

CLIMATE CHANGE, ENERGY AND ENVIRONMENT

GREEN GROWTH AND INNOVATION

Measuring Progress in Transition from
Planned to Market Economies

George Safonov
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Spurring green growth and innovation has positive impacts on economic growth and diversification, creation of new jobs, and environmental and human health.



Green growth and innovation are crucial aspects of building environmentally, socially, and economically sustainable societies in the modern world.



The CEECCA region faces a challenge in implementing sustainability-oriented technology and »greening« its economy. Many of these countries are lagging, but a few are among leaders in Europe.

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EXECUTIVE SUMMARY

The economies of Central and Eastern Europe, Caucasus, and Central Asia (CEECCA) grew at a varying pace in 2000–2019, with an average rate of 6.5 percent per annum (measured in gross domestic product in purchasing power parity, GDP, PPP). This economic progress was accompanied by some positive changes in environmental performance, but not in all areas and not in all countries in the region. For instance, carbon emissions have declined in most of the countries, but particulate matter (PM_{2.5}) concentration and related economic losses increased substantially and have now reached rather high levels.

The monitoring and control of green growth is not possible without a reliable information system (such as the OECD Green Growth Indicators); however, to date, over 70 percent of data on the relevant performance of CEECCA countries is missing. The available information shows some progress in green growth, particularly in the high-income states of the region, but still not comparable to the OECD level. All CEECCA countries have low spending on research and development (R&D), weak innovation activities, and a lack of competences in the mainstream green innovation and technologies. The green innovation is primarily focused on the absorption of innovation developed in foreign countries, including their adjustment and adaptation to the local needs, which will likely continue in the medium-term future.

To promote green growth and innovation in CEECCA countries, the following measures can be recommended:

Strategic planning. Development and upgrade of the national green growth strategy that sets ambitious »green« goals with quantitatively determined milestones for the short-, medium-, and long term. The strategy needs to be accompanied by a roadmap in which targets (expected results) are identified for specific sectors, regions, industries. The strategy should also outline the implementation mechanisms, legal, institutional, and other frameworks. The national socio-economic and environmental context must be taken into consideration.

Data and information. Introduction of the OECD Green Growth Indicators system as the information basis for monitoring progress in green growth, identification of failures, development of corrective actions, and setting specific targets for the future. Based on previous experience, it is evi-

dent that data collection for such systems is extremely difficult within the existing statistical reporting systems of CEECCA countries. Thus, many substantial improvements may be required, including the enhancement of the capacity of statistical services, adjustment of methodologies, and the creation of relevant reporting standards.

Implementation mechanisms. Based on the objectives and quantitative targets determined in green growth strategy, a set of mechanisms and instruments should be developed. The detailed analysis of the socio-economic context may help in defining specific instruments that could be selected from a long list of well-known ones from the international experience. These may include green taxes, pollution fees, various forms of subsidies for green transport and industrial technologies, removal of existing huge subsidies for fossil fuels, green procurement, as well as many others. The legal frameworks for the application of these tools must be developed as well.

Awareness-raising. Lots of measures may be implemented via behavioral changes in firms and individuals, who can be producers, consumers, and prosumers favoring green practices and products. The scale of these grassroots activities may depend on the features of the national and local economy, cultural specificity, and consumption patterns. However, the stronger the will of people to incorporate green activities and technologies, the faster and sounder the green growth will be.

Capacity building. Ambitious green targets will require extensive changes in the economy, including in both production and consumption practices. Many sectors will look quite different from what has been in place for many decades before. To accomplish these targets, strong capacity is needed both in terms of well-educated and qualified specialists and institutional structure. The education and advanced training programs focused on green economy and innovation are to replace and upgrade the existing systems.

Innovation and technologies. All CEECCA countries, even the high-income ones, are far behind the developed and large developing countries in patenting and innovation activities. For many regional economies, the absorption of innovations developed overseas may be an effective solution for the short- and medium-term future. However, for those

with sufficient capacity and resources, some focused innovation developments are relevant. Overall, R&D must significantly increase in all CEECCA countries; thus far, underfinancing from both public and private sources has been observed compared to many OECD countries.

Financial sources. The experience of many CEECCA countries (with Poland in the lead, receiving 17 percent of total EU funding) shows that external financial sources could play a critical role in green growth. These include the EU funds, projects funded by IFIs, the Green Climate Fund, and many others. The financial resources for the green economy can also be generated domestically, e.g., through pollution fees, fossil fuel fees, or auctions of carbon allowances. In some cases, win-win approaches can be applied, such as introduction or increase of levies for polluting products with a simultaneous reduction of taxes on labor, so that the greening measures would stimulate employment and increase social well-being.

International context. The international commitments and opportunities must be taken into consideration when developing green growth targets. Participation in the UN ecological conventions such as the UNFCCC provides CEECCA countries with access to additional sources of »climate« finance (at the global scale of 100 billion USD per year after 2020), as well as technology transfer, capacity building, and awareness-raising support. The green growth strategy may be combined with the low carbon development strategy, as required under the Paris Agreement.

Coordination and implementation systems. A functional implementation system is a necessary precondition for the effective implementation of the strategic plans. It should correspond to the national circumstances and legal and institutional frameworks, as well as reflect the international best practices to ensure coherence with up-to-date approaches to green growth and innovation. The engagement of business and dialogue requires a step-by-step approach, needs to be strategic, and finds ways to account for many vested interests.

The flagship projects. Many CEECCA countries demonstrate the political will for the implementation of national flagship projects in green technologies and innovations. Such (potentially) breakthrough projects could be considered priorities for concentrated actions under the Green Growth Strategy; however, they should be able to bring tangible and rather fast results both in terms of commercial effect and improvement of environment and population well-being. The flagship projects cannot resolve the green growth challenges if they cannot be expanded to a nationwide and/or global scale.

INTRODUCTION

Many policymakers and economists in Central and Eastern Europe consider environmental protection to be an unnecessary burden hampering economic growth. As this is far from the truth, this study aims to shed more light on the role of green growth in improving the economic well-being of a population, quality of life, and promoting sound and sustainable development in the long run.

The terms »green growth« and »green innovation« are spreading wide in the modern world. With origins in the concept of sustainable development (meeting the needs of the present generation without compromising the ability of future generations to meet their own needs), green growth has a relatively narrow meaning. OECD defines it as »fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies.« [OECD, 2020]

More broadly, green growth may also be interpreted as a process of creating a green economy, meaning that »to be green, an economy must not only be efficient, but also fair, recognizing global and country level equity dimensions, particularly in assuring a just transition to an economy that is low-carbon, resource efficient, and socially inclusive« [UNEP]. Thus, three dimensions of green growth should be taken into account: »sustaining and advancing economic, environmental and social well-being« [World Resources Institute].

Green growth is practically unattainable without green innovation, which is »the development and commercialization of new ways to solve environmental problems through improvements in technology (encompassing product, process, organizational, and marketing improvements)« [World Bank].

Green growth and green innovation go hand in hand, as international experience tells us. Patenting activities worldwide have been increasing in recent decades, and over 10 percent of recent patents are related to green innovation. Recent studies show that spurring green technologies has mostly the positive impacts on economic growth and diversification, the creation of new jobs, and improving environmental and human health.¹

Spending on environmental protection, R&D, green infrastructure development, the introduction of renewable energy, and climate and environment-friendly technologies has been increasing globally, not only in developed and large developing countries. The global economy is experiencing the new industrial revolution (»Industry 4.0«) in which green innovation plays a pivotal role. The UN Paris Climate Agreement and Sustainable Development Goals (SDGs), adopted in 2015, clearly set low carbon green growth as a mainstream of global development, with the target of nearly zero global carbon emissions right after 2050 (art. 4.19 of Paris Agreement).

The CEECCA countries are not really out of these trends; many of them have been engaged in green innovation, though there is still a lot to be done. There were successes and failures, mistakes and achievements, and the lessons learned can help to improve decision making and effective implementation of proper measures in the future. This study covers 27 countries of CEECCA region, including Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Macedonia FYR, Moldova, Montenegro, Poland, Romania, the Russian Federation, Serbia, Slovak Republic, Slovenia, Tajikistan, Ukraine, and Uzbekistan.

¹ See, for example, Ifrim et al. (2018): The Impact of Green Innovation on Organizational Performance: Evidence from Romanian SMEs, *Academic Journal of Economic Studies*, Faculty of Finance, Bank-

ing and Accountancy Bucharest, »Dimitrie Cantemir« Christian University Bucharest, vol. 4(1), pp. 82–88, March 2018; Aldieri L./Vinci C. P. (2018): Green Economy and Sustainable Development: The Economic Impact of Innovation on Employment, Sustainability 10, 3541; Sezen, Çankaya (2013): Effects of Green Manufacturing and Eco-Innovation on Sustainability Performance, *Social and Behavioral Sciences* 99(6): 154–163.

