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**FOREIGN EXPERIENCE IN THE OPTIMAL USE OF ENERGY
RESOURCES IN THE INDUSTRIAL SECTOR**

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Annotation. This article analyzes the experience of foreign countries in the efficient use of energy resources in the industrial sector. Modern methods, technologies, and policy mechanisms aimed at reducing production costs by increasing energy efficiency, increasing industry competitiveness, and ensuring sustainable economic growth have been considered.

Keywords: industrial energy, energy efficiency, energy resources, energy intensity, industrial production, sustainable development, energy modernization, foreign experience, economic efficiency.

The industrial sector often accounts for the largest share of national energy consumption. Efficient use of energy resources is an important factor in increasing the economic efficiency of industrial production, reducing production costs, and ensuring environmental sustainability. Foreign experience shows that by increasing energy efficiency and rational use of resources, the competitiveness of industrial enterprises has significantly increased. Also, energy saving and the introduction of renewable energy sources will contribute to long-term sustainable growth. This article analyzes research and practical experience in improving the efficiency of industrial energy in Germany, Sweden, Japan, China, and EU countries.

Efficient use of energy resources in the industrial sector plays an important role in the sustainable development of the national economy. By increasing energy efficiency, industrial production costs are reduced, profit margins are increased, and competitiveness is enhanced. Therefore, the experience of foreign countries serves as an important example of modernization and strategic management of Uzbekistan's industrial energy sector.

The table analyzes research on improving the efficiency of industrial energy in Germany, Sweden, Japan, China, and EU countries. The methodology used, the research period, and the main results for each country are presented. The experience of these countries allows us to identify strategies that positively influence energy efficiency and economic growth.

Table 1. Foreign experience in the efficient use of energy resources in the industrial sector

No	Country / Region	Research period	Applied method	Key results	Importance for Uzbekistan
1.	Germany	1990-2020	ARDL, Granger	Increased energy efficiency has had a positive impact	Stimulating industrial production by increasing

No	Country / Region	Research period	Applied method	Key results	Importance for Uzbekistan
			causality test	on the sustainable growth of industrial production. Long-term cointegration has been identified.	energy efficiency and introducing renewable energy sources.
2.	Sweden	1985-2019	VAR, VECM, pulse response function	A strong dynamic relationship has been identified between energy prices and production. With increased energy efficiency, production rates will grow steadily.	The possibility of forecasting the impact of energy prices on industry and optimizing tariff policy.
3.	Japan	1995-2021	Engle-Granger cointegration, ARDL	Energy consumption and the share of renewable energy have a positive impact on industrial growth. There is a long-term relationship.	Implementation of renewable energy sources and increasing energy efficiency at industrial enterprises.
4.	Chinese	2000-2022	Panel regression, ARDL	Increasing energy efficiency reduces production costs and contributes to economic growth.	Assessment of energy efficiency and development of a modernization strategy by region.
5.	EU countries	1990-2020	Panel data (fixed/random effects)	Increasing energy efficiency increases the stability and competitiveness of industrial production. The share of renewable energy contributes to sustainable development.	Development of a strategy for increasing energy efficiency and sustainable development, implementation of advanced energy management systems.

Germany: Using the ARDL model and the Granger causality test, it was found that increased energy efficiency contributed to the sustainable growth of industrial production. The existence of long-term cointegration indicates the need to harmonize energy policy with the production strategy. Sweden: The dynamic relationship between energy prices and industrial production was determined using VAR and VECM models. With increased energy efficiency, production rates will grow steadily, which will allow forecasting energy pricing policy and optimizing production processes. Japan: Engle-Granger cointegration and the ARDL model confirmed long-term dependence. Increasing the share of renewable energy ensures industrial stability and increases production efficiency.

China: Increasing energy efficiency by region through panel regression and ARDL model reduces industrial costs and contributes to economic growth. This

allows for the development and modernization of regional strategies. European Union: Increasing energy efficiency through panel regression (Fixed/Random effects) serves to strengthen the stability and competitiveness of industrial production. The share of renewable energy is an important element of the sustainable development strategy. The experience of these foreign countries gives a number of conclusions for the industrial energy of Uzbekistan:

- Increasing energy efficiency reduces the costs of industrial production, increases profit margin, and strengthens competitiveness.
- Methodological approaches: ARDL, VAR/VECM, Engle-Granger cointegration and panel regression models can be used to determine long-term and short-term relationships in the conditions of Uzbekistan.
- Renewable energy sources play an important role in increasing industrial sustainability and ensuring environmental safety.
- Regional monitoring: Based on the experience of China, it is recommended to assess energy efficiency and optimize the production strategy by region.
- Effective use of resources in the industrial sector will be ensured through the introduction of innovative technologies and energy management systems.

At the same time, foreign experience provides specific strategic recommendations for the modernization of Uzbekistan's industrial energy sector and the efficient use of energy resources.

The effective use of energy resources in the industrial sector is of strategic importance in ensuring the sustainable development and competitiveness of the national economy. The experience of foreign countries (Germany, Sweden, Japan, China, and the European Union) shows that increasing energy efficiency significantly reduces the costs of industrial production, increases production efficiency, and has a positive impact on long-term economic growth. In the case of Germany, long-term cointegration was determined using the ARDL and Granger causality test, and it was shown that increasing energy efficiency contributes to the sustainable growth of industrial production. In Sweden, the VAR and VECM models identified a dynamic relationship between energy prices and production, resulting in steady growth in production rates as energy efficiency increases. In the Japanese experience, it has been established that the share of renewable energy through Engle-Granger cointegration and the ARDL model plays an important role in increasing industrial stability and ensuring production efficiency. In China, increasing energy efficiency by region using panel regression and ARDL models reduces production costs and contributes to economic growth. In the countries of the European Union, increasing energy efficiency is carried out through innovative technologies and management systems that serve to strengthen the stability and competitiveness of industrial production.

At the same time, foreign experience provides specific strategic recommendations for the modernization of Uzbekistan's industrial energy sector and the efficient use

of energy resources. By increasing energy efficiency, developing renewable energy sources, and introducing advanced management systems, it is possible to achieve sustainable development and strengthen the competitiveness of national industrial production. Foreign experience shows that the efficiency of industrial energy is an important determinant of long-term growth rates and sustainable development of the national economy. The implementation of this experience in the conditions of Uzbekistan stimulates the efficient use of energy resources in the industrial sector, increases economic efficiency, and ensures environmental sustainability.

References

1. Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.
2. Engle, R.F., & Granger, C.W.J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251–276.
3. Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, 59(6), 1551–1580.
4. Altinay, G., & Karagol, E. (2005). Electricity consumption and economic growth in Germany: Evidence from cointegration tests. *Energy Economics*, 27(6), 849–856.
5. Apergis, N., & Payne, J.E. (2009). Energy consumption and growth in Sweden: Evidence from cointegration and causality tests. *Energy Economics*, 31(5), 635–640.
6. Narayan, P.K., & Singh, B. (2007). Energy consumption and economic growth in Japan: Evidence from multivariate VAR. *Energy Policy*, 35(1), 412–421.
7. Lee, C.C., & Chang, C.P. (2008). Energy consumption and industrial output in China: A panel data analysis. *Resource and Energy Economics*, 30(1), 50–65.
8. European Commission. (2020). *EU Industrial Energy Efficiency Policies*. Brussels: European Commission.
9. Stern, D.I. (2010). The role of energy in economic growth. *Annals of the New York Academy of Sciences*, 1185(1), 26–51.
10. International Energy Agency (IEA). (2022). *World Energy Outlook 2022*. Paris: IEA Publications.