



Decarbonising transport: The role of advanced biofuels in future transport options

European Biofuels Technology Platform (EBTP)
7th Stakeholder Plenary Meeting (SMP7)
Brussels June 21st, 2016

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Main conclusions

- Deep decarbonisation of transport will require a wide range of measures
- One single energy carrier cannot meet all needs
- It is not electric vehicles vs. biofuels, it is both electric vehicles and biofuels!
- Liquid biofuels are among the most versatile energy carriers
- Revolution gets more attention than evolution
 - e.g. the hype regarding electric vehicles
 - evolution of engines and fuels has brought us tremendous improvements in performance and emission reduction
 - now we have to focus on energy efficiency and CO₂ emissions
 - advanced biofuels offer a fast track to decarbonisation

Outline

- Emission and energy targets in transport
- Ways of reducing transport greenhouse gas emissions
- Definition of advanced biofuels
- Performance of biofuels
- Cost effectiveness of various measures to reduce greenhouse gas emissions
- Summary



The 2011 EU White Paper on Transport

- A vision for a competitive and sustainable transport system
- Growing transport and supporting mobility while reaching a 60% GHG emission reduction target
- Ten goals grouped in three main groups:
 - **Developing and deploying new and sustainable fuels and propulsion systems**
 - Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes
 - Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives



EU climate and energy packages 2020/2030



2020 climate & energy package

- Policy
- Documentation
- Studies
- FAQ
- Links

The 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020.

The package sets three key targets:

- 20% cut in **greenhouse gas** emissions (from 1990 levels)
- 20% of EU energy from **renewables**
- 20% improvement in **energy efficiency**

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the [Europe 2020 strategy](#) for smart, sustainable and inclusive growth.

10 % renewable energy in transport by 2020



EU leaders agree 2030 climate and energy goals

24/10/2014



EU Heads of State and Government have agreed the headline targets and the architecture for the EU framework on climate and energy for 2030. The agreed targets include a cut in greenhouse gas emissions by at least 40% by 2030 compared to 1990 levels, an EU-wide binding target for renewable energy of at least 27% and an indicative energy efficiency target of at least 27%. The decision underlines the European Union's position as a world leader in the fight against climate change. The agreed greenhouse gas target will be the EU's contribution to the global climate change agreement due to be concluded in Paris next year. The renewables and energy efficiency targets will increase the security of the EU's energy supplies and help reduce its dependency on imported fossil fuels.

Greenhouse emissions – a cut of at least 40%

The framework contains a **binding target** to cut emissions in EU territory by **at least 40%** below 1990 levels by 2030.

This will enable the EU to:

- take cost-effective steps towards its long-term objective of cutting emissions by 80-95% by 2050 in the context of necessary reductions by developed countries as a group,
- make a fair and ambitious contribution to the [new international climate agreement](#), to take effect in 2020.

To achieve the at least 40% target:

- [EU emissions trading system](#) (ETS) sectors would have to cut emissions by **43%** (compared to 2005) – to this end, the [ETS is to be reformed and strengthened](#)
- non-ETS sectors would need to cut emissions by **30%** (compared to 2005) – this needs to be translated into individual binding targets for Member States.

Non-ETS GHG -30 %

No target for renewable energy in transport 2030!



