

Key Performance Indicators for Wind Farm Operation and Maintenance

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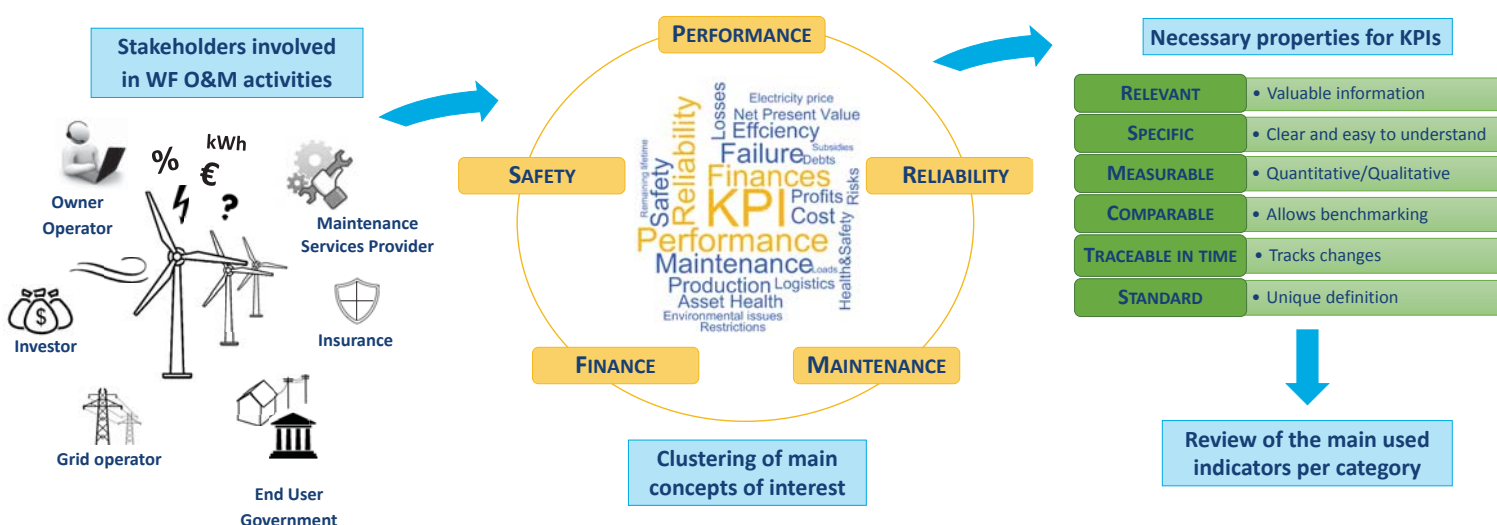


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INTRODUCTION

- ❖ The wind industry is now facing a challenging scenario with more offshore presence and without incentives for both development and operations. The current growing interest in optimising operations makes **wind farm (WF) operation and maintenance (O&M)** a new challenging field of study.
- ❖ The use of **key performance indicators (KPIs)** is one of the most widespread tools to get a comprehensive overview of a business and to measure the progress towards its stated goals. WF O&M would benefit from having a **suitable, well defined and standard set of KPIs** as many other industries and sectors. KPIs should inform about the general status of an operating asset, influence the decision-making process and reflect changes in the O&M strategy.
- ❖ During a joint industry workshop (JIW) organised by the **Advanced Wind Energy System Operation and Maintenance Expertise (AWESOME) project**, the definition of KPIs arose as one of the main needs for WF O&M.
- ❖ We present a **review** of the major existing indicators used in the O&M of WFs, not available in the literature so far. A final list of KPIs is suggested and verified against necessary properties, together with an analysis of the stakeholders involved in O&M and their interests.

METHODOLOGY & RESULTS



DISCUSSION

- ❖ We suggest a list of KPIs verified against the necessary properties.
- ❖ A check-mark (✓) indicates it fulfils it; a cross-mark (✗) it does not fulfil it; an asterisk (✓*) indicates that with some modifications it would fulfil the property.

	Relevant	Specific	Measurable	Comparable	Traceable in time	Standard		Relevant	Specific	Measurable	Comparable	Traceable in time	Standard
Performance							Reliability						
Time-based availability (%)	✓	✓	✓	✓	✓	✗	MTBF & Failure rate (%)	✓	✓	✓	✓	✓	✓*
Energy-based availability (%)	✓	✓	-	✓	✓	✗	MTTR & Repair rate (%)	✓	✓	✓	✓	✓	✓*
Maintenance							Finance						
Interventions per WT	✓	✓	✓	✓	✓	✓*	MTTF	✓	✓	✓	✓	✓	✓*
Reactive maintenance (%)	✓	✓	✓	✓	✓	✓*	OPEX (€/MW)	✓	✓	✓	✓	✓	✓
Schedule compliance (%)	✓	✓	✓	✓	✓	✓*	EBITDA margin (%)	✓	✓	✓	✓	✓	✓
Overtime jobs (%)	✓	✓	✓	✓	✓	✓*	LLCR (%)	✓	✓	✓	✓	✓	✓
Labour costs vs. TMC (%)	✓	✓	✓	✓	✓	✓*	DSCR (%)	✓	✓	✓	✓	✓	✓
TMC vs. AMB (%)	✓	✓	✓	✓	✓	✓*	LCOE (€/MW)	✓	✓	✓	✓	✓	✓

CONCLUSION & OUTLOOK

- ❖ This paper constitutes a good first contact to WF O&M aspects for those wind professionals and researchers that have not yet approached the field.
- ❖ After analysing the stakeholders involved, defining the properties for KPIs and a thorough review of the existing ones, we propose and discuss a suitable list.
- ❖ Further numerical validation is highly recommended to make quantitative evaluation for both onshore and offshore cases.

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