FUELLING EUROPE'S FUTURE

HOW AUTO INNOVATION LEADS TO EU JOBS

1 Executive Summary

Europe could improve its growth prospects and increase overall employment by supporting auto sector innovation to curb its dependence on imported oil. There are currently concerns that the transition to a low-carbon economy will be too costly to embark upon during the economic crisis. But improving auto efficiency and switching to domestic energy sources for vehicles could contribute to Europe's key objectives of stimulating economic growth and mitigating climate change.

These are the main findings of this in-depth technical and macro-economic study, which has drawn on the advice of a broad range of stakeholders in the transport sector.

The innovations investigated would also cut direct CO_2 emissions from cars and vans by between 64 per cent and 93 per cent by 2050 in the three technology scenarios examined in this project, helping the EU achieve its goal of cutting overall transport emissions by 60 per cent. Tailpipe emissions of health-damaging pollutants, such as NOx would be cut by more than 85 per cent, with soot particles down by more than 70 per cent. And European motorists would benefit from lower costs of vehicle ownership.

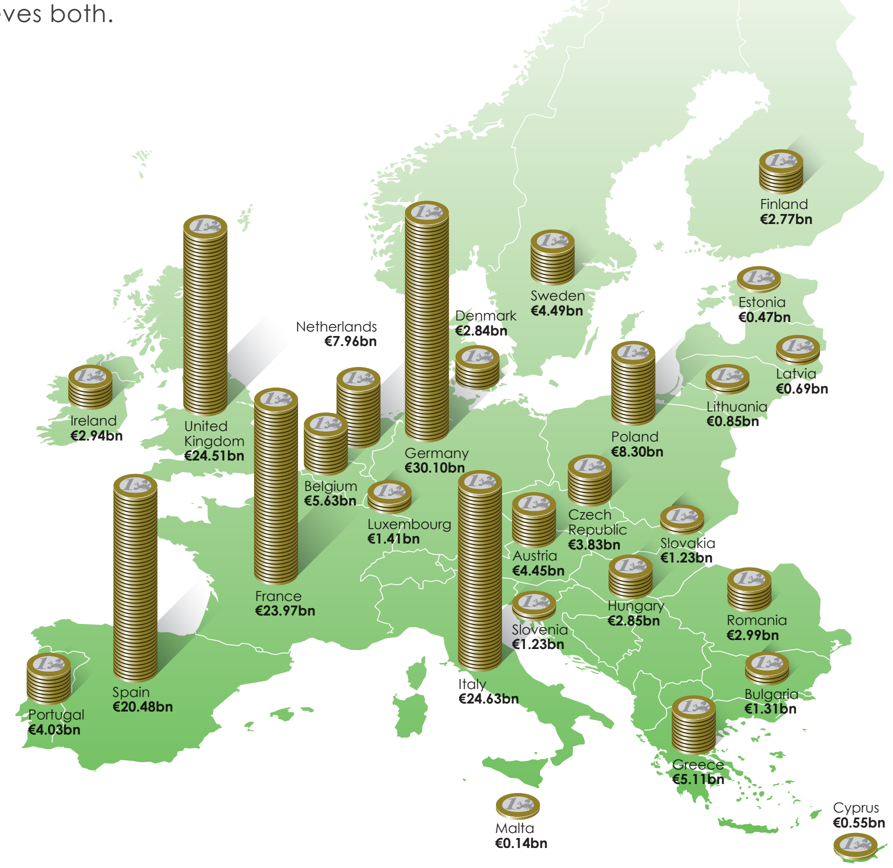
Job creation is a priority for policy makers across Europe. One way to boost growth in Europe would be to improve its trade balance, while another would be to shift the focus of spending from areas of low labour-intensity to areas of higher labour-intensity. The switch to low-carbon vehicles achieves both.

The fossil fuel supply-chain – including refining, distribution and retail – is one of the least labour-intensive value chains, and has most of its value-creation outside Europe. Therefore, reducing EU citizens' bills at the fuel pump and shifting spending towards other, more labour-intensive, areas of the economy induces net job creation. Furthermore, Europe excels in auto technology, and therefore increased spending on low-carbon vehicle components will create supply-chain jobs.

