# PRO-ENVIRONMENTAL BEHAVIOUR OF HOUSEHOLDS IN THE CZECH REPUBLIC

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## Abstract

PRÁŠILOVÁ MARIE, PROCHÁZKOVÁ RADKA, VARVAŽOVSKÁ PAVLA. 2015. Pro-environmental Behaviour of Households in the Czech Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 63(2): 607–616.

Apart from the positive effects, which are reflected in the relative improvement of the quality of life, the way households satisfy their needs has a direct impact on many environmental problems. Among them are global climatic changes, air, soil and water pollution, excessive usage of natural resources and loss of biodiversity. Sustainable consumption belongs to the key elements of global movement for sustainable development. It can be characterized as consumer behaviour which satisfies the needs of current and future generations. Czech households influence the environment every day by doing their shopping, consuming and using various kinds of products and services, the way they spend their leisure time, by commuting to work and travelling in general and, last but not the least, by producing waste. Both the location and the size of the household significantly influence the environment as well. 30 to 40% of environmental problems are caused by households. Thus, pro-environmental movements warn of the necessity to eliminate negative impacts of households' behaviour. This paper analyses development tendencies of relevant indicators of household operations which have impact on the environment. The attention is paid primarily to consumption of electrical energy, water and food by households, usage of personal means of transport and production of communal waste. Time series statistical methods were used when assessing development tendencies.

Keywords: household, environment, consumer behaviour, sustainable consumption, energy, water, organic foods, transport, communal waste

## INTRODUCTION

From time immemorial, man has been influencing organisms at individual, population and community levels as well as their environment by his actions and in other ways. At the moment he started to differ from animals, his actions increased in heterogeneity and intensity. Man's impact can be divided into direct and indirect. The direct influence includes deforestation, cutting and grazing vegetation, burning, felling and introduction of new species, etc. This way he indirectly influences his environment by drainage, irrigation, fertilization, soil degradation, pesticides and unintentional blending of flora and fauna. On the other hand, no other organism on earth has ever thought of the extent to which it can utilize nature, which it is a part of, without destroying itself. This fact forced man to try to get to know mutual relationships among all elements of nature, boundaries of current possibilities of their usage, or exploitation of nature to his advantage or disadvantage (Laštůvka, Krejčová, 2000). In the developed world, 30 to 40% of environmental problems can be assigned to households (Prášilová, Varvažovská, 2012). Households have direct and indirect impact on the environment. The direct impact is given by household lifestyle, i.e. by their activities, ways of living, eating habits and transport. The indirect impact is connected with acquiring necessary resources, energy consumption when processing, distributing, and eliminating waste, occupation of land in order to build roads, shops, etc. (Kušková, 2009).

## MATERIALS AND METHODS

For a long time it was assumed that the increase of negative impacts on the environment and the society will be solved by new technologies. In the 1990s, it started to be apparent that these technologies are unable to remedy our growing desire to consume more and more. Therefore, at the beginning of the twenty-first century, social and environmental impact of unconditional following of economic growth became evident. The current trend and the way how to extricate from the threatening problem of human society are represented by global effort into sustaining consumption. Unlike the idea of sustainable development focused mainly on companies, sustainable consumption is a task for households – consumers in particular. Kolářová (2006) defines it as *„consumption based on consuming products and services which provide basic needs of society and the quality of their life, and at the same time take into account the same needs of future generations“*.

Household is the most fundamental unit where joint economics takes place. In this regard, superior groups – segments (e.g. a household sector in the national economy, or social groups) can be understood as units, which do have some common features influenced by analogous factors; however, their economics might be defined as the total or average, but not as a compact economic unit, in which a mutual coordinated decision-making process about consumption takes place. Except for the family, no other social group carries this characteristic (Bárta and Bártová, 2012).

Koudelka (2006) defines consumer behaviour as *„one of the levels of human behaviour. It comprises the reasons which lead consumers to using a particular product, as well as the ways in which they do this, including the impact this process is accompanied by. Generally speaking, why and how consumers use the products“*. Consumer behaviour means consumers' behaviour when shopping, using and selling goods, and each person's substance is reflected in it. This is partially conditioned by genetics and partially influenced by the environment in which we live. Consumer behaviour cannot be taken out of its connection with other aspects of human behaviour.

A study (Ganglbauer, Fitzpatrick and Comber, 2013) presents the results of a qualitative research analysis conducted in fourteen households and the results of the probe in five households as a model of behaviour and viewpoints on ecological sustainability.

Development of ecologically-sustainable consumption and production systems depends on consumers' willingness to behave in a responsible and pro-environmental way. A large part of the research (Peattie, Gadgil and Liverman, 2010) focused on the areas with the most significant impact on the environment, namely households and their economics, mainly their choice of food and other examples of pro-environmental behaviour, such as transport behaviour while commuting to work,

spending leisure time and holiday travelling habits. Pro-environmental behaviour is a process which is strongly influenced by consumer values, norms and customs.

