

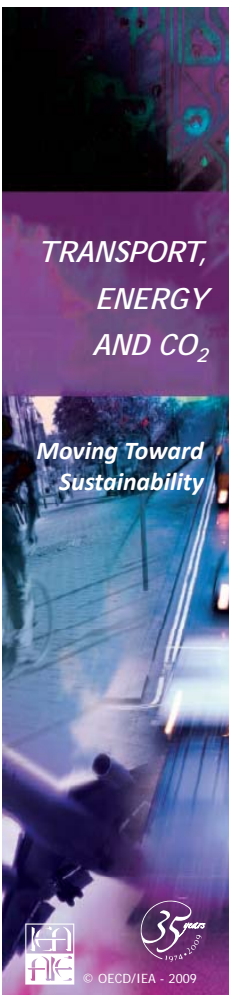


IEA EV/PHEV Roadmapping Project

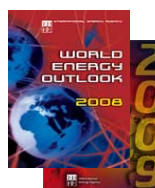
Lew Fulton, IEA/SPT

EUWP Workshop on Electricity in the Future Transport System

17 September, 2009



IEA and transport Relevant publications



- 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

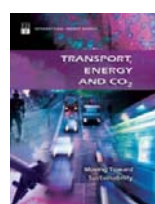


- Energy Technology Perspectives (ETP)

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



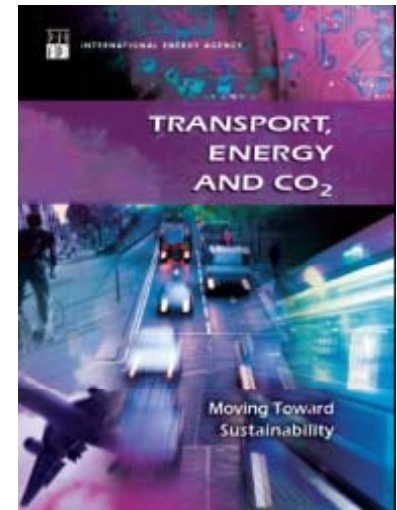
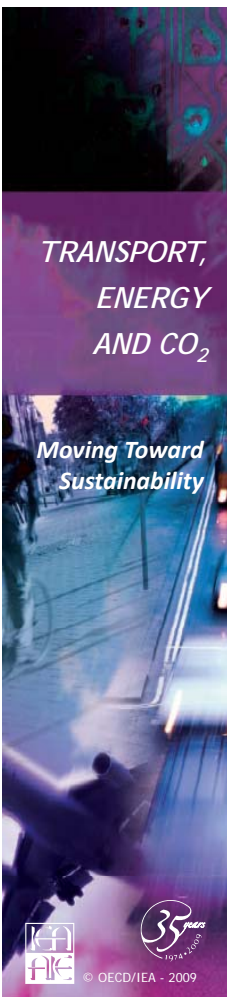
- Transport, energy and CO₂
Moving towards sustainability
"Transport book"

