

Major overhaul of conventional thermal power station

1. Organisations involved

Electrabel

2. Description of the case

Key points

- Major overhaul
- shut-down
- third parties
- safe maintenance

2.1. Introduction

Electrabel – the organisation

Electrabel forms part of GDF SUEZ, one of the world's leading energy providers, active across the entire energy chain in electricity and natural gas. The GDF SUEZ Group develops its businesses around a responsible growth model taking on the great challenges: responding to energy needs, combating climate change and maximizing the use of resources.

Electrabel is a market leader in the Benelux countries. Here the company sells electricity and natural gas, energy products and energy services to residential, professional and industrial customers. It also generates electricity and heat in a diversified production park. These activities are supported and optimized by portfolio management and trading operations of the GDF SUEZ Group on the European and international energy markets.

Electrabel supplies electricity and natural gas to six million customers in the Benelux countries, selling 97 000 GWh of electricity and 72 000 GWh of natural gas here in 2008 and employing 8,750 people in the region.

Different types of power stations are spread throughout Belgium and grouped into three zones; East, West and South. Zone East consists of six plants: Zandvliet Power, Mol, Kallo, Vilvoorde, Drogenbos and Langerlo.

The power station of Langerlo will be the topic of this case study.

Langerlo – the power station

Langerlo is a conventional thermal power station. This type of power station is defined by Wikipedia, the online reference database, as follows: "A thermal power station is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a steam turbine which drives an electrical generator." ¹

The process of generating electricity involves a complex series of consecutive steps, each step carried out in a different part of the station. In order to ensure that this process runs smoothly, efficiently and safely, regular maintenance of the station is necessary.

Two main types of maintenance are carried out: corrective maintenance – daily maintenance on request - and preventive maintenance.

Daily maintenance consists of smaller maintenance tasks which are recommended by the operators. Preventive maintenance is planned as a comprehensive overhaul every two years, and this requires a shut-down of the station while large sections of the station are being worked on. Every 8 years, a

¹ Wikipedia, the free encyclopedia, consulted at 31 March 2009, URL:
http://en.wikipedia.org/wiki/Thermal_power_station

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total overhaul is organised which involves opening the steam turbine to inspect and repair all its internal workings.

Significant resources - money, tools, materials and of course workers – go into each overhaul and therefore the process has to be very carefully planned.

Figure 1: Steam turbine and machine room at the thermal power station of Langerlo



Safety and health in Langerlo

Attention to safety is vital in a power station. Potential hazards include high steam pressure up to 100Bar and high tension up to 20kV; working at heights of up to 50m; working on big components and in confined spaces.

Electrabel is committed to provide a safe and healthy working environment in order to ensure the well-being of the employees.

Procedures at organisational level offer a framework for the practical implementation of the company's health and safety policy which is based on the principle of dynamic risk management. All the steps involved in the risk management are described, as are the roles and responsibilities of all parties involved. The policy also outlines how to carry out risk identification and evaluation, using the Kinney method to compare different risks, establish priorities and compare different solutions.

The health and safety policy is implemented on the level of the power station. The line managers are responsible for risk management and the compliance with the health and safety regulations. The health and safety department from zone East ("Care" Department) supports the line managers with advice on health and safety issues during major overhauls.

Examples of Electrabel's initiatives to ensure a safe and healthy working environment include:

- Line managers are required to attend a health and safety course
- Information related to safety and health is communicated in monthly organised informal meetings called toolbox meetings
- Specialist tasks for which Electrabel has no expertise contracted out to organisations with relevant experience
- Working only with contractors who acknowledge the importance of safe and healthy working
- A risk assessment carried out for each task by the responsible foreman, using the Kinney method
- Preparation of work permit sheets, accompanied by safety regulations, for each part of the plant requiring maintenance, guaranteeing the safety of the area
- Use of a database - Hazapro – containing all Material Safety Data Sheets (MSDS) for dangerous substances
- All but five percent of the company's safety policy documents available to workers through the intraweb

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Electrabel holds a VCA-certificate showing that the company complies with assessment criteria related to safety, health and environment.²

2.2. ***Aims***

The primary purpose of the periodic overhauls in Langerlo power station is to ensure continuous generation of electricity and a safe working environment for the workers.

Of course, the management of Langerlo also aims to comply with all relevant environmental and health and safety legislation.

