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APPLICATION OF NEODYMIUM MAGNETS IN A LOW-COST PARABOLIC CONCENTRATOR FOR SCHOOLS

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ABSTRACT
The objective of this article is to contribute, through bibliographic research, on the application of parabolic concentrators with neodymium magnet motors for application in schools. This study presents the fundamentals of the construction of a parabolic concentrator with permanent magnets, in order to serve the school public in the period of cold climates in the period of the school year of educational institutions. An attempt was made to analyze the existing instruments to deal with energy savings as well as the issue of the use of energy in water heating. This theme was chosen, after the importance it is made, due to the need to improve the conditions of thermal comfort in schools, as well as energy savings for the institution with the use of renewable energies, adapting to the UN 2030 agenda, at the end of the study the effectiveness of the use of parabolic concentrators with permanent magnets was verified, with advantages relative to solar panels.

Keywords: Parabolic Concentrator. Renewable energy. Neodymium Magnets. Schools.

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Revista ARACÊ
ISSN: 2358-2472

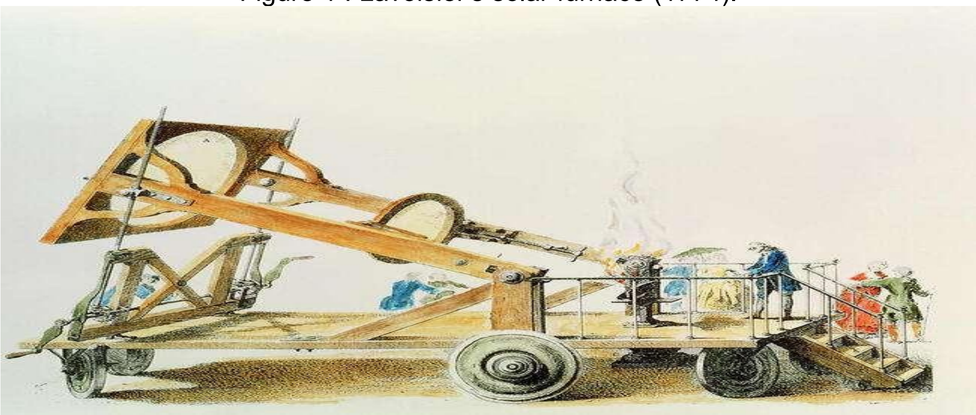
INTRODUCTION

The use of solar energy on a large scale is attributed to Archimedes (282 to 212 BC); that the Roman fleet in Syracuse Bay (now belonging to Italy), focusing the sun's rays until it heated up and caught fire. This event has been cited by several authors in the period between 100 BC and 1100 AD.

It was reported that the equipment used by Archimedes, which contained a glass, with 24 mirrors that converged on a focal point. Other scholars defend the idea that Archimedes would have used soldiers' shields instead of mirrors, due to the manufacture of glass. Glassmaking was incipient in the time of Archimedes (c. 287-212 B.C.), and he was not directly involved in this process. However, Archimedes contributed to the knowledge of optics and the improvement of glass lenses, with experiments that influenced the later development of glass manufacturing and optical technologies. This situation comes from the fact that it is an ancient material, being among the oldest materials made by man. It is then a material whose history is intertwined with the history of civilization itself (VIEGAS, 2006, 17).

In the mid-eighteenth century, the development of solar furnaces began in the Middle East and Europe, whose purpose was the melting of metals, especially iron and copper (Lodi, 2011). According to (KALOGIROU, 2009), the initial function was the development of the Lavoisier solar furnace in 1774, as shown in figure 1. This project had a main lens with a length of 1.32 m and a secondary lens with a length of 0.2 m, capable of reaching temperatures of 1750 º C.

Figure 1 : Lavoisier's solar furnace (1774).

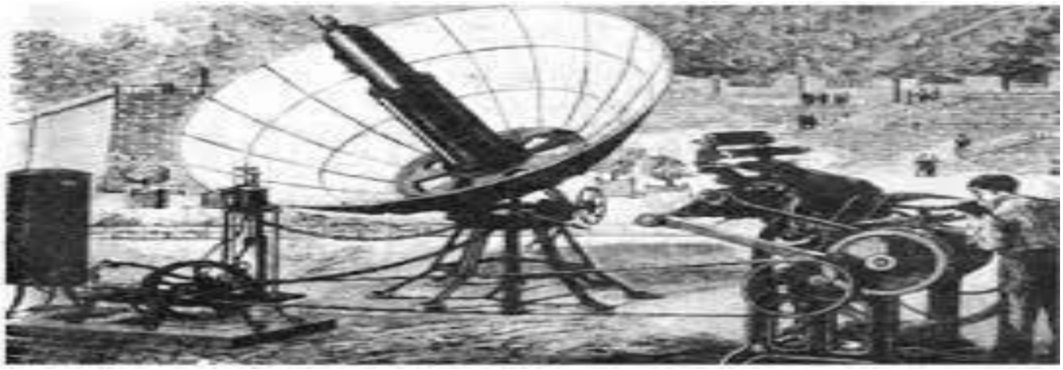


Source : Artwork Of Antoine Lavoisier's Solar Furnace is a photograph by Science Photo Library which was uploaded on September 26th, 2018.

Revista ARACÊ
ISSN: 2358-2472

In the nineteenth century, the first attempts to generate steam (at low pressure) in solar radiation emerged. In 1866, Augustin created the first solar engine equipped with a parabolic reflector and a cylindrical glass boiler, which supported a steam engine, in Europe and North Africa (RAGHEB, 2011 apud LODI, 2011). In figure 2, you can see the parabolic collector of a solar energy printer from 1882.

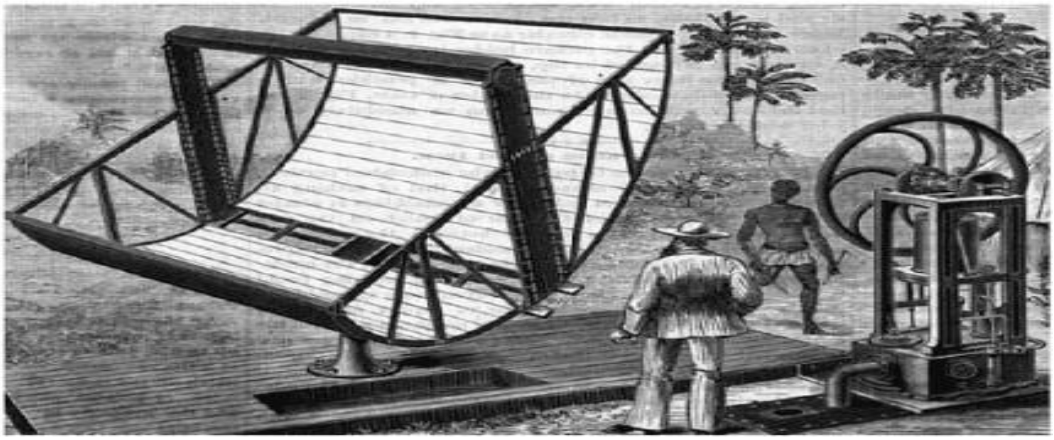
Figure 2 – Parabolic collector of a solar-powered printer (Paris, 1882)



Source: KALOGIROU (2009).

