EXECUTIVE SUMMARY

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A SAFE AND SUSTAINABLE FUTURE THROUGH BOLD CLIMATE ACTION

Assessment of the Impact of Greenhouse Gas Emissions Reduction Measures on the Social and Economic Situation in Uzbekistan

UZBEKISTAN | 2021

UNDP works in nearly 170 countries and territories, helping to achieve the eradication of poverty, and the reduction of inequalities and exclusion. We help countries to develop policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results.

UNDP assistance to Uzbekistan is aimed at achieving common interrelated goals: supporting the Government in accelerating reforms in sustainable economic development, effective public administration, adaptation to climate change and environmental protection.

Acknowledgment

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Introduction

Uzbekistan committed to the global climate change response immediately after the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The Convention seeks to achieve a stable concentration of greenhouse gases in the Earth's atmosphere at a level that would not allow dangerous anthropogenic influence on the climate system. Uzbekistan signed the Convention in 1993, ratified the Kyoto Protocol[1] in 1999, and in 2017 signed the Paris Climate Agreement[2], which "replaced" the Kyoto Protocol, and ratified the Agreement in 2018.

On its way towards implementing the Paris Agreement, Uzbekistan formulated its own commitments (its nationally determined contributions or NDCs) to reduce greenhouse gas (GHG) emissions. The country's contribution is reducing the specific emissions per unit of GDP by 10% by 2030 compared to 2010.

The current task is to define a *new amount* of Uzbekistan's emission reduction commitments for the next period (up to 2030). Although the Paris Agreement does not provide for a binding mechanism for the member-states to declare and achieve their NDCs, it nevertheless requires "ambition" and "progress" in their revision. . In other words, the subsequent commitment amount is supposed to be larger than the previous.

However, ambitious NDCs mean a transition to an active climate policy, or a transition from the "brown" development scenario (the current model of economic development with a focus on energy sector) to the "green" development scenario (implying climate change mitigation and adaptation measures). The transition to "green" development will require huge investments that should seek to respond to socio-economic challenges of development. Moreover, the amount of these investments increases with the increase of NDC ambitions (i.e. with stricter emissions reduction measures). The size of the new commitments should be **optimal**, i.e. such *that the costs of achieving such level of ambitions do not exceed the costs of eliminating the negative socio-economic effects that may arise as it is achieved*.

The **purpose of this analysis** is to develop recommendations for formulation of new Uzbekistan's emissions reduction commitments in the context of the Paris Agreement through the assessment of the emissions reduction measures' impact on the socio-economic situation in the country.

This analysis comprises 6 sections and 6 annexes.

Section One describes Uzbekistan's current involvement in global climate change response and gives an overview of where it stands regarding its current emissions reduction commitments.

[1] The Kyoto Protocol was signed in 1997 in Kyoto, Japan. The goal is to combat global climate warming by reducing emissions in developed countries and countries with economies in transition by 5.2% compared to 1990.

[2] Law of the Republic of Uzbekistan "On the ratification of the Paris Agreement" No. 491 of 02.10.2018.

Section Two proffers 8 conclusions/hypotheses, which were subsequently reflected in the calculation methodology used to assess the impact of emission reduction measures on the socio-economic situation in Uzbekistan. The findings are based on the analysis of 29 current studies published over the past 10 years.

Section Three presents the results of the analysis of the conditions that shape specific emissions dynamics in Uzbekistan. It consists of three parts:

1) Analysis of specific emissions dynamics by the key emitting sectors for the period of 1990-2017. For the calculations, the statistics of Uzhydromet (the amount of emissions) and the State Statistics Committee (the volume of production by sector) were used);

2) Analysis of the macroeconomic and institutional conditions that influenced the scale of specific emissions in the key five emitting sectors in Uzbekistan for the period of 1990-2017. These conditions were "searched" by the method of pairwise correlation and the method of econometric modeling among a large number of macroeconomic and institutional indicators contained in the World Bank database (World Development Indicators, WDI).

3) Comparison of specific emissions dynamics in Uzbekistan with worldwide green development benchmarks. As such, the average estimate of the size of specific emissions among the top 15 developing countries that have shown the best results in reducing CO2 emissions per $ 1 of GDP over the past 15-20 years was calculated. These countries, in turn, were selected from 75 developing countries around world available in the World Bank database (WDI).

Section Four presents calculations of the full scale of emissions, that is, not only for the five key GHG emitting sectors (direct emissions), but also for all 78 sectors that form Uzbekistan's economy (direct and indirect emissions). Although these calculations are crucial for assessing the scale of possible social and economic effects, such calculations have never done in Uzbekistan before. Indirect emissions can only be estimated based on model calculations. These calculations are based on the "Input-Output" Model[3] using the multiplier technique.

Section Five contains calculations of the impact of emissions reduction measures on economic indicators (output) and social indicators (employment, income from employment) exemplified by the energy sector. The choice of the sector is determined by the fact that the most complete information is available for this sector to model the consequences of resource saving measures. The effects that should be expected for the economy when implementing resource-saving measures in the energy sector (reducing the unit cost of natural gas for the production of a unit of electricity) are modeled on the basis of the Input-Output model.

Section Six proffers recommendations to consider national interests (in social and economic aspects) when identifying new commitments of the country to reduce emissions (in the context of the Paris Climate Agreement).

Uzbekistan is strongly committed to the Paris Climate Agreement to reduce greenhouse gas (GHG) emissions. The country is committed to reducing the specific emissions per unit of GDP by 10% by 2030 compared to 2010. .

With regard to the total amount of GHG emissions, as estimated by the Center of Hydrometeorological Services of Uzbekistan through its inventory of five sectors that are direct emitters, they dropped by almost 5.4% during 2010-2017, with consideration of

[3] The Input-Output model refers to the balance sheet method of forecasting economic phenomena – the traditional and most common ones in the economy. The balance sheet method involves the development of balance sheets, which are a system of indicators in which one part, which characterizes resources by source of income is equal to the other showing the distribution (use) in all directions of their consumption.

the absorptive capacity of forests they dropped by almost 3.5% (Table 1). The effect of carbon sequestration by forest vegetation has emerged in recent years, which indicates that large-scale programs for afforestation of the desert areas in the Aral Sea region have begun to yield results. The forestry sector had long seen as only CO2 emitter in previous years.

