

# Mental rebound

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# Abstract

Current research on causes of rebound effects focus on changes in limiting factors on consumption or production, such as financial or time costs. For instance if the energy efficiency of a car increases, the costs per kilometer also become cheaper and thus consumers might drive longer distances. However, rebound effects due to behavioral changes of households can also be observed for efficiency increases where the costs do not decrease. For instance people driving further with more efficient cars, even though the costs are not lower if higher investment costs are considered. To explain such rebound effects we propose a concept of “mental rebound”. This concept postulates that households apply a mental accounting (bookkeeping) for the environmental impacts caused. The use of higher efficiency, according to our concept, allows households to compensate for this pro-environmental action with an increase in consumption. For instance a buyer of a hybrid car accounts this purchase as a strong reduction in personal environmental impact and hence feels “allowed” to drive more. This report includes a formal description of the mental rebound concept. Based on existing surveys, we evaluate whether a mental rebound can be observed for the purchase of organic food and the absence of a car. In addition, we present the results of a pretest on the rebound effect of more efficient buildings which also provide indications of mental rebound effects. To support the concept of mental rebound, further investigations are needed; with this report we establish a basis for such studies. Although the proposed concept needs further verification, the reflections conducted and the formal evaluations allow some robust policy recommendations.

## Keywords

Rebound effects, mental budgets, mental accounting, household consumption, GHG emissions.



# 1 Introduction

## 1.1 Non-monetary causes for rebound effects

Rebound effects<sup>1</sup> induced by cost savings were the first to be investigated and originate in the field of economics, especially energy economics. In close analogy, *time savings* (Jalas, 2002; Spielmann, de Haan, & Scholz, 2008) and the *reduction of socio-psychological costs of ownership* (as first postulated in de Haan, Mueller, & Peters, 2006) might also be regarded as possible drivers for rebound effects. As an example of the latter, it may well be not the financial but the socio-psychological cost-of-ownership (due to neighborhood pressure, norms of a peer group, etc.) that prevents people from buying sport-utility vehicles (SUV) (de Haan, Peters, & Scholz, 2007).

The macroeconomic definition of the rebound effect, as given in de Haan (2008), is based on the elasticity of final energy demand with respect to changes in energy-efficiency. This is a purely descriptive metric that does not allow for causal interpretations. Neither does the macroeconomic definition allow separating the total rebound effect into direct, indirect, and economy-wide macro rebound effects<sup>2</sup>. For this, one has to switch to the microeconomic level. In this section, we therefore differentiate three possible causal mechanisms that can give rise to rebound effects. Moving towards causality also means distinguishing between drivers of human behavior. Price signals are one of those drivers, but there are others.

Economic (monetary) rebound is caused by price signals, i.e. by the sum of substitution effects and income rebound. This is the classic causal driver for rebound effects mostly dealt with in the literature and in empirical microeconomic field studies aimed at identifying and quantifying rebound effects. However, this causal mechanism requires that money is in fact saved and the increase in energy-efficiency does lead to saved energy costs, corrected for higher investment costs. Normally, more efficient technologies or services have lower operating costs, but higher investment costs (were that not the case, a classic win-win situation would be present). In rebound research it is important to account for the higher investment costs. It has to be kept in mind that in purchase decisions individual consumers often do not correctly compute total costs of ownership. Individuals use excessively high discount rates and weight the present (investment costs) too high in comparison with the future (running energy costs). The other side of the coin, however, which may occur especially in the context of human decisions specifically aiming at reducing energy costs, is that any change in investment costs is simply ignored and considered irrelevant to the environmental decision the individual is about to make ("that is another matter"). This can in part be described by the psychological effect called *mental accounting* (Thaler, 1999), and by the characteristics of human decision making under uncertainty; the Prospect Theory of Kahneman and Tversky unifies these effects among others (Kahneman & Tversky). If an income rebound effect only occurs due to incorrect discount rates or due to mental accounting (i.e., the consumer thinks he is net saving, and therefore starts spending more, but in fact has ignored the higher investment and is not net saving at all), in our terms this is not an economic rebound, but a socio-psychological rebound effect instead.

The rebound effect is defined as a function of (final) energy demand elasticity with regard to changes in energy efficiency. This is a purely descriptive measure that can in principle be determined empirically; this definition does not differentiate among different possible causes. Whereas it is generally implied that there should be a price signal

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<sup>1</sup> Increasing demand for energy subsequent to increasing energy efficiency.

<sup>2</sup> Direct rebound: increasing demand for the energy service with increased energy efficiency; indirect rebound: increasing demand for other energy services; economy-wide macro rebound: increasing energy demand on the macro level.

(induced by increased energy efficiency) in order for the demand response to come into existence, it might well be that innovative technologies have higher energy efficiency and hence lower energy bills, but need higher investments and have an identical cost of ownership, such that for the rational consumer there is no net price signal induced by the new technology. If the consumer were, however, to undervalue investment costs, i.e. have different preference weights for investment money than for energy bill money, he or she might perceive a price signal (towards the innovative technology) all the same. If, on the other hand, a consumer applies too high discount rates and values the present much more highly than the future, he or she might overvalue the additional investments and also perceive a price signal (towards conventional technology). It should be noted that the definition of the rebound effect in itself does not state that a price signal should be present, it merely builds upon changes in energy demand due to changes in energy efficiency. Price changes are the most often investigated, most widely accepted intermediate variable here, but other mechanisms could be present for so-called “bounded rational” decision makers and for so-called “imperfect markets”. We therefore distinguish different possible causal mechanisms that are suited to inducing (direct) rebound effects:

1. Income rebound (“economic rebound”, “rebound induced by rational price signal”): The increased demand for the energy service that has become more energy-efficient is due to economic reasoning only. This causal chain applies if the higher investment costs for the energy service with the better energy-efficiency do not fully compensate financial savings due to lower energy bills (and any tax cuts, incentives, etc.).
2. Socio-psychological rebound. The increased demand is due to reduced socio-psychological costs of ownership or usage for the energy service with the better energy efficiency. This effect will be present in most cases where the above-mentioned income rebound occurs, as consumers hardly ever exhibit fully rational decision making and often do not have precise knowledge about energy prices, pay-back periods, etc. Consumer decision making with regard to energy-intensive services is in most cases characterized by rule-of-thumb, heuristic decision approaches, and only rough, if any, knowledge on total energy costs.

Socio-psychological causes for rebound effect cannot be expected to be completely avoidable. But improved information, transparency, education, changes to the design of incentive schemes, etc., might help. All of these measures might be used to change the decision making behavior of bounded rational individuals towards the „homo oeconomicus“ concept. Main points of departure are that consumers weight prices differently according to the periodicity and payment method (daily out-of-the-pocket expenses, like gasoline costs, are given more weight than the annual car tax bill), according to the level of perceived control (car repair costs due to accidents are perceived as out of control and mostly not part of any „mass transit vs. own car“ cost comparison), and according to the transaction partner (being eligible for tax rebates might induce greater behavioral changes than direct rebates on the product price). All of these “psychology of the perception of money” effects might induce rebound effects due to perceived price signals, even though a price signal is in fact not present when proper financial computations are performed, including all cost components and applying realistic discount rates for future payments.

In addition to the above-mentioned effects that describe how people might deviate from “rational” decision making (in the homo oeconomicus sense), but personally perceive their decision as being rational, individual decision makers of course are not guided by monetary signals alone (“extrinsic motivation”, see Coad, de Haan, & Woersdorfer, 2009 (in press)); they also have goals, norms, and preferences (“intrinsic motivation”). Over the last decades many studies have been conducted to investigate the determinants of different environmental behaviors. For the following short overview we follow Peters et al. (2009 (submitted)). The theories most often applied are the theory of planned behavior (TPB, Ajzen, 1991) and the norm-activation model (NAM, Schwartz, 1997). According to the TPB, behavior is immediately influenced by a person’s intention to perform the behavior. Intention, in turn, is determined by (1) a person’s attitude towards the behavior, defined as an overall evaluation of its possible consequences, (2) subjective norms, referring to the perceived expectations of other important persons (social norms), and (3) the perceived behavioral control (PBC), defined as a person’s perceived power to perform the behavior due to non-motivational factors such as availability of opportunities and resources. Studies using the NAM explain environmental behavior as being influenced by (1) a personal ecological norm, denoting a strong intrinsic feeling of obligation to engage in the specific pro-environmental behavior. This personal norm is formed and activated by (2) the awareness of an environmental problem and by (3) the

awareness of environmental consequences of one's own behavior, denoting the perception that one's own behavior has harmful consequences for the environment and that, therefore, a change in behavior has an effect on the problem. For example, somebody might purchase a hybrid vehicle even if projected overall costs per vehicle kilometer are somewhat higher, because of a strong personal norm and at the same time the presence of strong social norms. This purchase decision could however weaken the personal attitude to also act pro-environmentally in other, upcoming decisions. For example, the personal feeling of obligation to reduce car driving as much as possible might become less strong once a hybrid vehicle is owned. Or the social norm not to use the car for very short trips might decrease once a hybrid vehicle is employed.

