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A solar data solution for PV project development in a Caribbean island: Validation and site-adaptation of a satellite-derived dataset, CAMS

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Abstract: Large-scale photovoltaic (PV) project development depends on reliable, low risk investment opportunities, which require high quality solar resource data. Trinidad and Tobago has relatively low electricity costs which imply tighter PV revenue margins and increased sensitivity of utility scale PV projects to resource uncertainty and financial risk. This makes Trinidad and Tobago a more difficult case for demonstrating PV bankability, and therefore a suitable case study for examining how resource validation and site-specific adaptation can enhance PV bankability in Caribbean environments. As detailed prefeasibility and feasibility methodologies are typically commercially confidential, openly documented approaches to solar resource validation and site-adaptation increase transparency and complement industry practice by supporting investment-grade decision making.

This study therefore aims to quantify the uncertainty in a satellite-derived irradiance dataset, Copernicus Atmosphere Monitoring Service (CAMS), and to assess how statistical site-specific adaptation can improve its accuracy for use in prefeasibility and feasibility level PV project assessments. High-resolution ground measurements were collected at two locations in Trinidad: an inland site instrumented with a Tier-3 station measuring global horizontal irradiance (GHI), and a coastal site equipped with a Tier-1 station measuring GHI, diffuse horizontal irradiance (DHI) and direct normal irradiance (DNI). Following quality control, these measurements were used to 1) validate, 2) site-adapt, and 3) re-validate the CAMS dataset at the (i) prefeasibility stage, by site-adaptation of hourly data and comparison of monthly means, and (ii) feasibility stage, through hourly comparisons. Site-adaptation techniques that were evaluated included measure-correlate and predict, linear adaptation and empirical quantile mapping.

In this seminar, the results of the site-adaptation techniques will be presented and their implications for prefeasibility and feasibility assessments of PV project development will be discussed. High-resolution ground measurements, combined with statistical site-adaptation techniques can be applied to obtain investment ready quality data. This research demonstrates that satellite-derived solar resource data can provide information for prefeasibility site screening and high-quality ground measurements are required at the feasibility stage.