CLIMATE POLICY INITIATIVE
NÚCLEO DE AVALIAÇÃO
DE POLÍTICAS CLIMÁTICAS
PUC-Rio

Misreporting in wind power contracts: Evidence from a feed-in tariff in Brazil

Executive Summary

Juliano Assunção, Joana Chiavari, and Dimitri Szerman

April 2014

Many nations around the world face an energy challenge. Meeting rising demand for electricity, enabling stable and secure supplies, and avoiding or offsetting greenhouse gas emissions are all factors in this challenge. Increasingly, renewable sources like wind and solar power are seen as important ways to reach these goals. Policymakers have used a wide variety of support schemes to drive market deployment of renewable energy, with varying degrees of success in terms of effectiveness and cost-efficiency

Feed-in tariff (FiT) schemes are the most commonly used incentive policy to spur renewable energy: by early 2012, FiTs were in place in at least 65 countries. In this study, we analyze one FiT implemented in Brazil in the early 2000s to extract lessons for Brazil and other countries as they refine their renewable energy policies. We look specifically at the 20-year contracts between wind farms and a government-owned utility in Brazil as part of the Incentive Program to Alternative Sources (PROINFA).

While PROINFA was successful in deploying energy to meet its goals – it accounted for much of the growth from 29 MW to 2,010 MW in installed wind capacity in Brazil between 2004 and 2012 – our analysis suggests that issues with the design of PROINFA's contracts reduced the program's cost-effectiveness.

Our key findings are as follows:

- We find systematic differences between reported and realized capacity factors (see box), indicating misreporting by project developers. The design of PROINFA's contracts, coupled with costly monitoring of wind data, led to this widespread misreporting.
- Misreporting was detrimental in two ways: It increased the cost of the policy, and reduced the amount of energy delievered.
- We simulate the effect of simple changes to the PROINFA contracts and suggest that a small alteration in their design – specifically, a 1% interest rate penalty to overpayments – would cause misreporting to vanish altogether, making the policy more cost-effective.

More generally, our analysis underlines that the details of policy design and implementation, not just the choice of policy type, are of first-order importance to renewable energy policy and can have serious implications for planning of electricity supply and energy security.

Capacity Factors in the Wind Industry

The capacity factor (CF) of a power plant is an important measure of the plant's productivity.

A CF for a given windfarm is calculated by determining the ratio between the actual electricity generated over a period of time and the hypothetical maximum possible, based on wind availability on the windfarm site.

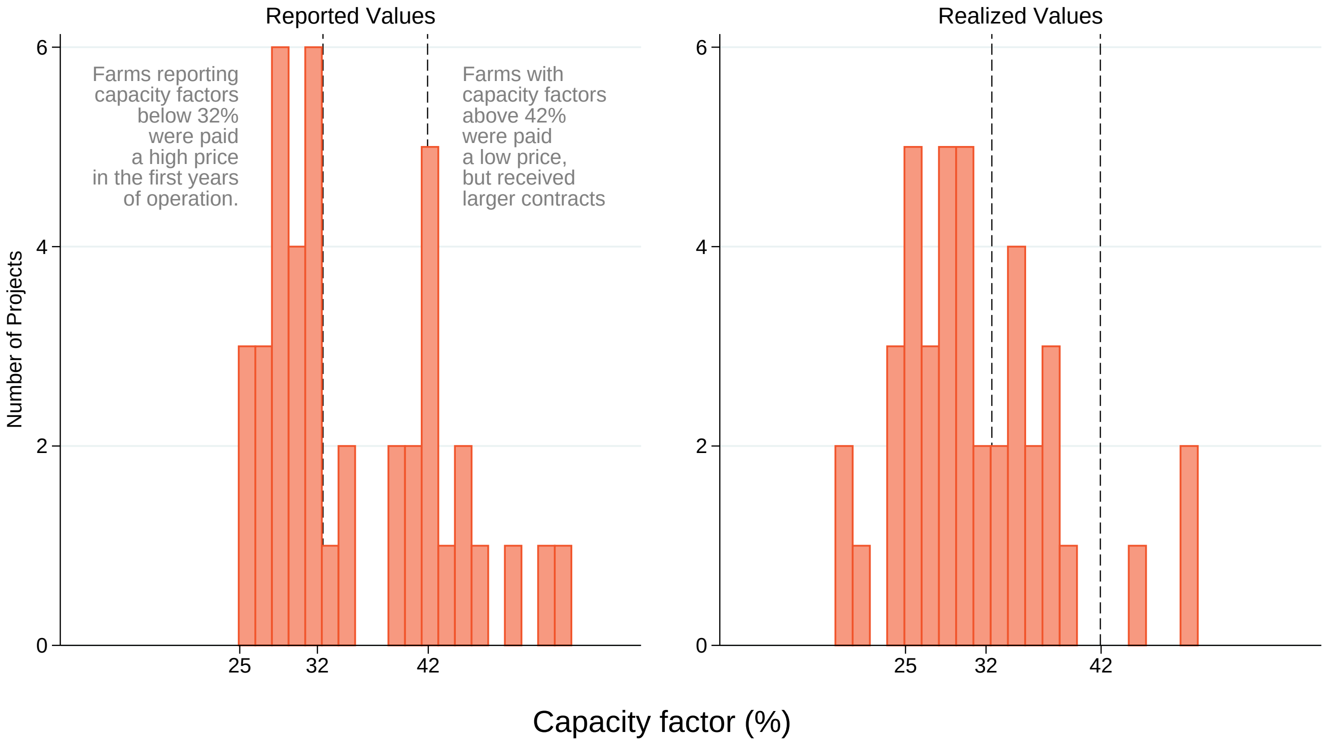
Investors and project developers use CFs to calculate the economic viability of a given site. CFs are also used by government and utility regulators to calculate feed-in tariff payments around the world, as was the case with PROINFA in Brazil.

