



# Maintenance - Quo Vadis?

Dipl.-Kfm. Gerhard Dewender

Dipl.-Ing. Jürgen Kaulitz

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## **Abstract**

The loss of capacity in Germany between 2005 and 2200 is expected to range from approximately 20 to 50 GW, depending on the hypothetical scenario: Phasing out of nuclear energy, service life of conventional power plants and compliance with the CO<sub>2</sub> reduction commitments according to the Kyoto Protocol.

About one third of the lignite capacity and one fourth of the existing hard-coal capacity have exceeded 30 years. In addition, the phasing out of nuclear energy increases the demand for new power plant capacities by approximately 20 GW.

Numerous power plant projects have been announced. Their total capacity will add up to about 18,000 MW by 2012, i.e. by the end of the second CO<sub>2</sub> trading period. The majority of planned facilities are hard coal-fired power plants at approximately 55 %, whereas the share of lignite-fired power plants will cover around 15 %. The stated aim is to build uniform-sized power plants. With regard to hard-coal fired power plants, units up to 1,100 MW constitute the target objective.

So what, with view to the above, are the framework conditions for the field of power plant service and maintenance? In which way will the conflicting priorities – attractive new plants and required service of existing plants – take effect? Will there be sufficient resources – raw material, upgrading capacities and specialist staff?

The importance of continuous quality assurance and on-schedule delivery is growing steadily and this pertains to plant operators, manufacturers, suppliers and service companies in equal measure.

## **Introduction**

The motto of the VGB-congress “The future is reality – investing into new power plants” reflects the generally optimistic mood. The industry continues on an upward trend, new power plants are presently being built and other tasks are being processed simultaneously. At the same time, old power plants are expected to continue operating, with a higher, degree of availability, if possible, but at a consistent cost level, and this target applies to maintenance tasks as well.

A great number of stakeholders and lobbies are now speaking up to verbalize their positive expectations. Everyone is focussing on the upward trend. The enormous challenges, however, which are attached to this development, cannot be disregarded.

Three protagonists are now entering this arena of challenges. On one hand, there are the power plant operators who have been rather reluctant regarding investments over the past years; on the other hand, there are the manufacturers and the plant engineering and construction enterprises who consider themselves to be at the end of a long dry spell. In addition, we have the power plant service branch, the power plant engineering service staff, who is expected to look after the existing power plant business and who, at the same time, has to be available to perform new installations.

Manufacturers/plant engineering and construction enterprises, suppliers, maintenance and service companies, all of us can look forward to big business. However, the mistakes of the past are now catching up with us.

### **Where are we now, where are we coming from and where are we going?**

For the past twenty years, no real new investments have been made. Above that, we are lacking one whole generation of junior staff. We have not made enough efforts, apprenticeship positions have been neglected, trainee programmes cut and technical apprentices have not been offered permanent jobs at the end of their training as it was done before.

A lot of new challenges are approaching at a rapid pace – in the field of existing power plants and in the one of new building projects.

Not every group being in some way involved in the construction of new power plants can be mentioned here. However, we can be sure that the expectations within the supplying industry where, in the meantime, many private equity companies have become owners, are high with view to securing large volumes and recapture returns of the past.

The entire issue also pertains to relatively tight budget expectations on the part of the plant operators and therefore of the supplying industry as well. For the latter has managed to survive by offering services on the domestic market instead and by trying to enter the international market with German power technology. On the whole, however, investments have been negative across the whole nation. Let us take the production industry – steel and pipe component manufacturing, forging industry and steel mill capacities – all of the above will run into a bottleneck in the foreseeable future.

This diagram of November 2005 has become obsolete by now. The scenarios are determined by the service life of existing nuclear power plants and the cost-efficient operation of fossil-fired facilities.

Moreover, the expected energy framework with the general investment conditions of the Federal German Government, the energy price development in connection with the regulation of grids and other plans by order of the cartel office play an additional role.

The power generation mix of the future remains uncertain and will depend on the availability of the fuels and therefore also on their prices. The prescribed emission limit values have to be complied with, as well as the voluntary self-commitment according to the Kyoto Protocol. Last but not least, there is the deadline in the year 2012. By this time, certificates must have been issued or acquired in compliance with allocation plan 2.

The plans for the erection of power plants in Germany are being implemented at present. The diagram of November 2005 shows that the major operators- RWE, E.ON, Vattenfall Europe, EnBW – seem to be more reluctant regarding substitute investments than for example foreign investors and utility networks.

