

## IMPROVING GREEN STRATEGIC MANAGEMENT IN CONSTRUCTION ENTERPRISES THROUGH THE EXPANSION OF RENEWABLE ENERGY USE WITHIN THE FRAMEWORK OF THE “UZBEKISTAN — 2030” STRATEGY

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### ABSTRACT

*This article analyzes Goal 51 of the “Uzbekistan — 2030” Strategy—the transition to a green economy and the expansion of renewable energy use—in relation to the strategic management of large construction enterprises. The study aims to substantiate scientific and methodological approaches to integrating energy efficiency, renewable energy, digital monitoring, and environmental performance into corporate management. Regulatory documents and international analytical reports are comparatively examined, and a conceptual management mechanism comprising seven components, together with measurable performance indicators, is proposed. Since no experimental testing at the level of an actual enterprise was conducted, economic benefits and emission reductions are interpreted not as forecasts but as potential impact pathways requiring verification.*

**Keywords:** *Uzbekistan — 2030, green economy, renewable energy, construction enterprise, strategic management, energy efficiency, green KPIs, digital monitoring.*

### INTRODUCTION

The stability of energy systems, the rational use of natural resources, and the mitigation of climate impacts are becoming strategic prerequisites for economic development. Goal 51 of the “Uzbekistan — 2030” Strategy, approved by Decree No. PF–158 of the President of the Republic of Uzbekistan dated September 11, 2023, sets the task of transitioning to a “green economy” and sharply increasing the indicators of renewable energy use, which forms its foundation. This goal includes increasing renewable energy capacity to 25,000 MW and its share of total consumption to 40%, developing “green certificates” and environmental labeling in industry, and introducing energy audit mechanisms in multi-apartment residential buildings [1]. These figures are policy targets and should not be interpreted as outcomes already achieved.

Construction enterprises participate in these changes in two ways: first, they consume energy through construction and installation works, machinery, production facilities, and temporary infrastructure; second, they influence design and material-selection decisions that determine the future energy demand of buildings and structures. The UNEP and GlobalABC report for 2024–2025 states that the buildings sector is associated with 32% of global energy

consumption and 34% of CO<sub>2</sub> emissions [3]. These global shares cannot be directly applied to construction enterprises in Uzbekistan, but they demonstrate that energy is one of the central areas of management in construction.

The practical problem is that enterprises often regard energy supply decisions as matters of current expenditure or isolated technical measures. However, investments in photovoltaic panels, storage equipment, energy-efficient machinery, or heat-management devices should be assessed together with financing, maintenance, operational risks, and environmental reporting. Thus, energy transition is not merely a change of energy source; it also requires the reorganization of strategic diagnostics, capital allocation, business processes, and performance control.

The aim of this study is to develop a scientifically grounded methodological approach to integrating national green energy priorities set for 2030 into the strategic planning and operational management systems of large construction enterprises. The research object is large construction enterprises, while its subject comprises organizational and economic relations, management methods, and criteria for assessing their effectiveness in the process of improving energy and resource efficiency.

### **RESEARCH MATERIALS AND METHODS**

The study was conducted through regulatory and conceptual analysis. The main sources were Decree No. PF-158 [1], the Presidential Resolution of December 2, 2022 on reforms related to the transition to a “green” economy [2], UNEP/GlobalABC [3], and IEA reports on renewable energy [4] and energy efficiency [5]. Systems analysis was used to establish the relationship between strategy, enterprise objectives, investment, implementation, and KPIs; comparison was used to examine different energy measures; and the indicator method was used to establish a procedure for calculating management outcomes.

The proposed approach is a conceptual model and is not presented as a system that has been econometrically evaluated using actual enterprise data or implemented experimentally. Its causal effects and economic profitability can be empirically assessed only after enterprise-level data on energy consumption, production volumes, equipment operating hours, tariffs, solar and wind resources, investment costs, and emission factors have been collected.

