

# **eco@work**

Sustainable reading from the Oeko-Institut

## Transport and climate action

How to achieve  
sustainable mobility?

The quality of the experience  
Interview with Dr. Konrad Götz

## Transport and climate action – how does it work?

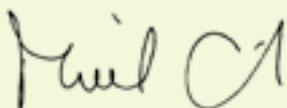
Perhaps, like many of my colleagues at the Oeko-Institut, you took the train to your holiday destination this summer and rented a bicycle when you arrived. Or instead of taking two long-haul trips, perhaps you spent one long “staycation” in your own country for a change. In Germany, we might choose the Baltic coast, the Black Forest or the Taunus mountains. Like sustainable transport as a whole, green tourism has many different facets. Here at the Oeko-Institut, we are working on a range of sustainable transport topics in order to answer one question: how can the transport sector help to mitigate climate change? Clearly, it's not enough to make cars more efficient if they are then used more often or for longer journeys. We believe it takes a package of good ideas to make transport sustainable. Car sharing, for example, can offer a genuine alternative to car ownership. Cities can take targeted action to encourage walking and cycling. And there's scope to shift freight off the roads and onto rail, thus reducing noise and pollution ... these are just a few examples.

We explore some of these topics and questions in this latest issue of eco@work. We look at some of the entry points and solutions to make transport more climate-friendly, and think about how this will affect its carbon footprint. We consider how policy-makers can create incentives for everyone to change their transport behaviour. And we focus on electromobility and especially its implications for the energy sector – for if our electric vehicles are to run on green power to make them genuinely emission-free, this will affect demand for wind and solar.

Sustainable mobility will also be the focus of our annual meeting this year. Its topic is “Priority climate protection – strategies for future transport”. By exploring policy options to turn innovative transport concepts into reality, we aim to create fresh impetus for the debate about transport-related climate action and ensure that it genuinely addresses key sustainability issues.

I do hope you will join us at this meeting, which will take place in Berlin on 12 November. Information about the programme and how to register – free of charge – is available at: [www.oeko.de/en/annualconference2014](http://www.oeko.de/en/annualconference2014).

Until then, we hope you enjoy reading this issue of eco@work.



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## “The quality of the experience must improve”

If we want people to choose sustainable transport options, we have to offer them something in return, says Dr. Konrad Götz. That includes convenient car sharing, pleasant and attractive railway stations, drinking water fountains and city centre seating. In this interview with eco@work, the mobility expert from the ISOE Institute for Social-Ecological Research in Frankfurt explains how mobility in urban and rural areas can become more sustainable and what he means by “quality of experience”.

### Dr. Götz, are the Germans still in love with their cars?

It's clear that in high-density urban areas, more and more people are moving away from car ownership. In cities like Berlin, the number of households without a car is increasing. That's because there's a good public transport system which people find very convenient. The emotional attachment is also decreasing: cars are no longer the status symbol they once were.

### But surely in rural regions, many people will be reluctant to get rid of their cars.

Sustainable mobility in rural areas is an important and, at present, a hotly debated issue. It's a major challenge. Many regions, such as Brandenburg, are depopulating, so funding a local public transport system is problematical. But at the same time, the population density in rural areas is too low to support solutions such as car sharing. Commercial operators would not make a profit here.

### What are the options?

Unfortunately, we mainly have make-shift solutions at present. For example, there are sporadic “on demand” bus services and smaller vehicles providing public transport. In some places, there are already some non-profit citizens' bus services. At some point in the future, it may even be possible to set up car sharing schemes based on driverless vehicles: they would simply turn up, and off the user would go.

### What about the cities: how can more sustainable mobility be achieved in urban areas?

From the user's perspective, mobility culture needs to be multi-optional and, in technological terms, inter-modal. It still has some way to go, however; for example, interconnected mobility is still far from perfect. In Frankfurt, where thousands of people come to the trade fairs, there is no guidance for pedestrians arriving at the station. There also needs to be a measure of integration between cycling and car sharing; that means providing secure cycle parking at car sharing centres, or a facility for transporting bikes on the vehicles themselves. And let's not forget that we need to improve the design of sustainable transport. The fact is that every design has a direct impact on use, whether the product is a computer, a bus stop or a bike rack. The quality of the experience also needs to improve, both at railway stations and in city centres.