Horizon 2050, all energy sources

Builds and expands the work done on ETP

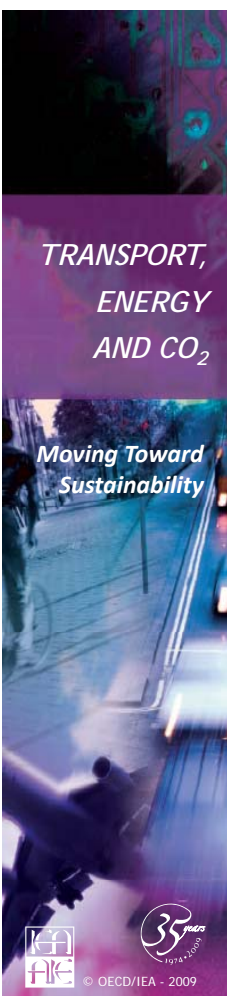
IEA's New Transport Publication

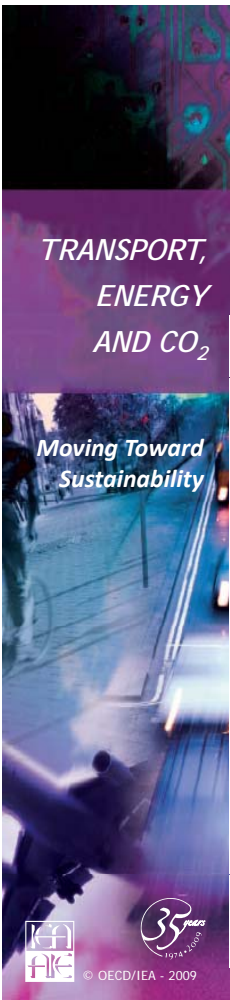
- For release October 2009
- Builds on ETP 2008, will feed into ETP 2010
- Transport analysis based on on-going development of IEA Mobility Model, supporting research
- Book features:
 - Indicator update and extension to more countries
 - Technology potential and cost updates
 - Fuel and Modal assessments (LDV, truck, aviation, shipping)
 - Detailed scenario analysis with regional detail – Baseline, High Baseline, Modal Shift, BLUE technology scenarios
 - Role of future technologies, modal shift
 - More regional detail than in ETP
 - Continuing development of CO2 mitigation cost analysis
 - Policy considerations



IEA EV/PHEV Roadmapping Effort

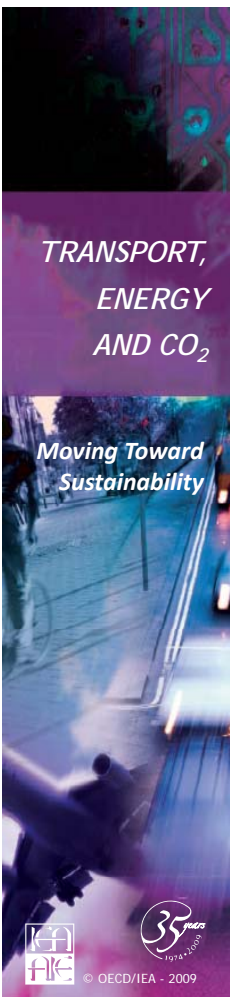
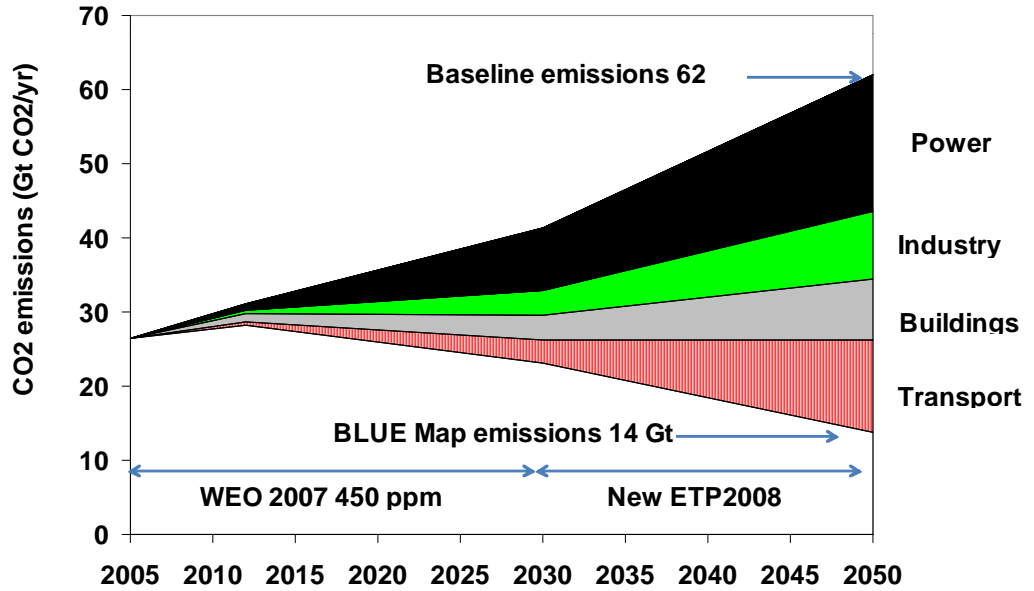
- In response to Hokkaido G8 request, IEA/SPT is developing roadmaps for 20+ major technologies
 - Gather stakeholders in workshops to develop a common view on how an EV/PHEV “roll-out” could occur over next 10-20 years
 - Identify key targets, pathways, near-term actions for governments, stakeholders
 - Understand where international collaboration/coordination is needed
- EV/PHEV roadmap addresses technology targets, vehicle deployment infrastructure, investment requirements
- EV/PHEV roadmap timeline:
 - Workshop held in January 2009
 - Draft report was circulated for review in August
 - Report to be published in October
 - Will be delivered to IEA Ministerial along with 3 other roadmaps (CCS, PV, Cement)
 - Feeds into ETP 2010





