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Reviewing key building blocks of an integrated carbon footprinting and consumer purchases' monitoring & reward system – interaction with the consumer

Climate Bonus project report (WP4)

Adriaan Perrels

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Climate Bonus – a carbon bonus/credit system for households

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Usva K. – Hongisto M. – Katajajuuri J.M. – Nissinen A. (2009): *Towards a system of assured carbon footprints applicable to product carbon labelling – Climate Bonus project report (WP3)*, VATT Research Reports 143:2

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Perrels A. – Nissinen A. – Sahari A. (2009): *The overall economic and environmental effectiveness of a combined carbon foot-printing and feedback system – Climate Bonus project report (WP6)*, VATT Research Reports 143:5.

Perrels A. – Heikkilä T. – Hongisto M. – Hyvönen K. – Katajajuuri J.M. – Nissinen A. – Usva K. (2009): *Sustainable Consumption and Production Exposed – Synthesis report of the CLIMATE BONUS study concerning combined use of carbon footprinting, monitoring, feedback, and rewards*, VATT Research Reports 143:6.

Reviewing key building blocks of an integrated carbon footprinting and consumer purchases' monitoring & reward system – interaction with the consumer (WP4)

Government Institute for Economic Research
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Abstract

This report is the third in a series of reports produced by the Climate Bonus study. In this project is surveyed what are the possibilities and effectiveness of the combined use of (1) verified carbon footprints (possibly visualised through labels), (2) personalised monitoring and feedback services to households regarding the greenhouse gas intensities of their purchases, (3) a reward system (bonuses) for consumers who manage to reduce the embodied emissions, and (4) a secondary reward system for retailers that successfully reduce the emission intensity of their sales. This third report deals with systematic information provision to households regarding the emission effects of their purchases. More in particular it reviews options and effectiveness of product information provision, monitoring of consumer activities and feedback to consumers. Next to a theoretical review it also discusses how consumers have reacted in various policy experiments in Finland and elsewhere. Also the developments in attitudes and levels of awareness and knowledge regarding climate change among Finnish consumers are summarised. In addition it provides an overview of theoretical and practical insights regarding the recommended features of consumer information, such as product labels. Last but not least the report discusses the pre-requisites and the eventually chosen specification of the reward (bonus) system for households.

Key words: bonus systems, carbon footprints, consumer choices, embodied emissions, emission monitoring, feedback, habits, home economics

JEL classification: D1, D8, Q01, Q54, Q56

Tiivistelmä

Tämä raportti on kolmas Climate Bonus -hankkeeseen liittyvään raporttisarjaan. Tutkimushankkeessa tarkasteltiin ilmastopolitiikan toimenpiteiden yhdistämisen mahdollisuuksia ja vaikuttavuutta. Yhdistelmä koostuu (1) verifioiduista hiilijalanjäljistä (mahdollisesti visualisoitu merkkinä), (2) kotitalouskohtaisesta ostoksien päästövaikutuksien seuranta- ja palautejärjestelmästä, (3) palkkiojärjestelmästä kuluttajille, jotka onnistuvat vähentämään ostoksien sisältämiä päästöjä ja (4) toinen palkkiojärjestelmä vähittäiskaupoille, jotka todistettavasti onnistuvat vähentämään kokonaismyyntinsä keskimääräisiä ominaispäästöjä. Raportti käsittelee systemaattista tiedon tuottamista kotitalouksille ostosten päästövaikutuksista. Politiikkatoimenpiteiden teoreettisen katsauksen lisäksi tarkastellaan kuinka kuluttajat ovat reagoineet erilaisiin toimintamalleihin Suomessa ja muualla. Lisäksi raportissa kuvataan suomalaisten kuluttajien asenteiden ja valveutuneisuuden lisääntymistä ilmastonmuutoksesta ja sen syistä. Raportissa on myös yleiskatsaus käytössä olevista kuluttajainformaation välineistä, kuten esimerkiksi tuotemerkeistä. Raportin lopussa käsitellään millaisia palkkiojärjestelmiä kotitalouksille voitaisiin tarjota sekä palkkiojärjestelmien peruslähtökohtia ja -edellytyksiä.

Asiasanat: palkkiojärjestelmät, hiilijalanjäljet, kuluttajan valinnat, toteutuneet päästöt, päästöjen seuranta, palaute, kulutustottumukset, kotitaloustiede

JEL luokittelu: D1, D8, Q01, Q54, Q56

Foreword

The study *Climate Bonus – a carbon bonus/credit system for households* is carried out by a truly wide scoped cross-sector consortium. It is amalgamating a wide range of sector knowledge, experience, and co-operation, and ranges from basic research to applied research. The ambition of this project is to create and gauge new approaches and solutions for climate change mitigation. The focus of Climate Bonus study is to give consumers, manufacturers and trade knowledge, means and opportunities to make selection in every day life to avoid carbon emissions.

The project may also be regarded as a very fitting example of the kind of integrated approach which the Advisory Board for Sector Research intends to promote. Furthermore, the project is also an example of how a substantial national research effort can create the basis for international co-operation, not only subsequently, but also concurrently. In fact for many national research themes it is straightaway beneficial to include a meaningful share of international co-operation, exchange or review.

The present report essentially shows the importance of information for the functioning of markets and for satisfactory choice making of consumers. It also illustrates that in an ever more complex world, not the least with respect to consumption options, product prices function less well as a compound indicator for all the features and impacts involved. Self-evidently, prices remain very important in terms of households' resource allocations, but evolution in product choice is a multi-facetted phenomenon involving product comparison, meditation of household members' preferences, scanning of peer behaviour, information transaction cost and efforts to break away from habits. Consequently, as information technology development seems to continue to lower the cost of information provision, it gets ever more interesting to consider the policy potential of information provision, e.g. through systematic feedback, as an additional means for public policies embedded in market behaviour (instead of operating on its margin or merely obstructing it). In this case the application is in the realm of environmental policy, but for VATT – and partner institutes – it may be also interesting to study applicability in health care, social policies, etc.

Helsinki, August 2009

Seija Ilmakunnas

Director General

VATT

Contents

1 Introduction

An important underlying philosophy of the Climate Bonus project is that credible and structured information provision and systematic feedback constitute essential elements for the alleviation of market failures in emission abatement markets. This is particularly the case when it concerns consumer product chains. In the report of WP3 the information system at the supply side was discussed. In this WP4 report the consumer side will be discussed, more in particular options and effectiveness of product information provision, monitoring of consumer activities and feedback to consumers. In other words this report considers the question how consumers deal with product information in relation to purchase decisions from many viewpoints. Several of these insights are put to test in the consumer pilot, which is discussed in the report of WP5. In the report of WP6 the macro-level implications of responsiveness are discussed in relation to the use of (other) policy instruments.

The report takes off in chapter 2 by picturing how consumers and producers communicate via the market and by briefly discussing various theories which (try to) explain mechanisms and effects. Chapter 3 deals in greater detail with the experiences with feedback to consumers. First, various theories are presented. Subsequently, the chapter continues by surveying experiences with feedback applied to domestic energy saving and personal diet monitoring. These issues have similarities with the monitoring options of the Climate Bonus system. Chapter 4 moves on to the practical implementation of information provision. Concepts of and experiences with product labels are discussed, with special reference to the encountered dilemmas and trade-offs regarding accuracy and simplicity. Finally, in chapter 5 the principles of an incentive or bonus system are laid out. Also an outline of the reward system in the pilot is presented.

2 Representing the interaction between production and consumption

2.1 Markets for consumer products convey more than price information

The standard non-extended understanding of what a consumer constitutes in economics boils down to a resources optimisation problem. In that setting the consumer is defined as an agent who seeks to maximise its utility and hence the choices and actions of the agent are the consequences (outcomes) of the maximisation process. The maximisation problem is subject to a bound (or rather bounds), being the available money (and time) budget of the individual or household. The budget depends on the prices of the goods to be consumed and on the income of the consumer[1].

In the above summarised standard approach consumption is equated to purchasing a product, while utility is in fact operationalised as material wealth. For a host of reasons this approach has its limitations, if one wishes to assess the dynamics and details of private consumption, as well as consequences of consumption beyond the realm of economics, e.g. social and environmental implications. One extension is to distinguish purchasing from consumption (i.e. using) proper. This can be easily integrated into economics, by viewing a *household as a production-consumption unit*. Households purchase goods and services on the market, which they combine with (non-paid) labour input of household members, service inputs of durable goods (appliances, house, car), and skills to produce a ready-to-consume product-service combination, such as a warm cup of tea. In this case utility maximisation gets more complex, as it may be related to e.g. possessions (durables), to plenty and/or high quality ready-to-consume product-services, and to synchronisation of one's consumption with others (communality). Furthermore, instead of a single monetary budget restriction a more complicated programming problem arises in which various combinations of money, skills, time budgets and task divisions may produce (close to) optimal utility. Obviously in this approach the role of prices gets diminished, without claiming that they would be unimportant.

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[1] In fact also the division between work time (and hence labour income) and free time should be included. It provides a shadow price for time. People with high and low money budgets respectively, and conversely low and high free time budgets, may still enjoy the same overall effective budget, e.g. because their skills relate to market and non-market activities respectively. Working time schedules are usually offered as a limited set of discrete choices, therefore in practice the optimisation approach tends to focus on income and prices only.

In the above section the terms 'consumer' and 'household' were used interchangeably. This is only accurate if a household consists of one person. Otherwise the decision structure within a household becomes a relevant issue as well. This adds further complexity to the (personal) utility function, which now also includes the utility of others. The environment of a consumer may also enter a consumer's utility function in relation to the social identity of a product. This can also apply to products regarded as conspicuously green, regardless of their actual (verified) 'greenness'. If a consumer takes societal benefits, such as greenness, into account, it means in fact that the considered product choice contains also public good aspects. The reasons why a consumer expands the utility function with societal benefits may not be purely altruistic. For example, a consumer may think that adapting consumption in a personally most suitable way may be a more effective way to deal with climate policy challenges than waiting for public interventions or a consumer may think that adapting consumption could to some extent attenuate tax increases or tightening of obligations. In the Climate Bonus project is presumed and tested in the pilot (see report of WP5), that consumer have a genuine interest in adapting their consumption such that it causes less greenhouse gas emissions. The reasons for that interest vary across consumers and possibly the significance of the various reasons varies over time.

In order to make the optimisation approach workable some strong assumptions have to be made or at least we don't know how well some of these assumptions hold. The approach can still provide valuable insights at higher aggregation levels (in terms of household type and product group), but with respect to e.g. specific product choices and their environmental impacts other and/or additional approaches are called for. One reason for this is *habit formation*[2]. The optimisation approach presupposes conscious choice making across the board. Behavioural studies have shown that such an assumption is untenable. A significant part of consumer behaviour is habitual. As regards purchase behaviour a habit can be seen as a prefixed choice (or a prefixed choice procedure) based on past experience. The choice has been reasoned in the past and given past and recent satisfaction the consumer considers it a waste of resources (e.g. time) to re-evaluate the choice.

A complement to habit formation is learning. Prior to the habituation of a consumption choice there will be usually a period of testing, e.g. comparing the performance to a previous default choice. Probably during the learning stage a consumer may be more susceptible for (extra) information. However, this may also mean that – as a kind of trade-off – the testing consumer is less susceptible

[2] There is a line of research in economics where habit formation is also used as a concept to explain persistence in household's budget allocations. However, those studies deal with high aggregation levels (e.g. purchases of non-durables and durables, and saving). In this study a more detailed level of habit formation is used, referring to rather narrowly defined product groups or even single products. This approach links more closely to approaches in marketing and social-psychology.

for information on consumption choices outside the testing phase. This resonates quite well with the theory of mental accounting (Thaler, 1999), which among other things indicates that people will find it more difficult step up efforts for a new type of action than for a known (experienced) type of action due to the different ways of ex-ante and ex-post evaluation of these actions.

Apart from some chance deviation fuelled by a need for variation, consumers need fairly strong outside signals to reconsider habitual choices. For example, non-availability of the default choice forces a consumer to reconsider the options. Also massive advertisement of a competing option or recommendation by an important peer will have (some) effect. Prices can play a role, but always in conjunction with *effective provision of information*.

