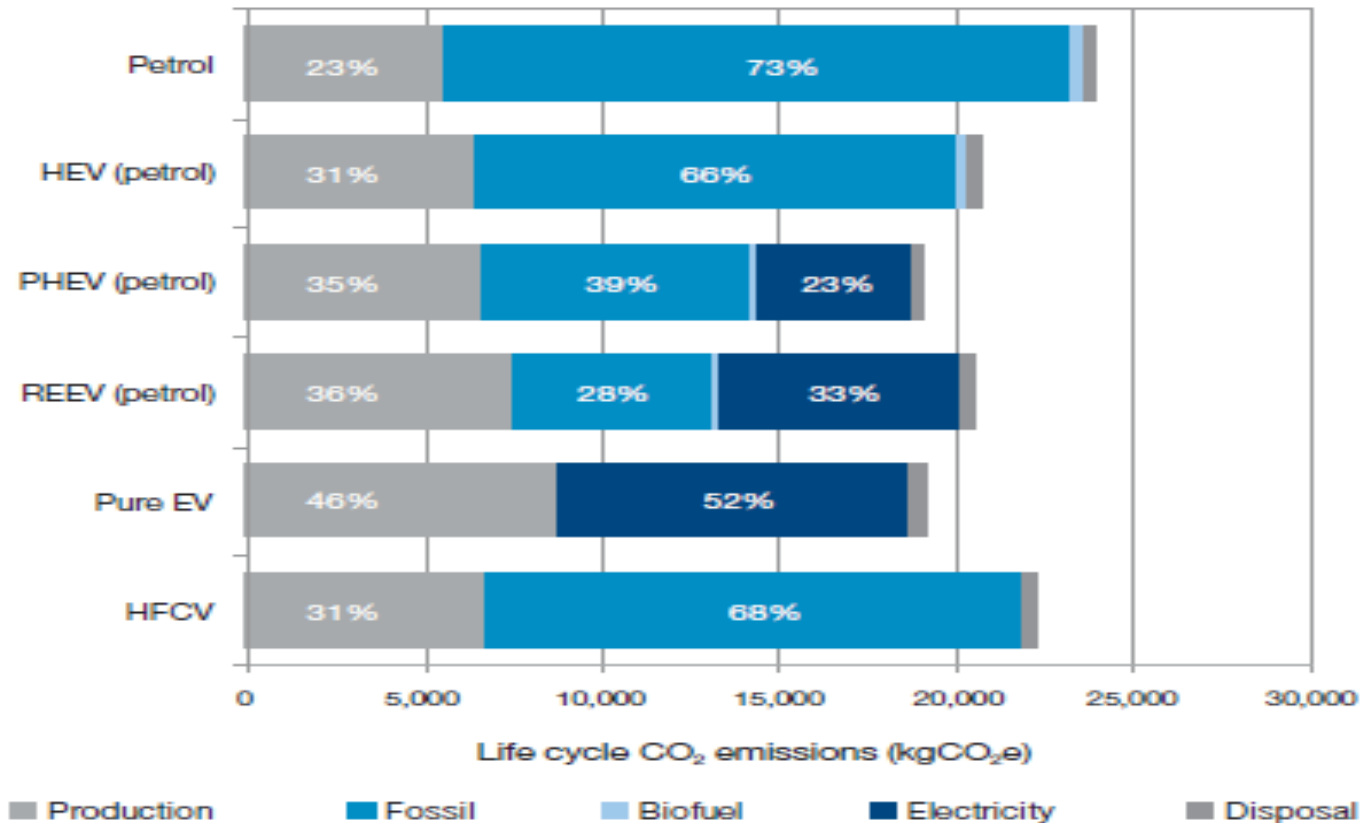


***“BEYOND THE TAILPIPE”***  
**Developing a route-map for policies  
to whole-life carbon savings**

**Andy Eastlake - LowCVP**

# 2011 – LowCVP highlights technology variations

Figure 2.4: Life cycle CO<sub>2</sub>e emissions for various medium-sized vehicle technologies in 2015



Source: Ricardo (2011)

