

Wind Farm in the North Access: Harnessing Wind Energy in Parana

German A. Schunk¹ – Francis U. Unrein²

*Electromechanical Engineering Department, Facultad Regional Paraná, Universidad Tecnológica Nacional
1033 Almafuerite Av, Paraná Entre Ríos, Argentina*

¹ germanschunk@alu.frp.utn.edu.ar

² francisunrein@alu.frp.utn.edu.ar

Summary— This project is developed in the city of Parana, which is the capital of Entre Ríos. In this city, a large number of inhabitants live in buildings and apartments in the center. This part of the city does not have many trees or vegetation, and this causes different problems, such as high temperatures and high cost of energy. Other areas on the outskirts, such as the North Access, are widely open, with a lot of trees and green space. The objective of the project is to analyze a solution to the high cost of the energy bills introducing a wind farm in the north access of the city. This project analyzes the causes and consequences of the problem and explain the strengths and weaknesses of the solution.

Keywords: wind farm, eolic turbines, energy costs, renewable energy

Resumen— Este proyecto está desarrollado en la ciudad de Paraná, capital de Entre Ríos. En esta ciudad, un gran número de habitantes vive en edificios y departamentos en el centro. Esta parte de la ciudad no tiene muchos árboles o vegetación y esto causa diferentes problemas, como las altas temperaturas o el alto costo de la energía eléctrica. Otras áreas suburbanas, como el Acceso Norte, son abiertas, con muchos árboles y espacios verdes. El objetivo de este proyecto es analizar una solución para los altos costos de las tarifas de energía introduciendo una granja eólica en el acceso norte de la ciudad. Este proyecto analiza las causas y consecuencias del problema y explica las fortalezas y debilidades de la solución.

Palabras clave: granja eólica, turbinas eólicas, costos de energía, energía renovable.

I. INTRODUCTION

This work is based on the city of Parana. This city has an area of 137 square kilometers and a population of more than 340,000 inhabitants. Parana has different areas, as the center and the outskirts, which have different characteristics. A large number of inhabitants live in buildings and apartments in the center of the city. This part of the city does not have many trees or vegetation, and this causes different problems, such as high temperatures and high cost of energy. Other areas on the outskirts, such as the North Access are widely open, with a lot of trees and green space.

The objective of this project is to analyse the problem of high cost and inefficiency of electricity in the last years, and to propose an ecofriendly solution by means of the installation of a wind farm in the North Access in Paraná. As well as this, it is going to propose an alternative for the conventional energy, using a renewable source

creating a wind farm on the outskirts of the city, specifically, in the North Access area.

To achieve these purposes, this project is divided as follows. Section II is going to show the area where the project will be developed, analysing the problem with their causes and consequences. Section III is going to present the solution with their strengths and weaknesses. Section IV is going to present a conclusion and the final arguments of the project.

II. PROBLEM DEFINITION AND ANALYSIS

A. Description of the Context

In this section, the problem will be contextualized. Paraná is a big city that is surrounded by the Parana River. It is the capital city of Entre Ríos, and it is located in the center-west of the province. The city has a population of 339,930 inhabitants. In this project the focus is placed on the North Access, which is a large plain located on the east side of the city, as it is shown in Fig. 1.

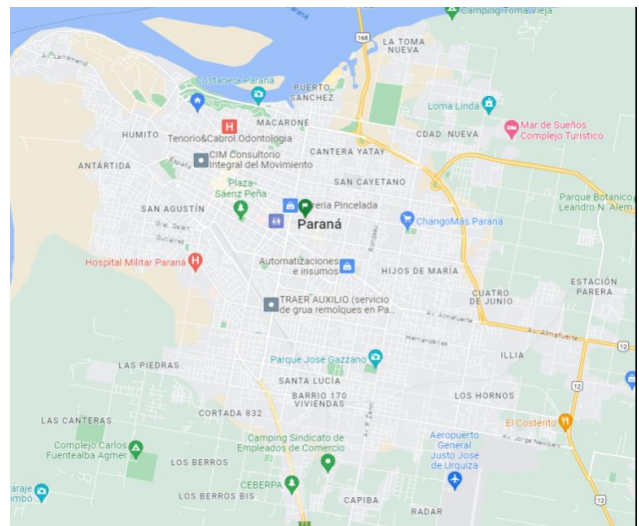


Fig. 1. Parana City Map [1]

The North Access area of Paraná has no factories or schools so it is a windy area. It is a busy area for the cars that circulate to enter the city of Paraná or leave it. The specific area to be analyzed is along Route 168 about 12km from the center of Paraná, near the Botanical Park. The area has a land of approximately 80 depopulated hectares.

