AUSFALLVERHALTEN VON WINDENERGIEANLAGEN

13. österreichisches Windenergiesymposium AWES 2018

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AUSFALLVERHALTEN VON WINDENERGIEANLAGEN

- Background:
  - Fraunhofer | Reliability and maintenance strategies
- Motivation:
  - Field data for maintenance optimization
- Common database:
  - Necessity | Capabilities | Approaches
- Initiatives
  - WInD-Pool | IEA Wind Task 33
- Application of data groups
  - Operational data | Status codes | Event data
- Summary

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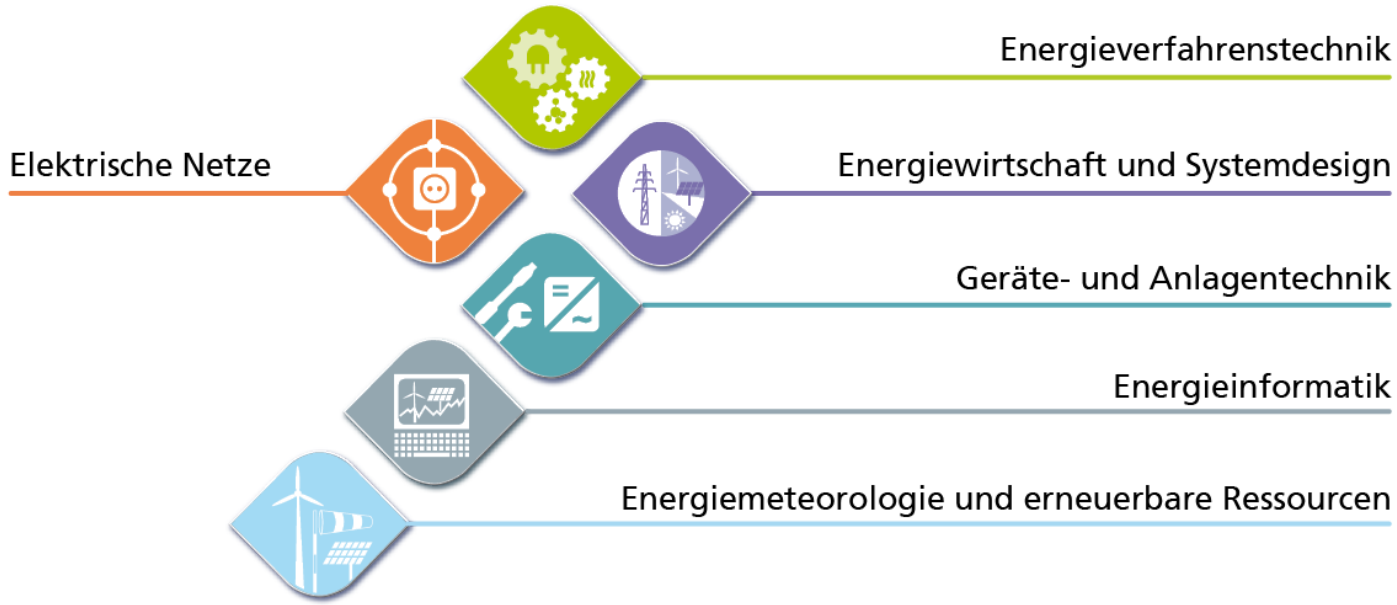
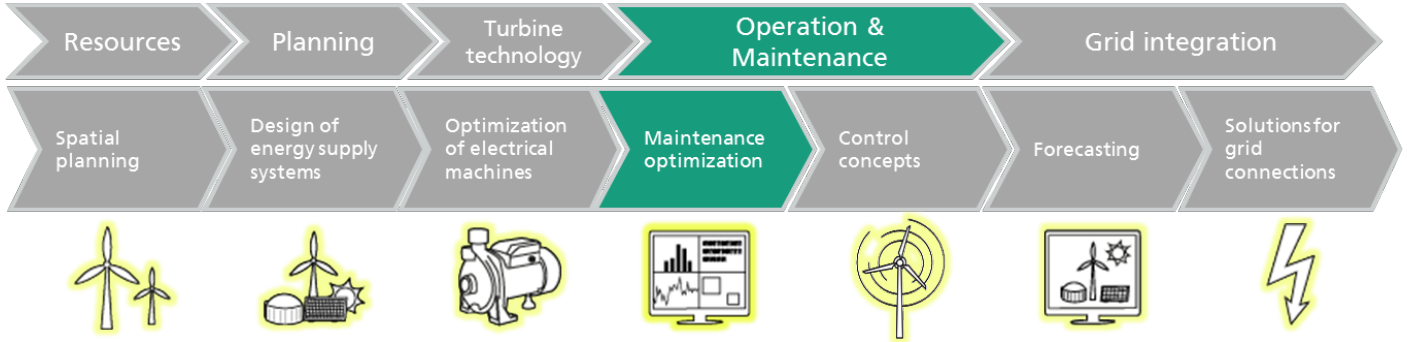
Ab 1. Januar 2018 ist das Fraunhofer IWES in Kassel ein eigenständiges Institut