### **RESULTS AND DISCUSSION**

1. The impact of strategic objectives on the management of construction enterprises. The tasks associated with increasing the share of renewable energy under the “Uzbekistan — 2030” Strategy [1] give rise to at least four management priorities for construction enterprises: diversifying energy supply, reducing energy consumption per unit of work performed, considering the operational efficiency of project facilities, and improving the verifiability of environmental information. The 2022 policy document sets out strategic tasks to increase industrial energy efficiency by at least 20% and reduce energy consumption per unit of gross domestic product by 30% [2]. These are not precise mandatory percentage standards at the enterprise level; company indicators are determined according to the type of project activity and the baseline.

**Table 1. Translation of national green priorities into enterprise indicators**

| National priority        | strategy | Management implications for the construction enterprise                                                        | Observable indicator                                     |
|--------------------------|----------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Renewable energy         |          | Assess the portfolio of solar generation/electricity procurement at the enterprise's own production facilities | Electricity from renewable energy sources, kWh; share, % |
| Energy efficiency        |          | Energy audits of machinery, production sites, and facilities                                                   | kWh / volume of work performed                           |
| Environmental monitoring |          | Document energy sources and emissions                                                                          | kg CO <sub>2e</sub> / functional unit                    |
| Green certification      |          | Verify materials, suppliers, and projects                                                                      | Share of verified certificates, %                        |
| Digital transformation   |          | Integrate BIM, IoT, and management information systems                                                         | Reporting completeness and accuracy                      |

Source: Compiled by the author based on [1–3]; the indicators are proposed rather than established measures.

2. Economic criteria for selecting renewable energy. It is not reasonable to assess energy projects solely on the basis of initial investment. In a construction enterprise, the costs of solar modules, inverters, batteries, maintenance, spare parts, and the system's service life are considered jointly. Indicators such as net present value (NPV), discounted costs, and the levelized cost of energy (LCOE) may be used for assessment.  $NPV = \sum_{t=1}^T CF_t / (1+r)^t - I_0$ , where  $CF_t$  is the net cash flow in period  $t$ ,  $r$  is the discount rate, and  $I_0$  is the initial investment. A positive NPV is one criterion, while seasonal production, interruptions, and technical risks are also evaluated separately.

The IEA's "Renewables 2025" analysis forecasts that solar energy will account for the largest share of global renewable electricity capacity growth during 2025–2030 [4]. However, a solar power plant will not automatically be the least expensive solution for every construction enterprise in Uzbekistan: daytime energy demand, roof or land availability, regional solar irradiation, grid connection conditions, electricity tariffs, and storage requirements affect financial outcomes. It is therefore proposed that improvements in energy efficiency, alternative electricity procurement, and on-site electricity generation be compared as a single investment portfolio.

3. An integrated mechanism for green strategic management. The study recommends applying seven interconnected stages to enterprise decision-making: (1) strategic diagnostics

of resources, energy, and environmental conditions; (2) defining economic and environmental objectives and assigning responsibilities; (3) optimizing equipment, energy, and material resources; (4) regional sourcing and green logistics; (5) BIM, IoT, ERP, and digital monitoring; (6) green KPIs reflecting energy, CO<sub>2</sub>, water, waste, costs, and profitability; and (7) integrated assessment and feedback. Renewable energy is thus viewed not as a stand-alone technical project but as an element contributing to the enterprise's strategic outcomes.

Integrating the renewable energy development objectives established in the “Uzbekistan — 2030” Strategy into the strategic management systems of large construction enterprises is of considerable importance. In this process, energy diagnostics, the definition of strategic objectives, investment mechanisms, digital monitoring, and performance evaluation are considered interrelated stages (Figure 1).

