Vysus Group

Whitepaper

Solutions for unblocking your maintenance burden

Industrial companies face the dual challenge of rising maintenance burdens and shrinking operating budgets. OEM based maintenance strategies developed during design often remain unchanged and unchallenged throughout an asset's life regardless of changing environments and commercial realities. This whitepaper explores the challenges of managing a growing maintenance burden through a maintenance optimisation process.

Introduction

Industrial companies face the challenges of increasing maintenance burden and rising pressure on operating costs. Maintenance strategies are seldom changed, except to add tasks in response to changing legislation or plant investigations. Many organisations have an underlying sense that they are doing unnecessary work (which may be evident through a high maintenance backlog) but don't know how to reduce it without adding to the risk of failure.

Maintenance optimisation uses historical asset performance, existing maintenance plans, and reliability targets to develop optimised maintenance strategies. This process has the power to balance a maintenance burden by doing the right work at the right time.

Technical and commercial challenges

Industrial facilities wrestle with a substantial maintenance burden but often lack sufficient resources to do the work. Maintenance plans are often transferred from generic OEM guidelines during design. Additions come from updates to regulations and recommendations from failure investigations. Over time, more and more tasks get added to the maintenance strategy but seldom are tasks removed. There is generally clear justification for performing each task, but much less clarity over how often they should be done.

27% savings

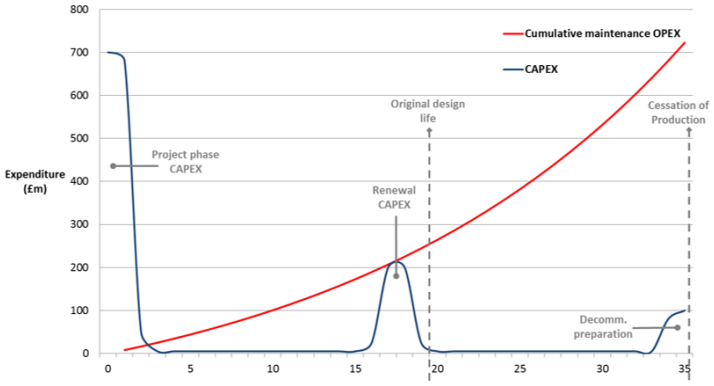
Vysus Group targeted key areas that offered the most benefit from optimisation and achieved 27% savings bringing the planned maintenance down to 245,000 hours at the cost of $74 million.

The difference between capital projects and operating plants

A typical industrial facility may have 50,000 tags, which generate 750,000 work orders at the cost of $2 billion over its 20-year life. It is interesting to note that the cumulative operating expenses (OPEX) of a plant over its life typically equate to the capital expenses (CAPEX), as shown in the graph below.

OPEX AND CAPEX

- Capital cost investments tend to be subject to rigorous scrutiny – peer reviews, design reviews, HAZOP, HAZID…… OPEX and maintenance is rarely treated in the same systematic way
- BUT over the full asset life cycle, OPEX spend is of a similar magnitude in the economic equation as CAPEX



However, far more rigorous scrutiny applies to the capital project than the day-to-day operation. Peer reviews, design reviews, HAZOPS, and other studies all play their part in defining the final project scope. But operating philosophies and maintenance strategies tend to continue unchallenged for years, even after significant production or commercial changes.

The downward spiral of increasing backlogs

Eventually, the maintenance backlog starts to grow indicating that there is too much work for the available resources. Once this trend begins, it tends to accelerate. Preventative tasks take too long to implement, and equipment breaks down. The repair scope increases, demanding more resources and causing the backlog to grow even further.

The risk of a significant failure also increases. Failures lead to downtime and disastrous safety or environmental consequences. In extreme cases, compliance to regulations may be compromised because statutory tasks fail to be done at the prescribed interval.

Many industrial facilities find themselves somewhere on this negative spiral. Maintenance departments do everything in their power to minimise their backlog growth but struggle to keep the system in balance. They may be aware of doing too much work or prioritising the wrong tasks but don't know how to resolve the problem.

Maintenance optimisation solutions

Maintenance optimisation during detail design offers the maximum return because the optimised solution applies over the entire life of the plant. However, it is never too late to begin a maintenance optimisation process. A review of the maintenance strategy while the plant is online can still yield significant benefits.

