7. A proposed green tax reform for Cyprus and its co-benefits for urban sustainability

Theodoros Zachariadis

1. INTRODUCTION

European countries generate most of their revenues through labour and income taxation. In 2016, direct taxes (comprising income taxes, corporate taxes, capital taxes and social security contributions) accounted for 65 per cent of total tax revenues in the European Union (EU) – and for 54 per cent of the corresponding revenues of the government of Cyprus (European Commission and Eurostat, 2018). At the same time, activities causing environmental degradation and depletion of scarce natural resources (eg, consumption of electricity, fuels and water, as well as production of waste) account for a small fraction of government finances: in 2016 they accounted for 6.3 per cent and 8.8 per cent of total tax revenues in the EU and Cyprus respectively. As a fraction of gross domestic product (GDP), these revenues have receded in the last two decades (more so in Cyprus than in the EU as a whole).[1] Thus, the current structure of European tax systems causes high labour costs; this endangers economic growth and employment, and rewards (or does not discourage) overexploitation of natural resources. At the same time, it encourages tax evasion and undeclared labour.

Low taxation of polluting and resource-depleting activities constitutes a hidden environmentally harmful subsidy, because these activities are often taxed below their socially optimal levels – that is, the costs of pollution or resource depletion are not covered by the existing taxes. According to international organizations, such subsidies amount to many billions of euros each year around the world, causing a significant loss of tax revenues and discouraging international attempts to mitigate climate change and improve the efficient use of natural resources (International Monetary Fund (IMF), 2015; Organisation for Economic Co-operation and Development (OECD), 2013). Environmental fiscal reform can correct

EZCURRA PRINT.indd 91 19/06/2019 16:03

this disparity by shifting the focus of government taxes and levies from labour and income to environmentally harmful activities.

As shown in the review of Withana et al (2013), several European countries have already introduced environmentally oriented fiscal reforms. Apart from saving energy and improving the environment, environmental taxes can produce better economic results than conventional taxes. Several studies have found that, depending on whether and how the additional public revenues generated from environmental taxation are recycled in the economy, an environmental fiscal reform may also be beneficial for economic growth. Even energy taxation, although leading to rising energy bills, tends to produce a benefit for consumers overall when compared with other forms of taxation (European Commission, 2013; Vivid Economics, 2012). If the environmental tax increases are accompanied by reductions in labour taxation, the overall effect can be beneficial in both macroeconomic and environmental terms.

Such reform reduces distortions in economic activity and changes relative economic prices, thereby encouraging innovation and investment in green economy sectors, which can create a competitive advantage for national economies. Countries may also use the revenues of green taxes to pay back public debt (Rausch, 2013) or to broaden the tax base if there is a large informal labour market (Markandya et al, 2013). According to Edenhofer et al (2015), some of the revenues should be used for infrastructure investments that enhance productivity. Higher levels of public infrastructure have been shown to be related to economic growth, reduced inequality and improvements in human wellbeing (Jakob and Edenhofer, 2014). Major international organizations such as the OECD, the IMF and the World Bank have underlined that green tax reforms are the most efficient way to ensure both fiscal sustainability and environmental protection (OECD, 2013; Parry et al, 2014).

This chapter sets out a proposal for a green tax reform in the Republic of Cyprus – the first to be submitted in the country up to now – to be implemented over a period of six years. It consists of three major elements – carbon, water and waste taxation – in the form of a carbon emissions tax, a water charge and a landfill tax respectively. This chapter provides an assessment of the annual tax revenues generated and, where possible, an estimate of the corresponding environmental improvements in the form of energy savings, emissions reductions and water savings, as well as the effects on firm competitiveness and social equity. As the intention of this proposal is to implement a revenue-neutral fiscal reform, the additional revenues raised through this reform can be used to reduce labour or other taxation, in order to increase employment and economic output; this latter point, however, is beyond the scope of this chapter.