Models that capture and concentrate the sun's rays through mirrors, in order to improve the effect caused by solar heating, have been around for a long time. In figure 3, it is possible to analyze John Ericsson's parabolic concentrator, created in 1870.

Figure 3 – John Ericsson's parabolic concentrator (1870).



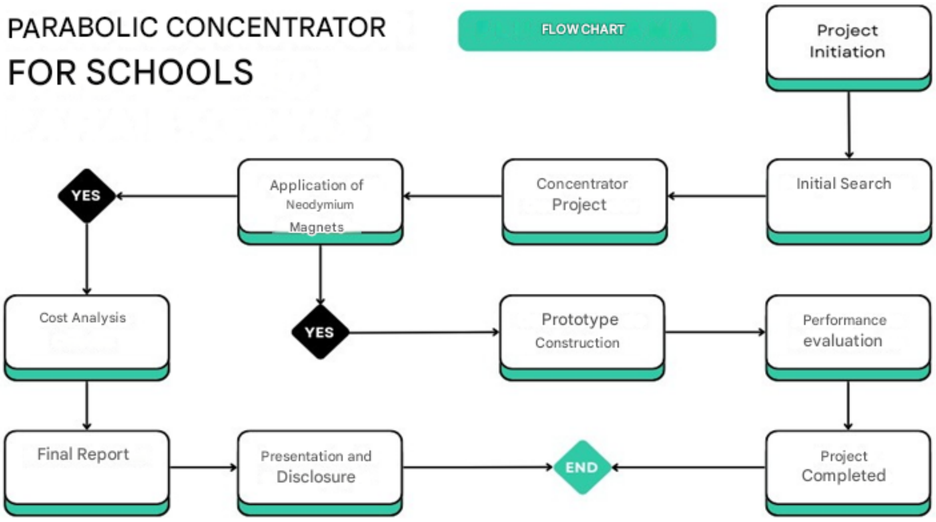
Source: RAGHEB (2011) apud LODI (2011)

Next, the search for clean and affordable energy will be explored, including research on the parabolic concentrator.

Revista ARACÊ
ISSN: 2358-2472

METHODOLOGY

Flowchart 01 – Parabolic concentrator for schools.



Source: Author's own, 2023.

Initially, an analysis was carried out to explore the issues involved in the issues related to SDG 7 of the 2030 agenda, proposed by the United Nations (UN, 2015), whose purpose is to ensure reliable, sustainable and modern access to clean and affordable energy for all.

The main searched words related to the research theme are linked to institutions with credibility in the area of sustainability and energy. These contribute to the elaboration of processes for the development of strategies and actions in order to achieve long-term objectives in the Brazilian and global energy sector. This refers to the industry and infrastructure involved in the production, distribution, and consumption of energy.

In the Brazilian context, it is the set of activities related to the generation of electricity, oil, natural gas and other energy sources used in the country. At the global level, the energy sector encompasses the various energy systems of different countries, including renewable, non-renewable and alternative energy sources. The energy sector plays a key role in economic development, environmental sustainability, and geopolitical issues, as well as being an important focus for innovation and investment.

An exploratory methodological approach was adopted, combining quantitative and qualitative techniques. To carry out the study, a bibliographic search was carried out in specialized sources, energy sector institutions and Brazilian websites. Data collection took place on January 15, 2023, covering the period from 2018 to 2022. The keywords selected

Revista ARACÊ
ISSN: 2358-2472

as a basis were: Parabolic concentrators, Renewable Energies, Neodymium magnets and schools.

DEVELOPMENT

RENEWABLE ENERGIES

Renewable energies are those obtained from natural sources that are naturally replenished and do not run out. They are considered sustainable forms of energy, as they do not emit or emit minimal amounts of greenhouse gases and other pollutants during their generation or use.

There are several sources of renewable energy, including:

i. Solar energy: Solar energy is obtained from solar radiation and can be converted into electricity through photovoltaic solar panels or used directly for water and space heating, as shown in figure 4.

Figure 4 – Solar Network

Source: https://rede.solar/energia-solar/,2021.

i. Wind energy: Wind energy is generated by the force of the winds, which move the blades of wind turbines as shown in figure 5, converting kinetic energy into electrical energy.

Revista ARACÊ
ISSN: 2358-2472

Figure 5: Wind energy

Source: http://www.brainmarket.com.br/2020/06/10/eolica-offshore-em-ascensao,2021.

ii. Hydroelectric energy: Hydroelectric energy is produced from the use of the flow of water in rivers, dams or waterfalls, which drives turbines that generate electricity, as shown in figure 6.

Figure 6: Itaipu Hydroelectric Power Plant.

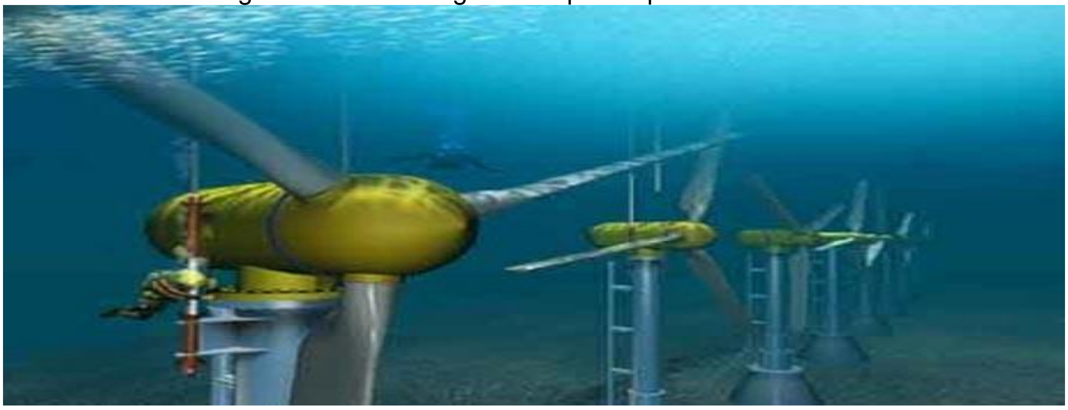
Source : https://clickpetroleoegas.com.br/usina-hidreletrica-de-itaipu, 2021 .

