

Climate Risk and Carbon Exposure Case Study: Énergie Verte – France

Executive Summary

This report evaluates the climate risk exposure of Énergie Verte, a fictional French energy company with a large power plant near the riverside in Lyon. Énergie Verte holds ~ 3% of the national market share with an annual production of 15.3 TWh through fossil fuel (80%) and renewable energy sources (20%) producing ~5.5MtCO₂ in 2023. Using public datasets from regulatory boards and verified sources, we quantify regulatory and physical climate risks, estimate financial impacts and offer strategic recommendations for risk mitigation.

Datasets from The Emission Database for Global Atmospheric Research (EDGAR), The World Bank Emissions Dashboard and Copernicus are taken for analysis. The datasets were chosen based on their transparency, update frequency, reliability and quality and direct relevance to transition and physical climate risks. They are also frequently referenced by regulatory bodies, international institutions, and climate policy researchers.

1. EDGAR: Detailed monthly and sectoral CO₂ emissions (1970-2024)
2. World Bank Carbon Pricing Dashboard: Annual EU ETS and national carbon tax data
3. Copernicus (NetCDF): Runoff data near Lyon used to estimate flood frequency and severity.

Transition Risks: Carbon Pricing Exposure

Énergie Verte is significantly exposed to carbon pricing regulations as a company with a high reliance on fossil fuels. France does not directly tax the power/energy industry, which is covered under the EU Emissions Trading System (ETS) which surged after 2018 with an approximate increase of 500% from 2018 to 2023, drastically increasing the company's regulatory burden. In 2023, compliance costs exceeded \$529.5 million for this emission profile. Since the regulations have been in place, a significant drop in emissions could be seen as shown in Fig.1.

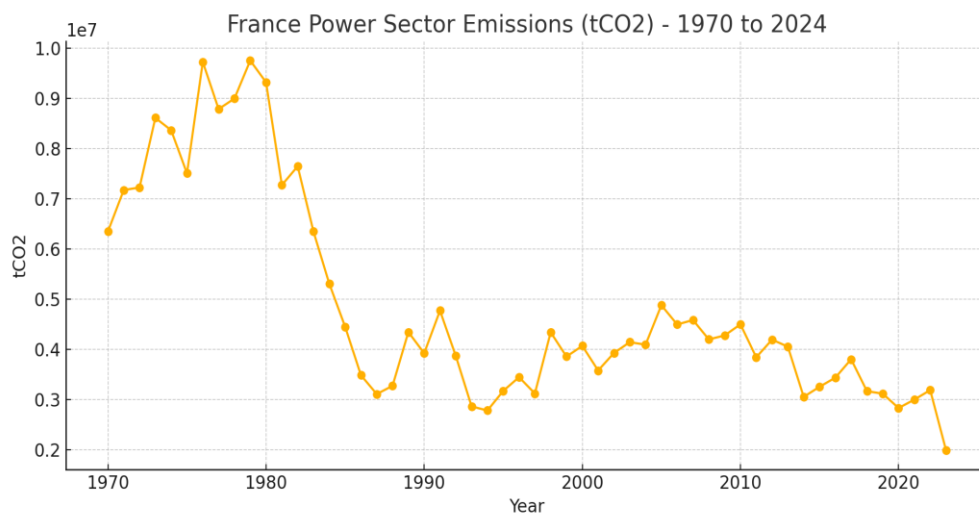


Fig. 1: Annual CO₂ Emissions for Power Sector (France)

Physical Risk: Flood Impact (Lyon)

To assess physical climate risk, runoff (ROWE) data from Lyon's box coordinates (2018-2024) was analysed. Using an ensemble of z-score and percentile thresholds, 2021 was classified as a 'Soft Flood' (Fig. 2) with an estimated loss of \$10M. Such events disrupt generation and increase infrastructure vulnerability, particularly for hydropower and thermal assets located in flood-prone zones.

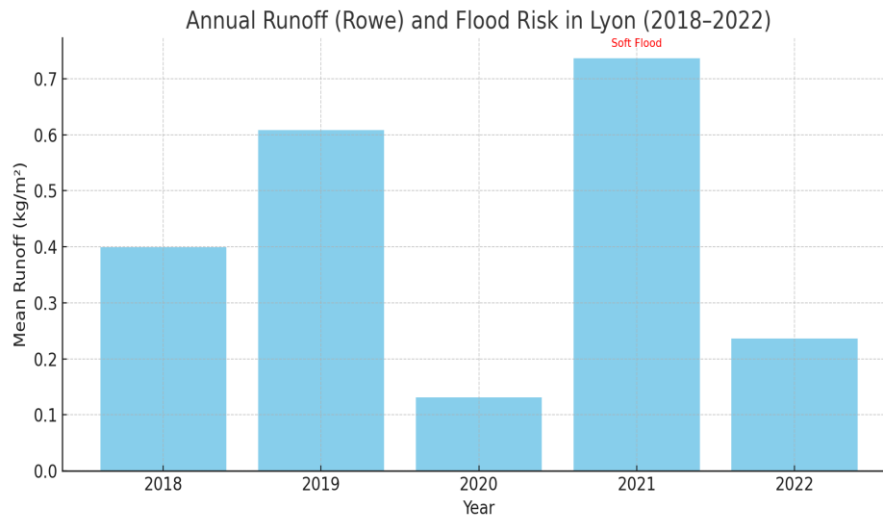


Fig. 2: Average annual ROWE, Lyon

Mitigation measures must be considered to prevent further deterioration of infrastructure, other assets as well as the associated logistic losses from such scenarios in the future.

Financial Impact Summary

Based on current emissions and climate patterns,

- Regulatory costs could exceed \$600M/year under EU ETS by 2028 if prices continue to rise.
- Flood events like 2021 may cost \$5-10M per year in direct losses, not accounting for supply chain delays
- Combined, transition and physical risks could reduce EBITDA margins by 12-18% if unmanaged.

These estimates underscore the urgency of proactive adaptation and decarbonization.

Strategic Recommendations

- Introduce internal carbon pricing based on EU ETS forecasts to anticipate costs.
- Gradually shift portfolio toward renewable sources, targeting 50% by 2030 to reduce regulatory risks.
- Conduct geospatial audits of generation assets to identify critical exposure zones and adjust accordingly.
- Integrate climate risk metrics into financial planning and asset management models.