EZCURRA PRINT.indd 92 19/06/2019 16:03

2. CURRENT STATUS OF ENVIRONMENTAL TAXES AND ENVIRONMENTALLY HARMFUL SUBSIDIES IN CYPRUS

2.1 Structure of Tax Revenues

In 2016 the total tax revenues of the government of Cyprus amounted to €6.1 billion or 34 per cent of national GDP – well below the EU average of 39 per cent. Indirect taxes accounted for 46 per cent of these revenues, while the shares of direct taxes and social security contributions were 29 per cent and 25 per cent respectively (European Commission and Eurostat, 2018). Environmental taxes, as defined by Eurostat, amounted to 2.9 per cent of national GDP – somewhat higher than the EU average of 2.4 per cent – and accounted for 8.8 per cent of total tax revenues; this fraction was lower than in the early 2000s, when environmental taxes accounted for 12.3 per cent of total revenues. Three-quarters of all environmental tax revenues came from fuel taxation. Conversely, there is essentially no taxation on pollution or the consumption of natural resources; hence, revenues from such taxes are almost zero and Cyprus ranks among the last countries in the EU for this category of tax.

2.2 Environmentally Harmful Subsidies

The term 'environmentally harmful subsidies' denotes broadly economic measures that – directly or indirectly – distort competition between technologies and lead to lower relative prices (and hence preferential treatment) of activities that cause environmental degradation or overconsumption of resources.

In line with this general definition, and with the findings of relevant studies (eg, *Umweltbundesamt*, 2017), the following environmentally harmful subsidies in Cyprus have been identified:

- According to the Excise Taxes Law 91(I)/2004, liquid fuels used for power generation are exempt from excise taxes. This exemption constitutes a subsidy of fossil fuel-based power generation in comparison to renewable power generation. On the basis of data from 2017, the revenues forgone by the government due to the lack of excise taxes on fuels used by the Electricity Authority of Cyprus (and the corresponding value added tax) amount to around €15 million per year.
- Agricultural gas oil is also legally exempt from excise taxes, which discourages energy conservation and the use of renewable energy in

EZCURRA PRINT.indd 93 19/06/2019 16:03

this sector. Revenues forgone amount to a few thousand euros per year.

- Automotive diesel oil enjoys a lower excise tax rate than automotive petrol. As diesel-powered vehicles generally cause greater health problems due to the higher emissions of particulate matter and nitrogen oxides, the preferential tax treatment of diesel oil constitutes an indirect subsidy. Depending on how this subsidy is defined, forgone revenues amount to a few million euros per year.
- Although Cyprus suffers from higher water stress than any other EU country (Eurostat, 2015), water prices include only a tiny charge of €0.01 per cubic metre to account for the costs of water scarcity and the costs of environmental pollution due to this scarcity. This essentially zero taxation level constitutes an indirect subsidy, encouraging the over-exploitation of valuable water resources and the increased use of energy-intensive desalination. The size of the subsidy is especially pronounced in the case of irrigation water.
- No tax or charge is applied to the production of municipal waste in proportion to the amount of waste generated. This leads to high amounts of waste being disposed of in landfill and discourages waste reduction and recycling initiatives. It should be noted that Cyprus ranks second in the EU for the amount of municipal waste generated per capita (Eurostat, 2017).

It is important to keep in mind that these subsidies have historically been granted by the government in order to achieve other general policy goals such as social equity and rural development. Although they lead to environmentally harmful behaviour, it is not recommended that they all be abolished immediately. It is important, however, to be aware that these subsidies exist and have both environmental and fiscal costs to society, and to keep them in mind when designing tax policy reforms.

3. PROPOSED INTRODUCTION OF ENVIRONMENTAL TAXES

3.1 Carbon Tax

The main policy proposal is to introduce a carbon tax for the use of fuels in all sectors that are not subject to the EU Emissions Trading System (ETS). All fuels are petroleum based, since coal and natural gas are not used in the Cyprus energy system. The carbon tax would be introduced gradually over the six-year period 2020–25, at annual increments of €20 (at 2015 prices)

EZCURRA PRINT.indd 94 19/06/2019 16:03

Table 7.1 Increase in the excise tax of oil products used in Cyprus due to the gradual introduction of the proposed carbon tax

(Eurocents'2015 / litre)	2020	2021	2022	2023	2024	2025–
Petrol	4.60	9.20	13.80	18.40	23.00	27.60
Automotive diesel	5.43	10.86	16.29	21.71	27.14	32.57
Heating diesel	5.43	10.86	16.29	21.71	27.14	32.57
Liquefied petroleum gas	3.04	6.08	9.12	12.17	15.21	18.25
Fuel oil	6.04	12.09	18.13	24.17	30.21	36.26

