Shifting Gear: Beyond Classical Mobility Policies and Urban Planning

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Mobility is the elixir of modern society. Man has been a travelling species for longer, of course. The quest not only for food, power and wealth, but also for ideas has inspired people to travel for ages. But during the modern era, we have perfected the mobility system. We now have a global economy that is not only functionally highly integrated, but celebrates this interconnectivity as well. This cultural celebration of the sheer endless opportunities is symbolized by the intercontinental holidays of middle class families. Sending images and story lines from faraway places and bringing insights and paraphernalia have become an indicator of social success. Less discussed but increasingly significant: Modern society thrives on the fuels, food and other resources (from rare earth to phosphates) that we extract or grow at faraway places and ship between different continents.

This era of 'hypermobility' has long been known to be unsustainable. The metabolistic dimension, the flows of resources and environmental effects, from oil drilling to CO_2 to spillage of phosphates into the seas, are the flip side of our progress and are something we now urgently have got to come to grips with. The knowledge of 'limits' dates back to the 1960s but is now finally giving way to knowledge that focuses on potentials, on transformations and on transition. Interesting is what this shift in emphasis could also mean for the debate on (car) mobility. After all, it was in the 1960 that the initial idea of allowing as many people into the world of car mobility (a car for everyone) started to arouse feelings of discomfort, something Phillip Larkin describes so well in his bleak 1972 poem 'Going, Going' (Larkin, 1972). The new post-war generations grew to maturity holding 'post-material' values (Abramson & Inglehart, 1995) and eloquently stated to raise question about the price of progress and growth.

While the occasional faraway holiday is a symbolic marker of success, it is the everyday reality of 'auto mobility', which has become the comfortable basis of Western day-to-day life.[1] This article focuses on this cornerstone of the system: the car. Cars are no longer a luxury belonging to the middle classes but are within reach of nearly everybody. What is more, the car can no longer be regarded as an individual technological artefact but has evolved into a 'large technological system' (Summerton, 1994) that has been perfected to include multilane motorways with giant petrol stations, parking houses in the inner cities, out of town shopping malls and also much of our urban fabric and form, from the cul-de-sac to the very idea of a suburban life styles as a blend between city and country living. This large technological system also comprises a powerful 'car industrial complex', that is crucial component of the economy, for instance, in terms of jobs, knowhow and innovation.

Car-based mobility is our default option, well embedded into our routines. It is our 'normalcy'. It is a cultural cornerstone that we cannot simply remove. Organizing mobility on a sustainable footing is a tremendous challenge. But it is one that, somehow, needs to be met. The 'small' agenda is one of direct environmental impacts, of health-related effects, of noise, particles and spatial impacts. There we at least know where to find solutions. The 'big' agenda is that of climate change and natural resources. Here many options to drastically reduce greenhouse gas emissions from transport have been identified. But strategic decision makers stare the scientific facts and predictions in the face like a rabbit looks at the headlights of a car approaching. There is a scientific consensus that achieving the 2°C target is *technically* feasible, for rich countries this would require a stunning effort to reduce emissions with a factor 5 (Rogner et al., 2007). Unfortunately, little progress towards the ultimate goal has been made over the last 15 years. In fact, current policy scenarios predict that the share of transport (which of course is more than merely cars) in greenhouse gas emissions may rise from the current 25 to 50% in the year 2050 (European Commission, 2011a). Hence we simply have to rethink the mobility strategies in a fundamental sense.

Hence the question is not if this legitimizes government intervention but *what sort of intervention* can be envisaged in the first place that may be promising to bring this transition about. Here serious 'out-of-the-box' thinking is required, or, in this context perhaps appropriate, 'gearbox' thinking, as we need to urgently shift gears.

1 This chapter focuses on the context of the developed world. It is obvious that the car is not within reach of everyone outside the rich countries. The predictions of a growing middle class in the developing world, reaching a stunning 3 billion in 2050, would logically imply a pervasive shift in the degree of car ownership elsewhere, with great environmental and spatial consequences. Such issues are beyond the scope of this paper.

As experts we need to provide the thinking that may be drawn upon in a new policy making. Yet we have to reconsider the sort of advice we give, as well as the very way in which we relate to the mobility field. The traditional approach would be to turn to governments, seek to persuade them with studies that assess which technical measures are potentially effective. Governments would then have to adopt and enforce these measures through legislation, emission standards and pricing measures. The reality of policy making and politics is that vested interests and lack of imagination stand in the way of even applying those measures that scientists have reason to believe to be powerful policy instruments, road pricing being one of the most well known.

The combination of a well-developed large technological system and a strong cultural adherence to the social and cultural practices of car mobility reality is a lethal cocktail. We cannot possibly come up with an alternative, let alone a blueprint. What we aim to do in this chapter is create a perspective that may help to find new strategies that go beyond the results of the thinking of the last 15 years. We start by briefly describing the problem at hand, and the technical solutions that have been identified to meet the challenge of a sustainable mobility.

1. The Problem at Hand

The transport sector is a major contributor to greenhouse gas emissions. Approximately 25% of global and European CO_2 emissions are transport related, and this share will increase. The bulk of the emissions are caused by road transportation and passenger car transport in particular (see Figure 1). In order to meet long-term climate goals, the European Commission has announced that the transport sector should limit its CO_2 emissions to 60% of 1990 levels (European Commission, 2011b). This is a serious challenge, certainly if we consider that in a scenario without policy change passenger transport activity would increase by 51% between 2005 and 2050 while freight transport activity would go up by 82% (EC, 2011a). Consequently, without additional climate policy, the share of CO_2 emissions from transport would continue to increase to 38% of total CO_2 emissions by 2030 and to almost 50% by 2050 (EC, 2011a).

There are three core elements to the 'solution':
- use alternative (non-fossil) energy carriers;
- use alternative fuel vehicles (AFVs) and
- travel less kilometres.

There is a clear distinction between these three elements regarding their emission reduction potential. This is illustrated by Figure 2. The combined potential of alternative fuels and AFVs is far greater than the potential of less travel.

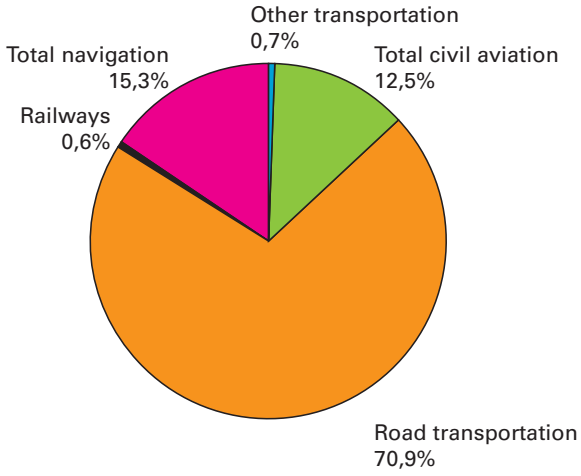


Figure 1. Share by mode in total transport CO_2 emissions, including international bunkers. EU-27 (2007).

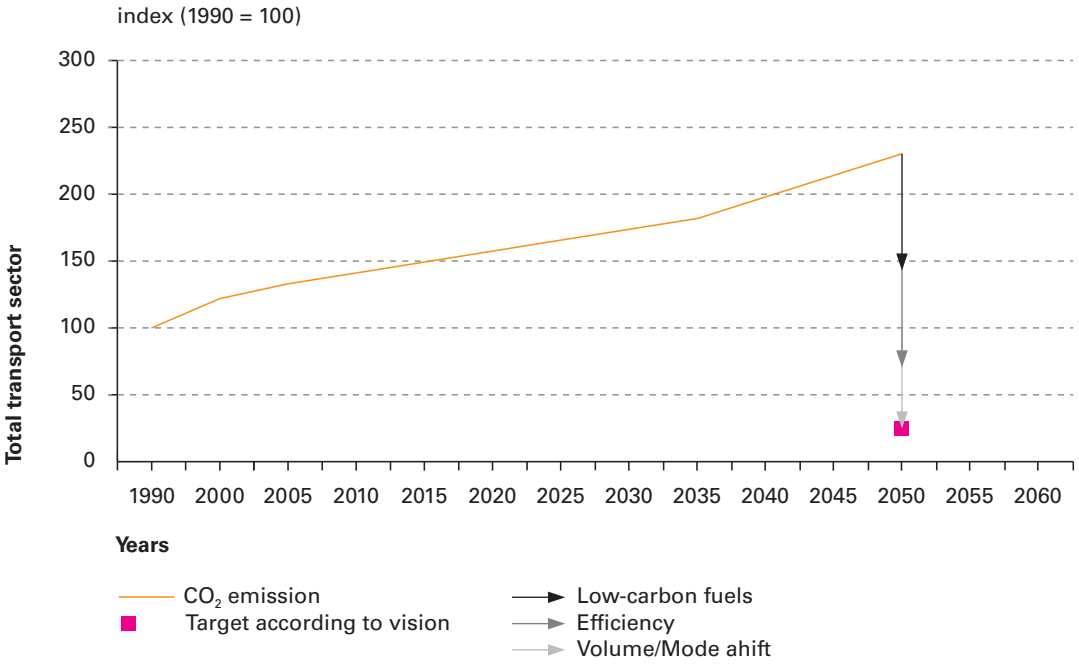


Figure 2. Route towards a low-carbon transport system in the EU in 2050. Feasible CO_2 emission reduction for transport. Schematic representation of potentially feasable emmission reduction for the transport sector, by 2050.

