

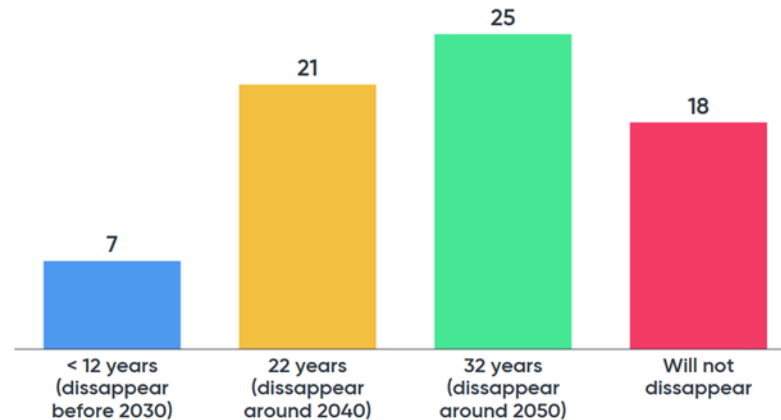


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THE END OF THE COMBUSTION ENGINE OR A NEW LIFE?

LUCIEN KOOPMANS

How many years will the IC Engine survive as part of the powertrain in new vehicles?



I LOVE THIS TOWN BUT THE TRAFFIC IS KILLING ME

Pollution from traffic congestion increases the risk of cancer as well as heart and lung disease for millions of New Yorkers

Support Congestion Pricing

For more, go to www.allchokedup.org



LET'S SHOW THEM WE'RE FUMING

Angry about air pollution?
Join the fight for clean air
#No2DirtyAir

To donate £3 text 'NTDA16 £3' to 70070

 clientearth.org/sayno2dirtyair 

Passenger cars

+ 118%

2015  1.1 billion

Average lifetime: 11 years

2050  2.4 billion

Road freight vehicle

+ 77%

2015  189 million

Average lifetime: 12 years

2050  334 million



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES 	11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	17 PARTNERSHIPS FOR THE GOALS 	 SUSTAINABLE DEVELOPMENT GOALS



GREEN

Shift transport systems to low polluting (GHG/air/noise) and climate resilient path

GLOBAL OBJECTIVES

Sustainable Mobility



EFFICIENCY

Increase the efficiency of transport systems by 2030



SAFETY

Improve safety of mobility across transport modes



UNIVERSAL ACCESS

Ensure for all equitable access to economic and social opportunities by 2030

Parliament pushes for cleaner cars on EU roads by 2030

Press Releases **PLENARY SESSION** **ENV** 03-10-2018 - 14:18

- Measures to accelerate the roll-out of E-cars
- Towards real conditions testing of CO2 emissions
- Call for support for European battery manufacturing



RDE

CO2 emissions from new cars should be cut by 40% by 2030 and market uptake of electric and low-emission cars should accelerate, said MEPs on Wednesday.

France to ban sales of petrol and diesel cars by 2040

Move by Emmanuel Macron's government comes a day after Volvo says only make fully electric or hybrid cars from 2019



France will end sales of petrol and diesel vehicles by 2040, plan to meet its targets under the Paris climate accord government has announced.

EU aims to cut CO2 emissions from trucks by a third by 2030

Julia Floretti

BRUSSELS (Reuters) - New large trucks in the European Union will have to emit at least 30 percent less CO2 by 2030 than in 2019 under the bloc's first ever CO2 standards for trucks proposed on Thursday that the industry said were "far too aggressive".



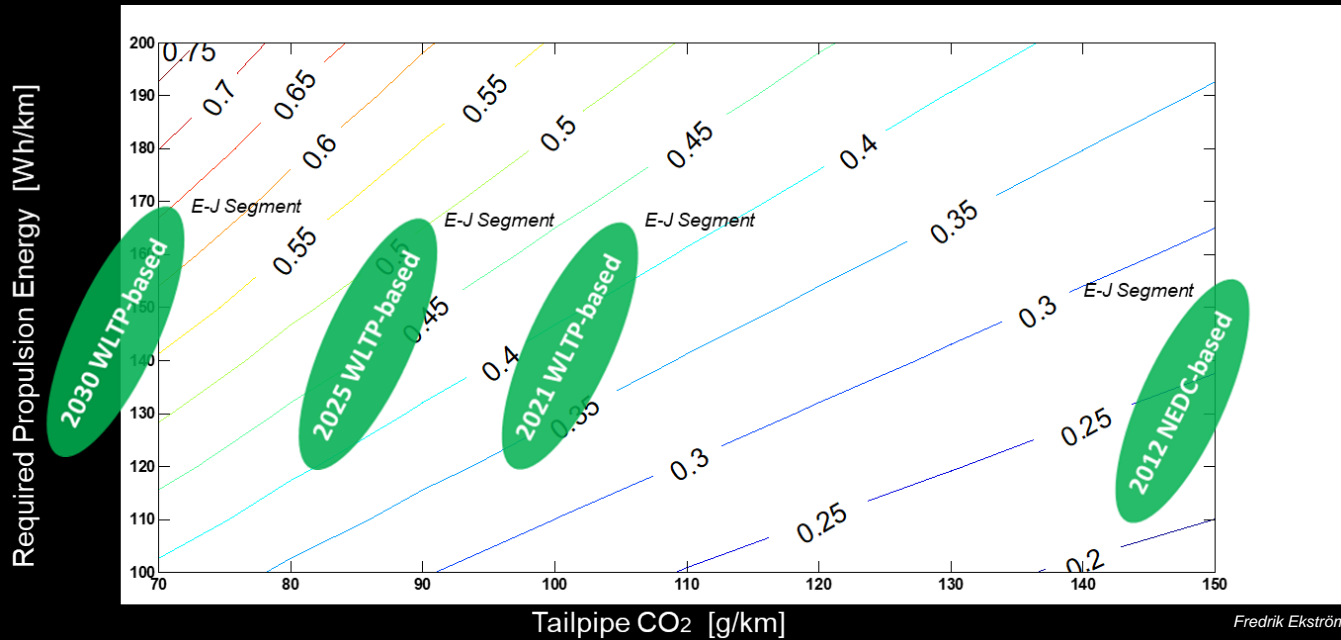
Britain to ban sale of all diesel and petrol cars and vans from 2040

