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INNOVATIVE MECHANISMS FOR IMPROVING THE ENVIRONMENTAL MANAGEMENT SYSTEM AT ENTERPRISES

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ANNOTATSIYA. Korxonalarda ekologik menejment tizimini (EMS) takomillashtirishning innovatsion mexanizmlari tahlil qilinadi. Iqlim o'zgarishi va resurslarning cheklanganligi sharoitida korxonalarining ekologik majburiyatlari kengayib borayotgan bo'lsa-da, an'anaviy boshqaruv yondashuvlari ko'p hollarda reaktiv xususiyatini saqlab qolmoqda. Tadqiqotda O'zbekiston Respublikasi Milliy statistika qo'mitasi, Ekologiya va iqlim o'zgarishi milliy qo'mitasi, UNECE, ADB, Jahon banki hamda UNDPning 2017–2025-yillarga oid ma'lumotlaridan foydalanilgan. Natijalar atmosferaga chiqariladigan zararli moddalar hajmi 25 foizga qisqargani va o'rmon bilan qoplangan maydonlar kengayganiga qaramay, qattiq maishiy chiqindilarni qayta ishlash darajasi 5,2 foizligicha qolayotganini ko'rsatadi. Bu holat korxonalarda ekologik boshqaruv tizimlarini sifat jihatidan takomillashtirish zarurligini asoslaydi. Raqamli ekologik monitoring, integratsiyalashgan ISO 14001 va ISO 50001 standartlari, yashil moliyalashtirish vositalari hamda yetkazilgan ekologik zararga mutanosib sanksiyalarni o'zaro bog'lovchi kompleks model taklif etilgan.

Kalit so'zlar: ekologik menejment tizimi, korxona, innovatsion mexanizmlar, barqaror rivojlanish, raqamli monitoring, ISO 14001, ISO 50001, yashil iqtisodiyot, ekologik audit.

ABSTRACT. Innovative mechanisms for improving enterprise-level environmental management systems (EMS) are examined. In the context of climate change and resource constraints, enterprises face expanding environmental obligations, while conventional management approaches often remain predominantly reactive. The study draws on data from Uzbekistan's National Statistics Committee, the National Committee for Ecology and Climate Change, UNECE, ADB, the World Bank, and UNDP for 2017–2025. The findings indicate that, despite a 25% reduction in atmospheric emissions and an expansion of forest-covered areas, the municipal solid waste recycling rate remains low at 5.2%. This highlights the need for qualitative improvements in enterprise-level environmental management systems. A comprehensive model is proposed that integrates digital environmental monitoring, ISO 14001 and ISO 50001 standards, green financing instruments, and sanctions proportional to the environmental damage caused.

Keywords: environmental management system, enterprise, innovative mechanisms, sustainable development, digital monitoring, ISO 14001, ISO 50001, green economy, environmental audit.

АННОТАЦИЯ. Анализируются инновационные механизмы совершенствования систем экологического менеджмента (СЭМ) на предприятиях. В условиях изменения климата и ограниченности ресурсов экологические обязательства предприятий расширяются, тогда как традиционные подходы к управлению во многих случаях сохраняют преимущественно реактивный характер. В исследовании использованы данные Национального комитета Республики Узбекистан по статистике, Национального комитета по экологии и изменению климата, UNECE, ADB, Всемирного банка и UNDP за 2017–2025 годы. Результаты показывают, что, несмотря на сокращение объёма выбросов загрязняющих веществ в атмосферу на 25% и увеличение площади территорий, покрытых лесами, уровень переработки твёрдых бытовых отходов остаётся низким — 5,2%. Это свидетельствует о необходимости качественного совершенствования систем экологического менеджмента на предприятиях. Предложена комплексная модель, объединяющая цифровой экологический мониторинг, стандарты ISO 14001 и ISO 50001, инструменты зелёного финансирования и санкции, пропорциональные причинённому экологическому ущербу.

Ключевые слова: система экологического менеджмента, предприятие, инновационные механизмы, устойчивое развитие, цифровой мониторинг, ISO 14001, ISO 50001, зелёная экономика, экологический аудит.

