



International
Energy Agency

Energy Challenges and Costs for Transport & Mobility

13th EU Hitachi Science and Technology Forum:
Transport and Mobility towards 2050

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To cover today:

- 1. The energy/transport challenge: trends and targets**
- 2. Components of the challenge**
 - Fuel Economy
 - Electric vehicles
 - Biofuels
 - Costs and benefits

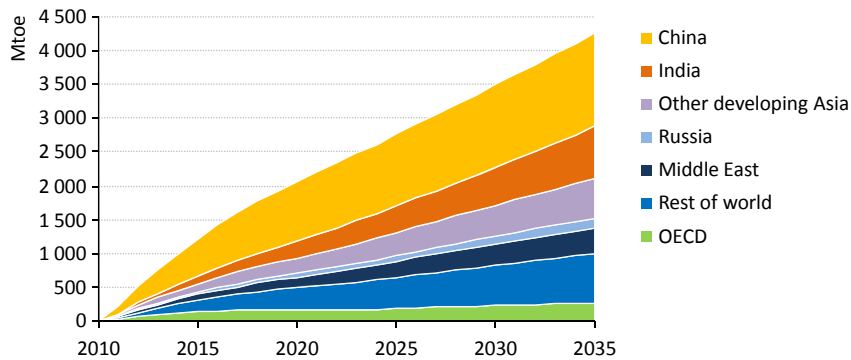
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Emerging economies continue to drive global energy demand

WORLD ENERGY OUTLOOK 2011

Growth in primary energy demand in the New Policies Scenario



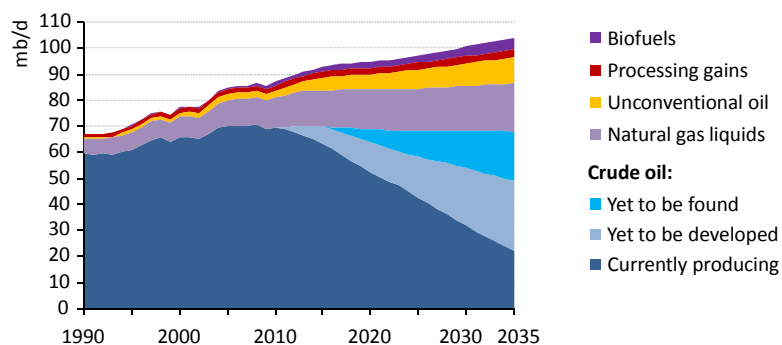
Global energy demand increases by one-third from 2010 to 2035, with China & India accounting for 50% of the growth

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Most new oil production capacity is needed to offset decline

WORLD ENERGY OUTLOOK 2011

World liquids supply by type in the New Policies Scenario



Decline at existing conventional fields amounts to 47 mb/d, twice current OPEC Middle East production; the largest production increases come from Iraq, Saudi Arabia & Brazil

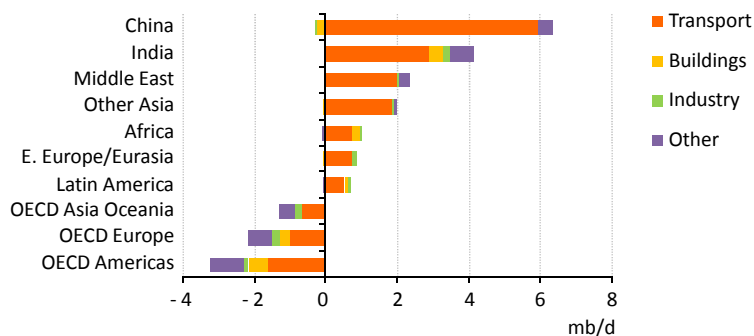
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Transport drives oil demand

WORLD ENERGY OUTLOOK 2011

Change in primary oil demand by sector & region in the New Policies Scenario, 2010-2035