Cold Start



ad vans from 2040 amid fears that : to public health.
dge in France, is part of the n, which has been at the heart of a

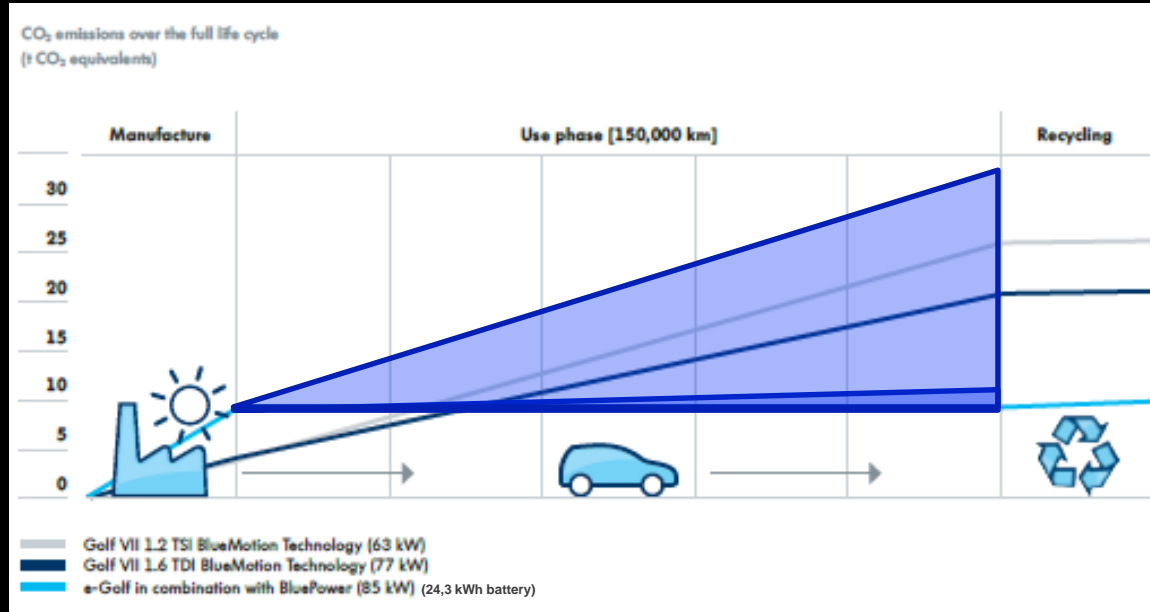
REQUIRED EFFICIENCY



Fredrik Ekström



WELL-TO-WHEEL & LIFE



Manufacturing
Batteries :
110 gCO₂/1 Wh**

**Driving* on
electricity** :
100 gCO₂/km**

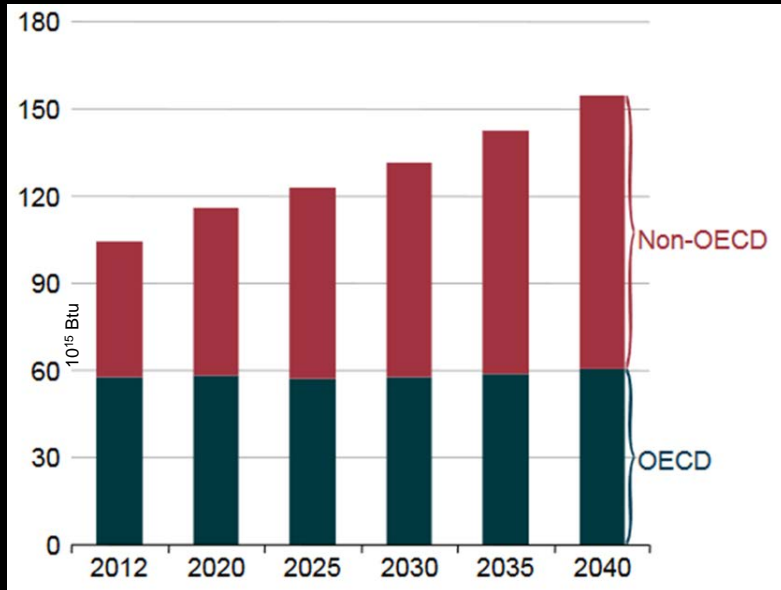
*WLTP driving

** Average/EUmix

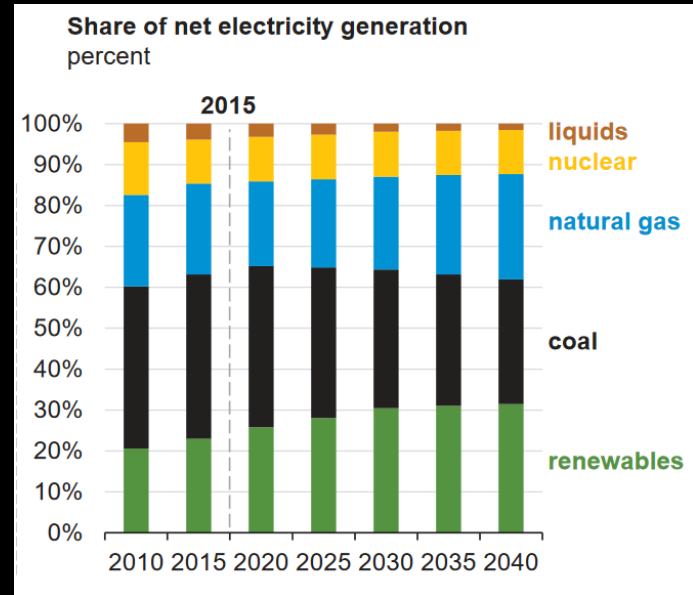
<http://www.greencarcongress.com/2015/06/20150620150608-garcia.html>

http://www.a-pointduurzaamheid.nl/files/4914/2348/7329/e_golf_Env_Comm.pdf

ENERGY CONSUMPTION



Source: U.S. Energy Information Administration | International Energy Outlook 2016

