Green growth in the Czech Republic selected indicators

Český statistický úřad
2014

CZECH STATISTICAL OFFICE

GREEN GROWTH IN THE CZECH REPUBLIC

SELECTED INDICATORS

2013

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FOREWORD

Iva Ritschelová,
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Information and statistics nowadays are rightly regarded as a new and valuable resource of our information age. Increasing requirements for environmental protection related to a number of activities at the national and international levels stimulate the rapidly growing demand for environmental information. This demand is highly motivated by the need to assess the state of and development within the different environmental domains, as well as the need to identify and describe the complex interrelationships with the economic and social aspects of sustainable development.

For many years the Czech Statistical Office has been actively developing an information base for a number of analytical activities in the fields of environmental science, environmental accounting, and sustainable development indicators, etc. In 2013, the environmental statistics department of the Czech Statistical Office commemorated its 20th anniversary. This fact additionally reflects the vast experience of the Czech Statistical Office in these fields.

The Green Growth strategy has been stimulated by a number of political discussions initiated more than two decades ago. Ideas regarding the systematic creation of prerequisites for better coordination of economic, social and environmental policy were, among others, incorporated within the EU strategic framework for 2007–2013. The basic ideas of strengthening synergies between environmental protection and economic growth were consequently integrated into Europe's new growth strategy – Europe 2020.

One of the more important aspects of promoting these synergies is the concept of an information base aimed at providing quality data for monitoring and decision-making processes. In contrast to continuing theoretical discussions, it is necessary from the practical perspective of official statistics to put concrete indicators into practice that are appropriate for decision-making. One of the big milestones in this process was the "Prague Memorandum" that was adopted at the 98th Director Generals of the National Statistical Institutes (DGINS) Conference 2012 held in Prague. The document supported the idea that it is time to find a consensual, albeit limited but practically feasible approach to moving forward.

"Green Growth in the Czech Republic 2013" is the second in a row of publications issued by the Czech Statistical Office in close cooperation with the Charles University Environment Center. Its aim is to describe this complex problem area from a number of perspectives by providing a bird's-eye view of the issue of green growth in the Czech Republic. With regards both to national conditions and data availability, a total of 27 indicators were selected for these purposes by a team of authors.

A major portion of the data referenced in the text is either directly produced by the Czech Statistical Office, or provided as an input to Eurostat for more aggregated statistics. However, not all domains in this complex problem field are covered by statistical surveys. Therefore, another portion of the data was mined from existing administrative sources. In this respect, I would also like to acknowledge all the other partner institutions that kindly provided additional data.

FOREWORD

Bedřich Moldan, Director,
Charles University Environment Center

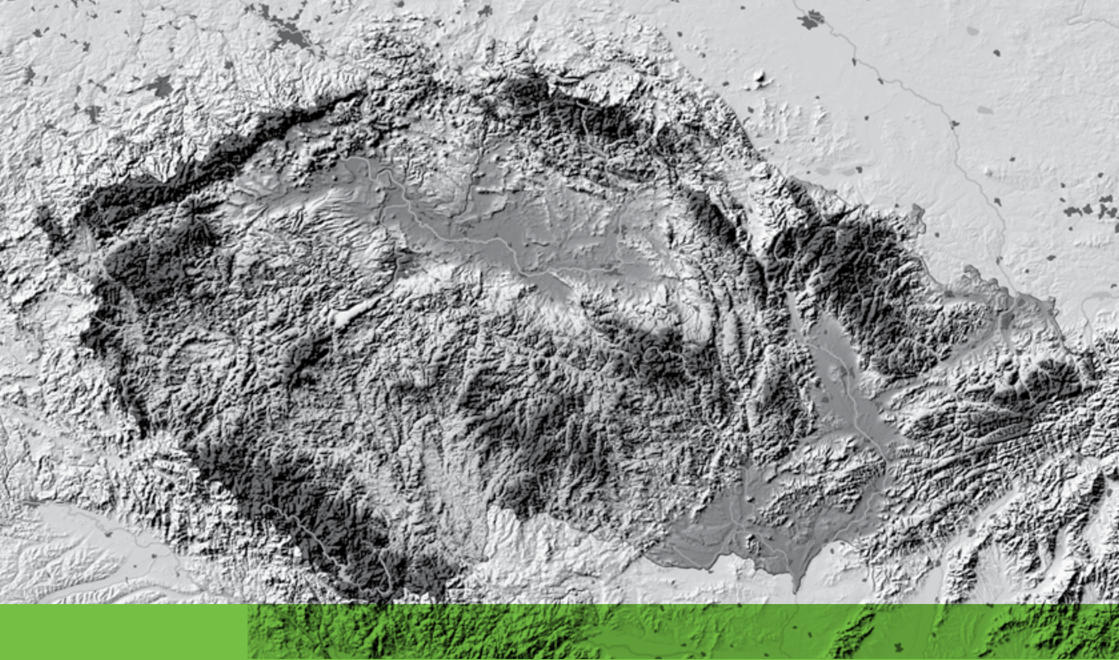
The outcomes of the Rio+20 Conference (2012) identified many areas for further work to move towards sustainable development and a greener economy. The key document, *The future we want,* states: "We acknowledge that a green economy in the context of sustainable development and poverty eradication will enhance our ability to manage natural resources sustainably and with lower negative environmental impacts, increase resource efficiency and reduce waste."

Every country is unique and has its own specific conditions, but green growth attracts their attention in regard to common topics such as increasing resource productivity, greening jobs and skills, education and innovation, green investments, etc. However, green grown is not an easy concept – – just like sustainable development in which took decades to translate a universal strategy into concrete policies and action plans, goals and targets, indicators… The good news is that many organizations and international bodies are ready to assist countries with developing, testing and applying green growth strategies.

OECD makes a systematic effort to *Put green growth at the heart of development*. It has been addressing the question of generating economic prosperity and well-being for all citizens while respecting environmental limits. Thus OECD elaborates on its long-term program of *Measuring the progress of societies*. The European Union also has a growth strategy for the coming decade – *Europe 2020*. The EU´s ambition is to become a smart, sustainable and inclusive economy. The European Environment Agency supports this vision with analytical work identifying which policies and innovations enable society to generate more value each year while maintaining the natural systems that sustain us. Another important actor in this field, UNEP, introduced its vision of greener, cleaner, low-carbon and resource-efficient economies and societies in 2009 and since then it has been working on elements of the *New deal for going green.*

In a further development in Mexico City in January 2012 the Green Growth Knowledge Platform was officially launched. The initiators were the Global Green Growth Institute of Korea, OECD, UNEP, and the World Bank. The Platform starts an even broader and truly global effort for both research and implementation of the green growth concept. A general framework was developed and offered to individual countries to use in their own national efforts. We have taken up this challenge and one may see the first results of its adoption in this brochure.

It seems that the concept resonates broadly – it has been taken up by governments and civil society organizations, industries and scientists, producers and consumers. Of course, it is a long way from visions and concepts to integrated policy making towards green economies. The Charles University Environment Center has been contributing to the measurement of green growth in the Czech Republic through several projects and initiatives. Cooperation with the Czech Statistical Office provides a unique opportunity to shift this crucial issue from the academic sphere closer to policy making and to make it more visible. This is necessary since the challenges we identified in the first publication on green growth two years ago still remain: we still need better tools for better policies for better lives.



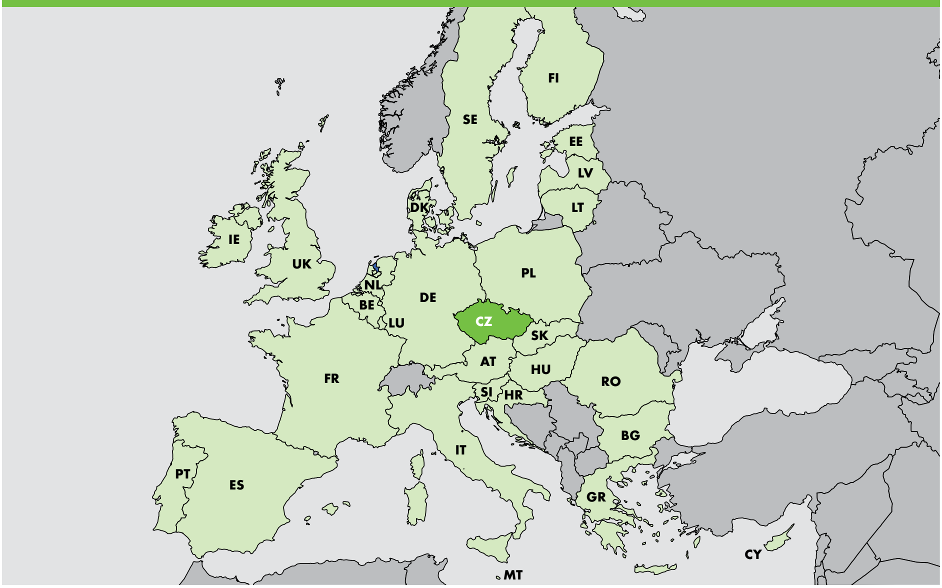
INTRODUCTION

The Czech Republic in numbers 2012

Indicator (Unit of measurement)	2012
Area (km²)	78 866
Population ('000 persons)	10 516
Mean altitude (metres above sea level)	450
Long-term average temperature °C	8.3
Municipalities (number)	6 253
Largest municipality – Prague (Capital City, thous. persons)	1 247
Population density (persons per km²)	133
Average age (years)	41.3
Gross domestic product per capita (EUR PPP)	20 200
Annual average foreign exchange rate (CZK/EUR) (Dec. 2013)	27.5
Inflation rate (%)	3.3
Average number of employees ('000 persons)	3 760
Registered unemployment rate (%)	9.36

Source: Czech Statistical Office, Energy Regulatory Office, Czech Hydrometeorological Institute

Figure 1: European Union: December 1st, 2013



The Czech Republic and green growth

The Czech Republic's economy has been performing remarkably well for almost a quarter of century since the Velvet Revolution in 1989, when the totalitarian regime and planned economy were overthrown. There has been periods of faster and slower development, complicated more recently by the world economic slowdown (recession), but the overall performance of the socio-economic system has moved closer to the West European model.

Over the years, national policies have recognized that economic growth has also had harmful side effects. The fossil fuel-based economy, a driver of growth in the past, may also hold back growth in the future. Recognizing these threats and new challenges, the Czech Republic adopted a Strategy for Sustainable Development back in 2004. The Strategy defined the principal (strategic) goals, as well as thematic and interim goals and instruments that were formulated in a way to harmonize the economic, environmental and social needs of society.

The recently updated Strategy (called the Strategic Framework for Sustainable Development in the Czech Republic) is designed to achieve the best attainable quality of life for the present generation and create conditions for a high quality of life for future generations. It defines five priorities: society, people and health; the economy and innovation; regional development; landscape, ecosystems and biodiversity; and stable and secure society.

The Strategy does not explicitly refer to the green growth concept, although these are closely interrelated. A sustainable economy is based on an increase in income, employment, public health and a secure society driven by investments and innovations reducing carbon emissions and pollution, thereby enhancing resource efficiency, and preserving biodiversity and ecosystem services. Green growth is thus not conceived as a replacement for sustainable development but rather as a subset of it. In practical terms, green growth is an engine and a means for a green economy – one of the fundamental pillars of sustainable development.

Thus, this concept is fully in compliance with the recommendations of many international organizations. They have worked with different assumptions and models, have included different specific factors in their thinking and have come to various definitions over the last couple of years, but those currently being used internationally have a lot in common. The green growth strategy aims to foster economic growth and development while ensuring that natural assets are used sustainably and continue to provide the resources and environmental services on which the growth and well-being rely (OECD). Green growth is efficient in its use of natural resources, clean in that it minimises pollution and environmental impacts, and resilient in that it takes account of natural hazards (World Bank). The green economy aims to improve human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP). The green economy cannot be resource efficient only because resource efficiency does not guarantee steady or declining resource use; to achieve sustainability we also need to focus on ecosystem resilience – the status, trends and limits of natural systems (EEA).

Since green growth has not been part of any official governmental strategy in the Czech Republic and remains more the domain of academic and non-governmental initiatives, this report uses the above concepts to frame green growth indicators in a consistent and analytically sound way.

Monitoring green growth

Although green growth has been widely recognized as a plausible means of achieving a sustainable future, there is no one common prescription for implementing strategies for green growth, or for monitoring them. Green growth clearly remains a rather abstract concept and hence provides little guidance to decision-makers. But policymaking requires a clear understanding of where we are and how we are progressing. It requires the concept to be translated into measurable indicators – and targets when possible – supported with appropriate communication to potential users.

Measuring progress in regard to complex and multi-dimensional change is a challenging task. No agreement exists yet on an analytical framework or a set of relevant indicators. To trace the development of the Czech economy in relation to green growth in the first report in 2011[1], we adapted the OECD indicator framework[2]. In order to capture not only the economic and environmental links, but also the social dimension, the first report structured the selected indicators into five interrelated groups: sustainability and equity; environmental and resource productivity; natural asset base; environmental quality of life; policy responses and economic opportunities. In total, 27 indicators captured the most important phenomena without any ambition to undertake either a comprehensive assessment of green growth or to narrow the indicator selection to a handful of headline indicators.

This second edition of the green growth assessment took a great deal of inspiration from various studies on sustainable development in the Czech Republic and from the latest international expert knowledge about the issue. A conceptual framework for selecting and organizing the indicators was adopted from the Green Growth Knowledge Platform[3] – a global network of researchers and development experts who address major knowledge gaps in green growth theory and practice (organizations such as the OECD, UNEP, the World Bank and others are behind this initiative).

The adopted approach stems from wealth accounting which enables policymakers to look at whether growth is achieved at the expense of asset depletion. The selected indicators are designed to capture the economy-environment linkage and demonstrate whether and to what extent economic performance is being "greened." The key principles of the way the framework works are the following (Figure 2 shows how these framework elements and indicators interrelate):

- The environment can be thought of as natural capital, and like other forms of capital, it delivers essential inputs into production and consumption (the production function provides a basis for the framework). Yet many of these inputs and the amenity services that support wellbeing are often not traded and hence are not sufficiently well captured by standard economic and environmental indicators.
- Inputs: the natural asset base. Natural capital provides both services (including sink services for pollution) and natural resources that constitute crucial inputs into production or directly affect wellbeing. Reducing the natural asset base need not necessarily contradict green growth given

[1] CSO 2011. *Green growth in the Czech Republic.* (Havranek, M. and Sidorov, E. – eds.), Czech Statistical Office, Prague.