Roughly 80% must come from a combination of CO_2 neutral fuels (electricity, hydrogen and biofuels) and vehicle technology (battery electric vehicles and fuel cell vehicles). There is a clear distinction between passenger car transport and

other modes such as heavy duty freight transport, shipping and aviation in this respect. Freight transport (road, rail, air and navigation) and civil aviation will be dependent on biofuels for large CO_2 emission reductions since alternative (electric or hydrogen) propulsion is not technically feasible. For passenger car transport (and light duty freight transport) electric and hydrogen propulsion is a viable option. If hydrogen and electricity are produced with wind or solar energy, this group, which is responsible for approximately 50% of transport CO_2 emissions, can emit up to 95% less CO_2 (Hoen, Geurs, de Wilde, Hanschke, & Uyterlinde, 2009).

Reducing travel demand or changing travel behaviour can attribute approximately a 20% emission reduction, mostly through road pricing and increased logistic efficiency in freight transport. The additional effect of spatial planning is limited at this point, not the least because in the developed world 70% of the building stock of 2050 is already there (Hoen et al., 2009, Hajer, 2011).

In the next two sections, we will look at some popular measures that aim to increase the use of AFVs and reduce the demand for mobility (amount of kilometres driven). The focus is on passenger transport and mostly on car-based travel. We will assess whether these measures can be effective from a technocratic point of view and at the same time from an energetic society perspective. We will illustrate that for effective policy making, there is often not only the need to look at technical potential or model-based scenarios but also at societal response to the challenges of sustainable mobility. The extent to which society accepts policies should be included in policy assessment, and this need becomes more pronounced if we take into considerations that modern society is made up of articulate, autonomous citizens and innovative companies. Many want change and are ready to take action. On the other hand, there are also citizens who are sceptical of the need for change. This scepticism often focuses not so much on the need for change itself, but stems from a lack of trust in government initiatives that aim for this change, and the idea that such initiatives will constrain their actions. Here lies the challenge of governments, which is to combine two societal developments:

- The need to attune our natural resource use to the earth's carrying capacity, here in particular the need to curb CO_2 emissions. This is a major challenge that we are faced with for the coming decades.
- The emergence of what we call the 'energetic society' (Hajer, 2011): A society of articulate citizens and firms, with an unprecedented reaction speed, both in terms of capacity to obstruct and in terms of learning ability and creativity.

In the next section, we will start of with a review of some possible measures to reduce demand for transport, or in other words drive less kilometres. In Section 4, we look at measures that aim to increase the use of clean vehicles using clean fuels.

2. 'Drive Less'

We find many examples of measures in literature that have the potential to reduce the number of kilometres that people and companies drive. To name a few, road pricing or congestion charging, improving public transport, telecommuting and teleconferencing, spatial planning to shorten travel distances, Park and Ride facilities to limit car traffic in cities and logistic efficiency in freight transport. With such a wide variety of options, it might be considered surprising that the emission reduction potential in Figure 2 is assessed to be limited.

We will elaborate a little on this by looking at the historical development of transport. It would be fair to say that in the past 200 years, mobility has 'exploded' (Mom & Filaski, 2008). The average distance that a person travels per day has increased with 1-4% each year (van Lint & Marchau, 2011). Apart from the increased travel distance, the population size has also increased dramatically. All in all the combined personal mobility of a growing population is roughly 80 times higher than it was in 1800. To put it differently, the mobility explosion is the result of much more people travelling many more kilometres over the past 200 years. What could be the reason for this massive increase in mobility?

The most important reason is that technological innovations in mobility have made it possible to travel much, much faster. Horse and carriage (the main mode of transportation around 1800) reached average speeds of 7 km/hour. Current car travel reaches average speeds of 70-100 km/hour and aviation surpasses that with ease with speeds of up to 900 km/hour. While travel speeds increased travel times remained fairly constant at roughly 1.1 hours per person per day (Zahavi & Talvitie, 1980; Schafer & Victor, 2000). According to Marchetti (1994), the 'law' of constant travel time has held for centuries and even applies to inmates who kill time by walking an hour on the prison grounds. We put law in parenthesis because there is also evidence that travel times are not constant. Harms (2008), for example, shows that for the Dutch case, people currently travel longer and more often than 30 years before. Interestingly, we do not find indications in literature that travel times decrease owing to higher travel speeds.

Apart from constant travel time, there is evidence that people tend to spend roughly the same percentage (15%) of their income on travel (Schafer & Victor, 2000). As a consequence, since faster travel is more expensive, with increasing income over time, people spend more money (in absolute terms) on travel, choose faster modes of travel and thus travel longer distances.

This tells us that there seems to be a 'natural tendency' of people to travel and that as long as we increase infrastructure capacity and invent technologies to increase travel speeds, it will be difficult to reduce the demand for travel.

Moreover, this natural tendency is reinforced by the elements of transport policy that aim to increase accessibility and decrease travel times. Such policies are aimed to facilitate travel, which instead of reducing the number of kilometres travelled, gives an incentive to travel more.

It should be noted here that there are differences between the different modes of travel. A kilometre driven by train is from a perspective of CO_2 emission reduction on average better than a kilometre driven by car. So if transport policies are successful in shifting travel demand to more energy efficient or CO_2 intensive modes travel demand policies may be effective from an environmental viewpoint. We should also note, however, that car travel is by far the preferred mode of transport. In the Netherlands, the number of passenger kilometres driven with cars is approximately six times as high as the number travelled by train. Train travel can accommodate only a limited part of a reduction in car travel. Moreover, the substitution between modes is limited. New public transport links generally attract new travellers instead of car travellers (Hilbers, van de Coevering, & van Hoorn, 2009). Reviewing what we have shown so far might lead one to argue that emission reduction technology (clean fuels and vehicles) cannot be only about changing the modal split but should also focus on CO_2 neutral transport. To see if this could be true, and whether the mechanisms described above indeed occur, we will review some successful or promising and some counterproductive measures to reduce kilometres driven.

Successful Measures

Road pricing and Congestion Charging

Use-related charges have been on the policy agenda for several decades. Singapore was the first to implement the Electronic Road Pricing (ERP) system in 1998. In London, Stockholm and Milan, similar schemes were introduced in 2003, 2007 and 2008, respectively. The main reasons for introducing these use-related charges are to improve accessibility in heavily congested urban area and to improve air quality. Li and Hensher (2012) give an overview of the effects of the congestion charging schemes (CCS) in the aforementioned cities (see Table 1).

The reduction in car traffic amounts to 15-20% in all four cities. The use of public transport increased substantially. Results for air quality are less clear. For London, no consistent evidence of improved air quality resulting from the CCS was found (Kelly et al., 2011). For Stockholm and Milan, positive effects on air quality are reported (Börjesson, Eliasson, Hugosson, & Brundell-Freij, 2012; Rotaris, Danielis, Marcucci, & Massiani, 2010).

The congestion charging in London presents a watershed in policy action in the UK (Banister, 2008). Although it has been successful in decreasing car use and

increasing public transport use (with little negative spin-off outside the charging area), it was very difficult to get it implemented. Before implementation, 40% of the people were in favour of the measure and 40% were against the measure, illustrating that substantial political commitment was needed to follow through. Interestingly public opinion has shifted since the implementation to 55% being in favour. Increases in public support have also been observed in Norway.