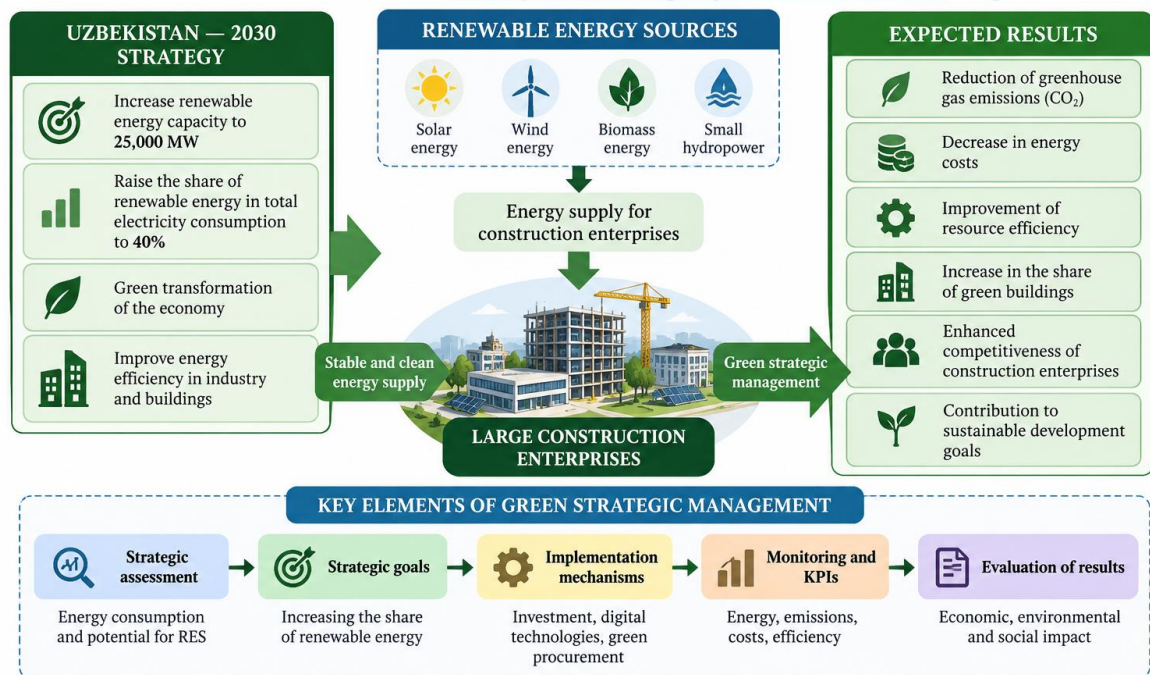


**Figure 1. The role of renewable energy in green strategic management of large construction enterprises within the framework of the “Uzbekistan — 2030” Strategy.**

**Source:** Developed by the author with the assistance of AI based on the “Uzbekistan — 2030” Strategy and scientific and methodological approaches.

At the strategic diagnostics stage, the baseline year, energy consumption, electricity and fuel balances, capacity requirements for production facilities, and energy-related risks are identified. At the objective-setting stage, specific measurable criteria are developed for electricity supply reliability, energy consumption per unit of output, and emissions. At the resource-optimization stage, the productivity of technical and organizational resources can be evaluated using DEA, slack analysis, or other methods; however, the results of these methods depend on data quality and the selected input and output variables.

Green logistics is linked to the distance over which materials are delivered to construction sites, the mode of transportation, and the share of recycled materials. A local supplier is not automatically regarded as the most environmentally preferable option: the total delivered cost

of materials and transportation emissions are evaluated. Digital monitoring, meanwhile, may support real-time monitoring of resource consumption and outcomes when facilities are dispersed across several regions. These assumptions must be tested through a pilot project.