INTRODUCTION

Over the past decade, global climate change, the accelerating depletion of natural resources, and intensifying environmental risks have fundamentally reshaped the demands placed on enterprises. Environmental performance is no longer merely a legal obligation; it has become a strategic factor determining a company's competitiveness. This trend is particularly relevant for enterprises operating in industry and construction, whose environmental management systems are increasingly shifting from a traditional, compliance-driven model toward a proactive, innovation-based approach.

Environmental policy in the Republic of Uzbekistan has entered a phase of systemic reform in recent years: a strategy for the transition to a “green” economy by 2030 was adopted¹, and state environmental governance was further strengthened in 2025 through the establishment of an independent National Committee for Ecology and Climate Change under the President. According to the Fourth Environmental Performance Review presented by the United Nations Economic Commission for Europe (UNECE) in Samarkand, air emissions in the country fell by 25% between 2018 and 2024, while experts highlighted opportunities for further strengthening pollution-prevention measures². This indicates that the positive shifts achieved at the macro level are creating favourable conditions for their broader integration into enterprise-level practices.

The core of the issue is that environmental management practices at many local enterprises are undergoing gradual development: environmental reporting is increasingly being aligned with regulatory requirements, opportunities for the digitalisation of monitoring systems are expanding, and the institutional integration of resource and energy efficiency with environmental performance is becoming increasingly important. Internationally recognised tools, such as the ISO 14001:2015 environmental management standard, also have significant potential for broader adoption among local enterprises, beyond their current application primarily by large, export-oriented companies.

At the same time, the increase in recorded environmental violations—from 47,000 in 2024 to 59,000 in 2025³—reflects, on the one hand, improvements in detection and enforcement systems and, on the other hand, the growing opportunities for further enhancement of enterprise-level environmental management practices. This dynamic reinforces the relevance of the present study.

The purpose of the study is to substantiate innovative mechanisms for improving enterprise-level environmental management systems, clarify the relationships among them, and develop practical recommendations. To achieve this purpose, the following tasks were set: first, to analyse the current state of environmental governance in Uzbekistan on the basis of statistical data; second, to reveal the potential of innovative mechanisms such as digital monitoring, integrated management standards, and green financing; and third, to propose an organisational-economic model for their implementation at the enterprise level.

LITERATURE REVIEW

The theoretical foundation for research on environmental management systems was laid by the concept of sustainable development formulated in the Brundtland Commission’s report *Our Common Future*: development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This concept was the first to link economic growth with environmental and social considerations and became the starting point for the subsequent institutionalisation of environmental management as a distinct managerial discipline.

The theory was further developed by J. Elkington, who proposed the “triple bottom line” concept, according to which an enterprise’s sustainability is determined jointly by its economic, environmental, and social performance. This approach shifted the emphasis from viewing environmental management merely as a compliance tool toward understanding it as a source of strategic competitiveness.

A particular contribution to the theoretical grounding of the relationship between environmental regulation and competitiveness is the hypothesis proposed by M. E. Porter and C. van der Linde, according to which well-designed environmental regulation stimulates enterprises to innovate rather than merely incur the costs associated with regulatory compliance. This hypothesis helps explain why strengthening environmental requirements in emerging-market economies, including Uzbekistan, can be viewed not as a constraint but as a driver of production modernisation.

At the operational level, international environmental management practice is based on the ISO 14001:2015 standard, which specifies requirements for an enterprise’s environmental management system, and on the GRI Standards for sustainability reporting, which ensure the comparability and transparency of organisations’ environmental disclosures. The joint application of these standards provides a methodological basis for translating the theoretical principles of sustainable development into measurable managerial procedures at the level of an individual enterprise.

The institutional context of the Republic of Uzbekistan is reflected in a number of normative legal acts: the Constitution establishes environmental protection as a priority of state policy; the Law “On Nature Protection”

1 O‘zbekiston Respublikasi Prezidentining 2022-yil 2-dekabrda PQ-436-son qarori. O‘zbekiston Respublikasining 2030-yilgacha «yashil» iqtisodiyotga o‘tish bo‘yicha islohotlarni amalga oshirish chora-tadbirlari to‘g‘risida // Lex.uz. — Toshkent, 2022. — URL: <https://lex.uz/docs/6303233>

2 Узбекистан на четверть сократил вредные выбросы в атмосферу: Четвёртый обзор результативности экологической деятельности ЕЭК ООН // Новости ООН. — 2026. — URL: <https://news.un.org/ru/story/2026/06/1468022>

3 Qurilish chiqindilari va ekologik huquqbuzarliklar holati bo‘yicha hisobot-taklif // O‘zbekiston Respublikasi Hukumat portali. — 2026. — URL: <https://gov.uz/ru/eco/news/view/160155>

sets out the legal basis for the use of natural resources; and Presidential Resolution No. PQ-436 (2022) establishes the institutional framework for the transition to a “green” economy. These documents demonstrate the consistent adaptation of international theoretical approaches to national conditions.