This picture has changed considerably. In the meantime, the major market-leading energy supply companies have realised that it is essential to maintain a strategic producer's position and have succeeded in catching up accordingly. Building large-scale hard-coal and lignite-fired units up to 1,100 MW has become a top priority. The new investors and operators, for example Statkraft, Trianel and Concord/Fortum, just to name a few, are building gas and steam turbine power plants, which are a bit smaller, but require a lower investment sum. They have a higher degree of availability, do depend, however, on the expensive fuel plan and are therefore, on the whole, only suitable for peak load use.

In addition, these new investors have special requirements. Fortum, for example, offers operational management and maintenance service, and the gas and steam turbine power plants are usually turned over as turnkey projects. The contract comprises a long term service agreement. Siemens and Alstom, for example, proceed in a similar manner.

### **The protagonists**

The protagonists – operators, engineering and construction enterprises, service companies – are facing a huge effort. The erection of the new power plants has to be managed, existing plants have to be maintained with a high degree of availability and the dismantling of old plants has also become an issue.

We have taken a close look at these different stakeholders. What are the conditions, the requirements and expectations which determine this development? We have, in this context, not failed to take the past into consideration and asked ourselves, where do they come from, what do they look like and what is left of them? Are they prepared for the new challenges?

### **Power plant operators**

Let us start with the operator. He was forced to face the liberalisation and the competition of the energy markets. The result were concentration and merges. Smaller, inefficient and older power plants were shut down, followed by outsourcing activities and bundling of capacities, as for example in our company's case. E.ON Anlagenservice was founded when the

maintenance branches of the large plant operators Bayernwerk and PreussenElektra were outsourced.

This was followed by a certain amount of reluctance in the field of new investments for almost 20 years. The entire industry suffered. Stringent cost management practises were exhibited, in other words, the companies lived off past investments, thus depleting their resources.

All of the above measures resulted in substantial cuts and a strong cost awareness. The companies were striving for a competitive edge and succeeded in achieving growing returns, which, in the end, all of us are now benefiting from because the funds are available to invest into new power plants.

However, the future challenges are enormous. The target is to build a new state-of-the-art power plant generation with the highest efficiency possible. Hard coal-fired power plants of the 600 °C category, built with materials withstanding a pressure up to 230 bars, shall yield an efficiency of 46 %. The efficiency of lignite-fired power plants shall amount to 43 %. The goal is to have the lowest emission values possible and to start up the new power plants no later than 2012.

The old power plants must earn the money. They usually do not have any more cost of capital. They are the cash cows which have to operate at a high degree of availability up to the day of switchover.

The demands on cost management regarding these old plants remain high due to the assumption that there the oversupply of maintenance companies and resources will persist which, as a result, will keep the prices from changing.

In the meantime, the operator is forced to change his internal structures as well. The new investment business entails the necessity of hiring new staff, new expertise has to be generated or acquired. In addition, there are the existing facilities which must operate simultaneously and as efficiently as possible. However, this area has gone unheeded up to now.

This leads to tension among the operators. The present objective is to manage the lack, internally and externally. The resources are limited for both, the existing business and the renewal of the new construction business.

### **Manufacturers/Plant engineering and construction enterprises**

The manufacturers, the plant engineering and construction enterprises, have been through a long dry spell for almost two decades. During this period, they strengthened their international activities and built manufacturing plants abroad. They tried to maintain their domestic client's position by means of the service and spare part business. They were forced to reduce capacities: Manufacturing plants in Germany were shut down for cost reasons, and early retirement schemes, etc. led to a reduction of staff.

On the whole, however, in the shareholders' view, these were negative investments, which resulted in a substantial number of bankruptcies with considerable consequences. Financial investors emerged like soldiers of fortune and bought the run-down and cheap structures from the liquidators.

Eventually only a small number of suppliers was left. When a company invites bidders to bid on the construction of a high-pressure piping system today and the buyer expects the provision of full warranty and liability, only three or four substantiated bids are submitted. When a large-scale tower-type boiler has to be erected adherent to the TRD and pressure equipment directive, only two or three bidders will submit their offers, depending on the size category.

In the past, German companies were the market leaders in power technology up to the eighties. For the major part, they were also leading in the field of power plant innovations. This role has been partially lost. Innovative structures were sold abroad. Let us take a look at nuclear energy: What happened to KWU, Aveva or Framatome? Meanwhile they have been taken over by French enterprises.

What has been done for research and development in the past 20 years? Today new technologies are in demand and everyone wants to install state-of-the-art power generation

equipment. But how can conclusions be drawn from or guarantees be given on new developments when no test runs have been performed during standard operation?