Hydroelectric power faces problems such as environmental impact, displacement of communities, and changes in the aquatic ecosystem. The construction of dams can lead to the depletion of water resources and present safety risks. In addition, it affects aquatic fauna and can emit greenhouse gases. Dependence on water availability makes hydropower vulnerable to climate change and prolonged droughts.

Solutions must be found to mitigate these impacts and find a balance between energy generation and environmental conservation.

ii. Tidal energy: Tidal energy is obtained by harnessing the movement of tides and sea currents to generate electricity. Figure 7 shows a plant moved by the use of the tides.

Figure 7: World's largest tidal power plant in Scotland.



Source : marsemfim.com.br, 2019.

i. Geothermal energy: Geothermal energy comes from the Earth's internal heat. It can be used through geothermal plants, which use steam or hot water from the subsoil to generate electricity or for direct heating, as shown in figure 8.

Figure 8: Geothermal Power Plant.

Source: energias3bvirgendevico.home.blog, 2021.

ii. Biomass: Biomass consists of organic materials, such as agricultural waste, wood waste, and energy crops, which can be burned or converted into biogas for electricity, heat, or fuel generation. Figure 9 shows a Biomass plant.

Revista ARACÊ
ISSN: 2358-2472

Figure 9 – Biomass Plant.

Source : Biomass stock image. Image of agriculture, macro - 72402677(dreamstime.com) ,2021.

These renewable energy sources offer a more sustainable alternative compared to non-renewable energy sources such as oil, coal, and natural gas, which are finite and release large amounts of greenhouse gases and pollutants as they burn. The use of renewable energy plays a key role in reducing greenhouse gas emissions, diversifying the energy mix, and transitioning to a cleaner and more sustainable energy system.

The main forms of non-renewable energy include:

NON-RENEWABLE ENERGY

Non-renewable energies are obtained from sources that are depleted over time and cannot be easily replaced or regenerated quickly. They have limited availability and are consumed faster than they are produced naturally.

- Fossil fuels: These are products obtained from the remains of ancient organisms that have undergone a long process of pressure and heat over millions of years. Oil, coal, and natural gas are prime examples of fossil fuels. These resources are used for various purposes, such as electricity generation, heating, transportation and as raw materials in the chemical industry. In figure 10, you can see an oil extraction platform, which represents a model of fossil fuel extraction. These resources are used for various purposes, such as electricity generation, heating, transportation and raw materials in the chemical industry. In figure 10, you can see an oil extraction platform, which represents a model of fossil fuel extraction.

Figure 10 – Oil Platform

Source : en.solar -energia.net, 2021 .

I. Nuclear energy: It is produced through the process of nuclear fission, in which heavy atoms, such as uranium-235, are fragmented into smaller atoms, resulting in the release of a large amount of energy. Nuclear energy is mainly used for the generation of electricity in nuclear power plants. In figure 11, a representation of a schematic drawing of the operation of a nuclear power plant can be seen.

Figure 11 – Nuclear Power Plant.

Source : celerosft.com, 2021.

Revista ARACÊ
ISSN: 2358-2472

WORLD ENERGY MATRIX

In 2018, global energy demand reached 14,282 Mtoe, according to the International Energy Agency. The following year, this demand increased to 14,486 Mtoe, representing an increase of 1.4%. However, due to the COVID-19 pandemic, the estimate for 2020 was 13,963 Mtoe, down 3.8% from 2019.

Forecasts for 2021 indicate a recovery in world energy demand, with an increase of 5.2% (14,689.0 Mtoe), exceeding the 2019 figure by 1.2%. In the last 48 years, both Brazil and other countries have undergone significant structural changes in their energy sources. In Brazil, there was a considerable increase in the share of hydroelectric energy, liquid bioenergy and natural gas.

In several countries, the increase in the use of natural gas and nuclear energy stands out. An example of this is solid biomass, which grew in the Organization for Economic Cooperation and Development (OECD) between 1973 and 2020, in contrast to what happened in Brazil and other countries. In fact, in the OECD, there is no longer a substitution of firewood for fuels. In several countries, the increase in the use of natural gas and nuclear energy stands out.

An example of this is solid biomass, which grew in the Organization for Economic Cooperation and Development (OECD) between 1973 and 2020, in contrast to what happened in Brazil and other countries. In fact, in the OECD, there is no longer a replacement of firewood with fossil fuels, which is still common in other parts of the world. In the OECD, there is an increase in the use of firewood in the pulp and paper industry and in space heating systems. Table 1 shows the domestic supply of energy in Brazil and the world.

Revista
ARACÊ
ISSN: 2358-2472

Table 1 – Domestic Energy Supply in Brazil and World (% and toe).

Fonte	Brasil		OCDE		Outros		Mundo	
	1973	2020	1973	2020	1973	2020	1973	2020
Derivados de Petróleo	45,6	33,1	52,6	33,0	29,9	23,8	46,1	29,4
Gás Natural	0,4	11,8	18,9	30,2	12,9	22,0	16,0	24,1
Carvão Mineral	3,2	4,9	22,6	13,8	31,1	35,7	24,6	26,2
Urânio	0	1,3	1,3	10,3	0,2	2,4	0,9	5,2
Hidro	6,1	12,6	2,1	2,4	1,2	2,6	1,8	2,7
Outras não Renováveis	0	0,6	0	0,5	0	0,1	0	0,3
Outras Renováveis	44,8	35,8	2,5	9,7	24,7	13,5	10,6	12,2
Biomassa Sólida	*44,3*	*26,0*	*2,4*	*5,2*	*24,7*	*11,3*	*10,5*	*9,1*
Biomassa Líquida	*0,5*	*7,7*	*0*	*1,02*	*0*	*0,15*	*0*	*0,61*
Eólica	*0*	*1,71*	*0*	*1,70*	*0*	*0,67*	*0*	*1,04*
Solar	*0*	*0,321*	*0*	*0,93*	*0*	*0,72*	*0*	*0,77*
Geotérmica	*0*	*0*	*0,16*	*0,81*	*0*	*0,64*	*0,1*	*0,67*
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
dos quais renováveis	*50,8*	*48,4*	*4,6*	*12,1*	*26,0*	*16,1*	*12,5*	*14,9*
Total - Mtep	**82,2**	**287,6**	**3.741**	**4.949**	**2.105**	**8.281**	**6.109**	**13.915**
% do mundo	*1,3*	*2,1*	*61,2*	*35,6*	*34,5*	*59,5*		

Source: Brazilian Energy Review 2020 — Ministry of Mines and Energy (www.gov.br)

Between 1973 and 2020, the OECD reduced the share of oil and its derivatives in its energy matrix by 19.4 percentage points. This was due to the effort to replace these products, mainly due to the shocks in oil prices that occurred in 1973 (from US$ 3 a barrel to US$ 12), in 1979 (from US$ 12 to US$ 40) and from 1998, when a new cycle of increases began, (Brazilian Energy Review 2020 — Ministry of Mines and Energy (www.gov.br)).

