Chapter 7
Decarbonization Trends in the Largest Post-soviet Countries and the Specifics of Their Inclusion in the Global Climate Agenda

Lyudmila Yu. Bogachkova, Lidiya S. Guryanova, and Nadezhda Yu. Usacheva

Abstract The research purpose is to identify the features and problems of the inclusion of Kazakhstan, Russia, and Ukraine in the global climate agenda through the analysis of aggregated indicators of decarbonization of these countries' economies. The final goal is to support the adoption of managerial decisions aimed at ensuring the sustainable development of these largest post-Soviet countries. The study outlines a modern vision of the technological conditions for the green transformation of world energy (energy transition) and describes the common economic tools of the global climate agenda. The ambiguity of the concept of "inclusiveness" of this policy has been revealed. It is argued that the consistency in achieving the entire set of sustainable development goals including not only economy's decarbonization, but also inequality reduction and improvement of the population welfare is of utmost importance for emerging markets which, according to the UN, include the post-Soviet countries under consideration. A comparative analysis of the dynamics of aggregated indicators of the carbon intensity of the economies of Kazakhstan, Russia, and Ukraine for 1990–2020 has been carried out. Prospects for improving their climate and energy policy have been discussed to support decision-making aimed at the coordinated achievement of energy policy goals.

L. Yu. Bogachkova (✉) · N. Yu. Usacheva
Volgograd State University, Volgograd, Russia
e-mail: bogachkova@volsu.ru

N. Yu. Usacheva
e-mail: n.y.usacheva@volsu.ru

L. S. Guryanova
Kharkiv National University of Economics, Kharkiv, Ukraine

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7.1 Introduction

A new annual report of the UN Intergovernmental Panel on Climate Change [18] published in August 2021 provides impressive data indicating the development of the global warming process and negative changes in the Earth's climate system, including those that seem to be irreversible. According to the authors of the report, 234 experts from 66 countries, the apparent driver of these processes is the anthropogenic impact on the environment, emissions of greenhouse gases (GHG) into the atmosphere, including the emission of carbon dioxide (CO_2), formed mainly in the field of traditional energy when burning hydrocarbons.

A purposeful transition (energy transition) to green energy, which exploits renewable energy sources (RES), such as hydroenergy, solar energy, and wind energy, is the main way to prevent global warming recognized by the governments of most countries and cross-country associations. The Global Energy Transition Strategy has been developed and implemented under the auspices of the UN with the aim of creating a low-carbon, energy-efficient, and inclusive green economy, characterized by the involvement of previously unclaimed natural and labor resources in production processes [30].

In the modern world, a broad consensus has been reached on measures for preventing climate change, despite the fact that there are climate skeptics among scientists and political and public leaders who question the anthropogenic nature of global warming [2, 7, 16, 24, 26] and the feasibility of the conception of energy transition [5].

In 1992, heads of a number of states adopted the Framework Convention on Climate Change [4]. Later in 1997, the leaders of 159 developed countries signed the Kyoto Protocol thus committing themselves to the reduction of greenhouse gas emissions during 1997–2012 (the first stage) and 2013–2020 (the second stage). As a result, tens of billions of dollars were invested in renewable energy. Finally, in September 2015, the heads of 193 states agreed on the 2030 Agenda for Sustainable Development (hereinafter referred to as the Climate Agenda), which included 17 Sustainable Development Goals (SDGs) [31]. The goals are as follows: cutting off subsidies for the use of fossil fuels and creating conditions in which the perpetrators of environmental pollution would pay for the negative consequences of their activities (SDG 13); application of environmentally friendly technologies, reduction of greenhouse gas emissions (SDG 9); increasing the share of renewable energy in the global energy balance (SDG 7); poverty elimination (SDG 1); inequality reduction (SDG 10) [29], etc.

In December 2015, the Paris Agreement was signed to secure the obligations of countries to implement the Climate Agenda. The main goal of the Paris Agreement is to keep the rise in mean global temperature to well below 2 °C above pre-industrial levels and preferably limit the increase to 1.5 °C by reducing global greenhouse gas emissions down to zero level by 2050, i.e., to achieve such a level of harmful emissions, which will be balanced by the absorbing capacity of forests and oceans. Currently, 191 countries have joined the Paris Agreement [29, 31].

