Sustainability of catching-up growth in the extended European Union

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Abstract: This paper is addressed to analyze a compatibility of an economic growth with the sustainability concept. Fast catching-up growth of consumption and production is characteristic feature of the new EU member states from the former Soviet block, however an essential increase of the resource efficiency resulted in the positive from the point of sustainability changes. Final energy consumption and emissions of green house gases have almost halved and the emissions of acidifying compounds have declined approximately three times during the 1991-2007 yr. period in the Baltic States, which were most deeply integrated into the extremely inefficient command economy of the former Soviet Union. Analysis of development trends in the old EU member states has showed that increase of resources efficiency is able to stop growth in the total use of resources and to avoid rebound effects, however, in order to reduce energy related ecological footprint, the de-fossilization of energy sector and essential acceleration in the use of renewable energy are absolutely necessary. More intense recovery of materials is a very important in order to reduce an essentially demand for the newly extracted materials. Conclusion is made that decelerating and more environmentally friendly growth gradually approaching the "zero growth" phase should be considered as the most promising and realistic option would allow to reduce ecological footprint of developed countries considerably without radical de-growth of consumption and production, as well as without social revolutions, which, as a rule, lead to unpredictable and undesirable consequences.

Key words: growth, deceleration, sustainability, de-fossilization, efficiency, recovery, renewable resources, de-growth.

1 Introduction

One of the most important and complicated questions considering the sustainable development concept is whether economic growth and environment are mutually compatible. Already at the very beginning of the seventies, J. Forester in his famous book "World dynamics"(1971) attempted to predict what could be expected in the coming decades if the human population, consumption of natural resources, and industrial production continued growing at the same rate. The conclusion was made that environmental pollution would reach

a catastrophic level as soon as the beginning of the 21st century and the ecological crisis would be inevitable.

This book was followed by several reports which were funded by the Club of Rome. In the best known of them - "Limits to growth" (Meadows et al., 1972) it is clearly stated that infinite growth on a finite planet is impossible and the time has come to seriously re-examine the priorities of further development. This widely published report was heatedly discussed and it is usually considered an important catalyst of the sustainability idea.

On the other hand, conclusions which were made in the "Limits to growth" resulted in a strict contraposition between the economy and the environment. So, a new impulse was needed for a further evolution of the sustainability concept. In the year 1980 most powerful international environmental organizations manifested a very important document – "World Conservation Strategy", which should be considered a decisive step towards the formulation of the sustainability concept. This document stressed the interdependence between conservation and development, as well as, emphasized that conservation cannot be achieved without development and that it includes both – the protection and rational use of natural resources.

The main approaches of "World Conservation Strategy" were further developed in the report by the World Commission on Environment and Development "Our common future" (1987). The report is rather often criticized, because in this document economic growth is considered a necessary condition for sustainability. However, it is noteworthy that the report emphasizes the idea that *….sustainable development clearly requires economic growth in places where essential needs are not being met* (p.44). Inadmissibility to exceed the limits of the Earth carrying capacity is emphasized several times in the report.

Another important message from the Brundtland report is the idea that despite viewing sustainable development as a global objective, *no single blueprint of sustainability will be found, as economic and social systems, and ecological conditions differ widely among countries* (p. 40). Very specific features of development which are characteristic of the new EU member states from the former Soviet block will be analyzed in this article along with other topics on compatibility of growth and sustainability.

Debates on compatibility of sustainable development with economic growth have become hot in the context of the current worldwide financial and economic crisis. The idea of radical de-growth has been reborn and presented as a baseline for further development, emphasizing that current political and social system in the developed countries is not able to solve complicated problems (Latouche, 2010, Martinez-Alier et al., 2010).

Three closely interrelated topics are discussed in this article. In Section 2 general regularities of growth are analysed, theoretical background and empirical evidence of decelerating growth are presented and attempts are made to diminish suspicions that rebound effects are unavoidable. Section 3 is dedicated to specific features in the development of new EU member states from the former Soviet block. Section 4 is dedicated to discuss "green decelerating growth" versus "radical de-growth" concept, and the unacceptability of the second option is emphasized.

2 General regularities of growth

A logistic (sigmoid) curve is often used to approximate dynamics of natural and social systems including economic growth. Accelerating growth is characteristic of the first stage, , and decelerating growth –of the final stage (Jurne et al, 2005). The rate of growth (first fluxion of logistic equation) is bell shaped with the extreme in the middle of time limits (Fig.1). Logistic equations and decelerating growth fit well for modelling of self-organization change in economic systems (Foster and Wild, 1999).

