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Emissions trading for households? A behavioral law and economics perspective

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Abstract This is the first research article on expanding emissions trading in the EU to households in which law and economics is explicitly and systematically combined with behavioral science. The goal of the article is neither to plead in favor nor against emissions trading for households, but rather to provide an analysis of such a scheme. To that end, the article gathers relevant theoretical insights and discusses how established empirical findings can be used to design a potentially workable scheme. The analysis not only presents an overview of possible economic and behavioral barriers, but also creates a feedback to its institutional design by presenting possible solutions to overcome them. Downstream allocation creates a more direct and visible carbon incentive, whereas administrative costs can be reduced by concentrating monitoring and enforcement upstream. Behavioral acceptance can be boosted via strategic communication, for instance by stressing that emissions trading is both effective (emissions are capped) and fair (those who emit less, pay less). Energy conservation can be stimulated by frequently sending updates to households of their carbon transactions to make the consequences of their behavior more noticeable. Whether these necessary conditions are also sufficient to ensure political acceptance remains an open question.

Keywords Climate change · Emissions trading · Household sector · Transport sector · Administrative costs · Behavioral conditions

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1 Introduction

The corner stone of climate law in the European Union (EU) is a greenhouse gas emissions trading scheme (ETS). This scheme, which focuses primarily on reducing carbon dioxide (CO₂) emissions, is up and running since 2005. The emissions are capped and those who receive emission rights, called ‘allowances’, can trade them with other emitters in the ETS. This system enables emitters to search for the cheapest emission abatement option: those with high abatement costs have the opportunity of buying allowances to comply with their targets from those with low abatement costs.

The EU ETS is basically a gigantic experiment in law and economics. The idea of creating pollution markets already received considerable attention by some of the founding fathers of law and economics, including Calabresi and Melamed (1972) building upon Coase (1960), as well as by various environmental economists (e.g. Dales 1968; Tietenberg 1980).

The ‘ETS Directive’, 2003/87/EC, regulates the design of the ETS until 2012 (COM 2003). The ‘amended ETS Directive’, 2009/29/EC, regulates its design for the current period 2013–2020 (COM 2009). Only big emitters are now included in the ETS: mainly electricity producers, but also steelmakers as well as cement, paper and glass manufacturers. The aviation sector was included in 2012, based on Directive 2008/101/EC (COM 2008), and the EU is in the process of building an agreement to include the international maritime shipping sector.

Electricity producers have to buy their allowances at auction, but the other participants receive most of their allowances free of charge. Producers largely pass on their carbon costs to consumers (Woerdman et al. 2009). Power companies, for instance, add a carbon mark-up—equal to the market value of the allowances—to the electricity bills they send to their customers. The latter could already save money by reducing energy use. Emissions trading by producers provides consumers with an additional incentive to reduce energy consumption. However, this incentive is indirect, in the sense that consumers have no control over the allowances themselves.

The EU ETS has effectively helped to reduce the emissions of large emitters, although the system suffers from several implementation problems, including an over-allocation of allowances which undermines the carbon price (e.g. McAllister 2009). Emissions in non-ETS sectors (such as households and transportation) are also decreasing, but the picture is mixed here as well (EEA 2014). Transportation emissions are not capped and have grown since the 1990s, until the economic crisis of 2007 after which they started to decrease. Motorists are now partly confronted with the external costs of CO₂ emissions via fuel taxes and motor vehicle duties that reflect the CO₂ intensity of the car. Household emissions decrease only slowly, although years with cold winters tend to show a moderate increase, whereas households fail to restrain their electricity consumption. These trends are somewhat disappointing, especially given that households are now confronted with the

external costs of CO₂ emissions, in particular via the carbon mark-up they pay somewhere in the price of electricity.

To get a grip on the emissions of energy end-users, a possible next step could be to include households and the transport sector directly under the emission cap of the EU ETS, for instance after 2020. This would target household energy use and personal surface transport (hence excluding air travel). Individual energy consumers not only drive energy production and the associated CO₂ emissions, but end-users arguably also have the widest range of options available to reduce those emissions (Niemeier et al. 2008; Dietz et al. 2009). As a consequence, including individual consumers under the EU ETS could be a promising strategy of further decreasing emissions.

Emissions trading for households may seem far-fetched. However, some individuals do already buy carbon offsets on voluntary carbon markets and some politicians have investigated its possible implementation, for instance in the UK (EAC 2008). In fact, Norfolk Island in Australia, with about 2500 inhabitants, started a 3-year test site in 2011 for trying out carbon trading for individuals. Also some companies, like Coca-Cola, have sponsored research on personal carbon trading (CTA 2012), while the attention from the climate research community for this option is clearly on the rise (e.g. Parag and Fawcett 2014; Fawcett and Parag 2010).

Consumers drive cars and live in houses or apartments where they use energy. Allowances could thus be allocated to energy end-users who could trade those emission rights. Their emissions are then capped and end-users receive a more direct, visible and ‘hands-on’ incentive to reduce energy consumption. This is likely to have an impact on climate policy acceptance and energy conservation behavior. Incentives may lead people, who are usually short-term oriented, to take into consideration the long-term damages of their climate-unfriendly behavior (Bowman 2011). Importantly, research suggests that law, via instrument choice and its institutional design, is able to change the ‘environmental mind’ (Feldman and Perez 2009). In particular, field experiments with taxation have shown that consumers underreact to taxes that are not salient compared to when they are made visible (Chetty et al. 2009).

The goal of this article is to examine whether the institutional design of emissions trading for energy end-users is economically feasible, and to study the behavioral conditions of successfully implementing such an expansion of emissions trading in the EU. The result is a behavioral law and economics analysis in which various insights from both disciplines are compared and where possible combined. Although the added value of behavioral law and economics should not be overestimated (e.g. Garoupa 2003; Pasche 2013), it does allow us (a) to better understand possible behavioral resistance against emissions trading for households and (b) to use that knowledge for designing a more efficient and effective scheme in which the impact of the carbon incentive is maximized.

The article contributes to the literature on climate change and instrument choice in three novel ways. First, as far as we know, this is the first article about emissions trading for households to combine law and economics with behavioral science both explicitly and systematically. Apart from a review chapter by Roy and Woerdman (2012), we are aware of one article by Sinden (2009) that does so in a very adequate albeit more implicit and somewhat less systematic fashion. Second, besides

gathering relevant theoretical insights, the article also discusses how already established empirical findings in the behavioral-economic and psychological literature can be used to design a feasible scheme of emissions trading for households. The article therefore not only provides an overview of possible economic and behavioral barriers to emissions trading for households, but also creates a feedback to its institutional design by presenting some solutions to overcome them. Third, the article does not limit the introduction of emissions trading for households to the nation state, which is common in the literature, but also considers its possible implementation at the EU level.