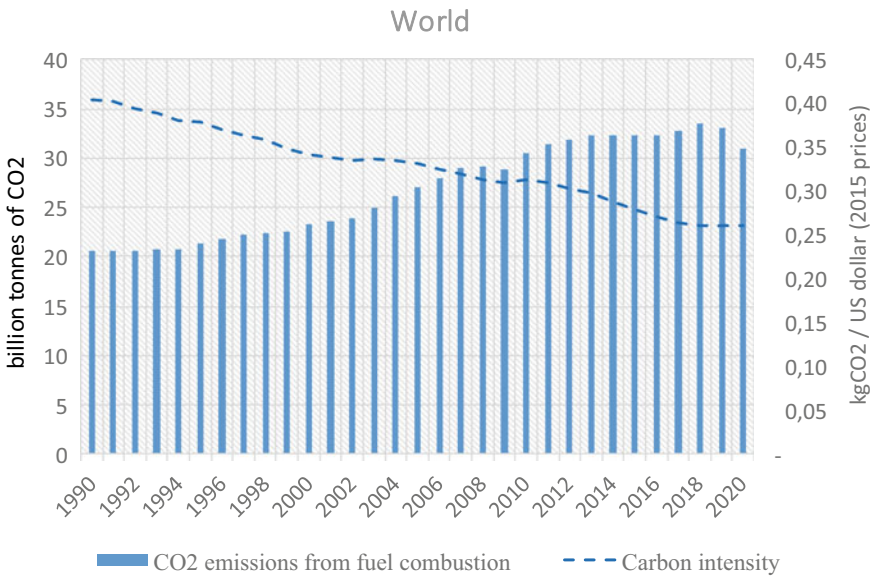

Fig. 7.1 Carbon dioxide emissions (on the left) and carbon intensity (on the right) of the world economy. *Source* Compiled by the authors based on [8, 11]

The effectiveness of international climate policy can be judged by the dynamics of the total volume of CO_2 emissions on the planet and by the aggregate indicator of the carbon intensity of the world economy, which is calculated as the ratio of global CO_2 emissions to the world gross product (Fig. 7.1). Figure 7.1 shows that from 1990 to 2018 carbon intensity had been declining every year by an average of 7 g. of CO_2 per one dollar of value added (at constant prices of 2015). However, the gross volume of carbon dioxide emissions had been increasing on average by 542.09 million tons per year [12]. In the last pre-pandemic year of 2018, global CO_2 emissions made 33.5 billion tons.

Despite the fact that from 2018 to 2020, the volume of global CO_2 emissions decreased from 33.5 to 31.1 billion tons (see Fig. 7.1), this is rather explained by the negative impact of the COVID-19 pandemic on global industrial production than by climate policy efficiency.

Therefore, CO_2 emissions are expected to show growth trends in the course of the post-pandemic recovery of the global economy. This means that the peak in CO_2 emissions has not yet been passed, and more work remains to be done to achieve zero CO_2 emissions—the main goal of the Paris Agreement.

The research purpose is to identify the features and problems of the inclusion of Kazakhstan, Russia, and Ukraine in the global climate agenda through the analysis of aggregated indicators of decarbonization of these countries' economies. The final goal is to support the adoption of managerial decisions aimed at ensuring the sustainable development of these largest post-Soviet countries.

7.2 Methodology

The study is based on the use of general scientific methods of analysis and synthesis, descriptive statistics, and comparative analysis, as well as graphical and tabular visualization of results. The research materials are represented with analytical and statistical data of the UN, the International Energy Agency, the independent information and consulting company Enerdata, the BloombergNEF research center, the Russian Center for Strategic Research, and other sources.

7.3 Results

The system of measures developed to implement the Climate Agenda includes a number of technologies and economic policy tools.

Technological conditions of the energy transition. While discussing the technologies required for the planet's transition to a carbon–neutral state, it is reasonable to compare two mid-2021 expert reports on the development of world energy until 2050. One of them was issued by the International Energy Agency (IEA) [20], and the other by the BloombergNEF research center [21].

The IEA report [20] contains the traditional vision of energy decarbonization based on the development of renewable energy sources (RES), solar and wind energy in particular. Let us note that in this case, the massive introduction of nanotechnology can play an important role in increasing the efficiency of RES generation and energy storage [14, 19]. At the same time, according to the IEA experts, the possibilities of achieving a zero balance of emissions by 2050 through the use of RES generation are very limited.