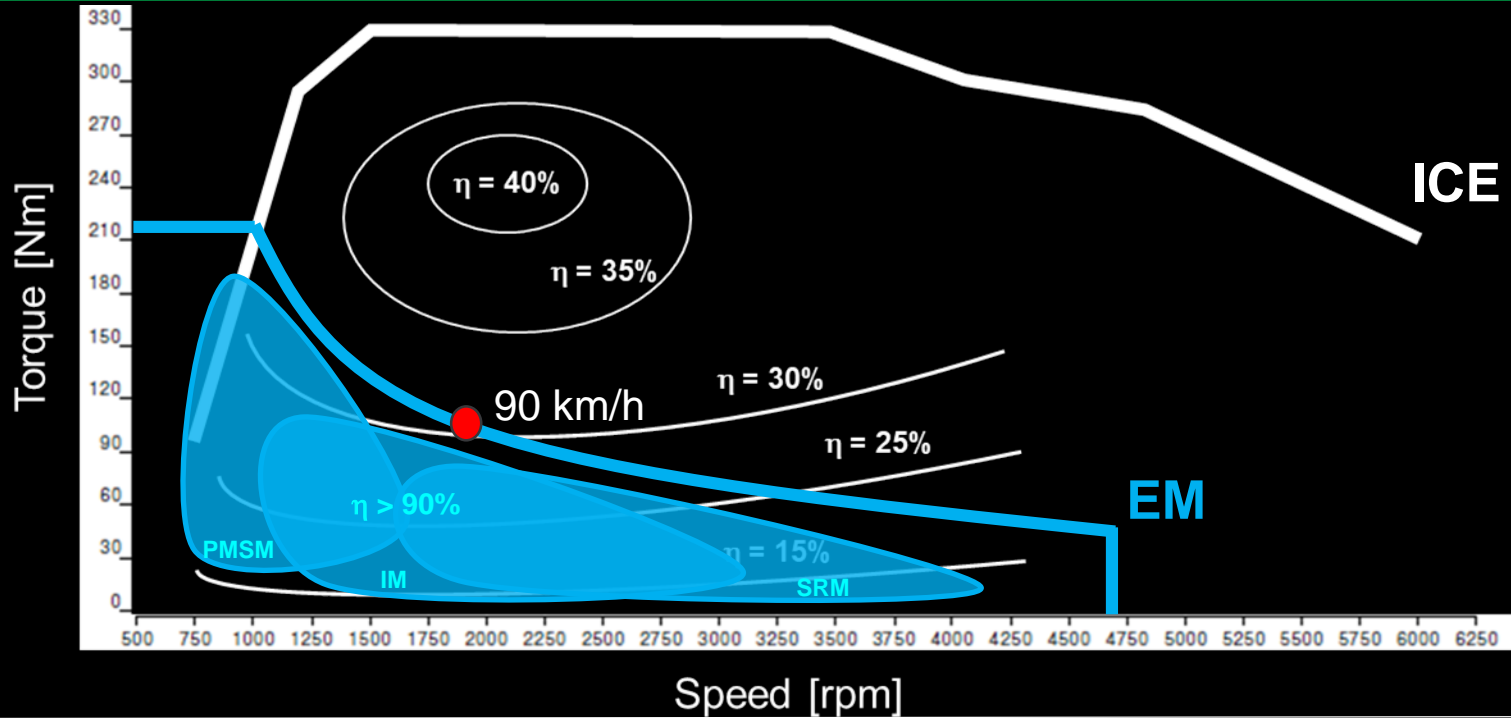


www.eia.gov/ieo 2017

What is the biggest hurdle for massive EV & PHEV adoption?