TABLE 1. GREENHOUSE GAS EMISSIONS IN UZBEKISTAN (1990-2017), MILLION TONS OF CO_2

Year	Energy	Industrial processes	Agriculture	Wastes	Total emissions	Forestry and other land use	Net emissions
1990	165.2	8.4	14.1	1.9	189.6	-12.1	177.5
2000	200.9	5.8	14.7	2.4	223.8	3.7	227.5
2010	162.8	8.3	23.3	2.5	196.9	8.4	205.3
2013	128.6	8.1	26.6	2.6	165.9	5.2	171.1
2014	130.9	8.6	27.4	2.6	169.5	-2.6	166.9
2015	124.3	8.3	28.5	2.6	163.8	-4.1	159.6
2016	129.0	8.6	29.9	2.6	170.1	-4.7	165.4
2017	136.1	8.3	30.6	2.7	177.8	-4.7	173.1
2010 -2017	-16.4%	0.0%	31.3%	8.0%	-9.7%		-15.7%

4 direct greenhouse gas emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and hydrofluorocarbons (HFCs). Estimates of CH4, N2O, HFCs emissions converted to CO2-equivalent units

Source: Hydrometeorological Service Center of Uzbekistan (Uzhydromet).

Uzbekistan should review its 2030 emissions reduction commitments. The Table 2 shows dynamics of some emission reductions achieved through methane (natural gas) leak reduction in energy sector and indicates trends for decreasing carbon intensity of GDP. However, other sectors' potential should be unlocked to preserve the positive dynamics.

TABLE 2. SPECIFIC EMISSIONS DYNAMICS IN UZBEKISTAN, 2010-2017

	2010	2013	2015	2016	2017
ПВЗ, $ (in 2010 prices)*	46 679 875 793.6	58 122 388 985.6	66 934 792 340.1	71 013 939 308.1	74 182 244 738.0
Emissions, million tons**:					
without forest absorption	200.1	190.3	185.3	185.3	189.2
with forest absorption	187.1	179.0	173.1	172.3	180.6

	2010	2013	2015	2016	2017
Emissions in kg per $1 of GDP (specific emissions):					
without forest absorption	4.22	2.85	2.45	2.40	2.40
with forest absorption	4.40	2.94	2.38	2.33	2.33
Dynamics of specific emissions: 2010 = 100%					
without forest absorption	**100.0**	67.7	58.0	56.8	**56.8**
with forest absorption	**100.0**	66.9	54.2	53.0	**53.1**

Source: authors' estimates.
Notes:
** Source: World Bank data.*
*** Source: Uzhydromet, emissions inventory results..*

In this regard, it is necessary to determine how much new amount of GHG emissions reductions the country could commit for until 2030 and what should guide such decision. The new commitment should be more ambitious because the Paris Agreement implies "ambitiousness" in reviewing national commitments. What is relevant for Uzbekistan now is transition to a proactive climate policy. However, such a transition would require substantial investments that are also in demand for addressing economic and social challenges.

The report proffers recommendations on formulation of new commitments. These recommendations have been formulated with consideration of assessment of impact of GHG emission reduction measures that those may have on the social and economic situation in the country. The report presents 10 key results of this study estimates and calculations.

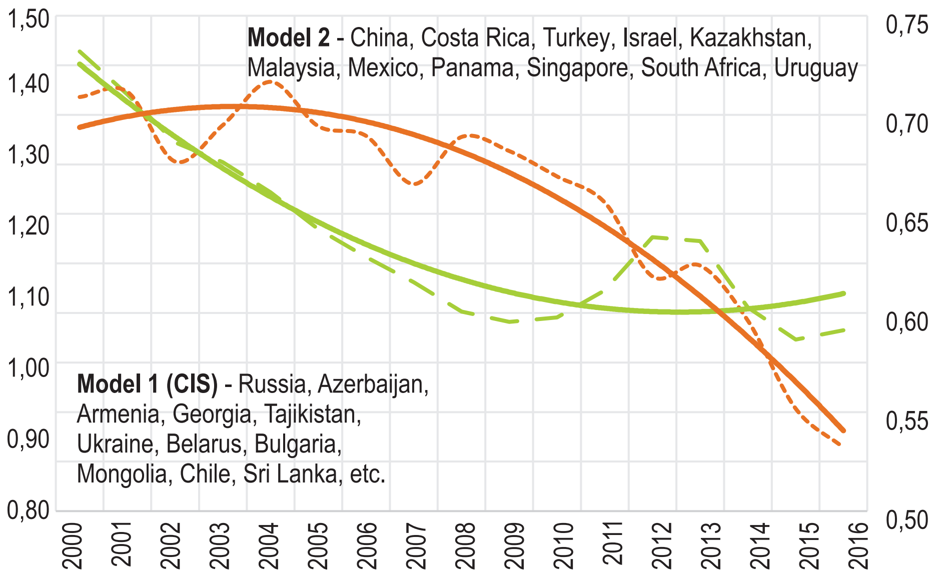
Key Findings of the Analysis

FINDING 1. NEED TO DEVELOP OWN MODEL FOR TRANSITION TO LOW CARBON ECONOMY: OVERVIEW OF GLOBAL EXPERIENCE

Prior to identifying the required resources, the country should at least outline its own model for transition to green economy pathway. An analysis of the existing approaches suggests that developing countries tend to use two models of specific GHG emission reductions (Figure 1).

FIGURE 1. SPECIFIC EMISSIONS REDUCTION MODELS USED BY DEVELOPING COUNTRIES, 2000-2016, (KG/$ OF GDP, 2010 PRICES)

Source: based on World Bank data analysis (WDI)



Model 1 is typical for most CIS countries and other nations (Russia, Azerbaijan, Armenia, Georgia, Tajikistan, Ukraine, Belarus, Bulgaria, Mongolia, Chile, Sri Lanka). These nations have seen their specific emissions decline rapidly since early 2000s.

Model 2 is fundamentally different: it was used for development of nations such as China, Costa Rica, Turkey, Israel, Kazakhstan, Malaysia, Mexico, Panama, Singapore, South Africa, Uruguay. These countries even observed a slight increase in GHG emissions early 2000s, while the emissions declined occurred only by the end of the period; in other words, these countries **did not rush to reduce their emissions.**

Model 2 countries are better positioned in terms of:

- spending on health (in% of GDP): growth by 1 p.p. against 0.2 p.p. for Model 1 countries;
- spending on education (in% of GDP): growth by 1 p.p. against lack of progress for Model 1 countries;
- structure of the economy (share of possessing industry (in% of GDP) was decreased by 2.5 p.p. compared to 3.7 p.p. for Model 1 countries

The advantages of the second model are obvious. Countries using this model seem to stand better regarding social indicators (health and education). They also have a better structure of economy that is important in terms of ensuring the sustainability of their economic growth, which is one of the most difficult challenges facing by the emerging market nations.