We define mental rebound as the increase in energy consumption or GHG (greenhouse gas emissions) subsequent to increasing efficiency due to mental reasons. For instance, if someone buys organic food he might think that he has done something good for the environment and can therefore drive a bigger car and/or longer distances. Thus the concept of "mental rebound" assumes that people keep something like an ecological account. That such mental accounts matter for financial activities is argued by Thaler (1999). While Thaler focus on a monetary bookkeeping we propose a bookkeeping for environmental impacts. "Increasing efficiency" also includes changes in consumption patterns towards more ecological consumption (or consumption *perceived* as being more ecological). In the literature the term "mental rebound" is not used and there is no extensive research focus on this issue. However, Hoffstetter et al. (2006) postulate that efficiency improvement can lead to changing preferences for mental reasons, which could for instance be a compensation for lower happiness due to changes in consumption.

## 1.2 Empirical evidence for mental rebound: Indications from current surveys and further evaluations

While the concept of "mental rebound" is intuitive and different anecdotal stories like "I separate the waste, therefore I am allowed to drive around a little more with my car" indicated its potential relevance, to our knowledge no empirical study has yet proven its existence. With this report we will outline a formal description of the mental rebound and investigate whether existing surveys provide evidence for mental rebound. First, we use the Swiss traffic survey to analyze whether households with no car fly more often. This would indicate that "having no car", which is broadly seen as climate friendly, leads to more flights, which are known for their high GHG emissions. Second, we consider the income and expenditure survey to analyze whether people who buy more organic food tend to compensate for this ecological behavior with other non-ecological activities. Third, we will lay out how the environmental survey 2007 (Diekmann, Meyer, Mühlemann, & Diem, 2009) could be used to investigate the presence of mental rebound effects. Finally, we will outline the results of a pretest conducted to assess for mental rebound in the case of more efficient buildings. Thus the report lays the groundwork for further in-depth analyses of the mental rebound. Conceptual reflections and results from existing surveys allow us to draw some conclusions and make some hypotheses on the rebound effect, which however need further verification. Of course these indications do not prove any causality yet. However, a general finding from the conceptual analysis is that, independent of the outcome of further research on mental rebound, the magnitude of this effect can be reduced by (i) increasing awareness of the gap between current consumption and the earth's carrying capacity and (ii) more transparency about the environmental impact of different activities and purchases.

## 2 Formal description

In this section we start with a general formal description of household consumption. Subsequently, the formal description of mental rebound is derived. Since we use different methods to analyze potential mental rebound effects and environmental accounting, we will describe the methods applied together with the corresponding results in sections 3 and 4.

### 2.1 Household consumption: An optimization problem

We assume consumers face a choice of  $n$  commodities labeled  $1, 2, \dots, n$ . The consumer is assumed to have a cardinal utility function  $U$  (cardinal in the sense that it assigns numerical values to utilities), depending on the amounts of the commodities  $x_1, x_2, \dots, x_n$  consumed. The model further assumes that consumers purchase goods  $x_1, x_2, \dots, x_n$  in such way as to maximize  $U(x_1, x_2, \dots, x_n)$ , considering different constraints on consumption like the expenditure budget,  $M$ , household time,  $T$ , and other household resources,  $R$ . Each commodity uses part of the household resources. The expenditure budget is linked to the market price  $p_1, p_2, \dots, p_n$ ; household time, to the time use of the products,  $tu_1, tu_2, \dots, tu_n$ , (which is equal to the inverse of the speed  $tu_1 = s^{-1}$ ), and other household resources needed to consume the commodities,  $ru_1, ru_2, \dots, ru_n$ . The problem of rational behavior in this model then becomes an optimization problem that is:

$$\max U(x_1, x_2, \dots, x_n) \quad x_i \geq 0 \quad i \in \{1, 2, \dots, n\} \text{ subject to } \sum_{i=1}^n p_i \cdot x_i \leq M; \sum_{i=1}^n tu_i \cdot x_i \leq T; \sum_{i=1}^n r_{ij} \cdot x_i \leq R_j$$

The impact of the household,  $I$ , can be described as:

$$I = \sum_{i=1}^n ei_i \cdot x_i$$

where  $ei_i$  is the environmental impact per functional unit of consumption. Changes in consumption due to a new product or an induced consumption change lead to an increase in household resource  $R$ :

$$\Delta R_j = \sum_{i=1}^n r_{ij, new} \cdot x_{i, new} - r_{ij, old} \cdot x_{i, old}$$

where the changing household resource,  $\Delta R_j$ , can also be expenditure,  $M$ , or time use,  $T$ .

### 2.2 Rebound effect

According to (Dimitropoulos & Sorrell, 2006) the rebound effect,  $R$  can be described as:

$$R_i = \frac{ENG - ACT}{ENG} = \left(1 - \frac{ACT}{ENG}\right)$$

where **ENG** is the percentage of savings predicted by engineering energy calculation, assuming ceteris paribus; **ACT**, describes the actual saving in energy consumption, including behavioral changes or marked adjustments. The rebound can be applied also to other environmental resource use and hence environmental impact in general. The rebound effect can be reformulated as elasticity of energy use to efficiency increase,  $\eta$ :

$$R_i = 1 - \eta_\varepsilon(E) \text{ with } \eta_\varepsilon(E) \sim \frac{\Delta E/E_0}{\Delta \varepsilon/\varepsilon_0} = \frac{ACT}{ENG}$$

## 2.3 Mental rebound

### 2.3.1 Mental environmental Budget

Relying on findings from the literature (Thaler, 1999) we propose that people have mental environmental budgets. Thus we can treat the mental environmental budget similarly to a household resource like income and time (see formal description above). The following formulation describes the total (subjective) environmental impact budget,  $EB$ , of a household:

$$EB_{hh} = \sum es_{hh,i} \cdot x_{i,hh} \quad (n \geq i \geq 0)$$

where  $es_{hh,i}$  describes the subjective environmental impact per consumption in functional units, fu, for the different activities/consumption categories  $i$ .

Difference between target and subjective environmental budget: Unlike for other household resources the subjective environmental budget is not necessarily in balance with the targeted budget,  $ET$ , of the household. The difference between the subjective environmental budget and the target budget,  $EB - ET$ , leads to cognitive dissonance (Festinger, 1957).

Difference between real and subjective environmental budget: The difference between the subjective and the real environmental impact of a household,  $EB - I$ , can be described as a lack of information about the environmental impact of different consumption activities:

$$EB_{hh} - I_{hh} = \sum (es_{hh,i} - ei_i) \cdot x_{i,hh}$$

where  $ei_i$  is the real environmental impact and  $es_{hh,i}$  the subjective impact per functional unit of consumption. Consistent with the proposed difference between the subjective and real environmental impact, a Dutch survey showed that people rate the impact of an appliance according to its size, and that energy consumption which is not visible (like hot water for a shower) tends to be neglected or underestimated (Schuitema & Steg, 2005).

Mental rebound

The formal description of mental rebound can be summarized from the formal descriptions of household consumption and rebound effect (above). The change in energy saving, applying the ceteris paribus assumption, corresponds to the change in total environmental impact of the household ( $ENG \rightarrow \Delta I$ ). The actual reduction of environmental impacts can be described as follows – neglecting other constraints than mental rebound:

$$ACT = ENG - \underbrace{\sum ei_i \cdot a_i \cdot \Delta EB \cdot \frac{x_i}{es_{hh,i}}}_{\Delta x} \quad \{1 \geq a_i \geq 0 \mid \sum a_i = 1\}$$

where  $\Delta x$  describes the change in functional unit through mental rebound. Mental rebound is determined by the amount of change in the subjective environmental budget,  $\Delta EB$ ; the share,  $a_i$ , describes how this difference is used to increase consumption in the different categories. The change in consumption ( $\Delta x$ ) is then accounted with the real environmental impact  $ei_i$  and summed up over all consumption categories to obtain the actual reduction in environmental impact. It is important to emphasize that for this case we assume the subjective environmental rebound,  $EB$ , to be equal to the personal target for the environmental impact,  $ET$ .

### 2.3.2 Mental accounting

In the sections above we have introduced the notion of a mental environmental budget as an additional household resource, complementing the financial budget. This mental environmental budget might also be regarded as an “operationalization of conscience”. Of course, households do not perform exact bookkeeping with regard to their environmental budget (most households do not even have an exact notion of their financial budget). Instead, we postulate that households have a fuzzy conceptualization of their mental environmental budget.

## 2. Formal description

Households can also be expected to apply mental accounting. Mental accounting is usually applied to financial bookkeeping, but also describes the effect that consumers have different „accounts“. In the context of mental environmental budgets, mental accounting might emerge in two different ways:

1. different accounts for different environmental compartments (e.g. local pollution vs. global GHG)
2. different accounts for different types of activities.

This mental accounting has an influence on how changes in the subjective environmental impact,  $\Delta EB$ , is “spent” on other activities,  $a_i$ .

