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Design Options for Employing a Carbon Tax in Turkey

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INTRODUCTION

Carbon taxation is one of the main policy options that can be employed for the purpose of climate change mitigation. Several countries are currently employing the policy instrument and several other countries are soon expected to follow in the aftermath of the Paris Agreement. However, there is no uniform carbon taxation policy with the specific design features of different systems displaying great variety, each suited to fit the specific conditions and necessities in each different country. A carbon tax design that has proven to be successful in one country can't be replicated to work successfully in another. Therefore, several key design aspects of carbon taxation policies need to be carefully examined before the launching of a carbon tax mechanism in a new country in order to yield the best results from the policy tool.

Turkey has been experiencing fast growth in its emissions stock in the recent years due to rapid economic development and energy policies that favor high carbon sources such as lignite. This situation creates several problems including excessive damages to the environment and the society. Additionally, Turkey has a significant international responsibility in combating climate change which is put at risk due to the apparent high emissions growth trajectory in the country. Therefore, there is a need for Turkey to formulate a comprehensive climate change mitigation strategy. In this backdrop, employing a carbon tax should be considered as one of the main policy options in furthering the country's climate change mitigation objectives.

The energy policy employed in the country has several aims like ensuring affordable energy to power the country's growing economy, curbing the dependence on imported energy sources and minimizing the negative effects on the environment. A carbon tax can potentially play an important role in realizing these aims given that the policy tool is designed to suit the specific needs and conditions of the country.

If Turkey opts to employ a carbon tax, the specific design aspects of the policy mechanism will be crucial in ensuring its effectiveness and durability. In this report, design considerations of carbon taxation policies are highlighted with a view to provide recommendations for a carbon tax design best suited for addressing the needs of the country. In this regard, the specific conditions in the Turkish market are examined and the options regarding the implementation of a carbon tax are assessed.

GENERAL GHG EMISSIONS SITUATION IN TURKEY

According to the Turkish Statistical Institute, the GHG emissions originating from the country increased by more than two-folds between the years 1990 and 2014, reaching 467,6 million tons of CO2 equivalent in 2014 up from 207,8 in 1990. The single largest source of this increase was the increased amount of energy related emissions. The energy related emissions stock in the country rose sharply from 132.5 million tons of CO2 equivalent in 1990 to 339.1 million tons in 2014. In the same period, the per capita emissions of the country increased to 6 tons of CO2 equivalent up from 3,5 tons[1].

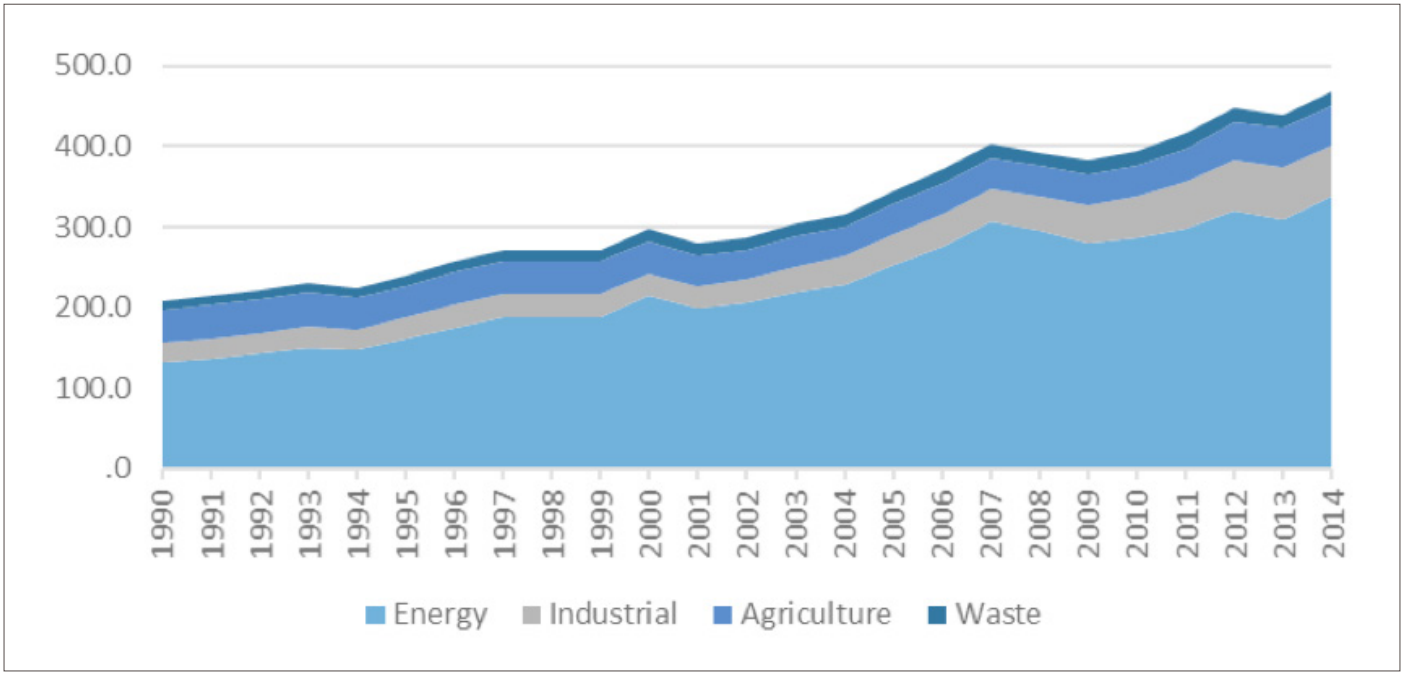
It is expected that in the absence of new policies, the GHG emissions of the country will continue to increase rapidly into the future. The Intended Nationally Determined Contribution(INDC) of the country submitted in advance of the Paris Conference pledges to reduce the country's emissions by 21% compared

1 Turkish Statistical Institute, accessed from http://www.tuik.gov.tr/PreHaberBultenleri.do?id=21582 on 21.8.2016

to the business-as-usual scenario by the year 2030. According to the document, the emissions stock of the country would reach to 1175 million tons of CO2 equivalent under the business-as-usual scenario by 2030 and the target is to reduce this figure to 929 million tons[2]. Even with the mitigation target, this level of increase in the emissions level would correspond to a colossal jump of nearly 135% between the years 2010 and 2030 and 350% between the years 1990 and 2030.

Turkey's emissions made up around 1% of the total world emissions for the year 2012[3]. Even though the current share of the country in the total world emissions is not very sizeable, the rate of growth in the emission stock is alarming. If the current trajectory continues, Turkey runs the risk of becoming one of the leading developing countries in the world responsible for GHG emissions.

GHG Emissions in Turkey by Sector (Million Tons of CO2 Equivalent)

