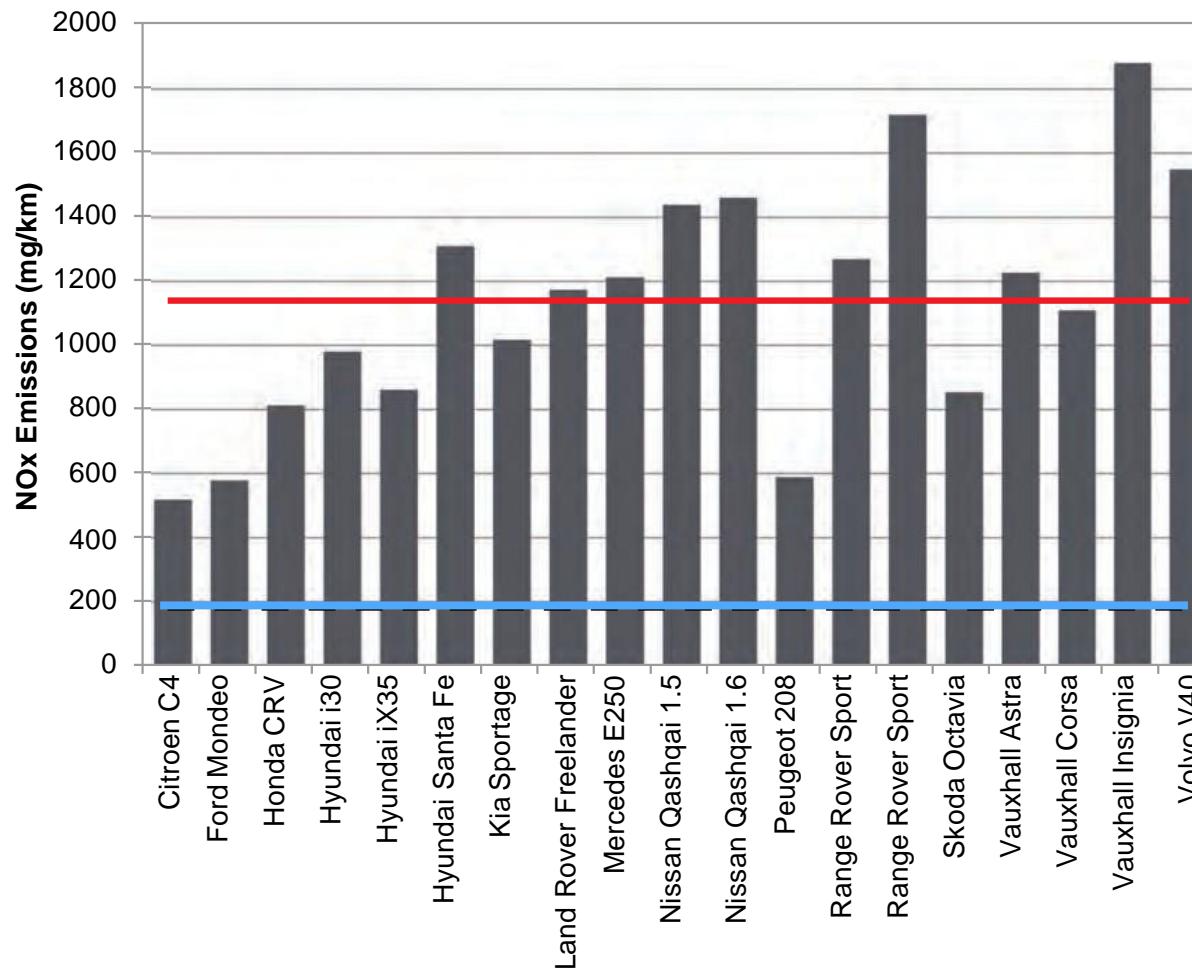
**Greenhouse gas emissions**  
Global: CO<sub>2</sub>

**Key advantages**  
Availability, Range

# Regulations becomes more constraining for PM, NOx and CO (here for diesel cars)



# The real emissions are on average 6 times higher than legal limit

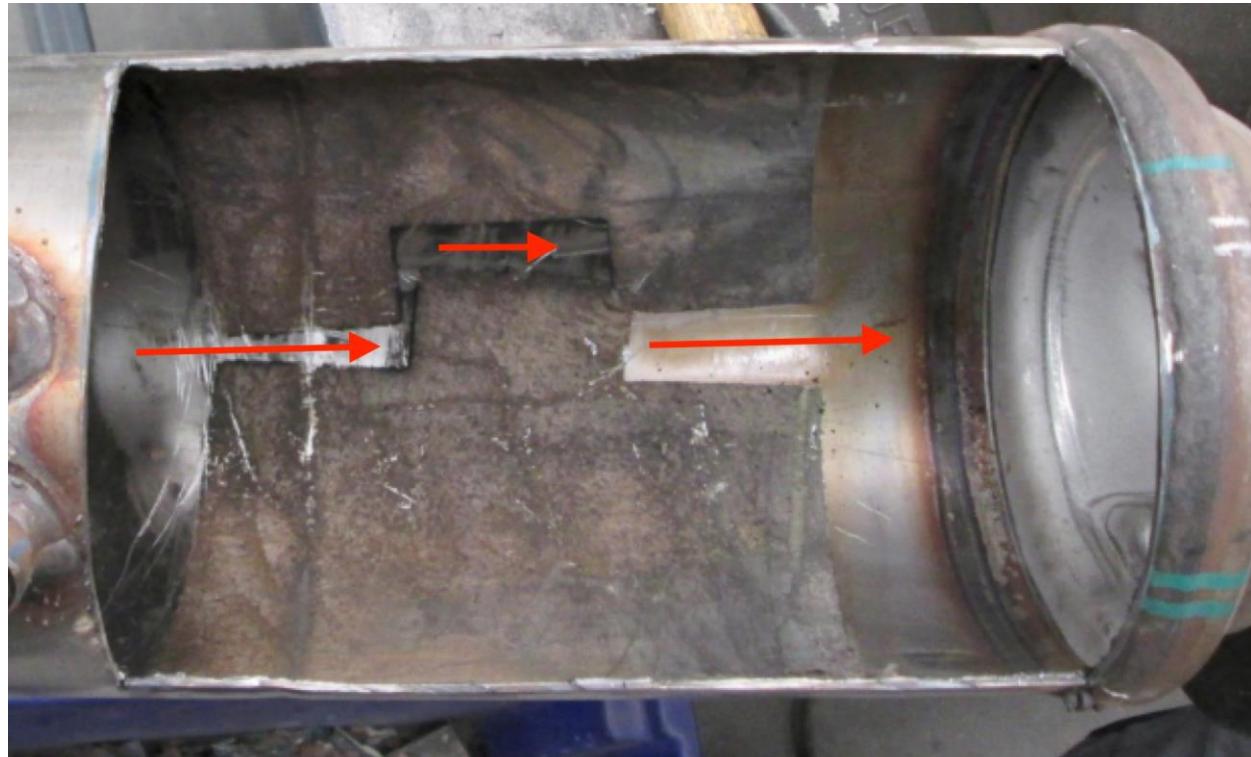


Measured average  
6 times higher

Legislation limit  
(EURO5: 180 mg/km)

Official tests in UK (EURO5 vehicles)

