A project is being undertaken to fulfill the criteria for earning a Master's degree in Finance from both the Nova School of Business and Economics and the University of the Andes

FEASIBILITY OF A WIND FARM ON THE COLOMBIAN COASTS

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ABSTRACT

This report examines the feasibility of implementing a wind farm in La Guajira, Colombia, a region known for its high potential for renewable energy generation. By using a comprehensive approach that combines traditional financial methods, such as cash flow analysis and Net Present Value (NPV) calculation, with the real options approach, the study addresses the technical, financial, and social aspects necessary to ensure the project's viability.

The project proposes an initial installation of 20 wind turbines with a total capacity of 70 MW, with the option to expand by adding 20 additional turbines, reaching a total capacity of 140 MW. This phased strategy not only optimizes initial resources but also allows for adjustments to the project's scope based on its operational performance and energy market conditions. Projections indicate an investment recovery period ranging from 5 to 8 years, depending on the evaluated economic and technical variables. The inclusion of real options adds flexibility and enhances the project's financial value by enabling strategic decisions tailored to uncertainty.

Beyond strong financial profitability, the project has significant social and environmental impacts. It is expected to provide clean energy to over 1 million households, benefiting approximately 3.7 million people in vulnerable regions such as La Guajira, Cesar, and Magdalena. Environmentally, the replacement of fossil fuel energy sources will reduce CO_2 emissions by approximately 40,320 tons per month, equivalent to removing 102,000 vehicles from circulation or planting 8 million trees. This impact not only helps mitigate climate change but also improves living conditions in rural and indigenous communities, which are traditionally underserved.

In conclusion, this project represents an opportunity to combine financial objectives with sustainable development, demonstrating that it is possible to promote profitable investments that also generate lasting social and environmental benefits. This initiative marks an important step toward energy diversification in Colombia and the promotion of a more inclusive and responsible development model.

INTRODUCTION

The generation of energy through renewable sources is a global priority today, not only for its contribution to environmental sustainability but also for its potential to drive socioeconomic development in vulnerable regions. This study analyzes the financial and socioeconomic feasibility of developing a wind farm in La Guajira, Colombia, a region characterized by high wind energy potential but also by significant poverty and limited access to basic services such as electricity.

As a Colombian mechanical engineer, my training is deeply rooted in solving problems through science, physics, and mathematics. However, I have always believed that this discipline goes beyond numbers: it is about making a positive impact on people's lives. In Colombia, one of the most pressing issues is the lack of access to basic services such as electricity and water. For this reason, I saw in this thesis an opportunity to combine two fields I am passionate about—engineering and finance—to propose a solution that is not only economically viable but also contributes to social development in one of the country's most disadvantaged regions.

The specific problem addressed in this research is to determine, using the real options approach, whether the wind farm project in this region is financially feasible. The relevance of this question lies in the multiple benefits that a project of this magnitude could generate: from economic profitability for investors to a positive impact on the quality of life of the local population, fostering social and economic development.

The main objective of this study is to demonstrate that the implementation of the wind farm is not only feasible but also highly profitable, while achieving its fundamental purpose of generating a significant social impact. This approach goes beyond traditional financial evaluation methodologies (such as cash flow analysis and net present value calculation), incorporating the consideration of the positive effect that a sustainable project can have on vulnerable communities.

The scope of the research is limited to analyzing the feasibility of the wind farm in La Guajira, a region in Colombia where natural resources are abundant but living conditions are precarious. In this sense, the proposal not only evaluates the technical and financial aspects of the project but also reflects on how such a development could transform the region.

The structure of the report is organized into seven sections. It begins with a literature review related to the topic, followed by a description of the data used and the applied methodology. Subsequently, the analysis results are presented, along with the conclusions and, finally, the references that support the work. This systematic approach seeks to ensure a comprehensive view of the project's feasibility and its implications in the fields of corporate finance and sustainable development.

LITERATURE REVIEW

1. Real Options Approach in Project Evaluation

The real options method has gained prominence as a tool for evaluating investments under uncertainty, especially for infrastructure projects with high initial costs and potential for managerial flexibility. Unlike the net present value (NPV) analysis, real options incorporate factors such as irreversibility, volatility, and the ability to adjust strategic decisions, making it ideal for renewable energy projects1. According to Copeland and Antikarov, this approach is particularly useful in contexts with high uncertainty, significant managerial flexibility, and initial NPV values close to zero1.

2. Real Options in Renewable Energy Projects

Renewable energy generation projects, such as wind energy, face unique challenges, including significant costs, technological uncertainty, and fluctuations in electricity market prices. Loncara et al. (2017) demonstrated that real options models, such as the binomial tree and Monte Carlo simulation, help manage risks by evaluating options like expansion, abandonment, and resizing of projects1. These methodologies have proven superior to static NPV, transforming initially low-return projects into more attractive investments.

3. Key Factors in Wind Farm Projects

The financial evaluation of wind farms depends on several critical elements:

- **Capacity Factor**: The ratio between actual production and maximum capacity, which can vary depending on wind profiles and technological characteristics1.
- **Government Support Schemes**: Feed-in Tariff (FiT) or Feed-in Premium (FiP) systems are essential to ensure revenue during the initial years of operation, reducing financial risks. However, these schemes also involve regulatory challenges that can influence investment decisions1.
- **Specific Risks**: These include climatic uncertainties, political risks, and electricity price fluctuations. A comprehensive analysis must consider these factors to ensure informed and resilient decisions1.