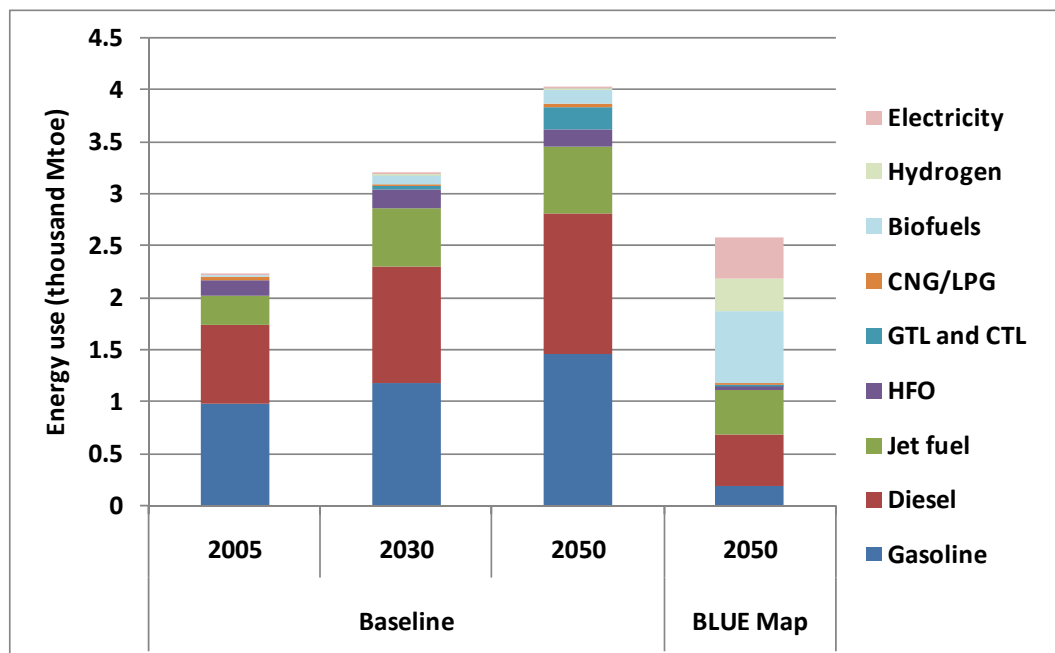
We need a global 50% CO2 cut by 2050

IEA ETP 2008: Where reductions come from



ETP Transport Energy use by scenario

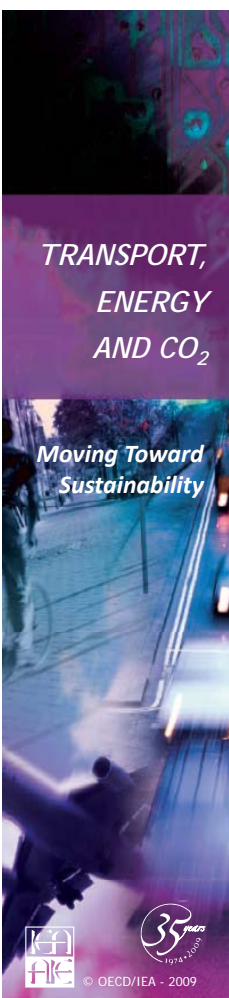
In BLUE Map, transport energy use returns nearly to 2005 level, with more than 50% very low CO2 fuels





Key Findings

- **Baseline (WEO Reference Case) transport fuel use 80% higher by 2050; a new High Baseline reaches 25% higher energy use in 2050**
 - Mainly dependent on car sales projections and freight sensitivity to economic growth
- **Fuel economy improvement remains among most cost-effective measures**
 - Can reach 50% improvement for LDVs and 30-50% for other modes by 2050 or before
- **Alt fuels still critical, though biofuels concerns growing; electrification may be key**
 - Biofuels still important but concerns about sustainability are growing; a roadmap for achieving 2050 levels in BLUE is needed
 - Costs for batteries and fuel cells are dropping; EVs may reach commercial production very soon
 - PHEVs appear to be a promising transition strategy



