

[NEWS :

Focus on coal technologies

GROWING NUMBER OF INTERNATIONAL CO-COMBUSTION PROJECTS

Assisting operators in Brazil and Poland

Tighter environmental regulation is pushing numerous coal-fired power plants to co-fire coal with biomass. Laborelec's knowledge in this field is increasingly being called upon throughout the world. Examples at the José Lacerda (Brazil) and Polaniec (Poland) power plants.

[Preliminary study for coal/straw co-combustion in Brazil

The José Lacerda coal-fired power plant in Florianopolis is currently firing local low quality coal. Changes in the local environmental legislation have led the plant to add rice straw in the fuel mix. This is related to the ban of field burning during the rice cultivation process that is developed in this region. 'We carried out a preliminary study to assess the feasibility of coal/straw co-combustion,' explains Patrick Allard. 'Based on this study, we established that the plant could accommodate up to 10% rice straw with limited risk of slagging and fouling inside the boilers.' Laborelec also helped the local plant operators establish the specifications for the purchase of appropriate additional equipment. This equipment is required for the plant retrofit so that straw can be injected into the boilers. 'We identified the most appropriate storage system, as well as fuel preparation and boiler feeding methods. In addition, we helped the plant comply with ATEX explosion-proofing standards. This is a standard GDF SUEZ best practice, even though the ATEX requirements are not legally binding in Brazil.' Laborelec will be called in to supervise the boiler start-up at a later stage.

[Assessing the use of agricultural biomass in Poland

The Polaniec co-combustion power plants (8 x 225 MWe) currently fire coal mixed with wood chips as well as limited quantities of agricultural biomass such as straw and sunflower residues. New Polish regulations, however, are gradually banning the granting of green certificates when co-firing wood in a power plant. From 2015 on, only agricultural biomass will be accepted. The plant operators asked Laborelec to assess this transition from wood to agricultural biomass. 'We analyzed the use of, among other things, wheat and coleseed straw, residual sunflower pellets, and fruit husks resulting from apple juice production,' notes Ryckmans. 'We evaluated the various properties of these types of biomass and their effects on critical corrosion, slagging, and fouling issues.' Laborelec is currently carrying out two studies for Polaniec. The first one aims to reduce the risk of congested coal mills. 'We are studying the use of co-injection. This consists of two different circuits feeding separate burners instead of co-milling coal and biomass together.' At the same time, Laborelec is investigating the feasibility of building a separate boiler fed with 100% local biomass resources. This entails a number of challenges since the presence of coal usually plays a protective role against fuel components such as alkalis that induce slagging and fouling inside the boiler.

yves.ryckmans@laborelec.com

PAVING THE WAY FOR INNOVATIVE COAL TECHNOLOGIES

Laborelec remains at the forefront of new technological evolutions in the international energy sector. Our services and research projects cover the full range of electricity generating technologies. In this edition we concentrate on our activities for coal-fired power plants, with a specific focus on co-combustion of coal and biomass, candidate materials for ultra-supercritical power plants, and carbon capture and storage.

coralie.goffin@laborelec.com



Our experts advise coal-fired power plants on how to minimize the negative side effects of co-firing biomass.

[In short

- Laborelec is taking part in a growing number of co-combustion projects around the world
- At José Lacerda, our experts are examining the feasibility of burning 10% rice straw with local coal
- At Polaniec, we are testing the co-combustion of agricultural biomass to gradually replace wood chips



DESIGN-REVIEW ADVICE FOR USC POWER PLANTS

Process automation aims to improve plant efficiency

Loborelec is a key partner in the design of the ultra-supercritical (USC) power plants in Germany and the Netherlands. Our Process Automation Team, among others, is providing Tractebel Engineering and Electrabel with advice on various design issues.

Process automation systems as well as operational staff greatly influence the power plant's overall efficiency. The Loborelec Process Automation Team was able to provide useful advice in both domains, based on their extensive know-how and field experience.

[Creating an efficient working environment

The organization of the control room has a major influence on staff performance. The composition of the monitor wall, the location of the control desk, and the use of windows are just a few examples. Jos Menting explains how Loborelec brings added value to this project: 'Throughout the years, our projects have taken us to many power plant control rooms. It has given us unique insight into common problems and best practices. Given this background, we are able to give input for the design and best layout of a control room.'