4. Advantages of the Real Options Approach

Several studies highlight the effectiveness of the real options approach in energy projects. Martínez-Ceseña and Mutale (2017) demonstrated that this model can enhance the financial value of wind projects by optimizing investment decisions in early stages and during operation 1. In the context of wind energy in Serbia, Loncara et al. implemented a compound model that includes options to expand, abandon, or repower a wind farm, achieving more robust results compared to traditional models1.

5. Renewable Energy in Colombia and La Guajira

Colombia, particularly La Guajira, offers significant potential for wind energy due to its favorable climatic conditions. However, the region faces social and economic constraints that complicate the implementation of large-scale projects. Wind farms not only have the potential to generate clean energy but also to improve the quality of life for marginalized communities, underscoring the importance of evaluating both financial aspects and socioeconomic impacts.

DATA

1. Technical Data of the Wind Farm

The proposed wind farm project in **La Guajira, Colombia**, is designed with the region's unique characteristics in mind. This area has significant potential for wind energy generation due to its climatic conditions. The initial proposal involves the installation of **20 wind turbines**, each with a nominal capacity of **3.5 MW**, resulting in a total installed capacity of **70 MW**. Additionally, the project includes an **expansion option** to install another **20 turbines**, bringing the total capacity to **140 MW**.

This scalable approach seeks to optimize initial resources while maintaining flexibility to expand the wind farm based on operational performance and market conditions in Colombia. The technical specifications include:

- **Hub height**: 120 meters. The hub height is essential to determine the turbines' interaction with wind currents since higher altitudes experience more consistent and less turbulent winds, directly improving generation efficiency.
- **Rotor diameter**: 130 meters. The rotor diameter determines the area swept by the turbine blades, influencing the amount of wind energy that can be captured. A larger diameter means higher energy efficiency.
- **Project lifespan**: 25 years. This period includes the operational phase and scheduled maintenance to ensure optimal performance throughout the lifecycle.

Wind Speed

One of the most critical factors for the wind farm's viability is wind speed, as it directly impacts the amount of energy the turbines can generate. Measurements were taken at a height of **10 meters**, using data collected over the past **five years** in **La Guajira**, one of the regions with the highest wind potential in Colombia. The results at this height show:

- **Average wind speed**: 7.89 m/s. This speed is sufficient for efficient energy generation.
- **Standard deviation**: 1.16 m/s. This reflects the variability of wind in the area.
- **Maximum recorded speed**: 12.23 m/s. This indicates the farm's potential under optimal conditions.
- **Minimum recorded speed**: 6.39 m/s. This shows that energy generation is possible even under less favorable conditions.

Since the turbines will operate at a height of **120 meters**, the wind speeds measured at 10 meters were adjusted to reflect conditions at that height using the **logarithmic wind profile** method. This method is widely used in wind energy projects to project wind behavior at different heights. The formula used is:

$$v_z = v_{z_0}\left(\frac{z}{z_0}\right)^{\alpha}$$

Where:

- v_z: Wind speed at the desired height (120 m).
- v_{z_0}: Wind speed measured at the initial height (10 m).
- z: Turbine operating height (120 m).
- z_0: Measurement height (10 m).
- α: Surface roughness exponent, reflecting the terrain's characteristics (assumed as 0.15 for smooth surfaces).

Applying this formula, the corrected wind speed values at **120 meters** are:

- **Adjusted average wind speed**: 11.49 m/s. This speed enables excellent energy generation performance.
- **Adjusted standard deviation**: 1.65 m/s. This indicates greater variability at this height but remains within acceptable operational ranges.
- **Adjusted maximum speed**: 18.65 m/s. This represents optimal generation conditions.
- **Adjusted minimum speed**: 9.26 m/s.

The adjustment demonstrates that higher altitudes capture faster and more consistent winds, resulting in greater energy efficiency and, consequently, higher financial returns for the project.

2. Financial Data

The financial success of this project depends on evaluating installation, operation, and maintenance costs, as well as the financing strategies used. The details for each financial aspect are as follows:

Installation Costs

The total estimated installation cost ranges between **USD 1,500,000 and USD 2,000,000 per MW installed**, including:

- **70%**: Costs associated with purchasing and installing the turbines, including key components such as towers, generators, and rotors.
- **20%**: Infrastructure required for the farm’s operation, such as access roads, foundations, and electrical substations.
- **10%**: Costs related to grid connection, such as transmission lines and equipment for integrating into the national power grid.

Operation and Maintenance (O&M) Costs

Annual operating costs amount to **3% of the total cost per MW installed**, covering activities such as:

- Preventive and corrective maintenance.
- Continuous supervision and monitoring of turbines.
- Replacement of worn-out components.
- Hiring operational personnel.

Discount Rate (WACC)

The project's feasibility was evaluated using the **Weighted Average Cost of Capital (WACC)**, which reflects the average cost of capital considering a mix of debt and equity financing. The formula used is:

$$WACC = (\frac{E}{V} * R_e) + (\frac{D}{V} * R_d * (1 - T))$$

Where:

- E: Equity (30% of the financing).
- D: Debt (70% of the financing).
- V: Total financing value (E+D).
- R_e: Cost of equity (10%).
- R_d: Cost of debt (7%).
- T: Tax rate (35%).