Beside the proposed mental account for the household (subjective) environmental budgets, classical mental accounting in financial budgets also matters for the rebound effect in the following ways:

1. Use of saved money: The proven fact that consumers set budgets for categories of expenditure (Heath & Soll, 1996; Thaler, 1999) implies for financial savings due to efficiency improvements that these savings will largely be re-spent on the same activity. For instance savings from a more efficient car are used toward a higher quality of car or more driving (however, the latter is probably limited by time use). Hence, the classical mental financial budgets favor direct rebound effects in the case of a cost reducing increase in environmental efficiency.
2. Use of financial incentive: That mental budgets also matter for financial incentives is proposed by Abeler and Marklein (2008). They claim that incentives given for a certain purpose are often also used in this way and hence that money is – at least for this case - not fungible. They found in a field experiment that even in a simple, incentivized setup many subjects do not treat money as fungible. When a label is attached to a part of their budget, subjects change consumption according to the suggestion of the label. A controlled laboratory experiment confirms this result and further shows that subjects with lower mathematical abilities are more likely to violate fungibility. One implication of these results is that in-kind benefits distort consumption more than is usually assumed.

## 3 Indications from existing surveys

### 3.1 Income and expenditure survey: Organic food and total GHG emissions

#### 3.1.1 Method

*Formal description of the case:* The consumption of organic food is an interesting case because one can argue that the household assumes that buying organic food is favorable for the environment. However, LCA studies show that for instance GHG emissions for organic food per functional unit (kg) are similar to those for conventional food. Hence, the subjective environmental impact is considerably smaller than the real environmental impact  $ei_{hh,organic\ food} \gg eS_{hh,organic\ food}$ . According to the mental rebound assumption, if all households had the same target for their environmental footprint, households buying organic food would compensate for this environmentally friendly action by driving more, booking more flights or other environmentally unfriendly actions. Hence, the share of organic products would have a negative influence on the total GHG emissions of households.

*Data and calculation:* We use the income and expenditure survey from the years 2000 to 2003 (BFS, 2003). We derive the total impact of all these households (Girod, 2008). Subsequently we analyze whether the households with a high share of organic food purchases have a higher environmental impact by (i) a regression analysis and (ii) comparing average share of organic purchases for different GHG emitter groups. Since environmental impact increases with expenditure (Kok, Benders, & Moll, 2006) we (i) use expenditure as the control variable in the regression analysis and (ii) keep the expenditure level constant within the different household groups.

*Limitation:* If the intended environmental budget of households buying more organic food is lower because of greater environmental awareness, total GHG emissions will be lower than average despite mental rebound. Hence, environmental awareness should be used as the control variable. However, this variable was not covered in the survey.

#### 3.1.2 Results

Table 1 shows the regression of the share of organic food and the total GHG emissions considering total expenditure as the control variable. We consider different cases: First, using only the control variable “total expenditure” shows that expenditure explains a considerable part of the variance in total GHG emissions. Second, the “share of organic food purchase” correlates significantly negatively with the “total GHG emissions”. This means that people buying more organic food have lower GHG emissions. The fact that in the third case, where only the “share of expenditure for organic food” and “total GHG emissions” are used, the coefficient of the organic share is not significant, can be explained by the correlation of expenditure and GHG emissions as well as the increasing share of organic food with income, which leads to an overlapping of two contradictory influences on GHG emissions. Controlling for “total expenditure”, the “share of expenditure for organic food” also correlates significantly negatively with the “total GHG emissions”.

### 3. Indications from existing surveys

**Table 1.** Regression of household GHG emissions with share of purchases of organic food and expenditure

	1. case	2. case	3. case	4. case	5. case
Independent variable:					
Share of organic purchases (0-1) <sup>1</sup>		-767.4***		-1150***	
Share of organic expenditure (0-1) <sup>1</sup>			-16.07		-347.3***
Independent variable:					
Spending (CHF/month)	0.173***			0.174***	0.174***
Constant	1187***	2210***	2179***	1230***	1211***
Observations	14584	14581	14581	14581	14581
R-squared	0.108	0.001	0.000	0.110	0.109

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. <sup>1</sup> Purchases and expenditure for food and beverages only. N=14'000 households

Table 2 shows different household groups with similar expenditure level and household structure, but decreasing total GHG emissions. It reveals that the share of organic purchases and expenditure decreases with increasing total GHG emissions. The differences in share of organic purchases are significant (p<0.01) between the 1<sup>st</sup> and 2<sup>nd</sup> as well as between the 2<sup>nd</sup> and 3<sup>rd</sup> quintile.

**Table 2.** Consumption of organic food by different GHG emission household groups

Household emitter groups	GHG	Share of organic purchases	Share of organic expenditure	GHG emissions [kgCO <sub>2</sub> e /month]	GHG emissions for nourishment [kgCO <sub>2</sub> e /month]	Total expenditure [CHF /month]
1 <sup>st</sup> quintile		6.0%	10.2%	1243	224	5666
2 <sup>nd</sup> quintile		4.6%	8.7%	1679	246	5752
3 <sup>rd</sup> quintile		3.9%	7.6%	2008	258	5617
4 <sup>th</sup> quintile		3.5%	7.2%	2383	269	5757
5 <sup>th</sup> quintile		3.3%	6.7%	3585	278	5811
Total		4.2%	8.1%	2178	255	5720

Note: <sup>1</sup> Purchases and expenditure for food and beverages only. The differences in the share of organic purchases are significant (p<0.01) between the 1<sup>st</sup> and 2<sup>nd</sup> as well as the 2<sup>nd</sup> and 3<sup>rd</sup> quintile.

#### 3.1.3 Discussion and Conclusion

First, it is important to emphasize that these results only deliver indications and that further investigations are needed. For instance, there are, beside the better environmental performance, other reasons like health or quality that can lead to the purchase of organic food. However, the results indicate that the purchase of organic food does not lead to higher GHG emissions because the purchase of organic food is seen as very ecological and therefore can be compensated elsewhere. However, this does not contradict the proposed concept of mental rebound, because what we observe could also be explained by different environmental targets among the households. The household purchasing organic food might be more environmentally aware and therefore set themselves a stricter target for their environmental impact. This effect could simply overlay the mental rebound of organic food purchase. To exclude this effect one would also have to consider environmental awareness as a control variable and proxy for the household target.

## 3.2 Traffic survey: Car availability and flights

### 3.2.1 Method

*Formal description:* Since car use is well known for its environmental impact, it can be assumed that people with no car have a considerably lower subjective environmental impact. Assuming an average target for personal environmental budget, households will compensate for the low car use with a higher frequency of other activities with high environmental impact. We will therefore assess whether households without a car take airplane flights more often than those who own one.

*Data and calculation:* The basis for this analysis is the Swiss traffic survey (BFS & ARE, 2007), which surveyed the mobility (including journeys) behavior of 9706 households. For these households we know how many flights they undertook for their last three journeys and whether they have a car. In addition, we will again control for income.

*Limitation:* If the subjective environmental budget of households with no car is lower because of higher environmental awareness, the total GHG emissions will be lower than average despite mental rebound. Therefore the number of flights could also be lower. Hence, environmental awareness should be used as a control variable. However, this variable was not indicated.

### 3.2.2 Results

Table 3 shows the output of a regression analysis for the number of flights. Considering only cars (Case 1) reveals a significantly positive relation. However, this is a cross correlation since both the number of cars and the number of flights depend on income (for flights and income see Case 2). Controlling for income reveals that the number of cars is indeed significantly negatively correlated with the number of flights.

**Table 3.** Regression of number of flights for journeys, number of cars and income

Independent variable	Case 1	Case 2	Case 3
Number of cars	0.0316***		-0.0141**
Income		0.0451***	0.0481***
Constant	0.102***	-0.0302***	-0.0250**
Observations	9706	7793	7793
R-squared	0.004	0.035	0.036

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Number of observations: 7793

Table 4 shows the underlying distribution of flights relative to household income class and car availability. Comparing the number of flights per household within the different income categories reveals that for the income category higher than 4000 CHF per month the households without a car take more flights, which is consistent with the results from the regression analysis.