The article is structured as follows. Section 2 provides an institutional design of allowance trading for households and assesses its economic feasibility by focusing on administrative costs, transaction costs and enforcement costs. Section 3 analyzes the possible behavioral consequences of introducing emissions trading for households and discusses the implications for its institutional design by focusing on the conditions to boost the behavioral feasibility of the scheme. Conclusions are drawn in Sect. 4.

2 Institutional design and economic feasibility

When building the ETS, the European Commission wrote in a Green Paper (COM 2000: 10–11): ‘Allocating allowances, monitoring emissions and enforcing compliance of small mobile emitters, such as private cars, raise complex technical and administrative issues. Consequently, if the Community wishes to follow a prudent step-by-step approach in the development of emissions trading, it should initially confine itself to large fixed point sources of carbon dioxide, where monitoring and supervision of the system is more feasible.’ This is exactly what the EU has done. The question is now whether it is time to take the next step: should the EU allocate allowances to households?

There are a few scientists, outside the field of law and economics, that have already advocated such a tradable scheme of personal emission quota (e.g. Fleming 2005; Niemeier et al. 2008; Fawcett and Parag 2010). Also some non-profit organizations advocate this scheme, for instance in Germany (Harders et al. 2008). A number of variants of the idea even received some political attention, for instance in reports to the Irish government (Comhar 2008) and to the British Parliament (EAC 2008). Although some variants of personal carbon trading still only allow fossil fuel producers to trade allowances, we will focus on the possibility that energy end-users actively engage in allowance trading themselves.

If the EU would expand emissions trading to energy end-users, such as households and motorists, the scope for trading allowances would be enlarged, thereby increasing the cost-savings potential and further decreasing the (already low) possibility of market power in the scheme (Convery and Redmond 2007). Including more sectors of the economy in an emissions trading scheme implies that there are less possibilities for individual firms and sectors to dominate the market and influence the allowance price. However, the common objection against such an enlargement is that administrative costs could be high, not only with regard to allocating the allowances to small sources, but especially with regard to monitoring

their emissions and trading patterns (e.g. Hamilton 1998; Anderson et al. 1999; Hargrave 1999; Butzengeiger et al. 2001; Comhar 2008; Lockwood 2010). In our article, we refine an ETS design developed at the University of Groningen which considerably reduces the magnitude of this problem.

Firstly, an amount of allowances can be allocated to each *category* of small emitters, such as households and motorists, proportional to its historical share in total emissions in a reference year (e.g. Koutstaal 1997; Nentjes 1998). Within the national or regional emission reduction target, the individual energy end-users within each category of small emitters, for example households, receive an amount of allowances proportional to its CO₂ emissions based on the *average* fuel use per adult person in a reference year.¹ Using an average (instead of individual data) simplifies the allowance allocation process and saves administrative costs. The consequence of such an allocation rule is that people living in small, well-insulated apartments and people without a car, for instance, will end up with an allowance surplus at the end of the year, which can either be sold or banked (to cover emissions next year or later).

Secondly, when purchasing fuel or energy, emitters have to hand over their allowances to the producers and importers that sell fuel and energy. This means that monitoring can concentrate on the level of producers and importers instead of the households themselves, which considerably lowers administrative costs (Koutstaal 1997; Woerdman et al. 2002; Nentjes et al. 2002).

Contrary to the common view, a downstream system which directly incorporates firms as well as households and car drivers can be administratively feasible by concentrating the monitoring activities as much as possible on the level of fossil fuel producers and importers (upstream) and by using a generic allocation criterion and chipcard technology for households and car drivers (downstream). The outline of such a ‘downstream trading and upstream monitoring’ approach that focuses on restricting fuel use is sketched below.

2.1 Downstream trading and upstream monitoring

For every unit of fossil fuel an end-user purchases from distributors, it has to hand over a corresponding number of carbon allowances. Distributors, in turn, can only obtain fuels from their suppliers in exchange for carbon allowances. In this way, all allowances will end up in the hands of producers and importers of fuel, including the allowances purchased by distributors to cover their fuel supply to consumers and other small users. Producers and importers of fuel are placed under the obligation to turn over to the environmental authorities carbon allowances for the carbon contained in the fossil fuels they have sold on the market. A legal provision needs to be created which prevents fossil fuel producers and importers from buying the

¹ Alternative allowance allocations are considered in Starkey (2012a), Wadud (2011) and Niemeier et al. (2008), for instance. One alternative could be to allocate the allowances not just to adults, but also to children (Sinden 2009). An argument in favor of doing so would be that each individual gets equal shares of the politically allowed ‘carbon emission space’. An argument against it would be that children only marginally increase the energy use of households. For example: going from 1 to 2 adults makes a big difference in household energy use, but going from 2 adults to 2 adults plus children makes a much smaller difference (e.g. Moll et al. 2005: 270).

allowances directly from the end-users to ensure that the carbon price signal remains salient for consumers at the moment they purchase fossil fuels from distributors.

Allowance allocation thus occurs downstream. However, monitoring of emissions (fuel sales) and checking whether they match with allowances concentrates upstream on the producers and importers of fuel whose number is usually limited; in the Netherlands, for instance, about 40–50. The bookkeeping of these fuel producers and importers is checked at the end of the emission year. It is determined how many allowances are actually present and how many they should have by calculating the number of required allowances on the basis of the administration of fuel sales. In the case of a determined shortage of allowances, the fuel producer or importer gets, say, 1 month to obtain (and thus buy) the necessary allowances. If it is not able or willing to do so, the company receives a fine which is a multiple of the highest expected market price (e.g. €100), while it remains obligatory for the company to hand over the lacking allowances to the authorities (as in the current EU ETS). This should ensure an effective enforcement and also signals a moral rejection of non-compliance with environmental norms (Mulder 2008; Feldman and Perez 2009).