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GREEN GROWTH AND INNOVATION: WHERE ARE WE NOW

The CEECCA countries have a total gross domestic product (GDP) of 3.2 trillion USD and a population of 405 million people (as of 2017). The income distribution of these countries varies and can be divided into 10 higher-income states, 10 upper-middle-income states, and 7 lower-middle-income states² (Table 1).

In the last two decades, all CEECCA countries demonstrated substantial economic growth (Figure 1). The total gross national income has tripled, and individual growth varied from a 2-fold rise in Slovenia to a 5-fold rise in Azerbaijan. The average annual GDP growth reached 6.5 percent in the region as a whole. However, the question remains whether this economic growth was sustainable and environmentally friendly or harmful to the natural resource capital, the environment, and the quality of people's life.

The traditional metrics of socio-economic activities (such as GDP and per capita income) are unable to provide an adequate measurement of the performance of countries in pursuing economic development, social progress, and environmental goals simultaneously. As a means to this end, many international institutions, such as OECD, UNDP and World Bank, developed a broad range of alternative indicators.

The OECD published a comprehensive list of green growth indicators, specifically including environmental and resource productivity, natural asset base, environmental dimensions of quality of life, economic opportunities, and policy responses, socio-economic development. Many CEECCA countries are providing statistical information to the OECD statistical database, but not all countries and not all required data are presented there so far.

The performance of CEECCA economies was heterogeneous over the last 20 years (Table 1). Notably, the total regional GDP productivity per ton of CO₂ emission and energy productivity (measured in GDP per unit of primary energy) increased almost twofold, and the renewable energy share in total primary energy supply did not change. At the same time, the total exposure of the population to hazardous air pollution by particular matters (PM_{2.5}) increased by 17 per-

cent. Significantly, the mortality rate (premature deaths per 1 million inhabitants) caused by PM_{2.5} pollution declined by 15 percent, and associated welfare losses declined from 10.2 percent to 8.2 percent of GDP, probably due to lower impact on highly populated urban areas. Some positive changes were observed related to access to improved drinking water, certification of forestry products, land use, and waste management, though this did not occur in all 27 countries. Another interesting indicator is a share of environment-related technologies in overall technological R&D, which vary substantially in the region: from 0 to 57 percent with the average (mean) value of 13 percent in 2015.

Since 2000, the economic growth in CEECCA countries was accompanied by substantial improvements in energy efficiency, solving some local problems with access to drinking water, the introduction and expansion of certification of sustainable forestry (in many, but not all countries), improvements in reporting and monitoring of relevant indicators, including those of measuring innovation activities in greening the economies (in many but not all countries). However, this growth led to a significant worsening of air and water pollution and increased waste production without proper treatment (see below).

The OECD metrics with approximately 30 indicators could potentially provide a sound basis for measuring progress in green growth and innovations for the CEECCA region (currently, about 50 percent of data is not reported, but the information collected is extremely valuable). The EU member states and, partly, the countries that signed the EU Association Agreements have more robust reporting and monitoring systems of green growth indicators than the other CEECCA states. This may be explained by significant support from the EU and other international donors for the creation of advanced data collection and processing tools.

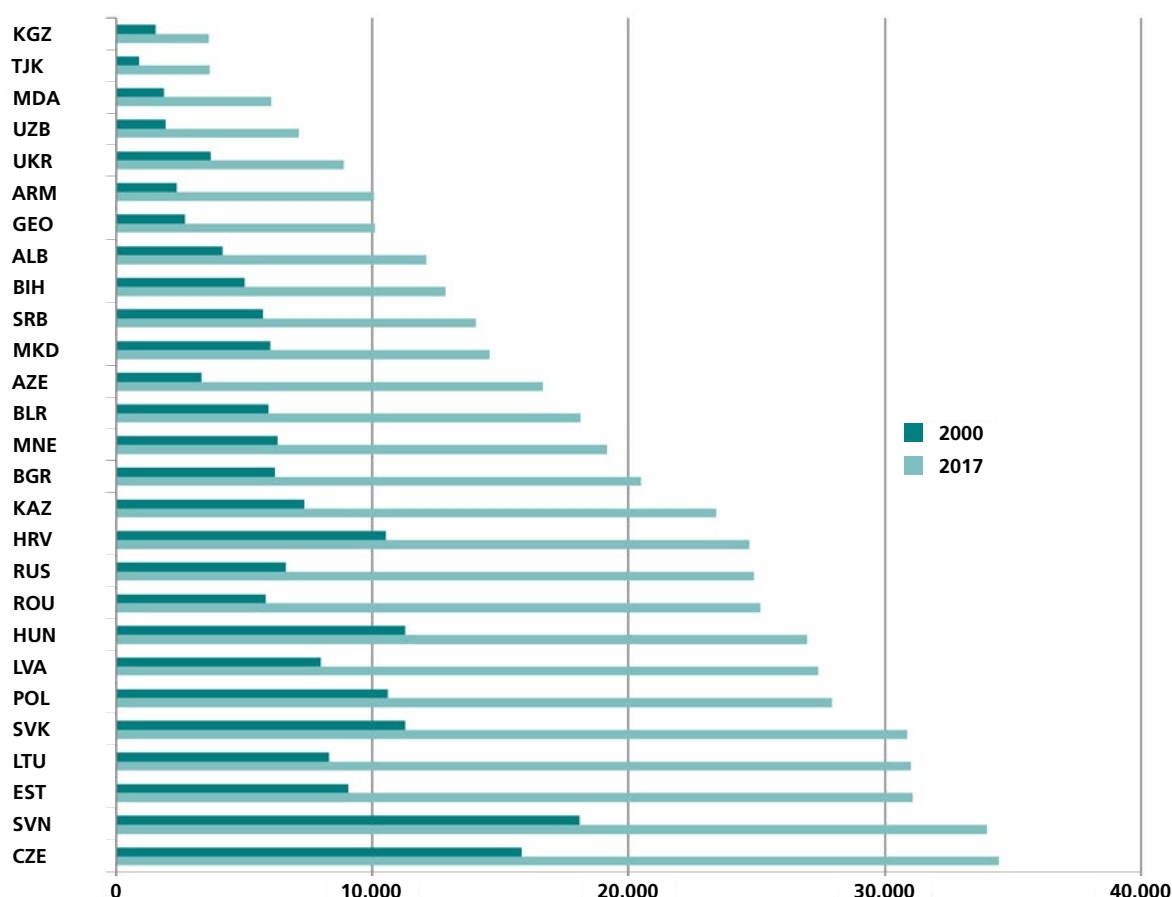
Different tools are applied to measure the environmental integrity of the economic growth. The widely spread Environmental Performance Index (EPI)³ ranks 180 countries on 24 performance indicators, including environmental health and ecosystem vitality. Environmental Health includes air quality,

² According to the classification by World Bank: <https://data.world-bank.org>

³ This index was developed by experts at Yale and Columbia in cooperation with the World Economic Forum.

Figure 1

Gross National Income (GNI) per capita per annum (PPP, current USD), in 2000 and 2017.



water, and sanitation, and heavy metal pollution. The Ecosystem Vitality index items, in turn, reflect the state of agriculture, water resources, air pollution, climate and energy, fisheries, forests, biodiversity, and habitat (Figure 2). As of 2018, Slovakia, Lithuania, and Bulgaria were listed among the top 30 countries, while Tajikistan, Uzbekistan (by environmental health), and Bosnia and Herzegovina (by ecosystem vitality) were significantly lower in their global EPI ranking. The mean value of indexes varies by the countries' income levels: the high-income group has an EPI of 66, the upper-middle-income group's EPI is 60, and the lower-middle-income group has an EPI of 53 (as of 2018). This does not mean, however, that all countries in the income groups perform evenly well or poorly, as the variation within the groups is also rather high.

Another tool, the Global Green Economy Index (GGEI), also provides useful information on the progress in greening the economic development, ranking them by 32 underlying indicators and datasets reflecting leadership and climate change, efficiency, markets, investments, the environment, and natural capital. The actual data on monitoring of per capita emissions of CO₂, SO_x, and NO_x, waste generation in CEECCA countries from 2000 to 2016 is presented in Figure 3 and Table 2.

Overall, the innovation activities in the CEECCA region are relatively weak. The total domestic spending on R&D has

increased in almost all high-income countries since 2000 but is still far below the average OECD level (Table 3). The number of patents registered with the Triadic patent families internationally (these include European, Japanese, and US patent organizations – the EPO, JPO, and USPTO) has increased in most high-income countries in the region since 2000 but is far below the levels of OECD patent activities.

About 12 percent of patents in OECD countries are related to environmental technologies and solutions (average from 2011–2013). Hungary registered a similar share of total patents (8 percent), Slovenia (9 percent), Russia, the Czech Republic, and Latvia (11 percent each), the Slovak Republic (13 percent), and Poland (14 percent). Estonia is among the leaders in OECD countries in relevant patents (17 percent). The high-income CEECCA countries demonstrate progress in innovation over time, and innovation activities on a national level are likely to contribute to the progressive greening of economic development, as the locally produced technologies and solutions are mostly applied domestically. However, the scale of innovation and ownership of patents in »green« technologies by the leading developed and large emerging economies has become much more prominent; the »absorption« of external innovations seems to play a crucial role in CEECCA countries.

