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Emissions Trading for Households?
A Behavioral Law and Economics Perspective

by

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Emissions Trading for Households?
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Abstract: This is the first article on expanding the EU ETS to households in which law and economics is combined with behavioral science. The article gathers relevant theoretical insights and discusses how established empirical findings can be used to design a workable scheme. The article not only presents an overview of possible economic and behavioral barriers, but also creates a feedback to its institutional design by presenting solutions to overcome them. The conclusion is that allowance trading for households is economically feasible. Downstream allocation creates a more direct and visible carbon incentive, whereas administration costs can be reduced by concentrating monitoring and enforcement upstream. Behavioral acceptance can be boosted via strategic communication, for instance by stressing that allowance trading is both effective (emissions are capped) and fair (those who emit less, pay less). Energy conservation can be stimulated by sending households monthly updates of their 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.

Key words: climate change, emissions trading, household sector, transport sector, administrative costs, behavioral conditions.

JEL codes: D03, D14, H32, H31, K32, R48, Q54

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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 (CO_2) 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 enables polluters to search for the cheapest emission abatement option. Those with high abatement costs have the opportunity of buying allowances to comply with their targets. This is attractive if the carbon price is lower than reducing emissions themselves. Those with low abatement costs are interested in selling allowances if the market price is higher than the cost of reducing their own emissions.

The EU ETS is basically a giant 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 Coase (1960) and Calabresi and Melamed (1972), as well as by various environmental economists (e.g. Dales, 1968; Tietenberg, 1980). Directive 2003/87/EC, the 'ETS Directive', regulates the design of the ETS until 2012 (COM, 2003). Only big emitters are currently included in the ETS: mainly electricity producers, but also steelmakers as well as cement, paper and glass manufacturers. They receive almost all allowances free of charge. Producers typically pass their carbon costs on to consumers. Power companies, for instance, add a carbon mark-up, equal to the market value of the allowances, to the electricity bills that they send to their customers. By reducing energy use, end-users could already save money. Emissions trading now provides them with an additional but indirect incentive to reduce energy consumption, in the sense that consumers have no control over the allowances themselves.

The ETS Directive was recently amended into Directive 2009/29/EC (COM, 2009). The 'amended ETS Directive' regulates the design of the European carbon market for the period 2013-2020. Because consumers disagree with the 'windfall profits' producers make by earning money with their free allowances, full auctioning will be introduced in 2013 for the electricity sector and partial auctioning for some other emitters in the scheme (Woerdman et al., 2009). The ETS will also be expanded. The aviation sector will be included already in 2012, based on Directive 2008/101/EC

(COM, 2008), and the EU is now building an agreement to include the international maritime shipping sector in 2013.

However, emissions in the non-ETS sectors are still increasing and thus remain a threat for the emission reduction obligations of EU Member States under the Kyoto Protocol of 1997 (EEA, 2010). Transport emissions are not capped and continue to grow. Motorists are now partly confronted with the external costs of CO_2 emissions via fuel taxes and motor vehicle duties that reflect the CO_2 intensity of the car. Household emissions decrease only slowly, whereas the electricity consumption of households is still increasing. In principle, households are now confronted with the external costs of CO_2 emissions, in particular via the carbon mark-up they pay somewhere in the price of electricity. To get a grip on those emissions, a possible next step could be to include households and the transport sector under the emission cap of the ETS, for instance after 2020. To put it simply: households drive cars and live in houses or apartments where they use energy. Allowances could thus be allocated to 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 as recent research suggests that law, via instrument choice and its institutional design, is able to change the 'environmental mind' (Feldman and Perez, 2009).