**Table 4.** Number of flights for journeys of different income group of households, with and without a car

Income group	Number of flights per household		Number of households (households with flights in brackets)	
	No car	One or more cars	No car	One or more cars
Lower CHF 2000	0.06	0.12	165 (9)	105 (9)
Up to 4000 CHF	0.04	0.06	590 (24)	825 (44)
Up to 6000 CHF	0.12	0.10	341 (36)	1751 (167)
Up to 8000 CHF	0.21	0.13	136 (24)	1579 (179)
Up to 10000 CHF	0.24	0.21	76 (13)	997 (178)
Over 10000 CHF	0.40	0.28	48 (12)	1180 (251)
Total	0.10	0.15	1356 (118)	6437 (828)

### 3.2.3 Discussion and Conclusion

The higher number of flights for journeys for households without a car compared to households of the same income group with at least one available car could be explained by a mental rebound effect. However, the sample size of households without car for the different income groups is quite small. In addition, the higher number of flights for households without a car could also be explained by (i) income rebound, since lower expenses for car use allow higher spending on holidays or (ii) logistic reasons, since households without a car can less easily choose car travel for a holiday, hence leaving plane or train as the travel mode. In addition we analyzed

## 3.3 Environmental survey: Flights, car, efficient building and environmental awareness

The environmental survey (Diekmann, et al., 2009) allows us (i) to assess the environmental footprint of participating households, (ii) to determine their environmental awareness and (iii) includes questions on different environmentally friendly (perceived) behaviors. Thus this survey would allow evaluation of the following three hypotheses, which are of interest in proving our concept of mental rebound and help to explain the results obtained above:

1. Households with higher environmental awareness have lower total environmental impact (controlling for same income and household structure). This would verify that higher environmental awareness leads to stricter mental environmental budgets and therefore that the mental rebound can hardly be measured on the aggregated (population) level, since people showing environmental behavior also choose stricter targets for mental environmental budgets. This would also explain why households buying organic food on average also have a considerably lower environmental impact.
2. Mental rebound I: Households which consider efficient appliances for purchase attach less value to the energy use of these appliances (compared to other households with similar environmental awareness). This would prove a mental rebound effect as defined in section 2.2, with the compensation occurring within the same mental account (activity).
3. Mental rebound II: Households which follow the classical – but overrated – energy/environment saving hints do not show a lower household footprint compared to households with similar environmental awareness and income. This would prove a mental rebound effect as defined in section 2.2, with the compensation occurring across different activities.

Such an analysis would be very valuable for the analysis of the mental rebound concept. However, the data are not yet available for external analysis because first the main evaluation of the data needs to be completed.

## 4 Rebound due to efficient buildings?

In the case of more efficient buildings, the rebound was analyzed in-depth by our own calculations and a pretest survey was conducted (Tobler & Reinhard, 2007). In the following we summarize the main contributions of this study.

### 4.1 No monetary basis for Rebound effects

Since it was assumed that the basis for a rebound effect are the monetary savings from the more efficient building, first the cost difference and CO<sub>2</sub> reduction of more efficient buildings (MINERGIE label) were calculated. Comparing MINERGIE-buildings to normal buildings, Reinhard and Tobler (2007) found that there are nearly no financial savings if the higher investment costs are considered. The carbon emissions are, however, reduced by more than 90 percent due to efficiency improvement and decarbonization.

### 4.2 Indications for (mental) rebound

Even if no basis was found for income rebound, the survey gives various indications of mental rebound: First, larger living space (in m) was observed for the surveyed sample (N=45) compared to the Swiss average. Second, more flights were observed for the people living in the efficient buildings, however this cannot be causally related to energy efficiency. In both cases income was considered as the control variable. Finally, asking directly what people would use the money saved from the more efficient building for indicates that mental rebound towards more consumption of GHG-intensive activities is possible, however for many households also an increase in quality of consumption is indicated. The quality orientation of marginal consumption and the therewith enabled decoupling of expenditure and material use is consistent with analysis of the Swiss income and expenditure households (Girod & de Haan, 2009, accepted for publication)

#### 4.2.1 Parameters of the survey

For the evaluation a sample of 100 addresses was randomly selected from the address list of the MINERGIE (label for efficient buildings) residents in the canton of Zurich (only buildings for private use were considered). The questionnaire was mailed on July 2, 2007; a reminder followed on August 13. The evaluation of the questionnaires started on November 8, 2007. The rate of return amounted to 45 percent (45/100) and the first return rate – before the reminder – already attained 30 percent (30/100).

#### 4.2.2 Larger Flat

Table 5 shows that MINERGIE households from our sample use twice as larger living space compared to average Swiss population derived from the Swiss income and expenditure survey (BFS, 2003). However, MINERGIE household have also more persons per households and higher household income. If we use a regression model for living space, household persons and household income (see Table 6) the value for the Swiss population with same income and number of persons per household like in our sample raises to 133 m<sup>2</sup>, which is still nearly half of the living space used by the households of MINERGIE buildings according to our sample.

Beside income and household members also other factors like living areas (rural versus urban) or age of building could be considered. However, these variables might not be as independent like income and household member because they

#### 4. Rebound due to efficient buildings?

could be influenced by the more efficient building itself, since such buildings could promote to live in rural areas or new buildings.

**Table 5.** Comparison of livings space use for MINERGIE inhabitants and Swiss population

	MINERGIE survey		Swiss income and Expenditure survey 2000 -2003		Difference between samples
	N	Average value	N	Average value	
Persons per household [n]	44	3.4	14583	2.5	135%
Living space per household [m <sup>2</sup> ]	45	250	14583	115	217%
Living space per person [m <sup>2</sup> ]	44	74	14583	46	161%
Household income [CHF/month]	40	13275	14583	7995	166%
Income per person [CHF/month]	40	3947	14583	3198	123%

**Table 6.** Regression model for livings space use, household income and persons per household from the Swiss income and expenditure survey 2000 - 20003

Independent variables	Coefficient	Std. Error	t-value	Significance level
Household income [CHF/month]	0.0016	0.0001	25.56	0.000
Persons per household [n]	12.57	0.2939	42.76	0.000
Constant factor	70.62	0.8544	82.65	0.000

Dependent Variable: Living space per household [m<sup>2</sup>]; R-squared = 0.1841; Number of observations = 14583

#### 4.2.3 More flights

The comparability for the number of flight is limited since we collected flights per household and the Swiss traffic survey collects flights per target person (BFS & ARE, 2007). In addition we had some outliers in our pretest, one household indicating 120 flights, another 72 flights in the year 2005. We corrected for the outliers by considering 3 flights per household and year in maximum for comparison. The targeted persons of the Swiss traffic survey show considerably lower number of flights compared to inhabitants of MINERGIE buildings (see table 7). Even if flights of the targeted persons are multiplied by the number of persons per households of the MINERIGIE buildings (3.4 persons) the average number of flights is nearly 50 percent higher compared to Swiss average. Beside the average number also the share of frequent flier is considerably higher in the sample of the MINERGIE households. Further research is needed to verify this indication.

**Table 7.** Number of flights during one year

	N	Average number of flights per year <sup>1</sup>	Average number of flights per			
			No flight	1 flight	2 flights	3+ flight
Households MINERGIE	45	1.33	42%	9%	22%	27%
Target persons (Traffic survey, 2005)	4'566	0.27	76.0%	20.4%	2.7%	0.6%

<sup>1</sup> Only up to three flights are considered.

#### 4.2.4 Spending of financial saving and wage increase

Figure 1 compares the allocation preferences indicated in the questionnaires of financial savings from the more efficient MINERGIE building with those for the same amount from a wage increase. For both wage increase and efficiency-related savings, the largest part would be allocated to personal savings: for a wage increase, 53 percent; for building efficiency savings, 42 percent. The second largest part is used for apartment expansion (18 percent for building efficiency savings

and 12 percent for wage increase). Never mentioned were the following preferences: more car use (person kilometers), more travel by train, secondary residential locations and working less.

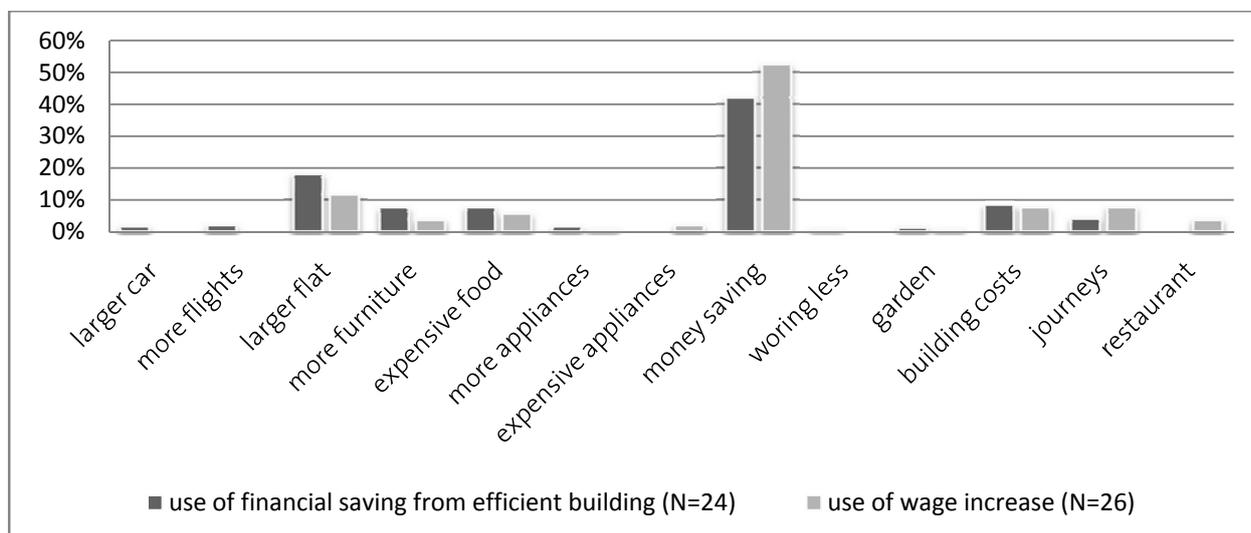


Figure 1. Preferences indicated for spending (i) savings from energy efficient buildings and (ii) wage increase.

