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Pirris hydroelectrical Project in Costa Rica: A counterfactual Analysis using FINPLAN

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Executive Summary

This report analyses counterfactuals for the Pirrís hydroelectric project, the largest hydroelectric project ever developed in Costa Rica in the Pacific zone of the country. Three different sensitivity analyses were developed: increases in the hydroelectrical plant management costs, inflation increments after 2023, and increases in the interest rate of the credit. The project was found to be very sensitive to changes in management costs; however, changes in the interest rate and inflation did not present a major financial risk.

The model suggests that hydropower continues to be a highly profitable and robust source of clean generation. It is recommended that the government maintain green financing strategies that allow access to affordable interest rates. Favorable financing conditions in Costa Rica are conducive to the long-term financial strength of the energy project.

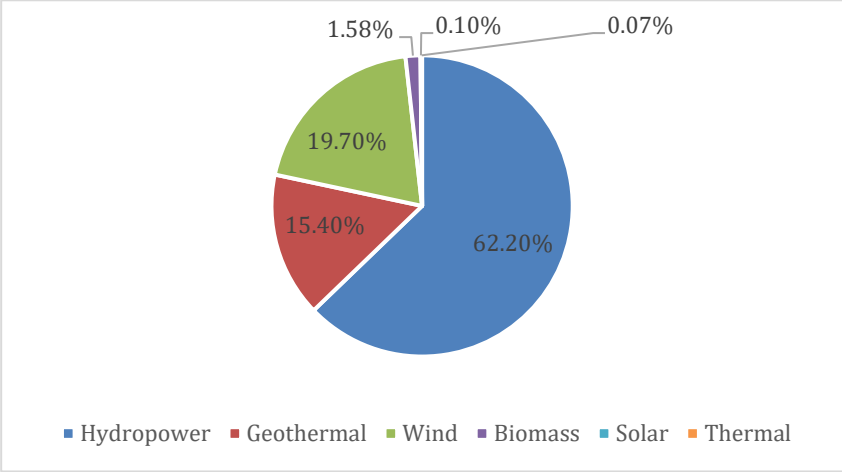
1. Introduction

The Pirrís Hydroelectric Project was selected for its development and construction after the approval of the required environmental impact study between November 1989 and June 1992. It is in the Pacific region of the country. It currently has an installed capacity of 1284 GwH/year and helps to ensure the stability of the quality of the energy supplied through the electrical system. The construction period of the project started in 2005, and the plant came into operation at the beginning of the year 2011.

The importance of this hydroelectric project lies in the characteristics of Costa Rica, in particular, the large water sources that allow the largest percentage of electricity generation to be generated in the country. According to official data from the Costa Rican Electricity Institute (ICE), by 2020, 63.2% of electricity generation came from hydroelectric sources.

This report aims to build a contrafactual analysis of the hydroelectric plant investment project. The main objective is to identify potential financial risks, to determine optimal strategies for distributing financing while diluting potential risks. It is important to take into consideration that the data presented below is limited to the availability of detailed and quality financial data.

Figure 1. Electricity Generation Distribution, 2020



Source: ICE, Average as of February 2020.

2. Methodology

The methodological approach followed a standard financial analysis using the FinPlan tool. This tool is a model for financial analysis of electric sector expansion plans developed by the International Atomic Energy Agency. The financial approach explores the changes in three relevant investment parameters: The net present value (NPV), the internal rate of return (IRR), and the debt-equity ratio (DER). The NPV represents the difference between the net earnings and the costs taken to a present value, we use a discount rate equal to the inflation rate in each period for this porpoise. The IRR represents the minimum discount rate that makes the project profitable, hence bigger IRR represents a more robust investment project. Finally, the DER represents the percentage of the project that is being financed with debt. An ideal DER is as approximate as possible to 0.7, representing a composition of 30% debt and 70% own capital.

The first part of the approach was to balance the financial strategy to achieve a number close to 0.7 in the DER. The financial data was reordered trying to mimic the total financing cost of the project. The data sources and the main relevant inputs are listed in **Table 1**. After a successful balanced case, the next step was to perform a sensibility analysis under different scenarios. The main indicators taken into consideration were: NPV, IRR, dividends, and loan repayment.