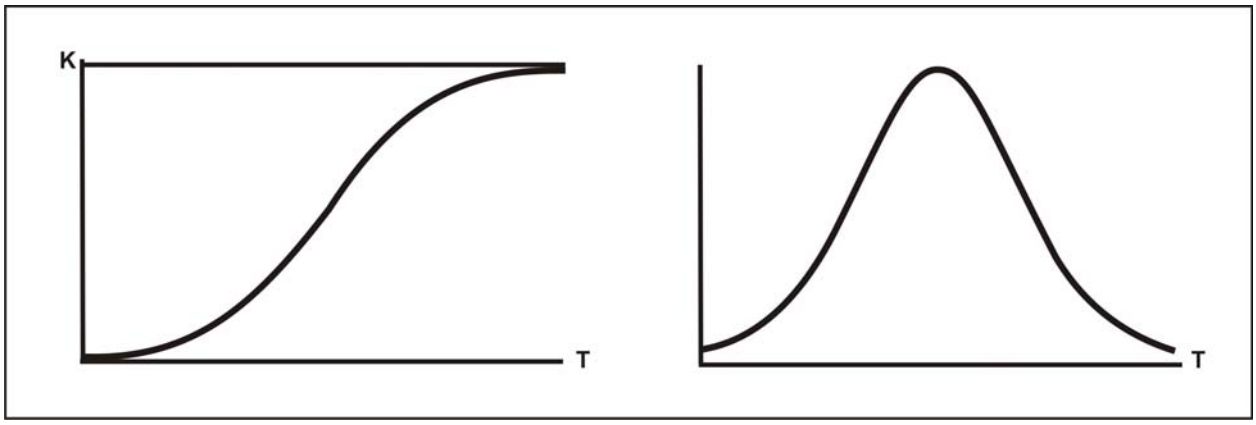

Figure 1: Logistic growth curve (left) and growth rate (right)

Inevitable deceleration of economic and population growth in more developed countries was emphasized already by J. S. Mill (1848). It was pointed out that the increase of wealth is not boundless because ...”*profits in the long run would tend to diminish and that the formation of new capital would thereby come to an end. This would bring industry to a halt and population to a stationary level*”. On the other hand, it was emphasized that a stationary state of capital and population does not imply the end of human development. J. S. Mill hoped that when a stationary state is reached, people will turn from concerns of self-interest to more socially and humanly worthy goals and in such a state many of the present problems will disappear. These more than 150- year old thoughts look very much like precursors of the sustainability idea. The idea of a steady state economy was further developed by H. Daly (1974)

The neoclassical growth model was elaborated in the middle of last century and is currently often used as a theoretical base for modelling of economic growth. This model only covers the right wing of logistic growth function i.e. this part of economy development which already passed the phase of extreme growth and is usually referred to as a “mature” economy. The countries of mature economy undergo a decelerating rate of growth because of diminishing returns and should inevitably reach the phase of steady state (“zero” growth) (Sollow, 1956, Barro and Sala-i-Martin, 1992). The technological progress is able to increase labour productivity and to push the level of “steady-state” to higher values. However the rule of diminishing returns and decelerating growth rate is still valid. Consequently, the technological progress is only able to reduce the rate of economic growth deceleration and delay the phase of “zero growth”.

An example of long term changes in GDP growth rate for Euro zone countries up to the current economic crisis is presented in Fig.2. Despite the GDP growth against time relationship is not strictly linear, a deceleration trend of economic growth is absolutely evident and the GDP growth rate has decreased approximately 3 times during the 46 year period.