Table 1

Selected green growth indicators in CEECA countries

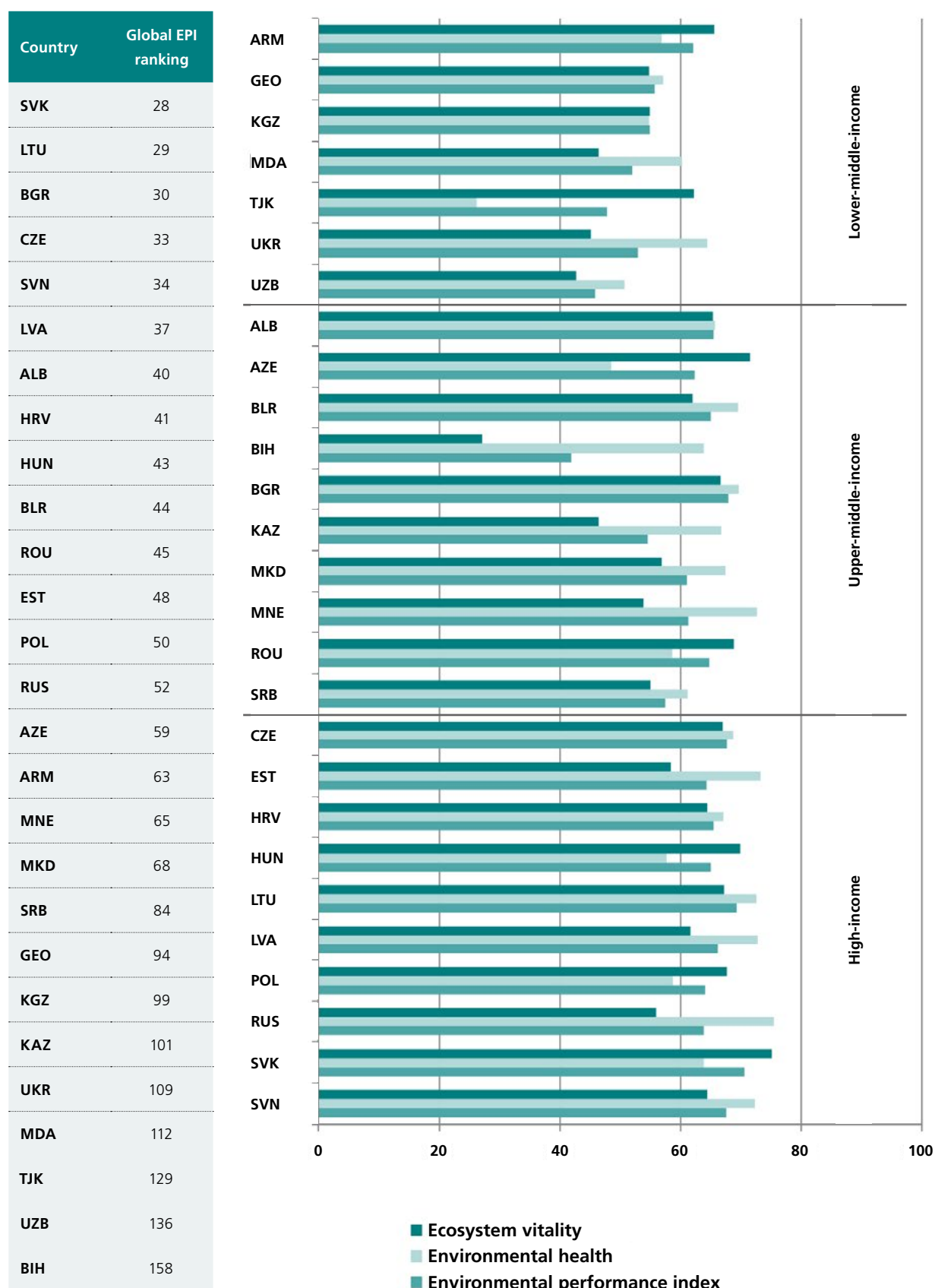
(for the most recent reported period, 2015–2016 for most of the regional economies)

	Economic productivity of energy, CO ₂ emissions, GDP per tCO ₂ (2010 US dollars per kilogram)	Energy productivity, GDP per unit of TPES (2010 US Dollar)	Renewable energy supply, percent of TPES	Mean population exposure to PM _{2.5} , micrograms per cubic meter	Mortality from exposure to PM _{2.5} , per 1 million inhabitants	Welfare costs from exposure to PM _{2.5} , percent of GDP	Population with access to improved drinking water sources, percent of the total population	Development of environment-related technologies, percent of all technologies
EECCA – in 2000	1.2	2,865	2.8	18.2	1,002	10.6	N/A	N/A
EECCA – in 2015	2.2	4,776	2.8	21.3	847	8.6	N/A	N/A
ARM	5.0	7,636	12.4	31.9	709	7.9	60.6	22.1
AZR	5.1	10,997	1.8	35.4	697	7.2	71.5	0.0
BGR	2.7	6,415	10.7	15.6	1,274	13.1	96.6	15.5
BLR	3.0	6,340	5.5	16.8	1,011	10.4	94.4	9.2
CZE	3.2	7,817	10.5	20.3	617	6.1	97.6	11.1
EST	2.2	5,884	17.6	6.9	295	3.0	81.7	17.4
GEO	3.9	7,097	24.7	23.0	900	9.9	73.0	5.6
HRV	5.4	10,019	23.3	18.2	804	8.1	90.5	4.3
HUN	5.6	9,466	11.5	22.4	923	9.4	81.5	7.7
KAZ	1.8	5,178	1.1	19.3	520	5.2	N/A	10.7
KGZ	1.9	4,746	24.1	25.2	416	5.0	66.3	57.3
LTU	7.1	10,383	19.6	13.5	858	8.7	91.7	6.5
LVA	6.4	10,773	39.1	10.0	847	8.8	81.9	18.4
MDA	2.2	4,888	10.3	17.5	782	9.2	70.0	N/A
POL	3.3	9,798	9.5	23.4	690	7.1	93.9	13.3
RUS	2.3	4,785	2.5	15.1	871	8.7	75.5	9.3
SRB	2.0	6,082	13.1	18.2	677	N/A	88.1	20.9
SVK	5.2	9,302	9.6	22.5	664	N/A	93.4	13.0
SVN	4.5	8,828	16.1	17.1	436	N/A	98.0	7.2
TJK	5.1	8,187	53.8	46.2	532	N/A	47.4	0.0
UKR	1.7	3,478	3.0	17.5	1,208	N/A	92.2	4.6
UZB	1.8	4,105	2.4	39.4	645	N/A	51.2	5.0

Source: OECD Green Growth Indicators, <https://stats.oecd.org>.

