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Sums make all the difference (Part 2)

THE PRICES FOR ENERGY ARE RISING AND THIS WILL NOT BE REVERSED. THE TIME IS NOW RIGHT TO CONSIDER THE ENERGY CONSUMPTION IN A COMPANY. EXPERTS **DR. ING. HEINER GERMAN**, MANAGING DIRECTOR OF GERMAN LEBENSMITTELTECHNOLOGIE GMBH, BERLIN; **UWE KESSELHUT**, MANAGING DIRECTOR CONSTRUCTION AND DEVELOPMENT AT WACHTEL GMBH & CO, HILDEN; **DR. MARTIN PITTRUFF**, MANAGER PRE-DEVELOPMENT, MIWE MICHAEL WENZ GMBH, ARNSTEIN; **DIPL.-ING. RALF GEBHARDT**, GROUP MANAGER CONSTRUCTION INDUSTRIAL OVENS AND VACUUM COOLING, WP BAKERY GROUP, DINKELSBÜHL; **DR. GERD MEYER**, MANAGING DIRECTOR, DAUB GMBH, HAMBURG, DISCUSSED WITH **MS. HILDEGARD M. KEIL**, EDITOR-IN-CHIEF OF BAKING+BISCUIT INTERNATIONAL, WHAT CAN BE DONE IN THE FIELD OF OVEN TECHNOLOGY TODAY AND IN THE FUTURE.

+ Part 1 of this discussion was published in *baking + biscuit international* issue 01/2007.

+ Meyer: The radiators do not have to be STIR coated but their radiation capacity must be correct. STIR is an aid for optimizing radiation.

+ Kesselhut: Sure, we do not claim anything else. By the way, we do not raise the temperature. We tried it in the beginning, but found no decisive improvements.

+ German: This is the key word. Optimizing the radiation. The classical baking oven is a radiation oven. There is a large spectrum of wavelengths generated inside the oven and in my opinion, nobody has determined yet in detail which wavelengths are needed for baking. There is a large potential to do so. For example, radiators operating amongst others, with the visible wavelengths of the infra-red light reduce the baking time of crisp bread significantly because the heat is transported much faster to where it is needed and the product is stabilized earlier. I feel that this is a broad field of research for energy savings.

+ Kesselhut: In principle we are still in the process of testing new ceramic mixtures and moving the radiation band in another direction. The subject has not yet been exhausted.

+ Meyer: If you imitate the principle of a thermo-oil oven, namely working with radiation then you have shifted part of the radiation. As far as performance is concerned, the total radiation is decisive. I have some doubt on the approach of shifting the band of radiation to a narrow width. I am convinced that you create more radiation surface by the way you structure the surface. We achieve the same effect with thermo-oil. However, we do not know the precise band of radiation. However, thermo-oil also has to do with surfaces. We also treat the surface, but we do not like to divulge how we do it. We have determined the optimum surface more or less empirically.

+ Kesselhut: Pointing out the larger radiation surface is correct. We have tried, but of course, we are not shifting the entire radiation into a narrow width. This is not possible after all. It is only possible to put a certain part of the heat radiation into a certain area and if we do so for 80-85%, then this is quite high.

+ Pittroff: This is where it comes full circle. Let's go back to the baking process. Aspects such as the proportion of radiation, the effectiveness of the different wavelengths and any other mechanisms are all issues not yet solved. It is known that specific ovens and their coatings have a certain effect but this is only qualitative knowledge. Details such as which wavelengths bands are acting here and what their effect is on



++ Dr. Gerd Meyer



++ Dr. Martin Pittroff

dark or light dough have not yet been questioned in detail. Applying STIR technology to the baking process is needed to deal with the physics behind that technology in order to try to find out why STIR has not yet been sweepingly accepted, despite the effects it seems to display. One cannot generally say whether this technology is good or bad. However, it would be more important to use physical knowledge when looking into the correlations.

+ German: Experience from my company shows that not only radiation ovens reduce the loss of baking but convection ovens as well. By using whole meal pan bread we discovered that a controlled increase of the moisture in the last baking section yielded a moister product while improving fresh-keeping and juiciness of the bread.

+ Keil: Up until now we have mainly discussed the process. What about the design and construction? What is new, what is the future? How about microwave technology, etc. Are there plans afoot to look closer into these technologies?

+ Pittroff: Microwave processes are certainly not a topic which can be considered under the aspect of energy savings. It needs to be discussed more in terms of advantages of the microwave technology for the heating behavior and whether it could be reasonably used for a certain product. First of all there must be a certain degree of functionality, then the question of energy management has to be considered and the comparison with conventional heating technologies made.

+ Gebhardt: The market for insulating material has developed. Most ovens are insulated with loose insulation fiber because the shape of baking ovens makes them unsuitable for using bricks or mats for insulation. The insulation fiber once used often settled after the coating of the insulation had burnt. This resulted in gaps in the oven's insulation. Today's insulation materials are protected and display certain elasticity. This means that when punching the material down, it will return to its former shape. The entire oven body keeps completely insulated during its entire service life.

Another aspect has been mentioned earlier: The oven's body must be tight. A leak may occur slowly which will cost additional energy. The problem is that this leak often remains undetected. However, it could be detected. There are cus-

tomers who integrate small gas or oil meters upstream of the burner which measures the gas and oil consumption frequently. A comparison, however, makes only sense when the product range remains the same. If the product range or quantities change by season or week, then the consumption values have to be assessed with great care.