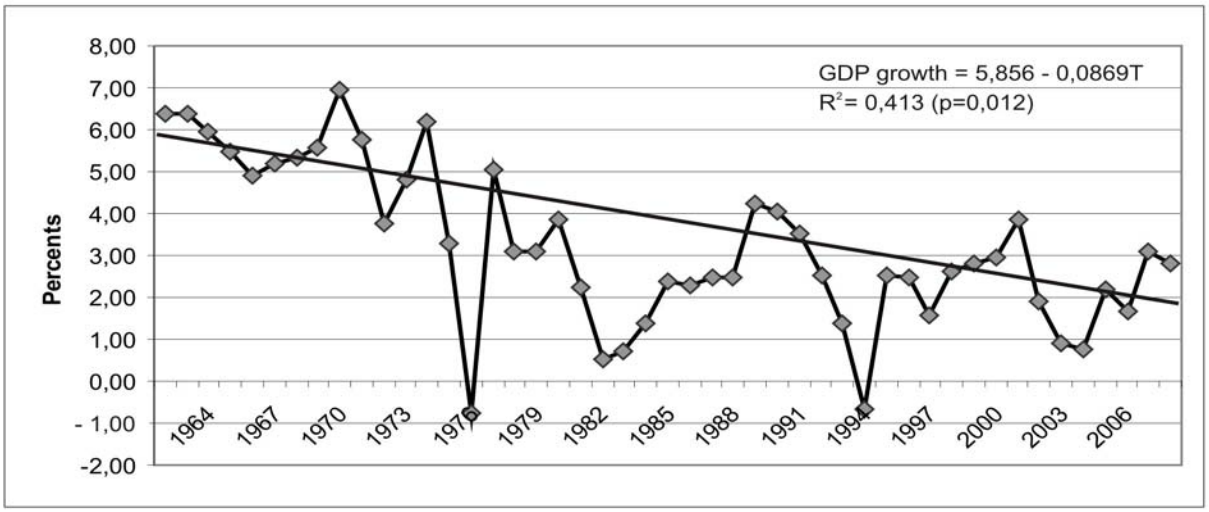

Figure 2: Annual GDP growth in the Euro zone countries. World Bank national accounts data.

Another important regularity of economic growth is related to the issues of convergence between poorer and wealthier countries and regions. Different methodologies are used to evaluate the occurrence and rate of convergence. However, the most widely used and best theoretically grounded is beta-convergence approach (Barro and Sala-i-Martin, 1992). The relationship between the growth rate and the initial level of GDP serves as a theoretical basis for a quantitative evaluation of beta-convergence. To achieve linearity of this relationship, both variables (growth rate and initial level) should be log-transformed. Convergence takes place if coefficient b (slope) of linear regression is negative and statistically significant.

It is necessary to note that beta-convergence approach is based on the neoclassical growth model and shows the speed of convergence to a hypothetical steady state i.e. "zero growth" phase (Rapacki and Prochniak, 2009). Further investigations have shown that beta-convergence approach can successfully be applied investigate the trends of different socio-economic and environmental indicators (Kerem et al., 2008, Wolsszcak-Derlacz, 2009, Liddle, 2009). The data on convergence of different socio-economic and environmental indicators in the extended EU are presented in the next section.

The concept of eco-efficiency is one of the most important constituents of the sustainability idea and connects economic growth with the environmental consequences of growth. The indicators of eco-efficiency are of particular importance to evaluate the level of economic dematerialization and the course of decoupling of the economic growth from the environmental impact including both – the use of resources and environmental pollution. However, the problem is that achievements in eco-efficiency are very often outweighed by growing production and consumption, and rebound effects directly or indirectly lead to a continuous increase in resource consumption and environmental pollution despite eco-efficiency gains. Rebound effects are very often considered an inevitable feature of market economy (Blake, 2005, Jackson, 2009).

However, the latest investigations have shown that essential changes took place in the developed countries over last decade before the current economic crisis. As it was noted by J. Spangenberg (2010) the reduction in use of all natural resources (except land) along with economic growth took place in Germany. According to the official data of International Energy Agency, any increase in the final use of energy was not recorded in Japan and the USA over last decade.

