Impact of Climate Change on Companies: A Case Study of China Yangtze Power

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Abstract: This study uses the extreme drought in the Yangtze River Basin in 2022 as a case study to investigate the effects of physical risks brought on by climate change on China Yangtze Power Co., Ltd. By constructing an event intensity-duration matrix the research identifies significant climate events and analyzes their financial and operational consequences. The drought led to a marked reduction in runoff causing a decrease in hydropower generation which resulted in a 6.54% drop in revenue and an 18.89% decline in net profit in 2022. In response the company implemented strategies such as cascade reservoir joint operation and divestment of financial assets to mitigate losses. The case underscores the materiality of climate risks to corporate performance and highlights the need for integrating climate risk management into corporate governance.

Keywords: Climate Change Physical Risks; Dual Materiality; ESG Report

1. Introduction

As climate change intensifies, public concern regarding this issue is growing. This increased public and societal attention has heightened regulatory pressure from society and governments on corporate environmental practices, thereby asset prices and market preferences, then indirectly impacting a company's financing capacity, reputation, and market valuation.[1][2] On the other hand, climate change itself is a significant factor capable of affecting a company's means of production and the arrangement of its daily operations.[3] Additionally, the quality of climate risk disclosures can likewise influence corporate production and operational activities by affecting financing costs, among other factors.[4] This study innovatively identifies climate change events experienced by the company in its annual production and operations through the construction and application of an Event Intensity-Duration Matrix, pinpointing the most impactful events. Based on this, it analyzes the financial and social impacts of the most significant event on the company.

2. Case Study

2.1 Company Profile of China Yangtze Power Co., Ltd

On September 29, 2002, China Yangtze Power Co., Ltd. (CYPC) was founded, initiated mainly by China Three Gorges Corporation. The company's primary operations include the hydropower generation, financing and investment, pumped storage, new energy, smart integrated energy, and the distribution and retail of electricity. Its operations span several countries, including China, Peru, Brazil, and Pakistan. Domestically, CYPC playing a crucial role in energy supply, generates about 17% of total hydropower generation.

2.2 CYPC's ESG Practices

CYPC focuses on identifying and managing key sustainability issues. It actively follows the "dual materiality" standard advocated by national regulators, constructing a materiality matrix from the dimensions of "Impact Materiality" and "Financial Materiality." By sorting out key sustainability topics, it carries out targeted and focused sustainability work (**Figure 1**).

Regarding the environmental aspect, "Dual Carbon" is a key social focus, aiming to build an environmentally friendly society and achieve sustainable development. As a leading enterprise in China's hydropower sector, CYPC generated 295.904 billion kWh of electricity in 2024, replacing an equivalent amount of electricity generated by methods like coal combustion. This equates to saving approximately 89.24 million tons of standard coal and reducing CO2

emissions by over 240 million tons.