From a law and economics point of view, it is important to realize that the scheme is to a large extent self-enforcing. In this design, fuel producers and importers (as well as distributors) have an interest in receiving the correct number of allowances alongside their fuel sales, because the supplier does not want to deliver fuel without the transfer of allowances by the buyer. It is not necessary that a national agency monitors the millions of fuel users, which considerably brings down the costs of monitoring and enforcement. The monitoring scheme fits in with existing institutions for levying excises on fossil fuels, present in most European countries. For instance in the Netherlands, traders and suppliers of mineral oils are already obliged to have a license and report each month the quantity they have supplied to the market, while they have to turn over the excise tax to the authorities. This administrative system of self-reporting is supplemented with occasional physical checks by civil servants auditing the books.

2.2 Free allowances and chipcard technology

To boost political acceptability, allowances can be allocated to households free of charge (‘grandfathering’) instead of auctioning them. At the beginning of the year, energy end-users receive the allowances for the coming year both for stationary and mobile sources on their allowance account. The national allowance agency, where all participants are registered, also sends a chipcard. This chipcard is connected to the allowance account. Households can therefore uprate the chipcard at the expense of their allowance account.²

² In principle, it is also possible to allocate the allowances free of charge to the distributors who will pass on the allowance costs in a mark-up on the fuel price, thereby avoiding allocation to households. However, this is not likely to be politically acceptable, because it would create a windfall profit for the distributors, while the consumers pay for the emission reductions. Households are better-off if they (instead of the distributors) get allowances for free, not only because they receive a wealth transfer, but also because it enables consumers to make a profit by selling allowances if they succeed in using less energy and fuel.

When purchasing fuels, the energy end-user has to transfer an amount of allowances (which corresponds with the carbon content of the acquired fuel) to the allowance account which the distributor holds at the national allowance agency. How does that work for mobile sources and for stationary sources? For stationary sources the transfer of allowances is enacted by connecting the allowance transfer to the mailing of the yearly gas- and electricity bill of the distribution company. If a household does not have a sufficient number of allowances, the distributor has the right to buy the required allowances and to recover the costs from the client. For mobile sources the transfer occurs by using the chipcard which households can fill by lowering their allowance account. An alternative is an allowance chipcard which enables allowances to be transferred directly from one's own account to the fuel supplier. Upgrading or writing off from the account is only possible in case of a positive allowance balance. A car driver who buys fuel can choose to transfer part of his own allowances or to buy the fuel with a mark-up price which reflects the price of allowances that the distributor has bought as a kind of service for customers (for instance for those clients that have forgotten to take their chipcard with them).

When a car driver goes to the cash desk, he or she not only pays the money for filling up the tank with fuel, but also transfers an amount of allowances to the allowance account of the distributor. At filling stations and at other strategic places machines are installed where one can electronically upgrade the allowance chipcard (buy) or write off from the allowance chipcard (sell) at the current market price. The automated machines can be exploited by companies who trade professionally in carbon allowances. The current market price arises from the transactions of and between the allowance trading companies. In practice, end-users most likely do not trade allowances directly with each other, but indirectly via intermediaries such as brokers or traders. To further increase visibility, this allowance price can even be shown on the already existing electronic notice boards, next to the petrol prices, near the road at filling stations. Allowance trading can even be used as a marketing tool by fuel distributors: 'this week allowances for half the price'.

At the end of the year the national agency establishes for every energy end-user the balance of the allowance account. This is equal to: free allowances (via chipcard or account) plus the purchased allowances minus the allowances sold minus the allowances used and transferred. This balance can be positive, but not negative. The positive balance is added to the allowance account for the next year. These can be sold by the account holder on the market (to other small end-users and/or to large industrial emitters under the EU ETS), or they can be kept as an investment. From a behavioral point of view, this scheme of emissions trading is preferable to a carbon tax, as the price signal associated with purchasing fossil fuels is more direct and thus more salient for households.

2.3 Market transaction costs and political transaction costs

Households will incur some transaction costs on the allowance market. Next to the costs of the chipcard technology (depreciation, interest and exploitation), the time costs of the extra allowance action have to be taken into account when paying the fuel bill at the filling station. A household has to search actively for information

about one's emissions and allowance prices and there are decision costs as to whether you will buy or sell allowances.

The law and psychology literature labels the aforementioned costs as 'cognitive costs' (e.g. Carrico et al. 2011). Making decisions on how to manage one's allowances requires mental effort and such effort is a limited resource that gets depleted upon repeated demand (Baumeister and Tierney 2011). As a consequence, people tend to economize on mental effort and thus avoid the effort that is involved in conscious decision making (Kahneman 2011). Consequently, most consumer decisions take place unconsciously, where people typically rely on prior choices (habits) or use mental shortcuts (heuristics). As a result, rather than consciously taking into account the amount of allowances that are associated with specific actions before deciding, it may turn out that consumers may simply choose whatever they chose in the past (thus relying on habits) or follow the majority (thus relying on heuristics).

For the average small energy end-user, however, those market transaction costs are not likely to be prohibitively high. Niemeier et al. (2008) even argue that the cost of each transaction would be rather low. However, a number of energy end-users may still decide to contract out the buying and selling of allowances to a specialized company in order to lower their transaction costs by avoiding the cognitive burden of trade decisions. Although economically rational, it does undermine the directness and visibility of the carbon incentive for this part of the population, at least to some extent.

The domestic implementation costs consist of the registration of the participants, the yearly allocation of allowances, the mailing of chipcards and the maintenance of all the allowance 'bank accounts'. For European countries, we roughly estimate this to be a few euro's per chipcard (similar to national identification cards or smart cards for public transport). An overview of cost estimates from 2008, for the UK only, indicates that running the carbon accounts is more costly than the participation costs and set-up costs of personal carbon trading (Starkey 2012b). Moreover, in a fully downstream system, running costs can rise to hundreds of millions of euros. However, in our hybrid design, monitoring focuses on the limited number of fuel importers and producers who already have a detailed administration of their fuel sales for commercial and fiscal reasons. The monitoring costs will therefore be limited to no more than several millions of euro's.

The introduction of the allowance chipcard requires investments in automated machines and a telecommunication network. The investment costs are comparable to the costs of installing a chipcard system of a bank with millions of account holders. Possibly, these costs can be shared between the allowance registry and the banks when the allowance chipper is combined, if desirable, with other existing chipcards from banks. The large-scale character and the intensive use of the machines will result in low costs per transaction.