In 2012 emissions trading in the EU will be brought 'to the skies' by including aviation. Should emissions trading also be brought 'to the floor', as suggested above, by allocating tradable emission rights to households? This article examines whether the institutional design of emissions trading for energy-using and car-driving households is economically desirable, and studies the behavioral conditions of successfully implementing such an expansion of the EU ETS. 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), it does allow us (a) to better understand any 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. Second, besides gathering relevant theoretical insights, the article also discusses how already established empirical findings in the economic and psychological literature can be used to design a feasible scheme of emissions trading for households. Third, the article 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.

The article is structured as follows. Section 2 provides the institutional design of an allowance scheme 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 section 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 authors, outside the field of law and economics, that have already advocated such a tradable scheme of personal emission quota (e.g. Fleming, 2005). A number of variants of the idea also received considerable attention in a report to the Irish government (Comhar SDC, 2008) and another report to the British Parliament (EAC, 2008). The concept also gained attention in Germany (Harders et al., 2008). Some variants still only allow fossil fuel producers to trade allowances. In

our article we will focus on the possibility that end-users actually engage in allowance trading themselves.

If the EU would enlarge the ETS by allocating allowances to energy end-users, such as households and motorists, a large scope would exist for competition, thereby increasing the cost-savings potential and further decreasing the (already low) possibility of market power in the scheme. 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 SDC, 2008). In our article, we propose an ETS design that considerably reduces this problem.

To lower administrative costs, 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 emission target of the Kyoto Protocol, the individual energy end-users within each category of small emitters, for example households, receive an amount of allowances proportional to its CO_2 emissions based on the average fuel use per adult person in a reference year. People living in small, well-isolated 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). 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 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 a firm or household 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.

Allowance allocation occurs downstream, but monitoring of emissions (fuel sales) and checking whether they match with allowances concentrates upstream on producers and importers of fuel, whose number is usually limited (in the Netherlands about 40 to 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 one 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, while it remains obligatory for the company to hand over the lacking allowances to the authorities. This combination should ensure an effective enforcement. Moreover, the presence of fines 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 system is to a large extent self-enforcing. In this design, fuel producers and importers (as well as distributors) have an interest to receive the correct number of allowances alongside their fuel sales: 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 to 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 Grandfathering allowances and chipcard technology

Just as in the current scheme for large emitters in the EU, allowances can be allocated to households free of charge ('grandfathering'). The large number of households incorporated in the trading scheme makes market power unlikely. At the beginning of the year, 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. (Instead of sending a separate chipcard it might be possible to combine it with existing chipcards from banks). Households can uprate the chipcard at the expense of their allowance account.

In principle, it is also possible to grandfather allowances to the distributors who will pass on the allowance costs in a mark-up on the fuel price, thereby avoiding allocation to households, but 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 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 the mobile sources the transfer occurs by using the chipcard which households can fill by lowering their allowance account. An alternative is a allowance pincard 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 the case of a positive allowance balance. A car driver who buys fuel can choose to transfer part of his own allowances or 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 or pincard with them). 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.

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 (which corresponds with the carbon content of the acquired fuel) to the allowance account which the distributor holds at the national allowance agency. 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 are exploited by companies who trade professionally in carbon allowances. The current market price arises from the transactions of and between the allowance trading companies. 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 then also 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 user unit the balance of the allowance account. This is equal to: grandfathered 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, essentially to other small end-users or to large industrial emitters under the EU ETS, or they can be kept as an investment.

2.3 Market transaction costs and political transaction costs

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. Households incur comparable transaction costs. A household has to search actively for information about one's emissions and allowance prices. Then there are decision costs as to whether you will buy or sell allowances. For the average small end-user, those market transaction costs are not likely to be prohibitively high. But a number of 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. Although economically rational, it does undermine the directness and visibility of the carbon incentive for this part of the population.

The domestic implementation costs consist of the registration of the participants as well as the yearly allocation of allowances and mailing of chipcards. For European countries, we roughly estimate this to be several million euro's, which implies a few euro's per chipcard. The monitoring focuses on the limited number of car 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 pincard or 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. However, these initial costs are obviously 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 emission market for large emitters, but they 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). Compared to an auctioning-based scheme, set-up costs of a scheme with free allowances are relatively low (Crals and Vereeck, 2005).