# Aftertreatment systems don't always work as we think they should



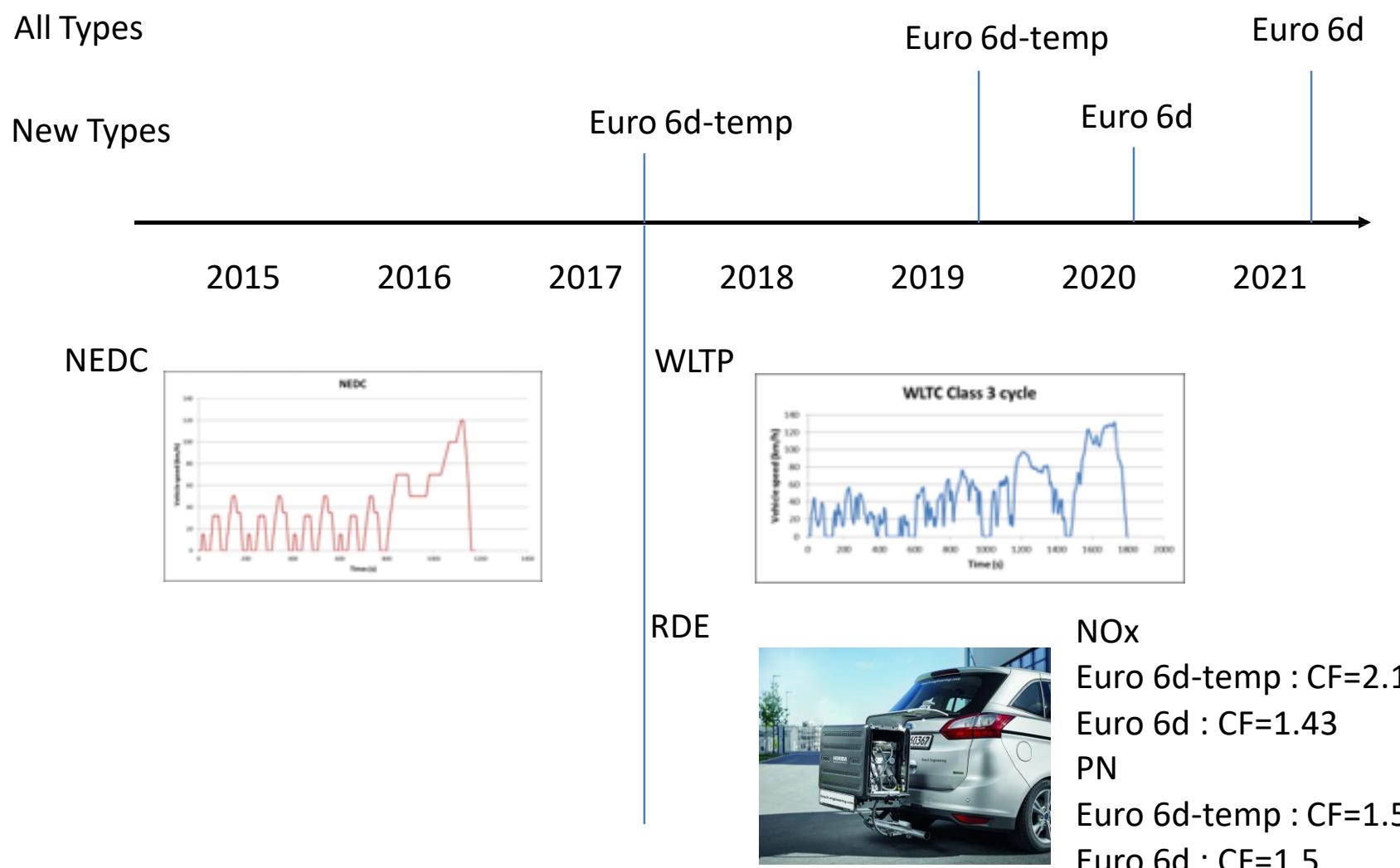
Filters on all diesel since EURO5

30% above the expected levels

High emitters dominate the average

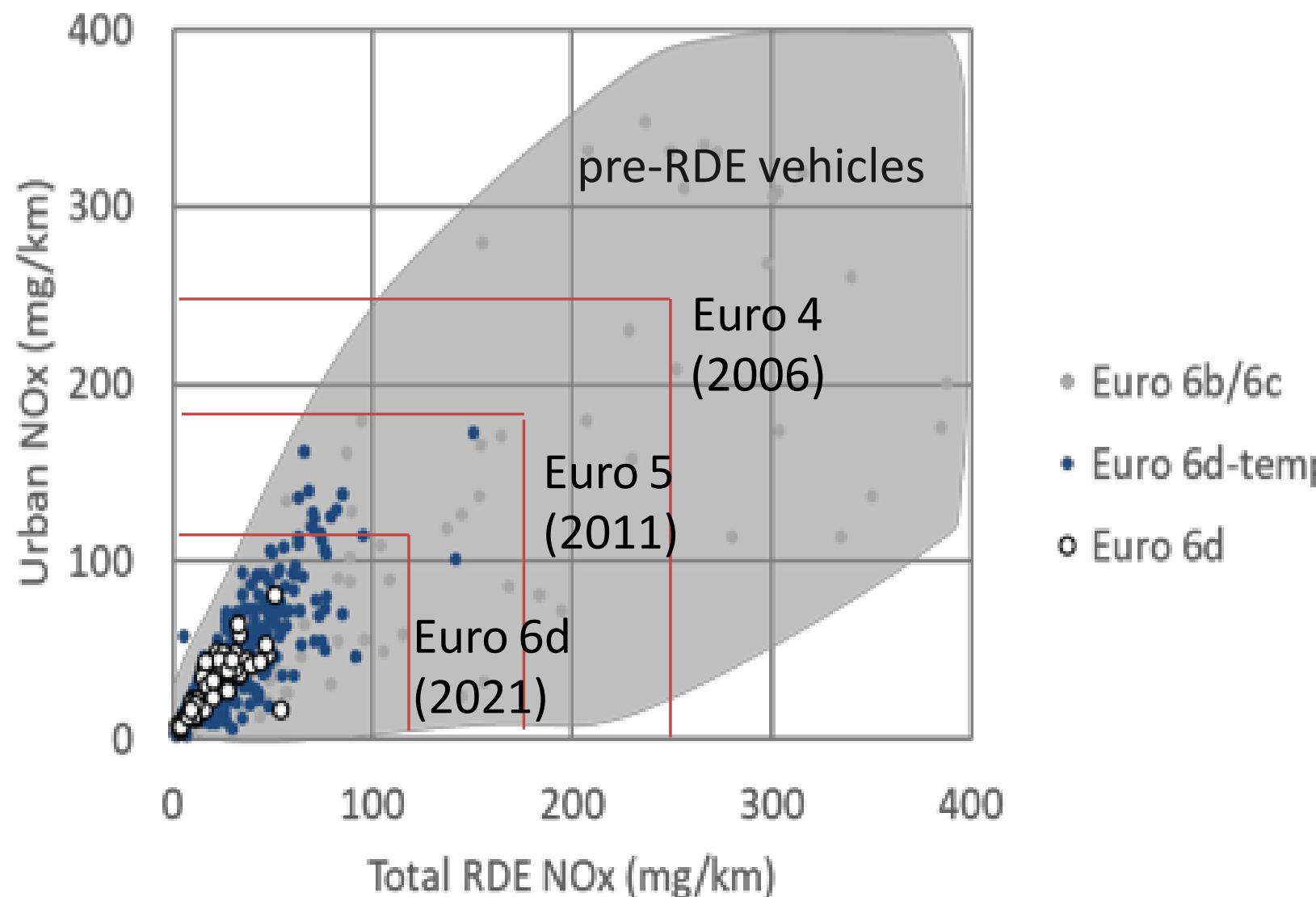
Boveroux et al., SAE, 2019

# Introduction of the WLTP and the RDE is a game changer



All cars comply now with  
EURO6d-temp  
and  
new types with EURO6d

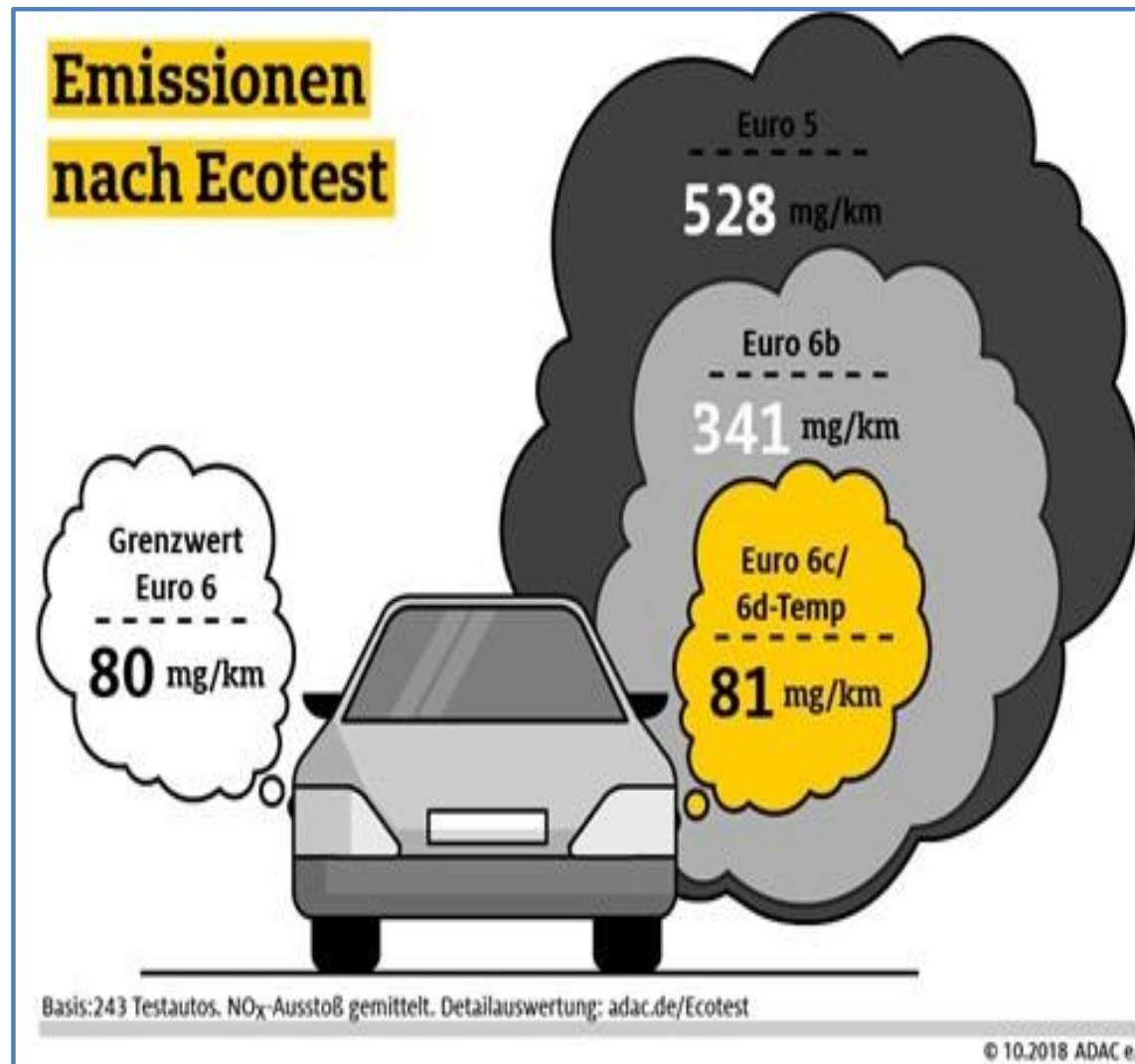
# Now, engines comply with the regulations, also in real life conditions



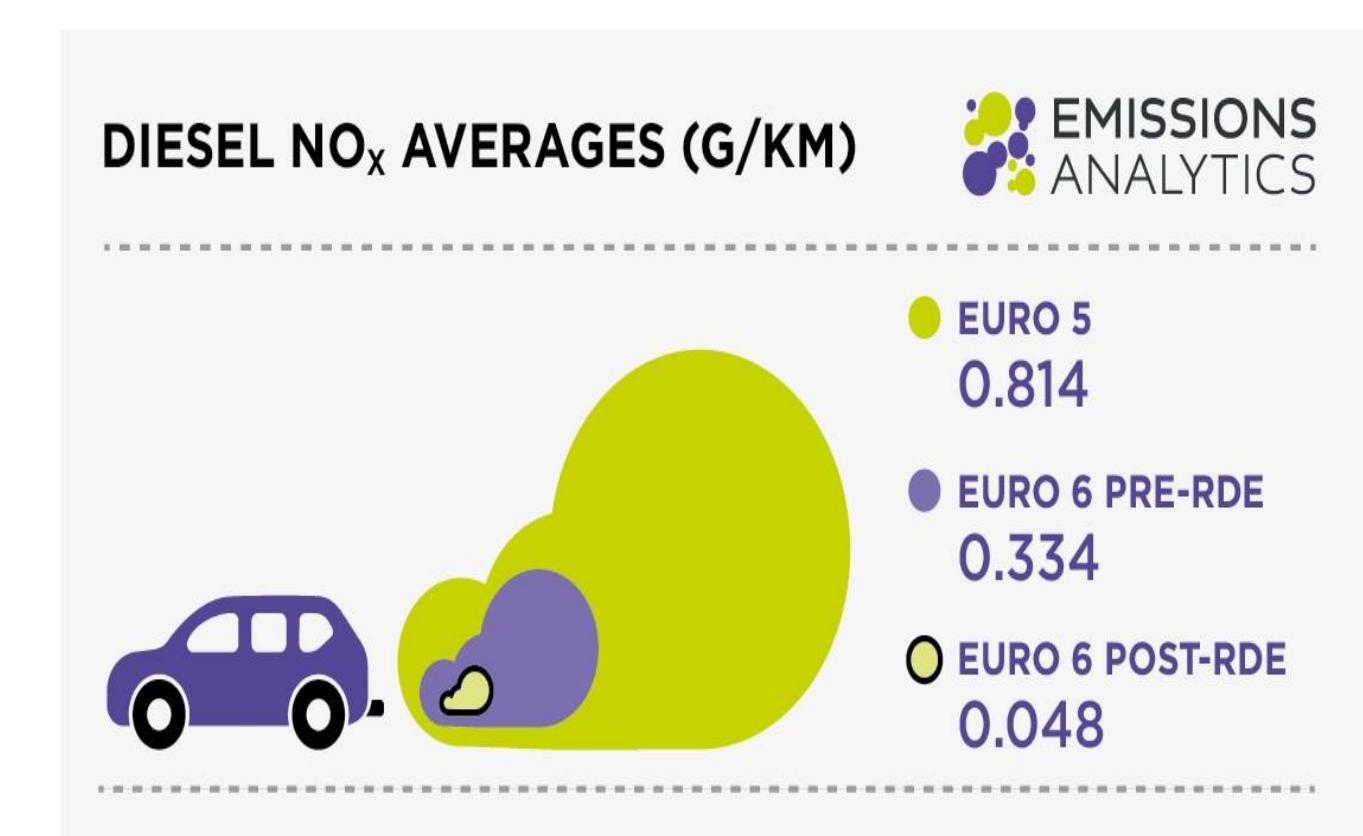
Very low NOx emissions  
on real drive emissions  
