Retrofitting and modernizing ENERGY FROM WASTE AND BIOMASS PLANTS

CONSULTING ENGINEERING INSTALLATION MAINTENANCE

11111



RETROFIT COMBUSTION OPTIMIZATION AUTOMATION FOR NEW PLANTS NEW GRATE TECHNOLOGY

ALWAYS ON YOUR SITE



24/7 SERVICE & SUPPORT



SUSTAINABLE TECHNOLOGY



INTERNATIONAL



Technikgruppe

... is an Austrian engineering company with 40 employees having international experience and worldwide engagement. Due to its long experience in Energy-from-Waste and biomass Technikgruppe also acts as an independent consultant for technical and commerical issues.

Please contact us for any question. We are happy to exchange our experience.

Matthias Lukic C.E.O

Every combustion line is unique and is a complex technical system. Every combustion line should be individually adjusted to optimize its operation. Our tailor-made automation systems, use extremely powerful control processors and extremely fast software to individually optimize each grate system to deliver a state-of-the-art combustion system that optimizes the combustion of waste to deliver:

- Enhanced profitability
- Enhanced reliability
- Enhanced availability



Matthias Lukic, founder, owner and CEO of Technikgruppe, has more than 25 years of experience in combustion of solid fuels on grates.



Damir Zibrat, Business Development Manager of Technikgruppe, has more than 25 years of experience in international strategical selling and marketing.

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Our approach

Over time automation systems become obsolete, spare parts become expensive and difficult to obtain and most importantly hardware and software technology advances. In traditional Process Control Systems and especially in older systems plants must "live" with many problems such as:

- Unstable steam production
- Large swings in steam production
- Periods of significantly reduced steam production
- Oscillations in primary air supply
- Oscillations in secondary air supply
- Oscillations in flue gas temperature
- Poor waste combustion large amount of total organic carbon TOC
- Slagging and fouling of the combustor
- Significant increases in consumption of chemicals for flue gas cleaning
- Large quantity of fly ash produced
- More reliance on operator intervention in the control room
- More stress in control room because of alarms caused by process variability

By retrofitting the latest state-of-the-art combustion control technology many of these problems will simply disappear. Our technical experts can assess your plant and using our many years of combustion expertise we can advise:

- How the control system can be upgraded, if fundamental changes are required or whether a combustion optimization system can be added
- Identify where the problems are in the combustion control system
- Identify if mechanical changes are required and how this will improve the system response
- Outline the benefits of replacing the grate with a grate using a different control method



AUTOMATION

Technikgruppe's Technical Experts have almost 30 years of experience in modernizing and developing the control and automation of the combustion process in Energy from Waste and biomass plants. As an INDEPENDENT ADVISOR Technikgruppe can offer:

• Consulting:

For retrofitting and modernization of old plantsFor combustion optimizationFor use of different combustion technologiesFor analysis of types of grates and feasibility of replace with different types of grate

- For construction of new plants
- Feasibility studies
- Training and Education through:

Personal on-site training Seminars Webinars or video conferences

- Engineering
- Installation of equipment
- Service



Technology of fire

The combustion process in Energy from Waste and biomass plants is very complex, and the demands on control systems in those plants are also very complex. There are many theories about the best combustion technologies to use and there are equally many different approaches to find the right solutions.

In most conventional control systems, there are many control algorithms which are implemented and many arguments how to compare different approaches to make a real difference. In all of these discussions there are two basic factors that are used in nearly all comparisons:

1. What main actions - have influence on - the quality of the combustion process?

2. Which measured parameters can be accurately compared to estimate the combustion quality?

Simplistically there are 3 main actions which have influence on combustion process.