FRAUNHOFER-INSTITUT FÜR
ENERGIEWIRTSCHAFT
UND ENERGIESYSTEMTECHNIK IEE

WWW.IEE.FRAUNHOFER.DE



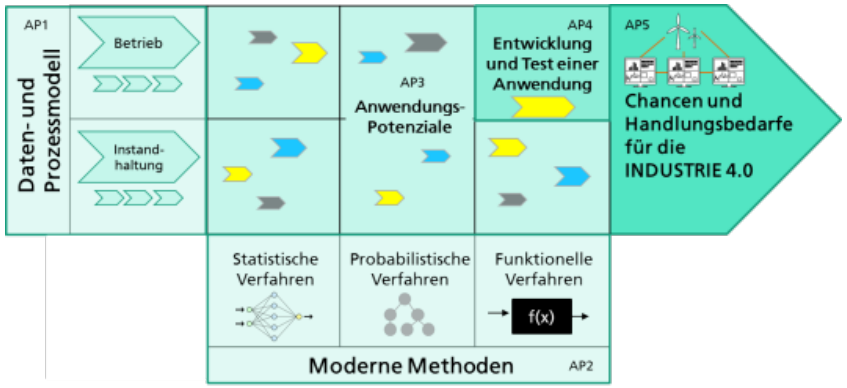
Windenergie @Fraunhofer-IEE

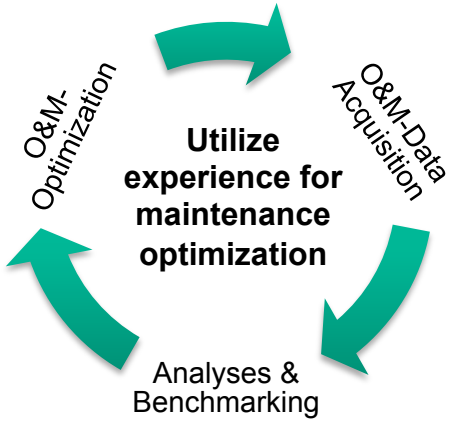


re•li´•a•bil´•i•ty (ri, līə 'bilətē) *n.*

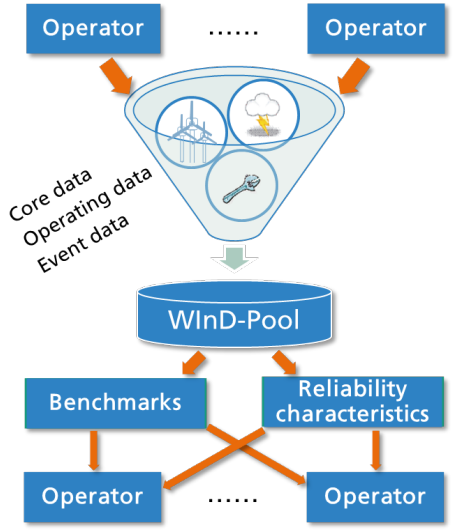
a person or thing with trustworthy qualities.

Task 33 · Reliability Data





WIND pool



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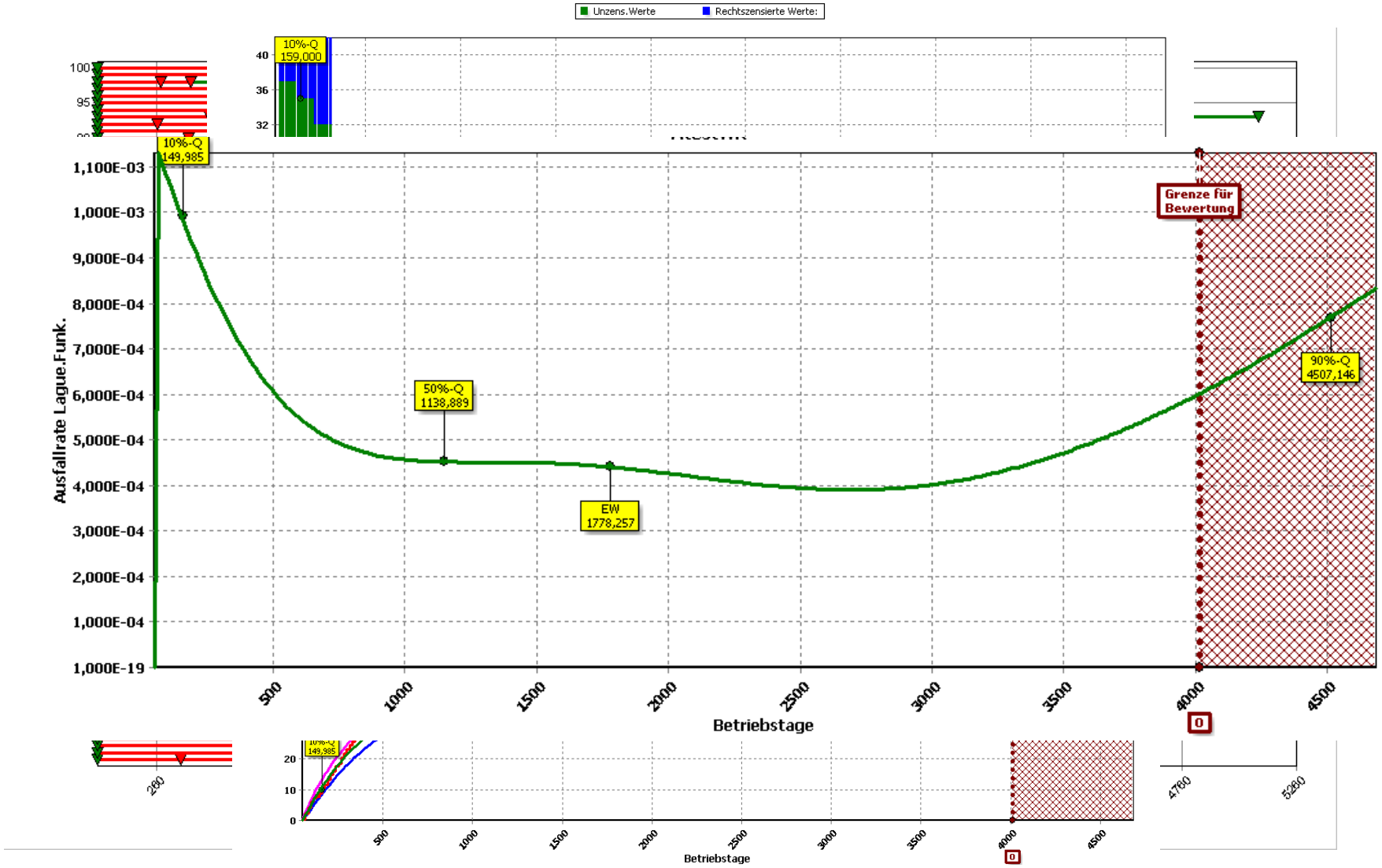
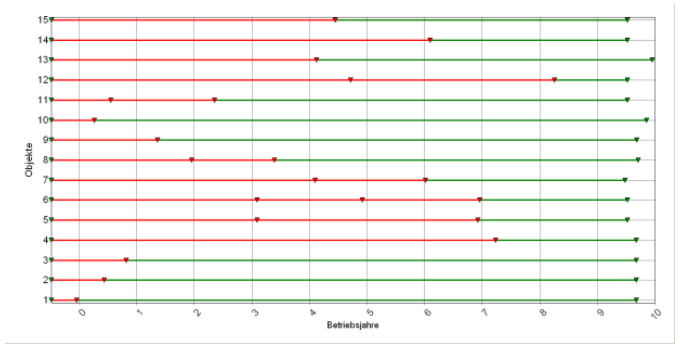
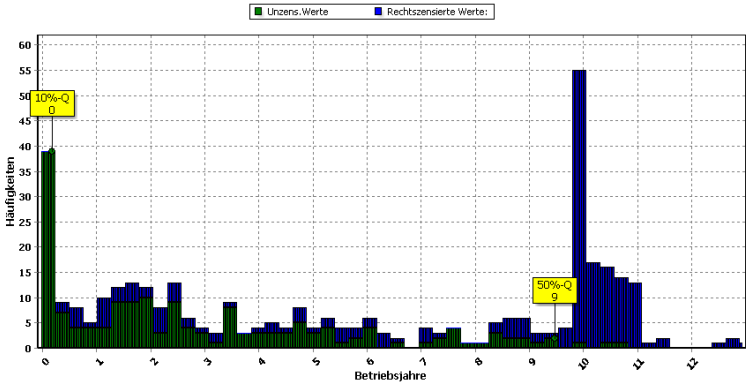
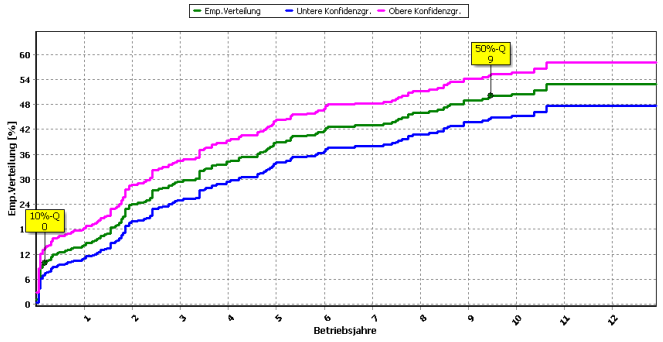
Field data for maintenance optimization

