Chapter 3. Towards green growth

This chapter reviews efforts by the Czech Republic to mainstream environmental considerations into economic policy and to promote green growth and sustainable development. It analyses progress in using economic and tax policies to pursue environmental objectives and discusses environmentally harmful subsidies. The chapter examines efforts to scale up environment-related and low-carbon infrastructure, expand related markets and support eco-innovation as a source of economic growth. It also reviews progress in mainstreaming environment in development co-operation programmes.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

3.1. The economy and the environment

The Czech Republic has a small, very open economy that grew faster than the OECD average for much of the 2000s. Growth has been driven by opening markets and inflows of foreign investment, supported by a competitive industrial base and a central location in Europe (OECD, 2016a). Manufacturing industry plays an important role, with transport equipment and automotive products accounting for nearly half the country's exports. Until 2008, income per capita was catching up with the OECD average. However, in the aftermath of the global financial crisis, growth almost stopped, mainly reflecting a decline in productivity growth. GDP growth picked up in 2015, with the absorption of expiring EU funds, before moderating in 2016. It is expected to remain above 3% in 2017-18 (OECD, 2017a).

Progress has been made in reducing poverty and unemployment, energy and greenhouse gas (GHG) intensity, and the intensity of forest and water resource use. However, with a strong industrial base and reliance on coal, the Czech Republic still has one of the most energy- and carbon-intensive economies in the OECD and the population is exposed to high air pollution levels. Road remains the dominant transport mode, and changes in land use, infrastructure development and intensive farming undermine ecosystem resilience. Progress towards sustainable development will require more cost-effective environmental policies, including a long-awaited green and growth-friendly tax reform.

3.2. Framework for sustainable development and green growth

The annual National Reform Programme, part of the European Semester cycle, is the main document to promote economic growth and implement the Europe 2020 strategy. EU cohesion policy provides the investment framework to reach the strategy's goals. Czech Republic 2030, which the government approved in 2017, is the main implementation platform of the 2030 Agenda for Sustainable Development (GOCR, 2017). This second update of the 2004 Sustainable Development Strategy (after that of 2010) supports the long-term orientation and coherence of sectoral, cross-cutting and regional strategies. It outlines six national priority areas: people and society, economic model, resilient ecosystems, municipalities and regions, global development, and good governance (Chapter 1.).

In 2014, the Council for Sustainable Development was moved from the Ministry of the Environment (MoE) to the Government Office. It is now chaired by the prime minister, which should support a whole-of-government approach to sustainable development. However, ensuring policy coherence remains a challenge. Contradictions between environmental and energy policies, highlighted in the 2005 OECD Environmental Performance Review (EPR), persist. For example, while the government states that the country's objective is to ensure a transition to a competitive low-carbon economy (GOCR, 2016a), the State Energy Policy emphasises that reducing CO_2 emissions is primarily an EU political commitment and that CO_2 emissions are not a key Czech environmental indicator (MIT, 2014). The Czech Republic was the last EU member to ratify the Paris Agreement, in October 2017, due to lengthy parliamentary debates. Although the energy policy envisages a switch from fossil fuels to nuclear power and renewable energy resources, uncertainty remains on the magnitude and financing of the transition (Chapter 1. , Section 3.4.4). In addition, a 2015 decision to lift restrictions on lignite mining sent contradictory signals. The adoption of the 2017 Climate Protection Policy is a positive step that should help in aligning policies.

There is no government green growth strategy, but the Czech Republic applied the OECD monitoring framework in developing a set of green growth indicators (CZSO, 2014). The indicators include environmentally related taxes, energy prices and green jobs that are not listed in sustainable development indicators. However, there is little evidence of their use in policy making. While the energy policy promotes conventional forms of energy as the main opportunities for growth and jobs,[1] assessing the social cost of carbon lock-in and the benefits of a low-carbon economy would help support the transition and social acceptance of carbon pricing. For example, it is estimated that lifting the mining limit would increase the cost of health damage from coal extraction and use from EUR 3.3 billion to EUR 5.8 billion over 2015-50, with a substantial share of the impact exported beyond Czech borders (Máca and Melichar, 2016). The Czech Republic could build on its good capacity for economic evaluation of environmental policies.

3.3. Greening the system of taxes and charges

3.3.1. Overview

The tax burden is moderate in international terms. The ratio of tax revenue to GDP was 33.5% in 2015, slightly below the OECD average of 34.3% (OECD, 2016b). Tax evasion, which is relatively high, has become a policy priority (OECD, 2016a). Subnational government has little fiscal autonomy: local government raises only 1.2% of total tax revenue, the second smallest share in the OECD. Public debt is low and the budget is broadly in balance, but pension expenditure will rise as the population ages: the ratio of elderly to working age population is expected to grow from 27% in 2015 to 59% in 2050. As in other OECD Central and Eastern European countries, the tax mix is skewed towards labour, with higher than average social security contributions.

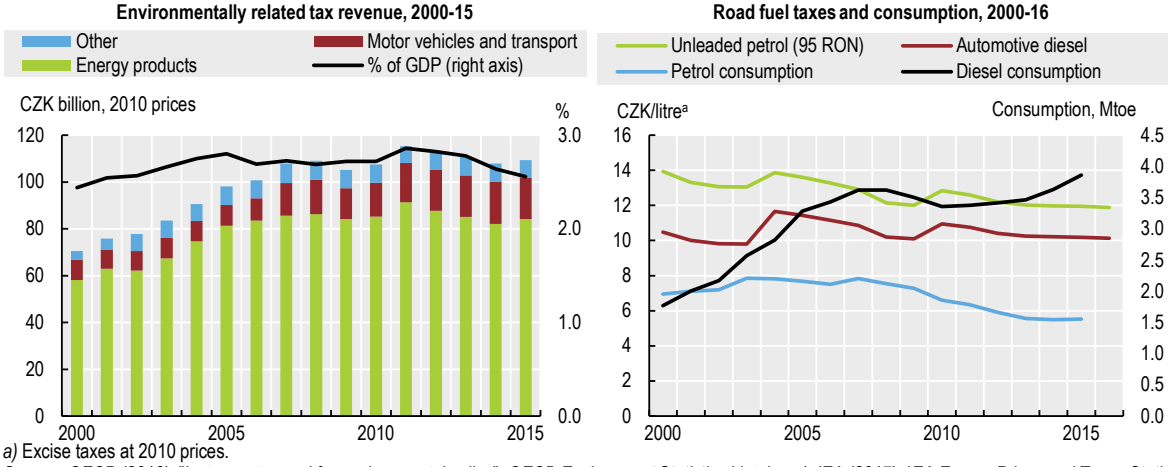
Environmentally related tax revenue rose from 2.4% of GDP in 2000 to 2.9% in 2011, then declined to 2.6% in 2015, well above the OECD average of 1.6%. Taxes on energy products account for the bulk of this revenue (78%, compared with the OECD average of 70%), while taxes related to transport (excluding fuels) generate relatively low revenue (16%, vs. 27% in the OECD). The rise in environmentally related tax revenue was driven by increased transport fuel consumption to 2008. Despite new taxes on energy products, the environmental tax burden in the economy has declined in recent years.

3.3.2. Taxes on energy products

Revenue from taxes on energy products rose in real terms over 2000-08, mainly driven by increased road fuel consumption (Figure 3.1). It peaked in 2011 following a rise in motor fuel taxation, then decreased due to a consumption slowdown, a decrease in real tax rates and a switch from petrol vehicles to more lightly taxed diesel ones. Like most OECD countries, the Czech Republic grants preferential tax treatment to diesel relative to petrol despite diesel's higher carbon and air pollutant emissions (Harding, 2014). The share of diesel in road fuel consumption grew from 46% in 2000 to 66% in 2015. Raising tax rates on diesel would better reflect the higher environmental costs associated with its use. Although the Czech Republic introduced taxes on natural gas, solid fuels and electricity in 2008 to comply with the EU Energy Taxation Directive (2003/96/EC), rates were set at relatively low levels, aligned with required minimums for non-business use, and they are not adjusted for inflation. Given the exemptions in place (Section 3.3.3), energy taxes do not provide a consistent carbon price signal across fuels and energy uses, which reduces their cost-effectiveness. Nor do they generally reflect other environmental costs from

energy use, such as noise, congestion and air pollution, which does not encourage polluters to take account of these costs.

Figure 3.1. Since 2011, lower and differentiated taxes on road fuels have reduced revenue and boosted diesel consumption



a) Excise taxes at 2010 prices.

Source: OECD (2016), "Instruments used for environmental policy", *OECD Environment Statistics* (database); IEA (2017), *IEA Energy Prices and Taxes Statistics* (database); IEA (2017), *IEA World Energy Statistics and Balances* (database).