### 4.3 Lessons learned for future surveys

This study lays a basis for further investigations on rebound effects of efficient buildings. This section summarizes lessons learned from the survey pretest (for the complete questionnaire, see Annex 1 (in German)).

#### 4.3.1 Quantitative aspects

The survey feedback question (question 23) allowed participants to rate the questionnaire for the fulfillment of various criteria on a scale from 1 (do not agree at all) to 5 (agree complete). All criteria (hard to understand, too long, interesting, boring, easy to answer, thought-provoking) got scores between 2.3 and 3 (see Table 7). Nevertheless, 43 percent of the participants did not want to be contacted a second time for a subsequent questionnaire.

Table 8. Feedback on questionnaire

	hard to understand	was too long	was interesting	was boring	was easy to answer	was thought-provoking
N	43	40	40	41	40	40
Mean	2.3	2.58	2.58	2.9	3.03	2.4
Std. Deviation	1.225	1.196	0.984	1.338	1.187	1.236
Variance	1.502	1.43	0.969	1.79	1.41	1.528

#### 4.3.2 Qualitative aspects

- Several respondents noted that the effort of looking for the data on the building, bills and other documents was too high
- Wrongly understood questions: Probably the estimates on the number of flights are even too low. In the corresponding question (10), we noted that the respondent should indicate the outward and return flight separately. Some persons noted in the feedback that they had indicated the outward and return flight as one

#### 4. Rebound due to efficient buildings?

flight. In addition, for long distance flights, which do not indicate a return flight, it is not plausible that a different travel mode was chosen for the way back.

- Not or badly answered questions: Questions on the second home were virtually left unanswered; question 12 (energy use of the building) was often answered inadequately; for question 15 (use of money saved through more efficient building) only rarely was expenditure in Swiss Francs indicated (however the percentages were correctly indicated – adding up to 100 percent).
- Comparability of answers: To compare the behavior of the inhabitants of MINERGIE buildings with Swiss average it is important that the questions are designed exactly the same like in the large surveys. The challenge is that to compare the living space you use as reference a household survey and to compare flights a person survey.
- For question 15 (use of money saved) many respondents did not have the impression of saving much money because of higher mortgages (which is consistent with the calculations on financial savings)

##### 4.3.3 Questionnaire for future survey on rebound from MINERGIE Buildings

Beside general improvements derived from the feedback and results described above, the following improvements would be suitable to assess possible (mental) rebound effects of MINERGIE Buildings:

- *Environmental awareness*: The condition for mental rebound is a certain environmental awareness, hence relevant questions should be included in the survey.
- *Subjective environmental impact*: If mental accounting exists, not the real environmental impact but the subjective environmental impact is accounted. Hence respondents' subjective reduction of environmental impact should be asked for. Beside a question on the absolute reduction (By what percent does the MINERGIE building reduce your GHG emissions?), questions comparing the environmental contribution with other actions should also be asked. For instance: What how high is the environmental impact of the following compared to the impact reduction by a MINERGIE building? i) one flight to New York per year, ii) recycling of waste, iii) having no car, iv) using a smaller car, v) using a hybrid car, vi) halving your living space, etc.
- *Justification of mental rebound*: Another way to evaluate the existence of mental budgets triggered by social norms is to ask how respondents judge the compensation of ecological behavior through some less ecological behavior. This, for efficient buildings these three statements should be judged by respondents:
  - Inhabitants of MINERGIE buildings are legitimated to book more flights compared to inhabitants of ordinary buildings.
  - MINERGIE inhabitants should book fewer flights compared to Swiss average to be consistent and credible in their behavior.
  - Living in a MINERGIE building has no influence on the legitimation for booking flights
- *Implicit or explicit?* To evaluate the mental rebound concept by a survey with direct questions on possible mental accounts and compensations of ecological behavior it is also important to distinguish whether this mental process is done explicitly or implicitly, which has consequence on the measurability per

## 5 General findings for future research and recommendation for policy

### 5.1 Indications for mental rebound concept from existing surveys

While the proposed concept of mental rebound cannot be verified by the analysis of existing surveys, the concept is able to help explain the results obtained:

1. More organic food purchases for households with lower total GHG emissions (controlling for income): Assuming mental rebound and that all households had the same target for their environmental impact, consumers of organic food would have higher GHG emissions since they compensate the environmentally perceived organic purchase by activities with a higher impact on climate. However, our results show that households with low GHG emissions purchase more organic food. This indicates that households can develop stricter targets for environmental impact together with more environmentally friendly actions, allowing them to mitigate mental rebound effects.
2. More flights for households without car availability (controlling for income): The higher number of flights for households without a car compared to households of the same income group with at least one available car could be explained by a mental rebound effect. However, the sample size of households without a car for the different income groups is quite small (see above). In addition, the higher number of flights for households without a car could also be explained by (i) income rebound, since lower expenses for car use allow higher spending on holidays or (ii) logistic reasons, since households without a car can less easily choose car travel for their holiday, hence leaving airplane or train as the main travel mode.

For an extended assessment of the concept of mental rebound with current surveys, evaluation of the data from the Swiss environmental survey (Diekmann, et al., 2009) would be suitable (see section 2.5).

### 5.2 Indication for mental rebound from case study (efficient buildings)

Although the case study conducted cannot verify the proposed concept of mental rebound, the concept is consistent with the results obtained and establishes a basis for further investigations in this direction:

1. *Larger flat*: Our pretest showed that inhabitants of MINERGIE buildings use 75 m<sup>2</sup> living space compared to 50 m<sup>2</sup> for the Swiss average of the same income level. The indications that MINERGIE building inhabitants use more living space compared to inhabitants of regular buildings (even if income is controlled for) should be further investigated, since, if confirmed, this would be a strong argument for a direct rebound effect, leading to a decrease in the overall efficiency gain of MINERGIE buildings.
2. *More flights*: The higher number of flights taken by households in efficient buildings is, despite its small empirical basis, quite impressive. Like the higher number of flights for households without a car, it indicates that people compensating for ecological behavior with more flights could be reality.
3. *Spending of money saved on a larger flat*: Consistent with the concept of mental financial accounts for different activities or consumption categories, 12 percent of the surveyed households indicated that they would spend additional income on a larger apartment, while 18 percent of the households would spend savings from more

## 5. General findings for future research and recommendation for policy

efficient buildings on a larger apartment. This effect indicates a certain danger for direct rebound: with time (eventually) more efficient buildings may lead to larger flats even if households do not save any money.

These are interesting indications, which have – if verified – a certain importance for climate policy (energy saving policy). Hence, the pretest provides a background for a larger and more representative survey on this issue. Such a survey should assess the following hypotheses:

1. *Larger flat*: Our pretest showed that inhabitants of MINERGIE buildings use 75 m<sup>2</sup> living space compared to 50 m<sup>2</sup> for the Swiss average of the same income level. The indications that MINERGIE building inhabitants use more living space compared to inhabitants of regular buildings (even if income is controlled for) should be further investigated, since, if confirmed, this would be a strong argument for a direct rebound effect, leading to a decrease in the overall efficiency gain of MINERGIE buildings.
2. *More flights*: In the pretest, inhabitants of MINERGIE buildings clearly showed a higher number of flights (see section 4.2, table 6). If this finding holds true, an indirect rebound could reduce the efficiency gain of MINERGIE buildings on a macro level.
3. *Mental rebound*: If the larger flat and higher number of flights for inhabitants of MINERGIE buildings is verified, the causality for these differences needs further investigation. Considering the explanation via the mental rebound concept the questions proposed in 4.3 for a future questionnaire should be considered in a broader survey.

### 5.3 Robust recommendation for policy

Even though the empirical basis for the mental rebound needs further research the following recommendation for policy to mitigate mental rebound effects can be derived from the proposed concept:

1. *Increase environmental awareness*: Greater environmental awareness reduces the personal environmental target for the environmental impact. Hence this leads to a dissonance between the attained goal and the actual environmental impact caused. As a consequence environmentally friendly actions are used to reduce this dissonance and they are less compensated through other – non-environmentally friendly – actions.
2. *Improve information about environmental impact of various actions*: If information about real environmental impact is increased, the difference between subjective and real environmental impact is reduced. Thus false compensation of environmentally friendly actions is avoided, e.g., that a household books an additional flight because it recycles its plastic bottles.