> THIS IS AN ENGLISH AS A FOREIGN LANGUAGE ENGINEERING STUDENT PAPER. READERS MAY MAKE USE OF THIS MATERIAL AT THEIR OWN DISCRETION<

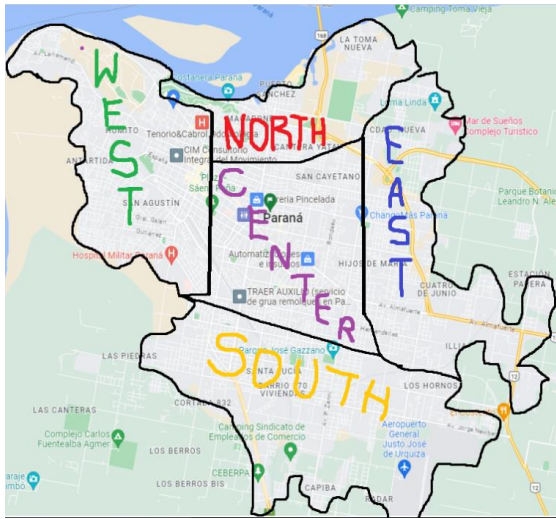


Fig. 2. Map of the Areas of the City of Paraná [2]

B. Problem Statement

The problem to be addressed is serious and needs to be solved. Electricity in Paraná is both costly and inefficient. It is costly because there is more demand than offer. It is inefficient because a high demand generates outages and line overloads. The objective of this project is to analyze the increase of the cost-effectiveness of electricity in Paraná.

C. Description of Scenes that Help Picture the Problematic Situation

This section presents some images related to the problem. In Fig. 3, a bill from January 2023 from a clothing store located in the center of Paraná is displayed. The bimonthly cost is highly expensive for electricity. In this case, the bimonthly electricity cost is around 119,185 pesos. This store exceeded the 600kw of the fixed charge almost every month, so its owners paid the maximum price in relation kw/pesos.

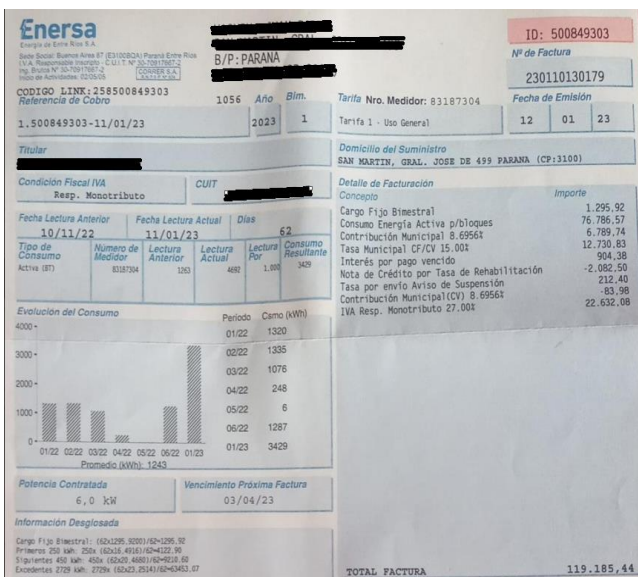


Fig. 3. Bimonthly bill from January 2023, in a store in the center of Paraná [3]

As shown in Fig. 4, the cost of electricity according to kilowatts consumption increased an average of 65.82% from January to June 2022. A user paid \$4,5558 the first 200kw. If a user spent 200-399 kw, they paid \$5,4511. In case of the user who spent 400-599 kw, they paid \$8,1184 and if they exceeded the 600 kw they paid \$9,4628.

Resoluciones EPRE		148/21	229/21 - 16/22	27/22	27/22	59/22	103/22		
	Cargo	Tarifa enero	Tarifa febrero	Tarifa marzo	Tarifa abril	Tarifa mayo	Tarifa junio	Incremento enero/junio	Incremento real (ajustado por inflación)
Consumo energía por bloque	Fijo	\$ 245,12	\$ 358,86	\$ 358,86	\$ 358,86	\$ 433,94	\$ 433,94	77,03%	
	Primeros 200 (precio por kw)	\$ 4,5558	\$ 5,2914	\$ 6,0734	\$ 6,0734	\$ 6,5745	\$ 7,3590	61,53%	31,28%
	De 200 a 399	\$ 5,4511	\$ 6,6023	\$ 7,3853	\$ 7,3853	\$ 8,1543	\$ 8,9388	63,98%	33,28%
	400 a 599	\$ 8,1184	\$ 10,5178	\$ 11,2998	\$ 11,2998	\$ 12,8830	\$ 13,6674	68,35%	36,83%
	mas de 600	\$ 9,4628	\$ 12,4751	\$ 13,2570	\$ 13,2570	\$ 15,2473	\$ 16,0318	69,42%	37,69%
Promedio incremento % consumo por bloque								65,82%	34,77%

Fig 4. Evolution of monthly prices in the year 2022, together with its average percentage [4]

The previous photos show the problem of high cost of electricity in Paraná. It is now necessary to analyze its causes and consequences.