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Energy taxes are relatively low by European standards (EC, 2016a). Like other Central and Eastern European countries, the Czech Republic has maintained low energy tax rates out of affordability concerns: about 14% of households face energy affordability risk,[2] the fourth highest share among 20 OECD countries (Flues and Van Dender, 2017).

Providing direct support to vulnerable households, decoupled from energy use, and setting tax rates at levels that better reflect the environmental costs of energy use would be more efficient for both efficiency and equity purposes than keeping taxes low. OECD simulations have shown that using a third of the additional revenue from higher taxes on heating fuels and electricity would decrease the share of Czech households facing energy affordability risk by 15% with an income-tested benefit and by 8% with a lump-sum transfer. In addition, lump-sum transfers can mitigate regressive impact, while income-tested transfers can result in a progressive impact of the tax reform. Finally, increasing energy taxes would improve health by reducing air pollution, which could partly offset the regressive impact. As poorer people live in cities with higher air pollution from heating, they would benefit the most from improved air quality (Branis and Linhartova, 2012).

3.3.3. Removing environmentally harmful support to fossil fuel production and consumption

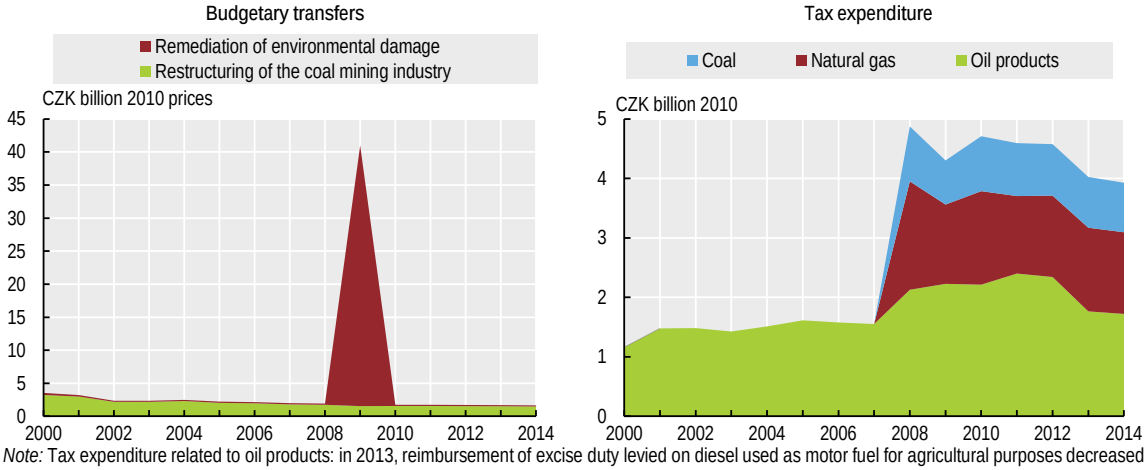
Since 2004, subsidies to the coal industry have been framed by EU rules, and state aid is allowed only for mine closure, treatment of health damage to miners and remediation of environmental liabilities related to past mining. Mining companies are held responsible for remediating damage caused by mining since 1994. The state has to deal with damage caused prior to that date. In 2009, the Ministry of Finance allocated CZK 40 billion

(about EUR 1.5 billion) to fund environmental clean-up projects on abandoned mines (Figure 3.2) (OECD, 2012a).

Support measures for fossil fuels mainly consist of tax expenditure related to energy consumption. Exemptions apply to various fuel uses: petrol and diesel not used for transport or heating; petrol and diesel used for commercial aviation and shipping; natural gas used for residential heating and in combined heat and power plants; liquefied petroleum gas used for heating; and coal and other solid fuels used in combined heat and power plants. Pure biofuels and biofuels contained in high percentage biofuel blends are subject to reduced excise duties. In addition, 40%[3] of the excise tax on diesel used in agriculture is refunded, as is 94% of the excise tax on diesel used for heating. Consumption of electricity generated from nuclear plants, renewables, biomass and/or waste is untaxed.[4] Other electricity is taxed at a single rate for all users. Fuels used for electricity generation are tax exempt (OECD, 2013a).

Despite a 2013 reduction in the refunded share of the excise tax on agricultural diesel use, total tax expenditure was estimated at CZK 4.1 billion (about EUR 150 million) in 2014, equivalent to 5% of energy tax revenue. This share is below the OECD average, a fact that may reflect lower benchmark energy tax rates.[5] Differentiated tax treatment encourages fossil fuel use, creates distortions and represents forgone budget resources that could be devoted to policies supporting economic growth, such as environment-related R&D.

Figure 3.2. Tax expenditure for fossil fuels lowers incentives to save energy



Note: Tax expenditure related to oil products: in 2013, reimbursement of excise duty levied on diesel used as motor fuel for agricultural purposes decreased from 60% to 40%.
Source: OECD (2015), "OECD inventory of Support Measures for Fossil Fuel", *OECD Environment Statistics* (database).

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There is no comprehensive information on potentially environmentally harmful subsidies and tax expenditure. The government plans to set up a National Budgetary Council to monitor the development of general government finances and compliance with fiscal rules (OECD 2016a). Its annual report could be a vehicle for screening public support programmes against their potential environmental impact and, more generally, for assessing their social costs and benefits. This would improve the transparency of taxation and public expenditure and could be used in reforming subsidies and special tax treatment that are not justified on economic, social or environmental grounds.

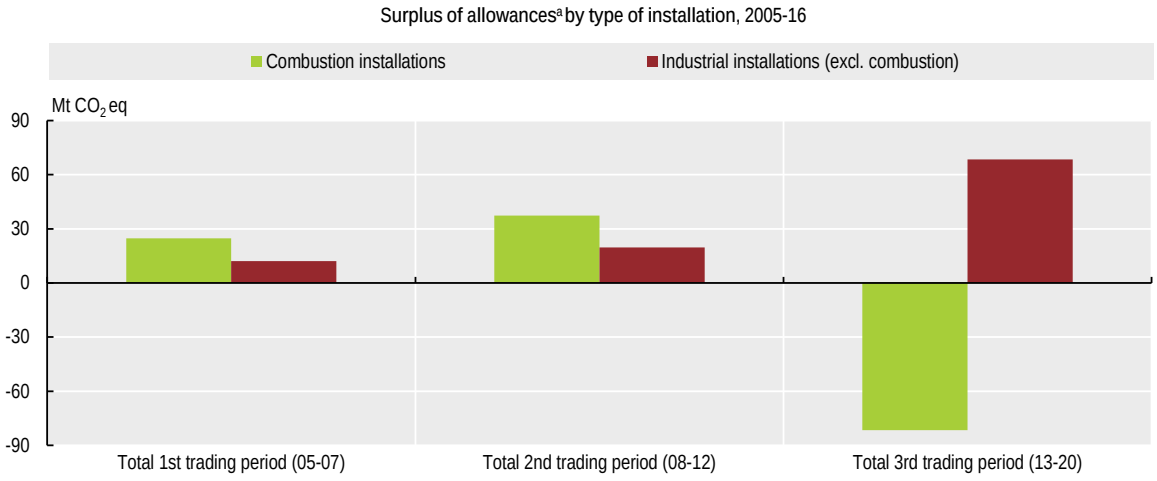
3.3.4. Carbon pricing through the EU Emissions Trading System

In addition to taxes on energy, the Czech Republic prices its CO_2 emissions via the EU Emissions Trading System (EU ETS). The emissions are generated by 349 stationary installations and five aviation entities (EEA, 2017). In 2016, power and heat generation was responsible for 80% of ETS-regulated emissions. Taking into account the price signals from taxes on energy use and the EU ETS, the Czech Republic priced 77% of its energy-related CO_2 emissions, compared with 40% on average in the 41 countries[6] representing 80% of world emissions in 2012 (OECD, 2016c). However, it priced only 16% of all CO_2 emissions at more than EUR 30 per tonne (a conservative estimate of the climate damage from one tonne of CO_2 emissions) and emissions priced at this level were primarily from road transport.

Taxes on transport fuels have historically been widely used as a way to raise revenue, with tax rates and tax bases consistently higher and larger than those of other types of energy use. The majority of carbon emissions from energy use in the Czech Republic arise in the industry and electricity sectors. Emissions in these sectors are mainly priced through the EU ETS, but allowance prices are low. As a result, the combined price signal from energy taxes and the EU ETS that applies to CO_2 emissions outside the road transport sector is among the lowest in Europe (OECD, 2016c).

Due to low allowance prices and an oversupply of tradable allowances, the EU ETS has not provided a strong price signal to induce low-carbon investment. Both combustion and industrial installations consistently received free excess allowances over 2005-12 (Figure 3.3). Although an increasing share of emission allowances has to be auctioned in the third period (2013-20), most energy-intensive industrial installations continued to receive free allowances in 2016, exceeding emissions in some sectors (e.g. iron and steel). As a result, over 2008-16, Czech industry accumulated more than 40 million tonnes of surplus CO_2 allowances.