Contrary to the existing green tradition, the report prepared by the BloombergNEF analysts for the first time announces the ambiguity of low-carbon development and outlines three scenarios—"green", "gray", and "red", which are not necessarily alternative [21]. All scenarios envisage an increase in the share of electricity in final energy consumption from the current 19% to 49% but the generation of electricity is carried out in different ways. The green scenario, as always, is based on the powerful development of renewable energy sources; the gray scenario assumes the preservation of gas and coal generation and a large-scale implementation of carbon capture and storage (CCS) technology; and according to the red scenario, decarbonization is provided primarily by means of nuclear energy production. Thus, it is increasingly recognized by the global expert community that not only renewable energy sources, but also hydrogen, nuclear energy, and carbon capture can play an important role in achieving zero emissions in the world.

From the viewpoint of the climate agenda, special attention should be paid to nuclear energy, since direct CO_2 emissions from nuclear power plants are practically zero. Today, there are 443 operating nuclear reactors in 34 countries around the world. On a global scale, the operation of all nuclear power plants in the world prevents the

emission of greenhouse gases in the amount of 2 billion tons of CO_2 equivalent per year, which is commensurate with the absorbing capacity of the entire forest area of the planet [22].

Scientists at the Joint Research Center under the European Commission performed a comparative analysis of various methods of generating electricity in terms of material consumption, emissions of pollutants into the atmosphere, impact on human health, and life expectancy [27]. As a result, it was found that in normal operation, nuclear energy is highly competitive with the green methods of energy generation. However, within the framework of the European climate strategy, the issue of recognizing nuclear energy as a sustainable source of clean generation has not yet been resolved.

The Russian standpoint on the peaceful atom is unambiguous: it will be impossible to solve the tasks of the climate agenda in the medium term without the use of nuclear energy [22].

Economic tools of the climate agenda. The climate agenda includes a wide range of economic tools [23]. International financial institutions, investment funds, and insurance companies are in transition toward de-investment in projects related to the exploitation of hydrocarbon energy resources and large volumes of CO_2 emissions. Stock exchanges and shareholders require companies to disclose their greenhouse gas emissions. In the field of carbon reporting, both voluntary initiatives (for example, the Carbon Disclosure Project [3]) and mandatory requirements (Directive 2014/95/EU44) have been developed. ESG (environmental, social, and governance impacts) reporting is becoming one of the factors that predetermine the success of large- and medium-sized enterprises. Energy efficiency standards and requirements are becoming more widespread around the world [13].

The International Civil Aviation Organization and the International Maritime Organization have developed and are currently implementing guidelines aimed at compliance with mandatory measures to improve energy efficiency and reduce GHG emissions from international air travel and shipping.

Today, green finance, green certificates in particular, have become widespread in the world. Initially, they were used to record and confirm the production and consumption of electrical energy based on alternative renewable energy sources. Later, a market for these financial instruments was formed. This market was used to attract private capital to the RES sector allowing companies to fulfill their environmental or social obligations, as well as to enhance a "climate responsible" image of the business. However, green certificates usually only apply to alternative RES (wind, solar, and small-scale hydropower), which limits support for low-carbon energy sources such as nuclear and large-scale hydropower [23].

Carbon pricing is one of the most drastic measures to ensure the reduction of greenhouse gas emissions. This economic tool implies financial obligations for companies-producers of CO_2 emissions and other harmful substances. Both mandatory and voluntary carbon pricing is applied in practice. Three types of carbon pricing can be distinguished: carbon tax; emissions trading system; mixed schemes.

In the Summer of 2021, it became known about the plans of the European Union to tighten the European climate agenda which includes the introduction of a cross-border tax on goods and services with a large carbon footprint imported into the EU [6]. Thus, it is planned to equalize the competitive conditions of European and foreign companies. The fact is that since 2005, European producers have paid for greenhouse gas emissions, while importers from other countries do not usually incur such expenses. Based on expert estimates, Russia and Ukraine will bear the greatest losses associated with the introduction of this carbon tax. For Russia in particular, losses can amount to €1.1 billion per year [28]. This makes urgent the problem of inclusiveness of the climate agenda in relation to countries with emerging market economies and the problem of adaptation to the energy transition of countries that export goods to the EU.

