

EA Technology suggests industry should follow the example of the electricity companies and switch to condition-based maintenance for its oil-filled switchgear.

# Maintaining switchgear the supply industry way

**M**any things have changed since the government privatised the UK's electricity supply industry in 1990 – and some of those changes have not been easy for the previously engineering-led companies to accept.

Since privatisation, distribution network operators (DNOs) have been under pressure to generate profits for their shareholders by keeping expensive maintenance to a minimum, while simultaneously satisfying industry regulator Ofgem that they are doing their best to maintain reliable networks.

According to its proponents, condition-based management of assets such as switchgear can help DNOs meet these apparently contradictory aims, and CBM has become increasingly popular in the electricity supply industry over the past decade. “Probably all of the DNOs are now using condition-based asset management to maintain their 11kV

switchgear,” says Anne McIntosh, lead consultant on materials and failure investigations at EA Technology.

## GOOD CONDITION

Condition-based maintenance is just one of four ways to manage the upkeep of engineering assets. The first is simply to run your plant until it breaks down and then tackle the maintenance. There is little support for this in an industry attempting to improve the security of its supplies.

The next approach is to schedule maintenance at regular intervals – scheduled, or time-based, maintenance. Although it is still popular outside the electricity supply, TBM is best suited to equipment that operates continuously and is subject to a predictable amount of wear and tear between visits from the maintenance staff.

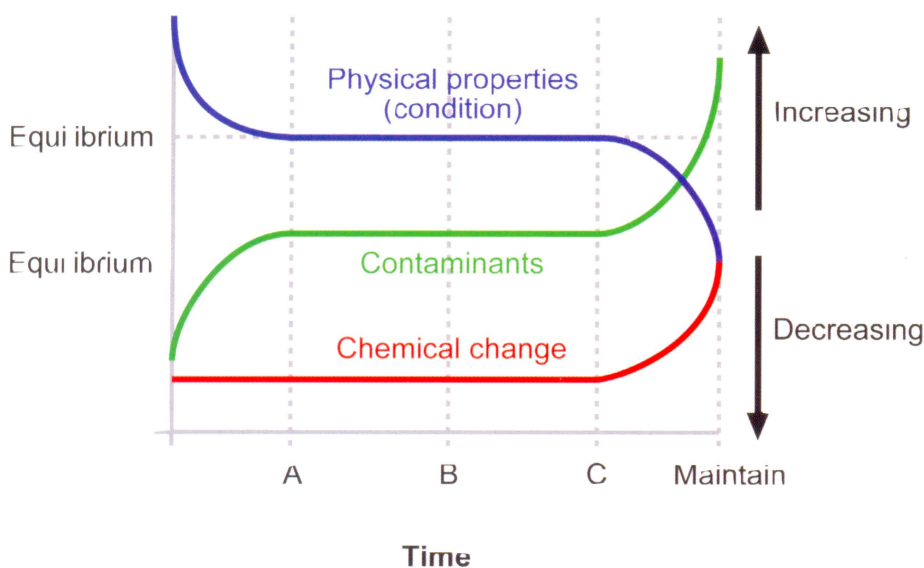
In contrast, condition-based maintenance is more suitable for equipment that operates occasionally – even only once or twice a year. Technicians monitor a parameter that indicates the condition of the equipment to determine the best interval between maintenance visits. In the case of oil-filled switchgear, they take a small sample of oil and analyse it for the products of corrosion or wear. CBM does not, however, take account of the impact of equipment failure on the electricity system.

Reliability-centred maintenance also weighs up the importance of the equipment to the whole system and the consequences of a failure. In many quarters RCM is considered more cost-effective than CBM but some industry insiders cynically suggest that reliability-centred maintenance often equals no maintenance.

A DNO must choose a maintenance regime that strikes the right balance between the reliability and quality of supply and the cost of equipment and maintenance – something that has become more pressing in the post-privatisation world.

