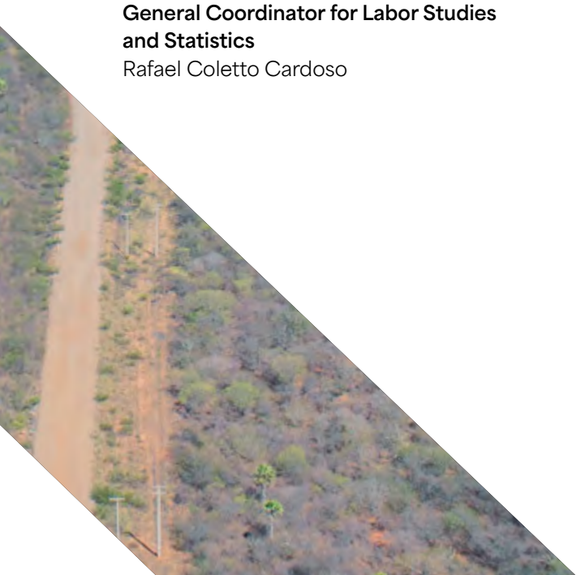
CHARACTERIZATION OF JOBS IN THE RENEWABLE ENERGY INDUSTRY IN THE NORTHEASTERN REGION

MINISTÉRIO DO TRABALHO E EMPREGO
GOVERNO DO BRASIL DO LADO DO POVO BRASILEIRO
DIEESE DEPARTAMENTO INTERSINDICAL DE ESTATÍSTICA E ESTUDOS SOCIOECONÔMICOS

Ministry of Labor and Employment
Esplanada dos Ministérios, Block F, 5th Floor,
Headquarters Building,
Brasília - DF 70.059-900

Minister of Labor and Employment
Luiz Marinho
Executive Secretariat of the Ministry of Labor and Employment
Francisco Macena da Silva
Labor Inspection Secretariat
Luiz Felipe Brandão de Mello
National Secretariat for Popular and Solidarity Economy
Gilberto Carvalho
Secretariat for Worker Protection
Carlos Augusto Simões Gonçalves Junior
Secretariat for Employment, Professional Development and Income
Magno Rogério Carvalho Lavine
Secretariat for Labor Relations
Marcos Perioto
Undersecretary for Labor Statistics and Studies
Paula Montagner
General Coordinator for Labor Studies and Statistics
Rafael Coletto Cardoso



Inter-Union Department of Statistics and Socioeconomic Studies (DIEESE)
National Office:
Rua Aurora, 957 - 1st Floor
ZIP 05001-900 São Paulo, SP - Brazil
Phone: +55 (11) 3874-5366 / Fax: +55 (11) 3874-5394
Email: en@dieese.org.br
Website: www.dieese.org.br

President - José Gonzaga da Cruz
Union of Retail Workers of São Paulo - SP
Vice President - Maria Aparecida Faria
Union of Public Health Workers of the State of São Paulo - SP
National Secretary - Paulo Roberto dos Santos Pissinini Junior
Union of Metal, Mechanical, Electrical Equipment, Vehicle, and Automotive Parts Industry Workers of Greater Curitiba - PR
Executive Director - Alex Sandro Ferreira da Silva
Union of Metal, Mechanical, and Electrical Equipment Industry Workers of Osasco and Region - SP
Executive Director - Cecília Margarida Bernardi
Union of Employees in Advisory, Survey, Research, and State Foundation Companies of Rio Grande do Sul - RS
Executive Director - Claudionor Vieira do Nascimento
Union of Metalworkers of ABC - SP
Executive Director - Edenilson Rossato
National Confederation of Metalworkers (CNTM)
Executive Director - Elna Maria de Barros Melo
Union of Federal Public Servants of the State of Pernambuco - PE
Executive Director - Gabriel Cesar Anselmo Soares
Union of Electric Power Industry Workers of São Paulo - SP
Executive Director - José Carlos Santos Oliveira
Union of Metal, Mechanical, and Electrical Equipment Industry Workers of Guarulhos, Arujá, Mairiporã, and Santa Isabel - SP
Executive Director - Marta Soares dos Santos
Union of Bank Employees of São Paulo, Osasco, and Region - SP
Executive Director - Paulo de Tarso Guedes de Brito Costa
Union of Electrical Workers of Bahia - BA

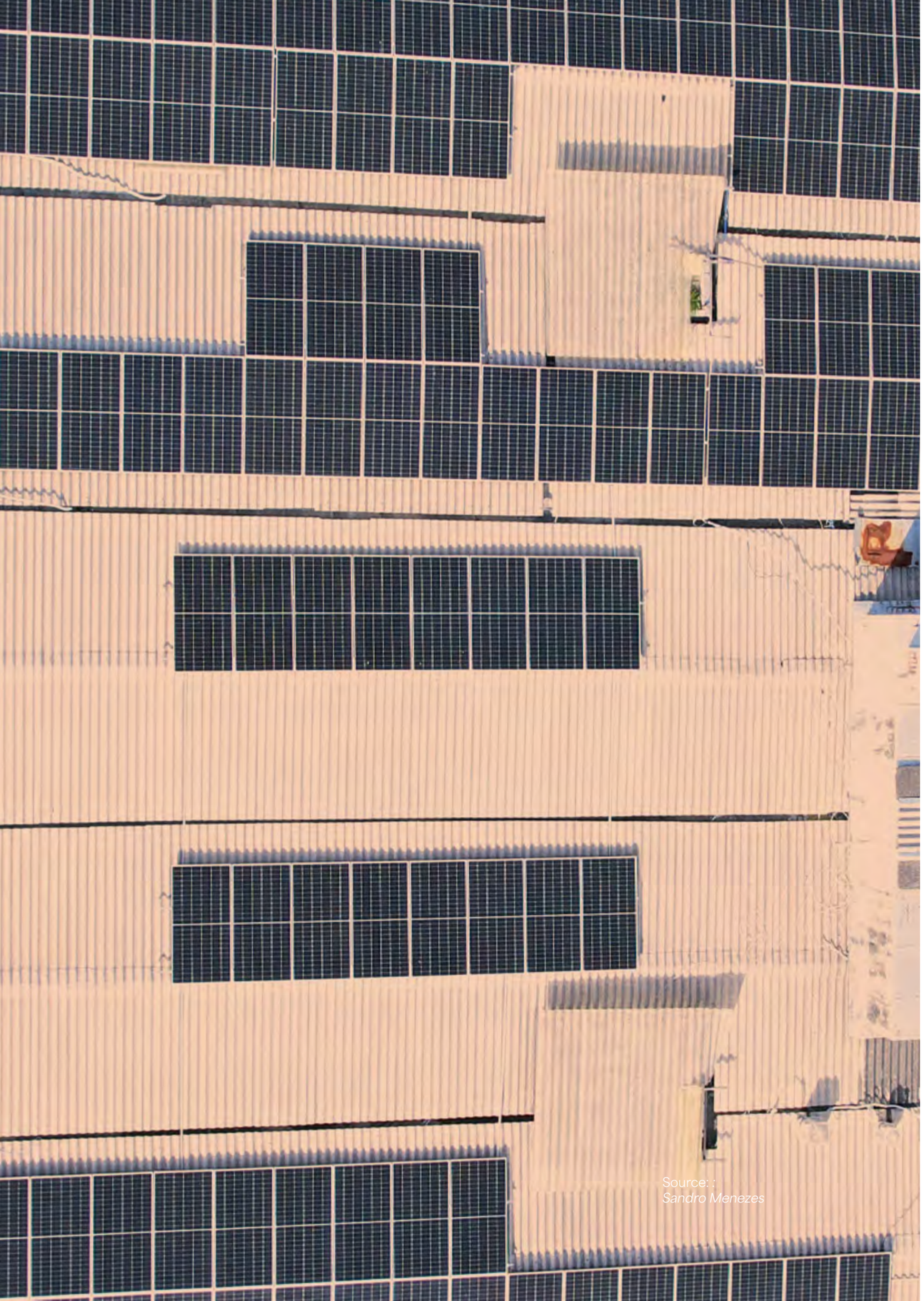
Technical Director
Adriana Marcolino - Technical Director
Patrícia Pelatieri - Deputy Director
Victor Gnecco Pagani - Deputy Director
Eliana Elias - Director of the DIEESE School of Labor Sciences

Responsible Team
Tiago Rangel Côrtes
Luís Edmundo Araujo
Rodrigo Fernandes Silva
Patrícia Toledo Pelatieri (coordination and editing)

Graphic project and layout
Julia Contreiras

Promotion Document No. 2/2023
Note: The texts do not necessarily reflect the position of the Ministry of Labor and Employment.

SUMMARY



Source: :
Sandro Menezes

CHARACTERIZATION OF JOBS IN THE RENEWABLE ENERGY INDUSTRY IN THE NORTHEASTERN REGION

MINISTÉRIO DO TRABALHO E EMPREGO
GOVERNO DO BRASIL DO LADO DO POVO BRASILEIRO
DIEESE DEPARTAMENTO INTERSINDICAL DE ESTATÍSTICA E ESTUDOS SOCIOECONÔMICOS

“The energy transition represents a strategic opportunity for Brazil to align climate policy, job creation, and sustainable development, taking on a leading role in this process.”

Source: :
Sandro Menezes

INTRODUCTION

The growing urgency to tackle the climate crisis has been driving profound transformations in global energy matrices and in sustainable development strategies. In this scenario, Brazil is poised to seize a strategic opportunity: aligning its energy policy with the generation of high-quality jobs, promoting activities that respect and regenerate the environment. The energy transition, especially with the advancement of renewable sources, emerges as a promising alternative, albeit one still constrained by structural and social challenges.

However, decarbonization of the economy cannot be seen as the sole solution to the environmental crisis. It is a multifaceted problem that requires changes in consumption patterns, land use, exploitation of natural resources, and waste management. In Brazil, sectors such as agriculture, livestock, and deforestation account for the largest share of greenhouse gas emissions, calling for integrated public policies that extend beyond the energy sector and include measures to preserve biodiversity and value traditional knowledge.

In this context, the concept of just transition gains relevance, formulated by the labor movement in the 1980s and incorporated into the climate agendas of the Climate Summit (COP) only from COP 21 in Paris (2015). The concept proposes that the required production changes whose aim is to address environmental challenges should not be made at the expense of precarious work or increased social inequality. Addressing these challenges requires broad social dialogue, participatory planning, and robust financing mechanisms that ensure inclusion and safeguard affected workers and communities.

