Minutes of Meeting

VGB-Technical Committee: **Generation and Technology**

VGB-Working Panel: **PGMON**

Power Generation Maintenance Optimisation Network

30th Meeting on 21./22. 4. 2005 in Dublin

Agenda

Welcome (Richard Sheehan)

Plant ageing and maintenance expenditure

TOP 1: Moneypoint Retrofit
Joe Dalton

TOP 2: Maintenance costs due to foreseen stops versus maintenance costs per running hour
Anders Rasmussen

TOP 3: Forced Outage rate at elder nuclear plants
Claude Degrave

TOP 4: Le Havre 1 coal power unit renovation for life extension
Antoine Despujols

TOP 5: C & I Upgrade Elsam
Robert Hvelplund

Maintenance Quality

TOP 6: Experience with Dublin Bay PP, Combined cycle GT 26 and Stork boiler
Joe Scally, UOMS

TOP 7: T 91, Experience of premature degradation of tubes in the gas path
Tony Kirwan, ESB

TOP 8: Tensioning Systems
Anton Angehrn, P & S

TOP 9: Short term reliability of steam supply for industry
Henk Wels

TOP 10 Examining different techniques towards an effective maintenance strategy
Santos Silva, Antonio Goncalves

Maintenance Organisations

TOP 11: VGB Generation and Technology
Michael Quinn, ESB

TOP 12: New structure of business unit Power Generation
Michael Quinn ESB

Miscellaneous

TOP 13.1 Topics suggested for next meeting

TOP 13.2 Place and date of next venue

TOP 1: Moneypoint Retrofit
Joe Dalton

Moneypoint Power Station is a 3 x 305Mwe coal fired power station, located on the west coast of Ireland. This presentation summarises the end-of-pipe technologies that were selected for installation in Moneypoint power station, in order to facilitate compliance with the Large Combustion Plant Directive.

The presentation can be found in the closed user group.

TOP 2: Maintenance costs due to foreseen stops versus maintenance costs per running hour
Anders Rasmussen

Elsam made an analysis of the maintenance costs directly related to starts. With the evaluation of the maintenance jobs of the last three years of e. g. Nordjyllandsvaerket PS they want to be able to compare the costs of a start of different units. For example the costs of a start of a 350 MW unit were specified. Items requiring start related maintenance included pre-heaters, valves and fans.

The presentation can be found in the closed user group.

TOP 3: Forced Outage rate at EDF nuclear plants
Claude Degrave

Within the framework of the survey undertaken by EDF to periodically check the operating performance of their Nuclear Power Plant fleet, a study on the evolution of the forced outage rate of the 900MW (34 units) and the 1300MW (20 units) series depending on the age of the different units has been carried out.
This study used statistical data stored in different data base.
The main results of the study are :
The Forced unavailability is continuously decreasing and the units could be considered at their full performance stage.
Maintenance performed, particularly on the Nuclear Island systems and components, seems appropriate.
The Forced Outage Rate trend for a 30 years age is estimated at 1.8% for 900 MW units and 2.5% for 1300 MW.
The Objective of 2% fixed at the very beginning for the new EPR standard seems realistic.
In order to detect possible deviations in the ageing process, this study will be periodically updated.

The presentation can be found in the closed user group.

TOP 4: Le Havre 1 coal power unit renovation for life extension
Antoine Despujols

Le Havre power plant located at the north of France has four units whose three are in operation (unit 3 is decommissioned). Unit 1 commissioned in 1969 is a 250 MW coal power station and must be refurbished in order to operate still about ten years.

A study was carried out to help refurbishment decision making at each step of the decision process for the most critical components that are the condenser, the boiler and the stator. Based on operating feedback analysis and expert interviews the critical failure modes were identified and for each of them the potential unavailability and repair costs were estimated as well as their occurrence frequency. Then, different scenarios were considered as a combination of refurbishment, preventive and corrective maintenance. The cost of each scenario was estimated either simply, or using a tool calculating the Net Present Value and its distribution function. That makes it possible to rank the scenarios and to identify the best one.

This kind of study helpfully support the decision making process of renovation for life extension.

The presentation can be found in the closed user group.

TOP 5: C & I Upgrade Elsam
Robert Hvelplund

Robert Hvelplund, Elsam Engineering presented a study on Modernization of Control Systems at the primary coal fired power plants in the Elsam Kraft system.
First an overview of the Elsam Kraft production portfolio was given as well as a short presentation of Elsam. As background of the study Elsam's vision and business plans for power plants was summarized.
A study was made taking into account the actual situation for

- Service and maintenance resources
- Engineering resources
- Resources at suppliers offices
- Remnant life time of installed control systems

The study recommended a schedule for modernization of control systems as well as strategies for service, maintenance and engineering for control systems in the recently merged company.

The expected advantages and gains from modernization were given.

