WP-29 Roundtable
Geneva, 24 June 2010

International Energy Agency

Achieving a Low Carbon Transport System Worldwide

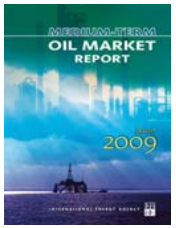
Pierpaolo Cazzola
International Energy Agency

Presentation outline

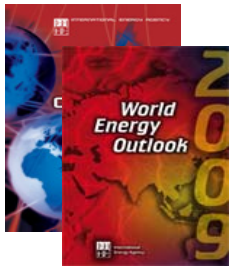
- IEA scenario analysis
- Focus on transport and low-GHG scenarios
  - Main assumptions and results
  - Focus on passenger light duty vehicles
    - Role of fuel efficiency
    - Role of advanced technologies
  - Global Fuel Economy Initiative
  - IEA Technology Roadmap on EV and PHEVs
- Conclusions

IEA, transport and liquid fuels

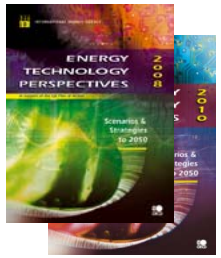
Relevant publications



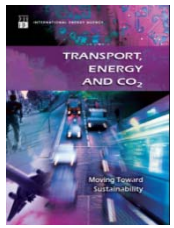
- **Medium term Oil Market Report**
  Horizon 2015, focus on oil
  Scenarios currently based on two different GDP growth assumptions



- **World Energy Outlook (WEO)**
  Horizon 2030, all energy sources
  Scenarios depicting different developments on the basis of policy actions
  One underlying assumption for GDP and population growth
  Includes a thorough analysis on the oil supply availability



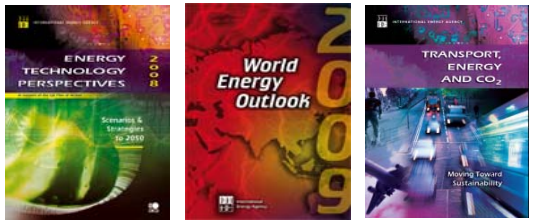
- **Energy Technology Perspectives (ETP)**
  Horizon 2050, all energy sources
  Scenarios that pay particular attention to the role of technology, especially on the demand side
  One underlying assumption for GDP and population growth



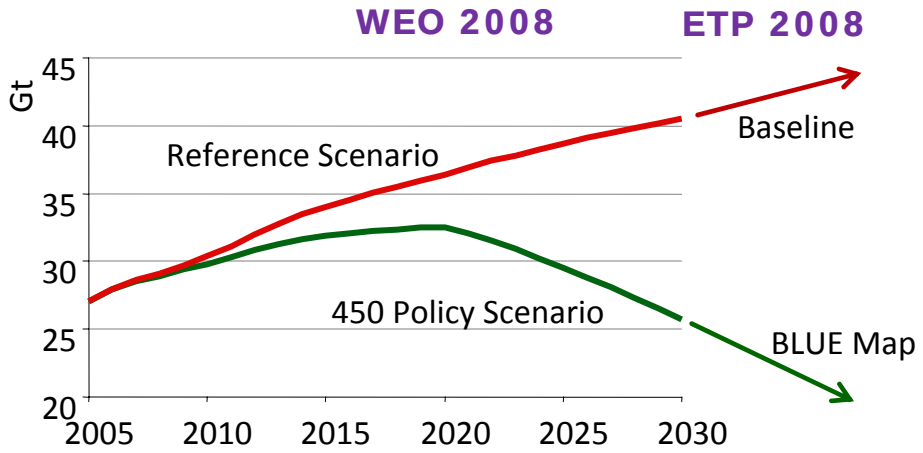
- **Transport, energy and CO_2 (Transport book)**
  Moving towards sustainability
  (Transport book)
  Horizon 2050, all energy sources
  Builds and expands the work done on ETP