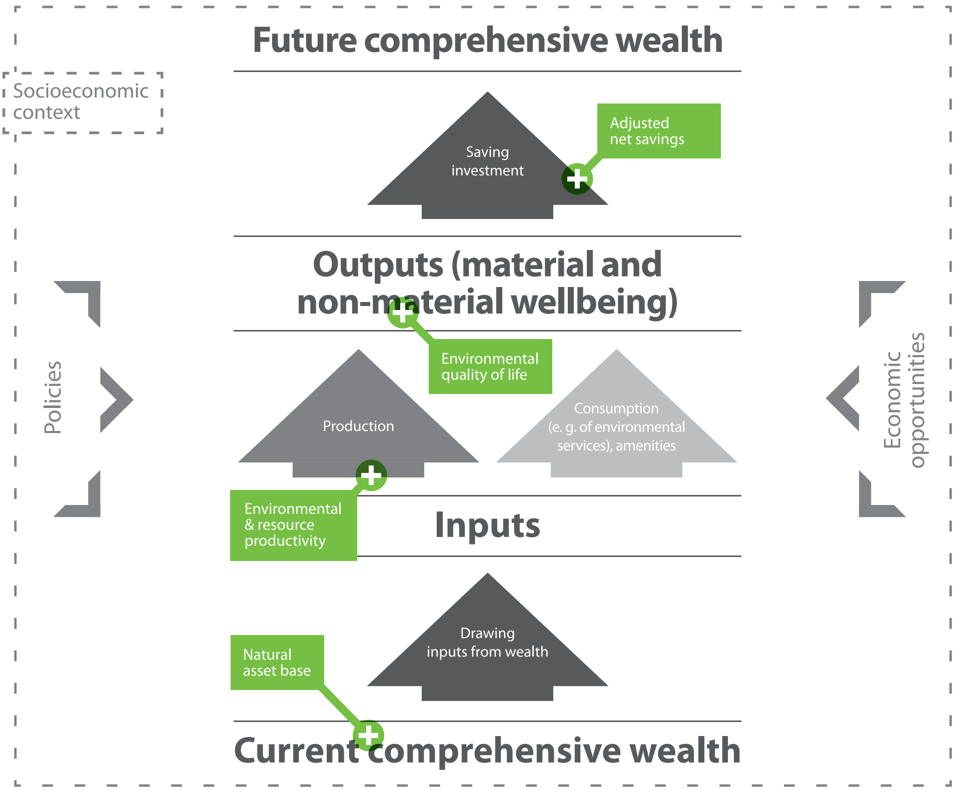
[2] OECD 2009. *Green growth strategy.*

[3] GGKP 2013. *Moving towards a Common Approach on Green Growth Indicators.* A Green Growth Knowledge Platform Scoping Paper. April 2013

that the importance of assets may change owing to recycling, higher productivity, or substitution. Indicators to monitor risks related to possible overuse and depletion are crucial for green growth assessment.

- Production: intensity/productivity. This category comprises measures focusing on environment-related "productivity," or its inverse, "intensity." The indicators can measure progress in producing and consuming more while using fewer environmental services and natural assets.
- Outputs: material and non-material wellbeing. Output refers to aspects that are not reported by conventional macroeconomic measures (the environment-related aspects of the quality of life); many of the quality of life aspects are measured (impact on labour productivity through effects on population health).
- The production function approach needs to be seen in the context of government policies, economic opportunities and the socio-economic background. Growth should be assessed in the context of important social goals, such as poverty reduction, social equity and inclusion, effectively linking the three pillars of sustainable development.

Figure 2: The production framework for green growth indicators and wealth accounting



Source: GGKP 2013

The Platform has identified and proposed almost fifty indicators to monitor green growth. This second report has selected 27 of these based on relevance to Czech conditions and data availability. Most indicators are derived from the data and information systems of the Czech Statistical Office, while the rest of the indicators come from a variety of other available sources. The following table sums up the main results.

	Indicator Name	Evaluation of trend		International comparison
		The whole monitored period	The last year-to-year change	
I.	**SOCIO–ECONOMIC CONTEXT**			
1.1	Genuine savings (Adjusted net savings)	+/–	+	+/–
1.2	Employment rate of older workers			
	– Men	+/–	+	+/–
	– Women	+		–
1.3	At-risk-of-poverty rate by gender			
	– Men	–	+	+
	– Women	–		+
1.4	Age index and dependency index			
	– Old age index	–	–	–
	– Economic dependency index	–	–	+/–
1.5	Life expectancy at birth			
	– Life expectancy (men and women)	+	+/–	–
	– Healthy life expectancy (men and women)	+/–	+/–	+
1.6	Gini index	–	–	–
1.7	Labour productivity	–	–	–
II.	**ENVIRONMENTAL AND RESOURCE PRODUCTIVITY/INTENSITY**			
2.1	Greenhouse gas productivity	+	+	–
2.2	Energy productivity	+/–	+/–	–
2.3	Renewable energy resources	+	+	–
2.4	Material productivity	+	+	–
2.5	Material and carbon footprint	+/–	+/–	+/–
2.6	Water use productivity	+	+	+
2.7	Efficiency of use of mineral fertilizers			
	– Nitrogen	–	+/–	–
	– Phosphorus	+/–	+/–	+/–
2.8	Waste treatment	+	+	+/–

III.	**NATURAL ASSET BASE**			
3.1	Coal extraction and reserves	–	–	n.a.
3.2	Forest growing stock	+	+	+/–
3.3	Water abstraction	+	+/–	+
3.4	Land use change	+/–	n.a.	+/–
3.5	Biodiversity threats	–	–	n.a.
3.6	Ecological debt	–	+	–
IV.	**THE ENVIRONMENTAL QUALITY OF LIFE**			
4.1	Health risks from air pollution			
	– Population exposed to PM_{10}	–	–	n.a.
	– Population exposed to PAU	+	+	n.a.
4.2	Health risk from air pollution – – Patients treated	–	–	+/–
4.3	Population connected to sewage treatment and public water supply			
	– Sewerage water connection	+	–	–
	– Public water supply	+	+	+
V.	**POLICIES AND ECONOMIC OPPORTUNITIES**			
5.1	Educational attainment: population over 15 years			
	– Upper secondary	+	+/–	+
	– Tertiary	+	+	–
5.2	Green jobs	+	+/–	–
5.3	Environmental protection expenditure	+	+/–	n.a.
5.4	Share of environmental taxes	–	–	n.a.
5.5	Expenditures on R&D	+	+	+/–
5.6	Energy prices: Electricity and heat	+/–	+	–

Explanations:

+ positive trend; values at the level of leading states;
+/– fluctuating values or stable values; values at the average level of comparable states;
– negative trend; values close to the lagging states.

The current assessment of green growth in the Czech Republic is not final. It can be seen as a contribution to international cooperation in the field of green growth indicators and also as an input into a debate on how to use the signals provided by the indicators for implementation of necessary actions. In order not to be pointed in the wrong direction, further research is needed to better understand the impacts of environmental developments on economic activity and vice versa. Besides research, an effective green growth strategy requires participation. Therefore, in addition to experts the public should also get involved in certain phases of the whole process, in particular in setting goals and targets, and assigning weights to particular indicators in designing policy measures.

I. SOCIO-ECONOMIC CONTEXT

Progress in the environmental sustainability of economic growth (i.e. green growth) should be assessed in the context of important social goals, such as poverty reduction or equity. This reminds us that sustainable development is about people: employment, health or social inclusion. The economic context (e.g. industrial structure) affects the design and timing of green growth policies, while the social context (e.g. relationships within society and the distribution of specific groups across the economic and environmental systems) captures the social challenges and opportunities, and the potential trade-offs or synergies related to particular developments or policy interventions.

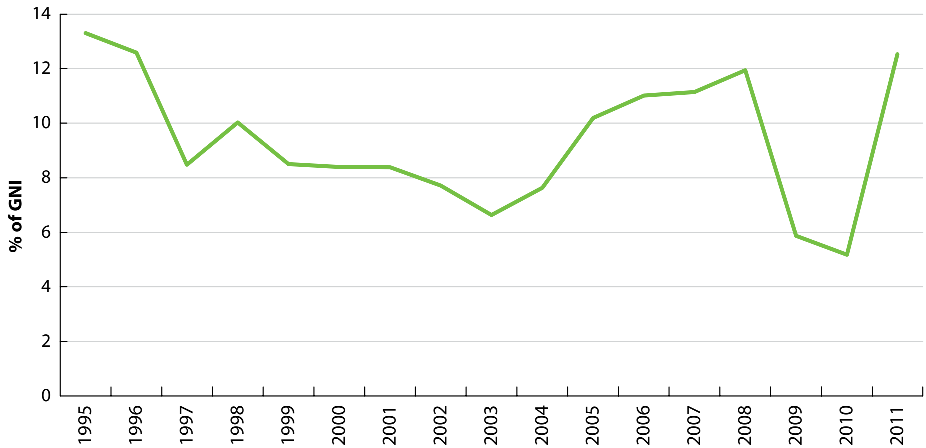
Many social aspects and their relationship to economic and environmental aspects are difficult to capture in an integrated way; moreover there is poor data availability. However, many important indicators already exist and these should inform green growth strategies on the social issues and equity concerns that can arise as a direct result of greening the economy – both at the national and international level. Health, poverty, equity and dependency of the elderly are among the most important issues for which strategies should be implemented in parallel with initiatives focusing on the broader social pillar of sustainable development.

1.1. Adjusted net savings

This indicator is calculated as a share of the adjusted national savings in the gross national income (GNI). Adjusted net savings are based on the adjustment of gross national savings for depreciation of produced capital *(–)*, current expenditure on education *(+)*, depletion of natural capital *(–)* and damages from environmental burden, including carbon dioxide and particulate emissions *(–)*.

Adjusted net savings seeks to provide a message to decision makers and policymakers as to how sustainable their investment activities are. While the standard measurement of "savings" and "investment" reflect a relative change in the value of a certain limited set of assets, adjusted net savings broadens the picture by adding environmental damage and creation of human capital. This indicator is based on a "weak sustainability principle", which assumes that natural capital can be perfectly substituted by any type of capital as an input to production.

Figure 3: Adjusted net savings (% of GNI)



Source: World Bank

Adjusted net savings captures the real rate of savings in the economy after taking into account investments in education, natural sources depletion and air pollution damage. The higher adjusted net savings, the better. The trend in the Czech Republic in adjusted net savings is influenced in a positive direction mainly by investments in education and by a decreasing rate of air pollution. On the other hand, there is a negative influence from the depletion of non-renewable energy sources. There was an overall growth trend in the country during the second half of the monitored period with a slump in 2009–2010 caused by the global economic crisis.

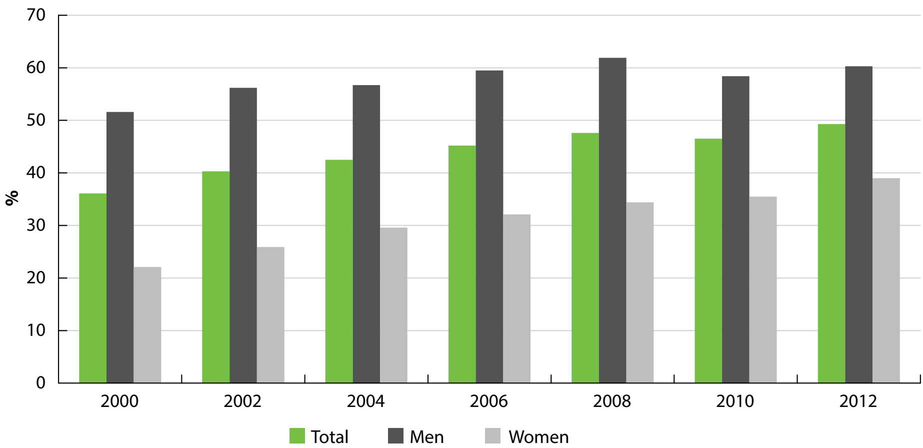
In an international comparison, the Czech Republic (12.5% of GNI) was above the EU average (9.6%) in 2011. In the same year it was placed 38th among 118 evaluated countries and territories by the World Bank (1st was China with 35%). The OECD – averaging around 7% – was led by Switzerland and Korea (22%) and Norway (19%). The United States came last (0.8%).

1.2. Employment of older workers

The employment rate of older workers is calculated by dividing the number of persons aged 55 to 64 in employment by the total population of the same age group. The indicator is presented for both men and women.

Employment of older workers monitors generational justice and equity in the society of a particular country. Older workers are often less flexible but they have more experience in a given field and provide a steady work output. The green growth concept should be implemented in a way that does not disrupt the social, religious and generational principles of sustainable development (the principle of "lifelong access" to work). The Czech Republic has set a goal of 55% for this indicator in the National Reform Programme.

Figure 4: Employment of older workers (% of total same age population)



Source: Czech Statistical Office, Eurostat

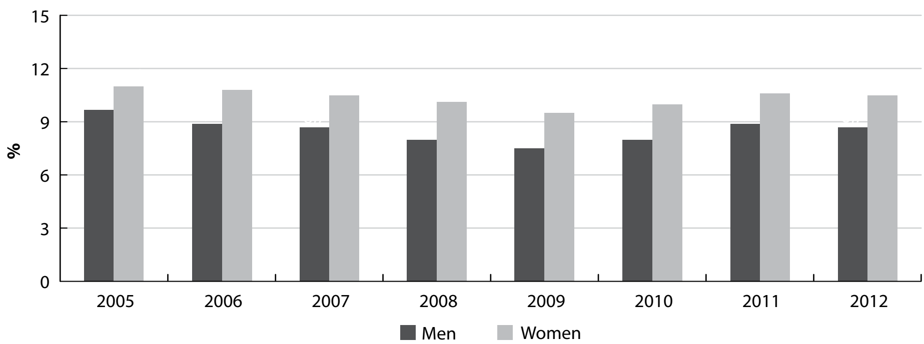
Employment of older male workers in the Czech Republic was steadily increasing up to 2008, then started to decrease mainly due to the economic crisis (during crisises companies tend to dismiss employees close to retirement age or employees leave for early retirement). Employment of older female workers in the Czech Republic has steadily increased. The average employment rate for both men and women of this age group in 2012 was 49.3%, which was slightly above the EU27 average (48.9%).

1.3. At-risk-of-poverty rate by gender

The at-risk-of-poverty rate is defined as the proportion of people with an equivalised disposable income below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income (after social welfare transfers).

Gender differences and inequalities are a fundamental feature of social exclusion and poverty. Women are less likely to secure a decent individual income through employment. This is demonstrated by women's lower employment rate, greater exposure to low pay, and, more broadly, by their lower average earnings. These average gender gaps in employment are more pronounced for particular subgroups, such as employment rates for older workers. In the period 2005 to 2009, the total at-risk-of-poverty rate declined (from 10.4% in 2005 to 8.5% in 2009). In the subsequent years of 2010, 2011 and 2012, the at-risk-of-poverty rate increased and fluctuated around 10%. The proportion of women considered to be at-risk-of-poverty was higher during the whole monitored period than men considered to be at-risk-of-poverty. This gap increased from 1.3% in 2005 to 2% in 2012. Social welfare transfers significantly affect the overall risk-of-poverty rate in the Czech Republic. In 2011, without social welfare transfers (pensions are excluded from welfare transfers), 18% of Czechs lived below the income poverty threshold, compared to 26.3% in the EU-28. In 2010, total government expenditure on social security in the Czech Republic accounted for 20.1% of GDP, which is relatively low compared to other EU countries (the EU-27 average expenditure on social security accounted for 29.4% of GDP). These figures demonstrate the efficiency of the social security system in the Czech Republic.