Between 660,000 and 1.1 million net additional jobs could be generated by 2030 in the three low-carbon technology scenarios examined in this research project, compared to a reference scenario in which cars continue to run on today's technology. In 2050, this rises to between 1.9 million and 2.3 million additional jobs, even when the jobs lost during this transition are taken into account. These benefits take time to achieve, because Europe's vehicle fleet takes 12 years to renew, but new jobs are created from day one.

Fig. 1.1

EU spending on petrol and diesel in 2012
Source: Eurostat, E3ME



Somewhat less than half of the additional jobs identified are direct jobs within the value chains for manufacturing vehicles and the supporting infrastructure. The prospect of these new jobs is set against a background in which Europe's auto industry is struggling with sluggish sales at home. Thus any new jobs arising from the manufacture of low-carbon vehicles would be offset by likely job losses as the industry in any case restructures to reduce over-capacity. The transition to low-carbon vehicles will also demand new skills from the workforce and that existing technologies are optimized. So, Europe must develop a pioneering environment to ensure it captures these opportunities.

Most of the new jobs are created outside the automotive value chain, in sectors such as services and construction, which benefit from the shift in spending away from the fossil fuel value chain and towards domestically-produced goods and services.

There are obvious uncertainties in assessing scenarios out to 2050, and the project has therefore taken care to use conservative assumptions throughout. Data on the cost of low-carbon vehicle technology have been largely sourced from the auto industry itself, including industry submissions for the European Commission's impact assessment on the proposed CO_2 standards for cars and vans in 2020. These have been supplemented with data from similar assessments for the UK and US governments, especially for the cost of zero-emissions vehicles.

Fuel price projections are based on the International Energy Agency's World Energy Outlook. Despite the long-term uncertainty, much is already known about the vehicles that are being designed today for 2020, and these are the vehicles that will deliver most of the benefits in the timeframe to 2030.

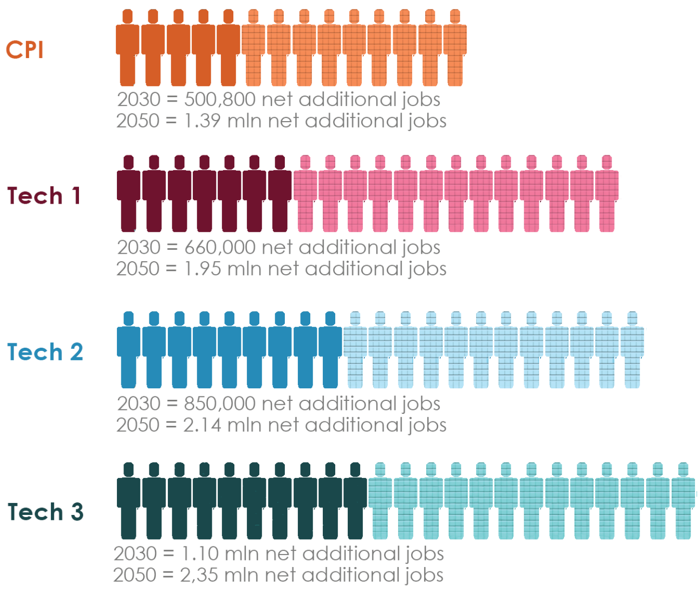
At an individual level, the cost of additional vehicle technology adds about €1,100 - €1,200 to the production cost of the average car in 2020 in the two scenarios that rely on conventional technologies, compared to the average 2010-manufactured vehicle. However, this is more than offset by the fuel savings realised by consumers.

The owner of the average new car in 2020 will spend around €300 to €400 less on fuel each year than the owner of the average 2010-manufactured car. Given that the increased capital cost is less than the amount saved on fuel, this improves the budgets of households.

At the EU level, the two scenarios that rely on conventional technology add €22-46 billion to the yearly capital cost of the EU car and van fleet in 2030, but this is more than offset by avoided yearly spending on fuel worth €57-79 billion in 2030. This makes the total cost of running and renewing the EU car and van fleet in 2030 about €33-35 billion lower than if the fleet were to continue running on today's technology.