Finland, a land of solutions

Strategic Programme of
Prime Minister Juha Sipilä's Government
29 May 2015

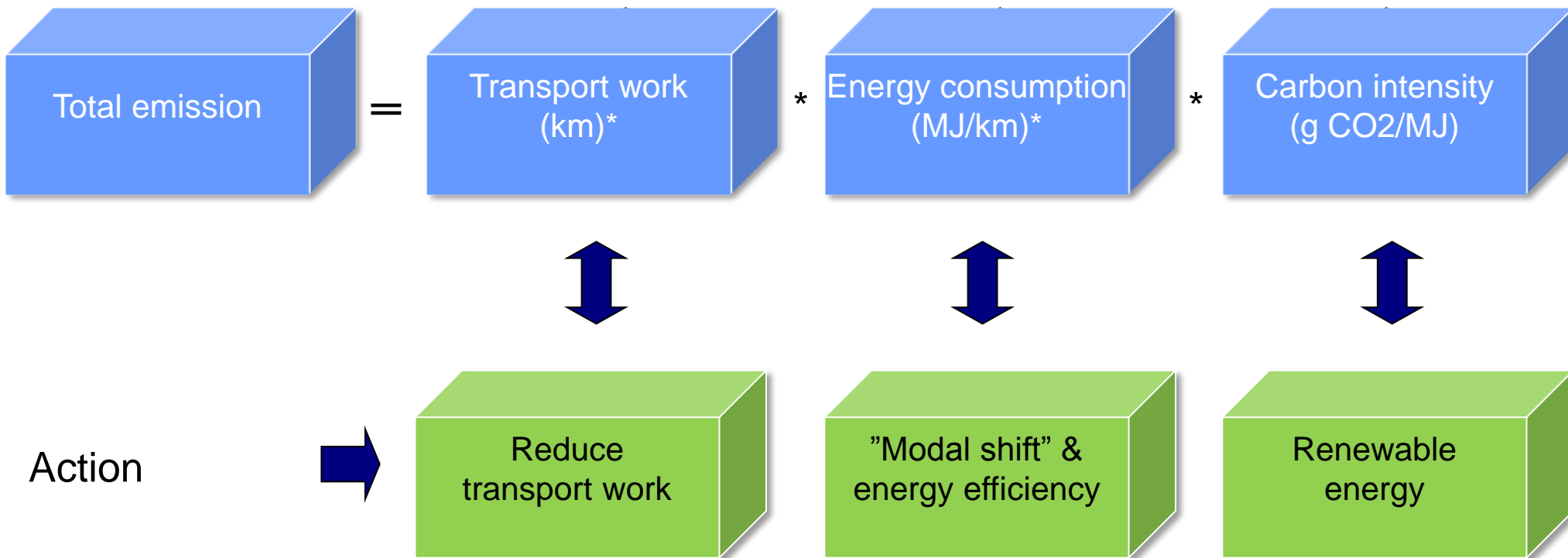
Ten-year objective:

- Finland is a pioneer in the bioeconomy, circular economy and cleantech. By developing, introducing and exporting sustainable solutions we have improved the balance of current accounts, increased our self-sufficiency, created new jobs, and achieved our climate objectives and a good ecological status for the Baltic Sea.

Transport:

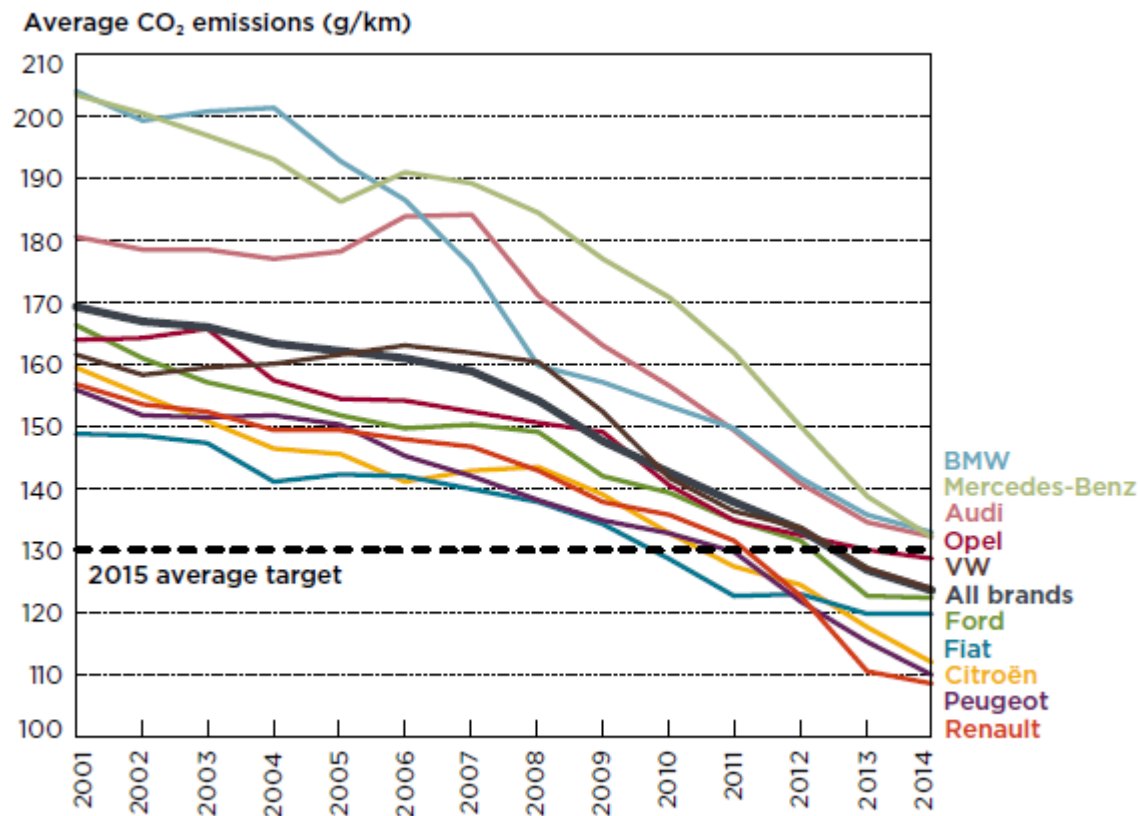
- The use of imported oil will be cut in half during the 2020s
- The share of renewable transport fuels will be raised to **40** per cent by 2030