### What do you mean by “quality of experience”?

We must create spaces that are both attractive and convenient for people. People living in cities are far more likely to go for a walk if we offer them drinking water fountains, adequate public toilets and comfortable benches when they want to take a break. They are much more likely to use their bicycles to move around the city if there are good cycle paths available, perhaps even a pleasant riverside cycle route. And they

are more likely to use the underground rail network if the trains and stations are pleasant and inviting.

### That sounds like a good offer for users. Do you expect anything from them in return?

Yes, of course. Car drivers must get used to keeping to the speed limits. We need to ensure that traffic flows steadily – in cities and on the motorways. We also need to ensure that our cyclists have good road sense and don't put other road users at risk. In my view, it would be very helpful to have proper cycle awareness courses, but spot checks and penalties certainly have a role to play as well.

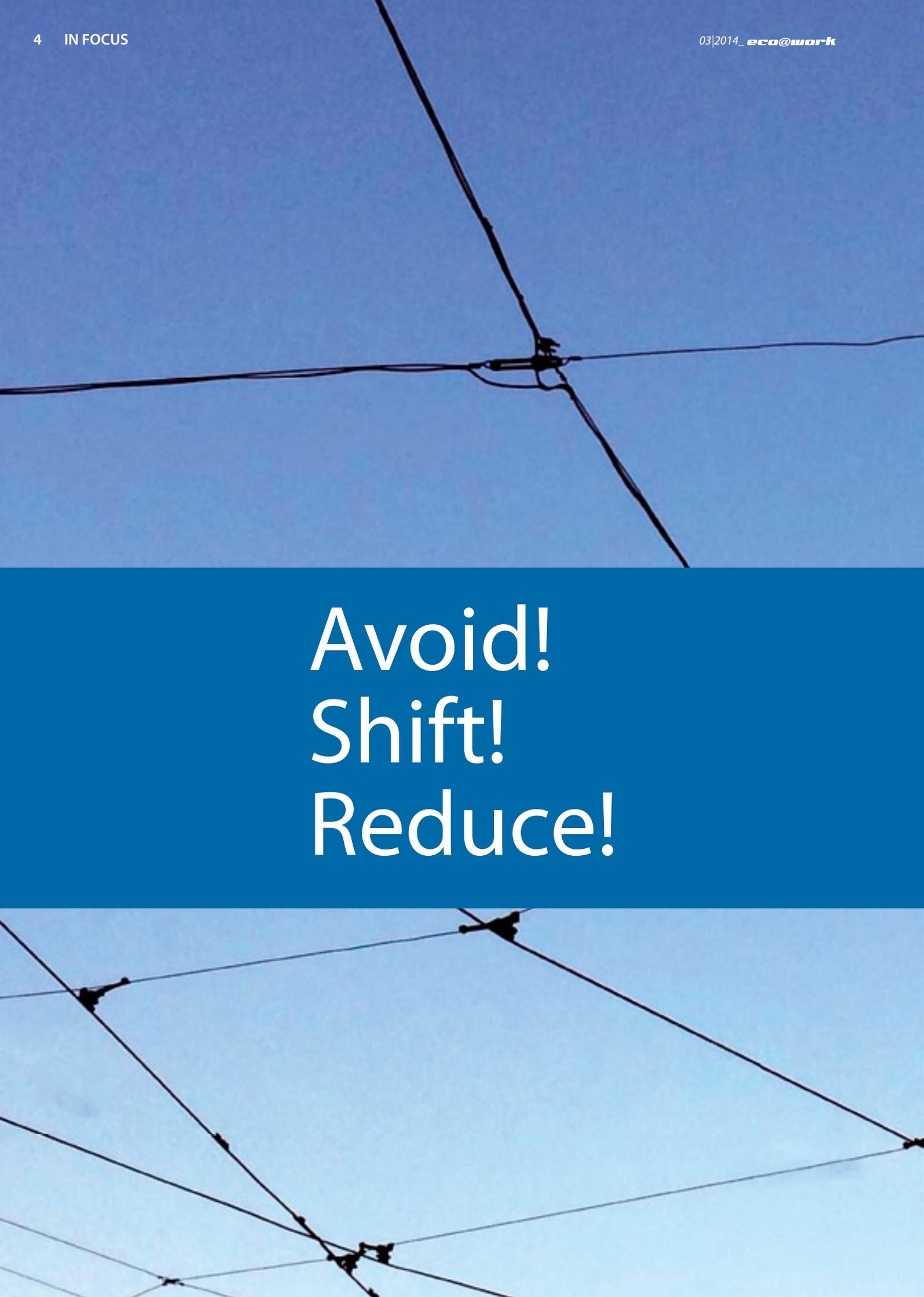
### Thank you for talking to eco@work.