The political process to implement emissions trading for small emitters will induce set-up costs, for instance in relation to consultancy reports, political discussions and legal changes. These initial costs are to a large extent unavoidable and necessary to reap the environmental and economic benefits of allowance trading for small energy-end users. Keep in mind that political transaction costs were

initially also high in the process before introducing the current emissions market for large emitters. Those costs declined along the way as cultural resistance against ‘pollution rights’ crumbled and as information on allowance trading among policy-makers improved over time (e.g. Woerdman 2005). At least compared to an auctioning-based scheme, the set-up costs of a scheme with free allowances are relatively low (Crals and Vereeck 2005).

However, there is a legal barrier that significantly adds to the political transaction costs of emissions trading for households, namely ‘double counting’ (Brohé 2010). At this moment, the allowances are given or sold to producers that pass on the associated carbon costs to consumers: the energy end-users hence already pay for their carbon emissions. If tradable allowances are given to end-users as well, they will pay twice (double counting), unless the allowances are not given or sold to producers anymore. This raises a serious dilemma: either to accept double counting with a scheme for small emitters that runs next to the existing EU ETS for large emitters, which could be unacceptable for consumers, or to drastically change the EU ETS by taking away the allowances from producers, which could be unacceptable for companies since they will lose their windfall profits (from those allowances that are still allocated free of charge). With those vested interests, path dependence of climate policy makes such a design switch improbable albeit not impossible (e.g. Woerdman 2005).

One way out, for instance, could be to allocate emission rights to households by taking most but not all allowances away from companies. Those firms can then sell their remaining allowances to consumers at a profit, which may increase industry acceptance. However, there is only a profit to made if companies receive this small part of allowances free of charge. This could be a political problem because the EU actually decided to move away from free allocation by increasing the auctioning of allowances in order to tackle windfall profits made by companies (COM 2009). Again on a more positive note, it must also be added that transportation emissions are currently not covered under the EU ETS: as a result there is no double counting problem with the inclusion of personal surface transport under an emissions trading scheme for households.

Another regulatory risk, adding to the political transaction costs of emissions trading for households, is increasing government intervention and re-regulation if an emissions market for energy end-users would have been created. Think of the possible introduction of a maximum allowance price to protect consumers, or a ban on trading the allowances (so that only the individual emission caps remain), which reduces welfare by artificially restricting the formation of an efficient carbon price.

Finally, a decision has to be made about the optimal level of governance. The advantage of building one or more national emissions trading schemes for households (‘bottom-up’) is that individual EU Member States can decide about their design and coverage. The disadvantage is that those emissions trading schemes remain small and that carbon prices for households will differ between Member States. If a thicker market with a single carbon price is preferred which provides more liquidity and cost-savings on emission reductions, those schemes need to be linked. However, linking will entail many potential legal problems, for instance related to differences in sector coverage, cap definition, allowance allocation,

allowance registration, possible price controls as well as monitoring and enforcement mechanisms. This could be a reason to ('top-down') devise a harmonized emissions trading scheme for households at the EU level right away. The disadvantage is that this requires the consent of a majority of the Member States, which increases decision-making costs and may thus be difficult to achieve. The political transaction costs that have to be made *ex ante* will depend primarily on the acceptance of the scheme by voters. The political transaction costs that arise *ex post* will depend mainly on the extent to which households are likely to change their energy consumption patterns under the instrument. Whether voters in their capacity as households will be worse off or better off compared to the current situation depends (a) on the allowance allocation criterion and (b) on the market price for CO₂ which will emerge on the basis of supply and demand.

On the one hand, in the allocation criterion that we propose there will basically be an allowance surplus for energy end-users with low emissions and an allowance shortage for end-users with high emissions. This could be seen as to reflect the polluter-pays principle and strengthens acceptability if end-users perceive this as fair (e.g. Woerdman et al. 2008). On the other hand, the market price for CO₂ is inherently uncertain, since it will always move on the waves of allowance supply and demand. Will this uncertainty lead to unacceptability of the scheme? And what behavioral conditions are required to boost acceptability? These and other questions will be dealt with in the next section.

3 Behavioral responses and implications for institutional design

Gaining public support for pricing measures is thought to be a crucial factor in the political implementation process (e.g. Steg and Schuitema 2007). Without public support, allowance trading for households is less likely to be implemented. Therefore, it is important to understand the factors that determine whether households find allowance trading acceptable. Moreover, assuming that enough public support for allowance trading for households can be mustered to warrant implementation, we turn to the question of effectiveness. Generally, the more energy end-users try and actually change their consumption patterns as a result of allowance trading, the more effective the system will be in reducing energy and fuel consumption. But what factors determine whether and how effective allowance trading will be in changing the consumption behavior of individual households?

The success of an emissions trading system for households depends on the behavioral responses of end-users. Therefore, drawing upon a number of behavioral principles established in behavioral economics and psychological research (e.g. Thaler and Sunstein 2008; Kahneman 2011; Baumeister and Tierney 2011), we will discuss (a) factors that may influence households' *ex ante* support for the emissions trading system considered above (acceptability) as well as (b) factors that determine *ex post* the extent to which the presented system will succeed in altering households' consumption patterns (behavioral effectiveness).

3.1 Household acceptance

From an economic point of view, one might expect that acceptability of emissions trading for households would depend on the extent to which households perceive emissions trading to be in their individual financial interest. Thus, households using relatively little energy (and end up with an allowance surplus under the allocation rule considered above) may perceive the emissions trading system as more acceptable than households using more energy (and end up with an allowance shortage under the presented allocation format). However, behavioral research suggests that people not only take into account their economic interests, but also consider (a) whether a policy leads to uncertainty (De Groot and Steg 2006), (b) whether a policy is fair (Schuitema et al. 2011), (c) whether a policy will be effective in solving environmental issues (Schuitema and Steg 2008), and (d) whether a policy threatens one's sense of privacy (Ogden 1999).

3.1.1 Uncertainty

The uncertainty associated with emissions trading for households should not be exaggerated: international energy markets create most of the uncertainty for energy prices (think of rising or declining oil prices), while a variable carbon price is already passed through to consumers' energy bills under the EU ETS.

