



# Ricardo-AEA

## Evaluation of Regulations 443/2009 and 510/2011 on the reduction of CO<sub>2</sub> emissions from light-duty vehicles

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## Study aims and objectives

- **Evaluate car and LCV CO<sub>2</sub> Regulations to better understand:**
  - Inefficiencies due to **design or implementation**. Importance of each aspect;
  - Areas that could be affecting **competitiveness or social equity**; and
  - If the legislative framework needs to be adapted in light of technological developments
- **Looks backwards at results and evaluates all elements in terms of:**
  - Relevance
  - Efficiency
  - Effectiveness
  - Coherence
  - EU added-value

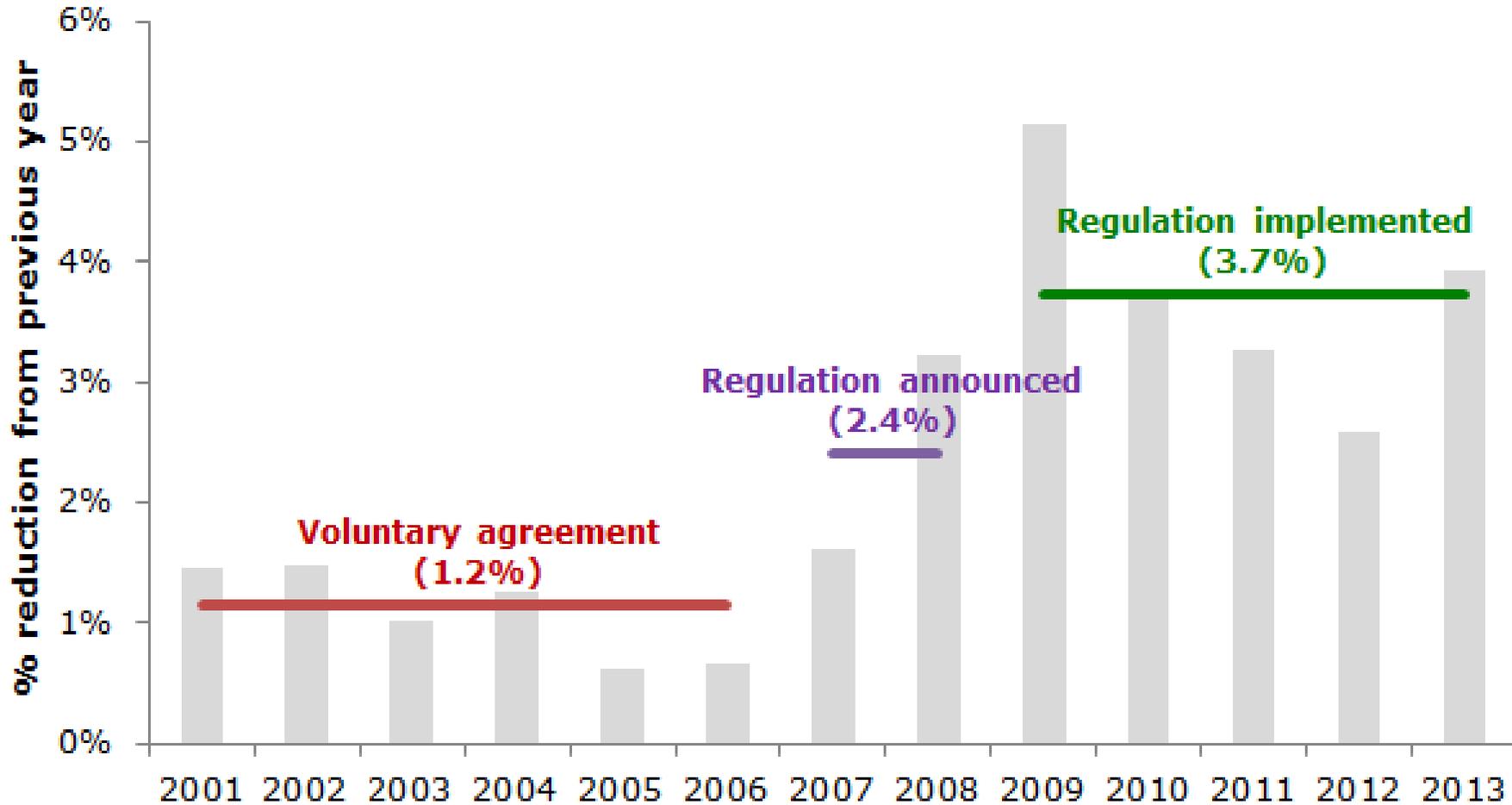
## Relevance – to what extent do the objectives of the Regulations still respond to the needs?