## 6 Literature

- Abeler, J., & Marklein, F. (2008). *Fungibility, Labels, and Consumption - Discussion Paper*. Bonn: Institute for the Study of Labor
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- BFS (2003). *Einkommens- und Verbrauchserhebung* ((Swiss federal office for statistics), Trans.). Neuenburg.
- BFS, & ARE (2007). *Mobilität in der Schweiz, Ergebnisse des Mikrozensus 2005 zum Verkehrsverhalten* ((Swiss federal office for statistics and land use planning), Trans.). Neuenburg, Bern: BBL.
- Coad, A., de Haan, P., & Woersdorfer, J. S. (2009 (in press)). Consumer support for environmental policies: An application to purchases of green cars. *Ecological Economics*.
- de Haan, P. (2008). *Identification, quantification, and containment of energy-efficiency induced rebound effects: A research agenda. Rebound Research Report Nr. 1. report EMDM1521*: ETH Zurich, IED-NSSI. Download: [www.nssi.ethz.ch/res/emdm/](http://www.nssi.ethz.ch/res/emdm/).
- de Haan, P., Mueller, M. G., & Peters, A. (2006). Does the hybrid Toyota Prius lead to rebound effects? Analysis of size and number of cars previously owned by Swiss Prius buyers. *Ecological Economics*, 58(3), 592-605.
- de Haan, P., Peters, A., & Scholz, R. W. (2007). Reducing energy consumption in road transport through hybrid vehicles: investigation of rebound effects, and possible effects of tax rebates. *Journal of Cleaner Production*, 15(11-12), 1076-1084.
- Diekmann, A., Meyer, R., Mühlemann, C., & Diem, A. (2009). *Schweizer Umweltsurvey 2007. Analysen und Ergebnisse. Bericht für das Bundesamt für Statistik (BFS) und Bundesamt für Umwelt (BAFU)*. Zürich: Professur für Soziologie, ETH Zurich.
- Dimitropoulos, J., & Sorrell, S. (2006). *The Rebound Effect: Microeconomic Definitions, Extensions and Limitations*. Paper presented at the 29th IAEE International Conference. from <http://www.ukerc.ac.uk/content/view/130/187>
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.
- Girod, B. V. S. (2008). *Environmental impact of Swiss household consumption and estimates for income rebound - research report nr. 2*. Zurich: ETH Institute for Environmental Decisions (IED).
- Girod, B. V. S., & de Haan, P. (2009, accepted for publication). Better or more? A model on changes in greenhouse gas emissions of households due to higher income. *Industrial Ecology*.
- Heath, C., & Soll, J. (1996). Mental Budgeting and Consumer Decisions. *Journal of consumer research*, 23, 40-52.
- Hofstetter, P., Madjar, M., & Ozawa, T. (2006). Happiness and Sustainable Consumption - Psychological and physical rebound effects at work in a tool for sustainable design. *International Journal of Life Cycle Assessment*, 11, 105-115.
- Jalas, M. (2002). A time use perspective on the materials intensity of consumption. *Ecological Economics*, 41(1), 109-123.
- Kahneman, D., & Tversky, A. Prospect Theory: An Analysis of Decision under Risk. 47( 2), 291.
- Kok, R., Benders, R. M. J., & Moll, H. C. (2006). Measuring the environmental load of household consumption using some methods based on input-output energy analysis: A comparison of methods and a discussion of results. *Energy Policy*, 34(17), 2744-2761.
- Peters, A., Scholz, R. W., & Gutscher, H. (2009 (submitted)). Psychological factors that influence the choice of new vehicles with regard to fuel economy and CO<sub>2</sub> emissions. *Submitted to Transportation Research Part F - Psychology*.
- Schuitema, G., & Steg, L. (2005). Percepties van energieverbruik van huishoudelijke apparaten (Perception of Energy Use of Domestic Appliances). In A. E. Bronner, P. Dekker, E. d. Leeuw, K. d. Ruyter & A. S. J. E. Wieringa (Eds.), *Ontwikkelingen in het marktonderzoek. Jaarboek 2005 MarktOnderzoekAssociatie (Developments in Marketing Research. Yearbook 2005)* (pp. pp. 165-180). Haarlem (NL): De Vrieseborch.
- Schwartz, S. H. (1997). Normative influences on altruism. *Advances in Experimental Social Science*, 10(221-279).

## 6. Literature

- Spielmann, M., de Haan, P., & Scholz, R. W. (2008). Environmental rebound effects of high-speed transport technologies: a case study of climate change rebound effects of a future underground maglev train system. [Article]. *Journal of Cleaner Production*, 16(13), 1388-1398.
- Thaler, R. H. (1999). Mental accounting matters. *Journal of Behavioral Decision Making*, 12(3), 183-206.
- Tobler, M., & Reinhard, M. (2007). *Minergie und Flugverkehr: Rebound? Semester Thesis 38/07*. ETH Zurich, Zürich.

# Annex 1 - Questionnaire of Pretest



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## Umfrage zu MINERGIE-Gebäuden und ihren Bewohnerinnen und Bewohnern

Vielen Dank, dass Sie sich Zeit nehmen, diesen Fragebogen auszufüllen!

Bitte beachten Sie folgendes:

- > Der Fragebogen sollte von jener erwachsenen Person, welche in der Regel für die Haushaltsausgaben verantwortlich ist, ausgefüllt werden
- > Falls mehrere Personen für die Haushaltsausgaben verantwortlich sind, sollte aus statistischen Gründen jene Person die als nächstes Geburtstag hat, den Fragebogen beantworten

Bitte mit dem beiliegenden Antwortcouvert zurück an ETH Zürich, IED-NSSI, CHN J72.1, Universitätstr. 22, 8092 Zürich.

### Informationen zum Datenschutz

Für diese Studie werden Personen in der ganzen Schweiz befragt. Die ETH garantiert, dass Ihre Daten absolut vertraulich behandelt und nur für die wissenschaftliche, nicht-kommerzielle Forschung verwendet werden.

Die Antworten aller an der Umfrage teilnehmenden Personen werden zusammengetragen und unter anderem nach Personenmerkmalen zu Statistiken verarbeitet. Aus diesem Grund enthält der Fragebogen einige Fragen zu Ihrer Person und Ihrem Haushalt. Die Statistiken erlauben keine Rückschlüsse auf Einzelpersonen.

**A. Fragen zu Ihrem MINERGIE-Haus**

1. Ist es korrekt, dass Sie in einem Gebäude im MINERGIE-Standard mit einer Fläche von «EBF» m<sup>2</sup> wohnen?

Ja,  Nein, korrekt ist, dass es sich um einen \_\_\_\_\_ Standard handelt und die Wohnfläche \_\_\_\_\_ m<sup>2</sup> beträgt

2. Wie involviert waren Sie beim Kauf- oder Mietentscheid?

Ich habe den Entscheid zur Hauptsache gefällt,  Ich habe den Entscheid gleichberechtigt mit weiteren Personen gefällt,  Ich war am Entscheid nicht beteiligt

3. Sind Sie Hauseigentümer oder Mieter?

Mieter,  Hauseigentümer

4. Wie wichtig war für Sie der MINERGIE-Standard Ihres Gebäudes beim Kauf- oder Mietentscheid?

	war entscheidend					war nicht relevant
	1	2	3	4	5	6
MINERGIE-Standard .....	<input type="checkbox"/>					

5. Wie wichtig waren die folgenden Gründe beim Kauf- oder Mietentscheid :

	war entscheidend					war nicht relevant
	1	2	3	4	5	6
Tiefere Heizkosten .....	<input type="checkbox"/>					
Tiefere Umweltbelastung .....	<input type="checkbox"/>					
Wohnkomfort .....	<input type="checkbox"/>					
Sonstige, nämlich _____ .....	<input type="checkbox"/>					
Sonstige, nämlich _____ .....	<input type="checkbox"/>					

### B. Fragen zu Ihrer Mobilität

6. Geben Sie bitte folgende Eigenschaften des Arbeits- oder Ausbildungsweges der drei ältesten Personen Ihres Haushaltes an.

(Das Hauptverkehrsmittel ist jenes Verkehrsmittel, welches die längste Teilstrecke zurück legt)

Weg zum Arbeits- oder Ausbildungsort (nur Hinweg):	älteste Person des Haushaltes	zweitälteste Person des Haushaltes (leer lassen falls nicht zutreffend)	drittälteste Person des Haushaltes (leer lassen falls nicht zutreffend)
Zweck des Weges	<input type="checkbox"/> Ausbildung, <input type="checkbox"/> Arbeit	<input type="checkbox"/> Ausbildung, <input type="checkbox"/> Arbeit	<input type="checkbox"/> Ausbildung, <input type="checkbox"/> Arbeit
Distanz des Hinwegs:	_____ km	_____ km	_____ km
Unterwegszeit (Tür zuTür):	_____ Minuten	_____ Minuten	_____ Minuten
Adresse: Arbeitsort	_____	_____	_____
Adresse: Postleitzahl	_____	_____	_____
Anzahl Hinwege pro Woche:	_____ mal	_____ mal	_____ mal
Hauptverkehrsmittel: (nur EINE Nennung)	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bah <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bahn <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bahn <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss

7. Geben Sie bitte folgende Eigenschaften für den häufigsten Freizeitwege der drei ältesten Personen Ihres Haushaltes an. (Freizeitaktivitäten sind: Besuche (Verwandte und Bekannte), nicht sportliche Aussenaktivitäten, Sport, Kulturelle- und Freizeitveranstaltungen, Gastronomie, unbezahlte Arbeit, alle privaten Einkäufe, etc.)