This suggests that countries that did not rush to introduce expensive green technologies managed to boost their development significantly and only after that they switched to an proactive low-carbon development policy. These countries' algorithm of actions was as follows: 1) to boost their development (large-scale investments); 2) reduce poverty; 3) create a scientific and technological groundwork for resource-efficiency; and only after 4) switch to proactive climate policy.

FINDING 2. MIXED SPECIFIC EMISSIONS DYNAMICS BY KEY GHG EMITTING SECTORS IN UZBEKISTAN

The analysis of the specific GHG emissions dynamics factors in the five key emitting sectors covered: 1) GHG emissions dynamics in transport over 20 years (Figure 2); and 2) emissions dynamics in the other four sectors (energy, ammonia production, cement production and agriculture) for almost 30 years (Figure 3).

FIGURE 2. SPECIFIC EMISSIONS IN THE 'TRANSPORT' SECTOR (2000=100%)

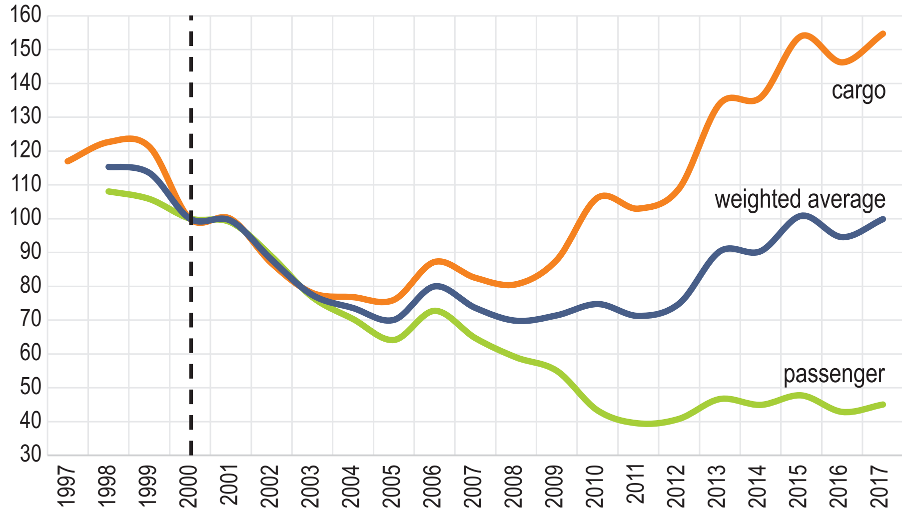
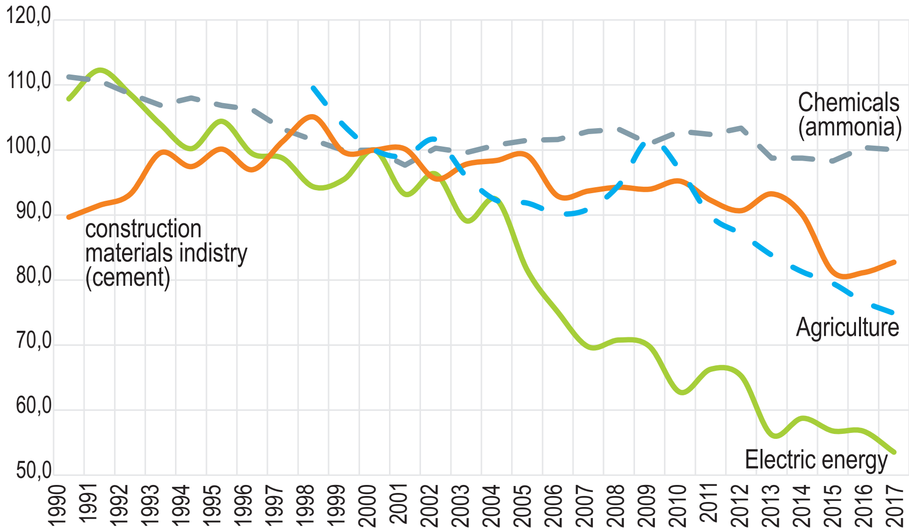


FIGURE 3. SPECIFIC EMISSIONS IN 'ENERGY', 'CHEMICALS' (AMMONIA), 'CONSTRUCTION MATERIALS INDUSTRY' (CEMENT), 'AGRICULTURE' (LIVESTOCK FARMING) SECTORS (2000 =100%)



The analysis suggests that the specific emissions dynamics are volatile and contradictory. This implies the need to analyze a wide range of factors that influenced the scale of specific GHG emissions in these five sectors.

FINDING 3. ALONG WITH INVESTMENTS INTO GREEN TECHNOLOGIES THERE ARE OTHER IMPORTANT FACTORS (CONDITIONS) OF TRANSITIONING TO LOW-CARBON DEVELOPMENT

Set of factors (conditions) analyzed: macroeconomic, structural, and institutional indicators:

- **Sectoral specific emissions (EM_EN, EM_CH ….);**
- **Investment factors (INV_ EN, INV_CH, …., FDI_gdp, GDS_gdp, GFC_gdp);**
- **Structural factors and pressure on natural capital (EML_IND, ECI, NRS_GDP);**
- **Openness of the economy and globalization (EXP_gdp, EXP_r, KOF);**
- **Resource effectiveness factors at macro-level (ENI);**
- **Macroeconomic stability (INF, DEV);**
- **Institutional factors (RoL, GEF, FoC).**

These factors were “searched” using the pairwise correlation method and the method of econometric modeling of a large number of macroeconomic and institutional indicators contained in the World Bank database (World Development Indicators, WDI). It is believed that the most important factor is that of investments into green technologies. However, the correlation analysis (Table 3) showed that along with the investment factor, there are other equally important factors, such as “foreign direct investments” and “share of investments to GDP” that shape emissions dynamics. Furthermore, investments make a mixed impact.