Apart from the distinction between habitual and actively evaluated product choices, there is the point of variation in the comparability of product attributes. This has two types of consequences. For a start straightforward factual information, such as prices, is easier to compare than fuzzy and/or complex information. This is called the *compatibility effect* (e.g. Auh and Johnson, 2005), which among others implies that competing on other aspects than price may be more difficult – or at least require more marketing effort – as consumers may have more difficulties in judging such attributes (by comparison). Therefore for example product labels with standardised information improve the possibilities to compete on other attributes than price only. Apparently also the envisaged Climate Bonus system would promote this. Yet, limitations to information capability (or limitations to the willingness to process information) call for caution in the attempts to overcome the compatibility effect (see also chapter 4).

The second consequence gets important when indeed comparability on other product attributes, such as environmental impact, is augmented by means of labels or other information systems. The addition of a new and significant label to the package may as such mean a new product attribute. Furthermore, often such labelled products may get subject to a new product-market strategy (i.e. restyled). This means in fact that the array of (close) substitutes has changed and depending on the new relative positions this may result in unintended reshuffles of market shares, due to various so-called *context effects* (Davies and Cline, 2005).

2.2 Conceptualising and positioning the consumption information flows in Climate Bonus

Of course for any market the efficiency of information provision and use is a key element, but in the case of markets for consumer products (as compared to many other markets) the information can have very diverse contents and roles. On the one hand there is a multitude of product attributes to be considered in relation to

the preference structure of the consumer (which may include preference of third persons) and on the other hand there are the resource constraints of money, time and skills. All in all it means that the amount, quality, accessibility, and media choice of the information provided in consumer markets plays a key role. In this light it is not amazing that consumers indicate with respect to willingness to adapt consumption choices in a climate friendly direction that they want *applicable information relevant to their setting and also ex-post information on the effectiveness of their actions.*

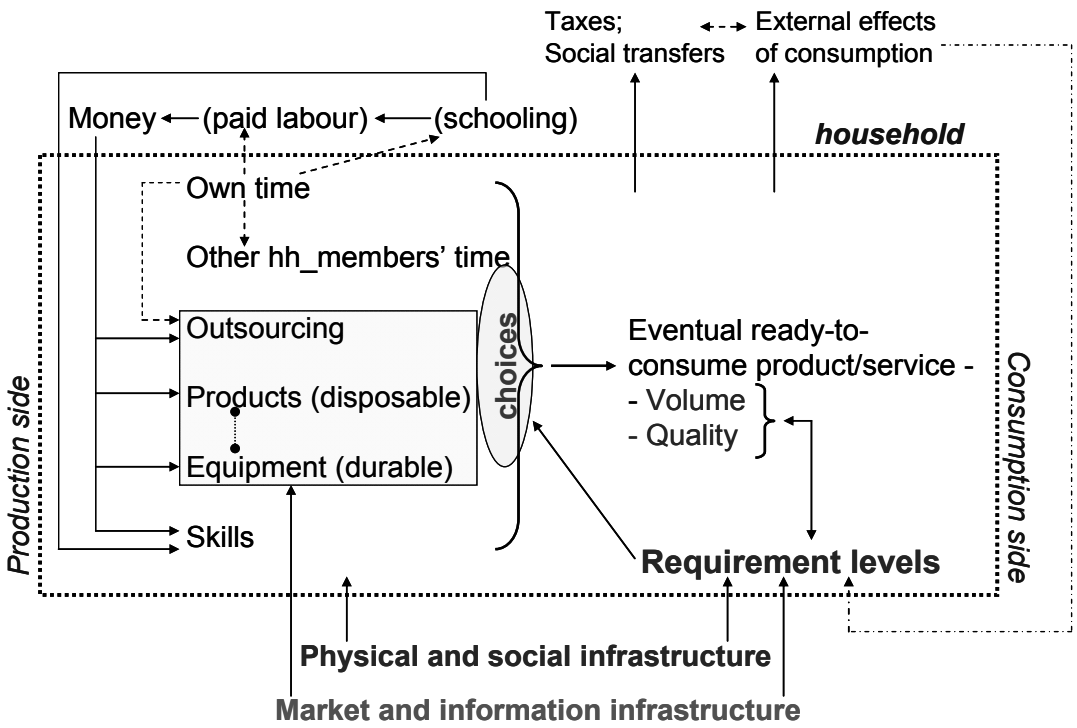
This brings us to an important premise in the Climate Bonus study namely that in modern consumer product markets consumers are exposed to a multitude of information types and contents via a multitude of information channels appealing to a complex set of utility attributes that the consumer *may* wish to contemplate, at least partly. Resource limitations such as money and time budgets, and consequently prices, do play a significant role in the information set-ups, but so do various other attributes, such as functionality, quality, durability, social distinction, and increasingly environmental or sustainability performance. The extension of the attribute set of ever more consumer products with the latter characteristics invokes new needs for information and feedback among consumers. This information cannot be summarised in a compound price (differential) only and consequently new information is necessary. Since it may be expected that the consumer wishes to use the information recurrently and also for comparison purposes, both with other products and with past consumer behaviour, a systematic and harmonised system of information is called for. Yet, even in that case there is still a lot of uncertainty regarding the effectiveness of the product information and feedback on consumer behaviour.

Finally, it should be realised that even though new information provision is needed alongside existing signals, such as prices, the signals of new information and e.g. prices should not be conflicting. Within this line of reasoning this means that for a well defined group of close substitutes the consumer expects that the products with a bad climate performance should have above average prices (for that product group).

The functioning of a household as a production-consumption unit is summarised in figure 2.1 below. On the one hand a household makes choices as regards what parts of the time resources is devoted to paid labour and/or schooling. As a result the household has a net endowment of time, money, durable consumer goods (purchased in previous periods) and skills. The choice making regarding actual products and services bought depends on the prices and the available money budget, but also on the requirement level of the household. Furthermore product choices will also be influenced by the available equipment and skills. In the background the physical and social infrastructure (i.e. living area) as well as the volume, functionality and diversity of markets influence preferences and choices too. The division of tasks and application and interpretation of requirement levels

happens typically in the context of routines and shared values and helps to habituate in choice making. On consecutive days only a small proportion of the consumption choices has to be reconsidered more thoroughly.

Figure 2.1 The household as a production-consumption unit



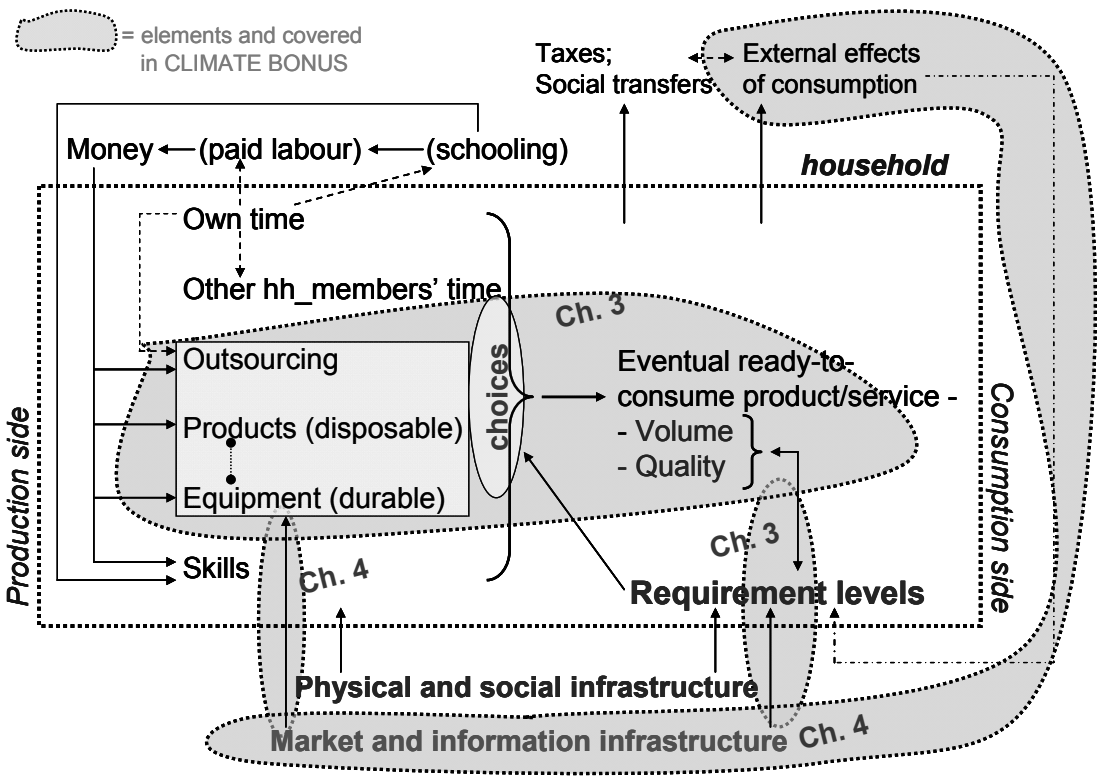
One of the external effects of household consumption is the direct and indirect causation of greenhouse gas emissions. Once households have gotten aware of that they may start to account for these external effects in their requirement levels regarding the volume and quality of their consumption. Yet, they may also decide that this should be handled by the authorities and may or may not realise that this may imply tax rises. Only after those changes in the household's evaluation framework have progressed sufficiently more detailed information provision on the greenhouse gas emission impacts of products and services (including monitoring and feedback) will have the chance to have more impact on product choice.

As explained before and also shown in figure 2.1 the additional information on greenhouse gas impacts of products is mixing in with all kinds of other information. Furthermore, a lot of choices are embedded in and dependent on larger frameworks of daily patterns and habits of which manoeuvring space is determined by the type of family, size and location of the home, working times, etc. Incidental variation in product selection is not a problem, but systematic shifts are more difficult to realise due to the implicit costs (efforts) to reconsider

habits and due to explicit costs (price differences[3]) and budget limitations. Consequently systematic prolonged information provision through feedback will be of help in these change processes, provided the data contents, lay-out and media choice are adequately developed.

In the Climate Bonus study only a part of the overall household functioning is studied. More in particular the interaction with external information, i.e. feedback on the embodied emissions of the own purchases and possible adjacent information such as product labels, is discussed. Furthermore, the possible ways this external information may influence consumer decision making is discussed. This is indicated in figure 2.2 by means of the shaded irregularly shaped areas.

Figure 2.2 The household as a production-consumption unit – interactions covered in the Climate Bonus study



[3] To date 'greenness' is predominantly seen as a premium characteristic. This may change over time. Furthermore, by no means all low emission alternatives are more expensive.

2.3 Methods to exemplify the links between production and consumption

The purchases of households cause money flows as well as flows of goods and materials. At the level of product chains producers monitor their sales, prices, and costs, and usually also try to get a grasp of the performance of their competitors, and of their key suppliers and clients (e.g. retailers). The demand response of consumers comes back to producers further back in the supply chain via the orders of their companies serving consumers. Systematic change in the composition of the orders points at changes in consumer choices. In addition to this primary economic feedback system there are secondary systems such as complaints and inquiries via websites.

The fact that consumers buy a product and are – apparently – willing to pay a certain price constitutes nevertheless curtailed information, even in several respects. For example, it would need price variation to find out whether a producer is charging a profit maximising price. It is neither known what kind of varieties of the product, including not (yet) available alternatives, would have the highest popularity among consumers. Indeed especially for products not (yet) sold current market information may be of limited value (depending on the attributes added or altered in the new product).This problem is also relevant with respect to the promotion of eco-efficient consumer products.

The above mentioned questions can be tackled with market models such as can be typically found in industrial economics applications. This is especially relevant if one wishes to assess impacts of the introduction of new 'green products' on market shares, profit margins, etc. or for the assessment of the market effects of participation and non-participation in supply chain based emission data generation systems.

At the level of the entire economy, and if limited levels of detail are need, input-output tables can be very helpful. However, for more product specific information provision lifecycle analysis (LCA) is needed (see the report of WP3 for more details). Yet, in that case more comprehensive changes in consumption patterns may be hard to assess by means of LCA only. In that case also consumption expenditure models and (bivalent) input-output tables (or other economic models) would be necessary.

For the envisaged Climate Bonus system analysis of overall economic and environmental impacts can be carried out by means of a consumption expenditure model linked to an input-output system with auxiliary material flow and emission tables. Examples of that kind of studies are ENVIMAT (Seppälä et al. 2009) and KulMaKunta (Perrels et al. 2006). For more specific analysis of certain product groups or consumption categories LCA models linked to either input-output systems or consumption expenditure models could be used,

depending on the purpose of the analysis (e.g. Liu et al. 2009). Also so-called household metabolism studies can be regarded as such an integrative approach (e.g. Vringer, 2005; Engström, 2006). A useful review of environmental impact modelling of household consumption is – among others – provided by Hertwich (2006).