Reducing CO₂ emissions



*passenger km/ton km

The power of vehicle regulations



ICCT European Vehicle Market Statistics 2015/2016







Renewable energy for transport

- The options are:
 - Liquid and gaseous biofuels
 - Renewable electricity
 - Renewable hydrogen
 - Electrofuels
 - Power-to-gas
 - Power-to-liquids





Alternative Fuels for Transport

	<i>Road</i>						<i>Air</i>	<i>Rail</i>	<i>Water</i>		
											
Range	<i>Urban</i>	<i>Medium</i>	<i>Long</i>	<i>Short</i>	<i>Medium</i>	<i>Long</i>			<i>Inland</i>	<i>Short sea</i>	<i>Maritime</i>
Natural gas					LNG	LNG	✗		LNG	LNG	LNG
Electricity		✗	✗		✗	✗	✗			✗	
Biofuels											
Hydrogen						✗	✗				✗

Liquid biofuels and methane are the most versatile alternatives!

Alternative fuel vehicle registrations within EU

	EVs BEV + PHEV	HEVs	Gaseous fuels
2014	69 996	176 525	238 666
2015	146 161	217 261	218 713
Change	+109 %	+23 %	-8 %
Total share	1.0	1.5	1.5

Total EU 28 registrations 14.4 million units
<http://www.acea.be/statistics>



Biofuels in the EU

BIOFUELS BAROMETER

A study carried out by EurObserv'ER.



Biofuel consumption for transport picked up in Europe after a year of uncertainty and decline, increasing by 6.1% over 2013, to 14 million toe (Mtoe) according to EurObserv'ER's first estimates. However it is still below its 2012 level when 14.5 Mtoe of biofuel was incorporated. Consumption of biofuel that meets the European Renewable Energy directive's sustainability criteria rose to 12.5 Mtoe, its highest level so far.

4.9%

the biofuel incorporation rate in European Union transport in 2014 (in energy content)

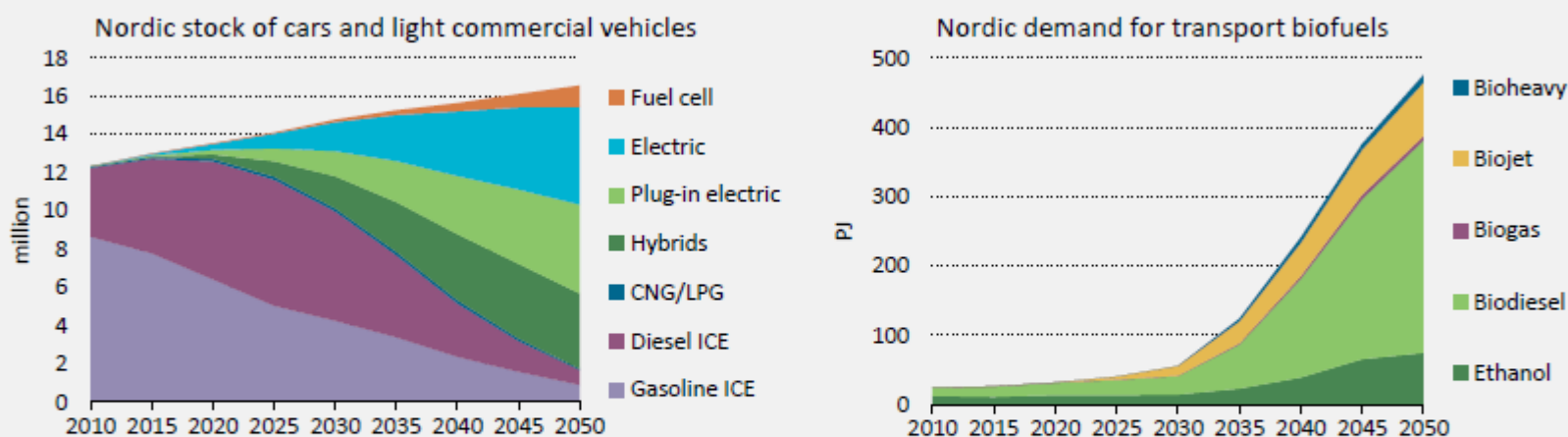
14 Mtoe

total biofuel consumption in European Union transport in 2014

Towards carbon free transport in the Nordic countries

Figure ES.7

Transformation of Nordic vehicle stocks and biofuel demand in the CNS



Figures and data in this report can be downloaded at www.iea.org/etp/nordic.

