Minutes of Meeting

VGB-Technical Committee:	**Generation and Technology**
VGB-Working Panel:	**PGMON**
	Power Generation Maintenance Optimisation Network
	48th Meeting on 24./25. 04. 2014 in Berlin

Agenda

Welcome (Henk Wels)

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Henk Wels, DNV-GL

TOP 2: Low merit operation / mothballing / decommissioning of power plants
Milan Andrejkovic, CEZ

TOP 3: Future VGB, Phase 2
Heinrich Grimmelt, VGB

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Mr. Braun, Mr. Unger, Mitsubishi Hitachi Power Systems

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TOP 1: How to model power plants that don't operate much
Henk Wels, DNV-GL

DNV-GL has set up a general model for reliability and availability in order to take account of operating conditions. From failure data we have found that a major step forward is to model plant failures by means of a failure rate during operation, a failure probability per start and a failure rate during standstill which is only a fraction of failure rate during operation. Parameters and coefficients were derived from failure data such as those gathered in the VGB KISSY database. We have forecasted failure rate, forced unavailability, etc. as a function of operating hours, starts and hours not in operation for conventional boilers, steam turbines and generators. Still, there are remaining questions to be solved such as a less high level and more detailed engineering view on how systems, components, etc. behave as a function of operating regime in order to improve the forecasting. The way forward would be to construct and agree on templates describing the dominant failure mechanisms as a function of operating conditions. Such templates would also allow constructing the appropriate maintenance regimes.

TOP 2: Low merit operation / mothballing / decommissioning of power plants
Milan Andrejkovic, CEZ

The current situation on the energy market leads us to rethink how to operate conventional units – from base load mode to operate in modes with increased flexibility, limited hours, summer shutdown of heating plants, conservation units or complete decommissioning.
When considering ways of operation we use economic evaluation in comparison to availability and fuel prices, legislative constraints (emissions ...), estimated future development.
The cost of the preservation and restoration of any service or vice versa decommissioning must also be included in the economic evaluation and decision-making, while at the same time ensuring adequate safety.
As a result we follow this ways of units operation:

- In operation – **base load, peak load, flexibility** (new, renewed units, heating plants)
- Low merit operation or in reserve with assumption of operation - **occasional operation**
- In reserve without assumption of operation (or very rare operation) - **mothballing**
- Shutdown - **decommissioning**

The presentation describes issues of this solutions and how CEZ Group is solving them.

TOP 3: Future VGB, Phase 2
Heinrich Grimmelt, VGB

The VGB PowerTech are facing the same challenges as our member companies in a dramatically changing business environment within our industry. There is no chance for continuing “business as usual” as you know it quite well from your own companies.

In the last Board of Directors Meeting in September 2013 the Board stated that the measures developed in Phase I of the project “Future VGB” were not sufficient although major results e.g. provision of additional resources for the area of RES were achieved. Therefore, Phase II of the project “Future VGB” has been initiated for 2014, which consists of the sub-projects “cost reduction”, “content oriented re-alignment” and “cultural change”. The project manager is Dr. Oliver Then who is reporting to a steering committee consisting of the CEO, the Executive Manager and the head of the workers council. A short information is enclosed in the mail.
The objective of the sub-project “cost reduction” is to realize a further cost reduction of a minimum of 1 mio. € until 2014 in addition to the compensation of revenue reductions in the nuclear power sector of 1, 25 mio. € until 2018. Within that framework a relocation of the VGB offices from Klinkestraße to the site of the simulator center/Kraftwerksschule (in the Deilbachtal about 10 km away from Klinkestraße), is being checked. The sub-project “content oriented re-alignment” comprises a check of the committee structure as well as the way of working in the committees. This will be done in close dialogue with member representatives via the general committees. As soon as results from those sub-projects are available and agreed upon in the VGB Board of Directors Meeting in June, a change in organization/culture may be required. This shall be approached in the second half of the year.
For the content-orientated re-alignment of our committee topics and structures we are seeking your active support as chairmen of the committees within the areas of our competence centers „Power Plant Technologies“, „Renewables, Distributed Generation“ and „Environmental Technology, Chemistry, Safety and Health“.
We are aiming at increasing our efficiency in the committee work by 20 % to cope with the expected reduction of VGB staff over the coming years. \\vgb-file\gf\dokumente cc2\2014-03-04 gremieninfo v2 engl.docx Seite: 2
For a collection of the relevant and forward-looking topics out of all Working Panels, Technical Committees and General Committees as well as other permanent bodies (SC, ETC, EWG) we have planned the following next steps:
1. Distribution of this general information to all chairmen and advisors
2. Collection of topics in the template enclosed in the mail; for the necessary discussions with regards to content the next round of committee meetings should be used
3. Feedback of the aligned topics within the reporting line of WG/EWG -> TC/ETC -> GC/SC according to meeting schedule
4. Presentation of intermediate results in the Executive Board Meeting on April 23rd 2014
5. Discussion, bundling and prioritization of topics/areas of interest as well as drafting an aligned committee structure in the upcoming meetings of the GC’s; these will be converted into workshop-type meetings to manage this issue properly (until early May 2014)
6. Alignment in the Technical Advisory Board Meeting on May 27th 2014
7. Presentation and decision in the Board Meeting on June 17th 2014

The VGB is convinced that we can successfully manage the upcoming challenges together and that we will be able to ensure to provide all relevant and value adding services you as members expect from VGB PowerTech.