IEA, scenario analysis

ETP, WEO and Transport book



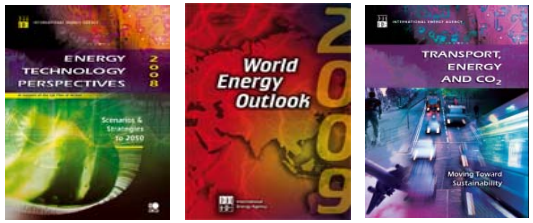
- The IEA analysis includes **two main families of scenarios**
  - **Reference/Baseline**
  - **450 ppm/BLUE Map**, emissions halved by 2050
    Compatible with IPCC 450 ppm CO_2 concentration



- The WEO and ETP scenarios are compatible, but not equal

IEA 450/BLUE scenario

Key messages



- **Halving GHG emissions by 2050 is possible**

  Beyond power generation (lowest cost option), significant cuts in transport and industry are required

- **Marginal cost of CO_2**

  2030 USD 50/t (WEO 2009)

  2050 USD 200 to 500/t (ETP 2008)

  - Oil price assumptions and long-term technology costs affect the estimate
  - Uncertainty increases with the GHG mitigation ambition level

- **Additional investment for 450/BLUE: about 1% of GDP**
- Important energy security benefits, other co-benefits

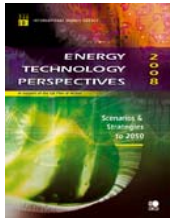
- **Need for a step change in government policies, with closer international collaboration**
  - A set of policy mechanisms attempting to reflect varied country-specific circumstances & negotiating positions has been included in WEO 2009

- **Need for a rapid switch to low-carbon technologies**
  - The ETP 2008 book includes specific technology roadmaps, aimed to provide a focus on what is needed (e.g. policies, RD&D funding) to achieve BLUE

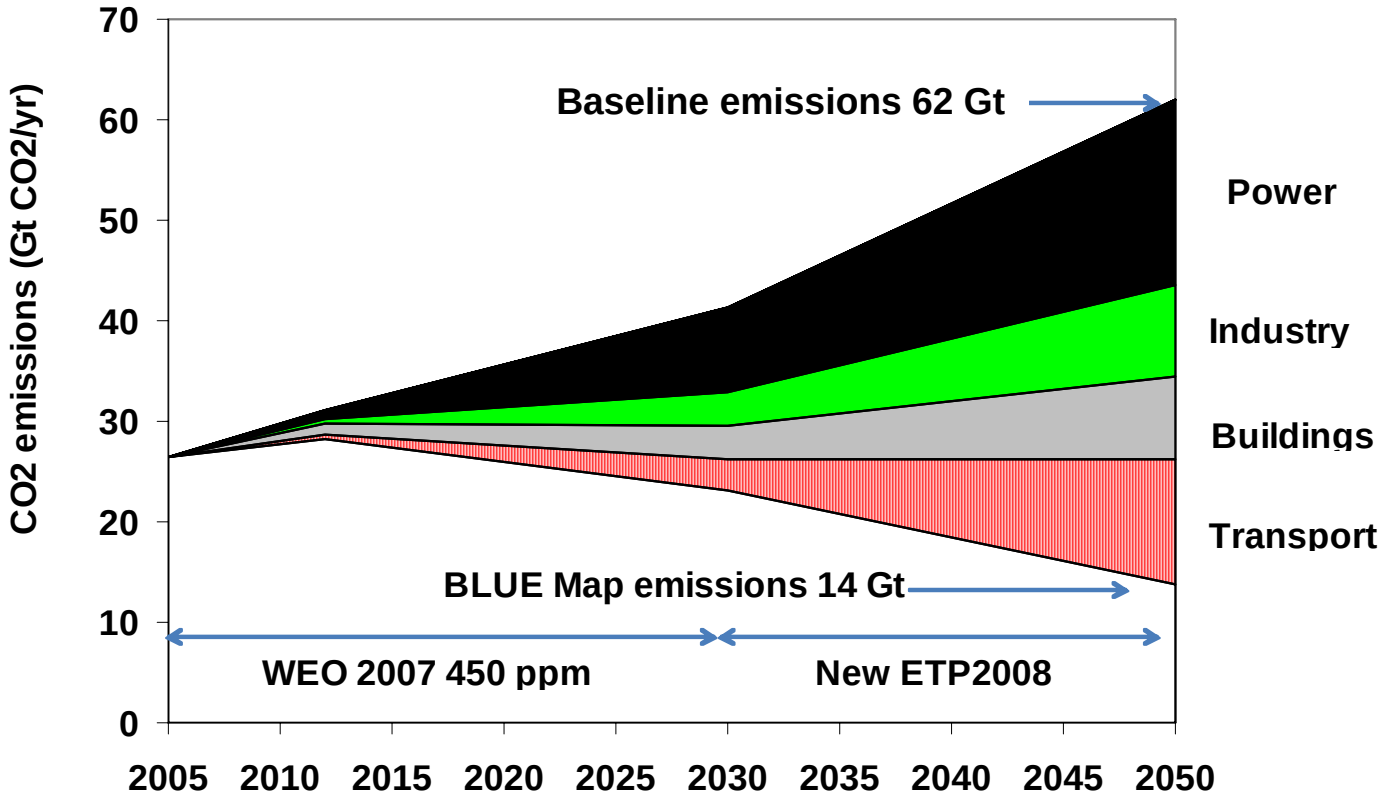
    They have been significantly developed for the ETP 2010