Impact of the projects	Congestion charging schemes			
	London	Stockholm	Milan	Singapore
Reduction in traffic (vehicles with four or more wheels) entering the zone during charging hours	18%	Trial: 22% after permanent implementation: 18%	14,2% (23% during the morning peak hours	40-45%) Area licensing scheme). 15% (electronic road pricing) 70%
Reduction in cars entering the zone during charging hours	33%	Not available	Not available	70%
Change in traffic beyond charging hours	Observed peak traffic after the charging hours in the first year, normalised in the coming years.	Observed peak traffic after the charging hours in the first year, normalised in the coming years.	Observed peak traffic after the charging hours	+23%
Change in traffic round the charging zone	-5%	+10%	-3,6%	Not available
Change traffic in the inner road	+4%	+5%	Not available	Not available
Increase in speed in the inner road	30% (From 14 km/h to 18 km/h	30-50% (33% in the morning peak	4%	20%
Change in speed in the inner road	Not available	Not available	Not available	-20%
Increase in bus speed inside the charging area	6%	Not available	7,8% Attributed to charging zone in combination with bus lanes.	Not available
Increase in the use of public transport	Above 7% totally, 37% in bus passengers entering the zone	9%	6,2% Totally, 9,2% in metro passengers	21%

Table 1. Some effects of CCS in London, Stockholm, Milan and Singapore. Source: Modified from Li and Hensher (2012).

Mobility Budget
A measure that seems to become more and more popular among Dutch companies is the so-called mobility budgets for employees with a company car. The traditional finance model for company car is to give the employee a tank card for which (s)he could essentially buy a 'limitless' amount of fuel. A mobility budget on the other hand gives an employee a fixed amount of money each month. The employee is free to decide how to spend this budget. Her or she may also decide to work at home if the schedule allows it or use public transport instead of the car.

This is an interesting approach since it creates an incentive for the car driver to 'earn money' by thinking creatively about his or her mobility behaviour. If by the end of the month, the employee has not fully used his or her budget the remainder can be spent on other things.

Pilots show that companies can set the mobility budgets below the average monthly costs of the traditional system so that they too save money.

Counter Effective Measures

Free Public Transport
Public transport is often viewed as the environmentally friendly counterpart of car traffic. It has been put forward regularly by local governments as a means of improving accessibility and livability (better air quality, lower noise levels) of cities. Research on free public transport and also adding new public transport services, however, shows it hardly results in people transferring from car use to public transport (Hilbers et al., 2009). It rather results in people who used to walk, bike or not travel at all to make use of public transport. Moreover, people who already used public transport tend to travel more often and greater distances. In the end, the net effect on accessibility and air quality might well be negative since only few less car kilometres are driven while additional kilometres are driven by bus, tram and metro.

This illustrates that good policy intentions of which citizens may benefit may result in the opposite outcome. In this specific case, it is probably the result of people finding the path of least resistance. For many individuals, the benefits of easy travel outweigh the benefits becoming healthier by cycling or walking and living in an environmentally friendlier city.

Financial Compensation for Commuters
Another example of pricing policy that leads to adverse effects is the 'commuter compensation'. This is a compensation for people who use their private car for the commute (or business trips for their employer in general) paid by the national government. The compensation amounts to 19 euro cents per kilometre

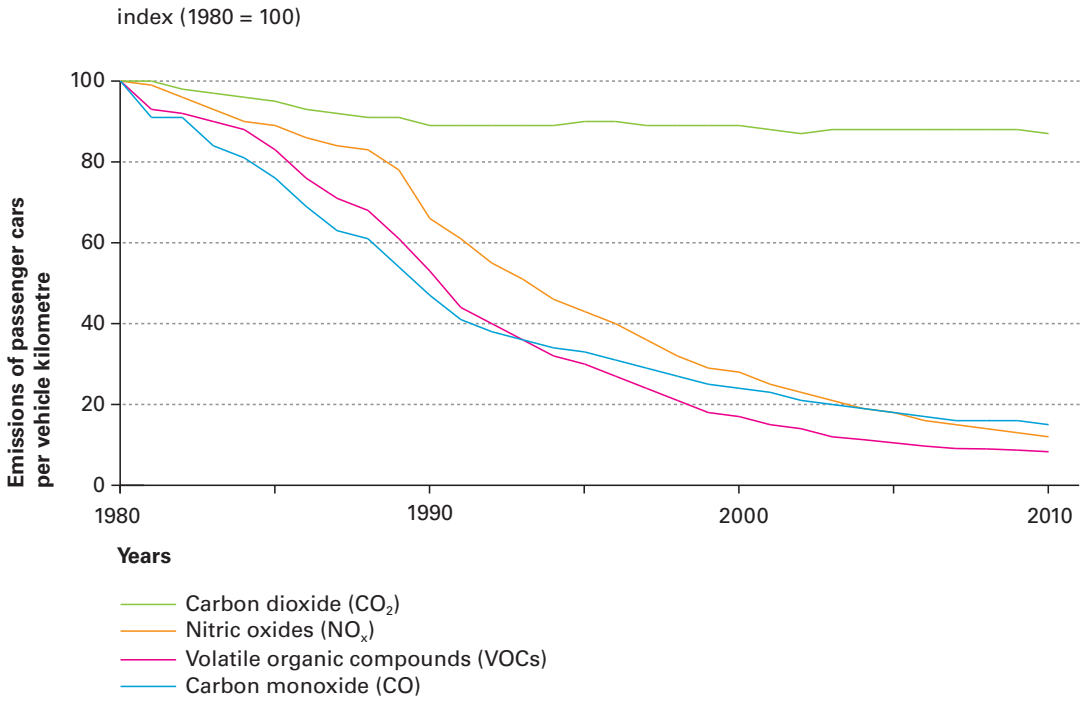


Figure 3. Trend in emission of CO_2 and air pollutants in The Netherlands. Source: CBS, Registration of emissions.

in the Netherlands. The measure creates an incentive to either work farther away from home or live farther away from work. In effect, the total amount of kilometre's driven increases by this measure, which in turn leads to more congestion, casualties and emissions. It is interesting to note that in April of 2012, an interest group announced that the commute compensation should be increased owing to rising oil prices. From the perspective of more sustainable mobility, this would be the exact opposite of good pricing policy. In fact in the so-called Green Tax Battle several Dutch experts argued that abolishment of the commute compensation would be a very efficient way to reduce CO_2 emission on the short-to-medium term (Stichting Natuur en Milieu, 2011).

3. Clean Vehicles and Fuels

Successful Measures

Emission Limits for Passenger Cars

Passenger cars have a very substantial part in the road towards sustainability. They contribute significantly to air pollution and greenhouse gas emissions. It is technically feasible to make (near) zero-emission passenger cars, provided new

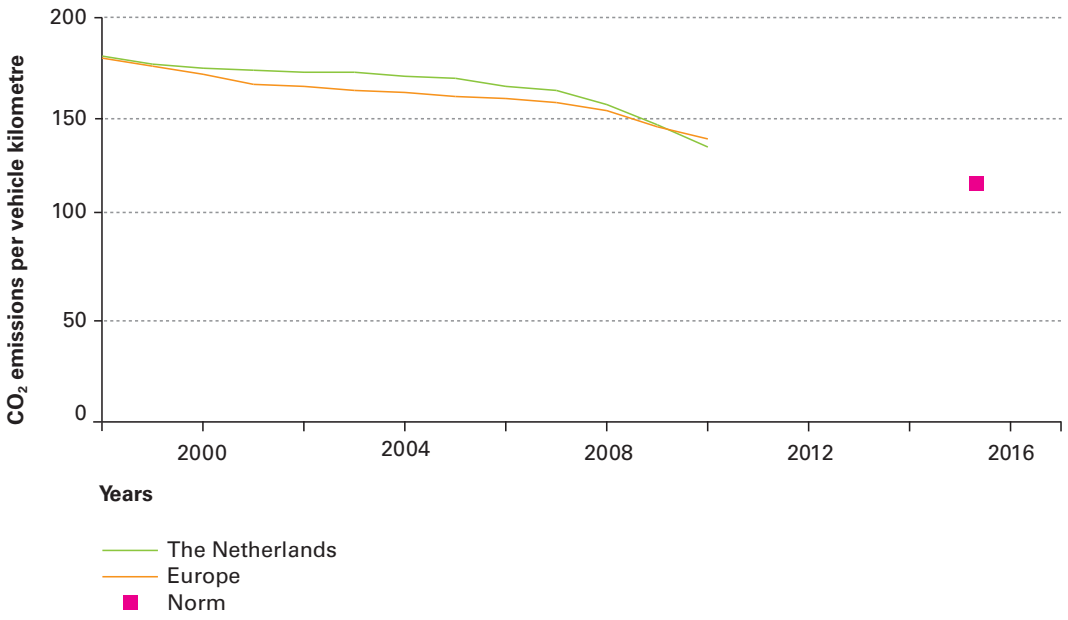


Figure 4. CO_2 emission of new cars in Europe and the Netherlands. Source: RDW, T&E.

vehicle technology emerges and renewable energy carriers will be available. Interestingly for air pollution there has been a long track record of policies that have achieved just that.