Furthermore, the substantial body of international theoretical research and national normative legal acts provides opportunities for expanding empirical studies specifically assessing environmental management practices at the level of individual Uzbek enterprises. Most available data currently reflect aggregated national or sectoral indicators, creating a basis for the further development of enterprise-level assessments. This perspective supports the approach adopted in the present study, which combines up-to-date statistical data from the State Statistics Committee, ADB, the World Bank, IEA, and UNDP with an analysis of the regulatory framework to identify practical directions for improving environmental management systems.

RESEARCH METHODOLOGY

The study draws on official reports of Uzbekistan’s State Statistics Committee and the National Committee for Ecology and Climate Change, the country’s Third Nationally Determined Contribution (NDC 3.0) submitted under the UN Framework Convention on Climate Change⁴ and its Biennial Transparency Report⁵, as well as analytical materials published by UNECE, the Asian Development Bank, and the World Bank, and figures reported in the media (Gazeta.uz, Yuz.uz, and the gov.uz portal). Statistical data cover the period 2017–2025 and, for certain indicators, 2018–2024.

The methodological basis of the study comprises comparative-statistical analysis (identifying indicator dynamics across years); content analysis of normative legal acts (presidential decrees and resolutions, laws); a systemic approach (to establish the interrelationships among different elements of environmental management—monitoring, financing, and the sanctions regime); and a synthesis of international experience (adapting ISO standards and the practices of developed countries to national conditions).

The availability of enterprise-level microeconomic data—such as individual firms’ environmental expenditures or the outcomes of EMS implementation—provides opportunities for the further expansion of detailed empirical assessments as relevant open statistical databases develop. Accordingly, the analysis primarily relies on sectoral and national aggregate indicators and applies them to the assessment of environmental management processes at the enterprise level.

ANALYSIS AND RESULTS

The statistical data collected on Uzbekistan’s environmental situation are summarised in a unified system in Table 1 below.

Table 1. Key indicators of Uzbekistan’s environmental governance⁶

No.	Indicator	Value / Period
1	Reduction in air emissions	25% (2018–2024)
2	Forest-covered territory	8.7%
3	MSW recycling rate	5.2% (2024)
4	Number of environmental violations	47,000 → 59,000 (2024–2025)
5	Construction waste volume	1.2 → 1.9 million t (2017–2025)
6	CO ₂ emissions	150.8 → 152.9 million t (2022–2023)
7	Sanitation service coverage by makhallas	88% (2025)
8	Foreign investment attracted to green energy	USD 6 billion
9	New green-energy capacity (launched in 2025)	3,500 MW / USD 4.2 billion
10	Digital tree passports	605,000 units

4 Ташкент 2025. Обновлённый определяемый на национальном уровне вклад Республики Узбекистан (ОНУВ 3.0) // UNFCCC. — 2025. — URL: <https://unfccc.int/sites/default/files/2025-11/Uzbekistan%20Third%20NDC%20rus.pdf>

5 GEF/YUNEP loyihasi. O‘zbekiston Respublikasining Birinchi va Ikkinchi ikki yillik shaffoflik hisoboti hamda Beshinchi milliy xabarnomasi // UNFCCC. — Toshkent, 2024. — URL: https://unfccc.int/sites/default/files/resource/BTR1_Uzbekistan%202024.pdf

6 Source: compiled by the author based on sources 1–13.

The table shows that national-level environmental indicators exhibit diverse dynamics: substantial progress has been achieved in several areas, while other areas demonstrate considerable potential for further improvement.