Figure 5: At-risk-of-poverty rate by gender (% of persons with an equivalised disposable income below the at-risk-of-poverty threshold)



Source: Eurostat

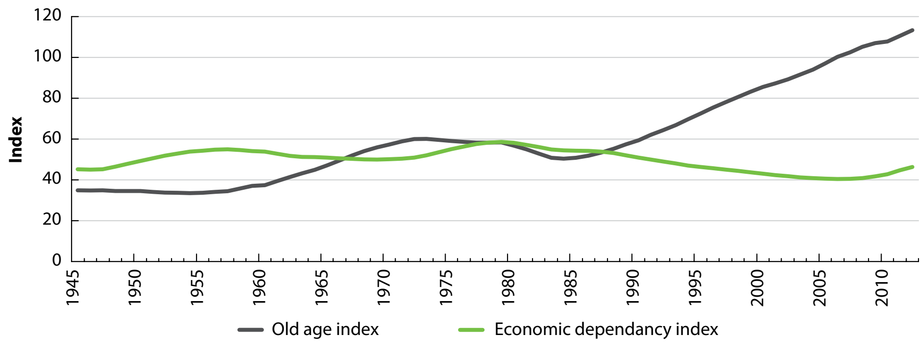
In 2012, the risk of poverty in the Czech Republic was lowest among all EU countries. This means that 9.6% of Czechs had incomes below the poverty threshold after social welfare transfers compared with 16.9% of the EU28 (in 2011). The highest at-risk-of-poverty rates in 2011 were found in Bulgaria (22.3%), Romania (22.2%), Spain (21.8%) and Greece (21.4%). Conversely, the lowest at-risk-of-poverty rates – besides the Czech Republic (9.6%) – were found in the Netherlands (11%), Austria (12.6%), Slovakia and Denmark (13%). However, it should be noted that the at-risk-of-poverty rate is a relative measure of poverty, and that the poverty threshold varies greatly between the Member States.

1.4. Old age index and economic dependency index

The old age index and economic dependency index are indicators of the actual age composition of a given country's population. The old age index refers to the number of people at the age of 65 and over per 100 people aged 0–14. The economic dependency index compares the number of people aged 0–14 and 65 and over with the number of people aged 15–64 (again generally expressed per 100 people of the latter age group). It serves as an indicator of the burden on the economically active part of the population.

Since the end of the Second World War until the mid-1950s, the old age index in the Czech Republic stagnated at a value of 35 (persons aged over 65 per 100 children aged up to 15), and then until the 1970s it increased to 60. Over the following 15 years the old age index gradually decreased slightly to a value of 50. From the mid-1980s up until today the relative ratio of elderly people and children has continuously increased in favour of the elderly. At the end of 2006, a situation where the 65+ age group outnumbered the 0-14-year age group was recorded for the first time, i.e. the old age index exceeded 100. According to the latest data on the age structure of the Czech population (as of 31 Dec. 2012), there were 113 seniors (65+ age group) per 100 children aged up to 15. Further growth of the old age index is also expected in future years. The economic dependency index has not – in comparison with the old age index – changed as significantly over the last 67 years. In the first half of the 1980s, the economic dependency index began to decrease and the downward trend was maintained until 2006 when the lowest value of 40.4 was recorded (persons of an economically inactive age per 100 people of an economic active age 15–64). The latest data from 2007–2012 indicate a return to a negative trend again, i.e. to an increase in the economic dependency index (46 in 2012).

Figure 6: Old age index and economic dependency index



Source: Czech Statistical Office

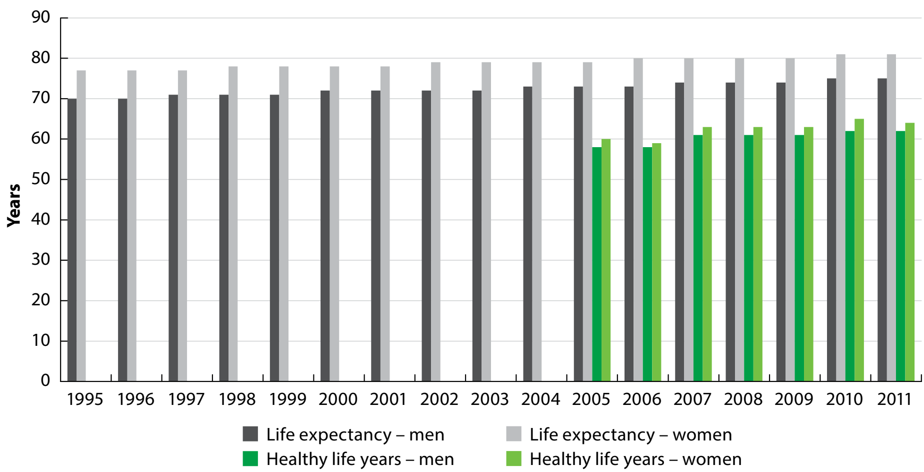
In 2012, old age index figures in individual EU countries broadly ranged from 55 (Ireland) up to 156 (Germany). In 10 – out of 27 – EU countries, children up to 15 years old outnumbered seniors older than 65 years. In other 9 EU countries, including the Czech Republic, the old age index was between 100 and 120. In half of the EU countries, the economic dependency index ranged from 45 to 50, with the highest value reported by France where there are almost 56 persons of an economically inactive age per 100 people of an economically active age. The Czech Republic had the 5th lowest value (45) among EU countries (ahead of Slovakia, Poland, Cyprus and Romania).

1.5. Life expectancy and healthy life years at birth

Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Healthy life years at birth indicate the number of years a person at birth is expected to live in good health.

Life expectancy at birth is the most commonly used indicator for analysing mortality. This indicator is closely related to health conditions, which are in turn an integral part of a country's development. Since life expectancy is not able to fully answer issues related to the quality of life spent in good health in a country, the "healthy life years" indicator has been introduced (life expectancy years without long term restrictions on activity). It also monitors health as an economic factor – an increase is one of the main goals of health policies in the expectation that this would not only improve the situation of individuals but would also lead to economic growth as a result of lower public healthcare expenditure and higher work performance.

Figure 7: Life expectancy and healthy life years at birth (years)



Source: Czech statistical office, Eurostat

Life expectancy for Czechs has risen by 5.1 years for men and by 4.5 years for women, to 74.8 years and 81.1 years, respectively, over the past 17 years. Also, healthy life years increased considerably (from 59.9 to 63.6 for women and from 57.9 to 62.2 for men) during 2005–2011.

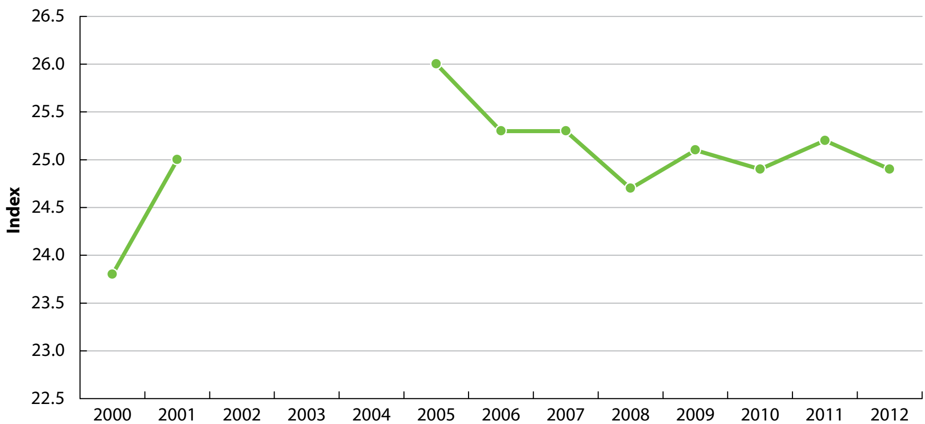
Despite the considerable improvement in the mortality ratio and health of the Czech population, life expectancy at birth has still not reached the EU27 average (women – 83.2, men – 77.4). However, the EU27 average for life expectancy in good health has been reached (women – 62.2, men – 61.8).

1.6. Gini index

The Gini coefficient of equivalised disposable income is defined as the relationship of cumulative shares of the population arranged according to the level of equivalised disposable income, to the cumulative share of the equivalised total disposable income earned by them[1]. The Gini index (named by the World Bank)[2] thus measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. The Lorenz curve plots the cumulative percentages of total income earned against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line.

A Gini index of 0 represents perfect equality (when everybody has identical incomes), while an index of 100 implies perfect inequality (when all income goes to only one person). Income inequalities are one of the most visible manifestations of differences in living standards within each country. High income inequalities typically imply a waste of human resources in the form of a large proportion of the population out of work or trapped in low-paid and low-skilled jobs. However, the Gini index is not an easy metric to interpret, especially in terms of its relation to green growth (e.g. non-subsidised environment-friendly goods and services may strengthen inequalities between people or social groups etc.).

Figure 8: Gini index



Source: Eurostat, SILC

Czech society experienced forty years of totalitarian government characterized by high income equality. Six years after the establishment of free market mechanisms and democratic rights in

[1] Eurostat (http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tessi190)

[2] World Bank (http://data.worldbank.org/indicator/SI.POV.GINI)

1995, the Gini index was still as low as of 22 and slowly rose to 23.8 in 2000. Since then, its value has oscillated around 25 with a peak of 26 in 2005 (data are lacking for some years). Analyses show that the level of income distribution was higher for men (a higher Gini index) than for women over the whole period. They also show that the index for Prague was higher (31.3 in 2008) than the national average and averages in other regions and is thus fully comparable with the advanced OECD countries.

There is considerable variation in income inequality across OECD countries. Inequality is above-average (31.3), for example, in Israel, Portugal and the United States, and below-average in many European countries. The Gini coefficient in individual EU countries broadly ranged from 22.5 (Norway) up to 35.9 (Latvia), with an average of 30.5 in 2012. Other than the Czech Republic, the other very egalitarian countries are – Iceland (24) and Slovenia (23.7), while Spain (35), Portugal (34.5) and Greece (34.3) are the most unequal EU countries.

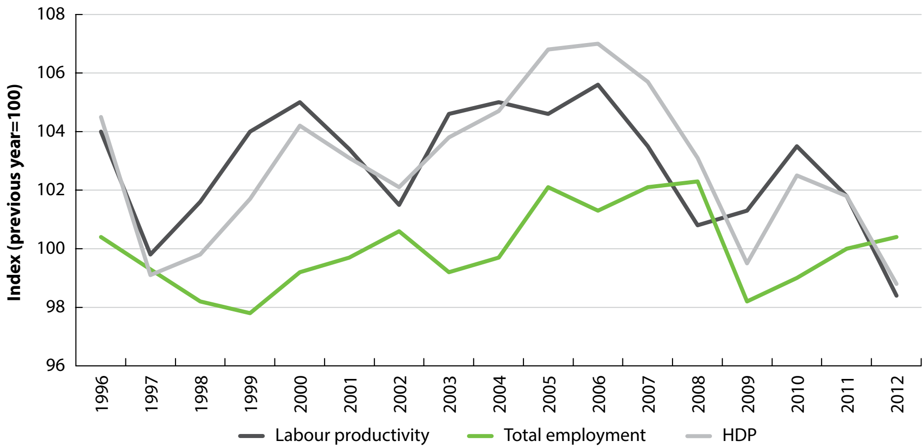
1.7. Labour productivity

At the macroeconomic level, labour productivity means the ratio of a product to the labour expended on it. Aggregated productivity is a share of GDP per employed person. The number of workers is obtained according to national accounting methodology; it includes employees and businesspeople, i.e. paid employees or employees in their own business without differentiating the type of labour activity (permanent, temporary, casual). It is measured in constant prices over a longer time period.

The labour productivity indicator measures the performance of some production factors. The growth of labour productivity is a necessary condition for sustainable development as it is directly reflected in increased economic competitiveness and indirectly in living standard growth.

As can be seen on the chart showing yearly change figures, over the period 1995–2012 labour productivity measured by GDP per employee grew by a yearly average of 2.6%. However, there were numerous variances recorded in the pace of growth: The highest average growth was in 2001–2005 (3.5%) while the lowest in 2006–2010 (1.9%). In 2012, negative growth was recorded. In comparison with average GDP growth, the productivity growth in both five-year periods referred to here was lower.

Figure 9: Aggregated labour productivity, employment and GDP (index, previous year=100)



Source: Czech Statistical Office

The level of labour productivity in the Czech Republic has gradually moved closer to the average level of the EU27, in particular due to accelerating growth in 2003–2006, and partly because of the limited investment activity in the developed EU countries and the shift in investment to countries with lower price and wage levels. Nevertheless, labour productivity in the Czech Republic remains low (about 75% of the EU27 level). Most former socialist countries (Lithuania, Latvia, Bulgaria, Estonia, Hungary, Poland and Romania) have even lower productivity levels than the Czech Republic.

II. MONITORING ENVIRONMENTAL AND RESOURCE PRODUCTIVITY/INTENSITY

The environmental and resource productivity/intensity of production and consumption and its evolution over time, spatially and across sectors is a central element of green growth. Understanding this evolution and the factors that drive these changes, which may be of a cyclical, short-term or long-term nature, is an essential ingredient in developing green growth policies. Progress can be monitored by relating the use of environmental services in production to the output generated, and by tracking decoupling in production and environmental service trends. The ultimate goal here is to achieve an absolute decoupling, i.e. the state where economic output is growing, but the pressures and impacts from the use of environmental services show an absolute decrease. Decoupling at the national level may come from the substitution of inputs, which can hide the increasing use of some scarce resources. Improvements may also come from changes in industry structure that may or may not be in line with green growth. Decoupling can be further partly explained by displacement effects – such as the substitution of domestically produced goods or services with imports, and requiring high levels of environmental services – that don't necessarily imply decoupling at the global level. Such a shortcoming in production-based measures can be addressed by focusing on consumption-based measures such as material and carbon footprints.

