International Energy Agency

Transport Future Workshop

2nd Workshop for Automobile and Energy

CO2 emission reduction from light duty vehicles by 2050: long term vision for short term actions

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- Technology cost and benefits

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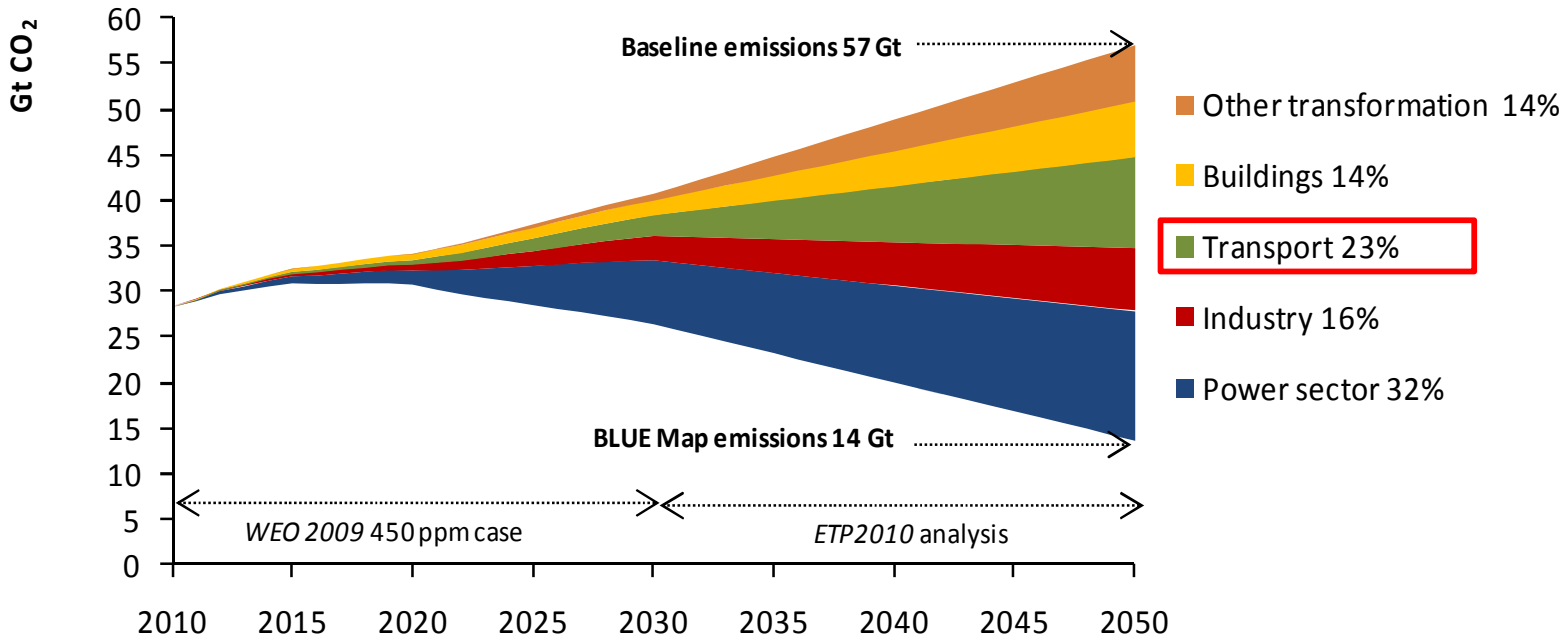
IEA ETP-2010: World energy-related CO_2 emissions abatement by region



In the BLUE Map scenario, transport accounts for 23% of reductions. Additional savings accrue in "transformation", since less high-CO2 fuels (such as coal-to-liquids) are produced for transport use.