Table 7.2 Projected net increase of government revenues up to 2040 after implementation of the proposed carbon tax

(Million Euros'2015)	2020	2021	2022	2023	2024	2025	2030	2035	2040
According to energy model	70.6	139.5	202.3	259.2	311.5	360.4	320.0	317.1	315.6
Assuming inelastic fuel demand	72.5	145.8	214.8	280.6	346.0	412.0	406.9	405.4	404.2

per tonne of carbon dioxide (CO_2). This means that the carbon tax could reach €120 (at 2015 prices) per tonne of CO_2 by 2025 and would remain at this level at real prices thereafter (ie, it would be adjusted for inflation each year after 2025).

This carbon tax would affect all economic sectors except those of electricity, cement production and brick and tile production, as these sectors are subject to the EU ETS. As a result, implementation of the tax would not affect electricity prices, but would affect the prices of oil products depending on their carbon content, as shown in Table 7.1.

In order to assess the changes in fuel consumption, public revenues and carbon emissions, we employed recent projections of an energy forecast model that we developed and that is being used by national energy authorities (Zachariadis et al, 2018). Table 7.2 displays the projected net change in public revenues for two cases: one using the price elasticities of our model, thereby assuming that higher retail fuel prices will reduce fuel demand and thereby reduce some of the anticipated tax revenues; and a second case with the assumption of an entirely inelastic fuel demand. The latter case is unrealistic, but it offers an overview of the possible range of effects depending on the response of consumers and firms to this tax. It is evident from Table 7.2 that additional tax revenues (from both the carbon tax and the additional value added tax calculated on the carbon tax) are

EZCURRA PRINT.indd 95 19/06/2019 16:03

projected to gradually increase and stabilize at around €320–400 million (at 2015 prices).

As regards the effect on energy consumption, Figure 7.1 shows the demand forecast for a baseline case without a carbon tax and for the linearly increasing carbon tax as proposed in this study. It is apparent that the proposed tax will mainly affect the road transport sector, as it will lead to an increase in fuel prices. Conversely, energy consumption in residential and commercial buildings is expected to be affected only marginally, because the proposed tax will not affect electricity prices and the residential and tertiary sectors of Cyprus are highly electrified.

Figure 7.2 presents the projected evolution of non-ETS CO_2 emissions in Cyprus with and without the application of the carbon tax, and the additional tax revenues raised. Despite the considerable reduction in carbon emissions, it is worth noting that the implementation of such a tax is not enough to decarbonize the Cyprus economy sufficiently for the country to comply with its commitment to reduce greenhouse gas emissions of non-ETS sectors by 24 per cent by 2030 compared to 2005 levels.

Starting in 2026, the carbon tax is expected to lead to energy savings in the order of 100–130 000 tonnes of oil equivalent per year or 6–8 percent of total energy demand. Apart from environmental benefits, this change will reduce the energy dependency of Cyprus and can lead to savings of €70–95 million (at 2015 prices) per year, thanks to lower fuel imports. This would help to substantially reduce the current accounts deficit of the Republic of Cyprus.

The increase in fuel taxes shown in Table 7.1 will lead to higher fuel prices and hence increased expenditures by households and firms. After 2025, when the full amount of carbon tax will be in force, fuel prices will be 27–42 per cent higher than in 2014–15. Percentagewise, prices will increase less for automotive petrol, as the price of this is already relatively high; and will increase most for heating oil, which has comparatively low prices and a relatively high carbon content.

Environmental taxes – like all other types of taxes – are subject to considerations of political costs. It is therefore necessary to explore the effect of the proposed carbon tax on the cost of living of households. Table 7.3 displays the maximum anticipated additional expenditures of households due to higher retail prices of automotive and heating fuels by net income decile. The average additional burden is expected to lie at €519 per household per year, or 1.1 per cent of the average net income. This will range between €151–€890 for the poorest and richest households respectively; with the exception of the top income groups, the additional burden corresponds to an almost constant fraction (1.2–1.5 per cent) of the income of other income groups. This means that – in contrast to the