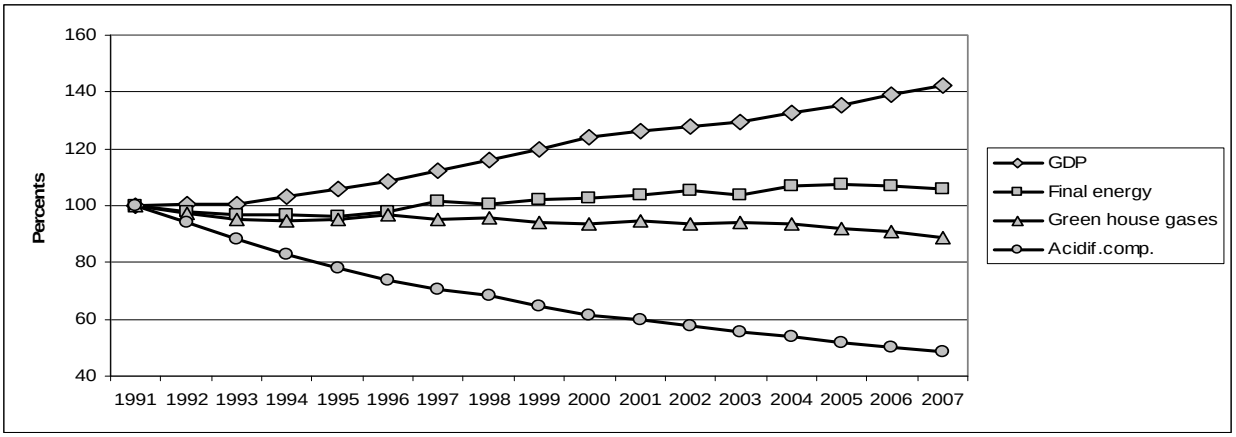

Figure 3: Decoupling of economic growth from environmental impact in EU_{15} states. Based on Eurostat data.

Analysis of changes in GDP, final energy consumption, emissions of green-house gases and acidifying compounds in EU_{15} is based on the concept of a double decoupling i.e. the decoupling of resource consumption from the economic growth and decoupling of environmental pollution and input to climate change from the resource use (Juknys et al., 2005). Taking into account the fact that measures and decisions needed to achieve primary and secondary decoupling are rather different, such a distinction presents more operational information for the analysis of reasons and consequences of the revealed development trends.

First of all, it is noteworthy that only relative primary decoupling i.e. decoupling of energy consumption from economic growth is characteristic of the period up to the 2004 yr., and the total energy consumption in EU_{15} countries increased by 6.8% over 1991-2004 yr. period. However, no increase in energy consumption was registered over last four years before the current economic crisis (Fig.3). Despite the fact that it is too short period for well grounded conclusions, it could be considered as the first signs of important changes in the course of development allowing to avoid rebound effect.

At the same time, it is necessary to mention that a wide implementation of different air pollution mitigation measures resulted in absolute secondary decoupling. Hence, the emissions of acidifying compounds per unit of consumed energy were reduced approximately 2.2 times over the 1991-2007 yr. period. Absolute, though less expressed secondary decoupling is characteristic of emissions of green-house gases as well (Fig. 3)

3 Catching-up growth of new EU member states

Economic and social cohesion is considered the most important objective of the EU Treaty. Therefore the equalization of living conditions and the quality of life are very important for a successful EU integration. The attention to convergence issues increased especially along with EU enlargement (Kerem at al., 2008, Halmai and Vasary, 2010).

A fast growth in production and consumption was a characteristic feature of new Central and Eastern European Member States of the EU (EU_{10}) before the current financial and economic crisis (Juknys et al., 2008). However, per capita production and household consumption in these countries is still approximately twice lower than in the old EU Member States (EU_{15}), and a further catching-up growth should be expected. It is of paramount

importance to ensure that the economic and social cohesion, being one of the key objectives of the EU, is not achieved at the expense of increased environmental impact.

The convergence of socio-economic and environmental indicators was analyzed according to β-convergence methodology. The data set covers the1995-2007 year period.

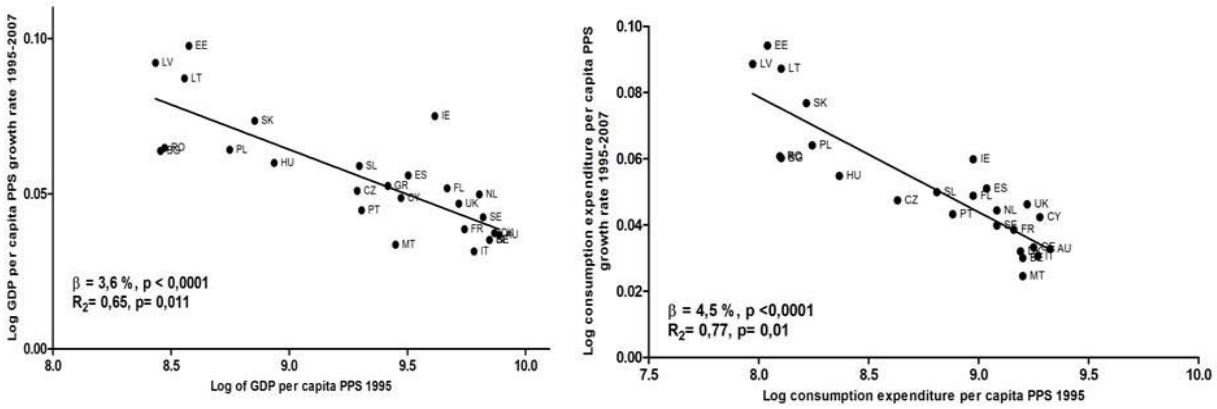

Figure 4: Regression of growth rate on initial (1995) level of GDP (left) and consumption expenditure (right) in extended EU. Based on Eurostat data.

