

# Sun, Wind, and Sweat: Local Labor Impacts of Renewable Energy Investments

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## Expanded Abstract

### Overview

Debates surrounding the importance of renewable energy sources in the context of climate change have become increasingly prominent. The 21st United Nations Climate Change Conference (COP21) was held in 2015 with the participation of governments from around 190 countries, each presenting their respective strategies aimed at mitigating greenhouse gas emissions. These strategies emphasize the importance of investing in renewable energy, particularly solar and wind power. Moreover, in response to the COVID-19 pandemic, numerous countries have advocated for post-pandemic recovery plans centered around renewable energy investments, driven by the expectation that such initiatives would stimulate job creation.

The literature on the effects of renewable energy investments on job creation remains limited, with a predominant focus on wind energy. Furthermore, empirical studies examining the relationship between energy sources and labor market outcomes have primarily centered on developed countries. As a result, there is a significant gap in research concerning the combined effects of solar and wind energy on the job market, particularly in developing countries. Thus, further investigation is necessary to understand the potential employment impacts of these renewable energy sources in various economic contexts.

Recent empirical studies examining the relationship between energy sources and labor market outcomes have predominantly focused on developed countries. For instance, [Fabra et al. \(2023\)](#) demonstrate that solar energy investments lead to increased employment in Spain municipalities, but they do not significantly reduce unemployment, indicating that firms may hire non-resident workers. In the United States, [Curtis and Marinescu \(2022\)](#) find that jobs created in the solar sector are primarily concentrated in commercial activities, while jobs in the wind sector are concentrated in installation and maintenance activities.

### Data and methodology

The empirical exploration of the local impacts of investments in renewable plants is conducted with a municipal-level panel. This panel combines aggregated data from power plants and labor market administrative information from 2003 to 2021.

The power plant data are obtained from two administrative databases maintained by the National Agency of Electric Energy (ANEEL): the Generation Information Database and the Distributed Generation Database. These data contain information on large-scale power plants, which includes the energy source, project stage details, the operation start date, geographic coordinates, and the installed capacity. The formal labor market outcomes in this study are derived from the Annual Social Information Report (RAIS) provided by the Ministry of Labor and Employment (MLE). The RAIS serves as a data collection instrument for gathering information on employers and workers in Brazil. The collected information includes data on the number of employees, wages, occupations, and employment relationships, among other variables.

In our empirical strategy, we explore the staggered investment in renewable power plants across municipalities. This approach allows us to leverage variations in the timing of investment in wind or solar plants to estimate the causal effects on labor market outcomes. Thus, as the identification strategy, we consider the timing of renewable plant investments is not influenced by factors that are correlated with the labor market dynamics at the municipality level.

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Our objective is to estimate the average treatment effect by phase of investment. To achieve this, we employ the staggered difference-in-differences. As a reference point for defining the intervention period, we utilized the date of power generation initiation. However, existing literature suggests that the local effects of infrastructure investment projects might occur before the operation (Gonçalves et al., 2020; Fabra et al., 2023). Therefore, based on Callaway and Sant’Anna (2020), we relaxed the assumption of no anticipation to identify the local effects resulting from the investments. This method is robust in the presence of arbitrary heterogeneity of treatment effects and provides transparency in selecting a comparison group.

## Expected results

The estimations indicate that investments in solar and wind generation have a dynamic impact on local jobs. Following the intervention, we find a heterogeneous effect over time. For solar energy, the average treatment exhibits statistical significance at the 5% level and demonstrates a positive effect in the first year before operation. In the case of wind energy, although the point estimate is positive in the intervention year, the parameter achieves statistical significance at the 5% level three years before operation.

The effects of investments in solar and wind energy are distinct. For solar energy, the investment effect is statistically significant at the 1% level with a positive sign during the pre-opening period. The result indicates that during this phase, employment increases by 0.6 percentage points, corresponding to an approximately 4% increase in the proportion of the employed population. On the other hand, the effects of investments in wind farms are positive both in the pre-opening and post-opening phases. Pre-opening, employment increases by 0.5 percentage points, resulting in an approximately 5% increase in the proportion of the employed population. Post-opening, the effect becomes even more substantial, with employment increasing by 0.8 percentage points, corresponding to a 9% increase in the proportion of the employed population.

Our database allows us to explore the heterogeneities of the impact of solar and wind investment on the local labor market. Thus, we investigate the average effect by sector and education. The effects of wind investments primarily increase the supply of low-skilled labor, particularly in the construction sector, and this effect is more pronounced among men with elementary education degrees. The investments in solar power predominantly increase employment in the services sector, which requires more skilled labor compared to the construction sector. Therefore, in the case of solar investments, there is an increase in employment for workers with high school education degrees. It is important to note that we did not find evidence that investments in solar or wind energy increase the availability of highly skilled workers, i.e., those with college degrees, locally.

## Conclusion

Our study provides insights into the positive outcomes of renewable energy investments in local economies. The findings highlight the significant potential for generating employment opportunities and promoting economic growth through the expansion of solar and wind energy projects. Moreover, these results can serve as a useful resource for policymakers in developing effective strategies that support a sustainable and inclusive energy future for local communities.

## References

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