Influence of households on the environment can be quantified in two ways, which can be applied to lower and higher levels, i.e. to individuals, a town, and a state, by means of either ecological footprint indicators or the equation model for environmental pollution. The ecological footprint is an indicator which quantifies the natural capital used by households and compares it with the total capital available on earth. The following data are used for calculation: consumption, which is converted to the amount of biologically productive land and water areas needed to produce the given resources and to assimilate them while using given technologies (Rázgová, 1999). The equation for environmental pollution is given by the product of three variables: the size of the population, the impact of production technologies and consumption (Librová, 2003).

A study by Garcia-Montiel *et al.* (2014) suggests that it is necessary to understand human attitudes and behaviour with regard to socio-economic possibilities and their environmental education. This provides an opportunity to disseminate environmental information based on the support strategy for sustainable consumption and waste management.

Household lifestyle is closely connected with all three factors mentioned above. In fact, they depend on the number of its members, on existing technologies available to each household, on the ways households spend their leisure time and do their shopping, which again influences production of goods and technology of services.

As Bárta and Bártová (2012) state, social learning takes place within the household, which significantly influences consumer behaviour. At home, we acquire eating habits, adopt hygiene habits, learn social behaviour and norms, basics of economics are created, and aesthetic opinions and morals are formed here.

The key element for making food systems more effective is to reduce food losses within the whole food value chain. Beretta *et al.* (2013) quantify food losses in Switzerland at different stages of the food value chain (agricultural production, manipulation after the harvest and trade, processing, food services, retail, and households), and identify the main reasons for losses. The energy review shows that 48% of the total number of calories produced within the whole food value chain is lost. Half of these losses could be avoided at the beginning of the food value chain, which means during agricultural production and processing. Households are responsible for almost half of the total losses, which could be prevented by responsible pro-environmental behaviour.

The data sources for the analysis of selected indicators which show development in pro-environmental behaviour of Czech households

were time series provided by the Czech Statistical Office, Transport Research Centre, the Prague Pipelines and Sewer Company, the Ministry of Agriculture of the CR, the Ministry of Transport of the CR, the Centre for Waste Management.

In the context of this paper, the sequence of factually and spatially comparable annual observations, which are definitely ordered with respect to time, is marked as time series. The time series analysis represents a set of methods used to describe time series or to predict their future behaviour. The visual analyses of indicator behaviour according to graphs together with determination of elementary statistical characteristics are basic methods used for further data analysis. The following one-dimensional model is the initial principle for modelling time series

$$y_t = f(t, \varepsilon_t),$$

where

$y_t$ ....... is the value of the modelled indicator in time $t$, $t = 1, 2, \ldots, n$,

$\varepsilon_t$ ....... is the value of the random element in time $t$.

Within the classical model, this does not concern knowing factual causes of time series dynamics, but only describing the movement forms (Hindls *et al.*, 2007). The model derives from decomposition of time series into four parts of time movement, trend ($T_t$), seasonal ($S_t$), cyclic ($C_t$) and random ($\varepsilon_t$).

The decomposition itself can be of two types:
● additive

$$y_t = T_t + S_t + C_t + \varepsilon_t = Y_t + \varepsilon_t,$$

where $t = 1, 2, \ldots, n$;
● multiplicational

$$y_t = T_t \times S_t \times C_t \times \varepsilon_t,$$

where $t = 1, 2, \ldots, n$.

When analysing non-periodic series, the key task is to determine their trend, and to capture the tendency of their development. In real life,

the empirical method is most common, where structural parameters of trend functions are estimated by the least squares method. Suitability of the trend function was evaluated by means of corresponding t-tests, the total F-test and the coefficient of determination.

## RESULTS

### Energy

Nearly the whole energy used by households is drawn from natural resources. Consequently, transformation of energy into electricity and heat produces a number of pollutants which pollute the air and have a negative impact on health and the quality of life of people and other organisms. By saving energy, households do not consider nature only, but also their family budget and health. Households represent an important sector of energy consumption. In the Czech Republic, households used whole fourth of used energy; transport energy usage reaches similar results (data from 2012). The highest consumption was shown by industry (37%).

Fig. 1 summarizes energy consumption in a three-member household in a town flat with the area of 80 m² with two adults and one child. The data include electricity for appliances and the heat for heating appliances and for water, regardless of how it is acquired.

As from 2001, it is compulsory in the CR to state information about operational demands of selected electrical appliances by means of an energy label. The same duty is in effect in the EU as from 1992, when the legal basis for energy labelling was formed (directive 92/75/EEC). In 2010, a new directive about energy labelling was adopted. The original labelling system was kept; however, its form and information on it have changed. This directive will be revised again at the European level before the end of 2014.