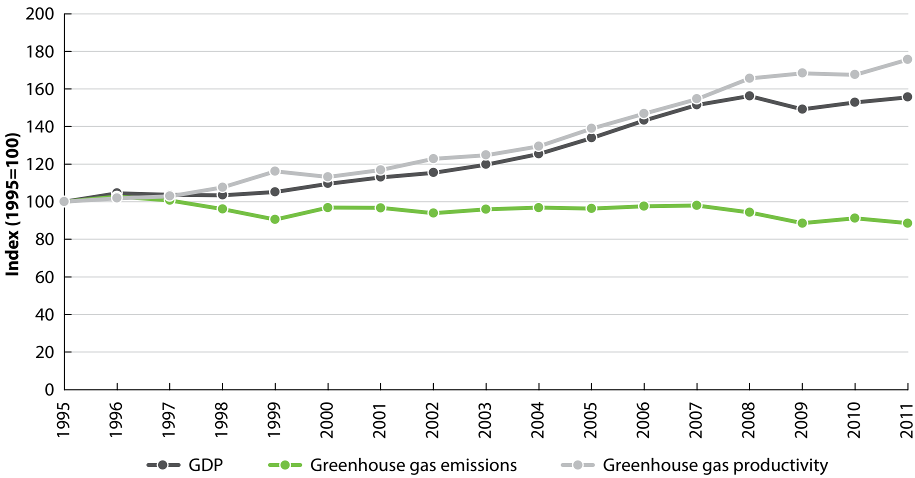
The main issues of importance to green growth include carbon, energy and resource productivity, which further comprises material, water and mineral fertilizer resources.

2.1. Greenhouse gas productivity

Greenhouse gas productivity is calculated as GDP in constant prices divided by greenhouse gas emissions. Greenhouse gas emissions include the total emissions of all greenhouse gases caused by economic production activities (in CO_2 equivalents), which are monitored by UN-FCCC. They also comprise household emissions, but exclude sinks from land use change.

Greenhouse gas productivity indicates the eco-efficiency of the economic system with regard to its contribution to global climate change. It increased by about 76% in the Czech Republic in 1995–2011. This increase was reasonably stable, with short-term declines in 2000 and 2010. The difference between greenhouse gas productivity and energy productivity indicates the shift towards less carbon-intensive energy carriers in the national primary energy supply (e.g. renewables). The increase in greenhouse gas productivity was mainly driven by an increase in GDP of about 56%, while greenhouse gas emissions went down only moderately by about 11%. This development resulted in a moderate absolute decoupling of greenhouse gas emissions from economic growth.

Figure 10: Greenhouse gas productivity, greenhouse gas emissions and GDP (index, 1995=100)



Source: Czech Hydrometeorological Institute, Czech Statistical Office

Greenhouse gas emissions fell dramatically at the beginning of the 1990's when the Czech Republic began the transition from a centrally planned to a market economy. It was accompanied by a slowdown in energy and emission-intensive heavy industries and an increase in services. Despite this, however, the proportion of heavy industry in the Czech economy is still comparatively high, and the Czech economy is greatly dependent on carbon-intensive solid fuels such as coal. This is reflected by relatively low greenhouse gas productivity compared to other industrial countries: it is about 56% of the EU27 average and about 73% of the OECD average.

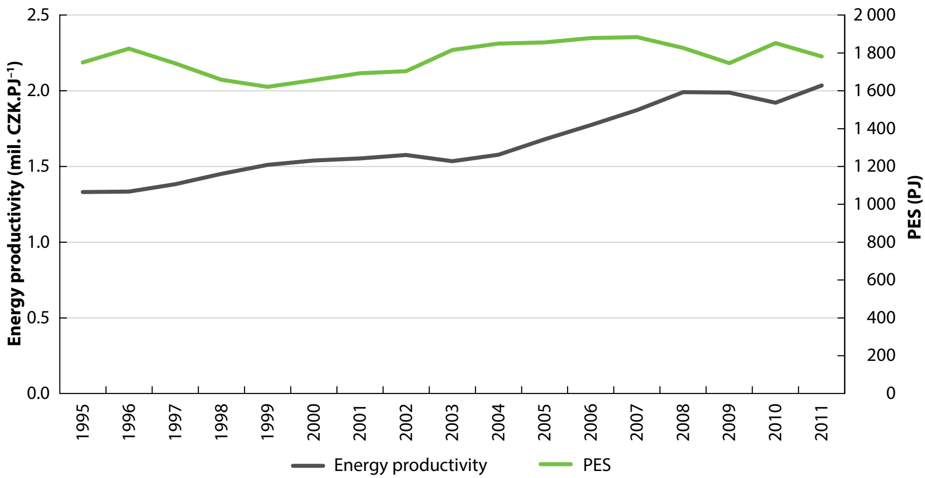
2.2. Energy productivity

The energy productivity indicator is the ratio between gross domestic product in constant prices and total primary energy supply.

Growing energy productivity allows the production of more economic output from the same amount of energy. This in principle does not necessarily reduce consumption of raw materials and fuels, but it does increase GDP produced by the same amount of energy. Energy productivity is influenced by technological development and economic structure.

Energy productivity in the Czech Republic steadily increased until 2008, since when it more or less stagnated for a number of reasons, e.g. the global economic crisis. Energy productivity has no legal binding target in the country, but energy intensity (the inverse value of productivity) according to the Czech Republic's energy policy should decrease annually by about 3%. The primary energy supply oscillates around 1 800 PJ.

Figure 11: Energy productivity (mil. CZK.PJ⁻¹) and primary energy supply (PJ)



Source: Czech Statistical Office

In 2011, the Czech Republic was about 18% below the OECD average in energy productivity.

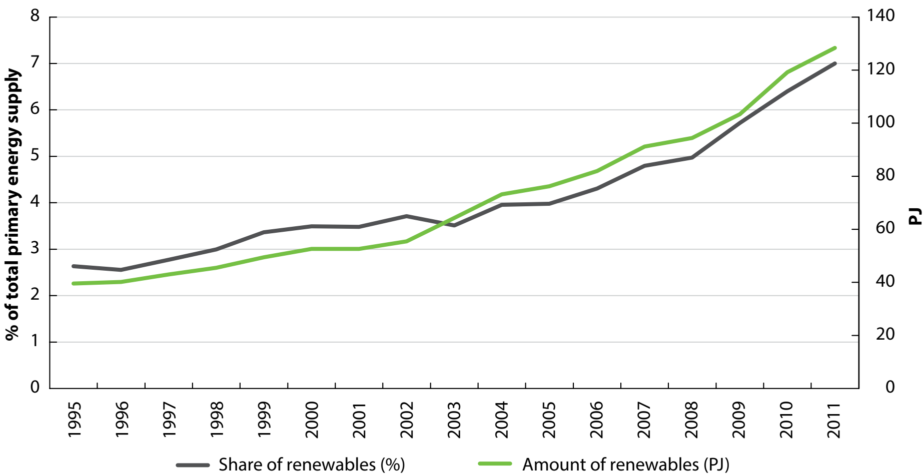
2.3. Renewable energy sources

This indicator is calculated as the total amount of energy produced from renewable energy sources (as specified by law 180/2005 Coll.) and the share of renewable energy sources of the total primary energy sources of the Czech Republic.

Renewable energy sources are the keystone of green growth, as they offer a sustainable, low carbon energy base for the economy. Their large scale deployment is limited by their low energy density compared to intensive non-renewable energy sources and the demands on other resources and technology.

There is a significant and growing trend in the use of renewable energy sources in the Czech Republic. The pace of growth has been increasing since 2002 mainly due to governmental financial support. Two binding targets have been set for the Czech Republic: One concerns the short term goal in renewable sources for the European Union as a whole (12% in 2010; the Czech Republic should have reached 8%, which was not met), and the other is the long term target for the country of 15% by 2030.

Figure 12: Renewable energy sources (%, PJ)



Source: Czech Statistical Office, Ministry of Industry and Trade

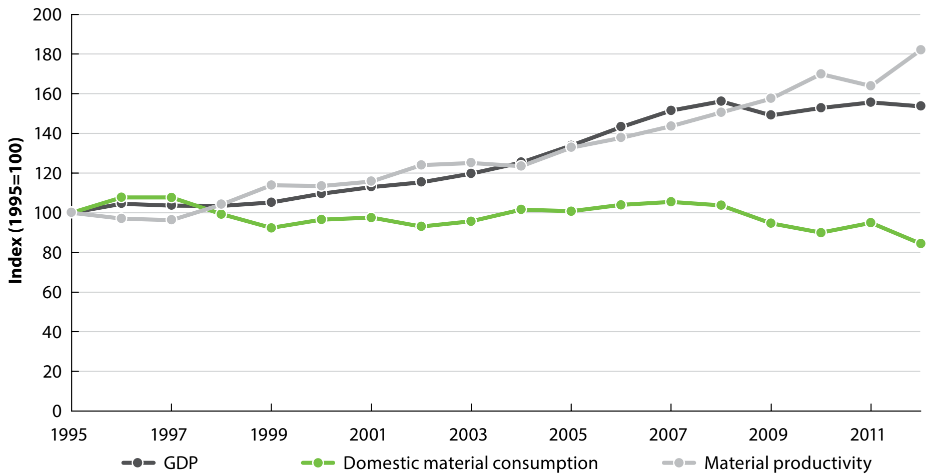
The average production of energy from renewable energy sources in OECD countries in 2011 was 8.2%, while it was only 7% in the Czech Republic.

2.4. Material productivity

Material productivity is calculated as GDP divided by domestic material consumption. Domestic material consumption is the sum of the physical amount of extracted raw materials (energy carriers, ores and non-metallic minerals) and harvested biomass (agricultural crops, timber logging, etc) acquired within a given country. All imports are added to these materials and all exports are deducted.

The material productivity of the Czech economy increased by about 82% in 1995–2012, which reflects a more efficient use of materials. The increase was quite stable, albeit with some fluctuations, such as in 2011. The overall increase was mostly driven by an increase in GDP by 54%, while domestic material consumption remained quite stable. In spite of the significant increase in material productivity, the Czech economy experienced only a slight absolute decoupling between material use and economic performance – domestic material consumption was 84% of its 1995 value in 2012, and this was mostly due to its noticeable decrease in the last year.

Figure 13: Material productivity, domestic material consumption and GDP (index, 1995=100)



Source: Czech Statistical Office

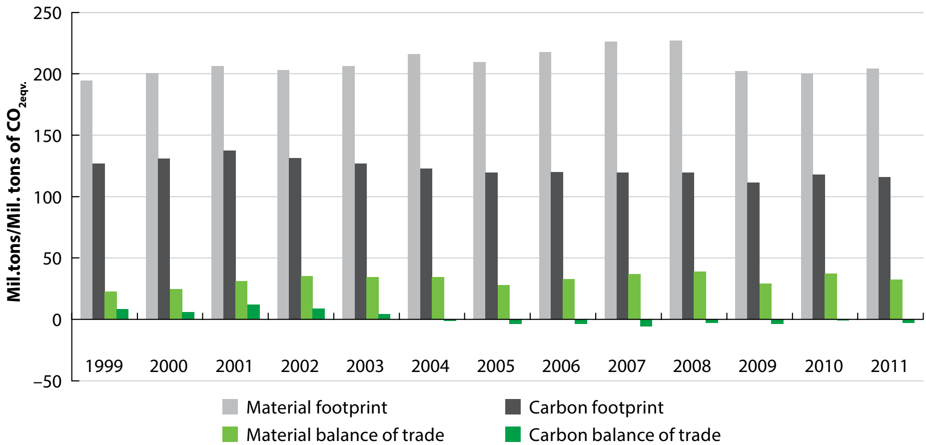
The material productivity of the Czech economy is about 30% lower compared with the EU27 and OECD averages. This is due to the fact that domestic material consumption per capita in the Czech Republic is only somewhat higher than in the EU27 and OECD, but its GDP per capita is about 20% lower. This disproportion between material use and economic performance can be attributed to the relatively high share of heavy industry in the Czech economy, as heavy industry is more material intensive, for example, than the services, and to the large proportion of solid fuels in the primary energy supply, as less energy per weight unit of solid fuels is produced in comparison to liquid and gas fuels.

2.5. Material and carbon footprint

The material footprint quantifies what amount of biomass it is necessary to produce and what amount of raw material it is necessary to extract in order to manufacture products for domestic final demand. The carbon footprint shows the amount of emissions of greenhouse gases that are released into the atmosphere during the manufacture of these products. Balance of trade indicators are calculated as the difference between raw materials/greenhouse gas emissions consumed/released during production of imported commodities and production of exported commodities.

The material footprint of the Czech economy increased only slightly by about 5% in 1999–2011, but it went up much more significantly in 1999–2008 (by about 17%). The carbon footprint decreased by 9% over the monitored period. This means that environmental pressures relating to the extraction and processing of raw materials needed to satisfy domestic final demand went up somewhat, but the related pressures on global climate system decreased. The positive material balance of trade indicates that the Czech Republic shifts the pressures associated with its material consumption abroad, protecting its own environment and harming the environment of other countries. The situation is fairer in the case of the carbon balance of trade. It is close to zero and suggests no significant shifts of environmental pressures abroad or from other countries to the Czech Republic.

Figure 14: Material (mil. tons) and carbon footprint (mil. tons of $CO_{2eqv.}$), and balance of trade



Source: Charles University Environment Center, Czech Hydrometeorological Institute, Czech Statistical Office

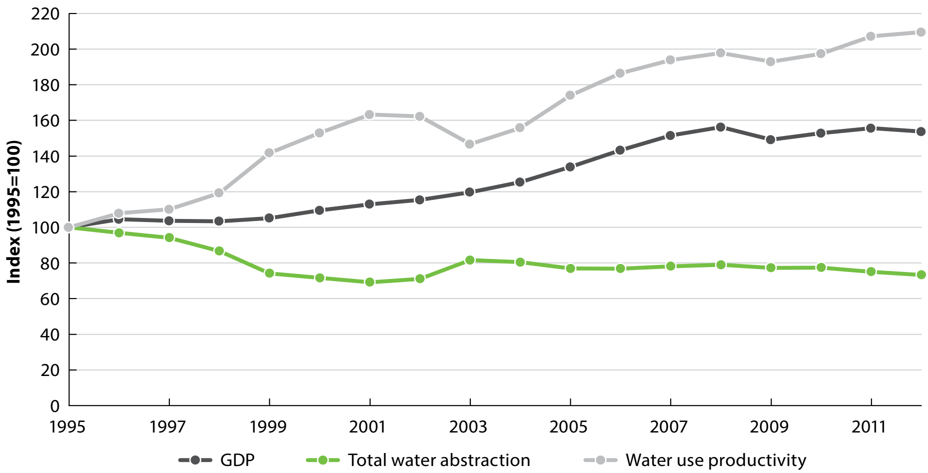
The material and carbon footprints of the Czech Republic are of a similar range as in many EU27 and OECD countries, while developing countries tend to have much lower footprints. Both material and carbon balances of trade are usually positive in EU27 and OECD countries. The even carbon balance of trade in the Czech Republic is influenced by the high proportion of coal in the Czech primary energy supply. Coal is more carbon intensive than other fuels, which implies more carbon embodied in goods produced in the Czech Republic and exported abroad.