TABLE 3. CORRELATION ANALYSIS RESULTS (PAIRWISE CORRELATION MATRIX)

Отрасли и индикаторы	Отрасли с прямыми выбросами				
	EM_EN	EM_CH	EM_CM	EM_TR	EM_AGR
EML_IND	-0.96	0.09	-0.78	-0.38	-0.73
EXP_r	0.12	0.42	0.21	-0.32	0.07
EXP_gdp	-0.62	0.59	-0.17	-0.76	-0.11
ECI	0.23	0.68	0.61	-0.66	0.53
FDI_gdp	-0.40	0.61	-0.14	-0.57	-0.04
GDS_gdp	0.00	0.73	0.31	-0.70	0.22
GFC_gdp	-0.46	0.13	-0.14	-0.20	0.01
ENI	0.98	-0.08	0.83	0.39	0.79
NRS_GDP	0.38	0.48	0.62	-0.36	0.59
INF	0.70	-0.01	0.63	0.47	0.74
DEV	0.52	-0.45	0.20	0.83	0.28
KOF	-0.88	0.42	-0.59	-0.71	-0.54
RoL	-0.60	-0.20	-0.75	0.20	-0.77
FoC	0.13	0.30	0.40	-0.14	0.34
GEF	-0.82	0.01	-0.71	-0.22	-0.52

(green) increase of the factor (condition) reduces sectoral emissions

(orange) increase of the factor (condition) increases specific emissions

Thus, out of these five sectors the only transport sees that higher investments contribute to lower GHG emissions. These include indicators such as those circled red. However, higher investments into the chemical sector, on the contrary, leads to higher specific emissions. Other sectors see either no link to investment at all or no significant impact.

Along with investments in green technologies there are other important factors (conditions) of transitioning to low-carbon development:

- **Mixed impact of investment factor:** Of the 5 sectors, only Transport was found to be negatively related to emissions (for FDI_gdp -0.57 and GDS_gdp -0.70). For Chemicals and Construction Materials Industry, a positive relationship was found (increase in specific emissions with an increase in investments). No link found for other sectors.
- **Positive impact of industrialization of the economy:** High values of pair correlation ratios between the indicator of industrialization EML_IND and specific emissions for the sectors of Energy, Construction Materials Industry , and Agriculture (-0.96, -0.78, -0.73).
- **Positive impact of external economic factor:** For the KOF index (level of globalization), significant negative correlation ratios were found for 4 out of 5 industries (from -0.54 to -0.88). For the EXP_gdp index (export), a negative relationship with specific emissions was found for two sectors (Energy and Transport) and only for one sector (Chemicals) a positive relationship was found.
- **Negative impact of increased energy intensity and pressure on natural capital:** For the energy intensity indicator ENI with three out of five industries , high (> 0.5) direct correlation ratios were found (from +0.79 to +0.98, Energy, Construction Materials, Agriculture). For the indicator of natural resources rent NRS_GDP, there is a direct relationship (increase of emissions) for Chemicals, Construction Materials, and Agriculture (from +0.48 to +0.62).
- **Positive impact of institutional factor** (strengthening of state institutions): Negative correlation ratios for three of the five sectors and for two of the three indicators (from -0.52 to -0.82, Energy, Construction Materials, Agriculture, RoL, GEF).
- **Positive impact of strengthening the macroeconomic stability:** Positive correlation between an increase in INF inflation and an increase in emissions (in four out of five sectors, from +0.47 to +0.74), as well as between an increase in DEV devaluation rates and emissions (in two out of five sectors).

The key finding of the correlation analysis is that the transition to green development policy may not see investments in green technologies play a decisive role in emissions reduction unless the quality of the macroeconomic environment is taken into account.

FINDING 4. MACROECONOMIC ENVIRONMENT DETERMINES SIGNIFICANT POTENTIAL FOR REDUCING SPECIFIC EMISSIONS IN SECTORS: ECONOMETRIC ANALYSIS

Correlation analysis helped in finding links between the specific emissions and a number of factors. However, this link can be quantified only through an econometric analysis using the factor coefficients. Such coefficients are provided by the econometric analysis toolkit. This analysis covered all factors identified for all the five sectors that are key GHG emitters.

The analysis shows that there are big potential for sectoral specific emissions reduction that may result from improvements in the macroeconomic environment (Table 4):

1. Strong link with indicators of macroeconomic and institutional environment: inflation rate, industrialization, globalization, pressure on natural resourves capital, limiting corruption, compliance with laws and government effectiveness.

2. Importance of industrial policy (development of the processing sector). It implies faster economic diversification, growth of new sustainable jobs, higher incomes of the population, i.e. socially oriented inclusive «green» development.

3. Factor coefficient allows assessing the factor's impact on specific emissions. For example, if during 2012-2017 the average annual inflation rate was lower by only 1 p.p. (11.9% instead of 12.9%), this would help enhancing the specific emissions reduction dynamics:

- **for Energy:** from **-3.33%** (average annual specific emissions reduction rate for 2012-2017) to **-3.57%** (calculation using the coefficient/ratio before the factor «Inflation» from the equation for the energy sector: **0.24**);
- **for Construction Materials Industry ector (cement):** from **-1.71% to -1.90%** (ratio **0.19**);
- **for Transport:** from an increase of specific emissions at **5.54%** to **5.05% (0.49);**
- **for Agriculture:** from **-3.0%** to **-3.53% (0.53)**.

TABLE 4. KEY FINDINGS OF ECONOMETRIC ANALYSIS EXEMPLIFIED BY ENERGY SECTOR (KEY EMITTERS)

# of Sector	Factor with statistical significance	Factor coefficient	Probability of 0 hypothesis deviation %	Explained variance R2
Energy sector (electric energy)				
1	Inflation (INF)	0.24	89	0.41
	Freedom from corruption (FoC)	-0.66	98	
2	Investment in the sector (INV)	-0.16	84	0.25
3	Freedom from corruption (FoC)	-0.46	91	0.45
4	Export (in% of GDP, EXP_GDP(-2))	-0.33	91	0.51

The econometric analysis also helps to calculate the potential for sectoral specific emissions reduction based on different factor values for Uzbekistan and in average for developing nations. For example, specific emissions reduction potential may be in lower inflation. It is above 20% in Uzbekistan, while it is 5-6% on average in other developing countries. Similar gaps for other factors include the following:

- **for inflation: 20-28%** Uzbekistan and **5-6%** in average for developing countries;
- **for energy intensity: 176** kg.o.e/ USD ths and **120.3** kg.o.e./ USD ths, respectively;
- **for pressure on natural resources capital: 14.7%** of GDP and **5.5%,** respectively;
- **for corruption control: -1.1 and -0.3,** respectively (on a scale from **-2.5 to +2.5);**
- **for compliance with laws: -1.1** and **-0.2** (on a scale from **-2.5** to **+2.5**);
- **for openness of economy** (export / GDP): **31.2%** and **45.8%**, respectively.

FINDING 5. IT IS NOT ONLY SECTORS THAT DIRECTLY USE FOSSIL FUELS (ENERGY, METALLURGY, ETC.) THAT HAVE THE LARGEST CARBON FOOTPRINT, BUT ALSO THE SERVICES SECTOR ,WHICH DOES NOT USE FOSSIL FUELS

To assess social and economic effects, it is important to assess emissions not only from the five sectors with direct GHG emissions, but also for all 78 sectors that make up the country's economy. Such calculations *have not yet been* done in the country. Indirect emissions can only be estimated based on modeling calculations.