Brazil is facing ecological, demographic, and technological transitions simultaneously, which directly impact the labor market. Although the renewable energy sector has grown, it has not yet emerged as a robust model for a just transition. The low job creation, the lower quality of occupations, and the dependence on imports reveal the need for a more integrated approach. This article proposes a reflection on the possible paths for a Just Ecological Transition in the country, articulating sustainable development, social inclusion, and the strengthening of decent work.

This study analyzes the characterization of employment in renewable energy activities (wind and solar) in the Northeastern region of Brazil. It is part of the Grant Agreement No. 01/2022, from the former Ministry of Labor and Social Security (MTP) and it aims to understand the impact of the expansion of these activities on job creation and regional development. The Northeastern region saw a significant increase in solar and wind energy generation capacity between 2006 and 2023. During this period, solar capacity rose from virtually zero to 10.92 GW, while wind capacity grew from 0.21 GW to 27.54 GW, according to data from the National System Operator (ONS). This behavior generates expectations about the development of new business chains and the decrease of regional inequalities. The report focuses on these two sources, excluding others, as they are the most representative to understand the new regional economic movements in the sector.

The study methodology was divided into three main parts: a) the measurement and qualification of job positions through secondary data using the Annual Report of Social Information (RAIS) for the selected years of 2016 and 2021; b) results from interviews with various social actors; and c) identification of labor and employer union representation, as well as a survey of collective agreements. While secondary data provides a quantitative overview, interviews complement the research project with information that is not captured by databases. Finally, the report includes final considerations with recommendations for public policies related to employment, labor, economic development, environment, and regulations.

“The climate crisis is also a crisis of labor and inequality.”

METHODOLOGICAL NOTE

The results and discussions presented in this study relied on the collection of secondary data and the production of qualitative data based on interviews.

Geographically, the study focused on the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Sergipe, and Bahia, which stand out for their high concentration of wind and solar energy projects in operation, according to the Generation Information System of the National Electric Energy Agency (SIGA/ANEEL)[1].

The methodology was structured in three main axes. The first axis consisted of collecting secondary data from official sources, such as RAIS, from 2016 and 2021, ANEEL, as well as information from sectoral associations and companies operating in the industry. These data enabled the mapping of formal employment evolution in the sector, characterizing the socioeconomic profile of productive activities under the National Classification of Economic Activities (CNAE 2.0), at the class level, referring to the activities of Electric Power Generation (3511-5), Electric Power Transmission (3512-3), and Electric Power Distribution (3514-0) in municipalities identified with operational projects.

The use of outsourced labor was also observed at all stages, from implementation, when the largest volume of workers is employed, to the operation and maintenance stages. Therefore, an analysis focused solely on the typical economic activities of electricity generation, transmission, and distribution would have limited the scope of the investigation. For this reason, it was necessary to examine the socioeconomic profile of workers involved in these stages, particularly those employed through contracted companies (outsourcing).

With the purpose of finding and identifying the activities of service provision and administration in the wind and solar energy industries, data was retrieved from RAIS, from the relevant companies mentioned in the interviews, from the companies listed in the labor demand reports of the National Labor Intermediation System (SINE), and from companies mentioned in collective bargaining agreements that use the terms wind and/or solar, available in the Mediator System (MTE). This strategy enabled the analysis of similarities and differences in the profile of employment arrangements of workers in this industry. At this stage, 60 active companies were identified.

1. Last query performed on July 3, 2023.

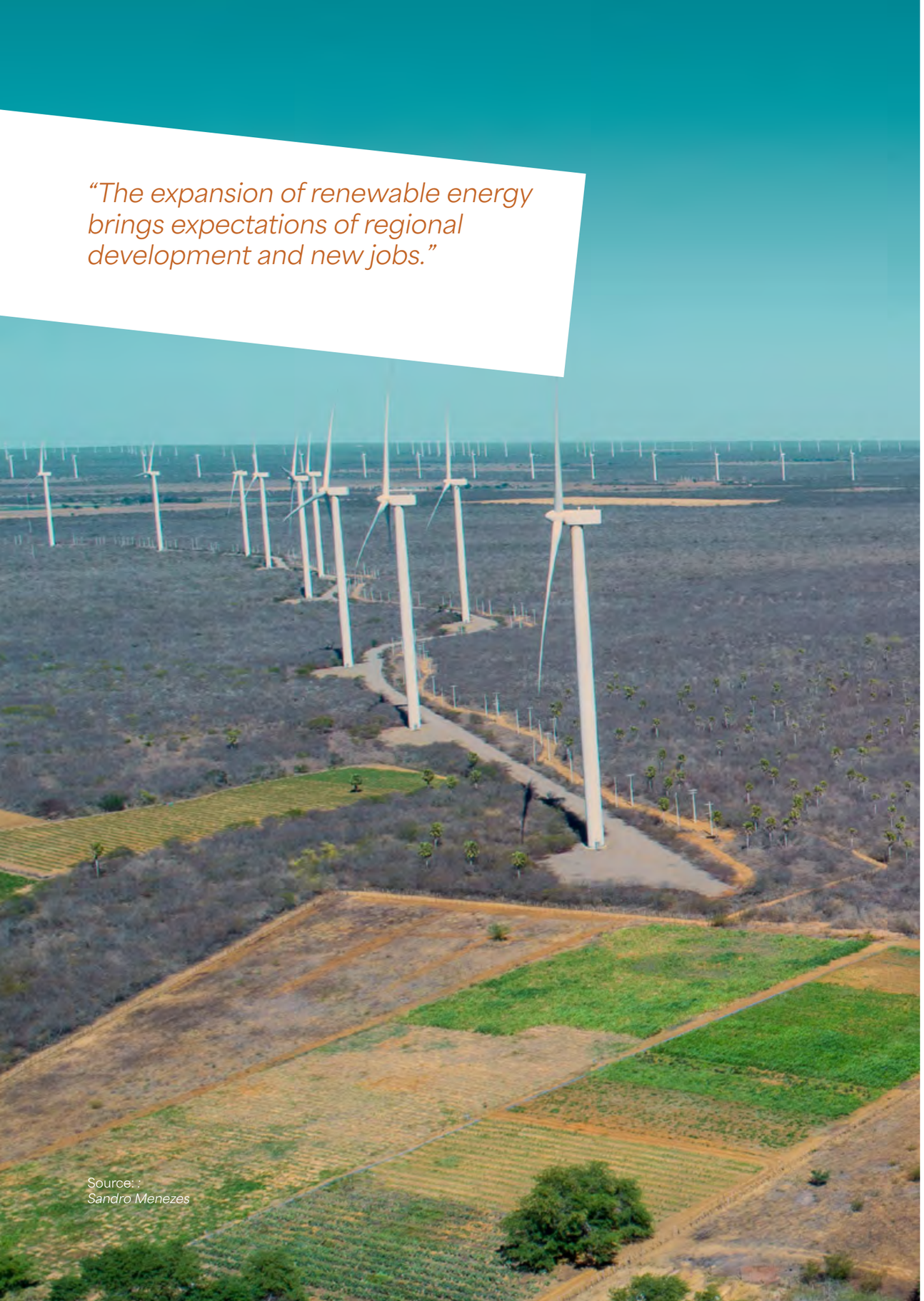
The second axis involved semi-structured, remotely conducted interviews, with representatives from companies and unions as well as public managers and experts, aiming to capture insights on the challenges of energy transition, the qualification of local workforce, and the bottlenecks in these sectors. Twenty-six (26) interviews were conducted between July and November 2023, of which 14 were held with union representatives, 2 with grassroots workers, 3 with researchers, 3 with representatives of social movements and community leaders, 2 with businesspeople, and 2 with public officials, encompassing representatives from virtually all states in the Northeast, except for the state of Alagoas.

The third axis focused on presenting the survey of trade union entities representing the workers of the renewable energy industry in the Northeastern region and the collective bargaining instruments negotiated in 2022, based on the search conducted in the National Registry of Trade Union Entities (CNES), and in the Mediator System of the Ministry of Labor and Employment (MTE).

The investigation incorporated the concept of just transition, acknowledging that the migration to a clean energy matrix should be accompanied by public policies that ensure social inclusion, worker protection, and respect for the environment. Therefore, the analysis was not limited to employment indicators; it also sought to assess the quality of occupations, levels of formalization, coverage of collective agreements, and the impacts on vulnerable communities.

Finally, the study acknowledges its methodological limitations, such as the absence of data disaggregated by type of energy in statistical databases on labor, the difficulty of accessing information on outsourcing, and the scarcity of studies on the social impacts of energy transition. Despite these challenges, the approach adopted made it possible to build an overview of the job market in the renewable energy sector in Brazil's Northeast, providing valuable input for the development of public policies aimed at generating jobs and income in a sustainable and inclusive manner, in line with the principles of a Just Ecological Transition.

“The expansion of renewable energy brings expectations of regional development and new jobs.”



Source: :
Sandro Menezes

Territory distribution and socioeconomic profile of current employment in the wind and photovoltaic energy sectors in the Northeastern region

The renewable energy sector in the Northeastern region recorded a strong growth in formal jobs between 2016 and 2021: in wind energy projects, the employment rate increased by 109.6% (694 job positions), with the electricity Generation activity accounting for most of the positions, although with a relatively reduced share in favor of electricity Transmission. The expansion was even more pronounced in the photovoltaic energy sector, which recorded a 368.4% increase (921 new job positions). The rise in absolute terms was primarily driven by electricity distribution activities, while energy generation, despite nearly doubling its number of jobs, saw its relative share decline from 89.2% to 40.0%.

THE DISTRIBUTION OF FORMAL EMPLOYMENT

The territorial distribution of formal employment in wind power projects in the Northeast is generally sparse, with greater dispersion in electricity generation activities than in transmission and distribution activities.

In 2016, employment in generation activities was found in coastal municipalities of the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, and in the São Francisco hinterland in the state of Bahia (Sobradinho, Juazeiro, and Sento Sé); between 2016 and 2021, the spatial distribution of this activity remained relatively stable.