Cross-boundary air pollution was a hot topic from the 1980s throughout the beginning of this millennium. For the transport sector, it resulted in EU legislation for road vehicles, the so-called Euro norms. Around the year 1990, it started with Euro 1 and currently only Euro 5 vehicles are allowed to be newly sold. Euro 6 limit values have also been agreed upon and will come into force around 2014. These Euro norms have been very successful (see Figure 3). Total emission of NOx, VOC and PM (particulates) of cars has dropped with more than 70% between 1990 and 2010, while mobility has increased with roughly 50%. The Euro norms initially confronted car buyers with additional costs (roughly €500-1,000 in current prices) mostly coming from the catalytic converter that filtered exhaust emissions but to the surprise of many the costs of the converter quickly came down and is now below €100.

We will not go into the details of why the Euro norms have been so successful and what made car manufacturers willing to adhere to the regulations set by the EU. We can say that it is probable that the sense of urgency about air pollution

and the associated environmental problems of acid rain was high at the time (Hajer, 2005). This might very well have created the willingness to pay for the additional costs. Although records show that car manufacturers initially objected to the emission limits in the end, they conceded to the EU regulations, perhaps in part to avoid reputational damage. Whatever the reasons have been, the fact is that these policies were very effective.

However, the successes for air pollution do not hold for CO_2 emissions (by far the dominant greenhouse gas emitted by the transport sector). Figure 3 shows that CO_2 emission levels hardly dropped in the same period that the Euro norms came into force even though energy efficiency has been on the policy agenda for more than 15 years. Until 2010, the approach was different from that of air pollution. It started with a series of voluntary agreements with the European, Japanese and Korean car manufacturers to reduce the CO_2 emissions of passenger cars with 25% between 1995 and 2008 to a level of 140 g of CO_2 per kilometre driven. Although the CO_2 emissions dropped slightly as can be seen in Figure 4, the European Commission felt that the progress was too slow. Important to note is that Figure 4 shows emission levels according to the ECE test-cycle. This means that CO_2 emission is measured on the basis of a stylized drive cycle with limited acceleration that is not comparable with real-world driving. Moreover, electric appliances and air conditioning are turned off during the test. This means that the progress shown in Figure 4 is smaller if real-world CO_2 emissions are regarded.

The lack of progress resulted in new negotiations between car manufacturers and the EC, which ultimately resulted in legislation. A norm (or limit value) for CO_2 emissions was set with substantial financial penalties for those who would not meet the target. The new legislation was finalized in 2010. It is interesting to see that around the year 2008 (when negotiations started), the CO_2 emission per kilometre dropped sharply implying that the strict approach was a lot more successful than the voluntary agreements. The drop in CO_2 emissions is probably also the result of the economic and financial crises and increased oil prices, that in turn led (at least in the Netherlands) to an increased interest in smaller more energy-efficient cars.

One might conclude from the above that emission limits for cars is a very successful measure and that the EC should continue on this path to ultimately induce the transition to zero-emission vehicles. Simply tightening the emission limit further and further would ultimately require that car manufacturers refrain from building cars with an internal combustion engine and shift production to battery electric and hydrogen cars, but such a ‘top-down’ policy approach is likely too simple to actually work.

First, we should consider that the current emission limit of 130 g CO_2/km is technically achievable without significantly altering size, comfort and performance levels of cars. A reduction of up to 95 g/km would even be feasible in this respect (Smokers, Fraga, & Verbeek, 2011). Further reductions, however, require advanced vehicle technology that will change the way car users are able to fulfill their mobility needs. Advanced vehicle technology such as plug-in hybrid, battery electric and fuel cell are required, which cannot be operated in the same fashion as conventional vehicles. Particularly battery electric vehicles and fuel cell vehicles currently have limitations with regard to range, fuel time and fuel availability (Hoen & Koetse, 2012). Van Meerkerk, van den Brink, and Geilenkirchen (2011) show, for example, that due to the current features of electric cars, only 5% of households would be able to substitute their conventional car with an electric car without having to alter their current mobility behaviour. Hoen and Koetse (2012) show that the average Dutch car owner has a strong negative preference particularly for electric and hydrogen cars.

Second, the additional costs that are associated with a shift to zero-emission vehicles are substantial and not comparable with the additional costs that were associated with the catalytic converter. Even with significant improvements to battery technology, electric cars are expected to be roughly €15,000-20,000 more expensive than a conventional car (Nijland, Hoen, Zondag, & Snellen, 2012). In the coming years, additional costs may be three times as high.

With the elaboration above, we want to make clear that AFV adoption cannot simply be enforced by setting stricter emission limits. There are strong indications that society may be hesitant and that there will be a need to 'engage' the general public. Hoen and Koetse (2012) show that car users who drive a limited number of kilometres a year are most likely to adopt an AFV in the coming years. Although technically this should be attributed to the limited range of these vehicle types and better performance on range will increase preferences, it also means that policies to promote electric vehicles aimed at this group will stand a better chance of succeeding than policies aimed at those who drive more. This illustrates the importance for policymakers to identify the individuals who are likely to energize the transition.

Purchase Tax Incentives

A Dutch example of pricing policy that has led to an increase of the share of fuel-efficient cars is the CO_2 purchase tax differentiation (Kieboom, Geilenkirchen, & van Meerkerk, 2010). It entails lower purchase price taxes for cars that emit less CO_2 and additional purchase tax for larger energy inefficient cars. Several other countries have adopted similar tax schemes (Denmark, Germany). In the Netherlands, a tax incentive is also in place for company car drivers.

It is interesting to see that the sales of small energy-efficient cars have increased substantially over the last years (Kieboom et al., 2010). The same holds for company cars (Ecorys, 2011). The average CO_2 emission of passenger cars is below the EU average and in 2011 was in fact close to the 130 g/km goal that is set for the year 2015. Car commercials on television actively promote the policy by stressing the tax exemptions for private and company cars, which some may consider surprising since car manufacturers usually make higher profits on larger cars.

4. The Need for an Alternative Approach

The account of policies based on typical technical measures such as taxation or CO_2 norms will not be sufficient to reach the goal of a carbon neutral mobility. Not only are the measures falling short in effects, but the expected political 'fall out' is such that politicians often already lose faith before the measures are put forward.

At some point, we will need to address established social practices of mobility more directly. This realization is not new, of course. Others have argued along similar lines that the traditional approach to transport planning generally focuses on economic arguments of rationality that fail to explain why the outcomes of policy measures hardly ever match up with expectations. Banister (2008) states *'…there always seems to be a reason for not changing and maintaining the status quo. However good public transport is, there will always be a reason for still using the car.'* The current car system seems remarkably stable and unchanging since it is reproduced through an extensive economic, social and technological network of vested interests, agents and flows (Dennis & Urry, 2009).

Some 'hard core' traditionalists may argue that it is 'technically feasible' to reach the desired outcomes purely by technological means. But their insistence fails to take politics into account. Surely, 'we have got the technology' but there is just no consensus on using it. We calculate that we can stay within the 2°C target for an estimated 1-2% of GDP annually (PBL Netherlands Environmental Assessment Agency, 2009a). But the political leadership cannot come to an agreement nevertheless. In the field of mobility, we see this being repeated. It is unlikely that in current circumstances, clean fuels and low carbon vehicles alone can deliver on the 2° goal. But can we step out of current habits and defaults? Reducing kilometres driven directly affects travel behaviour since it involves either changing the mode of transport (from car to public transport) or substituting trips altogether (through teleworking or Internet shopping).

