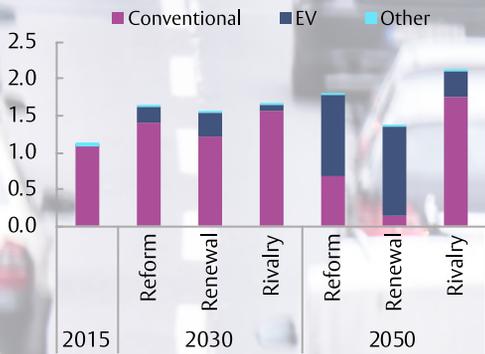


Energy demand in transport

Global LDV fleet
Billions

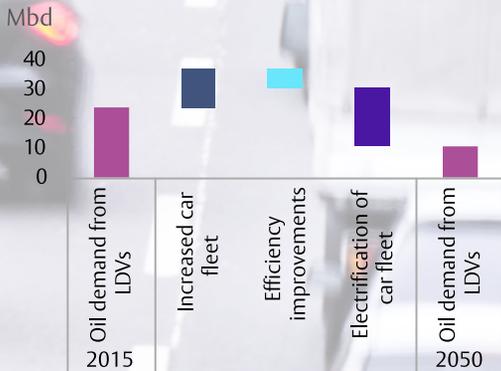


Source: Statoil



GLOBAL DEMAND FOR MOBILITY IS INCREASING AS POPULATION AND WEALTH GROW. GROWING PROSPERITY IN EMERGING ECONOMIES HELPS LIFT THEIR CITIZENS FROM POVERTY INTO MIDDLE CLASS AND WITH IT COMES AN INCREASED DEMAND FOR ENERGY

Oil demand from LDVs in Reform



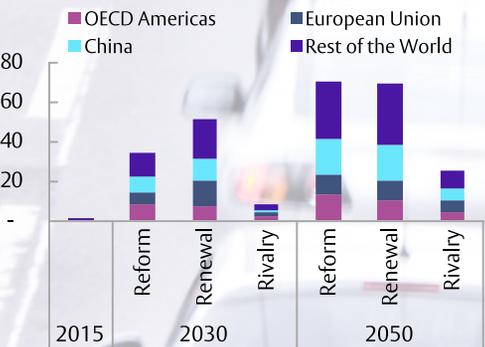
Source: Statoil

The transport sector represented more than half (56%) of global oil demand in 2016, growing by an annual average of 1.5% over the last decade. Three quarters of this demand came from road transport and more than half (56%) was demand from cars and motorcycles (LDVs).

The growth in demand has been driven by a growing road vehicle fleet, including heavy vehicles and motorcycles, which has more than doubled since 2000, from 1.1bn to 2.3bn road vehicles in 2015. Most of this growth has been motorcycles. The importance of the transport sector's part of total global oil demand is obvious.

With new trends and technologies emerging rapidly there are clear indications that the transport sector is changing and that mobility in the future will be of a different kind, composition and size than it is today.

Global EV sales
Millions



Source: Statoil

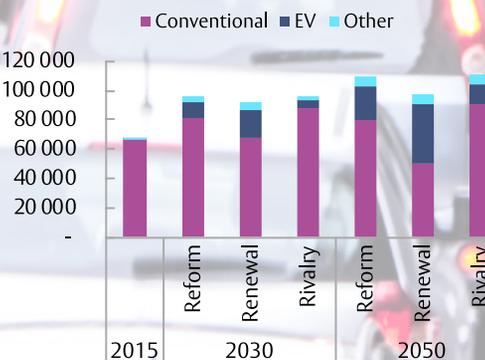
PUSH FROM POLICY

The emerging green shift in transport is now driven forward by regulations and incentives in many countries around the world, much due to increased focus on environmental issues and the COP21 Paris agreement.

Leading up to and following the ratification of the agreement, several countries have set clear targets for road transport emissions and actions to reduce CO₂ emissions and local pollution, which is an increasing problem accompanying congestion in urban areas.

Electrification of the global car fleet has been identified as one of the key actions that will make a significant impact. The multi-governmental forum "Electric Vehicles Initiative" (EVI), consisting of 15 countries such as China, India, US, France and Germany, is working to promote road transport electrification through collaboration and has set an ambitious target of 20 million EVs by 2020.

Global truck fleet composition
Number of trucks



Source: Statoil

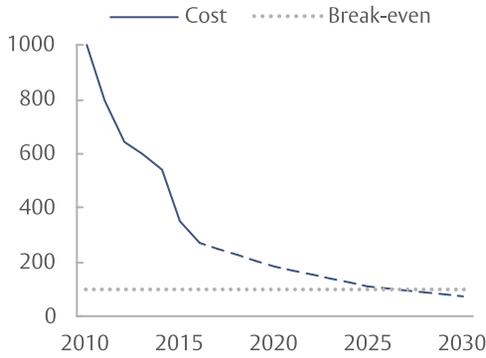
Although the target may be out of reach in the short timeframe, it sets a clear direction for the future development of road transport. Several countries are already debating banning internal combustion engine vehicles (ICEVs) by the end of the 2020s, some even sooner.