for diesel cars

Source: ACEA/JAMA PEMS data consulted  
19 November 2019

# Third parties confirm the strong reduction in local pollutant emissions



Source: ADAC Ecotest



Source: Emissions Analytics

# The price to pay is a more complex exhaust after-treatment

**DOC (HC)**

Diesel Oxidation Catalyst

**DPF (PM)**

Diesel Particulate Filter

**LNT (NOx)**

Lean NOx Trap

**SCR (NOx, requires AdBlue)**

Selective Catalytic Reduction

**ASC (NH<sub>3</sub>)**

Ammonia Slip Catalyst

**SDPF (PM+NOx)**

SCR+DPF

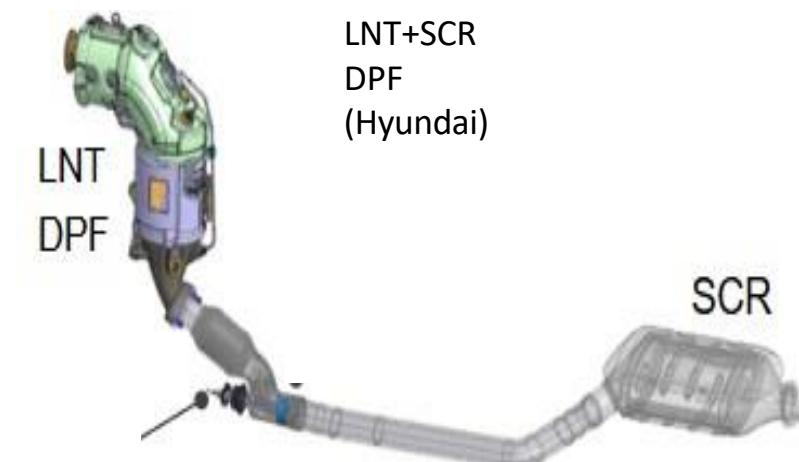
**Euro 6b**

DOC  
LNT  
DPF  
(BMW)