Understanding the inclusiveness of the global climate agenda. The concept of inclusiveness is multifaceted and is widely used in the energy transition literature. In a broad sense, inclusiveness is the involvement of countries in the global climate agenda. In the UN program aimed at the preservation of the environment, the term "inclusiveness" is used to denote the widespread production use of previously unclaimed natural and labor resources based on the development of renewable energy sources [30, p. 16].

The concept of inclusiveness has one more meaning which is important for developing countries and countries with economies in transition—conformity of climate change prevention (SDG 13) with other sustainable development goals, such as poverty elimination (SDG 1), improving the well-being of population (SDG 3), inequality reduction (SDG 10), and others [17]. The fact is that the climate policy tools developed for the leading countries (carbon pricing and promotion of alternative RES generation) lead to an increase in prices for energy and other goods. For this reason, relatively low-income populations in the developing countries and countries with economies in transition may have to spend a larger share of their income on electricity and gasoline. This leads to the deterioration of already low living standards and to exacerbated inequality in these countries and consequently contradicts SDGs 1–3 and SDG 10. In our opinion, ensuring the inclusiveness of climate policy in relation to these countries, understood as achieving consistency among all the goals of sustainable development, requires a synthetic approach to the choice of means of the energy transition. This implies the need to go beyond the traditional climate policy, which is limited by the regulation of price levels, the choice of specific methods of carbon pricing, and one or another form of compensation for losses of the most vulnerable segments of the population [17]. A set of additional measures is also required, including the development of safe nuclear energy, the introduction of carbon capture and storage (CCS) technologies, etc.

On the inclusion of the largest post-Soviet countries in the climate agenda: obligations and economies' carbon intensity dynamics. Kazakhstan, Russia, and Ukraine are the largest CO_2 emitters in the post-Soviet space. These countries are characterized by the largest population and production scale [1]. Table 7.1 shows the climate goals and obligations of the countries under consideration as parties to

Table 7.1 Basic, expected, actual, and target levels of GHG emissions in Russia, Kazakhstan, and Ukraine (exemplified by CO_2)

Year		1990	2018 (pre-COVID)		2030
Level Country		Basic	Expected	Actual	Target
Russia	mln tons	2,163.50	1,747.03	1,587.00	1,568.54
	%	100	80.75	73.35	70–75
Kazakhstan	mln tons	237.3	204.08	214.0	189.84
	%	100	86	90.18	75–85
Ukraine	mln tons	688.6	495.79	181.8	No more than 413.16
	%	100	70	26.4	no more than 60

Source Compiled by the authors based on [31]

the Paris Agreement to reduce greenhouse gas emissions. Thus, in a broad sense, the inclusion of Kazakhstan, Russia, and Ukraine in the climate agenda is currently proceeding.

If we assume that the movement of countries toward the set goals will take place through a uniform reduction of emissions (both by years and by types of GHGs), then the estimation of volumes of CO_2 emissions in 1990 will allow us to easily calculate the expected levels of emissions that should have been achieved by the last pre-COVID year of 2018. Comparison of actual CO_2 emissions with their expected values demonstrates the effectiveness of achieving the set goals (Table 7.1).

As shown in Table 7.1, Russia is reducing CO_2 emissions ahead of schedule: in 2018, the actual level of emissions (1,587 million tons) was lower than the expected level (1,747.03 million tons). Kazakhstan demonstrates the opposite trend: the expected level (204.8 million tons) is lower than the actual one (214 million tons), which can be considered as a sign of deficiency of the corresponding state policy.

Finally, Ukraine is fulfilling its commitments to reduce CO_2 emissions much ahead of the curve: actual emissions (181.8 million tons) are well below the expected level (495.79 million tons). Thus, against the background of growing global emissions (Fig. 7.1), the volumes of CO_2 emissions in the largest post-Soviet countries are decreasing (Table 7.1).

There is also a decrease in the relative shares of Kazakhstan, Russia, and Ukraine in the global volume of CO_2 emissions (Fig. 7.2).

Figure 7.2 shows that in 1990 the total contribution of the three countries to global emissions was about 15%, and by 2018, it decreased to 6% and mainly due to Russia's green policy. The shares of Russia and Ukraine in global emissions have more than halved. Kazakhstan's contribution decreased slightly. Thus, Kazakhstan, Russia, and Ukraine are not responsible for the increase in global CO_2 emissions (Fig. 7.1).