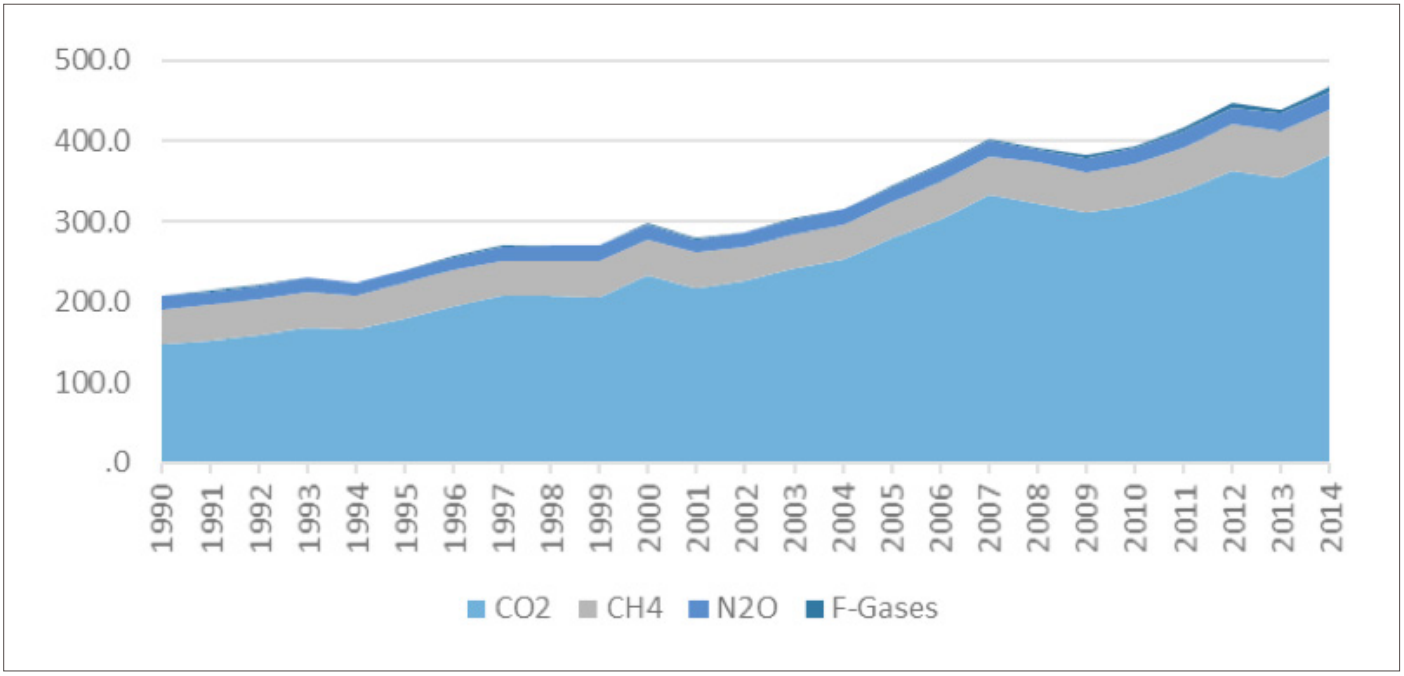


2 The Republic of Turkey, Intended Nationally Determined Contribution, accessed from http://www4.unfccc.int/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf on 5.6.2016

3 World Resources Institute, accessed from http://www.wri.org/blog/2015/06/infographic-what-do-your-countrys-emissions-look on 8.8.2016

The total GHG emissions originating from the country amounted to 467,6 million tons of CO2 equivalent in 2014 without accounting for land use, land-use change and forestry(LULUCF). 72,5% of this amount was caused by energy-related activities while 13,4% was caused by industrial processes, 10,6% was caused by the agricultural sector and 3,5% was caused by the waste sector[4]. The main GHG gases emitted are carbon dioxide(CO2), methane(CH4), nitrous oxide(N2O) and fluorinated gases (F-gases). Out of the 467,6 million tons of CO2 equivalent, 382,2 million tons were CO2 emissions, 57,4 million tons were CH4 emissions, 23,3 were N2O emissions and the remaining 4,9 were emissions of F-gases. While most of the CO2 emissions in the country originated from energy related activities, the bulk of CH4 and N2O emissions were caused by the agricultural sector. Around 85,2% of all CO2 emissions were energy related while 75,9% of all NO2 emissions and 54,3% of all the CH4 emissions originated from agriculture. Additionally, the gases that indirectly affect climate change include oxides of nitrogen (NOx), non-methane volatile organic compounds(NMVOC), carbon monoxide(CO) and sulfur dioxide(SO2).

GHG Emissions in Turkey by Gas
(Million Tons of CO2 Equivalent)



4 Turkish Statistical Institute, accessed from http://www.tuik.gov.tr/PreHaberBultenleri.do?id=21582 on 21.8.2016

From a sectoral point of view, the main sources of GHG emissions in the country include electricity generation, transportation, heating and industry. In terms of fuel type, the main sources utilized in the country include coal, natural gas and oil. Coal and natural gas are used mainly for electricity generation and heating while oil is used mainly in the transportation sector. Since Turkey lacks sufficient amounts of fossil fuel reserves, most of these resources have to be imported from abroad. Turkey imports %99 of its natural gas supplies and around 89% of its oil supplies on an annual basis[5]. The only significant fossil fuel reserves that Turkey has consist of lignite sources which are mainly used for the purpose of electricity generation. However, lignite resources have a relatively low calorific value when compared to hard coal and therefore a significant amount of the coal utilized in the country also has to be met by imports. As of the end of July 2016, Turkey had a total coal fired electricity generation capacity of around 16,6 GW out of a total of 77 GW of generation capacity from all sources. Around 9,8 GW of this capacity was fired by domestic coal consisting mostly of lignite while around 6,8 GW of capacity was fueled by imported hard coal[6]. In 2014, around %75 of the primary energy needs in the country were supplied by imported sources[7]. Since a large portion of the fossil fuel sources utilized in the country are imported, a carbon tax would have to be placed on more downstream phases of the supply chain for most fuels as opposed to taxing fuels at the production phase.

Currently, there is already a considerable level of taxation that is employed on energy consumption in the country. These taxes include special consumption and value added taxes employed on gasoline, natural gas and electricity consumption among others. The potential utilization of a carbon tax can replace some of these taxes in order to refrain from increasing the general tax burden on the economy.

An important recent trend that is being observed in the Turkish energy market is the increasing share of coal energy in the electricity generation mix mainly due to the policies designed to favor the utilization of domestic lignite sources. As a result, the emissions caused by coal powered energy generation reached 76 million tons of CO2 on the year 2014, making up a bulky 16% of the country's total emissions of CO2 equivalent[8]. Because of this large share, electricity generation sector should be one of the focus points of a potential carbon tax design that will be implemented in the country. However, other sectors also have considerable shares in the country's GHG emissions stock and considerable abatement opportunities can be realized with the application of a carbon that covers a range of sectors.

Under the current trajectory, the country's emissions are set to increase rapidly into the next few decades threatening to undermine its international responsibilities in the struggle against climate change and cause substantial harms to the society and the environment. A carbon tax can be one of the centerpieces in the design of a policy framework that will reverse this situation and situate the economy towards a low carbon trajectory. Such a shift in policy is necessary especially after the global consensus reached at the Paris Conference to contain the phenomenon of climate change below catastrophic levels. On the other hand, Turkey is still a developing country with considerable developmental needs. There are fears that an overly ambitious climate change policy may undermine the country's economic development. Therefore, there is a need to balance the developmental targets of the country with its environmental needs and responsibilities. A carbon tax can potentially play an important role in this regard and refrain from substantially harming the economy if the necessary provisions are included in

5 Republic of Turkey, Ministry of Foreign Affairs, accessed from http://www.mfa.gov.tr/turkeys-energy-strategy.en.mfa on 3.9.2016

6 Turkish Electricity Transmission Company, accessed from www.teias.gov.tr/yukdagitim/kuruluguc.xls on 12.9.2016

7 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016), p. 55

8 Algedik, Önder, 'Kömür ve İklim Değişikliği-2016'(2016), p. 18, accessed from http://www.onderalgedik.com/wp-content/uploads/2016/06/Komur-2016.pdf on 23.7.2016

the design of the policy instrument.

MAIN COMPONENTS OF TAX DESIGN

There are several components of the tax design that need to be considered when devising a carbon tax mechanism. These include the determination of the tax rate and setting a trajectory for rate increases over time, determining the base of the tax both in terms of sectors and GHG gases, determining the point of taxation, determining how to use the revenues generated and the determining whether special exemptions should be provided for chosen sectors. In the following parts of the paper, these policy options are deliberated on keeping the specific characteristics of the Turkish market in consideration.

DETERMINING THE INITIAL TAX RATE AND TRAJECTORY

The methodology used in determining the amount of the tax is clearly one of the defining features of any carbon tax mechanism. The main premise of carbon pricing is that emissions need to be priced because of the many costs inflicted on the society by these emissions, mainly their effect in causing global climate change. These costs are collectively referred to as the social cost of carbon. Theoretically, any pricing mechanism applied upon carbon emissions should reflect these costs to bring the maximum benefits to the society. The basic idea is to equate the incremental cost of reducing emissions with the incremental damage those emissions are causing[9].

However, in practice, estimating the social cost of carbon is a difficult endeavor. Since carbon emissions stay in the atmosphere over decades, their impacts depend on a number of factors including future economic developments and future policies adopted domestically and internationally. For example, CO2 emissions stay in the atmosphere for decades or even centuries, CH4 stays in the atmosphere for a period of 12 years, N20 stays in the atmosphere for more than a hundred years and some F gases endure for thousands of years[10]. Complex modeling and assumptions are thus needed to be made about the trajectory of future emissions, climate sensitivity and the impacts of climate change in order to estimate the costs of carbon emissions over an extended amount of time[11]. All of these are factors that include great uncertainty. Also, many of the potential impacts on human health and the environment are hard to monetize because the damages can't be classified under traditional market economics. Another problem is how to account for low probability events which may cause very high damages. It is generally hard to estimate potential damages in the distant future and the use of different discount rates and inter-generational measures can differ the estimations greatly[12].