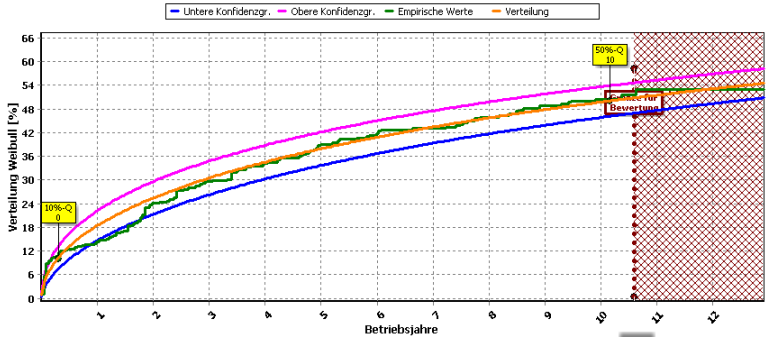


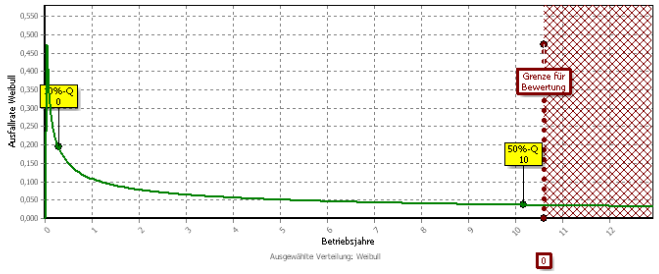
Field data for maintenance optimization











- **Preprocessing**
  - Plausibility check
  - Identify Outliers
- **Creating Sample**
  - Lifetime reference
  - Censored values
- **Empirical distribution**
  - Expected Value
  - Standard deviation, Coefficient of variation
  - Quantiles
- **Distribution function**
  - Weibull-parameters
  - Best fit
- **Reliability characteristics**
  - Density function
  - Failure rate
  - Confidence limits

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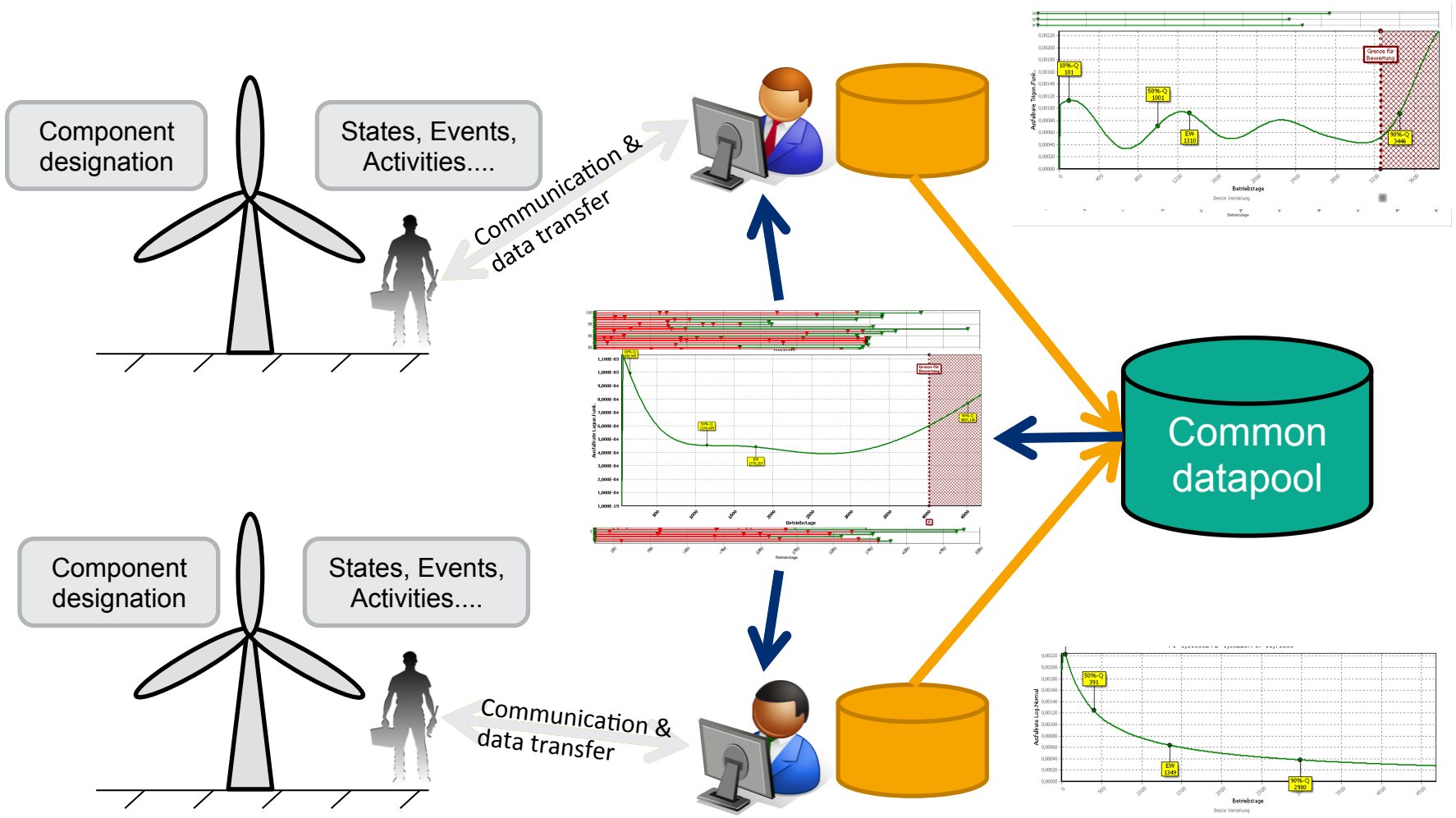
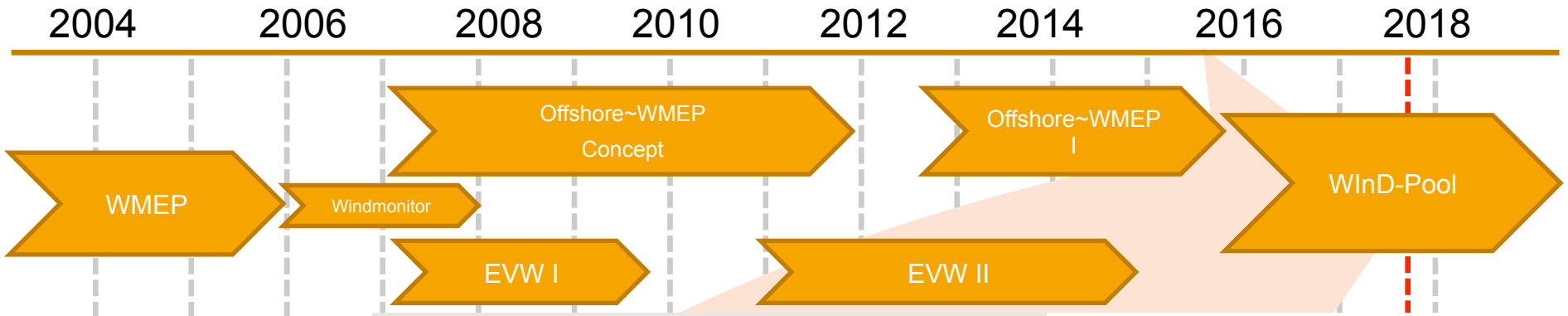
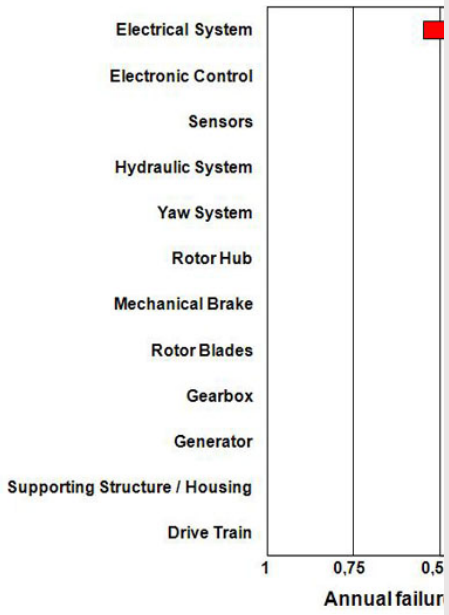
Common datapool for maintenance optimization