Weg zum Arbeits- oder Ausbildungsort (nur Hinweg):	älteste Person des Haushaltes	zweitälteste Person des Haushaltes (leer lassen falls nicht zutreffend)	drittälteste Person des Haushaltes (leer lassen falls nicht zutreffend)
Art der Aktivität:	_____	_____	_____
Distanz des Hinwegs:	_____ km	_____ km	_____ Km
Unterwegszeit (Tür zuTür):	_____ Minuten	_____ Minuten	_____ Minuten
Adresse: Arbeitsort	_____	_____	_____
Adresse: Postleitzahl	_____	_____	_____
Anzahl Hinwege pro Woche:	_____ mal	_____ mal	_____ Mal
Hauptverkehrsmittel: (nur EINE Nennung)	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bah <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bahn <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss	<input type="checkbox"/> Auto <input type="checkbox"/> Motorrad/Mofa <input type="checkbox"/> Bahn <input type="checkbox"/> Bus/Tram <input type="checkbox"/> Velo <input type="checkbox"/> zu Fuss

8. Wie viele Autos hat es in Ihrem Haushalt?

(Inkl. Autos von Lebenspartner/-in, noch zu Hause lebenden erwachsenen Kindern und weiteren im Haushalt lebenden Personen)

kein,  1,  2,  3,  4 oder mehr

9. Falls es Autos in Ihrem Haushalt hat, welche:

(Inkl. Autos von Lebenspartner/-in, noch zu Hause lebenden erwachsenen Kindern und weiteren im Haushalt lebenden Personen)

Marke	Modell	Motorgrösse (in Liter)	Treib- stoff	Schaltung	Baujahr/ Jahrgang	gefahrte km pro Jahr
_____	_____	_____	<input type="checkbox"/> Benzin <input type="checkbox"/> Diesel <input type="checkbox"/> anderer	<input type="checkbox"/> handgeschaltet <input type="checkbox"/> automatik <input type="checkbox"/> variomat/tiptronic	_____	_____ km
_____	_____	_____	<input type="checkbox"/> Benzin <input type="checkbox"/> Diesel <input type="checkbox"/> anderer	<input type="checkbox"/> handgeschaltet <input type="checkbox"/> automatik <input type="checkbox"/> variomat/tiptronic	_____	_____ km
_____	_____	_____	<input type="checkbox"/> Benzin <input type="checkbox"/> Diesel <input type="checkbox"/> anderer	<input type="checkbox"/> handgeschaltet <input type="checkbox"/> automatik <input type="checkbox"/> variomat/tiptronic	_____	_____ km
_____	_____	_____	<input type="checkbox"/> Benzin <input type="checkbox"/> Diesel <input type="checkbox"/> anderer	<input type="checkbox"/> handgeschaltet <input type="checkbox"/> automatik <input type="checkbox"/> variomat/tiptronic	_____	_____ km

10. Bitte geben Sie an wie viele Flüge die drei ältesten Personen des Haushaltes **im Jahr 2006** zurückgelegt haben.

Geben Sie bitte jeweils an, ob der Flug aus privaten (Ferien, Besuche, Einkaufen etc.) oder geschäftlichen Gründen (im Rahmen der Erwerbsarbeit) stattgefunden hat und ob es sich um einen Kurz-, Mittel oder Langstreckenflug handelte.

**WICHTIG:** Hin- und Rückflug werden als **zwei** Flüge angegeben. Ein Flug geht von Start- zu Zielflughafen, Zwischenlandungen werden deshalb nicht berücksichtigt.

	älteste Person des Haushaltes	zweitälteste Person des Haushaltes	drittälteste Person des Haushaltes
--	----------------------------------	---------------------------------------	---------------------------------------

**Kurzstreckenflüge** (kürzer als 1500km, Flüge innerhalb der EU) (Retour = 2 Flüge):

Anzahl private Flüge.....	_____mal	_____mal	_____mal
.....	_____mal	_____mal	_____mal
Anzahl geschäftliche Flüge.....	_____mal	_____mal	_____mal
.....	_____mal	_____mal	_____mal
Anzahl teils geschäftliche, teils private Flüge.....	_____mal	_____mal	_____mal
.....	_____mal	_____mal	_____mal

**Mittelstreckenflüge** (1500–3500 km, Beispiele: Moskau, Island, Ägypten) (Retour = 2 Flüge):

Anzahl private Flüge.....	_____mal	_____mal	_____mal
Anzahl geschäftliche Flüge.....	_____mal	_____mal	_____mal
Anzahl teils geschäftliche, teils private Flüge.....	_____mal	_____mal	_____mal

**Langstreckenflüge** (länger als 3500 km, interkontinentale Flüge; Beispiele: USA, Südafrika ) (Retour = 2 Flüge):

Anzahl private Flüge.....	_____mal	_____mal	_____mal
Anzahl geschäftliche Flüge.....	_____mal	_____mal	_____mal
Anzahl teils geschäftliche, teils private Flüge.....	_____mal	_____mal	_____mal

**C. Fragen zu Haushaltsausgaben**

11. Wie viele Zweitwohnsitze haben Sie?

kein,  1,  2,  3,  4 oder mehr

12. Geben Sie folgende Ausgaben für Energie in Ihrem Hauptwohnsitz an :

(Bitte keine Betriebsausgaben eintragen, sondern nur den Ausgabenanteil für den privaten Wohnsitz)

Energieträger	Verwendungszweck	BETRAG	DAUER für welche die Zahlung gilt
Heizöl.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____SFR	_____Monat(e)
	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>		
Gas.....	Kochen <input type="checkbox"/> Backen <input type="checkbox"/>	_____SFR	_____Monat(e)
Holz (Heizkessel. z.B Pellets)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____SFR	_____Monat(e)
Cheminee-Holz.....	Heizung <input type="checkbox"/>	_____SFR	_____Monat(e)
Fernwärme.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____SFR	_____Monat(e)
Sonstige.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>		
.....	Geräte und Beleuchtung <input type="checkbox"/>	_____SFR	_____Monat(e)
Elektrischer Strom (Standard Angebot)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>		
	Geräte und Beleuchtung <input type="checkbox"/>	_____SFR	_____Monat(e)
Ökostrom Strom	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>		
	Geräte und Beleuchtung <input type="checkbox"/>	_____SFR	_____Monat(e)

Geben Sie bitte an wie viel der Elektrische Strom kostet:

Standardangebot: \_\_\_\_\_Rp./kWh, Ökostrom: \_\_\_\_\_Rp./kWh,

Falls Sie für den Hauptwohnsitz zudem noch Energie beziehen, welche Sie nicht bezahlen müssen (Sonnenenergie, Erdwärme, Umgebungswärme, eigenes Holz), geben Sie diese mit entsprechenden Kenngrößen an.

Energieform	Verwendungszweck	Energieproduktion pro Jahr	Kenngrösse
Sonnenkollektor	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____kWh	Fläche: _____m <sup>2</sup>
	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>		
Photovoltaik	Geräte und Beleuchtung <input type="checkbox"/>	_____kWh	Fläche: _____m <sup>2</sup>
<input type="checkbox"/> Umgebungswärme (mit Wärmepumpe)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____kWh	Anteil an Wärmeversorgung: _____%
<input type="checkbox"/> Erdsonden	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____kWh	Anteil an Wärmeversorgung: _____%
<input type="checkbox"/> Cheminee	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____kWh	Anteil an Wärmeversorgung: _____%

13. Falls Sie eine Zweitwohnung haben, geben Sie bitte auch die Ausgaben für Energie des Zweitwohnsitz an:  
(Falls Sie mehrere Zweitwohnsitze haben, geben Sie die Angaben für den grösseren Zweitwohnsitz an)

Energieträger	Verwendungszweck	BETRAG	DAUER für welche die Zahlung gilt
Heizöl.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Gas.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/> Kochen <input type="checkbox"/> Backen <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Holz (Heizkessel, z.B Pellets)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Cheminee-Holz.....	Heizung <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Fernwärme.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Sonstige.....	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ SFR	_____ Monat(e)
.....	Geräte und Beleuchtung <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Elektrischer Strom (Standard Angebot)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/> Geräte und Beleuchtung <input type="checkbox"/>	_____ SFR	_____ Monat(e)
Ökostrom Strom	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/> Geräte und Beleuchtung <input type="checkbox"/>	_____ SFR	_____ Monat(e)

Geben Sie bitte an wie viel der Elektrische Strom kostet:

Standardangebot: \_\_\_\_\_Rp./kWh, Ökostrom: \_\_\_\_\_Rp./kWh,

Falls Sie für den Zweitwohnsitz zudem noch Energie beziehen, welche Sie nicht bezahlen müssen (Sonnenenergie, Erdwärme, Umgebungswärme, eigenes Holz), geben Sie diese mit entsprechenden Kenngrössen an.