2.6. Water use productivity

Water use productivity is calculated as GDP in constant prices divided by total water abstraction. Total water abstraction includes abstraction of both surface and underground water. Only abstractions higher than 6 000 m³ per year or 500 m³ per month are recorded.

Water use productivity in the Czech economy increased by about 109% in 1995–2012. The trend was mostly stable with one abrupt decrease in 2003. The increase in water use productivity was caused by both an increase in GDP by 54% and a decrease in total water abstraction by 27%. The latter decrease took place mostly in 1995–1999, while total water abstraction was more or less the same in 1999 and 2012. The decrease in water use productivity reflects the more efficient use of water in the Czech economy and indicates an absolute decoupling: a growth in economic performance and an absolute decrease in environmental pressures related to water abstraction.

Figure 15: Water use productivity, total water abstraction and GDP (index, 1995=100)



Source: Ministry of Agriculture, Water Research Institute of T.G.M., Czech Statistical Office

Water abstraction in the Czech Republic is dominated by surface water, which composes about 80% of total water abstraction. In 2012, water cooling of steam turbines for electricity production accounted for the largest share in total abstraction (46%), followed by public water supply systems (35%) and industry (16%). These three sectors were also responsible for the decrease in water abstraction in 1995–2001, while the increase in 2001–2003 was caused by the power industry only. Very low abstractions, on the other hand, are attributed to agriculture over the long term (about 2% in 2012).

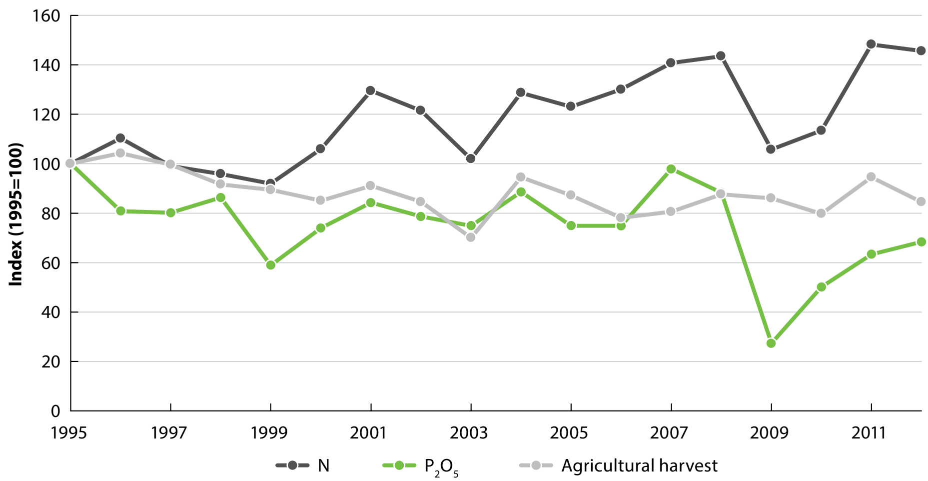
Compared to other EU27 and OECD countries, the Czech Republic shows below-average per capita water abstraction. Higher water abstraction is characteristic for countries that abstract water extensively for agricultural purposes such as Greece, Spain or Bulgaria.

2.7. Efficiency of use of mineral fertilizers

Efficiency of use of mineral fertilizers shows the total amount of applied mineral fertilizer in terms of net nutrients (N for nitrogen fertilizers and P_2O_5 for phosphate fertilizers) and the agricultural harvest expressed in physical units (in tons).

Use of nitrogen fertilizers went up by about 46% in 1995–2012, while use of phosphate fertilizers decreased by 32% in the same period. The development of both indicators was, however, quite uneven, showing significant year-to-year changes due to varying climatic conditions and the area under particular crops. The agricultural harvest declined by 15% over the whole period in question. Use of phosphate fertilizers went hand in hand with the agricultural harvest for the middle part of the period, indicating stable efficiency of use of phosphates, while efficiency improved in 2009 and was then followed by a gradual worsening in 2010–2012. For nitrogen fertilizers, efficiency deteriorated between 1995 and 2012 as more fertilizers were needed to produce the same amount of agricultural harvest in 2012 compared to 1995.

Figure 16: Applied nitrogen and phosphate fertilizers and agricultural harvest (index, 1995=100)



Source: Ministry of Agriculture, Czech Statistical Office

Compared to EU27 and OECD countries, the Czech Republic has average values for consumption of nitrogen and phosphate fertilizers. Unlike the Czech Republic, however, many EU countries have managed to reduce the application of both phosphate and nitrogen fertilizers in recent years. This, together with a stagnating agricultural harvest in these countries, led to an increase in efficiency of use of both types of fertilizers.

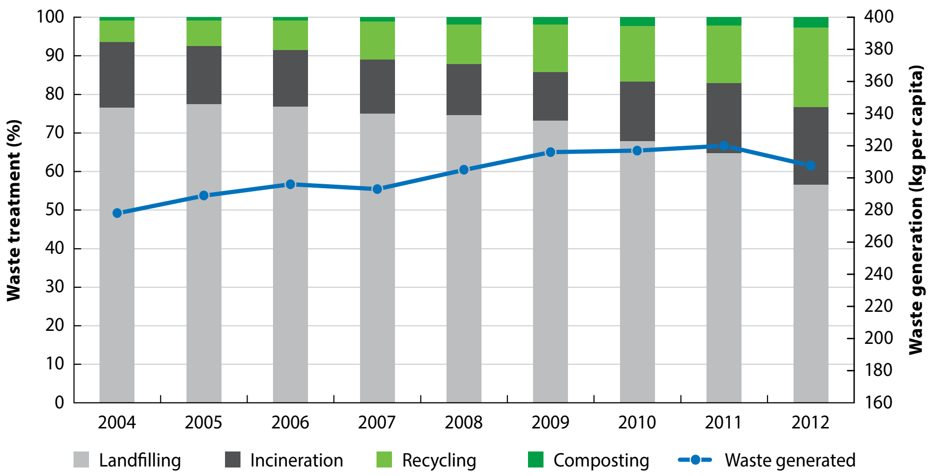
2.8. Municipal waste generation and treatment

Municipal waste generation denotes waste from household consumption, although similar waste from commerce, offices and public institutions is also included. The indicator comprises generation of municipal waste and its treatment methods, which includes landfilling, incineration, recycling and composting.

Although municipal waste accounts for only a small part of total waste generation, it is considered an important indicator of the sustainable development of a society.

The generation of municipal waste went up from 278 kg per capita in 2004 to 316 kg per capita in 2009, remained quite stable in 2010 and 2011, and then decreased to 308 kg per capita in 2012. The amount of landfilled municipal waste went down from 77% to 57% in 2004–2012. On the other hand, recycling and composting increased significantly from 6% to 24% in 2004–2012. Moreover, the amount of separately collected categories of municipal waste increased almost three times in 2002–2012.

Figure 17: Municipal waste generation (kg per capita) and treatment (%)



Source: Czech Statistical Office

Generation of municipal waste was below average in comparison with other EU countries. The EU27 average was 503 kg per capita of waste generated in 2011, while the average proportions of recycling, landfilling and incineration were 24%, 36% and 22%, respectively. Some developed countries such as Germany, Belgium and Switzerland, however, recycled more than 35% of municipal waste in 2011.

III. NATURAL ASSET BASE

Natural assets, comprising land and ecosystems, water, renewable natural resources, energy carriers, and biodiversity provide incessant flow of environmental services to human economy. Depletion of the natural asset base leads to the decline in the extent and abundance of these vital services. Therefore, protection and sustainable use of natural asset base and services derived from the natural environment are a prerequisite of the green growth. One of the guiding principles of green growth is keeping the natural asset base not declining and maintaining or restoring quality of natural resource stocks and biological diversity.

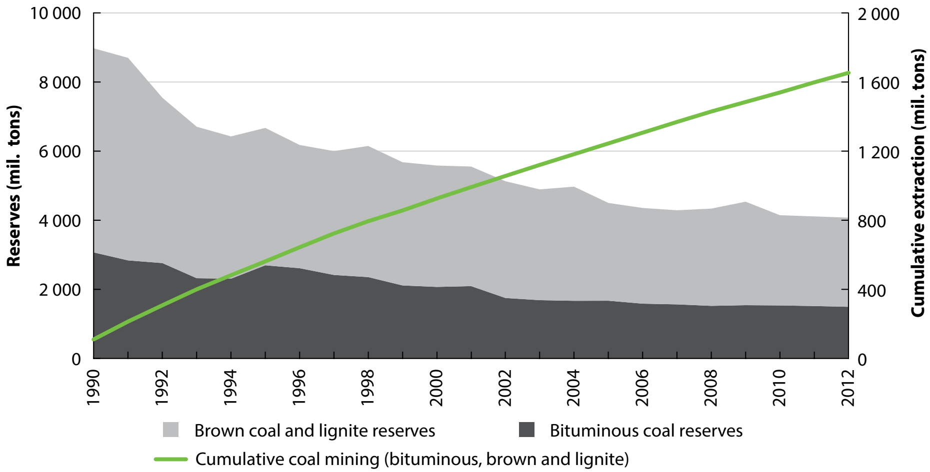
Human footprint on the environment, including mining, fishing or forestry, should stay within the productive capacity of the global as well as local environment. Furthermore, human activities should not lead to the depletion of natural asset base and degradation of ecosystems and biodiversity. Declining asset base constitutes a risk to future growth. Keeping a sufficient natural asset base provides an ecological insurance to human society. Depletion and degradation of the natural asset base brings additional economic costs to the human society. Indicators of the natural asset base are selected to monitor biophysical performance of natural assets, including land, ecosystems, freshwater, biodiversity and energy carriers.

3.1. Coal reserves and mining

Economic reserves are reserves suitable for mining under current technical and economic conditions. They are either "explored", which means that their existence is well proven, or "prospected", which means that their existence is based more on presumption thanks to sampling of the mineral deposit from outcrops and isolated mining works or from geological and geophysical data. Potential economic reserves are not suitable for mining under current technical and economic conditions, but might be usable in the future if these conditions change.

Explored economic coal reserves in the Czech Republic decreased by about 55% in 1990–2012 from 8 971 million tonnes to 4 074 million tonnes. As the cumulative mining of coal amounted to only 1 652 million tons over the whole period, the decrease in reserves was mostly a result of the re-classification of reserves from the category "explored economic reserves" to "potential economic reserves" and sometimes "prospected economic reserves".

Figure 18: Explored economic coal reserves and cumulative coal mining (mil. tons)



Source: Czech Geological Survey – Geofond

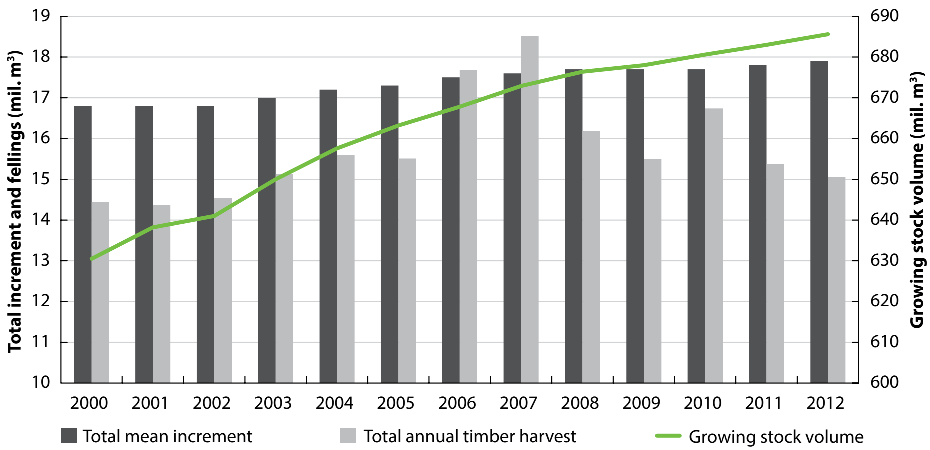
Although only about 0.4% of world coal reserves are located in the Czech Republic, the country's reserves of 4 074 million tonnes might seem quite large taking into account the fact that coal mining amounted to 55 million tonnes in 2012. It should be noted, however, that not all these reserves are currently accessible as they are either partly situated in protected areas or there are other cultural or legal restrictions prohibiting their extraction (e.g. the "ecological territorial limits for brown coal mining" in Northern Bohemia). Thus the life span of brown coal reserves in 2009 (based on mining in 2009, including losses from mining) was 45 years in total, but only 33 years when the territorial limits are taken into consideration.

3.2. Forest growing stock

Forest growing stock is the basic indicator of the sustainable use of forest ecosystems. The total mean increment reflects the production capacity of forest stands, which is based on total growing stock. The balance between increment and harvest indicates the sustainability of timber production over time.

Forest ecosystems cover one third of the area of the Czech Republic. Therefore, forests are a precious natural asset. Growing stocks and increments are related not only to timber production but also to other forest functions and services, such as carbon storage, water retention, biodiversity or recreation. Total mean increment, as well as balance of increments and harvest, are key indicators of forest production sustainability.

Figure 19: Forest growing stock, mean annual increment and the total volume of timber harvest (mil. m³)



Source: Forest Management Institute, Czech Statistical Office

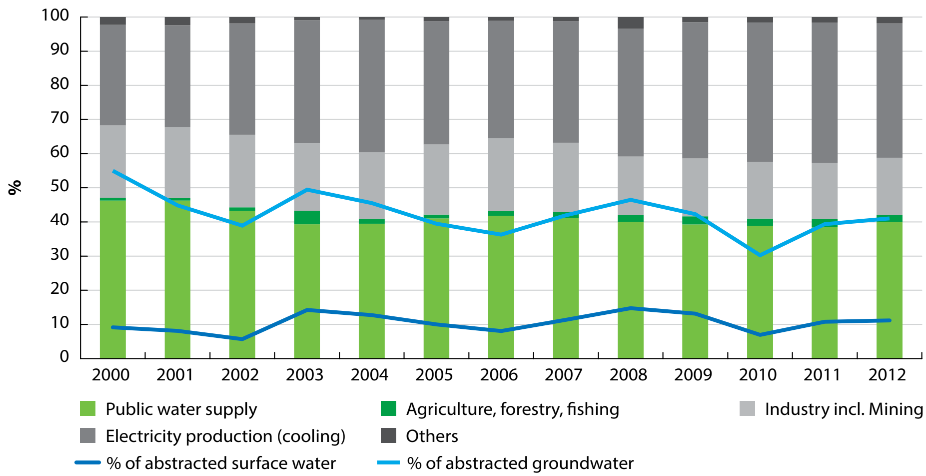
Forest growing stock is steadily increasing in the Czech Republic, and it expanded by 8% during the last decade. Since 1930, the total growing stock has almost doubled. Average growing stock has reached around 264 m³ per hectare of total forest land. The growing stock increase is caused mainly by thte increasing share of old-growth forests and increasing increments. However, total annual increments have been stagnating in Europe over the last few years. The total annual timber harvest decreased slightly over the last few years and is well within the limits of mean annual increments. In 2007 and 2008, timber fellings exceeded mean annual increments due to Kyrill storm damage. The timber harvest decreased from 6.3 $m^3.ha^{-1}$ in 2010 to 5.66 $m^3.ha^{-1}$ of forest land in 2012. The Czech Republic is among the OECD countries with the highest forest growing stocks, which reflects the country's natural conditions as well as forest management traditions. The timber harvest in national parks is limited. However, in comparison with other European countries, Czech forests are used relatively intensively, with the ratio of timber harvest to increments reaching a level of 0.85–0.9, although harvest intensity has been declining over the last few years.