Between 2016 and 2021, employment in transmission activities remained relatively stable in its geographic distribution, despite an increase in the number of available positions. Conversely, employment in distribution activities, initially dispersed in 2016, became markedly concentrated in the state of Pernambuco by 2021.

In 2016, the state of Bahia concentrated 33% of formal jobs in wind generation (142 jobs), with a strong presence in Sobradinho and Sento Sé; the state of Rio Grande do Norte accounted for 31.6% (highlighting Pedra Grande and João Câmara) and Pernambuco for 18.8% (mainly in Cabo de Santo Agostinho).

With the expansion that took place until 2021, Ceará became the state with the highest level of formal employment in wind electric power generation (40.2%), mainly concentrated in São Gonçalo do Amarante. In contrast, Bahia experienced a relative decrease in participation, but an absolute growth in number of jobs, while Rio Grande do Norte reduced its percentage share despite a mild nominal increase in municipalities such as João Câmara, São Francisco do Oeste, and Jandaíra.

In the electric energy transmission sector, the state of Bahia consolidated and expanded its employment level in 2021, with Brumado and Guanambi taking the lead and João Câmara in the state of Rio Grande do Norte displaying a relevant position. In the sector of wind electric energy distribution, as of 2021 the state of Pernambuco started to concentrate virtually all jobs, with Cabo de Santo Agostinho and Ouricuri standing out.

In 2016, formal employment in generation activities of photovoltaic plants was found in just five out of the nine states in the Northeast, with a higher concentration on the coast of Ceará and in the region of the São Francisco River in Bahia state. Juazeiro alone accounted for almost half of the jobs in the state of Bahia (49.3% in that year), and Caucaia stood out in the state of Ceará (26.9%). In 2021, the territorial configuration remained similar, however there was an increase in the total number of jobs: Ceará became the state with the highest concentration in the generation industry, especially in São Gonçalo do Amarante (with 60% of the jobs), while the state of Bahia showed a more scattered scenario. The employment level in the transmission industry kept the same spatial distribution between 2016 and 2021, and in 2021 the jobs in the distribution industry started to cluster in the state of Bahia, coinciding with municipalities that also recorded job positions in the area of photovoltaic electric power generation and transmission.

The state of Bahia expanded its participation in jobs related to transmission activities, rising from 70.4% (19 jobs) in 2016 to 95% (265 jobs) in 2021, with a strong concentration in Bom Jesus da Lapa (54.8% of the total number in the region for this activity). Similarly, 95.3% of formal employment relationships in the distribution sector were also concentrated in the state of Bahia in 2021, especially in Bom Jesus da Lapa and Juazeiro. In summary, between 2016 and 2021 growth and reorganization took place: increased concentration of generation activities in the state of Ceará and consolidation of the state of Bahia as the main hub for photovoltaic electric power transmission and distribution.

SOCIAL AND OCCUPATIONAL PROFILE OF FORMAL EMPLOYMENT IN WIND AND PHOTOVOLTAIC PROJECTS

The social profile of formal employment

in both 2016 and 2021, formal employment in wind and solar power projects in Brazil's Northeastern region was predominantly composed of brown male workers aged 30 to 39, with a completed high school education. This pattern is consistent with the findings of Rodrigues and Blanco (2009) and Montenegro et al. (2021), who reported a strong male presence in production, construction, and engineering roles.

Women's participation remains low, despite an isolated expansion in 2021 in the generation and operation coordination and control activities, with women representing less than 17.5% of formal jobs in wind energy projects in the Northeast, and less than 13.5% in photovoltaic plants, which underlines the persistent gender inequality and highlights the need to broaden the incorporation of women in the sector. The climate crisis may exacerbate these inequalities, as discussed by Oliveira et al. (2021).

As for the level of education, the jobs with a completed Higher Education degree in the wind sector became the largest share of the total number of jobs in the electric power generation sector (39% of the total or 290 jobs in 2021). Unlike the other activities, which had the highest number of formal jobs filled with workers with completed High School education in the two reference years.

The distribution by level of education in photovoltaic plants displayed a similar pattern to that of the wind plants regarding this attribute. The electric power generation sector registered a higher concentration of formal jobs in activities requiring a completed Higher Education degree in 2021 (38% of the total jobs or 178 jobs), while jobs in the electric power transmission sector (59.3% of the total jobs in 2016 and 81.7% of jobs in 2021) and in the electric power distribution sector in photovoltaic plants showed a higher concentration of completed High School education requirements (85.6% of the total jobs in 2021).

The results corroborate the findings by Montenegro et al (2021): larger companies tend to concentrate workers with higher schooling and longer tenure, while the composition by gender, race, and age in the Northeastern units reflects both regional patterns and specific dynamics of the electric power generation, transmission, and distribution sectors. In terms of professional qualification, the offer of technical and technological training increased between 2015 and 2019 and between 2010 and 2022 in Brazil, as there was an expansion of technological courses

in Renewable Energies (Higher Education Census, INEP). However, the decrease in the number of graduates since 2016 indicates the need to investigate dropout rates in these courses.

In terms of racial and age composition, most formal employment positions in these renewable energy projects are held by brown workers, reflecting the regional demographic profile, with the 30-39 age group accounting for the largest share of formal jobs in 2016 and 2021, and an increased share of the 40-49 age group measured in 2021. Studies such as the one conducted by Carballo-Cruz et al. (2022) indicate that green jobs tend to cluster male, older, and more qualified workers.

Regarding race/color, formal positions across all analyzed activities in the Northeast are predominantly held by workers who identify as brown. However, in the electric power generation sector, the number of workers identifying as white increased between 2016 and 2021, surpassing the number of brown workers in this category.

Occupation and type of employment

the operation and maintenance (O&M) team of wind farms is small and varies according to the size of the company and the contractual scope. It is usually composed of a manager, supervisor, and technical team, performing activities which range from monitoring to preventive and emergency turbine maintenance, as described by Santos (2016). For contractual reasons, manufacturers who carry out maintenance services on wind turbines limit the actions of the owner's technicians, assigning the responsibility for the electrical systems, medium-voltage grid, and substation equipment to the local team.

Technical supervisors are responsible for maintenance planning and control, report preparation, and indicator monitoring, as well as overseeing outsourced services; interviews indicated that supervisors need to be highly available and must respond to emergencies even when off duty, while Santos (2016; 2022) emphasizes that experience often takes precedence over education in critical situations.

Managers with a background in engineering are in charge of one or more farms, perform the management of contracts, technical teams, and macro indicators, and take on administrative and security functions, according to the size of the company, as described by Santos (2016).

At the top management level, financial oversight is primarily performed, without direct involvement in technical decisions, although companies with a large portfolio may have a technical board for impactful operational decisions, according to Santos (2016).

As for occupations and requirements, the Brazilian Classification of Occupations (CBO) establishes technical high school education for electrical/electrotechnical technicians, who may perform their activities after one year of experience. According to the study, electrotechnicians and electrical maintenance technicians were among the main occupations in the electric power generation sector in 2016 and 2021, with variations in job market share and in the number of formal jobs in the period.

In the electric power transmission sector, a marked occupational diversification is observed with the growth of the workforce: from only 2 occupations for 6 job positions in 2016, it increased to 29 occupations among 322 job positions in 2021. In 2021, the three main occupations – High and Low Voltage Power Line Installer (overhead and underground grid), Electrotechnician, and Electrician Technician – accounted for 69.3% of the job positions (130, 65, and 28 jobs, respectively), indicating a more specialized profile concentrated on a few key occupations.

In the electric energy distribution sector, expansion and diversification were also witnessed: in 2016, there were few predominant occupations (with Electrical Power Line Installer, Electrotechnician, and Administrator accounting for 89.8% of the job positions), while in 2021, seventeen different occupations were recorded. In 2021, Power Line Installer maintained the lead with 57.6% of the job positions (151), followed by Electrotechnician with 23.3% (61) - the latter with a reduction compared to 2016 - and the position of Office Assistant grew (8%, or 21 jobs), indicating a greater presence of administrative roles among the workforce.

The occupational distribution between 2016 and 2021 reveals a shift in the composition of roles, with a predominance of technical occupations in the photovoltaic energy sector and an increase in the absolute number of positions across various categories, indicating an expansion of the workforce and a reconfiguration of occupational demands.

In 2016, in the photovoltaic electric power generation industry, the position of Electrotechnician stood out (16.6% or 37 jobs), followed by Office Assistant and Electrical Engineer; in 2021, there was a shift to more specific maintenance roles, with Electrical Maintenance Technician (11.3% or 53 jobs), Utility Operator (6.2% or 29 jobs), and Mechanical Technician (6% or 28 jobs), showing a sharp increase in the demand for maintenance technicians over the years.

In the photovoltaic electric power transmission industry, the scenario shifted from small and scattered concentrations in 2016 (Power Line Maintenance Electrician, Maintenance Technicians, and some Engineers) to a strong concentration in 2021 for High and Low Voltage Power Line Installer (48% or 134 jobs), Electrotechnician (20.1% or 56 jobs), and Power Line Maintenance Electrician (7.9% or 22 jobs), demonstrating professionalization and emphasis on installation and maintenance activities in grids.

In photovoltaic electric power distribution, the predominance of field occupations was maintained: Power Line Installer represented the largest share (56.1% or 238 jobs), followed by Electrotechnician (22.9% or 97 jobs) and Office Assistant (4.7% or 20 jobs), confirming that the demand for labor is mainly technical and operational, with an emphasis on grid execution and technical support.

In terms of type of employment, those classified as undetermined employment term urban CLT (formal employment under the Consolidated Labor Law[2]) predominate in all activities of photovoltaic and wind projects analyzed in the Northeast in 2016 and 2021, that is, accounting for 95% of the formal jobs in these undertakings. This favors formalization. The presence of temporary work in this segment is residual.

It is also noteworthy to mention the increase in the number of formal jobs in Corporations (Publicly held or Privately held). In wind energy projects, they accounted for 70.8% (or 448) of the total number of jobs in 2016, and they subsequently accounted for 82% (or 1,088) of the total number of jobs in 2021. Whereas in photovoltaic energy projects, they jumped from 12.4% (or 31 jobs) of the total number of jobs in 2016 to 87.7% (or 1,027) of the total number of jobs in 2021.