Table 1. Main parameters and data sources

Parameters	Value	Source
US Inflation (first year)	3.4%	Federal Reserve System
Currency exchange rate (first year) CRC/$	437	Central Bank of Costa Rica
Plant Production (year)	1284 GWh	Instituto Costarricense de Electricidad
Total Financing (millions of dollars)	237	Instituto Costarricense de Electricidad

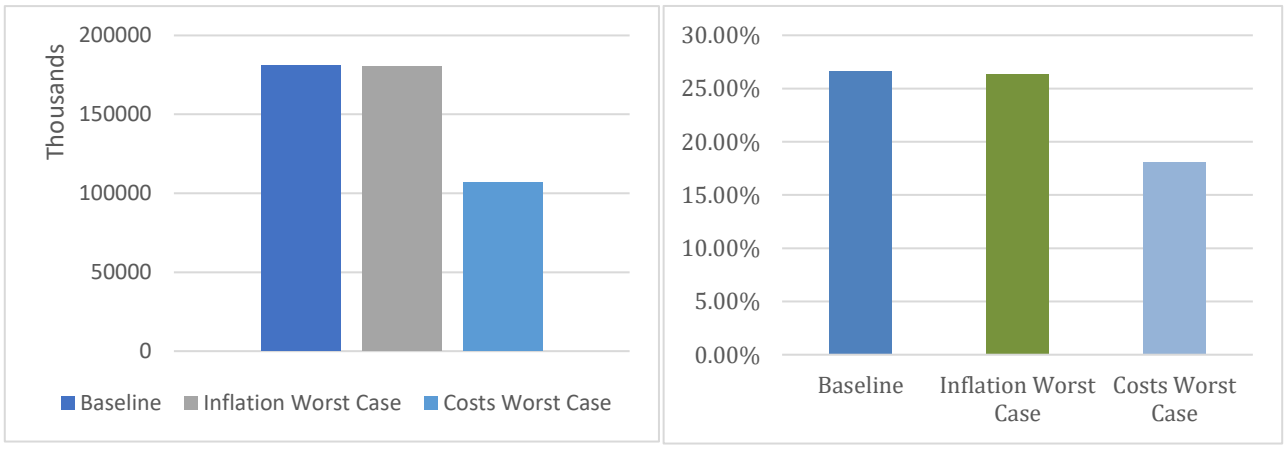
The sensibility analysis scenarios were:

- Sensibility analysis I: We perform standard stress on the credit interest rate. In this case, the interest rate was incremented multiple times, starting at 2.4% and finalizing at an interest rate of 26%
- Sensibility analysis II: We explore increments in the management and operation plant cost. The explored scenarios were increments in 10%, 20%, and a 30% of the baseline operative costs.
- Sensibility analysis III: We develop an analysis of the effects of inflation on the repayment flow. The explored scenarios were an inflation of 10% and a 20% concerning the baseline case departing from the year 2023 where no more inflation data is available.

3. Results

We start first by analysing the effect of the NPV and the IRR in the worst-case scenario of every sensibility analysis. The **Figure 2** presents the aforementioned results.

Figure 2. NPV and IRR in the worst-case scenarios.