Because of these reasons, there is no consensus on what the price of carbon should be and the estimations for it vary greatly. For example, in an assessment of 75 different studies based on different assumptions and models, the mean of the social cost of carbon estimates was found to be 25 US dollars per ton of carbon with a standard deviation of 22 US dollars under a 3% real discount rate[13]. The Interagency Panel on the Social Cost of Carbon estimated the social cost of carbon as 24 US dollars for the year 2015 without accounting for non-market impacts, the potential costs from catastrophic events and the costs of adapta-

9 Marron, Donald, Toder, Eric and Austin, Lydia, 'Taxing Carbon: What, Why and How?'(2015), Tax Policy Center, Urban Institute and Brookings Institution, p. 4

10 Ibid, pp. 4-7

11 Marron, Donald and Toder, Eric, 'Tax Policy Issues in Designing a Carbon Tax', American Economic Review: Papers & Proceedings 2014, 104(5): pp. 563–564

12 C. Morris, Adele and Mathur, Aparna, 'A Carbon Tax in Broader US Fiscal Reform: Design and Distributional Issues'(2014), Center for Climate and Energy Solutions, pp. 9-10

13 Marron, Donald and Toder, Eric, 'Tax Policy Issues in Designing a Carbon Tax', American Economic Review: Papers & Proceedings 2014, 104(5): pp. 563–564

tion. Most estimates of the cost of carbon generally fall between 5 and 20 US dollars per ton without incorporating the risks of catastrophic climate change events[14]. The International Monetary Fund recommends that a minimum carbon price of around 20 US dollars per ton would be reasonable for high emitting countries[15].

Another issue in estimating the social cost of carbon is whether the policymakers should focus on worldwide impacts of carbon emissions or only on domestic impacts. Since climate change is a global phenomenon, a ton of carbon emitted in one country has impacts on the whole world population. Therefore, ideally, a coordinated international response should focus on the global impacts. However, in the case of unilateral action, countries can either choose to focus on domestic impacts or to include international impacts. The difference between the two approaches is generally very large[16]. Because of these reasons, the use of the social cost of carbon in determining the amount of a carbon tax is problematic. However, there are several alternative approaches that can be used in setting the level of the tax.

An alternative to using the social cost of carbon in determining the price of carbon is to set the carbon tax level based on an estimate needed to meet a future emission reduction target or to reach a revenue goal. Such an approach would reflect the concerns about the impacts of climate change in addition to other factors such as political feasibility and international negotiations[17]. Even though such an estimate would be more certain than using the social cost of carbon, there are still several assumptions that need to be made in making such an estimate[18]. Turkey currently has a mitigation target outlined in its INDC but with the current target probably will not require the employment of additional policy schemes to be met. Therefore, if Turkey decides to adopt a carbon tax based on an emissions reduction target, an increased target would have to be set.

Another approach in setting a carbon tax can be to enact the carbon tax based on political feasibility without regard to the social cost of carbon or a specific policy target. Under such an approach, the tax rate will most likely be less than the social cost of carbon. However, such an approach would nevertheless provide incentives for GHG mitigation and serve as a framework for increased action in the future which could also be integrated with a potential global carbon pricing system with relative ease. The adoption of such a carbon tax could also demonstrate a willingness to take action against climate change on the part of the country even if the initial carbon price is set to be low[19].

Looking at the examples in the world can also provide a baseline for comparison in the case of determining a carbon tax rate for Turkey. The existing carbon tax levels in the world vary greatly from around 137 US dollars per ton employed in Sweden to as low as around 3 US dollars per ton in Japan[20]. For a country like Turkey which still has considerable developmental needs, it may be more apt to examine carbon tax rates applied in other developing countries. In the recent years, several developing countries like Mexico, Chile and South Africa have decided to adopt carbon taxation systems for the aim of climate change mitigation. Mexico initiated its carbon tax at a level of 3 US dol-

14 Center for Climate and Energy Solutions, 'Options and Considerations for a Federal Carbon Tax'(2013), pp. 5-6

15 W. H. Parry, Ian, de Mooij, Ruud and Keen, Michael, 'Fiscal Policy to Mitigate Climate Change A Guide for Policymakers'(2012), International Monetary Fund, pp. 15-16

16 Marron, Donald and Toder, Eric, 'Tax Policy Issues in Designing a Carbon Tax', American Economic Review: Papers & Proceedings 2014, 104(5): pp. 563–564

17 Ibid.

18 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 7-8

19 Marron, Donald, Toder, Eric and Austin, Lydia, 'Taxing Carbon: What, Why and How?'(2015), Tax Policy Center, Urban Institute and Brookings Institution, pp. 4-7

20 World Bank Group and Ecofys, 'Carbon Pricing Watch 2016, An advance brief from the State and Trends of Carbon Pricing 2016 report, to be released late 2016'(2016), p. 6

lars per ton of CO2 equivalent[21] while South Africa aims to initiate its tax at a level of around 8 US dollars per ton[22] and Chile aims to initiate its carbon tax at 5 US dollars per ton[23]. Even though these figures are not totally comparable due to differences in the design of the carbon tax in each country including several exemptions, they can provide a baseline for comparison for a potential carbon tax to be employed in Turkey.

Overall, an initial tax rate that is too high can provoke opposition and be politically unfeasible. It can also potentially hinder the country's economic development by increasing energy prices. On the other hand, a tax level that starts too low would not be very effective in abating the country's GHG emissions. Therefore, a careful balance needs to be struck when determining the initial tax level that would both be politically feasible and at a level that is meaningful enough in terms of promoting emissions reductions. Looking at the examples in other developing countries, it can be surmised that an initial tax rate around 3-5 US dollars per ton can be politically feasible and would most likely have a meaningful impact in triggering reductions in the country's carbon emissions.

After the determination of the tax rate, it is also important to determine how the rate will evolve over time and who should decide the rate increases and on what basis. Most researcher advise a rising trajectory for the tax rate as the social costs of carbon are expected to increase as GHG gases continue to accumulate in the atmosphere and a gradual implementation of the tax would give time for producers and consumers to adjust to the effects of the new policy instrument. A ton of carbon emitted in the future will most likely be more harmful than a ton currently emitted. A rising tax rate trajectory would promote investments in low carbon technologies while avoiding overly costly immediate reductions. By starting the tax at a relatively low level and gradually raising it, the industries and consumers would be given time to prepare, the transition costs would be reduced and the carbon tax would be more politically feasible[24].

Therefore, a system should be set up which would allow carbon tax levels to increase faster than the rate of inflation[25]. In nearly all of the carbon tax policies employed in the world, the tax rates were initially started at a low level and then gradually increased. In order to maximize the benefits from the policy instrument, the carbon tax scheme in Turkey should similarly be initiated at a low level with and gradually be increased with a clear timetable communicated beforehand to give the economy the necessary signals required for transitioning to a less carbon intensive economy.

SCOPE AND THE POINT OF TAXATION

Another important consideration in setting a carbon taxation scheme is determining the scope of the tax both in terms of the economic sectors and the gases that will be covered. In an economy, there is a wide range sources of GHG emissions. Ideally, a carbon tax is supposed to capture all of these emissions from all sources in order to be able to provide the most efficient abatement opportunities in the economy as a whole by equating the marginal incentive for emission reductions across all sources[26]. A broader coverage would offer the greater environmental benefits and revenue. It would also enable the policy instrument to be both simpler and more fair, reflecting the same cost of carbon for different sectors. However, in real

21 Ibid.

22 Ibid., p. 11

23 Reuters, 27.9.2014, 'Chile becomes the first South American country to tax carbon', accessed from http://uk.reuters.com/article/carbon-chile-tax-idUKL6N0R-R4V720140927 on 18.7.2016

24 Marron, Donald, Toder, Eric and Austin, Lydia, 'Taxing Carbon: What, Why and How?'(2015), Tax Policy Center, Urban Institute and Brookings Institution, p. 23

25 Ibid.

26 C. Morris, Adele and Mathur, Aparna, 'A Carbon Tax in Broader US Fiscal Reform: Design and Distributional Issues'(2014), Center for Climate and Energy Solutions, p. 13

life, sources of GHG emissions display great variety and several sources may be too costly to monitor and tax both in terms of sector and in terms of the type of gas. Therefore, a narrower tax coverage would be easier to enforce and would enable certain vulnerable or strategic sectors to be exempt, potentially making it more politically feasible[27].

In determining the optimal tax base, the administrative costs of expanding the tax base to a part of the economy should be compared with the expected efficiency benefits of the inclusion of the sector. The tax base should be set so that the benefit of an expansion in the base is equated to the increase in administrative costs[28]. There would be several advantages and disadvantages of the inclusion of each sector under a carbon tax mechanism. Overall, policymakers need to balance the benefits of a broad tax base with the increasing administrative complexity and costs when determining the carbon tax base[29]. However, a carbon tax can theoretically be initiated with a low base and be gradually expanded to cover additional sectors[30].