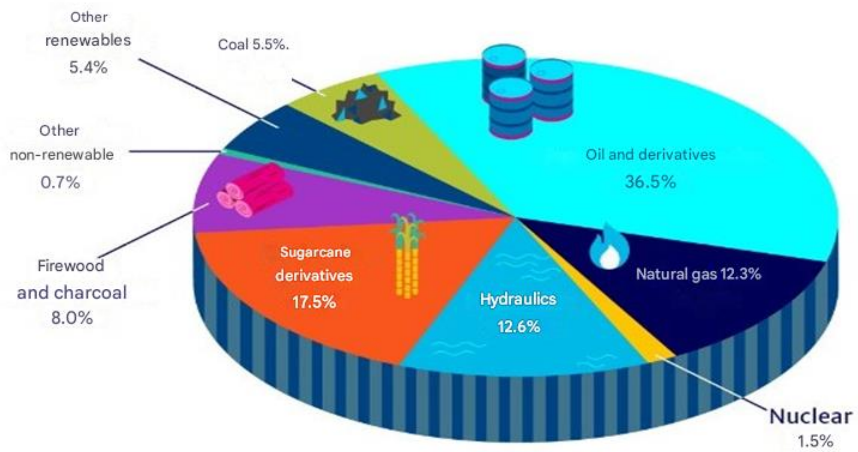
The COVID-19 pandemic has significantly affected the consumption of petroleum products, especially in the transport sector, with a forecast of a 9.3% drop in 2020. In the case of coal, the forecast is for a reduction of 4.6%. OECD countries, despite representing only 17% of the world's population, have a 42% share of the global economy (in terms of GDP at purchasing power parity) and 36% of energy consumption.

This indicates that these countries have a higher per capita energy consumption and a lower energy intensity compared to the rest of the world (Brazilian Energy Review 2020 — Ministry of Mines and Energy (www.gov.br)).

In the Global Energy Matrix, it is important to highlight the importance of the composition of energy sources. The energy matrix of a country or the world is a representation of the origin of the energy sources used to meet energy demands. In its described scenario, the global energy matrix is strongly dominated by non-renewable sources, such as coal, oil, and natural gas, which are finite sources and generally associated with significant greenhouse gas emissions and pollution ("Source: ENERGY MATRIX (epe.gov.br), 2021").

Revista
ARACÊ
ISSN: 2358-2472

Figure 12 – World Energy Martyr.



Source: Energy Matrix (epe.gov.br), 2021.

Renewable sources such as solar, wind, geothermal, hydropower, and biomass are considered more sustainable in the long term as they are naturally available resources that regenerate and have a lower environmental impact compared to non-renewable sources. However, as you mentioned, these renewable sources still represent a relatively small portion of the global energy mix, (Source: such as the International Energy Agency (IEA),2021).

The inclusion of hydropower and biomass in the category of renewable sources is appropriate, as these sources are generally considered part of the renewable energy mix due to their renewable nature.

However, the share of these renewables is slightly higher than the share grouped under "Other", reaching about 15% of the global energy mix, (Source: the International Renewable Energy Agency (IRENA),2022).

Transitioning to cleaner, renewable energy sources is key to mitigating climate change and reducing reliance on non-renewable energy sources. In recent years, there has been an increase in efforts to promote the use of renewable energy sources and reduce dependence on fossil fuels, which is an important step towards global energy sustainability, (Source: the United States Energy Information Administration (EIA) and Brazil's National Electric Energy Agency (ANEEL), 2021.

WORLD ELECTRICITY MATRIX

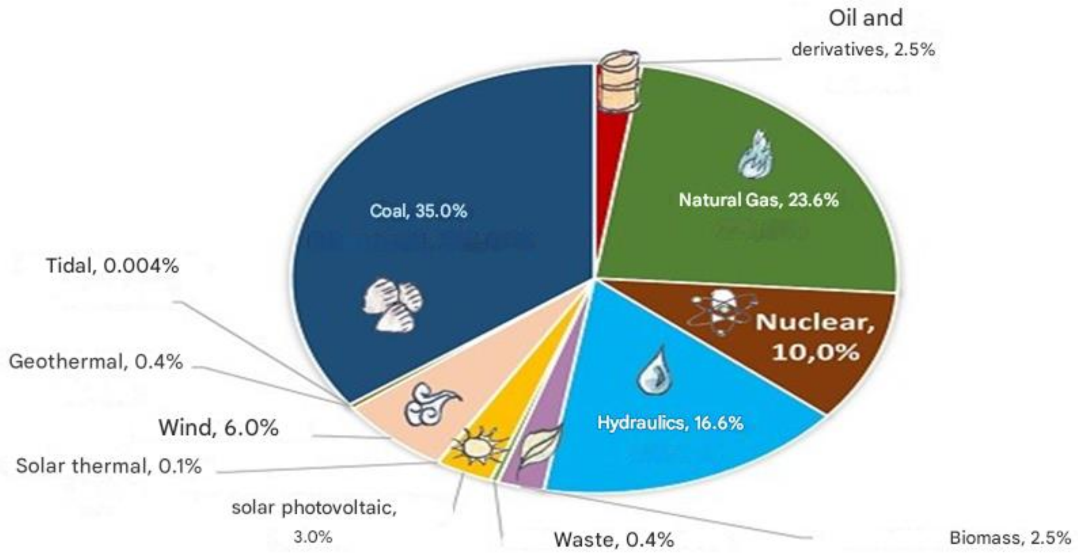
In the last 50 years, there has been a common trend of reduction in oil, derivatives and hydraulic energy, and increase in other energy sources, except mineral coal in the energy matrices of Brazil, OECD and other countries.

