Age is Just a Number

Extending the Life of Aging Assets

The right maintenance strategy is performing the right task at the right time. Asset performance management (APM) is a process that ensures that assets are safe, reliable, and efficient over their operating life.

THE PERFECT storm is hitting many companies in the energy and resources industries. Declining commodity prices, rising energy and input costs, infrastructure shortages (transportation, water, energy), and the usual complexities of environmental and regulatory requirements are compounded by the fact that their assets and their workforces are aging, yet they are still expected to improve safety, increase efficiency, and reduce cost.

Many of these companies invested heavily in new facilities when commodity prices were high, competing for construction resources and materials at the same time, and pushing project costs sky high. As a result, they are burdened with large debts and drastically limited capital budgets.

To survive, they need to do more with their existing facilities and find ways to extend the life of these assets safely and reliably to ensure production.

Age is just a number, and this is true for assets, machinery, and equipment as it is for humans. A well-designed, well-operated, and well-maintained asset will live longer than one that isn’t.

Improving Reliability

Once an asset is built, the design is fixed and it is difficult from a cost perspective to change the design of an operating asset – even though throughout the lifecycle there are options for improving design through rehabilitation, replacement or extension.

Also, the conditions under which the asset is operating are always varying.
Factors such as weather, raw material quality, regulations, production demands, energy and water availability and quality, and other environmental factors put pressure on this fixed asset and impact its reliability.

Is the way in which one approaches the maintenance relatively easy to modify? Defining (and implementing) the right maintenance strategy for a specifically designed asset operating in a given context will ensure that the asset lasts longer. The question then becomes, what is meant by the right maintenance strategy?

Essentially, the right maintenance strategy is performing the right task at the right time.

In a reactive maintenance environment, too little is done too late leading to asset failures with high downtime and repair costs. On the other hand, a time-based maintenance environment, doing too much too early, leads to unnecessary parts/labour expenditure and equates to performing surgery on a healthy person.

So let’s examine failure. The graph on top of the page shows time on the horizontal axis, and the conditional probability of failure on the vertical axis tracking a key indicator of an asset’s health.

In the past, we defined failure as that point when equipment breaks or has failed, which, in the diagram above, is located at the bottom-right end of the curve. But most failures do not occur instantly, so at some point, the indicator that we are tracking begins to change, indicating that the equipment is beginning to fail. This point is not necessarily related to age. The condition of this indicator deteriorates to a point where it can be detected and this point is known as Potential Failure, point P on the curve. If the deterioration is not corrected, it will continue until the point where the asset no longer performs its intended function.

The asset may still be working, but not at the desired performance level. This is point F on the curve, which is today’s definition of failure, the point where the asset fails to perform its intended function.

The amount of time that elapses between the detection of a potential failure and its deterioration to functional failure is known as the P-F interval.

Critical information at one glance.

Optimization of a maintenance task interval.

Turning Concept into Reality

We are well aware that the real challenge is not developing the right maintenance strategy but implementing it in the field. Time-based maintenance, i.e. maintaining after fixed time intervals, is effectively implemented through the CMMS while condition-based maintenance, which is our goal, becomes a major challenge.

Asset performance management (APM) is a process that ensures that assets are safe, reliable, and efficient over their operating life. It is represented...
here by a circle to reinforce the fact that this is a continuous improvement process; it is not a one-time exercise. The process is enabled by software and supported with best practices and an implementation methodology aligned with the requirements of ISO 55001 asset management standard.

Strategy development is the foundation of the process and typical starting point to define the optimal maintenance strategy for a piece of equipment. AssetWise APM software captures information about the probability and consequence of asset failure. It uses this information to prioritize which systems should be analysed further to improve their reliability strategy and choose between the reliability practices of reliability-centred maintenance and/or maintenance task analysis to derive a better maintenance program.

The next step is implementing the reliability program in the operational and maintenance systems. This is done by defining ‘indicators’ of asset health and linking them with sources of data, whether they be online sources (data historians) or manual inspection points collected via a route that is efficiently and consistently executed on a tablet device or otherwise. Indicators, which may be simple qualitative/quantitative inputs or complex rules and calculations, are the medium that bridges this gap.

The next step is performance management, which involves monitoring the performance of the asset to ensure it is doing its intended function, such as looking for signs of deterioration and identifying potential failures. This prompts the computerized maintenance management system (CMMS) to execute the corrective maintenance task before the asset reaches its functional failure point.

The CMMS plans, schedules, and executes the work and sends an alert when the maintenance is done. It does this in an efficient manner that minimizes distribution to the production process.

In the snapshot, not only can we see the historical trend of an asset health indicator but also points (with direct access to records) of potential failures, functional failures, and task performed on the asset – all at one glance.

But the APM process doesn’t stop there. All through the process we have been collecting critical data; the fifth step is analysis and optimization, which involves analysing the data that was collected in the previous four steps. Statistical tools such as Weibull analysis can be used to analyse that data, identify deviations from our original assumptions, and continuously improve the maintenance program based on actual performance. Identifying areas for improvement and feeding them back as updates to the originally defined strategy is a key element of the process.

Devising and implementing the right maintenance strategy can only prolong life to an extent, but there comes a time that the asset has to be retired and replaced. This then leads us to another question: when is the right time to retire an asset? In other words, what is the optimal “retirement age” for a given asset in a given operating context?

Condition-based maintenance becomes a major challenge.

Optimal Asset Retirement Age

Financially, a set depreciation rate (model) is applied to the value of an asset, which determines its financial end of life. That is, the point at which, financially, the asset is invaluable and can be discarded or replaced.

Technically, keeping an asset in operation until it is financially invaluable may not be optimal. On the other hand, and this is the scenario we wish for, it may be best to continue to operate the asset even beyond its financial life.

Therefore, financial and technical aspects have to be taken into consideration when determining the asset retirement age to optimize performance, risk, and expenditure of the asset portfolio over its complete lifecycle.

Asset performance management is a continuous improvement process.

Asset health indexing (AHI) analyses asset condition, risk, history, financials and other inputs to drive capital investment strategies. AHI, as the name suggests, is an index, a normalized number used to compare and summarize the overall health of assets. The calculation algorithm is defined for asset classes but calculated for each asset individually. Asset health indices allow comparative analysis of assets not only within a class but also between classes.

By incorporating the asset condition (which in itself is a combination of multiple variables), asset priority and financial models into the index can predict long-term fact-based asset replacement and repair requirements. Once the focal assets are identified through the use of AHI, detailed (time consuming) statistical reliability assessments can be performed to analyse the various available (repair/replacement) options.

Combining Weibull analysis, reliability block diagrams and Monte Carlo simulation, available options can be modelled and simulated over time to identify the most risk-cost-effective option for asset life. These tools help you to make the right forward-looking decisions and are valuable fact-based tools to employ for defensible asset investment or asset life extension decisions.