The carbon intensity of the economies of Kazakhstan, Russia, and Ukraine is also decreasing at a faster pace as compared to the global dynamics (Fig. 7.3). According to the data of the International Energy Agency, over the period of 1990–2018, CO_2 emissions per unit of value added decreased by 35% on a global scale, by 40%—in Russia, by 59%—in Ukraine, and by 58%—in Kazakhstan.

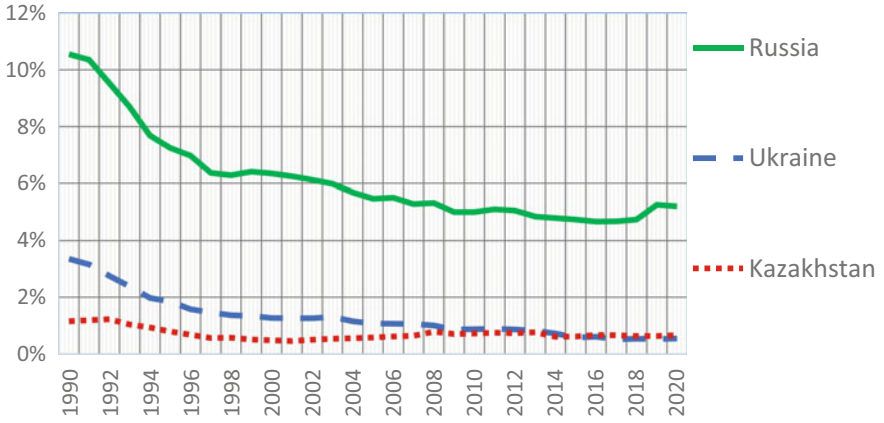

Fig. 7.2 Contributions of Russia, Kazakhstan, and Ukraine to global greenhouse gas emissions over the period of 1990–2020. *Source* Compiled by the authors based on [8, 11]

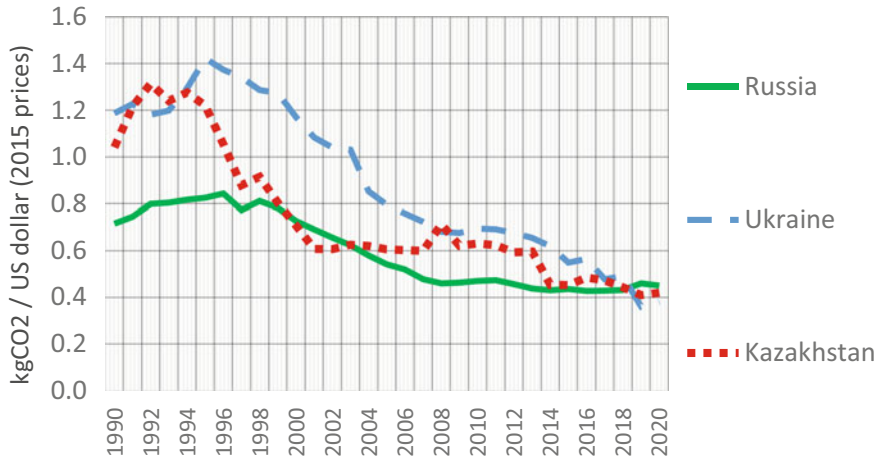

Fig. 7.3 Carbon intensity or CO_2 emissions per GRP unit at purchasing power parity in 2015 US dollars. *Source* Compiled by the authors based on [8, 11]

Reduction of CO_2 emissions and downward trends in the dynamics of relative contributions of Kazakhstan, Russia, and Ukraine to global emissions, as well as the decrease in the carbon intensity of their economies, give the impression of a high degree of these countries inclusion in the climate agenda.

Factors reducing the economy's carbon intensity and the problem of consistency of various sustainable development goals. The achievement of the described results in Kazakhstan and Ukraine was facilitated by the high rates of RES development, stimulated by green tariffs. In 2018, Kazakhstan ranked first among countries under

consideration in terms of contribution of RES generation facilities, including hydroelectric power plants, to electricity generation. At the same time, a slight decrease in Kazakhstan's contribution to global CO_2 emissions (Fig. 7.2) can be explained by the relatively high rates of economic growth in this country and the structure of energy balance, in which coal has the largest share [1].

