

Mechanisms of Economic Incentives for The Introduction of Energy-Saving Technologies in The Real Sector

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Abstract: This article is aimed at analyzing the mechanisms of economic incentives for the introduction of energy-saving technologies in the real sector, in particular, in industrial and manufacturing sectors. The article reviews the global and national importance of energy efficiency, the reforms being carried out in Uzbekistan, and financial instruments such as tax incentives, subsidies, green loans, and energy service companies (ESCO) used in international practice. It also covers the level of energy consumption of the Uzbek economy, potential and future strategic goals in the sectors based on statistical data. The conclusions of the study serve to ensure economic stability and further improve mechanisms for stimulating energy efficiency.

Keywords: Real sector, energy efficiency, energy-saving technologies, economic incentives, tax incentives, subsidies, green loans, ESCO, renewable energy.

Introduction: Currently, the real sector of the economy, especially industrial sectors, is one of the largest consumers of energy resources globally. The industrial sector consumes about 29 percent of the total energy produced worldwide (Copenhagen Centre on Energy Efficiency, 2016). Almost two-thirds of this energy consumption falls on four main industrial sectors: chemical and petrochemical, ferrous metallurgy, non-metallic minerals, and the pulp and paper industry. In the context of growing environmental problems, climate change, and the limitation of traditional energy resources, increasing the energy efficiency of industrial enterprises has become not only an environmental but also a vital economic necessity (Tadjibayev, 2025).

Although the industrial sector occupies a leading position in the structure of Uzbekistan's economy, the volume of energy consumption in the country is significantly higher than world standards due to the

obsolescence of existing production technologies (Khakimov, 2023). In this regard, increasing the energy efficiency of economic sectors and the social sphere, and the widespread introduction of energy-saving technologies and renewable energy sources (RES) have been identified as priority areas of state policy. The purpose of this article is to study the economic incentive mechanisms for introducing energy-saving technologies, statistical changes, and existing opportunities based on the example of Uzbekistan and international experience.

LITERATURE REVIEW

The discourse on energy efficiency and its economic stimulation in the real sector has been extensively covered in international and national literature. The European Court of Auditors (2022) highlights the critical role of energy taxation and carbon pricing in facilitating the transition to green energy, emphasizing the need to eliminate hidden subsidies for fossil fuels.

Zhang, Li, and Wang (2025) provide empirical evidence that green credit policies significantly reduce carbon emission intensity in manufacturing enterprises by tightening financing conditions for highly polluting industries.

In the context of Uzbekistan, recent studies underscore a transitional phase. Abdurahmonov (2026) and Nasretdinov (2025) focus on the management mechanisms and technological upgrades required in domestic industrial enterprises. Khakimov (2023) maps out the end-use energy efficiency policies in Uzbekistan, noting the high energy intensity compared to European standards. Furthermore, Sarkar (2024) points out the necessity of unlocking private sector financing and utilizing Energy Service Companies (ESCOs) for market transformation. Despite these contributions, there remains a gap in comprehensive analyses that concurrently evaluate administrative, financial, and tax-based mechanisms within Uzbekistan's evolving regulatory framework, which this paper aims to address.

METHODOLOGY

This study employs a mixed-methods approach based on comparative policy analysis and statistical observation. The primary data sources include official legislative acts of the Republic of Uzbekistan, specifically Presidential Resolutions No. PP-4422 (2019) and No. PP-436 (2022), as well as Cabinet of Ministers' resolutions on energy labeling. Statistical data regarding energy consumption targets, pilot project savings, and tariff impacts were synthesized from government reports and the UzDaily national news chronologies (2026).

The analytical framework involves benchmarking Uzbekistan's current and proposed energy incentive mechanisms against established international practices (e.g., EU Enhanced Capital Allowances, Chinese Green Credit Guidelines, and international P4P schemes). This comparative assessment evaluates the economic feasibility, investment efficiency, and regulatory

compliance of energy-saving interventions in the industrial and residential sectors.

RESULTS

1. State of Energy Efficiency and Statistical Indicators

The energy intensity of the economy in Uzbekistan is significantly higher than the average indicator of developed countries. Studies show that the average annual electricity consumption per 1 square meter of buildings in Uzbekistan is 350 kWh, whereas this indicator is 95-100 kWh according to European standards (Khakimov, 2023). In addition, total industrial energy consumption accounts for 35 percent of the country's overall energy consumption.