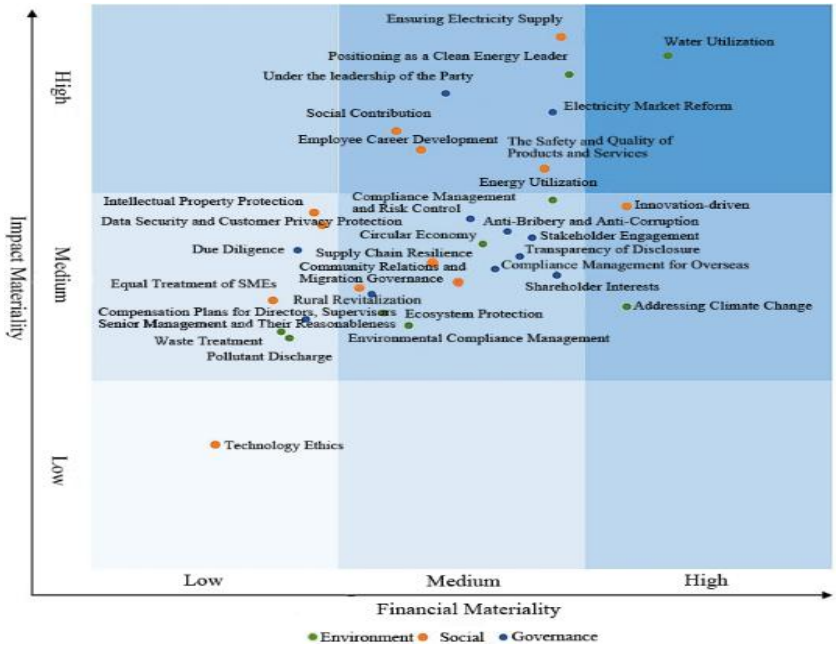

Figure 1. Identification of Double Materiality Issues for CYPC

Data source: ESG report 2024 of CYPC

On the social front, CYPC consistently adheres to the social responsibility philosophy of "Harmony as the Foundation, Creating Value, Contributing to Society, Green Development," actively fulfilling its responsibilities towards employees, the public, and partners. Regarding employees, the workforce remained stable overall in 2024, with 16 employees leaving, accounting for 0.3% of the total workforce. All employee turnover procedures were handled according to laws and regulations. Concerning employee safety and improving the working environment, the company had cumulatively spent RMB 217 million by 2022.

In terms of corporate governance, CYPC has established a clear, scientific, consistent, and efficient corporate governance structure by closely adhering to the "Company Law of the People's Republic of China" as well as other pertinent laws, rules, and listing regulatory requirements.

3. China Yangtze Power and Climate Change Impact

3.1 Analysis of Major Climate Change Events in the Yangtze River Basin Based on Impact-Duration" Dimensions

In the Yangtze River Basin, summer droughts, high temperatures, and heat-and-drought compound occurrences are the main climate change events. These events have wide-ranging and significant impacts. Floods caused by extreme rainfall have also occurred. The influence of related climate change events on the Yangtze River's discharge can be seen by examining historical runoff data from hydrological stations built along the river. Furthermore, a matrix based on the dimensions of event duration and intensity can be established to identify some major events (**Figure 2**).

Figure 2. Intensity-Duration Matrix of Major Historical Climate Events in the Yangtze River Basin

3.2 Climate Change and CYPC's Power Generation in the Yangtze River Basin

As CYPC's primary source of power generation is hydropower, changes in the Yangtze River's flow are crucial to its power generation output.

In order to demonstrate the particular effects of climate change on CYPC, the ensuing possible financial ramifications, and the company's corresponding policies, this section will examine the relationship between significant historical climate change occurrences in the Yangtze River Basin and CYPC's power generation.

The annual runoff data has correlation with annual electricity generation. For example, The Cuntan Station, located upstream of the Three Gorges Dam, serves as the inflow station for Three Gorges.

From this chart, it can be observed that in 2006, 2013, 2019, and 2022, severe meteorological changes occurred in the Yangtze River, causing significant impacts on the annual runoff of the main stem and the Jinsha River. Correlating with Figure 3, it is found that the runoff reductions in 2013 and 2022 had the most severe impact on the company's power generation business: total power generation decreased by 14% in 2013 and by 10.92% in 2022. (**Figure 3)** Meanwhile, taking the power generation of the Three Gorges Dam and the changes in runoff at Cuntan Station as an example, it can be observed that climate change indeed affects the hydropower operations of the Yangtze River by influencing runoff, thereby impacting power generation.

