

Best Practice Guidelines for the Use of Economic & Technical KPIs

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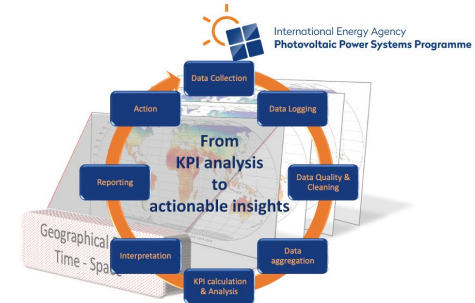
Technical KPI Calculation and their Usage



Introduction

- KPIs are essential tools for assessing the technical and economic performance of photovoltaic (PV) systems across different conditions and climates.
- **Challenges in KPI Calculation:** Handling raw PV data and selecting reliable tools are major challenges in calculating KPIs. Current standards are being critically evaluated.
- This report addresses critical questions regarding KPI use in PV monitoring, performance comparison, and indicators affected by external factors, while offering best practices for data acquisition and usage.

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Technical KPI overview

- This table summarizes all technical KPIs and their usage, divided into technical (T) and contractual usage by stakeholder.

KPI	Abbreviation	Private equity / Bank	Project Developer	Asset Owner / Asset Manager	EPC	O&M	Service provider / consultant
<u>Pxx energy yield</u>	P50 Yield	T/C	T/C	T/C	T		T/C
Performance ratio	PR			T/C	T/C	T/C	T/C
Availability				T/C	T/C	T/C	T/C
Soiling ratio	SR	T	T	T	T	T	T
Degradation rate	Rd	T	T	T	T	T	T/C
Performance loss rate	PLR	T	T	T	T	T	T/C
Energy performance index	EPI			T/C	T/C	T	
Capacity test	<u>CapTest</u>			T/C	T/C	T	
Capacity utilization factor	CUF / PLF				T	T	T
Maintenance response time	MRT			C	C	C	C

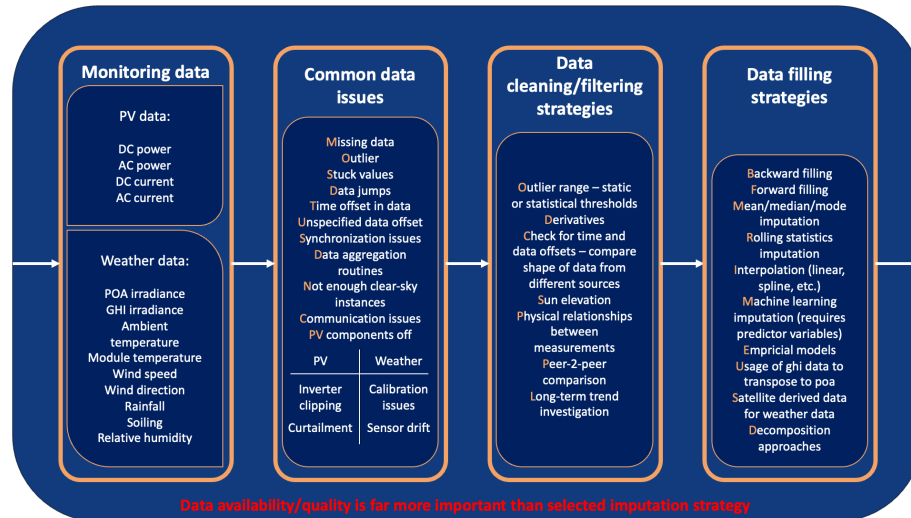
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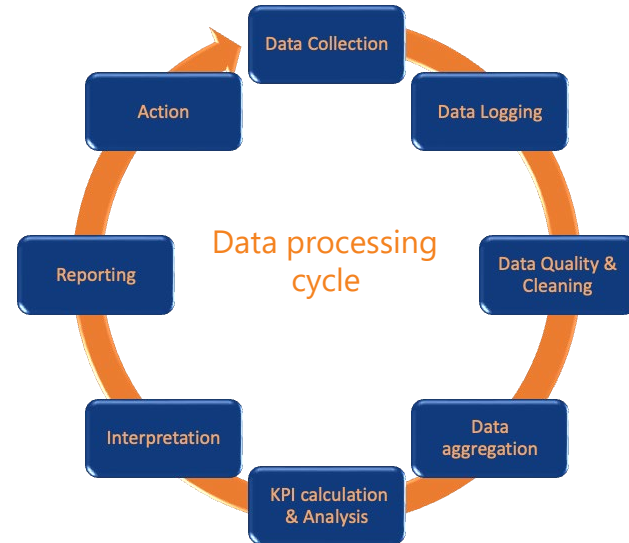
Data processing standards and best practices

- The data processing cycle is the heart of every KPI computation
- Each step has to be carried out carefully and taking into consideration existing best practices
- To do so, we developed a guideline for PV system data quality related issues
- These are to be used together with existing standards

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Guidelines for PV system data quality issues



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Existing standards:

1. **IEC 61724-1:2021:** Guidelines for monitoring PV system performance
2. **IEC 61724-2:2016:** Methods for evaluating PV system capacity
3. **IEC 61724-3:2016:** Energy performance evaluation methods for PV systems
4. **IEC TS 63019:2019:** Information model for assessing PV system availability,
5. **IEC TR 63292:2020:** Roadmap for robust PV system reliability



Special attention:

- maintain & calibrate weather sensors, especially irradiance sensors (KPI accuracy)
- data quality is not just about coverage but also validity
 - use known correlation and peer-2-peer comparison to validate your data
- record and store all data related steps from detected data issues, filtering, data imputation to data aggregation
 - **apply a unified data quality routine**



This studies covered several items:

- Overview on PV system KPIs presenting their common usage, advantages and drawbacks
- Discussion on current PV data processing and KPI calculation related standards and their limitations
- Best practices in data handling and proposition of a unified data quality routine
- Discussion on mapping potentials of commonly used KPIs, emphasizing their applications in various contexts
- **Standardization and Transparency in KPI Definitions:** Ensuring consistent and unbiased KPI definitions is critical to eliminating calculation discrepancies, promoting fairness in contractual agreements, and enhancing reproducibility across the PV industry.
- **Future Integration of Geospatial Mapping:** Expanding the use of geo-spatial KPI mapping from site-specific analytics to broader regions will enable better PV system design and tailored operational strategies, leveraging data-driven insights for enhanced performance predictions and contract optimization.