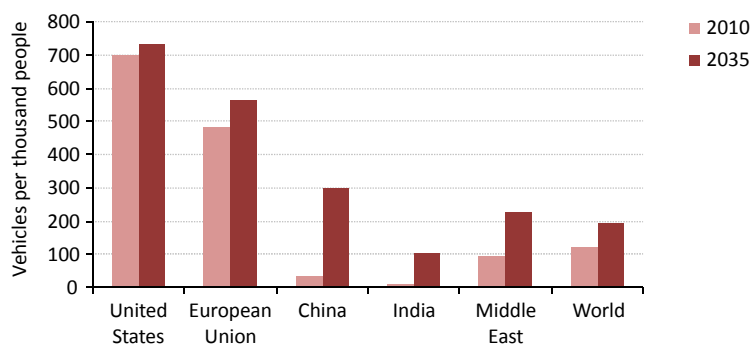
Transport net demand expands by 14 mb/d between 2010 & 2035, outweighing a net fall in demand of more than 1 mb/d in other sectors

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Oil demand is driven higher by soaring car ownership

WORLD ENERGY OUTLOOK 2011

PLDV ownership in selected markets in the New Policies Scenario



The passenger vehicle fleet doubles to 1.7 billion in 2035; most cars are sold outside the OECD by 2020, making non-OECD policies key to global oil demand

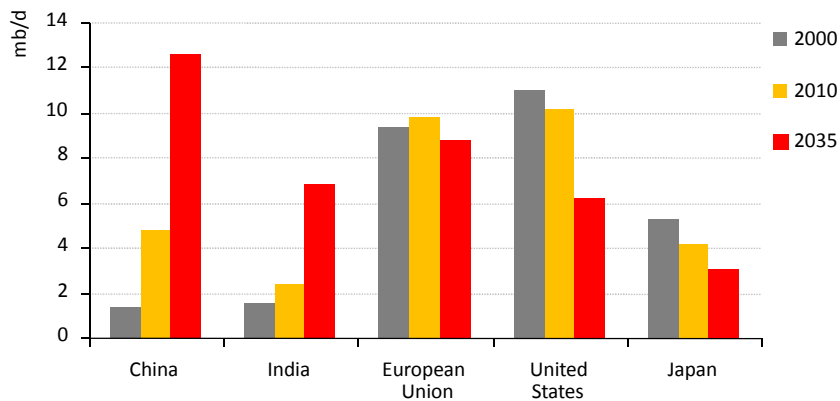
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Changing oil import needs are set to shift concerns about oil security

WORLD ENERGY OUTLOOK 2011

Net imports of oil in the New Policies Scenario



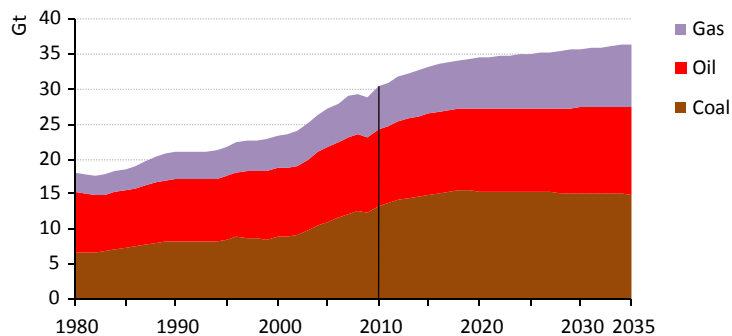
US oil imports drop due to rising domestic output & improved transport efficiency: EU imports overtake those of the US around 2015; China becomes the largest importer around 2020

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Existing and announced policies will not halt the rise in CO₂ emissions

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Energy-related CO₂ emissions by fuel in the New Policies Scenario, 1980-2035



Global emissions slow but still rise by 18% between 2009 & 2035, a trend consistent with a rise in global temperature of around 3.5°C

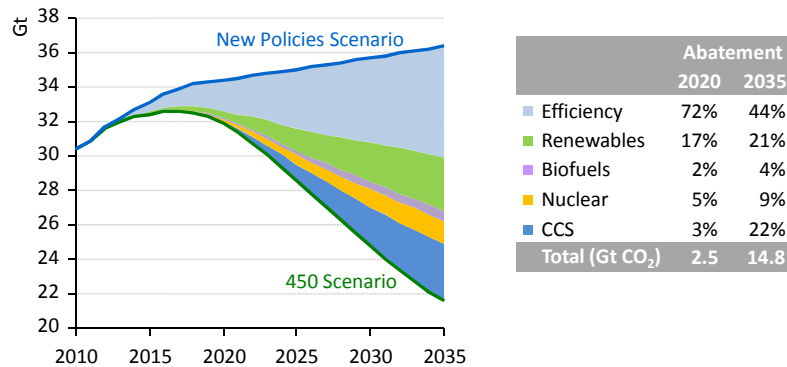
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Efficiency gains can contribute most to emissions reductions