About PROINFA

The PROINFA program was enacted in the aftermath of major power outages resulting from a combination of low rainfall and over-reliance on hydro sources. Launched in 2002, its goal was to deploy 3.3 GW of wind, small hydro and biomass, representing a 19.8% growth in installed capacity from non-large hydro sources. The program was an important step in renewable energy policy in Brazil because it signaled the Brazilian government's commitment to wind energy to private actors.

Under their PROINFA contracts, wind farms were required to report a forecast of their capacity factor (CF), a key productivity parameter and determinant of their economic viability (see box). During the first two years of operation, payments to wind farms depended on the reported forecast in two ways. First, the higher the forecast, the lower the price per MWh paid to farms. The goal of such a price scheme

Figure 1 Evidence of misreporting: Reported and Realized Capacity Factors in PROINFA wind farms



Notes: The figure shows frequencies of reported (left) and realized (right) CFs. Bins are of 1.5% width. The figure uses the 41 projects which started operating before 1st January 2013. The source of reported CFs is ANEEL's records. Realized CFs are computed using production data provided by Eletrobrás.

was to promote geographical dispersion of wind farms by effectively subsidizing low-productivity farms, or farms in non-prime locations. Second, the higher the forecast, the higher the quantity contracted (holding installed capacity fixed). After the second year of operation, realized CFs were used instead of the reported forecasts. Any discrepancies between reported and realized CFs would be adjusted for. Importantly, however, wind farms did not have to pay interest on any overpayments.

Results

We show that reported and realized CFs were systematically different, as visualized in Figure 1. The dotted lines mark important points in the price schedule: farms with CFs below 32% were paid a high price for the electricity they produced, and farms with CFs above 42% were paid a low price; in between these two points, prices decreased continuously. The data on the realized CFs (right panel) are smooth, whereas the reported CFs (left panel) are not only disproportionately concentrated around price schedule tiers but also underrepresented in the range between those tiers. Furthermore, reported CFs are consistently higher than realized CFs: the average reported CF is 35%, whereas the average realized value is 31%.

We interpret these discrepancies as systematic misreporting of CFs, and argue that PROINFA's tiered price schedule coupled with the absence of penalties on overpayments led to the observed behavior. The price scheme gave incentives to farms to underreport their CFs in order to get a better price per MWh produced. At the same time, reporting a higher CF increased the amount of energy contracted, and therefore total payments. We interpret the patterns in Figure 1 as resulting from these two incentives. It is important to note that forecasts had to be accredited by a third party, which presumably introduced costs to misreporting CFs.

The consequences of these discrepancies between reported and realized CFs in PROINFA were twofold. First, **they introduced gaps between expected and actual production**. Wind farms contracted by PROINFA were supposed to produce 14% more MWh's than they actually delivered. As a result, the amount of energy produced from renewable sources in Brazil was smaller than initially planned. Second, **they created a financial burden on PROINFA**. Of the total payments to wind farms in their first year of operation, 12% were over-payments, i.e., payments for energy that was not delivered. Although these payments were eventually returned to the government-owned utility company, no interest was paid on that amount.

Policy Implications

In 2004, a major reform in the power sector instated auctions as the contracting mechanism for electricity in Brazil. As a result, PROINFA's second phase was never implemented and today, no new PROINFA contracts are being awarded. Still, this study has implications for future feed-in-tariff schemes in Brazil and elsewhere.

Our main recommendation for policy makers is to **design mechanisms that mitigate misreporting within feed-in tariffs.** If reported CFs are a major component of determining payments, there are two potential ways to do this:

- First, the Brazil case shows that **tiered payment schemes can be useful for discouraging some misreporting if appropriately designed.** Brazil's tiered payment scheme was not designed with this purpose in mind; it was designed to encourage greater geographic distribution of windfarms, including into areas with fewer wind resources. While it was unsuccessful in reaching this original aim, our simulations suggest that had PROINFA instead operated under a constant unit price, the distribution of reported CFs becomes smooth, but **misreporting actually increases**: the gap between expected and actual energy production increases from 14% to 90%. Such unanticipated effects of the tiered payment system provide a valuable lesson for future feed-in tariffs. Tiered payments, as a mechanism, however, do have drawbacks: designing the appropriate tiers and pricing structures could prove complicated or have other unintended consequences.
- Therefore, we modeled another scenario that applies an interest rate penalty to overpayments resulting from misreporting. Our simulations show that **an interest rate penalty of 1% would cause misreporting to vanish altogether**, suggesting that this simple change would solve the problem stemming from costly monitoring of wind data gathered in prospective sites.

Finally, and overall, it is unclear what the benefits of having contracts based on reported CFs are. If project developers need some sort of insurance to smooth payments throughout the first years of operation, the government can explicitly offer such insurance, rather than devising more complicated payment schemes. This is an important take-away for other renewable incentive policies around the world. ■