Developing an Expert Assessment System for Green Industry Projects

A. Volosatova, T. Guseva, I. Tikhonova, and E. Averochkin

Abstract This article discusses ways to develop an expert evaluation system for projects aimed at environmental and technological transformation within the industrial sector. It analyzes both national and international green project taxonomies, underscoring that the majority of them incorporate pollution prevention and control principles based on the use of the Best Available Techniques (BAT). As part of the research, an evaluation algorithm was developed and a composite assessment criterion was refined. The article also provides the results of a comparative expert evaluation conducted on green projects within the construction materials industry across member states of the Eurasian Economic Union. In conclusion, recommendations are formulated that are aimed at fostering the balanced development of BAT and green taxonomies within the Eurasian Economic Union.

Keywords Best available techniques · Green industry projects · Green taxonomy · Expert evaluation · Eurasian economic union

1 Introduction

Sustainable development, the formation of a green economy, and the pursuit of national and international objectives are the realms that have been increasingly garnering attention across various countries. The shaping of a green economy stood out as a key priority during the Russian presidency of the Eurasian Economic Union (EAEU) in 2023. Scholars from numerous universities and research centres run research programmes devoted to the development of methodologies for working

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out, implementing, and assessing results of the sustainable development projects. Their efforts primarily focus on environmental regulation and the development of approaches to environmental and corporate rankings. However, no uniform expert assessment system for green projects, which is grounded in objective and transparent criteria, has been developed yet.

This article is dedicated to designing such a system for the expert assessment of projects focused on environmental and technological transformation within the industry. These projects are considered to be sustainable development tools aimed at enhancing resource and environmental efficiency, fostering a circular economy, and reducing industrial carbon intensity.

2 Designing Support Systems for Sustainable Development Projects: An Analysis of national and international Principles

Numerous strategies, policies, programs, and projects have emerged globally to achieve the Sustainable Development Goals (SDGs). Environmental projects include those aimed at climate change mitigation and adaptation, conservation of natural ecosystems and promotion of responsible production and consumption patterns [1]. In the 1980s, the term "environmental" began to be replaced by the term "green", with dedicated research groups, councils, and programs being created [2]. The ISO 14,030–3:2022 standard ("Environmental performance evaluation. Green debt instruments. Part 3: Taxonomy") published in 2022 proposes a classification of green projects, which are divided into six priority areas: (1) climate change mitigation; (2) climate change adaptation; (3) sustainable use and protection of water and marine resources; (4) transition to a circular economy, waste prevention and recycling; (5) pollution prevention and control; (6) protection and restoration of ecosystems and biodiversity [3].

According to ISO 14,030–3:2022, the key principles for creating systems to support green projects include: (1) reducing risks to the environment, natural habitats, biodiversity, human health, and welfare; (2) relying on evidence and scientific validity, incorporating research results and expert assessments; (3) assessing anticipated changes across all facets of green projects when establishing project goals and objectives.

The Russian taxonomy of green projects is largely based on these principles, with BAT-driven projects aimed at environmental and technological transformation in the industrial sector playing a great role, but the decision made in 2021 to use specific numerical indicators in the taxonomy appears irrational for two reasons. First, some of the values were drawn from BAT Reference Documents (BREFs) developed and updated in different years. Second, other values were sourced from European Union documents that lost validity in 2021, predating the approval of the Russian taxonomy.

A more logical approach, adopted in 2023, involves giving references to BREFs where relevant indicators are presented [4].

3 Developing an Expert Assessment System for Green Industry Projects

In Russia, BAT Reference Documents have been used since 2019 in the development and evaluation of draft programmes for environmental efficiency improvement and applications for environmental permits granted to large industrial manufacturers [5, 6]. The assessment process is overseen by the BAT expert community, whose activities are coordinated by the BAT Bureau [7, 8].

Projects seeking government support were, until recently, evaluated by various organizations (e.g., Skolkovo Foundation, certification bodies, etc.). As part of this study, we analysed the results of evaluating 54 projects across 12 areas of BAT application that received government support from 2018 to 2021. It was discovered that BREFs had been inaccurately chosen for 14 projects. The remaining 40 projects got soft loans totalling RUB 15.02 billion (Fig. 1).