In the Climate Bonus study no large model assessments are made. In the WP6 report will be used some explorative calculations by means of a consumption expenditure model.

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3 Information processing, attitudes, feedback and product choice

3.1 Theory

In the previous chapter was explained that even though resource limits and prices play a significant role, many other considerations kick in as well when a consumer chooses from a range of (close) substitutes. In other words consumers allow themselves a certain manoeuvring space to trade between various qualities (incl. the price) of the available alternatives. One such possible quality of a product could be its 'greenness', which could be conveyed by means of an environmental product label and/or through advertisements.

There is empirical evidence stating that consumers are willing to pay more for environmentally labelled goods. For example, Björner et a. (2004) found that Danish consumers are willing to pay – on average – 13% more for toilet paper and 17% to 29% more for detergents labelled with the Nordic environmental label ('Nordic Swan'). This indicates that a significant proportion of the consumers does rate the environmental characteristics of (at least) some goods as important enough to categorise them as distinctly different from other similar products.

3.1.1 Does a stereotypical green consumer exist?

A vast amount of research has been conducted – especially within the marketing sector – in order to determine the typical ecological consumer's profile and whether it is possible to determine some demographic and socioeconomic variables to explain consumer's willingness to 'buy green'. Possibly due to the dissimilarity in research methods, sample sizes, hypotheses or differences in the way the results are analysed, the conclusions do not appear to be very uniform.

Factors that are most commonly related to a stereotypical sustainable consumer seem to be high income class, above-average education and prestigious occupation, but even these are often contradicted (Vermeir and Verbeke, 2006; Roberts, 1996). For example, Vermeir and Verbeke state that the green consumer is a well informed middle-aged person with high income, above average education, and a prestigious occupation. They conclude that gender has no significance. In contrast, Bjorner, Hansen and Russell (2004) emphasize gender and number of children in the household, but discard level of education and income. Tanner and Kast (2003), on the other hand, see that monetary barriers or socioeconomic characteristics have no effect whatsoever.

Roberts (1996) summarises the results of 22 relevant demographic surveys and discovers that the conclusions vary quite significantly. For instance, from the total of 22 surveys, 6 found age to be negatively and 3 positively correlated with environmental decision making, while 8 found it not to have any significance at all and 5 excluded it completely from the research. Similar controversial patterns can be identified for all of the commonly used variables, such as socio-economic status, place of residence, sex, education, income and occupation.

The most extreme results imply that none of these variables would have any significance at all. A more plausible explanation might be that 'greenness' as such, i.e. detached from a product or service, may be hard to identify satisfactorily in applied consumer studies, because it can mean very different things for different consumers. In practice 'greenness' is always linked to a particular product or service in order to get meaning. As different categories of consumers will relate differently to these particular products for a host of reasons, we can only assess a kind of conditional or contextual 'greenness'. For example, for some categories of consumers cars cannot be 'green' by definition, whereas for other categories a hybrid car would pass for a green car, and for another category any car, which is sufficiently fuel efficient, may perceived as 'green'.

3.1.2 The role of attitudes and values

What the majority of existing research does seem to agree on is the importance of attitudes and values as an explanatory variable for environmentally benign or ethical consumer behaviour. In particular, somewhat intuitively, a positive pre-existing attitude towards environmental issues is often concluded to be the most significant factor involved (Roberts, 1996; Tanner and Kast, 2003; Uusitalo and Oksanen, 2004). In more depth, Vermeir and Verbeke (2006) say sustainable consumption is facilitated by universalism, idealism, benevolence, self-direction, equity, freedom and responsibility and negatively associated with ambition, hedonism, power, tradition, security and conformity.

As attitudes and values seem to be the most significant variables in determining sustainable consumption, it is important to consider what motivates this kind of behaviour. In conventional economic studies consumption decisions are often explained just by variables that are easily observable, such as the physical attributes of the goods and consumers' budget and time restrictions. But that kind of reasoning is not enough to explain the existence of donations to public goods and charitable giving. Hence there must be also some additional aspects that are not so clearly visible involved in making a 'good' consumption decision.

The model of impure altruism

One of the essential theories about voluntary contributions to public goods is Andreoni's (1990, 1995) theory of warm-glow giving and impure altruism. He presented the idea that the good feeling or conscience a consumer gets from donating to the common good is one of the attributes that a consumer can also have a preference over. So, instead of just fulfilling their own needs, consumers can also be motivated by this so called 'impure altruism'. Moreover, in contrast to being purely altruistic or purely egoistic, an impurely altruistic consumer is a mixture of these two and therefore motivated by both the actual donations and the warm-glow of giving. The more impurely altruistic the person is the higher is their valuation for the good feeling that results from donating.

Within the model of impure altruism, Andreoni (op. cit.) states that, when given the option, instead of taxes etc. consumers would rather donate directly to a good cause because it provides them with the optimal warm-glow effect. Therefore it is suggested that if the public sector desires to get more donations, instead of taxation it might be more profitable to encourage altruistic behaviour and subsidise it. In his latter paper from 1995 Andreoni develops the idea of warm-glow giving a bit further and does some empirical testing to determine which one is more likely to increase contributions to public goods – a positive or negative framing effect. Positive framing essentially means that the consumers are informed that donating to a public good will result in some positive externalities while in the case of negative framing the losses that will result from free-riding are emphasised. Andreoni (1995) concludes that even if in monetary terms the real incentives are identical, people are more likely to give to a public good if they are aware of the positive externalities it causes than when faced with negative externalities that will result if they do not contribute.

Menges et al (2005) tested the willingness to pay for green electricity in Germany. They found impure altruism as a relevant driver for the interviewed consumers. However, they also indicate that there is a risk for so-called 'crowding out' effects, meaning that beyond some level of voluntary contribution an increasing share of the consumers starts to regard private and public funding of green electricity as (partial) substitutes (see also Kotchen, 2005).

Next to the 'warm-glow' effect there may be the issue of control and identifiable impact of a voluntary 'green premium' paid by a consumer. Considering the answers of the pilot participants (see report of WP5, chapters 4 and 6) and also feedback in other public discussion, that seems to be aspects that elicit motivation. Contribution via – anonymous – public funding from taxes lacks that feature. Product information and feedback of a consumer's own impacts, as envisaged in Climate Bonus, enhance the perception of control and identification, and consequently reinforce the elicitation of the motivation.

The model of moral motivation

Another theory which attempts to rationalise spending on public goods is the economic model of moral motivation (Brekke et al. 2003). It is not completely different from Andreoni's theory discussed above, but aims to explain some seemingly irrational behaviour that impure altruism can not. For example, sometimes introducing an incentive has been discovered to decrease the volume of voluntary contributions (Brekke et al. 2003).

According to the economic model of moral motivation, consumers have an inner idea of what their ideal input to the public good should be. Considering this input, consumers first decide how socially responsible they prefer to see themselves. They then weigh their preferences between consumption and leisure and adjust their behaviour and inputs according to their perceived social responsibility and the willingness to contribute to the common good. (Brekke et al. 2003)

The model of moral motivation has to some extent different implications to public policy than the theory of impure altruism. It indicates that the implementation of economic incentives can sometimes decrease morally motivated contributions; for example the introduction of a fee for not participating or giving a subsidy for participation can actually cause the rate of participation to drop. According to this theory, public policy is not only effective through standard measures but also with the way it might form the individuals' perception of what is morally ideal. (Brekke et al. 2003).

Cultural evolution and consumption as a learning process

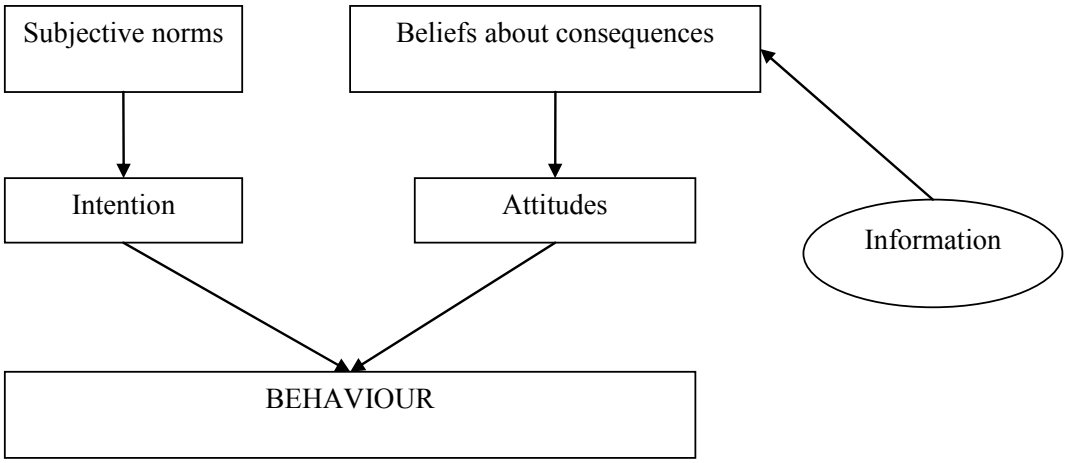
Buernstorf and Cordes (2008) considered consumption as a learning process and presented a model of cultural evolution to explain green consumption patterns. They divide consumer learning into two basic processes, individual and social learning. Individual associative learning is mainly about fulfilling one's needs while social learning is influenced by the society the consumer lives in. As a starting point, consumers are assumed to be more or less hedonistically biased. However, because of the social learning process the presence of green role models and conformity bias can enable sustainable consumption.

In essence, the probability of environmentally friendly consumption depends on the weight of the good role model and the impressionability of the consumer. One of the main implications that can be derived from this theory is that, largely due to the hedonistic bias, consumption patterns can not be 'locked in', i.e. even if sustainable consumption patterns are established it still requires constant effort to make sure they remain, since a majority of new products and technologies in the future may be expected to lure people 'back into hedonism'.

The theory of reasoned action

According to the theory of reasoned action and the theory of planned behaviour, the behaviour of people is determined by their intentions to have this behaviour and their attitudes towards the behaviour. The attitudes are influenced by the person's beliefs about the consequences of the behaviour. This is shown in the diagram below.

Figure 3.1 Flow chart of reasoned action



Thus, if a person is to make, say, a choice of product or energy use based on the environmental aspects related to the product, the person must have a belief that this choice has a certain positive environmental effect and in addition have a positive attitude towards wanting to induce this effect (Bartiaux, 2006). Information, such as provided by feedback tools, is an important factor in shaping the beliefs that people have about the consequences of their behaviour. If behavioural changes do not occur because consumers do not understand the link between their actions and environmental impacts, provision of information can remove this obstacle.

A review and summary of theories of environmentally relevant behaviour has been made by Matthies (2005) as cited in Fischer (2008). People in general have two types of actions: conscious decisions and habitual behaviour. Habitual behaviour saves time and effort, because routines do not require a process of evaluating one's behaviour; this has been done when the routine was formed. A problem arises if environmental issues were not considered at this point. This kind of habitual behaviour needs to be changed. For this to happen, a person must realise that there are other possible ways of action. There must also be the realisation that one's own behaviour is relevant and that there are ways to

influence own behaviour. After this realisation, the person will evaluate the options based on different norms (personal and social). There may also be other motives such as monetary savings from changed behaviour. As a result of the evaluation process, a new habit may be formed. But this requires that the person is informed of the relevance of behaviour and of alternative ways of action. (Matthies, 2005 as cited in Fischer, 2008.)

Feedback on personal behaviour confronts the consumer with the problem. It depends on the design of the system how this problem is presented; it may be framed as an environmental problem or, especially in the case of energy savings, as a problem of wasting resources and money. Feedback can also make visible the link between own actions and consequences, contributing to the realisation that own behaviour is relevant. Thus feedback is most successful if it: captures attention, links actions and effects, and activates motives for behaviour changes. (Fischer, 2008)

3.2 Finns' attitudes towards green consumption and climate change

As the role of attitudes and values is central in determining environmentally friendly behaviour, it is necessary to form an understanding of the Finnish people's views on environmental consumption so that estimates of acceptability and effectiveness of new policy instruments can be made. When it comes to attitudes, Finns seem to be quite inclined towards promoting sustainability. In the Eurobarometer 2008 poll conducted at the end of 2007 more than a third of the Finnish respondents said they were surely willing to pay 'a little bit' extra for environmentally friendly products, which is slightly above the overall EU27 average of 25 percent. In addition, only 14 percent of the surveyed Finns declared to be completely against paying any extra, while the corresponding EU27 average was 19 percent (Eurobarometer, 2008). Kuitinen et al. (2008), while referring to the National Climate Change Communication programme, show that for some emission reducing actions consumers in 2007 report a larger preparedness to perform them than in 2004, yet for some other actions, e.g. avoid flying, the preparedness went down somewhat.