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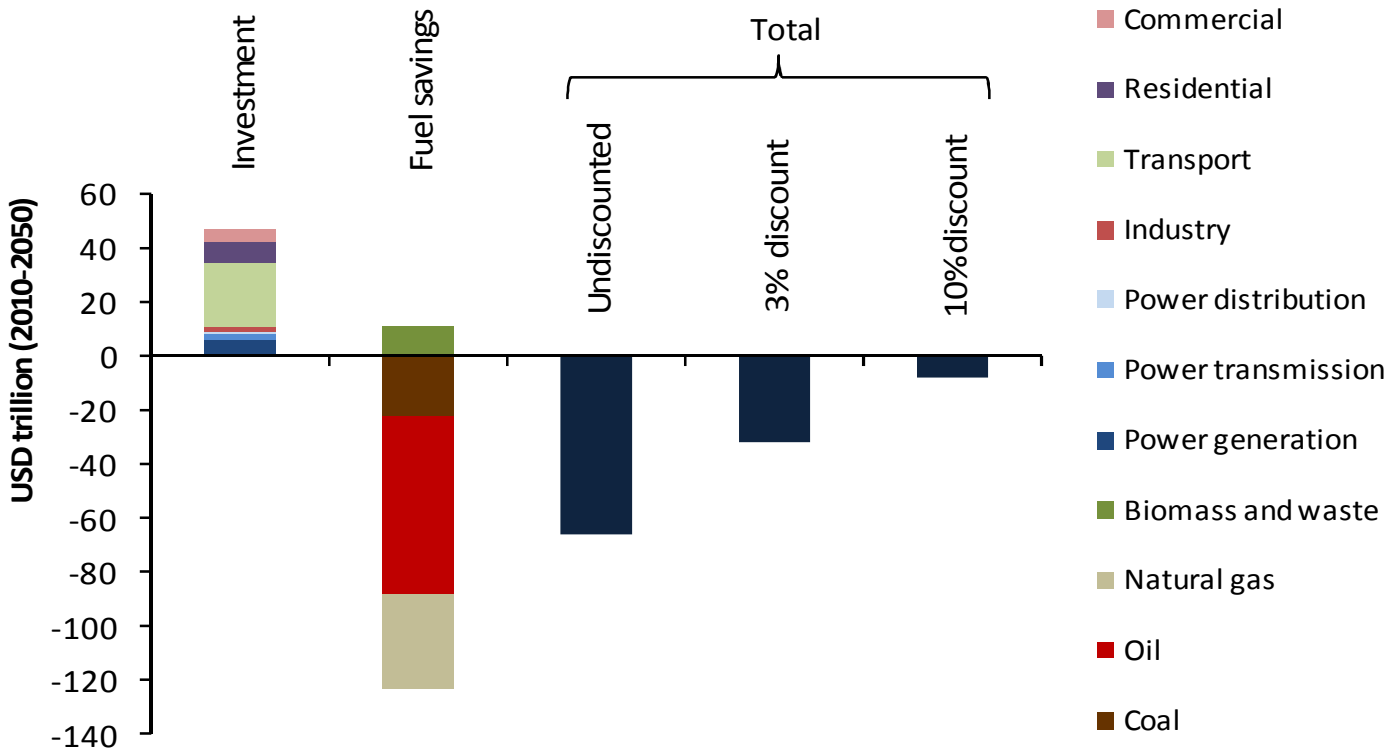
A low carbon future is cost effective



Even using a 10% discount rate, fuel savings in the BLUE Map scenario more than offset the additional investment required.

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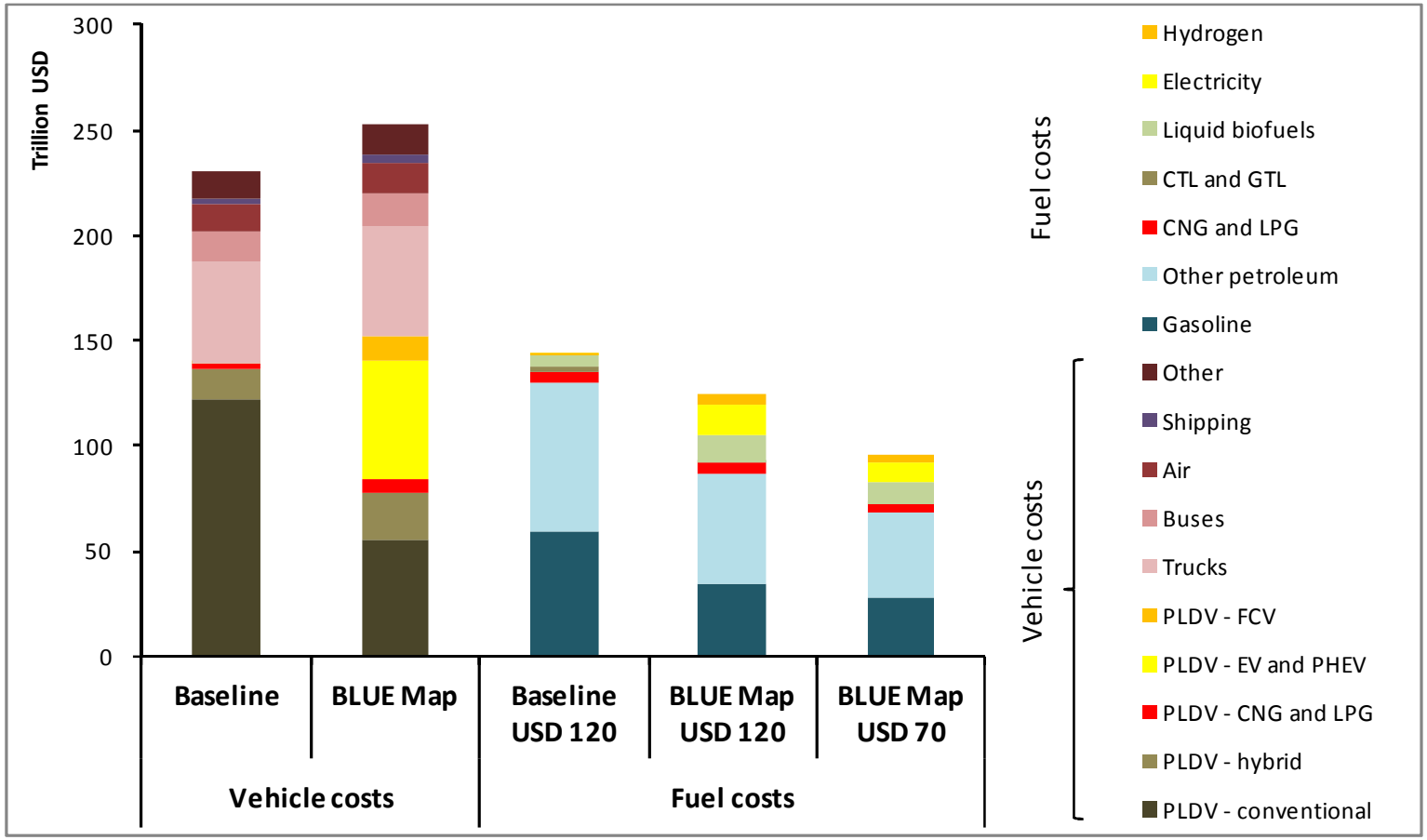
Global Vehicle and Fuel Costs, 2010-2050 by Scenario