This analysis estimates these emissions using the **Input-Output** model using emission multiplier technique for the **final product**. The multiplier value can be regarded as the sector's carbon footprint. This enables ranking the sectors based on the criterion of their contributions to total emission amount.

Estimates suggest that *all sectors contribute to GHG emissions*, while sector-average estimate of specific emissions is **754** kgs per 1 million UZS of **final product growth**. Besides, the largest amount of specific emissions come not only from direct fossil fuel users (electric energy, metallurgy, etc.), *but from the services sector, see Table 5*. This is explained by use of hydrocarbons (electric energy, metals, chemicals, etc.) for production of those services, and use of transport services ins services sector as well.

TABLE 5. TOP 15 SECTORS/SPHERES OF UZBEKISTAN WITH THE HIGHEST EMISSION MULTIPLIER VALUES

Sectors and spheres of activity	Direct emissions in tons per 1 million soums of production	Total emissions with an increase in the final product by 1 million soums (multiplier)	Excess of total emissions (multiplier) over direct emissions (specific emissions per 1 million sum of output)
Electricity, gas, air conditioning	10.61	11.268	1.062
Waste collection, treatment and removal services; waste disposal services	7.13	8.714	1.222
Sewer systems services ; sewage sludge	-	2.549	-
Natural water; water treatment and water supply services	-	2.523	-
Chemical products	0.64	2.446	3.822
Services provided by affiliates	-	1.757	-
Paper and paper products	-	1.711	-
Other non-metallic mineral products	0.46	1.262	2.74
Metallic ores	-	1.148	-
Sports. entertainment and recreation services	-	1.064	-
Other individual services	-	0.895	-
Bituminous coal and brown coal (lignite)	-	0.888	-
Transport services		0.875	2.303
Basic metals	0.38	0.829	5.921
Public administration and defense services; social security services	-	0.714	-

Sectors and spheres of activity	Direct emissions in tons per 1 million soums of production	Total emissions with an increase in the final product by 1 million soums (multiplier)	Excess of total emissions (multiplier) over direct emissions (specific emissions per 1 million sum of output)
Financial services (minimal values)		0.069	
Average emission multiplier value for all 78 sectors		0.754	

Source: Calculations based on the Input-Output modeling (considering all technological interconnections in the economy) using emission multiplier technique for final product

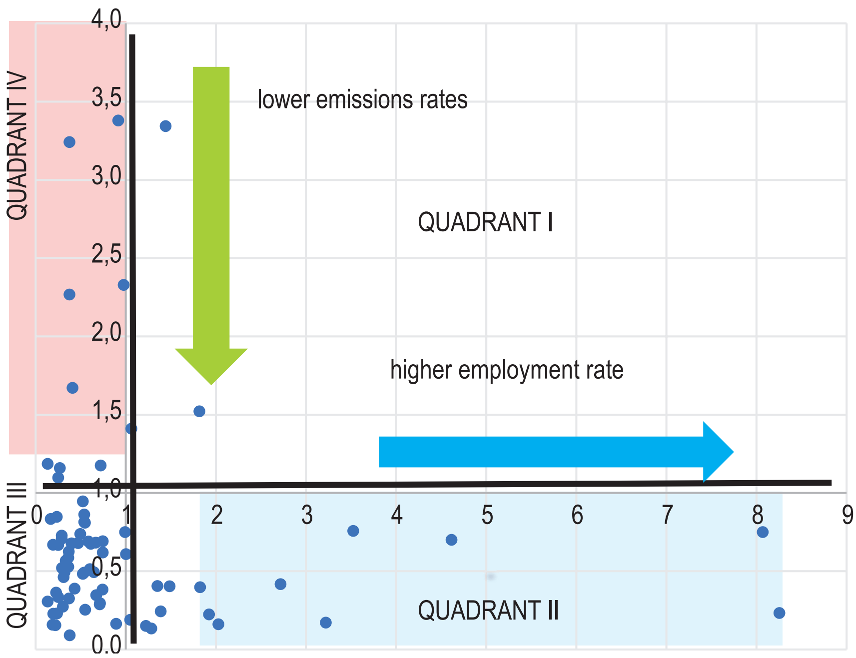
Of great importance is the excess of total emissions (direct emissions + indirect emissions) over direct emissions (third column). The greater this excess, the higher the indirect emissions. In sectors with high indirect emissions, the introduction of resource-saving technologies has the maximum emissions reduction effect for the economy as a whole. Such sectors include production of fertilizers, ammonia, cement, transport, and metallurgy.

FINDING 6. POSSIBILITY TO CHOOSE SECTORS FOR PUBLIC SUPPORT AS PART OF TRANSITION TO PROACTIVE CLIMATE POLICY

A similar approach was used to identify sectors that make the greatest contributions to solving Uzbekistan's *social problems,* including higher employment and bigger incomes from employment. For this purpose, the *employment* multiplier for **final product** and the *income from employment* multiplier for **final product** were calculated.

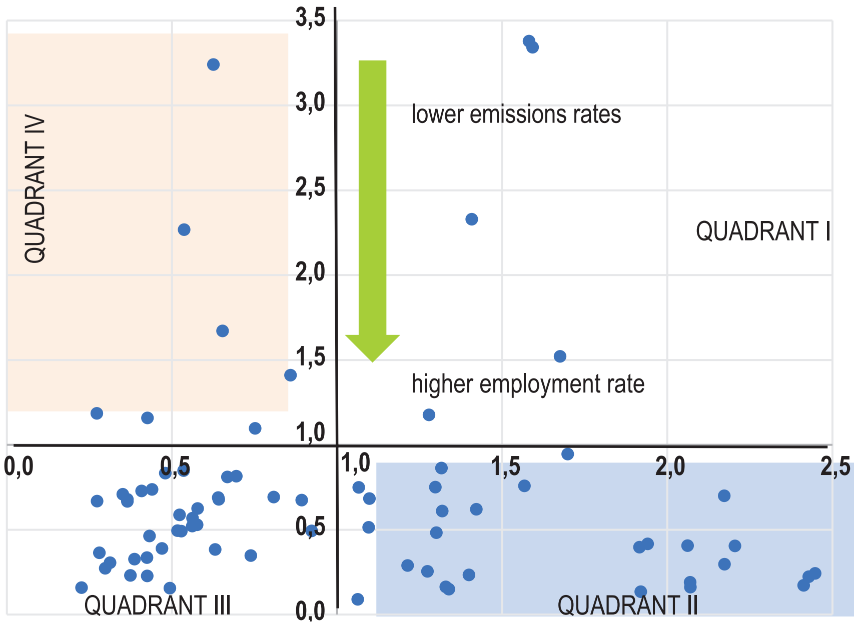
The combination of the emission multiplier and the employment multiplier made it possible to identify sectors in which moderate emission growth is combined with the largest contribution to **employment** growth (Figure 4). This condition is met by 14 sectors in the second quadrant (Figure 4, bottom right). It includes the **services sector** such as health, education, and employment services. These sectors are the *most promising targets of public support* as their development leads to both lower emissions and higher employment. These sectors account for only 10.2% of GDP, i.e. the current sectoral structure meets only 10% of the socially oriented green development. It also indicates the weakness of the business

