Solar energy and the Water, Energy, and Food Nexus in the Brazilian northeast - a case study

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Water, energy and food are essential resources for society. Their integrated management, based on the synergies and trade-offs offered by Nexus concept, is determinant in resources conservation and to attend the demand in the long-term. At Brazilian semiarid Northeast, coexist at Petrolina and Jauzeiro cities: the Sobradinho hydropower plant (HPP), with a 4,214 km² flooded area reservoir, and a fruit production center of 223 km², destined to Brazilian and international market. Both human activities depend on the water availability of São Francisco River and Sobradinho reservoir. Although the water demand for irrigation is intense ~ 348 m³ in 2016, the hydroelectricity generation prevailed as a priority during the extremely dry period from 2012 to 2017. As the Water Agency (ANA) maintained the reservoir outflow in rates above inflow, Sobradinho reservoir run dry twice.

Solar irradiation is a main characteristic of semiarid. Thus, hybrid hydro-solar power generation show potential to minimize conflicts related to water access. In national auctions of electric energy expansion have approved an increasing number of solar plants in this region. Moreover, a floating photovoltaic (PV) power plant is already being tested inside the Sobradinho reservoir. In this study, we analyzed scenarios of water management to improve the WEF Nexus at Sobradinho and target the 10GJ in 2012, 6, 7, 12, and 13. The software Water Evaluation And Planning (WEP) was used to model the scenarios. The results are expected in: saved water from evaporation, additional water available for multiple uses, and hydrolithic energy generated. The dimensions of the PV system were also estimated for the most demanding scenario.

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