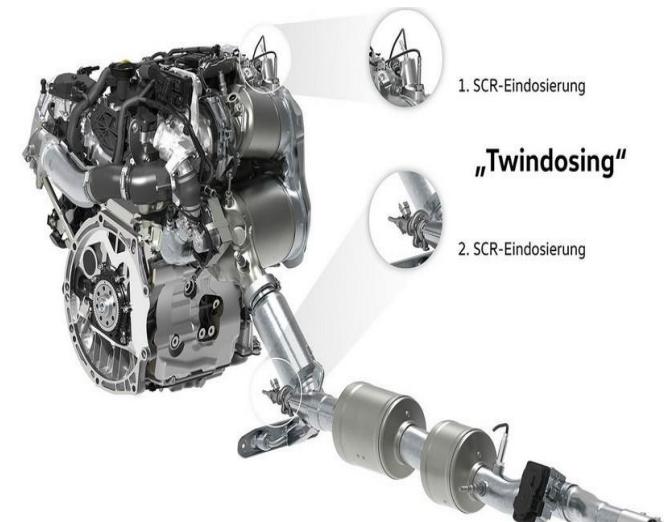


**Euro 6d-temp**

DOC  
LNT+SCR  
DPF  
(Hyundai)

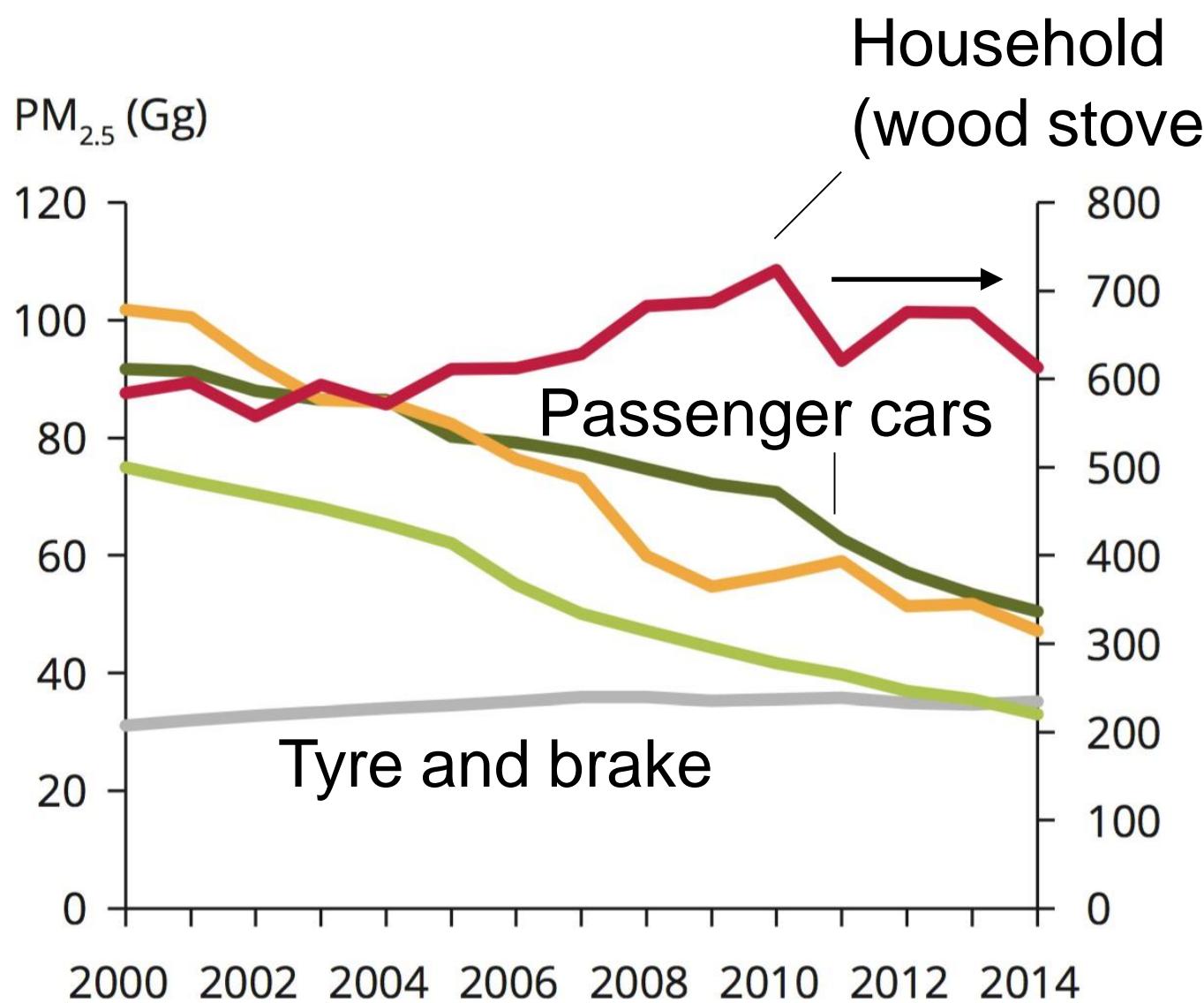


**Euro 6d**



DOC  
SCR + SCR + ASC  
DPF  
(VW)