FIGURE 4. DISTRIBUTION OF SECTORS BY QUADRANTS WITH HIGH (>> 1) AND LOW (<< 1) GROWTH RATES OF GHG EMISSIONS AND EMPLOYMENT



<u>Quadrant II:</u> Moderate emissions growth rate combined with the largest contribution to employment growth (14 sectors)

FIGURE 5. DISTRIBUTION OF SECTORS BY QUADRANTS WITH HIGH (>> 1) AND LOW (<< 1) GROWTH RATES OF GHG EMISSIONS AND EMPLOYMENT INCOME



<u>**Quadrant II:**</u> Moderate emissions growth combined with the largest contribution to growth of income from employment (21 sectors)

models adopted by national producers, who are interested in neither higher employment nor environment conservation.

Similarly, the combination of the emission multiplier and the income from employment multiplier enabled singling out sectors which combine moderate emission growth with the largest contribution to higher **incomes from employment** (Figure 5, right). These include 21 sectors also located in the second quadrant on the bottom-right of Figure 5.

Sectors in these two quadrants are those that, if stimulated, will help <u>simultaneously</u> reduce emissions, create new jobs, and increase incomes from employment. <u>Such scenario of economic growth can be considered as **socially oriented "green" growth**.</u>

FINDING 7. INTEGRAL MULTIPLIER CAN BE USED TO ASSESS THE DEGREE OF CLIMATE POLICY'S SOCIAL ORIENTATION

The proposed multipliers can be compiled into an integral multiplier to assess the social orientation of alternative "green" development scenarios.

An approach to forming an integral indicator: employment and income multipliers recalculated per unit of the emission multiplier and averaged by sector, with consideration of the weight of sector in the structure of employment or in the structure of incomes:

$$SGD(Lab) = \sum_j dlab(j)*(mult(Lab(j)) / mult(em(j)) / 78$$

$$SGD(Inc) = \sum_j dInc(j)*(mult(Inc(j)) / mult(em(j)) / 78$$

where:

dlab(j) is the share of sector *j* in the structure of employees (employment factor);

dInc (j) is the share of sector ***j in the total income from employment (the income from employment factor);***

(em(j)) is the share of sector *j* emissions in total emissions (the emission factor).

Integral multiplier: *0.7* SGD(Lab) + 0.3* SGD(Inc)*

The weighted values of social factors, i.e. the employment factor and the income from employment factor, can be changed as social goals are achieved. For example, with the higher external labor migration, the weighted value of the employment indicator can be increased, while with lower labor migration, the weighted value of the indicator by income can be increased respectively.

Uzbekistan*: SGD(Lab) = 2.16 and SGD(Inc) = 0.025.* The value of the integral multiplier for Uzbekistan = **1.52**.

The integral multiplier can be interpreted as follows:

If the higher social effect increases over several years with decreasing emissions, a **socially oriented "green" development** is achieved, i.e. *creation of new jobs and higher incomes from employment* (reduced emissions or slower rate of emission growth with a positive impact on social indicators).

Lower social effect indicates a **traditional** "green" development, i.e. emissions reduction regardless of how such policy affects employment and incomes from employment.

FINDING 8. MODERNIZATION IN THE ENERGY SECTOR: AN EFFECTIVE MEASURE TO REDUCE EMISSIONS

Calculations of the socio-economic impacts of emission control measures were exemplified by the energy sector. The key measure is technological modernization through introduction of modern combined-cycle gas and gas turbine technologies at 7 thermal power plants (TPPs). In 2015, UNDP released a report[4] that compares the technical characteristics of these technologies compared to outdated technologies. These data were incorporated into the Input-Output model.

Modeling results show **mixed consequences.** Undoubtedly, there was a decrease in emissions due to a decrease in the unit cost of gas for the production of a unit of electricity. Moreover, the reduction in emissions achieved by all sectors. The sector-average estimate of emissions was decreased: from **754** kg per 1 million UZS of growth in **final demand** to **631** kg, or 16%. This speaks about importance of implementation of resource-saving measures in the transition to low-carbon development pathway.

Table 6 shows the 15 sectors with the largest reductions in the emission multiplier that resulted from modernization of energy sector. Of these, only 4 are sectors with direct GHG emissions (highlighted yellow, those are electric power generation, waste processing, chemicals and cement production). Emission drops in other sectors resulted from their technological interlinks with the energy sector related to consumption of intermediate products. This confirms the importance of introducing resource-saving technologies not only in sectors with direct emissions, but also in *all other sectors that have technological interlinks* with the energy sector related to consumption of energy, water and other resources.

TABLE 6. 15 SECTORS WITH THE LARGEST DECREASE IN THE EMISSION MULTIPLIER THROUGH UTILIZATION OF RESOURCE-SAVING TECHNOLOGIES IN ELECTRIC POWER SECTOR (T/ UZS MLN OF GROWTH IN SECTOR'S OUTPUT)

# of Sector	Sector of economy	Emissions multiplier	мультипликатор выбросов		
			before modernization of electric power sector	after modernization of electric power sector	reduction
1 (33)	D35	Electricity, natural gas and conditioned air	11.268	8.959	-2.310
2 (36)	E38	Waste collection, treatment and disposal services; for waste disposal	8.714	8.552	-0.162

[4] Towards sustainable energy: a strategy for low-carbon development in the Republic of Uzbekistan. UNDP, Tashkent 2015, p.31.