3.3. Water abstraction

This indicator shows water abstraction (groundwater and surface water) per year as a percentage of renewable available freshwater resources, and the amount of surface water and groundwater use by sector. Only water abstraction exceeding 6 000 m³ annually or 500 m³ per month are included in the statistics.

Water abstractions have been more or less stable over time. The relative decrease in the share of abstractions from total freshwater resources in 2002, 2006 and 2010 was driven by higher volumes of rainfall in a given year, as shown in the chart. Surface water abstractions increased from 1 300 mil. m³ per year at the beginning of the period to 1 500 mil. m³ by the end of the period, while the consumption of ground water decreased from 550 mil. m³ to 380 mil. m³ per year. Of the total water drawn in the period 2000–2012, 47% was appropriated for the cooling of steam turbines for electricity production, 28% was abstracted by public water supply systems, 22% was used by industry and less than 2% of water was consumed by agriculture. Most groundwater was used by public water supply systems (84%) and by industry (9%).

Figure 20: Groundwater and surface water abstractions by sector and as a proportion of available freshwater resources (%).



Source: Czech Hydrometeorological Institute, Ministry of Agriculture, T. G. Masaryk Water Research Institute, Czech Statistical Office

In Europe, the Czech Republic is among those countries with sustainable water use and low water stress, due to its favourable geomorphological and climatic conditions. On average, two fifths of water is used for the energy sector in Europe, a quarter for agriculture, one fifth for public water supplies and 10% for industry. In southern European countries, the proportion of water used for irrigation is about 60%, while in the Czech Republic irrigation is negligible (2%). The countries with the highest rates of water abstraction with regard to total available freshwater resources are Greece, Cyprus, Denmark and Belgium.

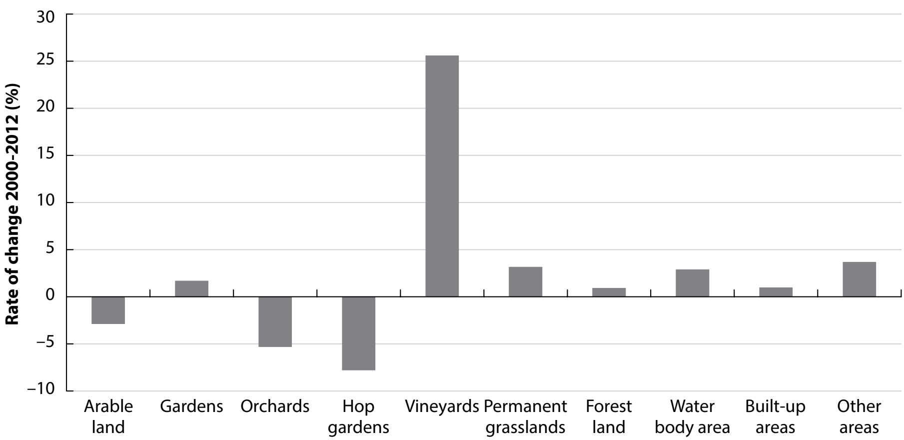
3.4. Land use change

Land use describes the spatial aspects of human socioeconomic activities associated with the land, and with the way in which land cover is transformed to serve human needs. The land use indicator tracks changes in the structure of land use. Land use change is assessed as the rate of change of land use categories.

The structure of land use reflects the economic activities of human society. The prevailing trend over the whole monitored period is that of a steady decrease in the proportion of arable land, from 39% in 2000 to 37.9% in 2012. Arable land has been transformed especially into pastures and permanent grasslands. However, a considerable amount of agricultural land, including grasslands, is still being consumed by the development of urbanized areas, especially by the sprawl of economic sites and infrastructure. The intensity of land take almost doubled to 0.4% per year.

The area of vineyards located predominantly in the Moravian region increased by 25.6% from 2000 to 2012, with an annual increase by nearly 2%, reaching 19 562 ha in 2012. However, this explosion has been partly balanced by a decline in other permanent cultures, such as orchards and hop gardens, which declined by 0.45% per year. What has been quite alarming is the steady loss of semi-natural and natural areas, such as semi-natural grasslands important for biodiversity.

Figure 21: Rate of land use change (%).



Source: Czech Office for Surveying, Mapping and Cadastre, Czech Statistical Office

The total turnover of land use change decreased in comparison with previous decades. However, dominant trends in the structure of land use change have been sustained, albeit with decreasing intensity, with the exception of land take. The majority of OECD countries have experienced similar declines in agricultural lands. Trends of land take by urbanization and the loss of semi-natural habitats are consistent with trends in the EU.

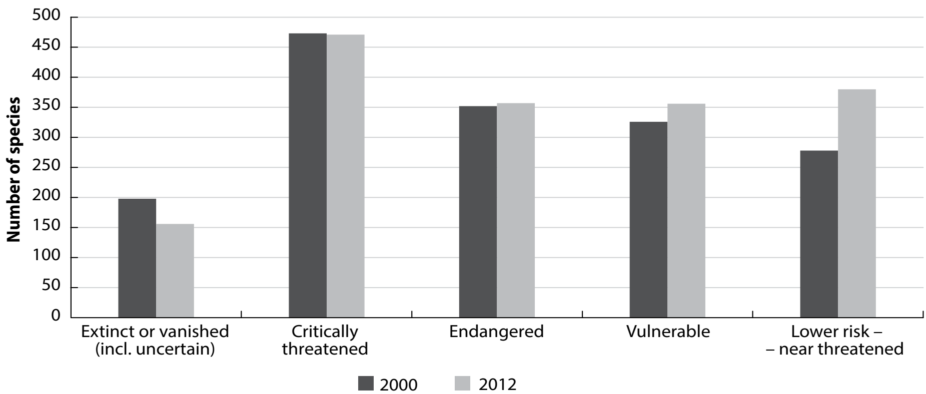
3.5. Biodiversity threats

Biodiversity threats are assessed as a change in the proportion of endangered plant species. Species are arranged in categories of threat according to the standardized criteria of the IUCN Red List. Threats to biodiversity from land use change, overexploitation, pollution, habitat fragmentation, climate change and other factors undermine the value of ecological assets.

Biodiversity is one of the bases for productive natural assets. Diversity of genes, species, functional groups and habitats support economic production as well as regulation and cultural ecosystem services. The leading indicator of a biodiversity threat is risk to species. Endangered species are assessed according to IUCN Red List criteria and categories. The compilation of Red Lists has been completed in a majority of countries and enables an international comparison of numbers of endangered species and major causes of threats.

The most recent Red List which permits the monitoring of changes over time has been compiled for plants. In total, 1 720 taxa have been included in the Red List assessment, which is more than half of the flora of the Czech Republic (59.2 %). From 2000 to 2012, there was an increase in the total number of species listed from 1 627 to 1 720. The number of species included in the category of globally or regionally extinct species decreased simply due to a reduction in the number of indeterminate cases; otherwise, the number of globally or regionally extinct species has increased by 7.2%. There was also a significant increase in numbers of endangered species in the categories 'vulnerable' and 'near threatened'. Critically endangered species still account for 27.4% of all Red-Listed species.

Figure 22: Change in the number of threatened species of plants between 2000 and 2012



Source: Grulich 2012[1]

The main reason for the increasing risk to biodiversity is increasing human pressure on natural and semi-natural habitats. The increase of the number of species in the lower risk categories of endangerment could pose a potential threat for the future state of biodiversity in an era of increasing human pressure and climate change.

[1] Grulich, V. (2012). *Red List of vascular plants of the Czech Republic: 3rd edition.* Preslia 84: 631–645.

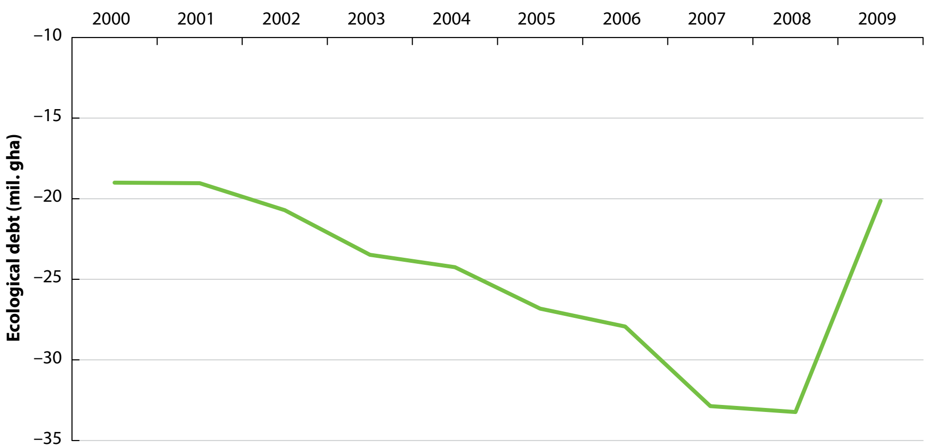
3.6. Ecological debt

The ecological debt is derived from national ecological footprint accounting. It measures the divergence between available biocapacity and the human demand on regenerative ecosystem resources. A majority of high income countries has an extensive ecological debt resulting not only from greenhouse gas emissions, but from the displacement of ecological demand to other countries also.

The ecological debt indicator is based on the most recent National Footprint Accounts 2012, which capture the year 2009. The Ecological Footprint measures the appropriation of ecosystem products and services in terms of the amount of bioproductive land and sea area needed to supply these products and services. The available productive area (supply) is denoted as biocapacity. The demand side is called the footprint. The ecological debt is the difference between available biocapacity and total demand (footprint).

The ecological debt has been steadily declining during the last decade. However, the last National Footprint Accounts assessment detected an improvement mainly due to a decrease in the total footprint from 5.85 global hectares (gha) per capita to 4.85 gha per capita. The current deficit is 20 mil. gha; while available biocapacity reached 29.5 mil. gha, it is not sufficient to cover the consumption footprint of the Czech population, which exceeds biocapacity by a factor of 1.7 (49.5 mil. gha in absolute numbers).

Figure 23: Ecological debt (mil. gha)



Source: Global Footprint Network, Charles University Environment Center

The Czech Republic is a net importer of global biocapacity. Net biocapacity imports are 2.5 mil. gha. A majority of OECD and EU countries also has a negative balance (ecological debt) in the areas of carbon footprint, fishing grounds and cropland, while some of them also have a deficit in forest areas and grazing land. Ecological debt enables an analysis of dependence on global biocapacity displaced by countries.

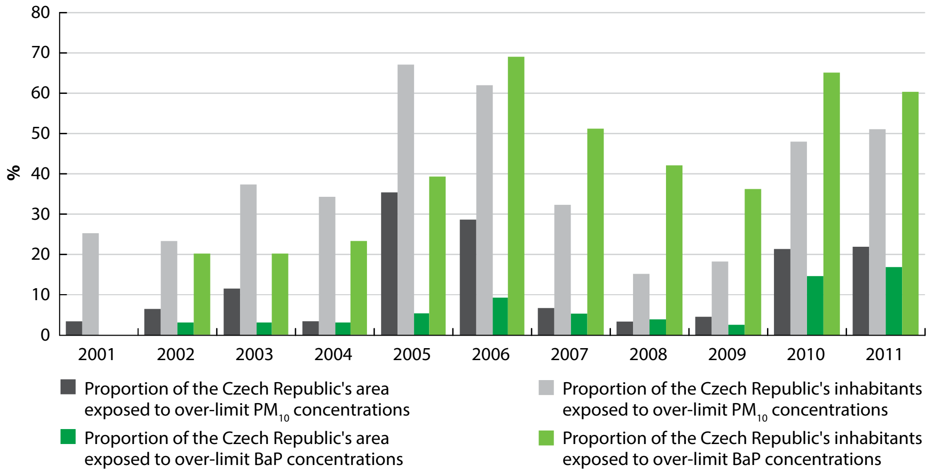
IV. ENVIRONMENTAL QUALITY OF LIFE

The environment plays a crucial role in people's physical, mental and social well--being. Environmental conditions affect quality of life in various ways: through air and water pollution, exposure to hazardous substances and noise, as well as through indirect effects from climate change, transformations in water cycles, biodiversity loss and natural disasters. Clean air and clean water are, inter alia, two important prerequisites for human wellbeing in the Czech Republic. Air pollution is considered over the long term a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from respiratory infections, heart disease, and lung cancer. The lower the levels of air pollution in cities, the better respiratory (both long- and short-term) and cardiovascular health of citizens. The most significant relationships between water and quality of life appear to stem not from water quantity per se, but rather from variables related to water infrastructure – wells, pumping stations, pipes, and sewers that deliver water to residents and remove wastewater. The resulting good health then brings many benefits, including enhanced access to education and the job market, an increase in labour productivity and wealth, reduced health care costs, good social relations, and of course, longer life.

4.1. Health risks from air pollution: population exposed to PM_{10} and PAH

Particulate matter refers to solid or liquid particles found in the air: The PM_{10} standard includes very small particles – with a diameter of 10 micrometers or less. Polycyclic aromatic hydrocarbons (PAHs) are often generally hazardous by-products of petroleum processing or combustion. The air quality data is obtained from the national air quality network across the country. The indicators PM_{10} and BaP have been developed gradually on the basis of SYMOS, EMEP and CAMx models.

Figure 24: The area and population exposed to over-the-limit 24 hour concentrations of PM_{10} and over-the-limit annual concentrations of benzo(a)pyrene (% of the total territory of the Czech Republic; % of the total population)



Note: *In 2005, the mapping methodology's precision was improved and, for the first time, a model that combined the SYMOS model, the European EMEP model and altitude data with concentrations measured at rural background stations was used to construct maps of PM_{10} concentration fields. In 2009, the methodology was redefined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and re-suspended particulate matter that are not included in emissions from primary sources are taken into account within the EMEP and CAMx models. Between 2002 and 2007, the benzo(a)pyrene mapping methodology was gradually refined. In addition to an increase of the number of monitoring stations, the mapping methodology'sprecision was improved in 2006. In 2006, a number of towns and villages were subsequently included among those areas where the BaP target value was exceeded.*

Source: Czech Hydrometeorological Institute, Czech Information Agency for the Environment

Particulate matter and polycyclic aromatic hydrocarbons represented by benzo(a)pyrene (BaP) are, over the long-term, the most important air pollutants. There are serious risks to human health from exposure to PM_{10} generated especially from transport and industry. The presence of PM_{10} in the air (depending on the length of exposure) contributes to a number of health problems – an increased incidence of coughing and breathing difficulty, bronchitis and reduced lung function. The effect of PAHs consists in their carcinogenic, mutagenic and toxic properties.