# So, in cities, other sources of PM become significant



Up to 40% of PM in cars  
from road, tyre and brake

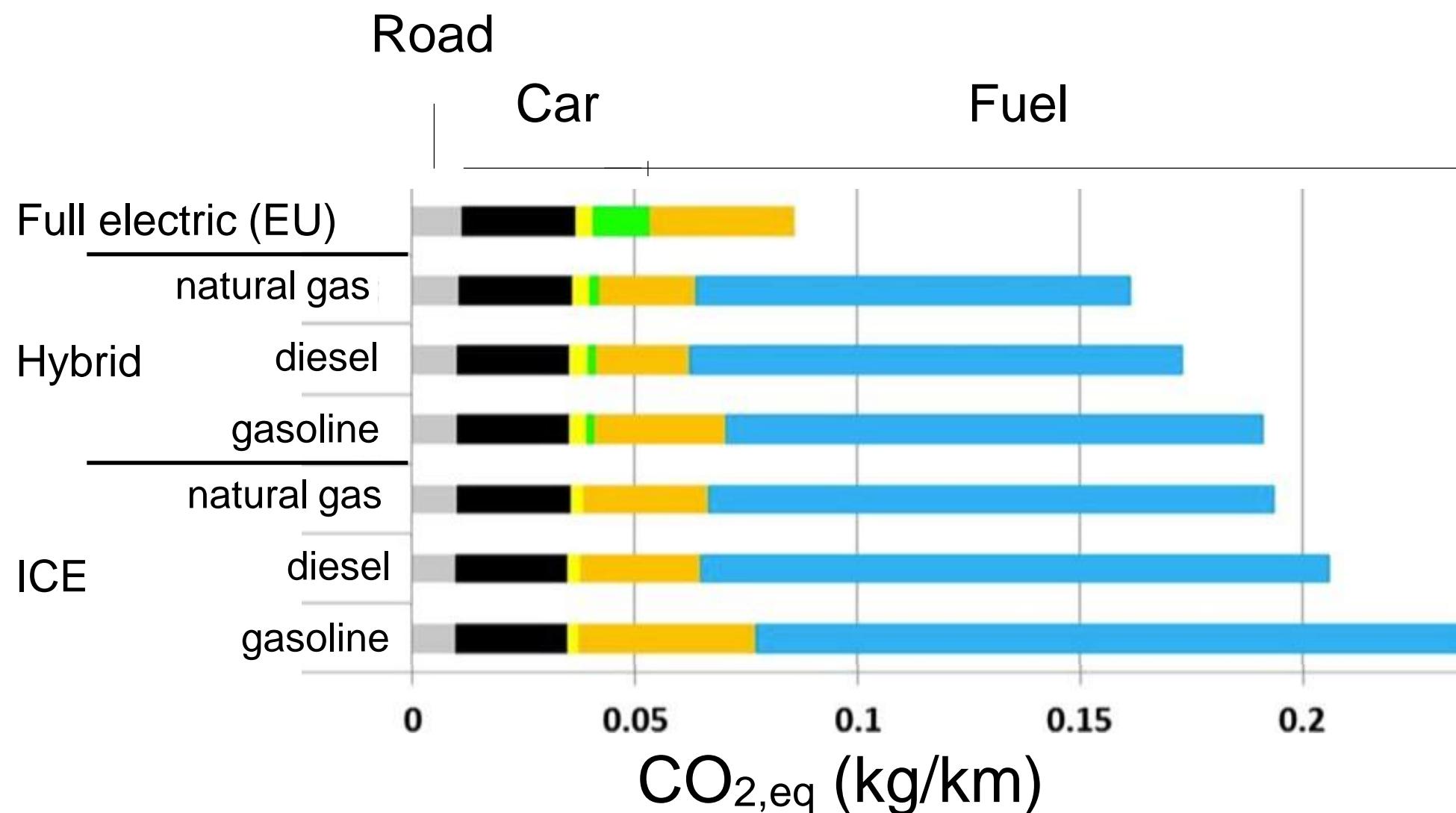
source: EEA, 2014

**Pollutant emissions**  
Local: PM and NOx

**Greenhouse gas emissions**  
Global: CO<sub>2</sub>

**Key advantages**  
Availability, Range

# Another motivation to opt out of engines is to reduce greenhouse gases

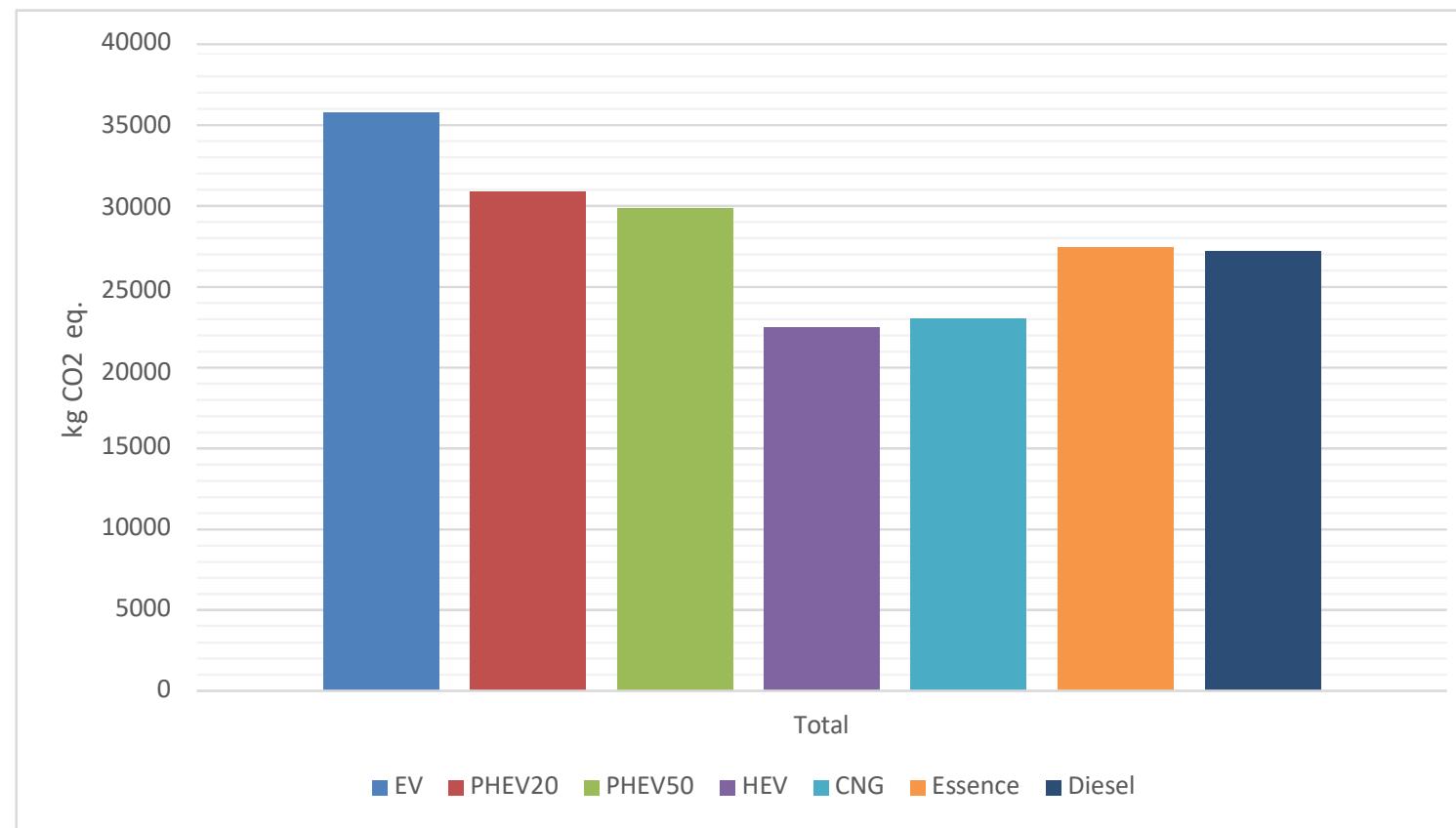


Main contribution  
from the fuel

Fuel can be produced  
from renewables

adapted from Bauer et al., 2015