PLDV=passenger light-duty vehicle; costs are in real $2008, 0 discount rate.

Fuel cost savings mostly or fully offset the costs of advanced technology vehicles in BLUE Map, especially if it results in lower oil prices (last bar)

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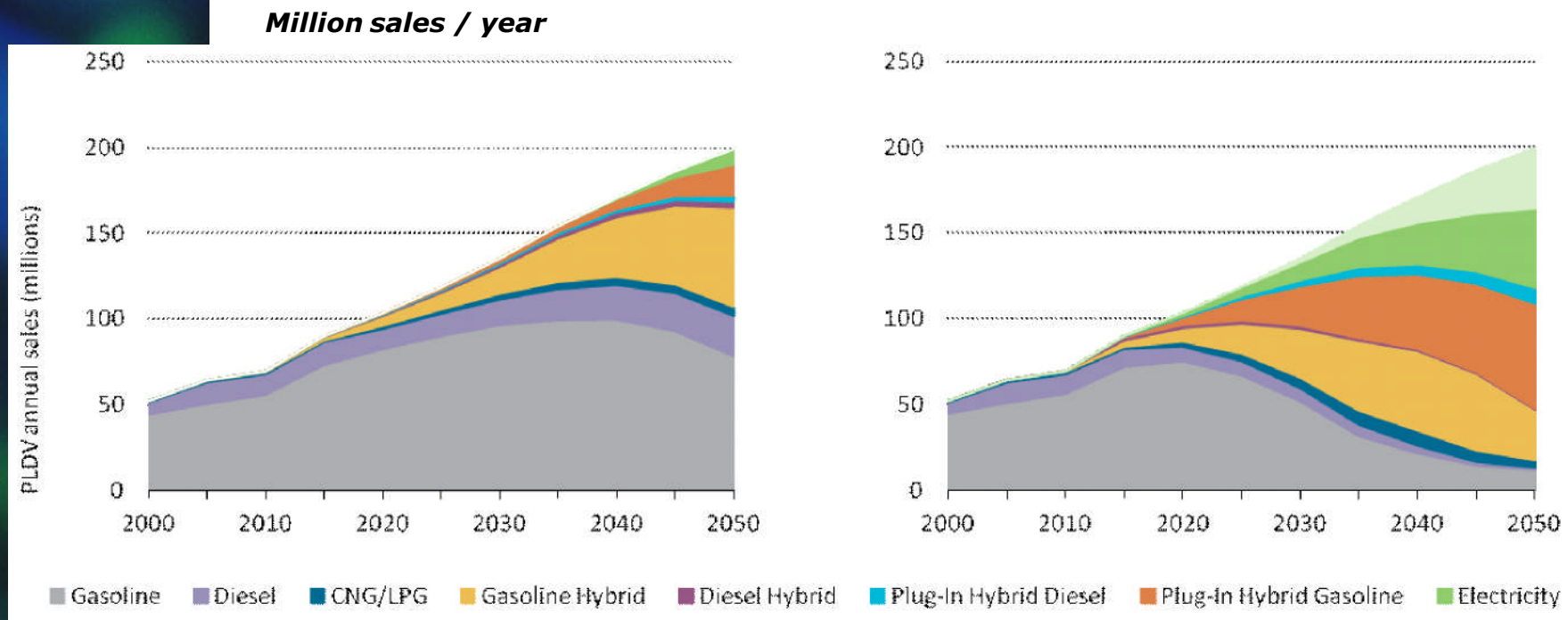
Passenger LDV sales by technology type and scenario: BLUE Map will be VERY challenging



In the ETP Baseline, sales are mainly conventional vehicles through 2050; hybrids reach about 30% of sales

In BLUE Map, strong penetration of hybrids by 2025, PHEVs and EVs by 2030, FCVs after 2035. By 2050, plug-in vehicles account for more than two-thirds of all sales.

