Carbon footprint and the concept of green economy and social inclusion in Snina town

Matej Polák, Martina Černegová

Abstract

At present, the result of turbulent changes on world markets becomes the centre of attention smart and sustainable growth. There sis a necessity to calculate and prognose development of situation in different regions of Slovak Republic. This means that the emphasis is on both the expansion of green logistics and green supply chains. It is therefore possible to reduce energy consumption and transport costs just minimizing transported kilometres, searching for new transport routes, the use of more efficient transport of goods, improving transport capacity of goods or consolidation of shipments. Since this is possible to achieve the elimination of carbon emissions and great emphasis is put on recycling, use of alternative fuels, but also for the observation of the carbon footprint.

1.1 Green growth

According to OECD (2011b) "means green growth in a certain way by promoting economic growth and development, while also protecting natural resources so that we can continue to enjoy the resources and environmental services on which depends our prosperity." On this basis it can be argued that the need to promote investment and innovation that is the basis for sustainable growth and allowing for the emergence new economic opportunities.

The main objective of green growth is to support institutions and incentives that contribute to increasing human prosperity. This is particularly the support of management, which uses natural resources and promote economic activities that are beneficial to society. It is therefore necessary to innovate mainly to practice, but also to understand and realize the value of natural capital.[1]

Green growth has its drawbacks and among the biggest are:
-    Lack of resources (lack of increased investment costs, eg. In need of capital intensive infrastructure due to water depletion or deterioration of its quality (equipment for desalinization)
-    Imbalance of natural systems (imbalance increases the risk of severe, sudden and potentially irreversible consequences dropout rate much damage affecting such are certain fish stocks and it is possible that is also reflected in biodiversity as a result of permanent climate change.

Green growth has the potential to solve many economic and environmental problems of today and also has the ability to gain access to new sources of growth through incentives and innovation, build investor confidence, new markets and creating macroeconomic conditions.[2]

The main areas in which it is necessary to adopt measures leading to the improvement of the status should be included:
-    Climate changes.
-    Biodiversity.
-    Natural resources and ecosystems.
-    Consumption and Production.

-     Cities [3].

It can reduce the risk of negative impacts on green growth, such as:

Insufficient funds

Lack of funds increases investment costs (e.g. in need of capital-intensive infrastructure due to the exhaustion of water supplies) or decrease its quality (e.g. dieselization equipment). If we look at it from this point of view, so the loss of natural capital may be higher than the gains of economic activity, which would hinder the move towards sustainable growth.

Imbalance of natural systems

It increases the risk of severe, abrupt and potentially irreversible consequences of major damage dropout rate, affecting for example certain fish stocks and it is possible that will be reflected in biodiversity as a result of permanent climate change.[4]

A framework for green growth

The road to economic growth of the economy depends on:
-     Political and institutional environment.
-     The level of development.
-     Subsidies on resources.
-     Specific environmental sensitive points [4].

The basis of any strategy of green growth is good economic policy. Flexible, dynamic economy is the best thing to stimulate growth and to transition to a greener path. Green growth requires efficient use of resources to minimize the environmental load. The key objective of economic policy is the efficient use and management of resources, and therefore requires fiscal and regulatory measures, which are generally not associated with the "green" agenda.

It focuses on effective ways of reducing the environmental burden to encourage the move to a new model of growth without exceeding the critical environmental boundaries at the local, regional and global levels.

However, the key role innovation will play. Positive results, even if only to a certain extent, can be expected from consumer behavior and the existing production technology (up to the level reached beyond which the depletion of natural capital have negative results). No innovation will be the possibility of replacing natural capital rather limited. However, by moving the boundaries of innovation can help to decouple growth from natural capital depletion.

