Energy from Waste

Virtual London 10-12 March 2021

Connecting the global waste to energy industry

technikgruppe®

COMBUSTION MANAGEMENT

It is a great pleasure for us to announce that TECHNIKGRUPPE had another successful participation in this interesting international conference on energy from waste.

www.technikgruppe.com/technology-of-fire

Energy from Waste: Virtual Conference, London 10–12 March 2021

In these three days, many presentations called for the modernization and improvement of the incineration capacity of existing plants. In our presentation the basic principles of unique methods for combustion optimization and improvement of combustion capacity were explained. Some case study results were strong arguments in favor of using our method. During the discussion we exchanged experiences with other experts.

If you have any further questions or are interested in technical advice, it is our pleasure to share our experiences with you and your employees. Further information on combustion optimization can be found at: **www.technikgruppe.com/technology-of-fire**

TECHNIKGRUPPE at the Energy from Waste Conference 2020 in London. For the photo gallery of the EfW Conference 2020, please use the link: http://bit.ly/2Q1Eqig.

It is a pleasure for us to personally welcome you to the LONDON EfW Conference 2022.

Energy from Waste
London 9-10 March 2022
Connecting the global waste to energy industry

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

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

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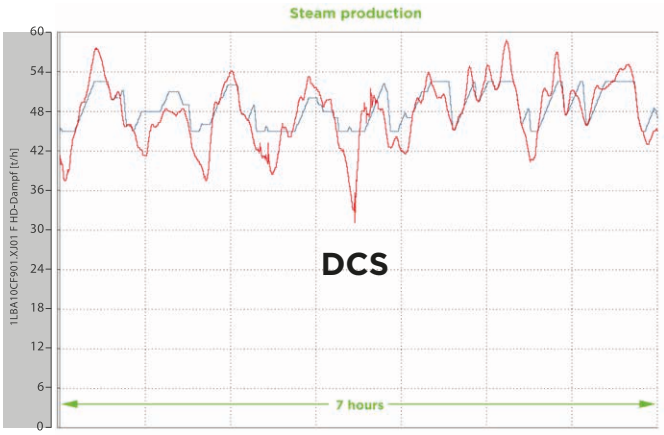
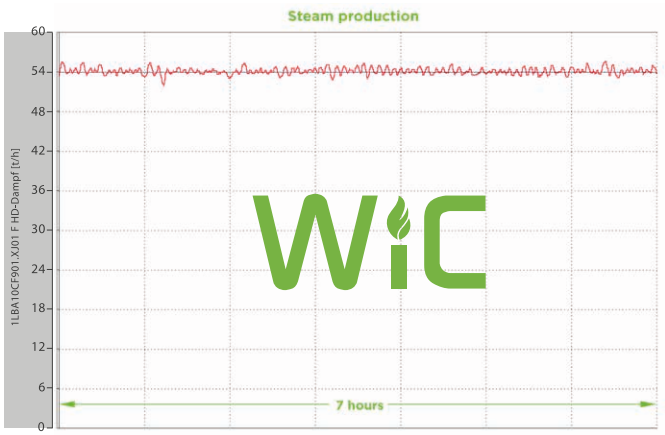
Below are some graphs of real case improvements that have an impact on profitability, reliability and availability. The integration of the WiC leads to significant additional earnings through:

Stabilization and enhancement of steam production

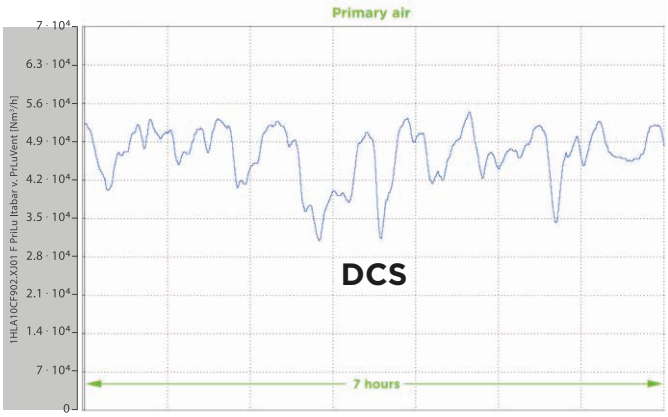


Steam production controlled by DCS

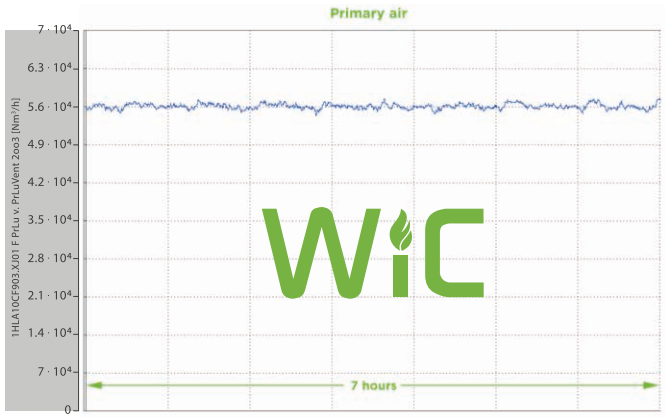


Steam production controlled by WiC (same line)

Stabilization of combustion air flow



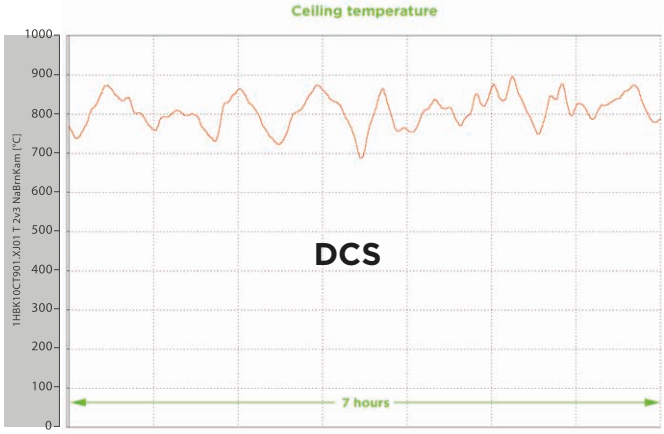
Primary air controlled by DCS



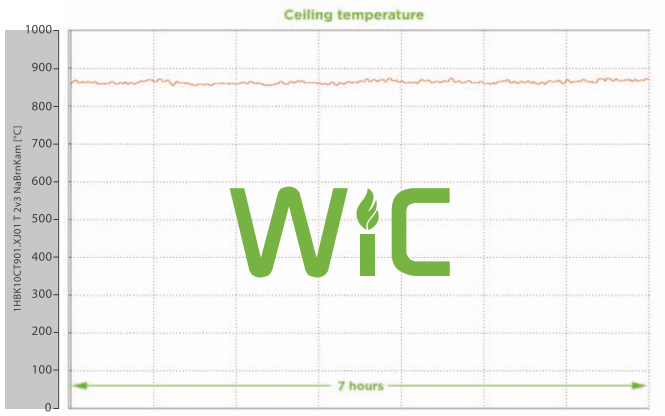
Primary air flow controlled by WiC (same line)