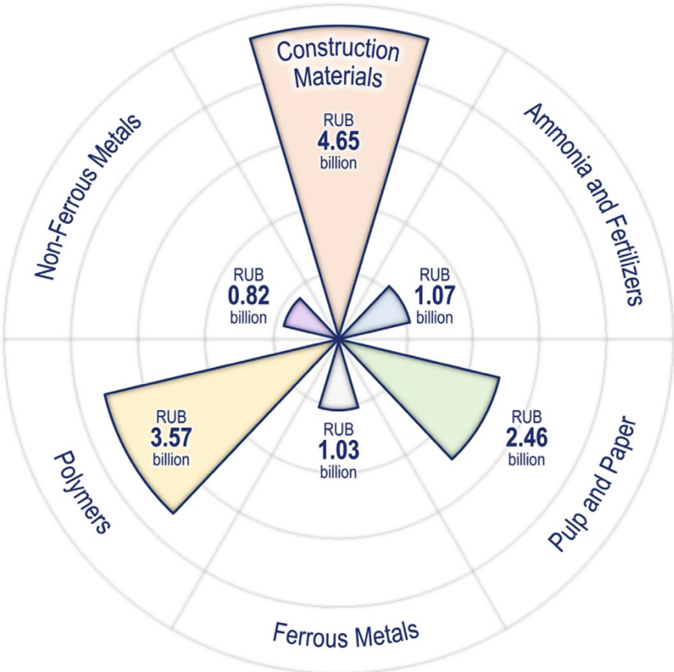

Fig. 1 Projects in BAT application areas that received government support

In several instances, support is extended to projects for establishing new enterprises whose resource and environmental efficiency fall short of BAT requirements. These results in the imprudent utilization of natural resources, increased environmental pollution, and the inability to commission newly created facilities, where compliance with BAT is a requirement established by environmental legislation. Examples of inefficient projects not meeting BAT but implemented in 2019–2022 requirements are known in such sectors as the construction materials, energy generation (large combustion plants), and chemical industry.

Information presented in BREFs is accessible to business representatives, project documentation developers, and experts, forming the foundation for enhancing the validity and transparency of decisions on supporting projects for the environmental and technological transformation of industrial facilities. It is recommended to design a uniform system for assessing green projects across all BAT application areas, drawing from the expertise of the Russian BAT expert community. The practice of expert assessment should be extended to investment projects supported within the framework of economic, industrial, and energy policy instruments [9].

The proposed expert assessment algorithm for green projects (Fig. 2) is based on the application of a composite assessment criterion, $K = K_1 \wedge K_2 \wedge K_3$.

The composite criterion K provides for the assessment of emissions targets or BAT-Associated Emission Levels (BAT-AELs) (K_1), compliance with resource efficiency indicators or BAT-Associated Environmental Performance Levels (BAT-AEPLs) (K_2), as well as fulfilling additional conditions, such as reducing carbon intensity or fostering a circular economy (K_3) (Fig. 3).