Fig. 1.2

EU job creation
in the 4 scenarios
Source: E3ME



2 Summary for policymakers

A strong European auto industry with a technological lead in low-carbon vehicles

Europe faces daunting economic challenges: to rein in public debt, revitalize stagnant economies and create new opportunities for millions of jobless workers.

At the same time, the European Union is committed to playing a lead role in tackling climate change. Among the EU's headline climate initiatives, the European Commission's Transport White Paper[1] sets a goal of reducing transport CO_2 emissions by 60 percent by 2050.

Political targets for climate action are coming under increasing scrutiny amid concerns that they might impose an excessive burden on industry at a time of economic hardship. It is therefore important to understand the economic impact of the transition to low-carbon vehicles.

And all the more so at a time when Europe's auto industry faces a sluggish domestic market, some over-capacity and growing competition from overseas rivals.

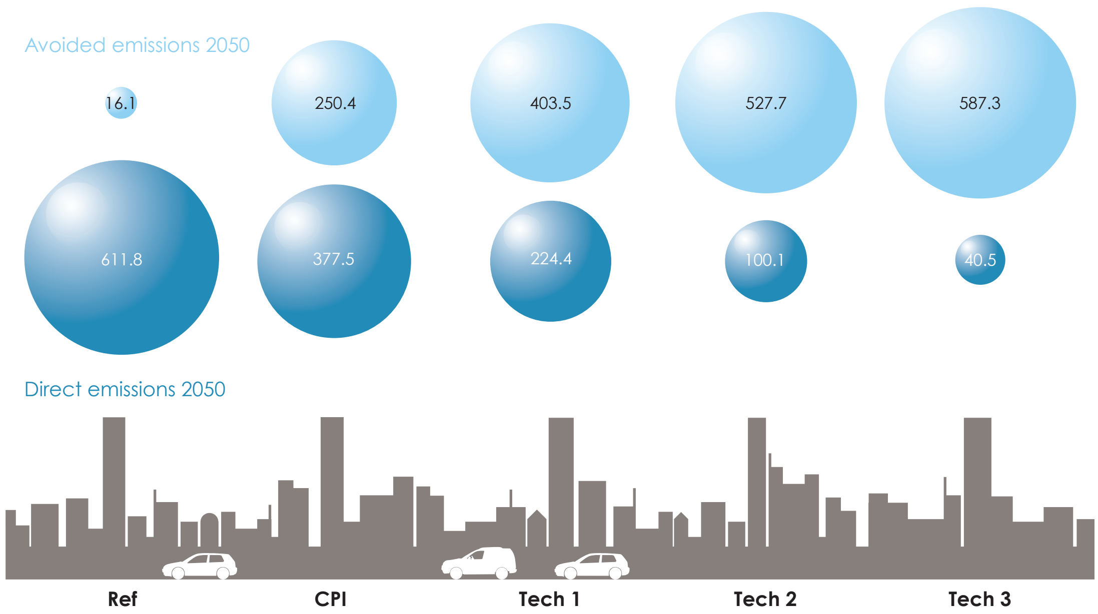
This study sets out to determine whether technologies to reduce CO_2 from light-duty vehicles – cars and vans – can strengthen Europe's economy by simultaneously stimulating innovation and improving the trade balance. The conclusion of more than one year of technical and macro-economic analysis, is positive on both issues (Fig. 2.1, Fig. 2.2)

Between 500,000 and 1 million net additional jobs could be generated by 2030 in the four scenarios examined here. This rises to 1.9 million to 2.3 million net additional jobs in 2050. These numbers take full account of jobs lost during this transition, for example in the refining, distribution and sale of fossil fuels. Lost tax revenues from lower spending on petrol and diesel can be made up by raising the rate of VAT and the overall result is that European consumers are still better off.

Somewhat less than half of the additional jobs identified are direct jobs within the value chains for manufacturing vehicles and supporting infrastructure. The prospect of these new jobs is set against a background in which Europe's auto industry is struggling with sluggish sales at home.