In spite of a continuing drop in emissions since 2000, air quality in the territory of the Czech Republic is not getting any better. There has been a significant increase of the number of people exposed to the over-the-limit value of PM_{10} (higher than 40 µg.m^{-3}) since 2008. In 2011, the air pollution limit value for the 24-mean PM_{10} concentration was exceeded in 22% of the country´s area with 51% of the population (The most affected areas were the Moravian-Silesian and Ústí nad Labem regions and the capital Prague).

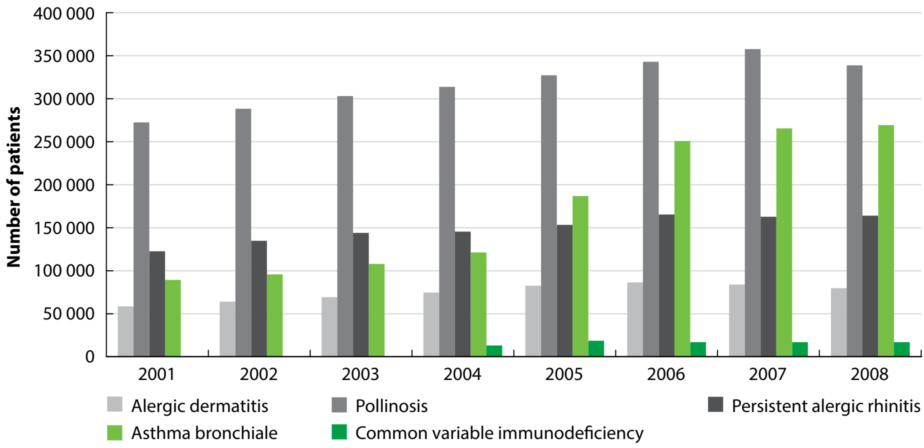
In 2011 – likewise in 2010 – a number of towns and villages were classified as areas with excessive air pollution limits for BaP. This concerns about 17% of the country's area with 60% of the population. The population affected decreased from 65% to 61%, while the affected area increased from 15% to 17% between 2010 and 2011. As in the previous year, BaP values were exceeded more regularly in the Moravian-Silesian region (highest annual average concentrations are repeatedly recorded in the city of Ostrava) and in Kladno.

4.2. Health risks from air pollution: patients treated for allergy

The indicator measures the total number of people treated for a specific type of allergic disease (asthma) every year. Allergic diagnosis data was collated within the System of Public Health Monitoring of the Czech Republic by using the annual statistical report on medical organization activities.

Poor air quality, inter alia, tends to be associated with an increased incidence of asthma (a form of allergic lung disease) and allergies. Long term increased concentrations can cause a deterioration in pulmonary function in children as well as adults, increased pulmonary tract morbidity, reduced life expectancy due to increased cardiovascular mortality, especially in the elderly and sick, and probably lung cancer. Recent epidemiological studies suggest that asthma symptoms can be made worse by increases in concentration of very small particulate matters ($PM_{2,5}$). Other studies indicate a link between exposure to polycyclic aromatic hydrocarbons (PAHs) and environmentally-induced asthma. Prevalence of asthma differs geographically.

Figure 25: Number of patients treated for an allergy



Source: Czech Health Institute

According to the Global Burden Asthma methodology developed by GINA[1], the prevalence of asthma was estimated at about 8% in the Czech Republic in 2008 (higher than in Germany –6.9%, France –6.8% or Austria –5.8%). The number of patients treated for asthma has continuously increased since 2001. The current estimate of asthma prevalence is about 10%, which is similar to the five largest West European countries: Germany, Great Britain, Spain, France and Italy.

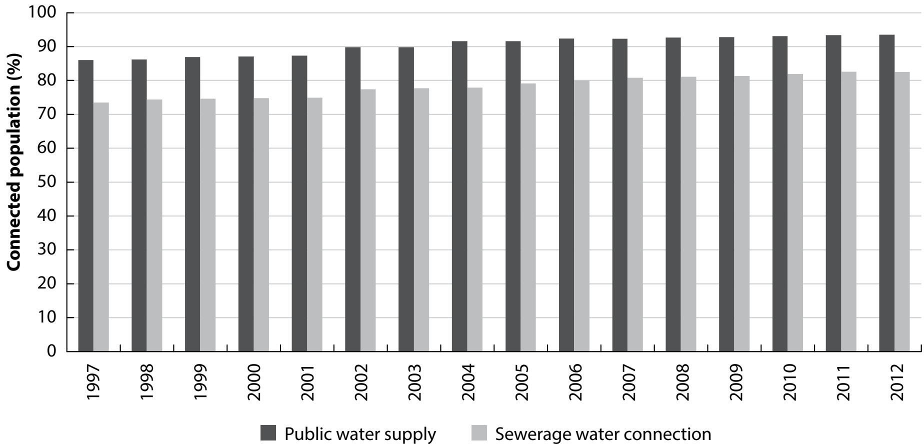
1 http://www.ginasthma.org/Global-Burden-of-Asthma

4.3. Population connected to sewerage treatment and public water supply

The indicators are constructed as proportions of the total population connected to sewerage systems, and to the public water supply network, respectively.

Waste water treatment reduces the amount of discharged pollution and is therefore an essential tool for improving surface and ground water quality. According to the State Environmental Policy of the Czech Republic, this desirable trend includes increasing the proportion of the population connected to public sewerage systems and to sewerage systems ending in waste water treatment plants. In many OECD countries the main concern is still the quality of the water supply – leakages in the distribution network, pipe breakages, and quality of water at the tap (the OECD has been working with the UN's Joint Monitoring Programme to identify and test such indicators).

Figure 26: Population connected to sewage treatment and public water supply (%).



Source: Czech Statistical Office

The proportion of the population connected to a waste water sewerage system increased from 74 to 83% in the last 15 years. Sewerage water treatment was expanded more in larger municipalities; recently, attention has focused on the development of waste water treatment plants in municipalities with populations of 2 000 to 10 000.

According to the latest international data, the share of the population connected to urban waste water treatment is above 80% in approximately half of the EU Member States for which data are available, peaking at 99% in the Netherlands, 97% in England and Wales, and 95% in Germany and Luxembourg. Since 1997, the Czech Republic has also improved access to the public water supply from 86 to 94% of the total population.

V. ECONOMIC OPPORTUNITIES AND POLICY RESPONSES

It is the principal role of government to set a legal framework which motivates business to employ sustainable production principles and encourages citizens to change their life styles and product choice towards sustainable consumption. The government is expected to create a socio-economic environment which provides new opportunities for the private sector and generates new jobs. Both market and non-market policy instruments are needed to change the way our socioeconomic system transforms energy and materials and creates well-being.

Research, development and innovation are important for economic growth and this applies to green growth as well. The corner stone of innovation is education and research. Education represents an investment in future human and social capital, and research represents an investment in the knowledge base.

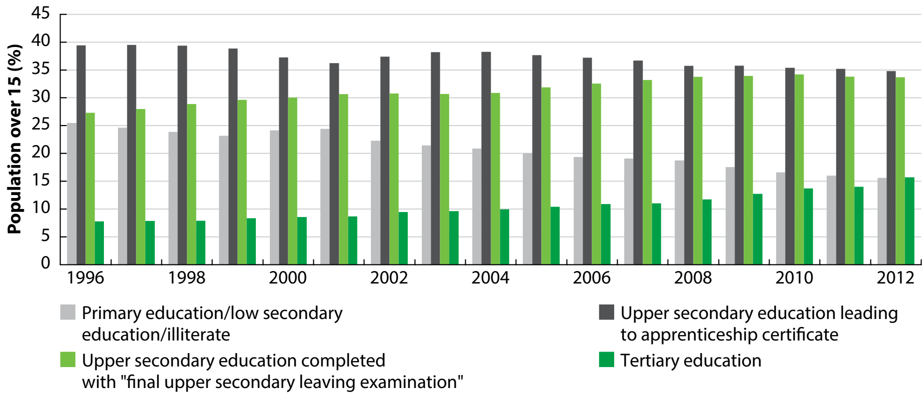
Investments in green technologies and environmental protection in general are a key element in moving towards green growth. Environmental taxation with energy pricing is a direct tool for governments to stimulate growth in a particular way. This is particularly true in the case of the Czech Republic since environmental levies are part of the environmental fund used for green innovations, the promotion of green jobs, and investment in the protection of the environment in general.

5.1. Educational attainment: population over 15 years

Educational attainment measures the highest level of education that an individual has successfully completed in formal education programmes.

Education today is inseparable from the development of human capital worldwide. That is why the majority of countries, economic and political unions, as well as different international organizations (e.g. OECD, World Bank and others) assess the level of educational attainment as one of the most important characteristics of a country´s development. Educational attainment refers to an important direct outcome of education as opposed to the inputs. According to the OECD, for example, education is an essential investment for long-term growth, developing the potential of nations and for responding to the fundamental changes in technology and demographics that are shaping labour markets. The EU sees its future economic success as dependent on having a highly educated population to be able to compete effectively in a globalised knowledge-based economy. Naturally, green growth goals are also strongly linked to the level of educational attainment. As with other European countries (e.g. Germany, Austria, and Sweden) school attendance is compulsory for nine years, usually from the age of 6 to 15 (basic education) in the Czech Republic[1].

Figure 27: Educational attainment: population over 15 years (%)



Source: Czech Statistical Office

Educational attainment at the upper secondary and tertiary education level of the Czech population has increased considerably since 1995. The amount of people graduating with an upper secondary education has increased from 27% to 35%, and the share of the population that has completed tertiary education has increased from 8% to 16%.

This positive development is reflected in the slow but continuous increase in numbers of graduates. Nevertheless, the percentage of the population that has attained a tertiary level education is considerably below the OECD average (30%). The Czech Republic has achieved the OECD average proportion of the population over 15 years of age that has attained at least an upper secondary education.

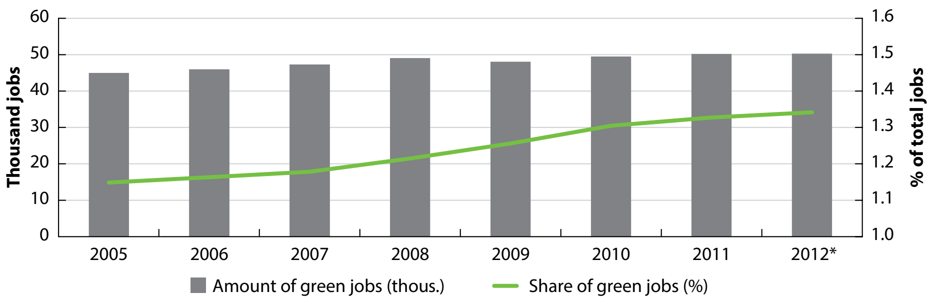
1 The illiteracy rate of the Czech population is under 1%.

5.2. Green jobs

A green job is defined as a job that contributes substantially to preserving or restoring environmental quality. Due to data constraints, the green jobs indicator presented in this publication is composed of the number of employees who are working in enterprises and institutions producing services for environmental and natural resources protection (mainly NACE codes 37 – sewerage, 38 – waste collection, treatment and disposal activities; materials recovery, 39 – remediation activities and other waste management services, 8130 – landscape service activities, 841 – administration of the State and the economic and social policy of the community, 8559 – other education n.e.c., 9104 – botanical and zoological gardens and nature reserve activities). This indicator does not include employees producing products used for resources and environmental protection.

Environmental protection may result in ambiguous impacts on employment. On the one hand, environmental policy creates new job opportunities while contributing to an improvement in the environment. On the other hand, phasing out environmentally harmful industries has adverse impacts that contribute to unemployment. This indicator is focused on the first effect and quantifies the green jobs whose role in the national economy should be strengthened.

Figure 28: Green jobs (in thousands) and as a proportion of total employees (%)



* Preliminary data
Source: Czech Statistical Office

The absolute number of green jobs was quite stable during the period in question. It shows a slight increase in the first half, a slight reduction in 2009 with a subsequent increase in the following years, and reaches its maximum in 2012. This contrasts with the development of the Czech economy, which has shown a fall in total jobs since 2008 (the total change in 2008–2012 is –7.2%). In relative terms therefore, of the total number of jobs in the Czech Republic, the number of green jobs increased over the whole period.

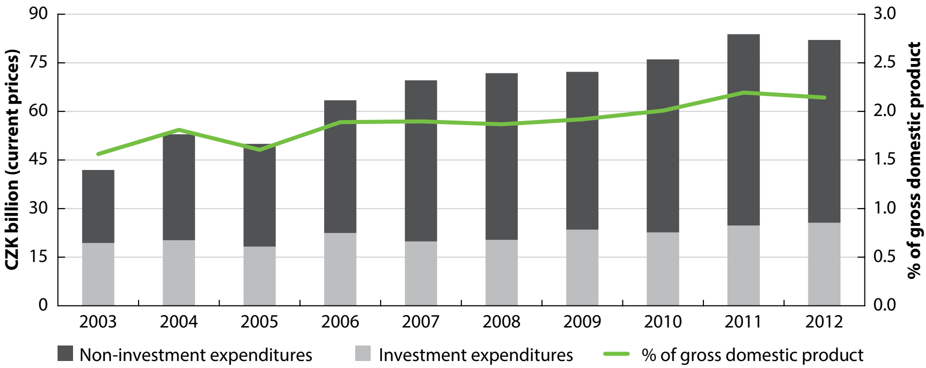
More than 50% of green jobs in the Czech Republic is concentrated in waste collection, treatment and disposal activities (52.4% in 2012), followed by employees in public administration involved in environmental protection, with an approximate 20% share (19.5% in 2012). Compared to other developed countries, the Czech Republic has a smaller share of green jobs than the EU15 average of about 2%. However, this comparison may not be representative due to differences in the definition of green jobs across countries.

5.3. Environmental protection expenditure

Environmental protection expenditure consists of environmental protection investment and non-investment expenditure. Investment expenditure includes all expenditure on acquiring long-term tangible assets for the protection of the environment. The general objective of environmental protection investments is to gather, manage, monitor and control, reduce volume, and prevent and eliminate pollutants or any other environmental damage ensuing from business activities. Environmental non-investment expenditure includes payroll, rental payments, utilities, energy and materials, as well as payments for services for which the main purpose is environmental protection. The general objective of environmental non-investment expenditure is prevention, reduction, adjustment or disposal of pollution and pollutants originating from commercial production.