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

Stabilization of flue gas temperature (ceiling temperature)



Ceiling temperature with DCS



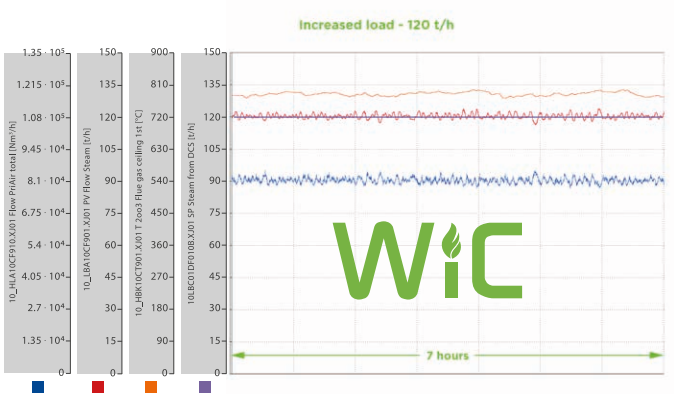
Ceiling temperature with WiC (same line)

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

Enhancing combustion capacity without mechanical changes

In most cases, the boilers are designed with large reserves due to a lack of control accuracy. This fact can offer the possibility of improving the combustion capacity by optimizing the combustion control.

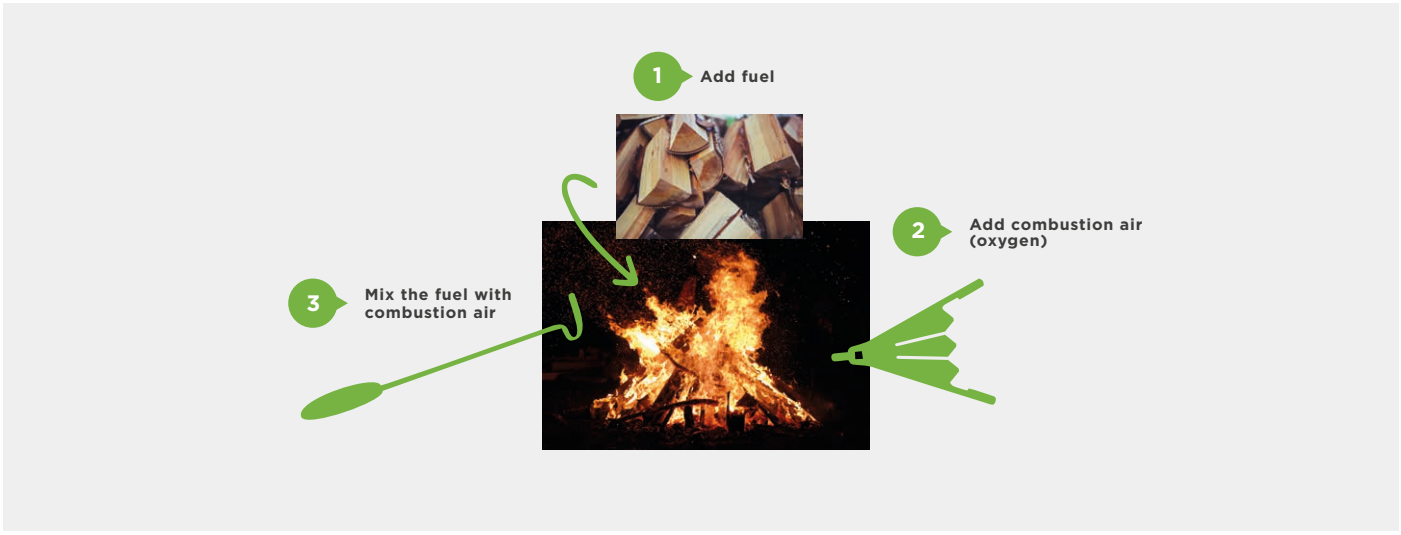
After stabilization of steam production, the real capacity could be determined.



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

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

The control of the combustion process is based on 3 main actions:



Technology of fire

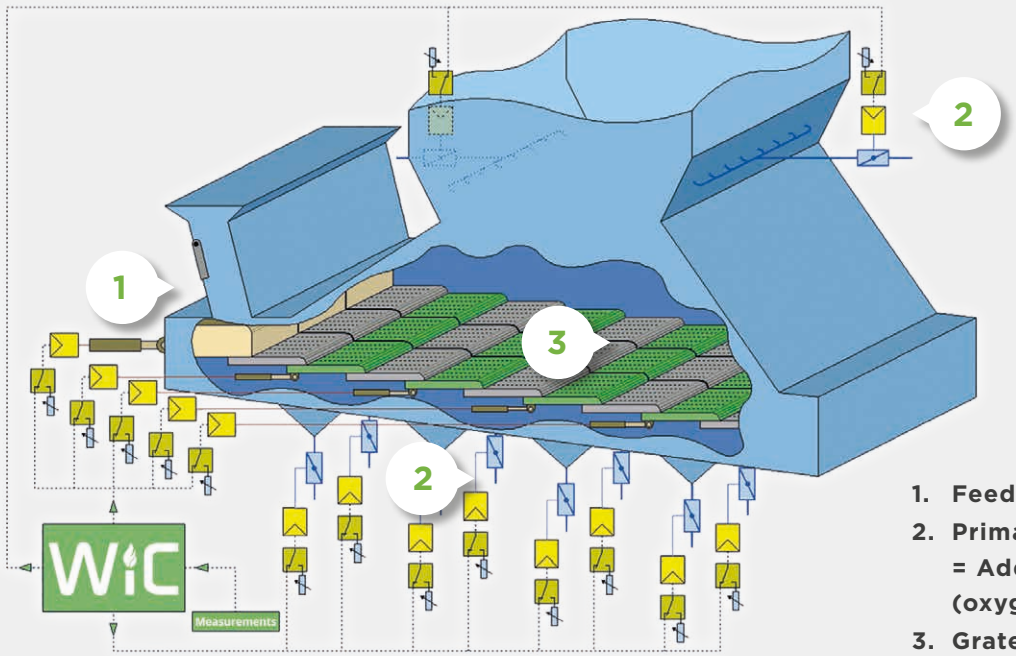
The combustion process in Energy from Waste and biomass plants is very complex, and the demands on control systems in those plants are also very complex. There are many theories about the best combustion technologies to use and there are equally many different approaches to find the right solutions.