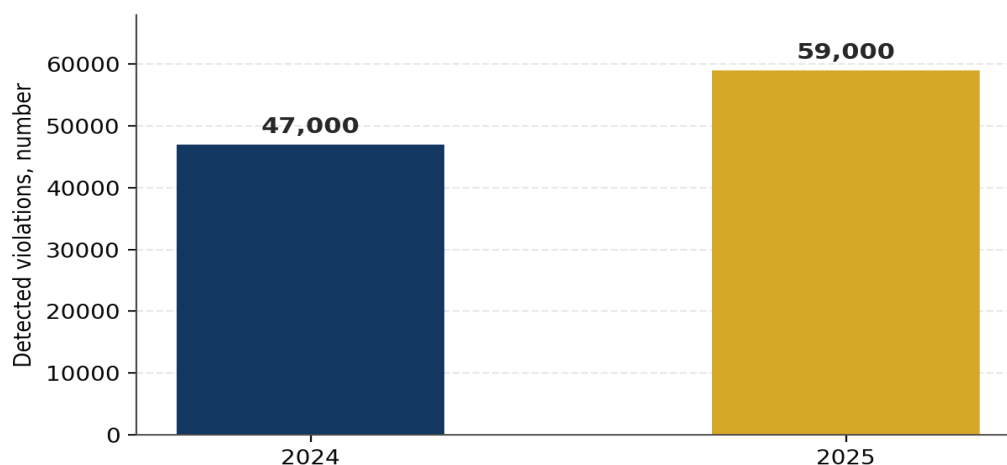


Figure 1. Dynamics of Environmental Violations Detected at Enterprises and Organisations in 2024–2025⁷

As Figure 1 shows, the number of recorded environmental violations rose from 47,000 to 59,000 between 2024 and 2025—an increase of nearly 26%⁸. This growth can be interpreted from several perspectives: on the one hand, it reflects the digitalisation of monitoring and inspection systems and the effects of strengthening sanctions proportional to environmental damage⁹; on the other hand, it highlights opportunities for further enhancing environmental management practices in certain sectors, particularly construction.

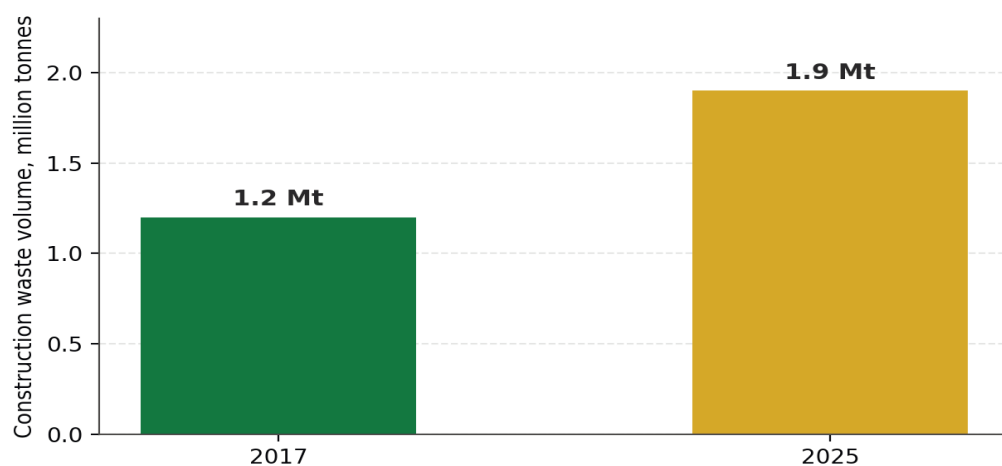


Figure 2. Dynamics of Construction Waste Volume in Uzbekistan in 2017–2025¹⁰

Figure 2 reflects the dynamics of construction waste volume between 2017 and 2025: the indicator rose from 1.2 to 1.9 million tonnes, an increase of 58%¹¹. While this trend is partly explained by the expansion

⁷ Source: compiled by the author based on data from the Government portal of the Republic of Uzbekistan.

⁸ Qurilish chiqindilari va ekologik huquqbuzarliklar holati bo'yicha hisobot-taklif // O'zbekiston Respublikasi Hukumat portal. — 2026. — URL: <https://gov.uz/ru/eco/news/view/160155>

⁹ Экологическую ответственность юриц в Узбекистане усилили: штрафы заменили на санкции, привязанные к размеру ущерба природе // Газета.uz. — 2026, 14 май. — URL: <https://www.gazeta.uz/ru/2026/05/14/sunctions/>

¹⁰ Source: compiled by the author based on data from the Government portal of the Republic of Uzbekistan

¹¹ Qurilish chiqindilari va ekologik huquqbuzarliklar holati bo'yicha hisobot-taklif // O'zbekiston Respublikasi Hukumat portal. — 2026. — URL: <https://gov.uz/ru/eco/news/view/160155>

of construction activities, it also highlights the importance of further developing waste-recycling and reuse systems (circular-economy elements) at the enterprise level to ensure the effective management of growing waste volumes (Figure 3).