Households consume approximately 4/5 of produced energy on heating (only one fifth
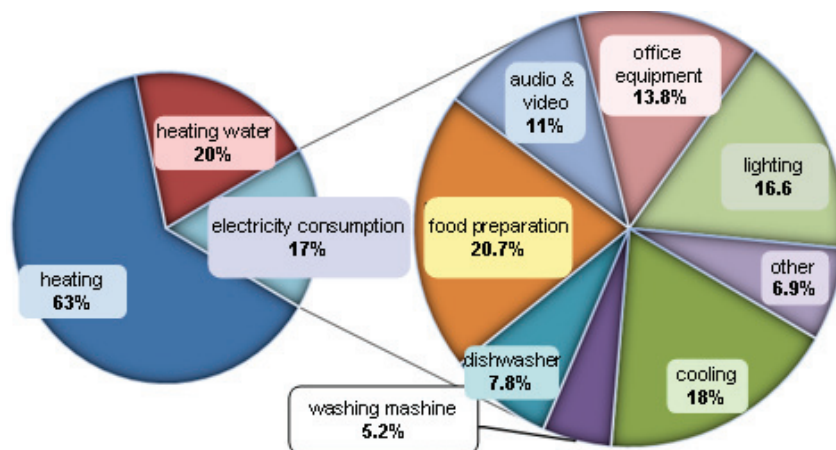


1: *Distribution of energy consumption in a model householdi (kWh/year, %) in 2010*
Source: http://elektro.tzb-info.cz, own data processing
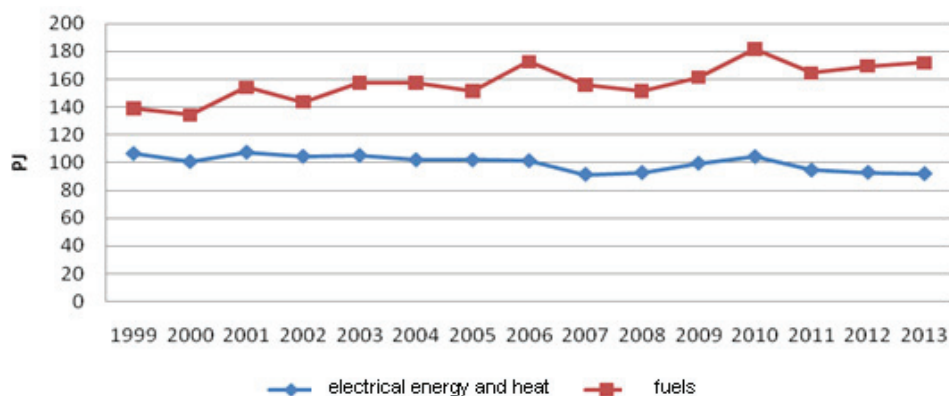
2: *Development of fuel, electricity and heat consumption by Czech households between 1999 and 2013 [PJ]*
Source: Czech Statistical Office (CSO), own data processing
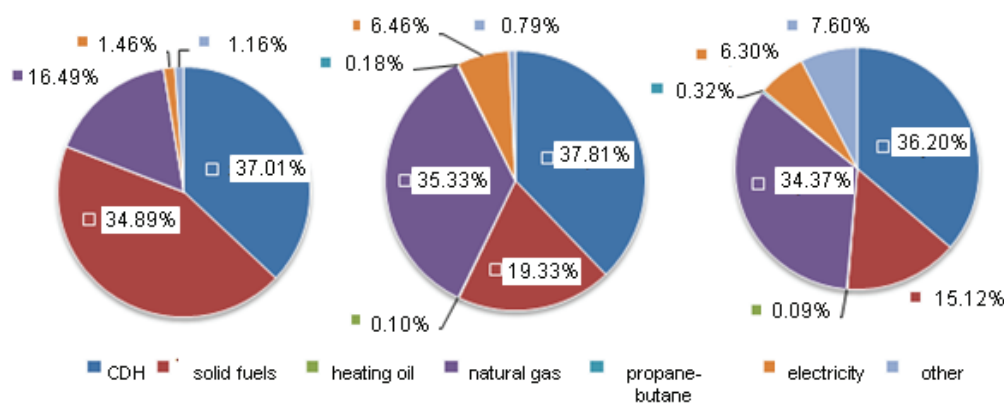


3: *Households according to heating methods in 1991, 2001 and 2012 [%]*
Source: The Czech Hydrometeorological Institute, own data processing

is assigned to the production of electricity). Information about heating methods is gathered once every 10 years from the national population and housing censuses (Fig. 3). Therefore, in the interim period the data are estimated and updated according to the number of newly-completed housing establishments and to the sources from distributors of fuels and energies. Since 2001, the household heating method has practically not changed. Currently, centrally distributed heating (36.2%) and natural gas heating (34.4%) prevail. Use of solid fuels (wood, coal) has been decreasing in the last decade at a very slow rate in comparison with the period between 1991 and 2001 when this method of heating dropped by 54.5%. This category includes more types of fuels with different impact on the environment, the specific classification of which cannot be determined clearly.

