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How can car sharing help in the energy turnaround?

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Realizing the energy turnaround is a challenge. This applies everywhere, but no more so than in the transport sector, which accounts for 29% of final energy consumption in Germany and whose energy consumption is to be halved in a generation. In recent years, the energy required for a person-kilometre (km) has already been considerably reduced. This saving, which up to now has been largely technological, has been more than offset by increased volumes of traffic.

To achieve further improvements, different arrangements are required. And what has been learned from car-sharing is very relevant here. It shows that people transport can be organized so that it impacts the environment less, saves travellers money and gives authorities greater scope to deal with other challenges.

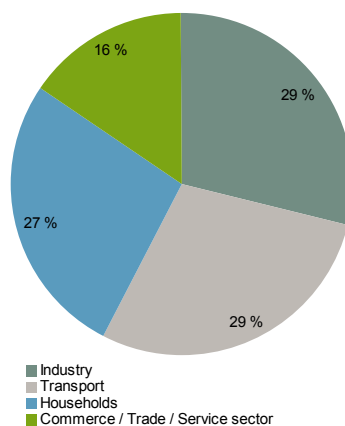
“Energiewende” (energy turnaround) is the term used for Germany’s move into the age of renewable energy and energy efficiency. This is the subject of hot debate, especially in relation to power generation. But how do things look from an energy consumption perspective? After all, primary energy consumption is to be halved by 2050.

The transport sector is central to the success of the energy turnaround

In 2012, final energy consumption in Germany was divided among four consumer groups: industry, transport, households and the commerce / trade / service sector.

At 29%, transport accounts for as much energy consumption as industry and is larger than all other consumption groups.

Figure 1: Percentages of final energy consumption



Source: AGEBA

The percentage shares accounted for by these four consumption groups have remained fairly constant over the last 20 years.

Around a fifth of German CO₂-emissions are generated by the transport sector. In order for the energy turnaround – and the German climate protection policy – to succeed, it is essential that energy consumption in transport is reduced. At present, however, there is still a shortage of practical strategies. As a result, the transport sector constitutes the “largest remaining gap in the energy turnaround”.

Increasing energy efficiency

In the last two decades, two trends in the transport sector have cancelled each other out: On the one hand, the volume of traffic has grown considerably – and this trend is likely to continue. On the other, no other sector has managed to achieve comparable increases in energy efficiency. A given journey now requires only half the energy needed at the start

of the 1990s. The end result is that the percentage of German final energy consumed by the transport sector has remained roughly constant. This will not be enough to ensure the long-term success of the energy turnaround.

Experts believe that using the technologies currently available further improvements in energy efficiency will soon be exhausted. Significant improvements could still be achieved by changing over to another technology; however, the example of electric vehicles shows how long it can take from the development of a new method of propulsion to its comprehensive adoption.

For this reason, the way in which our transport sector is organized is of major importance. Discussion of this subject has traditionally centred on limiting traffic volumes and how the conveyance of passengers and goods is distributed across individual modes of transport (the “modal split”) and how these modes interact.

But car sharing – a concept which is also known as car pooling, and includes car hire clubs and private arrangements – is, however, another interesting topic in this context. This is because its organizational model allows traditional solutions to be discarded in pursuit of a new approach, and because it shows how important it can be to open up (or re-open) alternative courses of action.

Car sharing ever more popular

In 2012, almost half a million people participated in car sharing in Germany. They used over 3,000 stations in around 350 towns and communities. In Karlsruhe – the epicentre of German car sharing – there is one shared car for every 500 inhabitants. The number of car-sharers and shared cars is presently increasing at approx. 20% p. a., meaning that their number is doubling every three to four years. Only in the USA are there more car share users, and only Switzerland has a higher user density.

Many people, once they started car sharing, subsequently disposed of their own car¹; it is especially attractive as a substitute for little-used second cars. On average, each shared car is used by 30–40 people. However, as not all of them have their own car, a shared car replaces 8–10 private cars. The average age of shared cars is usually 1–2 years.

Car sharing is much more convenient than it was even a few years ago. At present, there are three variants on the market:

- **Station-based car sharing.** This is the established variant, in which the car is picked up from a hire station and subsequently returned there. It is above all attractive for city dwellers who live near a station.
- **Free-Floating.** In this case, users look for a free shared car parked somewhere in the vicinity via their app (on a smartphone, for example). After use, it can be parked again anywhere in the target area.
- **Private car exchange.** A private car can be borrowed by other persons via internet platforms. While the other two variants are especially attractive for city dwellers, this form of car sharing also works in rural regions.

Most car sharers are now between 30 and 50 years of age, i. e. certainly potential car buyers. They are familiar with the internet and mobile phones, and they value the new opportunities which car sharing offers them.