However, it is the perception of uncertainty that impacts behavior and a large body of empirical research shows that individuals tend to be risk averse: they tend to favor riskless options (options with certain outcomes) over objectively equally attractive risky options (options with uncertain outcomes) (Kahneman and Tversky 1979). These findings help to explain consumer tendencies to purchase insurance against improbable losses (Eisner and Strotz 1961) as well as the preference of some households for fixed over variable energy prices, as documented for instance in the Netherlands (ACM 2015). And the fact is that allowance trading for individuals adds some degree of uncertainty to energy prices. The carbon market price will depend on the supply and demand of allowances by energy end-users, which is likely to differ from day to day. Consequently, implementation of the allowance trading system as described above will, relative to today's situation, lead to somewhat more (instead of less) uncertainty in prices for energy. End-users, being generally risk averse, may dislike this aspect of allowance trading, which may lead them to rate the system as less acceptable than the current system. Moreover, implementation of an emissions trading system would constitute a fundamental change (and thus a potential loss) relative to the status quo. As individuals are typically averse to the prospect of losing, which is called 'loss aversion', they tend to resist fundamental changes since these could yield losses relative to the status quo (e.g. Kahneman and Tversky 1979; Thaler and Sunstein 2008). Thus people's general reluctance to deviate from the status quo ('status quo bias', Samuelson and Zeckhauser 1988) may prevent them from accepting such an emission trading system.

Conversely, these analyses also suggest that acceptability of an emissions trading system can be boosted by mitigating households' uncertainty about energy prices, as

well as by accounting for households' tendency to resist to fundamental changes. Firstly, market solutions are likely to emerge here, which could potentially help to reduce cognitive costs. Within allowance trading systems, private companies may provide risk averse end-users the opportunity to buy some kind of insurance against high carbon prices. Furthermore, the distribution company could offer fixed prices for energy during a specific period of time. Alternatively, it could offer to buy the allowances from the end-user against a fixed price for one or more years. Secondly, some propose to introduce a maximum allowance price as a kind of 'safety valve' to reduce price uncertainty (e.g. Eyre 2010). Unfortunately, this would also distort the carbon price signal which could even complicate the process and thus reduce the certainty of reaching the emissions cap.

Thirdly, governments may stress the potential gains of an emissions trading system in communication (allowance trading is an effective and fair system in which those with an allowance surplus can save money). This may help in mitigating households' fear of losing as the result of implementing an allowance trading system. However, although communication is important, providing information should not be perceived as a sufficient condition for acceptance, as will be explained below.

3.1.2 Fairness

Questionnaire studies show that acceptability and fairness of pricing policies are highly correlated: people tend to accept pricing measures that are perceived as being fair (e.g. Bamberg and Rölle 2003). This suggests that making sure that emissions trading for households is perceived as fair is an important precondition for acceptability, and thus implementation, of the emissions trading system (e.g. Starkey 2012a). Energy end-users have different criteria for assessing whether a policy is considered fair (Schuitema et al. 2011). Specifically, people may perceive policies as being fair when everybody is affected equally (equality principle), but also when policies affect people relative to their share in the problem (polluter-pays principle).

It is unavoidable that some groups will claim unfair treatment, for instance because they feel that they are harmed more than others. Some could claim that they are being harmed disproportionately because they feel that they are not able to change their consumption patterns and thus are forced to buy additional allowances. This may be seen as particularly unfair if that is the case for vulnerable, low-income households living in poorly insulated homes (e.g. Thumim and White 2008). In the political process, however, acceptance is not necessarily undermined if such a 'loser lobby' is confronted with a 'winner lobby' as well, although it remains to be seen whether a possibly diffuse group of winners will be motivated and effective in collectively organizing themselves. Moreover, some allowances could be held back by the government to be distributed to those who submit successful applications for additional allowances based on unchosen exceptional circumstances (Hyams 2009).

Conversely, it can be stressed in communication that allowance trading can—depending on which criterion for fairness is used—be perceived as *more* (rather than *less*) fair than the current system. For instance, the basic rationale behind emissions

trading will be that those who emit more will be affected more negatively than those who emit less, which can be considered as fair from an equity point of view (Schuitema et al. 2011). Additionally, the emissions trading system can be perceived as a means of protecting the interests of future generations. Prior research on transport pricing found that policies that are perceived to protect future generations are considered to be more fair and thus more acceptable by end-users (Schuitema et al. 2011). Therefore, communicating that the rationale behind the emissions trading system is serving the ‘emit-less, pay-less’ rationale, may help in boosting acceptability.

Although communicating the rationale and potential effects of emissions trading for households may help, this strategy should not be seen as a sufficient condition for securing support: people tend to perceive information in a biased manner (Lord et al. 1979). As a result, ‘losers’ may not accept information about the fairness and effectiveness of emissions trading at face value. Nevertheless, the fact that allowances are handed out free of charge to end-users may also help to generate public support, because it implies a capital gift. Note that for consumers this is also preferable to a carbon tax (or allowance auctioning) in which they would have to pay for their emissions instead of receiving this wealth transfer (e.g. Verhoef et al. 1997). However, if allowance prices are low, as in the current EU ETS, the size of this wealth transfer is limited.

3.1.3 *Environmental effectiveness*

Finally, policies tend to be more acceptable when they are perceived as effective in the sense that they are able to solve the problems they are meant to address (Eliasson and Jonsson 2011). An allowance trading system with a fixed and declining emission cap will, by definition, lead to reductions in overall energy consumption, provided that allowances are not over-allocated and that monitoring and enforcement are functioning properly. Cap-and-trade is therefore effective in reducing emissions, which is referred to in the literature as ‘environmental effectiveness’ (e.g. Tietenberg et al. 1999; Boom and Nentjes 2003).

On the one hand, from a problem-solving point of view, it is a disadvantage that there are uncertainties associated with the magnitude, timing and distribution of climate damage. Moreover, there are some politicians and lobbyists trying to convince the general public that climate change is not a problem in the first place. Doubts surrounding the recent temporary flattening of mean global temperature or the scandal on errors made by the scientific Intergovernmental Panel on Climate Change (IPCC) are grist to their mill. Even some law and economics scholars stress the uncertainties and argue that it does not make sense to reduce CO₂ emissions in the United States or Europe as long as big polluters like China and India are not subject to international emission reduction obligations (e.g. Epstein 2010). On the other hand, showing evidence that allowance trading will, relative to the current system, be effective in reducing emissions domestically and in the EU at large, may help to increase the system’s perceived fairness and could therefore help to stimulate acceptability.

In this context it is also important to note that cap-and-trade is environmentally more effective than a carbon tax for consumers. Information is typically incomplete about polluters' emission reduction costs, which makes it difficult for the government to determine the optimal tax rate in such a way that individual pollution levels equal the agreed emission ceiling (e.g. Tietenberg et al. 1999). Such a tax would therefore create the risk for the government not to comply with its climate target (regulatory failure). This does require that a cap-and-trade scheme will be successful in avoiding or mitigating an over-allocation of allowances, which also occurred in the EU ETS (McAllister 2009). As a first step, the EU decided to further lower the emissions cap after 2020 and to establish a so-called 'market stability reserve' (MSR) that reduces the allowance auction volume in case of an allowance surplus (European Council 2014).