Preparing for a Life Cycle CO<sub>2</sub> Measure – Report for LowCVP 2011

# 2013 – LCA analysis gathers momentum

RICARDO-AEA

**Current and Future Lifecycle Emissions of Key 'Low Carbon' Technologies and Alternatives**  
Final Report

Naser Odeh  
Nikolas Hill  
Daniel Forster

Project carried out for the Committee on Climate Change (CCC)

17<sup>th</sup> April 2013

www.ricardo-aea.com

**Figure 4.10: Comparison of estimated average well-to-wheel greenhouse gas emissions in real-world conditions for various powertrains from 2010 to 2050**

Powertrain	2010 (gCO <sub>2</sub> e/km)	2025 (gCO <sub>2</sub> e/km)	2050 (gCO <sub>2</sub> e/km)
Petrol ICE	230	130	70
Diesel ICE	200	120	70
Petrol HEV	180	100	60
Diesel HEV	160	90	60
Petrol PHEV	160	80	30
Diesel PHEV	140	80	30
Petrol REEV	130	60	20
Diesel REEV	120	60	20
BEV	100	40	20
FCEV	120	60	20
H2FC PHEV	120	50	20
H2FC REEV	110	40	20
NG ICE	180	100	60
LPG ICE	200	110	60

Source: Ricardo-AEA (2012)

Powering Ahead  
The future of low-carbon cars and fuels

European Key, Nikolas Hill and Dan Newman  
Ricardo-AEA  
April 2013

**Figure 3.4: Estimated lifecycle emissions of different car technologies, now and in 2030**

Technology	Year	Manufacture	Transport	Operation	Infrastructure	Disposal
Petrol ICE car	Current	25	5	140	10	5
	2030	15	5	130	10	5
Petrol PHEV car	Current	30	5	130	10	5
	2030	15	5	70	10	5
BEV car	Current	55	5	50	10	5
	2030	25	5	10	10	5

Source: CCC analysis based on estimates developed by Ricardo-AEA.  
Notes: Base scenario. Reflects power sector decarbonisation over vehicle lifetimes. Assumes biofuels at their 2012 average levels for public refuelling stations.

**Reducing the UK's carbon footprint and managing competitiveness risks**  
Committee on Climate Change | April 2013

# *Manufacturers and legislators in harmony?*

## The shared agenda

- ❑ European Union recommendation 2013/179/EU -  
Developing the principles for Product Environmental Footprint (PEF)
  - Note this excludes ILUC consideration!
  
- ❑ SMMT 14<sup>th</sup> year of Sustainability Report
  - Energy and resources used in production
  - Year-on-year reductions
  - Covers over 95% of UK production
  - Includes Tier 1 suppliers
  