# of Sector	Sector of economy	Emissions multiplier	мультипликатор выбросов		
			before modernization of electric power sector	after modernization of electric power sector	reduction
3 (19)	C20	Chemical products (production of mineral fertilizers and ammonia)	2.446	2.100	-0.346
4 (35)	E37	Sewer system services; sewage sludge	2.549	2.034	-0.515
5 (34)	E36	Natural water; water treatment and water supply services	2.523	2.012	-0.511
6 (76)	S94	Services provided by affiliates	1.757	1.408	-0.349
7 (16)	C17	Paper and paper products	1.711	1.371	-0.340
8 (22)	C23	Other non-metallic mineral products (cement production)	1.262	1.121	-0.141
9 (6)	B07	Metallic ores	1.148	0.917	-0.232
10 (75)	R93	Services in the field of sports and organization of entertainment and recreation	1.064	0.860	-0.204
11 (40)	H49-51	Transport services	0.875	0.782	-0.093
12 (78)	S96	Other individual services	0.895	0.725	-0.170
13 (4)	B05	Bituminous coal and brown coal (lignite)	0.888	0.717	-0.171
14 (23)	C24	Basic metals (metallurgy)	0.829	0.701	-0.127
15 (68)	O84	Public administration and defense services; social security services	0.714	0.585	-0.129

Sectors with direct emissions

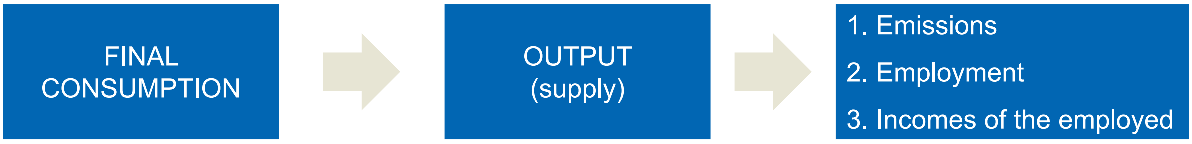
Source: Input-Output model-based calculations.

FINDING 9. MODERNIZATION IN THE ENERGY SECTOR NEGATIVELY IMPACTS EMPLOYMENT AND INCOMES FROM EMPLOYMENT

However, the impact of energy sector modernization on social indicators turned out to be negative. The general logic of this impact is shown in Table 7. Introduction of resource-saving technologies reduces demand for natural gas, transport services, chemicals, etc. This leads to smaller outputs in many industries, hence results to lower employment and decreased incomes from employment.

TABLE 7. REACTION OF ECONOMY AND SOCIAL INDICATORS TO TECHNOLOGICAL MODERNIZATION OF ENERGY SECTOR (MACRO LEVEL)

reaction of economy (technological interrelations)



сценарии моделирования (этапы)

	Final consumption (billion UZS)	Output (billion UZS)	Emissions (ths tons)	Employment (jobs)	Incomes (billion UZS)
a. BASELINE	255,151	398,771	160,144	4,071,604	57,306
b. MODERNIZATION OF THE ENERGY SECTOR (introduction of steam-gas units and turbogenerator units at , 7 thermal power plants)	No change (255,151)	Decrease by 600 billion UZS to 398,171	Decrease by 281 ths tons to 159,863	Decrease by 2,422 jobs to 4,069,181	Decrease by 94 billion UZS to 57,211
c. COMPENSATION: stimulating consumption while limiting emissions)	Increase by 499 billion UZS to 255,599	Increase vs stage (b) by 702 billion UZS to 398,873	Increase vs stage (b) by 281 ths tons to baseline 160,144	Increase vs stage (b) by 4,739 jobs to 4,073,920	Increase vs stage (b) by 101 billion UZS to 57,312

The first line is the baseline of the economy, emissions and social indicators. The second line is the effects made by the utilization of new technologies *while the volume of **final consumption** remains unchanged*. Thus, the volume of production will decrease by **600** billion UZS or **0.15%.** The employment will drop by **0.06%** but decrease in incomes from employment by **0.16%**. Accordingly, public budget revenues will also decline. In relative terms, these losses for the entire economy do not seem so great. **<u>However, one should not forget that these losses are exclusively associated with the energy sector modernization</u>**.

Thus, introducing new technologies in the energy sector will result in emissions reduction by **281** thousand t CO2-eq. with the same volume of **final demand,** but at the same time, this will worsen social indicators. This begs the question: by what value should the **final demand** be increased to achieve emission reductions but to compensate the negative social and economic impacts of utilization of new technologies in the energy sector?

The amount of compensation is shown in the third line of the table. To compensate for the negative social and economic impacts , the **final demand** should be increased by 499 billion UZS, which will be about **0.18%** of its baseline. Even such a slight growth of the **final product** turns out the economic decline (0.15%) into economic growth of **0.03%,** but this is *quite sufficient for compensation of negative social and economic impacts*.

Thus, resource-saving can be combined with growth of employment and incomes where enabling conditions are *simultaneously created for growth of **final demand*** (internal or external). In the transition to green development, it is important <u>to align the speed of introduction of green technologies and creation of enabling conditions for expanding market capacity</u>. Sectoral modernization policies require a selective approach: “green” technologies should first be introduced in areas that will help achieving the highest possible employment level. Additionally, own technological base, operation and maintenance of new equipment should be ensured. The emission reductions committed under the international treaties should be carefully considered and well-justified. They should not dominate over national social policy priorities such as boosting employment and poverty reduction.

FINDING 10. MODERNIZATION IN THE ENERGY SECTOR AFFECTS EMPLOYMENT AND INCOMES OF THOSE EMPLOYED IN OTHER SECTORS

Although the 0.15% decline is insignificant for the entire economy, the decline in output will be significant for certain sectors. Table 8 shows the effects of energy sector modernization on all sectors. In general, the economy may lose **2,420** jobs, 2/3 of which are highly paid (profitable) e.g. in natural gas exploration and supply, energy generation, manufacturing/processing sectors. Also, the financial and labor resources will be needed to compensate restoration of the lost jobs or provision of new jobs. Once again, it should be underlined that these are only the impacts of introduction of green technologies in the energy sector. The social and economic impacts of technological upgrading in other sectors have yet to be assessed and could be much complicated.

TABLE 8. IMPACT OF ENERGY SECTOR MODERNIZATION AND COMPENSATION MEASURES ON EMPLOYMENT (JOBS)

# of Sector	Sectors	Baseline (a)	After modernization (b)	Change in employment (b-a)	Increase of final consumption (c)	Change in employment (c-a)
1.	Agriculture, forestry and fisheries	564 790	564 773	-17	565 767	977
2.	Extraction of gas and oil	17 513	16 205	-1 308	16 233	-1 280
3.	Other extractive industries	58 306	58 267	-39	58 370	64
4.	Processing industry	584 735	584 544	-191	585 573	838
5.	Energy sector	69 349	69 189	-160	69 311	-38
6.	Water and irrigation	21 178	21 150	-28	21 187	9
7.	Transport	151 860	151 694	-166	151 961	101
8.	Building	201 427	201 425	-2	201 779	352
9.	Education	1 007 307	1 007 298	-9	1 009 071	1 764
10.	Health	440 362	440 356	-6	441 131	769
11	Other services	954 777	954 281	-496	955 970	1 193
	Total	**4 071 604**	**4 069 182**	**-2 422**	**4 076 343**	**4 739**

Methodology Used in the Analysis

Preliminary review of international practice found that there is no single or "adopted" methodology to assess the impact of GHG emissions reduction measures on socio-economic situation. **Most studies and researches assess the physical impacts of climate changes** (deterioration of water and air quality, temperature rise, damage from extreme weather events, etc.). These risks are well studied and assessed.