EZCURRA PRINT.indd 96 19/06/2019 16:03

EZCURRA PRINT.indd 97

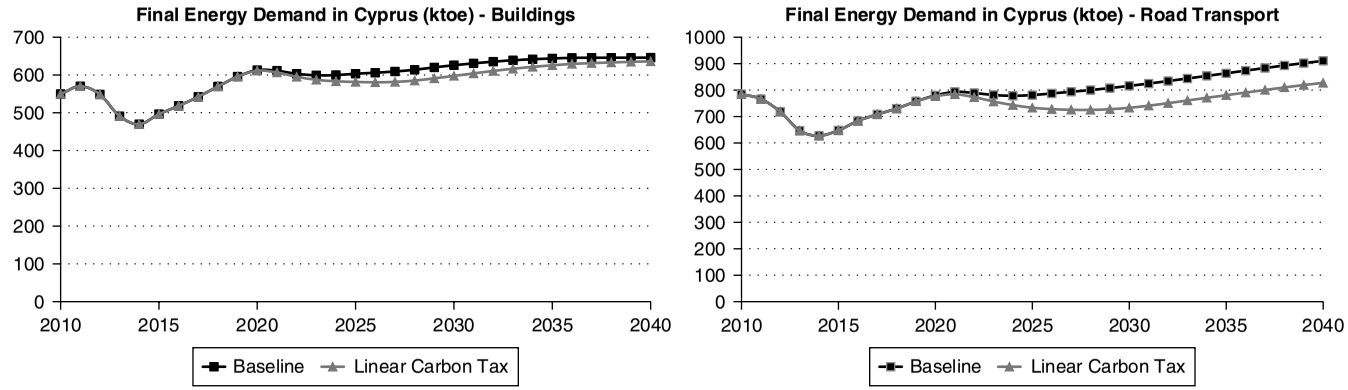

Figure 7.1 Projected evolution of final energy demand in buildings and transport in Cyprus with and without implementation of the proposed carbon tax

19/06/2019 16:03

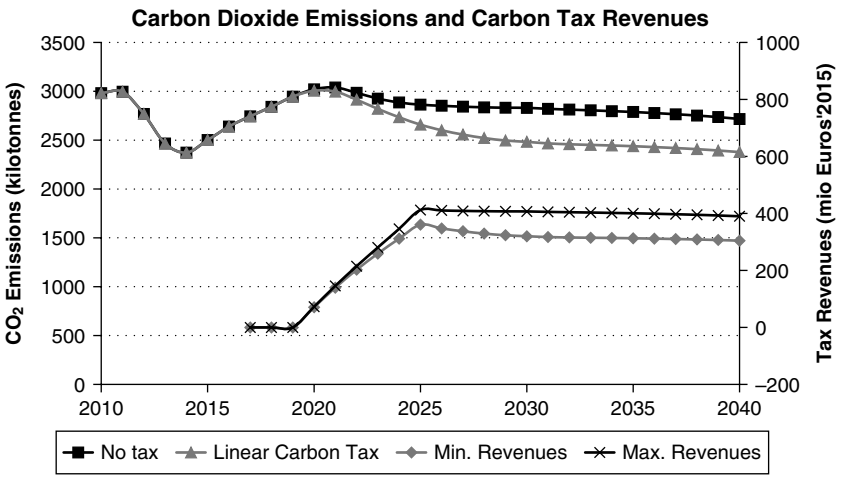

Figure 7.2 Projected evolution of non-ETS CO_2 emissions in Cyprus with and without implementation of the proposed carbon tax (left axis); and range of projected revenues from carbon taxation (right axis), which can be used to reduce the tax burden on labour

Table 7.3 Additional expenditures of households by income group in 2025 due to the introduction of the proposed carbon tax

(Euros'2015)	Extra expenditure for heating fuels	Extra expenditure for transport fuels	Total extra expenditure	Fraction of net income
Lowest 10%	52.35	98.50	150.85	1.3%
10%–20%	75.04	176.10	251.15	1.4%
20%–30%	75.64	274.49	350.13	1.5%
30%–40%	82.09	317.17	399.26	1.3%
40%–50%	113.03	374.02	487.05	1.3%
50%–60%	118.09	425.67	543.76	1.2%
60%–70%	158.90	467.30	626.20	1.2%
70%–80%	181.49	561.54	743.03	1.2%
80%–90%	172.81	546.65	719.46	1.0%
Top 10%	283.24	607.16	890.40	0.8%
All households	131.46	387.12	518.58	1.1%

Source: Family Expenditure Surveys of Cyprus for 2009 (processed by Dr Alexandros Polycarpou, Economics Research Centre of the University of Cyprus).