- ❑ Manufacturers' individual reports on LCA and sustainability



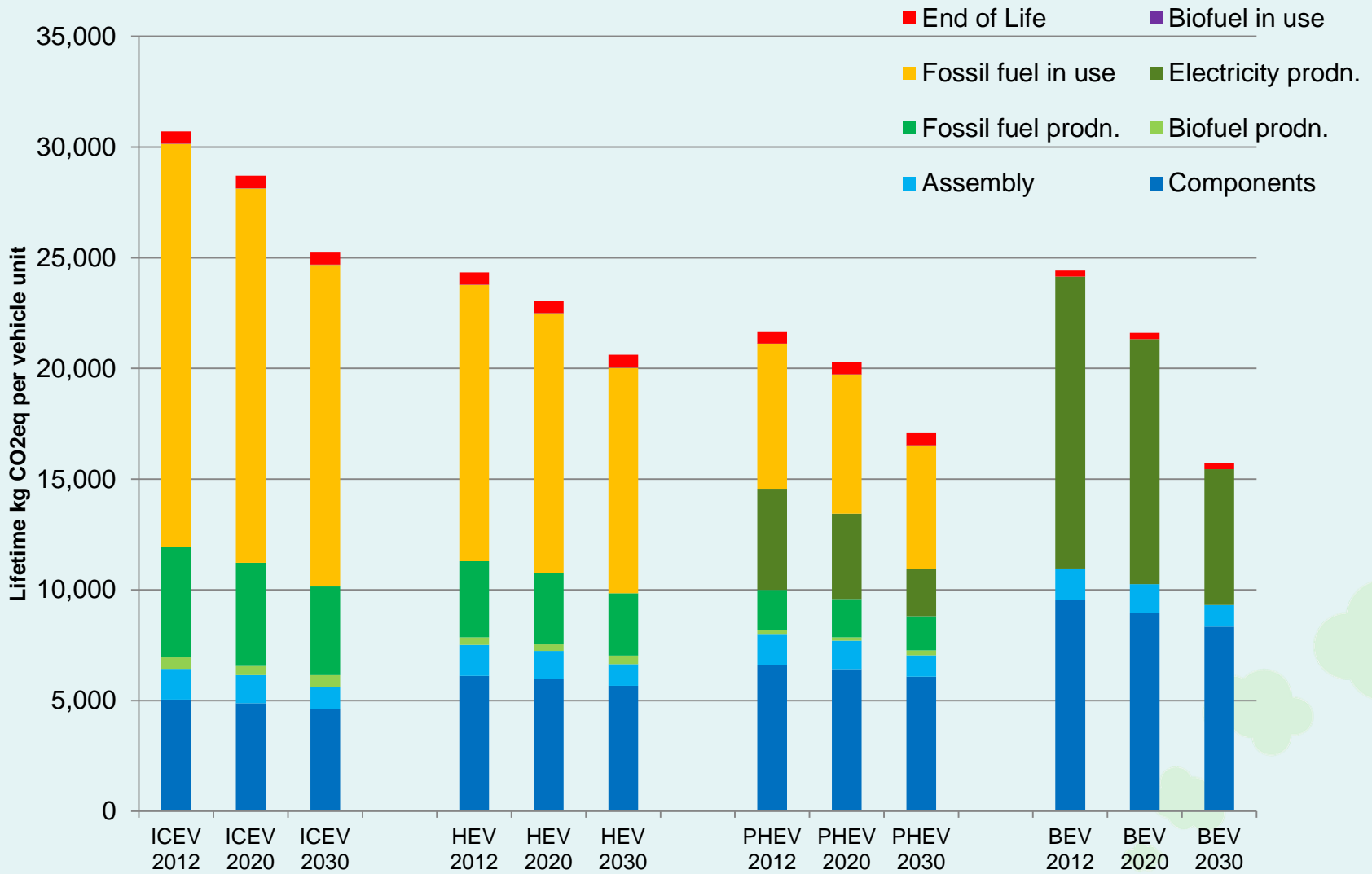
# ***LowCVP Report 2013 – released today***

Building on the previous LowCVP work:-

- To study how the change in technology will affect the life-cycle impact
- To identify the most carbon intensive phases of a vehicle life now and in the future
- To review key areas of sensitivity in input assumptions
  
- Considers four technology options
- (Petrol only) ICEV, HEV, PHEV, BEV
- From 2012, forecast for 2020, 2030
- Identifies potential of ‘best’ case options