Substituting the values:

$$WACC = (\frac{0.30}{1.00} * 0.10) + (\frac{0.70}{1.00} * 0.07 * (1 - 0.35))$$

$$WACC = 0.03 + 0.03255 = 0.06255 \text{ } or \text{ } 6.26\%$$

The **calculated WACC is 6.26%**, representing the average cost adjusted for risk, used to determine whether the project will generate value for investors.

3. Market Data

The Colombian electricity market offers unique opportunities and challenges for implementing renewable energy projects like this wind farm. The support policies implemented by the Colombian government aim to promote renewable energy development. Below are the most relevant policies:

Support Policies and Incentives in Colombia

1. **Income Tax Reduction**:
    - Article 235-2 of the Colombian Tax Code allows for a **50% reduction in income tax for the first 15 years** of operation for renewable energy projects. This benefit significantly improves the project's profitability and encourages investment in sustainability.
2. **Renewable Energy Certificates (CERs)**:
    - Projects can generate additional revenue through the sale of Renewable Energy Certificates, representing clean energy generation. CERs account for **5% to 10% of the project's total revenue** and are negotiable in international markets.
3. **VAT and Tariff Exemptions**:
    - Decree 829 of 2020 exempts VAT and tariffs for importing equipment and technologies related to renewable energy generation. This represents significant savings in initial costs.
4. **Local and Regional Subsidies**:
    - In regions like La Guajira, renewable energy projects often receive specific municipal tax exemptions, reducing operational costs by **3% to 5%**.

These policies create a favorable environment for renewable projects in Colombia, ensuring both environmental sustainability and financial feasibility.

METHODOLOGY

1. General Approach

The approach adopted for this project was **quantitative**, based on statistical simulations, financial analysis, and projections using mathematical models. This approach allowed for evaluating the feasibility of the wind farm under diverse scenarios and uncertainty conditions.

Three main analyses were performed:

1. **Wind Speed Simulation**:
    - Since energy generation directly depends on wind speed, this variable was projected for the next 25 years using a statistical model based on normal

distributions. The simulation respected historical parameters, such as the mean, standard deviation, maximum, and minimum values recorded over the past five years.

  - The formula for wind correction to adjust measurements taken at 10 meters to the hub height (120 meters) is:

$$v_z = v_{z_0}\left(\frac{z}{z_0}\right)^{\alpha}$$

This adjustment is crucial, as wind speeds increase with height due to reduced friction with the terrain, thereby improving the wind farm's energy efficiency.

2. **Energy Tariff Simulation**:
    - Using historical data on electricity tariffs in Colombia, future energy prices were projected through simulations modeling observed past behavior trends. This analysis allowed for forecasting the income generated by energy sales.
3. **Financial Analysis**:
    - A cash flow model was designed to calculate the **Net Present Value (NPV)**, considering revenue, costs, taxes, and other relevant financial variables.
    - Additionally, a **real options** model based on the Black-Scholes formula and Monte Carlo simulations was used to evaluate the expansion option and other strategic scenarios.

2. Models and Techniques

Wind Correction Formula

As mentioned earlier, wind speed adjustments were performed using the formula:

$$v_z = v_{z_0}\left(\frac{z}{z_0}\right)^{\alpha}$$

This adjustment enabled accurate estimation of wind speeds at the hub height (120 meters), which was critical for calculating energy generation per turbine using manufacturer-specific power curves.

Depreciation Using the Sum-of-Years-Digits (SYD) Method

The **Sum-of-Years-Digits (SYD)** method was used to calculate the depreciation of assets (infrastructure and grid connection). This method allocates a higher proportion of depreciation in the early years of the asset's life, better reflecting the initial wear and tear. The formula for calculating depreciation in a specific year is:

$$\text{Annual Depreciation} = \frac{\text{Remaining Useful Life}}{\text{Sum of the Digits of Useful Life}} * \text{ Initial Cost of the Asset}$$

Where:

- **Remaining Useful Life**: Number of years left in the asset's operational life during that year.
- **Sum of the Digits of Useful Life**: Calculated as 1+2+3+…+n1 + 2 + 3 + …+ n, where n is the total useful life.

This method allowed for precise modeling of depreciation costs, aligning them with the project's revenue cycleFor example, for an asset with a useful life of 10 years:

Black-Scholes Formula for Real Options

The Black-Scholes formula, adapted for real options, was used to value the wind farm expansion (installation of 20 additional turbines after year 10). The general formula is:

$$C = S_0 * N(d_1) - X * e^{rT} * N(d_2)$$

Where:

- C: Value of the real option.
- S_0: Current value of the project (calculated NPV).
- X: Investment cost of the option (installation of 20 additional turbines).
- r: Risk-free rate (assumed as the average return on Colombian government bonds).
- T: Time to option maturity (in years).
- $N(d_1)$ and $N(d_2)$: Cumulative probabilities under a standard normal distribution.

The parameters $N(d_1)$ and $N(d_2)$ are calculated as:

$$d_1 = \frac{\ln\left(\frac{S_0}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

Where:

- σ: Volatility of the NPV (estimated through Monte Carlo simulations).