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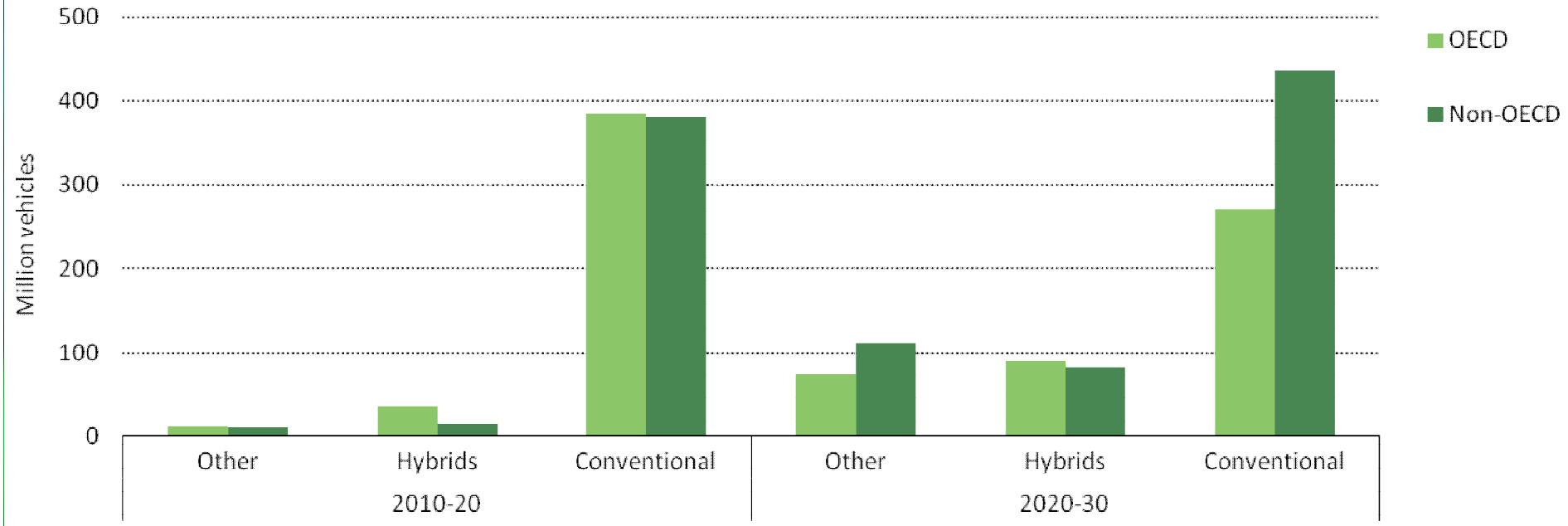
Cumulative sales in the low carbon scenario

- Most vehicles in the coming 2 decades will be ICE-powered
- EVs are needed, 10-year effort before they really begin to matter



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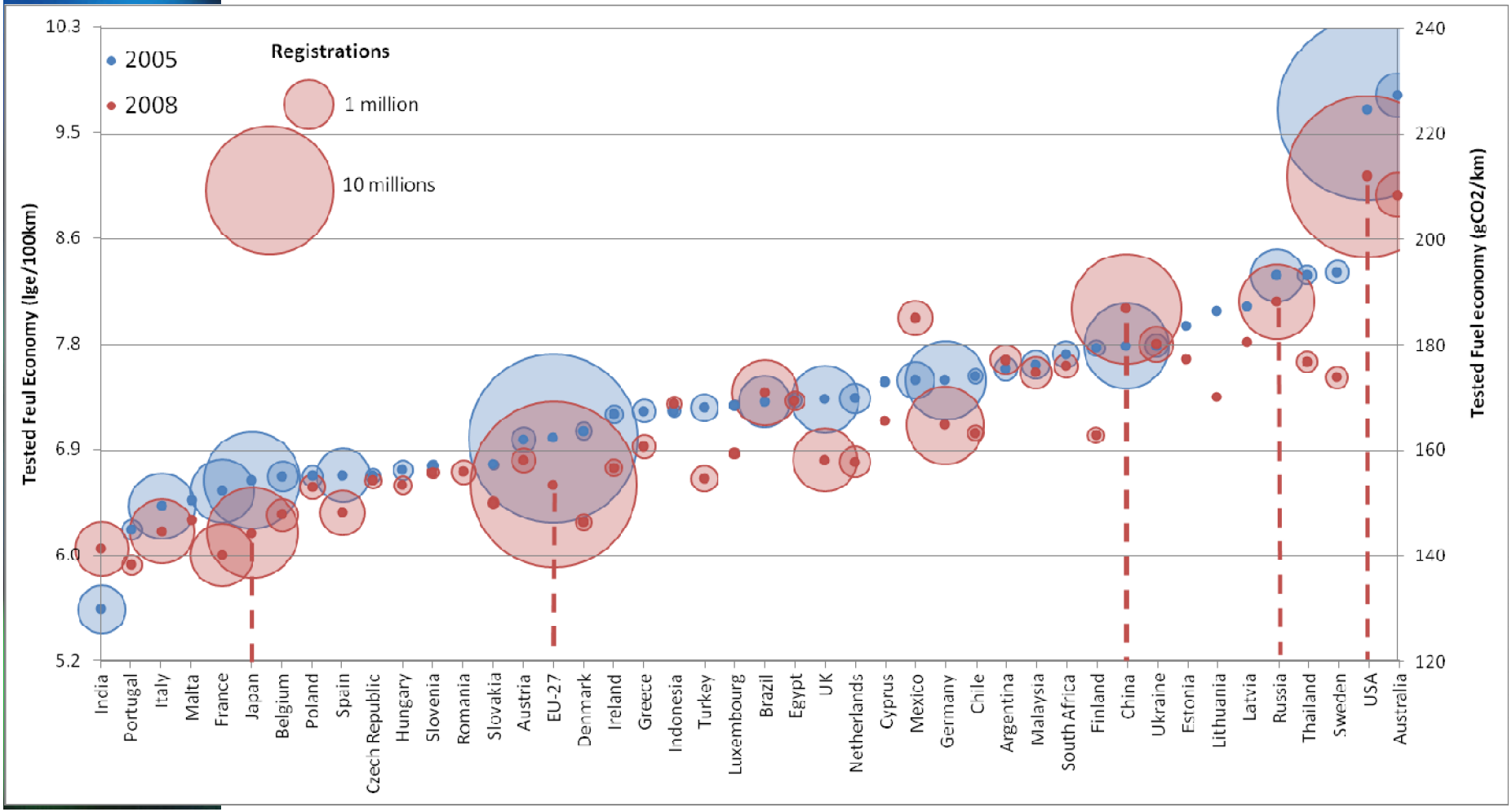
Actions for the next decade