The interviewer was Christiane Weihe.

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Dr. Konrad Götz from the ISOE Institute for Social-Ecological Research talks to eco@work.

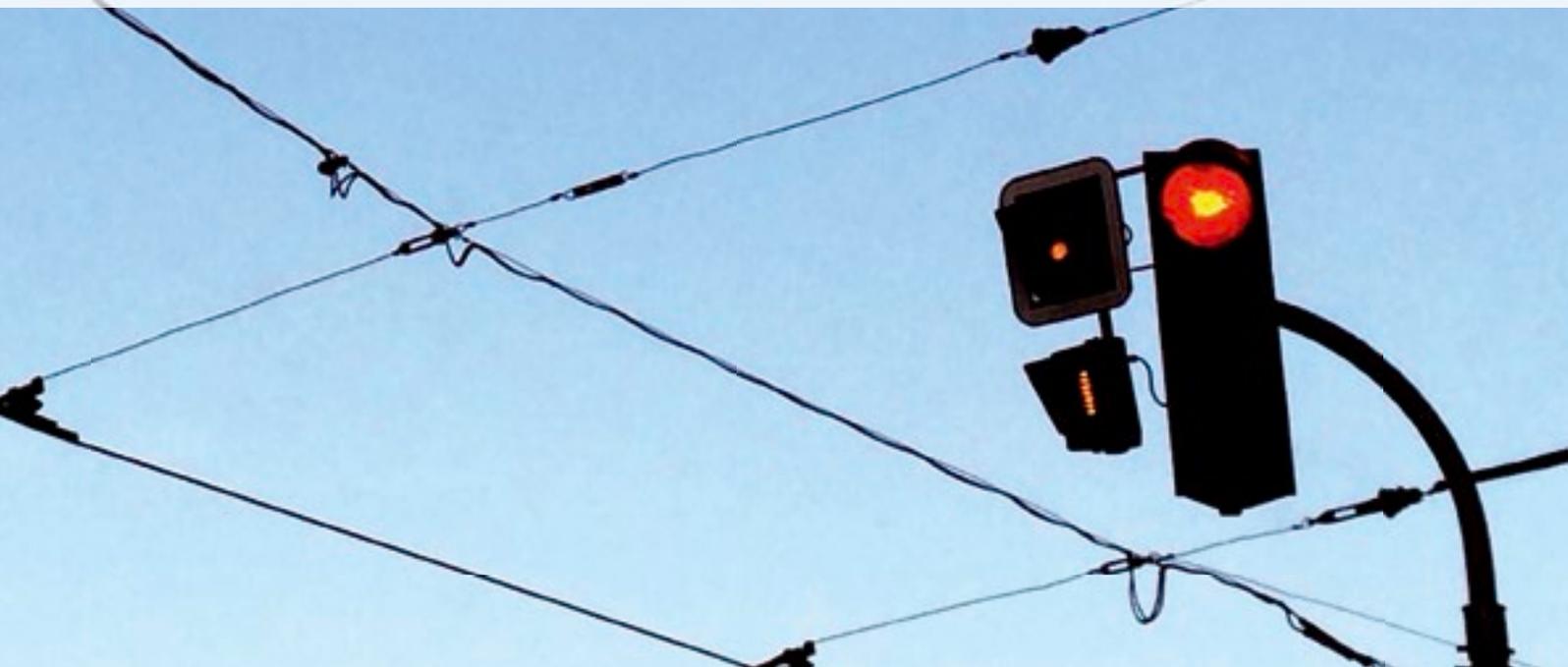


Avoid!  
Shift!  
Reduce!