Contractual working hours, length of employment, and compensation

Generally, the contractual working hours ranging from 31 to 40 hours per week were maintained. This hourly range accounted for 54.3% (or 344) of the total jobs in wind projects in 2016 and its share increased to 65% (or 862) of the total job positions in 2021. In photovoltaic projects, the distribution by contractual working hours bands showed concentration in the same hourly range - from 31 to 40 hours per week. Therefore, 86.8% (or 217) of the total number of jobs in 2016, and 87% (or 1,019) of the total number of jobs in 2021 were concentrated in this hourly range.

In 2016, wind projects with employment tenures of up to 5.9 months, 6-11.9 months, and 12-23.9 months recorded the highest number of jobs, accounting together for 51.4% (224 positions). In 2021, employment tenures of up to 5.9 months, from 36 to 59.9 months, and from 60.0 to 119.9 months accounted for the highest number of formal employment relationships, totaling 58.4% (or 775) of the total number of job positions.

In photovoltaic projects, a higher concentration was observed in the tenure ranges of 60.0 to 119 months and over 120.0 months, representing 61.6% (or 154) of the total number of jobs in 2016. Meanwhile, in 2021, the employment tenure bands of up to 5.9 months, from 60.0 to 119.9 months, and from 36.0 to 59.9 months amounted to 54.9% (or 643) of the total number of jobs.

However, the salary distribution in the activities under analysis is noteworthy. In 2021, power generation jobs had a compensation level above five minimum wages, both in wind and photovoltaic units of the Northeastern region. As for the jobs related to electrical power transmission and distribution, in 2021 their compensation level was between two to three minimum wages. Therefore, as energy production advanced and expanded the number of jobs in the subsystems, there was a concentration of wages in lower ranges.

Moreover, it is worth noting the increased share of enterprises in the Northeastern region with 100 to 249 employees, representing 28.1% (or 178) of the total number of formal jobs in wind enterprises in 2016, which climbed to 54% (or 716) of the total jobs in 2021. The situation is similar in the photovoltaic units in operation in the Northeast, with 44.0% (or 110) of the total number of formal jobs linked to enterprises with 100 to 249 employees in 2016. In 2021, this percentage rose to 77.1% (or 903) of the total number of jobs.

2. Formal employment pursuant to the Consolidated Labor Law (CLT) refers to the employment relationship governed by the Consolidated Labor Law (CLT), which provides for the rights and duties of workers. It is the most common formal employment relationship in the private sector and it also applies to the public sector (publicly held companies and mixed economy companies, where workers are not considered civil servants).

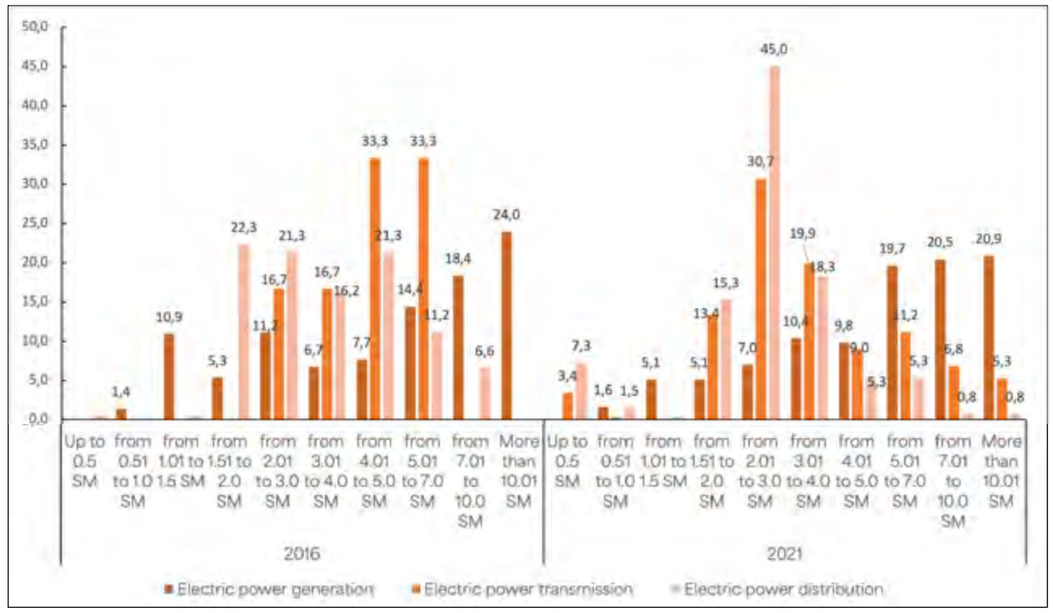
Tables, figures and charts

TABLE 1: Distribution of active formal employment in the economic activities of wind and solar enterprises, by CNAE 2.0 subclass, Northeast, 2016 and 2021

Enterprises of CNAE 2.0	Subclass	2016		2021	
		nº	%	nº	%
WIND POWER	Electric power generation	418	66,0	736	55,5
	Electric power distribution	197	31,1	262	19,7
	Coordination and control activities of the operations of electric power generation and transmission	12	1,9	7	0,5
	Transmisión de energía eléctrica	6	0,9	322	24,3
	Total	633	100,0	1.327	100,0
SOLAR PHOTO-VOLTAIC POWER		nº	%	nº	%
	Electric power transmission	223	89,2	468	40,0
	Electric power distribution	0	0,0	424	36,2
	Electric power transmission	27	10,8	279	23,8
	Total	250	100,0	1.171	100,0

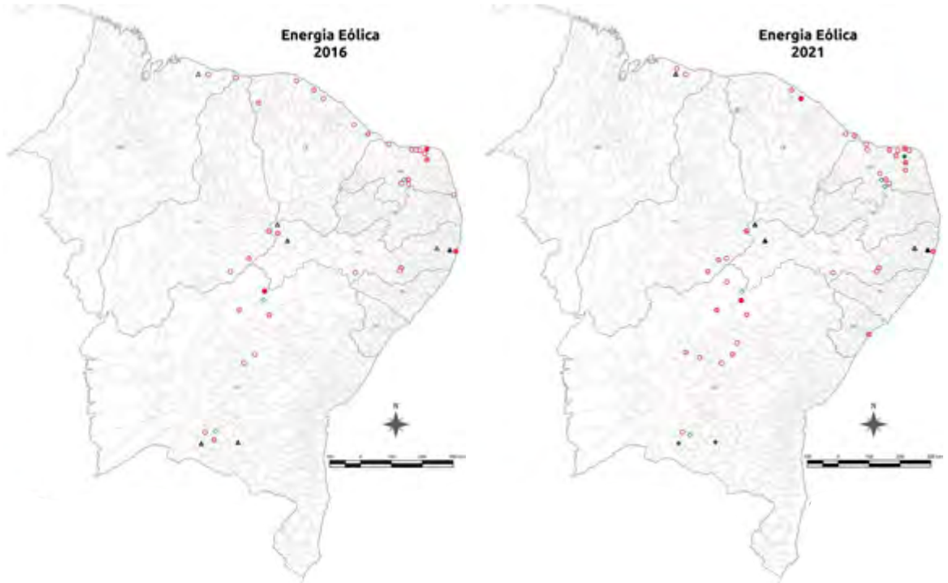
Source: RAIS (MTE). Developed by: DIEESE.

CHART 1 - Percentage distribution of active formal employment in the activities of Electric Power Generation, Transmission, and Distribution, according to the compensation range, Northeast, 2016 and 2021 (%).

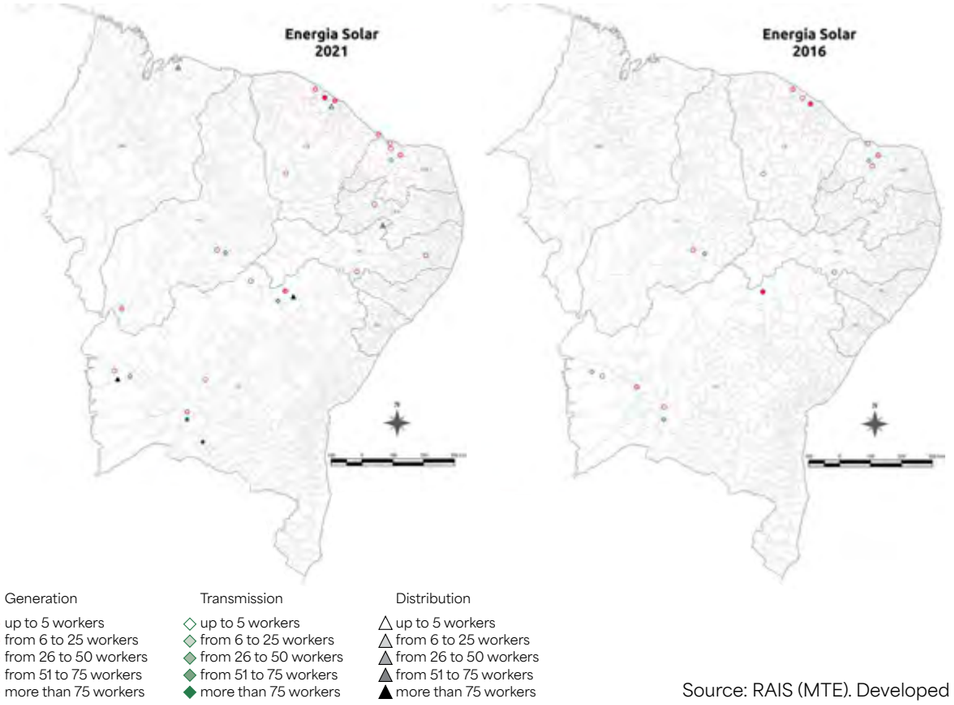


Source: RAIS (MTE). Developed by: DIEESE.

FIGURES 1 and 2: Distribution of active formal employment, by Generation, Transmission, and Distribution of electric power, Northeastern region, 2016 and 2021



FIGURES 3 and 4 - Distribution of active formal employment, according to activities of Electric Power Generation, Transmission, and Distribution, Northeast, 2016 and 2021



Source: RAIS (MTE). Developed by: DIEESE.

“Outsourcing is structural in the sector – present from installation to maintenance.”