Wind energy Information Data Pool: WInD-Pool





EVW I + II

Funding: BMU/PTJ

Phase I: 2006 – 2009

Phase II: 2010 – 2014

Partner: IZP, GEO, FGW, WindStrom, ENERTRAG

Offshore~WMEP

Funding: BMU/PTJ

Partner: IZP, FGW, Betreiber

Concept phase: 2007 – 2011

1st Execution phase: 2012 – 2015

WIND pool

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Wind energy Information Data Pool: WInD-Pool

WIND pool

Data acquisition

Operator ..... Operator

Equipment data
Operating data
Failure & maintenance data

WInD-Pool

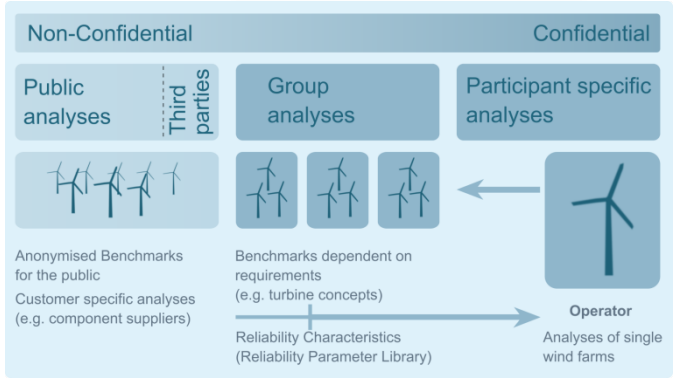
Benchmarks

Reliability characteristics

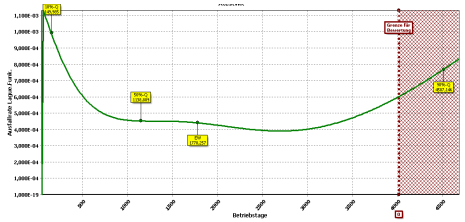
Operator ..... Operator

Performance Benchmark

Confidentiality



Reliability analyses



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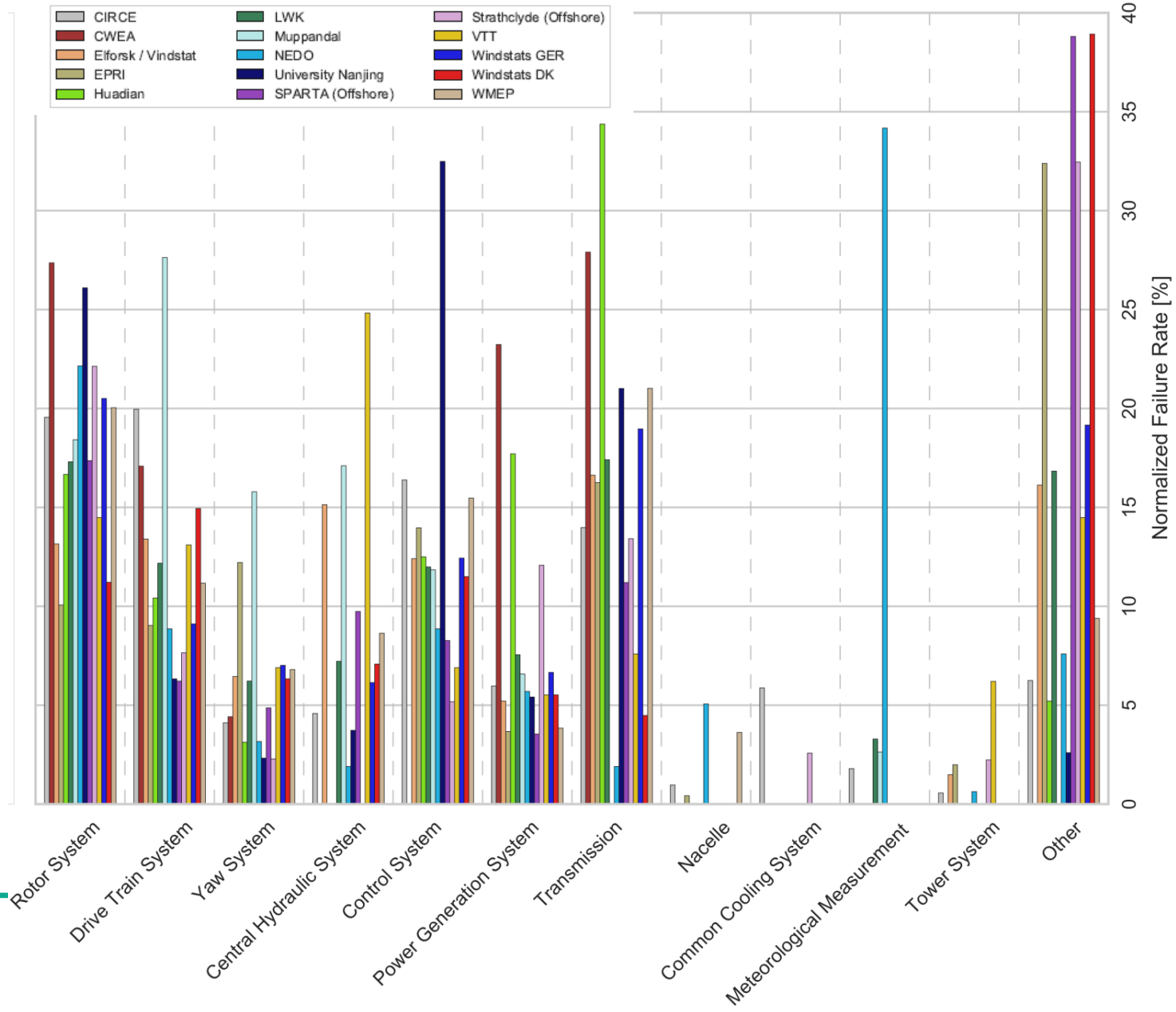
Common datapool for maintenance optimization