Nevertheless, when inquired about their consumption behaviour during the month prior to the survey, only 23 percent of Finns had actually purchased goods marked with an environmental label. Even though this percentage is slightly higher than the EU27 of 17 percent, it does implicate that the environmentally friendly attitudes do not necessarily translate into actual environmentally friendly consumption behaviour. Also Uusitalo and Oksanen (2004) discovered that even though a significant proportion of consumers are aware of the ethical aspects of their consumption, their actions do not necessarily reflect that. Furthermore, in their survey over 90 percent of respondents claimed that it was important that firms were ethical, but only 70 percent said it influenced their actual purchasing

behaviour at least at some level. (Eurobarometer, 2008; Uusitalo and Oksanen, 2004).

Taloustutkimus Oy has conducted a survey regarding the Finns' understanding of climate change. The results from 2002, 2004 and 2007 are comparable and give indications of how attitudes evolved. The survey shows that people are now more aware of climate change than before. A majority of the respondents, 86 percent, has noticed campaigns and news related to climate change. For the first time in five years, climate change was stated as the most important thing affecting people's lives, when faced with a choice between climate change, economic recession, storms, floods and other natural disasters, increased drug use, terrorism, refugee matters and other. (Taloustutkimus, 2007).

It is thus evident that awareness and concern have increased. But this has not yet turned into actions, at least not at a large scale. Of all respondents in the climate change survey, 30 percent stated that campaigns and news have had an impact on their lives or actions. This impact was stated as a worry over climate change by 40 percent and 45 percent stated that they have promised to make or have made changes in their lifestyle due to concerns about climate change. (Taloustutkimus, 2007).

As to the reason behind climate change, the five most commonly stated reasons are in descending order: pollution, energy use and emissions from industry, transport, CO_2 emissions, and human actions in general. People are keen to blame the industry and transport. What the survey does not reveal is whether people understand the link between consumption and industrial production. As to the willingness to act on climate change, the most popular actions are driving less (32%), saving energy (25%), recycling and sorting waste (23%), reducing consumption and waste (19%) and favouring public transport (18%). An overall change in consumption habits is something that 26 percent are very willing to do and 48 percent would be rather willing. Women especially state a willingness to alter consumption patterns (Taloustutkimus, 2007).

Summing up, it is evident that climate change is a recognised issue and people are well aware of the causes and consequences. There is also a rather strong willingness to change behaviour and in this way contribute to mitigating climate change. When asked what social measures would be the best for getting people to change their behaviour, information and advice was stated as the number one choice (32%). The use and support of new technology was in second place (29%). Raising energy prices or taxes was considered the best instrument by only 6 percent. People seem to be supportive of informative measures, even though these are often the ones which are most uncertain when it comes to impacts (Taloustutkimus, 2007).

3.3 Design requirements

In designing a feedback system, there are several questions to consider. How to frame the problem? What values should feedback emphasize? Should there be comparisons and if so, should comparisons be historical or normative? That is, should the consumer be compared to own previous behaviour or also others' behaviour?

Based on the summaries of studies presented in Benders et al. (2006) and Fischer (2008), the elements constituting successful feedback systems can be identified. First of all, immediate feedback is most influential. This strengthens the link between own actions and impacts, and thus increases the understanding that actions do matter. Secondly, feedback should be given over a long time period. One-shot feedback or information campaigns may induce effects directly, but people tend to fall back to old habits if they are not regularly confronted with the impacts of their actions (reported for example in Henryson et al. 2000). Breaking old habits and forming new ones is a time-consuming process, and long term feedback is most likely to lead to permanent changes in behaviour. Third, feedback should activate motives that drive behavioural changes. These may be related to environmental issues, monetary savings, resource conservation, etc.

Finally, personalised information seems to be the most influential. Feedback systems which have interactive elements and succeed in engaging the consumer often deliver the best results. People value the possibility to compare actions to personal history as this makes it possible to see if actions have had an impact (on energy use, or, in the case of Climate Bonus, on emissions). Also normative comparisons have been used, that is, comparison to other receivers of feedback or to a reference consumer. But this option encompasses the risk that those consumers noticeably below averages may increase their impacts. (Benders et al. 2006; Fischer, 2008). Psychologists (McCalley and Midden, 2002) also point at the importance of goal setting as a prerequisite for the effectiveness of feedback. Similarly the gaming element of comparison to either peer groups or the own history can be a helpful to boost or keep up motivation. In this respect one could also think of the formulation of personal – voluntary accepted – targets, e.g. in the case of Climate Bonus voluntary emission reduction targets (see also section 3.4.1 for an example).

As to the presentation of feedback, there are many alternatives and it seems that not one is significantly better than others. However, often the most successful feedback tools have in some way been computerised. What seems to be most important is that information, be it in graphs, figures or numbers, is clearly presented and that graphics and text are easy to interpret. Detailed information is often appreciated, but again, it must be presented in a clear format (Fischer, 2008). Furthermore, feedback is not necessarily confined to one information channel only. For example, as regards purchase behaviour there is a both a need

for ex-post (reflective) information on recent and cumulated impacts as well as real time decision support information when comparing product alternatives in the shop (or – for that matter – at internet).

3.4 Empirical evidence from energy and health oriented feedback studies

3.4.1 Feedback and energy use

Several empirical studies have been carried out to examine the effectiveness of feedback on consumers' energy consumption. Feedback methods have included, for example, informative, frequent billing based on actual consumption, information leaflets on energy saving, monitors displaying electricity use, frequent meter reading and energy audits. Summaries of international studies can be found in Appendix I of Darby (2006) (available at www.defra.gov.uk) and in Fischer (2008). These summaries show that most feedback experiments have reported savings ranging from 1% to 20%.

It is of interest to look at two experiments which have been carried out in Finland as they may give insights into what kind of feedback Finns value. Arvola et al. (1993) carried out a field experiment in Helsinki to see how changed billing would influence electricity use. Electricity consumption was measured in 696 electrically heated homes which were divided into four groups: three experimental groups and a control group. All experimental groups received bills based on actual consumption. In the second year of the experiment, two experimental groups received comparative feedback in addition to this, with saving tips included for one group. The feedback was in the form of a letter sent simultaneously with the bill.

During the experiment, all groups increased electricity consumption, but due to frequent, consumption based billing, the three experimental groups increased consumption 1.4–1.5% less than the control group. During the three years of the experiment, the group which received also comparative feedback and saving tips increased consumption 4.7% less than the control group. The comparative feedback was in the form of comparing own current billing period consumption to the same period the year before (Arvola et al. 1993).

When asked about their opinions about billing and feedback, most customers had positive views about consumption-based billing, and of those who had received feedback a majority had read the letters and found them useful. The most common reason to favour the billing was that it made it easier to follow consumption. People also liked the fact that frequent billing made visible the connection between the own consumption and changes in the electricity bills. As

to the feedback, clarity and easy comparisons were valued. The saving tips were appreciated, but not really used (Arvola et al. 1993).

A study by Haakana et al. (1997) aimed at reductions in heat, hot water and electricity use through feedback and focused advice. The participants were 124 district heated single-family homes in Southern Finland. The households sent in monthly readings of heat, electricity and water consumption during 21 months. Households were divided into four groups: group 4 only sent in the readings, group 3 received feedback on energy use, group 2 received feedback and focused advice in written form, group 1 received feedback and focused advice on video.

All groups reduced heat consumption during the experiment. The biggest saving, 9%, was reported in group 1. Group 2 reduced heat use by 7%, group 3 by 4% and group 4 by 3%. The main motivation for reducing energy use was saving money, reported by 68% of households. Environmental reasons were stated as the motive by 20%. As the monetary savings from reduced heat consumption are small, the authors deduce that this explains the small percentages in reduced heat consumption. As to electricity consumption, the mean savings during the experiment were 7% for group 1.5% in groups 2 and three and 1% in group 4. Electricity use varied during the course of the experiment, but in the first stage, when groups 1–3 started to receive feedback, electricity consumption was reduced at most by 21% (in group 1) and at least by 14% (group 4). For water consumption there were no statistically significant changes in consumption between the groups (Haakana et al. 1997).

Based on the results, the authors conclude that the feedback material had the most impact on energy savings. Over 40% of households reported that feedback had made them think about their consumption and 13% altered habits due to feedback. It must be noted that in this experiment feedback was made according to the wishes of households. To begin with, households were asked what kind of feedback they would find most interesting, and the feedback forms were made based on the answers. It seems that comparisons are highly valued: 83% households wanted comparisons between own consumption and similar houses in Finland, and 69% wanted comparisons also with participants of the study. Households were also interested in seeing energy consumption translated into costs (Haakana et al. 1997).

It is also interesting to look at an experiment carried out in the Netherlands, as it is concerned with reducing both direct and indirect energy use by the means of an internet based tool. Indirect energy use in this case refers to energy embodied in the expenditures of households. The experiment was concerned especially with the effectiveness of combined tailored information, goal setting and feedback. Almost 200 households within the same city participated in the study (Abrahamse et al. 2007).

The participants were divided in to two experimental groups and one control group. Each group filled in a questionnaire about energy related behaviours, and the information was used to calculate the direct and indirect energy use of each household. The experimental groups then received information about the environmental issues related to energy use, tailored information on energy savings and an individual goal of 5% energy savings. In addition, the second experimental group was assigned a 5% group reduction target. The tailored information included energy saving options specific to each household. After two months, the experimental groups filled out the questionnaire again, this time receiving tailored information and tailored feedback on their energy behaviours. The feedback indicated how much the household had saved energy since the beginning of the experiment. The savings were expressed as percentage of energy use in comparison to the first measurement, and in monetary terms. In addition, feedback was given about which behaviours had contributed to the energy savings. The intervention was repeated five months after the initial questionnaire. The control group filled in the questionnaire again at the time of the last intervention, but received no energy-related information (Abrahamse et al. 2007).

Total energy use of each household was calculated based on the use and ownership of electric appliances and other energy related behaviours. Energy savings were based on changes in these behaviours, reported by the participants. After the last intervention, total energy use by all households (experimental groups and control group) had decreased, but the decrease was only marginally significant. There was no statistically significant difference in energy savings between the experimental groups and the control group. When looking at direct energy use, the experimental groups reduced energy use by 8.3% while the control group increased energy use by 0.4%. There was no significant difference in the energy use of the experimental groups. Savings in indirect energy use were much less (3.8% decrease, 0.3% increase), and there was no significant difference between the control and experimental groups. The study looked at a total of 27 different energy-related behaviours. Of these, 15 were measured so that comparisons could be made before interventions and after the final intervention. For nine behaviours a significant change was measured, however, there was so significant difference between the experimental and control groups. Changes occurred especially in those behaviours that were easy to implement and did not require large effort, for example adjusting indoor temperature or using appliances efficiently (Abrahamse et al. 2007).

The authors conclude that the combination of tailored information, feedback and goal setting was successful in reducing direct energy use and that households did adopt energy saving behaviours. The additional impact from a group goal and group feedback was not significant. The fact that total energy savings did not statistically differ between the experimental and control group could be because there were very large variances in indirect energy use within groups due to for example holidays. When holidays were not included in the analysis, the

experimental groups did reduce total energy use significantly more than the control group. Because energy savings were calculated based on self-reported behaviour, they cannot be taken as accurate measures (Abrahamse et al. 2007).

3.4.2 Feedback and health issues

Computerised, tailored feedback has been used for providing people with information about issues related to health and nutrition. For example fruit and vegetable intake, smoking, breast cancer awareness and weight control have been tested with these facilities. The idea behind personal feedback is that it is similar to personal counselling, but cheaper to implement. The process consists of a "diagnosis" followed by information on personal health-related behaviour and suggestions for changes.

In early applications the diagnosis was made by having people fill out a written questionnaire on background information such as socio-demographic variables, health indicators and attitudes. These questions are often selected based on some view of the theory of behaviour. The background information provides data based on which a computer selects from a pre-determined file of messages the appropriate message to send to each participant. The feedback is then printed and sent by mail to the participants in the form of a personal letter. The variables based on which the message is chosen may vary according to what action is being targeted by the feedback. As computers and the internet have become more widely available, it has been possible to develop new applications in which the background information may be entered into the computer directly by the participant. Feedback may be provided immediately, or the internet may be utilised for distributing information. (Brug and van Assema, 2000; Brug et al. 1999). An example of internet-based health information are smoking cessation cites. These may combine information, peer support groups in the form of forums and chats and tailored information based on online questionnaires. (Etter, 2006).