The data on convergence of production (GDP) and consumption are presented in Fig.4. In both cases the lowest initial level and the highest growth rate resulting in the convergence of new and old member states are characteristic of the Baltic states (Estonia, Latvia and Lithuania), followed by other states from the former Soviet block.

For socio-economic indicators the highest rate of convergence in the extended EU is characteristic of prices (5.4%) and the lowest – of GDP and disposable incomes (3.5%). A faster convergence in consumption expenditures (4.5%) rather than disposable incomes (3.5%) is characteristic of most the EU_{10} countries. The main reason for this phenomenon is considered a fast increase in leasing, credits and other borrowing options before the current economic recession. The highest catching-up growth rate of the investigated socio-economic indicators including prices, was registered in Estonia, and followed by Lithuania, Latvia and Slovakia.

Table 1: Convergence rate of investigated socio–economic and environmental indicators

Indicator	β coefficient,%	p value
Gross domestic product per capita	- 3.6	<0.001
Disposable incomes per capita	-3.5	<0.001
Consumption expenditure per capita	-4.5	<0.001
Comparative price level	-5.4	<0.001
Energy efficiency (GDP per tne.)	-5.6	<0.001
Labour productivity (PPS per hour)	-3.6	<0.001
Emission of green house gases (CO_2 equiv.) per capita	-1.7	0.021
Emissions of acidifying compounds (SO_2 equiv.) per capita	-2.2	0.121

A fast increase in energy efficiency is considered a very positive feature of the EU_{10} development from the perspective of sustainability. A high rate of convergence (5.4%) is registered for this indicator (Table 1). Energy efficiency in the EU_{10} amounted only 56.6% of the EU_{15} level in 1995 and caught up to 77.5% in 2007 (Fig.4). Lithuania achieved the highest

energy efficiency among EU_{10} countries and reached 90% of EU_{15} level at the end of the investigated period as compared with 35% at the end of the Soviet period.

Convergence in efficiency of human resources (labour productivity) is much slower. Thus, in the EU_{10} countries labour productivity is still almost twice lower than in EU_{15} (Fig. 5). Cheap labour stimulates neither the implementation of modern technologies nor a faster labour productivity increase in these countries. This leads to low salaries and unsustainable massive economic emigration from some new EU member states including Lithuania.

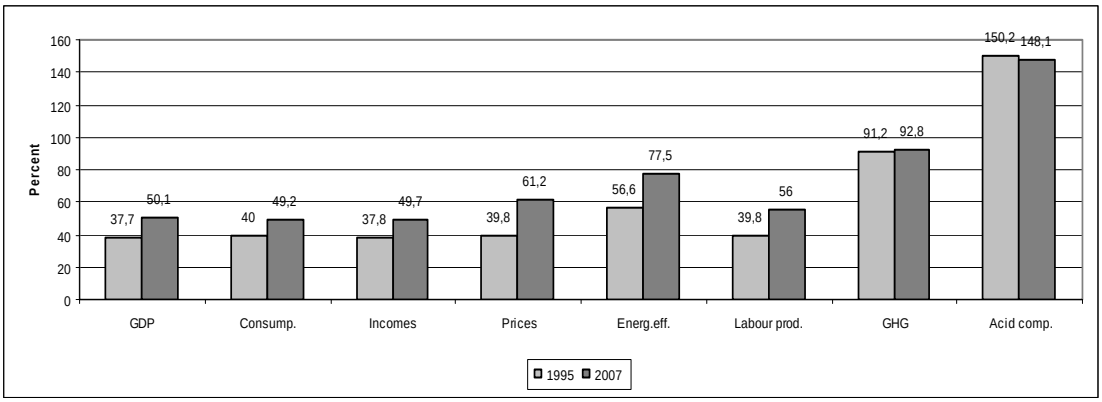

Figure 5: Catching-up growth of different indicators in EU10 countries (1995-2007). EU15 values =100%

The Baltic States were most deeply integrated into the former Soviet economy system, therefore the transition to market economy was most complicated for them. Taking into account that Lithuania has experienced almost the deepest transitional economic decline (Juknys et al., 2005), the data on changes in GDP, final energy consumption, emissions of green house gases and acidifying compounds are analyzed below (Fig.6). The main message coming from this figure would be that along with the 33% increase in GDP (in constant prices), the final energy consumption declined by 43%, the emissions of green house gases halved and the emissions of acidifying compounds decreased three times during the period from the reestablishment of independence up to the current economic crisis.