PROPULSION SYSTEMS



NEED NEW ENGINE OPTIMIZATION

Stop / start
Micro Hybrid



Mild
Hybrid



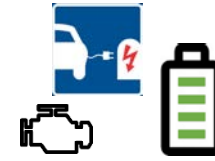
Full
Hybrid



Plug-in
Hybrid



Battery Electric
Vehicle with Range
Extender



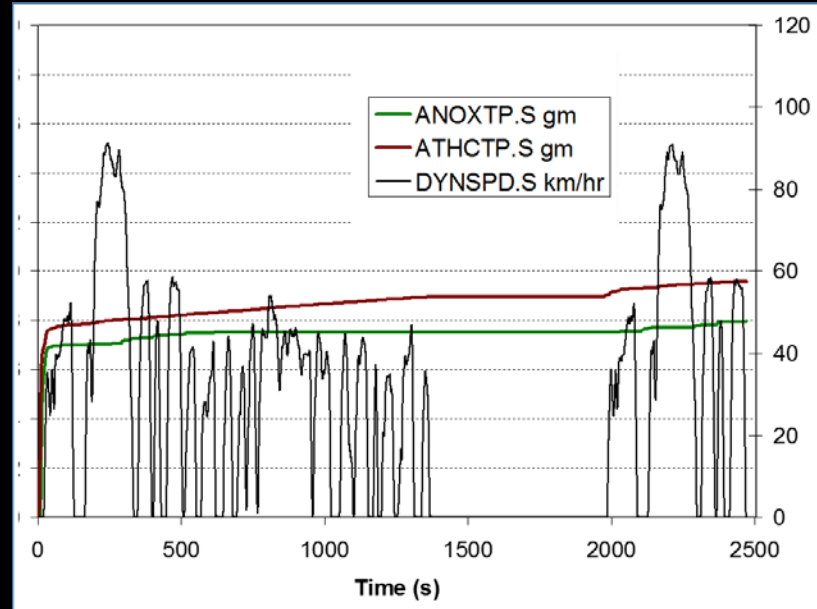
Battery Electric
Vehicle

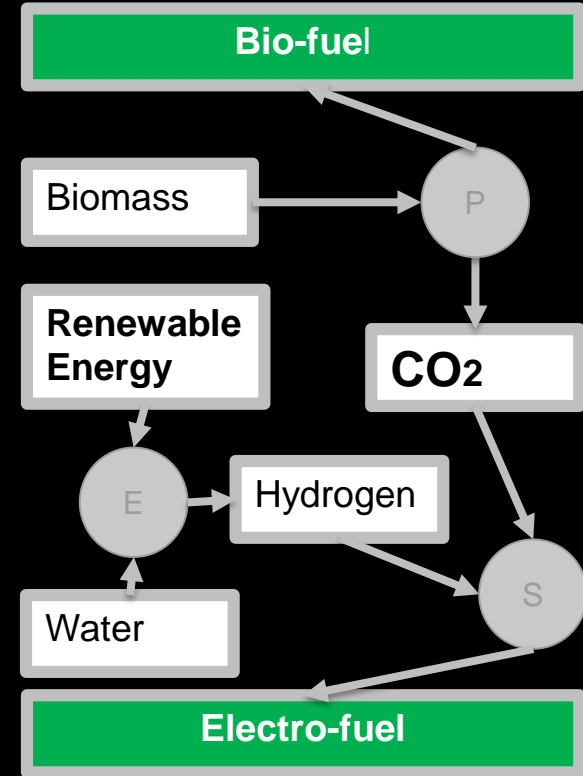
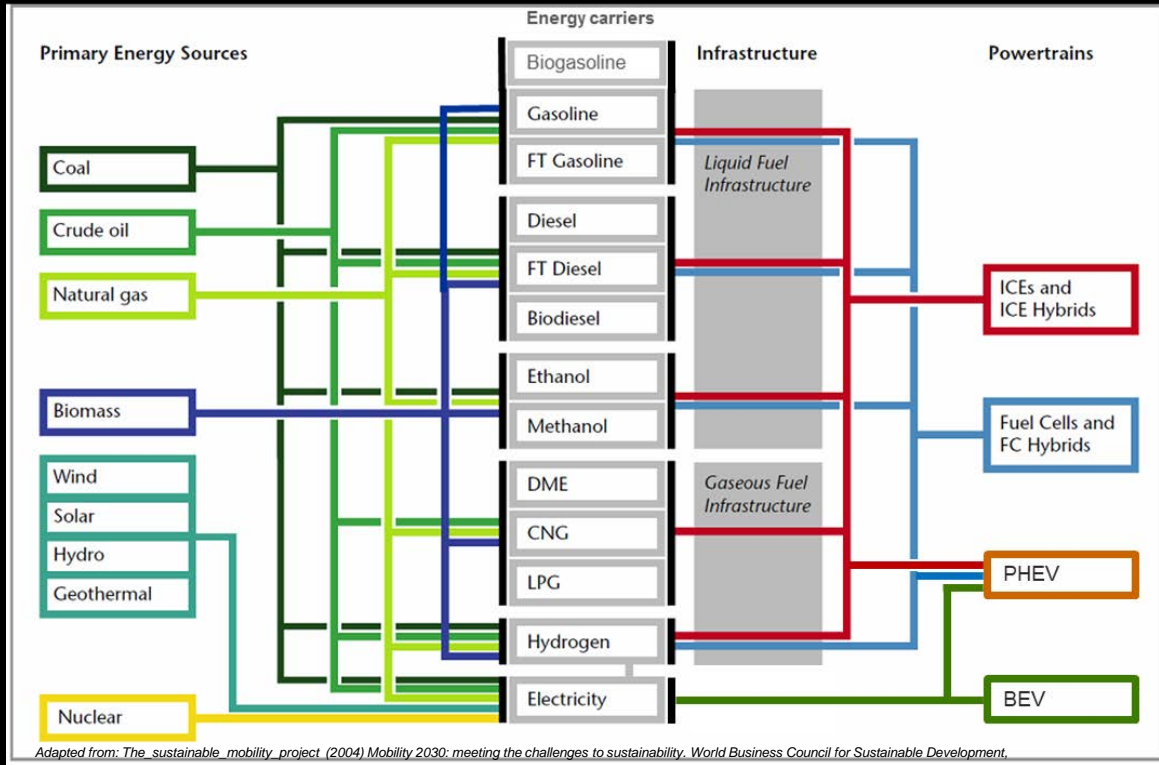


Increased vehicle cost, battery size, weight



STANDARD EMISSIONS





POSSIBLE TO CLEAN EXISTING FLEET!

