



Electrical Engineering
and Systems
Technology



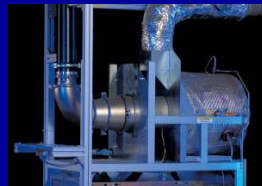
for the Use of
Renewable Energies



and Decentral
Energy Supply



Applications oriented
Research and
Development



Institut für Solare
Energieversorgungstechnik
Verein an der
Universität Kassel e.V.



www.iset.uni-kassel.de

Appropriate Failure Statistics and Reliability Characteristics

 **DEWEK 2008**
9th German Wind Energy Conference

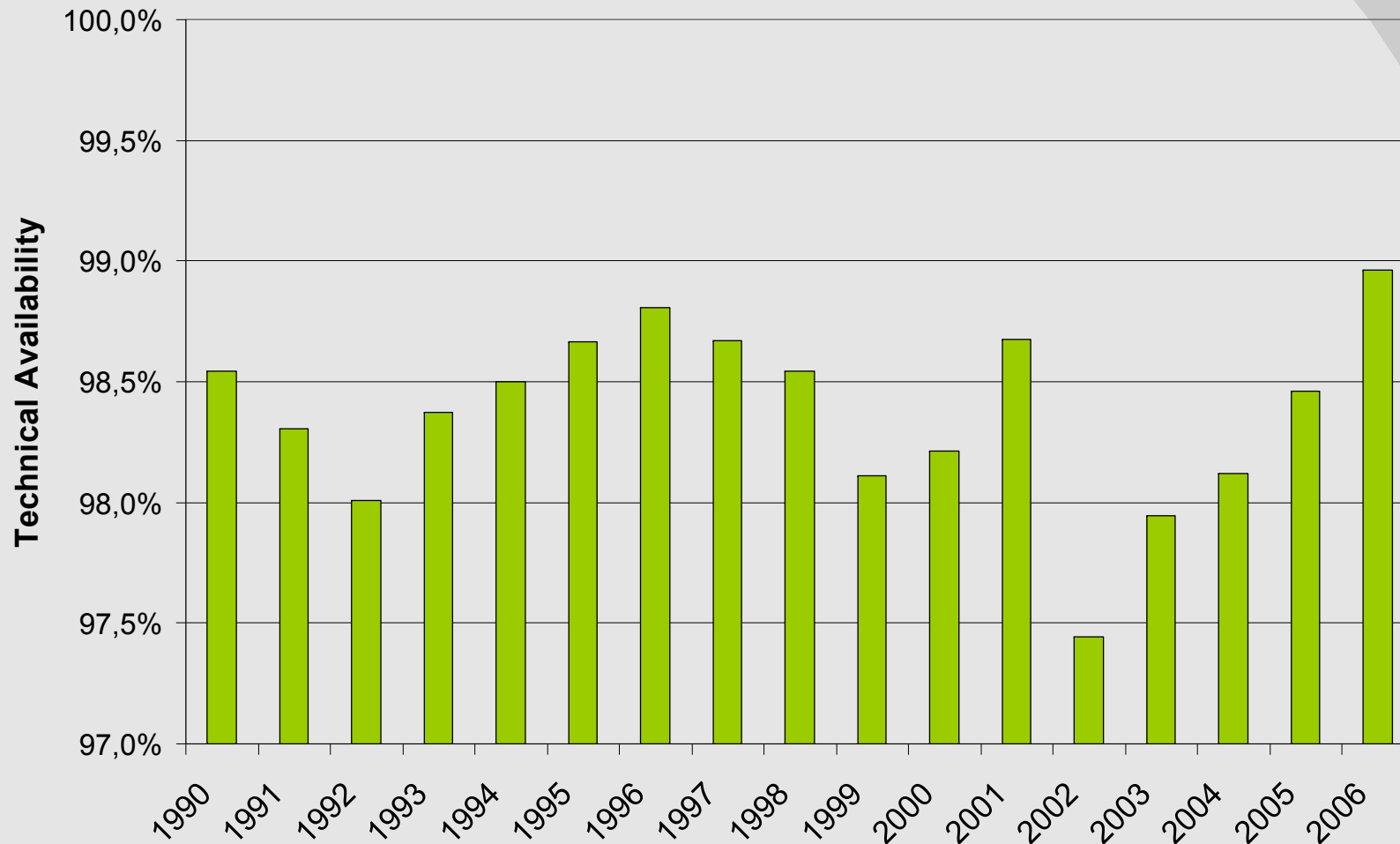
Session No. 12: Application

Bremen, November 27th 2008

S. Faulstich, B. Hahn , H. Jung, K. Rafik, A. Ringhandt

advancing energy systems

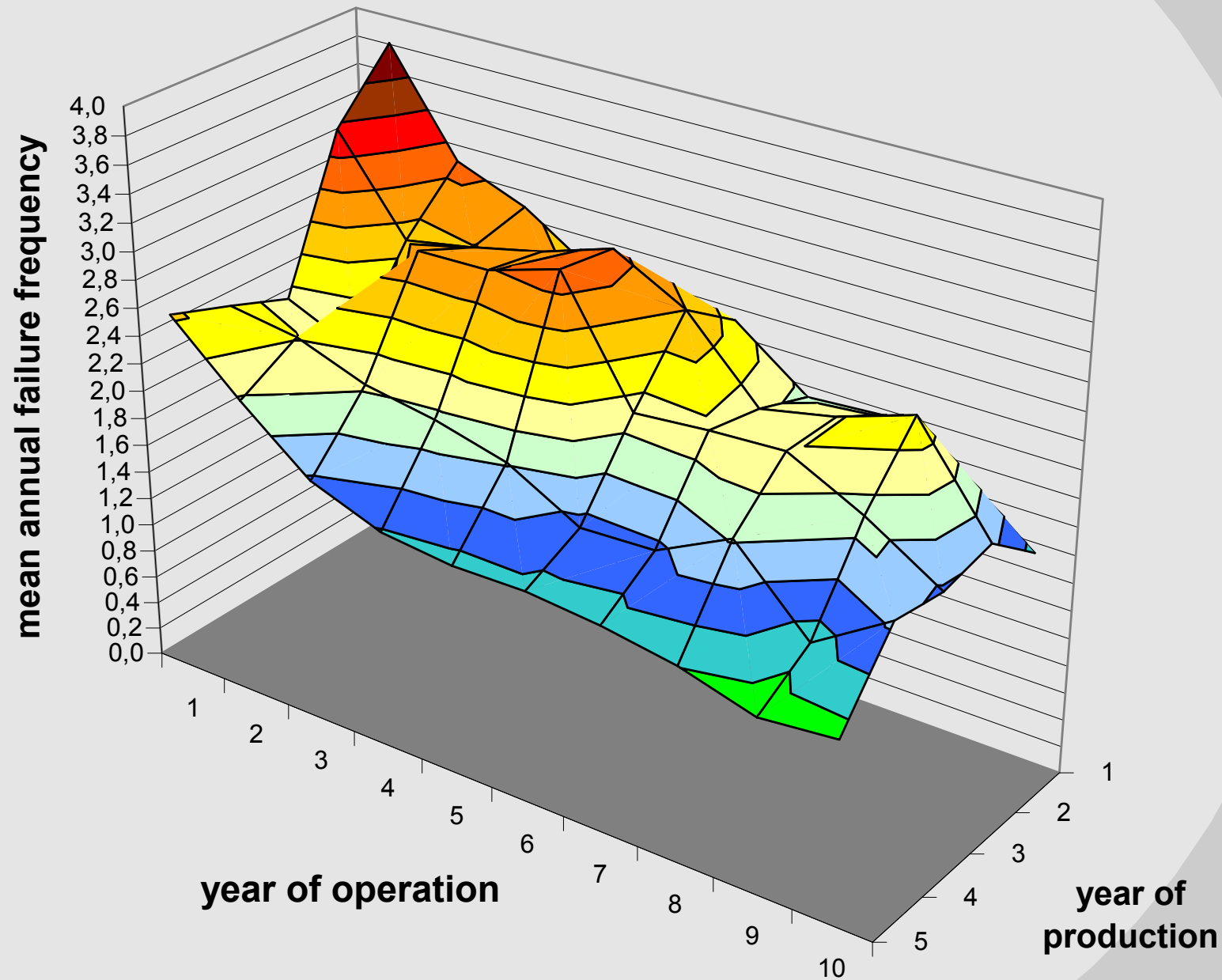
Availability



Scientific Measurement and Evaluation Programme (WMEP) in the funding programme „250 MW Wind“ (1989-2006)

193.000 monthly reports of operation and 64.000 maintenance & repair reports from 1500 wind turbines

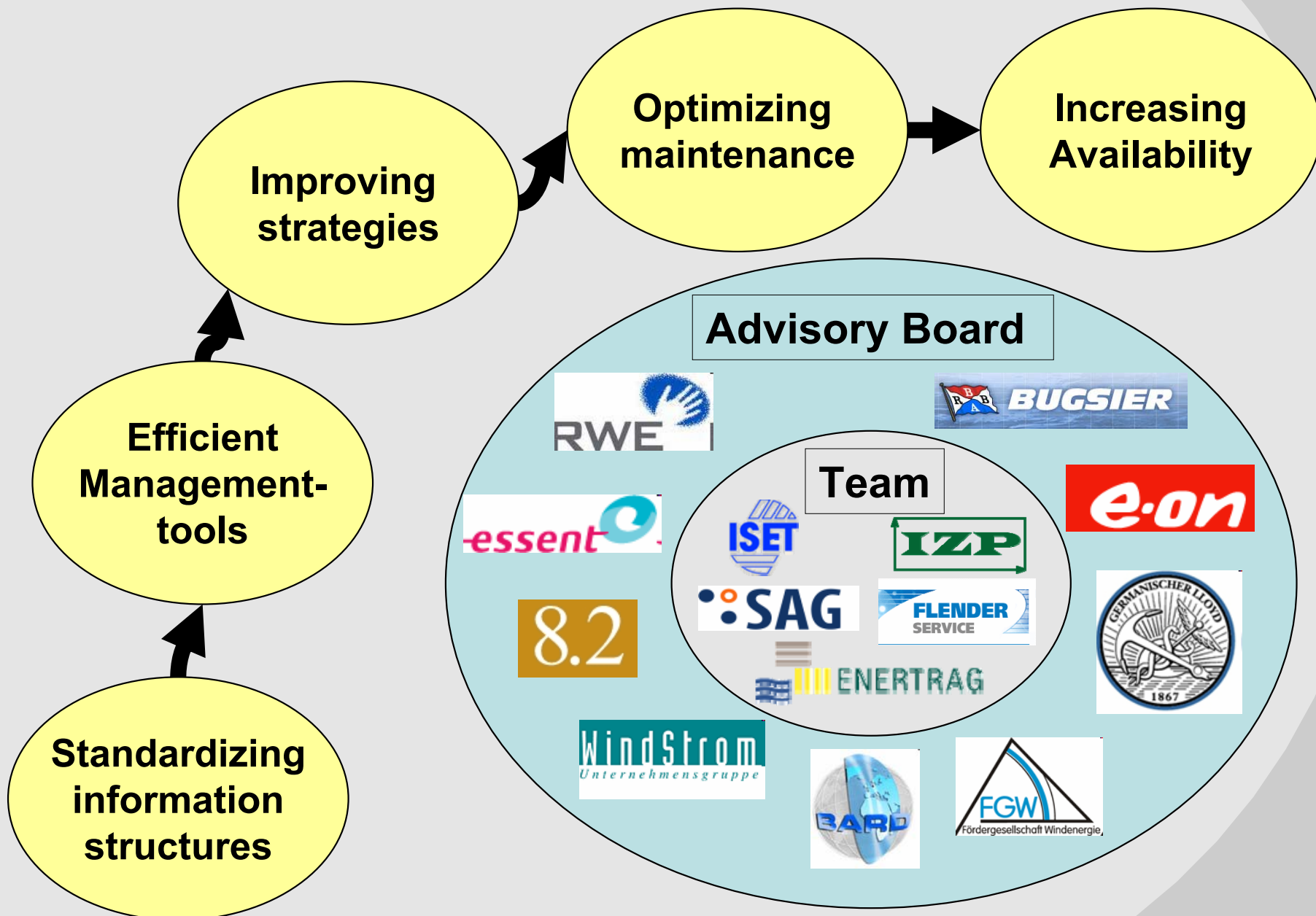
Value of experience



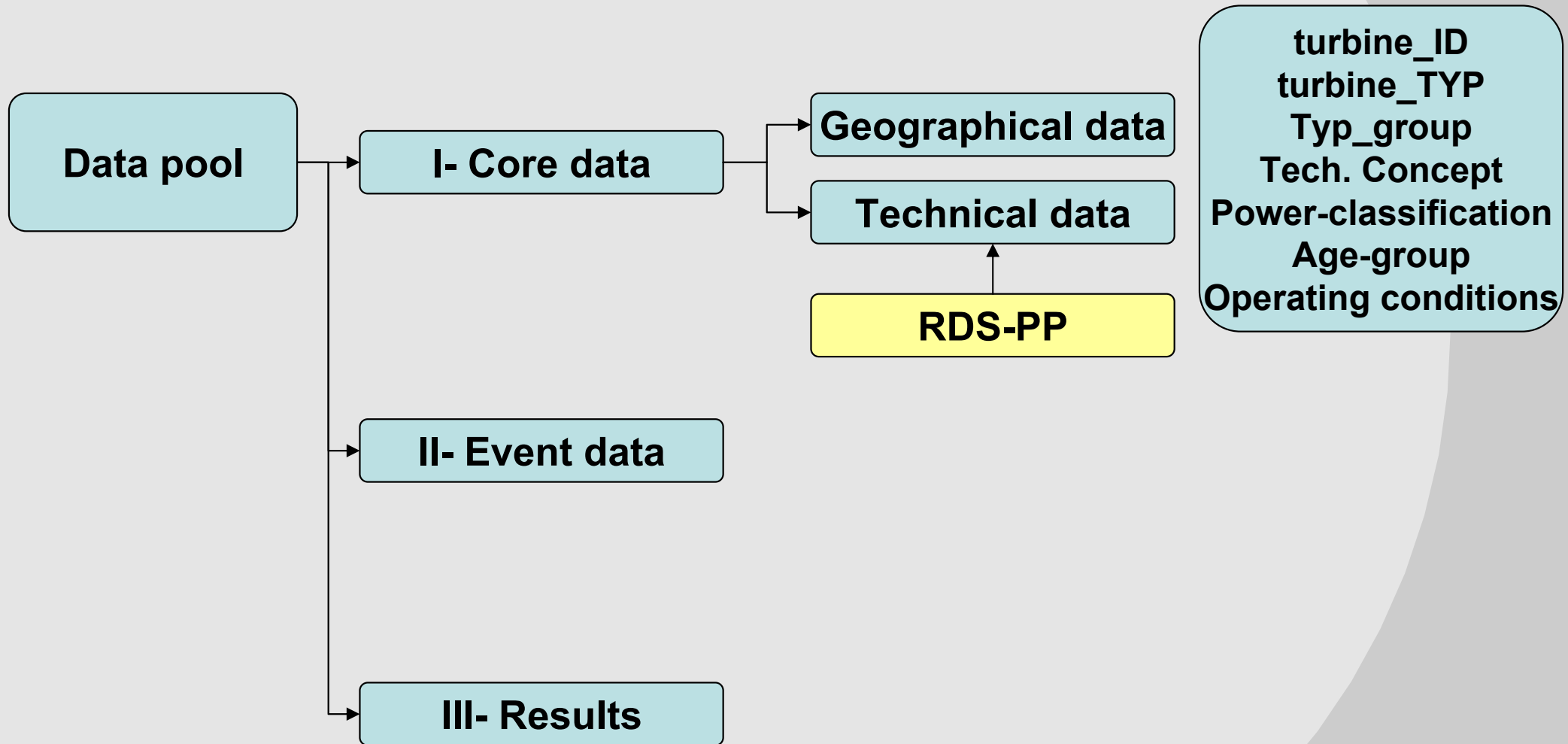
Task

- **Starting position:**
 - availability of about 95% to 99%
 - a number of faults cause unplanned down times
 - high maintenance efforts and cost
- **Task:**
 - appropriate Data structure
 - clear and unambiguous data pool
 - Differentiated analysis of reliability characteristics

Research Project „Increasing availability of WT’s“



Data structure

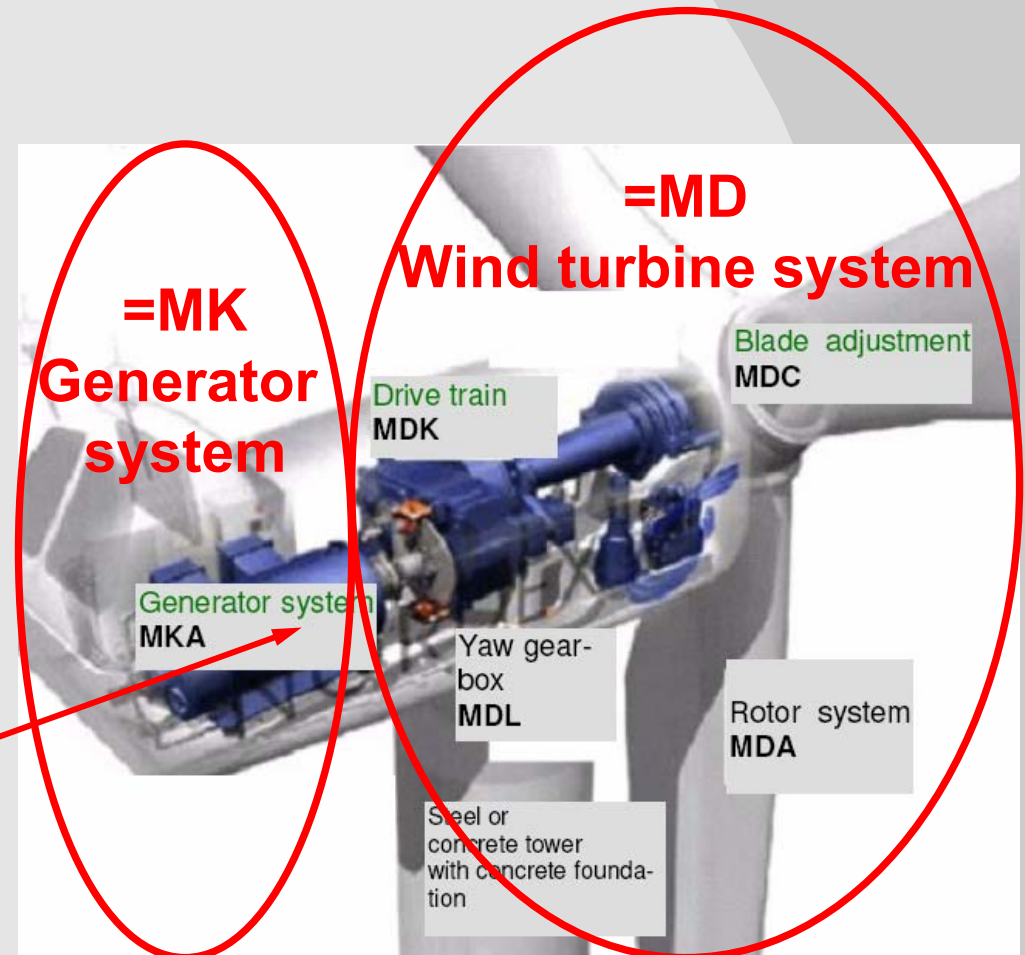


RDS-PP

- **RDS-PP:**
„reference designation system for power plants“
- **Guideline VGB-B 116**
- **Uniform indication of all functions of a system**

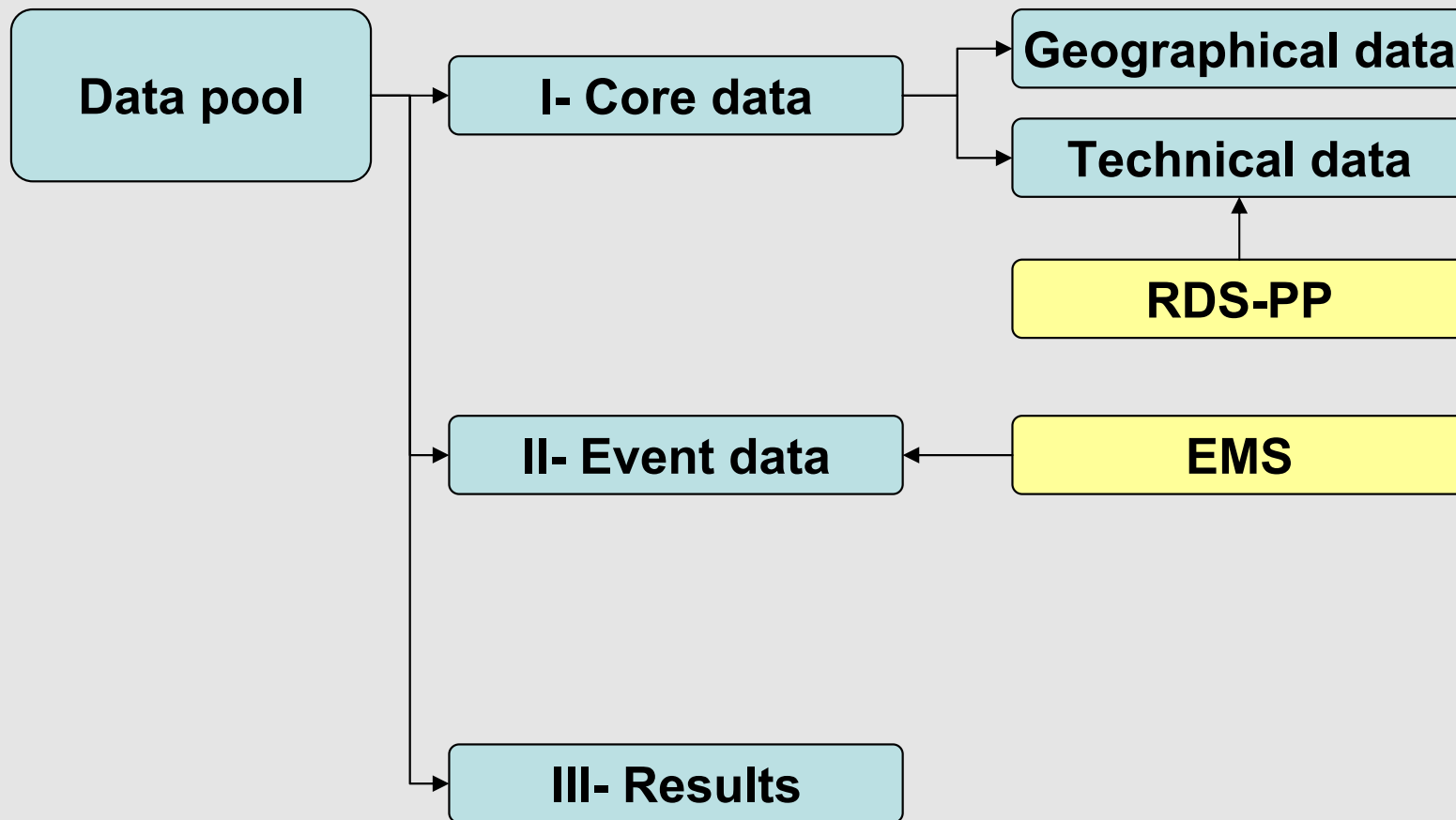


Source: Windpower.org

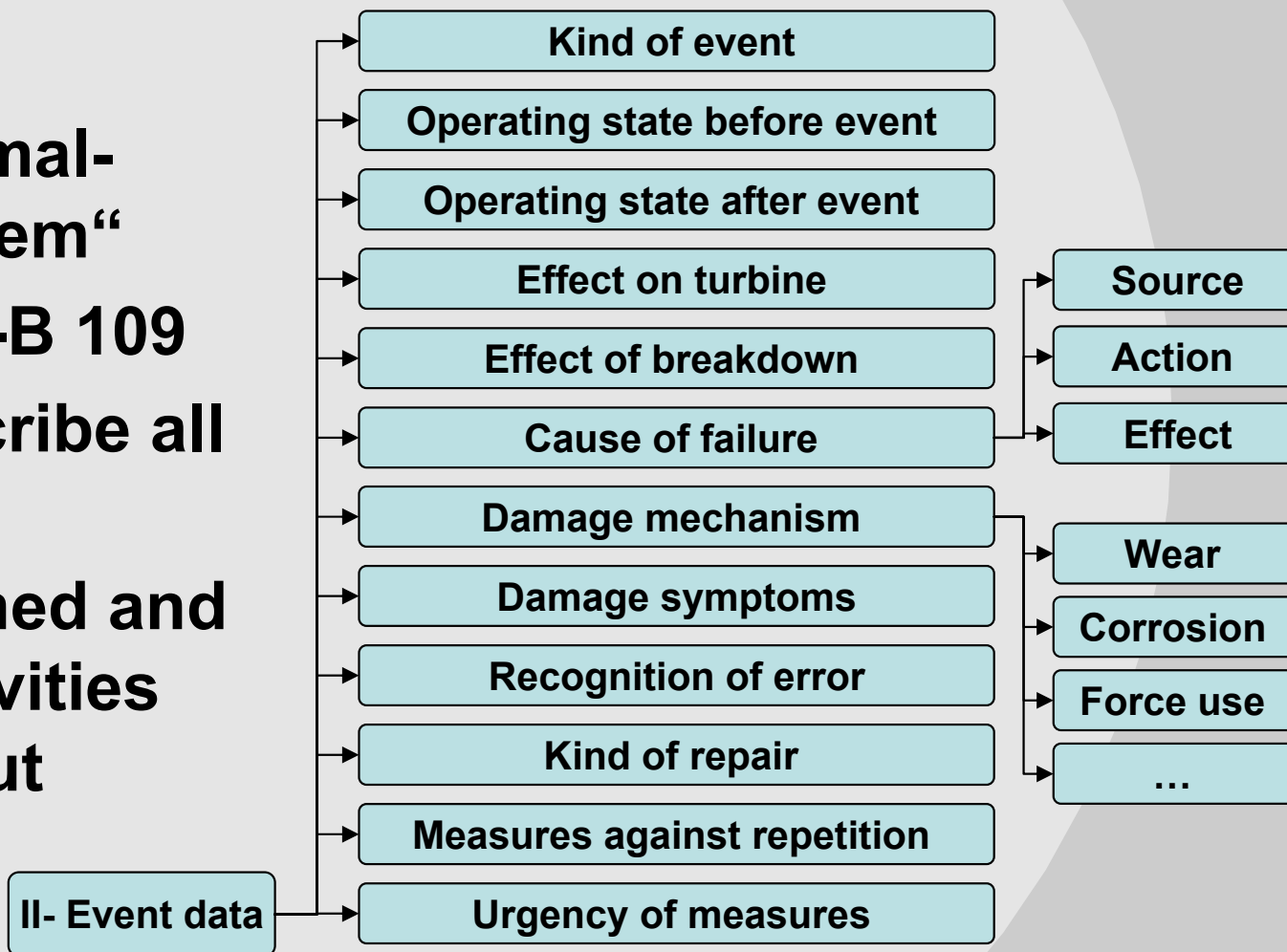


Source: VGB power tech

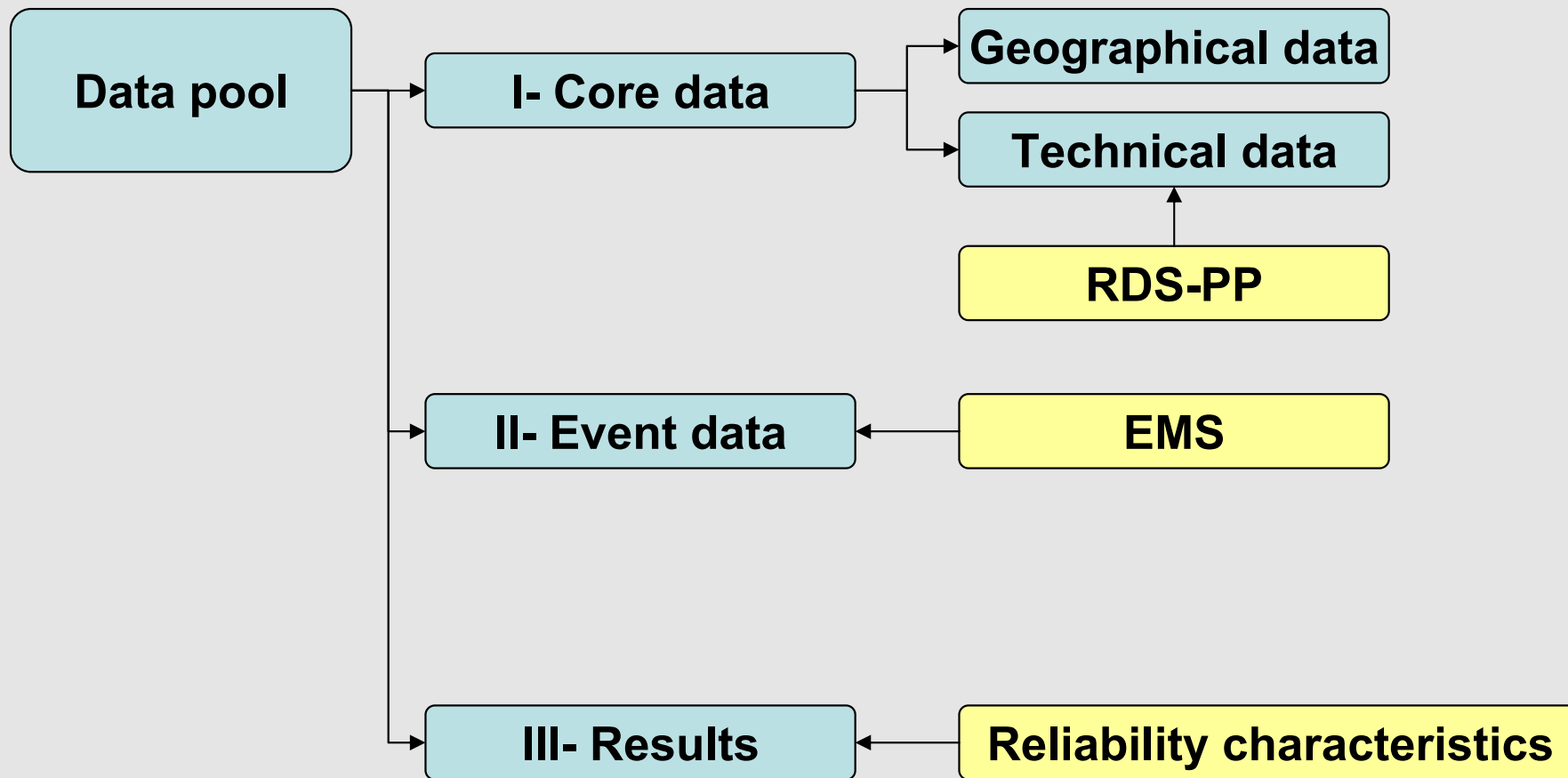
Data structure



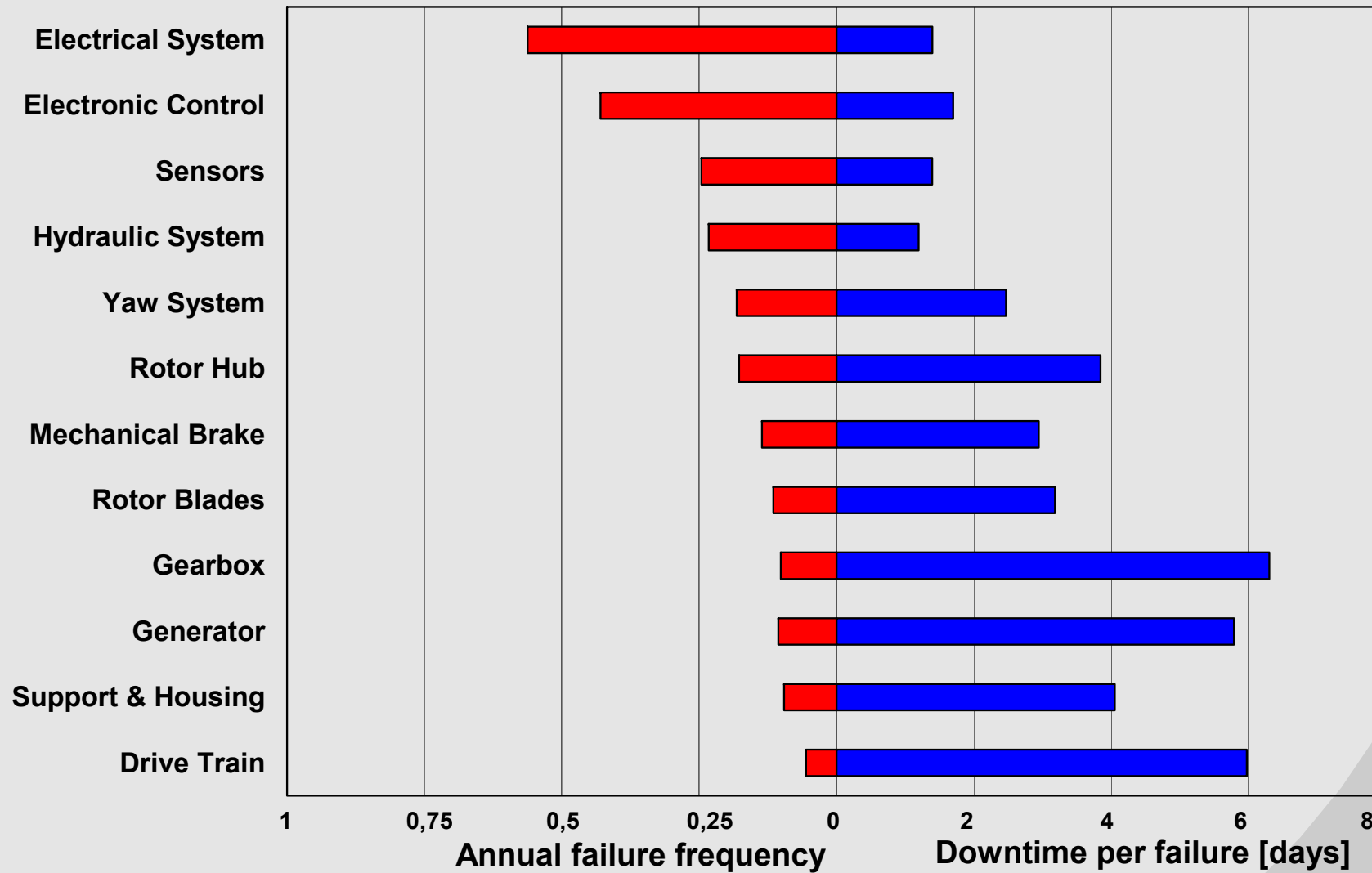
- **EMS:**
„Ereignismerkmal-Schlüssel-System“
- **Guideline VGB-B 109**
- **System to describe all events**
- **Event: all planned and unplanned activities with and without interruption**



Data structure

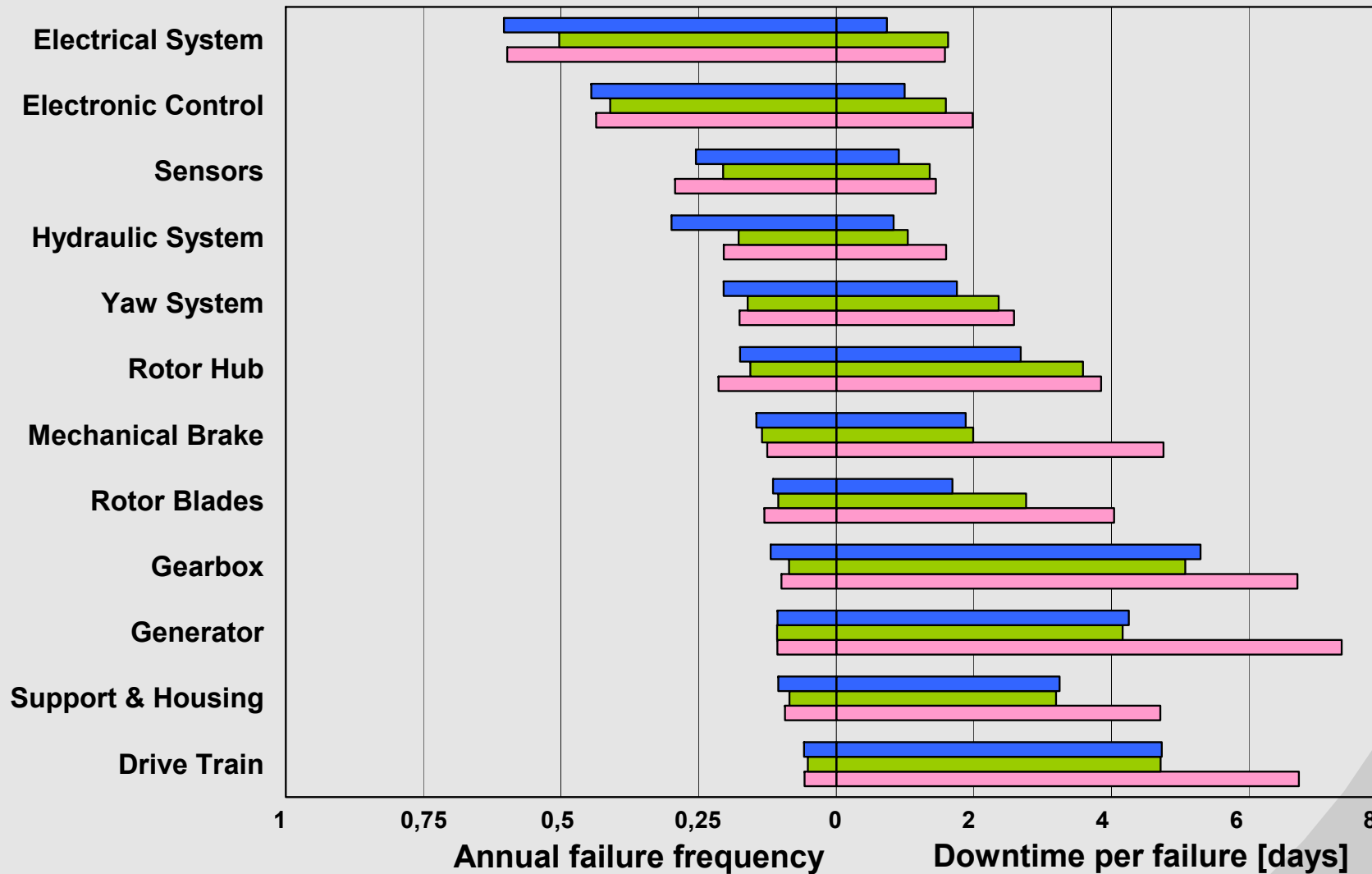


Reliability characteristics

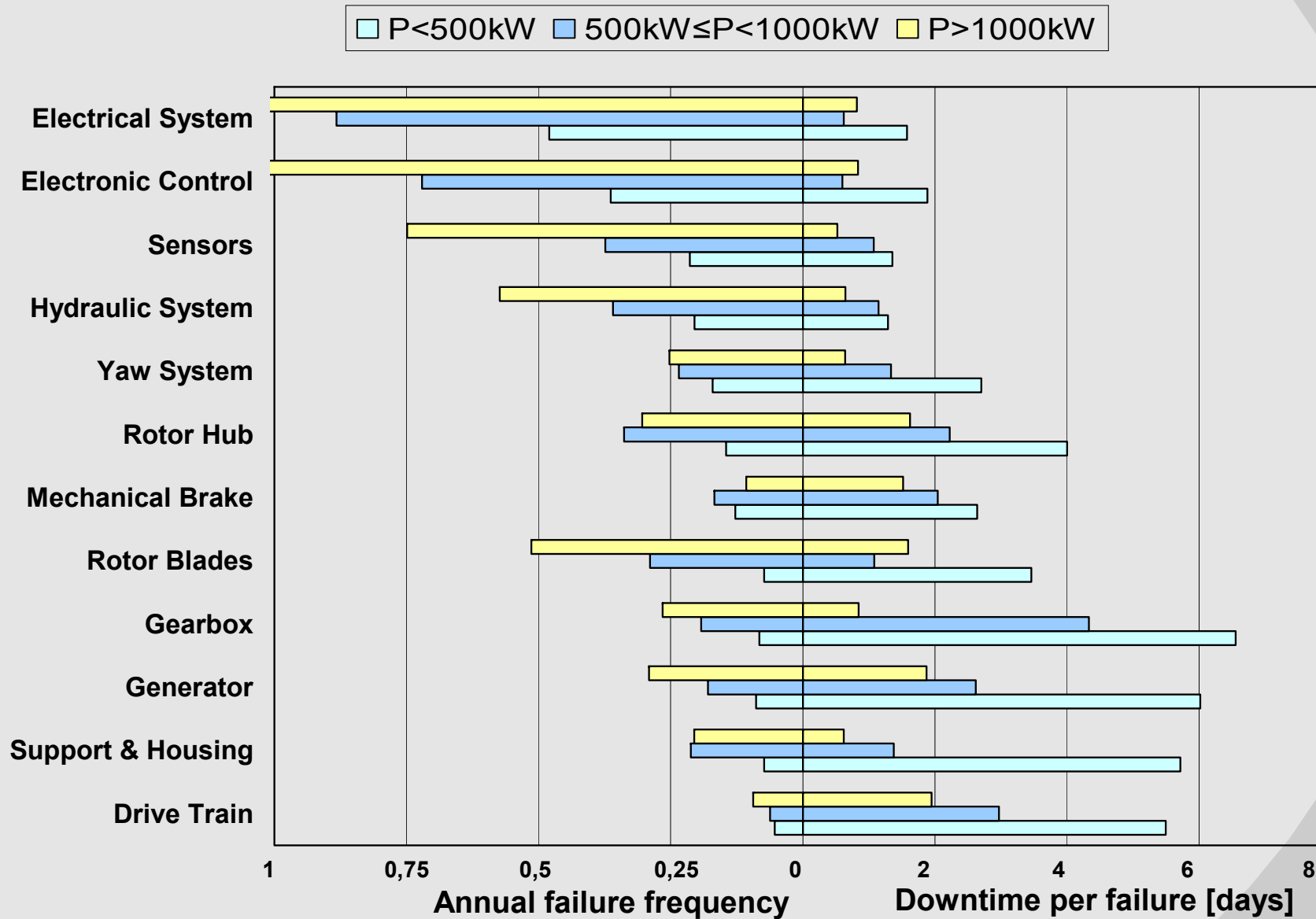


External Conditions

■ Highlands
 ■ North German Lowlands
 ■ Coast line



Small vs. Large

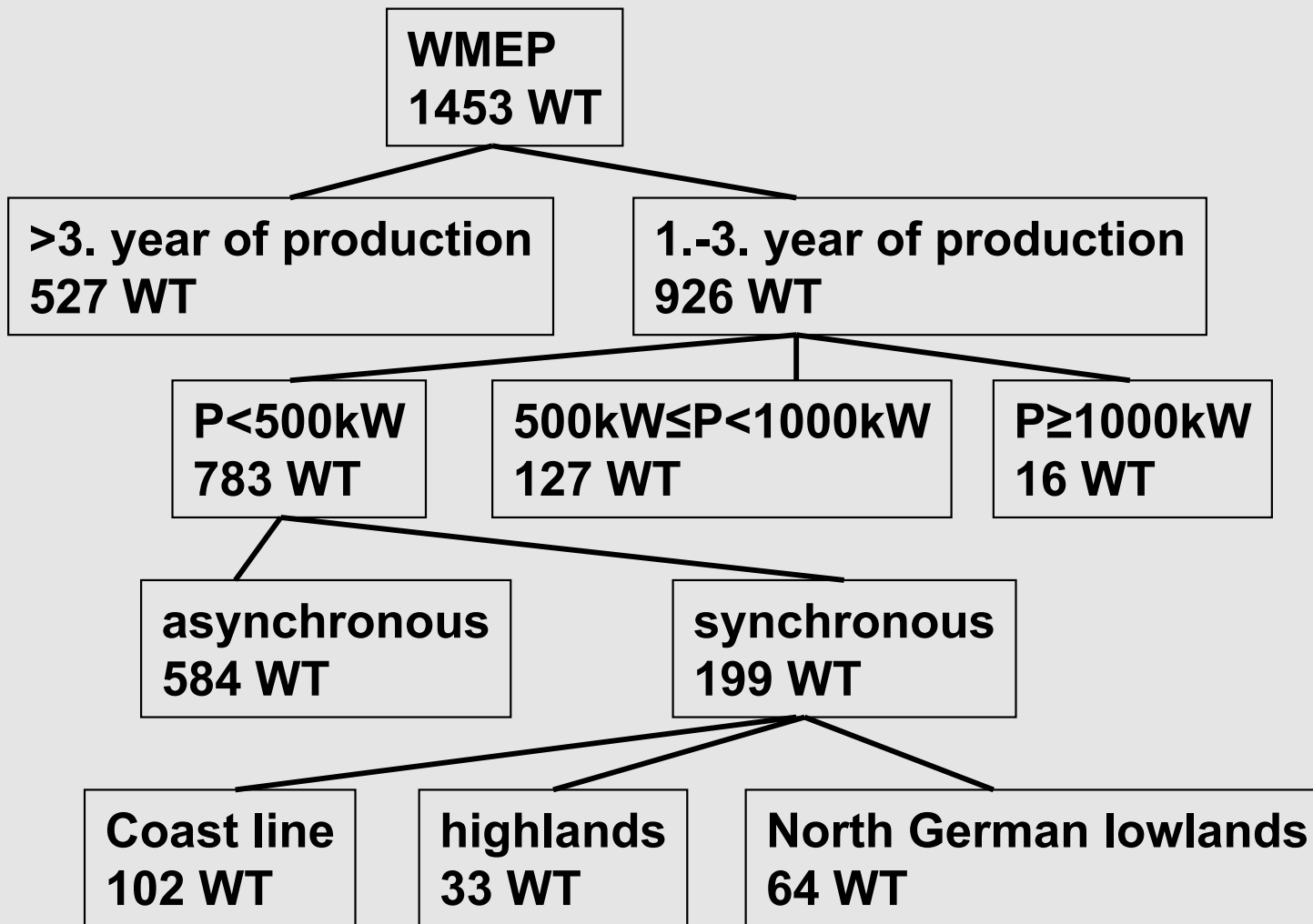


Detailed analyses

For improving the availability more detailed outcomes are necessary:

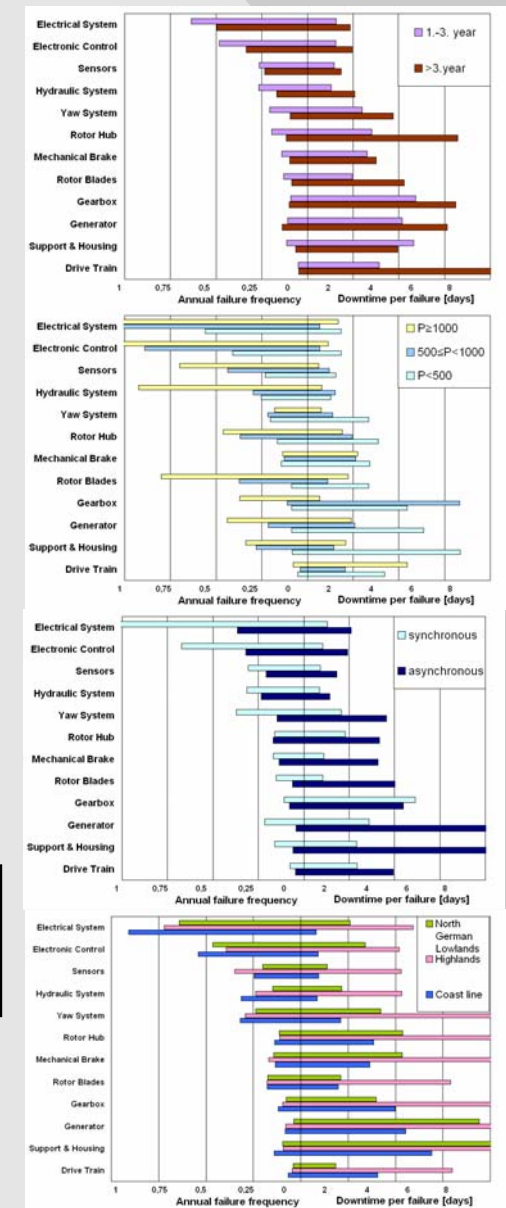
- Critical weak points for different technical concepts
- MTBF of single components of certain WT models under certain operational conditions
- MTTR of single components with different conditions for access
- Periods of time for planning, waiting and repair
- Cost of different maintenance measures
- ...

Parameter diversity



Turbine type???

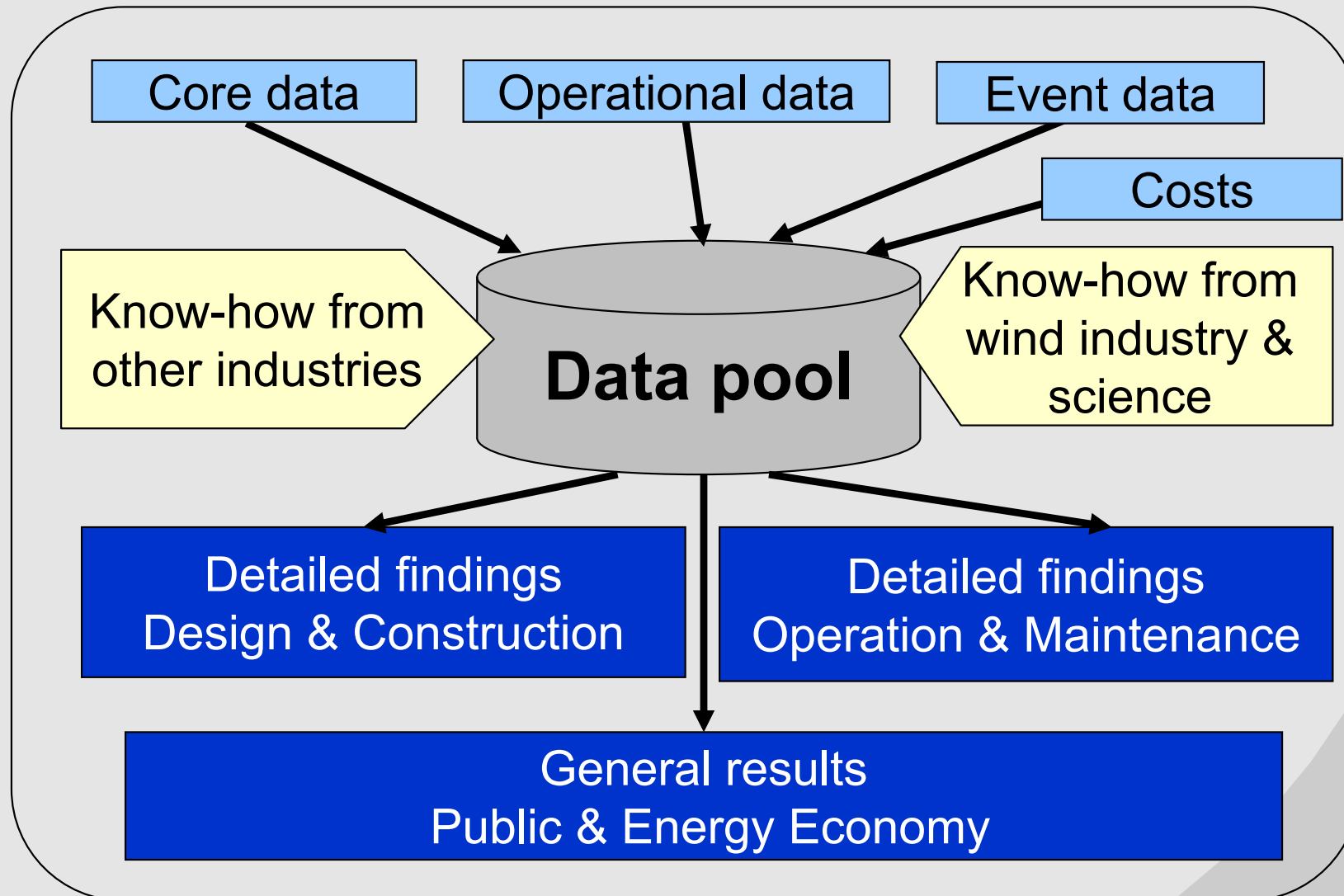
Year of operation???



Conclusion

- **Reliability of wind turbines has to get improved**
- **More detailed analyses necessary**
 - MTBF for individual components
 - MTTR with different conditions for access
 - Analyses of costs for different O&M strategies
- **Broad data base is needed**
 - joint data pool to jointly benefit from the experience
- **Common standards for the documentation of O&M measures to be defined**
- **Uniform data catalogue to be agreed on**
 - RDS-PP & EMS

Outlook





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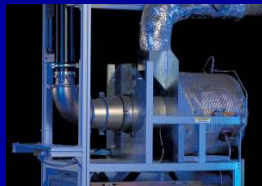
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Thank you for your attention,
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