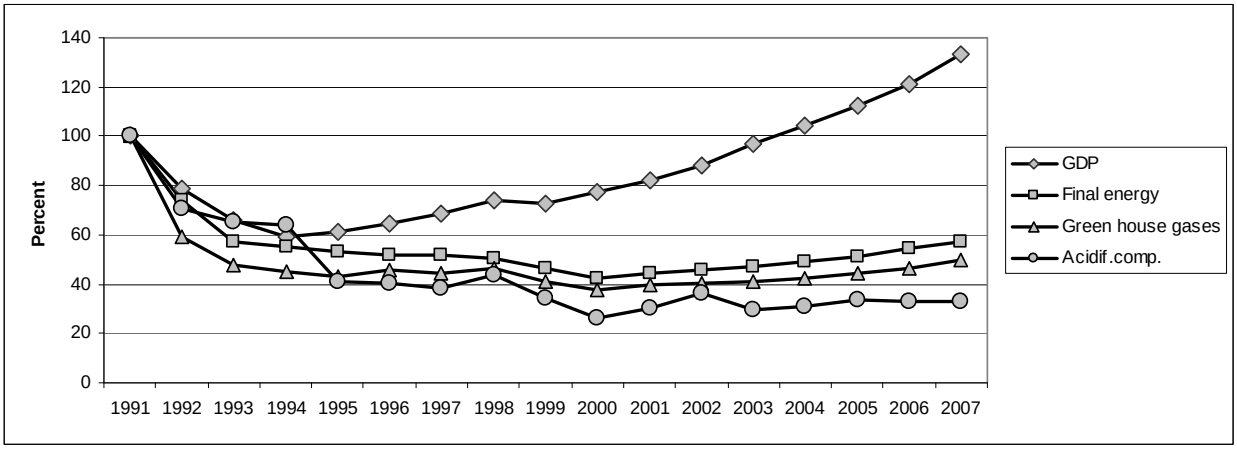

Figure 6: Decoupling of economic growth from environmental impact in Lithuania. Based on data of Lithuanian Department of Statistics.

Considering the energy use, an essential primary decoupling was achieved and a comparatively small increase in final energy use along the fast economic growth was registered during the 1995-2007 yr. period (Fig. 6). It is necessary to note that energy efficiency increased approximately 2.5 times during the entire 1991-2007 yr. period

However, a secondary decoupling, i.e. the decoupling of air pollution from energy use in the most EU_{10} countries including Lithuania is much weaker than in EU_{15} countries (Fig.6) Despite the essentially reduced emissions, such trends have led to the fact that the amount of emitted acidifying pollutants per unit of consumed energy is still approximately twice higher in Lithuania and most other EU_{10} countries than in the EU_{15} on average. This indicates the necessity to implement special air pollution mitigation measures primarily in energy and transport sectors. The decoupling of CO_2 emissions from energy use is even weaker (Fig.6). Thus a faster increase in the use of renewable energy sources would be very helpful in reducing the emissions of green-house gases per unit of consumed energy.

One of the key questions considering the sustainability of catching-up growth in New EU member states is whether they can catch up with the old member states in economic and social terms with an essentially lower environmental impact. The analysis of the current catching-up trends shows that a leaner use of resources and a smaller pollution than in the old EU member states is only possible on the consumption side. For example, over the1995-2007 yr. period the amount of municipal waste in EU_{15} countries increased by 21%, and on the contrary – despite a fast growth in incomes it declined by 5% in EU_{10} countries, currently being about 1.5 times lower than in EU_{15} countries.

What concerns the use of household energy per capita, it was approximately by one third higher in EU_{15} countries in the year 1995, and no convergence was detected up to the end of the investigated period. The traditions and habits of a leaner life in new Eastern European member states may be expected to cause a markedly lower consumption related environmental impact as compared to the old EU member states.

4 Green decelerating growth versus radical de-growth

A recent model of market economy is still based on the continuous growth of production and consumption. During the last decades, market has rapidly saturated, and consumption rather than production has become the main driving force of economy in the developed countries. Despite the fact that most politicians and economists formally accept the sustainability ideas and understand such fundamentals of sustainability as impossibility of

unlimited growth, the economy of the developed countries is still based on a debt driven stimulation of consumption and production growth.