What's new with car sharing?

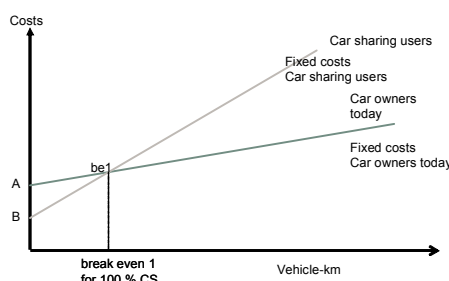
The most striking feature of car sharing is the *type* of user: fairly young, well educated and urban. Often they became familiar with car sharing during their student days as an economical and sometimes very practical solution. They are open to new patterns of use and new forms of cooperation, provided these offer added value.

Furthermore, the car sharing boom in Germany can be regarded as heralding a change to the *share economy*: Car share users are accordingly less interested in owning their own vehicles than in the transport services they provide, helping

them to realize their preferences in mobility and flexibility. The share economy originated in the virtual world, in which the goods (e. g. music files) are typically not in short supply and no-one could be excluded from their use. There was also no competition for their use. With car sharing, the model is now leaving the virtual world and entering the real world. This has considerable and attractive consequences on cost structure for consumers of transport services.

Accordingly, the main tangible change which car sharing brings is precisely this – the *change in the cost structure* for car sharing users: Figure 2 depicts this relationship. The green line shows the costs for a car owner: He buys a car (A) and can cover the first section relatively economically (shallow gradient). Things look different for a car sharing user (grey line): His initial costs (e. g. the annual fee) are quite low (B). On the other hand, each additional km cost more than for a car owner (steeper gradient). The two lines intersect at a certain number of km driven (break even 1, be1): Over a low km count, car sharing is cheaper than using a private car; for a higher km count, car sharing costs more. 10.000 vehicle-km p. a. is often considered as a break-even for the 100% car sharing, at which point annual savings of typically EUR 1,000 and more can be achieved.²

Figure 2: Cost structure of demand for mobility



Source: KfW

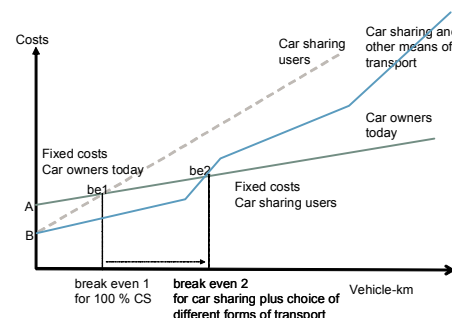
However, the decisive factor for the (new) mobility behaviour of a car sharing user is that the line in the graphic represents his cost maximum. Ultimately, each time he travels he can consider (ideally without fixed costs) which means of transport is best for him (car sharing car, bicycle, bus, train, ...). The costs of

car sharing combined with using different means of transport are thus in reality even lower (Figure 3, blue line) and the intersection point moves even further to the right (break even 2, be2).

Lease models are well known from other areas of life, e. g. for wedding dresses. That being said, the business model has not basically changed for decades. However, the changes in music titles are comparable: While 30 years ago, it was necessary to buy an entire LP, nowadays consumers mostly buy files containing individual songs. This has fundamentally changed the music market.

The area between the lines represents the cost savings compared to a car owner. The area bounded by the vertical A-B and the lines A-be1 and B-be1 shows the saving for a 100% car sharing user; and the area bounded by the vertical A-B, the line A-be2 and the lowest curve B-be2 shows the saving for a car sharing user who deliberately also uses other means of transport.

Figure 3: Cost structure for car sharing use and selection of various means of transport



Source: KfW

This cost saving is achieved at the expense of firstly, the greater time expenditure required for a car sharing vehicle and secondly, the extent of the economic exploitation of the transport alternatives. In addition to that, a private car enables journeys to be made more spontaneously. Modified organizational forms and new technologies can now specifically reduce this time outlay: for example, car sharing vehicles in free-floating pools can generally be accessed in a convenient manner. Mobility alternatives can be quickly determined via an app and their costs etc. can be compared more easily.

A user's eye view of car sharing

Obviously car sharing is more economical for users, as long as they stay below the break-even vehicle-km level. Moreover, the more car sharing users combine car sharing with other mobility options – and the more skilfully they do so – the more they will save.