- Tackle fuel economy now!
  - IEA activities: GFEI, FE Technology Roadmap, Policy Pathway
  - Potential for FE improvement
- Overcome the « EV valley of death »
  - EVI : activities and primary results
- Hydrogen, biofuels
  - The way to a zero carbon transport sector

IEA activities - GFEI

Status of worldwide fuel economy



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GFEI Project proposal

- On-road fuel economy measurement
- Fleet selection over several key partners countries
- Sample design key to representativity
- Use of OBDII + GPS
  - Road type, hour, elevation
  - Engine / vehicle parameters:
    - fuel consumption key one
- Launch saught in the coming months

Technology roadmap – Fuel Economy

- Fuel economy improvement from different approaches:
  - Vehicle technology on the test cycle
    - Powertrain improvement
    - lightweightning
  - Vehicle technologies outside the test cycle
    - Air conditionning, Head lamps, spare lubricants / tires
  - Non vehicle technologies
    - Driver support technologies (GSI, TPMS)
  - Non technology improvements
    - Road surface improvement
    - Driver behaviour

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Potential fuel economy abatment

Most of it is coming from vehicle technologies

		Fuel economy improvement (%)		
	Factors affecting fuel economy	**Cars**	**PTWs**	**Trucks**
Vehicle	Power train technologies (tested on cycle)	30 to 40	15 to 25	20 to 35
	Other power train / vehicular technologies (incl. auxiliaries)	10 to 20	5 to 10	10 to 20
Driver	Eco-driving	5 to 10	5 to 10	5 to 10
Road	Congestion	5 to 7	2 to 5	5 to 10
	Surface	2 to 7	2 to 7	2 to 7
Total (taking into account non-additivities)		**45 to 65**	**20 to 45**	**35 to 60**

Non vehicular benefits are limited, but cost effective

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IEA EV activities

- Dedicated Implementing Agreement on Hybrid and Electric Vehicles
  - Technical, R&D focused
  - 8 active tasks on EV related issues:
    - Heavy Duty Hybrids
    - Electrochemical Systems
    - Lessons learned from market deployment,…
  - Follow-up of activities from member countries
- The IEA EV/PHEV roadmap

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Electric Vehicles Initiative (EVI)

- **Launched at the Clean Energy Ministerial, July 2010**
  - **Kick-off meeting was held in Paris 29 Sept/1 Oct 2010**
- **14 countries: China, Denmark, Finland, France, Germany, India, Japan, Netherlands, Portugal, South Africa, Spain, Sweden, United Kingdom, United States**
  - **Together these counties account for about 80% of world's vehicle demand, probably most of EV sales in coming years**
  - **International Energy Agency serves in a facilitator role**
- **Three primary objectives:**
  - **Common data collection/analysis efforts**
  - **Greater RD&D collaboration**
  - **City forum that links cities within EVI countries, City case books to be launched at EVS26**
- **Recent Events:**
  - **Pilot Cities conference in Shanghai, April 21-22 2011**
  - **EVI Meeting in Barcelona, November 30 2011**