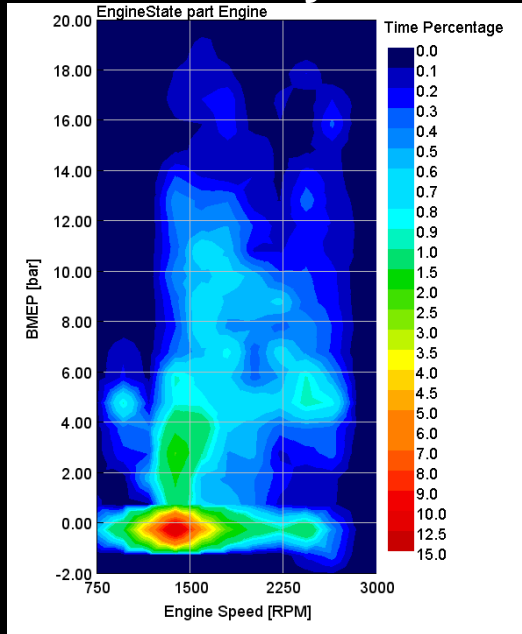
Josefine Preuss & Tankai Zhang



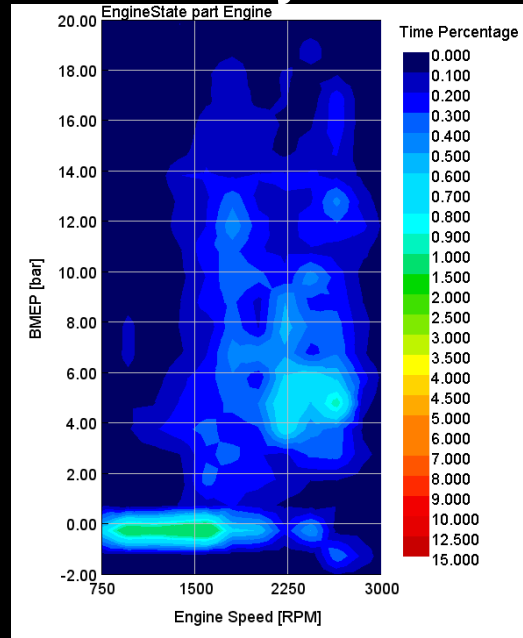
LYNK & CO on CTH HYBRID TEST-RIGG

ENGINE OPERATION REAL DRIVING

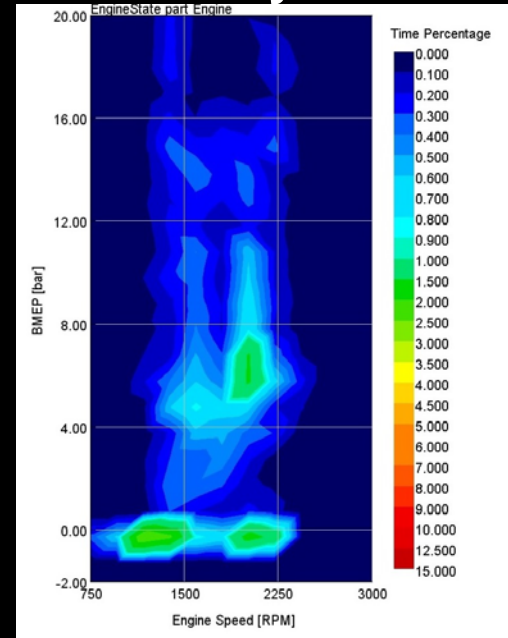
Micro Hybrid



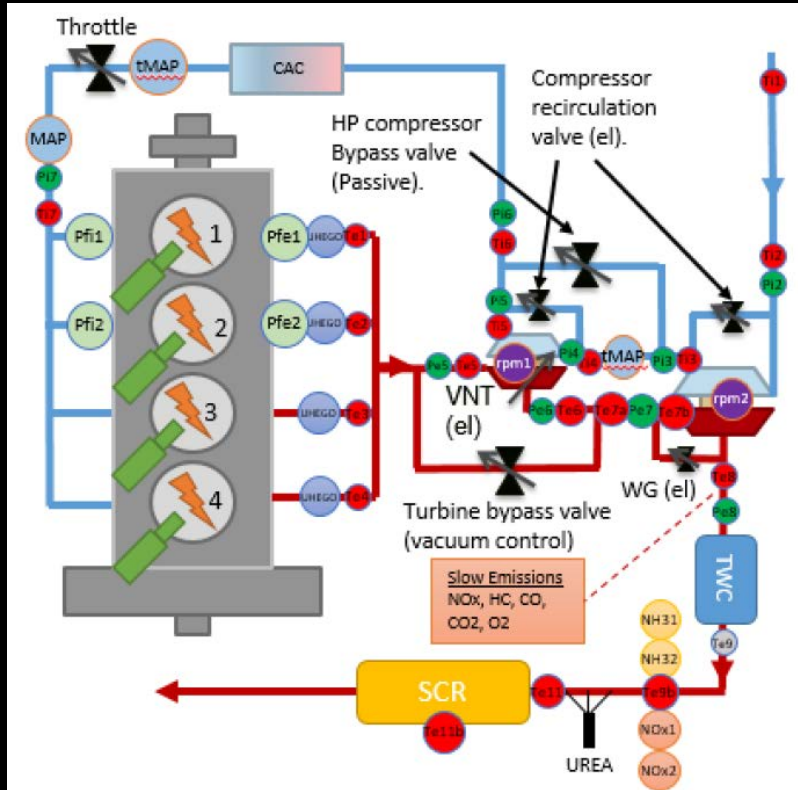
Mild Hybrid