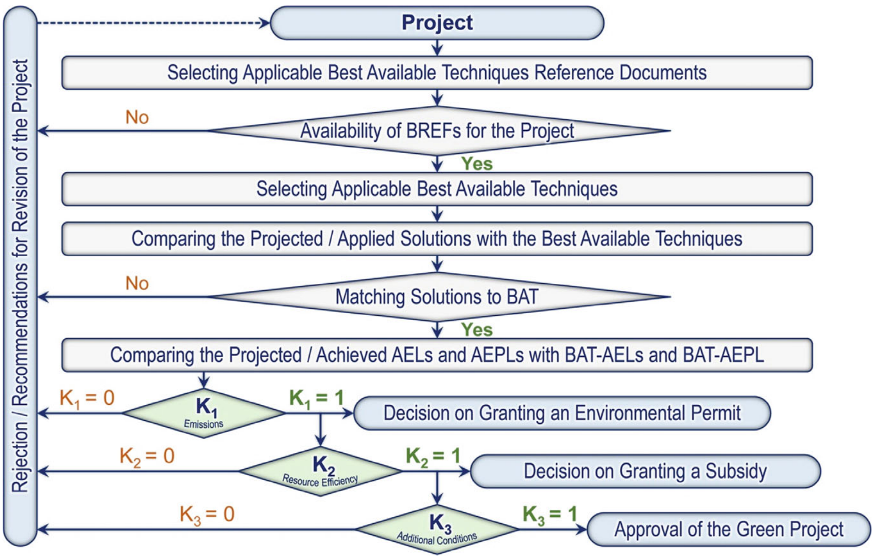

Fig. 2 BAT compliance assessment algorithm

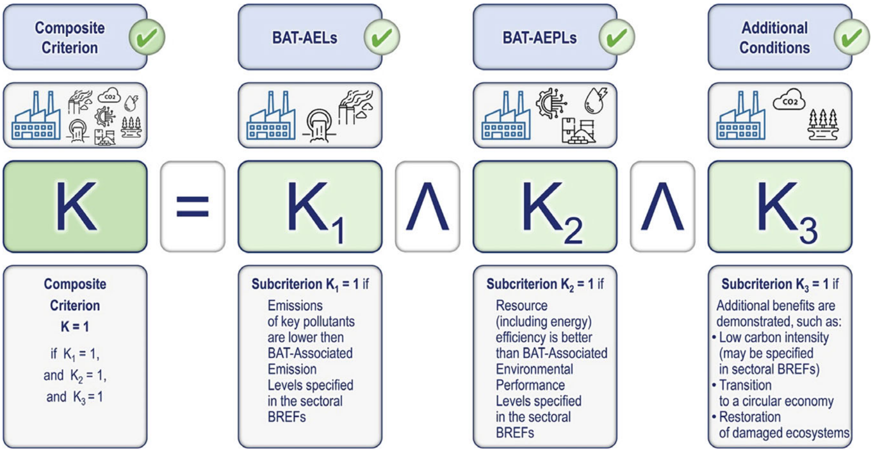

Fig. 3 Reference documents on best available techniques as sources of the assessment subcriteria

Subcriterion K_1 is a predicate with values of either 1 or 0. Achieving sectoral BAT-Associated Emission Levels is a requisite for assessing all projects. $K_1 = 1$ is a sufficient condition for making a positive decision on issuing an environmental permit.

Subcriterion K_2 is likewise a predicate, taking values of either 1 or 0. When assessing projects seeking subsidies from the federal budget and aiming to implement BAT, the second necessary and sufficient condition is achieving sectoral resource efficiency indicators (BAT-Associated Environmental Performance Levels) established in relevant BREFs. To obtain a favourable pre-financial expert assessment, both conditions $K_1 = 1$ and $K_2 = 1$ must be met.

Throughout the assessment, experts ascertain the technological and technical solutions responsible for achieving the declared (project) indicators and whether these solutions suffice to ensure compliance with established BAT requirements. Information from relevant BREFs, along with other reference documents and guidelines containing data on the best available and emerging techniques, is utilized by experts. Subcriterion K_3 is also a predicate that factors in additional project parameters (for example, reducing carbon intensity, fostering a circular economy, restoring damaged ecosystems, etc.).

Numerical values for aspects related to the circular economy or the restoration of ecosystem services have not been standardized. Therefore, experts assess whether the project plans to incorporate secondary resources into the production cycle and if the project encompasses measures such as landscape restoration or water management in depleted quarries, deciding whether the project solutions can be regarded as those providing additional environmental benefits.

In some industries, industry-specific greenhouse gas emissions indicators established in 2022 can be employed for assessing the carbon intensity of the manufacturing processes and products. Over time, a similar approach to that described for K_1 and K_2 could be expanded to include carbon intensity indicators.

4 Green Industry Projects in the Eurasian Economic Union: Expert Assessment

In the course of this study, we conducted a comparative analysis of projects vying for green status that were developed in the Eurasian Economic Union member states, namely Belarus, Kazakhstan, and Russia [9]. Resource-intensive industries using BAT were chosen for the analysis [10–14].