Green growth strategy recognizes that focusing on GDP (as an indicator of economic progress) overlooks the contribution of natural resources to wealth, health and prosperity. Therefore, this strategy takes into account a wider range of progress indicators that assess the quality and structure of growth, as well as the well-being and prosperity of the population. Therefore, it is the place to say that green growth is an essential component of sustainable development.[4]

Green growth strategy must address the many challenges associated with eco-innovation:
-     Too low or no cost for many environmental externalities
-     Dominance of existing technologies and systems can reduce the competitiveness of new technologies, their market entry and application.
-     Serious disturbances in development and global dissemination of green technologies can create obstacles to trade and investment.

An important factor in the success of the green growth strategy is well defined framework for action and a uniform set of criteria for economic and environmental policy. Therefore, it must avoid a high degree of coordination between ministries and other levels of government and stakeholders to help identify policy mix suitable to local conditions.[4]

Environmental performance of companies

The most important reason why companies implement environmental strategies is increased public interest in the environment. The world was made hundreds of opinion polls concerning the protection of the environment. They were performed in Europe, Asia and the USA, indicating that environmental protection has increased as a priority in developed and developing countries.

Based on surveys, it has been shown that in addition to traditional elements of corporate reputation as a reliable business ethics is an integral part of business reputation, become environmental attributes. It is a company policy that demonstrates an interest in environmentalism, the degree of sensitivity to public concern about ecology, environmental self-regulation and programs to minimize waste generation. Consumer research shows that customers highly value the direct benefits that organic products offer, as more freshness and flavor of food safety and healthiness and energy savings.[12]

Eco-friendly company image

Prevent the occurrence of pollution is much more effective than it removed later. According to M. Kvaltínová it should be noted *"that sustainability is an important part of corporate culture and strategy. In order to ensure sustainable development have to be established and the environmental aspects under their optimize resource consumption through the company processes in the development, production and sales."*

Socially conscious company will not turn away from negative environmental impacts of activities, but looking for solutions to eliminate them or reduce their impact on the environment. Effective tool for minimizing the negative impacts of production activities on environmental issues is environmental management. Therefore, each company establishes in the organization of environmental management system according to ISO 14001: 2004. This standard requires that a company has defined environmental objectives and create an appropriate management system to achieve them. It should focus on reducing energy consumption, to reduce heat leakage (building insulation). For healthy and conducive to investment in technologies that reduce the amount of emissions released into the atmosphere.[13]

1.2 The green economy

The green economy is by UNEP (2011b) characterized as "economy, promoting human prosperity and social equity while reducing environmental risks and ecological damage. Simply put, it is the carbon resource-efficient economy, promoting social inclusion. "

The concept of green economy distinguishes three interrelated spheres regards:
- Sphere of ecosystems (natural capital)
- Economic sphere (produced capital)
- Prosperity sphere (social and human capital).

The main objective of the green economy is such economic recovery, poverty eradication, reduction of carbon emissions and the degradation of ecosystems.[4]

According to UNDESA the green economy is:
- A tool for achieving of sustainable development.
- Creating green jobs.
- Effective use of natural and energy resources.
- Protecting biodiversity and ecosystems.
- Improving the system of government and legal system.

- A democratic, collective, responsible and stable.[5]

The basic elements of a green economy contained in the strategic documents are:
- A strategy for smart, sustainable and inclusive growth – Europe 2020.
- Roadmap for moving to a competitive low carbon economy in 2050.
- Our life insurance, our natural capital: an EU biodiversity strategy by 2020.
- Roadmap to a Resource Efficient Europe.
- General environmental action program of the EU 2020 - Good Life within the planet.

The documents, which were prepared by international institutions, many countries have begun implement green concepts and prepare their own national green strategy (e.g. in France, in 2010, the "National Strategy for Sustainable Development 2010-2013 is entitled: Towards a green and fair economy".[6]

"The green economy is considered efficient use of natural resources, effective management to prevent environmental degradation and minimize the waste of resources." Green Economy is the most appropriate way for the future development and generation of healthy population. Therefore, it is appropriate for people to change their habits, behavior and began to make changes in the use of resources.[7]