Energies **2017**, *10*(11), 1904;
doi:10.3390/en10111904

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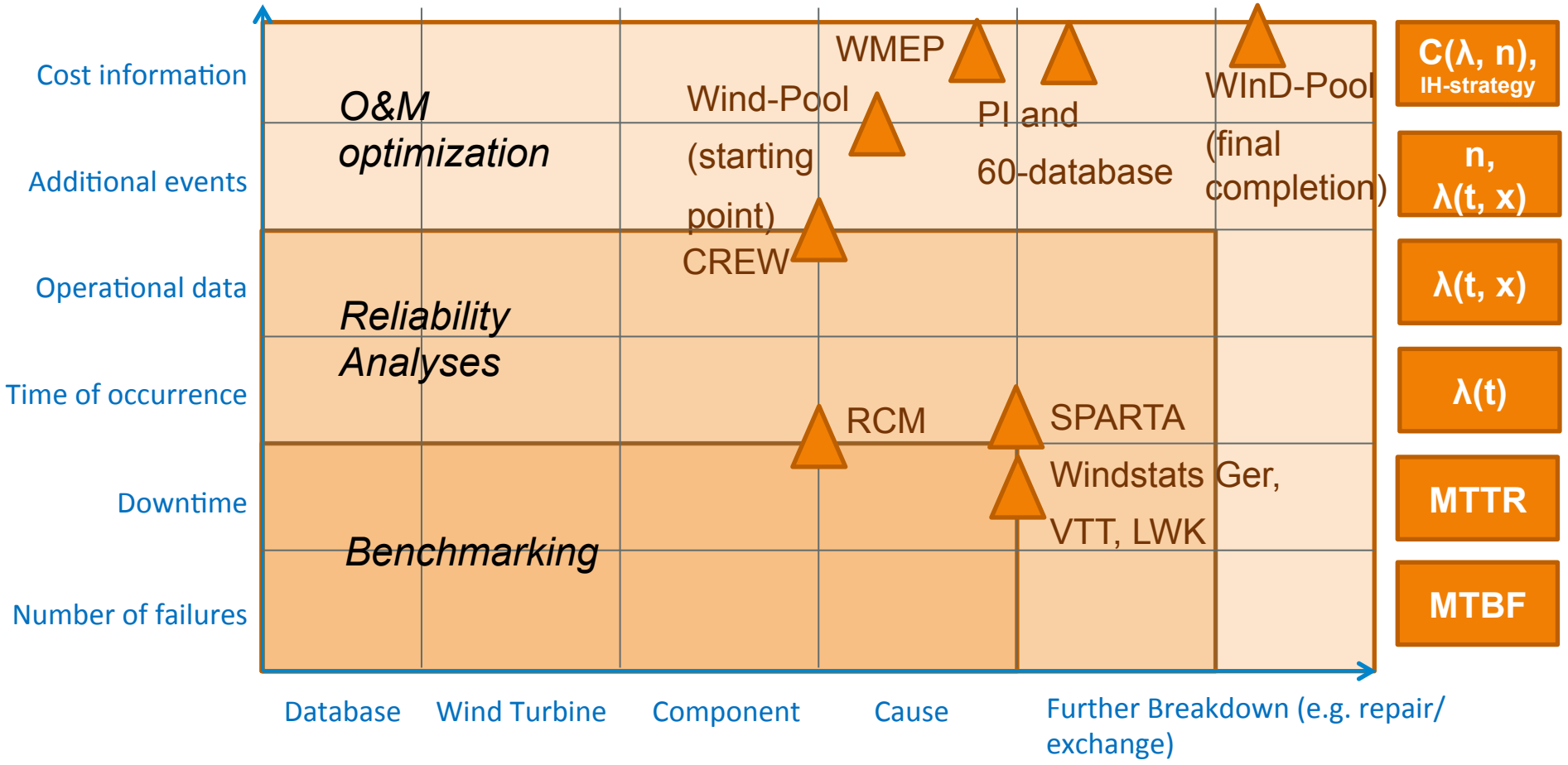
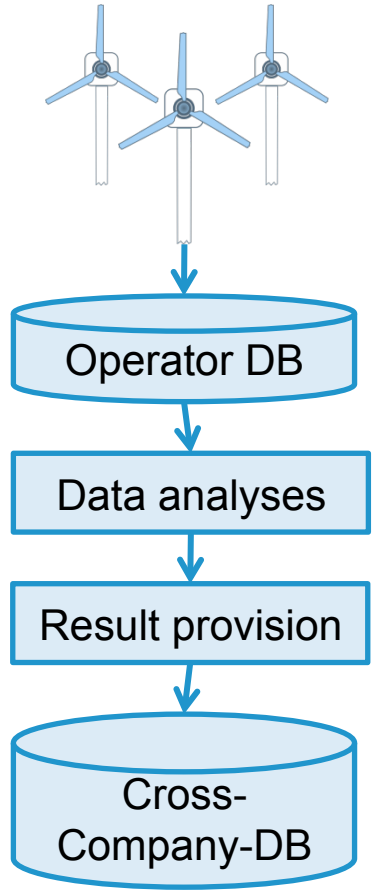
Common datapool for maintenance optimization