Source: ;
Sandro Menezes

SOCIAL AND OCCUPATIONAL PROFILE OF FORMAL EMPLOYMENT OF INSTALLERS OF PHOTOVOLTAIC SYSTEMS

Regarding the profile of workers pertaining to the occupation category of Photovoltaic Module Installer (CBO 7321-40), only in the year 2021[3] the Northeastern region stood as the second region with the highest share in this occupation in the country (25.5% of the national total or 308 active formal jobs). This pattern is strongly concentrated in the states of Rio Grande do Norte (27.6% of the regional total number of jobs), followed by Pernambuco (19.8% of the regional total number of jobs) and Piauí (18.8% of the regional total number of jobs). Just like the other occupations observed in this study, there was a higher participation of brown male workers with completed high school education. However, most workers with formal jobs were concentrated in the age group of 18 to 39 years old (84.7% of the regional total number of jobs or 261 jobs).

Although 98.4% of the total jobs in the Northeast under the occupation category of Photovoltaic Module Installer (or 303 jobs) were listed as undetermined tenure formal employees, there was a higher share of job positions found in the shorter employment tenure bands. Namely, 64.3% (or 198) of the total number of photovoltaic module installers held their position for up to 11.9 months in the occupation.

It is also worth pointing out the working hours range of 41 to 44 hours per week (97.1% of the total number of jobs or 299) and the compensation from 1.01 to 1.5 minimum wages (60.7% of the total number of jobs or 187), representing most of the formal employment relationships for the occupation in 2021. In this group, 35.4% (or 109) of the jobs were related to Limited Liability Companies, with a workforce of 4 to 49 employees (49.3% of the regional total number of jobs or 152) performing roles in electrical installation and maintenance activities and engineering services (62.4% of the regional total number of jobs or 192 jobs).

3. CBO was established in 2018.

Socioeconomic profile of active employment of service providers and/or administrators in the photovoltaic wind energy industry in the Northeastern region

Workers and union leaders reported that there is often a dissociation between the CNAE of companies and the activities they actually perform, with owners, providers, and managers of wind and solar farms often classified under different codes; this hinders union representation and underestimates the number of employees, which is why, based on interviews and the nominal identification of companies, a survey was conducted to more accurately capture the quantity and profile of renewable energy employment relationships in the Northeastern region; employer, public, and community representatives confirmed that employment varies by stage of the project (installation, construction, operation) and that the hiring pattern usually involves several companies contracted by the developer, an arrangement that fails to represent much of the work volume used in generation, transmission, and distribution in the official statistical data.

Sixty (60) companies were identified in this condition. Among these, it is worth pointing out that the main activity of eleven (11) companies is listed as Holdings of non-financial institutions, which accounted for 18.3% of the sample. As the second main activity in the group, nine (9) or 15% of the total number of companies operate mainly in the electric power generation sector, followed by 13.3% (or eight [8]) of the total with their main activity in Engineering services.

The total number of formal jobs linked to service providers in wind and solar projects in Brazil was 15,326 in 2016, distributed across 36 economic activities; the Northeast accounted for 33.4% of this total number of jobs (5,128 jobs) in 2016, increasing to 20,100 jobs in 2021 in Brazil (a 31.1% increase) and to 7,648 jobs in the Northeast, which accounted for 38.1% of the regional total number of jobs.

In 2016, 71.1% of formal employment relationships in the Northeast (3,644 jobs) were linked to the Construction of buildings, followed by Engineering services (10.3% or 530 jobs) and Assembly and installation of lighting and signaling systems and equipment (4% or 203 jobs); between 2016 and 2021, there was an increase in job positions in Construction of buildings (15.8% or 577 jobs) as well as in Engineering services (3.4% or 18 jobs) and in Assembly and installation (27.6% or 56 jobs).

The companies declaring Engineering services and Construction of buildings as their main activity accounted for 20% (12) of the sample total amount and concentrated over half of the formal employment relationships in the years analyzed, a piece of evidence that aligns with reports

from a union leader who was interviewed and who has been monitoring the installation of wind and solar farms in Bahia for over 10 years.

The social profile of formal employment

In both years that were analyzed, the job positions remained mostly held by men, with male participation slightly increasing from 90.8% in 2016 to 91.1% in 2021, while the female presence grew in absolute terms but decreased in relative participation. The union reports confirm the limited integration of women in farm operations, with isolated cases of initiatives for the hiring of women.

Regarding race/color, the predominance of workers who identified as brown became more pronounced, increasing from 73.4% (3,766) in 2016 to 85.8% (6,559) in 2021. Over the same period, the number of white workers declined in absolute terms, while the number of black workers showed a slight increase, indicating a shift in the racial composition of employment in the sample.

Regarding age and education, the 30-39 age group remained the most representative (39.9% in 2016 to 40.2% in 2021), with an increase in the 40-49 age group as well; in terms of education, completion of high school prevailed, rising from 40.5% (2,077) in 2016 to 50.8% (3,886) in 2021, while the other levels (except for illiterates) grew in absolute terms, suggesting a higher supply of qualified labor with secondary-level education associated with the weight of experience upon hiring.

The occupational profile of formal employment

Table 2 shows that the occupations with the highest numbers were Construction Laborer (rising from 17.7%, or 907 positions, in 2016, to 19.5%, or 1,493 positions, in 2021), Truck Driver (from 5.4%, or 277, to 8.8%, or 675), and Mason (from 3.0%, or 154, to 3.2%, or 245). Interviews confirmed that the construction phase generates substantial employment - reaching up to 3,500 workers per farm - with specific occupational demands at each stage, from earthworks to the assembly of internal and transmission networks.

The majority of formal jobs are clustered in the working hour range of 41-44 hours, with a high share both in 2016 and 2021, and the absolute increase in formal employment in 2021 reinforces the prevalence of this contractual regime in activities related to renewable energy hubs; interviews with workers and union leaders support the idea that the demand for intensive labor occurs especially during the installation and operation phases of projects.

Regarding employment tenure, the pattern reveals a strongly temporary character: in 2016, tenures of up to 23.9 months accounted for

77.5% of jobs, rising to 80.1% in 2021. The employment relationships whose tenure was up to 5.9 months increased from 47.3% to 50.0%, showing a significant absolute increase, thereby confirming, according to the statements, that a large part of the positions created are short-term, especially in the construction sector, as noted by Traldi (2017).

In terms of compensation, the concentration prevails in low and medium ranges: the range of 2.01-3.0 minimum wages had the highest share in both years, and the three ranges up to 3.0 minimum wages accounted for about 60% of the jobs both in 2016 and 2021, reinforcing the perception gained from interviews and literature (Zanferdini, 2016) that the energy projects generate many temporary jobs with limited compensation and low qualification requirements, without promoting sustained local economic diversification.

Type of employment and enterprise

regarding the type of employment contract, it has been observed that in 2016 almost all formal employment contracts (97.4%, or 4,993 jobs) were concentrated in the urban undetermined-tenure CLT (formal employment) system. In 2021, although this regime was still hegemonic, its share dropped to 86.8% of the total number of positions, even after an absolute increase of 1,647 jobs (33%). At the same time, contractual diversification was broadened: formal employment contracts under the Consolidated Labor Law (CLT) for a pre-determined tenure came to represent 11.1% (845 job positions) and apprentice contracts 1.2% (89 job positions), modalities that were practically residual in 2016.

Regarding the type of enterprise, the data reveals that the legal category of Limited Liability Company (LLC) maintained its leadership, decreasing from 81.1% (4,157 jobs) in 2016 to 78.6% (6,012 jobs) in 2021. However, this slight proportional decrease happened in parallel with a solid absolute increase in formal employment in this type of enterprise. At the same time, the category of Individual Entrepreneur jumped from only 4 job positions in 2016 to 608 in 2021, reflecting greater adoption of simplified legal structures and individual entrepreneurship.

Regarding the size of the enterprises, companies with 100 to 249 employees accounted for the largest share of employment relationships in 2016 (44.2% or 2,267 jobs), followed by those with 50 to 99 employees (15.5% or 795 jobs) and by those with 20 to 49 employees (14.8% or 758 jobs). In 2021, the scenario changed: enterprises with 500 to 999 employees took the lead, with 31.8% of the job positions (2,429), followed by those with 250 to 499 employees (28.6% or 2,187 jobs). The segment of 100 to 249 employees experienced the largest proportional decrease, with a 60.8% drop (1,378 job positions) compared to 2016.

Some final considerations

based on the analysis of formal employment in the identified enterprises, the level of employment was found to be higher than in wind and solar energy generation, transmission, and distribution activities. This industry registered 5,128 active formal employment relationships in the Northeast in 2016, and 7,648 active formal employment relationships in the region in 2021. They were widely concentrated in states such as Ceará, Rio Grande do Norte, and Bahia.

However, in the sample for the Northeastern region, the reports from the interviews conducted were substantiated. According to the interviews, the largest number of jobs is found in the early stages of a renewable energy hub - construction and installation stages - mainly for the occupations of Construction Laborer (19.5% of the total or 1,493 jobs in 2021) and Mason (3.2% of the total or 325 jobs in 2021). As such, these are activities with a higher participation of male workers in the respective occupations, aged 30 to 39, with completed high school.

Consequently, the length of employment was shorter (up to 5.9 months) for most positions, with longer working hours (from 41 to 44 hours per week) and compensation ranging from 1.01 to 3.0 minimum wages. This happened even with a significant number of indefinite-term employment contracts governed by the Consolidated Labor Law (CLT) (97.4% of the total in 2016 and 86.8% of the total in 2021).