Figure 3.3. Oversupply of allowances in the EU ETS has weakened emission abatement incentives



a) Difference between allocated and verified emissions.
Source: EEA (2017), *EU ETS data viewer* (database).

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Since 2013, combustion installations have not received excess allowances. However, the Czech Republic, like other lower-income EU countries, was granted a derogation to provide free allowances to its power sector worth about EUR 1.9 billion over 2013-19, conditional upon investment of equivalent value to modernise electricity generation and diversify the energy mix (EC, 2012). Accordingly, it presented a national investment plan of 363 projects, with a total value nearly triple the value of the free allowances. Between 2013 and 2015, however, a majority of free allowances were invested in lignite- and hard-coal-powered plants (EEA, 2016). There is no evidence of investment helping to diversify the energy mix. Free allocations weaken emission abatement incentives for firms and imply large costs for government due to forgone revenue. Full auctioning of tradable allowances avoids these drawbacks (OECD, 2017b). The Czech Republic should more rapidly increase the share of allowances auctioned to fund its transition towards a low-carbon economy. To build support from enterprises, the revenue could be used to reduce other business tax contributions.

3.3.5. Transport taxes and charges

Since 2000, transport tax revenue has doubled in real terms, driven by strong growth in road freight transport and the introduction of a toll system. However, transport-related taxes continue to represent a relatively small share of total environmental taxes. While this can be partly explained by a lower car ownership rate, it suggests there is room to increase the rates and broaden the taxes' base to better reflect environmental damage from transport.

Taxes on vehicles

While vehicle taxes are less efficient than fuel taxes and distance-based charges in reducing emissions of GHGs and air pollutants, when carefully designed, they can be effective in raising the share of low-emission vehicles in the car fleet. This is relevant in

the Czech Republic because the average age of cars is about 15 years (Cenia, 2016). The country has both one-off registration and annual recurrent taxes on vehicles, whose rates do not take environmental parameters into account. The (recurrent) circulation tax is the second largest source of transport-related tax revenue, after road tolls. It applies only to vehicles used for business activities. Personal use of company vehicles is exempted, so there is no incentive for employees to limit such use. The circulation tax rate is differentiated by engine size for passenger cars and by weight and axle size for other vehicles. Vehicles for public transport or transport of goods under 12 tonnes powered by electricity, compressed natural gas, liquefied petroleum gas or E85 are exempted, as are hybrid vehicles (ACEA, 2017).

In addition to the registration tax, an environmental tax was introduced in 2009 for second-hand, high-polluting (EURO 0-2) vehicles below 3.5 tonnes to promote fleet renewal and support the collection, processing, recovery and disposal of end-of-life vehicles (revenue accrues to the State Environmental Fund). This tax is paid for the first registration of an imported used vehicle and the first re-registration of a vehicle already registered in the Czech Republic. However, it has been ineffective in renewing the fleet because cars meeting EURO 2 and lower standards represent a decreasing segment of the car market. As a result, registrations of old cars (>10 years) increased and revenue from the tax declined.

Road pricing

In 2007, the Czech Republic introduced distance-based charges for trucks[7] and buses as a source of funding for the highway infrastructure. The electronic toll system operates on motorways, other high-speed roads and some first class roads. The rates[8] vary by emission class, number of axles, road type, day and time. The revenue is earmarked for transport infrastructure. Evidence shows peak-time traffic decreased by 15% with the introduction of time-varied charges (Gibson et al., 2014). Distance-based charges are an efficient tool to address some of the external costs linked to road transport such as air pollution and congestion, in particular if charges reflect air pollution costs of vehicles and driving location, and are linked to congestion levels. The Czech Republic could consider extending distance-based prices to passenger cars and light commercial vehicles, which pay for a vignette independent of distance travelled and emission class. Applying congestion charges in large cities, where investment in toll systems can be justified, could also help address environmental externalities. Revenue from road pricing may be used to pay for better public transport or may be recycled through an environmental tax shift potentially resulting in a double dividend. Instead of earmarking revenue to one project in particular, project selection should be based on an evaluation of social returns.

There is room to further develop traffic management in urban areas, as the 2005 EPR recommended. The share of car in passenger transport is growing, yet municipalities have rarely used the option to levy vehicle entry fees to regulate access to cities: related revenue has steadily decreased since 2000. Prague is considering the introduction of a low-emission zone, but not until a long-delayed ring road is completed.

3.3.6. Towards a green tax reform?

In 2007, the government outlined the principles of an environmental tax reform (Hogg, 2016). The initial plan was to implement it gradually over ten years, and it was expected to be revenue neutral. The first step was implementation of the EU energy taxation directive (2003/96/EC, Section 3.3.2) in 2008, which was associated with the

introduction of a single personal income tax rate and a reduction in corporate income tax rates. The second phase was supposed to address air pollution through increased air pollution taxes and the introduction of a carbon tax. This phase was discussed in 2011 when the European Commission proposed revising the directive to reflect CO_2 emissions in energy taxation.

However, progress has stalled. Contrary to the principle of the reform, overall taxes on energy have declined since 2011, while the implicit tax rate on labour has increased. While a carbon tax is among measures proposed in key strategic documents (e.g. the 2015 National Emissions Reduction Programme and 2017 Climate Protection Policy), its implementation has repeatedly been postponed. Air pollution tax rates were increased,[9] but remain well below the marginal cost of abatement and thus have not motivated emission reduction (Kiula, 2014).

While discussions have focused on CO_2 and local air pollutant emissions, there is room to review environmentally related taxes and charges on the basis of other environmental parameters. For example, while significant investment is needed in the water sector (Section 3.4.2), there is scope to increase water charges to better recover water service provision cost, and to reflect the environmental and resource cost of water use. Abstraction charges do not reflect water scarcity, and exemptions undermine the incentive to use water more efficiently (OECD, 2015a, 2012b). To address diffuse pollution, which affects most water bodies, the Czech Republic could introduce taxes on fertiliser and pesticide use. Such taxes have proved successful in reducing the use of harmful substances in other OECD countries (OECD, 2017c). There are also opportunities to improve economic instruments used for waste management (Chapter 4.). For example, the landfill tax is too low to make waste recovery cheaper than final disposal.

3.4. Investing in the environment to promote green growth

3.4.1. Environment-related measures in fiscal stimulus plans

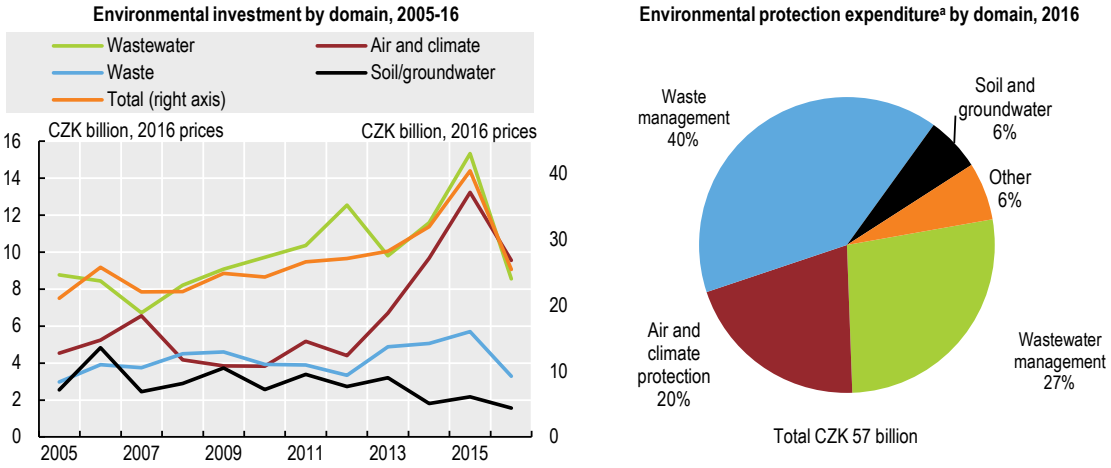
Responding to the economic crisis, the Czech Republic sold 104 million emission allowances under the Kyoto flexible mechanisms, representing about 0.5% of 2009 GDP,[10] to support energy saving in the housing sector. The Green Savings Programme, which ran until 2012, boosted GDP by nearly 0.4% in 2009 and 2010 and created more than 19 000 jobs, mainly in the construction sector (SEF, 2013). Although it did not reach its original objectives,[11] its long-term environmental benefits were found to outweigh the short-term increase in energy consumption (Pollit, 2011). It was instrumental in meeting the energy saving goal for 2010 and was subsequently renewed. The economy also benefitted from green stimulus packages similar to those in other European countries. It is estimated that the first round of a German car scrapping programme contributed 0.4 percentage point to Czech GDP growth in 2009 by boosting small car exports (Maleček and Melcher, 2016).