The main sectors responsible for emitting GHG gases in Turkey include electricity generation, heating, transportation, industry and agriculture. In the electricity generation, heating and transportation sectors, the main source of GHG emissions is the combustion of fossil fuels and these sectors would likely be the main targets under a carbon tax scheme. However, a truly comprehensive carbon tax should address activities other than fossil fuel consumption. There are several sources of carbon emissions apart from the fossil fuel combustion such as those that that result from industrial processes like iron and cement production and CH4 emissions that stem from agricultural production. However, the inclusion of these sources would require additional administrative structures to be set up.

Another consideration is to exclude any use of fossil fuels that don't result in GHG emissions. Provisions should be set up to exclude such cases like the use of petroleum as a feedstock in industry. Certain tax rebates can be set up for this purpose. Moreover, tax rebates can be provided for the utilization of carbon sinks such as the planting of trees on otherwise lightly vegetated land. However, the inclusion of such a provision would also cause challenges in enforcement since these would need to be measured against an uncertain baseline of what would have happened in the absence of carbon sequestration efforts[31].

Another important decision that needs to be made is regarding the point of taxation. A carbon tax can be potentially levied at several different points in the supply chain. The point of taxation would determine the entities that would be required to pay the tax, monitor their emissions or emission inputs and maintain a record of relevant activities. On the other hand, the point of taxation doesn't determine who bears the costs associated with the tax since the costs may be passed on between the different levels of the supply chain[32].

A carbon tax can be implemented downstream, upstream or in a combination of the two. The term upstream refers to the implementation of the tax on fuel producers and downstream implies the implementa-

27 PowerPoint Presentation. 'Overview of Carbon Taxes around the World and Principles and Elements of Carbon Tax Design'(2014), Roberton, C. Williams, Partnership for Market Readiness

28 E. Metcalf, Gilbert and Weisbach, David, 'The Design of a Carbon Tax'(2009), Harvard Environmental Law Review Vol. 33, p. 521

29 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 4-5

30 Kennedy, Kevin, Obeiter, Michael and Kaufman, Noah, 'Putting a Price on Carbon, A Handbook for US Policymakers'(2015), World Resources Institute, p. 19

31 Marron, Donald and Toder, Eric, 'Tax Policy Issues in Designing a Carbon Tax', American Economic Review: Papers & Proceedings 2014, 104(5), p. 565

32 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 4-5

tion on the end users of energy[33]. There are different advantages and disadvantages of both approaches. Under an upstream approach, the tax would be levied before the emissions occur. In order to do this, the carbon content of fossil can be used as a proxy for emissions. On the other hand, under a downstream approach, the emissions themselves would be taxed with end-users paying a fee for each ton of GHG gases emitted into the atmosphere. In some sectors, there may be advantages for imposing a downstream carbon tax such as in the electricity generation sector[34].

From a perspective of administrative simplicity, the tax should be levied upstream, at a point in the supply chain where there are relatively few taxable entities[35]. This point varies by fuel type and sector. The main fossil fuel sources that emit carbon in the country include coal, natural gas and petroleum. The options for taxing coal include taxing at the mines for domestic coal and taxing at the border for imported coal or taxing at the power plant level. Natural gas can be taxed either at the border or at the processor level. Lastly, petroleum products can be taxed on the imported crude oil as it enters the refinery or at the refinery level[36].

Turkish GHG Emissions by Sector (2014)

		Amount (kt of CO2 equivalent)	Percent of Total Emissions
Fuel Combustion Emissions	Energy Industries	132248	28,3%
	Manufacturing industries and construction	70085	15%
	Transport	73700	15,8%
	Residential/Commercial Fuel Combustion	51178	10,9%
	Fuel Combustion in Agriculture	3173	0,7%
	Fugitive emissions from fuels	8719	1,9%
	CO2 transport and storage	0,13	0%
Emissions from Industrial Processes	Mineral industry	41884	9%
	Metal industry	12151	2,6%
	Chemical industry	3469	0,7%
	Product uses as substitutes for ozone depleting substances	4917	1,1%
	Non-energy products from fuels and solvent use	388	0,1%
Agriculture		49522	10,6%
Waste Sector		16114	3,4%
	Total Emissions	467548.13	100%

33 Metcalf, Gilbert E., 'A Proposal for a U.S. Carbon Tax Swap, An Equitable Tax Reform to Address Global Climate Change'(2007), pp. 13-14

34 Ramseur, Jonathan L. and Parker, Larry 'Carbon Tax and Greenhouse Gas Control: Options and Considerations for Congress'(2009), Congressional Research Service, pp. 26-27

35 Center for Climate and Energy Solutions, 'Options and Considerations for a Federal Carbon Tax'(2013), p. 5

36 Metcalf, Gilbert E., 'A Proposal for a U.S. Carbon Tax Swap, An Equitable Tax Reform to Address Global Climate Change'(2007), pp. 13-14

GHG emissions caused by fossil fuel combustion made up around 72,5% of Turkey's total emissions for the year 2014. Therefore, around 72,5% of the country's emissions would be accounted for if only fossil fuel combustion is covered by the carbon tax. The main sectors responsible for fuel combustion emissions include the energy industry, manufacturing and construction industries, the transportation sector and the residential/commercial sectors.

Energy industry is the leading cause of fuel combustion emissions in the country, making up around 39% of the emissions caused by fossil fuel combustions and 28,3% of the country's total emissions[37]. The main source of emissions in the energy industry is the electricity generation sector involving the power plants fueled by natural gas and coal. A large part of the emissions caused from the electricity generation sector can be attributed to coal based thermal power plants operating in the country. These would also be the plants most liable to a carbon tax due to their high carbon content. Thus, the application of the tax in the electricity generation industry should be an important component of the carbon tax design if the policy instrument is to be effective. According to the figures provided by the Turkish Electricity Transmis sion Company, the total number of licensed natural gas power plants active in the country is 233, the number of licensed power plants fueled by domestic coal is 29 and the number of power plants fueled by imported coal is 8. In addition to these, the number of power plants fueled by a mix of fossil fuels and the unlicensed thermal plants amounted to a total of 110, bringing the total amount of thermal power plants in the country to 380[38]. This number of power plants would be subject to a carbon tax if the point of taxation was selected as the power plants in the electricity generation sector making it a viable option from the perspective of administrative ease. Alternatively, the fossil fuels used in the sector can be taxed at their production or at the border for the imported fuels.

The transportation sector is responsible for around 15,8% of the country's total emissions, mostly caused by the emissions from road transportation[39]. Utilizing a downstream approach in the transportation sector would be very hard due to many small sources of emissions on the end-user side. Therefore, it would be better to direct the program to where the fuels are produced or distributed[40]. This can be done at the refineries level where crude oil gets processed. There are currently four refineries in the country operating under the Turkish Petroleum Refineries Corporation(TÜPRAŞ)[41]. Currently, the level of taxation applied on gasoline in the country is among the highest in the European Union including the special exemption tax and the value added tax[42]. With the introduction of a carbon tax, a portion of these taxes can be restructured to reflect the carbon content of fossil fuels used.

37 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016)

38 Turkish Electricity Transmission Company, accessed from www.teias.gov.tr/yukdagitim/kuruluguc.xls on 12.9.2016

39 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016)

40 Kennedy, Kevin, Obeiter, Michael and Kaufman, Noah, 'Putting a Price on Carbon, A Handbook for US Policymakers'(2015), World Resources Institute, p. 19

41 Turkish Petroleum Refineries Corporation Website, accessed from https://www.tupras.com.tr/en/rafineries on 13.9.2016

42 Energy Market Regulatory Authority, 'Petroleum and LPG Market Pricing Report May 2016'(2016), p.7

Emissions from Transportation by Transport Mode (2014)

	GHG Emitted(kt of CO2 Equivalent)
Road Transportation	67070
Domestic Aviation	4090
Domestic Navigation	1350
Railways	563
Other	628
Total	73700

The fuel combustion emissions from the industrial sector accounted for 15% of the total emissions in 2014[43]. The main sectors responsible from the industrial fuel combustion emissions include the non-metallic minerals industry, iron and steel industry, the food processing industry and the chemicals industry among others. Many sources of industrial emissions are large facilities which can be taxed relatively effectively. On the other hand, smaller industrial sources that are more numerous may be harder to tax from an administrative standpoint, so these may be better addressed through an upstream approach at the point where the fuels are sold to the industrial customers[44].