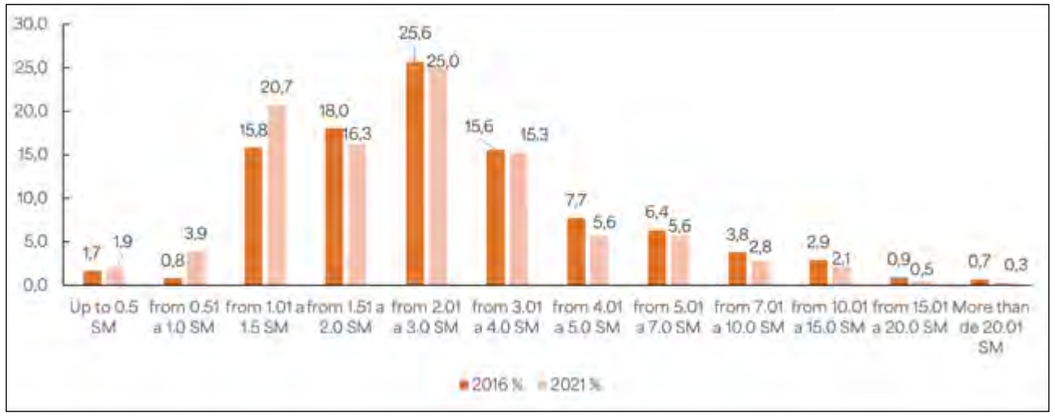
Just as surveyed in the activities of Generation, Transmission, and Distribution of electric power, the employment relationships of the companies were linked to enterprises under the Publicly Held Corporation category - 81.1% of the total number of jobs in 2016 and 78.6% of the total number of jobs in 2021 - and the greater number of job positions was concentrated in large-scale enterprises. In 2021, 60.4% (or 4,616) of the total formal employment relationships were related to enterprises with more than 250 employees.

TABLE 2: distribution of active formal employment in the 20 main occupations of identified enterprises, Northeast, 2016 and 2021

Soil Compactor Operator	2016		CBO Occupational Classification 2002	2021	
	nº	%		nº	%
Construction Laborer	907	17,7	Construction Laborer	1.493	19,5
Truck Driver (Regional and International Routes)	277	5,4	Truck Driver (Regional and International Routes)	675	8,8
Mason	154	3,0	Mason	245	3,2
Reinforced Concrete Reinforcement Installer	154	3,0	Installation Electrician	238	3,1
Administrative Assistant	143	2,8	Reinforced Concrete Reinforcement Installer	210	2,7
Security Guard	133	2,6	Office Assistant, General	195	2,5
General Assistant for Permanent Roadway Preservation (Except Railways)	126	2,5	Administrative Assistant	183	2,4
Installation Electrician	122	2,4	Security Guard	169	2,2
Truck Operator	110	2,1	Construction and Mining Machinery Operator	151	2,0
Office Assistant, General	103	2,0	Boilermaker (Iron and Steel Plates)	139	1,8
Construction Carpenter	100	2,0	Occupational Safety Technician	138	1,8
Electro-Electronic Maintenance Electrician	86	1,7	Civil Works Technician	138	1,8
Excavator Operator	81	1,6	Janitor	135	1,8
Occupational Safety Technician	80	1,6	Electrotechnician for Manufacturing, Assembly, and Installation of Machinery and Equipment	134	1,8
Quality Inspector	80	1,6	General Assistant for Permanent Roadway Preservation (Except Railways)	131	1,7
Storekeeper	75	1,5	Quality Inspector	122	1,6
Labor Timekeeper	74	1,4	Construction Carpenter	117	1,5
General Machine Maintenance Mechanic	73	1,4	Urban Bus Driver	109	1,4
Soil Compactor Operator	67	1,3	Electrotechnician	107	1,4
Operational Tow Truck Driver	65	1,3	Excavator Operator	94	1,2
Other	2.118	41,3	Other	2.725	35,6
Total	5.128	100,0	Total	7.648	100,0

Source: RAIS (MTE). Developed by: DIEESE.

CHART 2: Percentage distribution of active formal employment in identified enterprises, by compensation range in minimum wages (SM), Northeast, 2016 and 2021 (%)



Source: RAIS (MTE). Developed by: DIEESE.

TABLE 3 - Distribution of active formal employment for the occupation of photovoltaic system installer (CBO 7321-40), according to the contractual working hours range, employment tenure, and compensation range in minimum wages (SM), Brazil and Northeast, 2021

ATTRIBUTES	Northeast		Brazil	
	nº	%	nº	%
Contractual working hours				
Up to 30 hours	2	0,6	30	2,5
from 31 to 40 hours	7	2,3	53	4,4
From 41 to 44 hours	299	97,1	1.123	93,1
Employment tenure				
Up to 5.9 months	105	34,1	521	43,2
From 6 to 11.9 months	93	30,2	283	23,5
From 12 to 23.9 months	79	25,6	252	20,9
From 24 to 35.9 months	23	7,5	120	10,0
More than 36 months	8	2,6	30	2,5
Compensation Range Period (SM)				
Up to 1.0 SM (Minimum Wages)	28	9,1	129	10,7
from 1.01 to 1.5 SM (Minimum Wages)	187	60,7	511	42,4
from 1.51 to 2.0 SM (Minimum Wages)	67	21,8	356	29,5
from 2.01 to 3.0 SM (Minimum Wages)	25	8,1	182	29,5
more than 3,01 SM	1	0,3	28	2,3
TOTAL	308	100,0	1.206	100,0

Source: RAIS (MTE). Developed by: DIEESE.

Collective bargaining

The research also aimed to map the trade unions representing workers in the renewable energy sector in Brazil's Northeast region, as well as the collective bargaining agreements negotiated by these unions in 2022. The study identified 13 union entities in the region – 10 unions and 3 federations. Among the unions, 5 specifically represent workers in the electricity sector (SINDELETRIC-PB, SINDELETRO-CE, SINERGIA-SE, SINERGIA-BA, and SINTERN), while the other 5 represent workers in the broader urban industry sector, which includes not only electricity workers but also those in water and sanitation services and gas production (SINDURB-PE, SINTEPI, STIU-MA, STIUEA-AL, and STIUPB).

SINDELETRIC	Union of Workers in Electric Power Distribution Companies in the State of Paraíba
SINDELETRO	Union of Electricity Workers of Ceará
SINDURB-PE	Union of Workers in Urban Industries in the State of Pernambuco
SINERGIA	Union of Electricity Workers of Sergipe
SINERGIA	Union of Workers in Hydro and Thermal Energy Industries in the State of Bahia
SINTEPI	Union of Workers in Urban Industries of the State of Piauí
SINTERN	Union of Workers in the Energy Industry and Electric Sector Service Companies of the State of Rio Grande do Norte
STIU/MA	Union of Urban Industry Workers of Maranhão
STIUEA	Union of Workers in Urban Industries of the State of Alagoas
STIUPB	Union of Workers in Urban Industries of the State of Paraíba

Two of the federations operate nationwide (FNTIU and FENATEMA), while one operates only in the Northeast region (FRUNE). All three represent workers across the urban industry sectors.

FENATEMA	National Federation of Workers in Companies for Energy Generation, Transmission and Distribution, Power Line Data Transmission, Electric Vehicle Supply, Water Treatment, and Environmental Services
FNTIU	National Federation of Workers in Urban Industries
FRUNE	Regional Federation of Urban Industry Workers of the Northeast

The trade unions representing workers in the electrical industry signed 29 collective agreements in 2022. All of them were collective bargaining agreements, meaning documents signed between a workers' union and a specific company. Of the 29 agreements, 11 involved companies in the renewable energy sector. Five unions participated in these agreements. SINTERN, representing electricity workers in Rio Grande do Norte, signed five agreements - the highest number among unions in the Northeast. SINDELETRO of Rio Grande do Norte and STIU of Maranhão, representing urban industry workers in that state, each negotiated two agreements. STIU of Paraíba and SINERGIA of Bahia each signed one agreement.

The data show a clear disparity between the number of active enterprises and the small number of agreements registered in the Mediator system. It is important to investigate the reasons behind this low number of registered agreements; however, based on the experience of other sectors, some hypotheses can be suggested:

- Worker unions from other sectors may be negotiating on behalf of electricity workers.

- Agreements may be negotiated but not registered in the Mediator system.

- Some unions may lack the organizational structure to effectively represent workers.

- The end of the mandatory union tax has led to a reduction in financial resources for union entities.

"The sector's expansion must be accompanied by guarantees of stability and professional advancement."

The complex reality and proposals for debate

This section is intended to present the results of the qualitative research conducted alongside the collection of secondary data. The study involved trade union leaders, business associations, social movements, and renewable energy sector workers, as well as public officials. Through interviews, relevant information was gathered on workers' profiles, working conditions, job quality, required qualifications, and their relationship with trade unions.

Beyond these aspects, the research sought to examine the living conditions and socio-environmental impacts that the establishment and/or expansion of renewable energy projects (wind and solar) have brought to local communities. It also aimed to identify the main issues raised by the different actors based on their specific roles, along with their suggestions and recommendations for improvement.

In this regard, in addition to presenting a systematization of the findings, this section outlines syntheses and recommendations informed by the literature and by DIEESE's prior expertise on the subject, derived from its participation in earlier processes and published works

Decarbonization as an imposed consensus

the need for decarbonization to confront the climate emergency is a global consensus. It is widely accepted that CO_2 emissions—one of the main greenhouse gases—must be reduced, and to achieve this, the world's energy matrix must be *defossilized* through the replacement of non-renewable sources with renewable ones. Among the various pathways toward decarbonization, electrification has prevailed—in other words, the substitution of coal and oil with electricity generated from renewable sources.

Between 2010 and 2022, Brazil's installed electric power generation capacity grew by an average of 5.18% per year, with particular emphasis on wind and solar sources, which recorded growth rates of 31.04% and 136.43%, respectively, thereby significantly expanding their share in the national energy matrix (Ministry of Mines and Energy, 2023). However, this expansion of renewables does not necessarily represent an *energy transition*, since fossil fuel sources also increased in absolute terms[4]. For a genuine transition to take place, measures such as halting coal imports, closing mines, and suspending new fossil fuel projects would be required

4. The installed capacity of thermoelectric power plants increased by an average of 4.08 MW (Ministry of Mines and Energy, 2023).

- accompanied by policies to ensure social protection, job creation, and the retraining of workers affected by the decarbonization process.

The decarbonization consensus[5] reached Brazilian territories marked by the installation of wind turbines and solar panels, bringing significant transformations to traditional communities - creating jobs, generating income, and driving infrastructure development. Yet it has also caused environmental and social impacts, such as the displacement of wildlife and constant noise pollution.

Although all interviewees expressed support for renewable energy, even the more critical voices did so cautiously, careful not to be perceived as opposing environmental protection. Nevertheless, contradictions and differing interpretations have emerged regarding how these projects are implemented, revealing a legitimate desire to question this *imposed consensus*.