The lower their fixed costs are (for owners of compact cars these are just under EUR 2,000 p. a.)³, the more flexibly car sharing users can react to unexpected changes – e. g. increases in fuel costs. In addition, the following advantages are often cited:

- car sharing facilitates the use of alternative forms of transport and leads to corresponding cost savings;
- car sharing reduces the amount of time spent on mobility, e. g. time incurred in changing tyres or searching for a parking place;
- car sharing also affords protection against high repair costs;
- car sharing permits – dependent on demand at the time – the use of a wide variety of vehicle models;
- car sharing is especially suitable for groups of users, which only occasionally need a second car (e. g. families);
- Bundesverband Car Sharing (BCS, federal car sharing association); enables customers to use multiple car sharing organizations: customers of companies which are members of the BCS can also use the cars of all the other 127 BCS member companies;
- finally, car sharing helps users to have a clearer conscience regarding their environmental impact.

With all these advantages, it should not be forgotten that at this point in time car sharing is not an economically viable solution for those who travel a lot, travel frequently or spontaneously, or who require transport at short notice. This is likely to especially apply to many commuters and families with young children. Outside the cities, the network of providers and stations is much thinner. Hence, car sharing is still not a viable solution there at present.

It is to be expected that as car sharing expands it will create a denser network, make access to hire cars more convenient and, due to economies of scale, may also lead to cost reductions. Besides accelerating the growth of car sharing, these effects could also make car sharing attractive for new regions and user groups.

A car maker's view of car sharing

Interestingly, all the major German car makers are now rushing around the car sharing market – in some cases quite actively, with their own innovative strategies. Car sharing is important for them for several reasons.

Firstly, it is possible that a fundamental *change in mobility behaviour* is now in progress, towards a pattern in which – at least in some areas – the car no longer enjoys automatic pride of place. From this perspective, car sharing offers an environmentally promising path to the future; car makers can identify with this issue, and will want to help shape its course. If, however, the change proves less profound, then at least the car maker will not have missed out on a trend.

Secondly, *car sharing users* – being well educated and technologically literate – are attractive potential customers, whose loyalty to the respective company is to be encouraged. Creating such brand loyalty is all the more attractive, if the company can change its corporate image and redefine itself as a mobility provider (as Deutsche Bahn, for example, is trying to do).

And thirdly, it offers manufacturers of vehicles used for car sharing the opportunity to *test new technologies / vehicle models* over the short-term and on a wide basis. A welcome side effect is likely to be that they can also create loyalty in customers who do not desire a car of their own.

Advantages for the energy turnaround

For car makers, car sharing is still a niche market; and in spite of its impressive growth, at present less than one in a hundred Germans participates in car sharing. However, car sharing can be very important for the energy turnaround

as, at least in the cities (where over 80 % of Germans live), it enables simple and economical transport without acquiring a private car. Car sharing liberates car owners from the lock-in effect of owning their own vehicles and makes other means of transport more attractive; this could lead, quite unexpectedly, to a new modal split.

In addition, car sharing has notable and direct positive environmental effects: in general, fewer car journeys are made (as other modes of transport are also used), less fuel is consumed (as the car fleet is smaller and newer) and fewer cars are required (as numerous private cars are replaced). An important indirect environmental effect is that the vehicle fleet can be rapidly adapted if weather conditions change (e. g. as a result of climatic change) or new technologies are introduced (e. g. electric motors). On the other hand, car sharing makes cars available to persons who previously did not own a car. Their use of car sharing will (by itself) lead to an expansion of motorized individual transport.

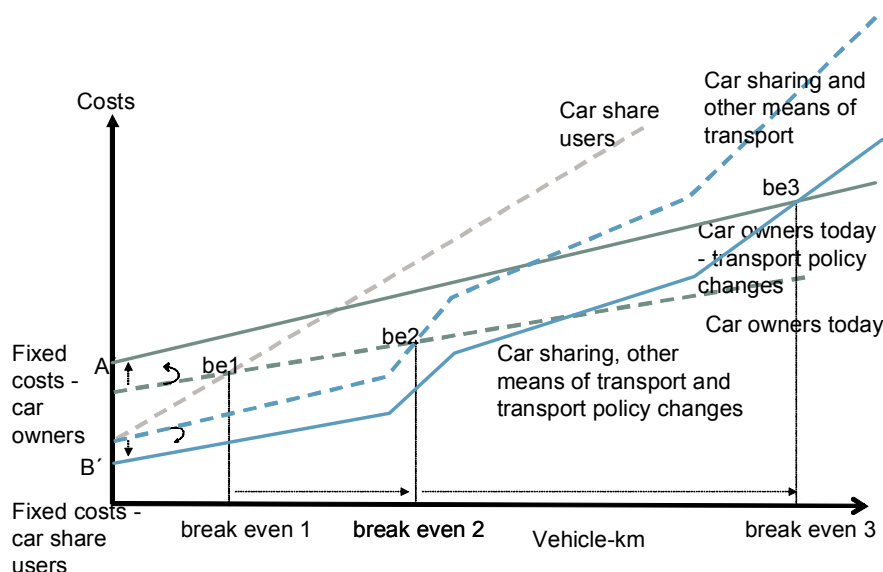
A reduction of the car fleet will mean that fewer parking spaces will be required. At first sight a reduction in paved surfaces has only an environmental benefit. But two other fundamental issues arise from this. On the one hand, large areas could be unexpectedly released within densely populated inner cities; offering local authorities new opportunities to shape the cityscape. And on the other, car sharing offers a democratically acceptable path away from a town planned around the car.