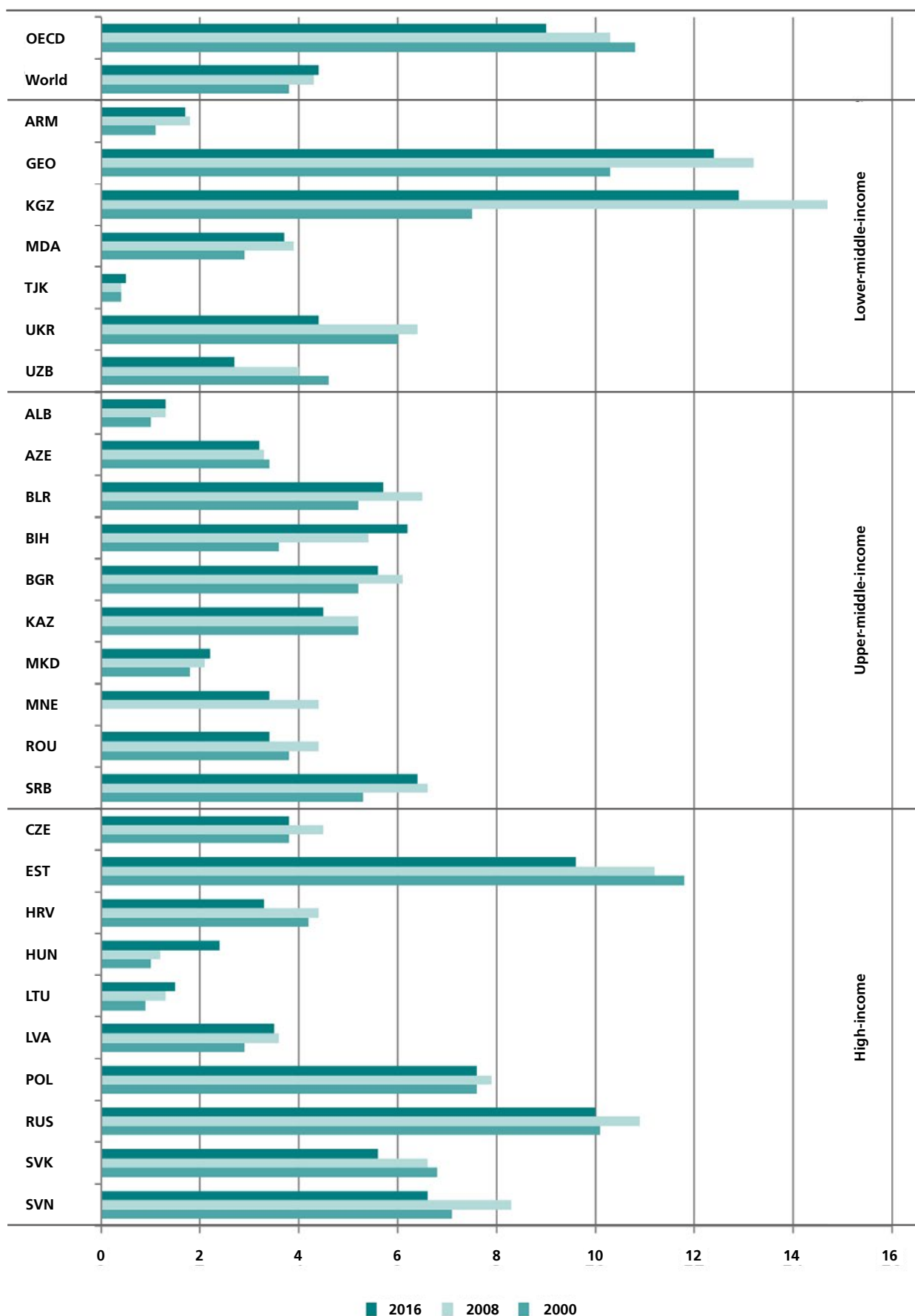
Figure 2

Environmental performance ranking [1=best, 180=worst] and measurement [0=worst, 100=best] of ecosystem vitality, environmental health, and EPI of CEECCA countries



Source: 2018 EPI Results

Figure 3
CO₂ per capita, tCO₂/cap



Source: OECD

Table 2
Municipal waste and air pollution in selected countries

	Municipal waste, kg/cap			SO _x , kg/cap			NO _x , kg/cap		
	2000	2008	2016	2000	2008	2016	2000	2008	2016
CZE	334	305	337	23	16	11	29	24	15
EST	452	391	377	69	52	23	32	31	24
HUN	445	456	382	42	4	2	18	16	12
LVA	269	346	407	7	3	2	17	18	18
LTU	364	468	437	11	7	5	15	18	18
POL	317	318	305	36	25	15	22	22	19
RUS	354	452	556*	37	33	29	26	27	24
SVK	316	312	347	23	13	5	21	19	12
SVN	513	541	464	47	7	2	30	29	18
OECD	555	541	523	31	20	10	40	31	23

Note: * author's estimate based on Rosstat data
Source: OECD database.

Table 3
Gross domestic spending on R&D, percent of GDP and number of patents registered in Triadic patent families in selected CEECCA countries

Country	Gross domestic spending on R&D, % of GDP			Number of patents registered in Triadic patent families, thousands		
	2000	2008	2016	2000	2008	2016
BGR	N/A	N/A	N/A	2	1	8
CZE	1.1	1.2	1.7	10	28	38
EST	0.6	1.3	1.3	1	3	10
HUN	0.8	1.0	1.2	42	31	33
HVT	N/A	N/A	N/A	6	4	4
LTU	N/A	N/A	N/A	1	3	5
LVA	0.4	0.6	0.4	5	2	2
POL	0.6	0.6	1.0	9	38	100
ROU	0.4	0.6	0.5	0	6	15
RUS	1.0	1.0	1.1	85	57	87
SVK	0.6	0.5	0.8	2	4	9
SVN	1.4	1.6	2.0	9	16	10
OECD	2.1	2.3	2.3	54907	48971	51363

Source: OECD database, 2018.

2

BECOMING GREEN AND PROSPEROUS?

Does the greening of economic growth allow for countries to become more prosperous? The recent experience of CEECCA countries provides different answers. The collapse of the socialist system in the 1990s led to uncontrolled de-growth and some environmental improvements but had a detrimental impact on the well-being of the population. During the uncontrolled economic recovery in the 2000s, the standard of living increased, as well as spending on air and water filters, better quality goods and services, medical treatment, and other services related to the quality of life. However, the priority then was GDP growth, not the quality of economic growth and development. This led to controversial improvements and the degradation of the environment in the region. The preferred pathway for CEECCA countries is comprised of economic development activity consistent with the requirements of green and sustainable growth.

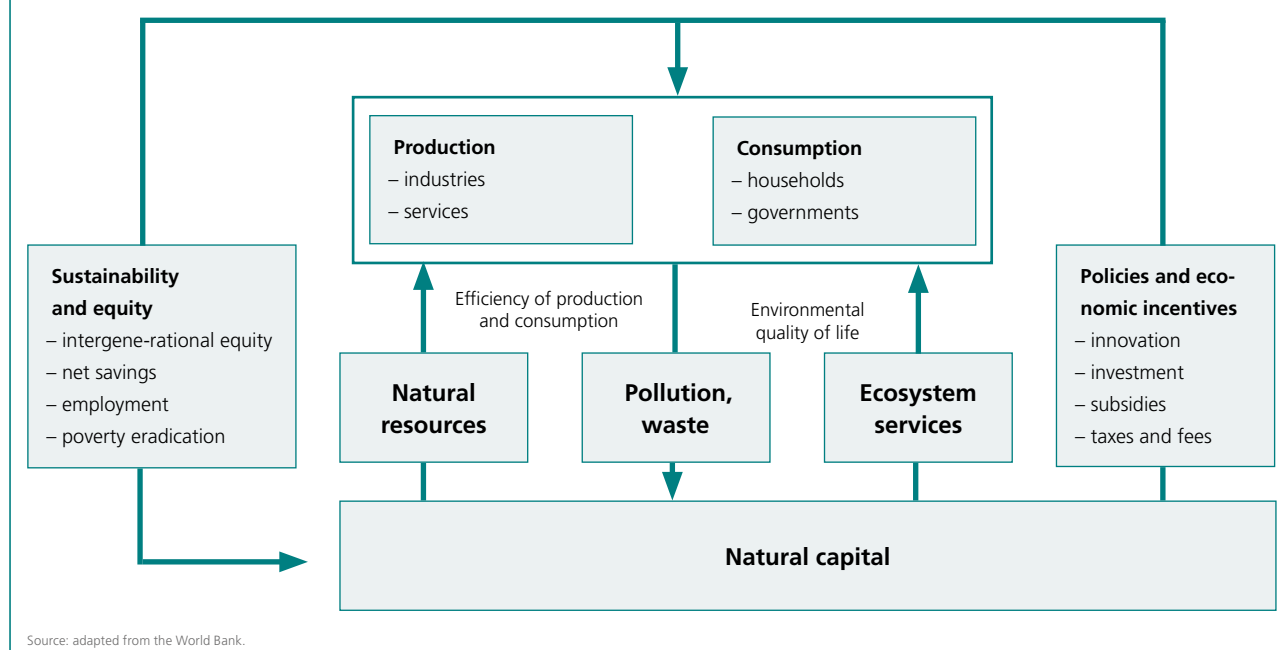
The widespread vision of the green growth policy framework is presented in Figure 4. This figure illustrates the interlinkages between natural capital, production and consumption sectors, roles of sustainability and equity, policies and

economic incentives, ecosystem services, the supply of natural resources, and the disposal of waste and pollution in a typical socio-economic system.

Based on the international experience, the following green policies and practices can contribute to sustainable and green economic growth through several channels:

- providing support for the increase of the amount of natural, physical, and human capital available, e. g., better management makes the soil more productive, reduces harmful impacts of natural disasters on capital assets, and healthier environment leads to more productive workers;
- efficiency improvement, e.g., removing subsidies and imposing environmental taxes on »bads« (such as polluting industries, fossil fuels) provides additional resources to governments to reduce labor taxes or support green »goods« (such as green transport or renewable energy), which may provide »win-win« solutions via in-

Figure 4
Components of the green growth policy framework



Source: adapted from the World Bank.

centives to increase employment while reducing pollution without an increase in overall taxation⁴;

- green policies stimulate innovation, e.g., the recent surveys in the EU showed that environmental regulation (existing or envisaged) is the main driver for the adoption of incremental innovations, the international sustainability standards (ISO and others) showed their effectiveness in upgrading environmental practices by firms in CEECCA region, mostly in »absorbing« foreign innovations and technologies, but to some extent promoting domestic innovations;
- green policies also bring non-growth gains to welfare, e.g., reduction of inequality in employment, poverty alleviation, increasing resilience to environmental and economic shocks (natural disasters or fluctuations in commodity prices), improved air quality, water, and soil, and lower human health risks associated with pollution, improved competitiveness in the markets with high environmental standards (e.g., in the EU), better loyalty of partners and clients, growing demand from increasingly green-conscious consumers.

