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CCUS in sugarcane ethanol mills: the way to make biofuels still more sustainable

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Carbon capture, utilization, and storage (CCUS) technologies provide a key pathway to address the urgent U.S. and global need for affordable, secure, resilient, and reliable sources of clean energy [1]. In the Brazilian sugarcane mills, basically all CO₂ emitted during ethanol production process corresponds to the null balance considering carbon absorption during photosynthesis process for the sugarcane growth. The perspective of capturing CO₂ in sugarcane mills and finding commercial uses for it represents an opportunity to replace CO₂ mainly produced from fossil fuels for different uses, special additional carbon credits for the mills' owner and lower carbon footprint in ethanol production process. In Brazil, if all CO₂ could be captured from fermentation process and biogas upgrading (biodigestion of vinasse), it could have a production of 25 million t CO₂.year⁻¹, considering 30 billion L of ethanol for the 2018/19 season.

In the last three years, many events in the public policies in Brazil have been reported such as the newest component of the Brazilian energy matrix: biogas and the establishment of biomethane specifications [2]; the Raízen project that traded energy from Biogas Bonfim, 20.8 MW at 251 R\$.MWh⁻¹[3] and the approval of the guidelines of RenovaBio which foresees expansion of the capacity and investments in new industrial units and technology by 2030 [4]. Based on that, the Research Center for Gas Innovation, University of Sao Paulo (RCGI/USP) together with a large sugarcane ethanol group will develop a pilot plant for 25 Nm³/h of biogas production and upgrade, testing advanced technologies for biodigestion and

biomethane production, to be compared with existing commercially available ones aiming to assess real figures for a technical economic assessment as well as for CCUS, including carbon capture from fermentation process and from biogas upgrade, comparing CCUS costs and possible use in local market (soft drinks, green house, agriculture, others). The execution of this project represents an opportunity to meet a real and current need of sugar-alcohol sector, considering the expansion and diversification of renewable sources for the Brazilian energy matrix.

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