A first project, where modernization of control system was implemented, was presented. Images were shown from the rehabilitation of control room as result of the change in operation, supervision and monitoring (purely screen based).

Finally experience gained from that project was given.

TOP 6: Experience with Dublin Bay PP, Combined cycle GT 26 and Stork boiler
Joe Scally, UOMS

The Dublin Bay Power Plant, comprises an Alstom GT26 in combined-cycle mode. It is the most efficient & largest single generator in Ireland. A description of the plant and the overall plant start-up process is given including the sequential combustion concept and how the unit can perform as a single shaft entity with 3 cylinder Steam Turbine, Generator and Gas Turbine and Axial Air flow Compressor all on the one shaft. Additionally, some of the features of the Work Management System employed at Dublin Bay Power are described. These show how the standardised best of breed software package can be utilised to add-value and become embedded into the overall management of the power plant. Add on features covered are routine Operations checking, data management, Job Planning, Risk Assessments, KPI management, Overhaul & other Project Management interfacing and Workflow management.

The presentation can be found in the closed user group.

TOP 7: T 91, Experience of premature degradation of tubes in the gas path
Tony Kirwan, ESB

In the mid 1980`s, ESB Power Generation commissioned its Moneypoint Power Station which comprises 3 x 305 MWe coal-fired Units. Early monitoring of T22 tubes in the Reheater confirmed micro structural degradation of the material due to uneven flue gas temperature distribution. Sections of these panels were replaced on all three Boilers in the period 1999 to 2000. The tube material for the panels was upgraded to T91. After 35,000 hour operation a number of issues have arisen which has raised concerns about the long term effectiveness of the upgrade. A number of other measures may now have to be considered.

The presentation can be found in the closed user group.

TOP 8: Tensioning Systems
Anton Angehrn, P & S

The power industry depends on bolted joints that are detachable. Because of the high forces, large diameter bolts are used, which can only be tightened and loosened with great difficulty. Especially problematic are the boltings of couplings, which have relatively short clamping lengths and large diameters.
Multi-jackbolt tensioners achieve the required high pre-load at low cost. The tensioning results from the tightening of several small jackbolts, which are symmetrically arranged around the main thread. These are tensioned with a simple, hand-held torque wrench.

In comparison to hex nuts, multi-jackbolt tensioners offer not only higher elasticity, but also a much better load distribution onto the coupling. The lifespan is therefore increased. Relevant tests and FEM calculations confirm the reliability of multi-jackbolt tensioners. Several couplings of high power throughput on turbines, generators, etc. have been equipped with multi-jackbolt tensioners. Some typical examples are explained in further detail in the accompanying article.

TOP 9: Short term reliability of steam supply for industry
Henk Wels

A utility was interested in risk-assessment for steam production to industry, in which the capacity of the boilers and combined cycle unit(s) were input over a period of 7 days.

NRG has written a spreadsheet that, combined with a macro for inputting the daily load profile, can calculate the expected frequency of insufficient steam delivery, the duration and the amount of steam not delivered. The spreadsheet is valid for a production situation with 10 boilers / combined cycle units both on a daily basis and on the basis of a yearly load duration curve. However, the small numbers on a daily basis are not easily interpretable. A risk profile transformed to a yearly basis is much more easily to interpret. By using colour coding and a risk-matrix, it is easy to see what production situations are unacceptable both as a result of high demand in relation to the fully available production capacity and as a result of taking production units out of operation for maintenance. It can therefore be used for maintenance optimisation.

With regard to the overall risk profile, the Base Case value for steam demand (50 % value) and a reasonably High Case (10 % probability of exceedance) are important. Therefore, per customer, characteristic demand profiles should be drawn and statistically combined using Monte Carlo analysis. The increasing uncertainty when supply is further away in time than the next few hours or days can be calculated using a “random geometric walk” process.

In the spreadsheet, average reliability and availability values are calculated that are reached only over a period of time. These values are reached in about 3 times the average repair time. The momentary reliability and availability can be calculated using Markov analysis. Momentary values can be much smaller than average values and should be used for short-term contracts. The difference is in precisely knowing the state of the production units when the prediction for the short-term contact is made. The average value of for instance availability is the result of the repair and failure process.

The presentation can be found in the closed user group.

TOP 10: Examining different techniques towards an effective maintenance strategy
Santos Silva, Antonio Goncalves

Given the increasing liberalisation, competitive driving forces and the Portuguese Government goal to privatise EDP Group, the Portuguese electricity utility, companies within EDP Group were asked to develop strategic plans in order to:

- Establish strategic objectives for each company, in line with those of the Group,
- Formulate strategies and policies in order to achieve the main objectives,
- Define specific action plans and programmes for the implementation of strategies.