IEA 450/BLUE scenario

Role of different sectors

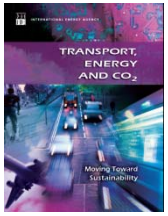


- Power generation decarbonisation is a fundamental step
- Transport is essential to go beyond emission stabilization
- Transport's role in 2050 is more relevant than industry and buildings

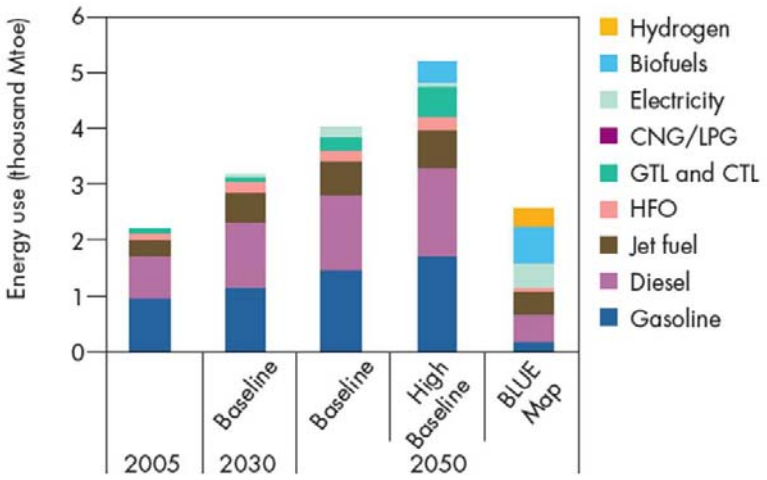


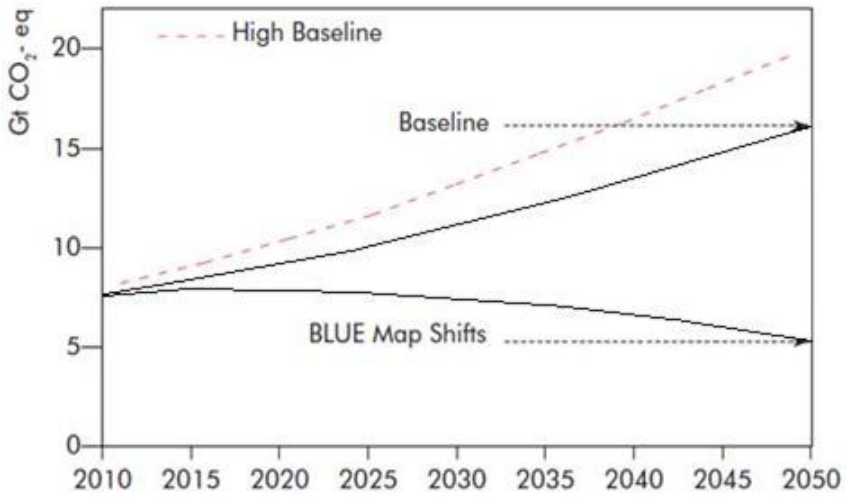
IEA transport analysis

Scenario results



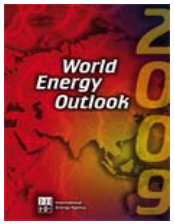
- **Baseline:** **energy demand and CO_2 emissions in transport nearly 80% higher by 2050**
  - The energy demand is mainly dependent on economic growth projections (expected recovery), car sales and freight sensitivity to economic growth
