

## **Long-Term Optimization of Outage Performance**

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Deregulation of the power markets and the accompanying pressure on electricity prices have forced all electric utilities to reduce their power generating costs in order to be able to hold their own in the new market environment.

This has also particularly affected the operators of nuclear power plants since they have to compete against the lower power generating costs of fossil-fired combined-cycle power plants and, in Germany, are faced with a difficult political climate.

The areas identified as having the greatest cost-cutting potential were fuel costs, operating costs and measures to increase plant availability. The main objective behind increasing plant availability was not only to improve the already high standard of operational reliability and plant safety even further, but also to significantly shorten the downtime needed for annual refueling outages.

In addition to carrying out benchmark studies with comparable plants, a variety of measures were discussed and quickly implemented. One of the first comprised long-term outage planning in which the planning of individual outages was combined into an overall outage concept spanning several years.

In order to reduce the number of systems requiring isolation during each outage, the so-called "production-oriented" outage was introduced in which major system outage work is performed on just one redundant subsystem at a time.

Analyses of the processes involved in outage tasks such as reactor servicing, in-service inspections, valve maintenance or work on specific components led to improvements in both costs and job sequences. For example, the time needed for removing and re-installing the reactor pressure vessel (RPV) closure head, for discharging and reloading the fuel assemblies and for manipulating core components and RPV internals along with all the necessary inspections was thus able to be considerably reduced. A 100% RPV inspection or eddy-current examination of the steam generators now takes less than half the time needed in the early 1990s.

These successes have been achieved not only through process improvements but also by introducing new, innovative technologies and integrating powerful data processing tools into the above service activities.

On-line valve diagnostics has served to provide up-to-date information at all times on present valve conditions while at the same time reducing the scope of valve maintenance activities to just those that are actually needed.

By awarding contracts for large service packages, nuclear plant operators have given service providers additional opportunities for reducing costs by utilizing synergies. Long-term contracts have increased this potential and also result in a closer partnership between plant operators and service providers.

In the future, it will be important to keep outage performance at its currently high level, although there is certainly potential for improvements here and there, and to stabilize overall outage performance reliability.