3.1.4 Privacy concerns

As mentioned before, the use of personal chipcards would allow for the registration of individual carbon allowances. This aspect may however run into public concerns about privacy. People tend to oppose policies that they perceive as to violate their privacy (Ogden 1999). Privacy concerns about allowance transfers could thus prohibit the implementation of emissions trading for households. Some countries do not have compulsory national identity cards to begin with (such as the UK and Denmark), where having to register for an allowance chipcard is already likely to raise privacy concerns. Moreover, as a way to tackle the administrative burden, it was suggested that distribution companies check whether their energy and fuel sales are accompanied by a corresponding transfer of allowances by energy end-users. It is clear that electricity and gas are consumed at home, but there may be opposition against data on allowance transfers at filling stations revealing where one has travelled.

At the same time, it should be recognized that stated concerns about privacy do not necessarily correlate with actual threats to—and safeguards for—privacy (Johnson et al. 2002). In fact, it appears that stated concerns about privacy may be constructed in a rather self-serving fashion. In one study (Bolderdijk et al. 2013), consumers who expected to gain financially from implementation of a policy that involves the collection of personal data ('winners') were less worried about their privacy than those who expected to lose ('losers').

In any case, the chance of an invasion of one's privacy should and can be reduced to a minimum via 'privacy by design' (CBP 2009). This means that the design of an emissions trading scheme for households should contain effective and transparent safeguards to protect and secure personal data. For instance, fellow consumers or companies should not be able to access and store data on individual allowance holdings and household emissions without prior consent.

3.2 Behavioral effectiveness

Assuming that enough public support can be mustered to facilitate the implementation of allowance trading for households, we turn to the question which factors

determine the behavioral effectiveness of an allowance trading system. An important factor is the allowance price itself. If the allowance price is low, for whatever reason (such as a generous emissions cap), there is not much of an additional financial stimulus to save energy, especially because household energy demand is typically price inelastic. However, the system's success will increase over time as more energy end-users succeed in changing their individual energy consumption patterns, which can be referred to as 'behavioral effectiveness'. There are two reasons for this. First, altered consumption patterns will allow to bring the cap—and thus aggregate emissions—down quicker from commitment period to commitment period. Reduced consumption levels will decrease the allowance price, which might create the political room for consumers to accept more stringent emission targets. Second, when many end-users fail to alter their consumption patterns, prices for allowances will increase (*ceteris paribus*). This could reduce acceptance of the allowance trading system (depending on the elasticity of energy demand) because end-users generally dislike paying higher prices for energy. Thus, the more end-users try to reduce their energy consumption, the more successful the allowance trading system will likely be.

Generally, two strategies can be used to change behavior in order to reduce energy consumption: end-users can purchase energy-efficient equipment ('efficiency') or end-users can reduce current consumption behavior ('curtailment') (Gardner and Stern 2002). Both strategies require end-users to make changes in their behavioral patterns. From a rational decision making perspective, these changes in behavior will come about because the incentives to reduce energy consumption change. Financially-aware end-users will immediately realize that after introduction of emissions trading it is in their self-interest to change their behavior by reducing their energy consumption. However, empirical research shows that people's behavior systematically deviates from the rational model (e.g. Thaler and Sunstein 2008; Luth 2010; Mercier and Sperber 2011) and that prices do not only have an instrumental impact but also a psychological impact on consumers (Bolderdijk and Steg 2014). Below, we discuss some behavioral factors that may determine whether such changes will actually occur, namely visibility of financial consequences, normative motivations for energy conservation, and habits.

3.2.1 Visibility

Allowance trading could, relative to the current system, make energy end-users more aware of the climate consequences of energy use. It provides clear negative consequences for undesired behavior: end-users that use relatively much energy will have to buy additional allowances. It also provides clear positive consequences for desired behavior: end-users that use relatively little energy will be able to sell their allowances. As such, the system provides the contingencies for behavior change advocated by applied behavior analysts (Skinner 1953). In principle, emissions trading for households could thus be effective in achieving behavior change, which would bring EU climate law more in line with the polluter pays principle (Larragán 2011). Visibility, or salience, of the incentive is important (Sunstein 2013). An experiment in the UK found that making explicit reference to carbon (in particular

under personal carbon trading but also under a carbon tax) increases the stated willingness to reduce energy consumption more than a non-overt price signal would (namely an energy tax) (Parag et al. 2011). Moreover, field experiments have shown that consumers underreact to taxes that are not salient compared to when they are made visible (e.g. on a price tag) (Chetty et al. 2009). Thus, it is important to realize that behavior change is more likely to occur when people are better able to associate specific behaviors with soon and certain consequences, that is, when behavior is always and immediately followed by noticeable implications (Lehman and Geller, 2008).

These insights may have some ramifications for the way allowance trading should be designed in order to maximize effectiveness. Although allowance trading makes the carbon incentive more visible compared to the current system, the direct consequences of energy use still remain somewhat invisible under the system presented above. Allowances are automatically, and in that sense ‘invisibly’, deducted from an allowance account via a chip card. End-users typically only learn of an allowance shortage (negative consequence) or an allowance surplus (positive consequence) after receiving feedback, which typically only happens after having made a string of transactions.

Therefore, the allowance trading system will prove more effective when the consequences of behavior are even more noticeable to end-users. So in addition to chip cards, end-users could be sent weekly, monthly or perhaps quarterly updates of their transactions and their allowance account, possibly including a prediction about the expected allowance shortage or surplus. Allowance *Apps* could be developed to facilitate those end-users that wish to be continuously informed via their smartphones. Such feedback could also incorporate information about others’ use of allowances: people are fundamentally social beings, and are thus influenced by the behavior of others. In an emissions trading scheme for households the feedback could indicate whether one’s carbon footprint is either within or exceeds one’s ‘fair share’ of the atmosphere (Sinden, 2009).