The rise in the production of clay blocks (characterized by a high void ratio and low density) and hollow bricks can be attributed to the diminishing use of solid brickwork in modern constructions. Also, stringent thermal resistance requirements for construction materials have been adopted universally. While past green building standards rarely touched upon the origin of construction materials, the focus has shifted to two crucial objectives: (1) ensuring the reduction of negative impact on the environment throughout the life cycle of construction materials, and (2) curbing the so-called embodied carbon, or carbon dioxide emissions accompanying the production of construction materials [15, 16].

Key environmental considerations in clay block production involve emissions of suspended solids, CO, NO_X, and SO_2 resulting from preparing brick mixtures [17, 18]. In Russia, carbon monoxide (CO), sulphur dioxide (SO_2), and nitrogen oxides (NO_X) are classified as markers, with BAT indicators established for emissions of these substances [18, 19].

The projects under analysis envision the construction of facilities with capacities ranging from 350 thousand tons to 2.5 million tons of porous clay bricks and hollow bricks per year (see Table 1). The assessment was conducted using the K criterion. Compliance with subcriterion K_1 was assessed using emission targets and compliance with subcriterion K_2 was assessed using resource efficiency indicators established in the Russian BREF 4–2023. Subcriterion K_3 covered fostering a low-carbon economy and a closed-loop production cycle.

Expert assessment results reveal similarities in technological solutions for projects A, B, and C. However, project C involves the production of hollow bricks, while projects A and B focus on porous clay blocks.

Regarding compliance with subcriterion K_1, it is noteworthy that all projects meet requirements for marker pollutant emissions. Project A, however, exhibits relatively higher CO emissions, possibly due to the addition of a significant quantity of combustible additives to the charge, such as sawdust (up to 150–160 kg per ton of product as per design documentation). Simultaneously, project A anticipates lower nitrogen oxide emissions compared to projects B and C.

Table 1 Ceramic manufacturing projects: key assessment results

Assessment criteria	Project A	Project B	Project C	BREF 4–2023
Production capacity, tons per day	2500 (porous clay blocks)	1800 (porous clay blocks)	350 (hollow bricks)	BREF 4–2023 is used for facilities with a capacity of more than 150 tons per day
K_1: Emissions				
Emissions (BAT-AELs), kg per ton of product				
CO	0.8	0.6	0.5	$\leq$0.8
NO_X	0.3	0.5	0.5	$\leq$0.5
SO_2	0.2	0.1	0.2	$\leq$0.2
Ways to reduce NO_X emissions	Described in the project	Described in the project	Described in the project	Optimization of the firing process
	Described in the project	Not planned	Not planned	Application of low NO_X burners
Ways to reduce CO emissions	Described in the project	Described in the project	Described in the project	Optimization of the firing process
	Described in the project	Not planned	Not planned	Exhaust gas combustion in a furnace
K_2: Resource efficiency (BAT-AEPLs)				
Specific heat consumption, GJ/t	0.95	1.15	1.30	$\leq$1.94 GJ per ton of end products for factories producing clay blocks; product type is not specified
Waste heat recovery	Described in the project	Described in the project	Described in the project	Waste heat recovery from a kiln system for brick drying
K_3: Fostering a circular and low-carbon economy				
Thermal conductivity, W/(m•K)	0.15–0.17	0.17–0.21	0.19–0.23	No information
Use of plant wastes (logging waste, woodworking waste, sunflower hulls, rice hulls, etc.)	Described in the project	Described in the project	Described in the project	Considered as BAT
Use of waste plastic	Not planned	Not planned	Described as a potential future solution	Not considered

Adding more combustible additives facilitates product porosity, reduces thermal conductivity (which is significant in the context of subcriterion K_3), and marginally curtails fossil fuel consumption (which is significant in the context of subcriterion K_2 and K_3, potentially reducing greenhouse gas emissions). Assuming the calorific value of sawdust to be 7 to 9 GJ per ton, the total heat released during combustion can be estimated at 1.2 GJ per ton of product, explaining the low consumption of natural gas (0.95 GJ per ton of product in project A).