- **All sectors still need to contribute to fight against climate change**
- **CO<sub>2</sub> performance of new vehicles needs to improve at a faster rate**
  - Annual rate of improvement needs to be ~5.2% for cars and ~3.2% for LCVs
- **Road transport needs to use less oil to improve security of energy supply**
- **CO<sub>2</sub> reductions must be delivered cost effectively without undermining competitiveness of the automotive industry or sustainable mobility**
  - Importance of the automotive industry to the EU economy is widely recognised
  - Importance of sustainable mobility highlighted in Transport White Paper

- **Achieved reductions in NEDC tailpipe CO<sub>2</sub> emissions**
  - Average 2013 emissions: **126.6 gCO<sub>2</sub>/km for cars** and **173.3 gCO<sub>2</sub>/km for LCVs**. Regulatory targets met early.
  - 72 car manufacturers (of 84) met their 2013 target. All but two joined pools.
  - **All larger car manufacturers on track to meet their 2015 targets** (15 already have of which 6 have emissions below 120 gCO<sub>2</sub>/km)
  - 12 (of 13) LCV manufacturers met their indicative 2013 targets.
  - 5 LCV manufacturers (48% of sales) have emissions below 175 gCO<sub>2</sub>/km
  - **Increased percentage of LCVs with emissions below 140 g/km** (27% in 2012, 32% in 2013)