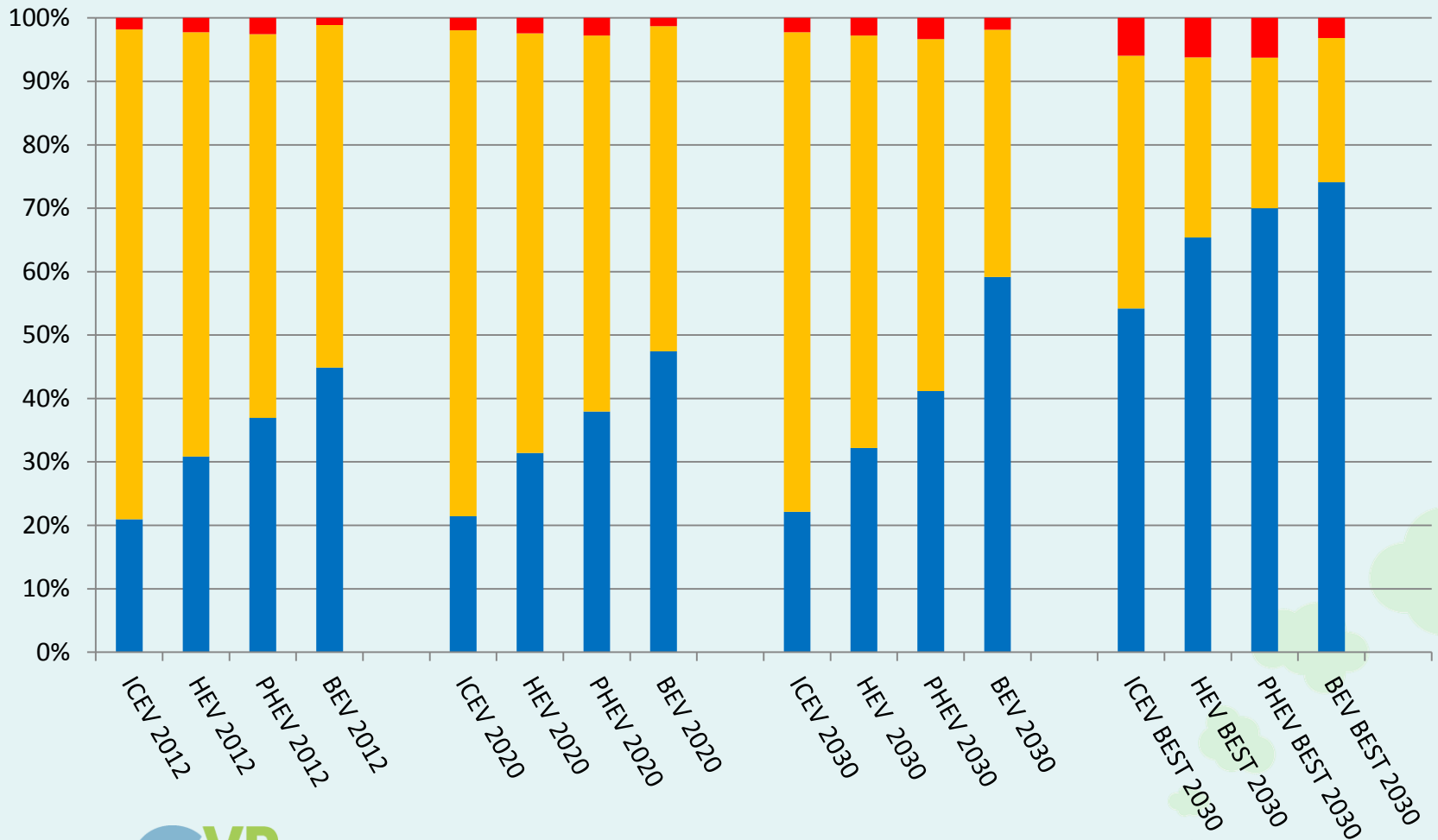
# Life-cycle impact improves with time.



# In-use phase still dominates before 2030

Proportion of Life Cycle CO<sub>2</sub>eq for primary phases

End of Life USE PRODUCTION



# ***Assumptions are critical***

Key assumptions used in this report

- GaBi 5 system developed by PE International, used by major OEMs with specified emission factors for each material
- Reducing carbon intensity of grid electricity for production and use
- Bioethanol blended in gasoline (E10 baseline)
- Driving cycle is NEDC
- Vehicle life 150,000km
- Progressive improvements in fuel consumption due to technology and light-weighting