Full Hybrid

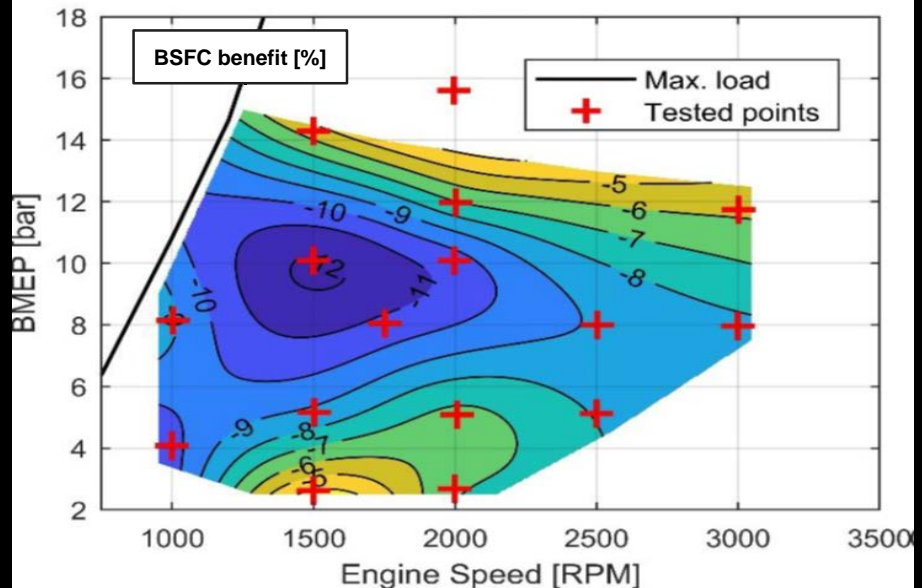


Mindaugas
Melaika &
Sarp Mamikoglu



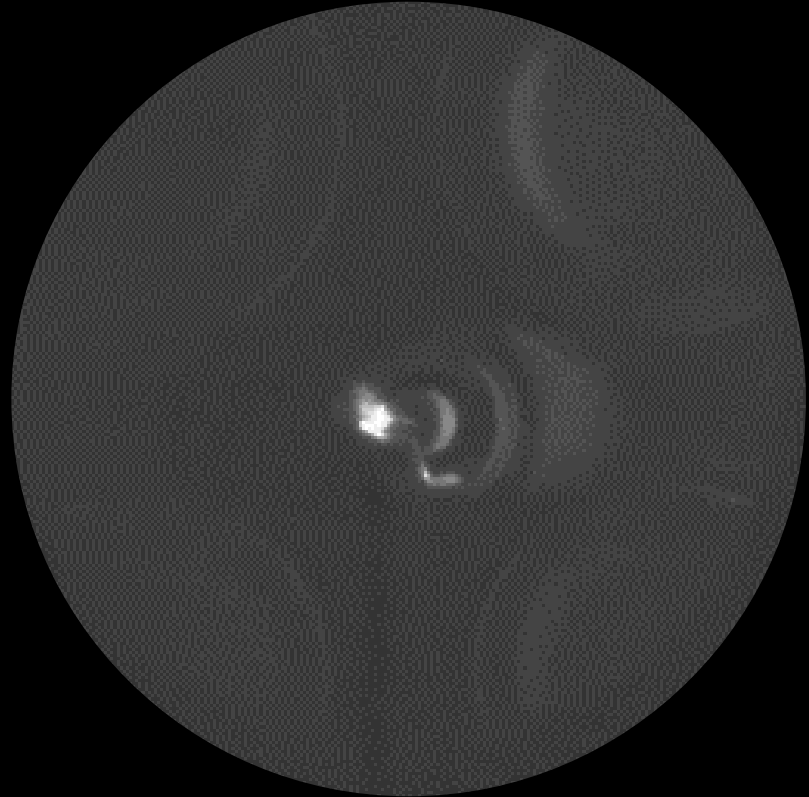
HOMOGENEOUS LEAN

with Two-Stage Turbocharger

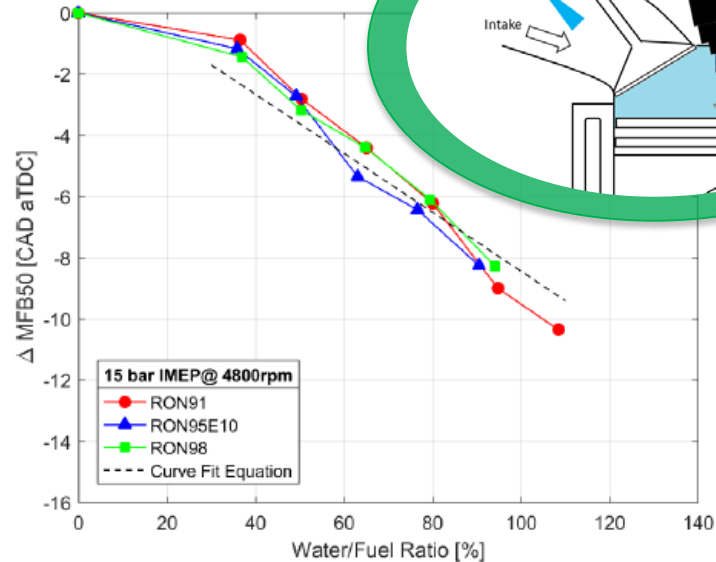
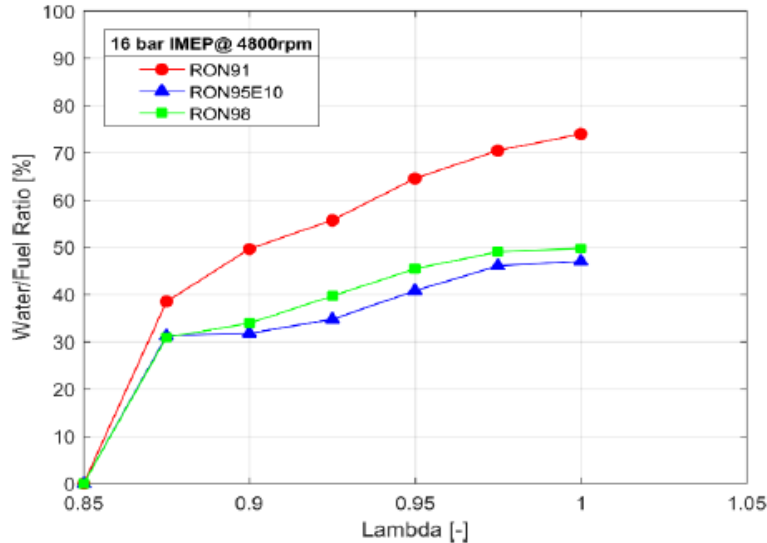
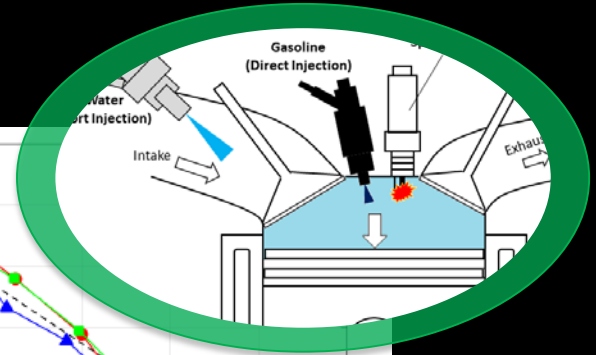