EZCURRA PRINT.indd 98 19/06/2019 16:03

perception that such a tax is regressive and affects low-income households more – the effects of the carbon tax will be uniform across most Cypriot households.

As regards the effect of the carbon tax on the production costs and competitiveness of Cypriot enterprises, it is possible to draw some conclusions from an earlier study that explored the effects of higher fuel and electricity prices by sector of the economy (Ketteni et al, 2013). This study showed that although energy is complementary to capital and labour in most sectors, higher energy prices have very low adverse effects on investments and employment in Cypriot firms. Sectors with a comparatively higher share of fuel costs are (1) mining and quarrying and (2) transport and communications, but even there the effects of the carbon tax seem to be manageable. As a part of the green tax reform, the government can foresee temporary tax credits or other rebates that can alleviate the adverse effects of selected economic sectors. On the other hand, implementation of the carbon tax should be seen by firms as an opportunity for energy efficiency investments that can increase productivity and hence offer economic advantages in the medium term.

4.2 Water Scarcity Charge

It is proposed that an additional water charge be implemented for both domestic and irrigation water supply, in the order of €0.10 (at 2015 prices) per cubic metre (cm), phased in gradually over two years – €0.05/cm in 2020 and an additional €0.05/cm in 2021. From 2022 onwards, this charge would be kept at least constant in real terms (ie, it would be adjusted for inflation each year).

The amount of €0.10/cm comes from studies carried out for the Water Development Department of Cyprus so that the country can achieve recovery of the full costs of water supply, in line with the requirements of the EU Water Framework Directive 2000/60/EC (WDD, 2010). More specifically, this amount corresponds to the estimated water scarcity cost (resource cost) and the environmental cost from overexploitation of water resources. National Regulation 128/2014, adopted by the government of Cyprus in February 2014, provides for the implementation of such charges and the first such decision was made in 2017. Zachariadis (2010) provided a different assessment on the basis of economic welfare analysis, leading to substantially higher scarcity costs than those of governmental studies. However, as water pricing is always a socially and politically sensitive issue, it was preferred to keep the modest cost estimates of the government; but one should keep in mind that these most likely will not lead to full recovery of the social costs of water use.

EZCURRA PRINT.indd 99 19/06/2019 16:03

Based on official statistics about the quantities of water billed to residential, industrial and agricultural consumers, this water charge is estimated to bring in additional revenues in the order of €10 million (at 2015 prices) per year – €6 million from water charges for domestic and industrial water and €4 million from charges for irrigation water. All households, firms and farmers are expected to pay this charge. Revenues will be collected through water bills. According to the national Regulation mentioned above, revenues from charges for the resource and environmental cost of water will go to the general government budget; no specific earmarking of any revenues is foreseen.

The water-saving potential of such a charge can be assessed on the basis of two existing studies: an econometric analysis of residential water demand in the three major urban areas of Nicosia, Limassol and Larnaca (Polycarpou and Zachariadis, 2013); and a simulation of long-term effects of water scarcity (Zachariadis, 2010). According to these studies, long-term price elasticity of residential water demand lies around −0.25 to −0.3. This could lead to potential water savings – if the proposed water pricing were implemented – in the order of 1.5–2 million cubic metres per year of residential and industrial water. Another 1–2 million cubic metres per year could be saved through the enforcement of proper irrigation water pricing in agriculture in line with the full cost recovery principle. Such water savings would help to enrich groundwater aquifers, especially those in coastal areas that are increasingly suffering from salinization. Moreover, these savings could help to reduce the dependence on water from desalination plants, which may cause damage to marine ecosystems in their proximity; these plants also require large amounts of electricity to produce freshwater and, since most electricity in Cyprus is produced in thermal power plants burning fuel oil and gas oil, desalination is the cause of substantial carbon and air pollutant emissions as well.