3.4.2. Expenditure for environmental protection

Between 2005 and 2015, environmental expenditure[12] rose from 1.2% of GDP to 1.5%.[13] This trend was driven by increased public investment in wastewater management as well as higher private investment in air and climate protection stimulated by the New Green Savings Programme in 2013 (Figure 3.4). Over the same period, operational expenditure on waste management grew considerably while spending on soil and groundwater,

including contaminated site remediation, decreased. In 2016, environmental expenditure fell to 1.2% with the transition to the new EU programming period. Capital expenditure accounted for 45% of total spending on environmental protection and current expenditure for 55%.

Figure 3.4. Investment in wastewater management and in air and climate protection increased significantly



a) Investment and internal current expenditure (excluding payments to specialised producers of environmental protection services) of the public and business sectors (including specialised producers of environmental protection services). Other: environmental R&D, administration and education and biodiversity and landscape protection. Excludes expenditure on water supply.
Source: CZSO (2017), "Environmental Protection Expenditure - 2016" (database).

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Some of the rise in waste management expenditure can be explained by treatment improvements. However, there has been no assessment of the outcomes of public support for investment or of the cost-effectiveness of municipal waste management services (Chapter 4. , SAO, 2017). Landfilling remains the main management method. Recycling rates are well below European averages. While waste management has been increasingly contracted out to specialised operators, distortion of competition remains a concern (OECD, 2013b). A system for benchmarking costs, as envisaged in the 2014 Waste Management Plan, would help improve municipal performance in waste service provision.

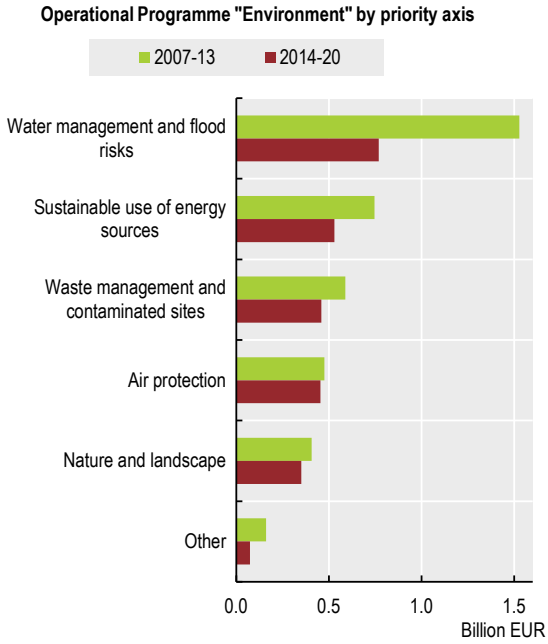
General government expenditure on environmental protection accounted for 1.1% of GDP in 2015, well above the OECD average of 0.8%, due to higher-than-average spending on wastewater management, mostly by municipalities, to meet EU requirements. Over 2005-15, the near doubling of investment helped increase the share of population connected to public sewage treatment plants, which grew by 8 percentage points to 81% in 2015, in line with the OECD average. The Czech Republic met the collection requirements of the Urban Waste Water Treatment Directive but not the 2010 treatment level objectives (Chapter 1.). Full compliance will require investing EUR 26 million in new treatment plants, 40% of which will come from EU funds (MoE, 2017a). Public investment in the extension and renewal of existing collection systems and treatment plants is estimated at EUR 300 million annually over 2017-20, in line with the 2009-15 average.

Water services are operated by public-private companies (OECD, 2015b). Individual utilities set tariffs, subject to price controls by the finance ministry. Municipalities are responsible for new investment while the private companies are responsible for operating and maintaining the network. Water bills cover operating costs for drinking water supply and sanitation infrastructure (OECD, 2012b). However, despite large increases in the past decade, tariffs remain too low to cover infrastructure renewal and new investment, partly because legal provisions prevent depreciation costs to be fully taken into account in tariff setting. It is estimated that achieving full cost recovery would not lead to substantial affordability issues, resulting in increasing the share of income spent on water and wastewater charges by households in the first income decile from 1.7% to 2.0% (Reynaud, 2016).

3.4.3. Financing investment in environmental protection

EU cohesion policy has been a major source of environmental infrastructure funding. Over 2007-13, EUR 22 billion[14] was allocated to the Czech Republic, representing an average of 2% of GDP annually (EC, 2016b). Transport was the first priority, receiving 35%, followed by environment (18%), mostly financed through the Operational Programme "Environment" (OPE) (Figure 3.5). Although OPE allocations in the 2014-20 programming period (EUR 2.6 billion) are one-third less than 2007-13 expenditure, the focus remains on issues where the country has not yet met EU obligations or is deemed at risk of failing to do so (MoE, 2015).

Figure 3.5. Making the most of EU funds requires improved strategic planning and procurement practices



Note: 2007-13: certified expenditure as of 31/12/2015 after de-commitments and corrections; 2014-20: allocated amounts.
Source: CENIA (2016), *Statistical Yearbook of the Environment of the Czech Republic 2015*; MOE (2015), *The Operational Programme Environment 2014-20*.

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Implementation of EU co-financed environmental infrastructure projects experienced considerable delay over 2007-13 due to problems meeting legal and administrative standards (Baun and Marek, 2013, OECD 2016a). Irregularities in procurement processes and inadequate public control have resulted in some funds being lost. Despite significant reforms in recent years, concerns remain about the lack of transparency, competition and enforcement (EC, 2017a). The lack of co-ordination between the MoE and intermediate implementing bodies (State Environmental Fund, National Conservation Agency), insufficient administrative capacity, complex procedures and a weak monitoring system have also undermined the Czech capacity to absorb EU funds (MoE, 2015). Although measures taken have significantly increased the absorption rate of 2007-13 funds at the end of the programming period, the uptake of EU funds for 2014-20 has been slow and deficiencies remain (MoE, 2017b, EC, 2017a).

The water supply and sanitation sector is fragmented into thousands of entities (owners and utilities) providing or operating public water services. Their heterogeneity impedes effective strategic planning, resource balancing and asset management of regional systems (World Bank, 2015). Planning weaknesses resulted in some EU co-financed investment being too high as water consumption fell (European Court of Auditors, 2015). The Czech Republic established an independent regulatory office for the water and sanitation sector in 2015. It aims to enhance regulation, ensure long-term sustainability of the sector and improve consumer protection (MOA, 2016). This is a positive step to improve the cost-effectiveness of service provision and it fulfils an *ex ante* condition for co-financing infrastructure projects within the OPE for 2014–20. As EU funding for

infrastructure declines, water and sanitation tariffs, along with those for waste management, will have to provide a greater share of finance.

3.4.4. Investment in energy efficiency and renewables

The Climate Protection Policy states that the cost of the transition to a low-carbon economy does not differ much from the cost of renewing the ageing energy system. However, the policy does not provide a clear overview of the actual and planned investment needed to achieve its targets.[15] Improving this information would help in tracking progress and gaining the confidence of private sector investors (OECD, 2017b). The gap between the State Energy Policy optimised scenario and the investment needed to reach the indicative target of an 80% GHG emission reduction by 2050 has been estimated at EUR 1.66 billion annually over 2020-50 (Trinomics, 2017). Investment in energy efficiency and renewable energy is mainly financed by the state budget, EU funds (EUR 2.2 billion is allocated for 2014-20), revenue from sales of carbon emission allowances and free allowances to the power sector (Section 3.3.4).

Energy efficiency

Heavy industry makes the Czech Republic one of the most energy-intensive economies in the OECD. Between 2000 and 2016, energy intensity declined at a faster rate than the OECD average. Improvements were largely attributable to progress in energy efficiency, in particular since 2004, as well as to the industrial restructuring towards less energy-intensive industry (Chapter 1.). Since 2000, industrial energy consumption has decreased steadily, whereas transport consumption grew strongly to 2008, slowed during the crisis, then recovered in 2014. In the aftermath of the crisis, energy consumption in the residential, commercial and public service sectors remained broadly stable, with annual variation due to climatic conditions.

Since 2010, the policy framework for energy efficiency has improved (IEA, 2016). An Energy Efficiency and Savings Department has been created within the Ministry of Industry and Trade, along with a cross-government co-ordination committee on energy efficiency. It is important to ensure that capacity and resources are sufficient to plan, implement, monitor and evaluate the energy efficiency policies and programmes.