The green growth policies require much more active and effective work from the governments and other stakeholders in managing the market and governance failures associated with stronger environmental and socio-economic commitments. They need to deal with the complex regulatory and market reforms, the introduction of green innovation and industrial policies, and remove administrative and other barriers affecting green transformations. There is no single unified solution, as the optimal solutions differ across countries regarding their diverse institutional capacities, transparency, accountability, and civil society engagement. The green growth strategies must correspond to the specific circumstances of each country, while »best practices« should be adopted with caution. Of course, the strategy documents alone are not enough to launch transformation processes. Often, they are prepared »behind closed doors« by governments without real engagement from other stakeholders, subnational authorities, civil society groups, or harmonization with other policy documents, and thus they are unlikely to be implemented effectively.

The following general recommendations for policymakers outline essential aspects of building national green growth strategies:

Maximize local and immediate benefits. The strategies need to account for the political economy of reform and aim to minimize the transition costs. Moreover, green growth strategies should generate visible and immediate local benefits such as increased efficiency and productivity, safety and resilience, job creation, and poverty alleviation.

Get the low hanging fruits first and avoid lock-ins⁵. The required changes cannot happen all at once as there are limited resources to resolve relevant complex problems and finite political capital to defend policies against the lobbying groups and political opposition. Focus on the sectors and interventions of top priority and urgency could help to achieve success, prevent reversibility, or reduce the inertia of reforms.

Actively manage the political economy of reform by targeting groups that are likely to oppose reforms. The natural ecosystem services could be valued against the economic costs of policy decisions to justify the trade-offs between economic interests and natural assets, for example.

Green accounting reaches beyond the valuation of natural assets, quantifying a country's stock of natural resources in relation to their depletion and GDP. Through green accounting, one can identify situations where economic growth does not create wealth (because natural assets are consumed more rapidly than other assets are created) and is not sustainable.

Behavioral changes in firms and individuals play an important role in green growth and spurring innovations. Besides raising awareness, education, and public promotion of »green goods«, market incentives are required for the expansion of environmentally friendly behavior. These may include deposit-refund schemes, discounts for greener products, eco-labeling, and many others⁶.

Unleash the power of the private sector. The ability to innovate and adjust production processes make private businesses a key to finding cost-effective solutions for green growth, and the role of the government is to provide appropriate incentives and regulations to them. The private sector has more financial resources than the public sector. The public-private partnerships are a widespread approach to mobilize additional resources for environmental projects and enhance the effectiveness of their implementation.⁷

Transparency and information disclosure. Besides prices, firms are subject to pressures from their customers, stakeholders, and investors. This pressure can be used to green their behavior. Promoting transparency and access to information on environmental impacts can create social pressure to reduce these impacts.⁸

Green procurement policies. The governments are significant buyers of goods and services and, therefore, can influence the economy to progress towards green growth by in-

⁴ For more information, see information from the OECD on tax innovation and the environment: <http://www.oecd.org/greengrowth/tools-evaluation/taxationinnovationandtheenvironment.htm>

⁵ See, for instance, Peter Erickson and Kevin Tempest, Keeping cities green: Avoiding carbon lock-in due to urban development, Stockholm Environment Institute, Working Paper No. 2015-11.

⁶ OECD, Creating Incentives for Greener Products Policy Manual for Eastern Partnership Countries, 2014.

⁷ More can be found on the World Bank website: <https://www.worldbank.org/en/topic/publicprivatepartnerships>

⁸ See, e.g., Carbon Disclosure Project: <https://www.cdp.net/en>

troducing »green« requirements to public procurement regulations. These types of policies help to sustain and enhance the markets for environmentally friendly supplies and reduce production costs.

Technological and industrial policies should provide long-term credibility and predictability for green business and need to be used with care within specific country contexts. Currently, the frontier innovation and R&D in green industries are concentrated in high-income countries and a few large emerging economies. In lower- and middle-income countries, capacity is often insufficient for frontier innovation, so policies supporting adaptation and dissemination of the existing technologies are required. The best way to accelerate technology diffusion is to reduce trade barriers⁹, engagement in international cooperation programs, and technology transfer frameworks.¹⁰

Innovative financing tools should be used in cases when green projects involve significant upfront costs. Such investments could be attracted via public-private partnerships, as numerous previous renewable energy projects have demonstrated. Renewable energy is capital intensive with a relatively long payback period, often facing the risks associated with alternative technologies (e.g., in the solar power sector, the new technologies affect production costs) or the use of unique resources (e.g., geothermal energy supplies depend on the availability of heating power). The public sector, international financial institutions, and bilateral donors can help by providing funds for project preparation as well as concessional elements for pioneer investments.

Innovation. Achieving greener growth requires both green innovation policies, supported sometimes by more targeted industrial policies, and environmental policies to create demand where the traditional environmental externalities are not fully reflected in market prices. The challenge is to combine innovation and environmental policies to ensure that they are well-balanced combinations of policies that support frontier innovation, policies that promote catch-up innovation, the policies regarding the adoption and spread of suitably adapted technologies, and policies that improve domestic absorptive capacity and strengthen local skills. The dissemination of green technologies can be accelerated through policies that increase adaptation and adoption capacity (such as policies promoting education in sciences and engineering) and through trade and industrial policies (such as local content requirements and technology transfers).

⁹ The Free Trade Agreements play an important role for reduction of trade barriers, see the description of free trade agreements online at The Balance: <https://www.thebalance.com/free-trade-agreement-types-and-examples-3305897>

¹⁰ For example, the technology transfer framework under the UNFCCC: <http://unfccc.int/ttclear/tec/tech-transfer-framework.html>

3

CASE STUDIES

The CEECCA countries can be differentiated by income, though their environmental performance is not purely dependent on wealth. The case studies below include: 1) Slovakia as a top country in the environmental performance among CEECCA countries; 2) Slovenia as a leader among CEECCA countries in eco-innovations according to the EU Eco-Innovation Index; 3) Kazakhstan as a resource-rich state from an upper-middle-income group, posited as a leader in green growth policy in the region of Central Asia; 4) Georgia as a lower-middle-income group country, that is actively integrating into the world economy, working on environmental and sustainable development challenges, implementing the EU regulatory frameworks under the EU Association Agreement.

3.1 SLOVAKIA

According to the global Environmental Performance Index (EPI), Slovakia is the top-ranked CEECCA country with a 2018 EPI rank of 28 (out of 180 countries). Its place in the index comes right after the USA and other leading developed countries (Table 4). The country's population has been increasing by 0.1 to 0.2 percent a year in the last decade and reached 5.4 million in 2018. Since 2010, the average GDP growth rate has been about 3 percent per year. In 2019, Slovakia's GDP per capita reached 37,268 USD (in purchasing power parity).

The country's best environmental indicators include:

- Ecosystem vitality (3rd place), good progress compared to its previous ranking at 6th place a year before;
- Biodiversity and habitat (19th place), with significant biome protections in place as well;
- Climate and energy (9th place), significant improvement compared to 26th place the year prior;
- Agriculture (13th place), specifically with regards to sustainable nitrogen management;
- Air pollution level (18th place), with a reduction of NO_x emissions intensity, but an increase in the intensity of SO₂ emissions intensity;

Table 4

The Global Environmental Performance Index in 2018

1	Switzerland	87.42
2	France	83.95
3	Denmark	81.60
4	Malta	80.90
5	Sweden	80.51
6	United Kingdom	79.89
7	Luxembourg	79.12
8	Austria	78.97
9	Ireland	78.77
10	Finland	78.64
11	Iceland	78.57
12	Spain	78.39
13	Germany	78.37
14	Norway	77.49
15	Belgium	77.38
16	Italy	76.96
17	New Zealand	75.96
18	Netherlands	75.46
19	Israel	75.01
20	Japan	74.69
21	Australia	74.12
22	Greece	73.60
23	Taiwan	72.84
24	Cyprus	72.60
25	Canada	72.18
26	Portugal	71.91
27	United States of America	71.19
28	Slovakia	70.60

- Heavy metal, lead exposure (20th place);
- Water and sanitation (42th place), improvement in drinking water supply and some regress in sanitation;
- Water resources, wastewater treatment (46th place).

Highly successful in its environmental performance, the country was ranked 21st by the EU Eco-Innovation Index in 2018. The country's performance had improved compared to 2015 when it ranked the 23rd. Slovakia outperforms many EU countries in the number of companies with ISO14001 certification. A significant contribution to the country's overall score relates to the socio-economic outcomes due to the relatively high proportion of green industries in the country's economy. The scores of resource efficiency and eco-innovation activities are very close to the EU average.