Sooner or later, a number of households will reach the stage when the saving potential of the current equipment will be depleted. Investments into new, preferably energy-efficient products will take place. What helps to make a choice is the existence of different eco-brands. Eco-labelling is labelling of products and services which are verifiably more eco-friendly both to the environment and to consumers' health during their whole life cycle.
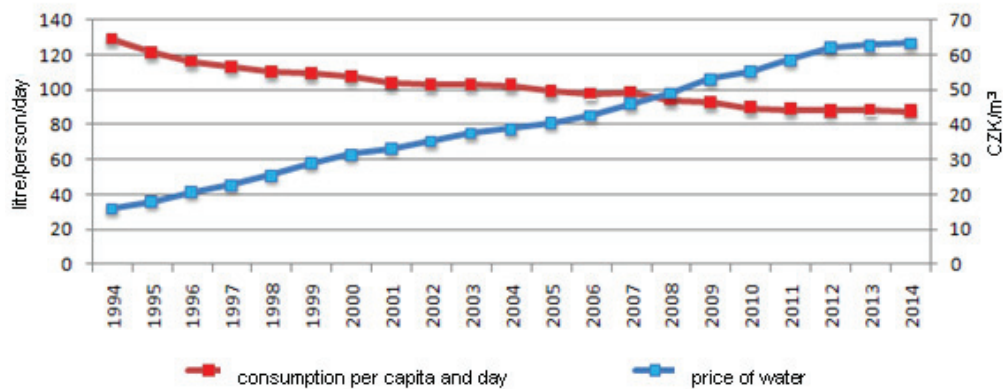
**Water**

Restructuring of Czech economy, reduction of the demanding nature of industrial technologies and water consumption in households have significantly contributed to the reduction of total consumption of surface and groundwater which started at the beginning of the 1990s and have continued since (Fig. 4). The highest decrease in water consumption against 1989 was recorded in 2001 (a drop to 79.83%).

In 2012, average daily water consumption in the CR reached 88.1 litres per person. However, this consumption decreased since 2000 approximately by one fifth. The reason was a lower demand for drinking water caused by introduction of more energy-efficient technologies and household savings (Fig. 5). In 2012, 93.5% of population was supplied with water by public water pipelines. In the same year, 33 litres of water per capita was lost in the pipeline. The model example demonstrates average daily consumption of drinking water per head during various activities in an average Prague household (Fig. 6). Despite the fact that the structure of consumption in various types of households may be different, it might be noted that most water in an urban household is used for personal hygiene and least for drinking.
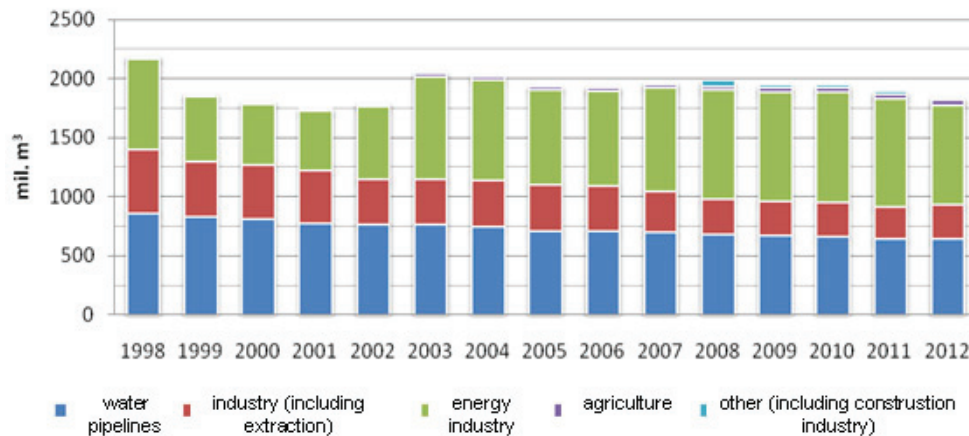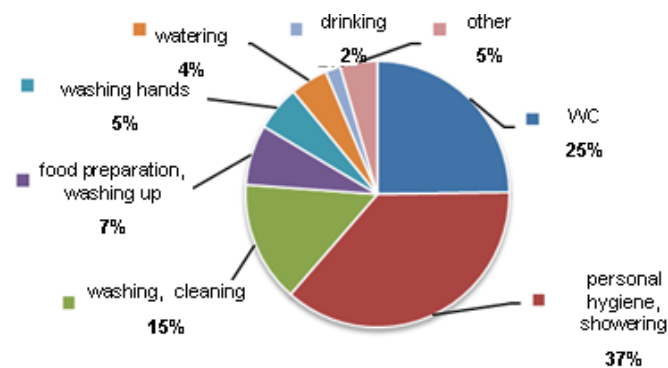
4: *Total water consumption by individual consumers in the Czech Republic between 1998 and 2012 [mil.m³]*
Source: Ministry of Agriculture, own data processing