TOP 4: SABS System
Mr. Braun, Mr. Unger, Mitsubishi Hitachi Power Systems

The Shield for Accelerated Boiler Service (SABS ®) is a newly developed protection system which enables a protected workspace to be formed in the most diverse of areas inside a power plant.
The SABS® consists of a flexible, stretchable special canvas. It covers the entire cross-section of a select area and protects the workspace underneath from any falling objects. The SABS® also includes all components needed for transport, installation and operation. The components of SABS® are patented.
Especially in the operation of fossil-fired steam generators, deposits develop at the bank tubes and steam generator walls. They are made up of precipitating slag and ash particulates and accumulate over time, coating the steam generator tubes. This has a detrimental effect on the heat transfer, leading to a considerable reduction in boiler efficiency. That is why steam generators need to be regularly cleaned, inspected for wear and possibly repaired. This involves shutting down the steam generator to allow the required repairs to be carried out in the furnace and in the convective area. The risk with this work is that those working in the furnace could be hit and injured by falling lumps of slag and ash. Thus, workspace is not safe and needs to be protected by means of special safety installations.
The protective devices used to date, such as safety nets and scaffolds, only afford limited protection and, in the case of scaffolding, need a considerable time to install. The SABS® has clear-cut benefits in comparison with conventional forms of safety equipment. In contrast to conventional safety nets, SABS® tightly seals off the edges and offers reliable protection from falling objects. The workspace underneath it is secure - and in comparison to safety scaffolds, installing SABS® yields considerably less time and work force investments, which reduces outage periods as well as inspection costs.
By using the Shield for Accelerated Boiler Service (SABS®) devised by MH Power Systems Europe Service GmbH, a completely protected workspace can be formed within a very short time. This both significantly cuts the outage periods and costs of a steam generator and, at the same time, markedly raises personnel safety.
Thanks to its high degree of flexibility and its modular setup, the application of the SABS® system is not limited to the furnace of fossil-fired coal power stations. It can also be deployed wherever working spaces surrounded by perimeter walls are to be protected from falling objects.

TOP 5: Condenser Outage
Henning Lundström, Hofor

<u>Overview</u>
The unit tripped due to an alarm from the LP pre heater condensate pump, but the following alarms were misinterpreted and the unit was restarted more times.
Basic reason for the alarms were leaks in the sea water condenser leading to seawater entering into the condensate side of the condenser, and consequently the conductivity of the condensate increased above the acceptable level. Finally the plant was shut down on a trip alarm in the DCS system.
Intensive salt contamination in the water/steam cycle was identified.
Cracks were identified in approx. 100 condenser titanium tubes

The unit had an outage for 7 weeks due to a comprehensive cleaning process necessary to restore stable conditions in the water/steam cycle

Cleaning process

In close cooperation with the plant Operational Department and Engineering Departments together with ALSTOM the ideas of washing out the salt contamination from the super heaters and the turbine was implemented by use of wet steam.
On line measurements and chemical analyses documented the results of the washing procedures. At least 500 g of salts were removed from the inner surfaces of the components.
The washing process was repeated several times
Samples test were taken from the super heaters to decide whether washing was sufficient or acid cleaning was necessary - SEM analyses showed that salt only were located in the surface - salt penetration would require an acid cleaning

Metallurgical analyses

The causes for the condenser leakages have been hard to answer from a metallurgical point of view.
Besides the 100 tubes with cracks the metallurgical analyses of the titanium tubes did not shown any damages like downwards bending or deformation by upsetting.
The basic cause was identified to be un-cooled tubes due to partially missing evacuation of the water chambers in the condenser. This led to voids between the cladding and tube sheet through which sea water may enter from the damaged epoxy lining.
In the condenser water chamber 2 out of 4 riddles on evacuation lines were stopped caused by biological activity (shells). The evacuation lines were only 1 inch i.e. very sensitive for blocking.
For some unknown reason the biological conditions in the sea water have been different to the conditions in the past and the humid environment in the evacuation riddles have offered suitable conditions for the shells to grow and in turn block the riddles.