In the last few years, some substantial steps had been made to enhance the country's environmental goals, sustainable development, eco-innovation, and circular economy. Nevertheless, these have not been enough to create sound country-wide trends in green growth. Research and innovation policy framework are still fragmented, the private sector has insufficient incentives for eco-innovation activity, low public spending on R&D in environmental and energy issues, and a lack of human resources for R&D are the main barriers nowadays.

The green economy is gaining visibility in Slovakia's policy agenda and regulation conditions to facilitate progress in

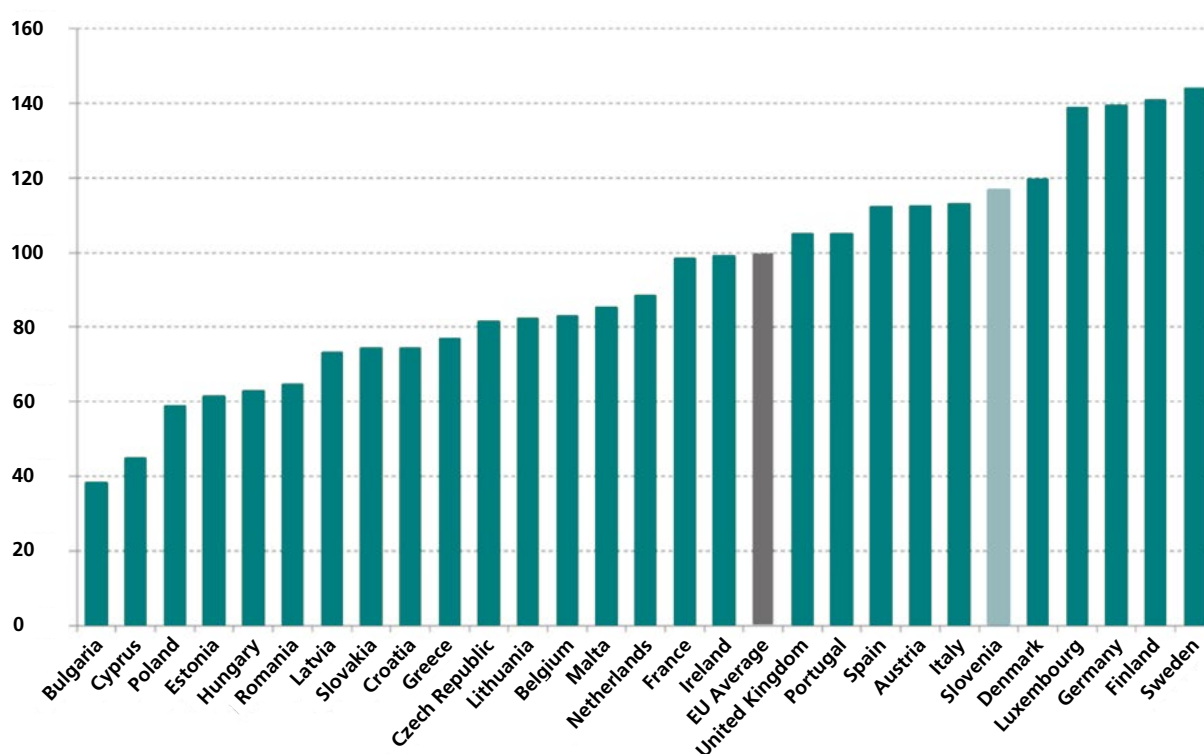
eco-innovation have been created in the waste management sector, for instance. During its Presidency in the Council of the EU in 2016, Slovakia actively contributed to the European debates on the transition towards a green and circular economy.

3.2 SLOVENIA

Slovenia has (relatively) abundant natural capital, a high level of biodiversity, and rich natural habitats. There are numerous opportunities as well as challenges related to its transition towards a green economy and in eco-innovation development.

The main drivers for eco-innovation and circular economy are in the private sector, NGOs, and municipalities, which increasingly promote a more sustainable lifestyle and develop eco-innovative and green economy products and solutions. In 2016 and 2017, the national government significantly strengthened its support of green growth measures by proclaiming the transition to a circular economy a strategic priority. Moreover, the country adopted the Smart Specialisation Strategy and Slovenian Development Strategy – 2030 and implemented the Roadmap for Slovenia's Transition to a Circular Economy together with the nationwide Partnership for Slovenia's Green Economy. This allowed the EU Eco-Innovation Index 2017 for Slovenia to rise to 115, placing the country right behind the leading eco-innovative countries (Figure 5). Slovenia's EU Eco-Innovation rank increased from 15th in 2013 to 6th in 2017 and then declined to 10th in 2018.

Figure 5
Slovenia's position in the EU Eco-Innovation Index 2017



Source: European Commission https://ec.europa.eu/environment/ecoap/slovenia_en

The EU Eco-Innovation Index includes five components for evaluation: 1) eco-innovation inputs; 2) eco-innovation activities; 3) eco-innovation outputs; 4) resource efficiency outcomes; and 5) socio-economic outcomes. In 2017, Slovenia significantly surpassed the EU average index in four of these components, all but resource efficiency outcomes. Material productivity, water productivity, energy productivity, and GHG emissions intensity continue to remain the greatest challenge for Slovenia.

The leading eco-innovation areas include automotive companies and electric mobility, sustainable mobility, energy efficiency in buildings and sustainable construction, efficient electric equipment, smart metering technologies, and pharmacy. Besides these areas with a primary focus on energy efficiency, other elements of the green economy include circular transitions in agriculture, the food sector (particularly concerning food waste and organic farming), and tourism.

Slovenia's achievements in greening its economy and promoting eco-innovations are plentiful:

- The government's environmental and energy R&D appropriations and outlays (0.66 percent of GDP) are above the EU average (0.57 percent);
- Total R&D personnel and researchers, employment in eco-industries, and eco-industry annual turnover are about 50 percent above the EU average;
- Eco-innovation related publications and media coverage are 2 to 2.5 times higher than the EU average;
- Enterprises that introduced innovations with environmental benefits within the enterprise and obtained by the end user are also significantly above the EU average.

The national eco-innovative businesses in Slovenia are well known in the EU and beyond. For example, the industrial conglomerate Hidria provides integral solutions in the automotive sector and electric mobility that makes the company a recognized innovative leader represented in 55 countries worldwide. The Automotive Cluster of Slovenia takes part in the Strategic Research Innovation Partnership ACS+ and the Edison Project, which aims to position Slovenia as a reference country for green mobility. There are numerous modes of shared sustainable mobility, such as Bikelj (bicycle sharing), Avant2Go (car sharing), and smart transportation platforms such as prevoz.org and GoOpti. Important eco-innovation areas in Slovenia also include energy-efficient buildings and sustainable construction with the leading companies Trimo, Lumar, Knauf Insulation, Riko, and M Sora. These construction companies provide innovative energy-efficient products and nearly zero-energy buildings. Sustainable farming ensures the local production of high-quality organic food. The number of organic farms doubled in Slovenia in the last decade. Green, sustainable, and responsible development has also become a brand of Slovenian tourism. The »Slovenia Green Accommodation« sign became an internationally recognized label.

However, Slovenia still faces numerous challenges in the transition towards a green economy and development of eco-innovations. Domestic R&D expenditures in Slovenia as a share of GDP have been declining since 2013. The green budget reforms in recent years were unsuccessful; however, Slovenia has a large share of green taxes that flow directly into the state budget. Many eco-innovations fail to penetrate the market due to insufficient means for capitalizing the environmental benefits of green products and, hence, have low competitiveness in relation to non-green products or technologies. The green public procurement policy was adopted in 2011 but failed in its practical implementation. As a result, a new decree on green public procurement came into force in January 2018 to enhance this instrument for green growth support. The country also lacks an integrated policy or framework focusing on eco-innovations.

3.3 KAZAKHSTAN

Kazakhstan has taken the lead in Central Asia in developing the strategy for transformation towards a green economy. The ideas of promoting green growth in Kazakhstan were first formulated under the Green Bridge Partnership Programme designed to facilitate »green« policy initiatives between Asian and European countries. The practical steps were designed from August to November 2011 when the International Institute for Environment and Development, together with the Ministry for Environment and the Organization for Security and Co-operation in Europe (OSCE), organized the Astana Green Economy Dialogue. In parallel, the Global Green Growth Institute, with support from the European Bank for Reconstruction and Development (EBRD), started the development of the Kazakhstan National Green Growth Plan that was finalized in 2012.

The priority issues interlinking the economic, social, and environmental problems in Kazakhstan were identified. They include the industrial, municipal, and toxic waste disposal and processing; water access, quality, and scarcity; urban air pollution; the Aral Sea legacy; desertification and land degradation; Caspian Sea ecosystem degradation; oil spills; biodiversity loss; and weak utilization of renewable energy sources. Based on research findings and public debates, breakthrough policy decisions were made. In May 2013, the »Concept of Kazakhstan's Transition to Green Economy« was adopted, and in August 2013, the »Action Plan for Implementation of the Concept« was approved by the Government.