2. Policies and instruments in the green economy in Slovakia and abroad

The European Union has not yet processed a common strategy for the green economy and green growth. The basic elements of a green economy are incorporated in strategic documents such as:
- A strategy for smart, sustainable and inclusive growth - 2020.
- Roadmap for moving to a competitive low carbon economy in 2050.
- Our life insurance, our natural capital: an EU biodiversity strategy to 2020.
- Roadmap to a Resource Efficient Europe.
- General Environmental Action Programme of the EU for 2020 - the good life in the context of the planet.[14]

Based on the documents that have been processed by international institutions, many countries have started to implement green concepts and prepare their own national green strategy. In France in 2010, it was adopted "National Strategy for Sustainable Development 2010-2013: Towards a green and fair economy" that has defined nine strategic areas:
1. Sustainable consumption and production.
2. Knowledge based society.
3. Policy
4. Climate change and energy.
5. Sustainable transport and mobility.
6. Protection and sustainable management of biodiversity and natural resources.
7. Public health, prevention and risk management.
8. Demographics, immigration and social inclusion.
9. International challenges of sustainable development and the fight against global poverty.[14]

The green economy is considered efficient use of natural resources, effective management to prevent environmental degradation and minimize the waste of resources. Green Economy I most appropriate way for the next generation of development and health of the population. It would therefore be advisable for people to change their habits and behavior began to make changes in resource use. Past should remain economic development, which is accompanied by a huge burden on the environment and depletion of natural resources. Even the private sector is now forced to

consider the "green" value chain and restructure their production. This is important because the efficient use of water, energy and materials is becoming a decisive factor of competitiveness. [15]

Sustainable economic development through green economy has become an important factor in the cross-border cooperation and should be conditioning the law within the EU Community. The government of each country should be in the green economy, based on the adopted technical choices to invest their funds.

The primary decision of the Slovak government should also create green inspections focused on the economy, and thereby strengthen the authority itself ecology and green growth, but also employment. Efficient use of and connection with EkoFond green economy and legal action to force the Slovak producers to upgrade, or a reasonable fee to the State for ignorance green growth economy. In view of the global financial crisis, it is essential for countries to review ways of development.[15].

For working capital we cannot be regarded as a large group of low-skilled labor, but the countryside is especially generation of qualified citizens who lost their jobs in industrial centers. Experts see potential for employment growth in the "silver" economy. Options on job creation in the green economy:

- Production focused on environmentally friendly outputs
- Services aimed at activities for environmental protection (recycling waste, landscape maintenance, flood protection)
- Services in rural tourism with the natural resources and landscape maintenance require manual labor.[16]

3. Ecological footprint

For the first time the concept ecological footprint came two professors, namely Mathias Wackernagel and William Rees of the University of British Columbia. These professors have questioned whether humanity lives above the limit carrying capacity of the Earth. Thus creating the unit of measure by which they were able to estimate the size of the area it needs a human or an activity to exist. It is thus the first unit of measurement can argue in natural resources and pollution.

The Ecological Footprint is defined by Greenpeace as a "measure of human demand for terrestrial ecosystems." It compares human demand with the ecological capacity of the Earth. It can be said that this is the amount of biologically productive land and sea required for recovery of a resource to man consumes the capacity of the Earth, and the wastes without significant damage [9].

Ecological footprint we consider mathematical tool for calculating ecological resources (Atlas 2010). Canadian William Rees approached the ecological footprint as follows: "How many surfaces (land or water) necessary for the continued lifestyle, how much you need it to current lifestyles and how to disposing of waste which we produce in it?" Ecological footprint calculation is based on three simple principles, namely:

- It is necessary to determine the amount of natural resources we consume and the amount of waste they produce

-   The resources and waste can be converted into the corresponding amount of biologically productive area of land (arable land, pastures, forests ...)
-   1 ha of biologically productive area of land is referred to as global hectares (gha).[10]

In order to compare the different areas through the so-called global hectare is necessary that the land and water area was normalized through its biological productivity. According to data from 2010, the countries with the largest ecological footprint per capita are:

-   United Arab Emirates (10.68 gha).
-   USA (8.0 gha).
-   Kuwait (6.32 gha).
-   Australia (6.84 gha).
-   Czech Republic (5.73 gha).
-   Austria (5.3 gha).
-   Slovak Republic (3.3 gha).