Key point

The CNS requires an almost complete phase-out of fossil-fuelled cars and a rapid roll-out of EVs, especially in urban areas. Biofuel imports are needed to decarbonise long-distance transport modes.

“Long-distance transport is less suited to electrification than urban transport and will require biofuels or significant advances in competing low-carbon technologies”

Benefits of biofuels

- Biofuels can serve all modes of transport
- The best of biofuels are fully compatible with existing and future vehicles and infrastructure
- Biofuels offer a fast track to transport decarbonisation
- Mandates can effectively bring biofuels to the market

Renewable Fuel Standard Program



Need help with this new site?
 Questions on the new website for the Renewable Fuel Standard program?
 Changes made to the new website for the Renewable Fuel Standard program.

1 2 3

EPA United States Environmental Protection Agency

Proposed 2017 Percentage Standards

Cellulosic biofuel	0.173%
Biomass-based diesel	1.67%
Advanced biofuel	2.22%
Renewable fuel	10.44%

<https://www.epa.gov/renewable-fuel-standard-program/proposed-renewable-fuel-standards-2017-and-biomass-based-diesel>

Definition of advanced biofuels

- Should not be based on food crops
- Should not raise environmental concern in any way
- Should have high processing efficiency
- Should be cost effective
- Should not cause any problems in distribution and end use**
- Should be compatible with existing and future vehicles**

- No one has yet presented an unambiguous definition of advanced biofuels!

No fuss alternative for diesel vehicles: Paraffinic diesel

- Many alternative feedstocks
- Alternative processing routes
- A true drop-in alternative, up to 100 %
- No modifications to infrastructure or vehicles
- No storage issues
- “By-pass lane” to decarbonisation



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

FINAL DRAFT
FprEN 15940

Standard to be finalised
June 2016

January 2016

ICS 75.160.20

Will supersede CEN/TS 15940:2012

English Version

22/06/2015

Volvo city buses and intercity buses ready for HVO

by Press release

Volvo Buses' Euro 6 engines for city buses and intercity buses have now been certified to run on HVO, a renewable fuel that replaces regular diesel. The fuel copes with storage and low temperatures in the same way as regular diesel, and reduces CO2 emissions by up to 90 per cent.

The engines that have been certified to use Hydrogenated Vegetable Oils (HVO) are the 5-litre and 8-litre Euro 6 engines *. Volvo Buses also approves HVO as a fuel for all buses with Euro 5 engines, with no reduction in service interval. This means that the majority of newer Volvo buses can now run on renewable fuel with very low environmental impact.

"This is an important step that gives customers who have access to HVO the opportunity to greatly reduce their climate impact while keeping the same high level of reliability and availability," says Edward Jobson, Environmental Director for Volvo Buses.



Green light for HVO-use in Scania Euro 6 range

8 OCTOBER 2015
[Press releases](#) | [Press room](#)

Scania has given the green light to hydrotreated vegetable oil (HVO) being used to power its Euro 6 range, provided the fuel used meets technical specification TS15940. Vehicles using HVO – which chemically mimics fossil-fuel-based diesel – can under optimal condition achieve up to a 90-percent reduction in CO2 emissions. HVO does not affect a vehicle's characteristics or its maintenance



From February 2016: approval for Hydrotreated Vegetable Oil (HVO)

Press Information

Mercedes-Benz truck models approved for alternative fuel HVO

22 February, 2016

- Approval for trucks with heavy-duty OM 470, OM 471 engines as well as medium-duty OM 936 and OM 934 variants
- Use of HVO validated by extensive testing; maintenance intervals unchanged
- The HVO raw material is sourced from controlled and certified cultivation facilities and as such does not compete with foodstuff production
- Clean, economical and powerful: engines from Mercedes-Benz

23/06/2016

Renewable paraffinic diesel brings about GHG reductions as well as reductions in local emissions

□ In older vehicles (Euro I...III) and mobile machinery, paraffinic diesel typically delivers:

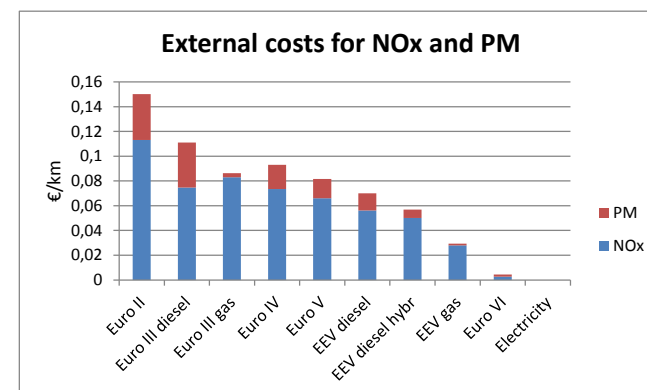
- 10 % reduction in NO_x emissions
- 30 % reduction in PM emissions
- 80 % reduction in PAH emissions