This model allowed for valuing the strategic expansion decision, considering different times to maturity and market scenarios.

3. Specific Steps of the Analysis

1. **Data Collection**:
    - Historical wind speed data and energy tariffs were obtained from governmental databases.
    - Wind speed data were used to estimate energy generation using specific turbine power curves.
    - Tariff data were used to model projected revenues.

2. **Construction of Cash Flow**:
    - The cash flow included revenue, costs, depreciation, taxes, and other factors, calculated over a 25-year horizon.

3. **Valuation of Real Options**:
    - Monte Carlo simulations were conducted to model NPV volatility and calculate the expansion value under different times to maturity.

4. Risk Assessment

1. **Government Dependency**:
    - Current incentives and support tariffs in Colombia may change due to presidential rotations, as the project spans seven presidential terms over 25 years. This risk directly affects the project’s profitability.
2. **Exchange Rate**:
    - The cash flow was projected with a fixed exchange rate of **1 USD = 4,500 COP**, but the Colombian peso has historically shown high volatility against the US dollar, which could significantly alter projected revenues.
3. **Environmental and Regulatory Conditions**:
    - Changes in climatic conditions, such as a decrease in average wind speeds, or stricter environmental regulations could reduce the wind farm’s capacity and revenue projections.
4. **Market Risks**:
    - Fluctuations in energy demand or unexpected price variations could alter projected revenues.
5. **Operational Risk**:

  - The wind farm infrastructure is exposed to mechanical failures or unforeseen maintenance costs.

RESULTS

1. Wind Speed Simulation Results

The wind speed analysis projected conditions at 120 meters above ground, adjusted from historical data. The key findings were:

- **Average wind speed**: 11.25 m/s.
- **Maximum projected speed**: 14.14 m/s.
- **Minimum projected speed**: 8.89 m/s.
- **Standard deviation**: ±1.45 m/s.

Energy generation was calculated using the **power formula**:

$$P = \frac{1}{2}\rho A v^3 C_p$$

Where:

- ρ: Air density.
- A: Swept area by the turbine blades.
- v: Wind speed.
- C_p: Turbine power coefficient.

The values used respected the original statistics by generating random data within the projected wind speed range and standard deviation. This method provided a robust estimate of annual energy generation.

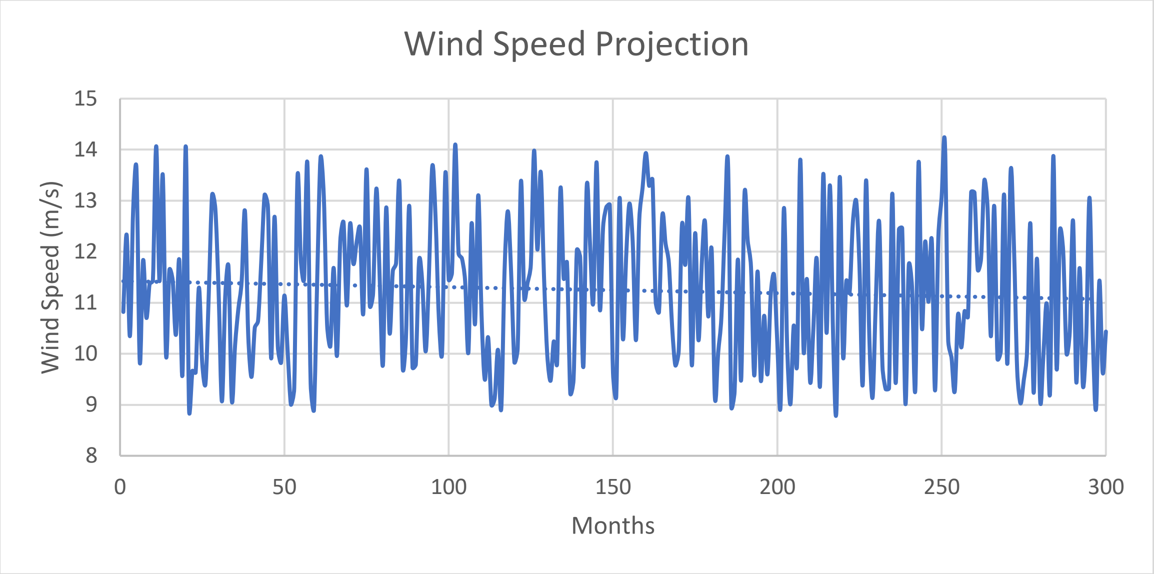

Figure 1 presents the projected wind speed over 25 years. The X-axis represents the months, while the Y-axis shows the average speed in m/s. Shaded bands indicate the variability of the projections.

Analysis:
The stability of the projected values ensures consistent energy generation, mitigating risks associated with climate variations. The projected energy efficiency supports the technical viability of the wind farm.

2. Energy Tariff Simulation Results

Energy tariff projections were based on historical data of electricity prices in Colombia, applying a consistent growth trend observed in the past. The main findings were:

- **Consistent growth**: The projected tariff does not have a well-defined maximum value due to its steady upward trend.
- **Relationship to revenue**: Total revenue was calculated by multiplying the projected energy tariff by the annual energy generated.