Experiences from the incident:

Maintenance plans
Improvement of the maintenance plan for: -
Check of the evacuation pipes
Check of conductivity meters
Regular metallurgical test of the U loops in the super heaters and other critical items
Changed conductivity measurements
New – fast response - direct in situ meters are now in place
One of the major lessons learned was the high response time for the original meters due to long pipes between the measuring point and the measuring devices and the use of ion exchanges. But a fast response time in case of leakages is vital to protect the steam/water cycle.
Cleaning process
Wet steam to wash in turbines and super heaters showed up to be difficult balance to avoid water in the boiler. Especially water in the U loops might worsen the situation when water evaporating and the concentration of salt will increase
Even though complicated boiler geometries salt can be removed - patience is required.

Biological processes

Biological processes may occur unexpected

TOP 6: Cycle watch
Tom Staes, Laborelec

Your combined-cycle units and peaking CTs are under tremendous stress from frequent cycling, and this stress is only getting worse. Your turbines already receive monitoring support, yet failed starts, trips, and outages still occur. With the CycleWatch solution monitoring your CT, you can be on top of every aspect of CT behavior—what is functioning as expected, and what's starting to deviate.

During the dynamic startup cycle, the CycleWatch solution will inform you when thermocouples begin to drift, fuel valves begin to act up, and nozzles begin to plug. Addressing these issues during normal downtime will prevent a trip from blade path deviations. The CycleWatch solution can indicate the low temps from contaminated fuel, preventing a flameout and failed start. When bleed valves begin to stick, the CycleWatch solution can give you advance notice to make repairs and prevent a compressor stall. When vibration at critical frequencies increases, the insight from the CycleWatch solution can let you address bearing, coupling, and casing issues during the next maintenance opportunity and prevent other problems down the line.

Variable Similarity-Based Modeling accounts for highly variable conditions and points out subtle deviations. VBM is advanced technology that processes more data at a higher frequency, which means that you're able to detect even the slightest deviations from "golden" starts before issues and outages happen.

TOP 7: Ageing aspects in the VGB KISSY data
Henk Wels, DNV-GL

Already in the 1980-ties KEMA Nuclear started to develop models on ageing in relation to maintenance optimization. Since that time DNV-GL and its predecessor DNV-KEMA have analyzed ageing of power plants many times. Such information is necessary at least for Life Time Extension to pinpoint the dominant components that should be bettered in order to operate (much) longer than originally expected. From the VGB KISSY failure data we have arrived at Crow-Weibull ageing coefficients for typical power plant components. However, it seems that an increase of average failure rate and forced unavailability as a function of age is influenced much by extreme values present in the data. When such extreme values can be regarded as outliers, statistically no ageing might be present at all. Therefore it is necessary to dig deeper in the technical problems at hand to check if they need to be regarded as outliers and to construct the relation between degradation mechanisms, potential failures and maintenance. Such an approach is being taken by DNV-GL in piping reliability for example at district heating.

TOP 8: Process and Plant Safety at E.ON

Adolfo Gonzalez, EON

To be added later

TOP 9: Presentation PS Mitte
Ernst Reichstein, Vattenfall

To be added later

TOP 10: Presentation Latvenergo
Olegs Linkevics, Latvenergo

The new member of VGB association, Latvenergo Group is a vertically integrated power supply utility operating in electricity and thermal energy generation and supply, electricity distribution services and transmission system asset management.

The majority of electricity generated by Latvenergo Group comes from three hydropower plants in Daugava river – Plavinas, Kegums and Riga HPP (overall capacity 1536 MW). Nowadays, reconstruction of hydroelectric units is under way, which includes installation of new turbine runner, new turbine bearing and shaft seal, rehabilitation of generator stator and rotor, new generator excitation system, rehabilitation of generator bearings and new control and protection system.

Latvenergo AS has substantial experience in construction and operation of different kinds of municipal cogeneration (CHP) plants. During the last decade Latvenergo Group has invested in construction of new gas-fired combined cycle (CCGT) units in its CHP plants ir Riga, using GTX100 machines (former Alstom) and GE gas turbines Frame 9FB (HS9001). It has also some experience in construction of biomass-fired unit with ORC technology. Nowadays installed electric capacity of Latvenergo AS CHP plants is 1031 MW, while heat capacity is 1857 MW. Latvenergo AS production portfolio consists from different types of fuel: gas, diesel and biomass.

Recently, AS Latvenergo has received an offer from GE to upgrade and increase efficiency of its CCGT units in Riga CHP-2 plant. It includes options, such as an Enhanced Compressor Package 4 and software upgrade, as well as OpFlex upgrade: OpFlex Reserve Turndown, OpFlex Autotune and Cold Day Performance (CDP), OpFlex Variable IBH and OpFlex Enhanced Transient Stability (ETS). AS Latvenergo is evaluating feasibility of these options and would appreciate if colleagues from VGB PGMON share their experience with GE proposed upgrades.

TOP 9: Place and date of next venue

The next meeting will be held on 16./17. October 2014 most probably in France.