International Energy Agency

Energy Technology Perspectives 2010

Lew Fulton

Low CVP Conference

Twickenham England, 14 July 2010

ENERGY TECHNOLOGY PERSPECTIVES 2010

Scenarios & Strategies to 2050

The context

- We need a global energy technology revolution to meet climate change and energy security challenges.
- Some early signs of progress, but much more needs to be done.
  - Which technologies can play a role?
  - What are the costs and benefits?
  - What policies are needed?

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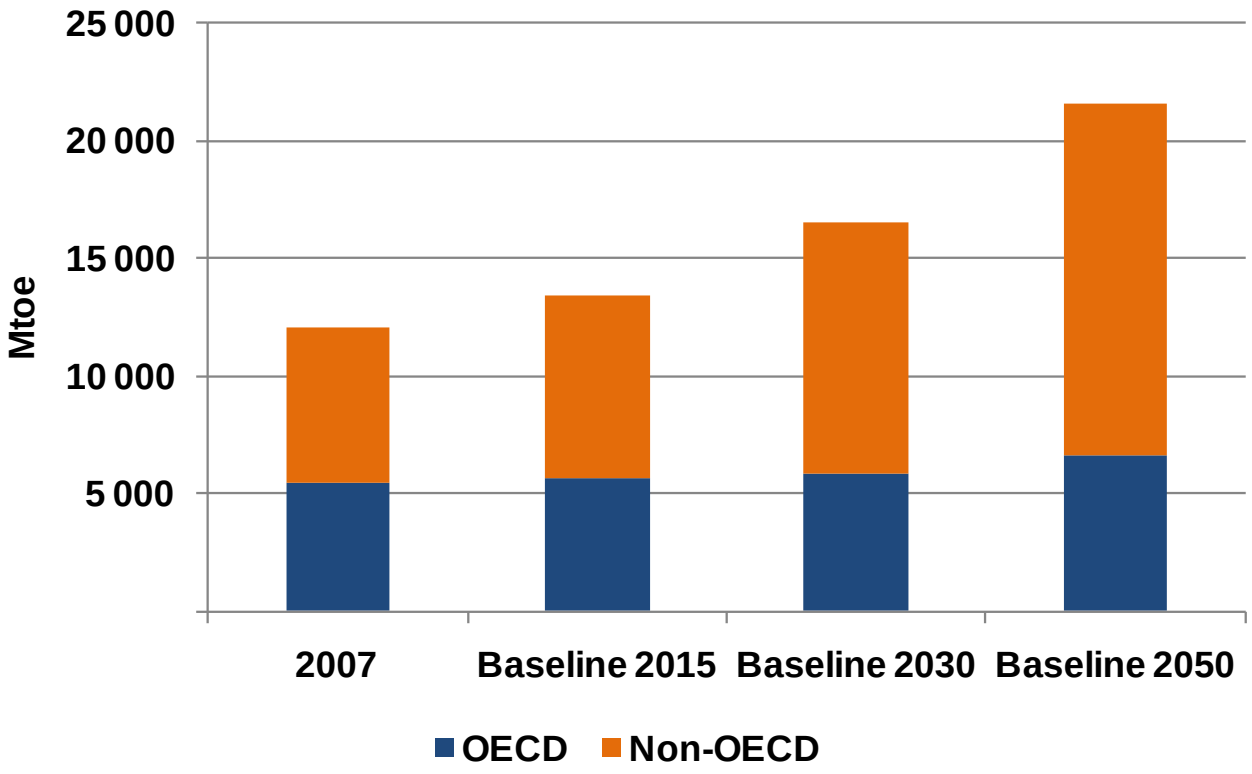
OECD and non-OECD primary energy demand in the Baseline scenario



Primary energy demand in non-OECD countries is projected to increase much faster than in OECD countries in the Baseline scenario.

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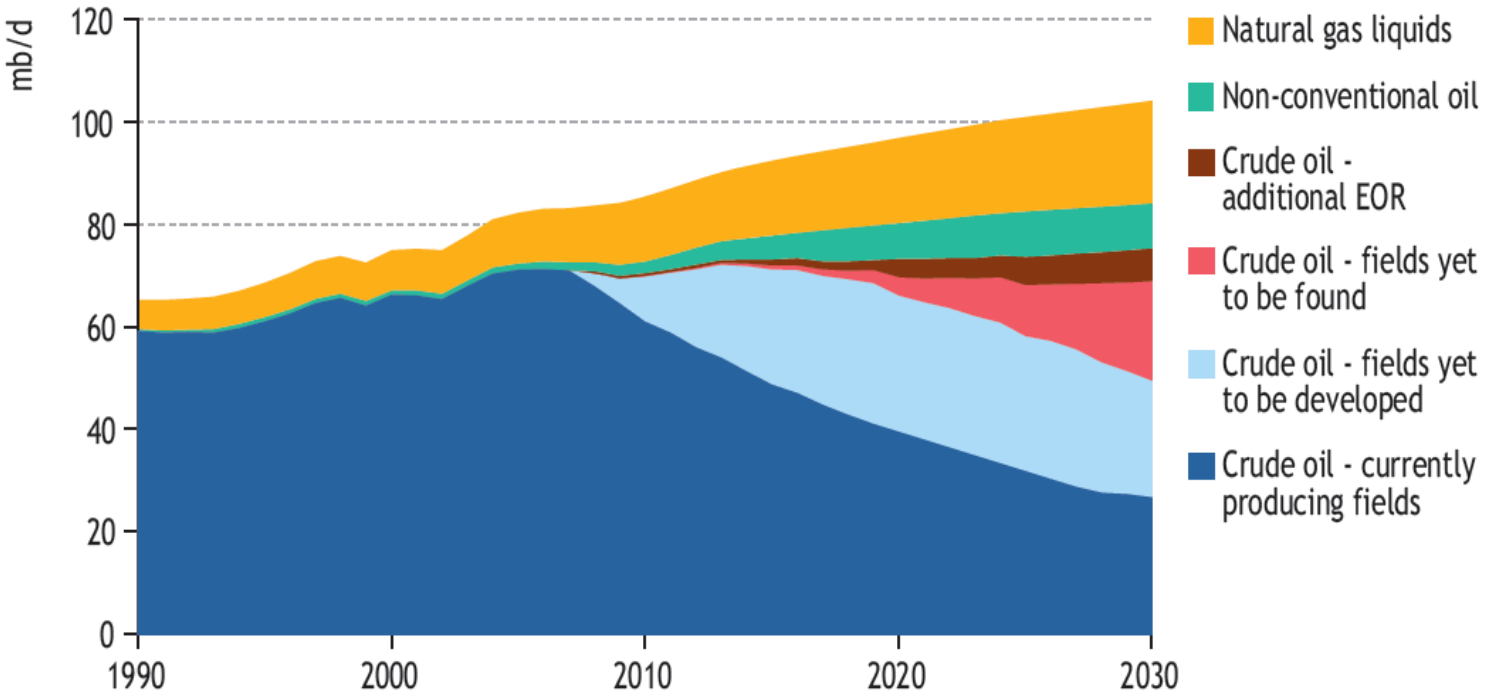
Let's not forget oil security!