Before an overhaul starts, objectives are set:

- Creating a safe working environment in which no accidents happen
- Involvement of all important stakeholders - workers performing maintenance, operators, contractors, the Health and safety Department and the employer.
- Following the overhaul plan as closely as possible
- The number of tasks needing to be re-done must as low as possible because fewer reworks means work of better quality.
- A detailed checklist must be drawn up for each component on which work will be carried out to ensure it is working correctly once the work is completed.
- The budget, based on information from previous overhauls and the cost of materials and wages, must be adhered to as closely as possible.

2.3. ***Scope of the project***

As said before, the organisation of a major overhaul requires excellent planning, well-established communication structures and a well-defined safety and health policy. It has to be said that such a project requires the cooperation of a large number of contractors. Of the workers employed for the overhaul, about 700 come from contractors and only 40 are full-time employees of Electrabel.

Each maintenance project follows a similar pattern or three major phases as outlined below:

- the preparation phase,
- the execution phase
- the evaluation phase/aftercare

Preparation phase

Preparation for the overhaul involves placing orders for tools, materials and new parts, preparing task descriptions accompanied by an SHE (Safety, Health, Environment) plan and developing a 'plan of action'. This 'plan of action' allocates time, workspace, people, money, tools, etc., to each different task.

The work group entrusted with the preparation of the maintenance work will also take a look at the reports of previous overhauls to enable better estimations of resources needed. This work group consists of the representatives of the health and safety department (Care Department) the production unit and the maintenance unit.

Another important task during this phase is the procurement of services Electrabel wants to outsource during the overhaul.

Before an overhaul starts, a 'task description' is drawn up for each task. This description also contains an analysis of the task to reveal possible risks related to it, and a further risk analysis based on the Kinney method to assess the level of any identified risks. These risk assessments are performed by

² <http://www.besacc-vca.be/VCA.htm>

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the responsible foreman who is usually one of the line managers. Measures to mitigate identified risks, prevent occupational accidents and manage the remaining risks are put in place. Possible measures include, for example, using forced ventilation or the provision of scaffolding.

Personnel planning is an important task. Contractors are engaged because the extent of the overhaul requires a large number of workers for a relatively short period of time, but working with third parties unfamiliar with standard company practice always creates additional potential risk factor. It is therefore necessary to guarantee good communication with such partners. Electrabel has an operational procedure for working with contractors which summarises the relevant health and safety regulations that contractors need to be aware of, and all the rules that apply specifically to the Langerlo site.

During the preparation phase a first meeting with the contractors is held, known as the 'start meeting'. This meeting explains the housekeeping rules of the plant to the contractors. They are also given information about the overhaul and the actual work expected from them. The commitment of the contractors to work safely, and to provide their workers with all necessary tools and materials to perform the job in an efficient and safe manner, are also checked at this first meeting.

A second meeting with the contractors, known as the 'kick-off', also takes place during the preparation phase. This meeting allows the foremen from Electrabel and the contractor to make agreements about the content of each task, SHE regulations and 'hold and witness points'. 'Hold and witness points' are situations in which the contractor immediately has to stop working. For example, when contaminated insulation is being removed, a hold point will be used to make sure that all contaminated insulation is removed before putting new one. At this second meeting it is again possible to check the commitment of the contractor to work safely and to provide its workers with the tools and materials they need to perform their jobs efficiently and safely.

Execution phase

While the work is being done, which normally takes about 4 to 5 weeks, various maintenance tasks will be performed and they are divided into several clusters. Conducting each cluster simultaneously requires excellent organisation and communication between different stakeholders.

Before a contractor gets permission to start a maintenance task, a third meeting is organised between the health and safety department and the contractor. Known as the 'start task' meeting, it is attended by the foremen from both Langerlo and the contractor and is an opportunity to finalise all agreements about the maintenance tasks, to remind the contractor of the safety regulations and to check whether the work permit sheet is in order. The contract worker who will actually carry out the work also has to be present at this meeting. To make sure that these meetings fulfil their role, a support document explaining what agreements have to be made during the meeting has been developed.

When the contractor finally starts the work, he has to collect the relevant work permit sheet which certifies that the area of the station being worked on is safe. This is further confirmed by a green card attached to the work post in the relevant area. The green card is a signal for all workers that maintenance is being done at that specific workstation.

Machines are tagged with a red danger card when they are part of the workstation being maintained, and if turning them while maintenance work was underway would be dangerous.

For example, to make pump A safe to work on, pump B has to be shut down and pump C left open. While maintenance is underway, Pump B and C will be marked with a red card to show that these pumps must not be touched, while Pump A will get a green card showing that it is safe to work on. The maintenance worker will receive a work permit sheet that confirms these precautions.