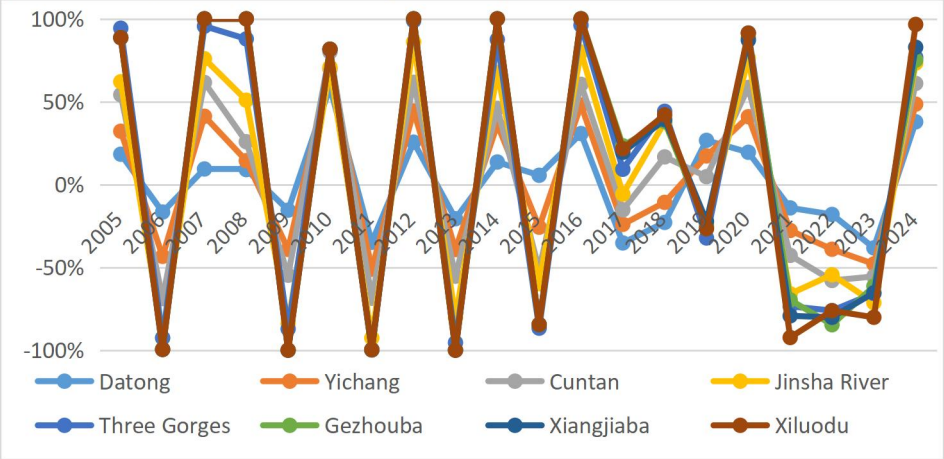

Figure 3. Correlation between Runoff and Power Output

3.3 The Yangtze Basin's Climate Change and the CYPC's Dual Materiality Issues

Changes in the runoff of the Yangtze River's main stem and tributaries, driven by climate change in the basin, significantly impact CYPC's core business—hydropower generation—which in turn affects CYPC's financial performance. The specific pathway can be summarized in the following diagram (**Figure 4**).

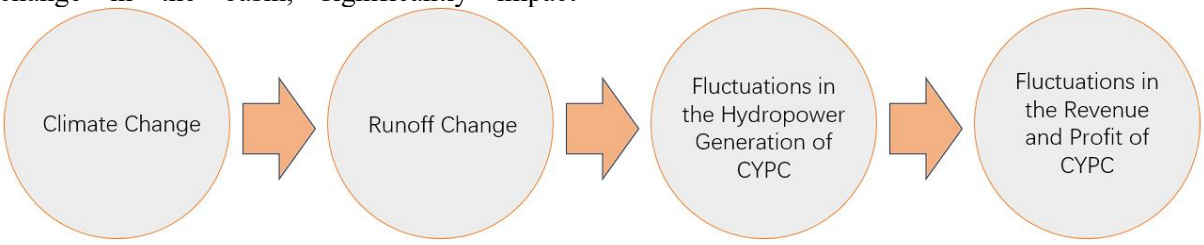

Figure 4. Impact Pathway of Climate Change on the Financial Performance of China Yangtze Power

Based on CYPC's ESG reports and financial reports, the following analysis of the dual materiality of climate change for the enterprise can be conducted.(**Table 1)**

In 2022, a persistent drought occurred in the Yangtze River Basin, reducing the company's hydropower generation revenue. The sharper decline in net profit compared to revenue was due to increased operating costs that year. Furthermore, the company's net cash flow from operational activities dropped by 13.49% on an annual basis, reducing its investment capacity, cash dividend capability, and debt-paying ability, thereby increasing financial and debt repayment pressures. To counter these impacts, management implemented responses in two main area as Table 3 shows.

Table 1. Elements and Process for Double Materiality Assessment of Climate Change at CYPC.

Physical Impact	Financial/Operational Consequences	Management's Strategic Response	Risks and Opportunities
The Yangtze River Basin experienced a protracted drought in 2022. Runoff in the middle and lower sections of the main stem significantly decreased as a result.	In 2022, CYPC achieved operating revenue of 52.06 billion, decreased 6.54% compared with 2021. Net profit attributable to shareholders was 21.309 billion, a year-on-year decrease of 18.89%. Meanwhile, the net cash flow from operating activities was 30.912 billion, a year-on-year decrease of 13.49%.	Implemented coordinated cascade reservoir operation among six hydropower stations (Xiangjiaba, Three Gorges, Gezhouba, etc.). Strengthened collaboration with meteorological departments to enhance hydrometeorological prediction and forecasting. Additionally, the company sold some financial assets to offset the decline in main business revenue.	Focusing on meteorological and hydrological monitoring and joint dispatch technology, it is building an integrated space-air-ground meteorological and hydrological monitoring system.

Data source: concluded from Financial report 2022 of CYPC, ESG report 2022 of CYPC

Using the Yangtze River Basin's drought in 2022 as an example, this analysis demonstrates the financial and social impact aspects of climate change on the enterprise, using the drought event to illustrate the dual materiality of climate change events for CYPC. The proactive response by CYPC's management and their integration of climate risks into the company's comprehensive risk management system further underscore the intensity of climate change impacts on the company.

4. Conclusion

The above case study demonstrates that physical risks arising from climate change can directly impact companies. The effects of climate change are no longer topics confined solely to corporate social responsibility reports but are significant factors that tangibly affect corporate production and operations, especially in industries closely linked to natural resources. Therefore, enterprises should closely monitor climate change indicators relevant to their industry, fully understand the potential impacts climate change may have on them, and proactively and actively fulfill their environmental and social obligations.

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