# The global benefit of EV depends on the origin of the car, batteries, and the electricity

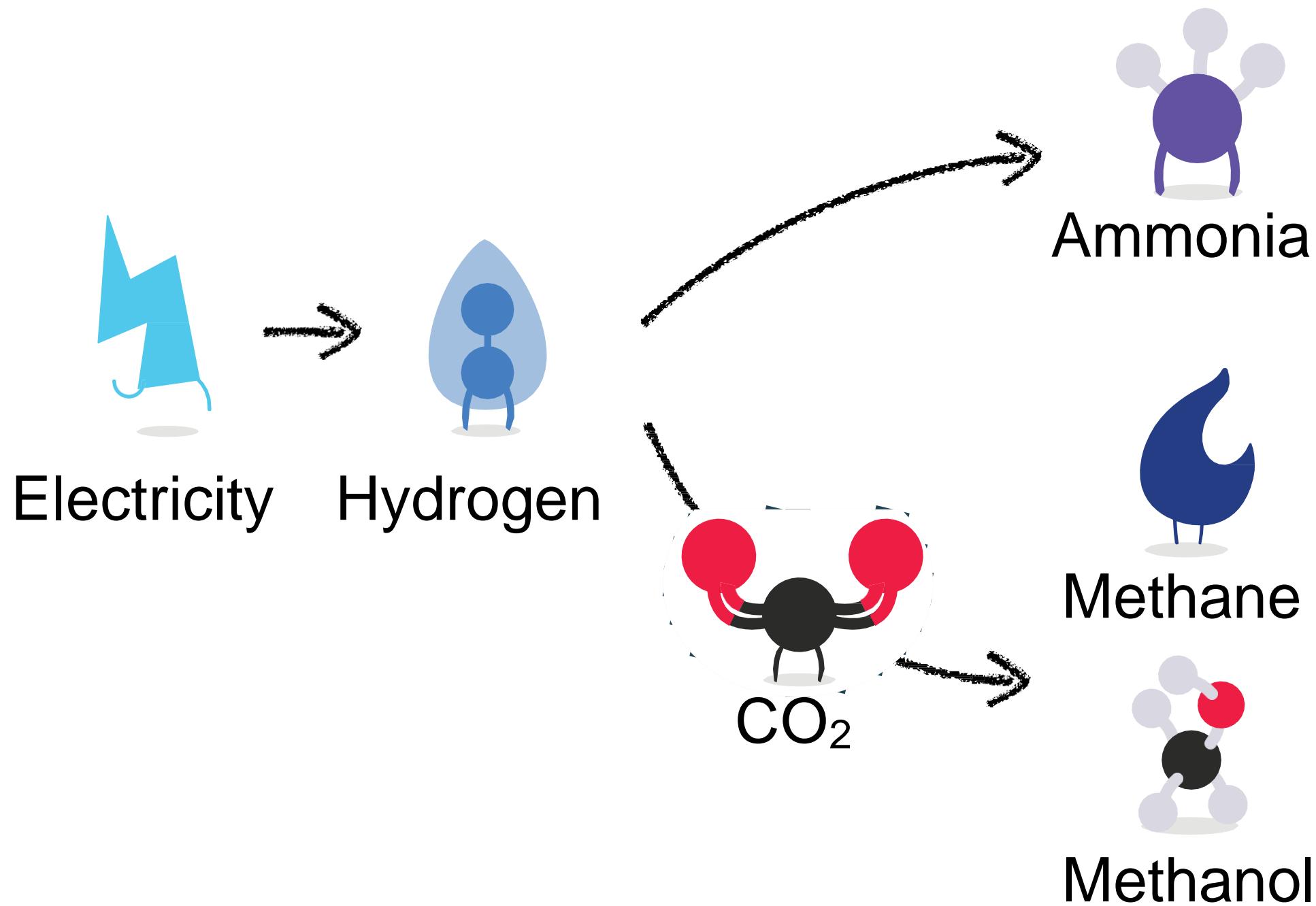


Considering EU energy mix,  
and batteries made in China  
EV emit more CO2 than  
other technologies

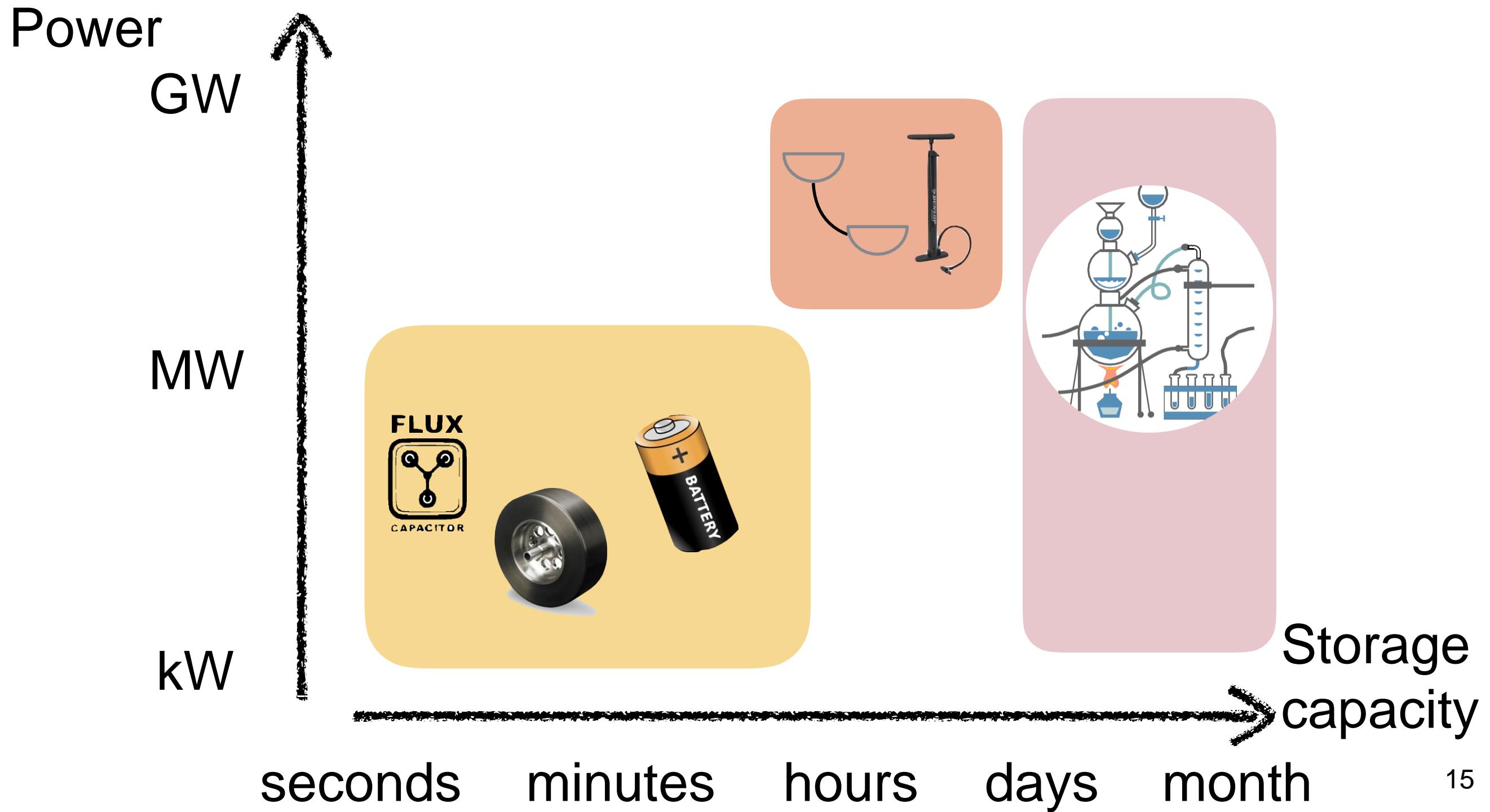
Figure 2.1 – Comparaison des émissions totales de  $CO_2$  entre différentes voitures sur l'ensemble de leur cycle de vie. Les consommations sont basées sur des tests NEDC et le mix énergétique est européen.

Source : Hendrix & de Bruyne (2018)

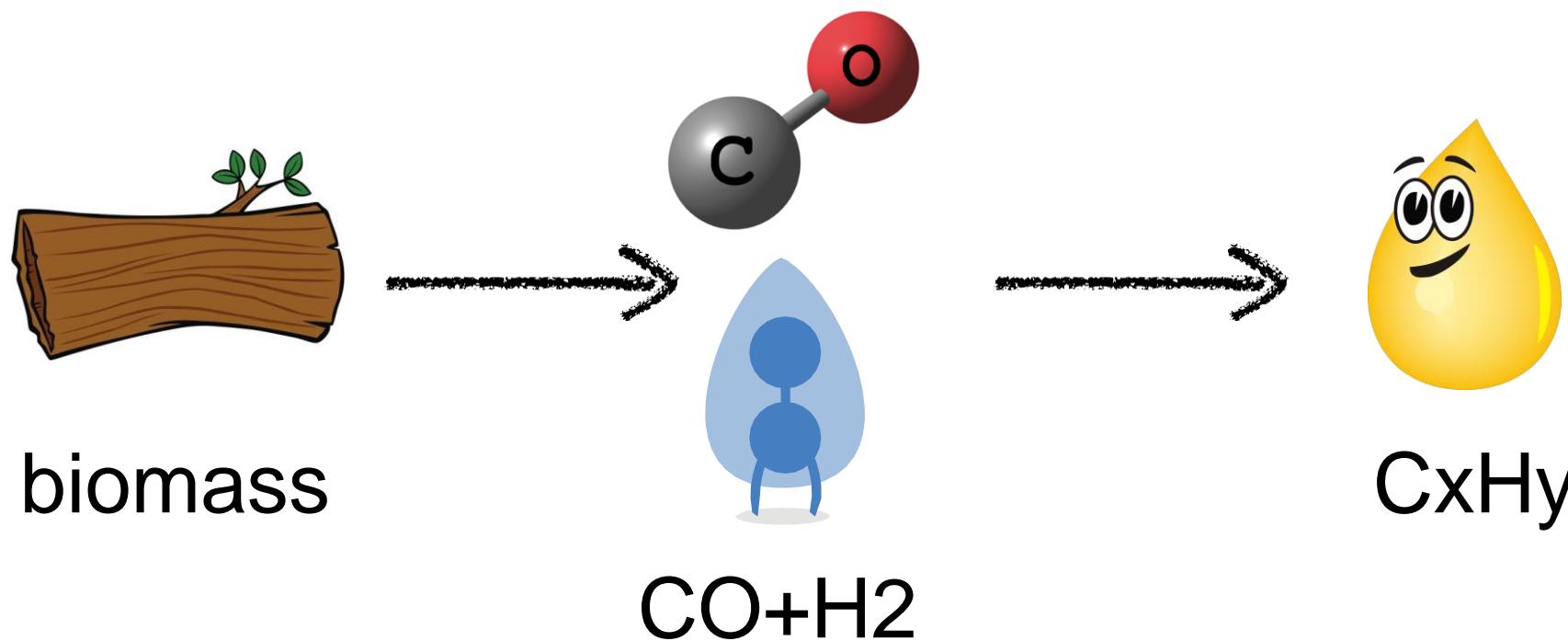
With or without CO<sub>2</sub>,  
we can produce fuels (P2F)