In most conventional control systems, there are various control algorithms and many arguments how to compare different approaches. In all comparisons two basic factors are used:

1. Which main actions have influence on the quality of the combustion process?
2. Which measured parameters can be accurately compared to determine the combustion quality?

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

1. Add fuel into the burning chamber
2. Add combustion air (oxygen)
3. Mix fuel with combustion air



1. **Feeder = Add fuel**
2. **Primary/Secondary air = Add combustion air (oxygen)**
3. **Grate = Mix the fuel with combustion air**

After more than 25 years of experience in combustion optimization, we can say that forward-moving reciprocating grates are ideally suited to the application of the 3 basic principles for combustion control.

These 3 main actions involve around 30 actuators. But these actuators offer many possible combinations for fine tuning.

If we have 20 actuators and each actuator has 10 possible positions - **how many possible combinations do we get??**

1 actuator provides 10 combinations // 0-1-2-3-4-5-6-7-8-9-
2 actuators provide 100 combinations // 00-01-02-03-04- 96-97-98-99
3 actuators provide 1000 combinations // 000-001-002-003-004-005-006-007 997-998-999
20 actuators provide 100 000 000 000 000 000 000 possible combinations for fine adjustment //
00 000 000 000 000 000 000 ..... 99 999 999 999 999 999 999

The status of the combustion process is changing every few seconds! **That means - every few seconds we need to fine adjust the actuators.** It is clear that the definition of appropriate combination every few seconds is a very complex task.

Whereas the checking of combustion quality is very simple → see some diagrams of KPI's from a combustion process.

How to assess the status of combustion?

Process data from combustion system

Fingerprint of current combustion status

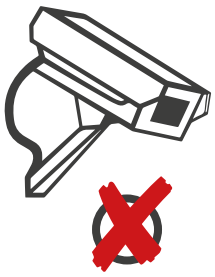
Modern automation systems provide various signals from the combustion process. These signals are the fingerprint of the current combustion status.

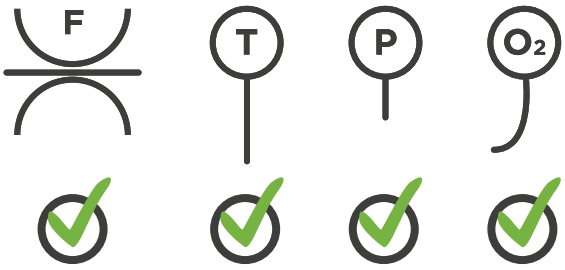
Finger print data

WiC

Feeder, grate, combustion air (30 actuators)

With appropriate algorithms it is possible to calculate the appropriate combination (1 out of billions) for the actuators positions. Standard industrial process controls cannot be used for this purpose! It is necessary to use particular powerful controllers.

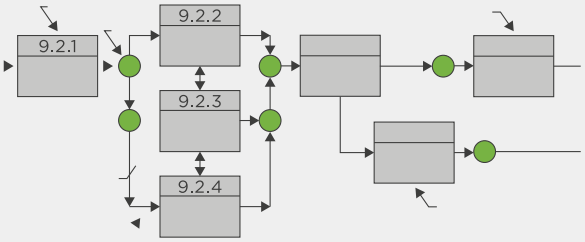




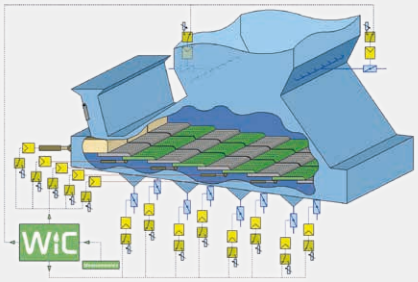
The WiC only needs standard process measurement as data inputs. **No thermo camera** or pyrometers are needed. This fact considerably reduces equipment and maintenance costs.

What is the difference between conventional controllers and WiC ?

Traditional systems **50**



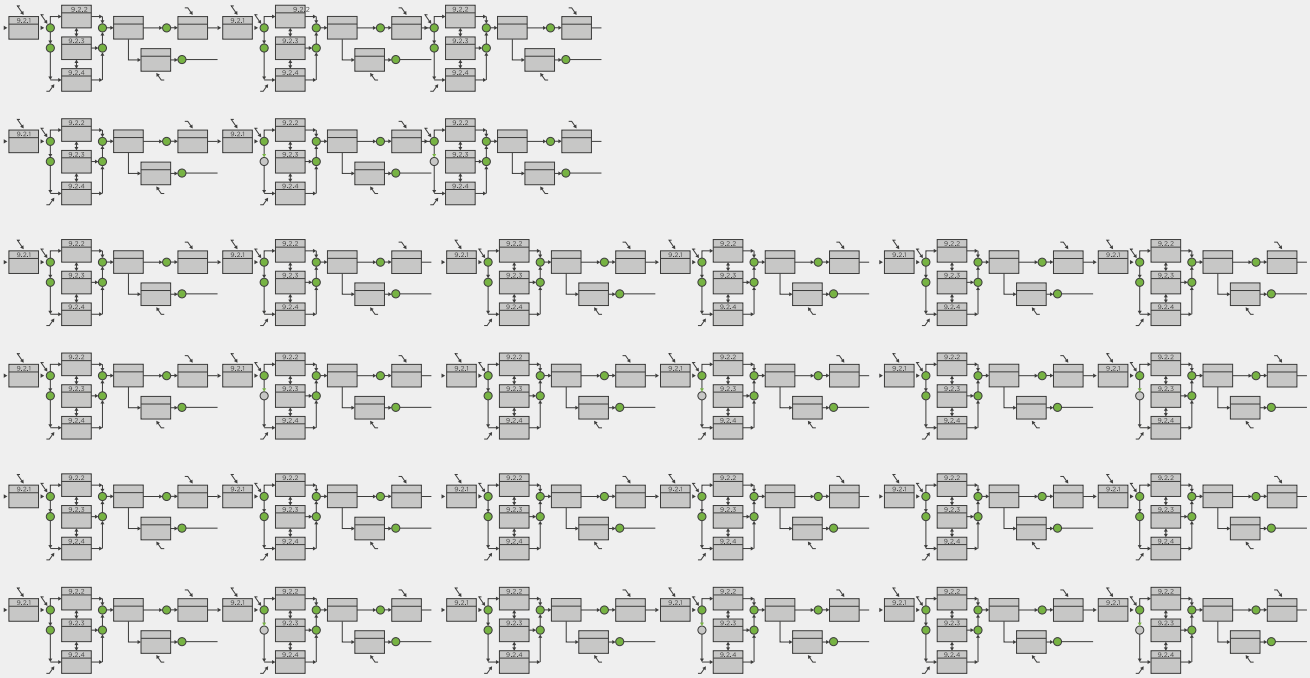
Conventional controllers have about 50 functional diagrams



100.000.000.000.000.000.000 possible positions for fine adjustment.