Of course, changing mobility habits has been discussed as well. How do we get a person who is currently commuting by car, to change modes and go by train instead? While the lock-in in countries such as Australia or the US is massive,

European countries often still have the size, scales and density that would allow a social alternative. Moreover, most likely people know that public transport is safer, less polluting and less susceptible to congestion.

Transport Policy Facilitates Travel

There are two fundamental principles to transport planning that have proven to be remarkably robust over a long period: (1) travel is derived demand and (2) people minimize their generalized cost of travel (Banister, 2008). This basically entails that all travel has purpose and hence economic value and that increased travel speeds reduce total costs of the system ('time is money'). Ex-ante (cost–benefit) policy evaluations often show that reduced travel time makes out a significant part of the overall benefits of an infrastructure project. This paradigm thus leads to the rationale that more travel needs more infrastructures, which explains the explosive mobility growth that we mentioned in Section 3. We need not explain that this paradigm is not compatible with the paradigm of sustainable mobility. We might argue that they are each other's exact opposites.

The Car as a Discourse

Even if the built environment is conducive to a more sustainable form of mobility, we see that this alternative fails to materialize. In Western European city regions, the densities, connectivity's and spatial lay out of work, recreation and living are such that a much more benign mode of transport could be envisaged. What is more, these countries do have the planning capacities to help bring about such changes. For countries such as Denmark, the Netherlands, Belgium or Norway, they do not have a national car industry that puts undue pressure on the governments. Yet still, even in countries with such a great advantage change is slow in coming.

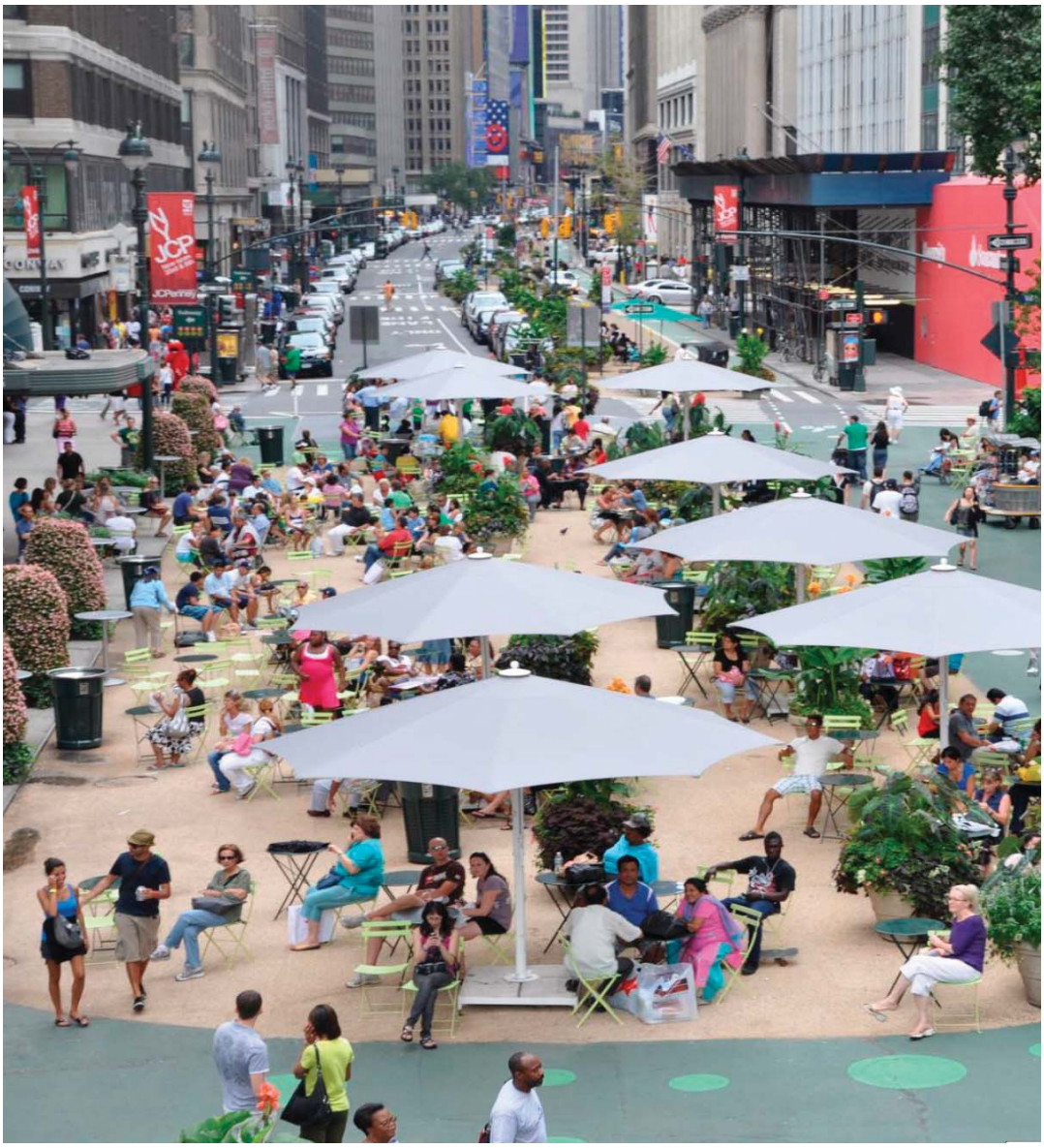
It is often underestimated how power is also embedded in discourse: in a particular way of seeing, underpinned by a more or less stable set of concepts, ideas and classifications (Hajer, 1995). The dominant discourse promotes and privileges car travel and reinforces the bias in the system (in terms of passenger kilometres per year car travel is almost four times higher in the Netherlands than public transport (Hilbers et al., 2009)). Cars and suburban life styles are a core component of advertizing and commercials. The car is accepted as the dominant and most desirable means of transport. Even in Dutch research, we hardly find future scenarios with no or even much reduced car travel. Most scenarios, even those with stringent climate goals incorporated in them, predict that car travel is dominant even in the long term. Sure, the car gives individual flexibility, comfort and convenience (Dennis & Urry, 2009) and is viewed by many as a tool that provides a great sense of freedom. A view that is constantly reinforced in advertisements and through policy privileges. But this default also stands in the way of finding out if there are viable alternatives that could link way of moving to cultural icons that could become new 'life style carriers'.

Thinking 'in the box' is trying to figure out how to organize the political dilemma surrounding measures that, some way or another, limit our freedom of car movement. Road pricing, increased parking fees, fuel levies – we can all name the policy measures that politicians fear owing to the lack of public support. Arguing that these measures are necessary, since there is a climate problem and that therefore CO_2 emissions need to be reduced, is insufficient. Here it is important to differentiate the smaller group of active skeptics of a 'after the car' discourse (Dennis & Urry, 2009) from the large contingent of people who do not actively choose against a more sustainable approach, but that simply live on default.

At this point, we must rethink the role of scientific expertise as well. After all, as experts we are co-producers of existing realities. By and large, experts are comfortable with a role of what Wildavsky (1979) called 'speaking truth to power', preferably using analytical techniques to arrive at '(cost) optimal' solutions. It is the type of relationship between science and politics that political scientist van Gunsteren (1994) described as learning via 'analysis and instruction'. Yet this approach is increasingly ill suited for our contemporary world. Our world is changing at a rapid pace (think of technological developments of cultural preferences) and the commanding power of the political centre is waning (Hajer, 2009). Interestingly, Van Gunsteren also coined a second type of learning, which he described as 'variation and selection'. This is interesting as it hints at ways to break out of habit, default and discourse. It suggests that there is a future in the experiment, the temporal. Furthermore, it suggests that incremental policy change via experiment may have one big advantage over large-scale change: It allows people to readjust their values based on actual experience of an alternative. Hajer describes his favourite example thereof in the PBL essay *The Energetic Society*, discussing the work of the Commissioner of the New York City Transport Department, Janette Sadik-Khan (Hajer, 2011, pp. 36-37):

> 'When Janette Sadik-Khan took office in 2007, she was confronted with a city that was short of money, but that urgently needed to improve the quality of its surroundings and come up with a new transport strategy. In addition, she was faced with a city that was, and still is, famous for the long drawn-out legal proceedings used by residents to effectively oppose all kinds of changes.
> Janette Sadik-Khan took a new approach: (1) let the city experience what is possible in terms of quality improvements; (2) implement plans quickly, if necessary on a temporary basis; and (3) measure change, analyze data and communicate the results.
> To improve the quality of the local environment small, temporary swimming pools were placed in various areas of the city in the summer months, when the city swelters. The most high-profile decision, however, was to transform Broadway, one of the main roads in Manhattan, into a series of squares between Times Square and Union Square. The transformation took

place literally overnight, by placing planter boxes in the middle of Broadway and painting green traffic-free areas on the road. This initially controversial 'reclaim the street' project is now incredibly popular. Sales on Times Square increased by 71%, there were 63% fewer injuries to car drivers and passengers, 35% fewer injuries to pedestrians, 80% fewer pedestrians walking in the road, taxi journeys to the north of the district went 17% faster and so on (New York City DOT, 2010a; New York City DOT, 2010b)'.