□ Euro VI heavy-duty vehicles are extremely clean

- Emission control technology determines emissions, not fuel composition
- However, high quality fuels are needed to sustain very low emission levels
- Paraffinic diesel puts less burden on the exhaust clean-up system than regular diesel

Emission performance of paraffinic HVO diesel fuel in heavy duty vehicles

Kimmo Erkkilä & Nils-Olof Nylund, VTT
 Tuomo Hulkkonen & Aki Tilli, Aalto University
 Seppo Mikkonen, Pirjo Saikkonen, Neste Oil
 Reijo Mäkinen, Helsinki Region Transport
 Arno Amberla, Proventia Emission Control

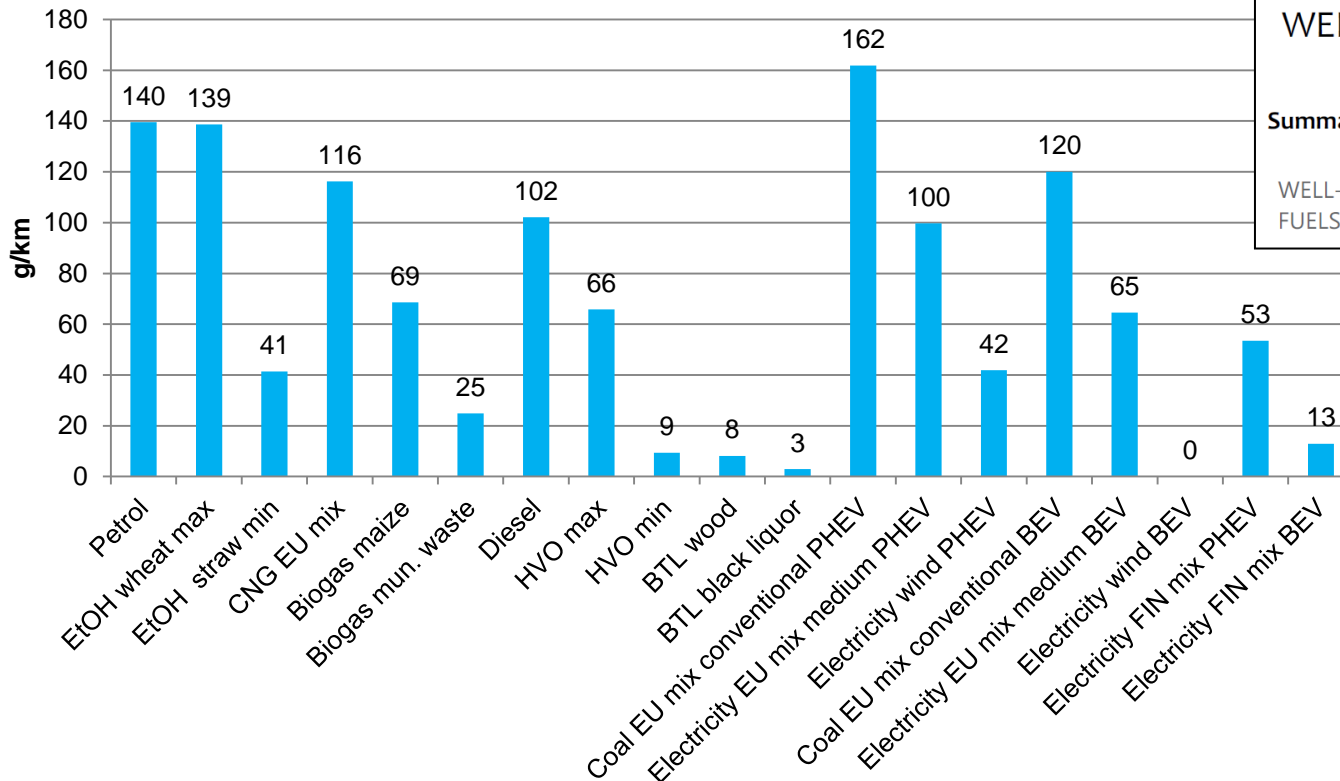



VTT data & Directive 2009/33/EC

Well-to-wheel CO₂ emissions

Passenger car WTW CO₂ emissions

C-category vehicle, performance values by the manufacturer,
fuel data JEC Well-To-Wheels Analysis 2014