## Transport and climate change mitigation

When it comes to protecting the climate, the transport sector seems to have gone off the rails. It certainly hasn't made much progress. Transport accounts for around a fifth of Germany's greenhouse gas emissions, but achieved only a 5.5 per cent emissions reduction between 1990 and 2012. In fact, including international air and sea traffic originating in Germany, transport emissions actually increased. But if Germany is

to achieve its climate target of cutting its greenhouse gas emissions by 80 to 95 per cent by 2050 compared to 1990, the transport sector must make a major contribution. There are starting points for more transport-related climate action at many levels, focusing, for example, on propulsion technologies and fuels, avoiding unnecessary transport use, and promoting a modal shift.



"Transport can make a major contribution to cutting emissions," says Dr. Wiebke Zimmer, Deputy Head of the Oeko-Institut's Infrastructure and Enterprises Division. In a joint project with WWF, BUND, Germanwatch, NABU and VCD, Oeko-Institut researchers have developed a climate action scenario which shows that this is possible (see "Transport for tomorrow" on page 7). Wiebke Zimmer explains how it can be done: "A modal shift and avoiding unnecessary transport use are key steps – and that applies to passenger and freight transport alike." Much more use should be made of rail and inland shipping for freight, because the transport sector's large carbon footprint mainly results from the movement of goods by road. "That's not surprising: Germany's freight volume more than doubled between 1990 and 2011," says Wiebke Zimmer. Starting points for the modal shift to rail and shipping include improving the rail infrastructure and boosting investment in the canal network. Another option is to extend the system of tolls for goods vehicles on all roads. "These measures must be based on appropriate, integrated and multi-modal transport planning within the framework of the Federal Transport Infrastructure Plan," says the Oeko-Institut expert. But

it's not only the freight industry which needs to avoid unnecessary journeys and carry out a modal shift: the same applies to private transport. "It's just as important to encourage more people to get out of their cars and onto their bikes or to use local public transport, including rail." Here too, there are diverse entry points: a great deal can be achieved by improving local public transport: introducing additional routes and more frequent services, integrating the various modes to a greater extent, and enhancing provision for cyclists by expanding the cycle path network, creating "fast lanes" for cyclists and providing cycle parking at central locations. "We also need to promote new concepts of mobility and multi-modal offers," says Wiebke Zimmer. "That includes car sharing, which, I'm pleased to say, is attracting a growing number of users in Germany, especially in cities." This is due to new and improved offers and the practical options afforded by apps and smartphones, as well as a steady shift away from car ownership among young adults (see the interview with Dr. Konrad Götz on page 3). Parking space management that offers parking privileges can also be used to encourage car sharing.

## Vibrant cities

The benefits of these new mobility offers are now recognised by countless users. But other transport policy measures – such as the introduction of speed limits or tolls for cars – are far less popular. "People forget that these measures can do much to enhance our quality of life," says Wiebke Zimmer, "After all, fewer cars mean less noise and less pollution." As she points out, transport has a direct and negative impact, especially in towns and cities. These include air pollution and the use of space for car parks. "The strategies for more climate action in the transport sector generally focus on the national, European or international level, but the municipalities have a crucial role to play," says Wiebke



Zimmer. "In a sense, they are the germ cell of sustainable mobility." Local transport planning creates key policy frameworks for local residents' mobility – and this radiates out to the national level as well. "What's more, towns and cities will not only benefit from less noise and pollution; by introducing car-free zones, they can free up space for more creative uses."

(for an in-depth discussion, see "Plugging into Mobility" on page 8). "Electromobility is ideal for car sharing: the limited range is less significant here," says Wiebke Zimmer. It's also crucial to utilise all the transport modes' existing efficiency potential. Ambitious EU-wide efficiency standards are essential for cars, but also for commercial and heavy goods vehicles.