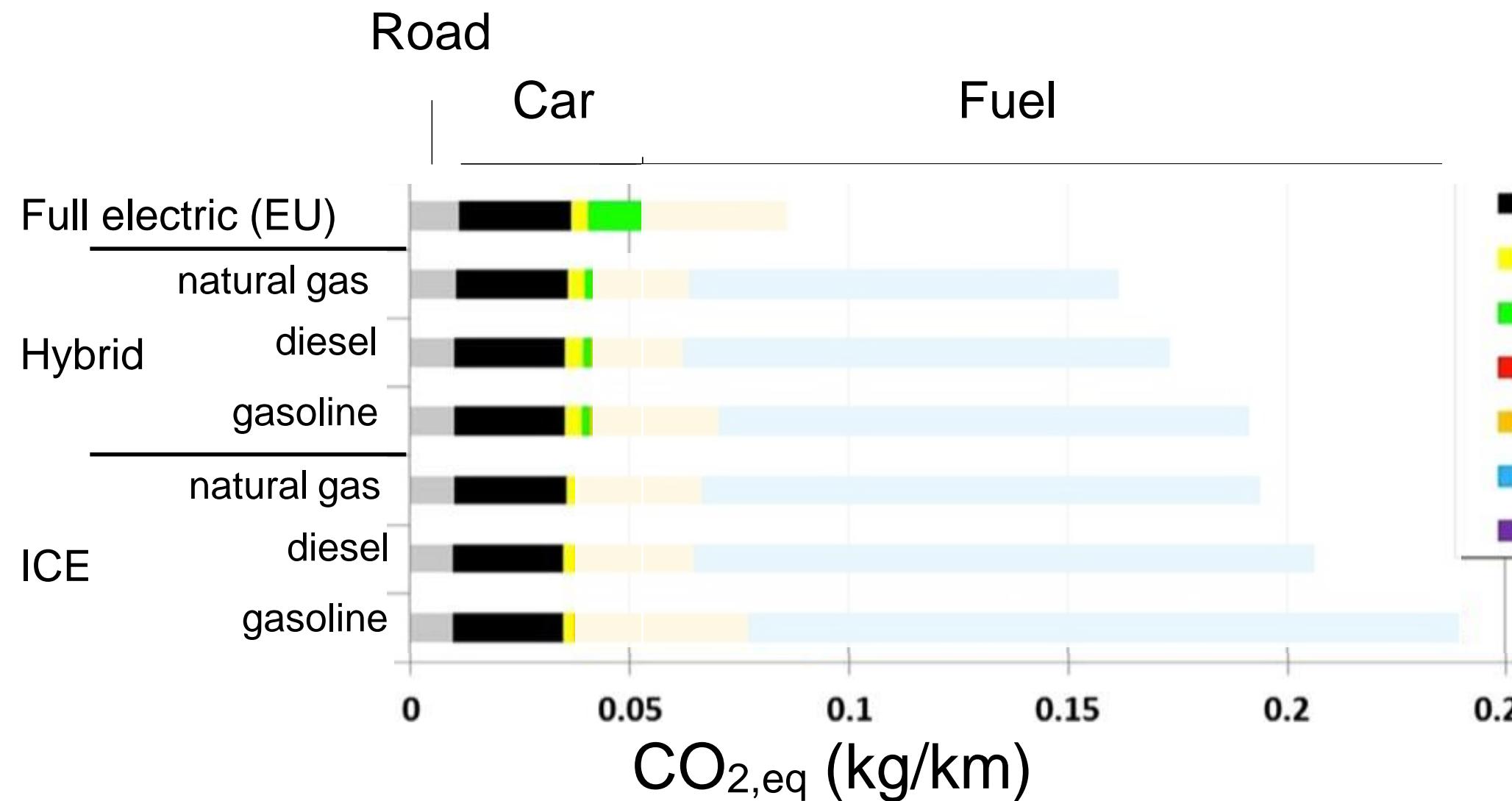
In any case, e-fuels are needed for long term storage of electricity from RE sources



Biomass is the renewable building block  
to produce Fischer-Tropsch synthetic fuels



