

# SOLAR PV IN BRAZIL

Utility-scale PV plants variability

A report by:



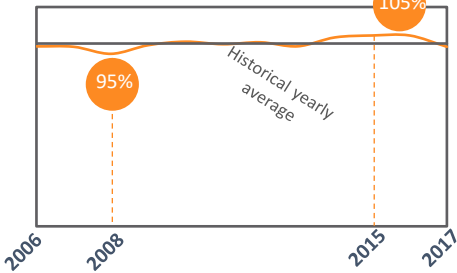
Recent projects are concentrated in the **Northeast region** and in the **North of Minas Gerais State**, which have similar irradiation characteristics.

Brazil has **2.9 GW of operational PV plants**, and **4.5 GW contracted**



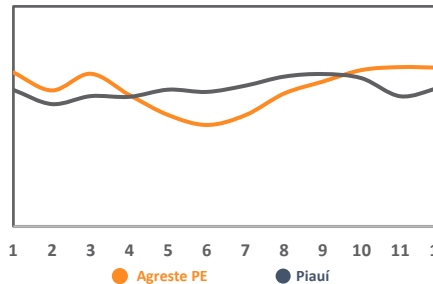
YEARLY

Solar PV energy generation has **very low** yearly variation, keeping within  $\pm 5\%$  of the long term average.



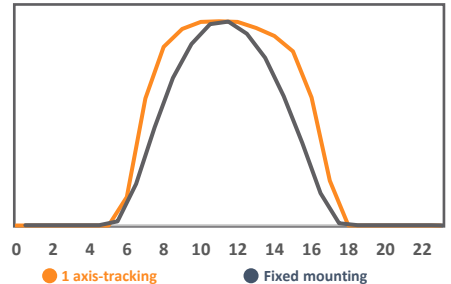
MONTHLY

Seasonality may depend on the region, but the **typical variation** is between 75% to 120% of the yearly average.



HOURLY

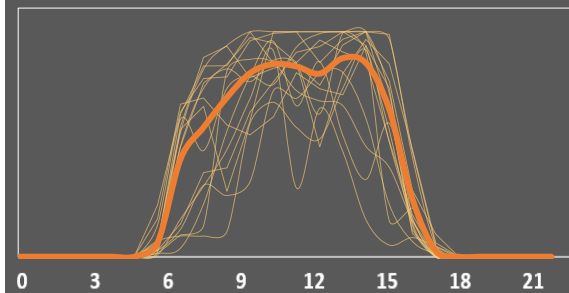
The average hourly profile is **similar** for the whole country. 1-axis tracking<sup>1</sup> plants have a **plateau** from 9AM to 3PM.



DOES IT WORK ON CLOUDY DAYS?

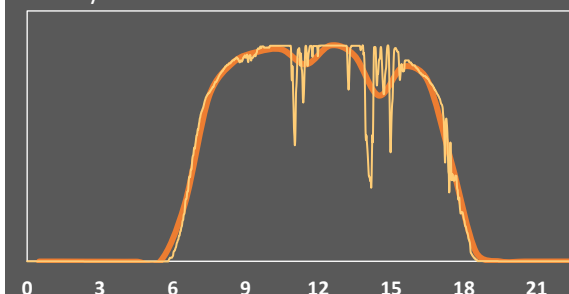


The generation of a single plant is affected, but it does not drop to zero. Even in overcast weather, **there is still generation**. As Brazil will hardly be all cloudy at once and the plants are spread, the total effect is reduced and the result is similar to an **average day**.



HOW ABOUT IN REAL TIME?

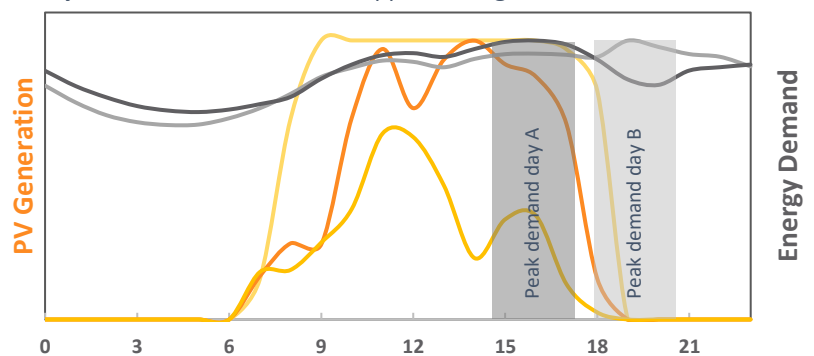
During operation, oscillation is much more **frequent** than on the figure above, drawn with hourly data. Due to peak smoothing, this difference may lead to curtailment loss **underestimation** for estimations made from hourly data<sup>2</sup>.



And on system peak demand?  
Can PV contribute?

Regarding the relation of PV generation with hourly demand, **PV can contribute** to the maximum demand for **some scenarios**, as shown in a prior study<sup>3</sup>.

However, as shown in the figure below, this contribution is highly dependent on the **demand profile**. If the maximum occurs during the **day**, PV contributes, and if it happens at **night**, this contribution is null.<sup>4</sup>



STAY TUNED!!

On the next 10-year Plan, we are studying the possibility to estimate the **joint contribution** of the variable renewable resources (PV and wind).

Learn more with other studies by EPE

Distributed Generation



Installed capacity  
over 3 GW <sup>5</sup>

Hybrid projects



Analysis and  
Simulation <sup>6</sup>

Floating PV plants



How do they  
work? <sup>7</sup>

Isolated Systems



Reduction on  
diesel use <sup>8</sup>



FURTHER STUDIES:

<sup>1</sup> PV projects on Brazilian auctions

<sup>2</sup> Effect of simulation timestep

<sup>3</sup> PV contribution for peak demand

<sup>4</sup> 10-year plan methodology

<sup>5</sup> PDE 2029 (DG projections)

<sup>6</sup> Hybrid power plants

<sup>7</sup> Floating PV systems

<sup>8</sup> PV on isolated systems

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