Fig 2.1

Direct tailpipe GHG emissions from cars and vans
Source: SULTAN



Thus any new jobs arising from the manufacture of low-carbon vehicles would be offset by likely job losses as the industry in any case restructures to reduce over-capacity. This raises the question of whether such a shift is feasible and attractive for EU manufacturers in an increasingly global automotive market. More and more countries are enacting tighter fuel-efficiency standards to cut rising fuel bills and tackle climate change (Fig 3.1).

Europe and Japan have world-leading fuel-efficiency targets, and the boost that this gives to innovation for their domestic auto manufacturers will strengthen their competitive position in international markets.

The competitiveness of Europe's auto industry depends on success in maintaining its technology lead. This lead will be increasingly challenged. China is trying to move ahead on the development of electric vehicles. The United States has set ambitious efficiency standards for 2025. Japan has made a robust start on hybrid technology. While Europe is currently a frontrunner in fuel-efficiency, other regions are catching up.

Projecting the costs of low-carbon cars

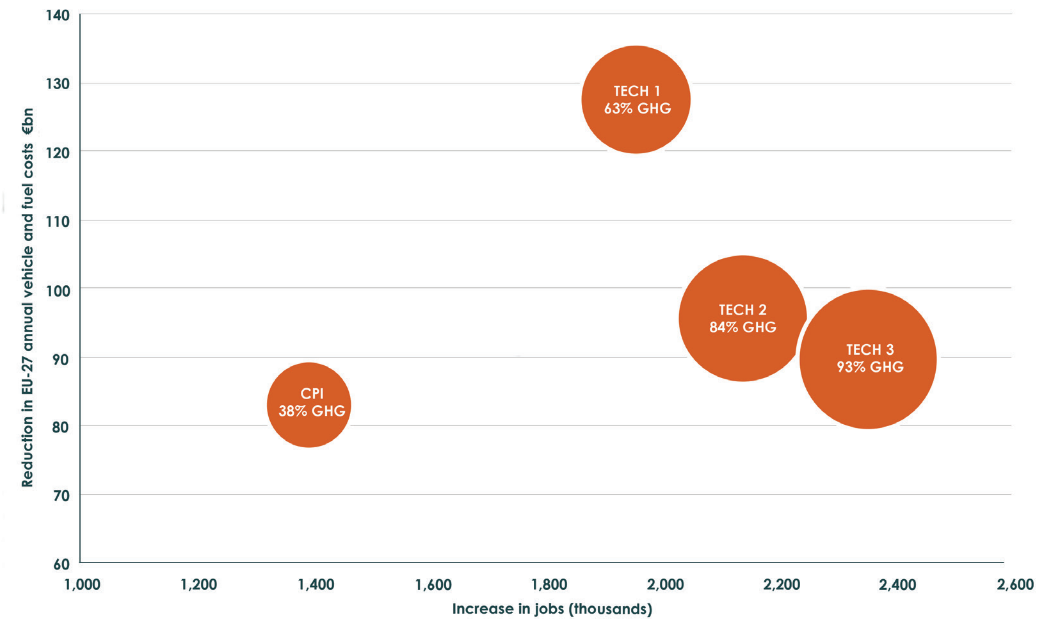
The project has benefited from the advice of a broad range of stakeholders in the transport sector, including auto producers, technology suppliers, workers' groups, energy providers and environmental groups. The data generated by the study will serve as a reference point for discussions about the low-carbon transition.

Understanding the economic impact has required detailed technical research to forecast the implied costs of technology, both for vehicles and for the supporting infrastructure for charging or refuelling. These projections of technology costs, combined with forecasts of future energy costs from the IEA, provide the key inputs to the macro-economic modelling of impacts on GDP and jobs.

The Working Group benefited from detailed data on the cost of improving the fuel efficiency of Internal Combustion Engine (ICE) vehicles, which were submitted in 2011 to the European Commission by the car manufacturers' association ACEA and the automotive parts suppliers group CLEPA.

Fig 2.2

Impacts on CO_2, employment and vehicle fleet costs in the four scenarios in 2050
Source: SULTAN, E3ME



These were supplemented with data from research conducted for the US Environmental Protection Agency (EPA). The starting point for analyzing the cost of advanced technologies, such as fuel-cells and batteries, was research for the UK government's Committee on Climate Change.

