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.

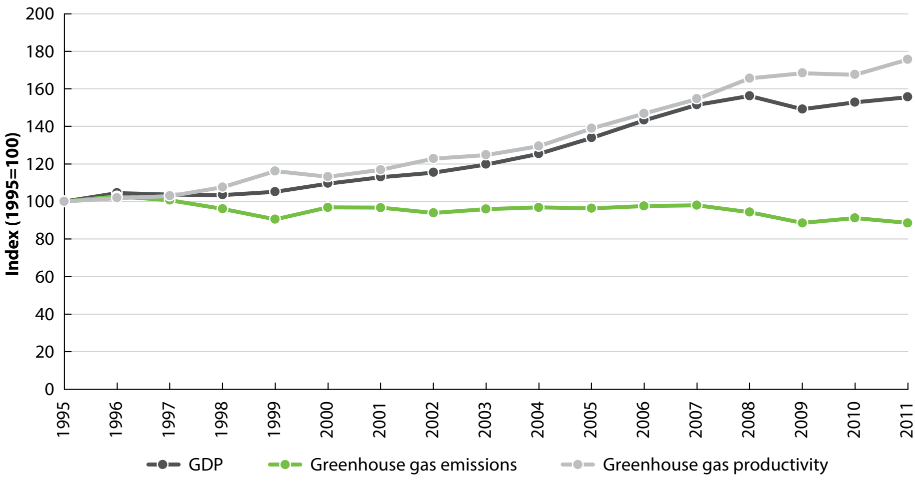
The main issues of importance to green growth include carbon, energy and resource productivity, which further comprises material, water and mineral fertilizer resources.

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 UNFCCC. 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.

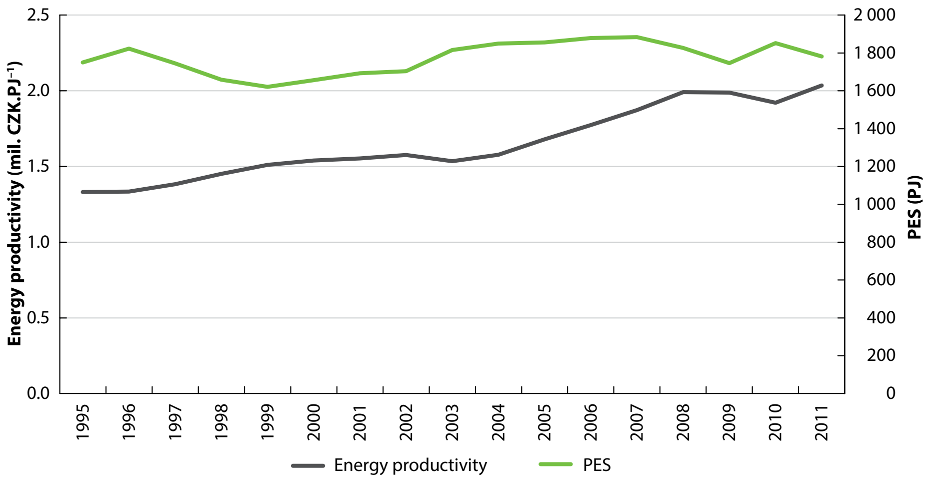
2.2. Energy productivity

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.