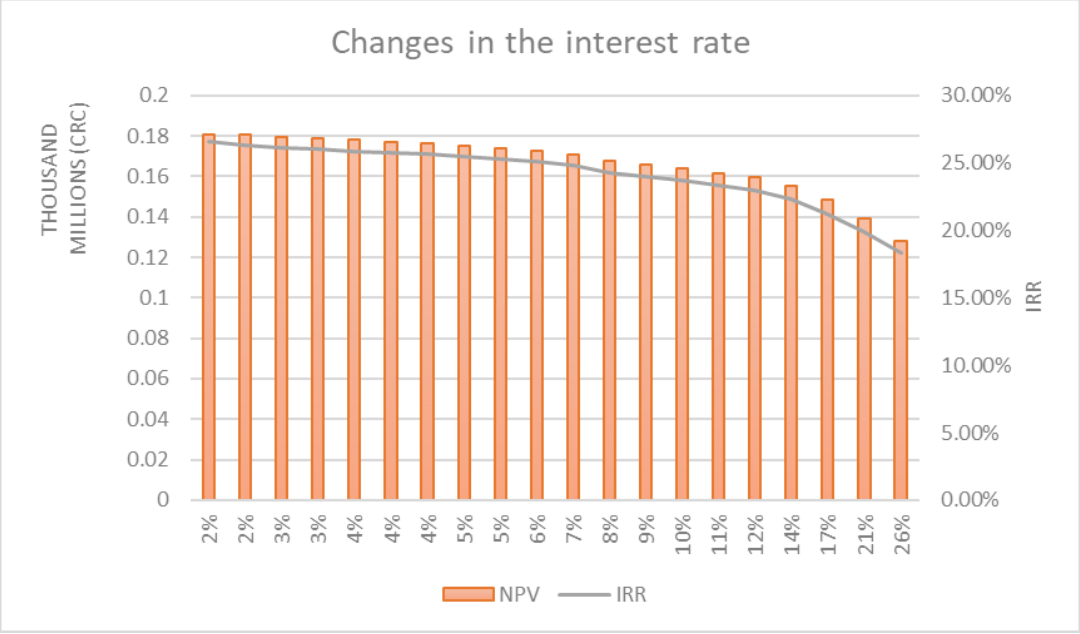


Source: Author elaboration using the FinPlan tool data.

The worst-case scenarios show that the project is robust to changes in the analyzed parameters. In particular, the parameter with the biggest impact on the project liabilities is the operation and management costs. The NPV decrement in the case where the management costs were augmented to 30% was more than 40% concerning the baseline case. The effect of the IRR is proportional to the changes in the NPV, but it is still a reliable project. The main financial indicators of rentability are always positive independent on the stress case.

Concerning the rest of the sensibility analyses on the interest rate, we didn't find significant changes in the NPV in most of the parameter variations. The lowest NPV in the catastrophic scenario of a 26% interest rate is around the 1.2 thousand million of Costa Rican colones (CRC). This phenomenon can be due to the low production costs of hydropower energy in the country, the high energy price, and the wide plant energy production installed capacity.

Figure 3. NPV and IRR reaction to changes on the interest rate.

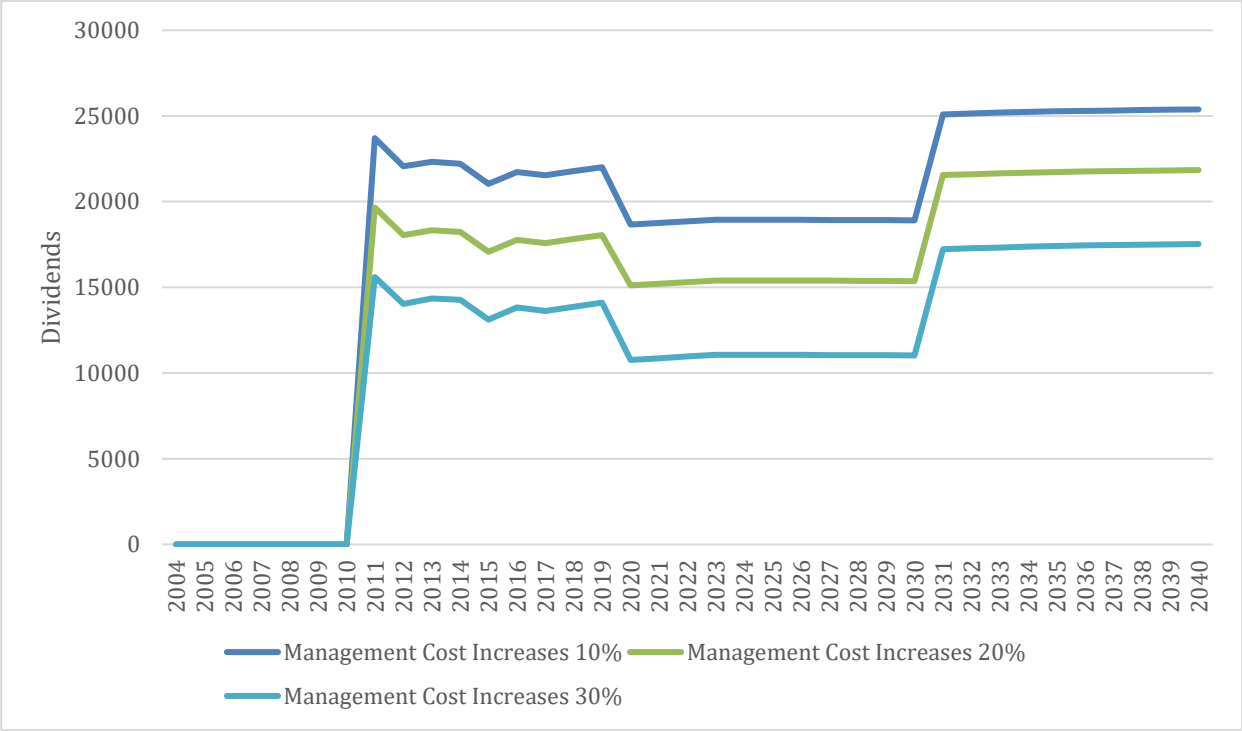


Source: Author elaboration using the FinPlan tool data.

