Results (continued)

Metrics must be defined which are relevant to a broad spectrum of wind farm operations and appeal to multiple stakeholders. These should also include relevant standards within each category and incorporate the chosen taxonomy. By incorporating major standards, uniformity of the benchmarks is achieved which would not otherwise be possible and make effective peer comparison impossible. The disadvantage here is the additional time required to prepare data in accordance with the standard for those participants who not currently use those standards.

Results

Multiple taxonomies exist for describing the structure of a wind turbine; we must normalise the turbine taxonomy as part of the benchmarking process otherwise cross-peer benchmarking is notpossible. There are a number of attempts within industry to standardise the way a turbine is described:

- IEC 61400
- Reference Designation System for Power Plants (RPS-PP)
- RPS-PP VGS
- Reliawind Taxonomy
- Sandia National Labs Taxonomy

The advantages of using multiple taxonomies, with an associated mapping table, is that it allows Owners/Operators to participate in an industry benchmark without the required effort to change their component taxonomy, thus removing as barrier to participation. The disadvantage of this approach is that direct comparison of reliability data across major component and subcomponents is not possible due to the differing naming conventions and categorisations.

To maximise the amount of usable data, a single taxonomy must be utilised.

Cleansed data table is used...

<table>
<thead>
<tr>
<th>SCADA SYSTEM</th>
<th>BI SYSTEM</th>
<th>WORK ORDER SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCADA data can be considered as raw data, it is collected automatically and can be as granular as 1 second intervals. The advantage of this data is its consistency in collection and formatting. The disadvantage is that the vast quantities of data means it requires significant processing and cleaning to be usable. Business Intelligence data is the next step along the processing chain. It is filtered and made available in a more usable and user friendly format than raw SCADA data. The advantage of this data is that it is easy to quickly analyse through different parameters. The disadvantage is that it is only as powerful as the system user. Work Order System data is used to record maintenance and repairs to the wind farm. This data records specific actions undertaken as part of the O&amp;M programme. The advantage of this data is that it is the additional contextualisation through. The disadvantage of this data is that it is typically manually entered, and subject to additional errors.</td>
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</table>

Conclusions

Craftering an effective benchmarking programme, taking consideration of the required taxonomies, data acquisition and processing, output requirements and delivery, as well as providing quality assurance, is essential in order to participants to realise the following benefits:

- Comparing existing O&M performance against previously communicated performance to understand any change in performance.
- Benchmarking at portfolio, country and global level
- Understand relative operating performance across your portfolio and compared to structurally similar operators on production, cost, reliability and logistics measures.
- Track asset performance over time
- Enhance Maintenance Strategy
- Investors and planners can choose the most appropriate time frame in which to carry out repairs
- Drive Organisational Improvements
- Motivate and engage your organisation to improve by providing a baseline for current performance and informing future targets
- Inform future production, cost and safety targets in annual performance management and planning cycles

References

1. Designation of wind power plants with the Reference Designation System for Power Plants – RPS-PP® - Special Print; Ugy Rechnow, Clemens Rosso and Helmut Bork