For this complex task the technical experts of TECHNIKGRUPPE have developed a very sophisticated software package with about 6500 functional diagrams.

WiC system **6500**



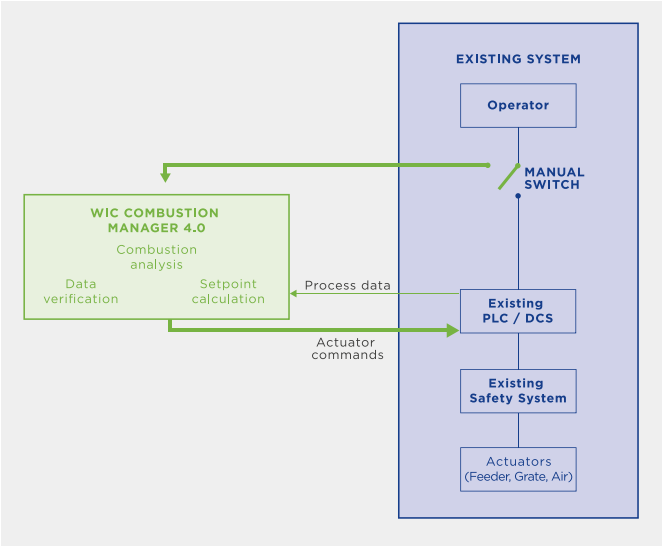
The WiC Combustion Manager has 6500 functional diagrams

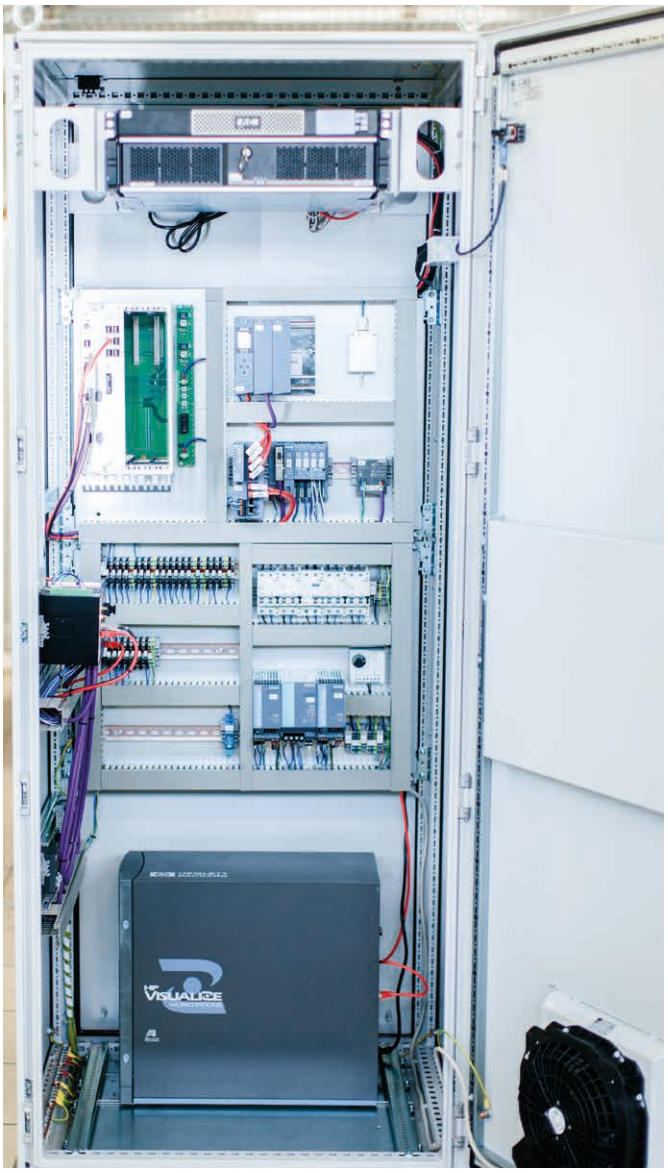
WiC uses real-time data processing, far more data than traditional systems. WiC processes some 6500 functional diagrams instead of typically 50.

Every plant is unique and for every particular plant the control calculations must be done thoroughly. In the combustion control process, it is necessary to calculate many equations simultaneously in real time.

With its 6500 functional diagrams, WiC provides a quality and accuracy which is not possible to reach with classic controllers and classic control strategies.

How is the WiC connected to existing automation systems?





In most applications the WiC is a bypass or an „add-on“ system to the existing combustion control system. It may also be integrated from project start up. The WiC usually comes in a cabinet of 600D x 800W x 2000H mm (24D x 31W x 79H inch) and is placed in the DCS room.

The basic working principle of the WiC is to “listen” to process signals coming from the DCS, calculate appropriate set points for combustion parameters and send them back to the DCS to control the actuators of the combustion system (air dampers, feeder- and grate-hydraulics).

Note:

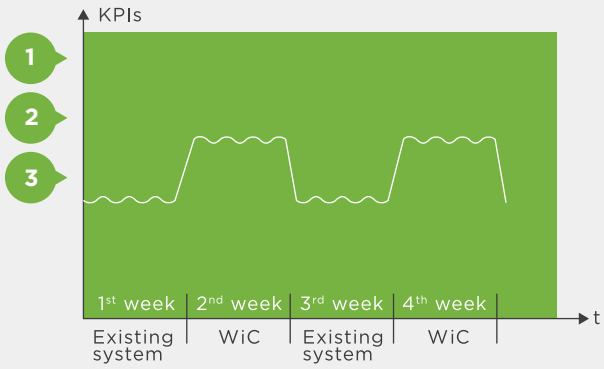
- WiC does not replace the existing system
- WiC is a bypass/add-on system for exact process set point calculations
- WiC does not interfere with the existing safety system
- With a single switch (software and/or hardware) the operator may define the source of set points, utilizing WiC-set-points or DCS-set-points. This is essential for the operators to gain confidence in a „new combustion philosophy”. The operators can, at any time, switch back to their familiar existing system and they can directly compare with the new WiC Combustion Manager.