Energieform	Verwendungszweck	Energieproduktion pro Jahr	Kenngrösse
Sonnenkollektor	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/> Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ kWh	Fläche: _____ m <sup>2</sup>
Photovoltaik	Geräte und Beleuchtung <input type="checkbox"/>	_____ kWh	Fläche: _____ m <sup>2</sup>
<input type="checkbox"/> Umgebungswärme (mit Wärmepumpe)	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ kWh	Anteil an Wärme- versorgung: _____%
<input type="checkbox"/> Erdsonden	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ kWh	Anteil an Wärme- versorgung: _____%
<input type="checkbox"/> Cheminee	Heizung <input type="checkbox"/> Warmwasser <input type="checkbox"/>	_____ kWh	Anteil an Wärme- versorgung: _____%

14. Geben Sie an wie stark Sie beim Einkaufen von **Lebensmitteln** auf folgende Kriterien achten:

	immer						nie
	1	2	3	4	5	6	
Biologischer Anbau.....	<input type="checkbox"/>						
Saisonale Produkte (bei frisches Gemüse und Früchten).....	<input type="checkbox"/>						
Schweizerische Herkunft.....	<input type="checkbox"/>						

**D. Fragen zur Verwendung der Einsparungen**

15. Betrachtet man nur die Kosteneinsparungen aufgrund des tieferen Energieverbrauch so sparen Sie im schweizerischen Durchschnitt im Vergleich zu einem konventionellen Gebäude, welches zwischen 1980 und 2000 erbaut wurden, mit einem Minergie-Haus «Variable\_Kosten2» Franken pro Jahr ein. Wofür verwenden Sie dieses Geld hauptsächlich? (Kreuzen Sie mindestens jene Bereiche an, für welche Sie das Geld tendenziell verwenden. Falls möglich geben Sie auch noch den Betrag in Franken oder in Prozent der gesamten Einsparung an).

**Mobilität**

- grösseres Auto, \_\_\_\_SFR; \_\_\_\_%
- mehr Auto fahren, \_\_\_\_SFR; \_\_\_\_%
- mehr Fliegen \_\_\_\_SFR; \_\_\_\_%
- mehr Bahnfahren, \_\_\_\_SFR; \_\_\_\_%,

**Wohnung**

- Ausbau der Wohnung, \_\_\_\_SFR; \_\_\_\_%
- Zweitwohnung, \_\_\_\_SFR; \_\_\_\_%
- teurere Einrichtung, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%

**Nahrung**

- teurere Nahrung, \_\_\_\_SFR; \_\_\_\_%

**Geräte**

- mehr Geräte, \_\_\_\_SFR; \_\_\_\_%
- teurere Geräte, \_\_\_\_SFR; \_\_\_\_%

**Sparen/weniger Arbeiten**

- Sparen/Vermögensbildung/3. Säule, \_\_\_\_SFR; \_\_\_\_%
- weniger Arbeiten, \_\_\_\_SFR; \_\_\_\_%

16. Falls Sie Schwierigkeiten hatten, die Frage 15 zu beantworten, beschreiben Sie bitte weshalb und wie man die Frage verbessern könnte:

Frage 15 war schwierig zu beantworten, weil:.....  
.....  
.....  
.....  
.....

Frage 15 wäre einfacher zu beantworten, wenn:.....  
.....  
.....  
.....

17. Nochmals eine ähnliche Frage: Falls Sie eine **Gehaltserhöhung** erhalten und «Variable\_Kosten» SFR pro Jahr mehr als bisher erhalten, wofür würden Sie dieses Geld verwenden?

**Mobilität**

- grösseres Auto, \_\_\_\_SFR; \_\_\_\_%
- mehr Auto fahren, \_\_\_\_SFR; \_\_\_\_%
- mehr Fliegen, \_\_\_\_SFR; \_\_\_\_%
- Bahn, \_\_\_\_SFR; \_\_\_\_%,

**Wohnung**

- Ausbau der Wohnung, \_\_\_\_SFR; \_\_\_\_%
- Zweitwohnung, \_\_\_\_SFR; \_\_\_\_%
- teurere Einrichtung, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%
- sonst, nämlich \_\_\_\_\_, \_\_\_\_SFR; \_\_\_\_%

**Nahrung**

- teurere Nahrung, \_\_\_\_SFR; \_\_\_\_%

**Geräte**

- mehr Geräte, \_\_\_\_SFR; \_\_\_\_%
- teurere Geräte, \_\_\_\_SFR; \_\_\_\_%

**Sparen/weniger Arbeiten**

- Sparen/Vermögensbildung/3. Säule, \_\_\_\_SFR; \_\_\_\_%
- weniger Arbeiten, \_\_\_\_SFR; \_\_\_\_%

18. Falls Sie Schwierigkeiten hatten, Frage 17 zu beantworten, beschreiben Sie bitte weshalb und wie man die Frage verbessern könnte:

Frage 17 war schwierig zu beantworten, weil:.....  
.....  
.....  
.....

Frage 17 wäre einfacher zu beantworten, wenn:.....  
.....  
.....  
.....

**F. Zum Schluss bitten wir Sie noch um einige Angaben zu Ihrem Haushalt.**  
**Die ETH Zürich sichert Ihnen zu, dass Ihre Angaben anonym bleiben (Datenschutz-Info: Seite 1).**

19. Bitte geben Sie Jahrgang und Geschlecht der drei ältesten Personen des Haushalts an:

Älteste Person: Jahrgang: 19\_\_\_\_; Geschlecht:  männlich  weiblich

Zweitälteste Person: Jahrgang: 19\_\_\_\_; Geschlecht:  männlich  weiblich

Drittälteste Person: Jahrgang: 19\_\_\_\_; Geschlecht:  männlich  weiblich

20. Wie viele Personen wohnen in Ihrem Haushalt insgesamt:

	Keine	1	2	3	4	5 oder mehr
... <b>älter</b> als 18 Jahre sind (sich selber mitzählen)	<input type="checkbox"/>					
... <b>unter</b> 18 Jahren sind.	<input type="checkbox"/>					

21. Welche Ausbildungen haben die drei ältesten Personen des Haushaltes abgeschlossen? (Bitte geben alle abgeschlossenen Ausbildungen an.)

älteste Person des Haushaltes	zweitälteste Person des Haushaltes	drittälteste Person des Haushaltes	Ausbildung:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Keine
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	obligatorische Schule (Primar-, Real-, Sekundar-, Bezirks-, Orientierungsschule, Pro-, Untergymnasium)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Diplommittelschule (bis 2 Jahre), Verkehrsschule, Sozialjahr, berufsvorbereitende Schule, Anlehre
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Berufslehre oder Vollzeit-Berufsschule (z.B. Handelsschule, Lehrwerkstätte)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Maturitätsschule, Berufsmatura, Diplommittelschule (3 Jahre)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lehrkräfte-Seminarien (z.B. Kindergarten, Primarschule), Musiklehrkräfte, Turn- und Sportlehrkräfte
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Höhere Fach- und Berufsausbildung (z.B. eidg. Fachausweis, eidg. Fach- oder Meisterdiplom, HKG, TS)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Höhere Fachschule (z.B. HTL, HWV, HFG, HFS), mind. 3 Jahre Vollzeitausbildung (inkl. Nachdiplome)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fachhochschule (inkl. Nachdiplome)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Universität, TU, ETH, HSG (inkl. Nachdiplome)

22. Gesamt-Bruttoeinkommen pro Monat **aller Personen in Ihrem Haushalt** (inkl. Renten):

Unter 2000 Fr.	2000 – 4000 Fr.	4001 – 6000 Fr.	6001 – 8000 Fr.	8001 – 10'000 Fr.	10'001 – 12'000 Fr.	12'001 – 14'000 Fr.	höher als 14'000 Fr.	weiss nicht	keine Angabe
<input type="checkbox"/>									

23. Jetzt ist es fast geschafft! Wie fanden Sie den Fragebogen?

Der Fragebogen...	stimmt gar nicht				stimmt völlig
	1	2	3	4	5
... war schwer zu verstehen. ....	<input type="checkbox"/>				
... war zu lang. ....	<input type="checkbox"/>				
... war interessant. ....	<input type="checkbox"/>				
... war langweilig. ....	<input type="checkbox"/>				
... war einfach und leicht zu beantworten.	<input type="checkbox"/>				
... hat mich zum Nachdenken angeregt. ..	<input type="checkbox"/>				

24. Falls Sie weitere Bemerkungen haben, können Sie diese gerne hier notieren:.....  
.....  
.....  
.....  
.....

**Noch eine letzte Frage...**

In ca. 6 Monaten möchten wir einige vertiefende Interviews zur Energiebilanz von MINERGIE-Bewohnern machen. **Dürfen wir Sie für ein solches ausführlicheres Interview kontaktieren?**  Ja,  Nein

**Herzlichen Dank für das Ausfüllen des Fragebogens!**

Index: «Stichprobe\_Nr»



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