Among the States whose ecological footprint was under 1 gha include:

-   Bangladesh
-   Afghanistan
-   Congo.

Slovakia found itself ranked 45th on the ecological footprint per capita 3.3 gha. Based on this value, we can say that the way of life in Slovakia is unsustainable [11].

3.1 Carbon

Carbon is an essential element of the organic materials, including proteins, carbohydrates, lipids, and nucleic acids. It is an essential building block for the environment and living organisms around us. Carbon is an element that is found in all living organisms. "It accounts for 18% of our body and is one of the main structural components of plants and trees." Carbon and its various forms circulate continuously between the atmosphere, oceans and continents. We say this is a carbon cycle in the environment. This cycle can be described as: the plants absorb CO_2 from the atmosphere and convert it via photosynthesis to biomass (wood, leaves, fruits, roots). Some of the carbon from CO_2, the breathing of plants and other living organisms, including humans, is released back into the atmosphere. Carbon residue remains embedded in the bodies of living creatures, the dead residue, soil and the like. The carbon cycle is repeated so naturally. In the use of fossil fuels (oil, gas, coal) they are released into the atmosphere large amounts of CO_2, eventually other greenhouse gases that contribute to climate change revolutionizes [8].

3.2 Carbon footprint

"The carbon footprint is a subset of the ecological footprint. This means that it is a part of the representation of the overall impact of human activities on the environment. Carbon Footprint understands the emissions of such gases which have an impact on Earth's climate, and the emissions are man-made."

For the calculation of the carbon footprint it GHG considered strictly, only carbon dioxide, or carbon-containing gases such as methane, if necessary a greenhouse gas of carbon as such nitrous oxide. In the calculation we can consider either directly activities such as use of motor vehicles or

power consumption. At a broader view, however, we take into account the emissions incurred during the life cycle of products and services. It is the time from raw material acquisition to production to processing waste from the material. However, this broader approach is difficult to quantify because it is not so easy to determine the boundaries of the analysis. Even the units in which the indicated values are different ecological footprint it may in fact be a determination of carbon, CO_2, the equivalent weight of CO_2 for all greenhouse gases. But it can also be an expression of effects in hectares (Wiedman and Minx, 2007.[12]

The carbon footprint is a metabolic cost of human civilization. Combustion of fossil fuels (coal and oil) accumulated during the Earth's geologic past releases significant amounts of CO_2. Released carbon enters the complex of biogeochemical variables, but a significant portion of this carbon accumulates in the atmosphere as "greenhouse gases" and influences the dynamics of the climate system. The biosphere reversibly absorbs a part of the carbon emitted by industry, for example heating, electricity or motor transport. As such a carbon is bonded to the vegetation. Respiratory processes are carbon from the ecosystem evolve to compensate for the other side of the photosynthetic assimilation of organic matter.

The carbon footprint is now viewed as the amount of CO_2 released by human activities. We can say that in the original sense of the ecological footprint is a hypothetical wooded area that is needed to capture the anthropogenic emissions of carbon dioxide (CO_2).[13]

In its present form indicator ecological footprint charged carbon emissions from several sources:
-    Fossil fuel combustion, deforestation.
-    Carbon in products.
-    The share of the state's CO_2 emissions from international transport.

