

Green Financing and Sustainability: Web Tools for Energy Efficiency Assessment

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Abstract

This article explores the role of green finance and web-based tools in achieving sustainable development goals. The primary focus is on assessing the energy efficiency of buildings and infrastructure. The paper analyzes modern digital platforms (e.g., Eco Green Building Standard, NYSERDA, Green Algorithms), which provide investors and developers with the ability to accurately assess the environmental sustainability of projects and effectively minimize their carbon footprint.

Keywords: Green finance, sustainable development, energy efficiency, web tools, environmental sustainability, digital platforms, carbon footprint, Eco Green Building Standard, NYSERDA, Green Algorithms.

INTRODUCTION

The scientific novelty of this article lies in the fact that it is the first to systematically summarize and analyze the role of specialized web-based energy efficiency assessment tools in green finance mechanisms in the United States, with an emphasis on their functional connection with investment decisions, the issuance of green bonds, and ESG reporting.

In recent decades, sustainable development and energy efficiency have gained global importance. Green finance, a mechanism that directs capital to environmental projects, is a key tool for reducing carbon footprints and using resources efficiently.

A key element in the implementation of green finance has been the use of web-based tools for energy efficiency assessment. Innovative digital platforms such as AI4EF and GAISSALabel offer cutting-edge solutions for analyzing and optimizing energy consumption. AI4EF uses machine learning to accurately model, forecast energy consumption, estimate retrofit costs and environmental impacts, and offer personalized recommendations for improving the energy efficiency of buildings and infrastructure.

GAISSALabel implements a labeling system that evaluates the energy efficiency of machine learning models themselves, thereby promoting the creation of sustainable software.

Furthermore, digitalization improves the efficiency of resource allocation and the accessibility of green projects. Platforms such as dltedgers' Proteus ensure transparency and traceability of financial transactions, which strengthens investor confidence and reduces risks in environmentally responsible projects.

Thus, the integration of web tools into green finance plays a crucial role in achieving sustainable development goals, ensuring effective energy efficiency management and stimulating investment in environmentally friendly projects.

The concept of green finance combines financial resources with principles of environmental sustainability to support projects that reduce carbon footprints, manage resources efficiently,

and improve quality of life. In the United States, this concept is rapidly developing and becoming firmly integrated into investment and financial practices.

Green finance in the US has emerged as a response to growing environmental concerns and the need for sustainable development. A significant milestone has been the creation of green banks- public or private entities specializing in financing environmental projects. A key player in promoting this model is the Coalition for Green Capital, which actively promotes the creation of such institutions at the state level [1].

The development of green finance is supported by several academic approaches:

- Institutional analysis and development (IAD) explains how regulations and the institutional environment influence the allocation of investments in green projects [2].
- signaling theory analyzes how companies use public green initiatives (ESG reporting) to create a positive investment image and attract capital [3].
- Behavioral finance examines how environmental, social, and governance (ESG) factors influence investor decisions and behavior [4].

In the United States, a variety of instruments are used to implement green finance: green bonds, green loans, and carbon risk agreements. For example, the agreement «The Carbon Principles», which requires major banks to assess carbon risks when financing energy projects [5].

Table 1 - Main green finance instruments in the USA

Tool	Target	Advantages
Green bonds	Financing of renewable energy and energy efficiency projects	Transparency, sustainability, and attracting ESG investors
Green loans	Supporting businesses transitioning to green technologies	Access to preferential financing terms
Green banks	Large-scale financing of sustainable development projects	Accelerating decarbonization, public-private partnerships
Equator Principles	Standardization of environmental risk assessment	Climate risk management, harmonization with international standards
The Carbon Principles	Carbon risk assessment in energy projects	Improving energy system resilience and managing investor risks
ESG investments	Taking into account environmental, social and governance factors	Increased confidence, long-term portfolio sustainability

The development of green finance in the US is driven by active collaboration between the government and private sector. Government regulation and major initiatives such as Equator The Principles establish a clear framework for managing climate and social risks in project finance. The private sector is increasingly investing in ESG (environmental, social, and governance) projects, viewing them as a source of long-term sustainable returns, not just as an element of corporate responsibility. Green banks Banks are a key instrument in decarbonizing the US economy, providing targeted financing at the municipal and state levels. Incidentally, the US is one of the world leaders in sustainable finance. According to International Capital

Market Association, the American green bond market is consistently among the top three largest in the world in terms of total issuance volume [6].

energy efficiency assessment tools are being actively integrated into digital ecosystems, automating analysis, accelerating decision-making, and improving design quality. In the US, web platforms have become a key element of sustainable development and decarbonization strategies.

energy efficiency analysis platforms perform a number of important functions:

1. Ensuring continuous control and monitoring of energy consumption in buildings and industrial facilities.
2. Comparison of current indicators with industry norms and established standards.
3. Support of design solutions based on energy audit and modeling data.
4. Generating the necessary documents to attract green financing and participate in carbon emission reduction programs.