Industrial Emissions from Fuel Combustion by Sector (2014)

	GHG Emitted (kt of CO2 Equivalent)
Non-metallic minerals	26948
Iron and Steel	14132
Food processing, beverages and tobacco	5028
Chemicals	4791
Pulp, paper and print	1687
Non-ferrous Metals	1311
Other	16189
Total	70085

43 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016)

44 Kennedy, Kevin, Obeiter, Michael and Kaufman, Noah, 'Putting a Price on Carbon, A Handbook for US Policymakers'(2015), World Resources Institute, p. 19

Fuel combustion emissions from the residential and commercial sectors also have an important part in the emissions mix in the country, amounting to around 10,9% of the total emissions. These emissions mostly result from the heating needs of the buildings. The main fuel used is natural gas, although significant amounts of coal is also being used. Like the transportation sector, the end users in the heating sector are much too numerous to be effectively taxed with a downstream approach. Therefore, a more upstream approach would be preferable in utilizing a carbon tax in this sector[45]. Taxing at the point of gas utility can be a preferable choice in this regard. Fossil fuels used for heating other than natural gas can be taxed at their sales.

CO2 is the most prevalent of the greenhouse gases and therefore most of the discussions regarding carbon pricing revolve around it. However, there are several other gases that considerably contribute to climate change. There may also be some cost effective opportunities for reducing emissions from gases other than CO2 such as CH4 and N2O among others. The inclusion of such gases should also be considered when forming a carbon taxation scheme.

Fuel Combustion Emissions based on Gas (2014)

Gas (kt)	CO2	CH4	N2O	Total
Energy Industries	131838	1.8	1.23	132248
Manufacturing industries and construction	69855	3.2	0.15	70085
Transport	72999	14.1	3.80	73700
Residential/Commercial Fuel Combustion	48281	105.3	0.18	51178
Fuel Combustion in Agriculture	3152	0.57	0.02	3173

Other Emission Souces Based on Gas (2014)

Gas(kt of CO2 Eq.)	CO2	CH4	N2O	HFCs/PFCs/SF6	Total
Emissions from Industrial Processes	55955	130.00	1808	4917	62810
Agriculture	787.7	31054	17681		49521.8
Waste	0.1	14258	1857		16114.4

45 Ibid.

CO2 emissions make up around 82% of Turkey's total GHG emissions[46]. It can be seen from the tables above that CO2 emissions constitute an overwhelming part of the emissions caused from fuel combustion. However, when we look at other sources of emissions such as industrial processes, agriculture and waste, it is clear that gases like CH4 and N2O have an increased share. The inclusion of these gases under the coverage of the carbon tax would considerably increase the opportunities of GHG abatement made available by the carbon tax.

However, the inclusion of such gases would also bring several complications and administrative burdens. Firstly, the inclusion of these additional gases would expand the economic activities subject to the tax and bring additional administrative burdens. Another challenge would be to account for the varying impacts of these different gases in contributing to climate change. Each type of gas has a different capacity for trapping heat and as aa result, a different global warming potential. For example, a gram of CH4 has a global warming potential of between 28 to 36 times more compared to a gram of CO2 and N2O has a global warming potential of between 265 to 298 times more relative to CO2[47]. A uniform tax would have to reflect these differences and be applied accordingly on these gases.

Emissions caused by industrial processes make up an important part of the country's emissions, contributing around 13,4% to the total emissions stock in 2014. The main sectors responsible for these emissions include the mineral industry (mostly cement production), the metal industry and the chemicals industry. Since most of these emissions are based on large facilities, they can be relatively easier to monitor. Moreover, agricultural emissions excluding fossil fuel combustion made up 10,6% and the emissions from the waste sector make up around 3,4% of the country's total emissions[48]. These emissions can be hard to monitor since they arise from many small sources and the introduction of an additional tax on the agricultural sector may not be politically feasible.

A carbon tax covering the emissions from fossil fuel combustion in the country including the energy production industries, the industrial sector, the transportation sector, the residential/commercial sectors and the agricultural sector can account for 72,5% of the country's total emissions. If the emissions from industrial processes are to be included, this figure can rise to cover around 86% of the total emissions. However, the specific coverage of the tax may change if certain sectors are determined to be exempted from the tax. The inclusion of the agricultural emissions and the emissions from the waste sector would probably not be feasible.

UTILIZATION OF REVENUES

Under any type of carbon tax design, there would be a considerable amount of revenues generated. One of the main decisions that needs to be made is how these revenues will be utilized. There are several options for using the carbon tax revenues that is being employed in various countries which have adopted the policy tool. However, each policy choice involves a trade-off between the various objectives pursued by the utilization of the carbon tax. These include realizing effective reductions in the country's GHG stock and transitioning to a low carbon growth pathway, minimizing the costs of the carbon tax on the general economy and alleviating the costs that will be borne by the most vulnerable groups in the society[49].

46 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016)

47 United States, Environmental Protection Agency, accessed from https://www.epa.gov/ghgemissions/understanding-global-warming-potentials on 13.9.2016

48 Turkish Statistical Institute, 'National Greenhouse Gas Inventory Report 1990-2014'(2016)

49 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 24-25

The options for the utilization of carbon tax revenues can be classified under three main categories. Firstly, the revenues generated can be used for the purpose of revenue recycling by various means to offset the additional tax burden borne on the economy. If all the revenue is recycled, the tax would be revenue neutral. Secondly, the revenues from a carbon tax can be incorporated into the general budget to be used for unspecified purposes or for addressing budget deficits. Finally, the revenues can be earmarked to be used for a specific purpose such as the promotion of low-carbon energy sources or addressing climate change adaptation needs. Naturally, a combination of the three categories is also possible and most of the carbon tax systems in the world use different mixes of the three options in their utilization of revenues.

Options for Utilizing Carbon Tax Revenues

Options for Utilizing Carbon Tax Revenues	
Revenue Recycling	Corporate Tax Cuts
	Income Tax Cuts
	Broad-based rebates
	Rebates granted to low-income households
	Energy price adjustments
Earmarking for a Specific Purpose	Renewable Energy
	Energy Efficiency
	Technology Development/Deployment
	Biological sequestration
	Adaptation
Inclusion in the General Budget	

Revenue Recycling

Revenue recycling is a popular way by which carbon tax revenues are being utilized across different carbon tax schemes in the world. The term refers to offsetting the impact of the carbon tax by reductions in other taxes or by other means of redistribution. If all of the revenue collected from a tax is returned to the businesses and individuals, the tax can be referred to as revenue neutral which means that the general tax burden on the economy stays level after the introduction of the tax. A revenue neutral tax may be easier to enact and sustain compared to a policy choice that would increase the general tax levels applied on the economy. Also, carbon taxes are regressive policies that place higher burdens on lower-income segments of the society compared to the higher-income segments. Therefore, it is appropriate to provide some relief for

those segments of the society and some of the businesses that may be especially affected by the use of a portion of the revenues collected by the tax[50].

Several carbon taxation systems in the world include revenue recycling measures. For example, the carbon tax designs in the North European countries of Finland, Sweden and Norway include such measures and the system in British Columbia enables 100% of the tax revenues to be returned to the economy[51].

Revenue recycling can be carried on in a number of forms. However, there are five main methods that are utilized in different systems in some combination as identified by Carl and Fedor. These are corporate tax cuts, income tax cuts, broad based rebates, rebates granted to specified impacted groups and energy price adjustments[52].

Utilization of corporate tax cuts for businesses is the most widespread form of revenue recycling used in carbon taxation schemes and is used in countries such as Sweden, Norway, Denmark and Switzerland. Corporate tax cuts can be applied either on payroll taxes or on profits. This approach is usually favored by economists as an efficient way to protect the competitiveness of businesses by cutting the costs of doing business in other areas[53].

Income tax cuts granted to individuals is another method of revenue recycling that is widely used. Countries such as Sweden, Denmark and Finland have used this approach in their revenue recycling. The main options are to reduce existing income taxes within a bracket or to increase tax-free income exemption. Both of these options have low administrative costs and they can benefit an important part of the population that may be adversely affected from carbon pricing measures, especially if the tax cuts are implemented progressively.

Another option is to use broad based rebates provided for the whole society in order to recycle a portion of the revenues generated by a carbon tax. Such a system has been used in some other carbon pricing systems but Switzerland has been the only country to utilize this approach in combination with a carbon tax. A criticism of this approach is that it doesn't differentiate between households and individuals while some segments of the society would likely be a lot more affected from the carbon tax due to a number of reasons[54].