WORLD ENERGY OUTLOOK 2011

World energy-related CO₂ emissions abatement in the 450 Scenario relative to the New Policies Scenario



Energy efficiency measures – driven by strong policy action across all sectors – account for 50% of the cumulative CO₂ abatement over the Outlook period

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Three key steps to a low-carbon future

- Deploy efficiency technologies as rapidly as possible, using strong policies
 - Nearly all efficiency technologies pay for themselves fairly quickly, particularly with rising energy prices (since they save fuel)
- Rapid, deep decarbonisation of electricity generation around the world
 - This will require high percentage renewables, energy storage, extensive deployment of CCS, much smarter grid management and end use signals
- Increased use of the 3 main potential zero carbon fuels (and energy carriers): electricity, hydrogen, bioenergy/biofuels
 - For transport, these all face major challenges

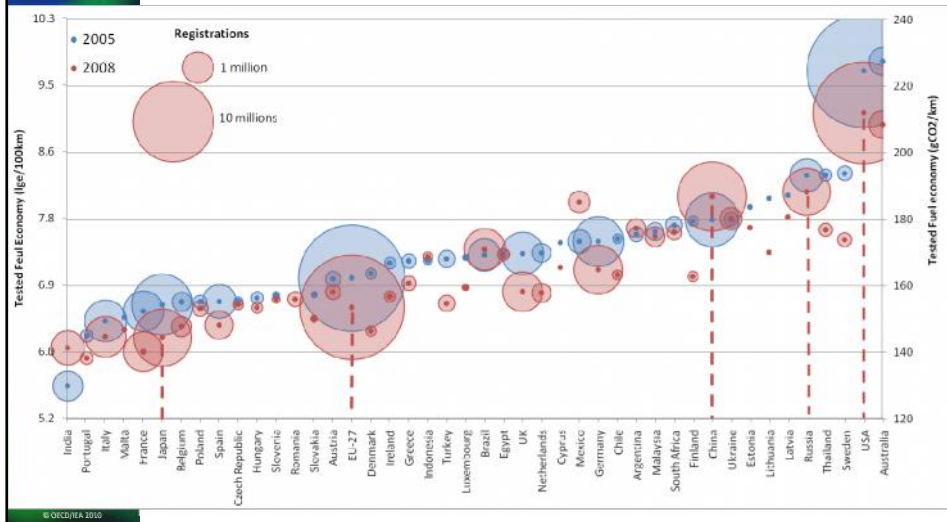
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IEA/Global Fuel Economy Initiative (GFEI)

Fuel Economy Study: average new LDV L/100km, results by country, 2005 and 2008



Results of IEA 22 country study

IEA estimates that the global average was about 8 L/100km in 2005. It improved to about 7.7 in 2008. But the rate of change was well less than that needed to hit GFEI targets.

		2005	2008	2030	Average Annual Percentage Change
Fuel Economy (lge/100km)	Estimated Global Average	8.07	7.67		2005 to 2008 (actual): -1.7%
	GFEI Base and Objective	8.07		4.03	2005 to 2030 (required): -2.7%

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Electric and Advanced Vehicles

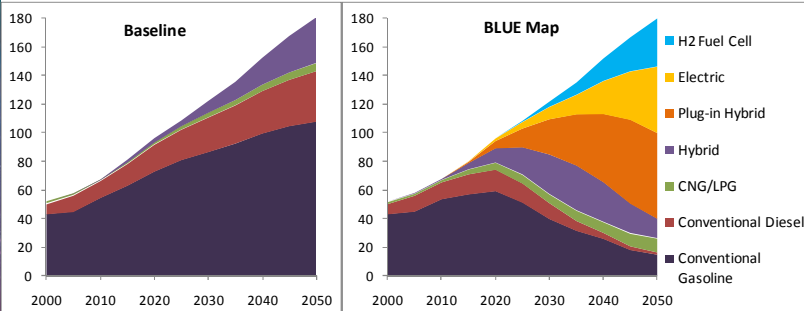
- IEA believes these will have to play a major role in reaching low CO₂ levels, especially after 2020
 - 2010-2020 critical period to reach scale economies, cut costs, be ready for full commercialization
 - By 2030, CO₂ intensity of electricity generation must be much lower in all countries
- Battery costs/characteristics remain a key issue
- Electricity side
 - What recharging infrastructure needed?
 - How will consumers recharge?