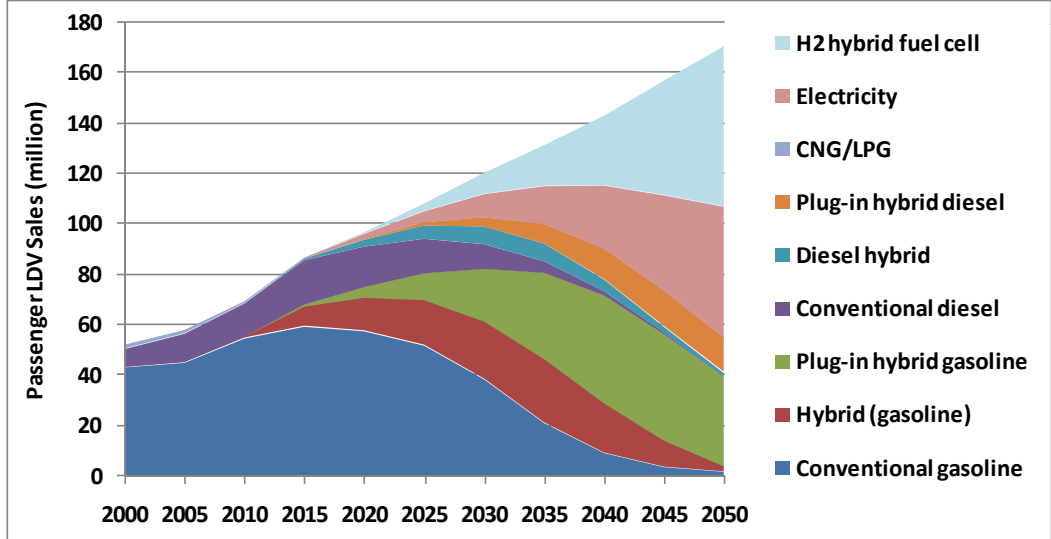
Key Findings (cont.)

- **Additional reductions can come from changes in the nature of travel**
 - Modal shift analysis suggests that a 25% reduction from 2050 Baseline is feasible (almost 50% compared to High Baseline), though more work is needed on the costs and policies to get there
 - Technologies such as Bus Rapid Transit will be important, but ultimately its about land use planning and a comprehensive approach to travel policies.
- **Together modal shift, efficiency improvements and alt fuels could cut transport CO₂ by 70% compared to baseline in 2050 (30% below 2005)**
 - More technology cost work is needed for aviation and shipping, but initial assessment suggests that many relatively low cost opportunities may be available.
 - For LDVs, 80% reduction in CO₂ by 2050 at under 200 USD/tonne in that year



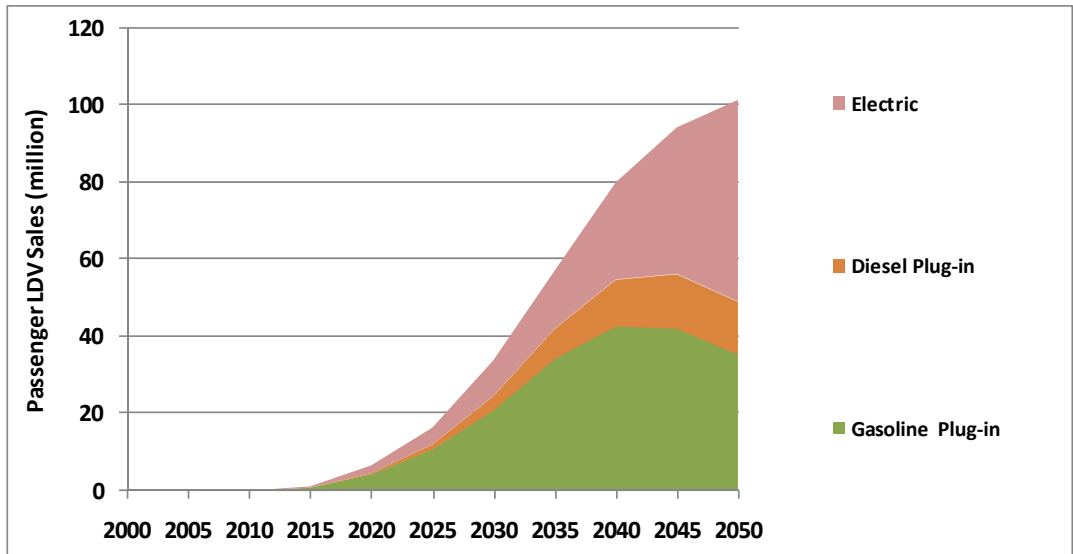
BLUE: advanced technologies must play a major role

Unprecedented rates of change in market penetration of advanced technologies



BLUE EV/PHEV sales trajectory to 2050

How can we achieve this?