The only flagship project was COMTES700 – which was also an EU-promoted component testing facility. This 700 °C technology has been tested for about one year at Scholven power plant in Gelsenkirchen, but it will take two more power plant generations before it can be put to use.

As far as the shareholders are concerned, a goldrush mood is prevailing among manufacturers and plant engineering and construction enterprises. The business expectations regarding the new investments are high, and everyone anticipates large volumes and high returns.

Private equity companies see an opportunity presenting itself and are now selling their structures, which they purchased at a low price, to strategic investors. As a consequence, these manufacturers who are being sold now are exposed to enormous pressure since the high purchase price has to be refinanced. In other words, the interests for this have to be earned first. This will also lead to pricing pressure.

After all, the manufacturers must also bear an increased risk. They are lacking one future generation as well. The older staff with all the experience in the field of power plant erection has retired and has to be reactivated by the hour. And there is an Achilles' heel as well. Is it possible at all to build high-tech power plants in such a short period? Does the responsible staff have the required experience across all value-added phases?

### **Maintenance/Service companies**

What is the situation like in the service sector? In the past, the service sector was dominated by the manufacturers. Along with cost pressure and increasing readiness to assume risk on the part of the plant operators, non-OEM-services entered the market. They developed competence and created lean structures through cost control, as well as overhead cost management. The only way to remain in business next to the structures of the manufacturers was to render similar services, to display a different service mentality, to act more quickly and flexibly and to eventually achieve a displacement potential through the price. In other words, these companies have collected market experience, fought for their positions, acquired qualifications and established themselves competitively.

This led to cutthroat competition and amounted to loss of know-how, capacity cuts and bankruptcies, followed by openings of new smaller-sized businesses.

It was not easy for the non-OEM's because they had to face the same guarantee and liability-related penalties and expectations. Medium-sized companies and family enterprises were able to join the competition to a limited extent only.

What kind of new situation will the non-OEM's face when new power plants are erected and older power plants have to be maintained at a state-of-the-art level simultaneously?

The OEM's want to secure their position on the market with long-service agreements which comprise all advantages and disadvantages. This is, on one hand, a carefree package, on the other hand, however, it is a road into dependency.

If the OEM wants to meet both requirements – i.e. get involved in the new investment business and supply services at the same time – he will have to strengthen his capacities. This target, however, cannot be achieved offhand. According to experience, it takes five to ten years to qualify as a specialist in the field of power engineering. In other words, OEM's and non-OEM's will have to learn to share and pursue coexistence and cooperation.

The non-OEM will have to take a stand now. His old customers want to know whether he will remain available as a reliable partner on a long-term basis. He will surely continue to focus his attention on the maintenance of the existing plants, plus he will offer an ad-hoc service for those power plants which will be shut down in the medium-term future. In other words, he will also have to be able to carry out sophisticated repair work at short notice.

On the other hand, he will not be able to neglect the new investment projects and will therefore have to acquire the required know-how. The new 600 °C materials call for – procedure qualification tests and qualified welders to enable him to carry out repair work when needed.

Meanwhile the non-OEM's have reached a level of competitiveness which allows them to move into other fields of activity and to work cost-efficiently in other types of industries, for example in the steel industry, which uses the winter shutdown period for maintenance work. This has been an effective alternative for service companies during the low-business period

from October to March. They might, however, have to backpedal and invest their complete capacities into their power industry partners.

All in all, the basic conditions have changed. This applies to the power plant service and the maintenance sector as well.

### **Required actions**

The power plant operators have to assume their role as clients. At the same time though, they have to invite bids for retrofitting measures in order to achieve their ambitious availability targets. Maintenance works on the principle: Periods can be postponed – but the costs will remain the same. And postponing the periods might entail even higher costs when the damage could have been limited by in-time measures.

They have to develop their technical staff for planning, supervision and possibly for in-company maintenance tasks as well. At the same time, the know-how of state-of-the-art power plant technology must be acquired and, simultaneously, the technical knowledge pertaining to older power plants must be safeguarded. Eventually, concerted actions will have to be initiated and partnerships with suppliers will have to be formed to secure resources.

The question is, however, whether service companies and plant engineering and construction enterprises will be prepared to close long-term agreements based on today's price level. It remains questionable whether this issue will meet the approval of the management.

The role of the client implies the development and maintenance of procedural knowledge. Project management skills are in demand, as well as the qualification to carry out site supervision and quality assurance tasks.

Site supervision mainly pertains to expediting, particularly the reliable supply of the respective components and auxiliary equipment to ensure that all deadlines are met. The schedule is usually tight and when delays occur, the entire order schedule is due to fall apart.