Transport policy requirements

Car sharing is certainly not a panacea. It helps only certain road users and only in densely populated areas. But the analysis of car sharing is useful, as it demonstrates in a tangible way how the choice of transport mode can change – if the cost structure of transport consumers changes – and where policy measures must be applied to create economic benefits for individuals and for society as a whole.

The starting point is again the known cost structure of a mobility seeker. Up to now, he has achieved his benefit by for-

Figure 4: Cost structure for car sharing, the use of other means of transport and policy measures



Source: KfW

going a locked-in investment and by optimizing his choice of means of transport (be1, be2). The vehicle-km optimum has been increasing constantly. Yet, this vehicle-km level can be increased further by specific transport policy measures. The intersection of the curves will be displaced further to the right, and the microeconomic improvement increases to the area bounded by the points A' - B' - be3 (Figure 4).

As an aside, the same analysis still basically applies if consideration is given not just to the economic costs of a person wanting to travel, but all possible costs (including time) are taken into account, and aspects such as convenience and spontaneity are also considered.

Investigating the individual incentive structure in mobility demand indicates what effects transport policy measures need to have, if they are to move the intersection of the lines as far to the right as possible. They will

- increase car owners' fixed and variable costs (i. e. displace their curve upwards or turn it anti-clockwise) and/or
- reduce the fixed and variable costs of users of car sharing and other means of transport (i. e. displace their curve downwards or turn it clockwise).

This may sound rather self-evident, but it

can – as the graphic analysis vividly shows – result in large efficiency gains at an individual level. Furthermore, the extent to which car sharing increases net traffic volumes, and the environmental impact of this increased volume, are significant at the macroeconomic level.

Purely financial measures, such as higher car taxes or a km-based road toll, seem the obvious way to go – as does an increase in public funding for alternative means of transport. If, however, all types of expenditure (including time) are factored into the analysis, the following issues could be worthy of further investigation:

- How can a convenient, widespread and reliable supply of car sharing vehicles be supported?
- How can the variable costs of alternative means of transport be kept as low as possible? To what extent does (local) competition exist?
- How well do the railways, local public transport and car sharing companies cooperate?
- How convenient / frequent is local public transport?
- How can freedom of choice over means of transport be supported?
- Who may drive where, and where

may they park?

- How can individuals be convinced to relinquish the lock-in effect of having their own cars?

The specific (and typically local) responses to such questions will determine whether those who live in small and medium-sized towns can be won over to a new blueprint for transport, in which it is no longer the car that enjoys pride of place, but the mobility requirements of the residents.

Such a transport revolution will obviously require significant financial support; not only to set up car sharing companies or finance their car fleets but also to realign local public transport, modify transport infrastructure at a local authority level or even to restructure a city.

Conclusion

The purchase of a car by a private individual means that he prefers to use his own vehicle to satisfy his transport requirements (lock-in). As a consequence of lower demand, the supply of other means of transport shrinks and social development focuses increasingly on motorized personal transport and ultimately becomes path-dependent. In recent years, however, technological innovations, new forms of organization and new user groups have led to a boom in car sharing.

The economic analysis of the incentive effects of car sharing shows that it liberates car owners from the investment locked into a car and increases their flexibility in choosing their means of transport. The efficiency gains at an individual level could be increased yet further by implementing suitable policies. The consequences will be larger individual efficiency gains, positive environmental effects and new opportunities to shape the urban landscape. In particular, these individual efficiency gains are independent of the environmental convictions that originally gave rise to the car sharing movement. It may be that the green image of car sharing is not helpful for its future growth.

The experience with new strategies in car sharing offers the opportunity to shift the focus away from the car and on to he

fulfilment of personal mobility requirements. This also opens up new approaches to achieving the objectives of the alternative energy turnaround. The transport sector would then cease to be the “largest remaining gap in the energy revolution.” ■

¹ In the case of station-based car sharing systems, more than one in two. Bundesverband CarSharing e. V. annual report 2012. 2013.

² Detailed analysis in, for example, Finanztest 03/2012. Teile und Spare. 2012.

³ Finanztest 03/2012. Teile und Spare. 2012.