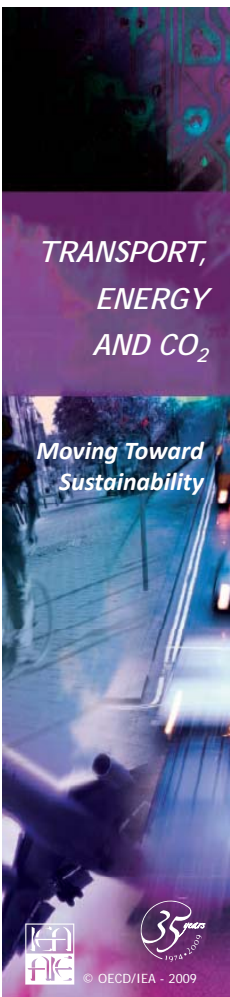


Annual sales targets:

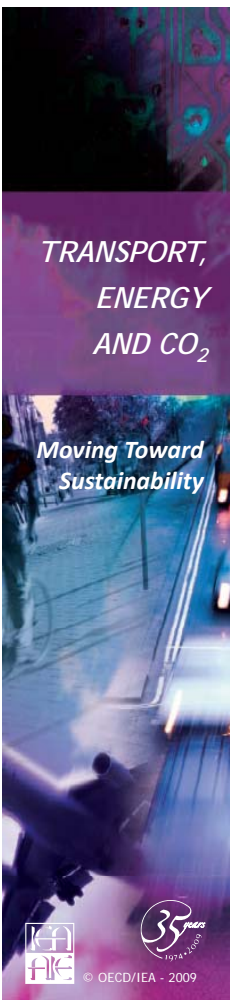
2020: 7 million: *e.g.* 70 models selling 100,000 each

2030: 30 million: *e.g.* 150 models selling 200,000 each

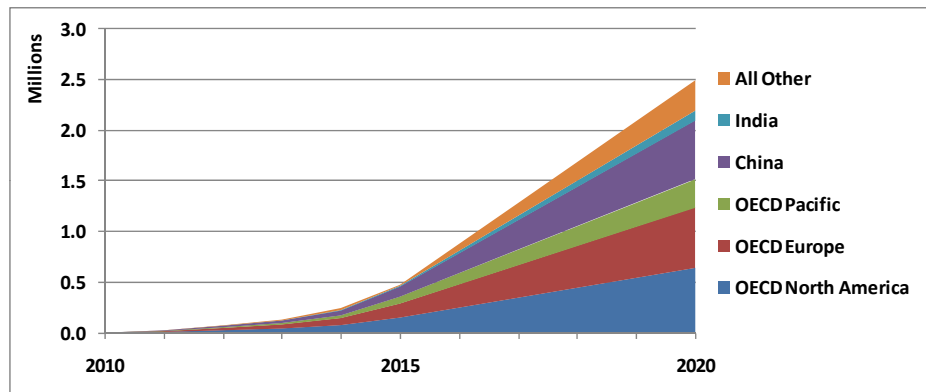
2050: 100 million: *e.g.* 400 models selling 250,000 each



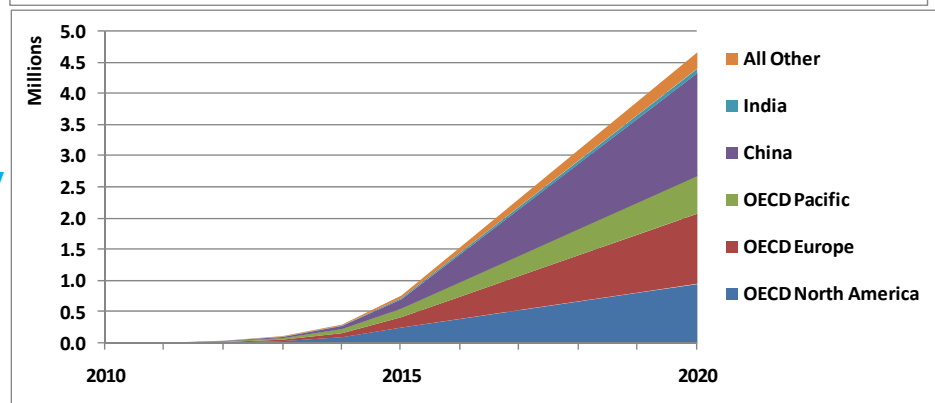
Roadmap target sales reach a combined 7 million per year by 2020