The installation of WiC takes about 4 weeks. The WiC does not interfere with ongoing operation; there will be no disturbance or plant shut down.

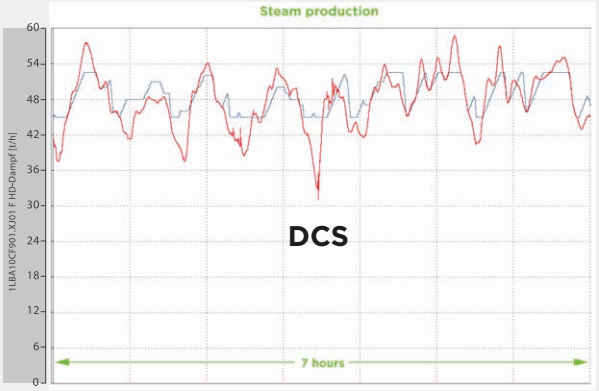
The commissioning of the WiC is finished within 10 minutes. Roughly 30 minutes after commissioning, it is possible to see first benefits of the WiC-system.

Note:
The WiC can also work as an add-on for any 3rd party combustion optimization system the customer might have implemented in the past.

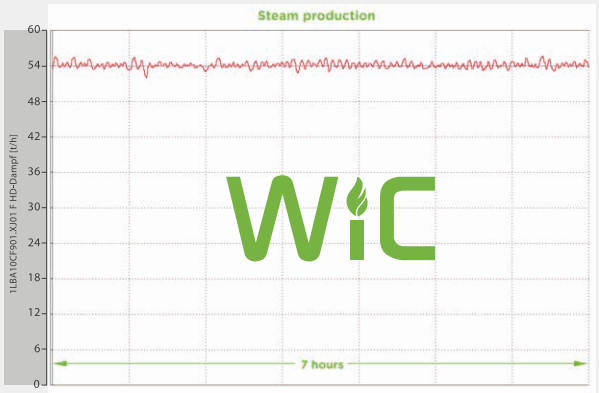
Measuring the benefit of the WiC



Stabilization and enhancement of steam production



Steam production controlled by DCS

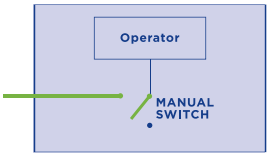


Steam production controlled by WiC (same line)

After the installation of the WiC, one important question comes up: “What is the benefit of the WiC Combustion Manager?” For answering this question, the following procedures will work as simple and reliable testing methods.

It is necessary to have approximately the same waste quality and then check the KPI’s under WiC- and under DCS combustion control.

With one simple switch plant operators can move between the existing system und WiC.



The periods under comparison may be selected according to similar waste conditions.

The commercially most important criteria are:

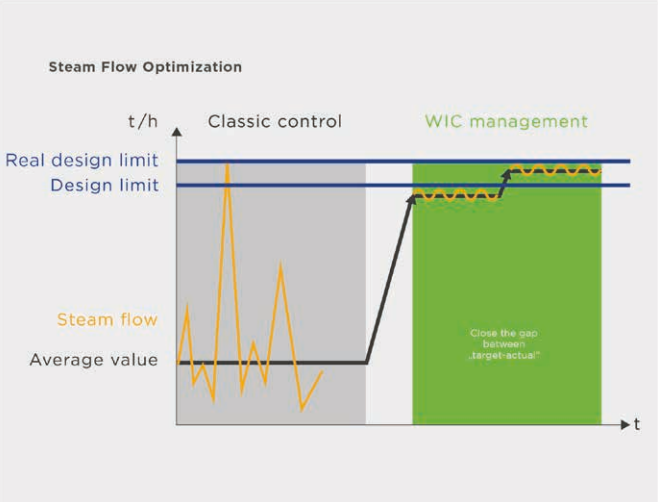
- stability of steam production
- amount of steam production
- waste throughput
- amount of additive consumption
- stability of flue gas temperature
- stability of primary and secondary air
- O2 concentration
- amount of operator interventions

Some criteria are short term, being relevant for a fast initial assessment of the WiC benefits. Long term benefits can be assessed on the basis of process signals over a period of several months after WiC installation.

The WiC is a fully automated system and provides operation without permanent observation (OWPO). Besides that, WiC is also a great help for operators in case of disturbances.

Note:
For the WiC implementation there is no need for mechanical modifications of the existing combustion system. WiC is an add-on system utilizing the existing equipment.

Enhancement of steam production towards real design limit

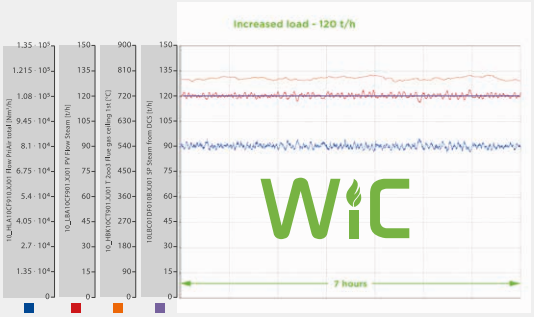


By implementation of classic control, big overshooting of steam production is possible and this is the main reason why the set point (average steam production) is kept below the design limit.

"Classic control" is very likely to produce dangerous overshooting above design limit! Therefore, in most cases, the design limit (MCR) is set **below the real design limit**.

That means, that in most cases the boilers are built with reserves to cover the overshooting due to lack of combustion control quality. These reserves may be utilised by implementing a more reliable and stable combustion control system. → WiC

After stabilization of steam production, the real plant capacity could be determined.



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

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

Because of the large oscillations in steam production (usually caused by poor quality of combustion control or inadequate type of grate) most boilers are oversized to overcome the 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 achieved.

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

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 approval body we were able to increase steam production and thus increased the combustion throughput 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 (10%) cannot be guaranteed for all plants but the design study will quickly show how much is possible.