The results of early applications show that personalised information tends to be better received than traditional formats of general information. A review of such studies is provided by Brug et al. (1999) who summarise the findings of eight studies. These were related to nutrition education, most often fat reduction and increasing fruit and vegetable consumption. Feedback based on the background information was provided in written form, most often in the form of a personal letter. This was compared to general information and/or no information. The results indicate that personalised information was more often read, remembered and appreciated than general information. All studies but one reported significant differences in fruit/vegetable and fat intake between the experiment group and control group, although the difference was often modest. The largest differences were found by Campell et al. (1994), who reported a 23% reduction in fat intake for the experimental group compared to a 9% reduction in the control group

which received only general information. There is thus reason to conclude that such personal feedback and information have a positive impact on health-related behaviour. However, all but one of the studies were one-shot experiments and not much can be said about the long-term impacts.

The impact of iterative feedback was studied by Brug et al. (1999) by sending not one but two tailored personal letters to the experiment group. The second letter was tailored based on the impacts of the first letter. The time span of the study was three to four months and the iterative feedback had a stronger impact than a single intervention. Nevertheless, based on the reviewed studies, it is not known whether behavioural changes were persistent. This would have required a much longer follow-up period. Also, the changes in behaviour were evaluated by the participants themselves, which may introduce bias into the results. (Brug et al. 1999).

The background information in the questionnaires makes it possible to distinguish between participants based on qualities such as education or motivation for change. Brug and van Assema (2000) used this possibility to study what affect these qualities had on how personalised information was received and understood. Often it is expected that highly motivated people are more willing to change their behaviour and acknowledge information, and that a higher education increases the ability to receive information. Brug and van Assema divided their sample into three stages of change in behaviour and three levels of education. Their sample was self-selected and a third of the participants were in the stage of pre-contemplation, meaning they were not planning to change their fat intake in the near future. This indicates that not only those people already committed to changing their behaviour are interested in information and feedback. The authors looked at differences in use, perceived effects and appreciation of the information according to the motivation to change and education. A significant effect of education was found for how interesting the tailored feedback was and for how interesting information about fat was. For both, the lowest educated group rated these highest. A significant effect of motivation was found for how credible the information was rated, with those respondents who had already decided to change their behaviour giving the highest rating. Both motivation and education were found to be significant for personal relevance, with the lowest educated group giving the highest rating and those in the stage of having made the decision to change behaviour. No significant interaction effects between education and motivation were found (Brug and van Assema, 2000).

The results seem to counteract the usual perception that higher education is associated with better understanding and appreciation of information. However, what the authors point out is that the personal feedback sent to participants was tailored according to their education. Thus, it was seen to that the information was easy to understand, and therefore what the results actually indicate is that

feedback that is tailored also to the recipients education can be useful for all levels of education.

4 Environmental product information for consumers

In the Climate Bonus project, the internet based monitoring programme of the Climate Bonus system is the channel to reach the consumers. However, in the further development of the system, a broader set of communication channels might be needed. In addition, it is good to review the general knowledge about environmental information to consumers, as this can be used both for the design of the internet based monitoring as well as to the design of other supporting communication tools. The possible supporting tools include e.g. product-related communication in packages and shelves at the markets, brochures and internet at the markets, informing about the carbon footprint in the receipt of each purchase occasion, communication via the media, and public information campaigns (or themes in a campaign of a related broader subject, like a climate change mitigation campaign).

In this chapter about environmental communication, first general viewpoints about environmental information to consumers are presented. Then aspects related to climate calculators and some other forms of environmental information like environmental product declarations (EPD's) and eco-labels are presented. Especially EPDs are relevant here, as the carbon footprint value can be seen as a subtract from the EPD presenting several environmental impacts classes and not just climate change impacts. After, some features specific to Climate Bonus System are presented. Finally conclusions about relevant communication aspects in the further development work with Climate Bonus System are outlined.

4.1 General notions about environmental information for consumers

As described in a Nordic manual about environmental communication to consumers (NCM 2007), a characteristic of the communication is that it tries to influence consumers through persuasion, argument, fascination, education etc. It tries to encourage consumers to accept voluntarily a specific message and act at their own initiative. Consumers are not forced to accept the message, and they are not promised any material reward for doing so. – Now one can straight away remark here that the Climate Bonus system may include much more than just environmental communication to consumers, as one can also tie up a reward for consumers if they behave more climate-friendly than they did before or they reference group does.

Comprehensibility is a critical feature of the information, and this is especially true for environmental information like climate change impacts and carbon footprints. As Schmidt and Poulsen (2007) noted, selecting most relevant environmental information and presenting it in a way which is understandable for common consumers is a main challenge. On the one hand, the information should

be simple, but on the other hand it should be sufficiently comprehensive and precise for the consumer to make the “right” choice, distinguishing between products with different environmental characteristics. But it should also be recognized that “very green” consumers seem to be willing to use detailed environmental information, e.g. as found in standardized EPD’s. In this case, one important element in this is that the information should be 3rd-party certified, because self-declared information is not considered as trustworthy. There is thus a future demand for differentiated environmental information, targeted at consumers with different needs and will to use the information.

Regarding the Climate Bonus system, the carbon footprint values as such given do not tell much to people, and they must be illustrated. This was done already at the first phase of the system, by relating the value to those of a reference group and a target value. It is also evident that some people do not want to see more than just the carbon footprint of their purchases and the guide, i.e. practical hints related to one's own purchases, whereas some people want to see the detailed structure of their carbon footprint balance, i.e. carbon footprint of each purchased product.

Credibility is of course an essential feature of the information. First, the information should be credible 'at the first glance', to win the consumer's attention and motivation go further. Second, the information should have so firm basis that it will stand against any critical statement, which surely will occur when such a common service will be launched. – Regarding Climate Bonus system, objective outlook of the Internet-site may be crucial, as well as visible presentation of the state organizations as the developers and administrators of the system. However, long-term credibility is maintained only by objective responses to any presented critics and questions by the users (FAQ-portion is very important at the Internet-site), as well as active development of the system which of course includes e.g. periodical updating of the system. And last but not least, credibility of each carbon footprint value in the system is important, and here the sources and verifiers of the information play a crucial role.

Reasonable feedback to the apparently climate friendly choices that people make is a pre-requisite to an understandable and credible climate calculators and the Climate Bonus system – any calculator that 'does not calculate' is not usable! And when there are consumption choices that are not properly handled by the system, feedback about this is needed. This will be a crucial challenge to the Climate Bonus system, as much of the carbon footprint information is at the moment only available at product group level, e.g. as estimates from the so called input output methods like the Finnish 'Envimat' (see Climate Bonus report of WP 3). It means that the selection of one brand over another at the market does not yet produce any difference to the carbon footprint of the purchases.

The guiding effect of the information is closely connected to the reasonable feedback. As long as e.g. food products, textiles and furniture are treated at the product group level, the positive feedback to the consumer comes from changes in the structure of consumption (i.e. substitution of one product group with another) or diminished consumption (e.g. decrease in the use of gasoline for a car and heat and electricity for an apartment). But it does not guide to make choices between brands, i.e. two brands of pasta, which can be the most obvious choice for many people at the market. Think e.g. a person that has decided about the menu already at home, checked the recipes, and made the purchasing list. If the Climate Bonus system does not include brand-specific information, there is no feedback even if the person may carefully consider each purchased food item. It is then crucial, how the guiding effect is understood and planned by the developer of the system, and how the missing and existing types of feedback are explained to the consumer. Even in a world of perfect carbon footprint information about every product, this would be an important matter to consider: what kind of feedback people get from the system, how the system guides people? Now it is important and complicated matter, as there are choices which quite evidently have very different carbon footprints (i.e. pasta from Finland and Italy) but for which the system does not give feedback. It is good to note here that this can undermine also the credibility of the system. Credibility might be increased if the data with different credibility and accuracy would be indicated in possible product specific printings, but this could again undermine the comprehensibility of the system.

Accuracy of the information is often considered as one of the key elements by researchers that work to produce the information. It is of course connected to the credibility of the information, too. However, one can claim that considering the consumer, the accuracy is important only when it has major effects on the feedback. In the purchasing situation, even if 'exact' product-specific carbon footprint values exist, when do they indicate any real differences between substituting brands or product groups? And does consumer understand what is a real difference, even if confidence intervals were shown instead of values? And how the accuracy is reflected in the carbon footprint balance shown at Internet and affecting the possible reward (bonus) from the system? If the results are highly inaccurate, any comparisons between brands of a specific product (i.e. pasta) may be meaningless. Then the carbon footprints, even if product-specific estimates, would only guide to follow some great lines in the choices, e.g. from rice to potatoes, from meat to vegetables, from milk to water. These are choices that can be communicated with other means, without a Climate Bonus system – on the other hand, as an automatic data collection application the Climate Bonus system can anyway be an attractive way to give feedback also about the impacts of such great lines in one's choices.

4.2 Climate Calculators

Hertwich et al. (2008) analysed essential features of climate calculators. They remind about usability goals, including that the system should be easy to use and easy to remember how to use it, and the system should be motivating and rewarding to use. In addition, one can mention such usability principles as (Nielsen 2001, as referred in Hertwich et al. 2008):

- Visibility of the system status – keeping users informed about what is going on.
- Match between the system and the real world – speaking the user's language and following real-world conventions.
- Error prevention – recognition rather than recall – minimising the user's memory load.
- Flexibility and efficiency of use – cater to both inexperienced and experienced users.
- Aesthetic and minimalist design – avoid irrelevant information. Provide help and documentation

Hertwich et al. (2008) remind that if the application is to be a means for measuring environmental performance and triggering behavioural change over time, the system must encourage and facilitate repeated use. Information and functionality must be organized and presented in such a way that suits both first-time users and experienced users, for example by making the most basic functionality visible and immediate for novice users, while providing additional levels of complexity, features and information to more experienced users.

Regarding the presentation of results, people should be given the opportunity to compare own climate impacts with their peers, and local and national averages or normative information on sustainable consumption. It is good if there are different levels of detail and sophistication, enabling different levels of accuracy in measurements. People should be allowed to set their own goals and choose the output presentation format most understandable and meaningful to them – this can be graphics or numbers or both. (Hertwich et al. 2008).

Related to advising and guiding of consumers, Hertwich et al. (2008) warn that individuals became frustrated when they either do not understand what they are asked to do, they cannot follow the advice given, or they perceive the information or advice is irrelevant for their own situation. Based on the background data about the household and lifestyles as well as the carbon

footprints of purchases and activities, the system should customize proposals for alternative behaviour and purchases (for decreasing the climate impacts).

Gunnarsson et al (2009) reviewed nine web based carbon calculators. The calculators were assessed first in terms of various quality demands, such as user-friendliness, transparency of assumptions and calculations, adaptability to the characteristics of the testing consumer (household), and clarity about the purpose of the calculator. Subsequently, the calculators were tested on their quantitative accuracy by applying a set of household circumstances for which the carbon footprint could be assessed reasonably accurately on the basis of other sources (i.e. a benchmark interval of the likely overall carbon footprint was available). The most transparent and user-friendly calculators did not necessarily produce the most credible estimate of the carbon footprint, whereas the spread in estimated footprints was quite large. Since internet calculators abound accuracy becomes truly an issue, similarly as is the case for the Climate Bonus system. Some kind of common quality assurance system was suggested.

All in all we conclude that internet based carbon calculators can be helpful in eliciting serious interest among households with respect to the climate implications of their consumption habits and the notion that they might do something about it. Those calculators are however not suitable for systematic monitoring and therefore neither for a wide scale changing of consumption habits.

4.3 Standardized environmental labels and declarations

It is good to note here that part of the information instruments have been standardised, and in the following sections some assessments about the efficiency of especially these information channels are presented. Eco-labels and the supporting schemes, i.e. type I labeling, are defined in the standard ISO 14024. Self-declared claims, i.e. type II labeling, are governed by the standard ISO 14023. They are short statements, symbols or graphics that a producer can be used in order to indicate specific environmental aspects of a product, component or packaging. Environmental Product Declarations (EPDs), i.e. type III labelling, are defined in the standard ISO 14025. They are based on life cycle assessments (LCA's) and the instructions and e.g. the format of information sheets given in the EPD system. However, it is good to note here that many so called environmental declarations do not adhere to the standard.