Instead of utilizing broad based rebates, an alternative is to provide rebates specifically for targeted communities. These may be low-income households or households that may be particularly impacted from the effects of a carbon tax such as those whose livelihoods depend on coal mining or rural households with highly inelastic energy demand. Such a system has so far only been used in British Columbia with a payment being utilized on an annual basis with the amount based on the income level of households[55].

Finally, adjustments in the energy prices are another alternative use of revenue recycling that has been favored in some carbon pricing systems such as Sweden. Adjustments in energy prices can involve reductions in electricity rates and existing fuel taxes or granting on-bill rebates tied to energy consumption. This approach directly compensates consumers for the effects of the carbon tax on energy prices. However, since the original intent of carbon pricing policies is mainly to create effective price signals in the economy and particularly regarding the energy prices, such an approach can be

50 Marron, Donald, Toder, Eric and Austin, Lydia, 'Taxing Carbon: What, Why and How?'(2015), Tax Policy Center, Urban Institute and Brookings Institution, p. 11

51 Carl, Jeremy and Fedor, David, 'Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world'(2016), Energy Policy, Volume 96, p. 56

52 Ibid.

53 Ibid.

54 Ibid.

55 British Columbia Government, accessed from http://www2.gov.bc.ca/gov/content/taxes/income-taxes/personal/credits/climate-action on 10.9.2016

considered as self-defeating[56].

Earmarking for a Specific Purpose

Alternatively, system can be set up to channel a portion of the revenues collected by the tax for use in a specific purpose. A popular option could be to use the revenues for aims related to climate change such as subsidizing renewable energy investments, promoting energy efficiency, promoting the development of low carbon technologies, biological sequestration and furthering climate change adaptation efforts[57]. Such an approach can be useful in helping to realize the vast investment needs in these areas and seems in line with the original intent of the carbon tax employment.

Such a linkage may be sensible from a political point of view but from an economic perspective an effective carbon tax would serve to reduce the need for such investments by incentivizing private research and development of clean energy[58]. Nevertheless, the utilization of a considerable share of carbon tax revenues for promoting low carbon growth would increase the effectiveness of the tax in reducing GHG emissions but could also cause the tax to be less feasible politically. It may make sense to earmark a portion of the revenues for spending in green growth but this hasn't been a very popular choice among the countries that have adopted a carbon tax. Reportedly, only 15% of the total carbon tax revenues are being spent on subsidizing green growth on a global scale[59].

Inclusion in the General Budget

Finally, another option could be to include the carbon tax revenues in the general budget without any earmarking or revenue recycling. This approach can potentially be used by countries with budget deficits that view carbon taxation as a means to address fiscal problems. For example, the employment of a carbon tax is frequently pointed out as one of the potential solutions to the United States' budget deficit problem[60]. However, the use of carbon revenues in supplementing the general government budgets hasn't been a popular choice for governments that have enacted carbon pricing systems[61].

In the study undertaken by Carl and Fedor, it has been shown that the use of carbon pricing revenues can be quite important in establishing the political feasibility of the pricing scheme. According to the results of the study, carbon pricing systems that have a large per capita impact tend to use carbon revenues in non-earmarked ways, returning most of the revenues collected by the tax through means of revenue recycling. The conclusion is that individuals and businesses may not support heavy carbon prices if the revenues are not used in a fiscally conservative manner[62].

Redistributing income through changes in the overall tax system would be a preferable way to address the adverse distributive effects of the carbon tax instead of through adjustments in the internal design of the tax. Adjustments made the carbon tax such as providing exemptions for wide sectors run the risk of creating distortions in the economy between different sectors and may reduce the environmental benefits of the

56 Carl, Jeremy and Fedor, David, 'Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world'(2016), Energy Policy, Volume 96, p. 57

57 Ramseur, Jonathan L. and Parker, Larry 'Carbon Tax and Greenhouse Gas Control: Options and Considerations for Congress'(2009), Congressional Research Service

58 Marron, Donald, Toder, Eric and Austin, Lydia, 'Taxing Carbon: What, Why and How?'(2015), Tax Policy Center, Urban Institute and Brookings Institution, p. 12

59 Carl, Jeremy and Fedor, David, 'Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world'(2016), Energy Policy, Volume 96, p. 54

60 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, p. 1

61 Carl, Jeremy and Fedor, David, 'Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world'(2016), Energy Policy, Volume 96, pp. 50-51

62 Carl, Jeremy and Fedor, David, 'Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world'(2016), Energy Policy, Volume 96, pp. 50-51

tax[63].

Therefore, for a carbon tax employed in Turkey, the ideal approach would be to include as little exemptions as possible and instead compensate such sectors through means of revenue recycling. For this purpose, the utilization of corporate tax cuts would be a preferable choice to offset any potential impacts of the tax by incentivizing other targets such as the creation of employment opportunities. Providing income tax cuts for individuals would also be a good option in order to redistribute a portion of the revenues collected by the tax to the society. This redistribution should be done progressively as the effects of the tax are most likely to be regressive, impacting lower income groups relatively more than higher income groups. Providing direct rebates to the general population or to targeted groups can also be an option. In particular, special provisions should be provided for the segments of the society that may be most affected in a negative way. Making adjustments in the energy prices is not advised since such an approach would serve to defeat the main purpose of the carbon tax which is to reflect the costs of carbon emissions in the energy prices. Finally, a portion of the tax revenues can be earmarked for spending in low-carbon growth. However, utilizing the bulk of the revenues in this way would not be advised especially if the tax is initiated at a relatively high level due to reasons of political feasibility and sustainability.

Currently, there are a number of taxes that are being applied on energy products in the country. The introduction of a carbon tax can help reform this system by making it more directed toward penalizing the utilization of carbon intensive modes of production. If proper revenue cycling measures are used, such an approach wouldn't inflict too much additional burden on the economy. Corporate and income taxes are neutral taxes in the sense that they don't incentivize a desired outcome. Therefore, substituting a portion of these taxes for a carbon tax would make sense from an economic point of view.

THE ISSUE OF CARBON LEAKAGE

Most carbon pricing regimes in the world employ some form of exemptions for certain sectors. As we have seen, several sectors may be exempted from a carbon tax scheme due to a number of reasons such as practical difficulties in implementation and high transaction costs. However, an additional motivation for providing exemptions for certain sectors is the issue of carbon leakage[64]. Whenever the concept of carbon pricing is raised, one of the first concerns that come to mind is carbon leakage. The concept refers to the loss of competitiveness in an economy due to stringent climate change policies which result in businesses moving their production to other countries, preventing any changes in the global stock of GHG emissions regardless of any domestic emissions reductions.

Concerns regarding competitiveness can especially be relevant for energy intensive and trade exposed industries in a country. Carbon intensive industries may be adversely affected and request some kind of compensation to be provided under the policy scheme. Several mechanisms can be effectively established to address the issue but these also run the risk of undermining the effectiveness of the carbon tax in creating GHG reduction opportunities. Therefore, it is advised that such exemptions should be used in the initial phase of the implementation of a carbon tax but they should gradually be diminished over the years as the economy adjusts[65].

The World Bank offers three main mechanisms by which to address the fears of carbon leakage and

63 E. Metcalf, Gilbert and Weisbach, David, 'The Design of a Carbon Tax'(2009), Harvard Environmental Law Review Vol. 33, p. 514

64 World Bank Group and Ecofys, 'State and Trends of Carbon Pricing'(2015), p. 78

65 Ibid.

competitive disadvantage. These are the application of partial or full exemptions for certain sectors or firms, the application of rebates and the employment of border carbon adjustment measures[66].

A way to address the problem of carbon leakage is to straight up provide exemptions for selected sectors. Such measures are most likely to be employed on energy intensive sectors that would be most affected from rising energy prices and face with reduced competitiveness in the international arena. These sectors can be made fully exempt from the tax or be obliged to pay reduced rates[67].

A second method includes transferring some of the carbon tax revenues back to the affected industries through reducing other taxes paid by the industry, or by providing other subsidies. This approach is the most commonly adopted in the countries that have a carbon tax regime. The purpose is to discourage GHG emissions while keeping the overall tax liability faced by the businesses level. The tax rebates or subsidies can be provided based on different factors. For example, the UK Climate Change Levy bases the subsidies provided for the businesses on the creation of employment opportunities and in the case of the Swedish NOx tax, the subsidies are provided based on economic output[68]. Such rebates and subsidies can encourage businesses to sustain their production as the energy costs go up and can help reduce the risk of the loss of employment[69].