The financial and economic crisis has highlighted the main weaknesses of such an approach and stimulated a search for new ways of development. The main stream of proposals is oriented to the indispensible greening of current economy. To achieve this goal, different strategic documents have been put forward over the last (2011) year: OECD green growth strategy, EU growth strategy 2020, EU plan for a competitive low carbon economy by 2050, etc.

From the perspective of sustainability, there are a lot of positive features in these strategic documents including plans of a considerable cut in green-house gases emissions, enhancement of energy efficiency, replacement of fossil fuels, reduction in air pollution, etc. However, these documents still consider the economic growth as an obligatory component of sustainable development, and the worst of it is that they do not even mention that infinite growth, no matter what a colour – green or another, will be impossible.

At the same time, the economic crisis has stimulated the rebirth of the opposite ideas on the necessity of radical de-growth of consumption and production, emphasizing that a current political and social system in the developed countries is not able to solve complicated problems (Latouche, 2010, Kallis, 2011). Two main closely interconnected branches of de-growth ideology can be distinguished. The first of them could be considered utopian as it is based on unrealistic presumption of peoples' ability to voluntary self limitation in favour of reduced environmental problems. It is considered that radical reduction in consumption and production could be achieved within the existing economic and political system with some cardinal improvements (Latouche, 2010, Martinez-Alier et al., 2010).

According to the opinion of other branch of de-growth ideologists, radical de-growth fits neither with market economy nor with representative democracy, and can't be implemented without revolutionary changes in the existing social and political system (Fotopopoulus, 2007). These neo-communistic ideas are based on a Marxistic vocabulary (class struggle, production forces, appropriation of production means, etc.). Such an approach is more oriented to the solution of social (poverty, equity, etc.) problems. A social revolution is considered the only possibility to solve recent problems.

In order to prove the necessity for radical changes, several misleading messages are usually sent from the camp of radical de-growth ideologists. First of all, it is emphasized that economic growth inevitably leads to an increased use of materials, energy and land (De-growth declaration, 2008). Another message is related with the statement that the reduction of ecological footprint in the developed countries needs an essential reduction of GDP (Latouche, 2010). Besides, a presumption is made that radical de-growth of consumption and production necessarily lead to the improved environmental quality and increased social equity.

However, J .van den Bergh (2011) in his well rounded analysis on possible outcomes of de-growth policy, has shown that the reduction of GDP may cause the reduction of investments in expensive cleaner technologies as well as renewable energy, thus leading to the use of cheaper and dirtier technologies, which may consequently result in the increase of environmental pressure. A similar situation can be detected in social sequences of de-growth policy. The de-growth of economy and the reduction of consumption instead of increased equality may mainly affect the weakest social layer and to reduce their possibilities. As J. Spangerberg (2010) puts it, a minimum of economic growth is necessary to keep social sustainability.

Taking into account that the radical de-growth concept does not fit with the current political system of the developed countries, it can't be implemented in a peaceful way,

without any social revolutions resulting in unpredictable consequences. The sentence from T. Jackson's book (2009) "Prosperity without growth" fits well to summarize the beginning of this section –"growth is unsustainable, de-growth instable".

The necessity to reduce ecological footprint of the developed countries in order to create space for a faster economic growth of the developing regions was deeply analyzed by F. Schmidt-Bleek (1993) as early as the beginning of 1990's. According to the approximate evaluations, the input of materials and energy in the developed countries should decrease by 90 percent (Factor-10) by the year 2050 in order to avoid overexploitation of natural resources. However, progress in this direction is still rather small. Zero growth (no rebound) of resources use rather than their diminishing is achieved in the best case (Fig.3).

Looking for the possibilities of essential reduction in ecological footprint of the developed countries, one should first of all make a strict distinction between the use of materials and energy. Taking into account that materials can be recovered (reused and/or recycled) this option, if properly used, is able to essentially reduce the demand for the materials newly extracted from the environment. The most advanced countries (Germany, Austria, Netherlands etc.) have already managed to recover up to two thirds of waste.

Despite the consequences of the second law of thermodynamics and the impossibility of a complete recovery of materials (Georgescu-Roegen, 1977), an essentially reduced demand (input) for newly extracted materials with the same simultaneous decrease of output (unused waste) could be achieved along with more intense recovery of materials. The most realistic goal for the nearest 20-30 years regarding waste recovery is to achieve the level of most advanced countries. This would allow to reduce the demand for newly extracted materials by approximately three times.