The total carbon, which is attributed to the state, is transferred to the global hectare using annual growth of the wood. All these processes contribute, either positive or negative, to influence radiation to the atmosphere. Carbon footprint, whether it be defined however, is a useful expression of the impact of our activities on climate. For the company's carbon footprint it is one of the newer instruments visibilities of the environmental performance of their products and services. The calculation for goods and services is already more sophisticated than for citizens and law in this case is highly demonstrates the problem with ambiguous definition of this variable and ambiguous boundaries lifecycle. Therefore, there are different standards such as. PAS 2050: 2008, which are based on the methodology BS EN ISO 14040 and BS EN ISO 14044, by means of which companies can assess the impact of the life cycle of their products on the climate (BSI, 2009).[14]

"The total amount of CO_2 and other greenhouse gases emitted over the life cycle of the technology, called carbon footprint." The technologies to produce electricity using fossil fuels produce a greater volume of CO_2 than renewable energy sources. For carbon neutral renewable energy technologies are known, ie the technological low carbon because it does not emit CO_2 during operation. When renewable energy generated CO_2 emissions by up during subsequent phases of their life cycle, such as mining, construction, maintenance and decommissioning.
The carbon footprint is a way of expression than the equivalent amount of emissions per kWh of energy produced. The carbon footprint is calculated using the life cycle assessment. This method is used to analyze the impact on the environment, taking into account the energy inputs and outputs of emissions during the entire production chain from exploration, extraction of raw materials to processing, transport and final disposal. This method is internationally accredited ISO standards.[15]

4. The area of interest - Snina town

Snina town is located in the north-eastern part of Slovakia, in the easternmost part of the Prešov region. The city is part of the Upper Zemplín and the entire district Snina from the north it borders with Poland, Ukraine forms the eastern border of the south adjacent to district Sobrance, west adjacent to district Humenné. Snina is located at the confluence of Pčolinka and Cirocha. It is surrounded by mountains Laborecká highlands, hills and Vihorlatské Bukovské hills. It is the starting points in the protected landscape area Vihorlat, which is of volcanic origin, and the National Park Poloniny, which since 1993 has been part of an international biosphere reserve Eastern Carpathians.

Snina town is economic and administrative centre of the region, which together with other 33 citizens live on an area of 80 503 ha with a population 38,129. The area of the city is 5,861 hectares. In 2014, the city had itself a population of 20,193, of which 10,213 men and 9,980 women. The town lies on the route Strážske - Humenne - Snina - Ubľa, which continues up to the border crossing with Ukraine. Quality and safety of road transport has increased the construction of a roundabout in the city. Rail transport in the region is provided by the railway tracks of local importance Humenné - Snina – Strážske. Town, as well as the whole district are among the economically less developed without significant resource base with relatively high unemployment although the region has in the Slovak Republic an important position in natural wealth.

Cadastral town neighbors with both the natural area Vihorlat and the National Park Poloniny. In addition to natural and cultural heritage, there is also a water reservoir Starina, which supplies water to a large part of the Košice, Prešov region as well.

4.1 Carbon footprint calculation

To calculate the carbon footprint calculator will use the city's carbon footprint. For the calculation of these are the most important components:

- Energy - consists of the final consumption of energy in all its forms within the administrative area of the city.
- Transport - in calculating the cover passenger transport and transport of inhabitants of the city and outside the city, whether by public or private transport, and also by rail and trucking.
- Waste and waste water - the carbon footprint of the city strongly influences the rate of waste production and its classification, respectively utilization.
- Land Use - land use changes in the city's carbon footprint can affect positively or negatively.
- Agriculture - the impact on the carbon footprint has also livestock and agricultural production in the city, notably with breeding pigs or cattle.

An essential step for calculating the carbon footprint is a calculation of a sectoral (energy, transport, waste, land use and agriculture) to the equivalent amount of greenhouse gases. To do this, we used emission factor, which shows the amount of greenhouse gas emissions in tones of CO_2. These factors should be the next step converted into the corresponding quantity of greenhouse gases, expressed in CO_2 equivalents (CO_2 e.q.). On this basis, we counted the carbon footprint of the city as: input data * emission factor. The calculation results we offer in Table 1. In Figure 1 we graphically present the major carbon footprint producers.