The State Energy Policy aims at reducing energy intensity to a level comparable to the European average by 2020. To reach the EU 20% energy efficiency target, the National Energy Efficiency Action Plan[16] (NEEAP) set an indicative national target of 51.1 PJ of final energy savings by 2020 (MIT, 2017a). Most savings are expected in the residential and industrial sectors and from cross-sector measures (Table 3.1). Surprisingly low savings are expected in the transport sector suggesting a need to improve co-ordination on energy efficiency policies between the ministries of transport, environment, and industry and trade.

Due to delays in drawing EU funds for measures of the 2014 plan, the 2016 NEAAP introduced additional cross-sector measures to meet the 2020 target. However, the country failed to achieve the expected 2014-16 energy savings, postponing a large share of saving efforts to 2017-20 (MIT, 2017b).

Table 3.1. Greater energy savings effort is needed over 2017-20

Sector	Total final energy consumption in 2015 (TJ)	Energy savings[a] in 2014-16 (TJ)	Energy savings[a] in 2017-20 (TJ)	Total energy savings[a] 2014-20 (TJ)	Public expenditure[b] (billion CZK)	Cost-effectiveness of measures (TJ/CZK)
Residential	275 194	2 094	13 355	15 449	52	298
Services	119 279	2 088	1 510	3 598[c]	16	229
Industry	315 639	2 118	9 640	11 758	20	584
Transport	271 674	n.a.	21	21	n.a.	n.a.
Total	**1 010 197**	**6 300**	**24 526**	**30 826**	**88**	**351**
Additional cross-sector measures		10 745	6 000	16 745	n.a.	n.a.
Total NEEAP 5		**17 045**	**30 526**	**47 571**		

a) Savings reported under Article 7 of the EU Energy Efficiency Directive (2012/27/EU).
b) From EU funds and national co-financing.
c) Savings in public buildings. Some savings in the service sector are accounted in the industrial sector.
Source: Eurostat (2017), *Simplified energy balances* (database); MIT (2017a), *Update of the National Energy Efficiency Action Plan of the Czech Republic.*

A range of investment programmes, subsidies and loans have been promoting energy efficiency. However, these programmes have been fragmented and not cost-effective,[17] and *ex post* monitoring of energy savings could be improved (EC, 2016c). Offering a simple, co-ordinated programme for households could help deliver improved outcomes in the residential sector (IEA, 2016). Funding for energy efficiency programmes has increased significantly but investment needs are high. Renovation of residential building stock may require CZK 40-50 billion (EUR 2 billion) per year over 30-40 years (Sramek, 2017). Grants and subsidies are financed by the government budget and EU funds. Because of the uncertainty of EU funding beyond 2020, the Czech Republic should start leveraging other sources of funding, including in the private sector (e.g. banks and energy providers).

In the building sector, energy efficiency is also promoted through stricter energy performance standards and performance certificates. However, as owners often opt not to have the certificate, about 75% of dwellings have the lowest rating, which is misleading and leads to little action by consumers. Greater awareness of available incentives and the multiple benefits of energy efficiency (e.g. economic, health, property value) to consumers could help trigger greater interest in the certificates, accompanied by penalties for non-compliance.

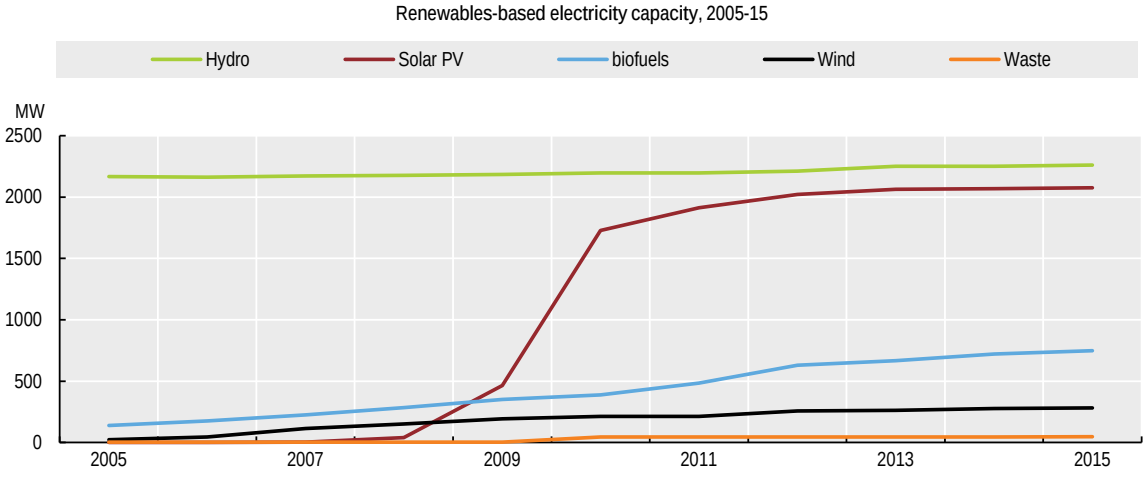
Multiple programmes support the replacement of inefficient heating equipment with highly efficient devices such as condensing boilers and heat pumps. However, the programmes also provide incentives for coal-fired heating, which should be phased out.

Like 12 other EU members, the Czech Republic adopted an alternative approach to Article 7 of the Energy Efficiency Directive, related to obligation schemes. It focuses on energy efficiency measures in the buildings sector that are important for delivering long-term energy savings in this sector. The lack of an obligation scheme, however, has made energy providers slow to address demand-side energy efficiency. NEEAP allows for the introduction of such obligation if the financial resources of the alternative approach are depleted and are insufficient to achieve the savings target set by the directive.

Renewable energy sources

Since 2005, power capacity based on renewables has more than doubled (Figure 3.6). Solar power was the main contributor to this growth, followed by biofuels (solid biofuels and biogases) and wind. A feed-in tariff (FIT, or guaranteed price) and feed-in premiums (FIP, paid on top of the market price) were introduced in 2005 as the main support mechanisms for renewables-based electricity. In 2010, favourable market conditions, supported by a decline in solar panel prices and generous FITs, resulted in the Czech Republic becoming the world's fourth-largest solar photovoltaic (PV) market (IEA, 2016). However, high FITs were not adjusted quickly enough to declining production costs, which led to a rapid and costly expansion of PV installations. In 2012, the government reduced its support significantly and set stricter criteria for eligibility. In addition, profit taxes of 26% on FITs and 28% on FIPs were imposed retrospectively on PV installations that began operating in 2009-10. In 2014, the FITs and FIPS were ended.[18] Profit taxes were reduced to 10% on FITs and 11% on FIPs for PV installations that entered into operation in 2010 (which benefit from the most favourable tariffs). Changes in support measure have made market conditions deteriorate considerably, and growth in renewables-based electricity capacity dropped from 43% in 2010 to 1% in 2015. Retroactive measures increased investor uncertainty and arguably resulted in a higher cost of capital for future investment (IEA, 2016).

Figure 3.6. Since 2012, changes in support measures have stopped the expansion of renewables-based electricity capacity



Source: IEA (2017), *Renewable information Statistics* (database).

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FIP and FIT payments are financed via a regulated levy on final electricity consumption, set as a component of the electricity price. The levy is paid by all end-users but industry has paid a lower rate than households since 2015 (Eurobserver, 2015). After increases in electricity prices in 2013, a share of the costs was transferred to the state budget.

Although good progress has been made towards the 2020 targets, new support mechanisms will be needed to reach the long-term targets of the State Energy Policy, which projects up to 25% renewables in electricity production by 2040. The instruments in place (subsidies and fiscal measures, such as exemptions from income, property and

electricity taxes or tax depreciation) could be combined with capacity auctions or quotas to avoid excess energy production (IEA, 2016). Introducing a carbon tax or increasing existing energy taxes on emissions in sectors outside the EU ETS would be a cost-effective tool to stimulate greater investment in renewables and energy efficiency.

The Czech Republic has a power system with sufficient, but inflexible, capacity reserves (mostly lignite and nuclear). Its high level of interconnection capacity provides some flexibility but there is a need for a closer market integration to reduce overflows of renewable power from neighbours (particularly Germany). Within the domestic market, the grid flexibility could be increased by fostering market signals for investment in flexibility and demand response.