4.3.1 Environmental product declarations, Eco-benchmark and Eco-labels

Schmidt and Poulsen (2007) made a review study focusing on environmental product declarations (EPD). They focused on the presentation of the results,

which are detailed and cover several environmental impact classes from LCA's. They listed the following features and aspects the communication of the results:

- The environmental consequences of purchasing decisions rarely affect consumers individually and immediately.

- On the other hand, consumers are asking for environmental product information that they can use in purchasing situations. Consumers want comparable and reliable environmental information on environmental product qualities.

- The consumers are willing to require environmental information, but that their willingness needs to be turned into practice. To persuade consumers to do so, they must be made aware of why it is essential and what questions they should ask. This can be realized through general environmental information to consumers through the sources they use to find product information: newspapers, advertisements, the Internet, special interest magazines and consumer magazines.

- Consumers' ability and motivation are very limited regarding assimilation of the (environmental) information in the form of graphic or quantitative environmental product declarations.

- Environmental aspects are likely to receive higher attention when they are connected to individual aspects such as personal health (e.g. organic food products) and private economy (e.g. energy efficiency and related economical effects).

- Consumers' acceptance of detailed and complex environmental information is higher for more complex and expensive products.

- Since consumers may have many motives for purchasing e.g. green electronic products, information needs to be multi-facetted. Arguments can emphasise the facts that green electronic products are a quality parameter, that they are healthier and that they save money.

- Consumers are positive about the idea of a simplified environmental declaration, as it would help them base their choice on the environmental qualities they find most important, e.g. chemical substances, energy consumption or reusability. Consumers want the information in the simplified environmental declaration to be verified.

Eco-Benchmark is a way to inform Finnish citizens about the environmental impacts of various products and services, presuming that a life cycle assessment (LCA) has been done of the product/service in question. The presentation type of

Eco-Benchmark integrates five environmental impact classes to one structured bar, however presenting also the impact classes in their own units of expression. In developing the Eco-Benchmark, the communication of quantitative environmental information, i.e. numbers and bars, was studied (Nissinen et al. 2006, Heiskanen et al. 2007). Around 60 people discussed in 10 focus groups, and it was found that even if most people preferred the simpler presentation formats, including ones based on aggregated and weighted results, there was in each group one or two people who were not prepared to leave the weighting of environmental impacts to anonymous experts. So it was concluded that there is reason to retain the detailed data alongside the aggregated results in public communications – people are different in this respect (i.e. the need for detailed results before making own conclusions and decisions).

Another aspect was that even with aggregated data, many of the users considered the information too complex – and perhaps, too undiscriminating – to be used as a "proxy eco-label" on product packaging. But at the same time, one of the most important strengths of the benchmarks was their quantitative nature, enabling consumers to identify large and important decisions, such as housing and space heating. From the people, many alternative suggestions for presentation formats were received, ranging from colour-coding to awarding points similar to those used by the WeightWatchers.

One specific theme in the focus groups was how people deal with the gaps, uncertainty and inaccuracy of the underlying data. The lack of credible and accurate LCA data as well as totally missing data for such important environmental impact classes as eco-toxic impacts of chemicals and impacts of land use on biodiversity were felt by the researchers as serious problems during the whole development work, and they wanted to see how people can deal with the shortcomings that this caused to the developed tool, i.e. Eco-Benchmark. Quite positive, it turned out that people understood quite well that the LCA results do not present 'the whole truth' of the environmental impacts of the products in question, but the best available information at the moment, which was however considered as useful. (Heiskanen & Timonen 2005).

Leire and Thidell (2005) made a review research on consumer perceptions, understanding and use of product-related environmental information. They concluded that it seems as if consumers, in general, have difficulties in relating environmental problems to products, in making distinctions between green and conventional products, and in grasping the environmental benefits of purchasing eco-labelled products. Further, they refer to studies which suggest that many consumers, who value product-related environmental information, do not differentiate between information on environmental, health and safety issues, but tend to view them holistically as an additional property of the product. And it has also been found that health is the main reason for many consumers to choose eco-labelled products.

Some other results of Leire and Thidell (2005):

- Findings on consumer preferences in terms of the information format and the level of detail are somewhat inconsistent. Some claim that a majority of consumers appreciate the simplicity of logotypes as information carriers for most every-day products. A diverging message is that a number of consumers find the simple symbols insufficient and would like to obtain additional information. As a way to meet the declared demand for more information, these studies propose expanded textual information, simple declarations explaining the significant environmental features of the products or a combination of labels and explanatory texts. The fact that people require different levels of elaborateness was well seen in the Finnish Eco-Benchmark project (see above). Some people did not want to see more details than just the aggregated result of five environmental impact classes, relying totally on expert judgements about the weights of the environmental impact classes. Meanwhile a part of people insisted to see the disaggregated results, i.e. each environmental impact class in it's own figure.

- Consumers seem to perceive as positive the opportunity that EPDs provide to prioritise among environmental aspects. Furthermore, comprehensive and quantitative information is reported to trigger positive judgements about the reliability of the information.

- On the other hand, both private and professional consumers have insufficient understanding of the information provided by EPDs and need assistance in the form of user guides or training. (A reason for confusion is that multiple formats of environmental product declarations are in use for comparable products).

- The few studies on environmental product declarations clearly indicate that the level of detailed information provided by these declarations is perceived as far too complex to be useful in making purchase decisions. One immediate issue is that consumers (private and professional) face severe difficulties in interpreting and making use of the information those declarations provide. Although the idea of declarations is that consumers should evaluate and compare alternatives based on their own preferences, most of these studies point to a need for enhanced utilisation of transparent guidelines and interpretation tools in order to assist consumers to make more informed choices.

- However, an interesting finding has been that even when consumers cannot interpret the detailed information of extensive declarations, such information is perceived as trustworthy and does build environmental credence toward the products.

- Regarding self declarations, they appear to have a weak trustworthiness as the information is not controlled or certified.

- Regarding the mandatory energy labels, consumers are positive, and apparently the reason is that consumers find the grading system helpful.

- Regarding producers' self-declared environmental claims, consumers react negatively to the information that is issued by producers and similarly to information that is not certified by third parties. In general, consumers prefer independently verified information.

- Reports repeatedly conclude that there is a discrepancy between consumers' intentions and their behaviour. Consumers are often found to overestimate their use of product-related environmental information. The most influential factors for the discrepancy were found to be that consumers prioritise other aspects, such as price and quality, and that purchases are guided by habits. Both private and professional consumers are reported to lack the time and financial resources for searching and examining environmental information during the purchase situation.

- Public awareness of the link between products, consumption and the caused environmental impacts is an area that requires further attention. A great number of individuals are still not perceptive to the environmental impacts of particular products and thus, are not likely to be interested in product-related environmental information. Obviously a Climate Bonus system offers good possibilities to make the link visible between products and climate change, as the carbon foot-print of each product directly indicates the relation between the problem and the product. On the other hand, the lack of product specific data and the obvious solution to use inaccurate estimates of wide product groups may undermine this.

- Consumers are aware of but do not use to the extent they claim. More product-related environmental information is certainly needed for additional products and product groups, but currently the information is not the limiting factor for consumers to choose green products. The existing information is not fully utilised.

- They stress the role of retailers and sales to serve as 'ecological gatekeepers', and indicate that generally, sales personnel have limited knowledge about eco-labels, but that they could potentially, help to guide consumers towards using product-related environmental information. This is evidently the case also with the Climate Bonus system, so that sales personnel at the markets could have a large role in introducing the system to clients and guiding them in the use of it.

4.3.2 Eco-labels

Eco-labels have been dealt somewhat in the previous chapter, but here the focus is totally on them. Eco-labels of course differ a lot from the way that the environmental information is used and shown to consumers in the Climate Bonus system: type I eco-labels point to ecologically good choices, and the label is voluntary for the manufacturers. However, as eco-labels are evidently the most visible product-specific environmental information system to consumers, it is worth seeing what has proven to be crucial for the efficiency of this type of communication.

From the Nordic Eco-labelling Scheme, the Swan label, a lot of experiences have been received during the 20 years of implementation, the scheme being adopted in 1989 and evaluated three times since 2009 (Aalto et al. 2008). The Swan's greatest strength was seen in its power to communicate a complex message in a simple form. Yet, it was also noted that the eco-labelling tool has limited possibilities to influence total consumption as well as consumers' use of goods and services – the label focus on the selection of one product/service over another. The role of the Nordic Swan vis-à-vis other environmental information systems has been raised up several times, which is a relevant issue for any environmental information system.

Regarding EU eco-label scheme, an evaluation reported in 2005 concluded that the original ideas behind the voluntary scheme are still valid and desirable: The EU Eco-label provides EU consumers with an environmental certification they can trust, and it can give businesses the opportunity to use one label for all their pan-European or global marketing. Yet the evaluation also revealed that there is still low awareness and uneven geographic take-up of the label, and that there are insufficient product group categories. Third-party verification has received strong support e.g. in a public consultation organised in 2007. (Aalto et al. 2008)

In the mid-1990s, the Swan label had gained a common recognition of more than 70% of Finland, Norway and Sweden. The knowledge level concerning the Swan label has increased in the Nordic countries since 1998. At that time, about every second respondent (48%) said the idea of the brand is to be "environmentally friendly" and every fifth (19%) identified the Swan as an "environmental brand". Respectively in 2004 more than the half of the respondents (57%) chose "environmentally friendly" and every fourth (26%) "environmental brand". The most recent survey from 2006 shows the Swan label is extremely well-known today. Among the Swedes and the Finns over 90% recognize the label. (Aalto et al. 2008)

The most recent survey (Taloustutkimus 2006, as referred in Aalto et al. 2008) also indicates that the image of the Nordic Swan has developed positively, and mostly in the direction aspired to in the Nordic Eco-labelling Board marketing

strategy. The respondents from all Nordic countries associated the label with the word 'environment', but also with the terms 'future' and 'credibility'. In particular, associations with the term 'future' had grown in the total Nordic sample since 2004, with the most visible growth in Finland and Norway. Additionally, the Finnish respondents associated the Swan strongly with 'quality', whereas this association was not equally strong in the other Nordic countries. The EU Eco-label was not as well-known as the Swan. In Finland, 24% of the respondents identified the correct meaning of the label in 2006.

The reasons for the differences are most likely partly due to the marketing efforts devoted to the Swan (see section 4.5). A broader reason may be that the Swan has managed to create (at least in part of the market) a 'virtuous cycle' of large numbers of criteria and licenses and market visibility, which in turn enables forceful marketing campaigns. The EU Eco-label has not yet been able to build up similar 'critical mass' in most of the Nordic countries. The 'virtuous cycle' of the Swan involves a further aspect. Widespread public recognition, in turn, creates brand value that supports the marketing of the label to new potential license-holders. For example, in Finland, the Swan has been among the ten most respected brands for many years.

As a conclusion, visibility of the Swan in the market is important in order to support public information campaigns, and vice-versa: public information is important to create demand for labelled products. (Aalto et al. 2008).

4.4 Presenting carbon footprint information

The obvious way to express personal and household-specific carbon footprint values is to express them as carbon dioxide equivalents, i.e. kg CO_2 eq. However, the unit looks quite technical and represents a scale that does not as such tell anything to most people.

Another option is offered by normalization, which is a normal procedure in the interpretation of results from life cycle assessments. The greenhouse gas emissions would be normalized by relating them to the annual contribution from an average consumer in a country or e.g. in the EU or the whole world. Detailed inventories, e.g. from IPCC, are available for this purpose, and the result is that the average World citizen emits greenhouse gases corresponding to 8700 kg CO2-equivalents per year (Stranddorf et al 2005 as cited in Schmidt and Poulsen 2007). The results can be reported as Person Equivalents (PE). For convenience, it can often be convenient to present the results in milli-person equivalents (mPE), where one PE is equal to 1000 mPE.

If Finland-specific values of greenhouse gas emission are preferred for normalization, the value that corresponds best to the above presented world value

is around 15 000 kg CO2-equivalents per year (Seppälä et al. 2009). However, input-output analyses also offer the greenhouse gas emission of private consumption, which is around 9 000 kg CO2-equivalents per year (Seppälä et al. 2009). This might be easier for people to recognize as the 'average climate impact of consumption' than the one measured from the total emissions of Finland, but on the other hand it is not internationally comparable as input-output studies have been done only from a number of countries and even they have differences in the methodology and thus are not comparable.