5. The term *decarbonization consensus* is drawn from the work of Breno Bringel and Maristella Svampa, who develop it as a successor to the *Washington Consensus* and the *Commodities Consensus*. They offer a critical perspective on the participation (or capture) of Latin American countries in these processes, which are largely driven by foreign interests and entail significant social, environmental, cultural, and economic costs for the region (Bringel & Svampa, 2023).

.

Generation of temporary and permanent jobs

Based on secondary data, this study helped estimate employment in the renewable energy sector in Brazil's Northeast, revealing methodological limitations and differing interpretations emerging from both the data and interviews.

The project implementation phase is characterized by a surge in hiring - between 2,000 and 3,000 workers - followed by a drastic reduction during the operation and maintenance phase, when enterprises employ only a few dozen workers. This occurs because the two stages demand distinct professional profiles: construction relies primarily on civil construction labor, while operation and maintenance require technicians and engineers specialized in electrical systems and electrotechnics.

Although there is broad consensus among stakeholders about the importance of hiring local workers throughout all project phases, this promise is rarely fulfilled. Companies claim that there is a lack of local qualification, particularly for operational and maintenance positions, whereas local communities argue that the more stable and better-paid jobs do not go to regional residents. Despite discrepancies between data and perceptions, there is a shared acknowledgment of this structural imbalance.

For the implementation phase, local employment registries - especially in areas where the National Labor Intermediation System (SINE) remains active - could and should be strengthened. For the operation and maintenance phase, there is a clear need to expand technical training programs at the local level, particularly for mid-level technicians, who constitute the majority of the workforce in this stage.

That said, it is worth emphasizing that permanent jobs in the renewable energy sector remain scarce and tend to decline with technological advancement - especially in newer projects that use remote monitoring systems. While there is consensus that these positions offer wages

above local averages, compensation remains significantly lower than in traditional energy sectors, including other renewable sources such as hydropower, with reports indicating that some workers earn up to 40% less than others in the broader electric power industry.

.

Renewable energy under corporate control

The expansion of renewable energy in Brazil's Northeast has taken place under strong corporate control, exposing inequalities among the actors involved and a notable absence of the State at all stages of the process. Companies have assumed the leading role in driving local transformations and are perceived by communities as the main agents behind changes in both landscape and daily life, while the State is remembered as distant and largely ineffective in addressing social and environmental injustices.

Essential public policies - such as professional training, healthcare, food security, and social protection - are not properly addressed by project operators, who have no legal obligations in these areas. The State, in turn, tends to act only when pressured by communities and institutions, revealing a lack of both effective instruments and political will.

Given this scenario, it is recommended that the remaining state-owned enterprises take on a leadership role, setting market standards through transparency and social responsibility, and ensuring that compensation measures respect and preserve local ways of life.

.

Working conditions

The assessment of working conditions for renewable energy workers is strongly influenced by the geographical location of the projects, which often entails long commuting times. The issue of commuting time - known in Brazil as *horas in itinere* - was affected by the 2017 labor reform, which removed the employer's obligation to count travel time to and from remote worksites as part of the paid working hours.

In the renewable energy sector, many projects are located far from urban centers, requiring workers to travel long distances on unpaved roads. This commute can consume up to half of their weekly working hours - without any form of compensation. Transportation is typically provided either by the workers themselves or by the company, often without financial support or reimbursement, a situation that could lead to future labor disputes and legal challenges.

Flexibilization, outsourcing and union representation

Union representation among wind and solar energy workers in Brazil's Northeast shows significant weaknesses, including the unions' limited access to workers, lack of information regarding representation, and the improper classification of companies within the electrical sector. Research conducted in the Mediator system identified only 11 collective bargaining instruments in 2022, with no record of collective conventions–indicating that the existing agreements do not ensure effective union representation, nor do they reflect the technical knowledge or bargaining capacity required to address the specific characteristics of the sector.

These weaknesses are further aggravated by practices such as outsourcing, the use of inappropriate corporate classifications (CNAEs), and the lack of transparency regarding corporate structures, including the identity of owners. As a result, there is a marked disparity in working conditions and wages between renewable energy workers and those employed in traditional energy sources such as hydropower, thermal, and nuclear - an issue that demands careful monitoring and deeper investigation.

Gender equality

The issue of gender equality is reflected in Sustainable Development Goal 5 - Gender Equality and in the concept of decent work, which calls for fair and non-discriminatory employment. It is important to note that, for the purposes of this report, the criterion of biological sex was used as a proxy for gender in order to achieve the most accurate approximation possible, given the available database (RAIS).

Despite the steady expansion of renewable energy projects in Brazil's Northeast, there has been a decline in women's participation: in solar energy, from 15.6% in 2016 to 10.5% in 2021; and in wind energy, from 9.2% to 8.9% over the same period - even as the total number of jobs increased.

Although there are a few successful initiatives, such as a wind energy project in Bahia that hired qualified women through a partnership with SENAI, overall data do not show significant progress in women's inclusion in the sector. This underscores the need for more effective public policies and targeted incentives to promote gender equity in the operation and maintenance of renewable energy projects, ensuring that the sector's inclusive potential translates into tangible results.

Rural retirement

The issue of rural retirement emerged in interviews with trade unions, researchers, and community organizers as an urgent concern - described as a “ticking time bomb” that could soon undermine one of Brazil’s main public policies for income distribution and poverty reduction among rural workers. The growing practice of leasing land for renewable energy projects - through long-term contracts, often containing automatic renewal clauses - risks disqualifying small farmers from their status as *special insured workers*, thereby jeopardizing their right to rural retirement benefits.

Although current legislation allows for the leasing of up to 50% of one’s land without losing eligibility for this status, contracts frequently cover 100% of the area, particularly during the wind measurement phase. This shift in land use also affects access to agricultural credit under the National Program for Family Agriculture (Pronaf), which is essential for the survival of small producers. Since most of these contracts began to be signed about a decade ago, the most serious consequences have not yet fully materialized - but there is still time to act to prevent the loss of this crucial social protection.

Given this scenario, it is recommended that the legislation governing rural retirement be reviewed to ensure that farmers who continue to produce and use land lease income as a complementary source of revenue are not penalized. It is also necessary to revise the criteria that define rural producer status, safeguarding access to agricultural credit and social security coverage, even in the face of the transformations brought about by renewable energy projects

Statistical classification

Changes in the productive structure and in occupational profiles challenge the current national statistical classifications, which require constant updating. The study identified a lack of appropriate categories for both economic activities and occupations.

It is therefore recommended that the National Classification Commission (CONCLA) of the Brazilian Institute of Geography and Statistics (IBGE) revise and update its frameworks to better capture the growing new modalities of electric power generation and the emerging occupations they entail.

.

Development model and inequality

corporate leadership in the implementation of renewable energy in Brazil’s Northeast has relied on confidential contracts, a lack of public regulation, and unequal negotiations - resulting in practices that compromise land use, promote a so-called *messianism of progress*, and reproduce *environmental racism*. Far from providing a solution to the region’s socioeconomic challenges, this model has generated few jobs, limited local tax revenue and benefits, and neglected social and environmental compensation measures.

As a hypothesis for future research, it is suggested that the competitive prices of renewable energy may stem from the improper use of land, the low remuneration of workers, and the concentration of income within opaque corporate structures linked to international investment funds. Given this context, there is an urgent need to analyze the functional distribution of income within the sector, with the aim of demystifying market promises and proposing mechanisms to prevent the deepening of regional inequalities

.

Environment and development

the relationship between society and nature must be the central axis of the energy transition. However, in Brazil’s Northeast, it has unfolded under a logic of *environmental blackmail*, in which the promise of climate salvation through renewable energy conceals deep social and territorial impacts. Although local actors do not deny the climate emergency, they question the real benefits that wind turbines and solar panels bring to their communities, warning of the risk that the Northeast may become a zone of environmental and social sacrifice in the name of clean energy.

Without changes in current practices - such as stronger control over land use, guarantees of food security, the creation of decent jobs, environmental compensation, and fair income distribution - this model tends to deepen inequalities while remaining market-driven. Therefore, it is essential that the State take a leading role in implementing renewable energy, through direct action, incentives, and effective tax and environmental regulation.

Internalization of production chains

This study defined job creation as the positions generated within the territories hosting renewable energy projects, highlighting the consensus among stakeholders on the importance of internalizing value chains to expand employment opportunities. Social movements and trade unions emphasize the need to decentralize industrial production from the Southeast and increase the participation of the Northeast, especially given the differences between the wind and solar energy production chains, which display varying levels of internalization depending on the public policies adopted.

While the wind energy chain has advanced through incentives that stimulated employment in sectors such as cement and metallurgy, the solar energy chain has remained dependent on the import of essential components, such as photovoltaic panels and inverters, which account for up to 80% of project costs. As a result, most of the jobs generated by this technology benefit exporting countries, underscoring the urgency of creating mechanisms to promote the internalization of the solar value chain in Brazil.

“The energy transition must also be a social transition.”

Source: :
Sandro Menezes

BIBLIOGRAPHICAL REFERENCES

ACTIONAID; AS-PTA Agricultura Familiar e Agroeco- logia; Comissão Pastoral da Terra (CPT); Grupo de Pesquisa e Estudos em Sistemas de Indicadores de Sustentabilidade Urbana, Rural e Ambiental (SURA) da Universidade Federal de Campina Grande (UFCG).

Indicadores de pressão, estado, impactos e resposta (PEIR) nos Assentamentos dos Brandões: uma abordagem integradora, participativa e sustentável para análise e conhecimento da realidade local. [S.l.: S.n.], 2021.

AGÊNCIA BRASILEIRA DE DESENVOLVIMENTO INDUSTRIAL; FUNDAÇÃO GETULIO VARGAS. Atualização do mapeamento da cadeia produtiva da indústria eólica no Brasil, Brasília, DF, 2017. Produto 6.1 - Análise do Potencial brasileiro no mercado de energias renováveis.

ANEEL [Agência Nacional de Energia Elétrica]. Sistema de Geração da Aneel (SIGA), 2023. Available at: < https://app.powerbi.com/view?r=eyJrIjoiNjc4OGYyYjQtYWM2ZC00YjllLW- JlYmEtYzdkNTQ1MTc1NjM2IiwidCI6IjQwZDZ-OWI4LWVjYTctNDZhMi05MmQ0LWVhNGU5Y-zAxNzBlMSIsImMiOjR9> Access on Jun 03 2023.