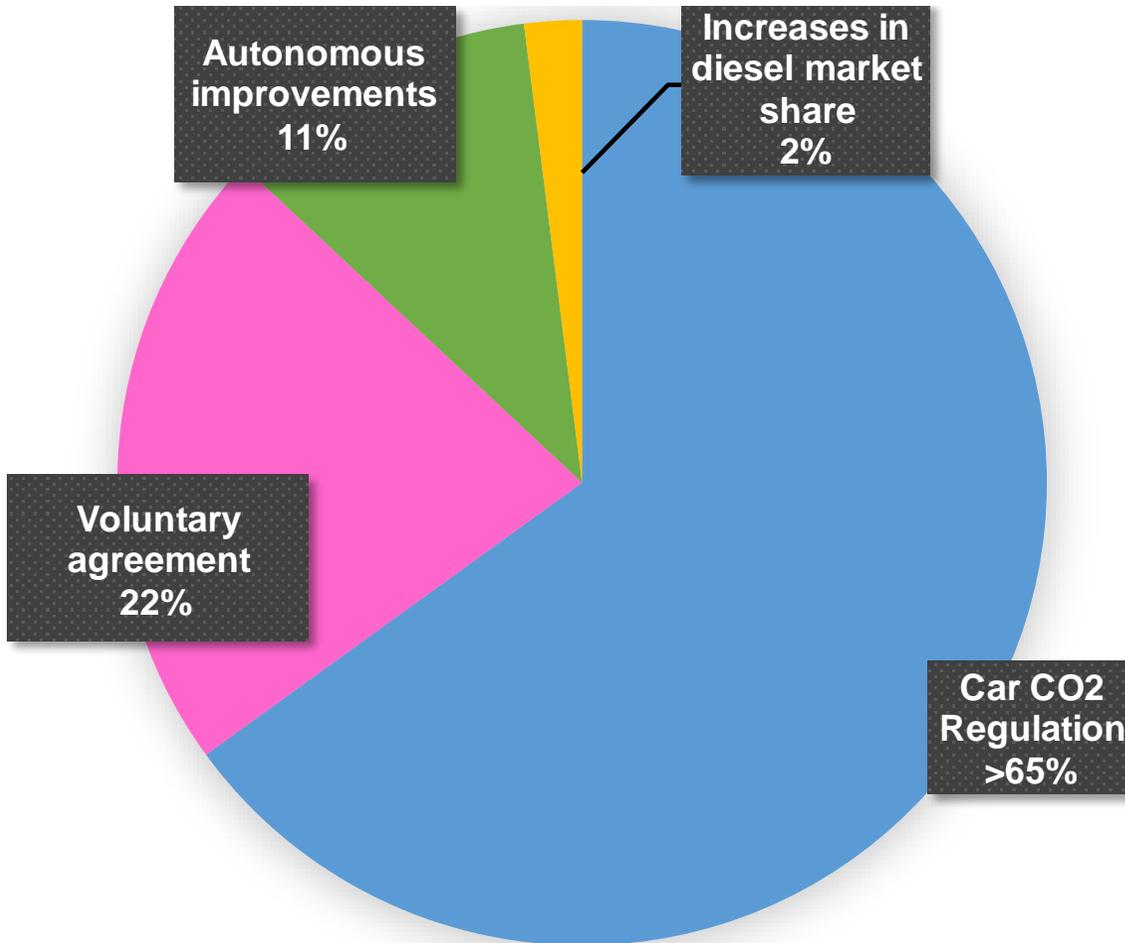
# Effectiveness of the Regulations

- Regulation's contribution to emission reductions – cars



- **Regulation's contribution to emission reductions – cars**

- High-level data suggests Regulation effective in reducing car CO<sub>2</sub> emissions



- Other factors that could have played a role include:

- National policies/incentives
- Fuel prices/taxes
- Shifts in vehicle segments
- Changes in vehicle mass

- **Weaknesses**

- **Test cycle emissions** - diverging from real-world emissions
- **Well-to-tank emissions** - Regulations incentivise vehicles with low TTW emissions that may have higher Well-To-Tank (WTT) emissions. WTT emissions are not covered by the Regulations
- **Embedded emissions** – Regulations may lead to vehicles with higher embedded emissions as these are not covered by them
- **Mass as utility parameter** – potentially disincentivises mass reduction as an abatement option
- **Small volume and niche derogations** – very limited impacts – in worst-case, target weakened by a fraction of 1%
- Other potential weaknesses (**super-credits** and **phase-in of targets**) have not weakened the targets in practice

- **Competitiveness and innovation**
  - Impacts appear positive. Some evidence standards induce R&D spending.
  - Patent application trends indicate EU automotive industry has increasingly focused on R&D for hybrid and electric vehicles
- **Social equity**
  - Likely positive impacts – no impacts on new vehicle retail prices identified
  - Consumers in all income groups benefit from improved fuel efficiency once vehicles pass to second-hand market
- **Environmental protection**
  - Exclusion of WTT and embedded emissions has so far not been a problem – may change if alternative powertrains become more prevalent
  - Most technologies and fuels with greatest life-cycle GHG benefit also have greatest potential to reduce NOx and PM