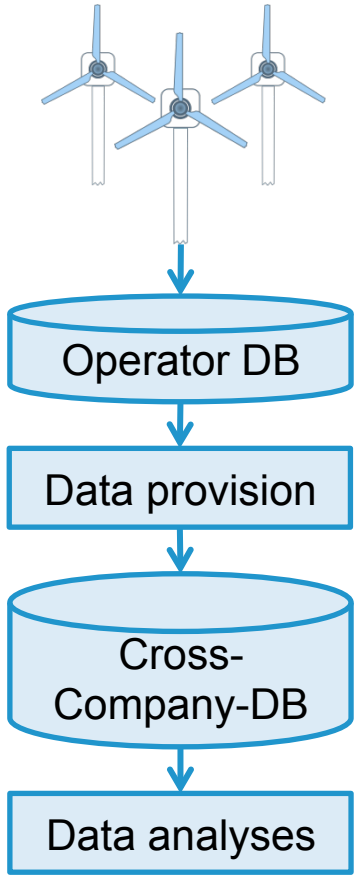
Common datapool for maintenance optimization

Result data approach



- Easy data transfer
- Less analyses effort for CC-DB
- Great effort for additional analyses
- Consistent results hard to ensure

Raw data approach



- Consistent results ensured
- Additional analyses easy to implement
- Enables reliability characteristics
- High effort for data transfer and standardisation
- Large database required

IEA Task 33 „Reliability Data“

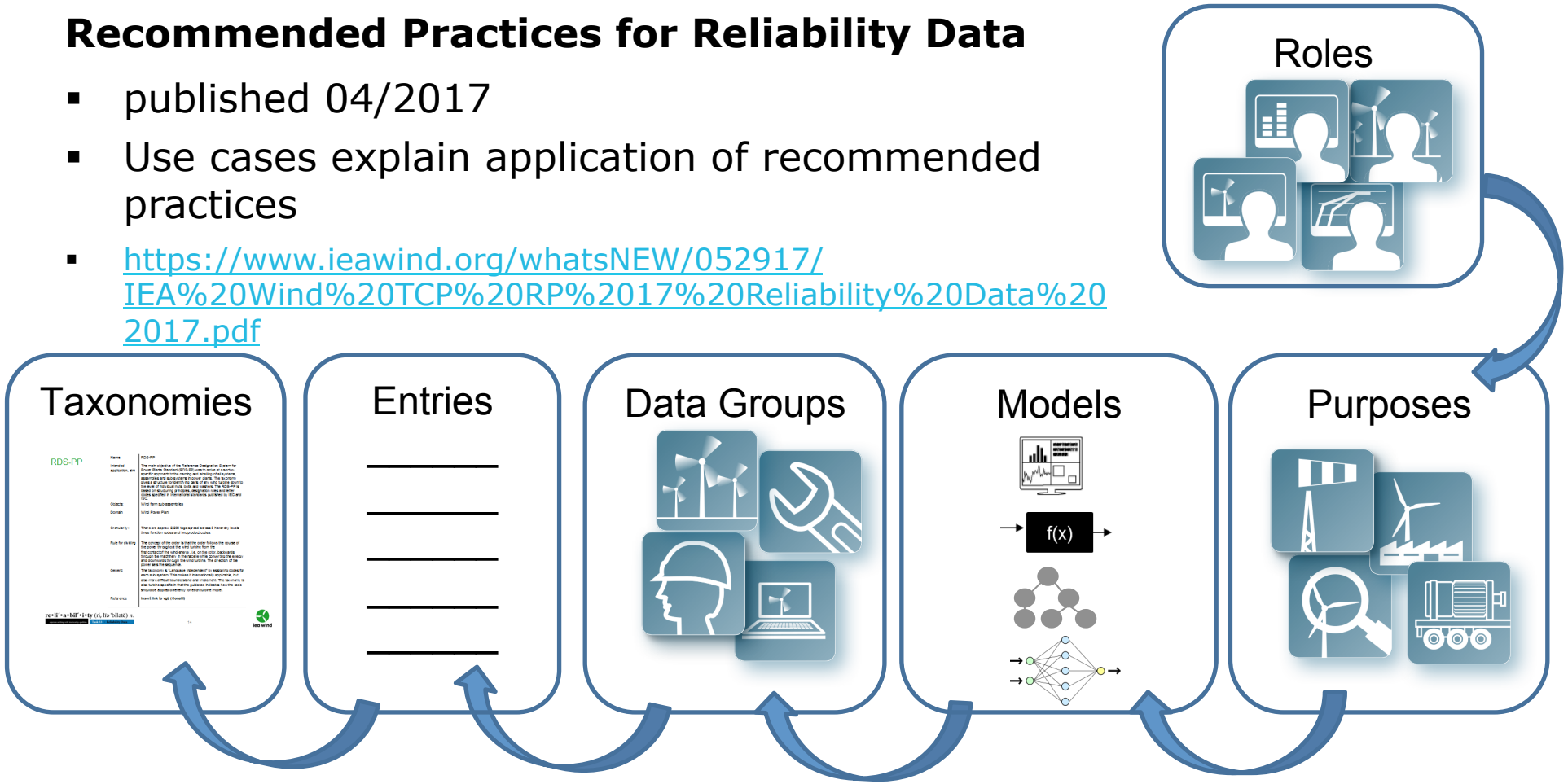
re•li´•a•bil´•i•ty (ri, līə 'bilətē) *n.*

a person or thing with trustworthy qualities.

Task 33 · Reliability Data

Recommended Practices for Reliability Data

- published 04/2017
- Use cases explain application of recommended practices
- https://www.ieawind.org/whatsNEW/052917/IEA%20Wind%20TCP%20RP%2017%20Reliability%20Data%202017.pdf