ARAÚJO, Bruno Plattek de; WILLCOX, Luiz Daniel - Eólica. Reflexões críticas sobrea experiência brasileira de política industrial no setor eólico. BNDES Setorial 47, p. 163-220, Mar, 2018.

BORGES, Bráulio. Estimativas dos impactos dinâ- micos do setor eólico sobre a economia brasileira Rio de Janeiro: - FGV-IBRE / LCA Consultores, fev. 2022.

BRASIL. Ministério do Meio Ambiente. - Resolução do Conselho Nacional do Meio Ambiente- CONAMA 465, Dec 05 2014.

BRINGEL, Breno; SVAMPA, Maristela. Do “consenso das comodities” ao “consenso da descarbonização”. [S.l.], 2023. Available at: https://editoraelefante.com.br/do-consenso-das-commodities-ao-consenso-da-descarbonizacao/. Access on Dec 24 2023.

CARBALLO-CRUZ, F.; CEREJEIRA, J.; SOUSA, R.; VOLOZHENIN, S. Economia verde e a evolução do mercado de trabalho em Portugal. Lisboa (Portugal): Escola de Economia e Gestão - Centro de Relações Laborais (Universidade do Minho), 176 p., nov. 2022. Available at: https:// www.ugt.pt/publicfiles/ruudjs1wlrb0adwptppvz9nuj- q7x41sek0ud5zn9.pdf. Access on Jan 02 2024.

CENTRAC. Resistência às indústrias de energia eólica e solar se expande para todos os territórios do semiárido paraibano. [S.l.], 2023. Available at: https://centrac.org.br/2023/04/04/ resistencia-as-industrias-de-energia-eolica-e-solar-se-expande-para-todos-os-territorios-do-semiarido-pa- raibano/. Access on Dec 23 2023.

DIEESE; WWF. Carvão mineral: experiências internacionais na busca por uma transição energética justa para o setor carbonífero no Sul do Brasil. São Paulo, 2021. Available at: https://www.dieese.org.br/outraspublicacoes/2021/carvaoMineral/index. html?page=1. Access on Dec 21 2023.

DIEESE. Empregos verdes e sustentáveis no Brasil. São Paulo: DIEESE, 2022. Available at: https://www.dieese.org.br/outraspublica-coes/2022/empregosVerdesSustentaveisBrasil092022.html. Access on Dec 21 2023.

FONSECA, E. S. Financeirização e mercado de trabalho: uma discussão teórica. Porto Alegre (RS). Perspectiva Econômica, v. 18, n. 1-9, jan./ jun. 2022. Available at: https://revistas.unisinos.br/index.php/perspectiva_economica/article/ view/24562/60749493 Access on Jan 11 2024.

HOFSTAETTER, Moema; AMARO, Venerando Eustá- quio; BENTES, Dulce. 1º Boletim Informativo do Fórum de Mudanças Climáticas e Justiça Socioambien- tal/RN. In: FÓRUM DE MUDANÇAS CLIMÁTICAS E JUSTIÇA SOCIOAMBIENTAL Natal, RN, 2020.

INEP [Instituto Nacional de Estudos e Pesquisas Educacionais]. Censo da Educação Superior, Brasília, DF, 2024. Available at: https://app.powerbi.com/view?r=eyJrIjoiMGJiMmNiNTAtO-Y1OC00ZjUzLTg2O-GUtMjAzYzNiYTA5YjliIiwidCI6IjI2ZjczODk3LWM4YWMtNGIxZS05N-zhmLW-VhNGMwNzc0MzRiZiJ9&pageName=ReportSectio- n4036c-90b8a27b5f58f54. Access on Jan 07 jan. 2024.

MACERON FILHO, Oswaldo; QUINTAIROS, Paulo César Ribeiro. Fontes de recursos do BNDES: um estudo sobre energia eólica. Revista Brasileira de Gestão e Desenvolvimento Regional - G&DR, Taubaté, SP, v. 12, n. 5 (número especial), p. 123-142, dez. 2016.

MACHADO, Nayara. Complexo eólico operado só por mulheres é inaugurado na Bahia. [S. l.], 2023. Available at: https://epbr.com.br/aes-brasil-e-unipar-inauguram-complexo-eolico-operado-exclusivamente-por-mulheres-na-bahia/. Access on Dec 25 2023.

MACIEL, Nadine Gabryella Pontes. Impactos so- cioambientais e processos de vulnerabilização de parques eólicos em comunidades camponesas tradicionais no agreste meridional de Pernambuco. Garanhuns, PE, 2023. Programa de Pós-graduação em Saúde e Desenvolvimento Socioambiental da Universidade de Pernambuco.

MINISTÉRIO DE MINAS E ENERGIA. Painel interativo: capacidade instalada Brasília, DF, 2023. Available at: https://www.gov.br/mme/pt-br/assuntos/secretarias/sntep/publicacoes/resenha-energetica-brasileira/painel-interativo. Access on Dec 25 2023

MONTENEGRO, A.; PIRES, A. M.; PINTO, G. X. A.; SCHNEIDER, K.; NASCIMENTO, L. R. A mão de obra na cadeia produtiva do setor solar brasileiro. Florianópolis (SC) ; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2021, 42 p. Available at: https:// www.absolar.org.br/wp-content/uploads/2021/12/ Estudo-Cadeia-Produtiva-Solar.pdf. Access on Aug 25 2023.

NASCIMENTO, M. G.; SOUZA, B. C. B. N; MENEZES JÚNIOR, R. A.; CÂMARA, R. A.; FERNANDES, A. C. G.; MELLO, S. C. Análise de impactos socioeconômicos devido a instalação e operação de empreendimentos de energia fotovoltaica: revisão e análise de nível de interesse por meio de um algoritmo de inteligência cognitiva aplicado a TREND DATA. Research, Society and Development, v. 12, n. 2, p. 1-15, 2023. Available at: < https://rsdjournal.org/index.php/rsd/article/ view/40172/32915>. Access on Jan 15 2024. OLIVEIRA, M.; PODCAMENI, LUSTOSA, M. G.,

M. C.; GRAÇA, L. A dimensão de gênero no Big Push para a sustentabilidade no Brasil: as mulheres no contexto da transformação social e ecológica da economia brasileira. Santiago; São Paulo: Comissão Econômica para a América Latina e o Caribe ; Fundação Friedrich Ebert Stiftung, fev. 2021. (Documentos de Projetos LC/TS.2021/6; LC/BRS/ TS.2021/1). 100p. Available at: < https://reposi- torio.cepal.org/server/api/core/bitstreams/66dfce7f-5bb1-4a44-beb9-e505e077a9a7/content>. Access on Jan 07 2023.

ONS [Operador Nacional do Sistema Elétrico]. Histórico da operação. 2024. Available at: < https://www.ons.org.br/paginas/resultados-da-operacao/historico-da-operacao/dados-gerais>. Access on Jan 07 2024.

PEREIRA, Lorena Izá . A territorialização de em- presas de energia eólica no Brasil: estrangeirização e estratégias de controle do território. Presidente Prudente, SP: Rede Brasileira de Pesquisa das Lutas por Espaços e Territórios (Rede DATALUTA), Jun 2023.

PORTAL SOLAR. Usina solar: o que é, tipos, como funciona, vantagens e desvantagens. Available at: < https://www.portalsolar.com.br/ usina-solar.html>. Access on Jan 15 2024.

RAIS [Relação Anual de Informações Sociais]. Microdados RAIS. Brasília: MTE 2016 e 2021. Available at: < ftp://ftp.mtps.gov.br/pdet/micro- dados/> Access on Jul 20 2023.

SANTOS, M. A. T. dos. Sistema de medição de desempenho para operação e manutenção de parques eólicos no Brasil. Natal (RN).201 f. (Dissertação de Mestrado) - Programa de Pós-Graduação em Engenharia de Produção (UFRN). Natal, 2016. Available at: < https://repositorio.ufrn.br/jspui/handle/123456789/22402>. Access on Nov 12 2023.

, W. G. Panorama da operação e manutenção de parques eólicos no Brasil. 78f. (Monografia de Conclusão de Curso) - Graduação em Engenharia Elétrica (UFC) - Fortaleza (CE), 2022. Available at: < http://www.repositorio.ufc. br/handle/riufc/72366>. Access on Oct 24 2023.

SIMAS, Moana; PACCA, Sergio. Energia eólica, geração de empregos e desenvolvimento sustentável. Revista de Estudos Avançados da Universidade de São Paulo, São Paulo, n. 27, 2013.

SISTEC - SETEC [Secretaria de Educação Profissional e Tecnológica]. Dados gerais de educação profissional e tecnológica. Available at: < https://public.tableau.com/views/ EPT_16366800852170/Resumo?%3AshowVizHo- me=no>. Access on Jan 08 2024.

TRALDI, M. Implantação de parques eólicos no semiárido brasileiro e a promessa da geração de empregos. Bahia Análise e Dados , Salvador (BA), v. 27, n.1, p. 174-202, jan./jun. 2017. Available at: https://publicacoes.sei.ba.gov.br/index.php/ bahiaanaliseedados/article/view/75/98. Access on Jan 15 2024.

TRALDI, Mariana. Acumulação por despossessão: a privatização dos ventos para a produção de energia eólica no semiárido brasileiro Campinas, SP.: Instituto de Geociências da Universidade Estadual De Campinas, 2019.

VASCONCELOS, Filipe Matos de. Geração, transmissão e distribuição de energia elétrica. Londrina: Editora e Distribuidora Educacional S. A., 2017, 224 p.

ZANFERDINI, R. S. Impactos dos parques eó- licos no mercado de trabalho nas cidades onde foram implementadas no estado do Rio Grande do Norte. Natal - RN. 124p. (Dissertação Mestrado) - Programa de Pós-Graduação em Economia, UFRN. 2016. Available at: https://repositorio.ufrn.br/bitstream/123456789/22116/1/ImpactosParquesEólicos_Zanferdini_2016.pdf. Access on Jan 15 2024.

MINISTÉRIO DO TRABALHO E EMPREGO

GOVERNO DO BRASIL
DO LADO DO POVO BRASILEIRO

DIEESE
DEPARTAMENTO INTERSINDICAL DE ESTATÍSTICA E ESTUDOS SOCIOECONÔMICOS