## Efficient and alternative

Less noise, less pollution, more climate protection: technologies also have a key role to play. Electromobility is one example: it can significantly reduce transport emissions, provided that it uses power from renewable sources

Reducing final energy consumption is the key to improving the transport sector's climate performance. "But this alone won't cut greenhouse gas emissions by 95 per cent by 2050 – and as an industrial nation, Germany needs to position itself at the top end of the range of reduction targets," says Wiebke Zimmer. "To achieve this target, additional sustainable and low-emission alternative fuels are needed." Possible options are sustainable biofuels from residues and waste, and renewable power-to-fuel.

Shipping and aviation pose a particular challenge in relation to climate change mitigation, for these are particularly high-growth sectors. Another challenge here is establishing international mechanisms for reducing emissions.

## Many steps

As is evident from the measures outlined, there's a lot of work to do to shrink the transport sector's carbon footprint. "But they also show that although there is plenty of work to do, there are also plenty of options," says Wiebke Zimmer. "Now transport policy-makers need to set the right course. And users need to take a good hard look at their mobility behaviour."

*Christiane Weihe*



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## Transport for tomorrow

Cutting transport emissions by more than 80 per cent by 2050 is possible, according to a joint paper produced by environmental organisations WWF, BUND, Germanwatch, NABU and VCD with scientific support from the Oeko-Institut. The paper, entitled "Climate-friendly transport in Germany", centres on a climate action scenario which draws on the organisations' ideas about how sustainable transport targets can be achieved. It defines a comprehensive package of strategies and measures, including a modal shift, avoidance of unnecessary transport use, and improved efficiency across all forms of transport. The introduction of alternative propulsion systems and the use of low-emission fuels are other components of the package. The paper also looks at policy measures to cut private vehicle use and to introduce more stringent EU-wide CO<sub>2</sub> limits for cars and commercial vehicles.

According to the scenario, passenger transport can be reduced by 15 per cent by 2050. A greater reliance on flexible mobility options – local public transport, cycling and car sharing – is anticipated. Movement of goods will initially continue to increase, but will then fall back to approximately the current level. A phase-out of fossil fuels and a modal shift

to rail and inland shipping can do much to cut emissions over the long term.

Based on the measures outlined, the Oeko-Institut concludes that there is potential to reduce the transport sector's final energy demand by around 70 per cent by 2050 compared to 2005, which would make it possible to achieve an 86 per cent cut in greenhouse gas emissions compared to 1990, according to the joint paper. As the prerequisite, Germany must rigorously pursue energy system transformation in the electricity industry, making use of renewables-based power-to-gas and power-to-fuel in vehicle propulsion systems. However, in the view of the Oeko-Institut's experts, more research is needed on whether, and how, biofuels and power-to-gas/power-to-fuel can be utilised in a manner that guarantees compliance with stringent sustainability criteria.



# Plugging into Mobility

## New challenges for the power industry

Super 95 or 98, E10 or not, diesel or automotive LPG: we already have a range of vehicle fuel options available. But there's one fuel which is still comparatively under-utilised: electricity. This situation can and should change, according to the Oeko-Institut's experts, for electromobility can make a major contribution to energy system transformation and the attainment of the German Government's climate targets – provided that it is based on green power. In a new study, our researchers conducted an in-depth analysis of the potential electricity demand for transport to 2050 and the implications for the energy industry.

The OPTUM project – the name stands for “Optimising the environmental benefit of electric vehicles” – had already furnished the proof: if the German Government comes close to achieving its target of putting up to six million electric vehicles on Germany's roads by 2030, this will have significant implications for power industry emissions.

Germany's renewable energy surplus will not be sufficient to supply 100 per cent green power for electromobility by 2030: this is one of the key findings of the study, which was commissioned and funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). This means that more renew-

able energy capacity will be required than is envisaged in current scenarios. Otherwise, electromobility will drive up power industry emissions.