  - **High baseline**: 25% even higher energy use and CO_2 emissions in 2050 possible with developing regions following very closely OECD motorization trends
- **BLUE Map:** **efficiency improvements and alternative fuels together can cut CO_2 emissions in transport by 70% compared to the Baseline in 2050** (i.e. 30% below 2005)



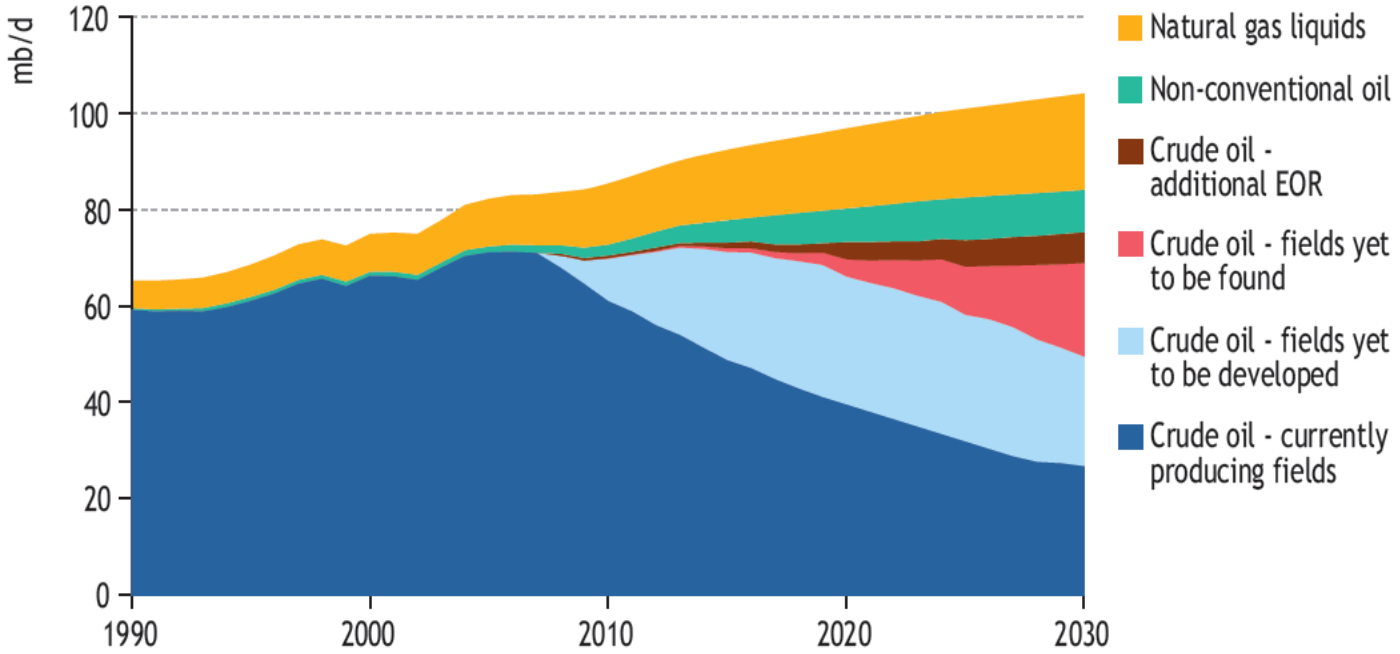


IEA transport analysis

Scenario results

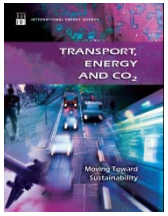


- **Energy security concerns strengthen the arguments for lower oil demand**
- **WEO 2009 Reference Scenario**
  - 64 mb/d of gross capacity need to be installed between 2007 & 2030 to meet demand growth & offset decline
  - Six times the current capacity of Saudi Arabia