These data were reviewed by automotive experts at Ricardo-AEA and the International Council on Clean Transportation (ICCT), both of which have a substantial track record in automotive analysis. The data were also reviewed by members of the Working Group with direct experience in the automotive industry, for example Nissan, CLEPA, members of the battery-makers' association Eurobat, and the trade union body IndustriAll Europe. Expert input on specific technologies was also contributed by other auto manufacturers.

The study found that reducing car emissions to the range of 90-95 g/km in 2020 would add €1,056 - €1,154 to the cost of manufacturing a car. For comparison, analysis of the same data for the European Commission in 2011, but by a different method, arrived at a similar figure of €1,159. In another study, the ICCT concluded that improving the efficiency of the internal combustion engine to meet a target of 95 g/km in 2020 would add less than €1,000 to the cost of a car.

This would be lower if full use was made of weight reduction measures. The analysis showed that in 2010, Hybrid Electric Vehicles (HEVs) were almost €3,000 more expensive to manufacture than the average 2010 ICE vehicle.

However, this cost differential narrows to around €1,000 in 2020 as HEVs become more widely deployed to meet proposed CO_2 standards and as a result of learning effects and scale economies.

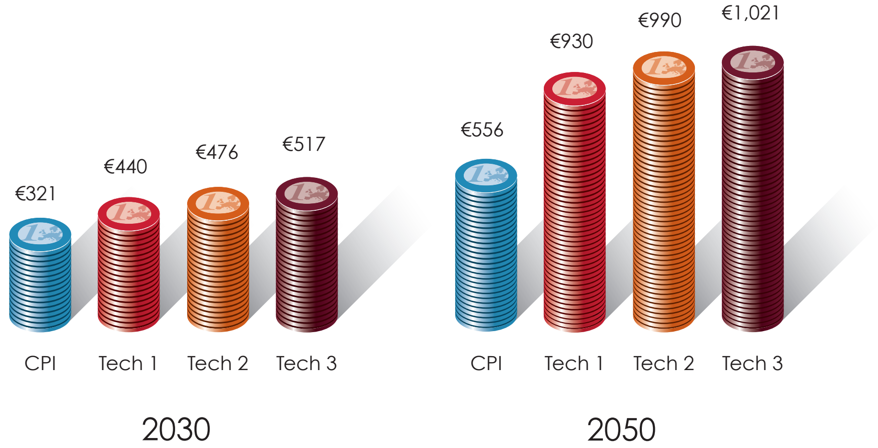
The additional manufacturing costs for Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) are likely to remain considerably higher than ICE or HEV technologies until after 2030.

The projections for reductions in the cost of batteries are more conservative than some recent estimates, for example by McKinsey[2] and Roland Berger[3]. When account is taken of fuel and other running costs, the Total Cost of Ownership of all key technologies converges quite quickly under a range of different assumptions.

Indeed, in all cases examined in this study, the additional capital cost to the motorist is more than offset by avoided spending on fuel. So, revisiting the example given above, hitting a target of 95 g/km in 2020 might add an extra €1,058 euros to the cost of manufacturing the average vehicle, compared to 2010, but the owner of the average new car in 2020 will spend between €300 and €400 less on fuel each year (Fig. 2.3).

Fig. 2.3

Average annual fuel savings per car under the scenarios modelled, versus the reference scenario
Source: SULTAN



Impacts of a shift to more fuel-efficient vehicles

While additional vehicle technology is an added cost to the motorist, it is equally an added source of revenues for auto component suppliers and companies in their downstream supply chain. Vehicle technology is an area in which Europe excels. Thus, from a macro-economic perspective, much of the money spent on additional vehicle technology remains within the European economy. There are over 3,000 auto parts companies in Europe, accounting for about 75 per cent of the vehicle industry's final product value.

At the macro-economic level, the two efficiency scenarios examined here add €22-46 billion to the yearly capital cost of the EU car and van fleet in 2030, but this is more than offset by avoided yearly spending on fuel, worth €57-79 billion in 2030.

This makes the total cost of running and renewing the EU car fleet in 2030 about €33-35 billion lower than if the fleet were to continue running on today's technology.