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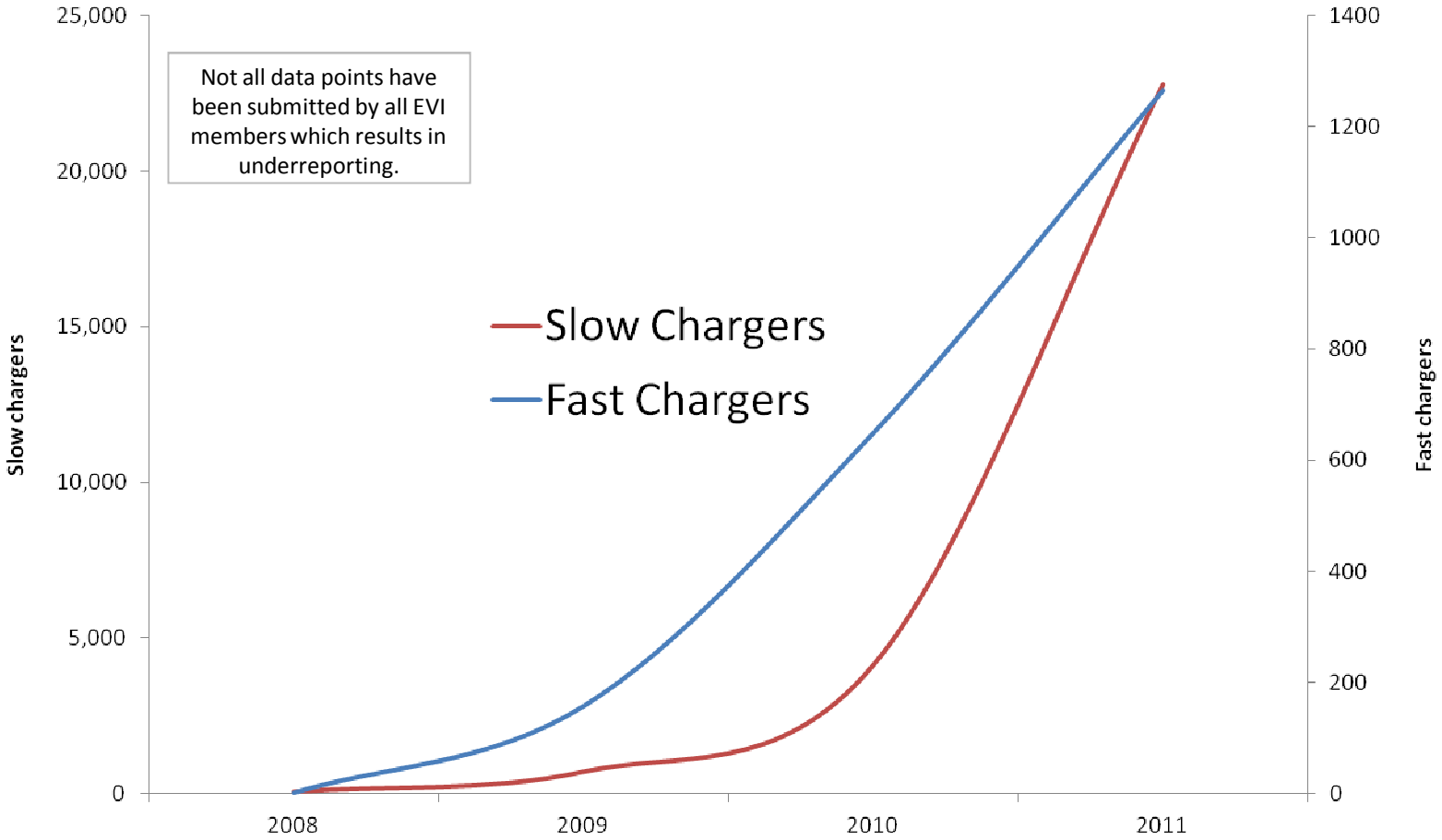
Growth of slow and fast charging points in EVI countries, 2008-2011



Electric Vehicles Initiative

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Some EV issues / questions

- Valley of death
  - High cost of cars
  - Lack of infrastructure
  - Need for major investments (by whom?)
  - Consumer awareness issues
  - Risk aversion
- Uncertainties
  - Will battery costs come down? How far?
  - What do the first 1/5/10% market share buyers want and need in an EV?
  - When and how will people recharge?
  - What will be the real CO2 impacts?

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Hydrogen fuel cell vehicles

- Longer term issue, no significant market penetration before 2030
- Zero carbon transport sector relying on three pillars
  - Electricity
  - Biofuel
  - Hydrogen
- ETP 2012 addressing this issue

Costs and CO_2 Benefits

- Fuel efficient technologies add costs to the vehicle purchase price
- Compensated by fuel savings over the life time of the vehicle
- Which technologies should be implemented, and when?
- Shift of spendings from fuel to vehicle
- Extra investment tiny compared to total transport spendings