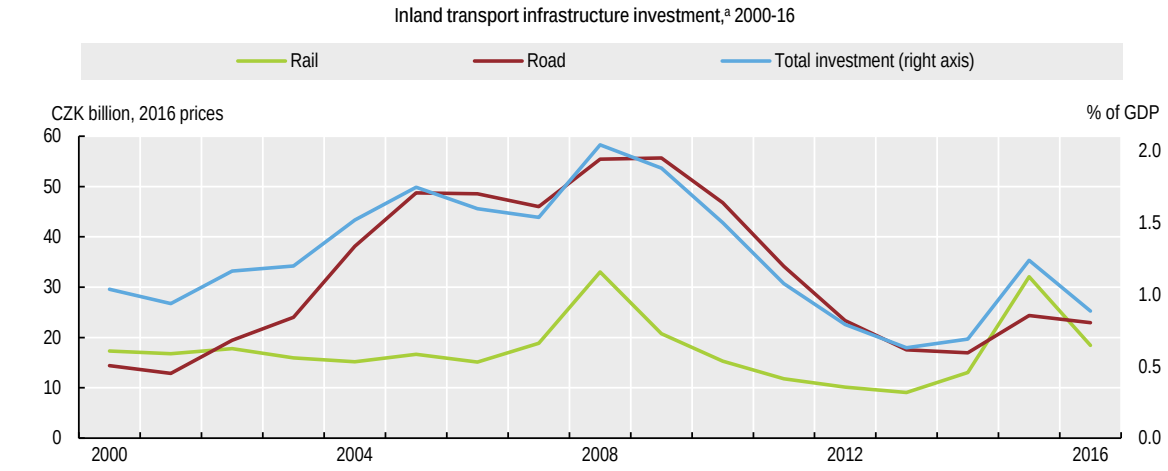
3.4.5. Investment in sustainable transport

Poor transport infrastructure continues to hamper Czech competitiveness. Road infrastructure quality is significantly below European standards and the rail network needs substantial modernisation (EC, 2017a). There are no high-speed railway connections, and cross-border connections are poor. Road accounts for a growing share of passenger and freight transport. It is a major source of local air pollution and GHG emissions from the transport sector increased by 60% between 2000 and 2016.

After sharp growth over 2000-08, investment in transport infrastructure fell substantially to 2013 before recovering with the late absorption of 2007-13 EU funds (Figure 3.7). In 2015, investment in transport infrastructure represented 1.2% of GDP, significantly more than the OECD average of 0.8%. Over 2000-16, road infrastructure absorbed two-thirds of transport investment, although rail investment exceeded road in 2015.

The 2013 Transport Policy for 2014-20 estimates that annual expenditure of 2.5% of GDP is required to operate, maintain and develop the transport infrastructure. The public budget and EU cohesion funds are the main sources of finance. Drawing of 2007-13 EU funding was delayed by structural deficiencies in project preparation and implementation. These include lengthy procedures for issuing building and land use permits and problems related to public procurement transparency and corruption (EC, 2017a).

Figure 3.7. Transport investment has been volatile and mostly dedicated to road



a) Excluding air transport.
Source: ITF (2017), *Transport* (database); MOT (2017), *Transport Yearbook 2016.*

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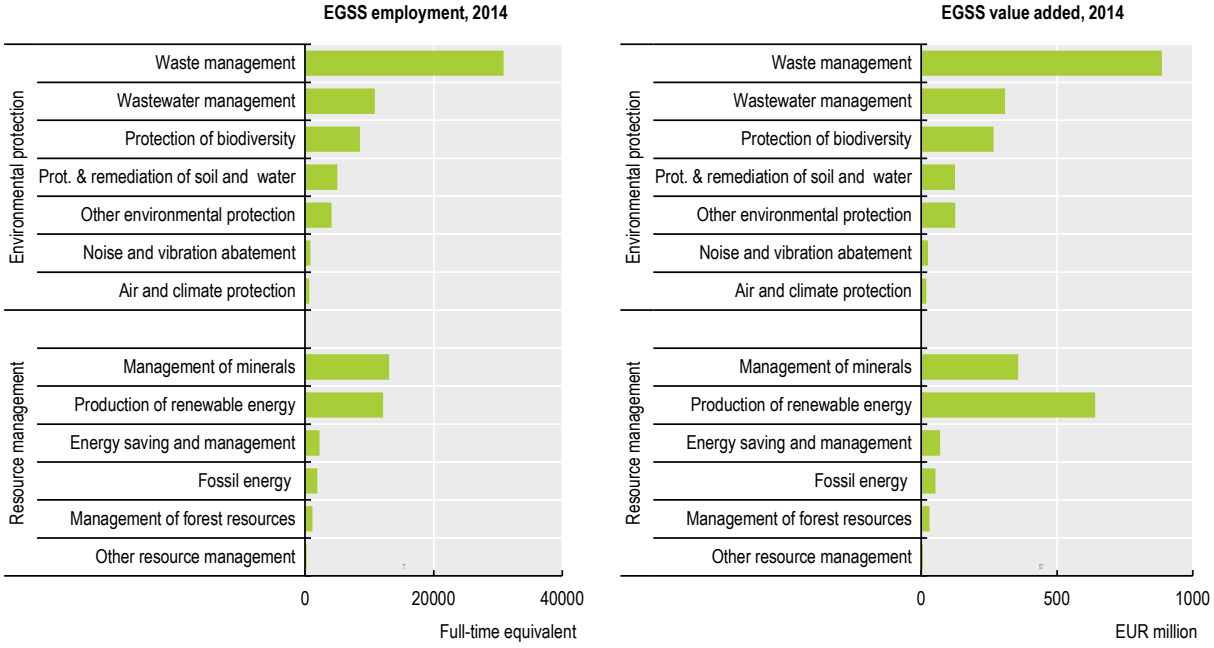
The Transport Policy suggests the Czech Republic could use various solutions to stabilise government funding of infrastructure, which would also help address the environmental externalities of road transport such as local air pollution, congestion and noise. These solutions include extending distance-based charging to a wider network and to other vehicle categories, ideally differentiating toll rates according to vehicle emissions and congestion levels and creating low-emission zones. Public-private partnerships are envisaged to finance only the most important sections of the road network.

3.5. Expanding environment-related markets and employment

In 2014, the environmental goods and services sector (EGSS) provided about 92 000 full-time-equivalent jobs. EGSS accounted for 1.8% of total employment and 2% of GDP, on a par with EU averages (Figure 3.8). The share of environmental protection in total employment increased from 0.9% in 2005 to 1.2% in 2014.

Figure 3.8. The environmental goods and services sector could be better monitored



Note: Environmental goods and services are those produced for the purpose of environmental protection (i.e. preventing, reducing and eliminating pollution and any other degradation of the environment) as well as resource management (i.e. preserving and maintaining the stock of natural resources and hence safeguarding against depletion).
Other environmental protection: protection against radiation; environmental research and development; other environmental protection activities.
Fossil energy: minimisation of the use of fossil energy as raw materials.
Source: Eurostat (2017), *Environmental goods and services sector* (database).

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Waste management provides the largest number of jobs and makes up the bulk of the value added in environmental protection activities, while management of minerals and renewables contributes the most to resource management activities. However, more than half of jobs in the renewables sector were lost between 2012 and 2014 when support was reduced, then removed.

There is no national survey on the EGSS. The CZSO estimates the sector's contribution to the economy through existing sources to meet EU requirements. Information on the EGSS is barely used in policy making and evaluation. Green jobs are scarcely mentioned in the State Environmental Policy. Existing statistics need to be improved to monitor trends in employment in green sectors and to support reallocation of labour from shrinking to growing firms and activities (EC, 2013). The Austrian and French governments, for example, regularly monitor skills and forecast future requirements for transition to a low-carbon economy (OECD, 2015c). They feed this information into education and training policy.

3.6. Promoting eco-innovation

3.6.1. General innovation performance

The Czech Republic is a moderate innovator, ranking 16th among the 28 EU countries. The importance of science, research and innovation has grown considerably (EC, 2016d, OECD, 2016d): R&D spending as a share of GDP nearly doubled to 2% between 2000

