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THE THEORETICAL–MODEL BASIS OF GREEN TECHNOLOGY STATISTICS WITHIN THE SUSTAINABLE DEVELOPMENT GOALS FRAMEWORK

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Annotation: This paper outlines the theoretical and model basis of green technology statistics within the framework of the Sustainable Development Goals (SDGs). It focuses on how national statistical systems can define and operationalise key green-technology indicators, using Uzbekistan as a reference context. The study proposes a conceptual framework of SDG-aligned indicators and discusses how these can be integrated into national statistical practice. The paper concludes with recommendations for strengthening the national statistical system to support monitoring of green technology adoption in industry.

Keywords: green technology, sustainable development goals (SDGs), green technology statistics, national statistical system, environmental indicators, Uzbekistan

Introduction

The transition toward sustainable industrial development is increasingly linked to the adoption of green technologies that reduce environmental pressures while maintaining economic growth. Within the 2030 Agenda for Sustainable Development, goals such as SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) require systematic monitoring of green technology diffusion and performance at the national level (UN, 2015; OECD, 2023).

In many developing countries, including Uzbekistan, national statistical systems are still evolving to capture green-technology-related indicators in a coherent and comparable way. While the System of Environmental-Economic Accounting (SEEA) provides a recognised framework for integrating environmental and economic data, its application to green technology statistics remains underdeveloped in practice (UN, 2021; UNEP, 2022). This creates a gap between high-level SDG targets and the availability of actionable indicators at the enterprise level.

This paper aims to clarify the **theoretical-model basis of green technology statistics within the SDG framework**, with emphasis on conceptually defined indicators and their integration into national statistics. The study addresses three main questions:

1. What are the main dimensions of green technology statistics?
2. How can national statistical systems structure SDG-aligned green technology indicators?
3. What institutional and methodological steps are needed for Uzbekistan's national statistical system?

Methods

The study follows a **conceptual-analytical approach**, combining international SDG-related frameworks, SEEA-based accounting concepts, and existing green-technology indicator studies (UN, 2015; OECD, 2023; UNEP, 2022). It does not rely on new primary data but synthesises these sources into a compact indicator framework that can be adapted by national statistical offices.

The analysis is structured around three building blocks:

- **SDG-aligned indicator domains** (energy, resource use, emissions, and technology adoption);
- **conceptual accounting relations** derived from SEEA and material-flow accounting (e.g., energy-use and material-use balances);
- **green growth and green technology indicator frameworks** documented in international studies and Uzbek-specific green-economy monitoring reports (OECD, 2023; CPRO, 2025; nsdg.stat.uz, 2025).

The proposed framework is illustrated using Uzbekistan as a stylised case, drawing on official SDG-related publications and recent OECD-based work on green-growth indicators for Uzbekistan (OECD, 2023; CPRO, 2025).

Results

The results present a **conceptual indicator framework** for green technology statistics that can be embedded in national statistical systems and aligned with SDGs.

1. Core dimensions of green technology statistics

Green technology statistics are organised around three main dimensions:

- **Resource and energy efficiency**: how efficiently enterprises use material and energy inputs.
- **Pollution and circularity**: how much waste and emissions are generated and how material flows are closed.
- **Technology adoption and investment**: the scale of green-technology adoption and associated investments in industry.

Each dimension corresponds to one or more SDG-related indicators, such as energy-use per unit of output (SDG 7 and 9), material productivity (SDG 12), and emissions intensity (SDG 13) (OECD, 2023; UN, 2015).

2. Indicators table aligned with SDGs

The following table summarises **key green technology-related indicators** that can be reported at national and sub-national levels and linked to relevant SDGs.

Table 1. Proposed green technology-related indicators aligned with SDGs

№	Indicator	Statistical expression (outline)	Main SDG relevance	Possible data source in national statistics
1	Energy use per unit of industrial output	Total energy use in industry / Industrial value added	SDG 7, 9	Energy balances, enterprise surveys

№	Indicator	Statistical expression (outline)	Main SDG relevance	Possible data source in national statistics
2	Material productivity	Industrial GDP / Domestic material consumption	SDG 12	SEEA-type material-flow accounts
3	Share of industries using green technologies	Number of firms using green technologies / Total reporting firms	SDG 9	Enterprise surveys, innovation surveys
4	Emissions intensity (CO_2 per unit of output)	CO_2 emissions from industry / Industrial value added	SDG 13	Emission inventories, energy statistics
5	Waste recycling rate in industry	Recycled industrial waste / Total industrial waste	SDG 12	Waste and circular-economy statistics
6	Green R&D share in total R&D	Green R&D expenditure / Total R&D expenditure	SDG 9	R&D surveys, innovation statistics

This indicator set is inspired by OECD-style green-growth indicators, SEEA-based accounts, and recent assessments of green technology indicators in developing-country contexts (OECD, 2023; UN, 2021; UNEP, 2022).

3. Current status in Uzbekistan

In Uzbekistan, SDG-related statistics are being compiled under the official publication *"Sustainable Development Goals in the Republic of Uzbekistan"* (nsdg.stat.uz, 2025), which includes energy-, environment-, and economy-related indicators (UN, 2015; nsdg.stat.uz, 2025). However, these indicators are still scattered across different modules and are not organised into a unified green-technology-specific framework. For example:

- Energy-use and emissions data are available but rarely disaggregated by green-technology adoption;
- enterprise surveys and innovation statistics are being expanded but do not yet systematically track green-technology-specific variables (OECD, 2023; CPRO, 2025).

Thus, the current national system provides much of the underlying data but lacks a coherent green-technology-indicator module.

Discussion

The proposed indicator framework strengthens the **theoretical-model basis** of green technology statistics within the SDG architecture. By anchoring each indicator in one or more SDGs and linking it to standard statistical sources, national statistical systems can move from fragmented reporting toward a more integrated, policy-oriented monitoring of green technologies in industry (OECD, 2023; UN, 2021).

For Uzbekistan, three main directions follow from the present analysis:

1. **Institutional integration**: establishing a dedicated "Green Technology Statistics" module within the national statistical system that coordinates with environmental agencies, energy authorities, and innovation bodies.
2. **Indicator harmonisation**: adopting a core set of SDG-aligned green-technology-related indicators (similar to Table 1) and ensuring their availability at regular time intervals for national and regional reporting.
3. **Capacity-building and data quality**: improving data collection in enterprise surveys, emission inventories, and material-flow accounts, while strengthening technical capacity to compile SEEA-style environmental-economic accounts (OECD, 2023; CPRO, 2025).

These steps would help Uzbekistan better monitor progress toward green-growth and SDG-related targets, especially in the industrial sector. At the same time, the indicator framework is deliberately simple and conceptual; future work can enrich it with empirical validation, including panel-data analyses of green-technology adoption once detailed firm-level data become available.

REFERENCES:

1. OECD (2023) *Green growth indicators for Uzbekistan and related discussions*. Paris: Organisation for Economic Co-operation and Development.
2. UN (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*. New York: United Nations.
3. UN (2021) *System of Environmental-Economic Accounting 2021: Central Framework*. New York: United Nations.
4. UNEP (2022) *Global assessment report on green technology and innovation*. Nairobi: United Nations Environment Programme.
5. CPRO (2025) *Greening the economy in Uzbekistan: State of play in 2023 – Monitoring progress based on the OECD green growth indicators*. Tashkent: CPRO.
6. nsdg.stat.uz (2025) *Sustainable Development Goals in the Republic of Uzbekistan*. Tashkent: National Statistics Committee of the Republic of Uzbekistan.