Courtesy of NYC DOT.

The point of the example is that Sadik-Khan worked with (1) experiment, (2) ex durante evaluation, (3) public relations and (4) experience as precondition for value change. She achieved pedestrianization that would never have worked through the old techniques. She created a *space of experience* that made it possible for citizens to visit and explore an alternative and think about the new preferences and possibilities that came with it. She used statistics to monitor the result and shared this with the public. She started cheap and quick, and only moved to more permanence and heavy investment after she had won the stakeholder and the general public.

A change in public acceptability will not happen overnight and the dominant discourse requires that policy measures aiming at more sustainable mobility will likely have to be eased in gently. Nevertheless, the New York case shows an alternative way to move about; it is thinking out of the box.

Facing the dilemma of moving towards sustainable mobility could benefit from thinking about the origin of preferences, public acceptability and behaviour and much less about the traditional (technocratic) transport planning solutions that focus on technology and technological acceptance, reduced travel times and improved accessibility. Moreover, we must realize that traditional transport planning has resulted in a situation where stressing the benefits of car use is the dominant discourse. A change in both of these key elements will facilitate a road to more sustainable mobility. In the next section, we will argue that there are six key steps or requirements to mobilize the Energetic Society that can help overcome the dilemmas pointed out in this section.

5. Exploit the Energetic Society

The need for an alternative approach towards sustainable mobility tells us that we need to look at mobility in 2050 from different perspectives. We need to look at more than just the physical and technical dimension of less movement and AFVs. We have established earlier that to achieve the goals, we need to drive less and change to alternative fuels and vehicles. But how to achieve this transition remains the question. The transition cannot be made by government alone, although the government does play a substantial role.

The government alone can define the goals, by taking a clear position for sustainability, by making sure that the 'polluter pays' by, for example, a carbon tax, and by taking away financial incentives that work in the opposite direction. Government can also influence mobility behaviour in the long term by working on an infrastructure of sustainable transport, from high speed rail connections, low or zero-emission river and marine freight transport to neighbourhoods

who combine working, living and recreation, thus reducing mobility needs. And government can influence mobility behaviour by creating rules and regulations that are favourable for sustainable transport. Still, all that is not enough to achieve the sustainable mobility goals for 2050. We need to leave the shelter of the silo and think socially, connecting measures to what we know from history and policy to aspirations about the future.

Historically, strong environmental regulation has always been accompanied by broader social movement. What is more, although the famous works of Donald Worster[2] and Samuel P. Hays[3] might have shown that those movements together produced a sea of change in their times, those contributing did so for very different reasons. The wilderness protection and the launch of the National Parks in the United States were the result of a coalition of German educated foresters, Washington-based policymakers, a newly urbanized population rediscovering the natural environment they had left a generation ago, and a political leadership ready to capture all the energies. The big surge of environmental awareness of the 1960 and 1970s came from a coalition comprising concerned biologists, such as Rachel Carson[4], local movements struggling with pollution sites, and a newly educated generation that discovered and prioritized 'post-material' values from the comfortable position of having grown up in families where parents had devoted their lives to beefing up the material quality of their family life.

We think that the climate change strategies of today demand a search for kindred spirits that can together create the often unlikely coalitions that then could bring about real social change. In other words, an effective climate strategy requires more than outlining a policy of effective goal achievement – it also must tap into social and cultural forces that can help make it work.

First, we need to give more thought to the importance of *framing*. Although it is arguably always the individuals that act, we know that they change their choices because of collective action frames. Big achievements in environmental politics can be explained because of broader cultural alliances, that is what the history of environmental politics reveals. Interestingly, these forces were mobilized through a shared way of seeing. 'Wilderness protection' was something many Americans positively related to, around 1900; it laid the foundation for the broad coalition of the conservation movement, composed of very different groups. 'Industrial pollution' was a mismatch with the aspirations of a new post-material generation in the 1960s.

2 Compare Nature's economy: A History of Ecological Ideas (1977).
3 Compare Conservation and the Gospel of Efficiency: The Progressive Conservation Movement 1890-1920 (1959).
4 Compare Silent Spring (1962).

The question now is whether 'climate change' has the maximum potential to mobilize social energy in the early 21st century. The current frame of '80%' reduction, 'cap-and-trade', a 'threat of apocalypse' and 'coordinated' policy efforts might facilitate an agreement among states, but is not going to help make this into a broad cultural force.

We think that a clean and fair economy based on energy that is in endless supply is the irresistible master frame. As Nordhaus and Shellenberger (2008) remind us, Martin Luther King did not say 'I have a nightmare'; he said 'I have a dream' and created a movement. Some decades ago, we used leaded petrol poisoning our very own children; we threw bottles in the bin harming garbage collectors and wasting resources. Our cars gulped down petrol in the way of children drinking lemonade. Looking back, and based on what we know today, it is pathetic. We may have a tendency to romanticize the past, but not one containing leaded petrol, scattered remnants of broken bottles or thirsty cars. In that vein, it might help to show how pathetic a continued reliance on fossils, polluting oil and dirty coal actually is.

Innovation in itself is a no go. It is a technocratic wish. Yet, coupled to the findings of climate change and 'peak oil', it forms into something. This is a frame that speaks of a move from the 'age of polluting fossils' to the 'age of autonomy, based on endless renewables'. Key words in that alternative discourse would be innovation, smart solutions, global justice, accountability and autonomy.

Smart solutions. Young people like iPods, not clumsy cassette players with big batteries (that quickly run out anyway). It is this generation that will have to be brought on board. They like efficient vehicles. Petrol is not going to become cheaper. All money spent on petrol cannot be used for other purposes.

Global justice. Renewables quickly create the potential for developing countries to take care of their own demands, through solar cells (photovoltaic [PV]), mobile networks and the like. Western commitments should, in that vein, perhaps be more about sharing patents and technology and less about money.

Autonomy. All people in the West like to think of themselves as autonomous choice making individuals. Renewables create autonomy for developing countries. Renewables enhance the autonomy from geopolitically unstable regions.

Endless supply. Some sources of energy are unlimited; we only have to find the ways to harvest them. What a dream, what a mental shift. Tap into that resource by directing innovation to harvesting the endless resources of renewables. What a focused target for our 'knowledge economy', that is, our universities and firms.

The social power of this discourse can be seen already. Local initiatives spring up everywhere. Solar energy PV schemes are tremendously popular, urban agriculture is 'cool'. Mobility is still very much a state thing. But it is a deeply cultural domain. Is it foreseeable that the trendy elitism is moving into driving hybrid, electric scooters, classy electric bikes?

Shifting gear. We need to shift gear. If we need to change the default in mobility, there clearly is a major role for the state. The role of the state is, first and foremost, one of setting long-term goals and making fully clear that these are no longer open to discussion. Only states can make futures more predictable and thus help create the environment that is conducive to making long term investments in a greening of the economy.

The prime task of the state is to set clear limits and clear goals. The state should create a level playing field, both in space and time, providing the certainties and opportunities that are needed to unleash a creative competition.[5] The government has to be a stable, trustworthy institution to give businesses and civil society a base for innovations. Citizens have no problems with a government that names the issues. They do have a problem with a government that appears not to care about the difficulties they come across in their daily lives. The business community, also aware of the challenges, needs clarity about the government's objectives and expectations. The same goes for finance, banks and private funds make risk assessments before investing, and in doing so require a future that is as predictable as possible. A future where investing in sustainable innovation is attractive. The problem for business is not so much over-ambitious government, but the perception of an unpredictable government. And as far as sustainability is concerned, predictability has not been a strong point in recent years. In the developed world, the 'green growth' frame has the potential to guide, bind and inspire and form a basis for the new discourse.