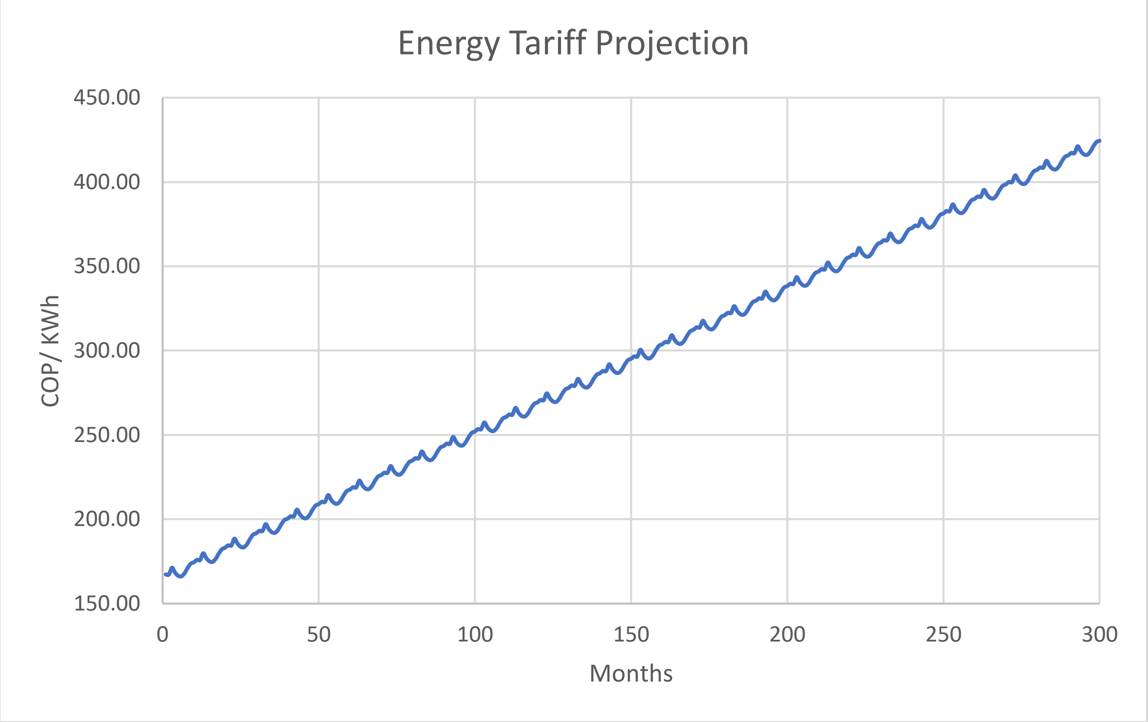

Figure 2 shows the projected energy tariffs over the 25-year project horizon. The X-axis shows the years, while the Y-axis indicates tariffs in COP/KWh. The main line represents the projected average value.

Analysis:
The steady growth of tariffs ensures increasing revenue over time, strengthening the project's financial viability. This result is particularly relevant for the planned expansion scenarios.

3. Financial Results

Net Present Value (NPV) and Internal Rate of Return (IRR)

The projected cash flow allowed for the calculation of the NPV under ideal conditions (without optimistic or pessimistic scenarios):

- **NPV (without options)**: USD 295,666,912.65.
- **IRR**: 24.36%.

These results confirm the profitability of the project even without considering the expansion option.

Impact of the Expansion Option

Four scenarios for option maturity were evaluated, considering financial viability starting in year 6, when the initial investment is recovered:

- **Year 6, 4-year maturity**:
    - Option value: USD 15,097.69.
    - NPV: USD 442,351,796.68.
- **Year 7, 3-year maturity**:
    - Option value: USD 9,009,630.31.
    - NPV: USD 437,284,192.67.
- **Year 8, 2-year maturity**:
    - Option value: USD 20,361,967.45.
    - NPV: USD 431,555,806.13.
- **Year 9, 1-year maturity**:
    - Option value: USD 33,603,702.89.
    - NPV: USD 424,995,131.63.