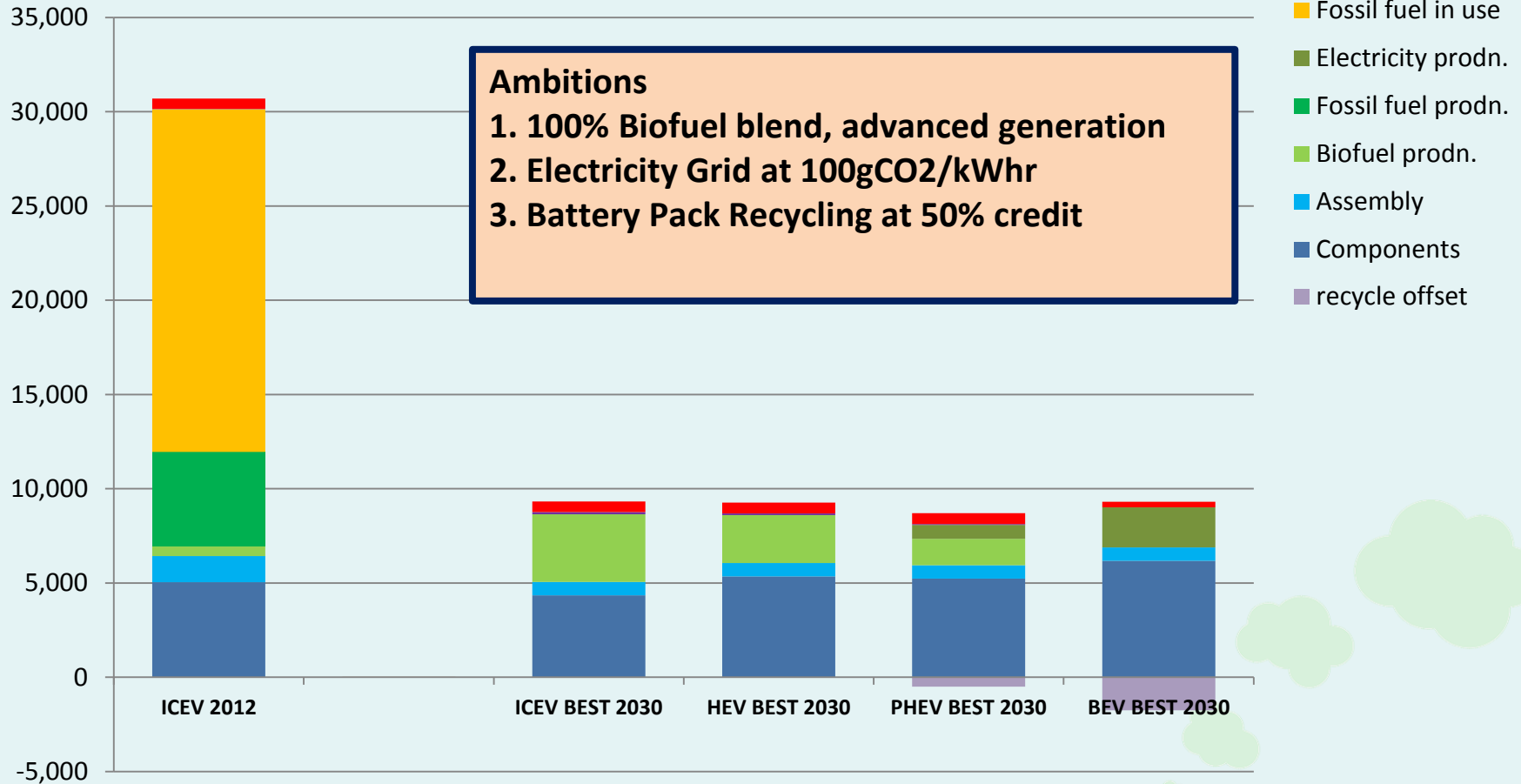
Sensitivity analysis

- Vehicle life to 300,000km (With battery replacement assumption)
- Light-weighting via aluminium or high strength steel
- Potential recycling benefit of traction battery packs



# Ambitious policies could deliver >65% reductions by 2030 for all technologies

CO<sub>2</sub>eq life-cycle impact 'best' case 2030  
using 'ambitious' policies

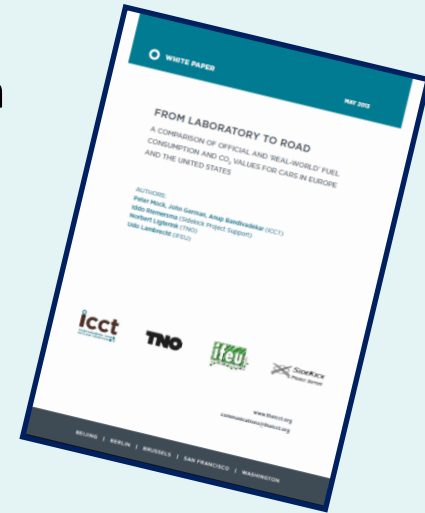


\*100g/CO<sub>2</sub>/kWhr relates to electricity generation at the point of consumption