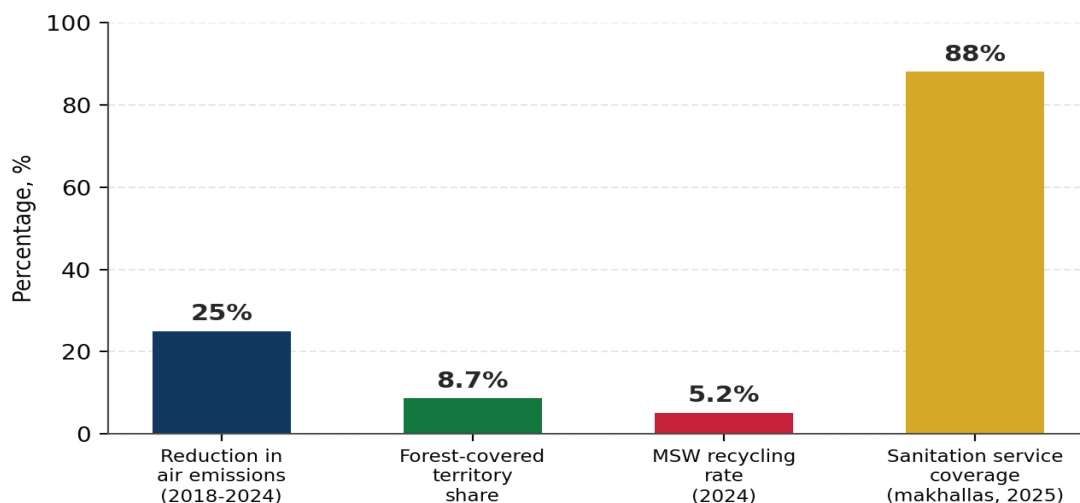


Figure 3. Selected Environmental Governance Indicators of Uzbekistan¹²

Taken together, the four indicators in Figure 3 present a systemic picture: macro-level achievements, such as the 25% reduction in air emissions and forest cover reaching 8.7%¹³ are accompanied by significant opportunities to further increase the recycling rate, which currently stands at 5.2%. In other words, strategic state-level measures—afforestation, waste monitoring, and the regulatory framework—are yielding results, while operational management at the level of enterprises and organisations, particularly in the waste-recycling chain, has considerable potential for further development.

One approach to enhancing this area is illustrated by a digital-monitoring practice already being piloted in the country: in 2025, under the “Green Space” initiative, electronic passports were issued for 605,000 trees, with their data entered into a unified monitoring platform¹⁴. This represents an example of state-level digital ecological monitoring that could potentially be adapted to the enterprise level.

Positive shifts are also visible in financing mechanisms: in 2025, construction of new green-energy facilities with 3,500 MW of capacity began, with a total value of USD 4.2 billion¹⁵, green energy overall attracted USD 6 billion in foreign investment¹⁶, and, in 2024, SAIPRO GROUP LLC issued the country's first corporate green bonds, worth USD 4 million¹⁷. This experience creates a favourable basis for gradually expanding access to green financing for small and medium-sized enterprises as well.

The results presented above make it possible to substantiate several interrelated innovative mechanisms for improving environmental management systems at enterprises.

Integrated Management Systems

Implementing environmental (ISO 14001:2015)¹⁸ standards in integration with an enterprise's quality management system reduces the costs associated with separate certification and ensures consistency in managerial decisions. Such integration is especially relevant for energy-intensive industrial enterprises, given the direct link between energy efficiency and environmental performance.

12 Source: compiled by the author based on the UNECE Environmental Performance Review and the Government portal of the Republic of Uzbekistan.