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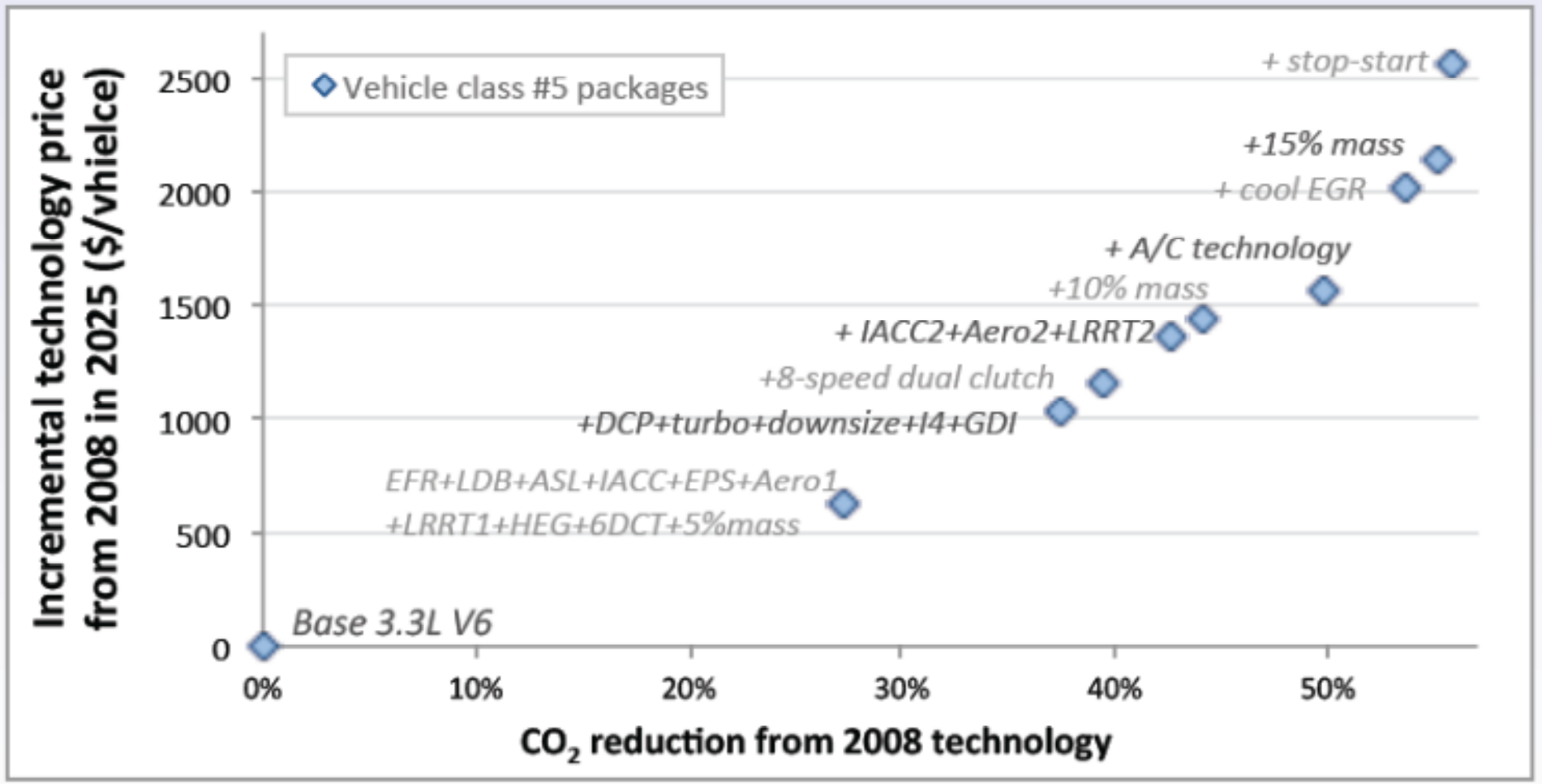
Technology cost and CO2 benefits

