Title: Impact of climate change in France

Prepared for:

Research thesis

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1. Topic:-

Study on the extent of climate change in France (temperature, precipitation, etc.) and its impact on our consumption (heating, air conditioning, etc.) and on electricity production.

2. Research Problem

Renewable energy providers face significant challenges in managing energy production variability caused by unpredictable weather patterns. In coastal regions such as Aquitaine, these challenges are intensified due to the heightened effects of climate change, including increased wind variability, temperature changes, and fluctuations in solar radiation.

Forecasting inaccuracies not only disrupt the balance between energy supply and demand but also result in financial penalties imposed by regulatory bodies for deviations in expected energy generation. These operational inefficiencies reduce the profitability and reliability of renewable energy systems, posing a significant barrier to the transition to cleaner energy sources. Addressing this issue is critical for optimizing energy production, meeting regulatory compliance, and ensuring long-term sustainability.

3. Research Question: -

- How can predictive analytics enhance the accuracy of renewable energy forecasts in France, thereby mitigating operational and financial challenges posed by climate-induced variability in weather patterns?
- Furthermore, how can these predictive capabilities ensure grid stability and boost profitability for energy companies by minimizing penalties and optimizing resource allocation?
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4. What Kind of Data Needed

1. **Weather Data:** Real-time and historical wind speed, solar radiation, temperature, and precipitation from weather services or APIs.
2. **Energy Generation and Consumption Data:** Historical energy output, turbine efficiency, and energy consumption patterns at the plant level.
3. **Geographical Data:** Information on wind farm or solar plant locations, terrain, and environmental conditions that impact energy generation.
4. **Plant Operational Data:** Production capacity, efficiency rates, downtime, maintenance schedules, and real-time performance.
5. **Economic and Financial Data:** Company profit, energy pricing, penalties, and financial

impacts from underperformance or inaccurate forecasts.

6. **Regulatory Data:** Relevant rules, penalties, tariffs, and compliance metrics as set by the government or energy regulators (e.g., CRE in France).

This project will combine **quantitative methods**, such as analysing weather data, energy production, and consumption metrics (e.g., wind speed, solar radiation, electricity output), to predict energy generation and evaluate its financial impacts (penalties, profits). Historical and real-time data will be used to assess how these factors influence output. **Qualitative methods** will explore government regulations, penalties for inaccurate forecasting, and industry challenges, through expert interviews and document reviews, to understand their effect on business operations. Integrating both methods will help assess how predictive analytics can improve energy stability and profitability, especially in coastal France, where climate variability poses challenges.

This data helps to build predictive models for energy generation, consumption, and financial outcomes, improving operational stability, reducing penalties, and increasing company profitability.

Conclusion

By tackling the dual challenges of climate-induced variability and regulatory compliance, this research aims to make meaningful contributions to the renewable energy sector in France. The findings will not only provide immediate operational benefits for energy providers but also support long-term goals of sustainability and energy security in coastal regions.