Condition Based Risk Management (CBRM)

Using probability of asset failure and consequece of failure to help you understand the risk of owning, maintaining and replacing your assets

What is CBRM?

CBRM is a powerful process that enables companies to use current asset information, engineering knowledge and practical experience to predict future asset condition, performance and risk for their assets. It is a comprehensive management methodology, which is well proven by users worldwide and ready for immediate implementation. For each asset:

- A health index - numeric definition of condition
- Probability of failure (POF)
- Risk - expressed in monetary terms (£s, $s or €s)
- Asset Criticality

For asset groups (including Transformers, Switchgear, Cables, Wood Poles, Steel Towers, Gas network assets):

- Health index profiles – overall distribution of health indices
- Failure rates
- Total risk
- Models intervention strategies (repair/replacement of an asset)
- Calculates results now and predicts the future

The process enables the current health index to be aged so that future, condition, performance (failures or failure rates) and risk can be estimated with and without interventions.

Condition - Health Index

Quantifying risk

The risk calculation is based on combining the POF value obtained from the health index with the consequences of failure. The consequences of failure are defined in several categories, typically network performance, safety, financial and environmental. In each category the average consequences are estimated (based where possible on recent failures). In each of the categories the consequences have their own specific units (e.g. CMLs/CIS/SAIDI/SAIFI for network performance, fatalities and injuries for safety, £s, $s or €s for financial and litres of oil, kgs of SF6, etc for environmental). Each of these consequences is given a monetary value. The overall risk is therefore calculated in monetary terms. The relative importance of individual assets can be accounted for by defining the 'criticality' of the asset separately in each of the categories.

The significance of risk in investment planning

The significance of risk in asset management decision making terms is two-fold. Firstly, it provides the opportunity to consider the criticality of individual assets. The asset in worst condition, with the highest POF, may not be the asset which poses the largest risk that may be a more critical asset that is in better condition. Secondly, and more importantly, quantifying risk enables comparisons to be made across asset groups. Because the measure of risk is the same for all assets, the benefit (the reduction in risk) for any intervention involving any combination of different assets can be compared. Therefore risk quantification potentially offers asset managers an invaluable planning tool; the ability to rank all investment projects on the basis of cost/benefit, and perhaps the ultimate ability to define the financially optimum risk profile and future investment plan. The potential power of this is illustrated further in the following section.
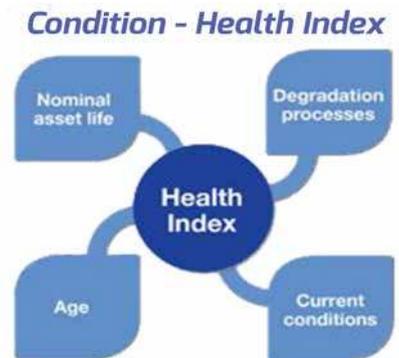
Financial optimisation

By quantifying risk in financial terms, CBRM provides the possibility of financial optimization of investment.

Using a simple Net Present Value (NPV) model, the cost of investment (which in NPV terms decreases if the investment is delayed) can be balanced against the increasing risk if an asset in poor condition, with an increasing POF and risk, is left on the network. This is shown in Figure 1. Different scenarios can be modelled to simulate different levels of investment using either a percentage annual replacement figure (i.e. replace the top 1% of highest risk assets each year) or an asset by asset targeted plan can be entered for replacement and maintenance activity. The impact of the strategy can be viewed in terms of the change to the risk profile over time for all assets and for individual assets.

For any asset the optimum replacement time (the time at which the sum of the investment cost and risk is at a minimum) can be calculated.

This provides a means to define the optimum replacement programme (the most cost effective programme) across all asset groups.

Compare investment secenarios

Risk = Probability x Consequences

- No investment
- 3.3% replacement (optimum investment)
- 1.5% replacement (reduced investment)
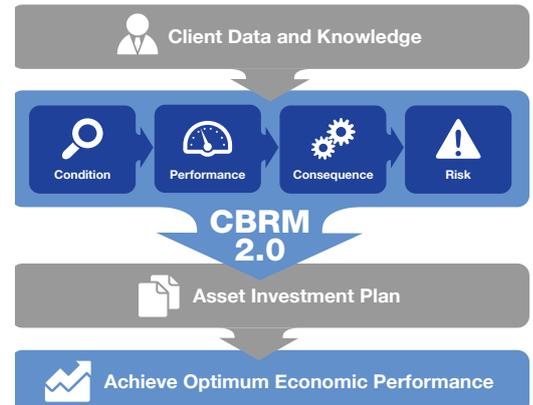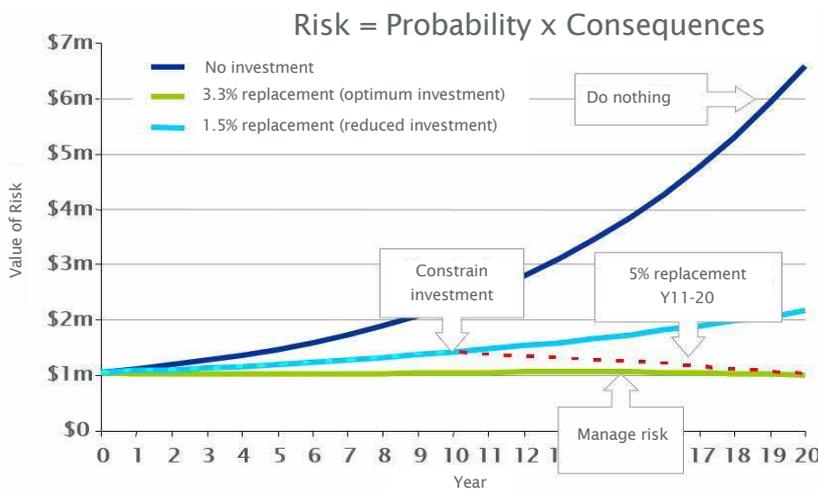
"CBRM is delivering the potential for considerable savings by optimising ongoing investment plans"

Figure 1 (Left): The NPV/risk curves for an individual asset, defining the optimum replacement year

Benefits

- Provides owners & operators with a methodology for rational investment in asset maintenance and replacement
  - Based on probability of failure and the consequence of failure
  - Assists owners with portfolio risk management, associated with
    - Location
    - Client Data and Knowledge
    - Asset types
    - Manufacturers
  - Assists with prioritisation of investment
- Provides operators with real cost savings in operations and maintenance
- Rational maintenance/intervention planning
- Prioritisation of maintenance/interventions
- Real cost savings in operations and maintenance
- Real cost savings in operations and maintenance

A proven approach

Developed by EA Technology, CBRM has been used by UK Electricity Distribution Network Operators (DNOs) for over ten years.

Over this period Ofgem have introduced regulatory reporting requirements for DNOs to report information relating to both asset health and criticality. Known as Network Asset Indices, these reports provide an indication of the risk of condition based failure of the network asset.

For further information call 0151 347 2313 or email sales@eatechnology.com

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