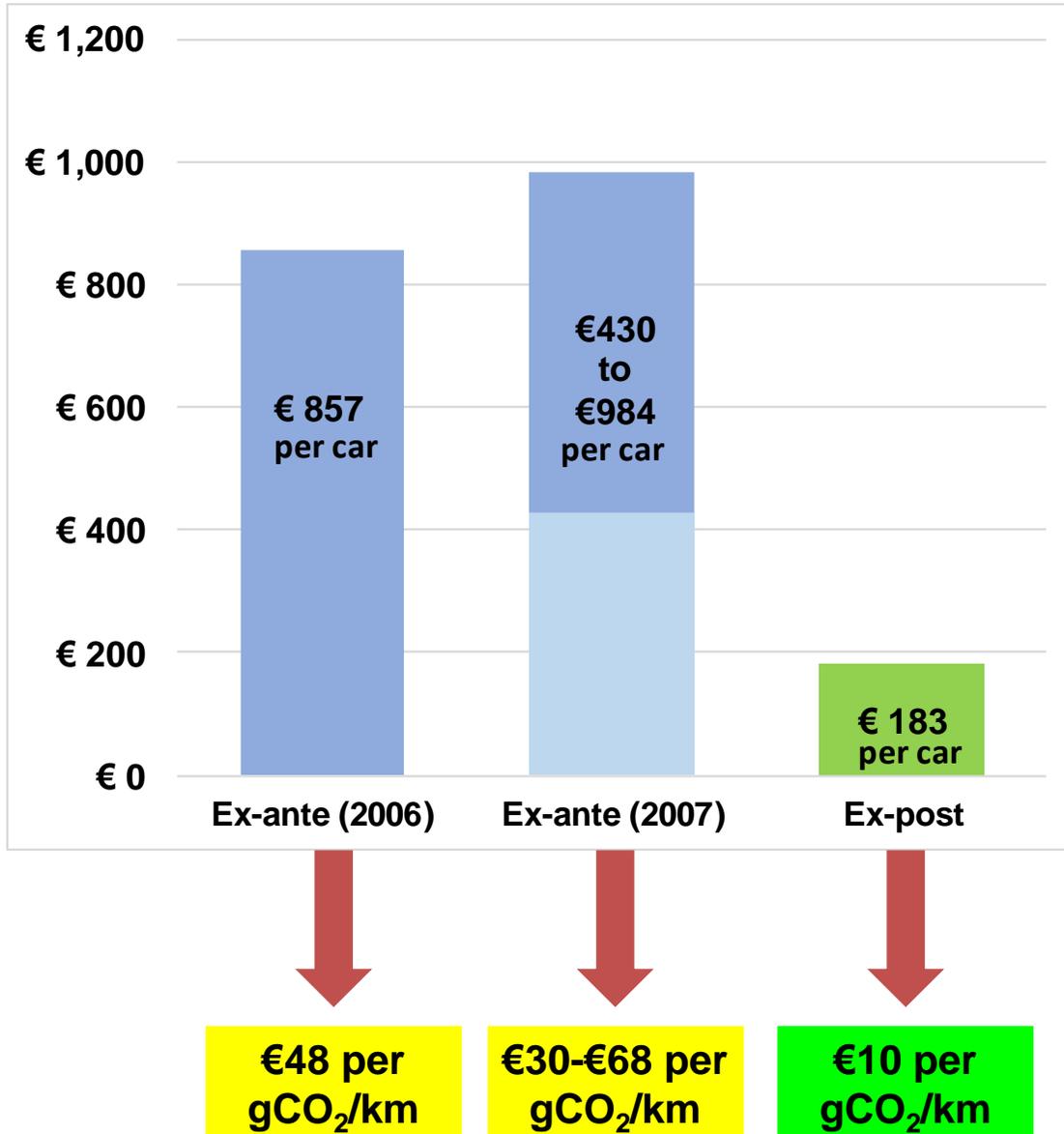
NPV Costs (2014 prices) and CO <sub>2</sub> savings	Ex-ante impact assessment	Ex-post evaluation
Costs to Society (2006-2020)	€25 billion	
Costs to society (2007-2013)		-€6.4 billion
CO <sub>2</sub> savings – all new cars 2006 to 2020	-636 MtCO <sub>2</sub>	-
CO <sub>2</sub> savings - new cars registered between 2007 to 2013	-	-138 MtCO <sub>2</sub>
<b>Cost effectiveness (€/tCO<sub>2</sub>)</b>	<b>+€39/tCO<sub>2</sub></b>	<b>-€46/tCO<sub>2</sub></b>

- Figures show **net economic benefits to society**
- Cost effectiveness better than expected because:
  - Fuel prices higher than anticipated between 2006 and 2013
  - Technology costs lower than anticipated