Unlike traditional methods, digital platforms provide organizations and individuals with access to up-to-date analytics and energy consumption scenarios in near real time. This digital approach is actively supported at the federal level through initiatives of the US Department of Energy. of Energy (DOE) [7] and US Environmental Protection Agency (EPA) [8].

Table 2 - Key web tools for assessing energy efficiency in the United States

Tool name	Organization / source	Main functions	Application
ENERGY STAR Portfolio Manager	US EPA	Monitoring and assessing building energy consumption, calculating ENERGY STAR ratings	Building management, certification, reporting
Building Energy Asset Score	US DOE	Energy efficiency analysis of buildings, identification of modernization potential	Design and reconstruction of buildings
Home Energy Saver	Lawrence Berkeley National Laboratory (LBNL)	Online assessment of home energy consumption	Individual households, energy audit
REopt Lite	US DOE – National Renewable Energy Laboratory (NREL)	Optimization of renewable energy systems and energy storage systems, cost and emissions analysis	Business, government buildings, campuses
EnergyPlus (web tools & API)	US DOE	Modeling of building energy consumption	Architecture, engineering, energy
OpenStudio Cloud	US DOE + NREL	Web platform for energy efficiency calculations with visualization	BIM modeling, sustainable design

The development of green finance in the US is inextricably linked to the use of digital technologies and web platforms. These tools are critical, as they enable standardized collection and analysis of data on energy efficiency, greenhouse gas emissions, and the overall

environmental impact of projects. This transparency and reliability of data allows investors and government agencies to make decisions based on verified information, effectively mitigating risks and increasing the investment attractiveness of sustainable projects.

Web platforms act as a bridge between financial capital and environmental responsibility, providing:

- reliable confirmation of energy efficiency and real emission reductions;
- creation of reports that are fully compatible with international standards such as Green Bond Principles ;
- optimization of transaction costs and accelerated access to green capital;
- integrating environmental, social and governance (ESG) factors directly into the investment decision-making process.

Transparent digital reporting is necessary for financial instruments such as green bonds, targeted energy efficiency loans, and government decarbonization programs.

A key barrier to attracting green capital is the information asymmetry between those issuing green assets and investors. Web tools effectively eliminate this barrier by providing public verification of actual performance. energy efficiency, unification of environmental performance calculation methods, and automated ESG reporting. For example, the ENERGY STAR Portfolio Manager is used to monitor over 400,000 buildings in the US (municipal, commercial, educational), and its data regularly informs the issuance of green bonds by corporations and cities [9].

To meet global green finance requirements, the web platform:

- guarantee compatibility with Green principles Bond Principles (ICMA);
- facilitate the preparation of reports according to Climate standards Bonds Initiative;
- are used for accurate calculation and verification of energy efficiency indicators within the framework of general ESG assessments.

The use of digital tools is a mandatory part of federal policy:

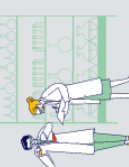
1. US Department of Agriculture programs of Energy decarbonization programs require the mandatory use of digital tools to obtain federal subsidies and grants.
2. US Environmental Protection The Agency uses ENERGY STAR to evaluate the effectiveness of state and municipal projects.
3. LEED certification through the LEED Online platform serves as a standard for participation in many public and private ESG initiatives.

The use of web tools provides the financial sector with the following benefits:

- reducing risks for creditors and investors;
- simplified issuance of green bonds and access to targeted grants;
- international recognition and comparability of reporting;
- increasing the accuracy of investment modeling.

Thus, green finance and web-based tools for energy efficiency assessment are key drivers of sustainable development.

Their combined application facilitates the efficient redistribution of capital into environmentally responsible projects, significantly increases transparency and trust in financial markets, and stimulates innovation in sustainable technologies.



For the continued success and scaling of these initiatives, it is necessary to:

1. Deep integration of digital solutions.
2. Standardization of methods and approaches to assessment.
3. Active cooperation between public, private and international structures.

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