World oil production in the WEO 2009 Reference Scenario



64 mb/d of gross capacity needs to be installed between 2007 & 2030 – six times the current capacity of Saudi Arabia – to meet demand growth & offset decline

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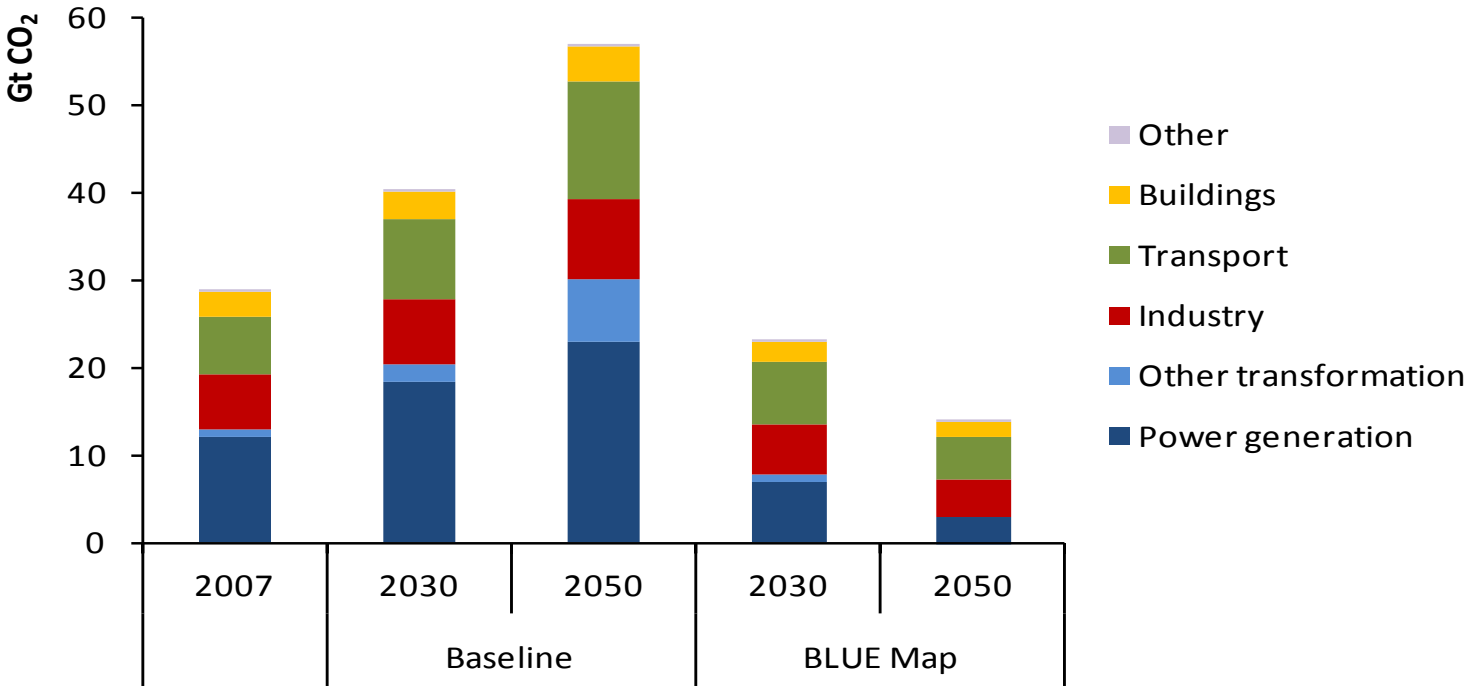
Global energy-related CO_2 emissions in the Baseline and BLUE Map scenarios



Global CO_2 emissions double in the Baseline, but in the BLUE Map scenario abatement across all sectors reduces emissions to half 2005 levels by 2050.

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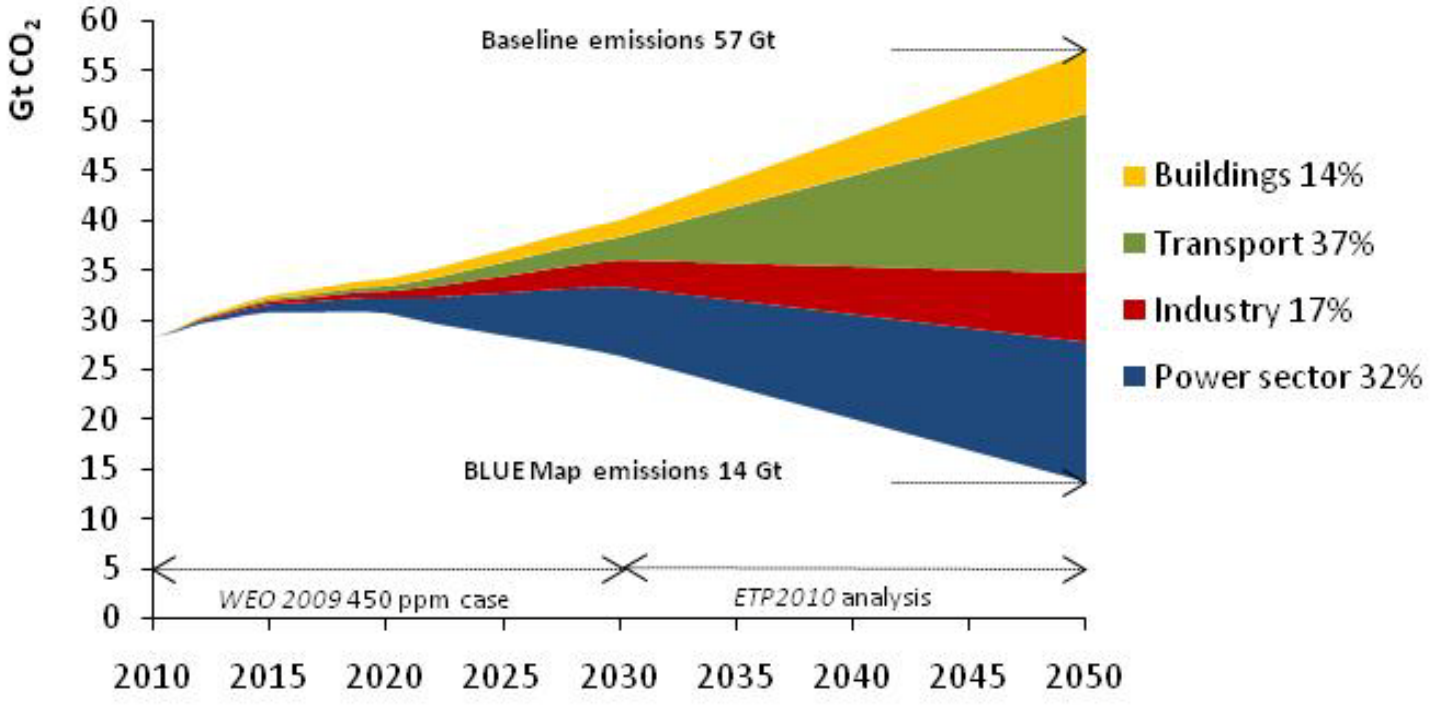
World energy-related CO_2 emissions abatement by sector