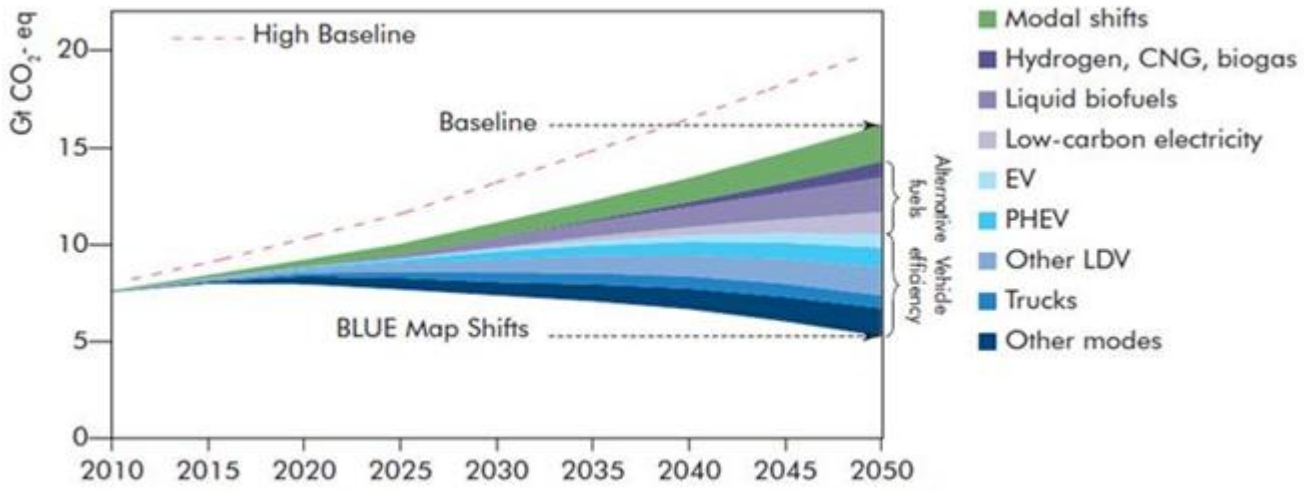


Transport

Key steps to achieve BLUE Map outcomes

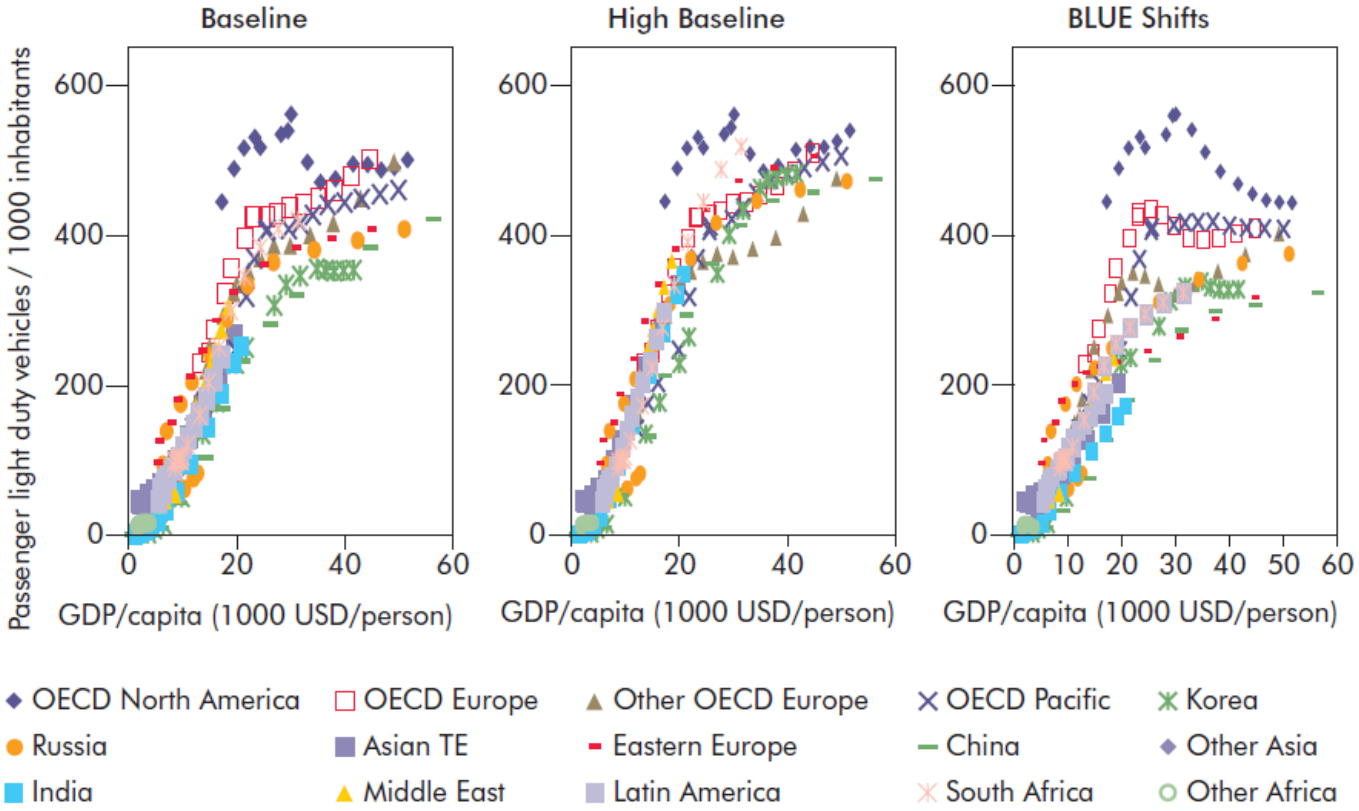


- **Improved efficiency** is fundamental for all modes
  - >50% improvement (J/km) for LDVs; 30-50% for other modes (lower potential)
- **Increased electrification** has a key importance for LDVs
  - Strong uptake of plug-ins and electric vehicles (before 2020); fuel cells after 2025
- **Alternative fuels** critical for aviation (also important in trucks & shipping)
  - Sustainable biofuels: only available fuel option leading to lower life-cycle GHGs
  - Advanced, low-GHG Biofuels reach 12% of transport fuel use by 2030, 25% by 2050 (mainly diesel demand)
- **Behavioral and logistical changes** (including modal shifts)
  BLUE Map/Shifts scenario (beyond BLUE Map)
  - 25% lower car and air travel in 2050 compared to Baseline
  - up to 2x travel by rail, bus (such as Bus Rapid Transit systems)
  - lower travel due to better land use planning, road pricing, telematics