J R C T E C H N I C A L R E P O R T S

WELL-TO-TANK Appendix 2 - Version 4a

Summary of energy and GHG balance of individual pathways

WELL-TO-WHEELS ANALYSIS OF FUTURE AUTOMOTIVE FUELS AND POWERTRAINS IN THE EUROPEAN CONTEXT



40% Reduction of Carbon Dioxide Emissions from Transport by 2030: Propulsion Options and Their Impacts on National Economy

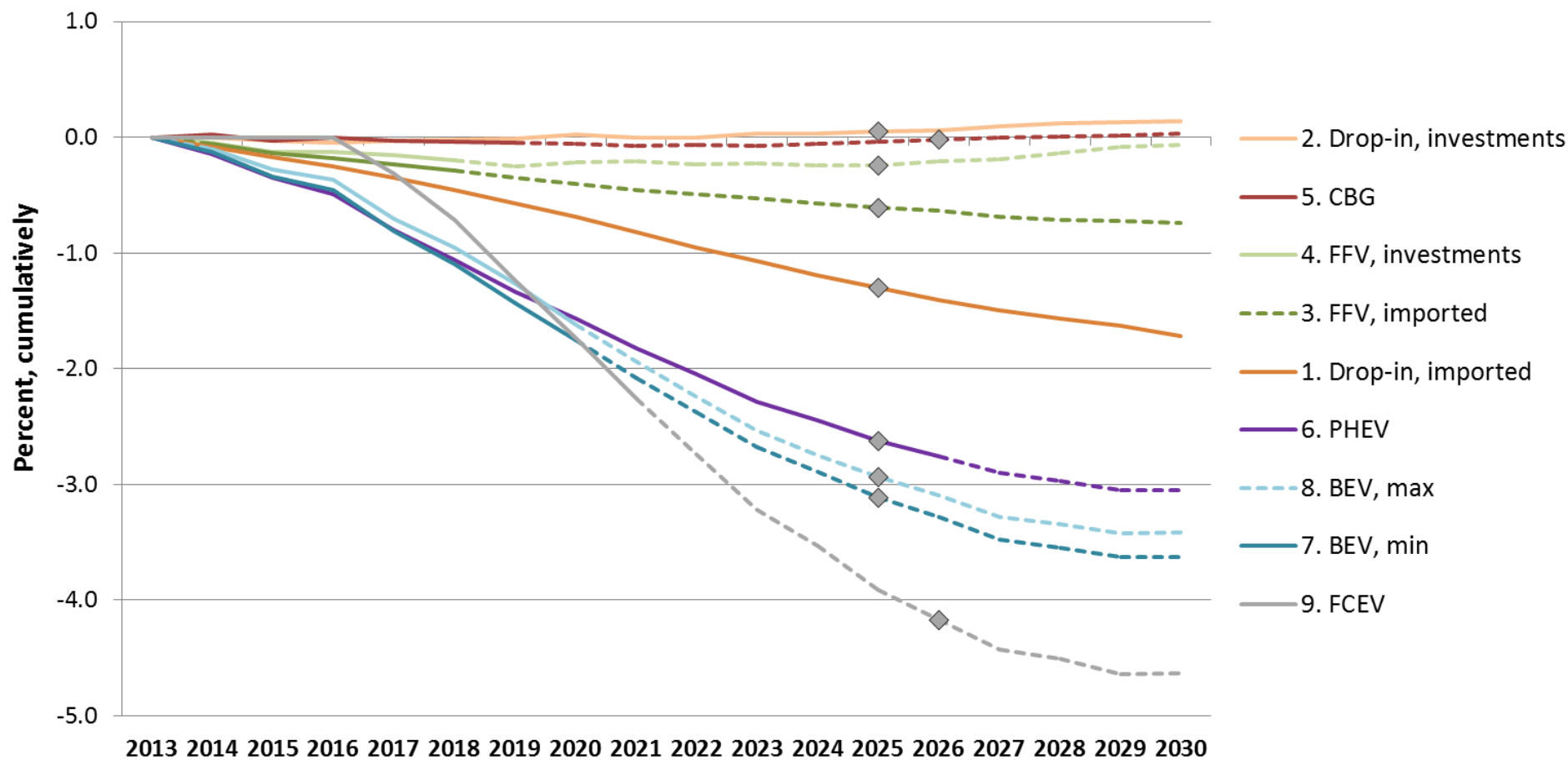
A joint study by VTT and VATT, the Government Institute for Economic Research



Impact on GDP

The outcome is specific for Finland but the methodology used is universal

Change in GDP, %, in comparison to baseline scenario



Please observe:

- General increase in GDP from 2005 to 2030 predicted at 30 %
- Curves for EVs and FCVs sensitive to price