D. Identification and analysis of causes or factors that give rise to the problem:

The causes that trigger the problem of the high cost of electricity bills are many. One of them is the high temperatures that the city has specially in summer. Trees, plants are not very common specially in the center of the city. This causes an increase in the temperature and a higher usage of the energy for air conditioners and refrigeration systems.

Another cause is that most of the people have regular bulbs in their houses and inefficient light systems that uses a lot of EPRE. This energy systems causes an increase of the prices because they are inefficient.

Thirdly, another cause of this problem is the increase in the price of the natural gas. The energy comes from the natural gas, this natural resource is running out in the world so the price increases.

E. Identification and Description of the Consequences

The consequences of the problem are the following. Mainly, a lot of people cannot access to electricity. The high costs of the bills force some people to choose between paying the electricity or other essential resources such as the water.

Another consequence is the low quality of life generated by the high cost of electricity. These prices consume a lot from people's monthly income.

Thirdly, another consequence is the loss of electricity generated by the inefficient lighting systems that the company provides. Defective electronic objects consume or waste more energy than a normal one.

III. THE WAY FORWARD

A. Problem approach

> THIS IS AN ENGLISH AS A FOREIGN LANGUAGE ENGINEERING STUDENT PAPER. READERS MAY MAKE USE OF THIS MATERIAL AT THEIR OWN DISCRETION<

The best option for solving the problem, that is, for reducing the cost of the energy bills, is by creating a wind farm, installing eolic towers in the north access of the city. This may not seem like a breakthrough technology but it may be an effective option.



Fig.5. Eolic towers working [3]

Eolic turbines produce energy in a renewable way, using the wind as the principal production factor. This should reduce the cost of the energy as the primary resource is infinite. Installing the necessary numbers of eolic towers to generate energy for the city, the inhabitants can have constant energy as it never stops producing it and can store the energy that is not used.

B. Strengths and Weaknesses of the Proposal

The installation of the wind farm has many strengths. One of them is the minimum maintenance that the eolic turbines need, as they work with basic mechanical pieces. Secondly, they produce little contamination. This energy does not contaminate the ground and the air as the common energy that we have on our houses does.

On the other hand, the wind farm has weaknesses. Firstly, the price of the turbines and the installation should be considered. The wind turbines must be imported and bought from another country, as they are not produced in Argentina. Another weakness is the noise that the turbines produce, being really annoying for the neighbours and dangerous for the workers if they do not protect their ears.

IV. CONCLUSION

To conclude with this project, it is important and necessary to highlight that high cost and inefficient of electricity in Parana is a serious and recurrent issue. This

problem affects thousands of people, mostly the poor people, because electricity is a primary necessity, and everyone consumes it. As stated in this project, the best way to solve this problem is by installing a wind farm in the north access of Parana. Wind farms are not very common in the country but they are very effective and less polluting so the introduction of this system is a good opportunity to improve our life quality, reduce the energy costs and reduce the contamination.

ACKNOWLEDGMENT

We would like to thank our teacher Maria Laura Sollier, who helped us in the development of this project.

REFERENCES

- [1] Google Maps, Location of Parana. <https://www.google.com/maps/@-31.7531508,-60.4950511,13z?entry=ttu> (accessed Jun 8, 2023)
- [2] Google Maps, Location of Paraná. <https://www.google.com.ar/maps/search/Paraná> (accessed Jun 9, 2023)
- [3] “¿Qué es una central eolica?”, *foronuclear.org*: <https://www.foronuclear.org/descubre-la-energia-nuclear/preguntas-y-respuestas/sobre-distintas-fuentes-de-energia/que-es-una-central-eolica/> (accessed Oct. 12, 2023)
- [4] “Senador provincial asegura que los aumentos de luz superan en un 35 a la inflación” *elentrerios.com* <https://www.elentrerios.com/actualidad/senador-provincial-asegura-que-los-aumentos-de-luz-superan-en-un-35-a-la-inflacin.htm> (accessed Nov. 12 2023)

German Schunk is a Electromechanical Engineering student at UTN FRP: germanschunk@alu.frp.utn.edu.ar. Francis Unrein is an Electromechanical Engineering student at UTN FRP: francisunrein@alu.frp.utn.edu.ar.

The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at gyugdar@frp.utn.edu.ar.