Outside the area of emissions trading, the possible efficacy of such an information loop has been confirmed by law and economics scholars in field experiments, where feedback about energy usage was provided to energy consumers, with a focus on peer comparisons (Ayres et al. 2009). A happy-face emoticon (‘smiley’) could even be included if a household saves more energy than others in the neighborhood (Schultz et al. 2007). In this way, end-users can more directly see the impact of their behavior and are able to associate behavior with consequence, which should make behavior change more likely.³

The market has a role to play here as well. Consumers are likely to demand more low-carbon energy in order to save allowances, for instance by switching to a more carbon-friendly energy company. It is uncertain, however, whether the advantage of

³ However, by making the costs of consumption products more visible, it may give people the impression that they are paying for something that was free in the past, and thus that they are incurring a loss by accepting the trading system. This impression may be mitigated in communication by explicating that consumers, via the carbon mark-up on energy, were basically already paying for allowance trading before. The acceptance problem is likely to persist, however, if the problem of double counting under the current EU ETS remains.

saving allowances will be high enough to outweigh the related switching costs for energy consumers. This ultimately depends on the stringency of the emissions cap.

Although a more visible carbon incentive could make consumers more aware of the climate consequences of their energy use, it may also bounce back among climate sceptics, as an unintended side effect, by actually further undermining their acceptance of an emissions trading scheme for households. Those who do not believe in climate change are now confronted with a more visible carbon price under such a scheme, which may actually enhance their resistance against end-user emissions trading. Moreover, the current criticism on the EU ETS (e.g. over-allocation of allowances, windfall profits, too low carbon prices) may also spill-over to the personal carbon trading debate and thereby diminish its prospects (Roy and Woerdman 2012).

3.2.2 Normative motivations

As argued above, emissions trading provides households, relative to the current system, a more visible incentive to reduce energy consumption: successful reductions in energy use allow households to sell unused allowances or allow them to avoid purchasing extra allowances. Therefore, in theory, implementation of an emissions trading system should trigger households to reduce energy consumption, because there is an additional reason for them to do so: they are more aware that saving energy could help them save money. As such, the emissions trading system attempts to change households' behavior by appealing to economic motivations.

To some extent, emissions trading has proven effective in reducing the energy consumption of large emitters (e.g. Nordeng et al. 2015; Gloaguen and Alberola 2013). However, small emitters such as households typically also have other than purely economic motivations for reducing energy use (Pelletier et al. 1998). Individuals may act pro-environmentally, even when there is no financial interest involved (e.g. recycling, buying organic vegetables and picking up litter). In these cases, people act in an environmentally-friendly way based on normative considerations: they feel that acting pro-environmentally is their moral duty (Nordlund and Garvill 2003), they experience social pressure to do so (Schultz 1999), or they act pro-environmentally because it allows them to perceive themselves as 'morally-good' persons (Bolderdijk et al. 2012).

Importantly, literature from behavioral economics suggests that, by exclusively focusing on the economic costs and benefits of different behavioral choices, financial incentives may actually crowd-out (and thus undermine) the impact of such normative motivations on behavior (Frey and Jegen 2001). Consequently, an emissions trading system may, as an unintended side effect, reduce the positive impact of normative considerations on energy conservation behavior. This shift in underlying motivations for conserving energy is particularly undesirable when normative considerations were the main reason for people to save energy in the first place, while the financial incentive is not large enough to be perceived as particularly motivating (e.g. Carrico et al. 2011). If so, the introduction of an allowance trading system may not have a significant behavioral impact or, through

its focus on economic motivations, even decrease rather than increase energy conservation behavior.

Empirical research indeed suggests that these kinds of unintended effects are possible. In the context of volunteering, for instance, financial rewards were found to decrease rather than increase performance (Gneezy and Rustichini 2000b). Similarly, financial penalties can backfire: penalties for collecting children from day-care centers after closure time paradoxically increased—rather than decreased—norm violations (Gneezy and Rustichini 2000a). By paying the fine, parents perceived this as if they had purchased the ‘right’ to violate the norm.⁴ In a similar vein, the extent to which allowance trading succeeds in motivating energy end-users to conserve energy does not only depend on the size of the incentive, but also on the positive or negative impact on end-users’ normative motivations. Whether allowance trading undermines the impact of normative considerations on behavior, and can thus even lead to lower rather than higher levels of energy conservation, is as yet unclear. Recent studies in the context of energy conservation suggest that caution is in order: making consumers aware of the (often rather small) financial advantages of concrete energy-saving actions may in fact undermine their motivation to do so (Asensio and Delmas 2015; Schwartz et al. 2015).

However, financial instruments are less likely to have the aforementioned undesired effects when they are perceived as supporting specific social norms rather than controlling and restricting one’s choices (Jordan, 1986; Frey and Jegen, 2001; Ryan and Deci, 2000). Communicating that the allowance trading system, compared to other policy instruments like standards or taxes, broadens rather than restricts consumer choice, may help end-users in realizing that allowance trading is less restrictive than current instruments. In addition, emissions trading for households could help to overcome the problem of ‘conditional cooperation’: consumers are more likely to behave pro-socially, for instance by saving energy, when this pro-social behavior of others is reflected by the institutionalization and thus the descriptive norm of households reducing or trading emissions (e.g. Frey and Meier 2004; Thøgersen 2006). Moreover, ‘green’ companies or environmental NGO’s could emerge to which end-users could donate their allowances, either to retire those allowances from the market—effectively lowering the overall emission cap—or to sell them and use the revenues to fund, say, wind or solar power projects. This could also help to sustain pro-environmental normative considerations.

Finally, Sinden (2009: 34) hypothesizes that emissions trading based on equal allowance allocation to each citizen might in fact support the ‘emerging norm’ of carbon neutrality. This can be done by framing this norm in terms of keeping one’s carbon footprint within one’s fair share of the atmosphere. The atmosphere has a limited capacity to absorb greenhouse gas emissions. The scheme could be presented to the public as a way to give each individual a ‘fair share’ of that capacity. An appeal to existing notions of fairness and equality increases the

⁴ Although more studies have reported such unintended effects of financial (dis)incentives (see Frey and Jegen 2001), it is yet not fully clear why and when this process occurs. It seems that adding money to the ‘mental equation’ changes people’s mindset, in which people start seeing the decision whether or not to act pro-socially as a business or gain rather than as an ethical or moral decision (Tenbrunsel and Messick 1999; Lindenberg and Steg 2007). Normative considerations are then rendered irrelevant for the decision.

likelihood that the scheme's economic incentives would reinforce rather than undermine normative commitments. A similar argument has been made by Parag and Strickland (2011). By allocating a transferable legal entitlement to a limited amount of emissions, the expressive function of the law as well as the financial incentives it provides to individuals may thus actually help new norms to develop (e.g. Sunstein 1996).