DAIMLER

HONDA

NEOT
North European Oil Trade

NESTE

OMV
OMV

TOYOTA



VOLKSWAGEN
AKTIENGESELLSCHAFT

st1

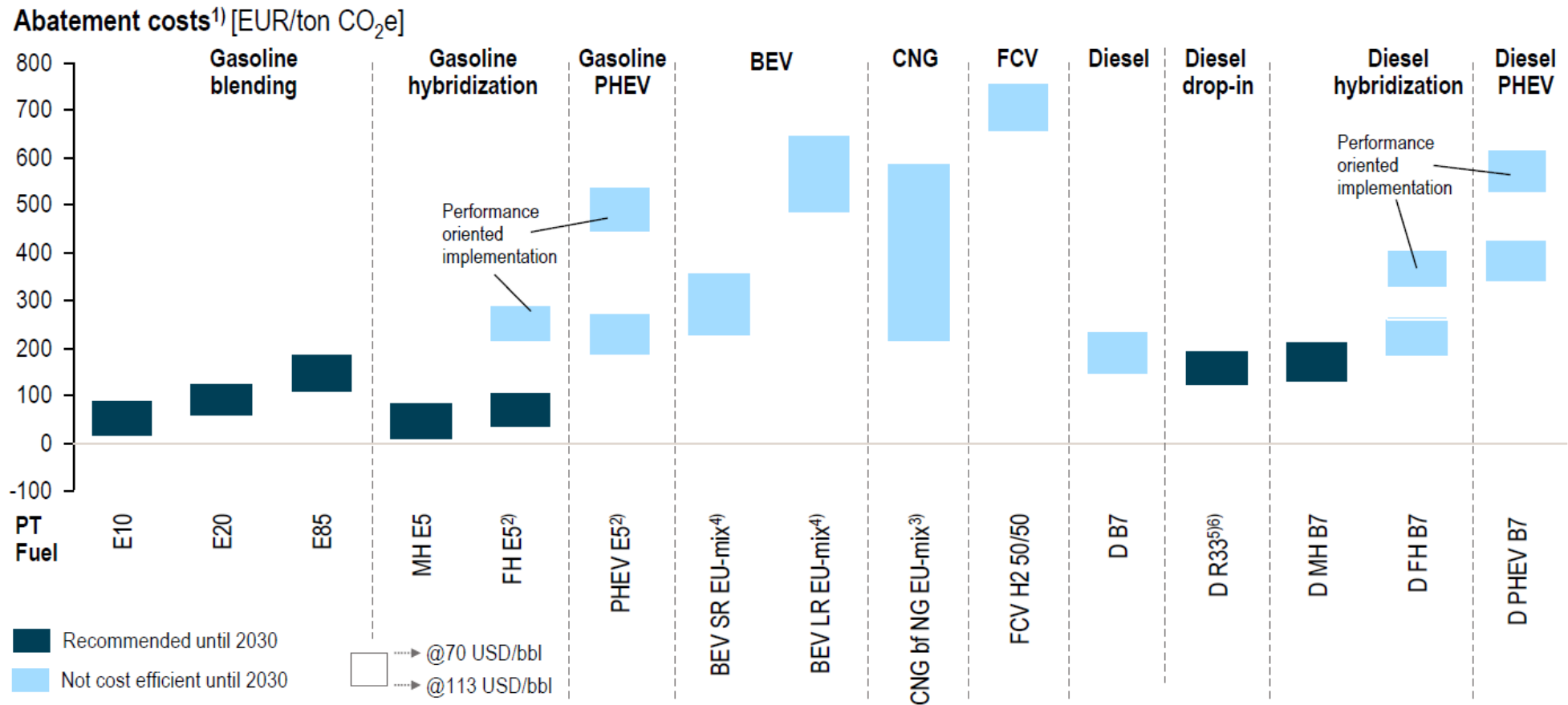


Integrated Fuels and Vehicles Roadmap to 2030+

Study results

http://www.rolandberger.com/media/pdf/Roland_Berger_Study_Integrated_Fuels_and_Vehicles_Roadmap_to_2030_v2_20160615.pdf

Figure 5: WTW GHG abatement costs pathways, C-segment PCs 2030 [EUR/ton CO₂e]