Bearing in mind that energy can neither be reused nor recycled, other ways to reduce energy related ecological footprint must be found. In this case it should be reminded that in the developed countries more than two thirds of ecological footprint are related to the use of traditional energy and are necessary to absorb CO_2 and air polluting compounds which are emitted during the burning of fossil fuel (Wackernagel and Rees, 1996). Using the terminology of "social metabolism" (O"Neil, 2011), it is not enough to reduce the amount of food used (energy in this case) and to consume it more efficiently (de-materialization). In this respect cardinal changes in the composition of food (trans-materialization) and shift to the food with less output (emissions of CO_2 and air pollutants) are absolutely necessary. The de-fossilization of energy sector and fundamental acceleration in the use of renewable energy are the most promising options.

The EU plan for a competitive low carbon economy looks very promising from this point. If the ambitious commitment to reduce green house emissions by 80 or even 90% by the year 2050 were implemented in all the developed countries, it would be an important step not only towards the essential deceleration of climate warming, but also towards the reduction of acidification and nitrification of the environment, as well as towards the radical improvement of urban air quality. Such positive changes would result in approximately 2-2.5 times reduction of ecological footprint. If the efforts to essentially reduce the demand for newly extracted materials by recovering them much more intensively, as well as the efforts to increase the resource (both - materials and energy) efficiency and more fast implementation of renewable energy are strengthened, a triple reduction of current ecological footprint seems an attainable, though complicated task, excluding the need for any social revolutions as well as radical de-growth of consumption and production.

Concluding this section it would be reasonable to come back to the question on compatibility of economic growth with the concept of sustainability. As it was already mentioned, in all newly developed strategic documents of the developed countries, economic growth is considered an obligatory component of sustainable development. Taking into account that these political documents were prepared during the period of the economic

recession, such a proposition could be understood, but having in mind a limited carrying capacity of the Earth, the question how long economic growth could continue and how fast it could be, is still on the agenda of sustainable development.

As it can be seen from the Fig.2, rather fast deceleration of economic growth (GDP) took place over last 50 years in developed countries,. If some reasonable regulations on the maximal use of natural resources (caps) will be implemented (Spangerberg, 2010) and some brakes for massive advertising companies and other means of artificial stimulation of economic growth will be established (Jackson, 2009), further decelerating economic growth can be expected after the recovery from current recession. More strict regulations of financial institutions and de-concentration of financial power are absolutely necessary to avoid recurrence of similar financial crises in the future.

5 Overall conclusion

The Extension of EU borders and financial as well as technological support, has resulted in the fast convergence and catching-up growth of production and consumption in the newly accepted EU member states from the former Soviet block. The fastest growth is characteristic of the Baltic States, which were most deeply integrated into the economy of the former Soviet Union and experienced the deepest transitional decline. Despite some increase in the use of energy and other natural resources during the period of fast growth (2001-2007), in general the development of the new EU member states looks promising from the perspective of sustainability. Along with the one third increase in GDP, final energy consumption and emissions of green house gases have almost halved and the emissions of acidifying compounds have declined three times during the period from the reestablishment of independence up to the current economic crisis.

A decelerating economic growth is a characteristic feature of mature economies. The GDP growth rate has decreased approximately 3 times in Eurozone over the 50 yr. period before the current economic crisis. A conclusion could be drawn that technological progress is only able to reduce the rate of economic growth deceleration and delay the phase of „zero growth". However, even decelerating growth has resulted in fast increase of ecological footprint of the developed countries and currently it exceeds allowable limits by approximately three times on average. The necessity to reduce ecological footprint of the developed countries down to allowable limits in order to make space for faster economic growth of developing regions is evident.

According to the experience of the developed countries, increase in efficiency of natural resources can, at its best, to stop growth in the total use of resources and to avoid rebound effect. Taking into account that in the developed countries more than two thirds of ecological footprint is related to the use of traditional energy, the de-fossilization of energy sector and essential acceleration in the use of renewable energy is the most promising option. Since materials can be recovered, this option, if properly used, is able to considerably reduce the demand for the newly extracted materials.

If the efforts to increase resource (both - materials and energy) efficiency, to accelerate transition from fossil fuel to renewable energy as well as to reduce the demand for the newly extracted materials by much more intense their recovery are essentially strengthened, a triple reduction in the current ecological footprint seems an attainable task for the developed countries. These would allow to avoid radical de-growth of consumption and production, as well as, social revolutions, which, as a rule, lead to unpredictable and undesirable consequences.

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