4. Measuring performance. At the level of a construction enterprise, evaluating the effects of a “green” strategy solely by the number of installed solar panels is insufficient. An initial set of indicators may comprise energy intensity (EI), the share of renewable electricity (RES), emission intensity (CI), and cost savings ( $\Delta C$ ): ; . Here, Q denotes a volume of work or a functional unit that is comparable in terms of quality and the nature of the activity. If differences in workload, weather, and production composition between the baseline and project periods are not adjusted for, direct comparison of indicators may lead to erroneous conclusions.  $EI = E/Q$ ;  $RES = E_{QTE}/E_{j\text{overall}} \times 100$ ;  $CI = CO_2e/Q$ ;  $\Delta C = C_{b\text{basic}} - C_{I\text{project}}$

**Table 2. Key corporate KPIs for energy transition**

| Indicator                 | Calculation method                                   | Management interpretation                         |
|---------------------------|------------------------------------------------------|---------------------------------------------------|
| Energy intensity          | $EI = E/Q$                                           | Energy consumption relative to work volume        |
| Share of renewable energy | $RES = E_{QTE}/E_{j\text{overall}} \times 100$       | Degree of transition to clean sources             |
| Emission intensity        | $CI = CO_2e/Q$                                       | Environmental burden and its dynamics             |
| Savings                   | $\Delta C = C_{b\text{basic}} - C_{I\text{project}}$ | Net operating difference over a comparable period |
| Investment return         | $NPV = \sum CF_t/(1+r)^t - I_0$                      | Discounted value of cash flows                    |

Source: Proposed by the author based on [4–6]; the formulas represent generally accepted assessment relationships.

When constructing a single composite score, normalization and the choice of weights must be transparent. For example, if energy expenditure is correlated with total production cost, or energy intensity with emission intensity, the same effect may be counted twice. This risk should be assessed through correlation testing, expert-assigned weights, and sensitivity analysis. The scientific and methodological conclusion arising from the study is that national targets should not be mechanically transferred into enterprise KPIs; instead, they should be converted into project-specific indicators that can be verified with data and for which management responsibility has been assigned.

5. Sequence of practical implementation. It is recommended first to collect 12 months of energy-balance data for the enterprise’s production facilities and construction sites and then identify energy-intensive processes. In the next stage, short-term energy-saving measures (meters, maintenance, and operating schedules) are distinguished from long-term capital projects (solar power systems, electrification, and thermal insulation). Technical suitability, capital cost, service life, risk, NPV, and emission outcomes are evaluated for each measure.

Finally, the results for the baseline and trial periods at the selected pilot facility are compared using the same functional unit.

The allocation of responsibilities within enterprise management is also important: the strategic unit approves objectives and weights; the finance department calculates investment efficiency; the chief power engineer maintains electricity and fuel balances; the technical department verifies actual work volumes and equipment operating modes; and the environmental specialist documents emission factors and reporting boundaries. This arrangement creates an organizational basis for turning a green energy initiative from a one-off project into a continuous management cycle.

From a discussion perspective, enterprise-level outcomes must be distinguished from national-level indicators. For example, it would be incorrect to convert the national target of 25,000 MW into a mandatory capacity indicator for an individual construction enterprise. The enterprise's actual contribution should be measured through each kWh of energy saved, procurement of alternative energy, verified reductions in emissions, and the creation of energy-efficient buildings or structures. The overall decarbonization of the national energy system must also be distinguished from the impact of an individual enterprise's operations.

## CONCLUSION

Goal 51 of the “Uzbekistan — 2030” Strategy provides an important political and institutional basis for developing green management in construction enterprises. Expanding renewable energy sources in construction organizations is not limited to increasing electricity generation capacity; it requires the integration of strategic investment planning, energy accounting, resource use, design, and environmental monitoring systems.

The study proposes a seven-stage management sequence for construction enterprises and a set of assessment indicators comprising energy intensity, the share of renewable electricity, emission intensity, and investment efficiency. This scientific and methodological approach clarifies the management link between national strategy and enterprise decisions. Future research should test the practical effectiveness of the management mechanism through primary observations of enterprises, pilot facilities, sensitivity analysis, and investment analysis. Without such verification, quantitative claims about specific savings or emission reductions would not be justified.

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