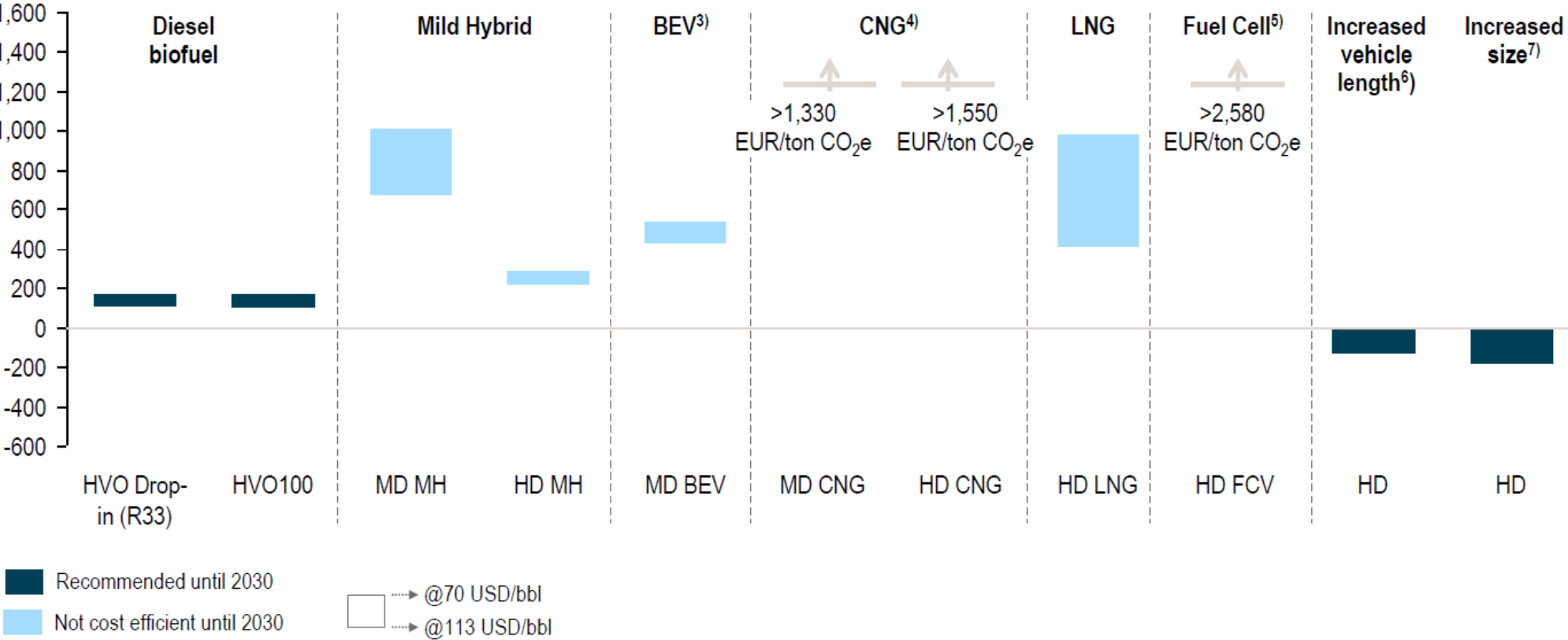


1) Compared to optimized Gasoline powertrain 2030 using E5, all technologies with 250,000 km lifetime mileage 2) 30% e-driving, higher e-driving share reduces abatement costs
 3) Large range between scenarios driven by decoupling effect of natural gas price 4) Risk of higher abatement costs due to need of second battery over lifetime, SR – short range with 35 kWh battery capacity, LR – long range with 65 kWh battery capacity, both using 2030 EU mix electricity, 5) Diesel fuel with 7% FAME and 26% HVO
 6) Abatement cost in existing vehicle: -67 EUR/ton CO₂ (high oil price), 7 EUR/ton CO₂ (low oil price)

Source: Roland Berger

Figure 6: WTW GHG abatement costs pathways of medium- and heavy duty vehicle 2030 [EUR/ton CO₂e]

Abatement costs [EUR/ton CO₂e]



1) Medium duty 2) Heavy duty 3) Exclusion of HD BEV due to incompatibility of BEV range with long haul requirements 4) High CO₂ abatement costs for CNG and LNG within MD/HD/City Bus s result from low quantities of vehicles (missing economies of scale) and CO₂ abatement potential compared to Diesel is small (<5% savings/km) 5) High system cost and low lifetime mileage in medium duty trucks causes very high abatement cost , therefore incompatibility 6) Increased efficiency due to aerodynamic measures to reduce drag 7) Length and gross vehicle weight increase, increased transport efficiency by 10%

Summary

- Deep decarbonisation of transport will require a wide range of measures
- One single energy carrier cannot meet all needs
 - It is not electric vehicles vs. biofuels
 - It is both electric vehicles and biofuels!
- Biofuels can serve all modes of transport, road, rail, marine and air
- The automotive manufacturers are now starting to see the value of high quality fungible biofuels
- At least until 2030, biofuels seem to be more cost effective than electrification in reducing GHG emissions
- Advanced biofuels can offer a fast track to decarbonisation



TECHNOLOGY «FOR BUSINESS»

