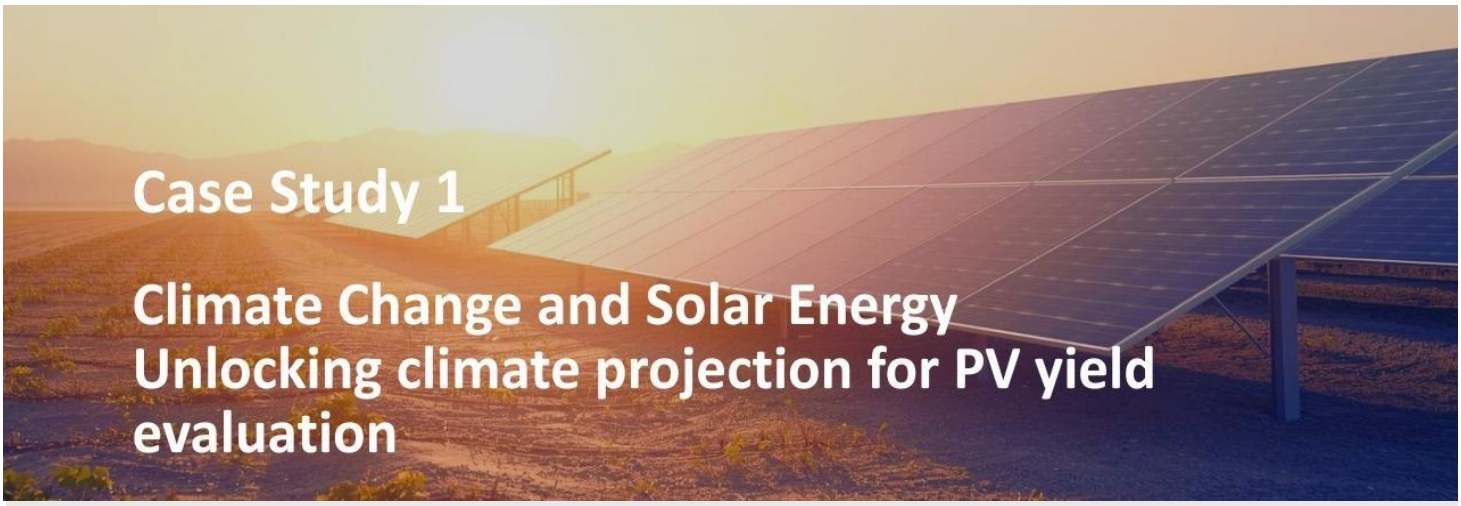

Case Study 1

Climate Change and Solar Energy
Unlocking climate projection for PV yield evaluation

PROJECT OVERVIEW

In the solar energy sector, a common assumption is that hotter means sunnier. But is this true, and how will climate change affect solar production? **Inside Climate Service (ICS)** supported **Everoze**, a European renewables consultancy, in exploring this question using the Global Climate and Energy dataset developed by ICS in collaboration with European partners under the Copernicus Climate Change Service (C3S). Together, they assessed how rising temperatures could affect solar panel efficiency and how climate services could improve long-term planning in the solar sector.

Partner	Site / Location	Industry	Duration	Funding Body
Everoze	Spain · Egypt · Senegal	Energy & Climate	24-month	C3S / Copernicus

THE PROBLEM

Large-scale solar photovoltaic (PV) projects typically operate for 20–40 years, with financing dependent on long-term energy output estimates. To design and evaluate PV production, developers and lenders rely on P50 (average) and P90 (conservative) PV yield scenarios that are commonly calculated based on a Typical Meteorological Year (TMY), a synthetic dataset built from historical climate records. As climate change shifts future conditions away from historical norms, relying solely on TMY data may reduce the reliability of these estimates.

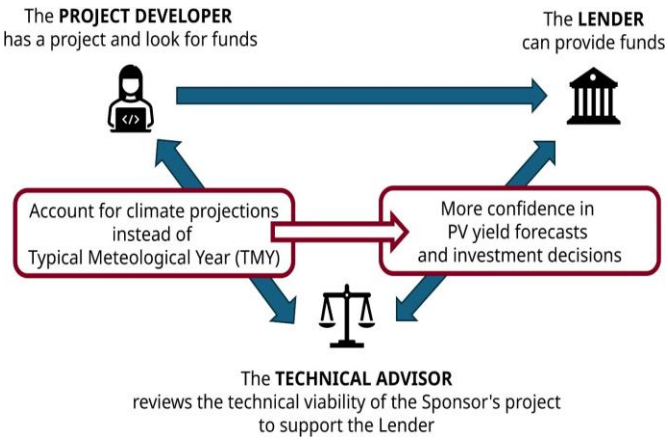

Figure 1: How a solar PV project is developed and financed, and how climate projections can support resource assessment and project financing

