AN INCONVENIENT TRUTH: HOW GREEN ELECTRICITY PRODUCTS CLAIM TO CONTRIBUTE TO THE ENERGY TRANSITION

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Overview

A successful fight of climate change will require great quantities of emission-free, green electricity (Davis et al 2018). The expansion of renewable energy generation capacity has therefore become a key challenge of human kind (REN21 2023). Only recently, the European Union agreed to strengthen its legislation for the ramp up of renewable energy (European Union 2023). As the liberalization of the European electricity market enabled consumers to freely choose their preferred electricity products and providers, the transition towards green electricity can also be fostered by industrial and private consumers (Radaal et al 2012). The demand for green electricity products and the offering of green electricity products claiming to build on a 100% of green electricity have, both, grown significantly over the past years (Mulder & Zomer 2016). Against the backdrop of the intermittent nature of renewable energy sources and the insufficient storage capacity installed (Braff et al 2016), one may ask how sound this claim can actually be.

Our paper assesses the wide-stretched claim of the provision of a 100% of green electricity by putting the actual course of green electricity demand in contrast with the actual course of green electricity generation in order to quantify the coverage of the demand by the supply during different time intervals. This analysis will enable us to evaluate various policy enforcements on their potential to amplify additional renewable energy generation capacity.

Methods

Once fed into the electricity mix within the grid, a physical tracking of green electricity volumes is impossible. Consequently, European electricity suppliers rely on so-called Guarantees of Origin (GOs), tradable energy certificates, as the fundamental mechanism to their offerings of green electricity products (Hamburger 2019). In previous literature, concerns have already been raised about the lack of transparency of the GO system and its inability to incentivize the expansion of renewable energy generation capacity (Markard & Truffer 2006; Hast et al 2015; Hufen 2017; Herbes et al 2020).

The assertion that an electricity product builds a 100% on electricity from renewable energy sources over a given year requires the cancellation of an equal amount of GOs generated within the same year (Hamburger 2019). Such an annual clearing allows high deviations between the date of the electricity generation and the consumption date, disregarding fluctuations in green electricity generation and green electricity demand throughout the respective year. As there might be time intervals in which green electricity demand exceeds green electricity generation, it is questionable what remains of the assertion of a 100% green electricity when applying shorter clearing intervals.

With our research, we, thus, aim to address the subsequent research questions:

1. How environmentally sustainable are green electricity products based on an annual GO clearing really?
2. What impact would a reduction in the clearing interval have on the expansion of renewable generation capacity?

We therefore calculate the quarterly, monthly, weekly, daily and hourly coverages of GO-based green electricity demand by GO supply. We first match historical GO statistics with data on historical electricity loads and renewable electricity generation. We then assess the coverage of GO-based green electricity demand with GO supply for a set of decreasing time intervals, namely quarterly, monthly, weekly, daily and hourly time intervals. The calculated coverages also allow us to draw conclusions on the potential impacts an enforcement of the respective clearing intervals could have on the expansion of renewable energy generation capacity.

Results

The preliminary results of our research reveal that the application of an annual clearing interval has been unable to ensure a continuous coverage of GO-based green electricity demand with green electricity supply. Furthermore, it becomes apparent that with an increasing reduction of the clearing intervals, the environmental sustainability of GO-based green electricity products further declines. In addition, the frequency of time intervals with negative coverages yields first insights on the impact that an enforcement of respective regulation could have on the expansion of existing renewable energy generation.

Conclusions

From our analysis, we can conclude that currently offered green electricity products claiming to build a 100% on electricity from renewable energy sources in fact also rely on conventionally generated electricity as there are time intervals in which the demand exceeds the supply. The proclaimed environmental sustainability of such products is therefore found to be unsatisfactory.

While past literature has critized the failure of the prevailant system to yield additional renewable energy generation capacity, we provide a novel approach towards possible regulation tightenigs that bear the potential for fostering an actual expansion of existing renewable energy generation capacity. Our work might also provide the necessary impetus for electricity suppliers to critically review their green electricity offerings and take voluntary measures to strengthen their sustainability claims. Policy makers might use our results to develop an improved regulation for the offering of green electricity products.

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