Another challenge is to improve the staff's decision making ability by giving them easy access to useful information. Loborelec's advice in alarm management and high performance human/machine interfacing (HP HMI) envisions exactly that. 'An alarm philosophy was developed based on our intelligent alarm methodology. It ensures that only viable alarm calls appear on the monitors,' explains Menting. 'On top of that, our HP HMI advice focuses on translating raw data into easy to interpret information.'

[Optimizing process performance

Beside optimizing staff efficiency, the Process Automation Team also worked out various recommendations to maximize process performance. Together with the Loborelec Combustion Team, they are advising on the best soot blower configuration and control system.

'We are also providing advice on cyber security. Intensifying automation can potentially open the door for cyber incidents,' warns Menting. 'Our recommendations aim at keeping security up-to-date to prevent any such incidents.'

renaud.desclee@loborelec.com



The composition of the monitor wall has a major influence on staff efficiency.

“EXPERTISE AND FIELD EXPERIENCE ARE VALUABLE ASSETS IN THE DESIGN OF NEW POWER PLANTS”

[In short

- The Loborelec Process Automation Team is advising Tractebel Engineering and Electrabel during the design-review of the USC power plants in Germany and the Netherlands
- Advice on alarm management, high performance human/machine interfacing, and control room design aims to maximize staff efficiency
- Loborelec is also providing advice to optimize process performance and cyber security

PROACTIVELY PREPARING FOR A NEW GENERATION OF USC MATERIALS

Through external and internal projects

The GDF SUEZ Group is currently building its first two 600/620 °C coal-fired power plants. Laborelec, however, is already preparing itself for the next generation of 700/750 °C ultra-supercritical (USC) power plants. Our experts are extending their know-how of candidate materials.

The future generation of USC power plants will produce energy more efficiently by operating between 700 and 750 °C and at 350 bar. These conditions pose new challenges for the materials that will be used. 'If we use the materials that are standard in today's USC power plants, such high temperatures and pressures would accelerate degradation and reduce lifetime,' explains Staf Huysmans. 'That is why experts around the world are searching for new and more robust materials that are able to withstand high temperatures.'

[Active in European research programmes

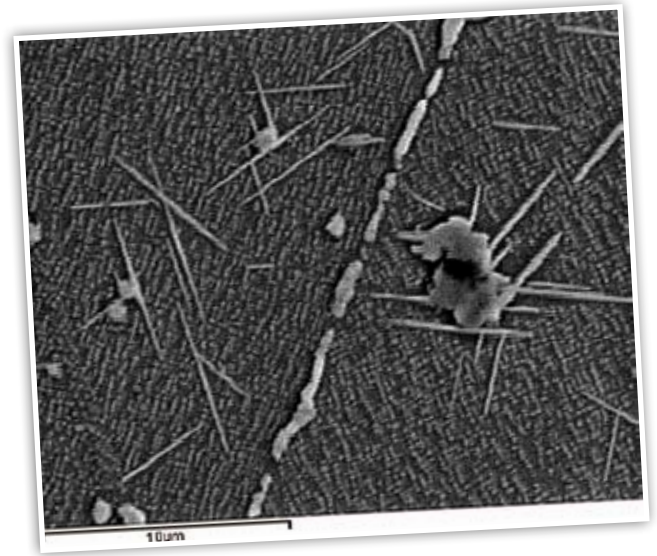
Laborelec is presently evaluating three promising USC candidate materials as part of the European COMTES 700 research project. 'Our job is to evaluate the microstructure of un-aged as well as aged material samples. This gives us a clear understanding of the degradation mechanisms at work,' states Huysmans. 'In our in-house lab we can use scanning electron and light optical microscopy, including digital imaging techniques, and other advanced techniques such as creep rupture and stress relaxation testing.'

Laborelec is also active in the Nordrhein-Westfalen PP700 Project. This project aims at building the world's first 700 °C USC demonstration power plant. Our experts are conducting various studies to validate candidate materials. Researching the impact of machining marks on crack initiation in a centrifugally cast alloy is just one of the areas under investigation.

[Extending knowledge through technology watch

Laborelec not only relies on external collaborations. By investigating specific areas, following up on the published literature, and maintaining close contacts with materials experts worldwide, our experts keep track of interesting developments regarding USC materials. 'This enables us to remain at the forefront of new material evolutions,' concludes Huysmans.

sigrid.gijbels@laborelec.com



Laborelec is able to characterize the properties and degradation mechanisms in USC candidate materials using in-house lab equipment such as scanning electron microscopy.