The final proposal for addressing carbon leakage involves the utilization of border carbon adjustments. A border tax adjustment approach would tax imports of carbon-intensive goods into the country from regions with less stringent mitigation policies at a level that would reflect the difference in regulation between the two countries. Specific energy intensive sectors can be chosen and import tariffs can be employed on those sectors. Also, rebates can potentially be provided to exporters[70]. However, this approach is hard to implement in practice since many countries are employing a number of measures to promote climate change efforts such as subsidies to renewable energy which can't be easily quantified into a carbon price[71]. Also, it must be noted that the employment of such a policy may lead to disputes between countries concerning the legislative framework of the World Trade Organization. Due to these difficulties, the employment of border tax adjustments is not the most feasible policy option in addressing trade competitiveness and leakage issues.

In Turkey, there are several energy intensive industries that may be deemed central to the economy such as the cement production and steel industries. Policymakers may decide to include certain provisions to protect such industries from the adverse impacts of a carbon tax. However, in doing so, introducing excessive exemptions to these sectors should be avoided and they should instead be incentivized mainly through other means such as by reductions in other taxes such as the corporate tax.

EQUITY CONSIDERATIONS

There are also other legitimate equity concerns that should be in consideration when designing a carbon tax. The equity of a tax can be assessed by looking at how the burden of the tax is likely to be distributed between different parties in the economy. The equity concerns that a carbon tax can arise are classified under the subclasses of vertical, horizontal, individual

66 World Bank Group, 'Carbon Leakage, Theory, Evidence and Policy Design'(2015), Partnership for Market Readiness, pp. 40-41

67 Ibid.

68 Ibid.

69 C. Morris, Adele and Mathur, Aparna, 'A Carbon Tax in Broader US Fiscal Reform: Design and Distributional Issues'(2014), Center for Climate and Energy Solutions, p. 36

70 World Bank Group, 'Carbon Leakage, Theory, Evidence and Policy Design'(2015), Partnership for Market Readiness, pp. 40-41

71 C. Morris, Adele and Mathur, Aparna, 'A Carbon Tax in Broader US Fiscal Reform: Design and Distributional Issues'(2014), Center for Climate and Energy Solutions, p. 36

and generational equity by Ramseur et al[72].

Vertical equity suggests that those with the greater ability should bear more of the tax burden. It is generally accepted that the main economic impact of increased taxes on energy would be borne mostly by the end-users of energy and the households due to higher prices of energy and other related goods. Carbon taxes are generally regarded to be regressive in the absence of specific provisions aimed at revenue redistribution. This is because lower-income households generally spend a higher percent of their income on energy related expenses compared to higher income households. In addition, certain regions and communities that depend heavily on the use of fossil energy may be particularly affected. Increased vertical equity can be achieved through adding various design elements accompanying the carbon tax such as reductions in other taxes such as the income tax or redistribution of a portion of the funds to low-income households or other specified groups. This redistribution can be made through various means such as lump-sum rebates or targeted energy assistance[73].

Vertical equity would be an important concern in Turkey where 29,4% percent of the country lived below the poverty line in 2014 according to the figures provided by the Turkish Statistical Institute[74]. Also, a large number of families in Turkey continue to use coal in households as a means of heating. Since 2003, the government has been providing welfare assistance to the low-income families in the form of coal to tend to their heating needs. It is reported that around 19,2 million tons of coal have been distributed to the families between the year 2003 and 2014[75]. Reportedly, around 2,25 million families had benefited from the coal assistance just for the year 2013[76]. A carbon tax can also potentially have a substantial impact on the communities sustained by coal mining which are geographically concentrated. Therefore, transitional assistance should also be offered to such communities vulnerable to the effects of a carbon tax. Since these issues are related to welfare, several revenue recycling options discussed in the previous parts of the paper should be utilized to compensate for any negative effects of the carbon tax. An effective way to provide compensation for any potential losses in employment in carbon intensive industries could involve investing in job training[77].

Horizontal equity, on the other hand, refers to whether taxpayers with similar characteristics receive an equivalent tax treatment. Concerns about horizontal equity may arise if there is a large disparity between the tax obligations of different sectors of comparable size. To address this, the carbon tax should be applied as uniformly as possible across the economy with as little exceptions as possible[78].

The concept of individual equity refers to the argument that any taxes an individual is obligated to pay should be commensurate with the benefit the individual receives from the taxed activity. A carbon tax can be classified under this category since the benefits of removing a level of GHG gases from the atmosphere that would otherwise be emitted can be seen as a public good, benefiting the whole of society[79].

Lastly, generational equity refers to the conviction that the burdens and benefits arising from governmental

72 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 19-21

73 Center for Climate and Energy Solutions, 'Options and Considerations for a Federal Carbon Tax'(2013), p. 4

74 Turkish Statistical Institute, accessed from http://www.tuik.gov.tr/PreTablo.do?alt_id=1013 on 27.8.2016

75 Türkiye Kömür İşletmeleri Kurumu, 'Kömür Sektör Raporu(Linyit) 2014'(2015), p. 52

76 Hürriyet, 7.11.2014, 'Kömür yardımı 3.5 kat arttı', accessed from http://www.hurriyet.com.tr/komur-yardimi-3-5-kat-artti-27532373 on 10.9.2016

77 Kennedy, Kevin, Obeiter, Michael and Kaufman, Noah, 'Putting a Price on Carbon, A Handbook for US Policymakers'(2015), World Resources Institute, pp. 26-27

78 Ramseur, Jonathan L., Leggett, Jane A. and Sherlock, Molly F., 'Carbon Tax: Deficit Reduction and Other Considerations'(2013), Congressional Research Service, pp. 19-21

79 Ibid.

policies should be fairly distributed across generations. These concerns are relevant in the case of human induced climate change since the effects of the GHG gases emitted today will continue to cause harm to several future generations to come. Therefore, as other policy alternatives aimed at climate change mitigation, the employment of a carbon tax can help in promoting intergenerational equity by reducing the future effects of climate change[80].

CHALLENGES DURING THE IMPLEMENTATION OF THE TAX

There are also challenges that will be faced after the design of the tax is finalized and it comes into effect. One of these will be to accurately assess the impacts of the tax so that appropriate modifications can be made whenever necessary. Countries are likely to face significant practical challenges during the implementation of the carbon tax related to gathering data on current and projected emissions and monitoring reporting and verification of emissions(MRV). Therefore, increasing technical and institutional capacity would be crucial in ensuring an effective carbon tax regime[81].

Often times, projected emission reductions from a policy tool can prove to be less or more than anticipated resulting in economic and environmental outcome that diverge from initial predictions. Therefore, an adjustment mechanism should be included in the policy mechanism that would allow minimizing the disruptive and unplanned changes. Certain time intervals can be determined by which the results of the policy tool can be assessed and according changes be made if needed[82]. Such a mechanism would require a strong monitoring mechanism to be established in order to properly assess the effects caused by the employment of the policy tool.

As a European Union candidate country, Turkey has been considering in joining the EU-ETS program for some time. Turkey's capacity in measuring emissions has considerably increased in the recent years with the country's preparations to conform its climate change legislation to that in the European Union. For this end, Turkey has been working on setting up a system for the monitoring and verification of its GHG emissions in collaboration with the Partnership for Market Readiness since the year 2011[83]. Within the scope of the project, a preliminary assessment for a pilot carbon market program has been going on with mainly the electricity generation sector, refineries and cement manufacturing sectors being targeted. As of 2015, the preparations for setting up a GHG monitoring, review and verification system had been going on in 18 power plants, 1 refinery and 5 cement factories as part of the project[84].

Turkey adopted the Regulation on Monitoring of Greenhouse Gas Emissions in 2012, aimed at regulating the principles and procedures of on the monitoring, verification and reporting of the GHG gases originating in the country. Under the legislation, several entities will be compelled to monitor and report their emissions such as facilities with thermal power equal to or higher than 20 MW, oil refineries and certain steel and iron production facilities[85].

Carrying on with the efforts to monitor its GHG emissions will be important for Turkey whether it chooses to opt for a carbon tax, a carbon trading mar-

80 Ibid.

81 Wang, Xueman and Murisic, Maya, 'Towards a Workable and Effective Climate Regime, Chapter 19: Taxing carbon: Current state of play and prospects for future developments'(2015), World Bank, p. 275, accessed from http://voxeu.org/sites/default/files/file/wang%20and%20murisic.pdf on 3.8.2016

82 Kennedy, Kevin, Obeiter, Michael and Kaufman, Noah, 'Putting a Price on Carbon, A Handbook for US Policymakers'(2015), World Resources Institute, pp. 21-22

83 Ministry of Environment and Urbanization, accessed from https://www.csb.gov.tr/db/iklim/editordosya/file/PMR.pdf on 23.7.2016

84 Partnership for Market Readiness Website, accessed from https://www.thepmr.org/system/files/documents/Turkey_PMR%20Project%20Implementation%20Status%20Report..pdf on 11.9.2016

85 Partnership for Market Readiness, 'Market Readiness Proposal Under the Partnership for Market Readiness Programme Turkey'(2013), pp. 40-41

ket or a combination of the two policy options.