5: *Water price development and its consumption per capita (1994–2012) and prediction for 2013 and 2014*
Source: CSO, own data processing



6: *Water consumption structure in a Prague household in 2012*
Source: Prague Pipelines and Sewer Company, own data processing
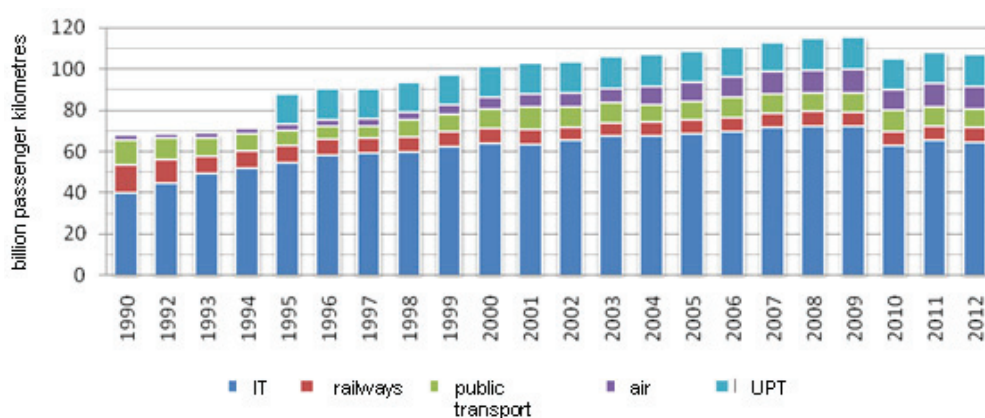
## Personal Transport

Impacts of transport are manifested not only in polluted surroundings of roads, but also in the construction process, where biological diversity is decreased or its initial function changes due to plant and animal species becoming extinct. Human health is threatened not only by chemical emissions, but also by a serious problem of acoustic emissions (noise, vibrations) and inactivity. Excessive use of motorised transport is one of the reasons for physical inactivity of current European as well as Czech population.

Socio-economic development in the CR has led to transport individualization and particularly to predominance of personal vehicle transport (Fig. 7). On 30th June 2012, 4,638 thousand personal vehicles were registered at the Central Registry of Motor Vehicles. Their average age was 13.9 years.
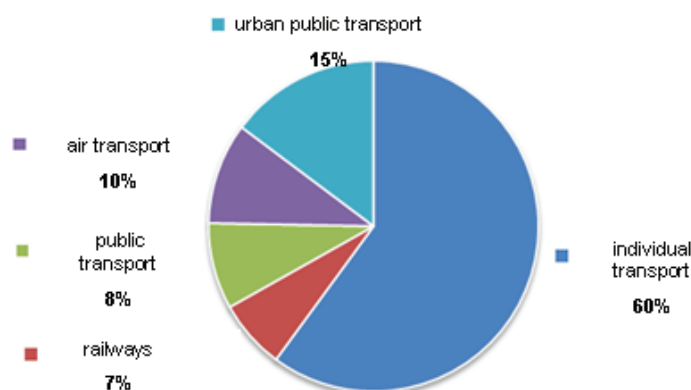
7: *Structure of transport capacities in personal transport in 2012 (in %)*
Source: Cenia, own data processing



8: *Transport capacities of personal transport according to specific types of personal transport in the CR in 1990–2012 (billion passenger kilometres)*
Source: Ministry of Transport, own data processing

Regarding the structure of the vehicle fleet according to propulsion systems, participation of diesel-powered vehicles is on the increase. In 2012, their participation was almost one third (1.4 mil. vehicles, i.e. 29.7%). Thanks to improvements of engines and the use of end-of-pipe technologies in diesel vehicles, this trend does not have a significant impact on the production of vehicle transport emissions. Alternative fuels and propulsion systems (natural gas and hybrids) are very low-spread in the CR at the moment (0.1%).

The total transport capacities of personal transport consistently grew in 1990–2009, on average by whole 3%. However, due to the descrease of transport capacities of individual transport by 12.9%, the number of total passenger kilometres has also decreased year on year by 8.9% in 2010. Transport capacities of railways in personal transport have been on the increase since 2010, in 2012 there was even the highest year-on-year increase since 1990, i.e. by 8.2% passenger kilometres. The highest increase in urban public transport was recorded by the underground in Prague, which served 60 million more persons in 2012 than in the previous year. The number of transport capacities in air transport

in the monitored period has quintupled from 2.18 to 10.61 passenger kilometres (Fig. 8).

The number of registered personal vehicles (under 3.5 tonnes) has increased since 2000 by approximately 1.3 million vehicles, i.e. by 37%, it has more than doubled since 1990 (Fig. 9).