The push from policy and stricter regulation on emissions has forced car producers to develop and expand their fleet portfolios with low- and zero-emission vehicles. This will lower the total portfolio CO₂ emissions and continue to allow producers to manufacture and sell ICEVs with large engines and accompanying large emissions.

Many of the large car producers have announced a release of a new electric/hybrid fleet portfolio around 2020. Biofuel content in transport fuel is expected to increase in both the road and non-road sectors due to stricter regulation, and would be a way to reach the targets.

Battery pack costs

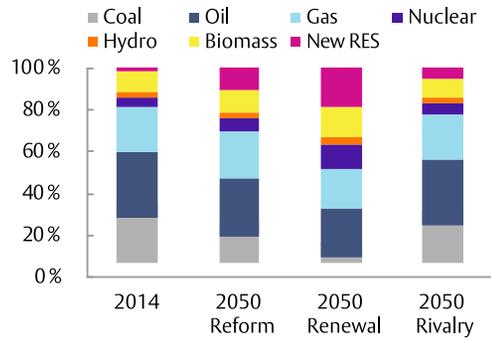
USD/kWh



Source: Bloomberg New Energy Finance

Global primary energy mix

2014 and 2050



Source: IEA (2014), Statoil

Non-road transport will probably increase with the focus on reducing congestion and local pollution and lead to a shift from road to rail, as the need for mobility is increasing rapidly and the preferred solution from an environmental and a governmental point of view is public transport, above and below ground. Furthermore, expectations are for rapid growth in air transport as global and regional mobility increases with higher income levels.

FUEL MIX OUTLOOK

The global fuel mix is changing, though not as quickly as the attention paid to wind and solar power suggests – or as it should from a global warming mitigation point of view.

In 1990 fossil fuels, net of international marine and aviation bunkers, made up 85.5% of global total primary energy consumption. In 2014 fossil fuels were down to 82.6%. The oil share of this total has dropped significantly, from 36.9% to 31.3%. But the gas share has increased, from 19.0% to 21.2%, and so has the coal share – from 25.2% to 28.6%. As for the non-fossil shares of energy consumption, biomass and hydro were about as important in relative terms in 2014 as in 1990. Nuclear has declined in both absolute and relative terms. New renewable energy including mainly wind, solar and geothermal energy increased its share from 0.4% in 1990 to 1.4% in 2014.

Fuel mix developments since 2010 indicate that the global mix could be in for major changes. Two trends stand out: Coal is losing market share, and new renewable power is growing at a pace making the “small starting points” argument for not paying attention, increasingly unsustainable.

SCENARIO IMPACTS

In Reform, the coal share of global TPED, which was 29% in 2014, declines to 20% in 2050. Barring either geopolitical developments suspending energy trade and technology exchange and forcing key countries to live within their energy resource means, or a decisive breakthrough for CCS, it is difficult to see a world-level renaissance for solid fuels. In Renewal, the coal share develops much as it does in Reform up to 2020, but then it drops at an accelerating pace to only 10% by 2050. In Rivalry, governments and investors rally behind coal for a lack of more secure alternatives, with only a minor decline in the share of fossil fuels in TPED to 25% by 2050 as a result.

The future oil and gas shares of world primary energy demand are also subject to uncertainty. The oil share is expected to continue to decline as the world’s car fleets go electric, with biofuels, CNG and possibly hydrogen playing supportive roles in select markets. There are however many views on how quickly and to what extent unconventional vehicles will side-line gasoline and diesel vehicles. OECD industrial and residential oil use dropped by 40% between 1990 and 2014, and there are no signs of a rebound in demand. The chemical and petrochemical industry will require more naphtha and light fuel oil as feedstock, but this will only partly compensate for the decline in other demand.

Driven by low prices the oil share of global TPED increases in the short term in all scenarios, but it peaks by 2020 in Renewal and in the mid-2020s in Reform as electric cars become fully competitive, and to varying degrees also because of energy efficiency and fuel substitution policies. The share is down from 31% in 2014 to 28% by 2050 in Reform and to 22% in Renewal. In Rivalry, the oil share levels out because of subdued economic growth and security of oil supply concerns, and it is still 32% by 2050, reflecting less emphasis on energy efficiency, less electrification of road transportation, and the fact that other fuels are hit harder by the political hardships that define this scenario.

TRANSPORT REPRESENTS MORE THAN 50% OF TOTAL OIL DEMAND IN 2030 IN ALL SCENARIOS

The three scenarios have different assumptions for drivers and trends that will impact the transport sector, while the common features are weighted differently in each scenario. In Reform, development continues along the current pathway, with focus on reducing emissions and local pollution, based on the expectation that market rationale will pull in the desired direction assisted by regulations and incentives. The momentum of EV penetration is growing, and economy of scale and total cost of ownership will make EVs more competitive compared to ICEVs.