In the BLUE Map scenario, transport provides the largest CO2 reductions of the 4 major sectors

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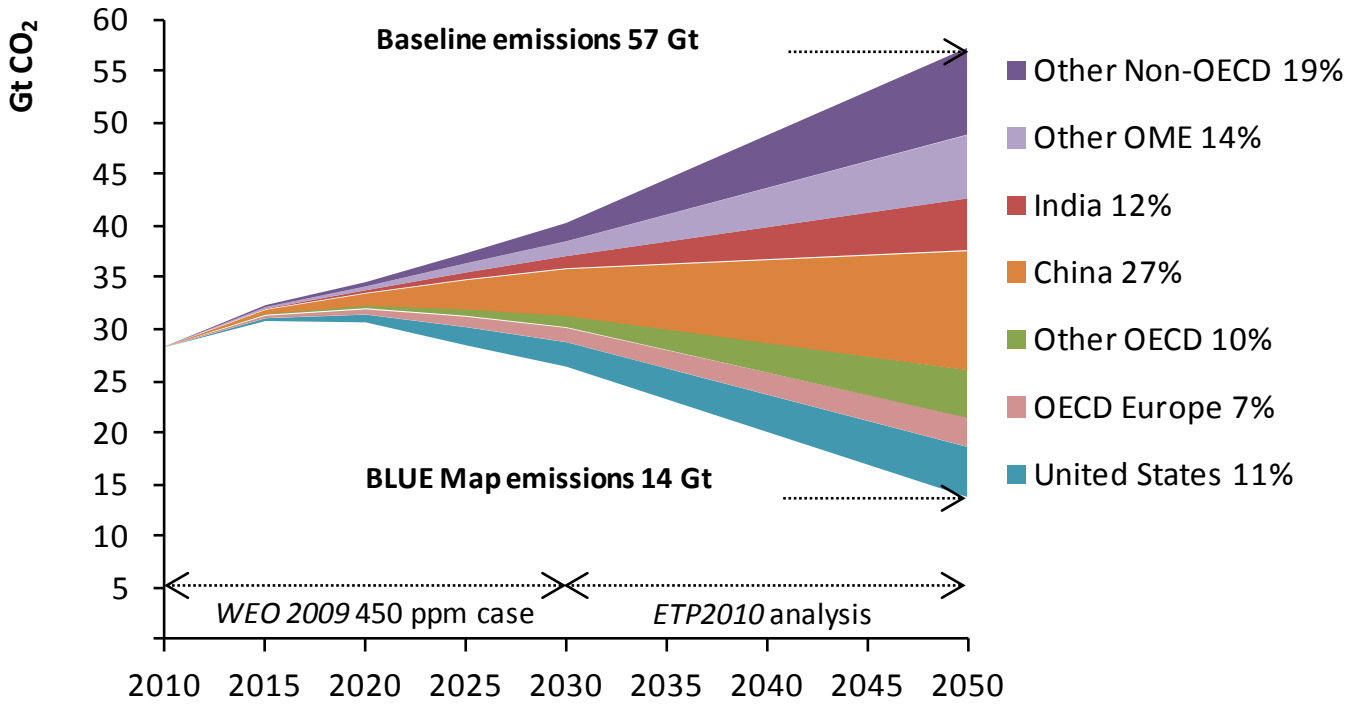
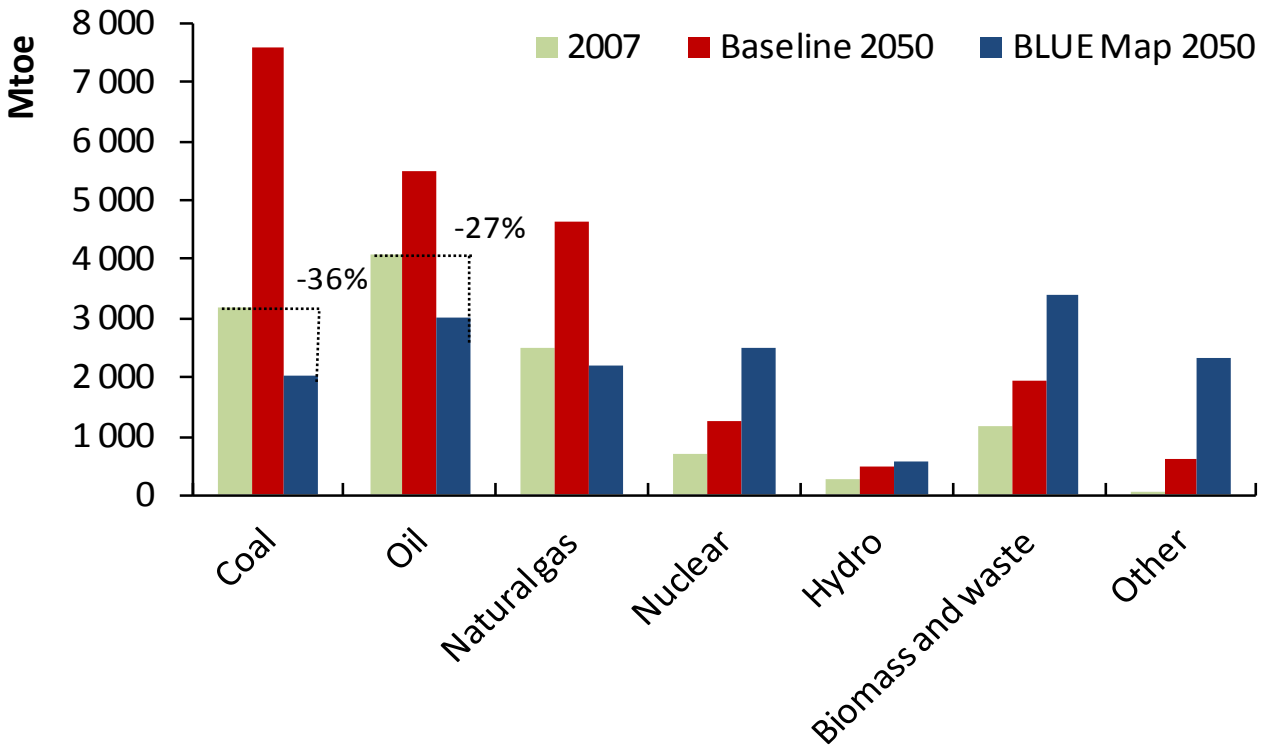
World energy-related CO_2 emissions abatement by region



