2nd Oxyfuel Combustion Conference

Maintenance optimisation of oxyfuel power plants

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1. Introduction

To better protect the climate and to reduce CO_2 emissions, the EU has issued the goal of reducing CO_2 emissions by the year 2020 by 20 % relative to the year 1990. Germany wants to go a step further and wants to cut the CO_2 emissions by 40 % by the year 2020 relative to the year 1990. To reach these ambitious goals, CO_2 emissions have to be reduced in all areas. The energy sector plays an important role here. The energy group Vattenfall has set its own goals for CO_2 reduction in order not only reach, but to excel beyond these political goals. According, Vattenfall's first goal is to reduce the emission of CO_2 by 50 % by the year 2030. Their second goal is the elimination of CO_2 by the year 2050 [1]. Vattenfall obtains 51 % of its power generation from fossil fuels, of which coal is the dominant source. This dominance will not change very much in the next few years. So in order to reach their own goals, Vattenfall will have to implement CCS technology.

2. CCS Roadmap

Vattenfall has several test complexes showcasing all three CCS technologies. For the oxyfuel process there is a roadmap which shows step by step the way from smallest complexes and the pilot plant in Schwarze Pumpe to the demonstration plant in Jänschwalde and ultimately to a commercial power plant. The planning of the demonstration plant in Jänschwalde has come a long way. In this power plant the oxyfuel process should operate on the largest scale to date. In addition, the complete CCS chain should be realised. And the power plant is a necessary intermediate step in a scale-up process. The transformation of all the experience gained should quickly bring the demonstration power plant and, with it, the oxyfuel process itself to the accepted state of the art. Because of this the pilot plant in Schwarze Pumpe was not only build to verify the oxyfuel process, but also to gain valuable knowledge regarding technique, process and materials. The experience gained in maintenance is no less important that gained in operation of the oxyfuel process. With this process, new components, air separators for instance, find their way into

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the power plant which were previously only found on a much smaller scales in the chemical. These new components demand an advancement of the usual maintenance processes.

3. Maintenance optimisation

To generate the knowledge which is necessary for the demonstration power plant, a project was started with the Chair of Power Plant Technology of the Brandenburgische Technische Universität Cottbus. Vattenfall also employs a team which concerns itself with maintenance matters during the construction of the complex [2]. Maintenance is based on DIN 31051 and its further developed standards. All four maintenance modes (service and support, inspection, repair and improvement) were used in the pilot plant. The basic aims and their costs had to be selected and illustrated. The main goal of the maintenance was to ensure the continued research operation of the complex. The associated costs were identified and optimised. In order to that a speciality was the fact that the air separator and the CO_2 units were serviced and repaired by the company which produced them. Complete replacement of assemblies, for example burners, or the testing of new flue gas cleaning systems were also attended and realised in terms of the concept of maintenance.
Due to the variety of challenges the following items must be worked out:

1. Safety evaluation of the new processes and as yet unusual materials and their states
2. Analysis of component availability and their effects on planning and costs
3. Analysis and optimisation of the maintenance boundary conditions
4. Development of a technical baseline derived from operating experience

Through maintenance execution at the pilot plant in Schwarze Pumpe, Vattenfall has collected maintenance data such as break down rates and components repair times. If these data are collated and processed, maintenance could be optimised ahead of time [3]. Therefore only the availability relevant components of the oxyfuel power plant are being focused. The components are organised in wear units such that the components in each wear unit share similar wear times. Afterwards, the afore-mentioned maintenance data will be linked to the wear units to describe the lifetimes of the components with the help of Weibull distributions. This allows the given strategies to be compared and an optimal strategy to be found.

4. Conclusion

Experiences and knowledge from the existing oxyfuel complexes are an important baseline for optimising the maintenance of the Jänschwalde demonstration power plant in advance.
This presentation will deal both with Vattenfall's maintenance optimisation and the collection of maintenance data pilot plant in Schwarze Pumpe as well as maintenance optimisation of oxyfuel power plants by the Chair of Power Plant Technology.

5. References

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