The aviation fleet size increases and the amount of air travel is expected to double over the next 15-20 years, pulling oil demand up, despite higher efficiency requirements and biofuel additions. Continued healthy economic growth supports global trading and thereby further growth in oil demand from shipping and trucking, although more efficient engines and use of gas and biofuels also have an impact.

cont. on p.24 ►

◀ cont. from p.23

In Renewal, strong coordinated global climate effort drives decline in energy intensity forward and enables a radical electrification of the road transport sector, and LDVs in particular. Strong support to research and technology development leads to breakthroughs and focus on environment increases the speed of consumer adaptation to EVs regardless of incentives.

Consumer behaviour is a vital component in this scenario, and it assumes that consumption per capita decreases on a global level; that we acquire less goods, reuse and mend things that are broken and travel less in a joint effort to reduce the strain on the global environment. In Rivalry, a world of increased tension and protectionism, the focus on environmental challenges fades as geopolitical unrest persists and capital investments reflect the trend. The consequence is slower technological development and more diversified driveline technologies, leading to a significantly slower electrification of the road fleet compared to Reform and Renewal.

In Reform, global oil demand from road transport continues to grow towards the end of the 2020s, although with large differences between regions.

The EU and other OECD countries will typically see a continuation of the downward trend, while emerging economies will grow into the early 2030s and even towards 2040 in some regions.

By 2020 the amount of full electric and plug-in hybrid electric cars is expected to reach around 16 million, 1.2% of the global fleet, missing the 20-by-20 target set by EVI. A pivoting point is reached around 2025 when EVs will gain a competitive advantage over ICEVs and the impact on global oil demand will become evident, no longer only in mature economies.

By 2030 the EV share of the global fleet has grown to around 12% and oil demand from transport is almost 5 mbd lower than in Rivalry. Through the 2030s the effects of changes in transport patterns, digitalisation and electrification strengthen, and light-duty diesel cars become an insignificant portion of new car sales. The electricity share of the global bus and truck fleet will have grown from almost nothing in 2017 to around 10% in 2030.

The growth of electrification is lower in this fleet segment due to slower turnover and the continued challenge that weight and size of the batteries represent. The global trucking fleet is expected to increase in all scenarios, driven by increasing population and economic growth. Potential trends of slowing and declining car density as regulations and incentives push towards increased use of public transport, add demand for transport of goods. Even in a Renewal world with less consumption, there will still be growth in demand for road freight. However, the demand for oil in trucking in this scenario is expected to decline due to fuel switching and improved energy efficiency.

Up until the early 2020s the three scenarios follow the same development before parting ways and ending up at very different endpoints by the end of the forecast period.

By 2050 oil demand in transport ranges from 26 mbd to 68 mbd, with road transport capturing from 60% to 75% of total oil demand in transport. The level of electrification in road transport accounts for the major portion of the differences between the three scenarios, where electricity demand in the transport sector multiplies from the current level of ~400 TWh by 5 to 20 times, ranging from 2200 TWh to almost 6000 TWh.

Fuel mix in LDV transport	2014	2030			2050			2014-'50, growth per year (%), CAGR		
		Reform	Renewal	Rivalry	Reform	Renewal	Rivalry	Reform	Renewal	Rivalry
Billion toe										
Total	1,1	1,2	1,1	1,3	0,8	0,4	1,4	-1,0	-2,6	0,6
Oil	1,1	1,1	1,0	1,2	0,5	0,1	1,3	-2,2	-5,8	0,5
Gas	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-2,1	-4,6	-3,4
Biofuels	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-9,5	-15,1	-2,3
Electricity	0,0	0,0	0,1	0,0	0,3	0,3	0,1	22,1	22,6	18,3
<i>Oil (mbd)</i>	23,6	25,0	22,4	27,7	10,5	2,7	27,6			
<i>Electricity (thousand TWh)</i>	0,0	0,5	0,8	0,2	3,0	3,5	1,0			

Fuel mix in other transport	2014	2030			2050			2014-'50, growth per year (%), CAGR		
		Reform	Renewal	Rivalry	Reform	Renewal	Rivalry	Reform	Renewal	Rivalry
Billion toe										
Total	1,5	2,0	1,6	1,9	2,3	1,6	2,3	1,2	0,1	1,1
Oil	1,4	1,7	1,4	1,8	1,9	1,1	1,9	1,0	-0,6	0,9
Gas	0,1	0,1	0,0	0,1	0,1	0,2	0,1	2,2	2,3	2,1
Electricity	0,0	0,1	0,1	0,0	0,1	0,2	0,1	4,9	5,9	4,1
Biofuels	0,1	0,1	0,1	0,1	0,1	0,1	0,1	1,5	1,3	1,5
<i>Oil (mbd)</i>	29,3	36,3	30,0	37,2	41,1	23,4	40,4			

Source: "Energy Perspectives 2017, Long-term macro and market outlook" – Statoil Report