Water pricing is politically sensitive in view of the fact that water is an absolutely necessary good. It is therefore important to assess the social equity effects of such a policy. As far as residential water consumers are concerned, Zachariadis (2010) conducted a preliminary (ex-ante) analysis of distributional impacts from the adoption of water pricing. According to the Family Expenditure Surveys carried out by the Statistical Service of Cyprus for the years 2003 and 2009 (Statistical Service of Cyprus, 2006; 2011), domestic water expenditures represent less than 0.5 per cent of total household expenditures on average; this fraction increases somewhat – but is still less than 1 per cent – for the poorest 20 per cent of households.

This means that water expenditures of Cypriot households are regressive, but represent a very low fraction of household income. If the proposed water charge is imposed (ie, €0.10/cm), the average household may have to pay €19–28 more per year for water; this may range between

EZCURRA PRINT.indd 100 19/06/2019 16:03

€12–17 for low-income households (or 0.1 per cent of their income) and €27–40 for high-income households (or 0.05 per cent of their income). Thus, the concerns of consumer associations and some policymakers over social equity are somewhat exaggerated and should not necessarily deter authorities from adopting these water charges.

4.3 Landfill Tax

Municipalities and firms are charged with different amounts per tonne of waste that they dispose of, depending on the landfill in which they deliver their waste. In the modern Koshi landfill site, for example, where the waste of the Larnaca and Famagusta areas is disposed of, charges have reached €80 per tonne; whereas in the old landfill sites of Kotsiatis and Vati, serving the areas of Nicosia and Limassol respectively, landfill charges have been less than €10 per tonne. Apart from the unequal and hence unfair treatment of citizens of the country, depending on where they live, the low landfill rates constitute an environmentally harmful subsidy, leading to inefficient waste management because they do not encourage reducing, reusing or recycling waste streams. This is in sharp contrast with the legal commitments of the Republic of Cyprus in view of the EU's Circular Economy Package, which requires that very small fractions of total waste should be disposed of in landfills by 2030 (European Commission, 2014).

It is therefore recommended that a uniform landfill tax be gradually introduced in all areas of Cyprus, which could reach €60 per tonne of waste by 2022 (at 2015 prices) – starting with €15 per tonne in 2019 and increasing by €15 per tonne each year up to 2022. A part of this tax is meant to recover the financial costs of waste treatment; the rest would correspond to a green tax encouraging alternative waste management options in line with the relevant EU policies. Evidently, this tax is in line with good practices in many EU countries. The expected revenues should amount to about €15–20 million (at 2015 prices) when the full tax is implemented. These revenues, however, may be expected to decrease after some years, because the amount of waste reaching landfill will be reduced as a result of the tax. Obviously, in order to reap the anticipated environmental benefits in waste treatment, proper surveillance should be enforced in order to avoid illegal waste dumping.

The implementation of a landfill tax need not have adverse distributional consequences. If local authorities collect waste charges from their citizens with 'pay as you throw' systems, which impose a waste charge that depends on the weight of waste generated in a household, then they can collect the required revenues to pay the landfill taxes in a socially fair and environmentally effective way.

EZCURRA PRINT.indd 101 19/06/2019 16:03

5. IMPLICATIONS FOR URBAN SUSTAINABILITY

The savings in automotive fuel consumption mentioned above as a result of the carbon tax can lead to considerable reductions in emissions of air pollutants in urban areas. Based on emission factors of passenger cars provided by the European Environment Agency (EEA) Emissions Inventory Guidebook (EEA, 2013), as well as information collected from national air pollution authorities, the decrease in transport fuel consumption shown in Figure 7.1 can lead to savings in automotive emissions of nitrogen oxides in the order of 520–580 tonnes from 2030 onwards; and to savings in sulphur dioxide emissions of about 4 tonnes per year. Taken together, and using widely accepted assumptions about the cost of pollutant emissions in urban areas (eg, see Zachariadis and Hadjikyriakou, 2016), the reduction in just these two pollutants could reduce environmental damage costs in Cypriot urban areas by about €7 million per year (at 2015 prices).[2]

These calculations do not include an assessment of avoided environmental damages from other pollutants (eg, particulate matter), and also do not include benefits from avoidance of other transport-related costs such as congestion, noise and traffic accidents. Zachariadis (2008) assessed the external costs from the use of vehicles in urban roads of Cyprus to exceed €1 per kilometre during peak traffic hours. Of those costs, 90 per cent are associated with congestion, but accidents and noise also have a sizeable economic impact. In the absence of a detailed transport model, which could simulate the effect of a carbon tax through the cost of transport use to traffic loads in a Cypriot city, it is not possible to offer a reasonably plausible assessment of the effect of the carbon tax on these externalities – but one can state with confidence that several millions of euros could be saved per year due to improved urban traffic conditions thanks to the implementation of the carbon tax.