EV



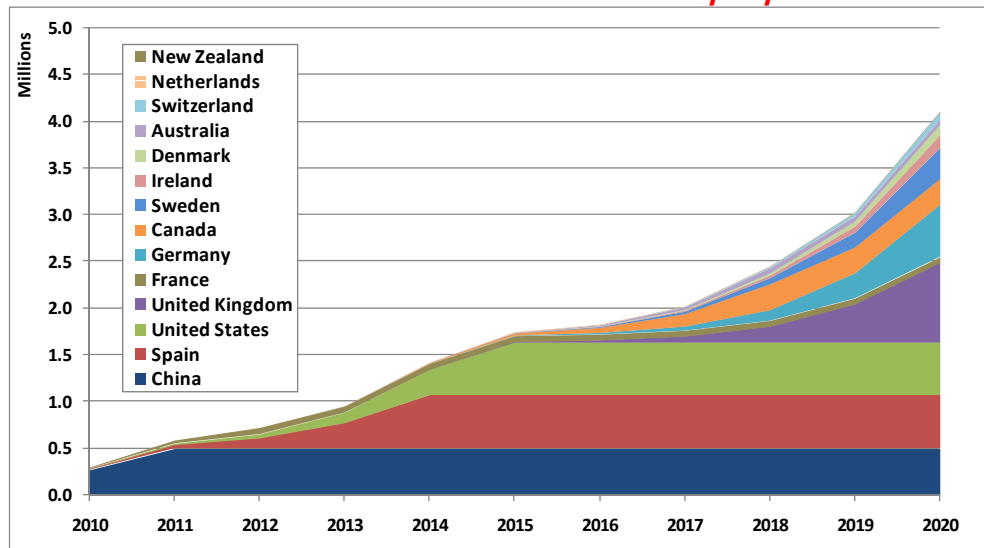
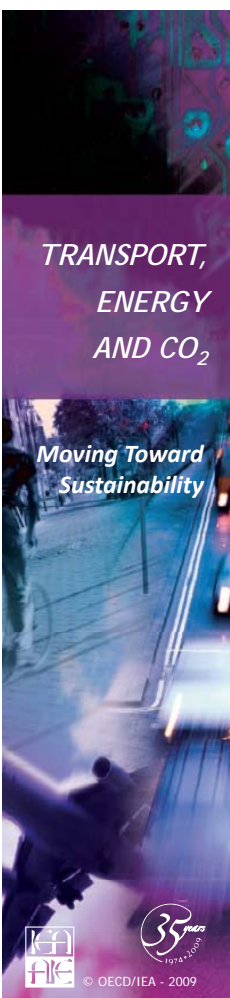
PHEV



Announced national targets for EV/PHEV sales – not far behind

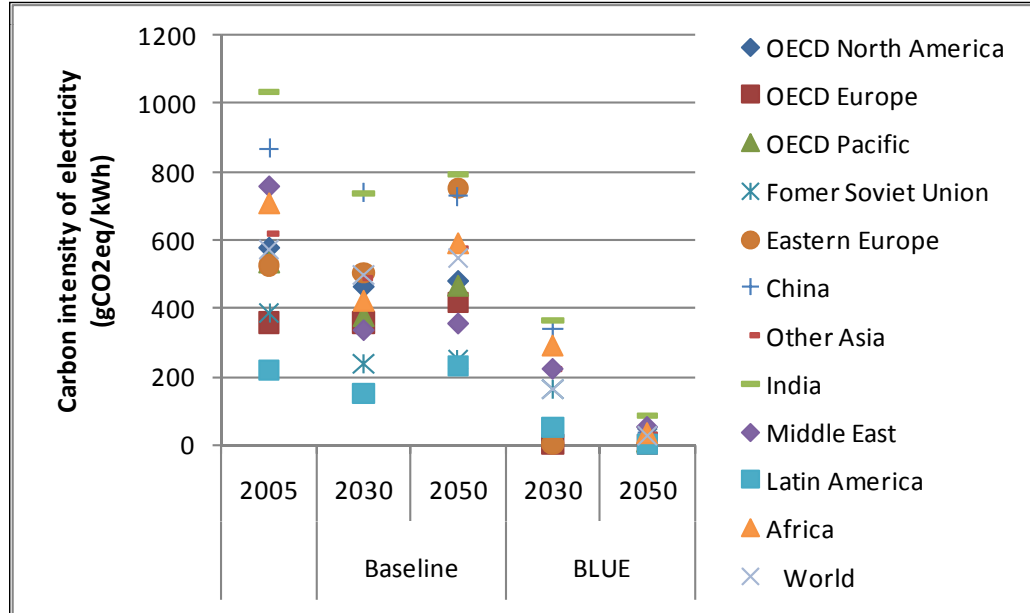
As of September 2009. Combined, the total reaches 4 million by 2020;

*However if EV/PHEV sales in each country continue to grow beyond when each target is met, and other countries also set and achieve targets, global sales levels could be far higher in 2020 than shown here. **Are manufacturers prepared for this?***