Revista
ARACÊ
ISSN: 2358-2472

The drop in the share of coal in Brazil was reversed due to the scarcity of rainfall, which had a direct impact on the cost of hydropower. As a consequence of the lack of rainfall, there has been an increase in the use of thermoelectric plants, many of which run on coal. This explains why reducing the use of coal is not always desirable in the Brazilian context. In contrast, in the OECD, there was a decrease of 17.8 percentage points in the share of mineral coal between 1973 and 2020.

Electricity is necessary for various daily activities, such as watching television, listening to music on the radio, lighting environments, turning on refrigerators, charging cell phones and many other things, as shown in figure 13 below.

Figure 13 – World Electric Martyr.



Source: ENERGY MATRIX (epe.gov.br), 2021.

BRAZILIAN ENERGY MATRIX

In the last 50 years, there has been a common trend of reduction in oil, derivatives and hydraulic energy, and increase in other energy sources, except mineral coal in the energy matrices of Brazil, OECD and other countries. In Brazil, the drop in the share of coal was reversed due to the scarcity of rainfall, while in the OECD there was a decrease of 17.8 percentage points between 1973 and 2020.

The scarcity of rainfall has an impact on the direct cost of hydraulic energy, since it is generated from water, which moves turbines in hydroelectric plants. When there is a shortage of rainfall, water levels in the reservoirs of the plants can decrease, which reduces the capacity to generate hydraulic power. This leads to an increase in energy production costs, as the supply of electricity from this source is compromised.

Revista ARACÊ
ISSN: 2358-2472

Table 2 presents the structure of the OIE (International Energy Organization) in the years 2019 and 2020.

Table 2 – Domestic Energy Supply (OIE)

ESPECIFICAÇÃO	mil tep		20/19 %	Estrutura %	
	2019	2020		2019	2020
NÃO-RENOVÁVEL	**158.316**	**148.518**	**-6,2**	**53,9**	**51,6**
PETRÓLEO E DERIVADOS	*100.898*	*95.247*	*-5,6*	*34,3*	*33,1*
GÁS NATURAL	*35.909*	*33.824*	*-5,8*	*12,2*	*11,8*
CARVÃO MINERAL E DERIVADOS	*15.435*	*14.027*	*-9,1*	*5,3*	*4,9*
URÂNIO (U3O8) E DERIVADOS	*4.292*	*3.727*	*-13,2*	*1,5*	*1,3*
OUTRAS NÃO-RENOVÁVEIS (a)	*1.780*	*1.693*	*-4,9*	*0,6*	*0,6*
RENOVÁVEL	**135.642**	**139.094**	**2,5**	**46,1**	**48,4**
HIDRÁULICA E ELETRICIDADE	*36.364*	*36.210*	*-0,4*	*12,4*	*12,6*
LENHA E CARVÃO VEGETAL	*25.725*	*25.710*	*-0,1*	*8,8*	*8,9*
DERIVADOS DA CANA-DE-AÇÚCAR	*52.841*	*54.933*	*4,0*	*18,0*	*19,1*
OUTRAS RENOVÁVEIS (b)	*20.712*	*22.241*	*7,4*	*7,0*	*7,7*
TOTAL	**293.957**	**287.612**	**-2,2**	**100,0**	**100,0**
dos quais fósseis	*154.023*	*144.791*	*-6,0*	*52,4*	*50,3*

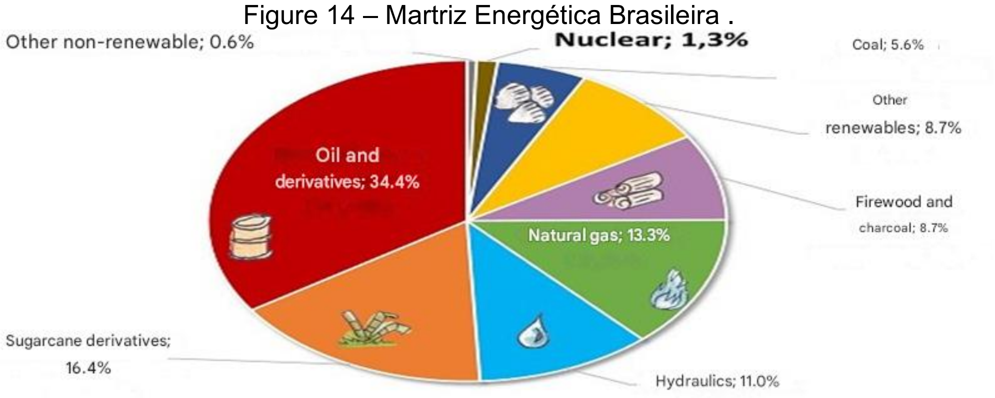
(a) Gás de alto-forno, de aciaria e de enxofre; (b) lixívia, biodiesel, eólica, solar, casca de arroz, biogás, resíduos de madeira, gás de carvão vegetal e capim elefante.

Source: Brazilian Energy Review 2021 — Ministry of Mines and Energy (www.gov.br)

The composition of the Brazilian energy matrix is significantly divergent from the global average. In Brazil, we have a higher proportion of renewable energy sources compared to the rest of the world.

If we consider the sum of the contributions of firewood and charcoal, hydroelectric energy, sugarcane derivatives and other renewable sources, renewable energies make up 44.8% of our energy mix, almost half of the total. Figure 14 shows the composition of the Brazilian energy matrix.

Figure 14 – Martriz Energética Brasileira .



Source: Energy Matrix (epe.gov.br), 2021.

Revista ARACÊ
ISSN: 2358-2472

Brazil stands out in the share of hydropower and solid bioenergy, with 65.2% and 9.1% respectively, compared to other countries, ("Source: ENERGY MATRIX (epe.gov.br), 2021"). Wind and solar power are expanding rapidly in all regions.

BRAZILIAN ELECTRICITY MATRIX

In 2020, the amount of Electricity Offered Domestically (OIEE) reached 645.9 TWh, which represents a decrease of 0.8% compared to 2019 (a drop of 1.2% globally is estimated, to 26,670 TWh). Solar energy generation showed the highest growth, with a rate of 61.5% in 2020, and distributed generation has already contributed with 45% of the total generated, ("Source: ENERGY MATRIX (epe.gov.br), 2021".

As solar energy increases its share in the OIEE, annual expansion rates are gradually decreasing, from 876% in 2017, to 316% in 2018 and 92.2% in 2019. . Table 3 shows the domestic supply of electricity (OIEE), ("Source: ENERGY MATRIX (epe.gov.br), 2021".