Combustion of low calorific waste

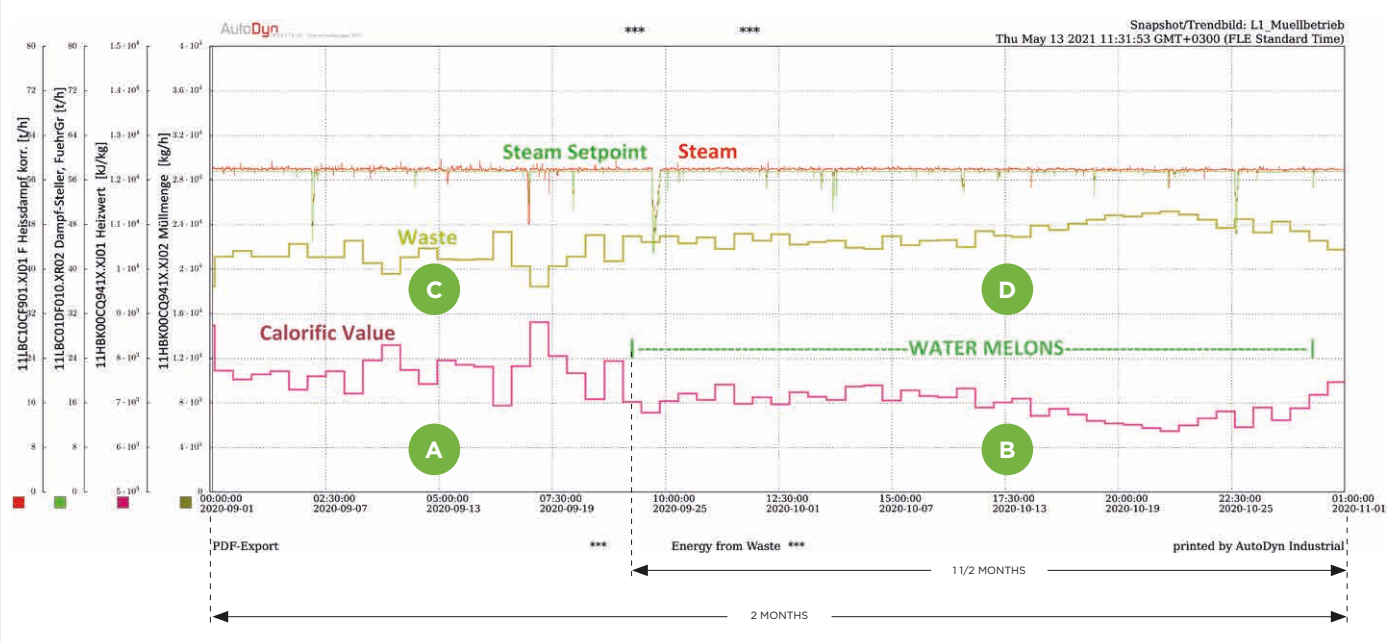
The incineration of waste with low calorific value is generally a very complex process.

Due to the great experience and expertise in the field of combustion technology, very complex calculations and very powerful processors, the WIC-Combustion Manager can optimally carry out the incineration of low calorific waste.

The following is an example of trends for an optimized incineration of low calorific waste.

C waste throughput with normal waste average 21 t/h

D waste throughput with watermelons average 24 t/h



A Calorific value normal waste average 7,5 MJ/kg

B Calorific value with watermelons average 6,5 MJ/kg

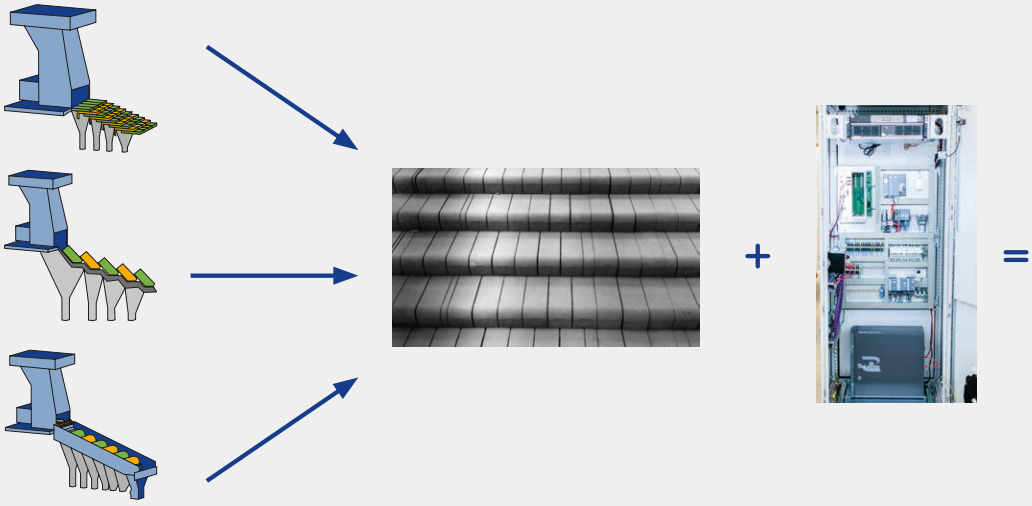
In this particular case, you can see a very successful incineration of waste with a high content of water, which was seasonal due to watermelons in the garbage.

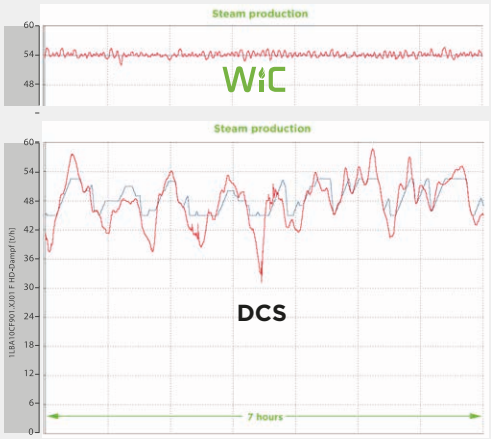
During the incineration of waste of normal quality, the calorific value of the waste averaged 7.5 MJ/kg, see **A**. The waste throughput for the incineration of regular waste averaged 21 t/h, see **C**. A high content of watermelons in the waste caused the average calorific value to drop to 6.5 MJ/kg, see **B**.

Nevertheless, the WIC Combustion Manager ensured stable and unchanged steam generation thanks to the appropriate combustion control!

Because of the lower calorific value of the waste, it is necessary to increase the waste throughput to 24 t/h, see **C**. This means, that WIC guarantees stable steam generation even in difficult situations, even with increased waste throughput – which means higher profit (money from the gate fee).