## ***BUT ... real world fuel use higher than NEDC***

Recent reports have noted that consumers fuel consumption typically exceeds test cycle results by an average of 25%

- ❑ ICCT report May 2013 –25% average increase based on users own data input
- ❑ Emissions Analytics/WhatCar? True mpg - 25% higher



Interestingly the results are very consistent even though some data are from a large dataset of users own fuel measurements and other from on-road testing using Portable Emissions Measurement System (PEMS)

## ***BUT ... Well-to-Wheel assessment is needed***

No current options completely eradicate carbon from the fuel use chain, however all have significant opportunities to reduce carbon

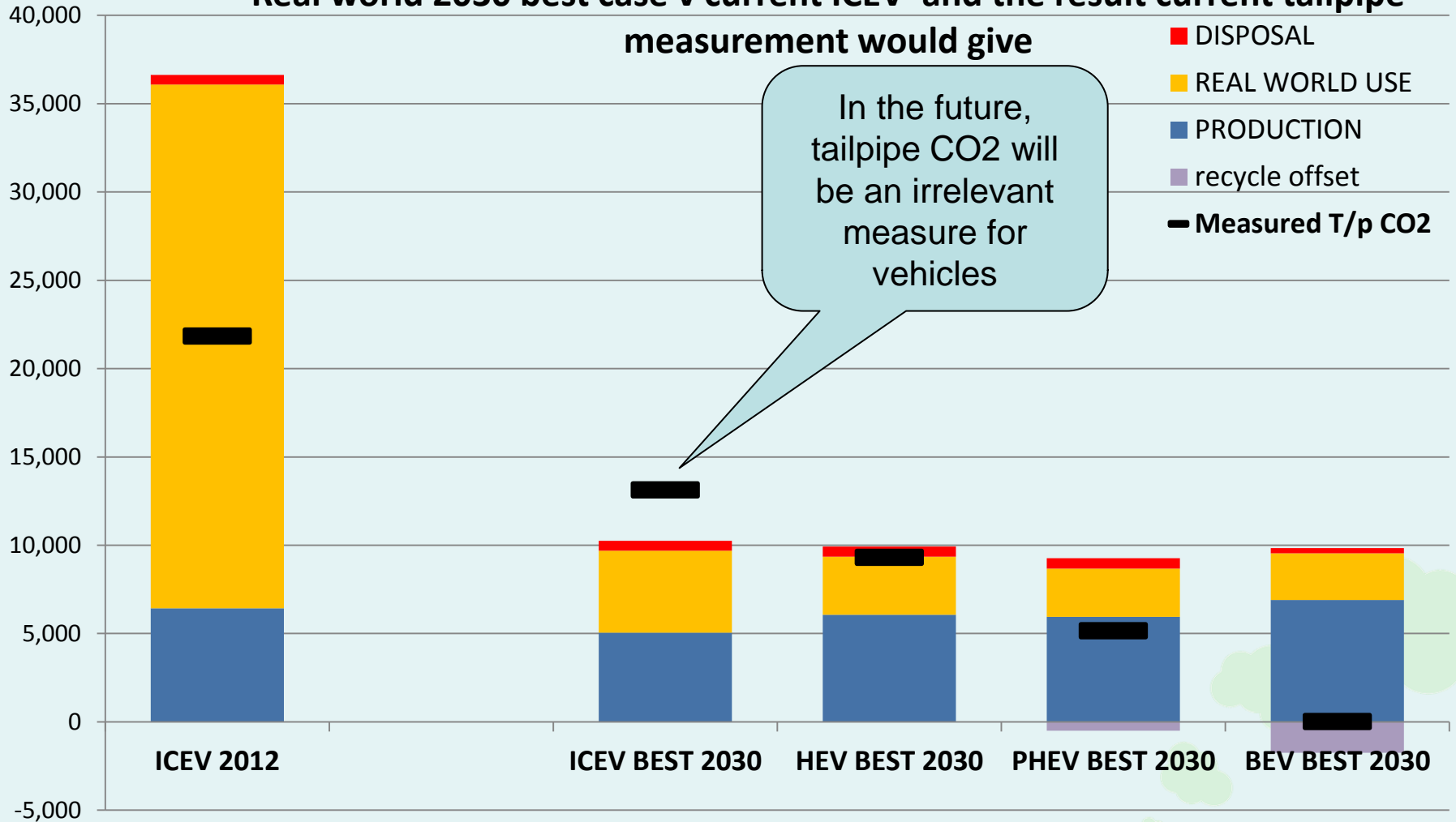
- Liquid fuels (petrol/diesel) – higher biofuel blends and substitution
- Electricity - renewables and the low carbon grid
- Gas – Biomethane
- Hydrogen – production from water electrolysis.