Total environmental protection expenditure demonstrated an upward trend (except for 2005) and doubled over the period 2003–2011. A slight decrease can be observed in 2012. The proportion of total environmental protection expenditure to GDP was more stable and ranged from 1.6 to 2.2% during the whole period.

Figure 29: Environmental protection expenditure in current prices (billion CZK) and as a share of GDP (%)



Source: Czech Statistical Office

In 2012, environmental protection investment amounted to 25.6 billion CZK (a 3.2% increase compared to 2011). This related mainly to wastewater management that accounted for 46%. Ambient air and climate protection accounted for 16%, waste management 12%, soil, groundwater and surface water protection and remediation 10%, and noise and vibration abatement 4%.The rest, 12%, was related to other activities (such as landscape and biodiversity protection, environmental R&D, and protection against radiation, etc.). Environmental non-investment expenditure amounted to 56.5 billion CZK (a 4.3% decrease compared to 2011). The vast majority of non-investment expenditure, 64%, was related to waste management. The rest was distributed as follows: 19% for wastewater management, 6% for ambient air and climate protection, 6% for soil, groundwater and surface water protection, and remediation, 2% for landscapes and biodiversity protection, and 3% for other activities (such as noise and vibration abatement, environmental R&D, and protection against radiation, etc.).

5.4. Environmental taxes

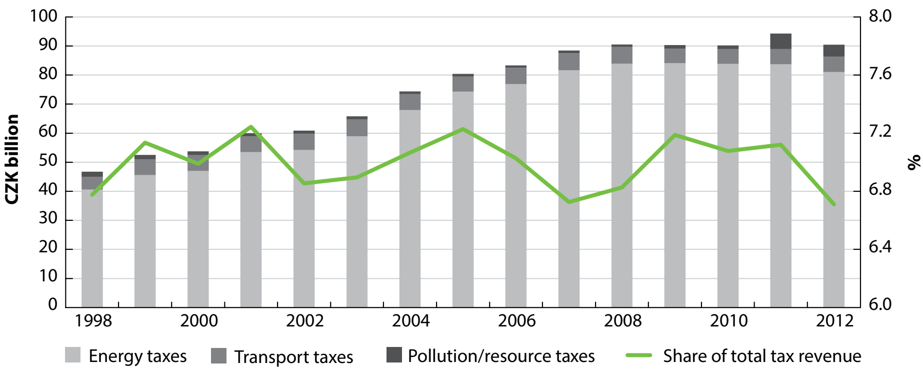
Environmental taxes as a market-based instrument are levied on products and activities with a proven negative impact on the environment with the aim to stimulate activities that minimize this negative impact. The higher the stimulus, the faster and stronger the response. Therefore, it is desirable to shift the tax burden from labour and consumption towards taxing negative environmental impacts. Here we present absolute values of environmental taxes and their contribution to total revenue from all taxes and social contributions.

Environmental taxes can be divided into three main categories: (1) energy taxes (taxes on energy products used for both transport, e.g. petrol and diesel, and stationary engines and heating purposes, e.g. fuel oil, natural gas, coal and elektricity; (2) transport taxes (related to the ownership and use of motor vehicles); and (3) pollution/resource taxes, which are usually small and therefore often grouped together. Pollution taxes include taxes for emissions into the air (except for carbon dioxide taxes) and water. In the Czech Republic, energy taxes represent the largest amount of environmental taxes – almost 90% in 2012.

In 2012, revenues from environmental taxes in the Czech Republic were over 3.4 billion EUR, or 90.4 billion CZK, which accounts for 6.7% of total revenue from all taxes and social contributions (TSC). The Czech Republic is slightly above the EU27 average (6.2% in 2011) due to the downward trend in this ratio in the rest of the EU.

In period 1998 to 2012, the highest share of environmental taxes was in 2001, reaching 7.2%, with revenues from environmental taxes reaching 60 billion CZK. In 2011, on the other hand, the highest revenues from environmental taxes were 94.3 billion CZK, accounting for 7.1% of TSC.

Figure 30: Environmental taxes (billion CZK) and their share of total tax revenues (%)



Source: Czech Statistical Office

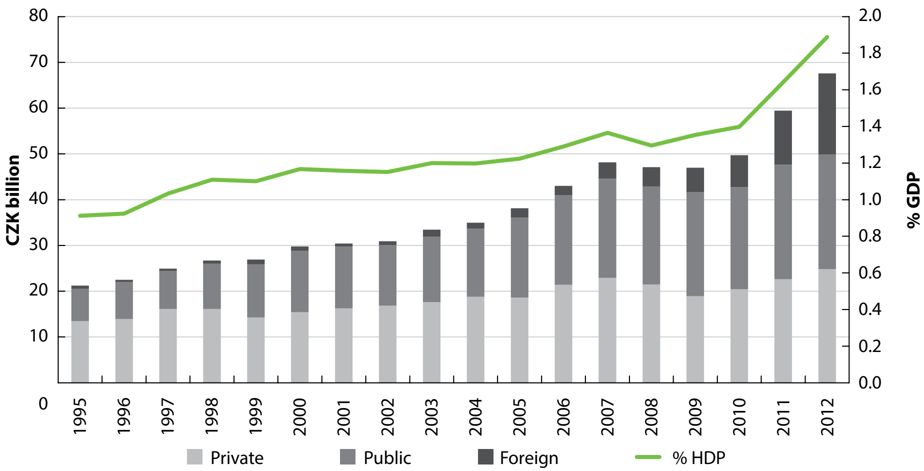
5.5. Expenditure on research and development

The Gross domestic Expenditure on Research and Development (GERD) indicator includes investment and non-investment expenditure on research and development by government, higher education institutions, business enterprises and private non-profit organisations. Research and development (R&D) refers to creative work undertaken on a systematic basis in order to increase the pool of knowledge (including knowledge of humanity, culture and society), and the use of this knowledge to devise new applications.

The role of R&D is essential in the green economy, since it directly contributes to growth by extending the knowledge base. R&D further indirectly influences the whole economy by creating innovations and information. Spending on R&D is an investment in knowledge capital. We present total expenditure on R&D here since it is difficult to distinguish R&D of importance to green growth; most R&D is indirectly related to green growth and sustainable development.

The chart shows the development of R&D expenditure in absolute terms and as a ratio to GDP. It reports a steady increase since 1996, with a slight drop in 2008 and 2009 related to the financial crises. A rapid increase in the last few years is mainly related to an increase in foreign investment (mainly due to the EU Framework Programme) and indicates a positive development in R&D expenditure.

Figure 31: Expenditure on R&D by source in 2005 constant prices (billion CZK) and as a ratio to GDP (%)



Source: Czech Statistical Office

In an international comparison of R&D expenditure as a ratio to GDP in 2011, the Czech Republic was below the EU27 average (1.9%), but it exceeds Southern European countries and most of the new EU member states (except for Slovenia and Estonia).

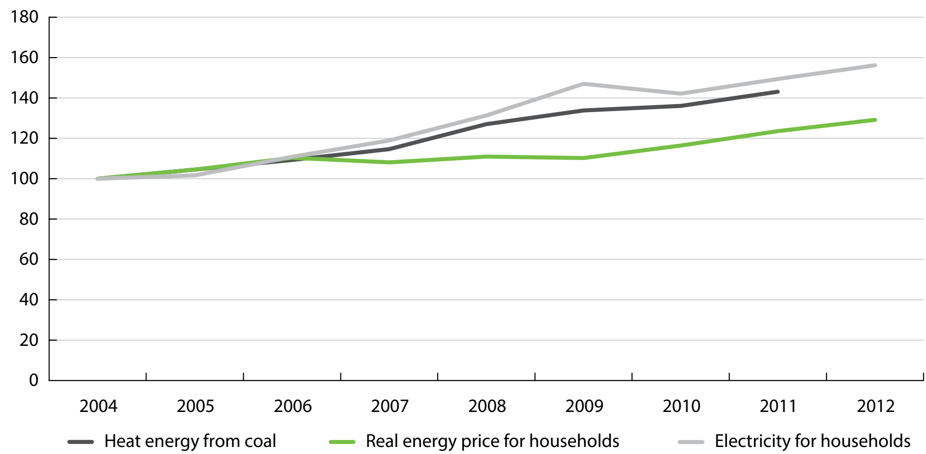
5.6. Energy prices

Energy prices are expressed as the average electricity price for a medium sized household, the weighted average price for heat generated from coal and the real energy price for households. The real energy price is derived from IEA data and reflects consumer and producer price indices.

Increasing energy prices provide negative motivation for energy consumption, encourage energy savings and have a positive influence on innovation and use of alternative fuels. However, high energy prices for industries might result in the favouring of imports and decreasing competitiveness of domestic enterprises on the international market.

We present three indicators related to the price of energy in the Czech Republic: The Figure below shows changes comparing the baseline level in 2004 (2004=100). All these indicators show a steady increase during the period in question which can be seen positively from a green growth perspective, since it motivates energy savings. The price for electricity has also been increasing because it has included financial support for renewable energy sources, which have shown a rapid increase in recent years. While the price of heating energy from coal has been increasing almost at the same pace, the overall real energy price index for households has recorded a much lower increase within the period in question.

Figure 32: Energy prices (index, 2004=100)



Source: Energy Regulatory Office, IEA.

In comparison to the development of the real energy price for households in OECD Europe, which has increased about 26.4% since 2005, the real energy price for households in the Czech Republic increased only about 23.6% within the same timeframe. The electricity price for households in the Czech Republic in 2012 (154 EUR per MWh) was lower in comparison with neighbouring countries, such as Austria (198 EUR per MWh), Germany (264 EUR per MWh) and Slovakia (179 EUR per MWh), and higher in comparison to Poland (148 EUR per MWh).

GREEN GROWTH AS A GLOBAL CHALLENGE

Significant development has been detected over the last few years despite the short history of the green growth strategy. Awareness of the strategy has been growing as international organizations (OECD, UNEP, EU and others) have supported the whole concept. It is no coincidence that support for the green growth strategy strengthened in a period of economic crisis when ways to achieve sustained economic growth and an increase in employment opportunities were intensively sought. Although only a short period of time has passed, the green growth strategy can be evaluated positively for its potential to encourage economic growth again with a view to supporting sustainable development. Increasing awareness of the green growth strategy at the international level shows that this strategy is becoming an important and solid basis for decision making in many states.

This international co-operation is very important to achieve positive synergies. It is focused on discussing and sharing best practices among countries. The green growth strategy has become a priority for the G20, which gives an unequivocal message to the international community. The OECD delivered a joint report with the World Bank and the UN to the G20 meeting in St. Petersburg, Russia, in September 2013. The report was focused on energy and on integrating green growth and sustainable development into structural reforms. The OECD also plays an important role by contributing to the revision of the System of Environmental-Economic Accounting and cooperating with UNEP as part of the Green Economy Initiative.

Recently, the Green Growth Knowledge Platform (GGKP) has been established that brings together with the Global Green Growth Institute, OECD, UNEP, and the World Bank. This is a global network of expert institutions that helps countries to make advances on measurement, design and implementation of green growth policies. These four leading international organizations have a shared vision for a set of indicators that can help communicate the central elements of green growth and a green economy. While there is no single green growth model, and green growth strategies need to be tailored to individual country conditions, the following areas are identified as central to monitoring progress towards green growth: Environmental and resource productivity and innovation, natural assets (including biodiversity) and their cost-effective management, environmental quality of life (including access to basic services such as clean water), related green growth policies, economic opportunities, and the social context of green growth and monitoring the sustainability of overall economic developments, for example through comprehensive wealth accounting.

The green growth measurement framework gives countries flexibility to incorporate the concept into their national development plans and to monitor progress on tackling their main environmental, economic and social concerns. Countries like the Czech Republic, Denmark, Germany, Korea, the Netherlands and the Slovak Republic have already applied and adjusted the framework and indicators. They have specific national contexts to assess their state of green growth.

With the support of the OECD, the Latin America Development Bank, the Latin American and the Caribbean Economic System and the United Nations Industrial Development Organization, work is underway in Mexico, Colombia, Costa Rica, Ecuador, Guatemala, Paraguay and Peru to apply the OECD indicators as a way to identify key areas of national concern and the scope for improving the design, choice and performance of policy instruments. The Latin American and Caribbean area is one of the regions in the world that largely depends on the exploitation of natural resources. A Pilot Project for six Latin American Countries will identify the applicability of the indicators in the Latin American Region. The pilot project is based from agreed OECD green growth indicators and fifteen UNEP (Latin America Counties) indicators. The proposed indicators are divided into six parts: Biological diversity, water resource management, vulnerability, human settlements and sustainable cities, social issues, economic aspects and institutional issues. The main features of the indicators support policy making at the country level, reflect national characteristics, do not use benchmarking (indicators are individually tailored for each country) and reporting has a standard and simple structure.

For example, Korea's Green Growth Strategy was established in 2008 and uses 23 indicators from the OECD framework. Mexico has developed 33 indicators: 8 indicators for socioeconomic context and growth (6 original indicators and 2 proposed indicators) and 25 indicators for environmental assessment and policy action (17 original indicators and 8 proposed indicators). In the case of Peru, 520 indicators were analyzed and 30 indicators were chosen. It is expected that following the results and experience gained in the pilot project, green growth indicators will also be implemented in other Latin American states.

INFORMATION SOURCES

Czech Environmental Information Agency (CENIA) | http://www.cenia.cz

Czech Geological Survey | http://www.geology.cz/

Czech Hydrometeorological Institute | http://www.chmi.cz

Czech Society for Ornithology | http://www.birdlife.cz

Czech Statistical Office | http://www.czso.cz

Energy Regulatory Office | http://www.eru.cz/

European Environmental Agency (EEA) | http://www.eea.europa.eu

European Commission | http://ec.europa.eu/index_en.htm

European Patent Office (EPO) | http://www.epo.org

Eurostat | http://epp.eurostat.ec.europa.eu

Forest Management Institute | http://www.uhul.cz

Charles University Environment Center | http://www.czp.cuni.cz

International Centre for Trade and Sustainable Development | http://ictsd.org/

International Energy Agency (IEA) | www.iea.org

Ministry of Agriculture | http://www.mze.cz

Ministry of Industry and Trade | http://www.mpo.cz

Ministry of the Environment | http://www.env.cz

National Institute of Public Health | http://www.szu.cz/

Organisation for Economic Co-operation and Development (OECD) | http://www.oecd.org

Scientific Committee on Problems of the Environment (SCOPE) | http://www.icsu-scope.org

T. G. Masaryk Water Research Institute | http://www.vuv.cz

United Nations Environment Programme (UNEP) | http://www.unep.org

World Bank | http://www.worldbank.org

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