Each combustion line is unique and each line must be analysed in detail. If you have problems with the incineration of low calorific waste, please contact TECHNIKGRUPPE and our experts will analyse your specific case.





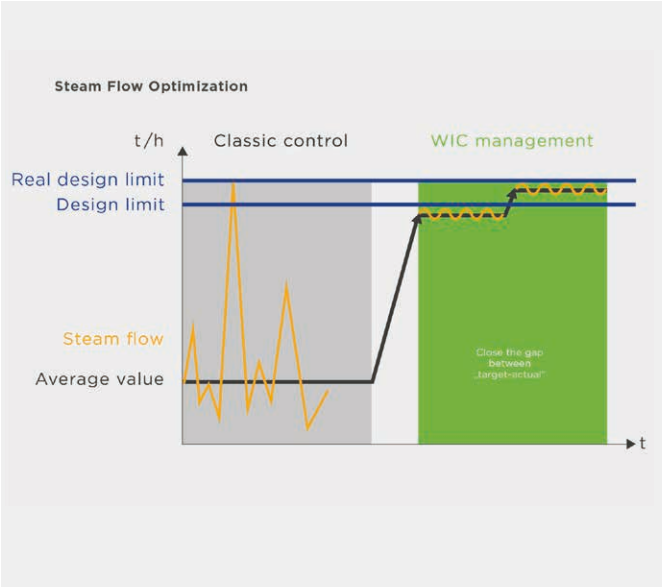
Less cyclic = more steam

More waste burnt

After years of operation waste characteristics change and this can cause problems which, due to limitations in the grate characteristics, cannot be solved. 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:

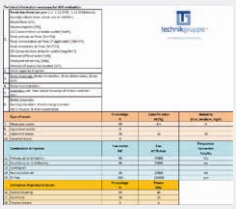
- Increased incineration capacity
- Improved burn-out quality
- Extremely stable steam production – increase boiler steam capacity, reduce plant trips and operator interventions

Changing the grate may seem expensive but it can have a very short return of investment.
In such cases, technical experts of TECHNIKGRUPPE can assist as independent advisors.

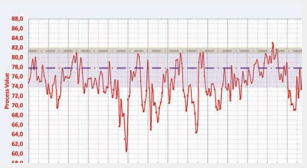


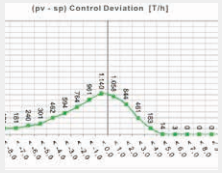
A typical project schedule would be:

1. Obtain measurement data, drawings ...
(may be done remotely/by e-mail)



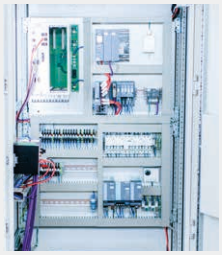
2. Make data analysis and feasibility study





3. Survey site – interview site team engineering/operations/maintenance

4. Install the WiC – fine adjust combustion



5. Train the operators and staff

The application of the WiC can significantly improve the profitability, reliability and availability of Waste-to-Energy and Biomass-to-Energy plants. If TECHNIKGRUPPE's feasibility study states that WiC delivers the best technical and financial results compared to other systems, TG offers you a free test installation including operator training on the terms „No Cure No Pay".

Payment is made in monthly rates, which are in any case less than the increase in profit through WiC.

What about the financing model for the WiC?

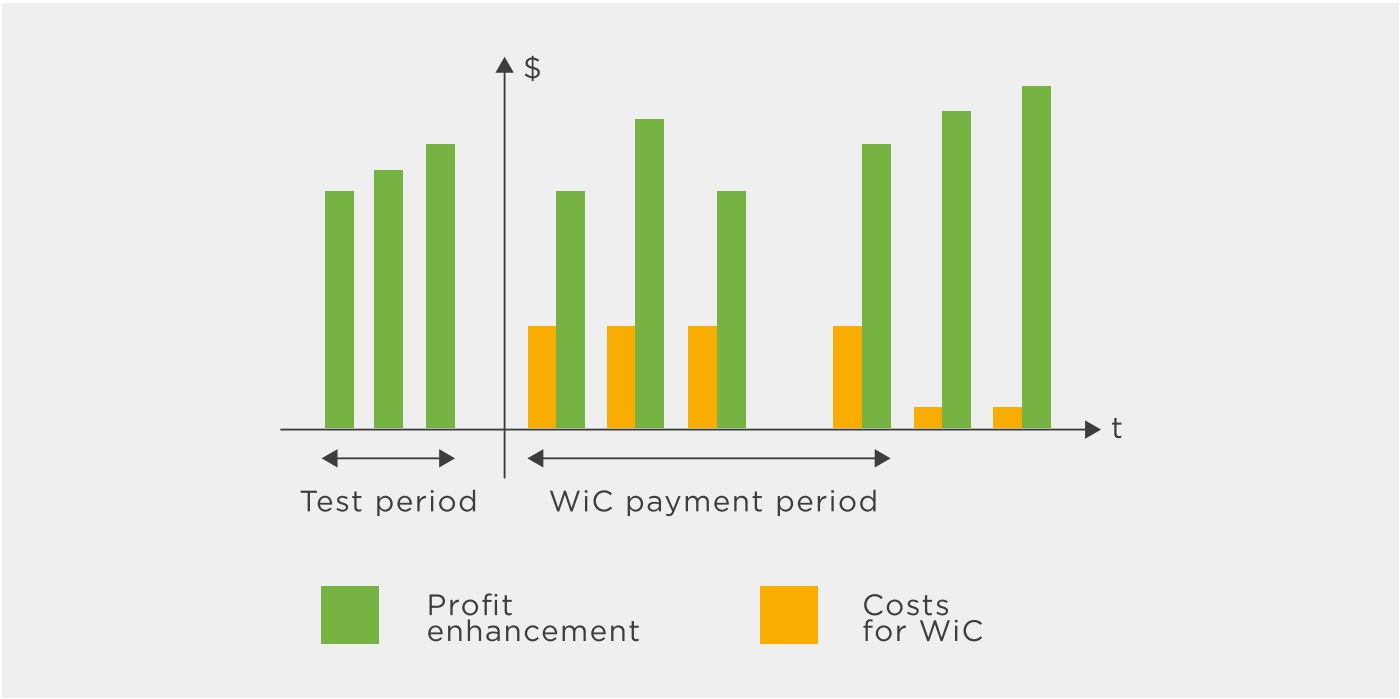
Besides the benefits mentioned above, the WiC provides a considerable additional advantage:

- **profits from the beginning of installation WiC offers more than all other systems on the market, also in terms of financing.**

After TG's feasibility study, TG can assess the possibilities and advantages of the WiC for your particular plant. If the outcome of the feasibility study is positive, TG is able to offer the installation and commissioning free of charge:

- **no upfront investment**
- **test installation and commissioning free of charge**
- **no technical risk, no commercial risk for you**

WiC generates additional profits from the beginning of installation



TG has great experience in reliably assessing the advantages of the WiC system on your particular plant.