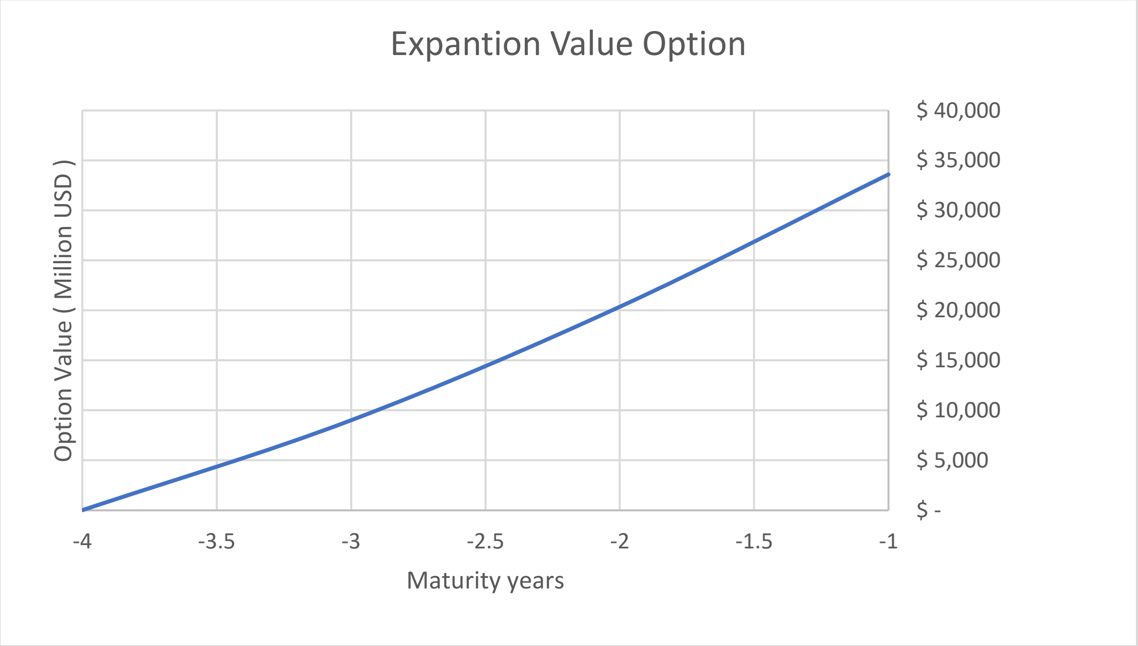

Figure 3 shows the values of the real option under different maturity periods. The X-axis represents the maturity years, and the Y-axis indicates the option value in Million USD.

Analysis:
The expansion option significantly increases the project's NPV, especially when exercised in years 6 and 7, reinforcing its strategic importance. This result highlights the project's flexibility to adapt to different market scenarios.

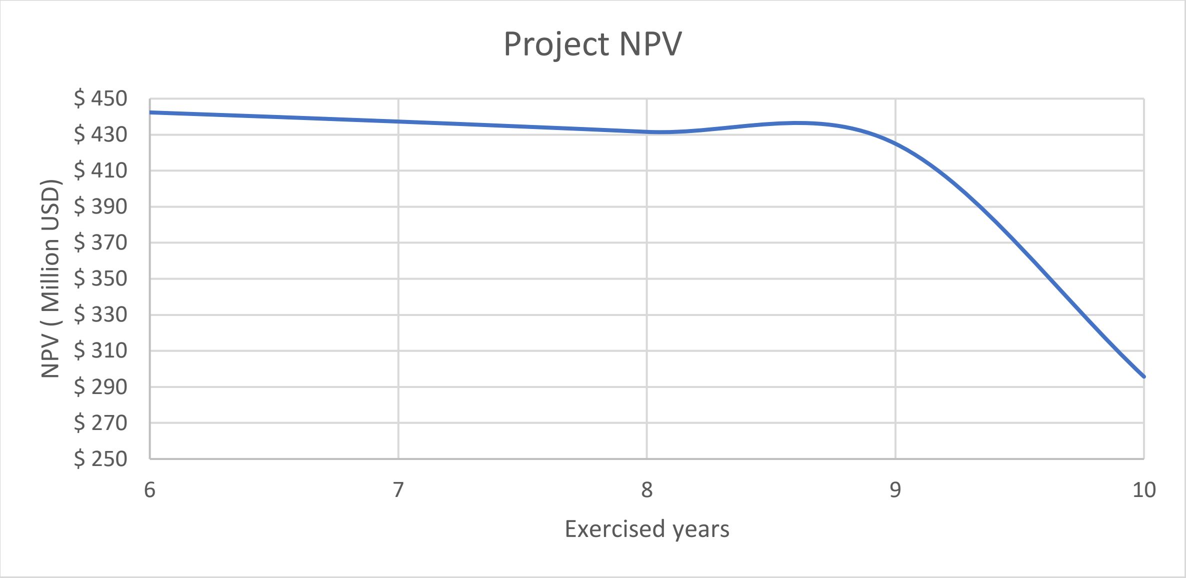

Figure 4 shows the values of the NPV under different periods if the option is exercised. The X-axis represents the years in which the option can be purchased, and the Y-axis indicates the NPV value in USD.

4. Social and Environmental Impact

Impact on Households

The energy generated by the wind farm would supply approximately **1,008,000 households**, assuming an average consumption of 100 kWh/month per household. This is equivalent to benefiting **3,729,600 people**, representing **94% of the population in La Guajira, Cesar, and Magdalena**.

Reduction in CO_2 Emissions

The wind farm would prevent the emission of approximately **40,320 tons of CO_2 per month** by replacing fossil fuel sources like coal and natural gas. This reduction is equivalent to:

- Avoiding the combustion of **1.1 million barrels of oil**.
- Removing **102,000 vehicles** from circulation for a year.
- Planting **8 million trees** and maintaining them for 10 years.

Socioeconomic Impact

The project would generate temporary jobs for both skilled and unskilled labor, stimulating related sectors such as transportation and services. It would also contribute to infrastructure development, including roads and power lines, significantly reducing energy poverty in rural and indigenous communities, which currently have limited or no access to electricity.

CONCLUSIONS

Technical Feasibility of the Project

- The wind speed analysis in La Guajira demonstrated ideal conditions for wind energy generation, with an average speed of 11.25 m/s at 120 meters above ground and minimal variability.
- The stability of the projected data ensures that the wind farm will operate efficiently throughout its lifecycle, maximizing generation capacity and minimizing operational risks.