At the same time, *there is no methodology to assess the impact of the "green" development scenario on social indicators* (human health, incomes, employment, quality of life, etc.).

This analysis uses a methodology with certain features that require considering social factors, including the following:

- Consideration is given to the **social factor** based on generalization and analysis of existing hypotheses in the field of socially oriented climate policy around the world;
- Transition from total emissions to **specific emissions**;
- Calculation of direct, **indirect and total** emissions;
- Consideration of **technological relationships** based on the input-output approach;
- **Multipliers'** technique.
- **Correlation analysis** to assess the established stable relationships between specific emissions and factors affecting their formation;
- **Econometric analysis** to quantify the degree of influence form macroeconomic, structural and institutional factors on the dynamics of sectoral specific emissions;
- A modeling approach based on **prioritizing existing country statistical reporting** instead of selecting popular models and use them then based on the available statistics.
- The rationale behind using the **Input-Out** approach is threefold:
- First, this approach is based on a reliable Input-Output table for 78 sectors. This database is prepared by the State Committee for Statistics in Uzbekistan in line with international standards;
- Second, this approach allows assessing the impacts at the sectoral and macroeconomic levels as well as dividing the impacts into direct, indirect and total with consideration of the technological interactions across the sectors, singling out each sector production and imports, final and intermediate consumption.

Third, it allows linking the identified impacts to changes in employment and incomes of the population.

Recommendations

The main recommendation is to make sure that national priorities are secured prior to transition to proactive climate policy (more ambitious emission reduction commitments).

In formulation pf new emission reduction commitments, several risks should be considered. Transition to proactive climate policy may affect the country's socio-economic development should these risks be left unconsidered. More specifically, the recommendations are as follows:

First recommendation concerns the **formulation** of the country's new generation emission reduction commitments. It should not use the traditional commitment statement (i.e., reducing emissions by ...% by a certain year), but it should read as **"maintain the year 2017 level specific emissions"**. In other words, the country should make efforts not to exceed by 2030 the level of specific emissions attained in 2017;

Second recommendation. There is a need to develop a methodology for assessment of indirect emissions in all sectors to have a full picture of total emissions across all sectors;

Third recommendation. Changes in macroeconomic and institutional environment should be taken into account. It is complicated to achieve the global average values of macroeconomic and institutional factors in a short while. To begin with, individual macroeconomic and institutional indicators should be introduced into the set of indicators that will help to *annual monitoring of changes in macroeconomic and institutional environment in comparison with global trends*. Together with monitoring of technological modernization (at least for the key emitting sectors) and environmental indicators, this will enable continuous monitoring and analysis of efficiency of the climate investments.

Fourth recommendation. There is a need to change the technological modernization model. An analysis suggests that there are limited possibilities for combining carbon-intensity reduction with social goals. The solution is to switch to a technological modernization model using **double-dividend technologies (win-win technologies).** They help combining traditional impacts (economic and social) and climatic (environmental) ones. Search of such technologies should become a top priority for Uzbekistan's technological upgrading policy.

Fifth recommendation. Tools should be developed to prioritize green projects. Not always and not all green technologies are *socially oriented, environmentally friendly and economically efficient*. Another challenge is that the creation of new jobs in "green" sectors may require investments e.g. in retraining of workforce. Moreover, green technologies may have *negative environmental/health side sub-impacts* that may not be immediately identified or may be underestimated. *The toolkit for prioritizing "green" projects* will allow distinguishing between "climate" financing and "other" investments within investment programs in order to correctly estimate the socio-economic impacts of precisely "green" investments. Currently, this issue remains debatable in many countries, including Uzbekistan.

Sixth recommendation. There is a need to enlarge the share of *processing/manufacturing industry,* which has the biggest potential to create sustainable employment among all other sectors. Its share in the national economy's sectoral structure is one of the indicators of inclusive economic growth.

Seventh recommendation. The country should develop and introduce national carbon regulation. Governments of nations with active climate policies apply special measures to products from countries without carbon regulation. *These measures may include inter alia carbon customs duties* that are actively debated today in political discussions and literature, which often are referred as “carbon protectionism”.

For Uzbekistan, such barriers may become an additional source of risk associated with the Paris Agreement commitments. This is because such carbon taxation will be imposed not only on the export of carbon-intensive goods from the five emitters (sectors) but it also affects other ones as all 78 sectors have a carbon footprint. Another reason for the high carbon intensity of exports and other goods in Uzbekistan is its technological backwardness, which is hard to reduce or eliminate within a short while. Regardless of the reasons, **the lack of in-country carbon regulation will increase Uzbekistan’s vulnerability to carbon barriers imposed internationally**.

The emission multipliers can be used to: a) develop *in-country carbon regulation* and b) establish a mechanism to *encourage enterprises to upgrade their equipment*. Emission reductions can be stimulated by the introduction of a domestic emission taxation (carbon tax). To this end, all sectors can be classified into categories: high carbon footprint (*category* 1, more than 3 tons), relatively high carbon footprint (*category* 2, from 1 to 3 tons), medium carbon footprint (*category* 3, from 0.5 to 1 ton), moderate carbon footprint (*category* 4, from 0.2 to 0.5 tons), low carbon footprint (*category* 5, less than 0.2 tons).

Eighth recommendation. There is a need to boost the afforestation. Obvious and simple as this recommendation may seem, it is of special significance for Uzbekistan. This is due to the fact that in recent years, *an increased carbon sink* has been observed in “Forestry” sector”. Although the overall amount of CO2 sink is still small (about 2.5% of total emissions), afforestation efforts should be further strengthened. This requires, firstly, unconditional afforestation as part of ongoing programs; and secondly, stronger measures to reduce pastureland degradation. These efforts should target a *2-fold expansion of the forest covered area by 2030 compared to 2020*.

Ninth recommendation. The country needs to build statistical capacity compatible with the requirements of proactive climate policy. Currently, statistics are not well-prepared to inform and help in monitoring progress in implementation of proactive climate policy.

Further research and modeling may help in further detailing and specifying each recommendation.