6. CONCLUSIONS

Cyprus faces serious energy and environmental challenges, which may be exacerbated in the future because of climate change. Compared with other European countries, it has low energy productivity, high amounts of municipal waste per capita and the worst water scarcity problem. National commitments for implementing EU legislation in relation to greenhouse gas emission reduction and improved waste management will become increasingly difficult to meet in the near future.

In view of these challenges, a fiscally neutral green tax reform can significantly contribute towards the transition to a path of economically

EZCURRA PRINT.indd 102 19/06/2019 16:03

and environmentally sustainable development. This chapter has outlined a proposal for one part of the tax reform – the implementation of environmental taxes at a level that is comparable to the economic costs that these environmental issues pose to society. More specifically, we propose the gradual implementation of a carbon tax to those sectors that are not subject to the EU ETS, a water scarcity charge, and a landfill tax for municipal and industrial waste that is disposed of in landfill. We have demonstrated, to the extent possible, the environmental benefits and the increase in public revenues that these taxes will bring about in the medium and long run. We have also assessed the effect of these taxes on firm competitiveness and social equity, underlining that potential adverse impacts of these measures will be manageable and should not be used as an excuse for not proceeding with a green tax reform.

This chapter has not dealt with the second part of the reform – namely, the reduction in labour or other taxes that could be facilitated by increased government revenues from green taxation. This is an equally important part of the reform, as the government could spend the higher public revenues by providing targeted aid to vulnerable households in order to alleviate adverse distributional impacts and reducing labour costs, thus boosting employment in the economy. Political acceptance of the reform will crucially depend on how the additional environmental tax revenues are deployed within the economy of Cyprus.

The international experience has shown that the adoption of a gradual green tax reform can have substantial positive effects on both the environmental and economic performance of a country. Our assessment shows that urban areas may benefit from considerable improvements in air quality and reductions in pollution costs if the proposed carbon tax is implemented. Further effects – such as reductions in road congestion, accidents and noise – which have not been quantified in our study highlight the substantial side benefits of green taxation. It is therefore recommended that the national economic authorities of Cyprus proceed with this reform in order to enable the transition to a more productive, more resource-efficient and less polluting economy.

NOTES

1. See also summary statistics on environmental taxes on Eurostat's webpage: http://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics, last accessed 22 April 2019.
2. Assumptions: nitrogen oxide emission factors of average in-use cars: 0.16 and 0.65 grams per kilometre for petrol-powered and diesel-powered cars respectively; sulphur content of both petrol and diesel fuel equal to 50 parts per million; fuel consumption of average

EZCURRA PRINT.indd 103 19/06/2019 16:03

in-use cars: 7.7 and 5.9 litres per 100 kilometres for petrol-powered and diesel-powered cars respectively; marginal damage cost of emissions: €20,000 per tonne of nitrogen oxide and €30,000 per tonne of sulphur dioxide; 50 per cent of total vehicle kilometres are travelled in urban areas.

REFERENCES

Edenhofer O, Jakob M, Creutzig F et al (2015). 'Closing the emission price gap'. *Global Environmental Change* 31, 132–43.

EEA (2013), EMEP/EEA *Emission Inventory Guidebook 2013*, Technical Report No 12/2013, European Environment Agency, Copenhagen.

European Commission (2013), Tax Reforms in EU Member States 2013: Tax Policy Challenges for Economic Growth and Fiscal Sustainability. Report No 5/2013 of 'European Economy' series, Directorates-General for Economic and Financial Affairs and for Taxation and Customs Union; doi: 10.2765/40142.

European Commission, 2014. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards a circular economy: A zero waste programme for Europe, COM(2014)398 of 2 July 2014.

European Commission and Eurostat (2018), 'Taxation trends in the European Union – 2018 Edition', Luxembourg; doi:10.2778/025314.