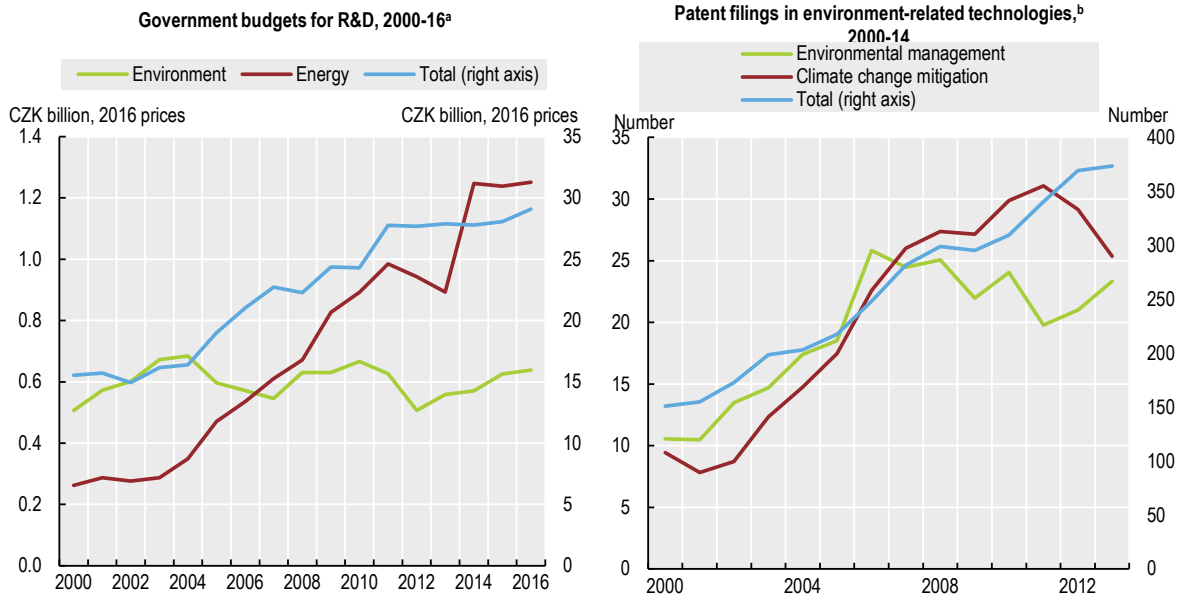
and 2015 (OECD, 2017d). With public R&D expenditure at 0.9% of GDP, the Czech Republic is on track to reach its 2020 target of 1%. Despite this progress, total R&D intensity remains below the OECD average of 2.4% of GDP, and the Czech science, technology and innovation system is still lagging. Increased spending has largely been funded by foreign-owned firms (mainly automotive) and EU funds, while domestic R&D funding has stagnated or decreased. Higher R&D intensity has not been matched by improved innovation outcomes.

The National Research, Development and Innovation Policy (NRDIP) for 2016-20 identified the following shortcomings: management and financing of research, development and innovation are fragmented, insufficiently strategy-driven and poorly co-ordinated. Limited research capacity does not generate top results globally. Collaboration between research organisations and enterprises is poor, and small and medium-sized enterprises do not innovate. The NRDIP aims to tackle these challenges by streamlining governance, implementing a new evaluation framework, developing applied research and improving research and innovation capabilities in the business sector (GOCR, 2016b).

3.6.2. Performance in eco-innovation

The Czech Republic is an average eco-innovation performer: in 2016, it ranked 10th out of the 28 EU countries, just above the EU average and ahead of most other Central and Eastern European countries (EC, 2017b). Environment accounted for 2% and energy 4% of the government R&D budget, in line with the respective OECD averages (Figure 3.9). Since 2000, increased priority has been given to energy, while the share devoted to environment has fallen. The shift in focus from general environmental management to climate- and energy-related technology is reflected in patent applications in these fields, although to a lesser extent in recent years. Patents filed in environment-related technologies in the Czech Republic remain limited.

Figure 3.9. Public budgets and patent applications have shifted from environmental management to climate- and energy-related technology



a) Government budget appropriations or outlays for R&D; breakdown according to the NABS 2007 classification.
b) Patent statistics are taken from the Worldwide Patent Statistical Database of the European Patent Office, with algorithms developed by the OECD. Data refer to patent applications filed in the inventor's country of residence according to the priority date and apply solely to inventions of high potential commercial value for which protection has been sought in at least two jurisdictions. Data refer to three-year moving averages.
Source: OECD (2017), *OECD Research and Development Statistics* (database); OECD (2017), "Patents in environment-related technologies ", *OECD Environment Statistics* (database).

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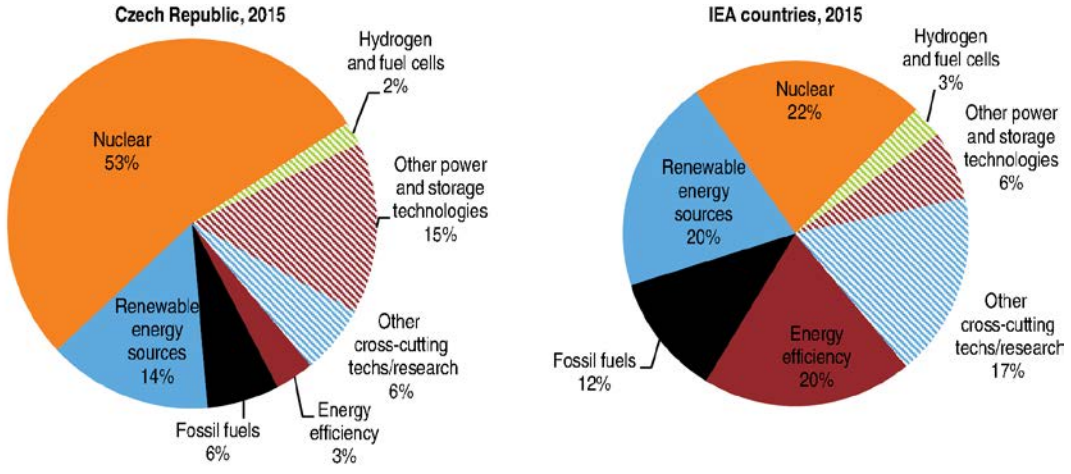
In contrast with the trend in IEA countries, public expenditure on energy-related research, development and demonstration (RD&D) has shifted towards nuclear energy, which absorbed more than half of spending in 2015 (Figure 3.10). Since 2011, this shift has been accompanied by declining budgets for energy efficiency and renewables, which accounted for 3% and 14%, respectively, of public RD&D expenditure in 2015, compared with 20% each in the OECD. Nuclear energy is followed by fossil fuels (adaptation of conventional combustion to comply with emission limits), renewables and energy efficiency as priorities for the energy sector in the NRDIP and the National Research and Innovation Strategy for Smart Specialisation (RIS3) (GOCR, 2016b, 2016c).

Figure 3.10. The public energy R&D budget is geared towards nuclear energy



Source: IEA (2016), *Energy Technology RD&D Budgets* (database) .

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There is no national policy outlining a coherent approach on eco-innovation (EC, 2017c). A programme to support environmental technology was developed in 2006 and revised in 2009 but has not been updated since then. Sustainable management of natural resources, efficient use of materials and energy are promoted in the NRDIP and RIS3. Eco-innovation is listed among solutions to ensure a healthy and good-quality environment and efficient use of natural resources, under the RIS3 priority "Agriculture and environment".[19] However, research in these areas seems to be promoted to avoid jeopardising long-term prosperity rather than as an opportunity for growth.

Nevertheless, a number of funding programmes, agencies and ministries support eco-innovation and circular economy (EC, 2016e). The MoE provided input to the NRDIP and RIS3. It co-operates with the Technology Agency of the Czech Republic to fund circular economy projects in waste management and in water and resource efficiency, including nanotechnology (Chapter 4.). The Epsilon programme 2015-25, managed by the Technology Agency, prioritises sustainability of energy and material resources and environmental protection as means of ensuring well-being. It supports projects that develop industrial applications of new technologies and new materials in energy, environment and transport. The Ministry of Industry and Trade focuses on sustainable energy policy. For example, promotion of low-carbon technology (including management of energy and secondary raw materials) has been allocated EUR 37.5 million from the European Regional Development Fund under the Operational Programme "Enterprise and Innovations for Competitiveness" for 2014-20.

The eco-innovation policy mix is mostly composed of supply-side measures, mainly R&D support but also network and partnerships (e.g. centres of excellences on material research and on global climate and ecosystem changes), along with training and consulting services (EC, 2016e; GOCR, 2016c). Demand-side instruments, including regulations, standards, labelling and certification, have played an increasing role. However, there is limited use of price and tax instruments, and green public procurement has not progressed as planned.

Eco-innovation faces the same challenges as general innovation: weak outcomes of R&D activities, limited co-operation between academia and business, fragmented R&D policy

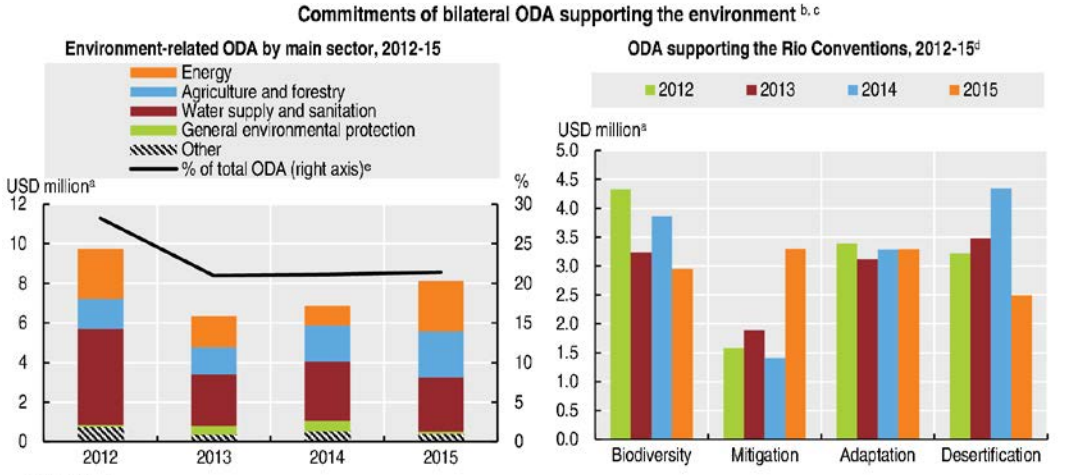
and funding framework, high dependence on the activities of foreign-owned companies, and inefficiency in the business environment, in particular related to instability of the regulatory framework and other administrative hurdles.