The political transaction costs will depend on the acceptance of the scheme by voters. Whether voters in their capacity as households will be winners or losers compared to the current situation depends on (a) the allowance allocation criterion and on (b) the market price for CO_2 which will emerge on the basis of supply and demand. On the one hand, in the allocation criterion that we used there will basically be an allowance surplus for 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 for CO_2 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?

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 (Steg and Schuitema, 2007). Without public support, allowance trading in 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 in households can be mustered to warrant implementation, we turn to the question of effectiveness. Generally, the more end-users try and 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 how effective allowance trading will be in changing the consumption behavior of individual households?

In sum, 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 psychological research and behavioral economics (e.g. Thaler and Sunstein, 2008), we will discuss factors that may influence households' support for the proposed emissions trading system (acceptability) as well as factors that determine the extent to which the proposed system will succeed in altering households' consumption patterns (behavioral effectiveness).

3.1 Household acceptance

Based economic theory, one would predict 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, from an economic point of view, one would predict that households using relatively little energy (and end up with an allowance surplus under the proposed allocation) perceive the emissions

trading system as more acceptable than households using more energy (and end up with an allowance shortage under the proposed allocation). However, behavioral research suggests that people not only take into account their economic interests, but also consider whether a policy leads to uncertainty (De Groot and Steg, 2006), consider whether a policy is fair (Schuitema et al., forthcoming), whether a policy will be effective in solving environmental issues (Schuitema and Steg, 2008), and whether a policy threatens one's sense of privacy (Ogden, 1999).

3.1.1 Uncertainty

A large body of empirical research shows that individuals tend to be risk averse, that is, they tend to favor riskless options (options with certain outcomes) over objectively equally attractive risky options (options with uncertain outcomes) (Kahneman and Tversky, 1979).[1] These findings help to explain consumer tendencies to purchase insurance against improbable losses (Eisner and Strotz, 1961) as well as household preferences for fixed over variable energy prices.

Allowance trading will inherently lead to some degree of uncertainty in energy prices. The carbon market price will depend on the supply and demand of allowances by end-users, which is likely to differ from day to day. Consequently, implementation of the proposed allowance trading system will, relative to today's situation, lead to more 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 (Kahneman and Tversky, 1979), they tend to resist fundamental changes (e.g. Thaler and Sunstein, 2008). Therefore, people's reluctance to deviate from the status quo ('status quo bias', Samuel and Zeckhauser, 1988) may prevent them from accepting an emission trading system.

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

[1] For instance, most people prefer receiving 30$ over an 80% chance of winning 45$, despite the fact the latter option has a higher expected utility.

accounting for households' tendency to resist to fundamental changes. Market solutions are likely to emerge here. 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.

Additionally, the government may stress the potential gains of an emissions trading system in communication (allowance trading is an effective and fair system, while 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.

3.1.2 Fairness

Questionnaire studies show that acceptability and fairness of pricing polices are highly correlated: people tend to accept pricing measures that are perceived as being fair (Bamberg and Rölle, 2003). Thus, 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. End-users have different criteria for assessing whether a policy is considered fair (Steg, 2004; Schuitema et al., forthcoming). 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 they are harmed more than others. Some could claim that they are being harmed disproportionately because they feel they are not able to change their consumption pattern and thus are forced to buy additional allowances.

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., forthcoming). 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 fair and acceptable by end-users (Schuitema et al., forthcoming). So communicating that the rationale behind the emissions trading system is serving the emit-more, pay-more rationale, may help in boosting acceptability.

3.1.3 Environmental effectiveness

Finally, policies are rated as more acceptable when they are perceived as effective in the sense that they are able to solve the problems they are meant to address (Schuitema and Steg, 2005). 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'.