Financial Viability

- The project is highly profitable, with a Net Present Value (NPV) of USD 295,666,912.65 and an Internal Rate of Return (IRR) of 24.36%, both significantly exceeding the calculated WACC, confirming its economic feasibility.
- The inclusion of an expansion option in year 10, evaluated using the Black-Scholes model, significantly increases the project's value, reinforcing the flexibility and adaptability of the wind farm to different market scenarios.

Social and Environmental Impact

- The wind farm will have a significant social impact by providing energy to approximately 1,008,000 households, benefiting over 3.7 million people in the departments of La Guajira, Cesar, and Magdalena.
- Additionally, the project contributes to environmental sustainability by avoiding 40,320 tons of CO_2 emissions per month, equivalent to removing 102,000 vehicles from circulation or planting 8 million trees.
- Reducing energy poverty in indigenous and rural communities in the region is one of the project's most important achievements, improving the quality of life and promoting local economic development.

Contributions to Regional Development

- The construction of the wind farm will generate temporary jobs and stimulate related sectors such as transportation and services. Moreover, it is expected to improve local infrastructure, including roads and power lines, benefiting neighboring communities.

Identified Risks

- Although the project is technically and financially feasible, it faces risks associated with changes in government policies, exchange rate volatility, and possible variations in climatic or market conditions. However, these risks can be mitigated through appropriate management and constant monitoring of critical variables.

Relevance of the Project

This project demonstrates that it is possible to combine financial and social objectives, providing economic benefits to investors while promoting a positive impact on local communities and the environment.

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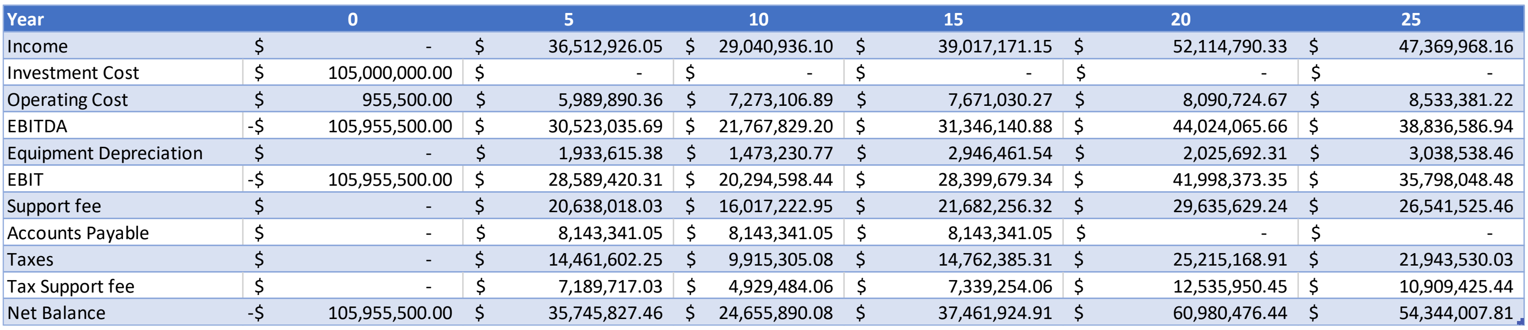
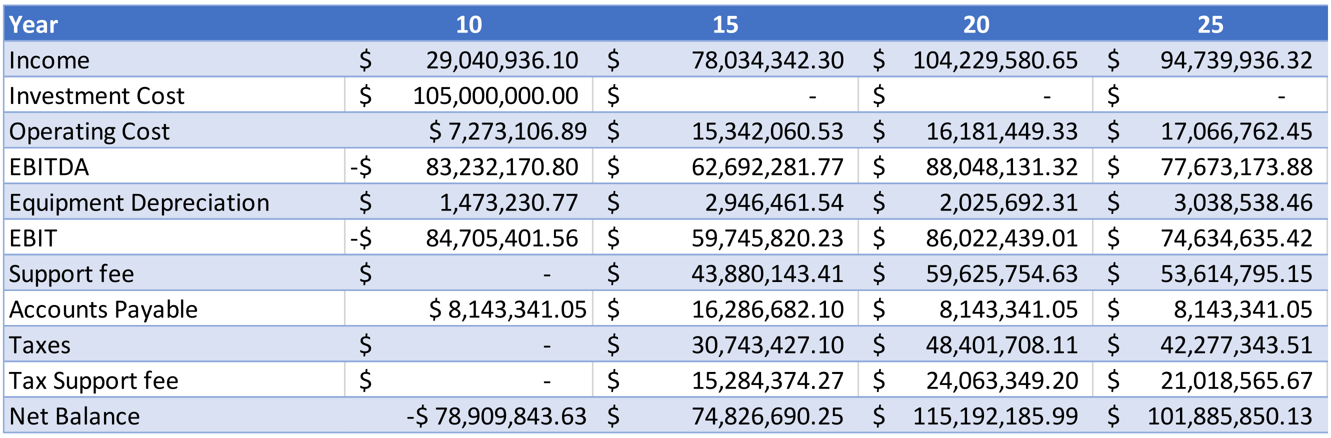
ANNEXES