Second, *setting the defaults right* is a very powerful idea. All forms of organization come with a bias, as the American political scientist Schattschneider observed in the early 1960s (Schattschneider, 1960). Later that decade Bachrach and Baratz (1962) famously elaborated the idea that much power is embedded in 'non-decisions'. These ideas are now very relevant to the climate debate. *Our society's default is based on the consumption of fossil fuels*. In ordinary life we take one 'non-decision' after another, perpetuating the non-cool, climate-harming lifestyles. States can change defaults. Set the rules that make it attractive to conserve energy and to turn to renewables. One clear marker could be to define

5 This is the position also argued for by Anthony Giddens in his *Politics of Climate Change*. It is a call for what he calls an *enabling state* (Giddens, 2009).

new 'priority rules'. These new priority rules might be based on the trias energetica (Lysen, 1996): Highest priority should be given to energy saving, followed by the use of renewables; only then followed by 'cleaned' fossils. Combine this with explicit commitments to CO_2 reduction targets.

This requires using judicial and institutional means. Mobility budgets, CO_2 targets for regions? Or perhaps, closer to the initiative of Janet Sadik-Khan, experiments on a local level with adjustments of the rules of the game. For instance, we know that the limit to cycling is a distance from home to work of around 8 kilometres. Within that many people would consider it, beyond that hardly anybody does. What would be the effect of a radical prioritization of low carbon traffic during the morning rush hour? Slow clean traffic having a priority to combustion engine-driven vehicles? Copenhagen is getting close with its wide bike lanes. City governments have the power to undertake this experiment.

Third, *dynamic regulation*. Make sure you keep the dynamics going, through a system of *dynamic regulation* via which only the top 10 or top 20 vehicles are entitled for a tax reduction, thus stimulating innovation. The core of such a system is that government rewards those that embrace innovation and penalizes laggards. Compare the Japanese Toprunner programme where the best performing (in energy efficiency) is taken as a 'benchmark' for the industry requirements.

Fourth, *financial instruments*. We know that one reason for the faulty default towards fuels comes directly from the fact that fuel prices do not cover all costs. So far, we have been unable to internalize environmental costs. States can support the development of the autonomous society by correcting this bias of the industrial age. Make fossil fuels expensive: The single biggest stimulus is putting a high price on CO_2 emissions. The effectiveness of financial instruments is conventional wisdom. Nothing new, but they are to be an essential part of the mix. By pricing detrimental environmental effects, polluting products and activities become more expensive. This encourages citizens and companies to choose environmental friendly alternatives. Such pricing in addition stimulates innovation. For sustainable mobility to take hold a carbon tax, or another form of carbon emissions pricing, encouraging the use of AFVs and alternatives to travel is an important component.

Fifth, stimulate citizens to *share*; sharing cars give consumers access to a pool of resources, enabling them to choose the perfect vehicle for each and every occasion, a sports car for dates, a utility vehicle for holidays, a small car for errands and a classic car for a wedding (Chase, 2011), while saving them the costs of owning, maintaining and parking a car. Sharing cars may also remove some of the inhibitions identified towards alternative fuelled vehicles (Hoen & Koetse, 2012).

Sixth, use learning through 'variation and selection': Here it is crucial to decentralize goal achievement. This can be done setting national targets and provide the incentives to compete, allowing, indeed encouraging, creativity in goal achievement. This is to be accompanied by a new, much upgraded organization of monitoring and feedback.

The value of feedback is what Fung (2004) has theorized to be 'accountable autonomy'. Set targets, monitor progress, show differences in performance. A subsequent key role for the state is basic policy evaluation: Explain why some are ahead and others lag behind. Put a premium on improvements. Yet there is also a flip side: Punish misuse of the rules that are meant to prevent climate change from getting out of hand. Of course, there will always be loopholes; the thing is to fix them quickly.

Monitoring and learning are closely connected (Sabel, 1994). Moreover monitoring especially is an instrument through which the government could demonstrate its support of transparent collaborations between citizens and business. Free access to information can open up the door to new forms of collaboration between the private and the public sectors (Fung, Graham, & Weil, 2007). At the societal level, there are significant benefits, partly because new innovative services can be developed that the government is unable to deliver itself (van den Broek, Huijboom, van der Plas, Kotterink, & Hofman, 2011). This could be a way to develop the 'clearly targeted personal information, including social pressure, awareness raising, demonstration, persuasion and individual marketing' that is crucial to the acceptability sustainable mobility according to Banister (2008).

An advanced version of monitoring and feedback is the 'test, learn and adapt methodology' of randomized controlled trials (RCTs). Long a prerogative of medicine, the method is also now used in international development and business to identify which policy or sales method is the most effective. Effectively with the use of RCT policies can be evaluated and adapted while they are being implemented, which sharpens the feedback loop (Haynes, Service, Goldacre, & Torgerson, 2012).

6. Concluding Remarks

Sustainable mobility is a very ambitious vision of the future. It is one that has to inspire change in a physical environment that is not very conducive to this ideal. Over the last 70 years, we have created an extensive urban environment that is largely based on endless supplies of fossil fuels. It has become a large technological system that comes with many default options that we will need to change in order to achieve a sustainable future. This large technological system is not merely a physical entity. It comprises life styles, industry, commerce.

Interestingly, we see a return to urban values at the same time. Economists are rediscovering the value of the dense inner cities (Glaeser, 2011); cities are now the major centres of new jobs, and demographically people move back into more dense urban environments. Partly this is an effect of the crisis. Urban living is less costly than suburban living combined with urban jobs. Partly it is a true value change.

At the crossroads of value change, physical and social technology, with the aid of regulation, pricing and information, we may shift gear and release new social energy. The key is that the mobility modus is determined by more than just the need to go from *a* to *b*. The reasons alternative transport modes can be competitive or attractive are that they combine low emissions with additional goals. Societal goals such as livability in cities, citizens' concerns with health and well-being, personal goals such as an experience, a sense of identity, autonomy or business goals such as a corporate identity, cost reductions or maintaining competitiveness. And, also, the current recession helps the starting trend of sharing expensive consumer products such as cars.

PBL calculations show that the EU goals for sustainable mobility are theoretically achievable by 2050 (PBL Netherlands Environmental Assessment Agency, 2009b). However, policy towards sustainable mobility has an only chance of success if it builds up to a new discourse, which is co-produced across all levels and among governments, individuals and businesses. Participation is no longer to take place in the formulation of government policy; it now becomes an involvement in active social engagement.

We are not saying that small steps and local initiatives are the solution, just that without them there will be no solution. Here we should not forget that some of the new associative governance formations, such as the C40 cities[6] collaborating on climate change, are not without power. The C40 represent 8% of the global population and agreements in such association can therefore really make an impact, for instance, by kick-starting innovation using the power of public procurement.

Government at all levels can shift gear in the right direction and support successful initiatives, thus promoting incremental change in the right direction. Of course, while the strategy will remain, the tactics may change. Policy must be adaptive and co-created to some extent, so that it can respond flexibly to changing circumstances or new insights.

Practically, the devolution of policy making towards regions and municipalities and the use of markets and individuals to deliver services and innovations need to be matched by monitoring and feedback tools of the information society as mechanisms to identify and nurture successful innovations and prevent straying in the wrong direction. This can be done by government through evaluations and RCTs (Haynes et al., 2012) and by citizens, by comparing the performance of cities and businesses on a sustainability scale.

If environmental history teaches us anything, it is that major shifts were always the result of a combination of factors, including changing cultural preferences, new knowledge and often facilitated by experiences of actual crisis. The trick this time round is to try and get the change going without the latter one. Here experts may help, not only by pointing at the need for change, but much more by identifying the viable alternatives. The combustion engine car is unsustainable and does not fit into the ideal of a clean future for 2050.

6 C40 Cities Climate Leadership Group, <www.c40cities.org/>.

References

Abramson, P. R., & Inglehart, R. *(1995). Value change in global perspective*. Ann Arbor, MI: University of Michigan Press.

Bachrach, P., & Baratz, M. S. *(1962)*. Two faces of power. *The American Political Science Review, 56*(4), 947-952.

Banister, D. *(2008)*. The sustainable mobility paradigm. *Transport Policy, 15*, 73-80.