In the BLUE Map scenario, most of the reductions in energy-related CO_2 emissions are in non-OECD countries.

Primary energy demand by fuel and by scenario



By 2050, coal, oil and gas demand are all lower than today under the BLUE Map scenario.

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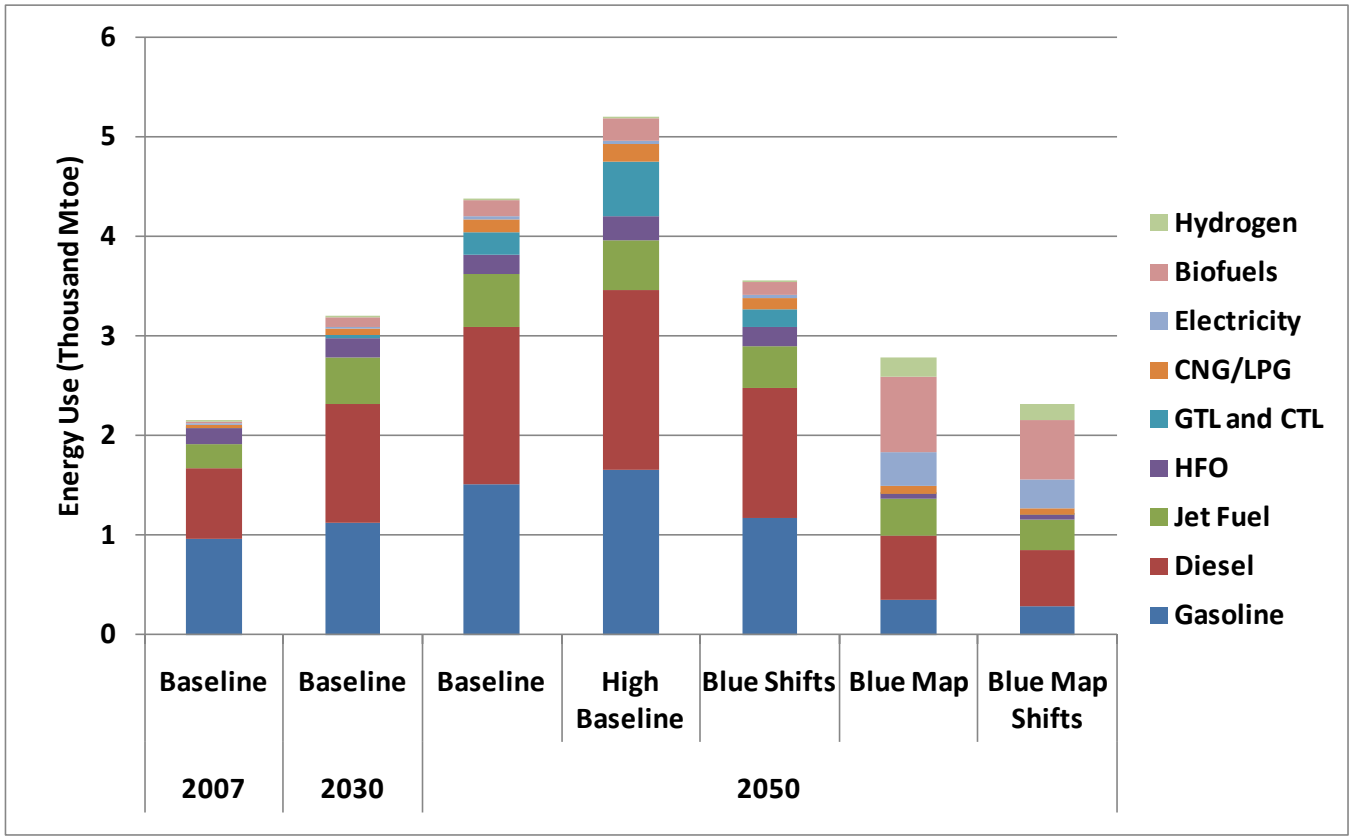
Transport Energy Use by Scenario



Global transport energy in Baseline doubles by 2050, and increases by 2.5x in High Baseline

About a 20% reduction in BLUE Shifts relative to 2050 Baseline, 45% in BLUE Map, 60% for Map/Shifts

Key Transport Results

- **BLUE Map**
  - 50% reduction in conventional new PLDV (car, SUV) fuel intensity by 2050
  - 30-50% reduction in energy intensity for bus/truck/rail/ships/aircraft by 2050
  - Strong uptake of advanced technology vehicles and Fuels
    - Plug-in Hybrids [PHEVs], starting in 2010-2015
    - Battery electric vehicles [BEVs], starting in 2010-2015
    - Fuel cell vehicles [FCVs], starting in 2025
    - Advanced, low-GHG Biofuels reach 12% of transport fuel use by 2030, 25% by 2050
- **BLUE Shifts**
  - 25% lower level of car and air travel in 2050 compared to Baseline
  - Up to 2x travel by rail, bus (such as Bus Rapid Transit systems)
  - Lower travel demand due to better land use planning, road pricing, telematic substitution