- 1. Adding fuel into a burning chamber
- 2. Blowing oxygen into the fire
- 3. Mixing the fuel with combustion air





After many years of experience in optimizing the combustion processes in Waste and Biomass plants, we have demonstrated that mixing the burning fuel is one of the most important actions inside the combustor, and is especially effective with special FORWARD MOVING RECIPROCATING GRATES. Because of this, Technikgruppe's combustion controller (WiC combustion manager) is primary developed for implementing on FORWARD MOVING RECIPROCATING GRATES.

WiC is our very unique product using state-of-the-art software and high-speed controllers to achieve great combustion optimization. WiC is simple to implement and can either be retrofitted as a "by-pass" system to any existing DCS control system, or it can be integrated into the DCS during the development and construction of the new control system.



When WiC is integrated into the plant, optimizing the combustion process can achieve considerable savings by:

Stabilization and enhancement of steam production



Steam production controlled by DCS

Steam production controlled by WiC (same line)

Stabilization of combustion air flow



Primary air 6.3 - 104 6.3 - 104 4.9 - 104 4.9 - 104 2.1 - 104 2.1 - 104 7. 104 0 0 7 hours

Primary air controlled by DCS

Primary air flow controlled by WiC (same line)

Ceiling temperature

Please NOTE! The higher amount of primary air is related to an increase of waste throughput/steam production

1000

900

800

700

500

200

100

009 NaBrn

2 400

006 BK10



Stabilization of flue gas temperature (ceiling temperature)

Please NOTE! The average temperature is, of course higher because of enhancement of waste throughput/steam production

Ceiling temperature with WiC (same line)

What are basic Combustion Control principles of WiC?



The controlling principle of WiC is based on 3 main functions:

- Mixing of burning fuel with combustion air
- Blowing oxygen into the fire
- Adding fuel into a burning chamber

The Forward moving reciprocating grate is an excellent example for implementation of the three (3) basic actions.

Moving grate (1) provides the mixing of fuel with combustion air. The primary air supply (2) blows oxygen into the fire. The feeder (3) adds more fuel into



the burning chamber. These 3 actions are controlled by approximately 30 different actuators and most of these actuators are analog devices.

Using 30 actuators each which can be individually adjusted, creates billions of possible combinations but each one has some impact on the process. To really optimize the combustion process the Technikgruppe WiC system adjusts each actuator every 1-2 seconds in small increments and with billions of possible combinations it is a very demanding task for the control system.



How do we determine the right combination for fine adjustment of the actuators?

Modern automation systems in Waste and Biomass plants can process more than 100 measurements from the plant process parameters. Those parameters are the fingerprint of current combustion state. WiC then takes these parameters and carries out further calculations and determines the appropriate combination for fine adjustment of the equipment actuators. Quickly processing so many inputs and fine tuning the actuators every 1-2 seconds requires an extremely powerful controller and complex software. Most DCS controllers on the market today are constrained by scan times and they are unable to process the information quickly enough. Technikgruppe's WiC system provides this high-speed processing power, dedicated to the combustion optimization process.

For any additional information about WiC please download material from www.technikgruppe.com or contact Technikgruppe GmbH directly. Our experts are available to answer all your questions.





WiC generates additional profit right from the start

Because of WiC's ability to fine tune the process and provide extremely high-quality combustion optimization on forward moving reciprocating grates it can generate considerable savings and increase profitability.

Technikgruppe's technical team will analyze measured data and quickly estimate the technical and commercial benefits of implementing WiC. This analysis will prove that:

- WiC will provide the best technical solution (in comparison with other systems on market)
- WiC will generate the greatest profit (in comparison with other systems on market)

In considering combustion optimization Technikgruppe team will offer:

- Feasibility consulting free of charge
- Engineering and WiC installation (for performance testing) free of charge
- Training for operators free of charge

- Operation proving and testing for a period free of charge
- After a successful test period payment options are agreed with monthly payment rates which are less than profit realized

This is an extremely unique payment model, leaving the customer with NO technical risk, NO commercial risk and a fully optimized combustion process.