"LABORELEC PARTICIPATES IN INTERNATIONAL USC RESEARCH PROJECTS"

[In short

- Laborelec is building knowledge of candidate materials for the next generation of ultra-supercritical (USC) power plants (700 to 750 °C)
- In the COMTES 700 and the PP700 projects, our experts collaborate with international experts to characterize the degradation mechanisms of USC candidate materials
- In-house R&D projects, technology watch and international contacts ensure that Laborelec remains at the forefront of new evolutions in this domain

DEVELOPING KNOW-HOW IN CARBON CAPTURE

Multiple research and pilot projects

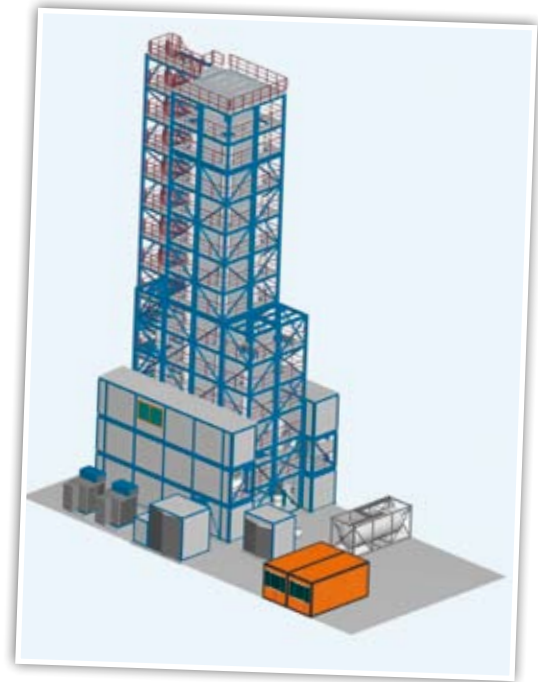
Carbon capture and storage (CCS) is viewed as a key emerging technology to curb atmospheric CO₂ emissions. Laborelec is developing its expertise to provide technical support during CCS projects initiated by the GDF SUEZ Group and to anticipate challenges when operating carbon capture units. Our experts are taking part in numerous research projects.

- Assessing the **environmental impact** of carbon capture installations. Laborelec is developing methods to quantify liquid, solid, and gaseous emissions, and to define their impact on the environment. This is done through life cycle analysis.
- Researching solvents with a **slower degradation** pattern. The solvents that capture CO₂ in post-combustion carbon capture installations thermally and chemically degrade over time, thus affecting process efficiency and entailing solvent reinjections. Laborelec has acquired new equipment to study alternative solvents.
- Quantifying and qualifying liquid and solid **waste streams** to assess how they can be recycled and how their discharge into the environment can be reduced.
- Testing **material resistance** to corrosion and wear in laboratory together with the University of Louvain-la-Neuve (UCL).
- Developing and testing an on-line system to **monitor organic emissions** generated by post-combustion carbon capture installations at a pilot site in Esbjerg (Denmark). Laborelec is also **monitoring corrosion** there in the framework of the CESAR project and carrying out metallographic analyses on corrosion samples.

coralie.goffin@laborelec.com

[R&D activities grouped into Clean Coal programme

Laborelec's R&D activities in the field of coal technologies are now grouped into the Clean Coal research programme to better address customer needs. This programme focuses on increased plant availability and flexibility, reduced operation and maintenance costs, increased plant efficiency, environmental impact reduction, and CCS.



A CO₂ capture pilot unit will start operation in the Netherlands after the summer of 2010.

[CO₂ capture pilot plant in the Netherlands

Electrabel, E.ON, and Hitachi Power Europe are building a semi-mobile pilot plant for CO₂ capture at Electrabel's Gelderland coal/biomass power plant in Nijmegen. This pilot unit, designed by Hitachi, will enable to investigate the behaviour of different solvents in the post-combustion capture process. Electrabel – and, after two years, also E.ON – will integrate the semi-mobile pilot plant in their power plants to perform the test programme under real conditions.

'Our main objectives are to acquire operational experience, reduce the energy consumption of the capture process, and assess its environmental impact,' explains Emmanuelle Bertrand. 'Laborelec is involved in the technical decisions related to pilot plant design, choice of solvent, test programme, and experimental results. We are also providing specific technical advice on emission measurements, liquid sampling and analysis, corrosion, and environmental impact, among other things.'

[In short

- Laborelec is developing its CCS expertise through numerous in-house and European research projects
- Laborelec's Clean Coal programme groups all R&D activities involving coal technologies for an improved customer service
- Our experts are assisting with the development and future operation of a carbon capture installation at an Electrabel power plant in the Netherlands