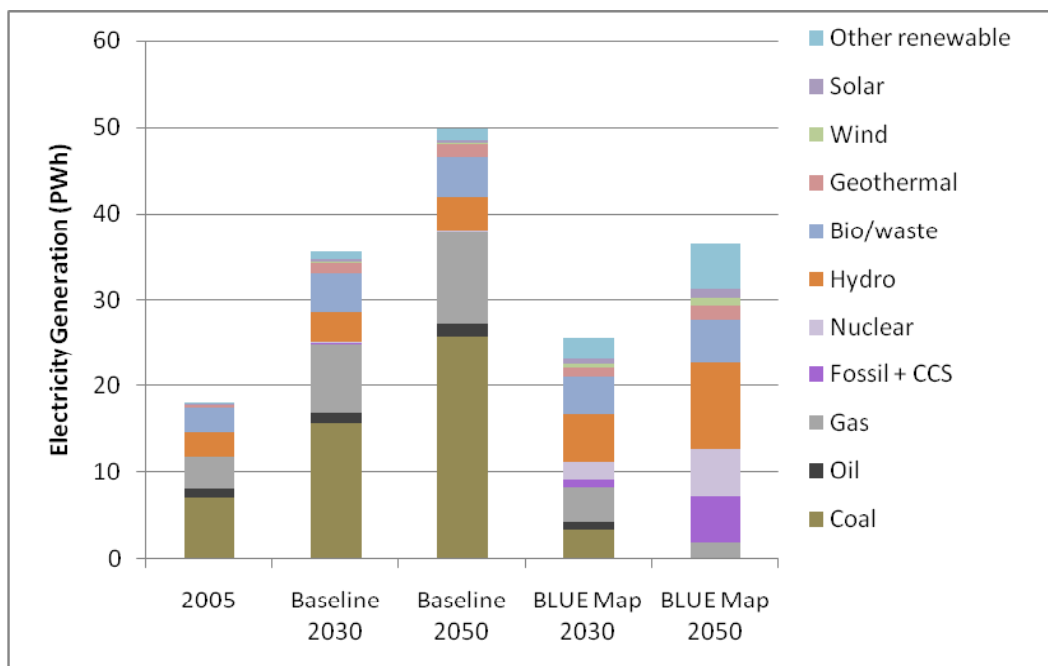
GHG intensity of electricity production

By 2050, electricity generation radically decarbonised in BLUE Map – but not in Baseline



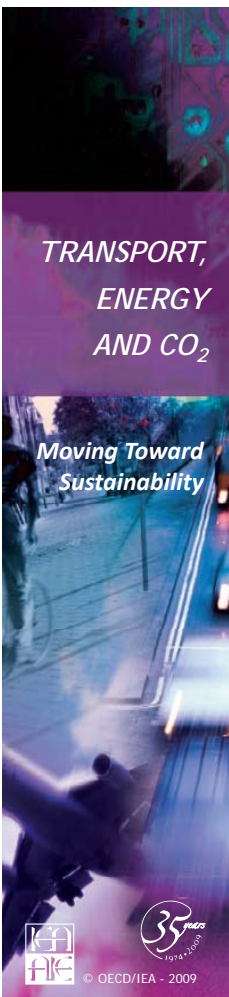
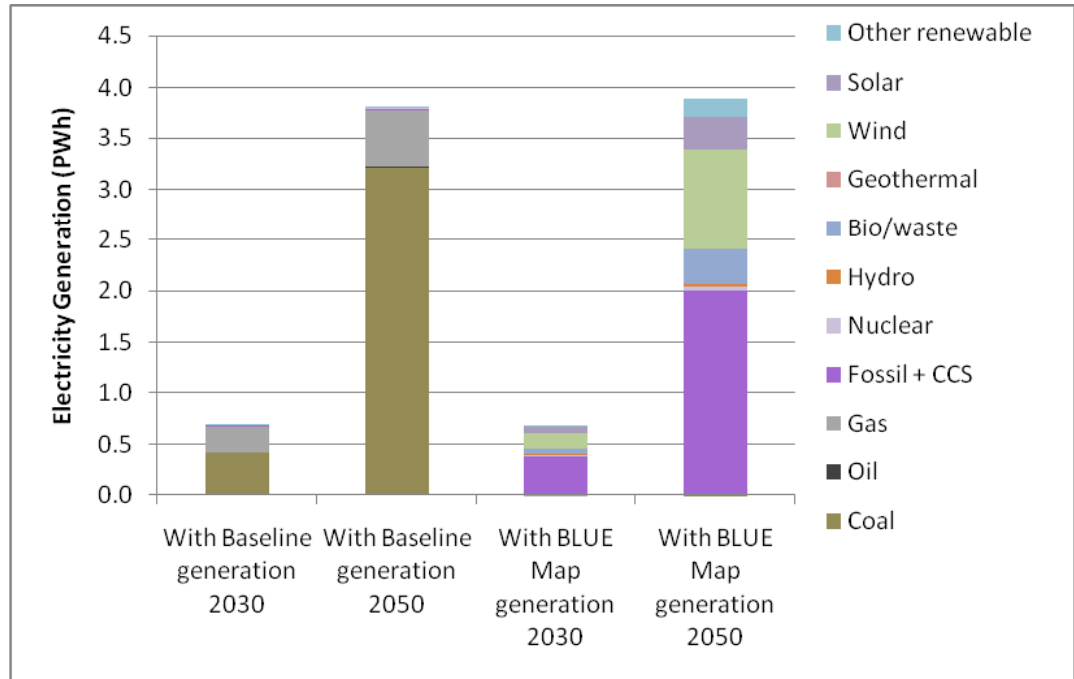
Electricity generation worldwide, by scenario and year