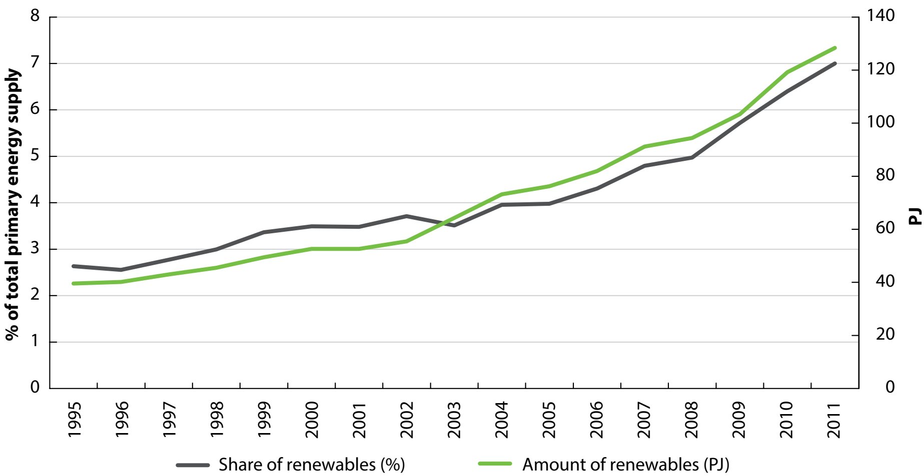
2.3. Renewable energy sources

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

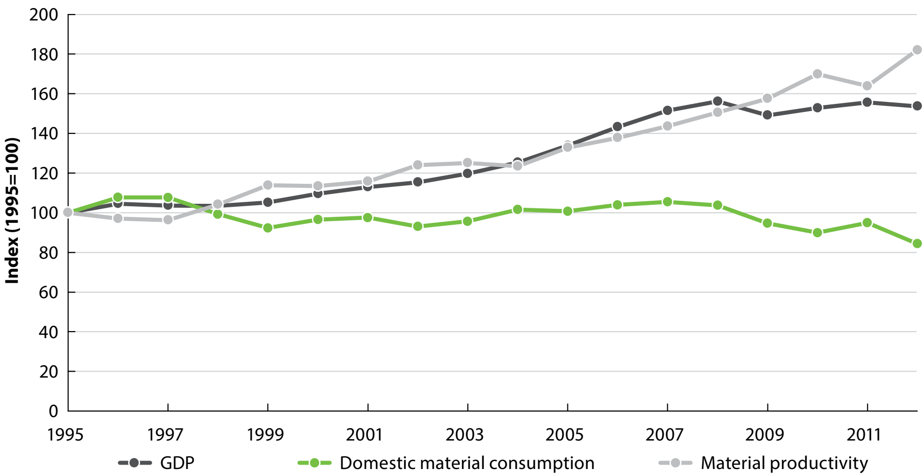
The average production of energy from renewable energy sources in OECD countries in 2011 was 8.2%, while it was only 7% in the Czech Republic.

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

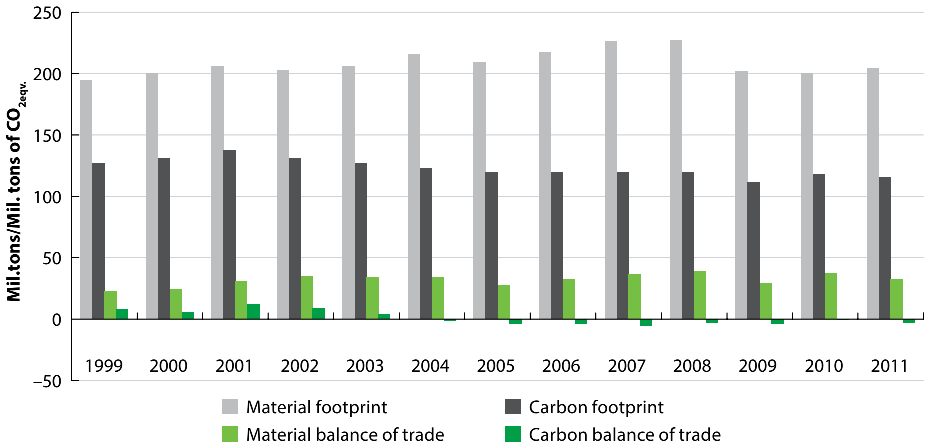
The material productivity of the Czech economy is about 30% lower compared with the EU27 and OECD averages. This is due to the fact that domestic material consumption per capita in the Czech Republic is only somewhat higher than in the EU27 and OECD, but its GDP per capita is about 20% lower. This disproportion 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