The process of maintenance optimisation

The first step is to develop a forward-looking plan. We take the existing tasks defined in the computerised maintenance management system (CMMS) and calculate the labour burden associated with that plan. The result of this step is a report that shows the labour hours per equipment type, discipline, or interval. It is a vital step to identify where maintenance expenditure happens and where the most significant opportunities are.

Depending on the site opportunities and priorities, they could move forward in one of three ways:

- Expense focussed. The focus is usually on the first four or five categories in terms of cost.
- Interval focussed. This approach focusses on the most frequent tasks, for example, all weekly activities. However, care must be taken not to overextend intervals, leading to breakdowns and the added cost of corrective maintenance.
- Discipline focussed. An analysis of which discipline has the most preventative maintenance tasks may highlight some opportunities for optimisation.

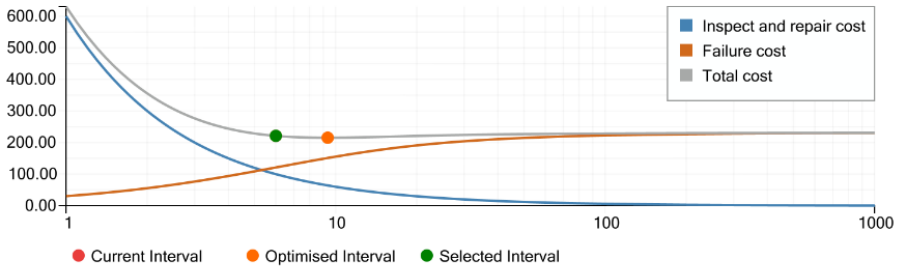
Besides a facility analysis, other inputs are also needed to perform an optimisation study. Actual maintenance costs along with reliability targets provide valuable information to the program. Failure rates and causes are also important indicators of equipment performance, especially if data comes directly from the asset maintenance history. Optimisation software tools use all these inputs and provide reports for review and action.

Sometimes, a piece of equipment may require more preventative maintenance than currently registered in the CMMS. However, this is rare, and the benefit of reduced breakdowns justifies the increased cost. In practice the optimisation process lowers the maintenance burden overall.

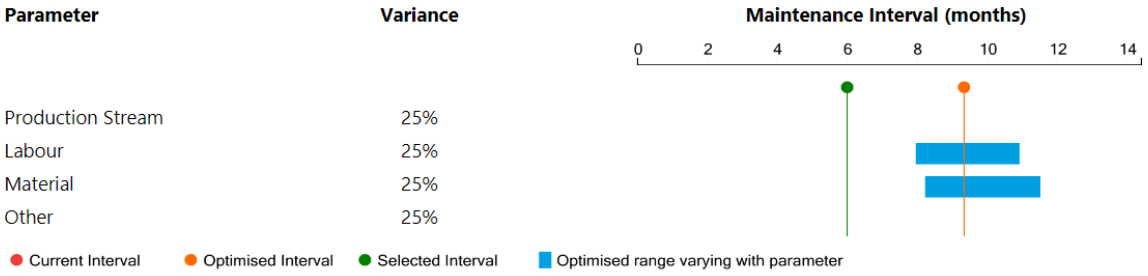
Non-safety critical equipment optimisation

The optimum point for non-critical equipment is when the total cost of ownership (TCO) is the lowest. TCO is the cost of preventative maintenance combined with the costs of repair and lost production. As the maintenance intervals extend, the cost of preventative maintenance goes down. But when that interval gets too long, the costs of repair and lost production goes up as shown in the graph below:

Cost v Interval



Sensitivity Analysis



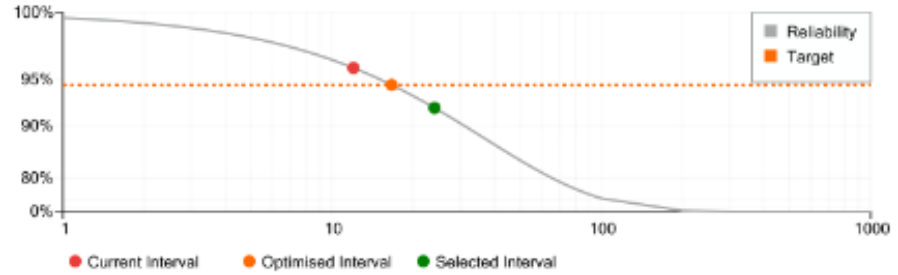
Safety Critical equipment optimisation

The optimum point for critical equipment cannot be set based on cost due to the safety implications of a failure. In this case, optimum intervals are derived from reliability targets. For example, selecting a reliability target of 95% on the graph below automatically sets the maintenance interval.