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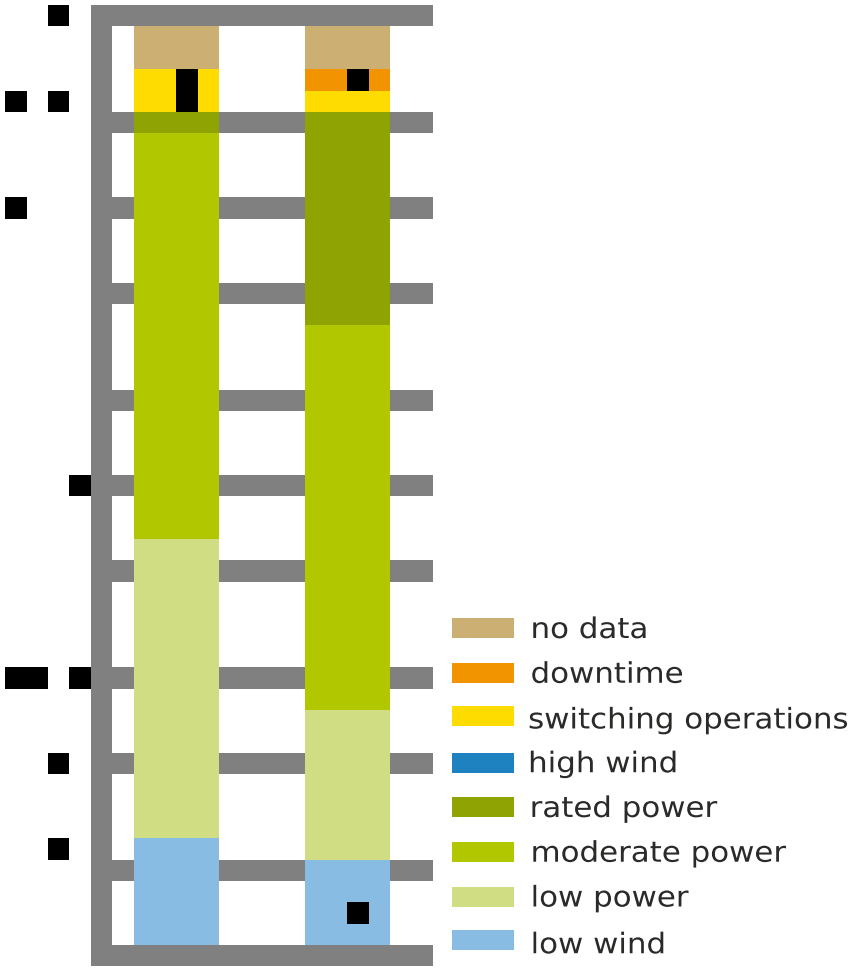
Data groups & Taxonomies

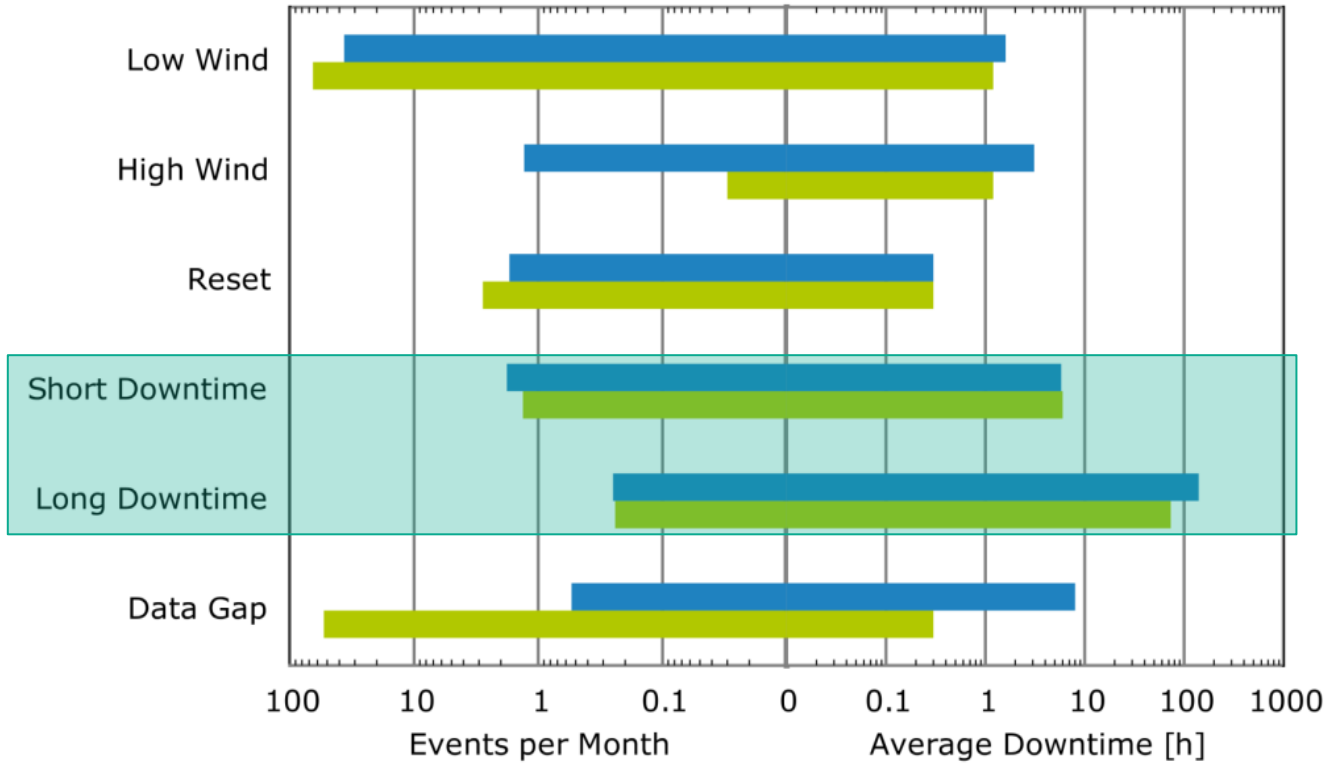
Data groups	Sub-groups / objects
Equipment data (ED)	Identification
	Time data
	Technical information
Operating data / measurement values (OP)	Time stamp
	Measurement values (SCADA, etc)
	Operational states
Failure / fault data (FD)	Identification
	Time data
	Failure description
	Failure effect
	Failure detection
	Fault properties
Maintenance & inspection data (MD)	Identification
	Time data
	Task / measure / activity
	Resources
	Maintenance results

Data groups / taxonomies	Equipment data	Operating / measurement data	Failure data	Maintenance & inspection data
VGB RDS-PP®	o			
NERC GADS	o	-		-
ReliaWind	o			
ISO 14224	o*		+*	+*
FGW ZEUS		o	+	+
IEC 61400-25		+		
IEC 61400-26		o		

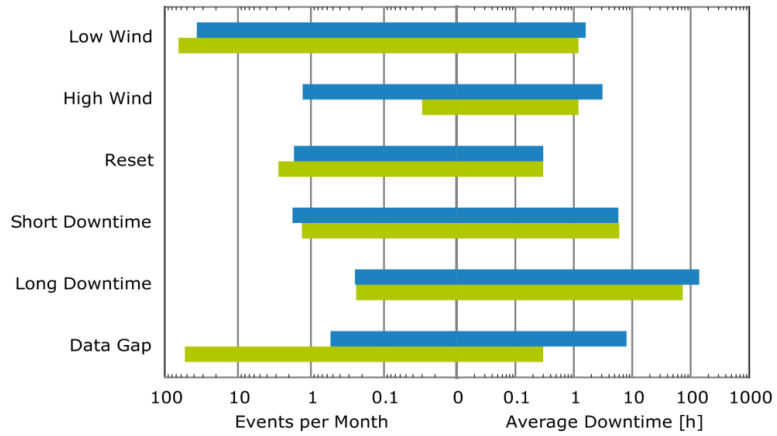
+	entries with a high level of detail
o	entries with a medium level of detail
-	entries on a more general level
*	not wind-specific