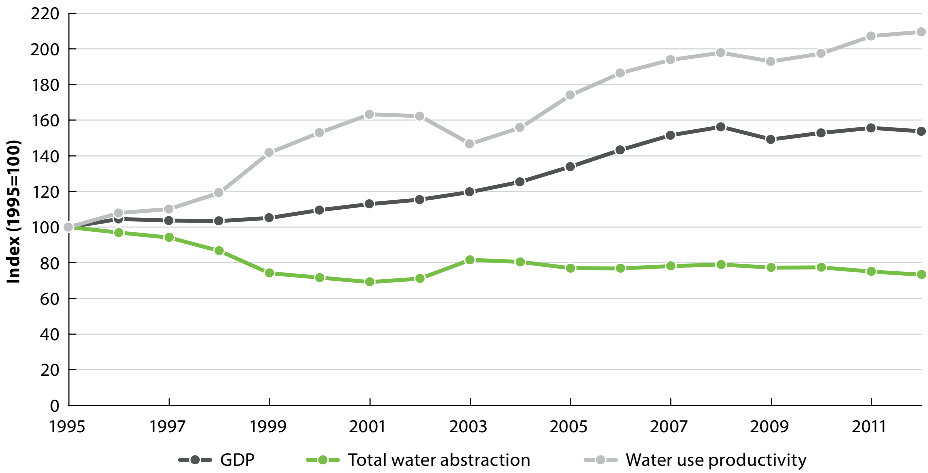
The material and carbon footprints of the Czech Republic are of a similar range as in many EU27 and OECD countries, while developing countries tend to have much lower footprints. Both material and carbon balances of trade are usually positive in EU27 and OECD countries. The even carbon balance of trade 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).

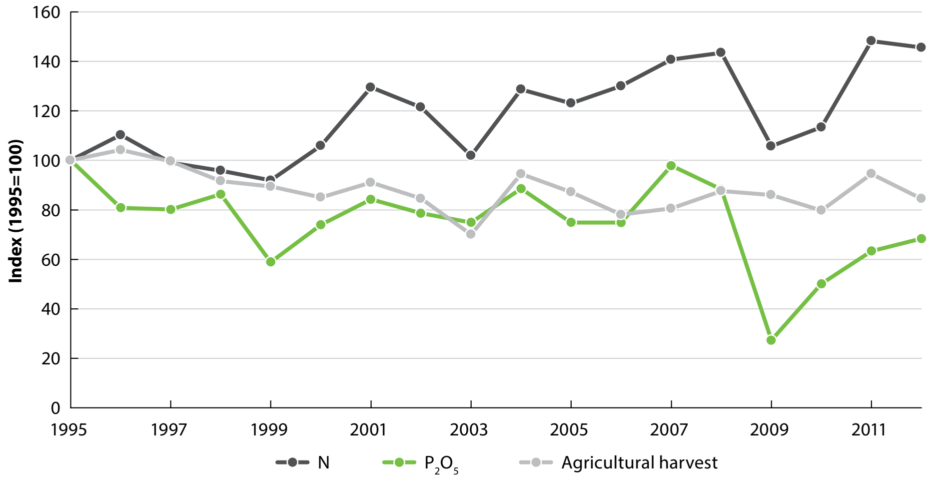
Compared to other EU27 and OECD countries, the Czech Republic shows below-average per capita water abstraction. Higher water abstraction is characteristic for countries that abstract water extensively for agricultural purposes such as Greece, Spain or Bulgaria.

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.

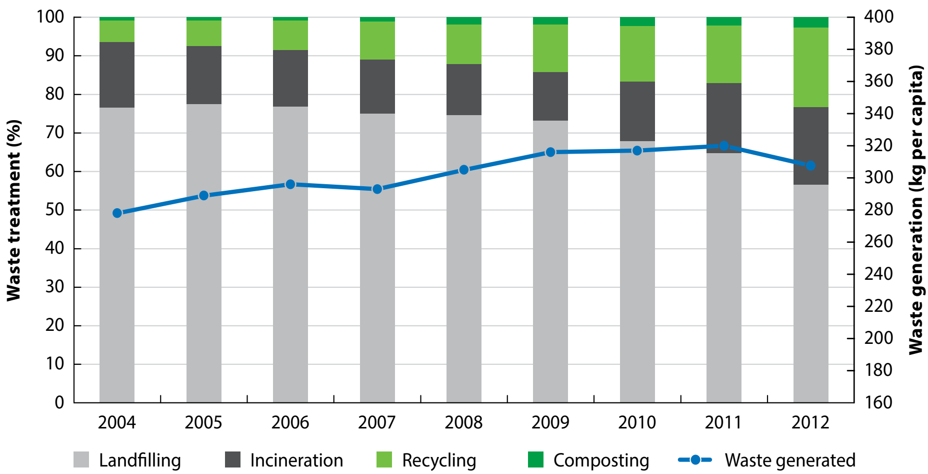
2.8. Municipal waste generation and treatment

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.