Table 1. The total amount of CO_2 in Snina town*

	t CO$_2$ equity totally	t CO$_2$ equity per citizen	Ratio [%]
Energy	130 755,731	6,39	88,11
Transportation	12 502,572	0,61	8,42
Waste	5 075,85	0,24	3,43
Territory utilization	47,6	0,002	0,03
Agriculture	18,249	0,0009	0,01
Totally	**148 400,0023**	**7,25**	**100**

Source: own processing of data provided by the Snina town (* data are approximate)

The data in Table 1 shows that the carbon footprint of the town accounted for in 2013 the value of 7.25 t CO$_2$ eq. per capita.
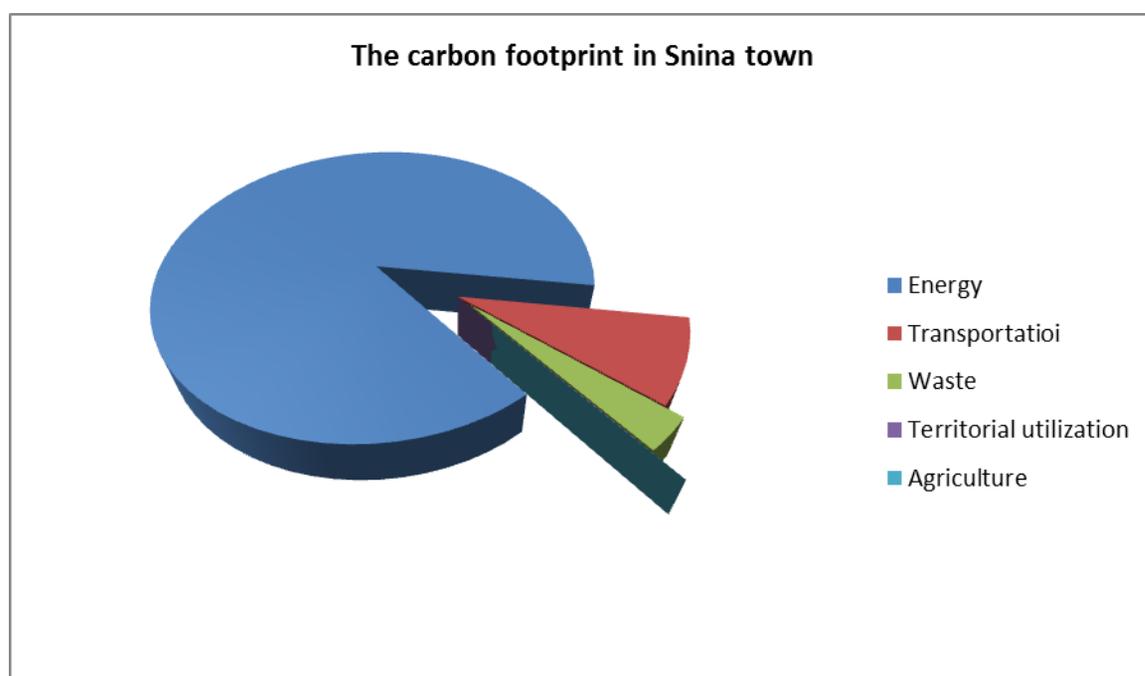

Figure 1, The carbon footprint in Snina town
Source: own processing of data provided by the Snina town as mentioned within Table1

5. Draft of measures

We have created a list of possible measures to reduce the carbon footprint of a city, and thus its contribution to global climate change. We create the list by unit areas:

- Energy - insulation urban buildings (Municipal Authority, Municipal Cultural Centre), replacement of windows, installation of photovoltaic panels, support for cogeneration of electricity and heat
- Transport - promotion of electro mobility, building infrastructure for walking and cycling

- Waste - encourage the separate collection of municipal waste components with an emphasis on biodegradable waste, increase the availability of containers for separate waste collection and waste collection other ingredients, such as WEEE, cartons ...
- Land use - support the planting of greenery in the city, the care of the state of vegetation, protection of agricultural areas and forest land in the town.

6. Conclusion

In conclusion we can say that the solution of the current environmental situation we find in many areas with the use of the principles of sustainable development, but also in many activities, such as the use of indicators carbon footprint.