Ambitious targets were set by the government, including:

- Energy efficiency improvement by 30 percent by 2030 and 50 percent by 2050;
- Share of gas-fire power generation to reach 25 percent by 2030 and 30 percent by 2050;
- Share of »alternative« (solar, wind, hydro, and nuclear) energy sources in electricity generation to reach 30 percent by 2030 and 50 percent by 2050;

- Reduction of CO₂ intensity of electricity generation by 15 percent by 2030 and 40 percent by 2050 (compared to the 2012 level);
- Emissions of SO_x and NO_x to reach »European levels« by 2030;
- Waste treatment to reach 40 percent by 2030 and 50 percent by 2050;
- To fully satisfy the needs of the population, agriculture, and other sectors in water supply by 2050.

The government of Kazakhstan adopted the following priorities for green economy transformations:

- *Environmental taxes and fiscal reform* to transition away from taxing »goods« to taxing »bads« (pollution). This greening of the tax code could bring more revenues to the state budget while providing incentives for the reduction of environmental damage. The related idea of green revenue reinvestment schemes might require substantial preparatory steps, capacity building, and overcoming the »polluting« industries' lobbyist activities.
- *Sustainable government procurement* enables the government to shift markets towards sustainability through preferential policies regarding infrastructure, goods, and services that are produced through environmental- and socially-sound methods.
- *Subsidy reform* to phase out support for »brown« sectors (e.g., fossil fuels) while strengthening and enhancing »green« practices (such as renewables).
- *Green energy investment frameworks*. The incentives for renewables could be combined with the short-term incentives for cleaner technologies for fossil fuel industries. The smart policy of phasing out the old and outdated assets and the substitution of new »clean« technologies in the energy sector could bring about extremely cost-effective solutions.
- *Certification of sustainable production and trade* can provide independent assurance of utilizing green and inclusive practices for the production of goods and services and act as a market driver towards green activities.
- *Green innovation policies* aiming at hard (technology) and soft (institutional) innovations to improve resource efficiency and reduce environmental impacts.
- *Policies to support inclusive green social enterprises* to effectively develop, test, and roll out technologies that enable small- and medium-sized enterprises (SMEs) and the informal economy to contribute to green growth.
- *Payments for ecosystem services* that provide the land users with financial incentives to manage the land in

ways that also provide ecosystem services such as watershed protection, carbon storage, and biodiversity management.

The criticisms of Kazakhstan's green economy deal with a few challenges that have not been resolved to date, such as the slow evolution of the legal and institutional frameworks that prevent from effective implementation of the green growth targets; strong lobby of »traditional« businesses against greening the development pathway; weakening of the political will for green growth at the high level; governmental changes affecting the functionality of environmental authorities (transfer of the Ministry of Environment's responsibilities to the Ministry of Energy in 2014, then reestablishment of Ministry of Ecology, Geology and Natural Resources in 2019); and a significant lack of capacity in environmental and climate policies.

The international cooperation frameworks may stimulate positive changes in national green growth policy, including the participation of the country in the Paris Climate Agreement, implementation of green energy projects (e.g., EBRD/GCF framework project on renewable energy: 557 million US dollar investment, 330 MW capacity), expansion of international technology and innovation transfer, engagement in the global carbon market and re-launch of National Carbon Emission Trading Scheme, as well as the restructuring of the national economy in favor of high value-added sectors.

One of the critical initiatives to enhance innovation and investments into environmental projects in the country is the establishment of the International Center for Green Technologies (ICGT)¹¹ in 2018 at the International Financial Center – Astana (IFCA). The IFCA is an economic zone with international legal jurisdiction and favorable conditions for businesses. ICGT launched its activities after the Expo 2017 »Energy for Future«, where a special focus was made on green energy technologies. The ICGT started its activities, and some residents of the IFCA have already been initiating large scale green projects in the country, with potential expansion into the Central Asia region.

3.4 GEORGIA

Since the 1990s, the interest in environmental problems and sustainable development in Georgia has boomed. The country ratified main UN and other international environmental treaties, established national governmental bodies responsible for environmental issues, and became involved in numerous international projects and programs with a focus on sustainable development and green growth.

However, the environmental sector experienced substantial reorganizations during the 2000s with high instability of institutions, loss of qualified personnel, and inadequate capac-

¹¹ <http://mfa.gov.kz/ru/content-view/o-mezdunarodnom-centre-zelenyh-tehnologij>

ity at national and sub-national levels. A series of organizational failures took place, such as the establishment of the National Commission on Sustainable Development in April 2005 that never assembled or creation of the Department of Sustainable Development in 2010 with only three staff members that failed to coordinate and monitor implementation of any of the Millennium Development Goals (MDGs).

In 2013, the government assigned the Ministry of Economy and Sustainable Development to be the lead authority in environmental and natural resource use issues, promoting policy integration and coherence, and intragovernmental coordination. The eleven high priority challenges for the country included: 1) water resources; 2) ambient air; 3) waste and chemical substances; 4) the Black Sea; 5) biodiversity and protected areas; 6) land resources; 7) forestry; 8) mineral resources; 9) disaster risk management; 10) nuclear and radiation safety; and, finally, 11) climate change.

Some progress in promoting the green growth was observed in the last few years, observable in the adoption of the national Green Growth Initiative, establishing a mechanism for promoting investment in green projects (2010); the National Programme »For Strong, Democratic, United Georgia« (2012) which declared environmental protection and rational use of natural resources one of the government's priority areas; the 2014 Socio-Economic Development Strategy of Georgia («Georgia 2020») with some limited focus on the environment; State Strategy for Regional Development of Georgia (2010–2017) with environmental protection among top strategic objectives; and efforts to integrate green goals into an agricultural development strategy (2015–2020).

The outcomes of such declarative and chaotic environmental policies in Georgia are quite illustrative:

- Overall emissions of key hazardous pollutants (TSP, CO, SO_x, NO_x, VOCs, NH₃) dramatically increased from 264,000 to 451,000 tons per annum since 2008. Particularly, emissions of NO_x increased by 120 percent¹², CO increased by 170 percent¹³, and VOCs increased by 35 percent¹⁴;
- The exposure of the population to PM_{2.5}¹⁵ pollution increased by approximately 25 percent in 2000–2016 from 16 to 21 µg/m³¹⁶;
- CO₂ emissions increased from 10.3 to 12.4 million tCO₂ in 2000–2016. The energy intensity of the Georgian economy continues to be high at 2 to 2.5 times above the average in Western Europe;
- Renewable energy generation fluctuated in the range of 0.8–1.2 million tons of oil equivalent (mtoe) per year during 2000–2015, with no growth in recent years. However, the potential of RES is considerable. The utilization of biomass could generate 3–13 TWh per year, the geothermal potential is about 3 TWh per year, and solar energy potential is estimated at 60–120 GWh annually;
- Only 26 percent of wastewater is treated, the rest is polluted and discharged into outer waters¹⁷;
- There is still no system of reliable municipal waste reporting and monitoring (nor was there a legal requirement for this until 2015), though the amount of such waste is significant, at 0.8–1 million tons per year.

The strengthening of green growth policy in Georgia is promoted under the process of implementation of the EU Association Agreement, signed in 2014. The Ministry of Environment and Natural Resources, in cooperation with the EU, has developed the Roadmap for the Implementation of the EU-Georgia Association Agreement on Environment and Climate action. The Ministry's Division of Sustainable Development and EU Integration Policy, the Environmental Information and Education Centre, and other relevant governmental institutions on national and subnational levels are authorized to strengthen the green growth policies and provide sound monitoring and reporting services according to requirements of the EU-Georgia Association Agreement.

In recent years, Georgia has demonstrated some progress in strategic planning aimed at green growth and development:

- The Green Growth Strategy was developed with the intention of creating sustainable economic growth by attracting new technologies and financial capital for green economy oriented projects.
- Low Emission Development Strategy (LEDS) was finalized. It defines the goals, policies, and measures within each economic sector in the context of sustainable development in Georgia. Moreover, it provides a roadmap for implementing the strategy and monitoring results in energy, buildings, transport, industrial processes, agriculture, waste, land use, and forestry sectors.
- The National Adaptation Plan was approved with the primary objective of enhancing the country's preparedness and adaptive capacity by developing climate-resilient practices that reduce the vulnerability of highly exposed communities.

¹² NO_x affects symptoms of bronchitis and asthma, leads to respiratory infections and reduced lung function, premature mortality, and morbidity from cardiovascular and respiratory diseases.

¹³ High levels of CO can be harmful to humans by impairing the amount of oxygen transported in the bloodstream to critical organs.

¹⁴ The effects of VOCs include eye, nose, and throat irritation; headaches, loss of coordination, nausea; and damage to the liver, kidney, and central nervous system, some VOCs are suspected or known to cause cancer in humans.

¹⁵ The fine particles smaller than 2.5 microns (PM_{2.5}) pose the greatest risks to health, as they are capable of penetrating peoples' lungs and entering their bloodstream.