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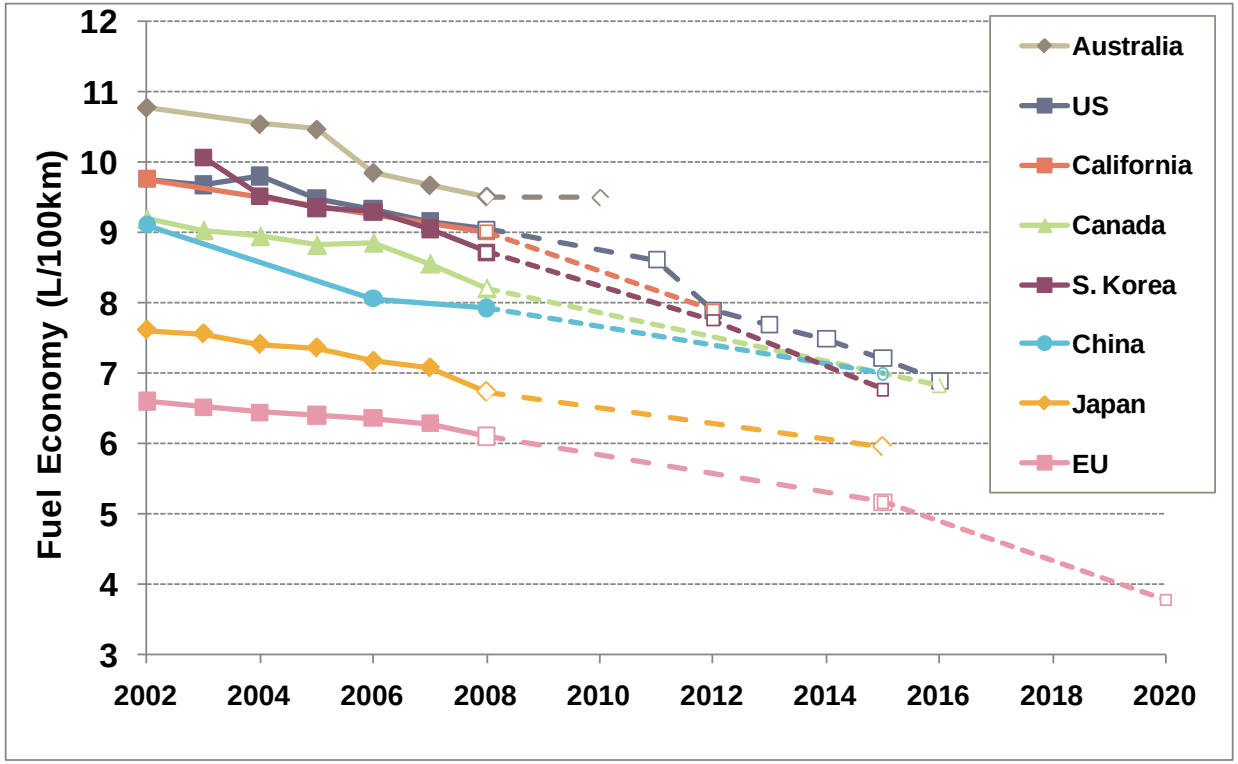
Transport market transformation is underway

Strong light-duty vehicle fuel economy standards in place in many major economies through 2015



Source: ICCT, 2010; fuel economy figures shown reflect each country's own test procedure; solid lanes show history; dashed lines show enacted standards; dotted lines show proposed standards

Through 2020, the standards shown here could save around 300 MTOE (over 2 billion barrels). This would increase further if standards continue to be tightened after 2015 and/or are extended to more countries.

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The Global Fuel Economy Initiative (GFEI)

- Launched on 4 March 2009 in Geneva by IEA, ITF, UNEP, and the FIA Foundation

50BY50 GLOBAL FUEL ECONOMY INITIATIVE

www.50by50campaign.org

FIA Foundation for the Automobile and Society

International Transport Forum

UNEP

- GOAL: reduction in fuel consumption per km of 50% by 2050 (for the vehicle stock) compared to 2005
- Roughly equivalent to an implementation of a 50% improvement by 2030 for new sales, worldwide
- Four main activity areas:
  - Analysis of global fuel economy trends and potential
  - Outreach to governments, assistance in policy development
  - Outreach to stakeholders, dialogue to improve coordination
  - Information campaigns

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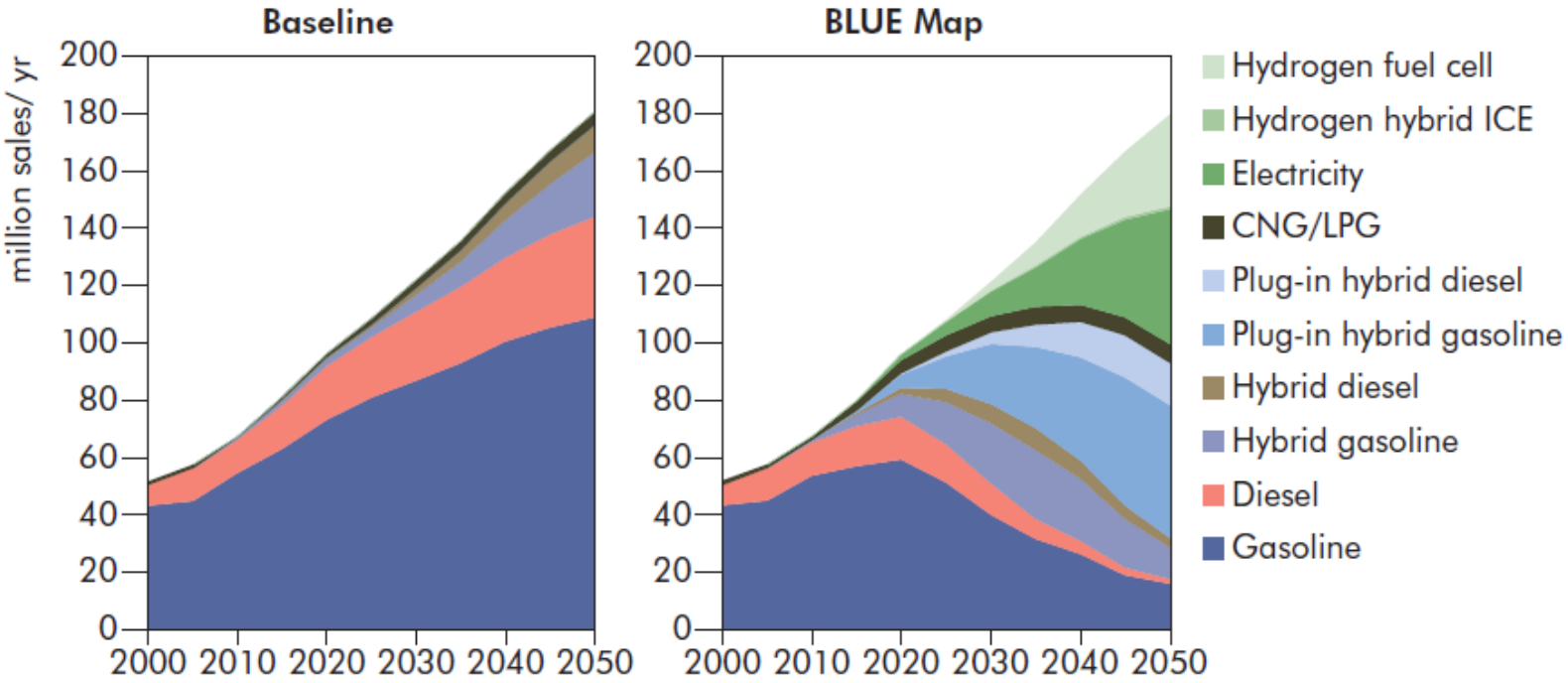
Passenger LDV sales by technology type and scenario