13 Узбекистан на четверть сократил вредные выбросы в атмосферу: Четвёртый обзор результативности экологической деятельности ЕЭК ООН // Новости ООН. — 2026. — URL: <https://news.un.org/ru/story/2026/06/1468022>

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15 От идей к инвестициям: как растёт зелёное финансирование в Узбекистане // Yuz.uz. — 2026, 2 апрель. — URL: <https://yuz.uz/ru/news/ot-idey-k-investitsiyam-kak-rastet-zelenoe-finansirovanie-v-uzbekistane>

16 В сферу «зелёной» энергетики Узбекистана привлечено 6 млрд долл. иностранных инвестиций // Ритм Евразии. — 2025, 24 июнь. — URL: <https://www.ritm Eurasia.ru/news--2025-06-24--v-sferu-zelenoj-energetiki-uzbekistana-privlecheno-6-mlrd-doll.-inostrannyh-investicij-81117>

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18 ISO 50001:2018. Energy management systems — Requirements with guidance for use. — Geneva: International Organization for Standardization, 2018.

Digital Ecological Monitoring

The digital infrastructure being developed under the “Digital Uzbekistan—2030” strategy¹⁹ can also fundamentally transform enterprise-level environmental control. Sensor networks (real-time air- and water-quality tracking), IoT-based monitoring, and analytical dashboards would allow enterprise management to detect and address adverse trends before regulatory thresholds are breached rather than afterwards. The experience of entering tree data into a unified monitoring platform²⁰ demonstrates the technical feasibility of this direction.

Green Financing Mechanisms

Green bonds²¹, preferential lending, and ESG-reporting-based incentive schemes are important tools for encouraging enterprises to invest in environmental improvements. Current practice shows²² that these mechanisms have been successfully applied primarily to large projects involving foreign partners, creating a practical foundation for their broader application. Accordingly, the development of simplified green-lending programmes for small and medium-sized enterprises, including through domestic commercial banks, could further expand the scope of green financing.

A Damage-Proportional Sanctions Regime

The new sanctions model introduced in 2026—calculating fines not as a fixed sum but in proportion to the scale of environmental damage caused (from two to ten times, depending on the severity category)²³—is consistent with what economic theory calls the “Porter hypothesis”: well-designed environmental regulation encourages enterprises to invest in innovation rather than simply pay penalties²⁴. The transition from the previous fixed-fine system to a damage-proportional sanctions mechanism creates stronger economic incentives for enterprises to address environmental violations and invest in preventive measures²⁵.

Circular Economy and Public-Private Partnership

The current recycling rate of 5.2%, together with the steady growth in construction waste volume, highlights the importance of introducing circular-economy elements at the enterprise level: establishing recycling chains for raw materials, reintroducing production waste as secondary resources, and using public-private partnership models to develop recycling infrastructure. Such an approach yields not only environmental but also economic benefits, as secondary raw materials reduce dependence on imported resources.

At the same time, the effective implementation of the proposed mechanisms requires consideration of the financial and human-resource capacities of small and medium-sized enterprises, certification costs, and differences in the level of digital infrastructure development across regions. Implementation should therefore proceed gradually and be adapted to enterprise size and sectoral characteristics.

CONCLUSION AND SUGGESTIONS

The analysis shows that Uzbekistan has achieved notable positive dynamics at the macro level in environmental governance—a 25% reduction in air emissions, expanding forest cover, and substantial investment attracted to green energy—while environmental management systems at the enterprise level, particularly in waste recycling, have significant potential for further development.

Further improvement in this area requires the combined application of five interrelated innovative mechanisms: integrated ISO 14001/50001 systems, digital ecological monitoring, green-financing instruments adapted for small and medium-sized enterprises, a damage-proportional sanctions model, and public-private partnerships that introduce circular-economy elements. Each mechanism, when applied individually, can contribute to improving environmental performance; however, their coordinated application as a coherent system can substantially enhance the environmental performance of enterprises.

19 O'zbekiston Respublikasi Prezidentining «Raqamli O'zbekiston — 2030» strategiyasini tasdiqlash to'g'risida»gi PF-6079-son Farmoni // Lex.uz. — Toshkent, 2020.

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22 Узбекистан делает ставку на реформы в развитии энергетики // Энергетика и промышленность России. — 2025. — № 07 (507). — URL: <https://www.eprussia.ru/epr/507/3569979.htm>

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The findings of this study may serve as a practical and methodological basis for developing policies aimed at improving enterprise-level environmental management systems and for further academic research in this field, including the continuation of the author's doctoral dissertation.

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