It is known that heat losses from buildings, usually measured in watts per hour, are a result of the temperature difference between the inside and outside. The thermal conductivity of solid clay blocks is 0.5 to 0.6 W/(m•K), while that of the planned products (projects A, B, and C) range from 0.15 to 0.23 W/(m•K). This implies that buildings constructed with porous clay blocks will likely require less fuel for heating than those with solid bricks of the same geometry.

Comparative expert assessment results, utilizing the K criterion and BREFs, can serve as a foundation for providing recommendations on BAT compliance for the responsible sourcing purposes.

5 Developing BAT Principles and Improving the Green Project Taxonomy of the Eurasian Economic Union

Under the guidance of Academician Glazyev of the Russian Academy of Sciences, work on formulating the concept for integrating the principles of the green economy in the Eurasian Economic Union has been ongoing since 2021 [20]. In 2022, a proposition was made to incorporate the enhancement of resource efficiency and the implementation of Best Available Techniques among the core principles of green integration.

A model taxonomy of green projects for the EAEU was approved in 2022, encompassing key areas such as energy, construction, water supply and sanitation, waste management, and biodiversity protection. The document was prepared considering international experience (see for example [3, 21]). However, the general part of the relevant document only mentions the pulp and paper industry along with waste paper recycling. Sections reflecting country-specific nuances have been developed considering the environmental and climate regulations in Kazakhstan and Russia. Similar to the Russian taxonomy published in 2021, the document discussed employs specific numerical indicators of CO_2 emissions from official EU documents, which expired in 2021. It is advisable to enhance the model taxonomy by adopting the approaches outlined in ISO 14,030–3:2022 [3] and abandoning specific numerical indicators [3]. The core of the taxonomy should be grounded in principles that improve resource efficiency and introduce BAT, fostering a reduction in negative environmental impact and CO_2 emissions.

Such a decision would broaden the spectrum of green projects, aligning with the priority integration areas and the interests of EAEU member states. To improve tools for supporting green projects, it is recommended to develop methodological international standards in the realm of BAT and conduct a comparative analysis of the environmental and resource efficiency of key industries.

Considering the priority integration areas and the significant role of Russian experts in drawing up BREFs such as metallurgy, chemicals, heat and power engineering, and the production of construction materials, it is recommended forming a united BAT Expert Society [9] for the Eurasian Economic Union. Simultaneously, green projects executed through collaborative efforts by EAEU member states could undergo expert assessments based on harmonized principles.

6 Conclusion

The study has yielded the following results:

- The mechanisms ensuring the development and implementation of sustainable development projects were analyzed, proposing a classification of national and international instruments for supporting green projects covering taxonomies from Asia–Pacific countries, BRICS member states, the EAEU, the EU, and the OECD. It is demonstrated that, in relation to industrial development, all taxonomies are prepared with consideration for Best Available Techniques requirements.
- An algorithm for expert assessment of projects for environmental and technological transformation within BAT application areas was developed, and a composite assessment criterion was devised. This approach facilitates the assessment of design solutions, accounting for meeting emissions targets (K_1), resource efficiency indicators (K_2), and additional conditions (K_3) in areas such as reducing carbon intensity, fostering a circular economy, ecosystem restoration, etc.
- Based on the results of our comparative analysis of industrial development projects in EAEU member states, it is evident that expert assessment using the proposed algorithm and the K criterion allows for a judicious selection of projects that ensure high resource and environmental efficiency in BAT application areas.
- Recommendations were formulated for improving the Eurasian taxonomy and principles for selecting projects for environmental and technological transformation in EAEU member states, including (1) identifying common areas of BAT application in the context of Eurasian integration; (2) conducting a comparative analysis of resource efficiency, environmental efficiency, and carbon intensity of priority industries; (3) establishment of the Eurasian expert community in the field of BAT. These recommendations were instrumental in the preparation of the draft concept for introducing green economy principles in the EAEU.

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