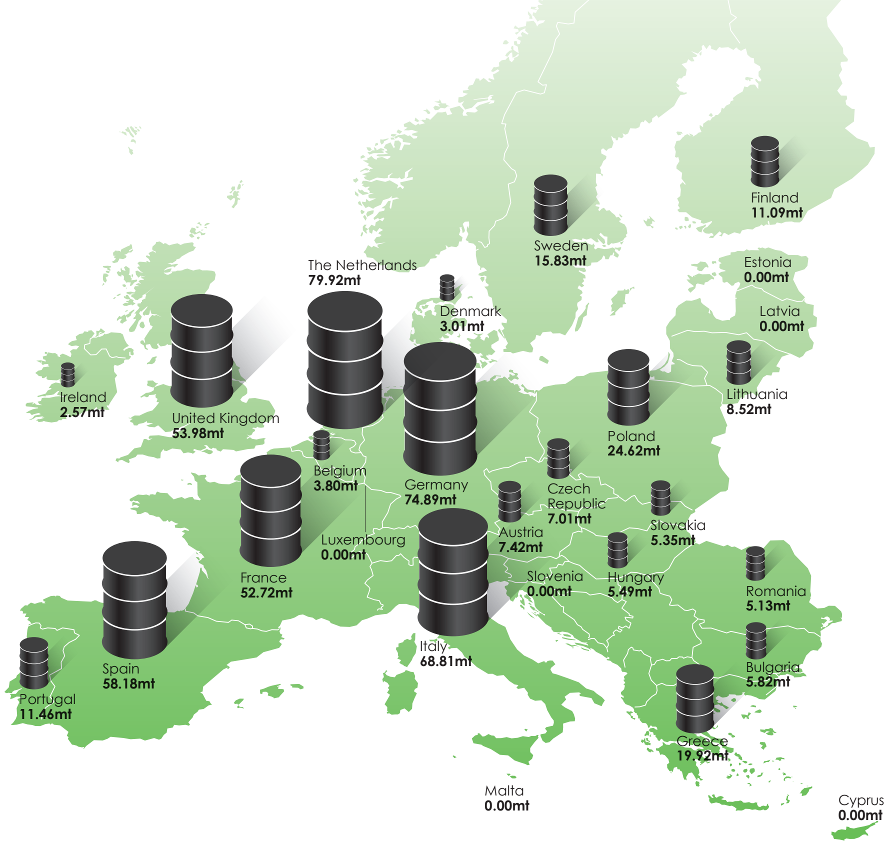
Europe is a major oil importer. Some 4 billion barrels of oil were imported into the European Union in 2012 at a value of €385 billion (See Fig 2.4). Compared to most other sectors of the European economy, the value chain associated with petrol and diesel has two main features: it has a low intensity of labour, meaning that for every million euros of value added, relatively few direct jobs are created (Fig 2.5); and most of the value chain is outside Europe, meaning that much of the money spent on diesel or petrol leaves the economy.

Some of the oil revenue that accrues to petro-states is recycled back into the European economy through purchases of EU exports, but an analysis of EU trade with petro-states shows that this represents a very small percentage of total EU trade. Therefore, the reduction in EU trade that might result from a reduction in spending on oil imports is negligible.

The future cost of oil is also expected to increase. In its central case, the IEA projects that crude oil prices will increase from €59 per barrel in 2010, to €105 per barrel by 2030. Furthermore, if steps are not taken to reduce EU demand for oil, then domestic reserves will be steadily consumed and import dependency will increase further.

Fig. 2.4

Annual crude oil imports to the EU (includes imports for refining)
Source: COMEXT, Eurostat



In contrast to the production of petrol and diesel, the European auto sector has a long supply chain dominated by European suppliers; the value chain has many more jobs associated with it than the oil supply chain; and Europe exports vehicles (and vehicle designs) to other world regions.

Europeans spend around €269 billion each year on cars and vans, with most of that value accruing to European manufacturers and their suppliers. Even when Europeans buy non-European brands, the majority of those cars are manufactured in Europe.Thus, the transition to low-carbon vehicles represents a shift in spending away from the fossil fuel supply-chain, which creates low value for Europe, and towards the vehicle supply-chain, which creates high value for Europe. By using the macro-economic model E3ME, we have made estimates of the change in economic flows.