The payment period is negotiable, but typically 3 or 5 years, after which customer will own WiC. During the payment period customer has the right to cancel the payment contract and ask Technikgruppe to remove the system without any costs or impact to the original DCS control system.

Technikgruppe remains extremely flexible and are prepared to negotiate other payment options to fit with individual business models.



Standard load - 109 t/h

After stabilization of steam production the real capacity could be estimated.

Enhancing combustion capacity without mechanical changes

After running with WiC for 1-2 years you will notice that steam production is very consistent without large swings in output. Because of the large oscillations in steam production (usually caused by poor quality of combustion process control or inadequate type of grate) many boilers are oversized to overcome the negative swings in steam production and to mitigate the risk of poor performance of the steam circuits. This means that real design limit for steam production, in some cases, is much greater than typically expected. Therefore, by reducing the oscillation in steam production greater steam output may be realized.

Depending on the individual design and installation of the plant, and after a detailed engineering evaluation and the necessary approvals, it may be possible to enhance steam production though increased incineration capacity without any hardware changes. This means that good control of the combustion process can improve the output of the existing boiler.

Case study

After implementing WiC and removing the large oscillation in steam production Technikgruppe experts monitored steam production over a long period of time to prove the process was indeed extremely stable. Technikgruppe then carried out a detailed design evaluation on the boiler and steam circuit and with approval from the notified approval body they were able to increase combustion throughput and thus increased the steam production by approximately 10%. This was all accomplished by using WiC to reduce steam oscillations, thus creating a very stable process without any mechanical changes. Of course, this cannot be guaranteed for all plants but the design study will quickly determine where this approach is possible.

900 150 1.35 · 105 150 1.215 · 10⁵-135-810 135 1 st [°C] 120 720 1.08 · 105-120 10_HLA10CF910.XJ01 Flow PriAir total [Nm³/h] 10LBC01DF010B.XJ01 SP Steam from DCS [t/h] PV Flow Steam [t/h] ceiling 105-630 105 9.45 · 104 · T 2003 Flue gas 8.1 · 10⁴-90-540 90-6.75 · 10⁴-450 0_LBA10CF901.XJ01 75-75 0_HBK10CT901.XJ01 60 5.4 · 10⁴ · 60-360 4.05 · 10⁴-45 270 45 30- $2.7 \cdot 10^{4}$ 30-180 1.35 · 10⁴-15-90 15 7 hours 0 0 0 0

Increased load - 120 t/h

This led us to a load increase of 10 % from original MCR

It is important to emphasize that even after increasing steam production from 109 t/h to 120 t/h the steam production is still stable.

Changing the type of grate to increase steam production and waste throughput

After years of operation waste characteristics change, and this can cause problems which cannot simply be solved due to limitations in the grate characteristics. However, it may still be extremely financially viable to retrofit another type of grate along with WiC and benefit from the longer-term savings which will include:

- Increased Incineration capacity
- Improved burn-out quality
- Extremely stable steam production possibilities to increase boiler steam capacity, reduced plant trips and less operator intervention

Changing the grate may seem expensive but it can have a very short return of investment.



Grate exchange - types of grate





Forward moving reciprocating grate to forward moving reciprocating grate





Reverse acting grate to forward moving reciprocating grate





Roller grate to forward moving reciprocating grate

Often old grates are beset by problems with excessive wear, poor reliability or simply poor combustion performance. Considerable savings could be realized if the grate were changed to a well designed forward moving grate. Technikgruppe's technical experts have the experience of assessing grate performance and can determine the viability of changing the grate.

The Technikgruppe team can offer the full service from engineering design through to project management, commissioning and optimization using WiC.



Less cyclic = more Steam

More waste burnt

Simply changing the type of grate can have considerable positive effect on combustion quality and profitability. However much greater saving will be realized if the change were also to include Technikgruppe's WiC combustion manager.

For additional information about WiC please download materials on www.technikgruppe.com or contact Technikgruppe directly.



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