# Using these fuels in cars would remove a large CO<sub>2</sub> penalty



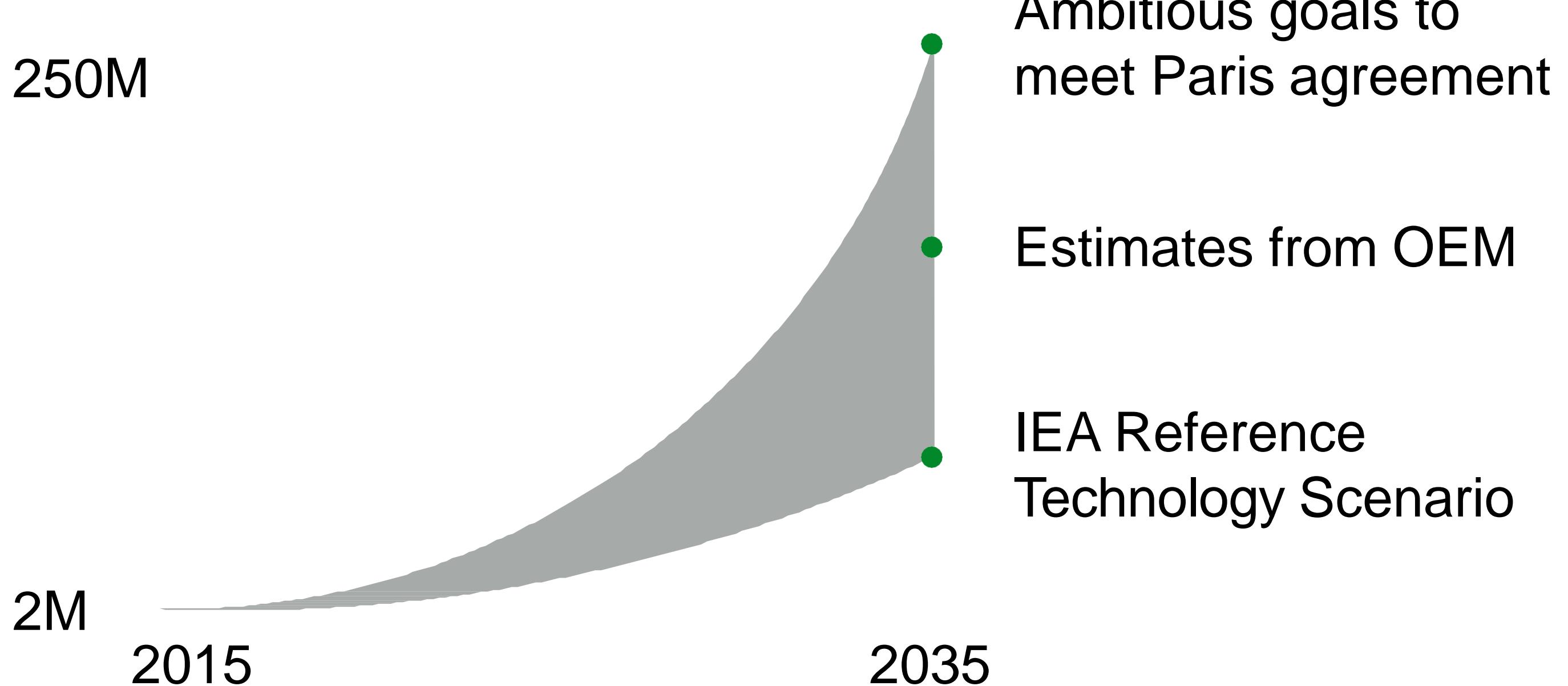
adapted from Bauer et al., 2015

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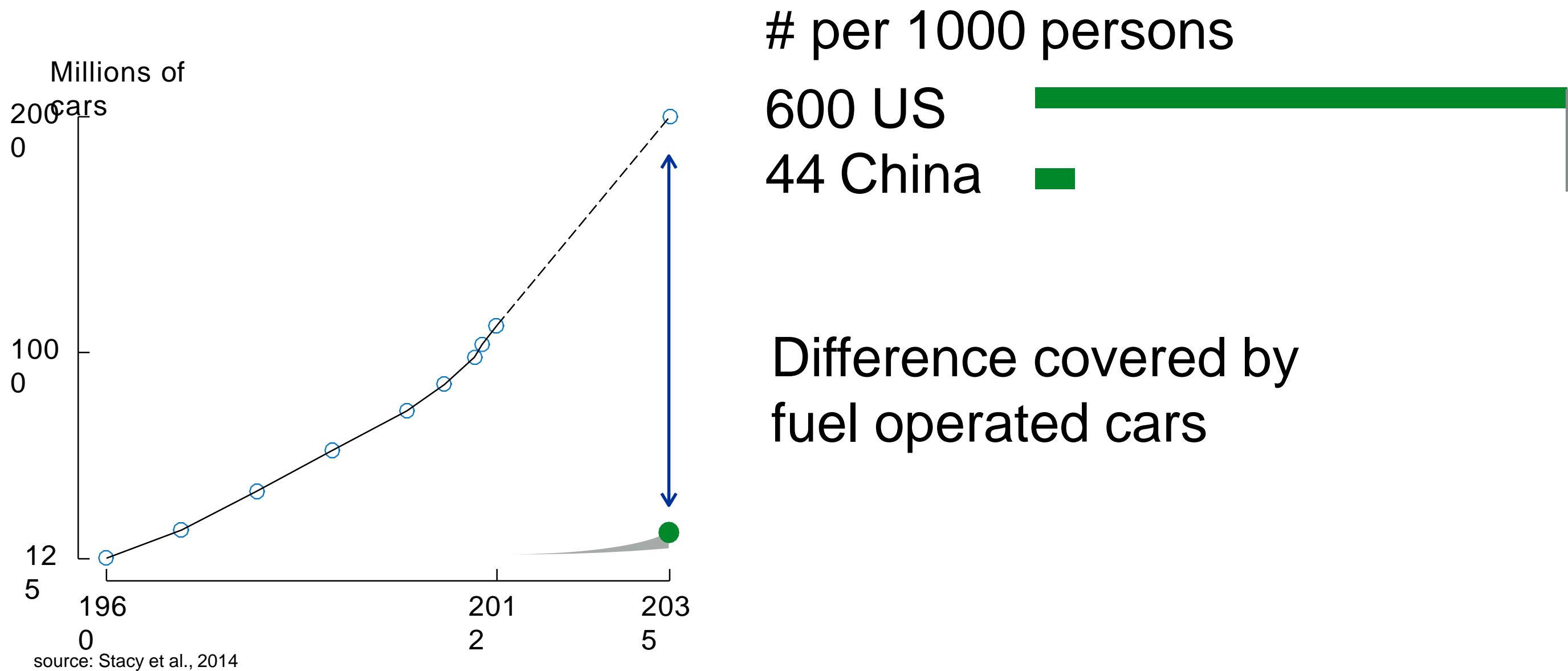
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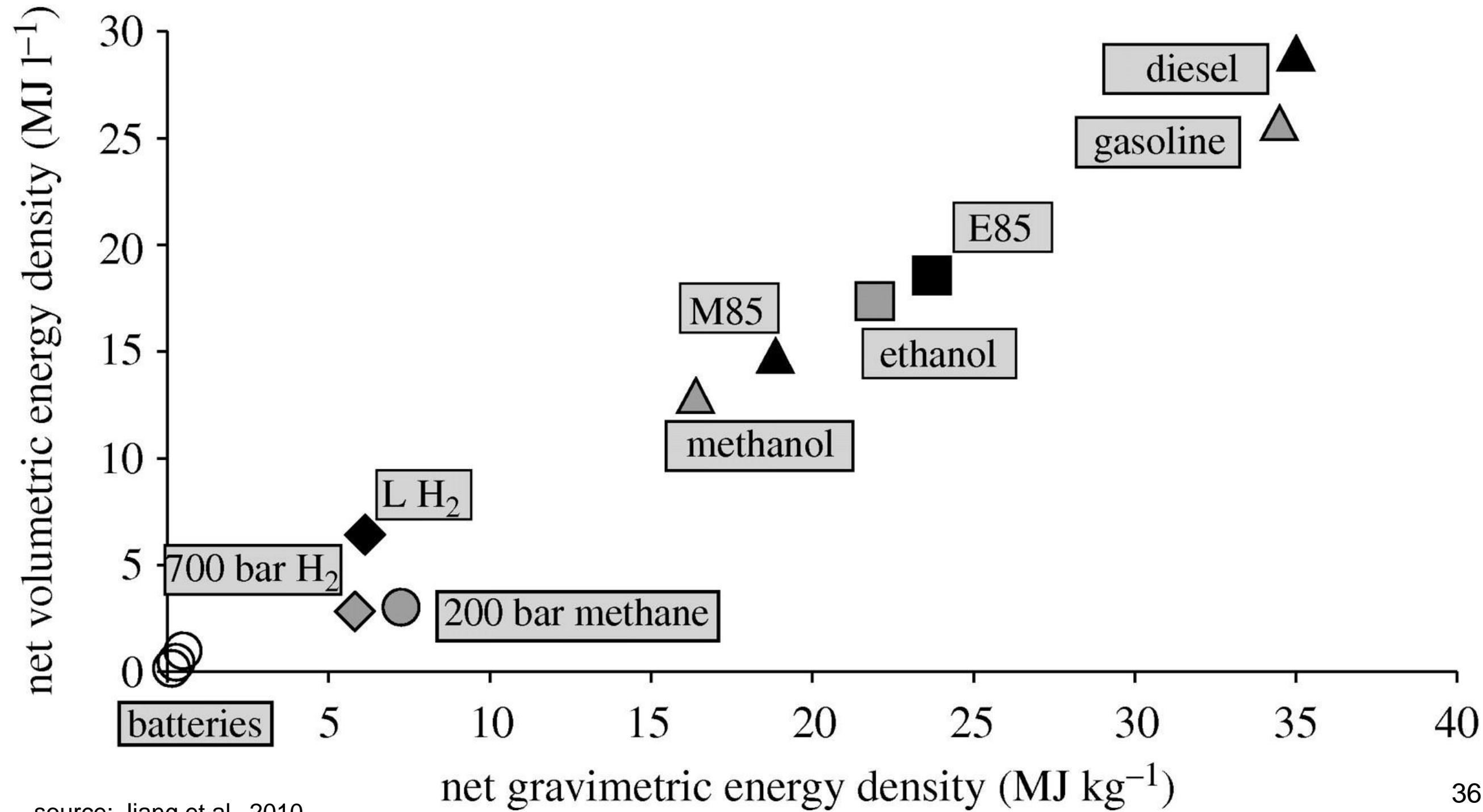
# Electric cars are growing fast but will they keep the pace?



Piston engine is a well-known, cheap, technology proven to scale on a large market



# Fuels have large energy densities compared to batteries



# To sum up

Commercial solutions exist  
to meet current targets

Real Driving Emissions and Dieselgate  
made a (temporary?) paradigm shift

Solutions available and in development  
for even cleaner combustion

E-fuels and synthetic fuels shall  
become available

Less cars in cities whatever their  
powertrain is a must