Table 3 – Internal Electricity Supply (OIEE)

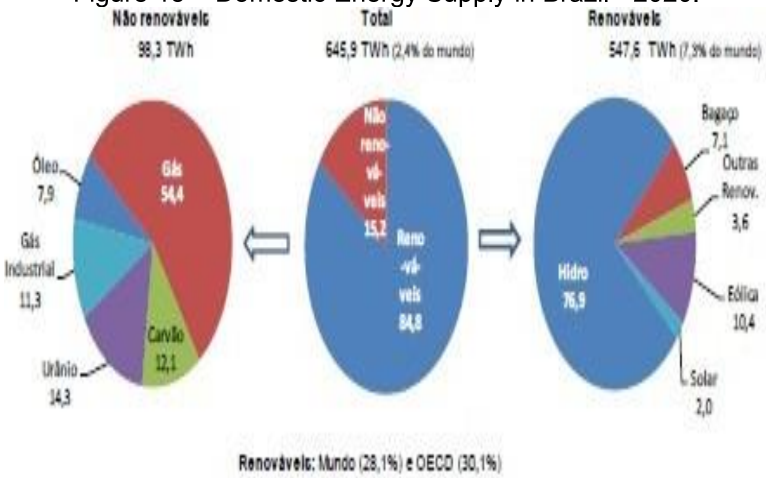
ESPECIFICAÇÃO	GWh		20/19 %	Estrutura (%)	
	2019	2020		2019	2020
HIDRÁULICA	397.877	396.327	-0,4	61,1	61,4
BAGAÇO DE CANA	36.827	38.776	5,3	5,7	6,0
EÓLICA	55.986	57.051	1,9	8,6	8,8
SOLAR	6.655	10.750	61,5	1,0	1,7
OUTRAS RENOVÁVEIS (a)	18.094	19.966	10,3	2,8	3,1
ÓLEO	6.926	7.745	11,8	1,1	1,2
GÁS NATURAL	60.448	53.464	-11,6	9,3	8,3
CARVÃO	15.327	11.946	-22,1	2,4	1,8
NUCLEAR	16.129	14.053	-12,9	2,5	2,2
OUTRAS NÃO RENOVÁVEIS (b)	12.060	11.121	-7,8	1,9	1,7
IMPORTAÇÃO	24.957	24.718	-1,0	3,8	3,8
TOTAL (c)	**651.285**	**645.915**	**-0,8**	**100,0**	**100,0**
Dos quais renováveis	*540.395*	*547.587*	*1,3*	*83,0*	*84,8*

(a) Lixívia, biogás, casca de arroz, capim elefante, resídos de madeira e gás de c. vegeta; (b) Gás de alto forno, de aciaria, de coqueria, de refinaria e de enxofre; e alcatrão; (c) Inclui autoprodutor cativo (que não usa a rede básica).

Source: Brazilian Energy Review 2021 — Ministry of Mines and Energy (www.gov.br)

Figure 15 represents the OIEE (Internal Electricity Supply) matrix. Graph 'a'' presents non-renewable energies, central graph 'b'' highlights the comparative advantages of renewable sources, which represent 78.1% of the Brazilian electricity matrix, compared to the world average of only 28.1% and the OECD bloc with 30.1%, graph 'c'' presents renewable energies.

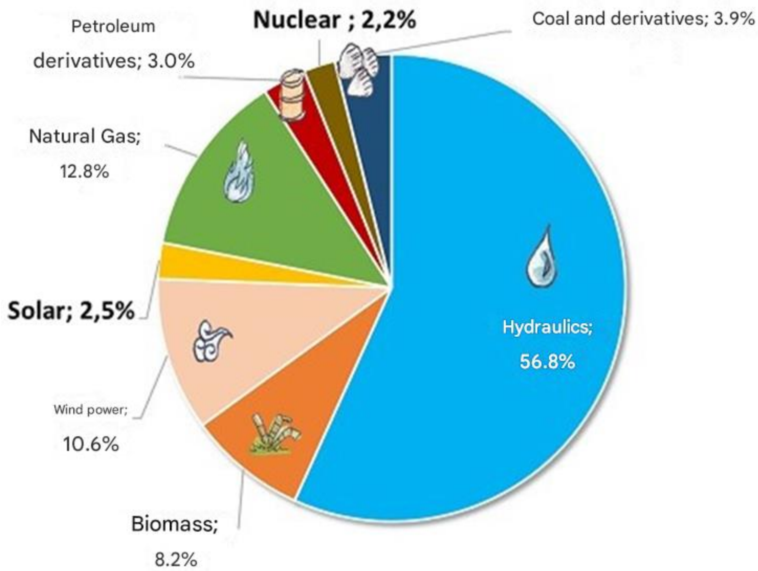
Figure 15 – Domestic Energy Supply in Brazil - 2020.



Source: Brazilian Energy Review 2020 — Ministry of Mines and Energy (www.gov.br)

Brazil's electricity matrix is predominantly composed of renewable sources, This is due to the fact that a significant portion of the electricity generated in the country comes from hydroelectric plants. In addition, wind energy has shown significant growth, which contributes to keeping the Brazilian electricity matrix mostly renewable. Figure 16 shows the composition of Brazil's electricity matrix.

Figure 16 – Brazilian electric martriz - 2021.



Source: ENERGY MATRIX (epe.gov.br), 2021.

ADVANCES IN ENERGY

The purpose of the theme "Energy Breakthroughs: Parabolic Concentrators, Muammer Yildiz's Turkish Motor, and Enhancement with Neodymium Magnets for Electric Bicycle Motors" is to explore the innovations and technological breakthroughs in the areas

Revista ARACÊ
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of power generation and utilization. It seeks to analyze how parabolic concentrators, Muammer Yildiz's Turkish motor, and the use of neodymium magnets can be combined and applied to improve the efficiency and sustainability of energy sources. This involves investigating the possibilities of power generation, engine enhancement, and how these technologies can contribute to a cleaner, more energy-efficient future.

PARABOLIC CONCENTRATORS

Parabolic concentrators, also known as parabolic mirrors, are devices that use solar energy to heat a thermal fluid in a high-pressure tube located at the focal point. This generates steam at high temperatures, which reaches about 1000°C, and is used to drive turbines and generate electricity. However, these systems rely on sunlight, which requires additional technologies to ensure overnight steam generation and maintain a continuous supply of electricity 24 hours a day. To keep up with solar movement throughout the day, synchronous motors are essential, although this setup does not allow for seasonal adjustments in the solar tilt.