The average age of registered personal vehicles is on the increase and in 2012 reached 13.9 years. In the age structure of registered personal vehicles, a group of vehicles older than 10 years significantly predominates, with 59% share. The proportion of vehicles younger than 2 years increased in 2012 against the previous year by 23.3% (Fig. 10). There is a significant change in the vehicle fleet structure according to the EURO emission standards. Proportion of personal vehicles which meet EURO IV and V standards tripled between 2007 and 2011.
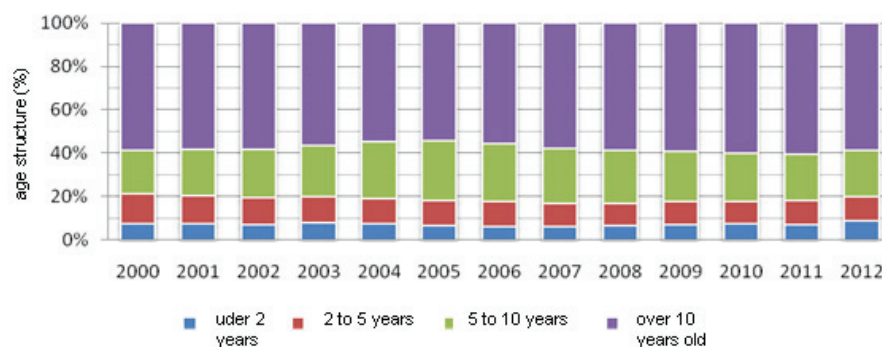
## Food

Information about the development of consumption of basic food is a concentrated reflection of a number of factors, some of which influence population's consumer behaviour long-term, others in short-term cycles. With the improvement of Czech households' living
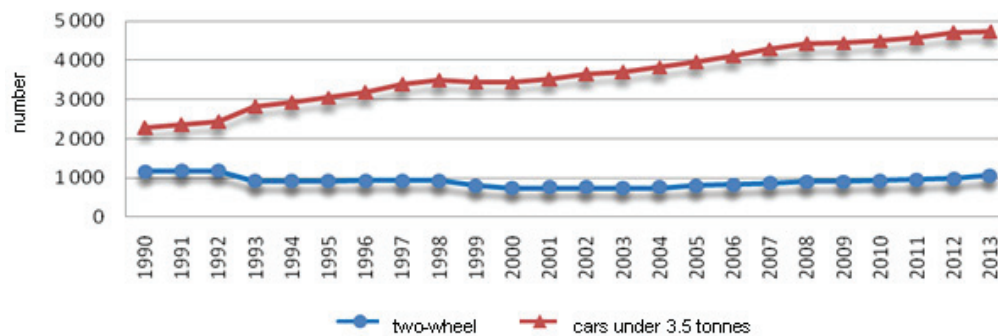
9: *Development of the number of registered two-wheel and personal vehicles in 1990–2012 and prediction for 2013*
Source: Ministery of Transport, own data processing



10: *Age structure of personal vehicles in the CR in 2000–2012 (in %)*
Source: Ministery of Transport, own data processing

standards, demands on the quality and whole year availability of the widest range of food possible are growing at the same time. This brings both positive and negative impacts on the environment. Over the recent years, the Czechs have changed their diet. Consumption of particular types of food, e.g. meat, vegetables, rice, is influenced by the change in eating habits caused by tourism as well as by the number of foreigners in our population, but the purchasing demand has the greatest impact on consumption of particular types of food. Mass advertising as well as health education also promote changes in shopping habits.

In the monitored period (2000–2011), the total food consumption increased, particularly that of vegetable products. Consumption of majority of food products has increased or reached a stagnation point rather than decreased. The only significant decrease was recorded in beef, bread and spirits consumption. On the contrary, the highest increase was recorded in non-alcoholic drinks, wheat bakery products, other dairy products, cheese, butter, wine, southern fruit, and cereal products overall. According to the research, growing vegetables and fruit in people's own gardens has become popular again. However, in this case, price is not the main reason. It is the growing interest in products which do not require chemicals that is crucial. In recent years, demands for organic products and food have grown in the CR. The total area of organic

soil increased between 1990 and 2012 from 480 hectares to 490 thousand hectares and currently, 12% of agricultural land in the CR is being farmed organically (information from 2013).

The total turnover of organic food from domestic producers including export reached 2.24 billion CZK in 2011, out of which 1.67 billion was spent on organic products by Czech consumers. Average annual consumption per capita is constantly at the level of under 200 CZK (158 CZK in 2011) and their share on the total food consumption equals 0.65%.

Whenever Czech equivalents of foreign products are available, Czech consumers and their households are recommended to buy domestic products. The main reasons mentioned are saving energy, decreasing emissions, support of Czech producers and of original Czech products and varieties (breeds). Information about the country of origin and food producer must be stated on the packaging or on the attached parts. In order to highlight good quality Czech food, logos Klasa and 'Český výrobek' (Czech product) are usually used.

### Waste

In 2012, the total waste production in the CR reached 23.4 million tonnes, out of which 19.9 million were produced by company activities. Companies also produced the total amount of hazardous waste, i.e. 1,475 thousand tonnes.