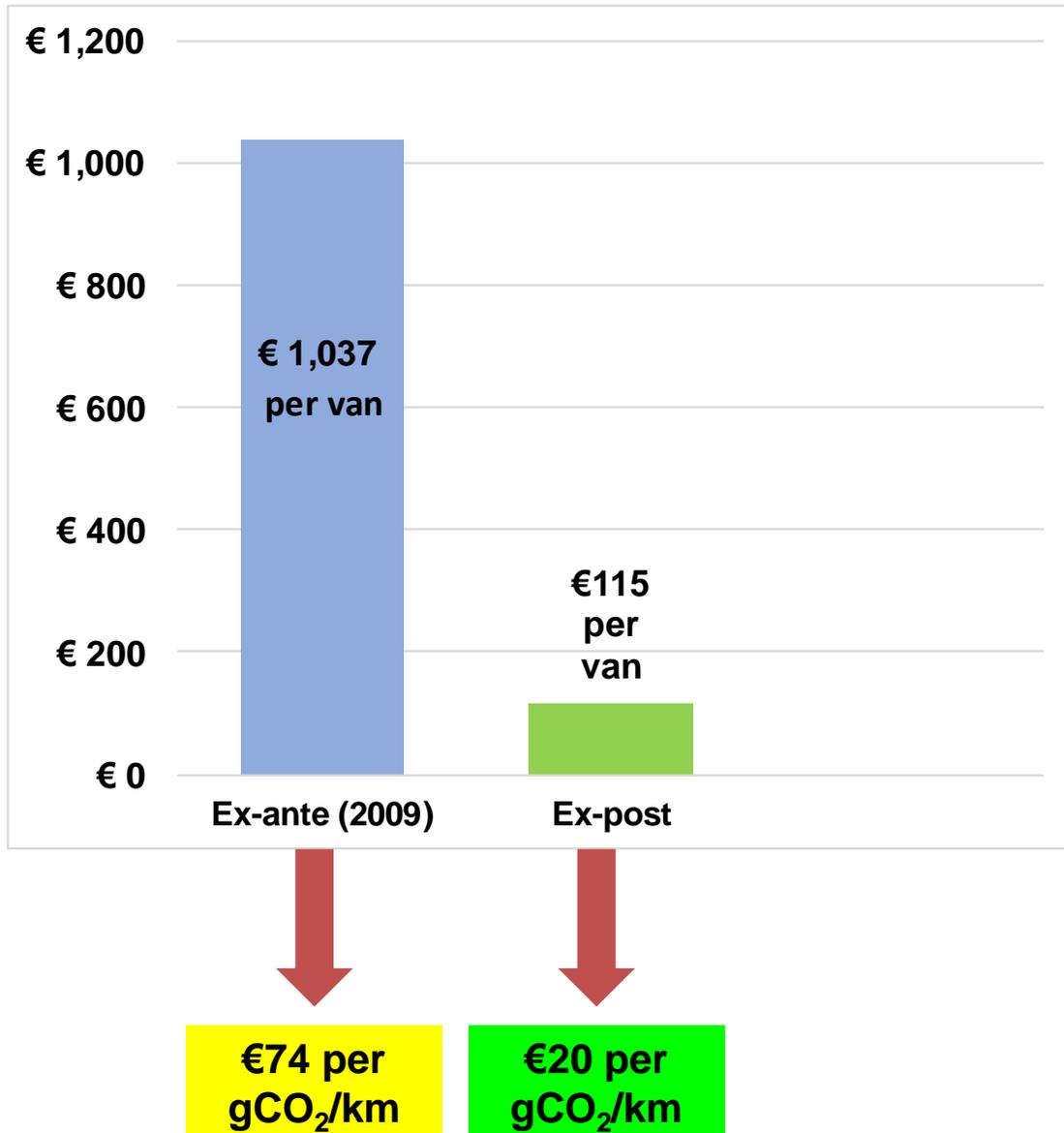
**Note: cumulative emissions and economic benefits will increase in future years**

NPV Costs (2014 prices) and CO <sub>2</sub> savings	Ex-ante impact assessment	Ex-post evaluation
Costs to society (2010-2020)	-€5.3 billion	-
Costs to society (2010-2013)	-	-€0.9 billion
CO <sub>2</sub> savings – all new LCVs 2010 to 2020	-60 MtCO <sub>2</sub>	-
Lifetime CO <sub>2</sub> savings - new LCVs registered between 2010 and 2013	-	-5.2 MtCO <sub>2</sub>
<b>Cost effectiveness (€/tCO<sub>2</sub>)</b>	<b>-€39 to -€33/tCO<sub>2</sub></b>	<b>-€166/tCO<sub>2</sub></b>

- LCV CO<sub>2</sub> Regulation **highly cost effective already** with significant benefits
- Ex-ante impact assessment assumed starting point of 203 gCO<sub>2</sub>/km in 2010 – more recent data indicates average emissions were around 185 gCO<sub>2</sub>/km in 2010