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Passenger LDV sales by technology type: a low Carbon future will be challenging

Million sales / year



In the IEA/ETP baseline, sales are mainly conventional vehicles through 2050; hybrids reach about 20% of sales

In BLUE Map (or 2 degree scenario), strong penetration of hybrids by 2015, PHEVs and EVs by 2020, FCVs after 2025. By 2050, plug-in vehicles account for more than two-thirds of all sales.

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IEA/EVI Analysis: projected electric and plug-in hybrid vehicle sales through 2020, based on national targets

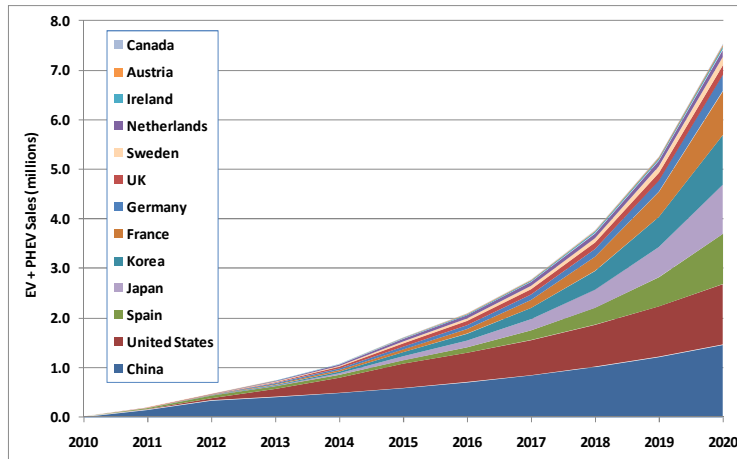


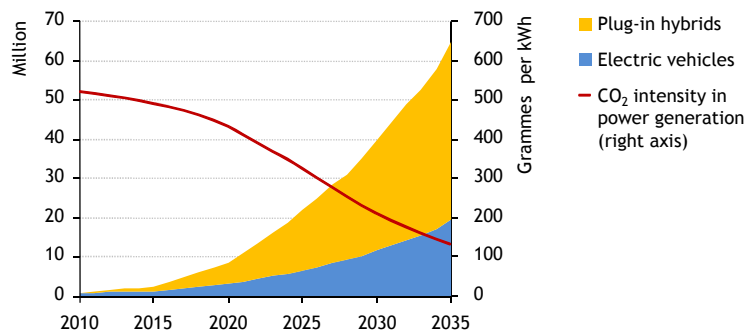
Figure based on announced national sales and stock targets, with assumed 20% annual sales growth after target is met, if target is before 2020 (e.g. China's target is for end of 2011).

EV / PHEV sales could reach seven million by 2020

Transport: electrification must follow electricity decarbonisation

World Energy Outlook 2010

Sales of plug-in hybrid and electric vehicles in the 450 Scenario & CO₂ intensity of the power sector



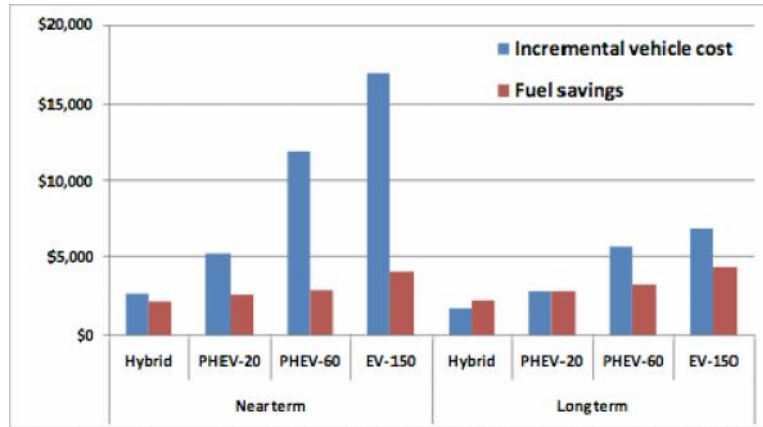
Plug-in hybrids & electric vehicles reach 39% of new sales by 2035, making a big contribution to emissions abatement, thanks to a major decarbonisation of the power sector