Kristoffer Clasén

ENGINE KNOCK



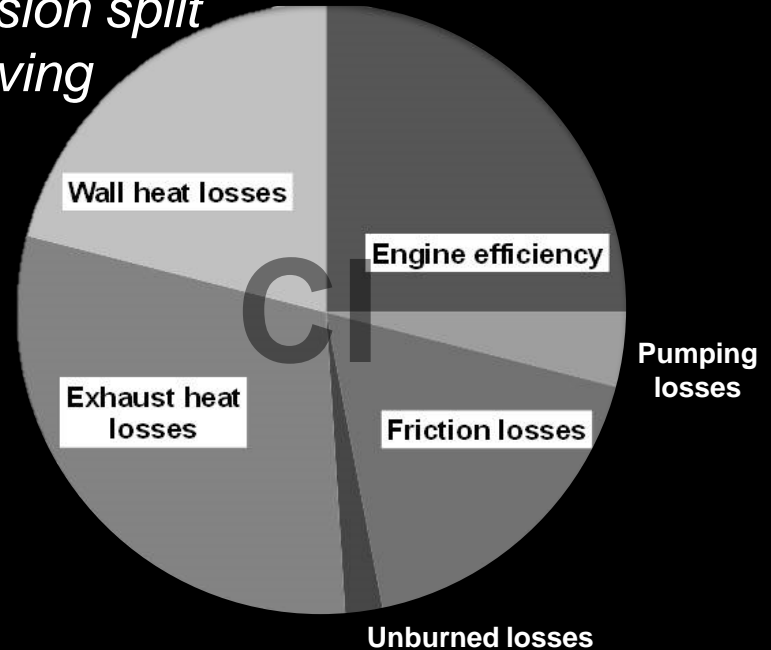
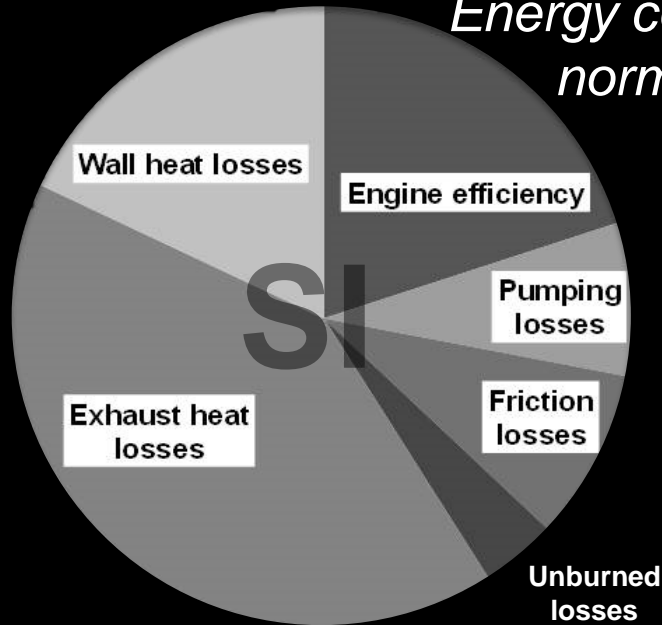
WATER INJECTION