BLUE Map lower than Baseline in 2050 despite strong shift toward electricity, including EVs





Incremental electricity generation for EVs and PHEVs in BLUE Map Requires up to 10% more generation in 2050, but what kind will we get?



Roadmap: some technical findings

- **EV incremental costs could be high unless all of these targets are met:**
 - Battery costs drop to \$300/kWh (target for 2015)
 - Vehicle range on batteries is limited (e.g. 150 km)
 - 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 v. 13,000 OECD-wide
- **But...**
 - Could become an issue in specific areas
 - Availability of low-CO2 generation will be key
 - Load management; grid integration issues emerge
 - EV/PHEV share of world generation could reach 10% by 2050

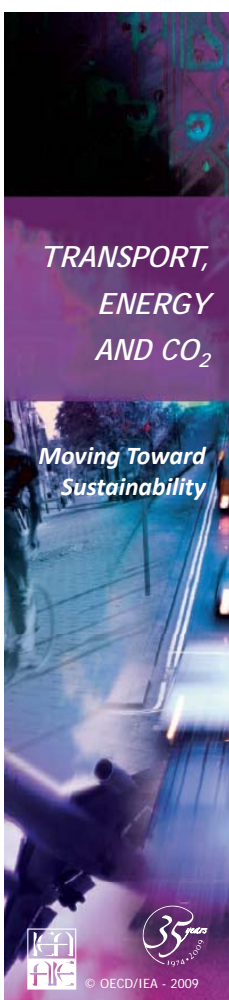
Roadmap key findings

- EVs and PHEVs are expected to provide large private and social benefits, in particular in reducing oil use, GHG emissions and pollutant emissions
- The worldwide target for combined EV and PHEV sales share of LDVs should be at least 7% in 2020 (about 5 million) and 50% by 2050 (80 million).
- Near term time-line:
 - Testing, small scale production, optimisation of vehicle designs should occur during 2010-2012
 - Model deployment and moderate levels of production, 2012-2015
 - Rapid introduction of models and scale up of production (toward 100,000 per model) will be needed from 2015, in order to hit 2020 targets.
- Very important to get battery costs down to USD 300/kWh for EVs by 2015
 - Battery durability and life-spans must be adequate
- From 2012 (or earlier), coordinated development of infrastructure, perhaps focusing on a number of large metropolitan areas to begin with



Key findings (cont).

- Strong support needed from national and local governments:
 - Ensure necessary standards are in place
 - Coordinate vehicle sales, recharging infrastructure investments
 - Use a comprehensive mix of policies that leverage stakeholder interests; probably will need to include EV/PHEV purchase incentives for some years
 - Take measures to reduce risks to manufacturers and battery suppliers
 - Foster research, development and demonstration (RD&D) to reduce costs and resource-related issues, especially on energy storage and smart grid technology.
- Automakers must develop viable business models – need good understanding of consumer preferences
- Role for international collaboration
 - Coordinating and sharing research
 - Setting standards, targets
 - Help coordinate national roll-out efforts and avoid bottlenecks
 - Monitor and periodically report on progress
- This Roadmap strongly encourages stakeholders to continue to work with the IEA in an on-going fashion to implement the roadmap and monitor progress.





Next Steps

- Roadmap publication October 2009
- Endorsements from governments
- Develop a system for monitoring
- Annual or bi-annual roadmap updates and reports