However, positive changes are being observed as a result of recent reforms. By 2030, the government plans to reduce the energy intensity of the economy by 1.5 times and introduce 14 GW of new renewable energy sources (7 GW solar, 7 GW wind). The strategic goal has been upgraded to bring the share of RES in total electricity generation to 54 percent by 2030.

In the current year, Uzbekistan plans to save 4.3 billion kWh of electricity and 2.8 billion cubic meters of natural gas solely through technological improvements. Pilot projects in 190 facilities across 14 regions demonstrated an energy-saving potential of up to 40 percent. Furthermore, energy efficiency measures at 25 large industrial enterprises are expected to save 1.6 billion kWh of electricity and 600 million cubic meters of gas. Overall, technological modernization can reduce energy consumption by 30 percent, and mandatory energy audits can provide an additional 25 percent reduction.

2. Overview of Economic Incentive Mechanisms

To stimulate the transition, Uzbekistan has integrated several economic and administrative mechanisms. Table 1 summarizes the primary policy tools currently implemented in the Republic compared to global best practices.

Mechanism Category	International Practice (Examples)	Implementation in Uzbekistan
Tax and Customs Benefits	Enhanced Capital Allowances (ECA), reduced VAT (EU)	5-year full tax exemption for RES producers; 10-year property/land tax exemption for large RES installations

Mechanism Category	International Practice (Examples)	Implementation in Uzbekistan
		(>0.1 MW).
Subsidies & Compensations	Direct capital grants for energy-efficient upgrades	30% compensation (up to set limits) for individuals purchasing solar panels, water heaters, and EE gas burners.
Green Financing & Credit	Green Credit Guidelines (China), low-interest commercial loans	Interest rate coverage on bank loans for EE devices (excess of refinancing rate compensated for SMEs and individuals).
Administrative / Regulatory	Strict eco-design standards, banning obsolete tech	Ban on importing category "B" and lower household/industrial appliances since 2022. Mandatory ISO 50001 for state enterprises.

DISCUSSION

Problems and Future Prospects

Despite the positive shifts taking place in the Republic, a number of problems remain relevant when benchmarked against global standards. First of all, access to financial resources for Small and Medium Enterprises (SMEs) in financing "Green Economy" projects remains limited. Studies show that only 30 percent of such enterprises can utilize preferential loans and grants, making the large-scale introduction of green innovations difficult (Sarkar, 2024). Additionally, an acute shortage of specialists operating in the field—particularly energy auditors, process engineers, and renewable energy experts—acts as a significant barrier

to implementation.

Another strategic issue is tariff policy and subsidization. As noted by the European Court of Auditors (2022), keeping energy tariffs traditionally low (hidden subsidies) reduces the motivation of enterprises to voluntarily invest in energy-saving technologies because the payback period becomes artificially extended. To address this, Uzbekistan has initiated the introduction of differentiated tariffs (a block tariff system) for the consumption of electricity, natural gas, and hot water. This market-based approach will require higher payments for energy consumed above the norm, economically compelling consumers to optimize their energy use.

In order to further improve the system in the future, it

is highly recommended to integrate digitalization (Big Data, IoT, Artificial Intelligence) technologies into energy management (Safarov, 2025). The full launch of the "Energy Efficiency Evaluation and Analysis Index" (EEEEAI) system would allow for evaluating the annual energy consumption dynamics, technological modernization indicators, and staff qualifications of enterprises. This point-based system could provide additional targeted incentives to the most effective entities, mimicking the successful Pay-for-Performance (P4P) schemes observed internationally.

CONCLUSION

The introduction of energy-saving technologies in the real sector of Uzbekistan is a vital pathway to ensure sustainable economic growth, adapt to global environmental standards, and increase the competitiveness of manufactured products. The 30% compensations provided by the government, the coverage of loan interest rates, and the 5-10 year tax incentives serve as a robust foundation for widely involving individuals and legal entities in this energy transition. Aligning energy prices with free market principles through differentiated tariffs guarantees that enterprises will see a faster return on investment projects, thereby elevating their intrinsic motivation. The complex implementation of the administrative, financial, and technical mechanisms outlined in this study will undoubtedly yield significant economic and environmental dividends in the near future.

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