## CONFIRMATION

The DTI has confirmed the growing popularity of condition-based maintenance in the supply



EA Technology's analysis of the physical and chemical changes in 11kV switchgear over time. It uses this information to establish appropriate maintenance intervals.

industry. Bill Slegg and Simon Faiers of consultancy British Power International, in their report *Resilience of the Electricity Transmission and Distribution Systems*, say: "Distribution network operators have migrated, or are in the process of migrating, from time-based to condition-based maintenance regimes."

And, in December 2002, industry regulator Ofgem published the results of its first survey of asset risk management. It concluded that: "Some companies have carried out comprehensive studies to identify asset and network risks and have defined the asset conditions which impact network performance... Some companies have used these defined conditions to derive their inspection and maintenance policy."

The report points out that Ofgem seeks to promote, and test, "good asset stewardship" in the energy industries.

### INDUSTRIAL STRENGTH

Now EA Technology says industry and the public sector could save millions of pounds by following the electricity supply industry's lead and adopting the same maintenance philosophies for oil-filled 11kV switchgear.

EA technology argues condition-based switchgear maintenance lets operators extend service intervals by many years, while improving reliability and safety. "Optimising maintenance regimes on the basis of condition could cut costs by more than 80%, from around £650 per switchgear set to less than £110 – or more than £100m for the approximately 200,000 units in Britain," says McIntosh. "Our research proves that, by applying effective condition-assessment techniques to switchgear, the vast majority of units will operate safely and reliably for many years without additional maintenance. This is confirmed by several reliability-centred maintenance studies."

### PLAYING CATCH-UP

Of course, industry has some catching up to do. "The DNOs are further down the road than the private networks are," says McIntosh. "People have been slow to come around, but they have vast populations of switchgear that they need to monitor and condition-based asset management is becoming extremely popular."

As a purveyor of asset management tools and services, EA Technology clearly has an axe to grind, but it says the financial logic is unassailable. Many of its arguments were developed as it worked for three years with a large UK electricity company to develop a Live Tank Oil Sampling system. Using LTOS, switchgear users can take a 50ml sample of oil while the equipment is partially energised, removing the need to isolate and shut it down – an important consideration in industry.

EA Technology's tests on oil from more than 500 switchgear units due for maintenance at



Siemens press picture

the end of a 10-year interval revealed that less than 1% actually needed attention within the next six months. Less than 7% would need re-testing within 30-36 months and the condition of over 90% of the units was such that re-testing and maintenance could be postponed for several years.

All the talk of lengthening intervals between maintenance for ageing oil-filled switchgear should be ringing alarm bells for *Electrical Review* readers. For several years, there have been fears about the safety of poorly maintained, manually operated, oil-filled switchgear, which has a habit of exploding if opened or closed under load by an inexperienced or hesitant operator.

### OUT OF SIGHT...

Many in industry have adopted an 'out of sight, out of mind' attitude to such equipment. "One of two things tends to have happened," says McIntosh, "switchgear has either been completely forgotten about or it is being desperately over-maintained."

Ironically, CBM could reduce the risks associated with maintaining such switchgear because it might be shut down for maintenance less frequently. "Shutting down switchgear at

regular intervals to inspect and maintain the unit can positively induce faults, and carries risks for maintenance personnel," says McIntosh. "There are also major implications in terms of isolating the switch, shutting down plant, the expense of the maintenance itself and the cost of bringing in backup power supplies if required."

### TECHNOLOGY

Today, much of the switchgear on the market is designed with condition-based maintenance in mind and is fitted with sensors for automatic and continuous monitoring. For older switchgear, it may be possible to retrofit monitoring equipment at the substation, although this is an expensive option.

The reality is that, because of the long life of most switchgear, manual tests for condition-based maintenance will be with us for decades. There is plenty of pre-1970's, oil-filled switchgear in service today. "Oil-filled switchgear, whilst very old, was well designed and probably over-engineered in the first place," says McIntosh.

CBM is here to stay – and where the electricity supply industry leads, private networks look set to follow. ■