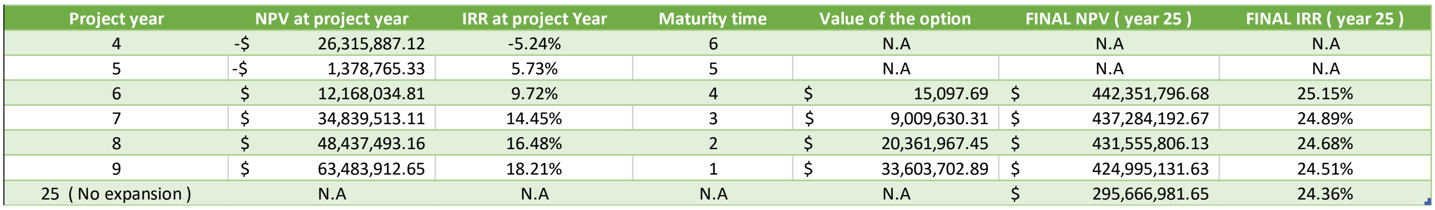
Year	0	5	10	15	20	25
Income	$ -	$ 36,512,926.05	$ 29,040,936.10	$ 39,017,171.15	$ 52,114,790.33	$ 47,369,968.16
Investment Cost	$ 105,000,000.00	$ -	$ -	$ -	$ -	$ -
Operating Cost	$ 955,500.00	$ 5,989,890.36	$ 7,273,106.89	$ 7,671,030.27	$ 8,090,724.67	$ 8,533,381.22
EBITDA	-$ 105,955,500.00	$ 30,523,035.69	$ 21,767,829.20	$ 31,346,140.88	$ 44,024,065.66	$ 38,836,586.94
Equipment Depreciation	$ -	$ 1,933,615.38	$ 1,473,230.77	$ 2,946,461.54	$ 2,025,692.31	$ 3,038,538.46
EBIT	-$ 105,955,500.00	$ 28,589,420.31	$ 20,294,598.44	$ 28,399,679.34	$ 41,998,373.35	$ 35,798,048.48
Support fee	$ -	$ 20,638,018.03	$ 16,017,222.95	$ 21,682,256.32	$ 29,635,629.24	$ 26,541,525.46
Accounts Payable	$ -	$ 8,143,341.05	$ 8,143,341.05	$ 8,143,341.05	$ -	$ -
Taxes	$ -	$ 14,461,602.25	$ 9,915,305.08	$ 14,762,385.31	$ 25,215,168.91	$ 21,943,530.03
Tax Support fee	$ -	$ 7,189,717.03	$ 4,929,484.06	$ 7,339,254.06	$ 12,535,950.45	$ 10,909,425.44
Net Balance	-$ 105,955,500.00	$ 35,745,827.46	$ 24,655,890.08	$ 37,461,924.91	$ 60,980,476.44	$ 54,344,007.81

Annex 1: Cash flow every 5 years without purchase option, with only 20 turbines.



Year	10	15	20	25
Income	$ 29,040,936.10	$ 78,034,342.30	$ 104,229,580.65	$ 94,739,936.32
Investment Cost	$ 105,000,000.00	$ -	$ -	$ -
Operating Cost	$ 7,273,106.89	$ 15,342,060.53	$ 16,181,449.33	$ 17,066,762.45
EBITDA	-$ 83,232,170.80	$ 62,692,281.77	$ 88,048,131.32	$ 77,673,173.88
Equipment Depreciation	$ 1,473,230.77	$ 2,946,461.54	$ 2,025,692.31	$ 3,038,538.46
EBIT	-$ 84,705,401.56	$ 59,745,820.23	$ 86,022,439.01	$ 74,634,635.42
Support fee	$ -	$ 43,880,143.41	$ 59,625,754.63	$ 53,614,795.15
Accounts Payable	$ 8,143,341.05	$ 16,286,682.10	$ 8,143,341.05	$ 8,143,341.05
Taxes	$ -	$ 30,743,427.10	$ 48,401,708.11	$ 42,277,343.51
Tax Support fee	$ -	$ 15,284,374.27	$ 24,063,349.20	$ 21,018,565.67
Net Balance	-$ 78,909,843.63	$ 74,826,690.25	$ 115,192,185.99	$ 101,885,850.13

Annex 2: Cash flow for every 5 years in which the expansion option is executed. 40 turbines.



Project year	NPV at project year	IRR at project Year	Maturity time	Value of the option	FINAL NPV (year 25)	FINAL IRR (year 25)
4	-$ 26,315,887.12	-5.24%	6	N.A	N.A	N.A
5	-$ 1,378,765.33	5.73%	5	N.A	N.A	N.A
6	$ 12,168,034.81	9.72%	4	$ 15,097.69	$ 442,351,796.68	25.15%
7	$ 34,839,513.11	14.45%	3	$ 9,009,630.31	$ 437,284,192.67	24.89%
8	$ 48,437,493.16	16.48%	2	$ 20,361,967.45	$ 431,555,806.13	24.68%
9	$ 63,483,912.65	18.21%	1	$ 33,603,702.89	$ 424,995,131.63	24.51%
25 (No expansion)	N.A	N.A	N.A	N.A	$ 295,666,981.65	24.36%

Annex 3: Representative table of the value of each option according to the maturity time, with its respective NPV and IRR at the end of year 25