A further study, entitled “E-Mob 2050: Scenarios for electromobility's climate contribution”, goes further than OPTUM, for it investigates how the

trend towards transport system electrification will affect power generation and considers the changes that will be required in the power industry to 2050. It thus takes a longer view than the OPTUM analysis. "We looked at potential electricity demand trends in the transport sector to 2050," explains Florian Hacker, a senior researcher at the Oeko-Institut. "Our analysis concludes that there will be a significant increase in demand, especially after 2030, due to new technologies and the expansion of e-mobility." The study focused on electric vehicles, but also considered the implications of (possible) electrification of the transport system as a whole. "The analysis includes all modes of transport that can be powered by electricity at present or in the near future," Florian Hacker explains. "That excludes aviation and maritime transport, as it's unlikely that electric propulsion will be feasible here." Besides looking at electric cars, the experts turned the spotlight on road and rail freight, as well as investigating the use of power-to-gas and power-to-fuel to replace conventional equivalents in the transport sector. "In terms of efficiency, this technology leaves something to be desired because it consumes large amounts of electricity," says Florian Hacker. "For that reason, large-scale use of these fuels for climate change mitigation should only be considered for applications which don't allow the use of electric propulsion, such as aviation."

For E-Mob 2050, the Oeko-Institut's experts worked with other scientists and the business community to develop two scenarios on possible market trends for electric propulsion systems and green power-to-fuel. Both are based on the assumption that there will be a substantial expansion in the use of electricity in the transport system by 2050. "The Boundless E-Mob scenario is posited on a further increase in transport demand," Florian Hacker explains. "In the Regional E-Mob scenario, on the other hand, mobility behaviour changes and there is a substantial reduction in transport services compared with the present level."

The study shows that an increasing role for e-mobility in passenger and goods transport by 2050 will drive up electricity demand for transport; in the scenarios, its share of electricity demand rises

to 15-25 per cent. "This would make the transport sector a major electricity consumer, and if power-to-gas and power-to-fuel are included, the percentage is even higher," says Florian Hacker. If the additional demand is not met from renewables, this could increase power industry emissions by an additional 16 or 50 million tonnes, depending on the scenario (Regional E-Mob or Boundless E-Mob). However, the use of renewables offers the potential for substantial transport emission reductions – by more than 80 per cent compared with 1990, with no increase in power industry emissions. "Even so, the additional demand for renewable energies would then exceed the current expansion scenarios by a considerable margin," says Florian Hacker. "And there is very little scope to meet this demand from unused surpluses."

Nonetheless, expanding the renewable energy capacity to such an extent that it meets e-mobility demand in full will also create surpluses. "That's because there will always be moments when either all the vehicle batteries in the system are fully charged, or the charging stations simply don't have enough capacity to integrate all the renewable energy," explains Florian Hacker. For 2050, the scenarios therefore allow for a 9-10 per cent surplus in the total amount of renewable electricity produced. "One option is to turn this power into gas or fuel, although this may not fully utilise the peak output from renewables. However, it's better to utilise the green power directly wherever this is technically feasible, simply because power-to-gas and power-to-fuel systems are less efficient."

Florian Hacker highlights another of the study's findings: due to the high efficiency of electric propulsion systems, large-scale electrification can also dramatically reduce the transport system's final energy demand. "In the Boundless E-Mob scenario, there is a 66 per cent reduction in demand compared with 2010, and a staggering 77 per cent reduction in the Regional E-Mob scenario by 2050." This would exceed the German Government's 40 per cent reduction target by a substantial margin. He adds: "A comparison of the two scenarios shows that final energy demand – and therefore the additional expansion

requirement for renewable energies – would be much lower if we focused on avoiding unnecessary transport use and promoting a modal shift.

## A long-term view

With its E-Mob 2050 project, the Oeko-Institut underlines the clear need for action on electricity demand in the transport sector and highlights the interaction with the power industry. "If electric vehicles are to make an effective contribution to protecting the climate, we need to look to the future now – and take appropriate action," says Florian Hacker. "The core message is that rising demand for electricity must be met from renewables if e-mobility is to help achieve the much-needed improvement in the transport sector's carbon footprint." If electricity demand from transport develops as predicted in the project scenarios, but without a corresponding expansion of renewable energies, most of the additional electricity demand will have to be met from conventional fuels. And the choice between coal and solar really should be an easy one to make.

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