The EDP Group Board also defined the main objectives for the most relevant areas of intervention:

- Prepare Companies within the Group for an environment of flexibility and growing competition in the National Electricity System,
- Promote the operation of the electricity generation system in conformity with the logic of Power Purchase Agreements, signed with the Portuguese Transmission Grid Company, consolidating and developing the benefits of this instrument of management,
- Consolidate environmental policies with the objectives of management, reinforcing the sensibility for the environmental questions,

- Modernise technical and administrative organisation, developing and improving the human resources capabilities within the company,
- Adjust human resources capabilities to the company‘s needs in order to promote efficiency and assure best levels of motivation, effectiveness and productivity,
- Guarantee the rationality of investment decisions in technical and economical terms, submitting them as a rule to the cost/benefit analysis.

CPPE, the main generation company resulting from the unbundling of EDP Group, launch its Strategic Plan in 1996 with the following objectives:

- Develop a strategic vision for CPPE,
- Develop realistic implementation plans to pursue opportunities in the key areas,
- Quantify the impact of strategic initiatives.

The Strategic Plan was afterwards detailed into Operational Plans, which have been developed and implemented for Thermal and Hydro Power Plants and for Corporate, Support Functions and Processes (Accounting, Purchasing and Logistics, Human Resources Management, …). Finally, costs, benefits and investments, for each action plan were estimated.

STRATEGIC PLANNING CPPE
The strategic plan began on February 1997 and was developed in three stages. The first one involved the following activities:
Internal analysis and benchmarking,

- Analysis of supply and demand,
- Identification of growing opportunities,
- Determination of the value created by the strategy,
- Definition of the detail of the strategy.

Benchmarking
The in-house analysis and the benchmarking performed with other so called Best Practice power stations, showed that there were substantial improvement opportunities in the areas of operation and maintenance.

Maintenance Optimisation at CPPE

The plan stated the following tasks:

- Enlarge maintenance cycles - Overhauls,
- Reduce units unavailability due to maintenance,
- Reduce Periodic Preventive Maintenance and increase Predictive or Condition Maintenance,
- Set up a Centralized Maintenance Structure for overall planning, carrying out outsourcing maintenance contracts and increasing the use of internal manpower to optimise the outsourcing of maintenance works.

In order to achieve the goals we defined and implemented a Maintenance Strategy based on “trade-off” Risk vs. Reliability Analysis. For the Risk (RBM) and Reliability (RCM) Analysis we use a qualitative approach, and for Improving the Condition Maintenance and Diagnostic Inspection Critical components identification we use Maintenance Criticality Factor (MCF), and Fault Sensitivity and Monitoring Practicality (FSMP).

CONCLUSIONS
The main results found of CPPE RCM-RBM Program with improving the Condition Maintenance and Diagnostic Inspection were:

- For the overall Exploration Structures, Maintenance and Operation, internalize and enlarge the Knowledge based on Risk and Reliability Management;
- Calling on the know-how of the people directly involved in Maintenance and Operation;
- Providing a good balance between Planned and Corrective Maintenance;
- Allowing standardisation of maintenance techniques;
- Integrating into the overall process of maintenance management;
- Client oriented, i.e. taking into account production targets
- Overhauls cycle for Boilers and Turbines enlarged from 3 years to 4 years;
- Profits for One Thermal Power Station (4 groups x 250 Mw) forward 15 years
  Availability = 11,6 %
  Maintenance Costs = 12,7 x 106 €
- Outsourcing: Annual Reduction Costs/Total Cost (4 Thermal Power Stations) = 6 % (1,5 x 106 €)
- Good evolution in Total Unavailability (Forced and Scheduled); from 13,6 % at 1996 to around 6 % in the last years.

The presentation can be found in the closed user group.

TOP 11: VGB Generation and Technology
Michael Quinn, ESB

In 2000 it was agreed with Eurelectric that VGB should take care about the technical issues of Power generation and distribution on the European level. Consequently three “European Technical Committees” were founded:
ETC Generation and Technology
ETC Nuclear Power Plants
ETC Environment

These ETC`s are established now more or less. ETC Gentech has four “Working Panels”, which cover most of the wide field of generation. PGMON is one of them. The terms of reference of the ETC are:

- Optimisation of Operations and Maintenance
- Assess technologies
- Technical input to Eurelectric
- Information exchange
- Initiate and co-ordinate Research and Development
- Input to European Guidelines
- Input to CEN Standards

The presentation can be found in the closed user group.

TOP 12: New structure of business unit Power Generation
Michael Quinn ESB

ESB decided to implement a new structure of the business unit “Power generation”. The design criteria for the decision making were presented. In essence, the structure is organised into asset owner and asset operator.

In the new structure there is on top the general manager. On the next level below one can find the asset manager, the Safety, Engineering & Environment Manager and the different group station managers. There is also a Commercial Manager and an Energy Trading and Risk Management