- *In the Baseline, sales are mainly conventional gasoline and diesel vehicles through 2050; hybrids reach about 20% of sales*
- *In BLUE Map, strong penetration of hybrids by 2015, PHEVs and EVs by 2020, FCVs after 2025. By 2050, plug-in vehicles account for more than half of all sales.*

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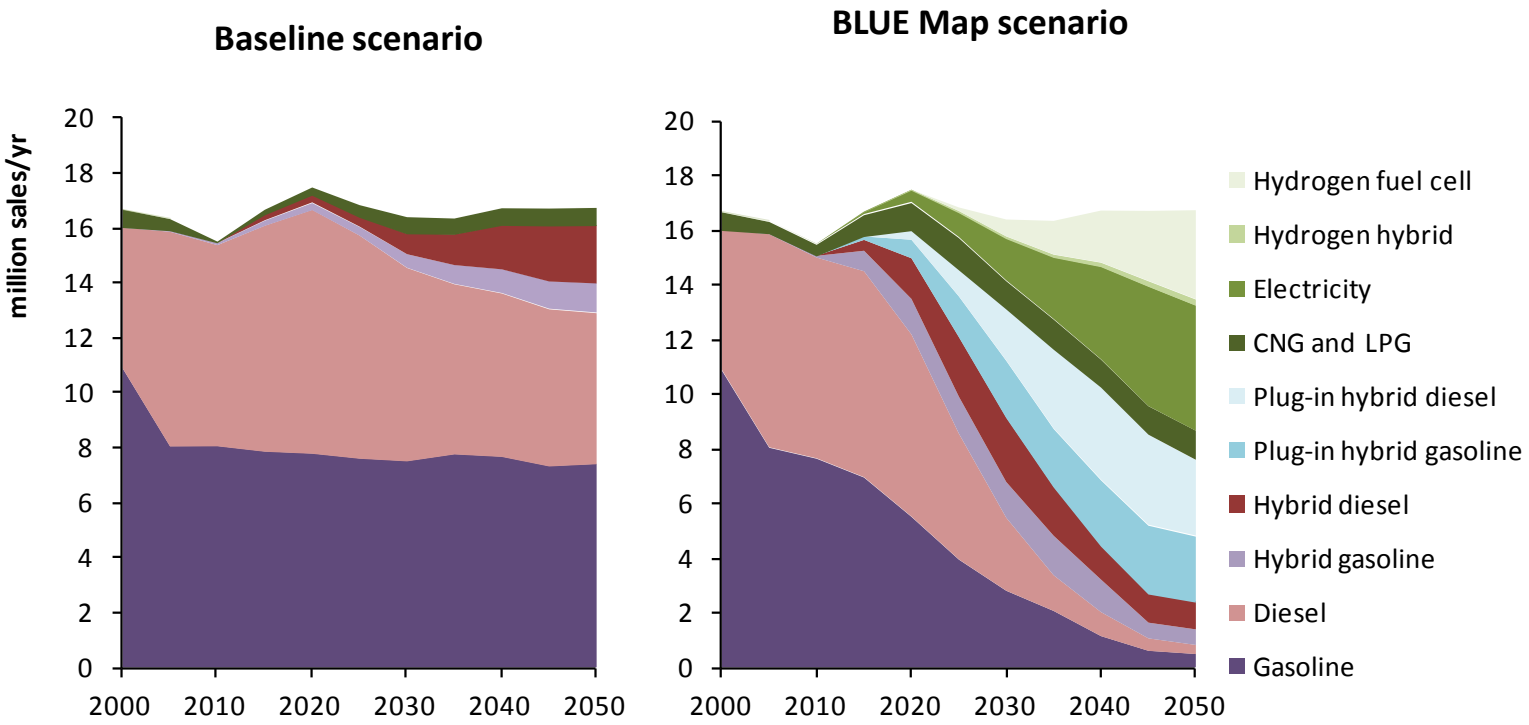
Passenger light-duty vehicles sales by technology in OECD Europe in the Baseline and BLUE Map scenarios



A wide range of new LDV technologies contribute to emissions reductions under the BLUE scenario.

Projected electric and plug-in hybrid vehicle sales through 2020, based on national targets