Eurostat (2017), 'Energy, Transport and Environment Indicators – 2017 Edition', Luxembourg; doi:10.2785/964100.

Eurostat (2015), Online information on the Water Exploitation Index, available at https://ec.europa.eu/eurostat/web/products-datasets/-/t2020_rd220, last accessed 22 April 2019.

IMF (International Monetary Fund) (2015), 'How Large Are Global Energy Subsidies?' Working Paper WP/15/105. Washington, DC.

Jakob M and Edenhofer O (2014). 'Green growth, degrowth, and the commons'. *Oxford Review of Economic Policy* 30, 447–68.

OECD (2013). *Climate and Carbon. Aligning Prices and Policies*. Paris, France.

International Renewable Energy Agency, 2015. *Renewable Energy Roadmap for the Republic of Cyprus*, January. Available at www.irena.org/publications.

Ketteni E, Mamuneas T and Zachariadis T (2013). 'The Effect of EU Energy and Climate Policies on the Production Sectors of the Economy of Cyprus – Final Results'. Economic Policy Paper 01-13, Economics Research Centre, University of Cyprus, February 2013. Available at http://ucy.ac.cy/erc/documents/DOP_1-13.pdf, last accessed 22 April 2019.

Markandya A, González-Eguino M and Escapa M (2013). 'From shadow to green: Linking environmental fiscal reforms and the informal economy'. *Energy Economics* 40, S108–S118.

Parry IWH, Heine D, Lis E and Li S (2014). *Getting Energy Prices Right: from Principle to Practice.* International Monetary Fund, Washington, DC. ISBN: 978-1-48438-857-0.

Polycarpou A and Zachariadis T (2013). 'An Econometric Analysis of Residential Water Demand in Cyprus'. *Water Resources Management* 27, 309–17.

Umweltbundesamt (German Federal Environment Agency) (2017). 'Environmentally Harmful Subsidies In Germany – Updated Edition 2016', Dessau-Roßlau,

Germany. Available at www.umweltbundesamt.de/en/publikationen/umweltschaedliche-subventionen-in-deutschland-2016.
Vivid Economics (2012), 'Carbon taxation and fiscal consolidation: the potential of carbon pricing to reduce Europe's fiscal deficits'. Report prepared for the European Climate Foundation and Green Budget Europe, May 2012.
WDD (Water Development Department) (2010), 'Costs and Pricing of Water Services in Cyprus', April 2010 (in Greek). Available at www.moa.gov.cy/moa/wdd/Wdd.nsf/all/ 82D260F5DEAC3827C2257A29002AED9F/$file/Enimerotiki_Timologisi.pdf?openelement.
Withana S, ten Brink P, Kretschmer B, Mazza L, Hjerp P and Sauter R (2013). 'Evaluation of environmental tax reforms: International experiences'. A report by the Institute for European Environmental Policy (IEEP) for the State Secretariat for Economic Affairs (SECO) and the Federal Finance Administration (FFA) of Switzerland. Final Report, Brussels, 2013.
Zachariadis T (2008). 'Road to Nowhere: An Assessment of Social Costs from the Use of Cars in Cypriot Cities'. *Cyprus Economic Policy Review* 2, 51–80.
Zachariadis T (2010). 'Residential water scarcity in Cyprus: Impact of climate change and policy options'. *Water* 2, 788–814.
Zachariadis, T and Hadjikyriakou, C (2016), *Social Costs and Benefits of Renewable Electricity Generation in Cyprus*. SpringerBriefs in Energy. Springer International Publishing, doi: 10.1007/978-3-319-31535-5.
Zachariadis T and Hadjinicolaou P (2014). 'The Effect of Climate Change on Electricity Needs – A
Case Study from Mediterranean Europe'. *Energy* 76, 899–910.
Zachariadis T, Michopoulos A, Vougiouklakis Y, Struss B, Piripitsi K and Ellinopoulos C (2017). 'In-Depth Assessment of the Energy Efficiency Potential in Cyprus'. *Cyprus Economic Policy Review*, Vol 11, No 2, pp86–112.
Zachariadis T and Taibi E (2015). 'Exploring Drivers of Energy Demand in Cyprus – Scenarios and Policy Options'. *Energy Policy* 86, 166–75.

EZCURRA PRINT.indd 105 19/06/2019 16:03