Therefore, showing evidence that allowance trading will, relative to the current system, be effective in reducing emissions, may help increasing the system's perceived fairness, and will therefore boost acceptability.

3.1.4 Privacy concerns

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 the 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. 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 an ETS for households.

Therefore, the chance of an invasion of one's privacy should be reduced to a minimum via what can be called '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.

3.2 Behavioral effectiveness

Assuming that enough public support can be gained to allow implementation of allowance trading for households, we will turn to the question which factors determine the behavioral effectiveness of an allowance trading system. The system's success will increase as more end-users succeed in changing their individual energy consumption patterns, which can be referred to as 'behavioral effectiveness', for two reasons. First, this will allow to bring the cap, and thus aggregate emissions, down quicker from commitment period to commitment period. Second, when many end-users fail to change their consumption patterns, prices for allowances will increase (*ceteris paribus*), which might lead to lower acceptance levels (depending on the elasticity of energy demand) in the sense that end-users may dislike paying higher prices for energy. And low acceptance levels might even jeopardize the continuation and enforcement of allowance trading in the long run. To summarize, the more end-users try to reduce their energy consumption, the more successful the system will 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 behaviors ('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 automatically as the incentives to reduce energy consumption change. Rationally acting 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 to some extent people's behavior systematically deviates from the rational model (e.g. Thaler and Sunstein, 2008). Various behavioral factors (visibility of financial consequences, normative motivations for energy conservation, and habits) determine whether such changes will also actually occur, as we will discuss below.

3.2.1 Visibility

Allowance trading will, relative to the current system, make end-users more aware of the 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 exact the contingencies for behavior change advocated by applied behavior analysts (Skinner, 1953), and thus should prove effective in achieving behavior change. However, behavior change is more likely to occur when people are better able to associate specific behaviors with soon and certain consequences (Lehman and Geller, 2008), that is, when behavior is always and immediately followed by noticeable consequences.

This analysis may have some ramifications for they way allowance trading should be set up in order to maximize effectiveness. Although allowance trading makes the incentive more visible compared to the current system, the direct consequences of energy use actually still remain somewhat invisible under the proposed system. 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 having made a string of transactions.

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). In this way, end-users can more directly see the consequences of their behavior and are able to associate behavior with consequence, which should make behavior change more likely.[2] Outside the area of emissions trading, its possible efficacy has recently 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).

[2] 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 (Jakobsson, 2004; Steg, 2004), 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.

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. The relative price effect in economic theory assumes that as the price for a good increases, its demand will decrease (*ceteris paribus*). 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. This approach has proven effective in reducing the energy consumption of large emitters (e.g. Point Carbon, 2010: 5).

However, 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 feel 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, forthcoming).

Importantly, literature from behavioral economics suggests that, by 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 conserve energy in the first place, while the financial incentive is not perceived as particularly motivating. If so, the introduction of an allowance trading system may not have a significant behavioral impact or, through it's focus on economic motivations, even decrease rather than increase energy conservation behavior.

Empirical research suggest that these kinds of effects are to some extent possible. In the context of volunteering, for instance, financial rewards were found to decrease rather than increase performance (Gneezy and Rustichini, 2000b) and the crowding-out effect can dominate the relative price effect (Frey and Jegen, 2001). Additionally, a monetary fine for collecting children too late from day-care centers, namely after closure time, paradoxically increased rather than decreased norm violations (Gneezy and Rustichini, 2000a). By paying the fine, people perceived this as if they had purchased the 'right' to violate the norm.[3] In a similar vein, the extent to which allowance trading succeeds in motivating end-users to conserve energy does not only depend on the size of the incentive (the relative price effect), but also on the positive or negative impact on end-users' normative motivations.