Intervals

Current: 12.00m **Optimised:** 16.64m **Benchmark:** **Selected:** 24.00m

Target v Interval



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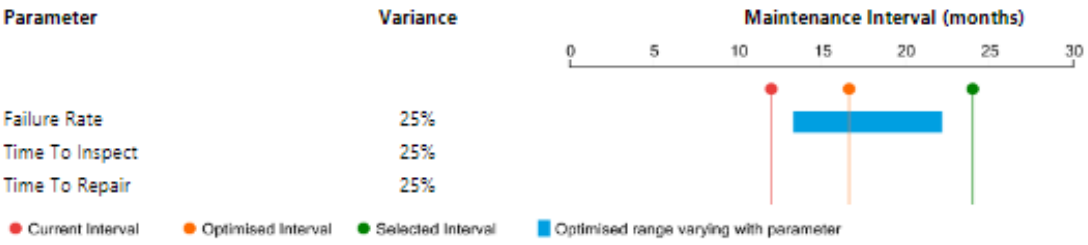

Case Studies

Vysus Group has performed maintenance optimisation studies all over the world and across diverse industries and disciplines. Some examples that illustrate the savings achievable are quoted below:

A comprehensive maintenance optimisation review of several facilities in a single client organisation covered an annual maintenance burden of 390,000 hours and $100 million. Vysus Group targeted key areas that offered the most benefit from optimisation and achieved 27% savings bringing the planned maintenance down to 245,000 hours at the cost of $74 million.

In a more focussed project, a client wanted to optimise maintenance on equipment without an immediate safety or production impact. Vysus Group focussed on the low voltage (LV) electric motor population, including items that could run to failure with minimal impact. The study covered 970 items and took three weeks to complete. LV motor annual maintenance hours reduced by 7127 with a 65% savings on maintenance costs.

In another example Vysus Group recently completed a pilot study with KOTUG International a leading towage company, on the maintenance regime for two medium speed four stroke diesel engines. The scope was to optimise interventions utilising a condition monitoring strategy, reducing intrusive interventions and component replacement based on client historical data and failure rates. The Pilot identified potential savings of 1 million dollars over the estimated remaining life of the vessel reviewed. Koos Smoor (Manager Fleetperformance & Innovation) said that KOTUG were very pleased to participate in this pilot, as an innovative organisation we like to stay ahead with these developments, it gave us many useful insights and highlighted potential savings.

It is crucial to note that these are not one-off savings. Maintenance optimisation reduces the labour burden over the entire remaining life of the plant. In other words, these savings accumulate each year. A reduction in labour burden can free up skilled resources for further value-adding work.

How to compensate for low quality source data

Maintenance optimisation relies on quality input data for the optimisation algorithms. Incomplete or unreliable CMMS information can skew the interpretation of failure rates and causes. But compensation for uncertainty in source data is possible using the sensitivity parameter. This parameter defines data confidence in numerical terms, which is taken into account during the optimisation.

65% savings

LV motor annual maintenance hours reduced by 7127 with a 65% savings on maintenance costs.

We can also improve source data quality by including reference libraries. Vysus Group has a substantial internal reference library for comparing equipment class performance. We also have access to industry standards like OREDA, which has a similar function. Our engineers work with these data sources continuously, which means we have a high level of expertise in interpreting and applying the data. Any discrepancies between plant and reference data can be explored further to verify reliability targets.

There is some leeway available in how aggressive to be with implementation. Choosing a safety margin between the optimum point and the current maintenance interval allows for a step-by-step approach. Further adjustments are possible after monitoring the initial results.

Even if the source data is not perfect, sensitivity factors and reference libraries can help attain most of the available benefits.

Conclusion

Increasing maintenance burdens and reducing operating budgets is putting pressure on industrial plants globally. However, a thoughtful maintenance optimisation process can help to overcome these challenges.

Vysus Group helps industrial clients analyse their existing maintenance strategy and collect the source data necessary for optimisation. We use software models to make data-based decisions on maintenance tasks and intervals to reduce the maintenance burden at their facilities. Our solutions take risk and reliability targets into account, viewing maintenance costs as an investment with corresponding safety and commercial benefits.

Vysus Group adopts a collaborative approach to projects, helping our clients to solve their problems and analyse results. We work alongside our clients to execute the optimised maintenance strategy and produce management of change (MOC) documents to implement recommendations from the study.

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