Transport

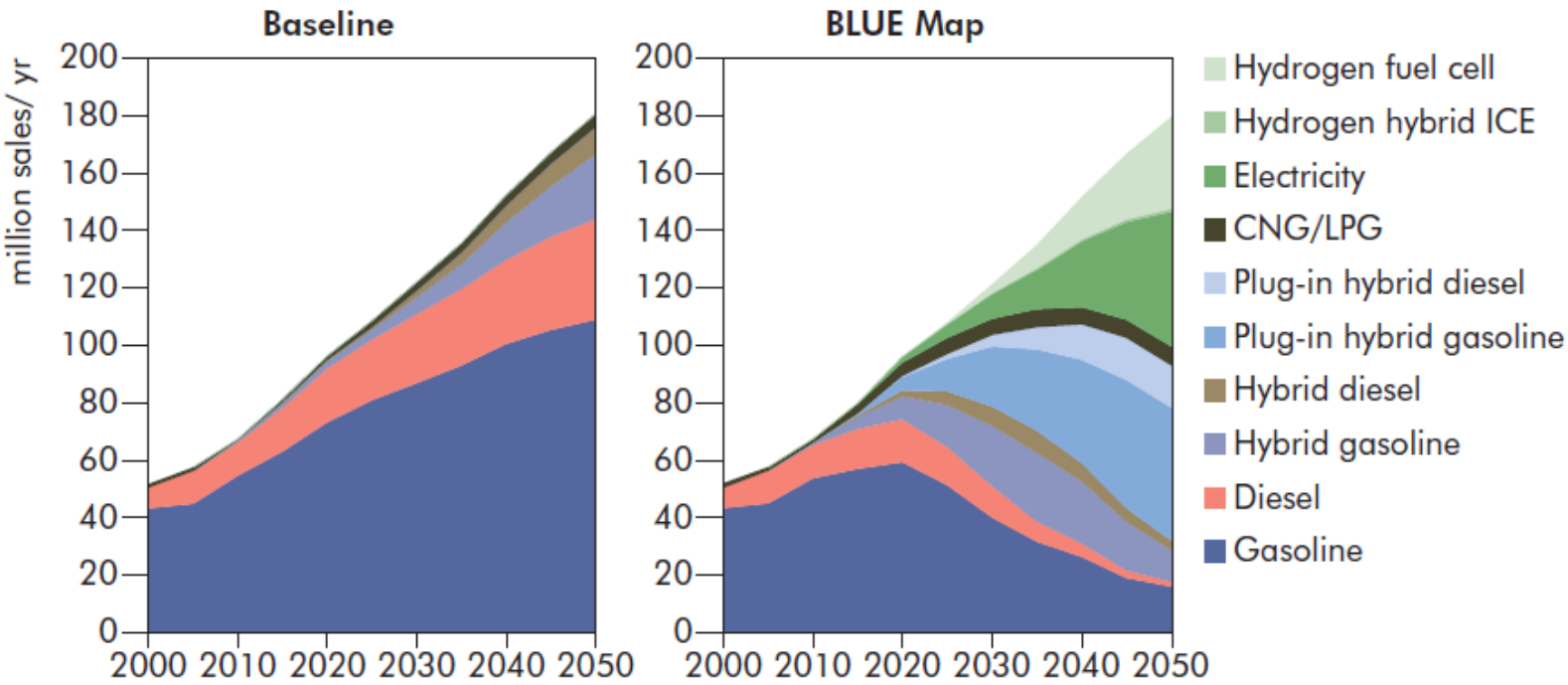
Passenger LDV sales and income



- Strong increases in vehicle ownership
- Total stocks worldwide rise from 700 million to 2.2 billion in 2050 in the Baseline and nearly 2.7 billion in the High Baseline
- BLUE Shifts: lower growth, but total stocks still reach 1.7 billion in 2050

Transport

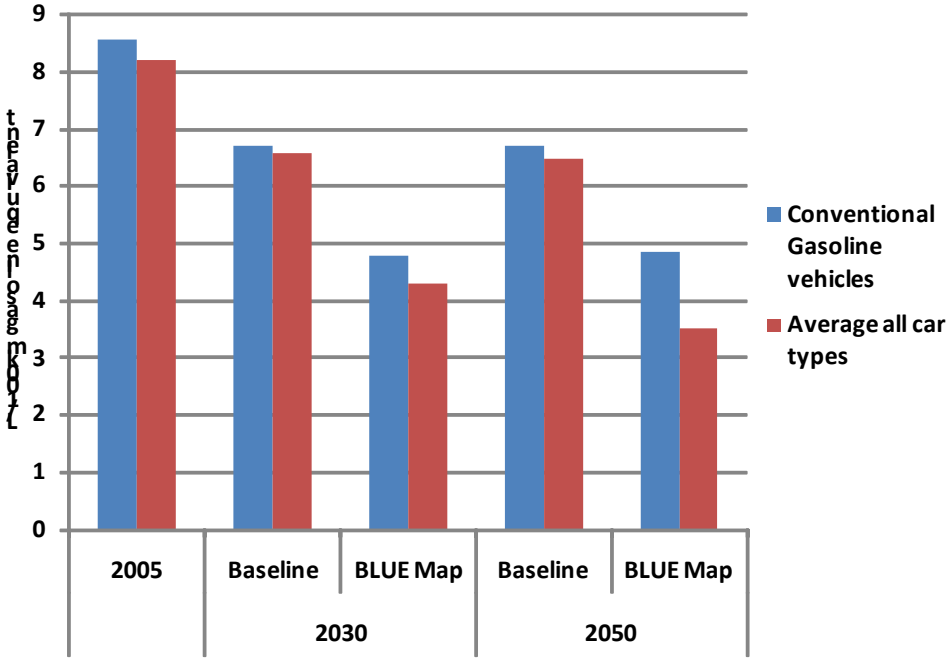
Passenger LDV sales by technology type and scenario