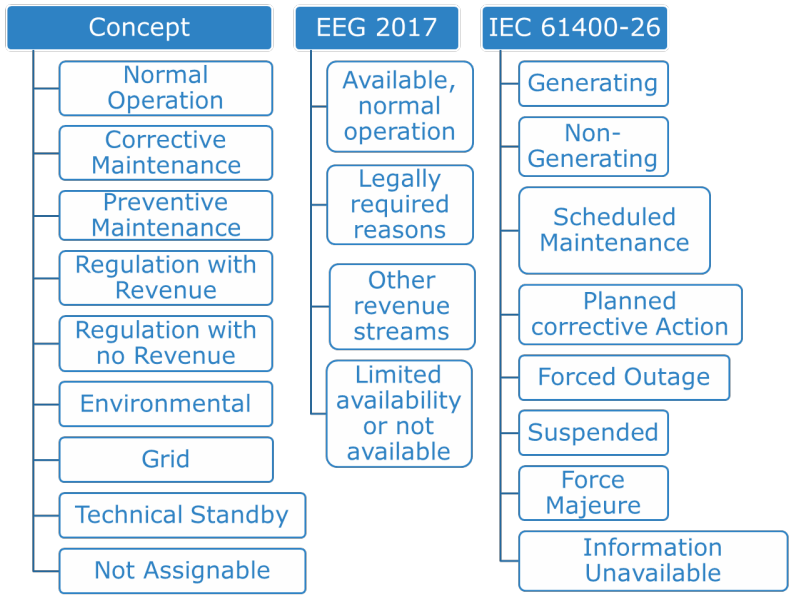
Operational data

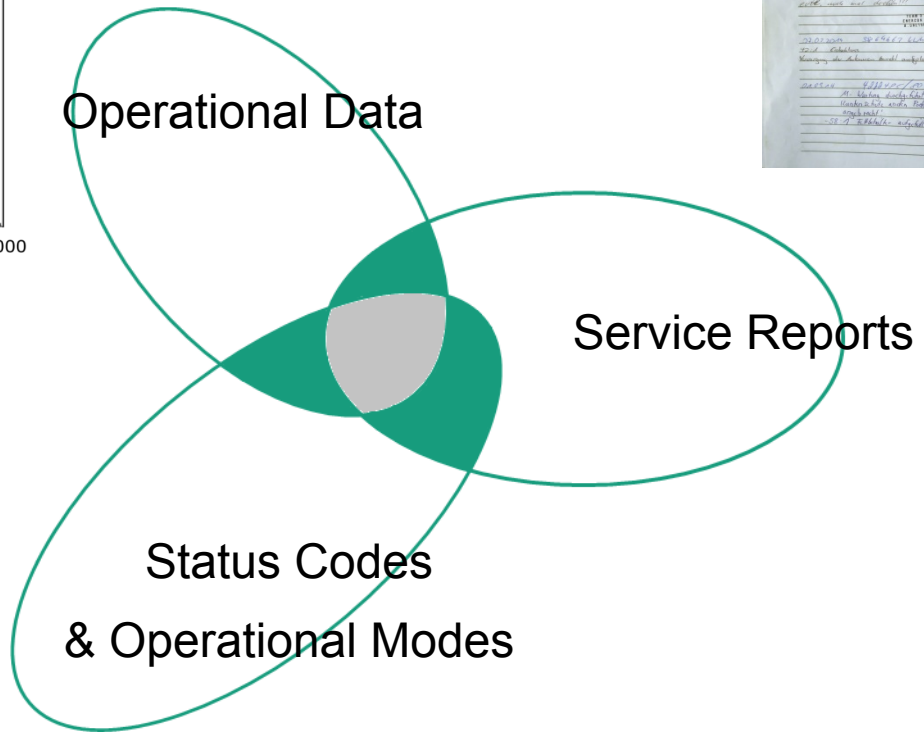


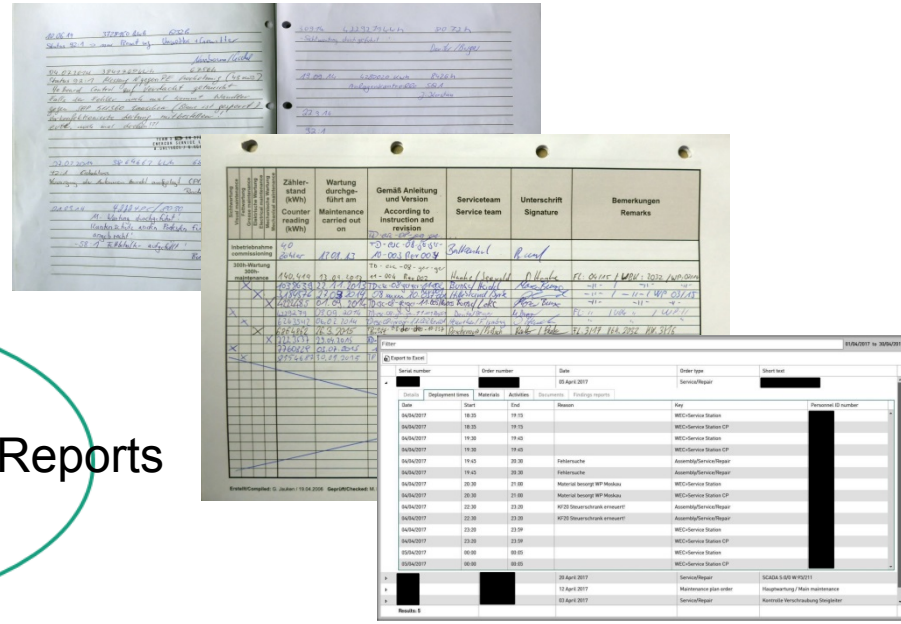


Applying operational and event data









Summary

- WInD-Pool is an ongoing initiative of Operators and Fraunhofer IWES turning operational experience into knowledge
- WInD-Pool provides significant benefits for participating Operators
- Further Operators are welcome to join the initiative
- Detailed maintenance data are the next “BIG STEP”
- Application of standards is very important for comparability
- Fundamental questions can be answered as part of research work
- Results on onshore and offshore WT show significant differences

THANK YOU FOR THE ATTENTION

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Reliability and maintenance strategies
Energy Economics and Grid Operation

Fraunhofer Institute for Energy Economics
and Energy System Technology (Fh IEE)

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