Figure 17 - Parabolic Chute Concentrator

Source: cienciamx.com, 2018.

MUAMMER YILDIZ'S TURKISH ENGINE

On the other hand, Muammer Yildiz's Turkish Motor, developed in 2013, innovates by using neodymium magnets to create an oscillating magnetic field within a static magnetic field. This motor is composed of a rotor and a stator located on the same shaft and in relative motion.

The rotor contains permanent magnets distributed in several magnetic phases, while the stator has a second sequence of permanent magnets.

Permanent magnet motors operate within the principles established by physics, including the laws of thermodynamics and the conservation of energy. However, the claim of permanent magnet motors supposedly producing infinite energy or performing work without energy consumption contradicts fundamental laws of physics, such as the principle of conservation of energy, which makes such claims inconsistent with established scientific principles.

However, there is a gradual evolution in the perception of the motor, and it is only a matter of time before it is recognized as an important research and development initiative by renowned universities around the world, despite its incompatibility with the established principles of current physics. Figure 18 shows the magnetic motor developed by Muammer Yildiz.

Figure 18 - Turkish Muammer Yildiz magnetic motor

Source: revolution-green.com/yilditz-magnetic-motor-update 2015

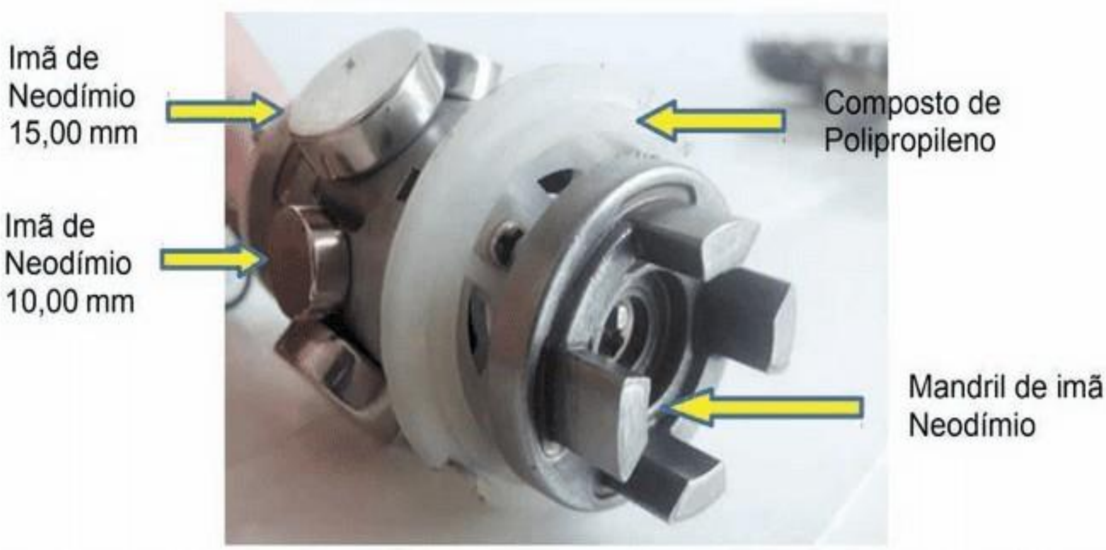
MOTOR ENHANCEMENT WITH NEODYMIUM MAGNET

On the other hand, according to the study by Pontes (2018), the development of a research that combined generative functions to compose the magnetic field element was suggested. The polarization of neodymium magnets does not consume any electrical

Revista ARACÊ
ISSN: 2358-2472

energy to form the magnetic field and generate clean energy used to rotate the holder with the magnetic chuck in order to loosen or tighten the screws by means of the rotor, flashlight and LED lighting, as well as the battery level indicator, which is rechargeable, as illustrated in Figure 19.

Figure 19 – Magnetic screwdriver rotor with Neodymium magnets



Source: https://www.atenaeditora.com.br/catalogo/ebook/aplicacao-de-energia-renovavel-enhancement-of-the-motor-with-magnet-neodymium, 2023 .

Figure 20 below shows the right side view of the prototype permanent magnet screwdriver, which has been successfully tested. The rotor movements with neodymium magnets and all the functionalities of the prototype met the operating expectations. The test also approved the LED lamp of the flashlight, with the electrical and mechanical circuits.

Figure 20 – Right side view of the prototype Magnetic Screwdriver

Source: https://www.atenaeditora.com.br,2023 .

ELECTRIC BIKE MOTOR WITH NEODYMIUM MAGNETS

Regarding the electric bicycle motor with Neodymium magnets (5.4), Flávio, Leislye and Duarte (2022) proposed the creation of an electric bicycle prototype that would use common and affordable components on the market, maintaining gears to ensure greater autonomy compared to commercial electric bicycles.

During the production of the generator, they noticed the efficiency of neodymium magnets in creating a magnetic field, which, combined with the rotor and stator composed of coils, generated alternating current. To do this, they adapted an automatic alternator donated by a used car parts dealer. The first step was to remove the copper from the rotor, eliminating the need for external power for magnetization and power generation during rotation.

Next, the 12-pin rotor underwent manual machining to create a cavity capable of accommodating an N35 neodymium magnet. Magnets in the round format, composed of Nd2Feb, Class N35, magnetic charge of 6.5 kg in silver color, play a crucial role for several reasons:

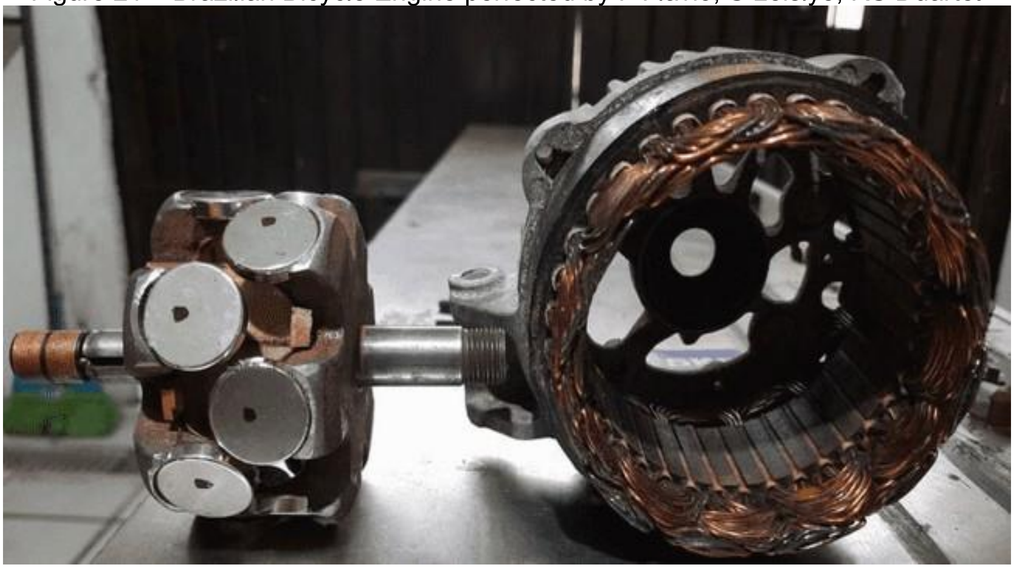
1. Energy Efficiency: Manually machining the rotor allowed for the creation of a cavity that would accommodate an N35 neodymium magnet. This type of magnet is known for its high magnetic flux density, which results in a higher efficiency in generating electrical current. This means that the system can produce more electrical power with less effort, making it more efficient and cost-effective in terms of energy consumption.
2. =Power Generation: By inserting the N35 neodymium magnet into the cavity, the magnetic field generated is stronger and more stable, allowing for the effective production of electric current. This is essential for the operation of the generator, as the current generated is used to power the electric bicycle, offering enough autonomy to meet the needs of users.
3. Durability: The choice of N35 neodymium magnet, along with its Nd2FeB composition, is important for the durability of the system. Neodymium magnets are known to maintain their magnetism for long periods, making them ideal for long-lasting applications such as electric motors in bicycles. The Nd2FeB composition is corrosion-resistant and offers greater magnetic stability.
4. Reduction of External Power: The ability of the N35 neodymium magnet to maintain its magnetism without the need for external power means that the

Revista ARACÊ
ISSN: 2358-2472

system can function autonomously, without relying on additional power sources to magnetize the rotor. This is beneficial as it reduces the complexity and costs of the system.

5. Overall Performance: The detailed specifications of the magnets, such as the N35 class and the 6.5 kg magnetic load, are indicative of their ability to provide the performance required for the project. These characteristics contribute to the overall effectiveness of the motor/generator, ensuring that it is able to generate the electrical energy needed to propel the electric bike efficiently.

Figure 21 – Brazilian Bicycle Engine perfected by F Flávio, S Leislye, RS Duarte.



Source: https://repositorio.animaeducacao.com.br/handle/ANIMA/24194, 2022.

PARABOLIC CONCENTRATOR AND NEODYMIUM MAGNET

Water heating is an important need in several sectors, and the development of sustainable solutions to meet this demand has been a priority.

One promising technology is water heating using a parabolic concentrator and neodymium magnet motors. The parabolic concentrator uses curved mirrors to concentrate sunlight on a focal point, increasing the intensity of incoming solar energy. When directed to a water heating system, the parabolic concentrator can generate high temperatures and provide a renewable energy source.

The integration of neodymium magnet motors in this system has several advantages, as these motors have a high magnetic force and are efficient in energy conversion. They can be used to drive water pumps, allowing the continuous circulation of hot water through the heating system.

Revista ARACÊ
ISSN: 2358-2472

By combining the parabolic concentrator and neodymium magnet motors, it is possible to generate hot water and clean energy simultaneously. Concentrated solar energy heats water, which can be stored for later use in heating systems or be converted into electricity to power other devices. This system has environmental and economic advantages, such as the reduction of greenhouse gas emissions by replacing fossil fuels, in addition to using a free and inexhaustible source of energy.

Neodymium magnet motors are efficient and durable, reducing the need for frequent maintenance and replacement. However, implementing this system requires significant upfront investments, and the efficiency can vary based on geographic location and weather conditions. It is important to conduct detailed studies to assess technical and economic feasibility before a large-scale implementation.

In summary, heating water with a parabolic concentrator and neodymium magnet motors is a promising solution for generating hot water and clean energy, contributing to a more sustainable and less fossil-fuel-dependent future.

FINAL CONSIDERATIONS

The Brazilian energy matrix and the world energy matrix present significant divergences in their composition and characteristics. The global energy mix is predominantly based on non-renewable sources such as oil, coal, and natural gas, with a notable share in nuclear power. In contrast, the Brazilian energy matrix is notable for its high dependence on renewable sources, mainly hydropower and biomass, with a growing role for wind and solar energy.

BRAZIL'S ENERGY POTENTIAL:

Brazil holds a vast energy potential due to its abundance of natural resources. Its main source of energy is hydroelectricity, powered by numerous rivers and watersheds. In addition, the country has vast areas suitable for the generation of wind and solar energy, expanding its energy potential, as well as a considerable reserve of biomass from its agroindustry.

EXPANSION OF NEW RENEWABLE ENERGY SOURCES:

Brazil has been actively promoting the expansion of renewable energy sources, with policies encouraging wind and solar energy, resulting in a steady increase in installed

Revista ARACÊ
ISSN: 2358-2472

capacity. This contributes to the diversification of the energy matrix, reduction of greenhouse gas emissions and greater resilience of the energy system.

POTENTIAL OF USING PARABOLIC CONCENTRATORS WITH NEODYMIUM MAGNETS

Parabolic concentrators with neodymium magnets present an innovative method for the production of thermal and electrical energy, taking advantage of the concentration of solar energy. Its advantages include high efficiency in capturing solar energy, a low carbon footprint, and flexibility in producing electricity and heat. However, they also present challenges, such as the high initial cost, reliance on scarce resources such as neodymium, and the need for storage to provide continuous power.

Advantages

1. Energy Efficiency: Parabolic concentrators with neodymium magnets have high efficiency in converting solar radiation into thermal energy, making them effective in generating electricity and heat;
2. Emission Reduction: This technology contributes to the reduction of greenhouse gas emissions, aligning with sustainability and climate change mitigation goals.

Disadvantages

1. High Initial Cost: Implementing parabolic concentrators with neodymium magnets requires significant investments.
2. Neodymium Shortage: Reliance on rare materials such as neodymium can present availability challenges;
3. Energy Storage: Intermittent solar power generation requires storage systems to provide constant power, increasing complexity and costs.

In summary, the Brazilian energy matrix is notably more dependent on renewable sources compared to the global matrix, and the country has great potential for the expansion of renewable energies, including parabolic concentrators with neodymium magnets. While this technology offers notable advantages, issues such as costs, resource availability, and energy storage must be carefully considered in the search for sustainable energy solutions.

Revista ARACÊ
ISSN: 2358-2472

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