Carbon footprint, it is useful not only for ordinary people, but also for large companies and is one of the most important tools to measure the impact of human activities on the environment. It can say that the carbon footprint for the company is one of the newer instruments visibilities of the environmental performance of their products and services. According to our calculations the carbon footprint of the Snina town in 2013 achieved the value of 7.25 t CO_2 eq. per capita, while the largest share of the carbon footprint of the area had energy, up 88.11%.

In recent years, the city began a gradual thermal insulation of residential houses and buildings belonging to the city, resulting in lower energy intensity. A few years ago the city began Project support separate collection components of municipal waste and placed several containers for separated waste. The containers were placed on the two larger residential areas. Regarding transport, it was reconstructed pedestrian and bicycle route to Sninské rybníky (ponds) recreational area and at the entrance to the town was built a new roundabout.

References

[1]. OECD, 2011b. Towards Green Growth. OECD, 144 pp. [online]. Retrieved from: <http://www.oecd.org/greengrowth/48224539.pdf>

[2]. Enviroportal. [online]. Retrieved from: <http://www.enviroportal.sk/environmentalne-temy/starostlivost-o-zp/zeleny-rast>

[3]. OECD, 2011. Towards Green Growth. ISBN 978-92-64-094970. [online]. Retrieved from: <http://www.oecd.org/greengrowth/47985987.pdf>

[4]. UNEP, 2009. Global Green New Deal. UNEP, 2009. 155 pp. [online]. Retrieved from: <http://www.sefalliance.org/fileadmin/media/sefalliance/docs/Resources/Green_-economy/GGND Final Report.pdf>

[5]. UNDESA. 2012b. A guidebook to the Green economy. Issue 2: Exploring green economy priciplex. Undesa, 2012, 24 pp. [online]. Retrieved from: <http://sustainabledevelopment.un.org/content/documents/743GE%20Issue%20nr%202.pdf>

[6]. Enviroportal. [online]. Retrieved from: <https://www.enviroportal.sk/uploads/files/Zeleny%20rast/ZREANALYZA.pdf>

[7]. Blog Pravda. [online]. Retrieved from: http://greenandsafetyworld.blog.pravda.sk/2013/03/10/zelena-ekonomika-vyzva-21-storocia-oddelit-hospodarsky-rast-od-emisii-sklenikovych-plynov/

[8]. Forestportal. [online]. Retrieved from: <http://www.forestportal.sk/SitePages/les_financie/biomasa/cyklus_uhlika/cyklus_uhlika.aspx>

[9]. Greenpeace. [online]. Retrieved from: <http://www.greenpeace.org/slovakia/Global/slovakia/report/2009/5/ekologicka-stopa-infopdf.pdf>

[10]. Ekostopa. [online]. Retrieved from: <http://www.hraozemi.cz/ekostopa.html>

[11]. Ekostopa. [online]. Retrieved from: <http://www.hraozemi.cz/ekostopa>

[12]. Wiedman, T., Minx, J.: A Definition of Carbon Footprint; ISAUK Research Report 07-01 [online]. Retrieved from: <http://www.researchgate.net/publication/252489707_A_Definition_of_'Carbon_Footprint/file/60b7d52b42ae1d9583.pdf>

[13]. Ekologická stopa. [online]. Retrieved from: <http://www.ekologickastopa.cz/uhlikova-stopa/>

[14]. BSI, 2009. [online]. Retrieved from: <gttp://bsigroup.com/en/Standards-andPublication/Industry-Sectors/Energy/PAS-2050/>

[15]. GENERATION, Október 2006, č. 268. [online]. Retrieved from: http://www.parliament.uk/documents/post/postpn268.pdf

Contact

doc. Ing. Matej Polák, PhD.
VVCB Kapušany
082 12 Kapušany 568
E-mail:x matej.polak@gmail.com

Ing. Martina Černegová
ul. Laborecká 16,
066 01Humenné
E-mail: