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Anticipating failures:

How to prepare your environment for effective prognostics

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Industrial asset management benefits greatly from condition monitoring and predictive analytics. Asset performance management (APM) diagnostics provide thorough technical insights to help the operator understand when something might fail, need repair and replacement. However, answering "what if" has relied still on the expert's subjective gut feeling. As we discussed in the firs article in this series, that's no longer the case. Prognostic technologies help utilities better explore different hypotheticals to improve decision-making and operations planning. Prognostic technology offers many benefits, and in part two we go through the groundwork that an organization first needs to lay to establish an effective prognosis program.

How to prepare for prognosis

To fully reap the benefits of prognostic efforts, the organization first needs to take several preparatory steps. With this preparation, the organization can gain new understanding of equipment and, likely, identify fresh opportunities to technically optimize condition monitoring.

1. Target prognosis

The organization must first determine which equipment it wants to target to gain prognostic information. This will have the most value if the equipment is truly critical for continuous plant operations and involves considerable costs and effort in case of malfunction or failure. The best targeted equipment also has condition and process data that is being recorded and available for further quantitative processing.

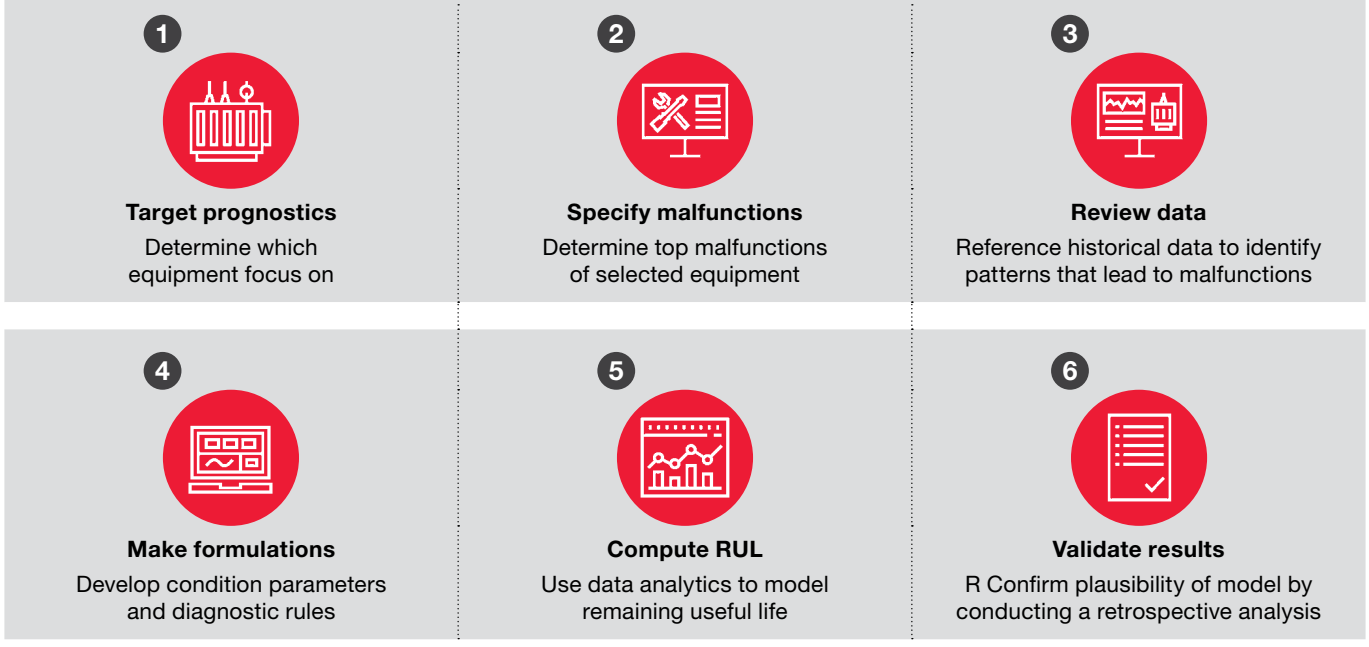
2. Specify malfunctions

Malfunctions don't always mean a complete failure or outage. Yet even when the equipment keeps running, if can be functioning well below its maximum potential. To identify suboptimal states, review the list of possible malfunctions and determine the top 10 malfunctions of the equipment type selected.

The organization may have experienced these malfunctions in the past five or ten years. Or, perhaps no expense was spared to avoid these actually happening. Either way, it's important to examine these malfunctions in depth to determine the true root cause and how they are typically detected in the data.

Operations insight.
With transparent information about future risk profiles, operators can improve operations and maintenance as well as increase maintenance scheduling efficiency.

Six steps to developing effective prognostics



3. Review data

Data analysis is only as good as its data. Having prioritized the equipment and its related malfunctions, identity all related data sources. Ensure the data history exported from the historian is reliable and accurate.

How much data history is exported will vary depending on the prognostic horizon demanded and the type of malfunction. Generally, three to five years of historical data should be sufficient.

Review the data by visualizing it over time. Try to identify data patterns that explain malfunctions.
When determining data patterns is difficult, apply advanced stochastic methods. Also verify any observations from the data with experienced plant engineers.

4. Make formulations

After carefully distinguishing between direct and indirect causal relationships, specify correlations of data to particular malfunctions. Formulate useful condition parameters that reflect diagnostic rules of thumb involving arithmetic or logical functions. During this process, consider the period of data observation and make sure to observe contingencies and dependencies on other rules. Further, determine a set of value ranges for formulated parameters.

5. Compute RUL

This stage requires advanced knowledge of data analytics. Condition and process data, as well as the complementary malfunction and parameter specifications, all need to be fed into a stochastic model. The computations will:

- Project equipment condition over an explicit time horizon
- Apply diagnostic rules at different future time stages
- Infer malfunction likelihoods based on prognostic and diagnostic results
- Obtaining a set of malfunction-specific remaining useful life (RUL) distributions
- Consolidate data for a total equipment RUL distribution
- Convert distribution to a meaningful illustration for maintenance planning

6. Validate results

It's essential to ensure the plausibility of results. Conducting a retrospective analysis validating the results with empirical observations from the past is an example. Don't stop there; continuously monitor prognostic results and ascertain their plausibility.

These six steps position the organization to analyze how current reliability management processes can be leveraged using the insights from prognostics. With newly transparent information about future risk profiles, operators can improve operations and maintenance as well as increase maintenance scheduling efficiency. Advanced prognostics tools provide foresight about the future state of assets. In so doing, the APM solution provides a basis of essential information for asset management decision making.

Final thoughts

Prognostics solutions enable operators to minimize unscheduled downtime by creating commercially optimal condition-based maintenance schedules.

Leveraging the powerful new prognostic capabilities of an advanced APM solution, plant operators can improve overall equipment performance, secure asset availability and extend asset lifecycles by avoiding excessive maintenance action and costly redundancies. Nevertheless, a prudent application of prognostic solutions requires an extended skill set. Prognostics complements and requires operator experience and manufacturer know-how, but it also necessitates a shift in thinking and language towards a risk management approach.

Learn more about our APM solution and what the power of prognostics can do for you. To fully reap the benefits of prognostic efforts, organizations need to take preparatory steps that allow them to gain new understanding of equipment and identify fresh opportunities to technically optimize condition monitoring.

Learn more about Lumada for asset and work management.

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