Börjesson, M., Eliasson, J., Hugosson, M., & Brundell-Freij, K. *(2012)*. The Stockholm congestion charges – 5 years on. Effects, acceptability and lessons learnt. *Transport Policy, 20*, 1-12.

Chase, R. *(2011)*. The new economy will be built by the people, empowered by technology. Presentation at PICNIC Festival 2011.

Dennis, K. & Urry, J. *(2009). After the car*. Cambridge, UK: Polity Press.

European Commission. (2011a). *Impact assessment – Accompanying document to the white paper. Roadmap to a single European transport area – Towards a competitive and resource efficient transport system*. COM(2011) 144 final, Brussels.

European Commission. *(2011b). White paper: Roadmap to a single European transport area – Towards a competitive and resource efficient transport system*. COM(2011) 144 final, Brussel.

Ecorys. *(2011). Zicht op zakelijke (auto)mobiliteit (in Dutch)*. Rotterdam, Netherlands: Vereniging van Nederlandse Autoleasemaatschappijen.

Fung, A. *(2004). Empowered participation: Reinventing urban democracy*. Princeton, NJ: Princeton University Press.

Fung, A., Graham, M., & Weil, D. *(2007). Full disclosure: The perils and promise of transparency*. Cambridge, UK: Cambridge University Press.

Giddens, A. *(2009). Politics of climate change*. Cambridge, UK: Polity Press

Glaeser, E. L. *(2011). Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier and happier*. New York, NY: Penguin Press.

Hajer, M.A. *(1995). The Politics of Environmental Discourse. Ecological Modernization and the Policy Process*. Oxford University Press.

Hajer, M.A. *(2005)*. Coalitions, practices, and meaning in environmental politics: From acid rain to BSE. In D. Howarth & J. Torfing (Eds.), *Discourse theory in European politics* (pp. 297-315). Basingstoke, UK: Palgrave Macmillan.

Hajer, M.A. *(2009). Authoritative governance: policy-making in the age of mediatization*. Oxford, UK: Oxford University Press.

Hajer, M.A. *(2011). The energetic society. In search of a governance philosophy for a clean economy*. The Hague, Netherlands: PBL Netherlands Environmental Assessment Agency.

Harms, L. *(2008). Overwegend onderweg. De leefsituatie en de mobiliteit van Nederlanders (in Dutch)*. Den Haag, Netherlands: Sociaal en Cultureel Planbureau.

Haynes, L., Service, O., Goldacre, B., & Torgerson, D. *(2012). Test, learn and adapt: Developing public policy with randomised controlled trials*. London, UK: Cabinet Office Behavioural Insights Team.

Hilbers, H., van de Coevering, P., & van Hoorn, A. *(2009). Openbaar vervoer, ruimtelijke structuur en flankerend beleid: de effecten van beleidstrategieën (in Dutch)*. The Hague, Netherlands: PBL Netherlands Environmental Assessment Agency.

Hoen, A., Geurs, K. T., de Wilde, H., Hanschke, C. B., & Uyterlinde, M. *(2009). CO_2 emission reduction in transport: Confronting medium-term and long-term options for achieving climate targets in the Netherlands. PBL report 500076009*. Bilthoven, Netherlands: PBL Netherlands Environmental Assessment Agency.

Hoen, A., & Koetse, M. J. *(2012). A choice experiment on AFV preferences of private car owners in the Netherlands, PBL working paper 3*. Den Haag, Netherlands: PBL Netherlands Environmental Assessment Agency.

Kelly, F., Anderson, H. R., Armstrong, B., Atkinson, R., Barratt, B., ...,Wilkinson, P. *(2011). The impact of the congestion charging scheme on air quality in London*. Boston, MA: Report 155, Health Effects Institute.

Kieboom, S. F., Geilenkirchen, G. P., & van Meerkerk, J. *(2010). Consument zuinig bij aankoop nieuwe auto? De toegenomen verkopen van zuinige auto's verklaard (in Dutch)*. Roermond, Netherlands: CVS.

Larkin, P. (Ed.). *(1972)*. Going, going. *High windows*. London, UK: Faber and Faber.

Li, Z., & Hensher, D. A. *(2012)*. Congestion charging and car use: A review of stated preference and opinion studies and market monitoring evidence. *Transport Policy, 20*, 47-61.

Lysen, E. H. *(1996)*. Trias Energetica: Solar strategies for developing countries. *Proceeding of the Eurosun Conference Freiburg*, Germany, 16-19 September.

Marchetti, C. *(1994)*. Anthropological invariants in travel behavior. *Technological forecasting and social change, 47*(1), 75-88.

Mom, G., & Filaski, R. *(2008). Van transport naar mobiliteit, De mobiliteitsexplosie, 1895–2005 (in Dutch)*. Zuthpen, Netherlands: Walburg Pers.

New York City DOT *(2010a)*, Annual report fiscal year, New York: Times Square Alliance.

New York City DOT *(2010b)*, Sustainable streets index 2010, New York: New York City Department of Transport.

Nijland, H. A., Hoen, A., Zondag, B., & Snellen, D. *(2012). Elektrisch rijden in 2050 (in Dutch)*. Den Haag, Netherlands: Planbureau voor de Leefomgeving.

Nordhaus, T., & Shellenberger, M. *(2008). Break through – Why we can't leave saving the planet to environmentalists*. New York, NY: Houghton Miffin Books.

PBL Netherlands Environmental Assessment Agency. *(2009a). Growing within limits: A report to the global assembly 2009 of the club of Rome*. The Hague/ Bilthoven, Netherlands: Author.

PBL Netherlands Environmental Assessment Agency. *(2009b). Getting into the right lane for 2050.* The Hague, Netherlands: Author.

Rogner, H.-H., Zhou, D., Bradley, R., Crabbé, P., Edenhofer, O., Hare, B., ..., Yamaguchi, M. *(2007).* Introduction. In B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, & L. A. Meyer (Eds.), *Climate change 2007: Mitigation. Contribution of working group III to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY: Cambridge University Press.

Rotaris, L., Danielis, R., Marcucci, E., & Massiani, J. *(2010).* The urban road pricing scheme to curb pollution in Milan, Italy: Description, impacts and preliminary cost-benefit analysis assessment. *Transportation Research Part A: Policy and Practice, 44*(5), 359-375.

Sabel, C. F. *(1994).* Learning by monitoring. The institutions of economic development. In N. Smelser & R. Swedberg (Eds.), *Handbook of economic sociology* (pp. 137-165). Princeton, NJ: Princeton Sage.

Schafer, A. & Victor, D. G. *(2000).* The future mobility of the world population. *Transportation research part A, 34*(3), 171-205.

Schattschneider, E. E. *(1960). The semisovereign people: A realist's view of democracy in America*. New York, NY: Holt, Rinehart and Winston.

Smokers, R., Fraga, F., & Verbeek, M. *(2011).* Support for the revision of Regulation (EC) No 443/2009 on CO_2 emissions from cars. Service request #1 for Framework Contract on Vehicle Emissions, TNO.

Stichting Natuur en Milieu. *(2011). Green tax battle: Schaf overheidssubsidie reiskosten af (in Dutch)*. Persbericht Stichting Natuur en Milieu.

Summerton, J. (Ed.). *(1994). Changing large technical systems*. Boulder, CO: Westview Press.

van den Broek, T., Huijboom, N., van der Plas A., Kotterink, B., & Hofman, W. *(2011). Open overheid. Internationale beleidsanalyse en aanbevelingen voor het Nederlands beleid (in Dutch)*. Delft, Netherlands: TNO.

van Gunsteren, H. R. *(1994). Culturen van besturen (in Dutch)*. Amsterdam/ Meppel, Netherlands: Boom.

van Lint, H., & Marchau, V. *(2011). De file dat ben jezelf (in Dutch)*. Delft, Netherlands: Publicatieburo Bouwkunde.

van Meerkerk, J., van den Brink, R., & Geilenkirchen, G. *(2011). De elektrische auto: wie kan ermee uit de voeten? Onderzoek naar het vervangingspotentieel van elektrische auto's (in Dutch)*. Antwerpen, Belgium: Bijdrage aan het Colloquium Vervoersplanologisch Speurwerk.

Wildavsky, A. *(1979). Speaking truth to power: The art and craft of policy analysis*. Brunswick, NJ: Transaction Publishers.

Zahavi, Y., & Talvitie, A. *(1980)*, Regularities in travel time and money expenditure. *Transportation Research Record, 750*, 13-19.