- Short term actions in the US



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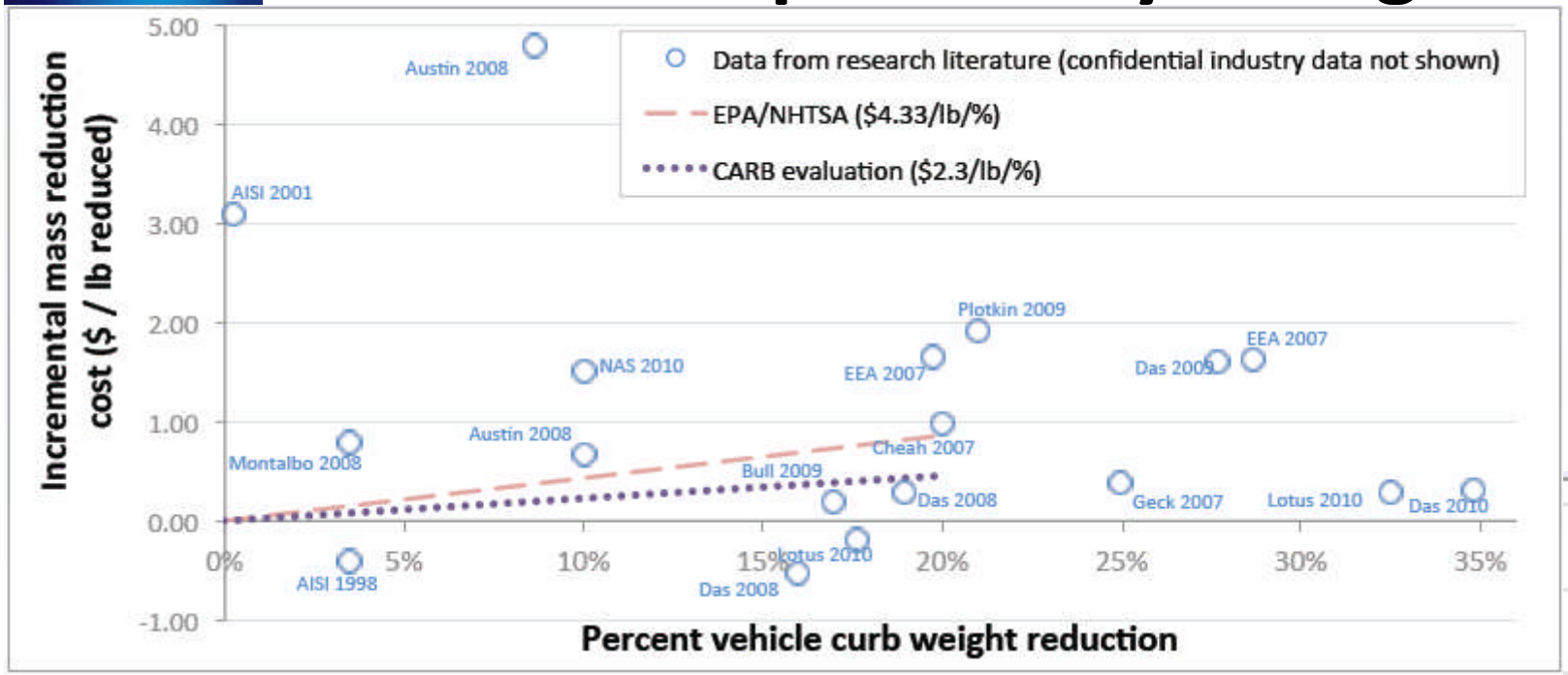
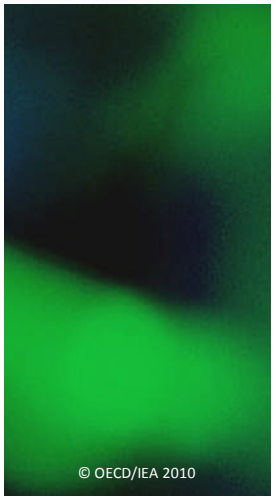
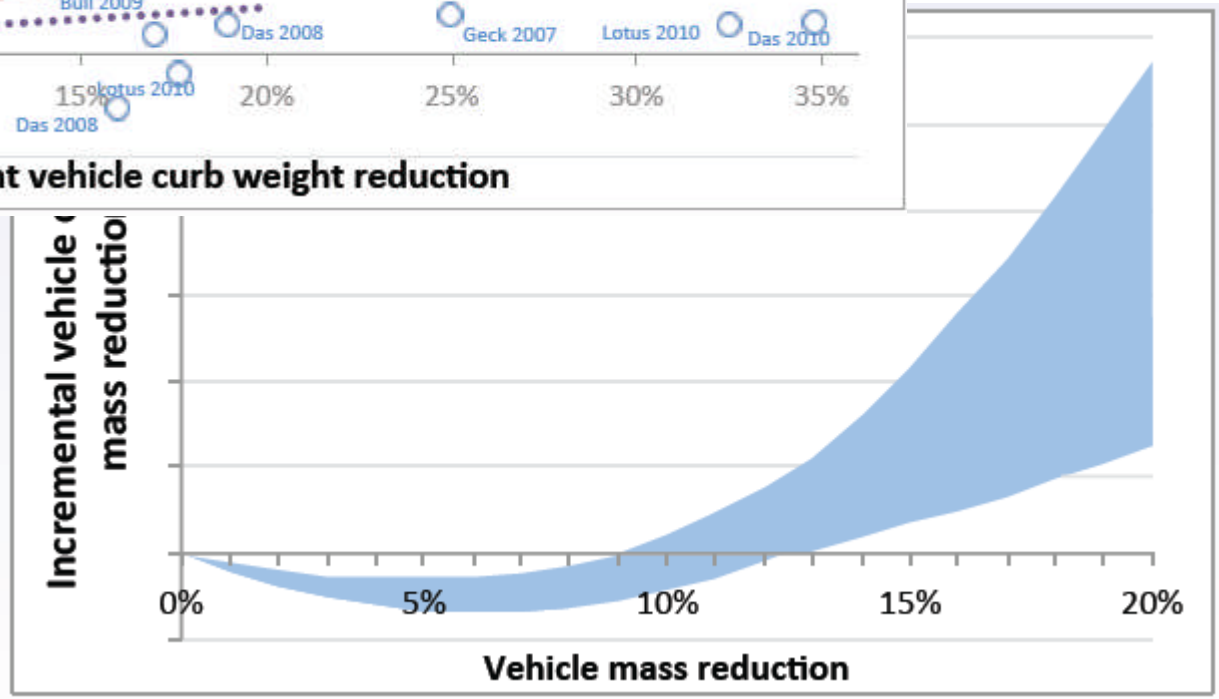
Weight marginal abatement cost lower than previously thought?





Source: Lutsey, 2012



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Conclusions

- Vehicles technologies are necessary to reach low carbon transport system
- Short term action on all aspects of fuel economy can bring substantial savings for limited (or negative) costs
- Engage now for zero tailpipe emissions vehicles to be deployed after 2020
- Policies are key to success for the transition toward a sustainable transport sector

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