TECHNICAL SPECIFICATIONS AND QUALITY CONTROL PROCEDURES FOR REDUCING THE UNCERTAINTY IN PV INSTALLATIONS: RESULTS OF THE FP7 PROJECT PVCROPS

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PV CROPS

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1. INTRODUCTION

- Large grid-connected PV plants have become an interesting financial product all around the world:
  - The annual energy production should be maximized
  - The uncertainty of the investment and the risk of failures should be minimized
  - The responsible for a possible under perfomance must be easily detected → Module manufacturer, Inverter manufacturer, Designer, Constructor, Operation and maintenance staff
- Technical and financial issues should be linked
- PVCROPS project has developed:
  - A free sofware tool for the energy yield forecast (SISIFO)
  - A general proposal of technical specifications and the corresponding quality control procedures to check if they are fulfilled
  - Testing kits to perform the quality control procedures

2. ENERGY YIELD FORECAST

- SISIFO is a free software tool (www.sisifo.info) to simulate energy production that uses **a model based on parameters guaranteed by the manufacturers**, **a baseline losses scenario** and **operating conditions**.

$$P_{DC} = P^* \frac{G_{ef}}{G^*}\left[1 + \gamma(T_C - T_C^*)\right]\left[a + b\frac{G_{ef}}{G^*} + c\, ln\frac{G_{ef}}{G^*}\right] f_{DC} \qquad P_{AC} = P_{DC}\, \eta_{INV}\, f_{AC} \qquad E_{AC} = \int_{t=0}^{t=T} P_{AC}\, dt$$

- P^*: Module nameplate DC power
- T_C, γ: Coefficient of module power variation due to T_C
- a, b, c: Parameters related with the variation of module efficiency with G_{ef}
- f_{DC}: Other DC losses: wiring, soiling, shading…
- η_{INV}: Inverter power efficiency
- f_{AC}: Other AC losses: wiring, technology issues…

- More accurate estimation of energy and lower uncertainty if
  - G_{ef} and T_C are measured with reference PV modules of the same technology.
  - P^*_M, γ, a, b and c of a representative sample of modules are measured (better than datasheet)

3. TECHNICAL SPECIFICATIONS AND QUALITY CONTROL PROCEDURES

- The technical specifications (TS) report about how the PV installation must be implemented
- The quality control procedures establish the tests that should be done to ensure the PV installation meets the TS
  - G_{ef} and T_C measured from reference PV modules (same angular, spectral, thermal, dirt response) → **Uncertainty reduced**
  - PV modules not only characterized at STC (P^*_M), but also behaviour with T_C (γ) and with G_{ef} (a, b and c)
  - Analysis of *PR* at Standard Test Conditions (PR_{STC}, not site-dependent nor time-dependent) → **Uncertainty reduced**
  - Real behaviour of PV plant: DC power characterization, inverter efficiency, AC power response (actual losses scenario) → **Uncertainty reduced**

We are looking you forward in the parallel event (Thursday 17th Sept 13:20–18:30):

“PVCROPS: Novel solutions for a high PV penetration in EU electrical networks with lower LCOE”

(At 17:00: Quality control procedures for the bankability of PV plants: Software and Hardware solutions)