3.7. Mainstreaming environmental considerations in development co-operation

The Czech Republic joined the OECD Development Assistance Committee in 2013. Its net official development assistance (ODA) began at 0.11% of gross national income (GNI) and had risen to 0.14% by 2016. It will need to increase its budget for ODA significantly to meet its target of 0.33% of GNI by 2030 (OECD, 2017e, 2016e). Bilateral aid has focused mostly on education (17% of gross bilateral aid), government and civil society (13%), water supply and sanitation (8%) and agriculture (also 8%).

Support to the environment decreased in real terms between 2012 and 2013 before recovering (Figure 3.11). In 2015, it represented 21% of bilateral allocable aid,[20] below the DAC average of 30% (OECD, 2017f). The Czech share of bilateral allocable aid focusing specifically on climate change reached 14% in 2015, compared with 24% on average in the DAC. The country has pledged USD 5.3 million (CZK 110 million) to the Green Climate Fund.

Figure 3.11. Aid in support of environment remains modest



a) At 2015 prices.
b) Data refer to activities that are marked with at least one of the environment and/or Rio policy markers. They include activities targeting the environment, climate change mitigation or adaptation, biodiversity conservation and sustainable use and/or desertification control either as explicit and fundamental objective of the activities or as important but secondary objective.
c) The marker data do not allow exact quantification of amounts allocated or spent in support of the environment. They give an indication of such aid flows and describe the extent to which donors address these objectives in their aid programmes.
d) An activity can target the objective of more than one convention, thus ODA flows should not be added.
e) Percentage of bilateral allocable aid. Activities not screened against the environment marker have been excluded.
Source: OECD (2017), *OECD International Development Statistics* (database); OECD calculations.

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Environment and climate protection are among the cross-cutting priorities[21] of the Czech Development Co-operation Strategy (MFA, 2010). However, mainstreaming these priorities into programmes is a work in progress. The Czech Development Agency has focal points on environment. It screens and monitors projects for the environment focus and is trying to develop a methodology for integrating cross-cutting priorities into projects more systematically. Human resource capacity is constrained, however, and there is limited leadership and advocacy for these issues within the system.

Recommendations on green growth

- Implement an environmental tax reform so that prices better reflect environmental externalities, including GHG emissions and local air pollutants:
  - introduce a carbon component in energy product taxation to reflect the external costs associated with carbon emissions outside the EU ETS and provide a stronger and more consistent price signal across the economy; raise the excise tax on diesel to at least match that on petrol, and index the taxes on both fuels to inflation; consider recycling part of revenue from higher taxes on heating fuels and electricity to vulnerable households using an income-tested cash transfer.
  - extend distance-based charging to a wider network; link road tolls for passenger vehicles to the vehicles' emission standards; extend the annual road tax to all (not only business) vehicles; make its rate vary by fuel economy and air emission standards and delink it from the age of vehicles; harmonise the rates of the registration tax on new and used vehicles and tighten environmental criteria to promote fleet renewal towards cleaner vehicles; implement low-emission zones as planned in the Air Protection Act.
  - remove environmentally harmful exemptions to the energy and vehicles taxes; consider establishing a green tax commission, possibly as part of the National Budgetary Council, to review the environmental effects of fiscal instruments, identify subsidies with adverse environmental effects and prioritise which to phase out.
  - ensure that groundwater abstraction charges reflect resource scarcity and remove exemptions that are not justified on environment grounds. Consider introducing taxes on fertilisers and pesticides.
- Improve the effectiveness of EU funding for green infrastructure by strengthening public procurement procedures, improving project co-ordination, oversight, planning and evaluation, and ensuring the achievement of measurable environmental targets.
- Promote investment in low-carbon energy technology: assess the environmental impact of investment in electricity production under the national plan on free allocations and select projects with the highest social return; increase more rapidly the share of permits auctioned in the power sector under the EU ETS.
- Strengthen cross-government co-ordination on energy efficiency activities; reinforce transport-related measures in NEEAP; streamline support programmes for households and phase out support to coal boilers; consider introducing energy savings obligations for energy providers; develop the capacity of the banking sector to leverage investment in energy efficiency.
- Introduce new support mechanisms for renewable electricity, avoiding any retrospective changes; strengthen the national electricity grid and increase power system flexibility, including through enhanced regional co-operation and demand response.

- Promote efficient provision of water services by improving the regulatory framework, including for the financing of these services; apply user charges that allow sustainable cost recovery; promote inter-municipal co-operation; ensure systematic monitoring by independent regulatory authorities of utilities' efficiency and service quality.
- Develop monitoring and analysis of the EGSS; forecast skill requirements resulting from the transition to a resource-efficient and low-carbon economy and adapt education and training policies accordingly.
- Develop and implement a comprehensive and coherent framework for promoting eco-innovation by improving the co-ordination of energy, innovation and environmental policies across the government; streamline public support for R&D and ensure that it targets long-term priorities; improve co-operation between academia and business and ensure sound framework conditions for business innovation; develop demand for environmental goods and services.

Notes

[1] According to the State Energy Policy, "Strong focus on renewable sources poses a considerable risk. Yet the active involvement of Czech industry in the development and production of these technologies does not require that they be situated and directly supported in the Czech Republic. This, on the other hand, is necessary in the case of advanced conventional technologies (nuclear energy, high-efficiency coal, large cogeneration) where successful reference projects are a significant aspect of competitiveness. Moreover, the multiplier effects on the economy are considerably greater."

[2] Affordability is defined here as a combined notion of expenditure and disposable income. It refers to households spending more than 10% of disposable income on heating fuels and electricity and falling below the relative poverty line (60% of median income) after expenditure on energy.

[3] The share is 40% for plant production, forestry and fish farming, and ranges from 40% to 87% for animal production, depending on livestock intensity.

[4] Electricity generated from renewables and biomass is exempted if it is produced in installations with capacity up to 30 kW and consumed on production site.

[5] Tax expenditure is a relative preference within a country's tax system, measured with reference to a benchmark set by the country.

[6] The OECD countries plus Argentina, Brazil, China, India, Indonesia, the Russian Federation and South Africa.

[7] In 2010, the charge was extended from vehicles over 12 tonnes to vehicles over 3.5 tonnes and was differentiated by time.

[8] For buses, the rate varies by emission class only.

[9] The law regulating emission taxes was amended to reduce administrative costs. The number of pollutants covered was lowered from 20 to 4 (SO_2, NO_X, VOCs and PM); the rates are to increase until 2021.

[10] Revenue from the sale of 103.7 million assigned amount units amounted to CZK 20.5 billion.

[11] These were reducing total CO_2 emissions by 1%, saving 6.3 PJ in heating and creating 30 000 jobs.

[12] Investment and internal current expenditure (excluding payments to specialised producers of environmental protection services) of the public and business sectors (including specialised producers of environmental protection services). Includes expenditure on air and climate protection, waste and wastewater management, protection and remediation of soil and groundwater, other environmental protection activities (R&D, administration, education) and biodiversity and landscape protection. Excludes expenditure on water supply.

[13] The Czech Statistical Office (CZSO) figure of 2.1% doubles account payment to, and expenditure of, specialised producers of environmental protection services, thus overestimating expenditure, particularly on waste management.

[14] European Regional Development Fund and Cohesion Fund, after decommitment and correction.

[15] The targets are a 32 Mt CO_2 eq GHG emission reduction by 2020 and 44 Mt CO_2 eq by 2030, compared to 2005 levels (corresponding to reductions of 42% and 48%, respectively, from 1990 levels). Post-2030 targets towards an 80% emission reduction by 2050 are indicative.

[16] Implementing the Energy Efficiency Directive (2012/27/EU).

[17] In the initial Green Savings Programme, EUR 0.39 of public funds was spent per kWh saved.

[18] Exceptions were made for wind, geothermal, biomass and hydropower installations that had secured a building permit before the legislation took effect and that were in operation by end 2015.

[19] It also includes sustainable management of natural resources, sustainable agriculture and forestry and sustainable food production.

[20] Excluding activities not screened against the environment marker.

[21] The others are i) good (democratic) governance and ii) respect for the basic human, economic, social and labour rights of beneficiaries, including gender equality.

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Part II. Progress towards selected environmental objectives