Regarding the changes in the management costs. We find that this is the most sensitive parameter in the project. In this case, we analyze the dividends lost when we increment the operation and manager costs. In this case, the dividends decrease up to 16% in the best case of a 10% increase, and to 52% in the worst-case scenario of 52%. We can conclude that management capacity is necessary for optimizing the project's financial outcomes. These results are displayed in **Figure 4**.

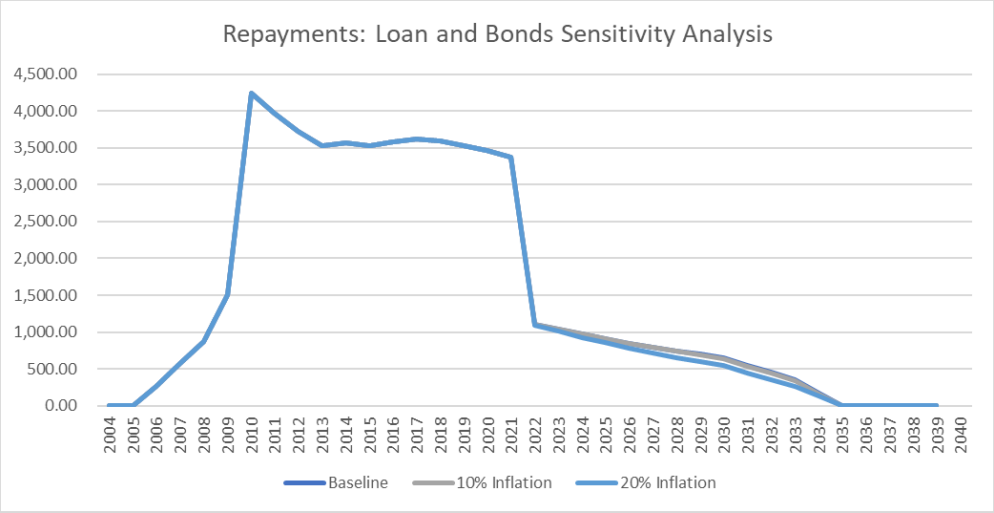
Finally, the last sensibility test studied the effect of inflation on loans and bond repayment. We find that the repayment flows are not too sensitive to change in Costa Rican inflation. One possible explanation for this phenomenon is the high duration of the credit maturity, such that the largest payment to the principal balance is generated in the first years of profitability of the project. These results are presented at **Figure 5** listed below.

Figure 4. Dividend reaction to increases in the operative costs.



Source: Author elaboration using the FinPlan tool data.

Figure 5. Repayments: loans and bonds reaction to the changes in the inflation rate.



Source: Author elaboration using the FinPlan tool data.

4. Discussion

The mentioned results have shown the robustness of the hydro-electrical projects for the successful renewable energy generation strategy of Costa Rica. The low cost of production due to the country's large rivers and springs and the special, green-focused financial resources enhance the reliability of the hydro-electrical plants even in the worst catastrophic case scenarios.

Costa Rica is a country that has been characterized by a very articulated climate strategy and economic development with a sustainable approach. The country has been a leader in the implementation of long-term climate strategies in the Latin American region. This articulated and planned leadership has allowed access to funds for the development of energy transition projects with very favorable financing conditions.

The financial analysis elaborated above seems to demonstrate that the financing strategy based on green bonds is ideal for maintaining the profitability of these investment projects. The projects are robust and profitable due to the high price of electricity (because of the monopolistic concentration at the state level in generation) and the low production costs in projects of this type. However, good management seems to be the key component to making the projects financially sustainable. This study was limited by the limited availability of specific financial data and the limited flexibility of the software for the development of non-parametric sensitivity scenarios such as Monte Carlo simulations.

5. Conclusion

In conclusion, large-capacity hydropower is the most optimal and robust generation source in cost-benefit terms. However, the main costs of the project are associated with the management and financing of the plant. Good management in conjunction with long-term financing options is vital for plants to develop and operate profitably. Articulated policy and clear objectives are essential to be recipients of special funds, so the country's political authorities are urged to maintain the policy of multilateral cooperation in the financing of these projects.

In addition, the natural monopoly model in the generation of electricity attributed to the Costa Rican Electricity Institute has proven to be a success. This is due to the institute's ability to set high energy prices that allow it to invest in research, development, and maintenance of these sustainable electricity plants.

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