¹⁶ State of Global Air: <https://www.stateofglobalair.org>

¹⁷ UNECE (2016): Environmental Performance review – Georgia.

- The National Energy Efficiency Action Plan, Renewable Energy Action Plan, National Climate Action Plan »Climate 2021–2030«, and Forest Sector Reform Strategy are planned in the coming years.

The government of Georgia provided high-level political support to incorporating Sustainable Development Goals (SDGs) into the national frameworks since 2015. The country also became a party to the Energy Community Treaty in July 2017. Georgia is deeply involved in cooperation with the Green Climate Fund, GEF, and many other international cooperation initiatives aiming at green growth and sustainable development.¹⁸ In Georgia, the issue of implementation beyond the white paper and policy stage of all green policies and projects is very relevant, as many initiatives in previous years have failed in practice.

* * *

The trends towards greening economic development are observable in all CEECCA countries; however, the speed and scale of transformations are far from desired levels. To some extent, the existing energy systems and infrastructure inherited from the socialist era, as well as behavioral models, governance, and business models, pose a serious barrier to fast changes. On the other hand, a lack of financial resources and experience in implementing green growth approaches also prevents the fast evolution of socio-economic systems, especially in low- and medium-income countries. In this sense, international support (including financial aid, technology transfer, knowledge sharing, and capacity building) is extremely important, and the scale of cooperation with low-income countries is to play a vital role in green transformation processes.

The resource rich countries face another challenge – strong dependence on exports of fossil fuels and heavy industry products (metallurgy, chemicals, and others). This hampers countries that do not want to change their industrial sectors until the demand in international markets is high. The high-income countries, especially those cooperating under the EU and OECD frameworks, are actively involved in greening their economies due to strict requirements imposed by such international organizations, financial and methodological support, technological cooperation, and experience exchange.

Without international engagement, commitments, and enforcement mechanisms, many countries tend to adopt mostly declarative goals without effective implementation of their green growth strategies or avoid setting clear and quantitative targets at all.

¹⁸ Green Climate Fund (GCF) financed 4 projects in Georgia: the Green Cities Facility; Scaling-up Multi-Hazard Early Warning System and the Use of Climate Information in Georgia; Geeref Next; and the Sustainable Energy Facility. More details can be found on the GCF website: <https://www.greenclimate.fund/countries/georgia>

4

CONCLUSIONS AND RECOMMENDATIONS

The transition from planned to market-oriented economies in the CEECCA region in the 1990s was accompanied by a dramatic economic downturn, large scale political and socio-economic reforms, unprecedented legislative and institutional transformations. The social and economic priorities dominated over the green growth and environmental protection in that period, though the first steps to modern environmental regulation and »green« accounting were made then in most of these countries.

This period of economic crisis was supplanted by rapid economic growth in the 2000s which varied by country: the fossil fuel and resource rich ones increased their production of energy and pollution-intensive products (oil, gas, coal, metals, chemicals, and others) reflecting the rising demand in the world markets, while the others benefited from the increased demand for agricultural products, services, labor, technologies, and materials. This period was also associated with the accumulation of financial resources by governments, implementation of financial stabilization programs, and the consolidation of businesses and markets. GDP growth led to increasing anthropogenic impacts on the environment, mostly due to the old-style of management and outdated technologies, which were intensively used to boost production.

In many CEECCA countries, the reforms of environmental regulation and programs aimed at green growth were launched in the 2010s, with different level of success. For instance, Poland was very active in developing environmental protection policies and applied up-to-date financial instruments (debt-for-nature swaps, pollution fees, and so on); however, at the time of writing, the country is ranked 50th (out of 180) in the environmental performance index and 26th (out of 28) in the EU Eco-Innovation Index.

The natural resource rich countries demonstrated different processes. The exhaustion of old crude oil fields in Kazakhstan in the early 2010s and active engagement of environmental groups led to the adoption of the Strategy for Transition to Green Economy (2013), implementation of which has been slowed due to opening new oil reserves, increased prices for petroleum and metal, and strengthening of the coal lobby after 2014. The Russian government dismissed the Committee on Environmental Protection in 2000 and substantially weakened ecological regulations aimed to increase the production of major export goods (oil, gas, coal,

metals, chemicals, and petroleum products). Growth in this sector has led to increased pollution and damage to the environment and ecosystems, while it has resulted in the accumulation of financial resources by the government, large businesses, and banks.

At the same time, several EU-member countries in the CEECCA region are actively engaged in the green growth agenda and have succeeded to a large extent. Slovakia became a leader in environmental performance, overcoming many developed countries of the world, and Slovenia is a leader in eco-innovation in Eastern Europe and Eurasia.

On the other hand, low-income countries in the CEECCA region, such as Armenia, Georgia, Kyrgyzstan, Tajikistan, Uzbekistan, and others, continue to struggle with the problems of economic development and poverty, rather than green growth and sustainability.

The CEECCA country analysis shows that the key barriers for effective green growth policy deal with the frequent political changes (governments, ministries, regulatory frameworks), lack of institutional capacity and competences for policy-making, insufficient financial resources, wrong priority setting (absence of green growth performance indicators, green procurement rules, and procedures), corruption, or the dominance of »traditional« businesses in environmental policy-making.

A significant advantage for progress in green growth and eco-innovation deals with the EU framework for relevant policymaking and reporting. The CEECCA countries that are also EU member states or implement the EU accession agreements often demonstrate stronger commitments to expand green economic developments and R&D in environmental areas. The obligatory reporting of specific indicators, monitoring, and need for policymaking in accordance with EU rules are very helpful for future reforms and greening of the economy.

The role of eco-innovation in green growth is not well articulated in the CEECCA region. The efforts to enhance innovation processes are observable in many countries and some significant achievements are recognized. For instance, Slovakia demonstrates examples of world-class innovation through its companies and products on the international markets. At the same time, the country is ranked rather low in its environ-

mental performance. In contrast, Slovenia is a leader in the majority of environmental performance indicators but fails to demonstrate leadership in eco-innovations thus far.

Overall R&D spending in CEECCA countries is very low compared to OECD countries. It could be the result of weak patenting activities or a lack of competences in mainstream green innovation and technologies. Green innovation in this situation can, therefore, primarily be based on the absorption of innovations and technologies developed in foreign countries and their adjustment and adaptation to the local needs, at least in the medium-term future.

The creation of an ecosystem for startups is a prerequisite for domestic green innovation. There is a long path between the invention and innovative product or technology. It requires an effective legislative framework and institutions, venture funds, support in commercialization, and outreach in the markets. Nowadays, most of the technological innovations are a result of large corporate investments, and the market entrance barriers for innovative products are high. Therefore, the domestic eco-innovation requires collaborative efforts between the governments, businesses, academia, and an expert community.

Spurring of green growth and eco-innovation in CEECCA countries requires the following steps:

- Development of a national Green Growth Strategy aiming at ambitious »green« goals and a roadmap for reaching specific targets.
- Introduction of a system of Green Growth Indicators for monitoring and evaluation of progress in green growth, identification of failures, and the development of corrective actions.
- Adoption of the implementation mechanisms based on the objectives and targets determined in the Green Growth Strategy, such as green taxes, pollution fees, subsidies for green transport and eco-technologies, removal of fossil fuel subsidies, green procurement, green bonds, and others.
- Raising awareness and instigating behavioral changes in firms and individuals, as the stronger the will of people to change for green, the faster and sounder the green growth.
- Capacity building for deep and wide changes in the economy, production and consumption practices, expansion of competences, and qualification of specialists.
- Support of eco-innovation and »green« technologies, creation of the ecosystem for startups.
- Financial resources are essential for green growth and eco-innovations, venture capital is required for domestic inventions and startups, as well as for absorption and adaptation of external innovations.
- International commitments and opportunities can play a critical role in spurring green growth. For example, participation in the Paris Climate Agreement requires the implementation of a low carbon development strategy and provides access to international climate finances via »sustainable development mechanisms« and climate adaptation funds.
- Coordination and implementation systems should correspond to the national circumstances, legal system, and institutional frameworks, but also should reflect the international best practices to ensure coherence with the up-to-date approaches to green growth and innovation.
- Flagship projects may play an important role in enhancing the capacity of industries and research institutions in eco-innovations and provide reputation and visibility in the world markets.

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- World Resources Institute**: <https://www.wri.org/>

ABOUT THE AUTHORS

George Safonov is the head of the scientific research center on environmental and natural resource economics at the National Research University »Higher School of Economics« (HSE), Russia. He started scientific research in environmental economics since 1995, focusing on green growth and sustainability, climate change economics, environmental and health risk management. He authored over 80 scientific publications and a series of educational courses on the economics of green innovation, climate change, energy, and the environment.

Contributing authors: Alexandra Dorina, HSE University; Mikhail Safonov, University of California – Irvine; Andrey Stetsenko, MSU/HSE University; Andrei Bolotov, RSAU.

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Matthias Jobelius, Head, Dept. for Central and Eastern Europe
Phone: +49-30-269-35-7726

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