- 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

Transport

Passenger Light-duty vehicle fuel economy



- Passenger light-duty vehicle (PLDV) fuel economy improves slowly in the Baseline (no extension of existing standards assumed)
- Much stronger improvement in BLUE Map with maximum uptake of available incremental technologies; achieves about a 50% reduction in new LDV energy intensity by 2030, and an additional 20% by 2050

Transport

Costs of Baseline and BLUE Map, 2010-2050

- If EV and fuel cell vehicle costs drop as anticipated, by 2050 the transport BLUE Map scenario should be achievable at a marginal cost of or below USD 200/tonne CO_2
- During the transition costs will be higher, but costs will drop as volumes become higher so early high unit costs may not be that significant in the long run
- On average between 2010 and 2050, BLUE Map may not be much more expensive (possibly even cheaper) than the Baseline
  - In the Baseline, the total (undiscounted) cost of vehicles of all types between 2010 and 2050 is about USD 230 trillion USD, with another USD 150 trillion cost for fuel
  - In BLUE Map, vehicle costs rise by an additional USD 22 trillion (10%), but fuel costs (at USD 120/bbl) drop by USD 20 trillion (about 20%)
  - However, if the price of oil in BLUE drops, more savings take place (assumingthe same technology uptake). If the price drops to USD 60/bbl, the additional savings are USD 30 trillion

Global Fuel Economy Initiative

IEA amongst founding partners

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

- 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

EV/PHEV Roadmap

Technical findings

- **Vehicle range on batteries is likely to be limited (e.g. 150 km)**
- **EV incremental costs would be too high unless all of these targets are met:**
  - Battery costs drop down to USD 300/kWh
  - Batteries last nearly the life of vehicles (e.g. 15 years) and are amortized over this time frame
- **Electricity demand does not look like a significant issue on a regional scale before 2030**
  - 200 TWh in 2025 for vehicles vs. 13 000 TWh OECD-wide (total demand)
- **But…**
  - Could become an issue in specific areas
  - Availability of low-CO_2 generation will be key
  - Load management; grid integration issues are likely to emerge in case of a success fo EV/PHEVs
  - EV/PHEV-related share of power generation may reach 10% by 2050

Conclusions

- Without policy interventions, oil use and related CO_2 emissions worldwide could double by 2050
- We can change this picture and cut transport CO_2 below current levels via a combination of
  - Strong efficiency improvements to all modes, combined with global harmonization of test procedures (WLTP, WHDC and WMTC)
  - Rapid uptake of advanced technology vehicles after 2015
  - Strong adoption of alternative fuels (especially electricity and biofuels, and eventually hydrogen)
  - Modal shifts via smart growth and strong investments in state-of-art transit and bus systems
- It appears reasonable to target a 50% improvement in fuel consumption (i.e. reduction in L/100km), on average, around the world by 2030
- If research delivers successfully technological cost reductions and policy support is in place, the cost of this alternative future may be surprisingly small or even negative on a societal cost basis, especially if oil prices are high (in Baseline), even if transition costs would be higher