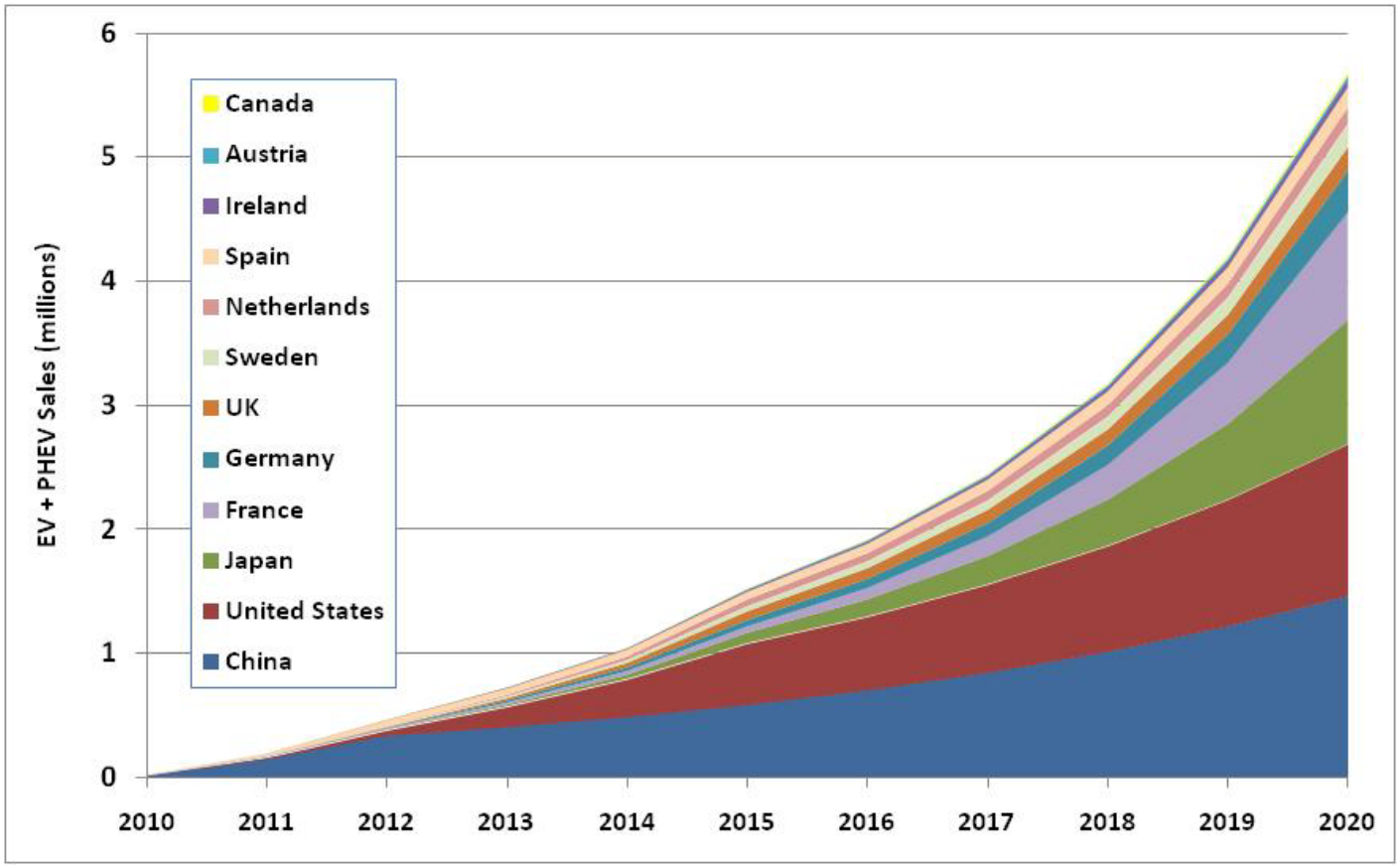


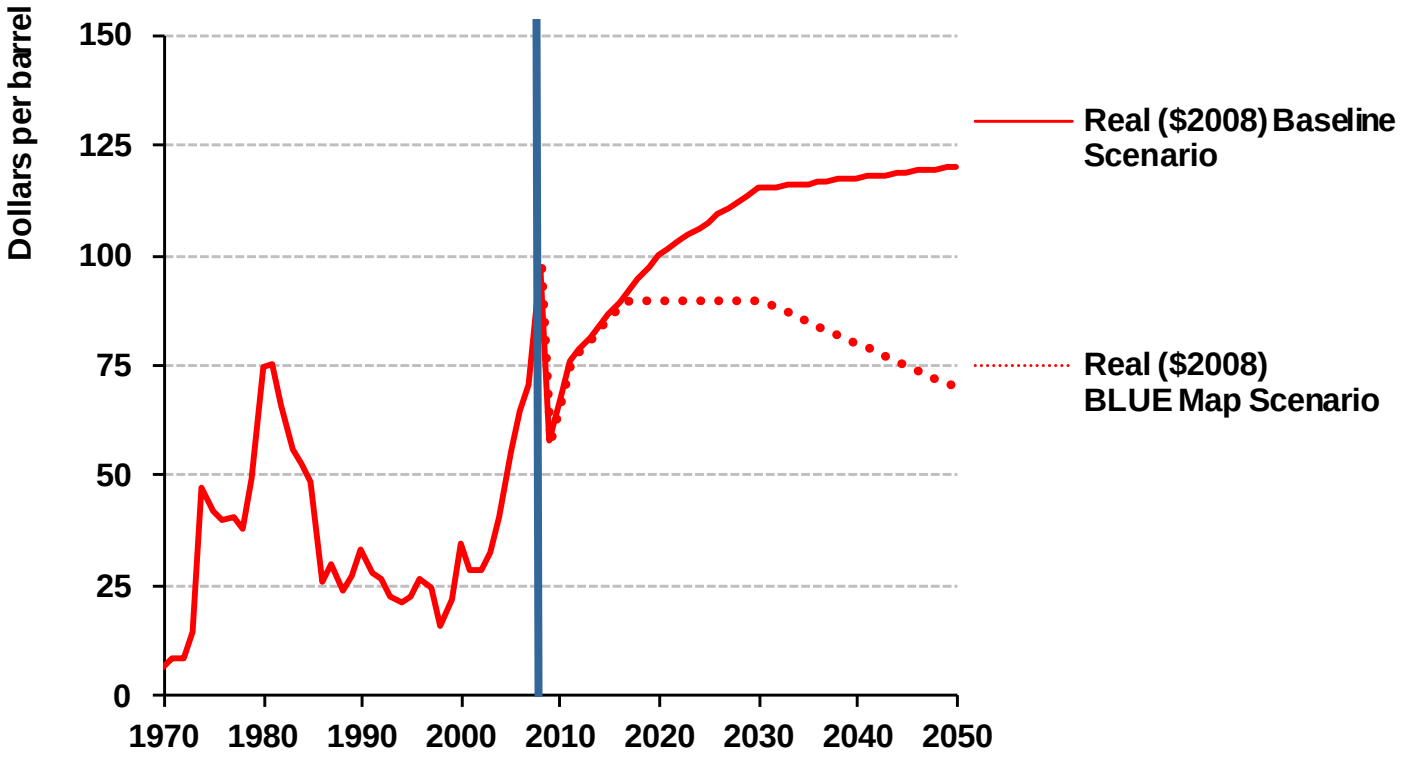
Figure based on announced national sales and stock targets, with assumed 20% annual sales growth after target is met, if target is before 2020 (e.g. China's target is for end of 2011).