Russia's economy is characterized by a relatively low level of carbon intensity as compared to Kazakhstan and Ukraine (Fig. 7.3) due to the large shares of hydro and nuclear generation in electricity production. High rates of nuclear energy development have a positive effect on the reduction of CO_2 and other greenhouse gas emissions.

As shown in Table 7.1, over the period of 1990–2018, Ukraine had ranked first among the countries under consideration in terms of reduction of CO_2 emissions (in % to the level of 1990). In 2020, Ukraine made the smallest contribution to global emissions (Fig. 7.2) and reached the lowest level of the economy's carbon intensity (Fig. 7.3). It is also known that over the past 5 years, the country had achieved the greatest success in increasing the contribution of solar and wind power plants to the total volume of electricity generation. This was facilitated by large-scale foreign investment [1], which testifies to a high degree of inclusiveness understood as involvement in the process of wind and solar energy generation. However, the main factors behind these results also include a deep economic recession, a sharp decline in the real disposable income of the population, deindustrialization, industrial decline, and the war in Donbas [1]. Thus, Ukraine's inclusion in the climate agenda, understood as consistency in achieving sustainable development goals, is highly problematic.

In all post-Soviet countries, the systemic economic crisis that followed the collapse of the USSR and its negative socio-economic manifestations played a significant role in reducing CO_2 emissions. Real GDP growth rates in 1995–2018 were lowest in Ukraine (128.51%), medium in Russia (197.57%), and the highest in Kazakhstan (345.14%) [1]. In the course of the economic development of these countries, other conditions being equal, the trends in CO_2 emissions may be reversed. In this regard, despite the reduction in the contributions of Kazakhstan, Russia, and Ukraine to global CO_2 emissions, coordinators of the United Nations Environment Program (UNEP) assess the progress of Russia and Ukraine in the field of decarbonization of the economy as "critically insufficient" and the achievements of Kazakhstan as "insufficient" to achieve the goals of the Paris Agreement [23, p. 21].

Enhancement of national energy policies for coordinated achievement of sustainable development goals. The problem of modernizing energy policy in Kazakhstan, Russia, and Ukraine has become urgent and aggravated against the background of the anticipated introduction of cross-border carbon regulations by the European Union [25]. All three countries are major suppliers of goods with a large carbon footprint to the EU, and their losses from the introduction of the cross-border carbon regulations are estimated by analysts at billions of dollars. To reduce and neutralize the expected damage, it is planned to use national systems for monitoring CO_2 emissions and internal trade in CO_2 emissions.

Kazakhstan already has an exchange for trading CO_2 emissions, and now this republic has announced plans to introduce its own cross-border carbon regulation similar to the EU to reduce the tax burden on Kazakh exporters to the EU. Experts admit the possibility of creating a unified carbon regulation system in the EAEU after the unification of the gas and energy markets in 2025 [25].

Today, Russia does not have an internal carbon pricing system. To exclude payments of the carbon tax to the EU countries, Russia is developing the mechanisms of internal regulation of emissions with payments to the state budget. It is also planned to achieve recognition of this regulation at the international level so as to replace payments to the EU budget with internal payments for CO_2 emissions in Russia [10, 15].

Ukraine also plans to launch an internal emission trading market as part of the country's obligations under the Agreement of Association with the European Union. Ultimately, the EU's position on the introduction of the cross-border carbon regulations in relation to Ukraine will depend on the degree and quality of implementation of this agreement [9].

To solve the problem of the inclusion of post-Soviet countries in the coordinated achievement of various sustainable development goals, it is advisable to use nuclear power, which is characterized by a low-carbon nature and high technological and economic efficiency. The most promising areas for the development of this industry are represented with two-component nuclear power with a closed fuel cycle, hydrogen power, and mass commercial production of small-scale nuclear power plants for power supply to remote regions [22].

7.4 Conclusion

Thus, the inclusion of the post-Soviet countries in the climate agenda and sustainable development policy can be ensured through the enhancement of national energy strategies in the following areas: an integrated approach to the choice of technologies for the transition to low-carbon energy, including the elements of the gray and red scenarios in addition to the green trend; introduction of national systems for monitoring greenhouse gas emissions and CO_2 emissions trading; development of transparent competitive market mechanisms for stimulating renewable energy generation; and creation of the conditions for attracting investments in the capital market by means of green finance.

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