The work permit sheet will also mention the safety regulations which must be observed for the actual task. With the work permit sheet, the contractor receives a checklist which he has to use to perform a short risk assessment before he starts maintaining that part of the plant. This last-minute risk assessment serves as a double check and decreases the risk of accidents.

Daily observation rounds are made by the Care Department and the line managers to check on the execution of tasks. There are also internal daily meetings to address possible problems such as delays, missing tools and materials, safety issues, accidents or incidents, unexpected extra work,

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difficulties with or between contractors, etc. All incidents and accidents are written down in a logbook. Accident reports from the contractors are included.

Evaluation phase

In the evaluation phase, conclusions are drawn from the way the project has progressed and by identifying problem areas which will need specific attention during the next overhaul.

Different topics are addressed in the evaluation report covering areas such as health and safety, communication structures, planning, cooperation with contractors, and so forth.

Special attention during the evaluation phase is paid to any area where it has been necessary to repeat maintenance work that has not been effective. It is very important to avoid further unscheduled and costly shut-downs of the power plant before the next overhaul is due, particularly since other power stations won't be prepared to compensate for the unexpected shortage of power.

If, during the evaluation, it seems that some maintenance tasks have not met the required standard, an investigation is organised to find out what went wrong, addressing questions such as whether the failure has been caused by human error, by the use of the wrong materials or by an inherent fault or characteristic of the machine.

The answers to such questions will be recorded in the evaluation report so that further failures can be prevented during the next overhaul.

2.4. Results and evaluation

The result of a major overhaul is better productivity and improved safety of the power station.

The overhaul is considered 100 percent successful only if no accidents have occurred during the work, if all important stakeholders have been involved, if productivity has improved, if the budget and all aspects of the overhaul plan were respected, if there has been no need to re-do work, and if all the criteria defined in the preparation phase have been met.

It is difficult to produce specific figures that demonstrate the incremental improvements in safety and accident prevention enjoyed as a result of this system since, by its very nature, the procedure is designed to be flexible so that it can be slightly modified wherever necessary each time an overhaul is carried out.

There are factors that make it a real challenge to comply with the criteria defined in the preparation phase:

- During the overhaul about 700 of the 740 workers are contractors. A significant proportion of these workers do not speak either the official language of the region or English. This makes it very difficult to communicate with them about the content of the task and the hazards to which they will be exposed.
- As these overhauls are very large projects, planning must start several months in advance. In the meantime, the power station is still running and it is always possible that during this period additional areas of the power station are discovered to be in need of maintenance.
- During the execution of a maintenance task, workers might be confronted with additional work that needs to be done because unexpected problems are peculiar to closed systems.
- Contractors might hinder each other when doing their respective jobs. It's important that the health and safety department or the line managers intervene very quickly when such problems occur in order to search for appropriate solutions.

Of course there are also some factors that contribute to the success of these projects:

- Electrabel has developed an effective three-phase communication structure which creates enough time for the partners to exchange all information needed to perform the maintenance task efficiently and safely.

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- Thanks to good follow-up during these projects, the work group can rely on information from previous overhauls to make correct estimates of the time, costs, and numbers of workers needed for the next project.
- All the power stations in Zone East, to which Langerlo belongs, exchange experiences so that they can learn from each other.
- An effective method that clearly identifies both safe and dangerous parts of a workstation minimises the risk of dangerous situations during maintenance work.

2.5. Contact information

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2.6. Transferability

Since every large industry is confronted with the problem of periodical maintenance shut-downs, other companies using large-scale machinery or closed systems can apply the information available from Electrabel's experience of overhaul procedures.

Throughout all the phases of the overhaul, safety is an important issue. Risks are minimised through performing more than one risk assessment, at different times and by different persons and taking appropriate measures. All organisations facing high-risk situations should implement several risk assessments, reducing the accident risk as much as possible.

The communication structure applied by Electrabel to its cooperation with contractors can be used by all types of organisations working with third parties. Three meetings, each with a specific part to play in the process, allow Electrabel to discern the attitude of the contractor towards health and safety at work. By meeting with the contractor three times before work begins, important information can be repeated, reducing the risk of the contractor failing to understand what is required and allowing enough time for the contractor to ask questions.

3. References, resources:

Interview with Kim Lieten at 24 July 2008

Attending: Karen Muylaert from Prevent, Kim Lieten, Dirk Heirwegh, Marc Caethoven, Frank Gerinckx from Electrabel

Website Electrabel Belgium, consulted at 31 March 2009; URL: http://www.electrabel.be/homepage_corp/homepage.aspx

Wikipedia, the free encyclopedia, consulted at 31 March 2009, URL:

http://en.wikipedia.org/wiki/Thermal_power_station