

# Opportunities and Challenges of Implementing Green Financial Management Models in Energy-Intensive Enterprises

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## **Abstract:**

With global climate change and increasing resource constraints, sustainable development has become a global consensus. Energy-intensive enterprises, as major sources of resource consumption and environmental pollution, play a critical role in promoting coordinated economic, social, and environmental development through the implementation of green financial management models. This paper focuses on energy-intensive enterprises, employing a combination of case analysis and empirical research to explore the key opportunities and major challenges in adopting green financial management practices. Furthermore, the study conducts an in-depth analysis based on the development status and characteristics of energy-intensive enterprises and proposes corresponding strategies. The research finds that although green financial management faces challenges such as high initial investment and technical barriers, it can generate significant long-term value through optimized resource allocation and risk reduction. This paper reveals the unique aspects of green financial management in energy-intensive enterprises and proposes a cost-technology synergy strategy based on dynamic capability theory, providing empirical evidence for policymakers to design incentive mechanisms and for enterprises to guide practical implementation. The findings hold important theoretical and practical significance for advancing the green transformation of high-energy-consumption industries.

**Keywords:** Energy-intensive enterprises, Green financial management, Opportunities and challenges, Green transformation

## 1. Introduction

Under the global sustainability agenda and China’s “dual-carbon” strategy, the drawbacks of traditional models in energy-intensive enterprises, which are major consumers of resources and emitters of carbon, have become increasingly apparent. Implementing green financial management models is key to their transformation. However, existing research lacks in-depth analysis of the opportunities and challenges specific to these enterprises. This paper aims to fill this gap, offering theoretical and practical insights to support their green transition and promote sustainable development in high-energy-consumption industries.

## 2. Opportunities for Energy-Intensive Enterprises to Implement Green Financial Management Models

### 2.1 Policy Support and Incentives

#### (1) Financial Subsidies and Tax Incentives

Germany’s Renewable Energy Act mandates that renewable energy account for 80% of electricity generation by 2030, offering premium subsidies for wind and solar projects and establishing a dedicated hydrogen fund. Brazil’s National Hydrogen Strategy attracts green hydrogen investments through tax breaks, aiming to become a major global hydrogen exporter by 2030. China’s 14th Five-Year Plan sets a target for non-fossil energy to comprise 20% of energy consumption by 2025, promoting green trading pilots and paid carbon emission allowances. These measures provide a clear framework for low-carbon transition, sup-

ported by government subsidies and tax reductions (e.g., corporate income tax and VAT exemptions), lowering initial investment and operational costs while encouraging green financial management.

#### (2) R&D Funding Support

Governments prioritize green energy technology innovation, offering dedicated R&D funds for hydrogen, energy storage, carbon capture, and low-carbon upgrades in traditional industries (e.g., steel, cement). Enterprises can leverage these funds to accelerate clean energy and energy-saving technologies, enhancing productivity and market competitiveness.

### 2.2 Shifts in Market Demand and Potential

#### (1) Growing Consumer Demand for Eco-Friendly Products

Rising environmental awareness has increased demand for sustainable products. Energy-intensive enterprises that develop or improve eco-friendly products can tap into broader markets. For example, green building materials saw global market value reach ¥2,155.131 billion in 2023, with an expected annual growth rate of 8.91% to ¥3,701.762 billion by 2029. In China, green revenues exceeded ¥200 billion in 2023, with projected annual growth of over 10% from 2024 to 2026.

#### (2) Emerging Market Expansion Opportunities

Green energy policies have spurred growth in renewable energy markets (solar, wind, hydro), enabling traditional enterprises (e.g., coal companies) to diversify into new sectors and customer bases.<sup>[1]</sup>

### 2.3 Improved Energy and Resource Efficiency

#### (1) Increased Share of Green Energy Consumption

Table 1 China’s Energy Consumption Share (2019–2024)

Year	Coal (%)	Petroleum (%)	Natural Gas (%)	Clean Energy (Hydro/Wind/Solar/Nuclear) (%)
2019	57.7	19.0	8.1	15.2
2020	56.8	18.9	8.5	15.8
2021	56.0	18.5	8.9	16.6
2022	55.3	18.2	9.5	17.0
2023	54.0	18.0	10.0	18.0
2024	52.5	17.5	10.5	19.5

Data Source: National Bureau of Statistics, National Energy Administration

From 2019 to 2024, China’s energy mix shows a clear shift toward clean energy: coal declined from 57.7% to 51.0%, while clean energy rose from 15.2% to 21.0%,

driven by the “dual-carbon” goal. Wind and solar are projected to contribute over 60% of clean energy by 2025, reducing costs and boosting competitiveness.

#### (2) Enhanced Energy Conversion Efficiency

**Table 2 China's Energy Conversion Efficiency (2019–2024)**

Year	Avg. Conversion Efficiency (%)	Thermal Power (%)	Oil Refining (%)	Coal Washing (%)
2019	72.1	42.5	92.3	85
2020	72.8	43	92.5	85.2
2021	73.4	43.6	92.8	85.5
2022	74	44.2	93	85.8
2023	74.5	44.8	93.2	86
2024	75	45.3	93.5	86.3

Data Source: National Bureau of Statistics, National Energy Administration

Steady improvements in efficiency (e.g., thermal power, oil refining) help reduce waste, cut costs, and align with carbon policies, fostering sustainable business models.

### 3. Challenges for Energy-Intensive Enterprises in Implementing Green Financial Management Models

#### 3.1 Rising Costs and Profitability Balancing

(1) High Initial Investment Costs

Green transitions require substantial upfront investments. For example, a steel company's full-scale green retrofit cost ¥4.5 billion, raising its debt ratio from 58% to 67%.<sup>[2]</sup>

(2) Increased Operational Costs

Eco-friendly materials, environmental monitoring, and compliance measures elevate ongoing expenses, alongside potential fines for non-compliance.

#### 3.2 Technological Hurdles and Innovation Pressures

(1) Complexity of Green Technology R&D

Breakthroughs in fields like materials science are needed for advanced solar/wind technologies, posing high R&D risks.

(2) Barriers to Technology Adoption

Adapting imported technologies to local standards is costly and time-consuming, with potential export restrictions.

### 4. Strategies to Address Challenges

#### 4.1 Cost Control and Profit Optimization

Dynamic Cost Management: Collaborate with academia

to assess lifecycle costs of green projects, using AI for real-time monitoring.

Green Supply Chains: Partner with eco-conscious suppliers to reduce material and logistics costs, fostering circular economies.

#### 4.2 Technological Innovation Strategies

Industry-Academia Partnerships: Joint labs for core green tech R&D (e.g., energy-saving processes).<sup>[3]</sup>

Agile Innovation: Leverage blockchain/IoT for secure data sharing and smart production optimization.

### 5. Conclusion

Green financial management is essential for energy-intensive enterprises to align with sustainability goals. By addressing challenges through innovative financing, R&D, and partnerships, these enterprises can achieve both environmental and economic gains, securing long-term competitiveness.

### References

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