Only by combining a WTW approach **together** with in-use vehicle energy efficiency will the lowest carbon pathway for the use phase become apparent.

There is no single solution so keeping our options open allows optimum combinations and applications of transport energy pathways

# Tailpipe CO<sub>2</sub> is no longer representative

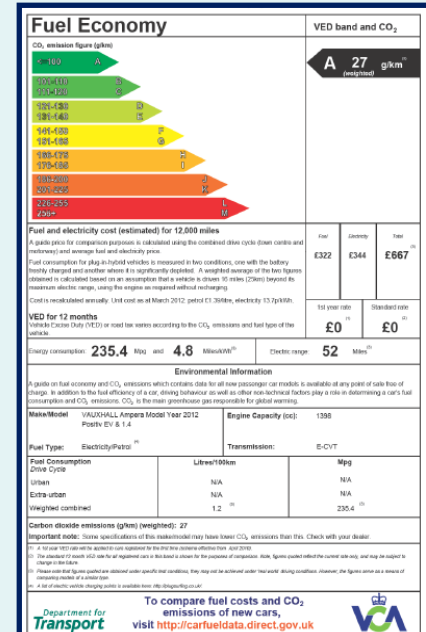
Real world 2030 best case v current ICEV and the result current tailpipe measurement would give



# What we are doing now?

The LowCVP work programme is taking on the challenge

- ❑ Consumer label revised for new technology, further research on-going
- ❑ Buses already use WTW, GHG, real world – focus now is growing the market
- ❑ Fuels roadmap pathways to lower carbon fuels both for the current fleet and the future vehicles
- ❑ HGV technology and gas fuel strategies and incentives
- ❑ Van and minibus market research and support
- ❑ Encouraging innovative vehicle solutions



## ***Why we must change***

- ❑ Tailpipe test results are increasingly unrepresentative, consumers are losing confidence and need more consistent information
- ❑ Focus on lower carbon fuel/energy in combination with vehicle efficiency improvement
- ❑ Awareness of life-cycle considerations is rapidly increasing
- ❑ Full life-cycle analysis is highly complex and needs further development
- ❑ Geographical boundaries for material, production and energy sources can have significant effect
- ❑ The range of fuels and technologies available in the future need an appropriate common metric which reflects their true impact
- ❑ The use phase of vehicles dominates carbon impact so is the obvious place to start
- ❑ For commercial vehicles the use phase is even more dominant
- ❑ **Regulation** will happen!

# ***The conference today starts our journey looking “Beyond the Tailpipe”***

- ❑ We hope for industry and consumer sessions to share their views and identify how all stakeholders and LowCVP members can work together to introduce new cycle and WTW information as soon as possible.
  - Defining the boundaries and inputs for fuel and energy pathways
  - Research on consumer information needed
- ❑ To continue to research the models and techniques allowing further development of the methods to cover the other phases of the vehicle life-cycle
  - Research in battery production and recycling
- ❑ **UK again has an opportunity to lead the way** in a voluntary agreement for carbon reporting of vehicles and providing the best consumer and operator information
- ❑ Engaging now we can inform the development of regulation in the future

***THANK YOU***

**Andy Eastlake - LowCVP**