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Some cost estimates

Hybrids, PHEVs and EVs v. gasoline vehicle over time



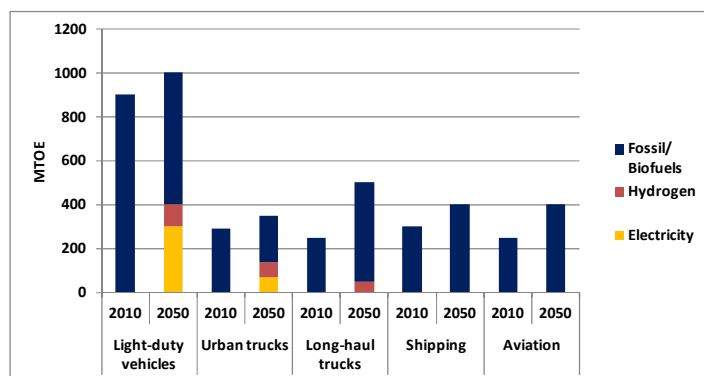
Notes: PHEV-20= 20 km range, etc; fuel savings estimated over 160k kms of driving; base gasoline vehicle efficiency improves over time; oil prices \$80/bbl near term, \$120/bbl long term; battery costs decline over time from \$750 to about \$300/kWh

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How much biofuels will we need worldwide by 2050?

Even in ETP 2 degree scenario, electricity and H2 will have limited transport application if no technology breakthroughs; 2000 MTOE up for grabs



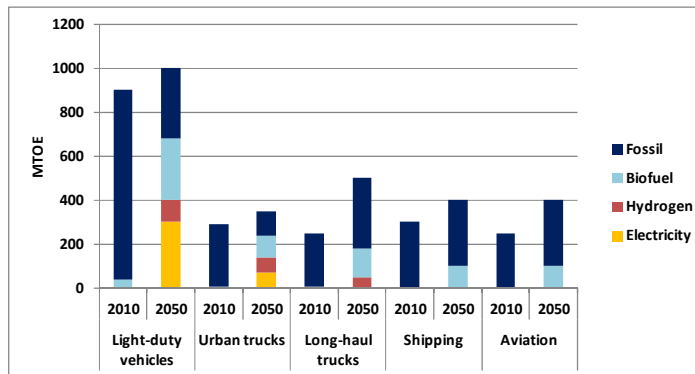
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How much biofuels will we need worldwide by 2050?

In ETP 2 degree scenario, we have about 700 MTOE of biofuels in 2050 compared to 70 today; can we do this?

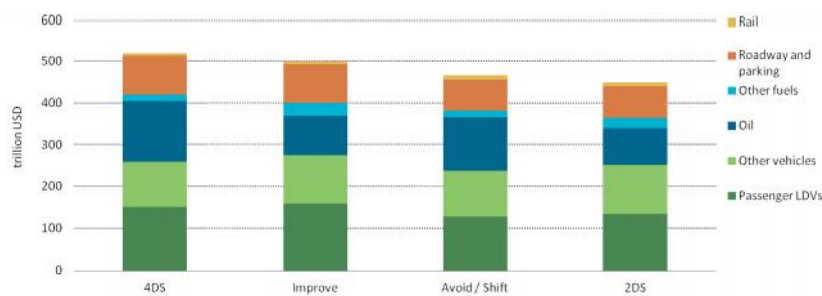


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What will it all cost?

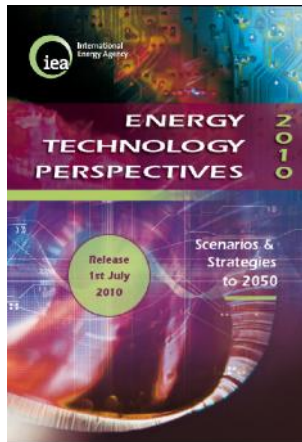
Cumulative transport costs by scenario, 2010-50



The IEA *Improve* case greatly reduces the expenditures on fuels, whereas the *Avoid/Shift* case cuts down infrastructure and vehicle costs.

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