INCLUDING THE PUBLIC IN THE DECISION-MAKING PROCESS

For any policy mechanism to be successful, it is important to have the support of the general public. Generally speaking, new taxation policies are not very popular among the citizens since they can potentially increase the financial burdens of households and negatively impact businesses. Any type of additional tax policy is initially likely to be unpopular among the citizens even if it is designed to be revenue neutral. Carbon taxation is such a policy that can have significant impacts on the economy as a whole. A carbon tax is especially likely to elicit strong opposition from certain stakeholders such as coal based power plant owner and energy intensive manufacturers.

Therefore, it is important to take measures aimed at promoting public support for the policy tool both before and after its launch. To this end, several measures can be taken. The goals and the benefits expected from the tax should be clearly communicated to the public well before the implementation of the policy tool and workshops should be organized aimed at bringing together various stakeholders including representatives from the government, civil society and the business community to provide inputs on how to implement the tax in the most efficient manner. Several other countries have drafted their carbon taxation policies with ongoing consultations with the public such as South Africa which issued a carbon tax policy paper for public comment in 2013 well before the anticipated implementation of the tax, detailing the proposed design features of the tax[86].

A recent study examined the preferences of the Turkish public regarding a carbon tax. According to the results, Turkish people tend to prefer a carbon tax with a progressive cost distribution compared to a carbon tax with a regressive cost distribution. This refers to higher income segments of the society bearing more of the taxes impact compared to lower income citizens. Earmarking the revenues for a specific purpose also increases the public acceptance of the tax either for income redistribution or for promoting environmental policies. There is also a preference for a carbon tax that boosts public awareness towards climate change. The results suggest that according to the Turkish public the most valued attribute of the carbon tax is the use of revenues, followed by the distribution of cost and raising awareness towards climate change[87]. Such studies should be replicated and the results should be taken into account in order to implement a carbon tax that would reflect the preferences of the public and be more politically feasible.

ACCOMPANYING CHANGES IN POLICY

The utilization of a carbon tax can't be considered independently from the other energy policies in the country. In the case of Turkey, the implementation of a carbon tax needs to be accompanied with a number of changes in the country's energy policy in order to fully benefit from the positive effects of the policy tool.

As part of the country's energy policy, extensive amounts of fossil fuel subsidies are currently being provided in the country. Most of this amount is being provided to promote domestic lignite utilization for the purpose of curbing the country's import dependence in energy generation. According to the Overseas Development Institute, the subsidies provided to fossil fuels in the country amounted to 627 million dollars on average including subsidies provided for coal mining, upstream oil and gas and coal fired power for the

86 Department of National Treasury Republic of South Africa, 'Carbon Tax Policy Paper'(2013)

87 Gevrek, Z. Eylem and Uyduranoğlu, Ayşe, 'Public preferences for carbon tax attributes', Ecological Economics 118 (2015) , pp. 194-195

years 2013 and 2014[88]. Another recent study estimated the total amount of subsidies provided for the coal industry to be around 730 billion dollars for the year 2013. It must also be added that these figures fail to capture several types of incentives made available for the coal industry which are hard to quantify. Such additional incentives include investment guarantees and several subsidies provided under the Regional Incentive Scheme. Therefore, the actual figures of fossil fuel subsidies in the country are likely to be higher[89].

Additionally, several recent changes were made in the energy policy of the country providing new incentives for domestic lignite utilization in the country. Recently, a new tax has been introduced that will be applied upon coal imports aimed at use in electricity generation. The level of the tax will be applied as 15 US dollars per ton of coal[90]. Furthermore, a recent change in the Electricity Market Law brings new incentives for domestic lignite sources such as a purchase guarantee for electricity generated by domestic lignite to be applied at a level of 0.05 Euros per kWh and a commitment to buy at least 6 billion kWh's of coal generated electricity[91].

Another law that has recently passed provides additional incentives for any investments that are deemed strategic. Coal plants fueled by domestic sources fall under this category. These incentives include exemptions from the duty to carry out environmental risk assessments and exemptions from corporate taxes, tariffs and stoppages. Such investments can also enjoy free leases of state lands, receive a discount of 50% on their energy costs and receive wage subsidies and insurance premiums[92].

This extensive framework of subsidies provided for coal utilization in the country threaten to increase the GHG emissions of the country rapidly in the coming decades as the lifetime of thermal power plants extend over a long time horizon. With these current policies in place, the employment of a carbon tax wouldn't be very effective. It wouldn't make much sense to subsidize carbon emissions on the one hand and taxing them on the other. Therefore, one step that needs to be taken is to at least provide a timetable for a phase-out of fossil fuel subsidies before the introduction of a carbon tax.

A carbon tax can be an important part of the country's climate change mitigation policies but it should not be the sole component. Several other policy mechanisms should be considered alongside it. One of these options is participating in the EU ETS system. Turkey has for long been considering the possibility of participating in the scheme. The potential participation of the country in the European carbon trading system wouldn't make a carbon tax redundant. Several countries active in the EU ETS system also employ domestic carbon taxation policies, mostly exempting those sectors that participate in the ETS. A carbon tax and a carbon trading mechanism can potentially be used together as there are different advantages of each option and some emission sources that are hard to cover under a carbon trading scheme can be more easily covered by a tax.

88 Bast, Elizabeth, Doukas, Alex, Pickard, Sam van der Burg, Laurie and Whitley, Shelagh, 'Empty promises G20 subsidies to oil, gas and coal production'(2015) ,Overseas Development Institute and Oil Change International, p. 41, accessed from https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9957.pdf on 8.9.2016

89 Acar, Sevil, Kitson, Lucy and Bridle, Richard, 'Subsidies to Coal and Renewable Energy in Turkey'(2015), p.10

90 Enerji Enstitüsü, 2.8.2016, 'Elektrik üretimi amaçlı kömür ithalatına ton başına 15 dolar vergi getirildi', accessed from http://enerjienstitusu.com/2016/08/02/komur-ithalatinda-ton-basina-15-dolar-vergi-getirildi/ on 11.9.2016

91 The Guardian, 6.9.2016, 'Turkish coal plants in line for public subsidies', accessed from https://www.theguardian.com/environment/2016/sep/06/turkish-coal-plants-in-line-for-public-subsidies on 10.9.2016

92 Turkish Grand National Assembly, accessed from https://www.tbmm.gov.tr/kanunlar/k6745.html on 12.9.2016

CONCLUSION

The design of a carbon tax is a complex process where several considerations and potential trade-offs need to be taken into account. Any potential carbon tax scheme to be employed in Turkey needs to be built upon an examination on the specific market conditions in the country. If the necessary provisions are included in the design, a carbon tax can be a powerful for Turkey in moving towards a low carbon economy with minimal harm to the country's economic growth and developmental prospects.

One of the main considerations of a carbon tax design would be to ensure its political feasibility. This can be done by redistributing a large portion of the revenues by various means of revenue recycling. In this, particular attention should be given to compensating the potential losses of particular groups that may be most affected from the tax. Also, the inclusion of the public in the decision making process can serve to strengthen the public support for the policy instrument.

A carbon tax should also be effective at a meaningful level. For this to be realized the two main considerations are setting the rate of the tax at a meaningfully high level and the inclusion of as much sectors as possible. A balance should be struck so that considerable amounts of GHG emissions can be abated without substantially reducing the competitiveness of the country's economy.

Another consideration in the employment of a carbon tax is the protection of key carbon intensive industries from carbon leakage and the loss of trade competitiveness. Provisions can be designed to shield such industries from a portion of the effects of the carbon tax. However, these provisions shouldn't include wholesale exemptions of large sectors from the tax but instead should focus on providing tax cuts in other areas.

One of the main goals of the energy policies pursued by the government is curbing import dependency in energy sources. This can mostly be observed in various policy choices regarding the promotion of domestic lignite. A carbon tax would harm the domestic lignite industry but would also help to promote several domestic renewable sources in the country. The energy imports of the country are highly based on carbon, so in general it can be concluded that in the end the employment of a carbon tax wouldn't hurt the energy independence of the country at a high level. Instead, with the promotion of the renewable sources in the country, a sustained carbon tax can perhaps help in promoting an energy independence not based on domestic lignite but instead based on a long term growth in the renewable energy capacity in the country.

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Design Options for Employing a Carbon Tax in Turkey

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