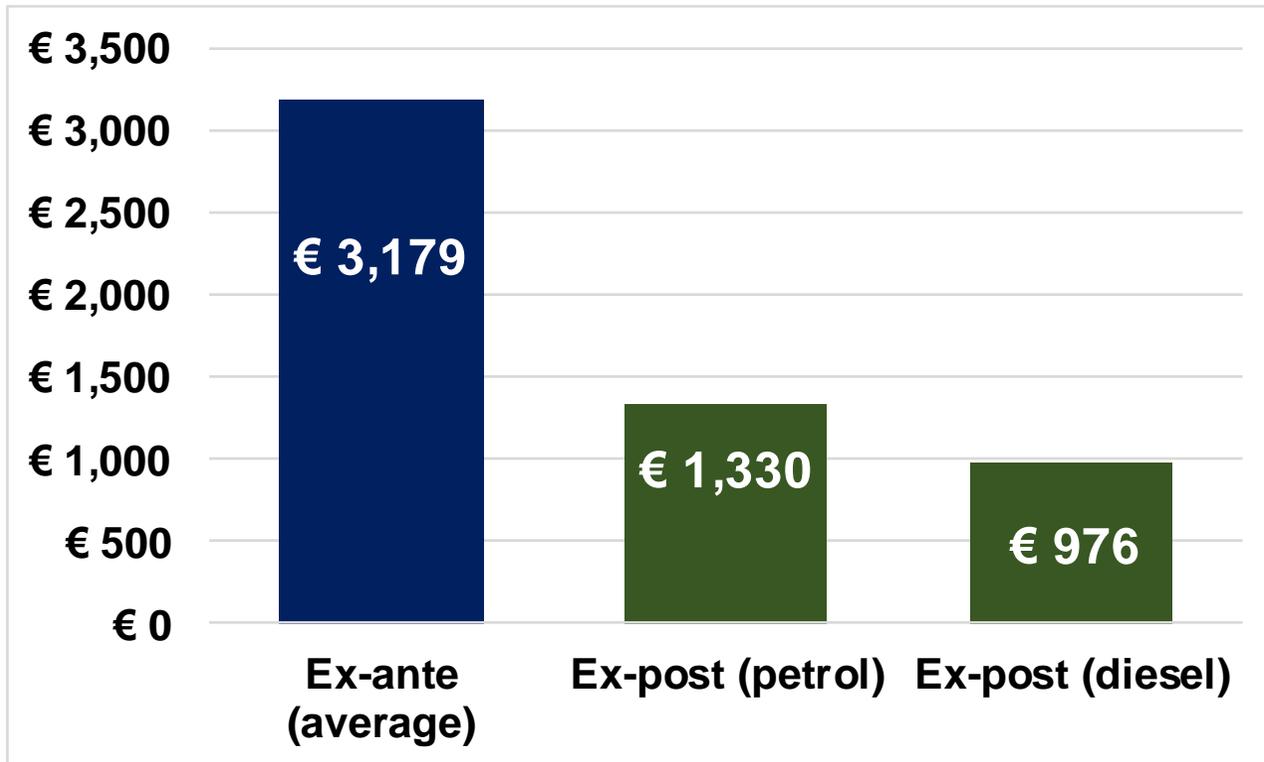


- Costs incurred by manufacturers much lower than anticipated
- Total costs to (2007-2013) predicted to fall in range of €36 billion to €81 billion
- Ex-post evaluation indicates total actual costs were **€17 billion**
- Costs of CO<sub>2</sub> abatement technologies much lower than predicted



- Costs incurred by manufacturers much lower than anticipated
- Original Impact Assessment significantly overestimated baseline LCV emissions performance
- Total costs to manufacturers predicted to be €7.5 billion
- Ex-post evaluation indicates total actual costs were **€0.8 billion**

## Lifetime fuel cost savings – passenger cars



- Fuel cost savings for cars and LCVs significantly lower than anticipated
- Due to increasing divergence between NEDC and real-world performance
- For LCVs, issue compounded by inaccuracies in 2010 baseline CO<sub>2</sub> performance

# Coherence: how the Regulations fit with other policy objectives

- **Alignment of Regulations with other EU action**

- Regulations coherent with demand-side EU measures (Car CO<sub>2</sub> Labelling Directive and the Clean Vehicle Directive)
- Member States use CO<sub>2</sub> based vehicle tax policies to influence purchase behaviour
- EU Directives on fuels, energy carriers and energy infrastructure work with the Regulations to reduce GHG emissions
- Euro emission standards and CO<sub>2</sub> Regulation targets may lead to trade-offs between air pollutant emissions and CO<sub>2</sub> emissions performance
- No explicit conflicts between safety requirements and the CO<sub>2</sub> Regulations



- Automotive industry requires high regulatory certainty given the large investments required to comply with targets.
- Only EU-level action can achieve the level of certainty required.
- High risk of uncoordinated action at Member State level. Wouldn't achieve same levels of effectiveness and efficiency as has been achieved.
- Widely varying break points employed by Member States to differentiate taxes, fiscal incentives and fuel economy labels
- Policies subject to national sovereignty so unlikely they would create a level playing field.

## Regulations:

- still highly **relevant** in the context of need to reduce GHG emissions from road transport in line with economy-wide targets
- **effective** in ensuring emissions reductions and in increasing the rate of reductions.
- significantly more effective than the previous car CO<sub>2</sub> voluntary agreement
- use of NEDC test cycle emissions to measure performance is a key weakness
- significantly **more cost-effective** than originally anticipated
- broadly coherent with other EU policy measures. In many cases, they work together with these other measures to reduce CO<sub>2</sub> emissions from road transport
- clear added value from EU-level action. Unlikely to be achieved from Member State level action

# QUESTIONS?

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