Whether trading allowances undermines the impact of normative considerations on behavior, and can even lead to lower rather than higher levels of energy conservation, is, as yet unclear. However, financial instruments are less likely to have the aforementioned undesired effects when they are perceived as supportive rather than controlling (Jordan, 1986; Frey and Jegen, 2001; Ryan and Deci, 2000). Allowance trading could be perceived as leaving individual freedom intact: this should preserve end-users' normative motivation for energy conservation, while simultaneously making it more attractive to save energy. Additionally, 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. Finally, 'green' companies or 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.

[3] Although more studies have reported such unintended effects of financial (dis)incentives (see Frey & 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 & Messick, 1999; Lindenberg & Steg, 2007). Normative considerations are then rendered irrelevant for the decision.

3.2.3 Habits

A fully functioning emissions trading system provides an incentive for 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 thus should lower their consumption goal and should 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.

One of the reasons for this inconsistency is that behavior is typically governed by habits. Instead of consciously weighing costs against benefits before making any decision, people tend to rely on previously made decisions ('habits') to facilitate the decision making process (e.g. North, 1990). A habit, once formed, is hard to break (Aarts and Dijksterhuis, 2000). This might explain why people, even when it is in their financial interest to do so, often fail to change their behavior but instead rely on previously made choices or habits.

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. An important empirical question is then whether the proposed system of emissions trading will provide households with a strong enough incentive to reconsider their consumption 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.

The effect of emissions trading can be significantly increased by the way the information about the financial costs and benefits of energy conservation is presented to households, a principle called 'framing' in psychological literature (Kühberger et al., 2002). For instance, choosing to set the thermostat at 19 instead of 22 degrees Celsius has little consequences at single days, but leads to substantial energy savings on a yearly basis (Burson et al., 2009). In principle, thermostat setting, aggregated over one year, may even determine whether a household will end up with an allowance shortage (22 degrees Celcius) or surplus (19 degrees Celcius) 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).

Recognizing that habits prevent behavior change to occur, social psychologists have developed techniques that help people to follow-up on their intentions. By asking people to make specific plans to accommodate their 'implementation intentions' (Gollwitzer, 1999), psychologists have been able to persuade people to try a new bus-route as well as 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, 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). Therefore, the effects of financial incentives can be enhanced by also providing relevant information on how to achieve the energy conservation goals (Stern, 1999).

4. Conclusion

Currently only large emitters in the EU, such as electricity producers, receive tradable emission rights, defined as 'allowances' under Directive 2003/87/EC and Directive 2009/29/EC. Emissions trading will be brought 'to the skies' by including the aviation sector in 2012, based on Directive 2008/101/EC. In this article we have posed the question whether emissions trading should also be brought 'to the floor' by allocating allowances to households, for instance after 2020. Our answer to this question is a cautious and conditional 'yes'.

Households basically emit CO_2 by using energy and by driving cars. The problem is that their emissions continue to grow. Emissions trading for households as a solution to this problem is economically feasible. The advantage is that their emissions will be capped and they would receive a more direct and visible carbon incentive compared to current policies. Administration costs can be reduced (a) by allocating allowances downstream based on the average fuel use per adult person in a reference year, (b) by using chipcard technology for car drivers and (c) by

concentrating monitoring and enforcement upstream on fossil fuel producers and importers.

Market transaction costs are likely to be low. Political transaction costs partly depend on the acceptance of the scheme by households themselves. Communication ('framing') of the scheme is then important, for instance by stressing that allowance trading is both effective, since emissions are capped, and fair, because those who emit less also pay less. 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.

Behavioral acceptance can also be boosted by mitigating uncertainty about energy prices. Market solutions are likely to emerge. The distribution company could create an opportunity for risk averse end-users 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. 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. Therefore, end-users could be sent weekly or monthly updates of their transactions and their allowance account, perhaps including a prediction about the expected allowance shortage or surplus.

In spite of its economic feasibility, emissions trading for households will meet with some behavioral 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 experiments in which the actual consumption behavior of households is measured, should shed more light on this complicated issue.

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