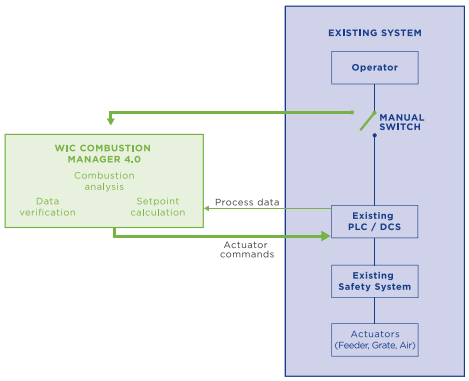
After commissioning, the customer can immediately measure the short-term benefits of the WiC (financial benefits). At that point the customer can decide freely, without any obligations, whether to go on with a contract for the WiC. The entire risk is on TG. The customer can monthly quit the contract for whatever reason without any further obligations.

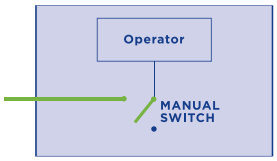
If a leasing model with monthly fees is chosen, the fees are in most cases less than the short-term profit enhancement. After a certain time, the customer becomes the owner of the WiC and pays only for the software licence and optional maintenance.

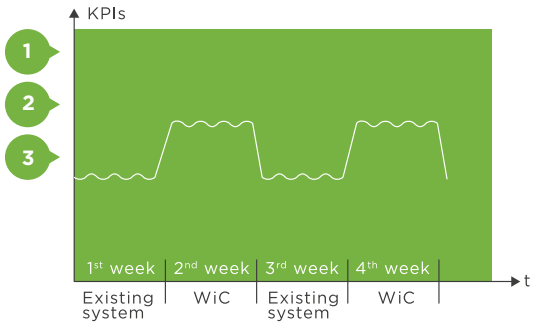
Commercial benefits of the WiC Combustion Manager

Every plant and every incineration line is a unique system. Good result on one line in a particular plant does not automatically mean good result on the other. TG's basic purchasing model provides a Combustion Management System without any commercial and technical risks. The implementation of the WiC is totally financed by TG. Our tested and proven methods provide simple and reliable comparison between „before" and „after" WiC installation. **Finally, only a test run and evaluation will provide a real picture of the system quality.**

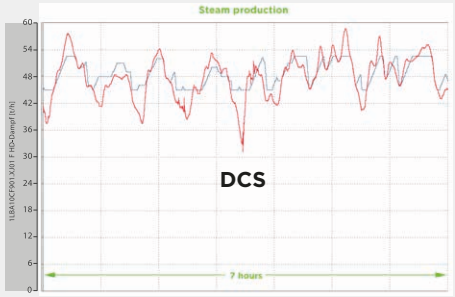
How to measure the financial and technical benefit of the WiC?



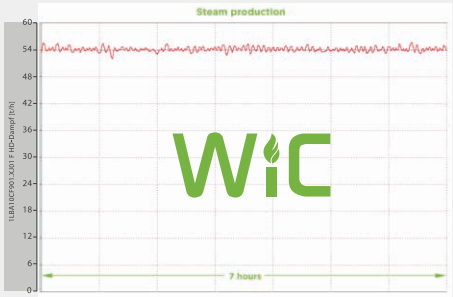




(1) Stabilization and enhancement of steam production



Steam production controlled by DCS

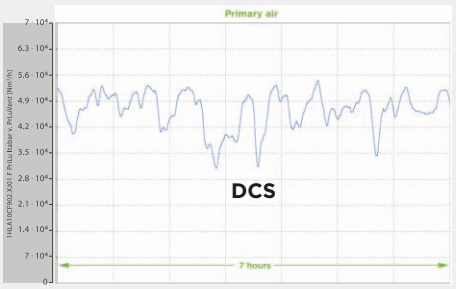


Steam production controlled by WiC (same line)

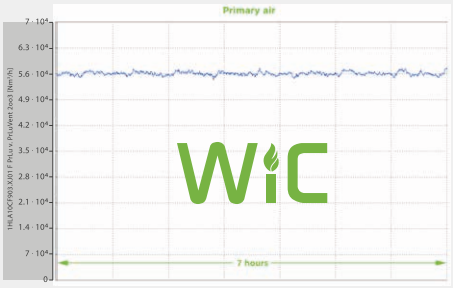
Stabilization of steam flow brings:

- increased steamproduction
- increased waste throughput
- increased electricity production
- better burn out quality

(2) Stabilization of combustion air flow



Primary air controlled by DCS



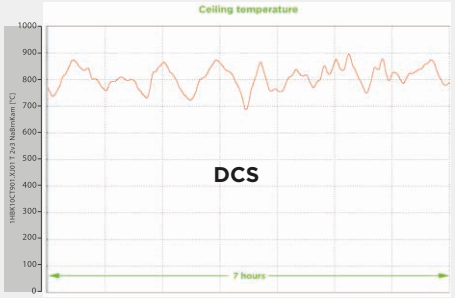
Primary air flow controlled by WiC (same line)

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

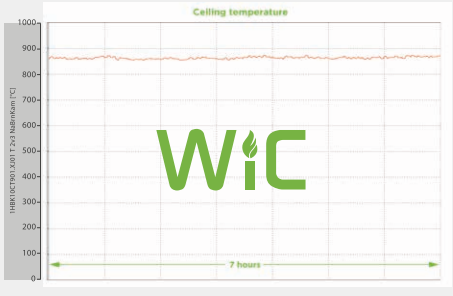
Stabilization of combustion air brings:

- less additives in flue gas cleaning
- less energy and mechanical forces on fans
- less slagging and fouling

(3) Stabilization of flue gas temperature (ceiling temperature)



Ceiling temperature with DCS



Ceiling temperature with WiC (same line)

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

Stabilization of flue gas temperature brings:

- less slagging and fouling
- less wear on refractory
- less corrosion
- less cleaning effort
- lower ceiling temperature
- better heat transfer

Energy from Waste

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