EV / PHEV sales could reach nearly five million by 2020

Role of Biofuels

- In global baseline, biofuels now about 1.5%, reach 3% in 2030, 4% in 2050, mostly 1st gen
- BLUE Map, biofuels reach about 10% of transport fuels in 2030, 25% in 2050
  - In LAC, biofuels reach nearly 20% in 2030, 40% in 2050
- After 2030 main growth for trucks, ships aircraft
- After 2020, all new biofuels are 2nd generation (and cane)
  - 2nd gen Costs reach competitive levels with $120/bbl oil by 2020-2025
  - Cane to ethanol (and eventually cane-biodiesel?) expected to play an important role
- We must "solve" the sustainable feedstock problem
  - With 50% of biomass from waste products, remainder can be produced on <5% of ag land, but unclear if even this share is sustainable

Crude oil and CO_2 price



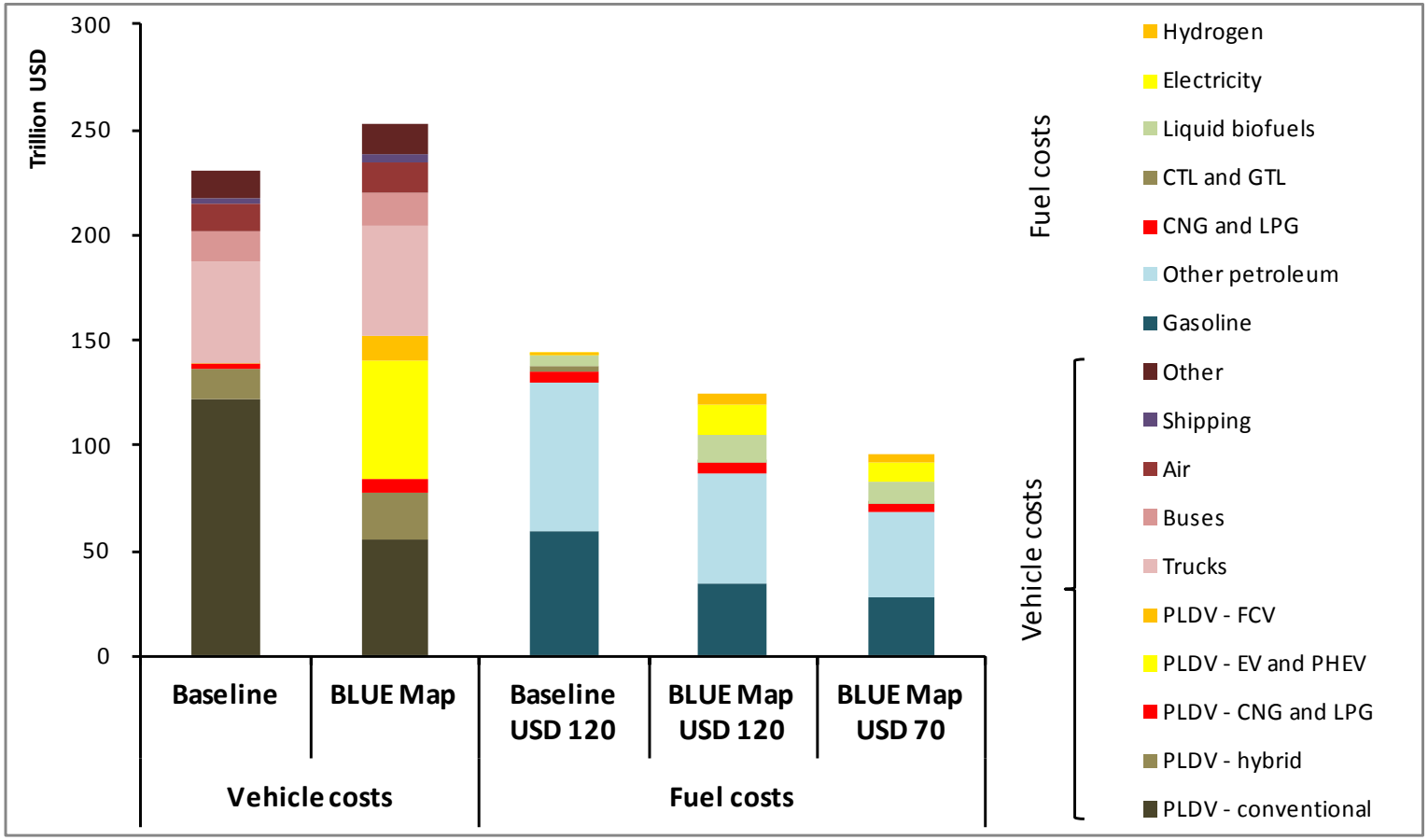
Impact of CO_2 price on costs for crude oil:

2020 50 USD/t CO_2 = 21 USD/bbl: 90+21 =111 USD/bbl

2030 110 USD/t CO_2 = 43 USD/bbl: 90+43 =133 USD/bbl

2050 175 USD/t CO_2 = 73 USD/bbl: 70+73 =143 USD/bbl

Global Vehicle and Fuel Costs, 2010-2050 by ETP 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

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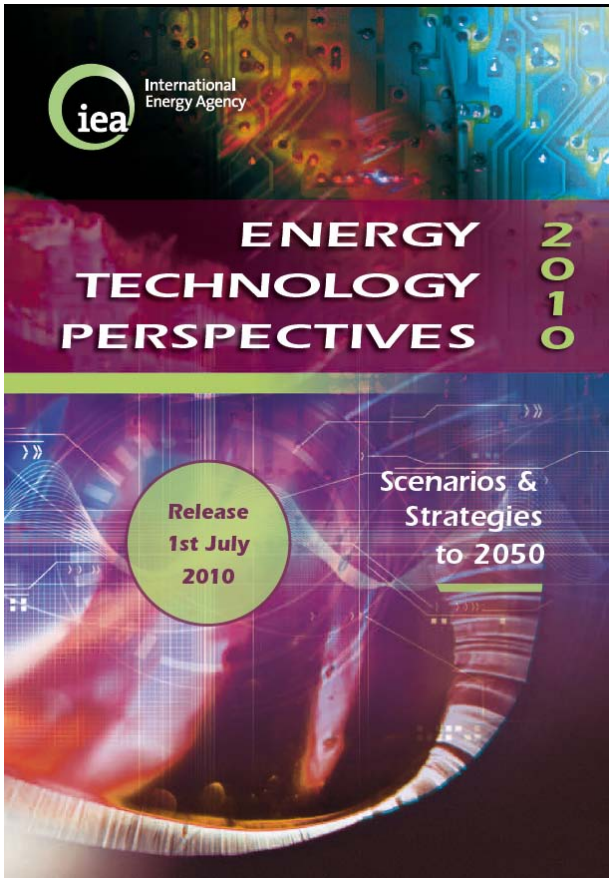

Thank You

www.iea.org/techno/etp/index.asp