In the monitored year, 3.2 million tonnes of communal waste were produced (308 kg/capita). Common collection of waste (mixed) comprised the biggest part, i.e. 2.2 million tonnes, separated waste 402 thousand tonnes, and bulky waste 313 thousand tonnes. The structure of communal waste is mentioned in Fig. 11.

Communal waste is a heterogeneous mixture of many substances and objects which have lost their original importance. This is manifested in the changing composition of both the quantity and quality of waste. Communal waste is defined according to § 4, article b), law No. 185/2001 of the Code, on waste. As Hlavatá (2006) states, over the last years composition of communal waste has changed due to concentrated housing development, changes in heating systems in urban areas, lifestyle changes, higher consumption of ready-made products, packaged drinks. Deviations in waste composition can also be attributed to better discipline of some households when separating their waste.

The total communal waste production per capita reached 308 kg in 2012. In comparison with the EU27 average, communal waste production in the CR is low and reaches 64% of the average of 27 countries of the European Union.

Fig. 12 shows that common collection from containers or collection bags made the predominant part of the produced waste (68% in 2012), separated waste (glass, plastic, paper) amounted to 13.9%, bulky waste (furniture, carpets) to 9.7% and communal services waste (cleaning streets, parks, etc.) to 1.8%. Since 2002, when people placed 16 kg of paper, plastic, glass and metals into the coloured containers, the proportion of separately collected components has been growing continuously. In 2012, 43 kg were separated per capita, namely 14 kg of paper, 11 kg of glass, 10 kg of plastic and 4 kg of metals were collected per capita.

Further analysis has shown that the highest increase in communal waste production (against 2007), occurred in 2008, by 151 thousand tonnes. In 2012, this type of waste production decreased by whole 125 thousand tonnes, which was the highest amount in the monitored period. Based on the communal waste structure analysis, it is evident that in 2012 common collection (mixed waste),
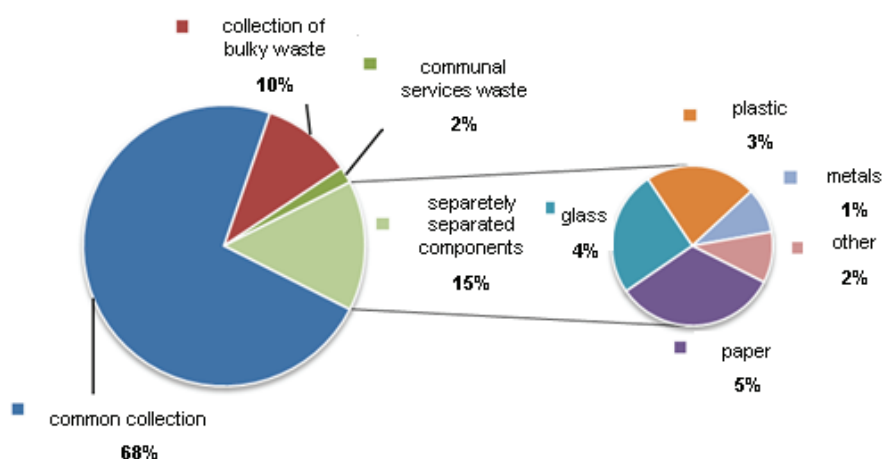


11: *Structure of communal waste of Czech households in 2012*
Source: CSO, own data processing
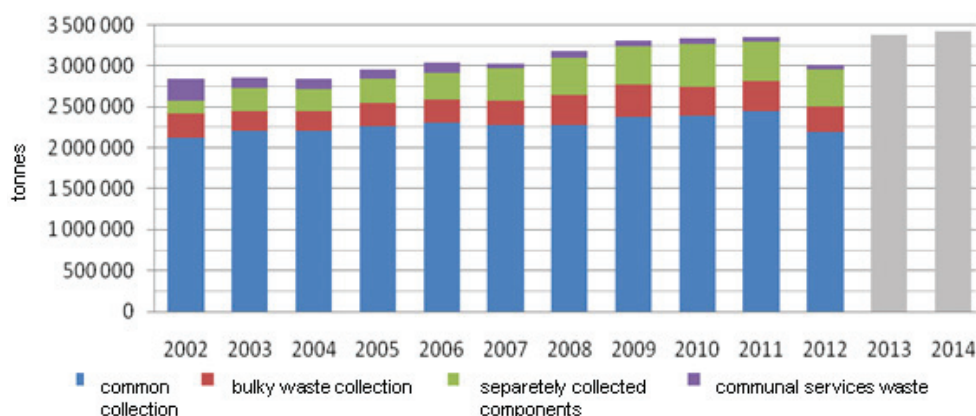


12: *Development of communal waste production in the CR in 2002–2012 and prediction for 2013 and 2014*
Source: CSO, own data processing

after years of continuous growth, has returned by falling by 250 thousand tonnes of the produced mixed waste to the level in 2003. The highest absolute annual increase of bulky waste took place in 2008 (by 59 thousand tonnes against 2007). On the contrary, the highest decrease in bulky waste production was recorded in 2010 and amounted to 50.6 thousand tonnes. The amount of separately collected components of communal waste almost tripled in the monitored period. Unlike other elements of communal waste, the development of communal services waste shows a decreasing trend. In 2012, against 2002, the total communal services waste production dropped to 21%. Waste management system has gradually improved and thanks to technological progress this has led to the decrease in the amount of landfilled waste.