In a scenario in which the Internal Combustion Engine is either optimized or hybridized, the capital cost of Europe's fleet of cars and vans increases by €64 billion by 2050 (excluding taxes), compared to a future in which the fleet continues running on today's technology. The total fuel costs, including tax, for running Europe's fleet of cars and vans are reduced by €323 billion in 2050 compared to a future dependent on today's ICE.

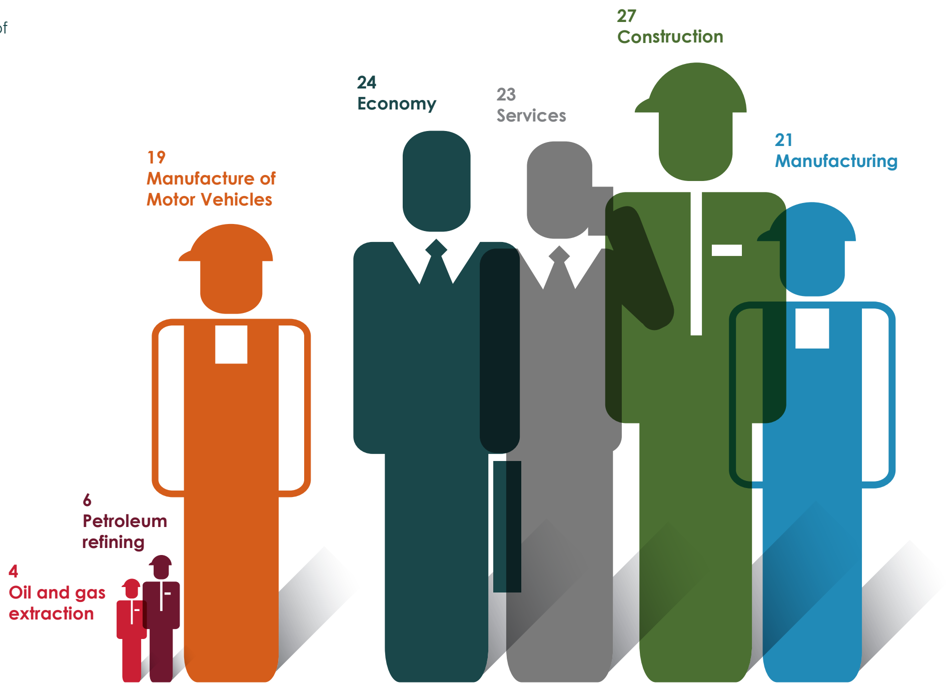
This is split between €191 billion of avoided spending on fuel and a €132 billion reduction in government receipts from fuel taxes, fuel duties and VAT. Of the €191 billion of avoided spending on fuel, part of the reduction falls on the refining, distribution and retail sectors, leaving approximately €140 billion of avoided spending on imported crude oil or oil products.

The net effect of reduced expenditure on petrol and diesel and increased expenditure on vehicles translates to €222 billion of additional GDP in Europe after second order multiplier effects are taken into account.

The transition to spending more on vehicles, less on fuel, and more in other areas of the economy, also changes the sectoral composition of the economy, leading to a substantial increase in European employment of 1.95 million net additional jobs in 2050 (Fig. 2.2).

Fig 2.5

Comparison of the relative labour intensity of different sectors of the European economy (jobs per €million of value added) Source: Eurostat, E3ME



Impacts of a shift to alternative fuels

The impact of switching to alternative fuels, such as electricity and hydrogen, requires consideration of three new factors – the impact of replacing spending on imported oil with spending on domestically produced hydrogen or electricity; the impact of deploying the charging or refueling infrastructure; and the impact of interactions that are created between the transport system and the power system.

The requirement for additional infrastructure was modeled both for charging plug-in electric vehicles and for providing hydrogen to Fuel Cell Electric Vehicles. Three different electric vehicle-charging network densities were examined to capture the range of uncertainty around motorists' charging preferences. These included differing amounts of home-charging, workplace-charging and public-charging.