4.5 Specific features of the Climate Bonus System as a channel for environ-mental information to consumers

The Climate Bonus system integrates many properties and features of different instruments for delivering environmental information to people and persuading them to change their behaviour to a more climate friendly one. It takes information and may work hand in hand with climate labels, like the one by Carbon Trust. It includes a climate calculator. Supporting the information given by eco-labels, it can inform about choices that have smaller carbon footprint than other comparable products. It can use the climate impact data from environmental product declarations (EPDs) and give benchmarks to the values from EPD's.

In addition, the visionary future Climate Bonus System includes specific features which make it quite unique in the field of environmental information (and in the field of environmental policy instruments, which is dealt with in the report of WP6). First, regarding the type of information, it collects and handles quantitative climate impact information from the levels of individual households, market, country levels and any level between. Second, which is crucial for the work load needed of consumers, the data collection from each level is automatic. Third, regarding the motivation of people to use the system, it offers a reward to consumers from climate friendly behaviour and purchasing choices.

One can mention here also the specific features of computer technology when any kind of persuasion is striven for (here it is the persuasion of people to change their behaviour and purchasing so that their climate impacts would decrease): Computers are persistent, have access to and control unlimited amounts of data, may create convincing multimedia experiences and enter people's homes (IJsselstein et al. 2006, as referred in Hertwich et al. 2008).

5 The incentive system

5.1 Introduction

In the envisaged Climate Bonus system reward or incentive systems can be considered at two levels. On the one hand there could be an incentive system for supply chain participants or just for retailers, which would be based on the achieved emission reductions of embodied in the sales. On the other hand a reward system for households (consumers) can be devised such that consumers, who manage to reduce the (embodied) emissions of their purchases sufficiently, will get rewarded. In this report the focus is on the consumer incentives, whereas in the WP6 report supply chain incentives will be discussed.

More in particular the first concern is to devise a simple bonus point system for the consumer pilot of the Climate Bonus project. In all likelihood the bonus system for the pilot will differ considerably from eventual commercially applicable systems, but it should serve the essential feature, namely that consumers adapt their purchase behaviour in response to an anticipated reward for the 'right' behaviour. The bonus system will be implemented in the Demo interface, about which is reported in more detail in the WP5 report.

5.2 Necessary and possible features

The incentive or bonus feature is supposed to function as an additional motivator on top of the monitoring system. For a start the bonus system can assist to make participation in the carbon monitoring system more attractive. This is supposedly in particular relevant for hesitant consumers, i.e. those who basically agree with the eventual purpose, but wonder about possible adverse effects regarding the fulfilment of their household's consumption requirements. Second, it should assist to achieve more emission reduction than otherwise would have been the case, by boosting or at least keeping up motivation. In the pilot we can only test the second feature, not the impact on willingness to participate. Furthermore, in the context of some kind of consumption restraint any feedback on use is much more effective if the consumer has accepted a (self-imposed) reduction target. This is particularly true for reward systems, since they constitute a kind of meta-feedback (i.e. feedback on how effectively one has responded to the original feedback). Yet, within the context of the *first* field test of the system (see the report of WP5) self-imposed targets were regarded (by the researchers) as too burdensome a complication, as it would require extensive information and clarification to give participants the impression they chose a justified target, while the participants had already to learn and get accustomed with many other features and facts.

Rewards, bonus points or rebates could also be offered in relation to the market introduction of new low emission alternatives. As we learned in chapter 2 the habitual character of many product choices implied that new products need extra attention and attractors to make consumer reassess their choices. Subsequently in order to improve the chances that the reassessment results in a change of choice, a reward system, notably rebates, would help to overcome the compatibility effect (see section 2.1) as it easily ties in with price comparison. Yet, within the context of the first modestly sized field test the inclusion of bonus options in relation to new product promotion was practically and commercially unfeasible.

Another necessary feature of a bonus system is that it should be straightforward, meaning that an increase in achieved emission reductions should translate into an increase in bonus points. A complication is however that the smaller the reductions in emission intensity of purchases the riskier it gets to claim actual improvements. This is due to uncertainties in the carbon footprints and the underlying information (see also the report of WP3). This means that some kind of threshold has to be applied, such that bonus points are only awarded after passing the threshold. A second complication is formed by the fact that even consumers, who are quite loyal to a retail chain, will purchase a not negligible share of their purchases from elsewhere. In principle consumers could even try to exploit the reward system by trying to purchase as selectively as possible, depending on what retail chain is rewarding what sort of behaviour. A solution to this would be to use an award system based on the *emission intensity* of the registered purchases instead of basing it on absolute amounts of emissions.

5.3 The bonus system in the pilot

As it is essential to be able to assess the impact of bonus systems on consumer responsiveness separately from that of monitoring systems, approximately 50% of the participating households was offered carbon monitoring services only, while the other half was offered both carbon monitoring *and* bonuses. As the participants spread out over three urban areas, the two smaller groups in Turku and Joensuu were offered both the monitoring service and the bonus option, whereas the larger group in the greater Helsinki area got the monitoring service only.

For reasons explained in section 5.2 the bonuses were awarded on the basis of calculated emission *intensities* of the registered purchases. The bonus was awarded when the *change in emission intensity* was passing a certain threshold. The threshold depended on the level of the original emission intensity of the typical shopping patterns of a household. In case of already low intensities the threshold was smaller than for average intensities, and vice versa it was larger in case of high original emission intensities.

As explained in the report of WP3 awarding of households should be based on reliable data only (i.e. the award should be truly justified). With this principle in mind it was decided to link the awarding of bonuses to food purchases only, because these were the only automatically registered purchases in the test. So, even though the emission monitoring also provides feedback on emissions from home energy and transportation, the awarding is based on emissions of food stuffs only.

Since we want to know how people *change* their purchase behaviour in response to feedback on the emission levels and in response to bonuses, some kind of pre-pilot reference level should be obtained. This was achieved by adding some questions on shopping and food habits and key household characteristics in a pre-pilot questionnaire. Subsequently this information was combined with the information obtained from the 2006 consumption expenditure survey of Statistics Finland and the internally provided category level carbon footprints, based on earlier work of the Finnish Environmental Institute and Agrifood Research Finland.

Table 5.1 Example of the establishment of the reference levels per household type on the basis of the 2006 household survey*

number of hh_members		1		1		1		2		2		
age category		<30		30-64		65+		<30		30-64	kilo price	emissions
net income		14 179 €		23 270 €		17 664 €		29 160 €		46 806 €	€/kg	kgCO2ekv/kg
disposable budget		16 773 €		20 116 €		14 622 €		29 822 €		36 318 €		
budget share of foodstuffs		10,2 %		11,4 %		14,6 %		10,2 %		12,9 %		
budget share of fooodstuffs + beverages		13,6 %		15,0 %		16,3 %		13,0 %		16,0 %		
budget share of fooodstuffs + beverages + restaurants		21,2 %		19,2 %		17,1 %		19,7 %		19,4 %		
	emissions	purchases in kg	emissions	purchases in kg	emissions	purchases in kg	emissions	purchases in kg	emissions	purchases in kg	kilo price (€/kg)	specific emissions (kgCO2eq/kg)
fruit, fruit products	-	47,1	-	79,4	-	85,9	-	86,3	-	162,3	x	xx
vegetables	-	8,3	-	11,0	-	8,7	-	16,2	-	22,7	x	xx
greenhouse vegetables	-	19,4	-	26,5	-	19,6	-	34,1	-	51,1	x	xx
leituce, salad	-	3,1	-	4,8	-	3,3	-	4,4	-	7,9	x	xx
potatoes	-	2,0	-	4,5	-	2,8	-	5,8	-	8,7	x	xx
other veghetables	-	20,2	-	41,1	-	52,2	-	41,3	-	99,7	x	xx
cereals and pastry	-	90,4	-	115,6	-	111,3	-	150,6	-	215,0	x	xx
rice, rice products	-	3,5	-	3,7	-	2,2	-	7,1	-	7,1	x	xx
milk products	-	117,7	-	154,1	-	157,2	-	218,6	-	296,7	x	xx
cheese	-	15,3	-	19,2	-	13,8	-	31,4	-	44,4	x	xx
fats and oils	-	6,3	-	14,4	-	18,6	-	13,7	-	30,7	x	xx
eggs	-	3,8	-	8,9	-	10,0	-	9,8	-	17,1	x	xx
fish	-	5,8	-	16,6	-	16,7	-	10,9	-	31,2	x	xx
meat products	-	28,4	-	50,5	-	41,6	-	51,0	-	94,1	x	xx
beef	-	2,5	-	2,5	-	3,6	-	3,2	-	7,9	x	xx
other meat	-	17,1	-	23,1	-	19,0	-	36,9	-	64,2	x	xx
coffee and tea	-	2,3	-	3,7	-	4,2	-	2,7	-	7,0	x	xx
juices	-	9,5	-	10,0	-	6,4	-	18,5	-	14,5	x	xx
non-alcoholic beverages	-	52,0	-	43,6	-	15,4	-	79,6	-	66,3	x	xx
alcoholic beverages	-	314,8	-	410,4	-	95,3	-	449,7	-	703,1	x	xx
sugar, sweets	-	28,4	-	26,3	-	16,7	-	44,3	-	41,6	x	xx
infant nutrition	-	0,6	-	0,8	-	0,6	-	1,0	-	1,5	x	xx
other food	-	28,4	-	30,4	-	19,5	-	42,7	-	60,4	x	xx
kg CO2; kg food per hh	691	827	978	1101	863	725	1264	1360	1987	2055		
kg CO2 per person	691		978		863		632		994			
kg CO2 per kg food		0,84		0,89		1,19		0,93		0,97		

*) Only a part of the household types is shown and for confidentiality reasons no unit prices or specific emission figures can be shown.

The generic reference levels as shown in table 5.1 were subsequently differentiated by food pattern, meaning that a household consumes significantly more or less meat and/or dairy products than the average of that household type. For the resulting table of differentiated figures threshold levels were established

for the possible activation of the correction term. In practice this meant that for reductions achieved for high initial intensity levels a lower (0.5) award effect was applied, whereas for reductions achieved at already low intensity levels an elevated award level (1.5) was used. In summary, the threshold levels for awarding bonuses were established in three steps

- Select appropriate generic intensity level for that household type
- Correct for possible significant deviations in food patterns (dairy and meat)
- Establish applicable threshold level for bonus awarding

Considering current shadow values applied to client bonus systems and considering the implied prices of carbon dioxide in the emission trade system, it was decided to apply a shadow value of € 0.10 per kilo of CO_2 equivalent. Assuming that in future version the greater part of household emissions could be addressed, while reductions of 5% to 20% would be possible, the award system would enable bonus earnings up to 400 euro. For food only, the interval would be between 50 and 100 euro.

The awarding of bonuses as applied in the pilot was based on the following formula:

$$B_{it} = (I_{i0} - I_{it}) \cdot V_{it} \cdot k_i \cdot (365 \ / \ N_t)$$

B_{it}	Bonus points collected by household *i* in time period *t*
I_{i0}	Intensity of the purchases of household *i* at the start of the monitoring
I_{it}	Intensity of the purchases of household *i* in period *t*
V_{it}	Volume of registered purchases (in kg) of household *i* in period *t*
k_i	weighting factor of bonus earning based on initial intensity I_{i0} (for a long term use of monitoring system this weight correction factors should be recalibrated depending on the progress households are making)
N_t	Number of days that the monitoring has covered in period *t* (365 refers to a year)

6 Conclusions

For the transition towards a low emission consumption basket the provision of adequate product information to consumers is an essential element. Even if environmental policies mandate full integration of external effects into prices, retail prices cannot be expected to have a sufficiently clear guidance function for consumers. On the one hand there are just too many other factors affecting retail pricing, whereas product specific carbon footprints may have significant uncertainty variations. On the other hand, even if consumer's product choice is heavily influenced by prices, it is in most cases not overwhelmingly dominated by them. Other attributes of products kick in as well, but their influence is often harder to quantify as compared to prices. Systemised information provision on product attributes would help to overcome the compatibility effect and enables consumers to (re)evaluate product choices on a wider basis.

A broader evaluation basis in principle enables consumers to improve their choices and hence augment their utility. Whether the improvement is realised depends on the ease of use of the broader evaluation base and on the extent to which the new information succeeds to touch habits or habitual decision making.

At a generic level Finnish consumers seem to be reasonably aware of the fact that their consumption contributes to the emission of greenhouse gas emissions. They also state to be willing – at least to some extent – to change their consumption patterns. To this can be added that they also wish to get more or more precise information in terms of fitting their personal questions and needs. So, generally speaking there seems to be fertile ground for services such as the envisaged Climate Bonus system.