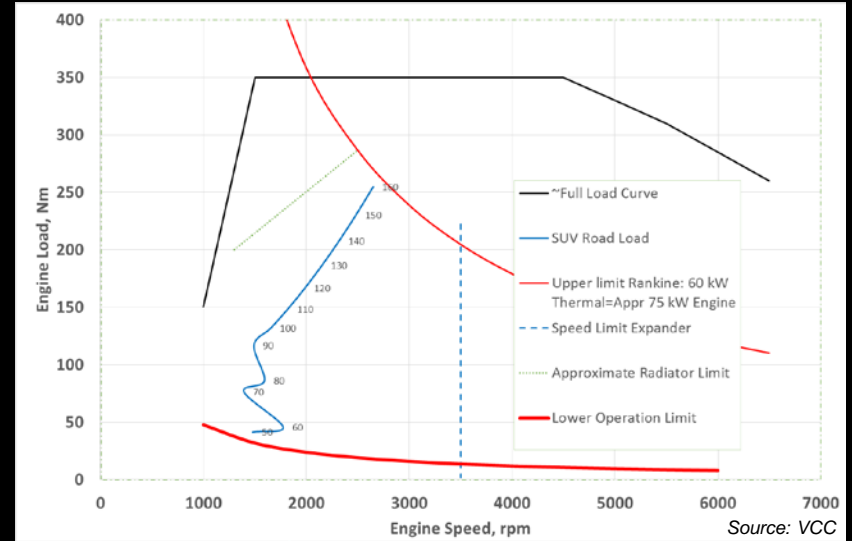


Jayesh Khatri

ENGINE eff. IMPROVEMENT POTENTIAL

*Energy conversion split
normal driving*

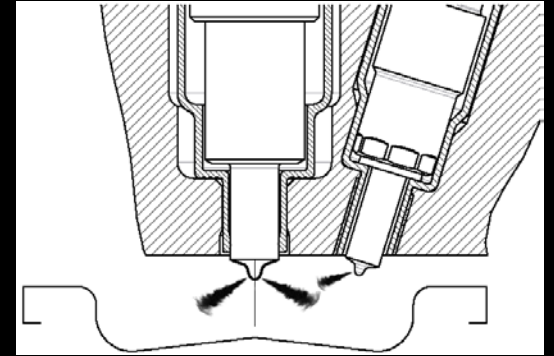
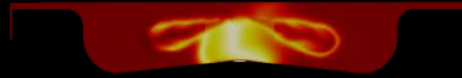
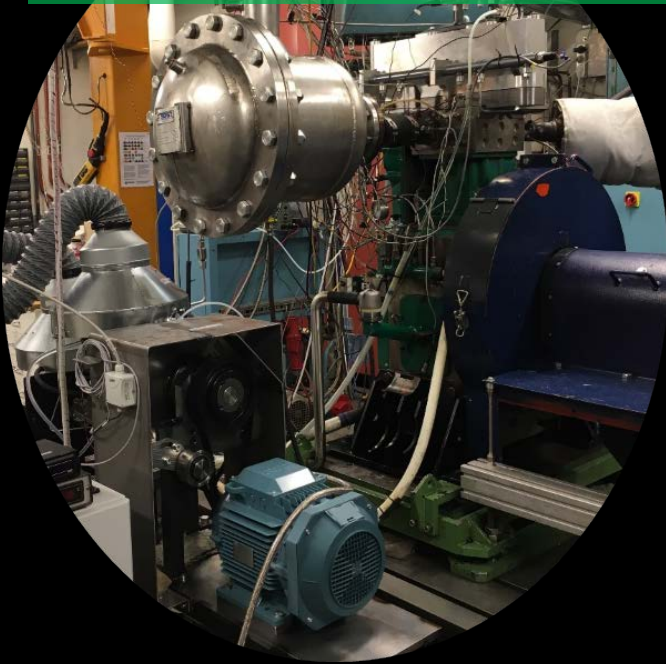




Technology / Cycle	NEDC	WLTP	FTP-75	US06	HWFET	130 km/h
Waste heat recovery	0-1%	3-4%	4%	6-7%	5-6%	10%

Fredrik Ekström & Jelmer Rijpkema

BIO-DIESEL and -METHANOL

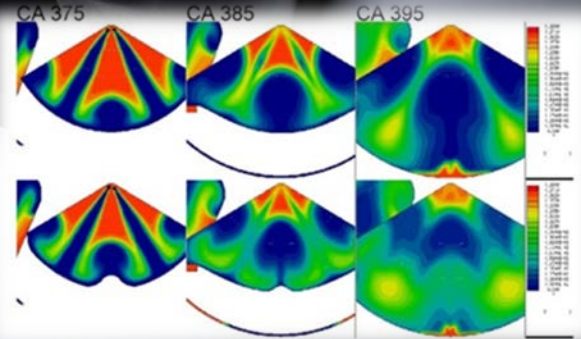


Lower Emissions

Michael Saccullo & Andreas Nygren



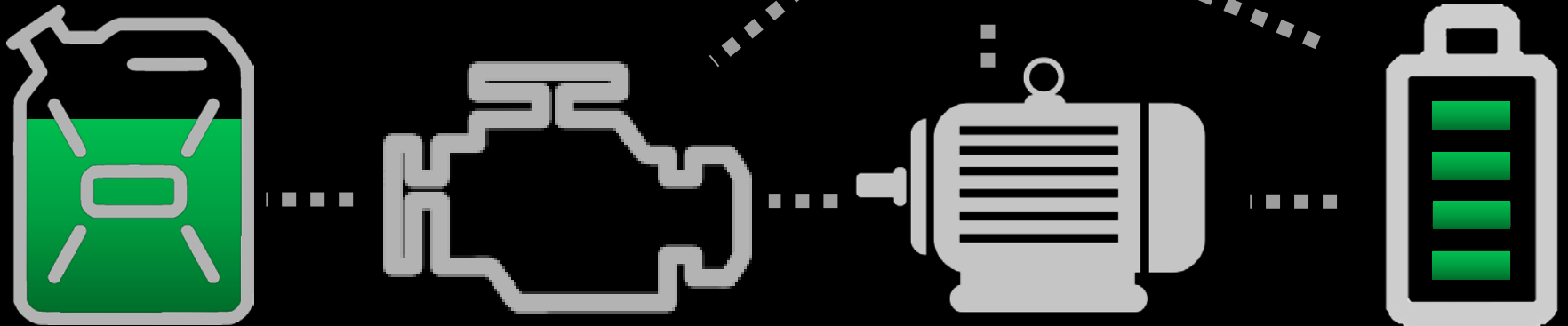
Developed with VOLVO AB
2 % better fuel economy
Halved particulate emissions



Jan Eismark

CONTINUOUS OPTIMIZATION

Energy and Emissions management



Ali Ghanaati

THE NEW COMBUSTION ENGINE LIFE:

**Electrified
Connected
Renewable fuels**

For a SUSTAINABLE FUTURE

Sreelekha Etikyala



CHALMERS
UNIVERSITY OF TECHNOLOGY