3.2.3 *Habits*

A fully functioning emissions trading system, as sketched above, adds an explicit incentive for energy end-users to change their behavior: reducing energy consumption allows end-users to sell rather than purchase allowances, which can save them money. End-users should thus lower their energy consumption goal and make necessary changes in their behavior to accommodate their new consumption goal. However, people often fail to meet their self-set goals: intentions often do not translate into behavior (e.g. Aarts and Dijksterhuis 2000).

One of the reasons for this inconsistency is that behavior is typically governed by habits. Instead of consciously weighing costs against benefits before making a decision, people tend to rely on previously made decisions ('habits') to facilitate the decision making process (e.g. Aarts and Dijksterhuis 2000; North 1990). A habit, once formed, is hard to break. This might explain why people, even when it is in their economic interest to do so, often fail to change their behavior but instead rely on previously made choices, thereby reducing the extent to which—and speed by which—energy-users will change their consumption patterns after the introduction of an emissions trading system.

However, habits can be broken when people can somehow be brought to reconsider their initial choices (Fujii and Gärling 2005; Maréchal 2010). This can, for instance, be achieved by introducing financial incentives. A group of authors, including a lawyer and a psychologist (but not an economist), has recently argued that this 'behavioral wedge' can be achieved in climate policy by creating sufficient financial incentives next to organizing effective marketing, providing credible information and keeping it simple, among other things (Vandenbergh et al. 2010). An important empirical question is then whether the considered system of emissions trading will provide households with a strong enough incentive to reconsider their consumption habits. This will also depend on the stringency of the emission cap set for households: if the cap does not really bite, allowances prices will be low, which is insufficient to break habits. At the individual decision level (for instance when deciding how high to set the thermostat temperature on a certain day), the financial incentive provided by the emissions trading system to conserve energy is only limited and somewhat distant, and thus may prove insufficient to make all households reconsider their habits.

However, the effect of emissions trading for households can be increased by carefully considering the way that information on financial costs and benefits of energy conservation is presented to people, a well-known principle called 'framing' in psychological literature (Kühberger et al. 2002). For instance, choosing to set the thermostat at 19 instead of 22 °C has little consequences at single days, but leads to

substantial energy savings on a yearly basis. In theory, thermostat setting, aggregated over 1 year, may even determine whether a household will end up with an allowance shortage (22 °C) or surplus (19 °C) by the end of the year. So the impact of emissions trading on energy conservation choices may be increased by presenting households with the consequences of energy conservation on an aggregate level (per year), rather than on a disaggregate level (per day) (e.g. Burson et al. 2009). This can also be done, and should be particularly relevant, for big innovative consumer goods that save energy compared to the old models, such as hybrid cars, LED TV's or micro combined-heat-and-power CV boilers.

Recognizing that habits prevent behavior change to occur, psychologists have developed techniques that help people to follow-up on their intentions. By asking individuals to make specific plans to accommodate their 'implementation intentions' (Gollwitzer 1999), psychologists have been able to persuade them to try a new bus route, for instance, or to purchase consumption goods in a bio-shop (Bamberg 2002). This entails that the effects of allowance trading on household energy use may be enhanced by simultaneously introducing tools that help households to translate their energy conservation goals into matching behavior. For instance, in empirical research it is established that households consumed significantly less energy when they were given specific information on how to accommodate their energy saving goals, compared to households that did not receive this information (Abrahamse et al. 2007). As a consequence, the effects of financial incentives can be enhanced by providing brief and clear information on how to achieve the energy conservation goals (Stern 1999), which is also relevant in the context of emissions trading for households.

4 Conclusion

Currently only large emitters in the EU, such as electricity producers and steelmakers, receive tradable emission rights, defined as 'allowances'. In 2012 emissions trading was brought 'to the skies' by including the aviation sector. In this article we have raised the issue whether emissions trading could also be brought 'to the floor' by allocating allowances to households, preferably at an EU level, for instance after 2020. Our behavioral law and economics analysis indicates that such a scheme is conditionally feasible from a micro-economic and behavioral perspective, but its implementation is unlikely from an institutional-economic point of view, especially because of emissions double counting under the current EU ETS.

The advantages of emissions trading for households are that end-users' emissions will be capped and that they would receive a more direct and visible carbon incentive compared to current energy and climate policies. Administrative costs can be reduced by: (a) allocating free allowances downstream based on the average fuel use per adult person in a reference year, (b) using chipcard technology for car drivers and (c) concentrating monitoring and enforcement upstream on fossil fuel producers and importers.

Market transaction costs are likely to be rather low. Political transaction costs, however, partly depend on the *ex ante* acceptance of the scheme by households.

Using psychological insights to ‘frame’ the scheme in communication to people is then important, for instance by stressing that allowance trading is both effective and fair, since emissions are capped and because those who emit less also pay less. In addition, allowance trading could be communicated as a way of increasing individual freedom in making environmental choices in order to preserve normative considerations to reduce energy consumption. Although communication may help in this respect, providing information should not be perceived as a sufficient condition for acceptance.

The allowance price will be inherently uncertain, which people generally tend to dislike. Behavioral acceptance can therefore be boosted by mitigating uncertainty about final energy prices. Market solutions are likely to emerge here. The distribution company could create an opportunity for risk averse end-users of energy to buy some kind of insurance against high carbon prices, for instance by offering fixed energy prices for some period or by offering to buy the allowances against a fixed price for one or more years.

The success of emissions trading for households will also increase as more end-users succeed in reducing energy consumption levels *ex post*. The problem is that the direct consequences of energy use could still remain somewhat invisible, in spite of the personal carbon incentive, when allowances are automatically deducted from an allowance account. Using psychological insights on feedback mechanisms, end-users could be sent weekly or monthly updates of their transactions and their allowance account (also via smartphone *Apps*), perhaps including a prediction about the expected allowance shortage or surplus, to associate behavior with consequence.

In spite of its conditional feasibility, emissions trading for households will meet with some resistance, in particular from those (high emitters) who lose compared to the status quo. Although we have indicated several ways of mitigating their concerns, it remains an open question whether those necessary conditions are also sufficient to ensure political acceptance. Future research, for instance in the form of additional experiments in which the acceptance levels or energy consumption behaviors of households are measured, should shed more light on this complicated issue.

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