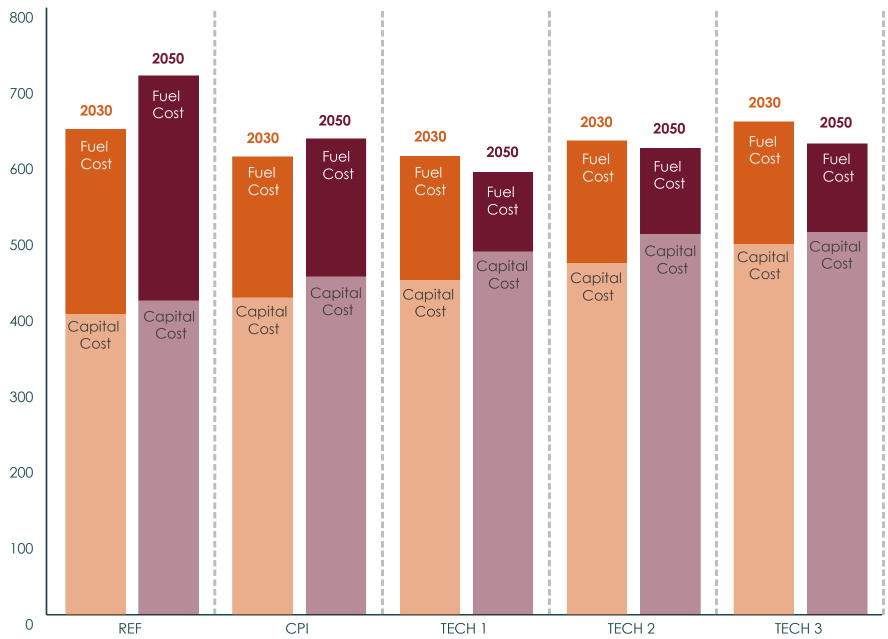
The annualized costs of EV infrastructure were large – 26 billion to 80 billion in 2050 in the two scenarios that include advanced vehicles.

Even so, the combined annualized cost of the vehicle technology and the infrastructure technology remains less than, or broadly similar to, the avoided costs of fossil fuels (Fig.2.6). In other words, the money saved by burning less fossil fuel is enough to pay for both the additional vehicle technology and the new energy infrastructure that is needed. In the process, substantial numbers of jobs are created.

Switching fuels to electricity and hydrogen is likely to have a positive impact on the European economy. Firstly, it leads to greater vehicle efficiency because fuel cells and electric vehicles are inherently more energy-efficient than combustion engines. More importantly, the production of electricity and hydrogen is predominantly a domestic supply chain by 2050; so the fuel switching represents substitution of domestic production for imported fuels. Infrastructure investment also has a positive impact on GDP because infrastructure projects stimulate domestic activity and require relatively high labour input in the supply chain.

Fig. 2.6

Total cost of ownership in 2030 and 2050 for each of the five scenarios
Source: SULTAN



Impacts on government revenues

A major concern to national governments is the prospect of lower revenues as the petrol and diesel tax base is reduced. The scenarios in this study are government-revenue-neutral and VAT has been increased (on a country-by-country basis) to meet the lost receipts from excise duties. The analysis also suggests that taxation of the increased economic activity that results from a switch to low-carbon vehicles largely compensates for the lost tax revenues from fuel.

Impacts on workforce

This study has also looked at the skills needed in the European workforce to ensure it can retain a competitive position during the transition to low-carbon vehicles. It has found that some parts of the industry are already experiencing minor skills shortages, particularly in the field of 'mechatronics', where mechanical and electrical engineering skills are combined.

There is also significant competition for software developers needed to develop battery management systems.The pace of the transition to low-carbon vehicles allows time for the development of the relevant new skills in Europe, but only if industry, governments and academic institutions start planning now.

Impacts on pollution

The levels of CO_2 and air pollutants emitted by vehicles are significantly reduced in all three of the more advanced technology scenarios. Cuts to CO_2 are in the range of 64 per cent to 93 per cent by 2050 (Fig. 2.1). For NOx, the reduction is between 85 per cent and 95 per cent, and particulates are reduced by 74 per cent to 95 per cent (Fig. 2.7).

Fig. 2.7

Direct tailpipe particulate emissions and avoided particulate emissions in the 4 scenarios in 2050
Source: SULTAN