OUR SOLUTION

To support Everoze in computing P50 and P90 scenarios, ICS played a crucial enabling role by providing hourly solar irradiance, wind and temperature data, specifically prepared for PVsyst, the2022 to 2026. This involved collecting, down-scaling and bias adjusting climate data, integrating atmospheric reanalysis with an ensemble of six climate models across four emission scenarios, delivering global coverage at 0.25° spatial resolution and hourly delivering global coverage at 0.25° spatial resolution and hourly frequency from **1950 to 2100**.

industry-standard PV yield simulation tool. ICS drew these inputs from the C3S Global Climate and Energy dataset, whose technical development ICS led from This allowed Everoze to run batch simulations over 50-year periods and evaluate PV yields under varying climate conditions at sites in Spain, Egypt, and Senegal, comparing climate projections with other long-term factors such as module degradation and system downtime.

RESULTS & IMPACTS

Across all tested models and scenarios, simulations revealed an offsetting behaviour: rising temperatures reduce module efficiency, while increasing solar radiation boosts production. These effects largely balance each other, resulting in small net yield changes. At a site in Egypt, climate change impacts on Performance Ratio (PR) were consistently smaller than those from module aging and random downtime events. However, climate change could still drive a ~2% shift in PR, a non-negligible margin for lenders and developers.

By integrating climate projections into PV project development, ICS and Everoze demonstrated the practical value of high-resolution climate data in yield modelling. The study showed how this approach helps developers and investors improve long-term forecast accuracy and reduce uncertainty in project financing and risk assessments, enabling the solar sector to plan for future climate conditions rather than relying solely on historical data.

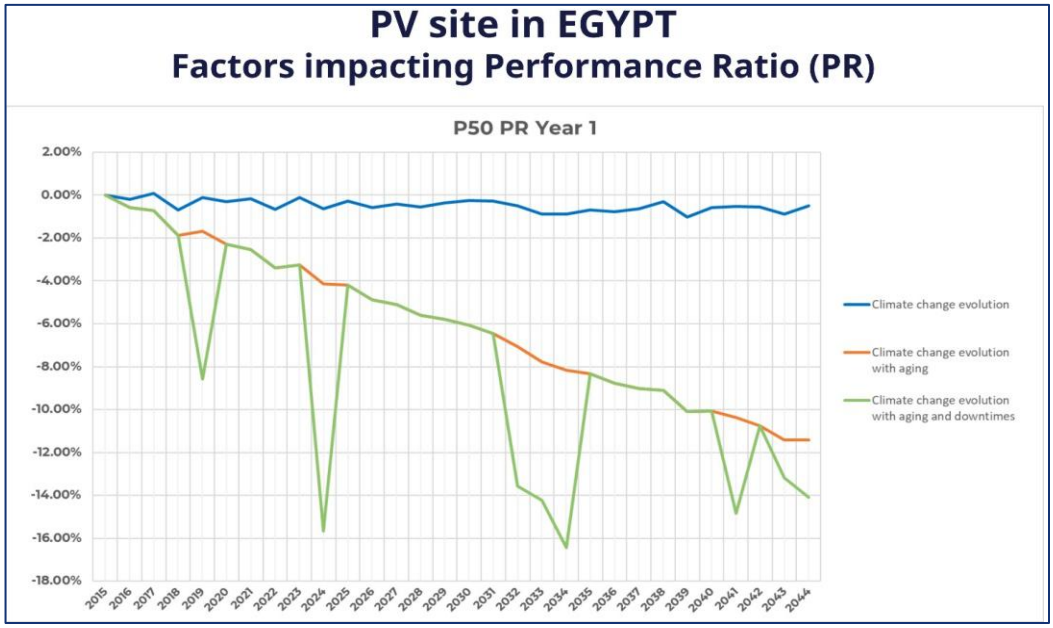

Figure 2: Temporal evolution of factors (climate, aging and random downtimes) impacting the Performance Ratio (PR) for the solar PV site located in Egypt in the P50.

DURATION & SCOPE

This case study was developed under the Copernicus Climate Change Service 2 (C3S2) Enhanced Energy Operational Service, Lot 1, a 36-month contract started in September 2022, led by ICS in collaboration with ARRMINES, EDF, ENEL Global trading, and Everoze SAS. The contract aimed to improve understanding of climate variability impacts on energy supply and demand over time.

COLLABORATION

Partner: Everoze, a consultancy specialising in renewables, storage, hydrogen, and energy flexibility.