## DISCUSSION

Economic, social and technical changes over the recent years have positively influenced Czech household management of water and energy, have brought new tendencies in personal transport, and have had a positive impact on production and separation of communal waste. The results of secondary time series data analyses positively evaluate tendencies of Czech households to separate usable elements of waste. Most water in households is used for personal hygiene and for household duties. Both of these activities more or less "enrich" water with biological or chemical substances. Therefore, households should consider ways how they could minimize their contribution to its pollution. Using public sewer system in order to remove solid and hazardous waste is not pro-environmental either. Transport in the Czech Republic represents one of the main factors which negatively influence the environment. Road transport occupies the largest part in this regard, its impact being manifested in production of air-polluting emissions, which influence human health, particularly in large cities with high density of vehicle transport. Carbon emissions contain considerable amount of substances which are toxic and genotoxic, some are carcinogenic and other

contribute to atmospheric warming. What can be praised is the decrease of transport capacities of individual transport, whereas transport capacities of railways in personal transport since 2010 have grown. Although a group older than 10 years with 59% share predominates in the age structure of registered personal vehicles, participation of vehicles younger than 2 years increased in 2012 against the previous year by 23.3%. The increase in the amount of emissions of less demanding vehicles in the vehicle fleet is another precondition for the reduction of transport emissions. A number of cities try to motivate their citizens to use public transport instead of cars by introducing integrated transport systems, „Park and Ride" and „Bike and Ride".

With improving living standards of Czech households, demands for the quality and whole year availability of the widest possible range of food are also growing. This brings both positive and negative impacts on the environment. Time series development of food consumption in the CR demonstrates positive changes in consumption of particular types of food, which is a result of economic changes mainly – development of consumer prices, offer, and availability of products on the market, promotion, and health education. This way the diet of Czech households has become more varied and healthier. Our choice of food influences not only our health but also health and beauty of nature. This is why we should be interested in the origin of food and in the way it was acquired.

The total area of organically farmed land increased between 1990 and 2012 from 480 hectares to 490 thousand hectares and at the moment 12% of agricultural land in the CR is organically farmed. In spite of existing shortcomings, pro-environmental behaviour of Czech households has changed significantly. This is owed to the following facts: increasing care of individual households for their members' health, their active effort to improve the environment, and also nutrition-oriented educational programmes as well as access to information about the state of the environment guaranteed by the law.

## CONCLUSION

This paper summarizes the main tendencies of negative impacts of household activities on the environment, possibilities of their elimination or decrease. One of the solutions is a pro-environmental way of life, which does not require solving ecological crisis, but taking responsibility for one's actions. This paper analyses development tendencies of relevant indicators of household management which influence the environment. Attention is paid mainly to the consumption of energy, water and food by households, use of personal transport and to communal waste production. The results acquired have pointed to positive turnaround in the relationship of Czech households with the environment, which is influenced by economic, social and technological changes. Households try to contribute to the protection of the environment mainly by separating waste, saving energy, water and using eco-friendly products. Based on the analyses conducted, it was discovered that among the key factors in the development of the environment in the CR are not only restructuring of Czech economy or integration into the EU, but also changes of lifestyle and living standards of the households. Households represent important sector in energy consumption. In the Czech Republic, households used whole quarter of the consumed energy, while the biggest proportion of

this energy was used for heating. The proportion of households heated by a central heating system and by natural gas has been stabilized, the proportion of households heated by solid fuels have positively decreased and the proportion of households which use technologically new methods and sources of energy which are highly eco-friendly has positively increased. Individual transport represents 60% of transport capacities in personal transport. Since 2010, transport capacities of railways in personal transport have increased. The average age of registered personal vehicles is still on the increase and in 2012 reached 13.9 years. However, the proportion of vehicles younger than 2 years increased in 2012 against the previous year by 23.3%. The structure of the vehicle fleet according to the EURO emission standards has changed significantly. The proportion of personal vehicles that meet EURO IV and V standards tripled in 2007–2011. Time series development of food consumption in the CR demonstrates positive changes in consumption of particular types of food, the contributing factors being consumer prices, offer and availability of products on the market, promotion and health education. This way, the diet of Czech households has become more varied and healthier. The waste management system is also gradually improving and thanks to technological developments the amount of landfilled waste has been reduced. The amount of separately collected components of communal waste has almost tripled since 2002. Based on the indicators analysed, pro-environmental behaviour of households in the Czech Republic shows positive tendencies, which must continue to be developed and supported.

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