When, for example a maintenance company cooperates with a Croatian specialist firm and a shortage of material arises causing the start of the project to be postponed by one month, this specialist staff will not be available any longer because it has to carry out its next order.

This chain of dependency has to be completely reconsidered with view to the fact that human resources are limited.

The manufacturer is interested in maintaining his existing know-how, to develop new know-how and to reactivate former know-how and experience. This includes the knowledge of those who were possibly sent into retirement too soon.

In addition, deactivated structures have to be reactivated, strategic alliances in Germany and abroad have to be developed and, last but not least, resources on the procurement market for raw stock, production capacities and installation have to be safeguarded.

When a plant operator awards a contract, he should make sure of the following: Are the resources available and what kind of performance risk does he take by awarding this contract? The maintenance companies also attach great importance to the safeguarding of know-how and the acquisition of new know-how in the field of state-of-the-art technology. The recruitment and training of additional qualified specialists is one of their top priorities. There is a special demand for service engineers, project managers, site managers, and, above all, for high pressure welders. A lack can lead to a serious bottleneck when different installation tasks have to be carried out at the same time.

Another vital issue is the development of strategic alliances in Germany and abroad – horizontally and vertically – as well as safeguarding of resources on the procurement market. Special attention is paid to the small-scale contracts which usually evoke only little interest. Membrane walls, single headers, which are now required to ensure the availability of older facilities, are running short. The same applies to pipes, forgings, insulation and filling materials.

Particular attention is also given to production capacities (e.g. the manufacturing of pressure parts) which are also suitable for emergency stops in the maintenance field. Manufacturing plants that are gearing up for contracts in connection with new investment projects will not

retool for small-scale contracts. In other words, separate replacement part lines will have to be set up. In addition, cranes, forklift trucks and, above all, operating staff will be required. We believe that anticipatory action is necessary to safeguard all resources.

### **Maintenance - Quo Vadis?**

In summary we can say: The market bottleneck can be perceived by everyone. A true indicator are the delivery times. The raw stock, as well as the supply of pressure parts, has become an incalculable risk. As of 2008, we are expecting a staff bottleneck, because there will be a demand for installation work in the new power plants next to the usual installation work in the maintenance sector.

Another question is: In which way are the remaining resources allotted? Will they be moved to the new investment business or will they remain with the existing business? This certainly depends on the market price development as well, since maintenance companies and plant engineering and construction enterprises are controlled by short-term targets.

Maintenance companies must prove to be reliable partners. Frankness is the aim. Companies should take positive steps towards each other and sign statements and agreements to allow planning ahead and to ensure the long-term security of advance financing.

On one side, clear commitments have to be made: We will remain available for the existing power plants, because it is our core business – on the other side, we have to make sure that we are always working to capacity.

An example: If we do not guarantee the Polish installation companies continuous capacity utilisation, they will not do business with us any longer. At present, ceiling wages are being paid in Scandinavia, Great Britain and Ireland. A very important issue is, after all, safeguarding resources between the countries and the infrastructural interests of the countries. In our opinion, the price can be used as a regulator. We have increased the prices for our East European companies and are striving to ensure their year-round capacity utilisation. This was the only way to keep them in the country.

It is necessary to revise one's thinking completely. It is not possible any longer to draw on abundant resources. After a maintenance measure or an overhaul had been completed, it was followed by an audit (e.g. measurement of the pipe wall thickness), which usually led to an additional volume of approximately one third compared to the original bid. In the past, this was not a problem. Material could be re-ordered from the warehouse or the market and required specialist staff could be acquired from recruiters or service contractors. This will not be possible any longer. Only planned and pre-ordered items and staff will be available.

Maintenance measures will have to be planned not just precisely, but also with foresightedness because additional supplies will not be obtainable as in the past and doing a "touch up" will be possible to a very limited extent only.

Maintenance companies should be involved in new investment projects, also in the plant manager's interest. It will enable him to find new business partners and to acquire knowledge of new technologies in order to stay competitive.

It is necessary, however, to put the mutual expectations a bit more into perspective. It is necessary to take steps towards each other, get to know each other's potentials and to develop feasible solutions together. This will take time, of course, just like acquiring experience and practical knowledge takes time.

We hope to have this time. We all have to be open, willing to learn and everybody has to do his homework. We all know the basic conditions now and know what to do. This is where a paradigm shift takes place. Whatever was right for the management in the past is now obsolete and wrong. We are all in danger to lose our competitive edge if we do not act.