Experiences with feedback in energy saving actions and personal diet monitoring indicate that this can contribute to significant and lasting changes in consumption patterns. Yet, the design of an appropriate feedback system, which appeals to a large and diverse audience, is fraught with challenges. The information should be sufficient for its purpose, but overall simplicity seems to be the guiding principle. Internet based feedback enables tailoring of the feedback, both in terms of lay-out and contents. Tailoring of the feedback to the needs, wishes and capabilities of the consumer makes the information more effective in terms of response and helps to keep up participation in feedback programmes. Tailoring can even be dynamic, meaning that the feedback system learns from the user and vice versa.

When consumers voluntary participate to monitoring and feedback systems with the aim to achieve some kind of reduction (saving), it is recommendable that the participation includes the acceptance of a self-imposed target.

Feedback experiments and programmes for e.g. energy saving actions and personal diet monitoring schemes can provide useful insights how to set up such schemes and what approximate response level could be expected. Feedback experiments show large variation in effectiveness, i.e. varying between 1% and 20% shifts or reductions in consumption. Generally spoken it seems a reasonable first shot to expect between 5% and 10% reduction of change. In the case of the envisaged Climate Bonus system this would be a so-called static effect (of reduced embodied emissions), meaning that it does not include effects of changes in the product portfolio (new low emission products).

Also in the envisaged Climate Bonus system it is important to carefully consider the trade-off between accurate, but more costly and time consuming, carbon footprints and less accurate, but less costly and quicker to realise, carbon footprints. The credibility of a monitoring and feedback system among others depends on the transparent communication regarding the accuracy levels of the footprints and on the use of the footprints in ways which are appropriate for the accuracy levels of those footprints.

It is also good to realise that consumers get information and feedback via various channels, such as public media, shop advertisements, product packages and labels, and other – often simple – web based climate calculators with limited reliability.

References

Aalto K. – Heiskanen E. – Leire C. – Thidell Å. (2008): The Nordic Swan – From past experiences to future possibilities. The third evaluation of the Nordic ecolabelling scheme. TemaNord 2008:529.

Abrahamse W. – Steg L. – Vlek C. – Rothengatter T. (2007): The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviours, and behavioural antecedents. Journal of Environmental Psychology 27, 265–276.

Andreoni J. (1990): Impure Altruism and Donations to Public Goods: a Theory of Warm Glow giving, *Economic Journal*, Vol. 100, pp. 464–477.

Andreoni J. (1995): Warm-Glow Versus Cold-Prickle: The Effects of Positive and Negative Framing on Cooperation in Experiments, *The Quarterly Journal of Economics*, Vol. 110, No. 1, pp. 1-21

Arvola et al. (1993): Billing feedback as a means to encourage household energy conservation: A field experiment in Helsinki. Proceedings of the 1993 summer study of the European Council for an energy efficient economy. 11–21.

Auh S. – Johson M.D. (2005): Compatibility effects in evaluations of satisfaction and loyalty, *Journal of Economic Psychology*, Vol.26, pp.35–57.

Bartiaux F. (2006): Do information and awareness work? Proceedings: Sustainable Consumption and Production: Opportunities and Threats, 23–25 November 2006, Wuppertal, Germany.

Benders R.M.J. – Kok R. – Moll H.C. – Wiersma G. – Noorman K.J. (2006): New approaches for household energy conservation – In search of personal household energy budgets and energy reduction options, *Energy Policy*, Vol. 34, pp.3612–3622.

Björner T.B. – Hansen L.G. – Russell C.S. (2004): Environmental labelling and consumers' choice – an empirical analysis of the effect of the Nordic Swan, *Journal of Environmental Economics and Management*, Vol. 47, pp.411–434.

Brekke K.A. – Kverndokk, S. – Nyborg, K. (2003): An Economic Model of Moral Motivation, *Journal of Public Economics*, Vol. 87, pp. 1967–1983.

Brug J. – Campbell M. – van Assema P. (1999): The application and impact of computer-generated personalized nutrition education: A review of the literature. Patient education and counselling 36, 145–156.

Brug J. – van Assema P. (2000): Differences in use and impact of computer-tailored dietary fat-feedback according to state of change and education. Appetite 34, 285–293.

Buensdorff, G. – Cordes, C. (2008): Can sustainable consumption be learned? A model of cultural evolution, *Ecological Economics*, Volume 67, Issue 4, pp.646–657.

Campbell M. – DeVellis BM. – Strecher VJ. – Ammerman AS. – DeVellis RF. – Sandler RS. (1994): Improving dietary behaviour: the effectiveness of tailored messages in primary health settings. American Journal of Public Health 84, 783–787.

Darby (2006): The effectiveness of feedback on energy consumption. A review for DEFRA of the literature on metering, billing and direct displays.

Davies A. – Cline Th.W. (2005): A consumer behaviour approach to modelling monopolistic competition, *Journal of Economic Psychology*, Vol.29, pp.797–826.

Eckström R. (2006): *Food, energy and the environment from a Swedish perspective*, dissertation, Royal Institute of Technology dept. of Urban Planning and Environment, Stockholm.

Etter J-F. (2006): internet-based smoking cessation programs. International Journal of Medical Informatics 75, 110–116.

Eurobarometer (2008): *Attitudes of European citizens towards the environment*, Special Eurobarometer, European Commission.

Fischer (2008): Feedback on household energy consumption: a tool for saving energy? *Energy Efficiency,* Vol.36., pp.79–104.

Gunnarsson J. – Kivioja M. – Pyrko J. (2009): It must be Yeti! – Tracking carbon footprints on the web, ECEEE 2009 Conference proceedings, pp. 1811-1819

Haakana et al. (1997): The effect of feedback and focused advice on household energy consumption. Paper presented at the Summer Study of the European Council for an Energy Efficient Economy.

Henryson et al. (2000): Energy efficiency in buildings through information – Swedish perspective, *Energy Policy,* Vol.28, pp.169–180.

Heiskanen E. – Timonen P. – Grönroos J. – Honkanen A. – Katajajuuri J.-M. – Kurppa S. – Mäkinen T. – Nissinen A. – Seppälä J. – Virtanen Y. – Voutilainen P. (2007): Developing a benchmark tool for sustainable consumption: an iterative process, Applied Environmental Education and Communication, Vol. 6, pp.127–137.

Heiskanen E. – Timonen P. (2005): Feedback from consumers about the drafts of Eco-Benchmark. (Only in Finnish: Kuluttajien palautetta mittatikku-ympäristötyökalusta). Kuluttajatutkimuskeskus, Työselosteita ja esitelmiä 90.

Hertwich E. (2006): Accounting for Sustainable Consumption: a Review of Studies of the Environmental Impacts of Households, in Tim Jackson (ed.), *The Earthscan Reader in Sustainable Consumption*, pp. 89–108, Earthscan, London.

Hertwich E. – Larsen H.N. – Pettersen I.N. – Solli C. (2008): Climate calculators and expert sys-tems. Proceedings: Sustainable consumption and production: Framework for action, 10–11 March 2008, Brussels, Belgium. Conference of the sustainable consumption research ex-change (SCORE!) network.

Kotchen M.J. (2005): Impure public goods and the comparative statics of environmentally friendly consumption, *Journal of Environmental Economics and Management*, Vol. 49, pp. 281–300.

IJsselsteijn W. – Kort Y d – Midden C – Eggen B. – Hoven E v d (2006): Persuasive Technology for Human Well-Being: Setting the Scene, in W. IJsselsteijn et al (eds.), *Persuasive Technology,* PERSUASIVE 2006 conference proceedings*,* book series Lecture Notes in Computer Science LNCS 3962, pp. 1–5, Springer-Verlag Berlin-Heidelberg.

Kuittinen O. – Neuvonen A. – Mokka R. – Sivonen R. (2008): *Ilmastoasenteiden muutos ja muuttajat (Change and factors of change in climate attitudes)*, Valtioneuvoston kanslian julkaisusarja 9/2008, Helsinki.

Leire C. – Thidell Å. (2005): Product-related environmental information to guide consumer pur-chases e a review and analysis of research on perceptions, understanding and use among Nordic consumers. Journal of Cleaner Production 13 (2005): 1061–1070.

Liu Jingru – Wang Rusong – Yang Jian-xin (2009): Environment consumption patterns of Chinese urban households and their policy implications, *International Journal of Sustainable Development & World Ecology*, Vol.16, No.1, pp. 9–14.

McCalley L. – Midden C. (2002): Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation, *Journal of Economic Psychology*, Vol. 23, pp. 589–603.

Menges R. – Schröder C. – Traub S. (2005): Altruism, Warm Glow and the Willingness-to-Donate for Green Electricity: An Artefactual Field Experiment, *Environmental & Resource Economics*, Vol. 31, pp.431–458.

NCM (Nordic Council of Ministers) (2007): Environmental information to consumers. A Nordic manual. ANP 2007:750. www.norden.org/pub/miljo/miljo/uk/ANP2006750.pdf

Nissinen A. – Seppälä J. (2008): Eco-labels to provide guidance about product climate impacts to consumers (In Finnish, Tuotteiden ilmastovaikutuksista kertovat merkit). Valtioneuvoston kanslian julkaisusarja 11/2008.

www.vnk.fi/julkaisukansio/2008/j11-tuotteiden-ilmastovaikutuksista-kertovat-merkit/pdf/fi.pdf Press release in English: www.ymparisto.fi/default.asp?contentid=296331&lan=fi&clan=en

Nissinen A. – Grönroos J. – Heiskanen E. – Honkanen A. – Katajajuuri J.-M. – Kurppa S. – Mäkinen T. – Mäenpää I. – Seppälä J. – Timonen P. – Usva K. – Virtanen Y. – Voutilainen P. (2006): Developing benchmarks for consumer-oriented LCA-based environmental information on products, ser-vices and consumption patterns. Journal of Cleaner Production 15(6): 538–549.

Perrels A. – Ahlqvist K. – Heiskanen E. – Lahti P. (2006): *Kestävän kulutuksen mahdollisuudet ekotehokkaassa elinympäristössä (the sustainable consumption potential in an eco-efficient living environment)*, VATT Research report 120.

Roberts J.A. (1996): Green Consumers in 1990s – Profile and Implications for Advertising, *Journal of Business Research*, Vol. 36, No.3, pp. 217–231.

Schmidt A. – Poulsen P.B. (2007): Benchmarking and additional environmental information in the context of Type III environmental declarations. Force technology. www.anec.eu/attachments/ANEC-R&T-2007-ENV-004final.pdf

Seppälä J. – Mäenpää I. – Koskela S. – Mattila T. – Nissinen A. – Katajajuuri J-M – Härmä T. – Korhonen M-R – Saarinen M. – Virtanen Y. (2009): Environmental impacts of material flows caused by the Finnish economy (ENVIMAT), manuscript 12.3.2009. (In Finnish, Suomen kansantalouden materiaalivirtojen ympäristövaikutusten arviointi ENVIMAT mallilla). Project web pages in English: www.environment.fi/syke/envimat

Taloustutkimus (2007): Kansalaisten käsitykset ilmastonmuutoksesta. (The citizen's understanding of climate change), a survey for the Ministry of Trade and Industry as part of the Climate Change Communication Programme, http://www.ilmastonmuutos.info/fi/cfmldocs/index.cfm?ID=1272

Tanner C. – Kast S.W. (2003): Promoting Sustainable Consumption: Determinants of Green Purchases by Swiss Consumers, *Psychology & Marketing*, Vol. 20, No.10, pp. 883–902.

Thaler R. (1999): Mental Accounting Matters, *Journal of Behavioural Decision Making*, Vol.12, pp. 183–206.

Uusitalo O. – Oksanen R. (2004): Ethical Consumerism: A View from Finland, *International Journal of Consumer Studies*, Vol. 28, No. 3, pp. 214–221.

Vemeir I. – Verbeke W. (2006): Sustainable food consumption: Exploring the consumer "attitude - behavioral intention" gap, *Journal of Agricultural & Environmental Ethics*, Vol.19, No.2, pp. 169–194.

Vringer K. (2005): Analysis of the energy requirement for household consumption, dissertation, Utrecht University.

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143:1. Perrels Adriaan – Hongisto Mikko – Hyvönen Kaarina – Katajajuuri Juha-Matti – Nissinen Ari: A quick scan of climate policy services and of underlying data system approaches. Climate Bonus project report (WP1). Helsinki 2009.

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