Invisible excess energy consumption could be stated for example if steaming valves are leaking or because they are dirty or jamming. In this case, water is permanently running into the oven. This water is turned into steam which is hardly noticed. The steam generator is constantly producing additional steam which escapes. This can be determined via a water meter. If the valves are leaking and water is running into the oven, WP ovens for example, trigger a warning signal.

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+ Kesselhut: We use a similar approach, but, we check the heating time. If the heating time is too long, a valve must be leaking. But this is not all of it. We also integrate a sensor in the steam generator. Previously, the generators were controlled by the thermostat. The temperature sensor ▶

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controls the steam generator more reliably and provides more data. For example, it states the degree of cooling down of the steam generator, the temperature rising curve and makes sure that the generator does not overheat. The steam generator always has the same temperature. When baking croissants at a low temperature, in many ovens the last row tends to come out too dark. Therefore, our steam generation depends on top heat. The advantage is that the steam generator is not heated up so much when baking at lower temperatures.

+ Meyer: Sometimes, we do very little things to save energy. In a thermo-oil oven, the boiler plant can be used for proper control. The baker does not have to think about it. No matter whether he bakes rolls at 220°C followed by bread at 280°C, the control makes sure that the boiler is heated correspondingly. Coatings are another approach, maybe not enough to yield real energy savings, but for control purposes and optimum process management. This is all due to the construction and control and not because someone arrives in the morning, observes bad weather and opens the slides a little bit more. There are customers in the premium level who may pay several hundred dollars more for one batch that was made with a faulty control. They say that intelligent traceability and optimization will pay off to include energy savings. We have done a lot to avoid wasting energy and now we are in the process of optimizing the application.

+ Keil: Dr. German, is the potential for avoiding wasting energy really exhausted already?

+ German: After the first energy crisis, Winkler introduced a cascade system where the hot flue gases from the pre-baking oven were transferred to the last baking section. This resulted in enormous savings, but today it has almost disappeared. This is something that could still be applied.

+ Gebhardt: Pre-requisite for that is that both components are from the same company. When buying different components for pre-baking and final baking from different companies, then each section has its own waste gas connection. The question is, who is combining both systems and who is assuming the risk?

+ Keil: What will happen if both components are from the same company?

+ Gebhardt: If there is a separate pre-baking oven, this is usually an independent oven. Furthermore, the heat requirements must be adjusted for each one.

+ Meyer: The effort for transferring the heat is not that great.

+ German: Some manufacturers of biscuit ovens have a design that provides for that.

+ Gebhardt: The pre-bake oven used to be an oven with a

high starting temperature, short baking time and often equipped with a stone plate bottom. After the bread had been stabilized it was transferred via conveyor into a second oven. This created a linking problem. When using an oven with an integrated pre-baking zone, then linking would be possible. If there is a tunnel oven with only one burner, it is possible to feed the gas to the heated section first and from there to the colder ones. Ovens with several burners provide for a more distinct temperature profile.

+ Meyer: In terms of flexibility and reasonable utilization, I do not feel that such a process has much chance. In particular, tunnel ovens should not be pure mono-lines but rather produce the opportunity to be operated with different temperature curves as well. No baker is capable of predicting which products will be requested by the consumer in four or five year's time. We clearly determine the trend towards flexibility.

+ Pittroff: When comparing thermo-oil and other oven systems, it can be stated that the same products can be baked in a convection oven at lower temperatures with the same result. This is logically following the principles of heat transfer and also results in less energy consumption. In other words: To achieve the same baking result, a thermo-oil heated radiation oven has to be operated at a higher temperature level than a hot air rack oven for example, despite the lower baking losses in the thermo-oil oven. This all affects the energy consumption. Even though the convection forces a higher loss on baking, the total energy consumption is lower because all other losses such as loss of radiation, flue gases etc. are on a lower level.

+ Meyer: I have my doubts. The convection results in a quicker heat transfer, but it also dries out and this results in a different product. Adding to that, a chimney is required for each rack oven while a series of thermo-oil trolley ovens need only one central boiler and one chimney.

+ Pittroff: Prior to iba, our company conducted respective trials. Final results are not yet available, but the results from multiple trials are. A lot more work is still required to examine the differences in detail. Of course, a trolley or wagon oven for rolls is not the same as a rack oven for rolls, but when the dough piece is the same, it is possible to comment on the baking process.

+ Kesselhut: I would recommend that bakers using a rack oven made from any manufacturer should quickly purchase a new quick start burner. Such burners can be retrofitted. Even an older rack oven will use less energy as a result.

+ Gebhardt: Was the 11% figure you mentioned earlier derived from a comparison between a quick start burner and a burner running in continuous mode as in the past or between a quick start burner and a standard burner used today which turns off?

+ Kesselhut: The 11% make the difference between a common burner with a scavenging time of only 30 seconds to 60 seconds and a quick start burner. The test is available from Weishaupt.

+ German: We have not yet addressed the separation between oven and chimney. The oven manufacturers' sell only the oven, so the chimney engineer has to start from there. The oven manufacturer specifies parameters such as a certain suction draught but not on how to produce it or its permitted tolerances. The operator of the oven has to make sure that the minimum value of what is required will be set. The cooperation between oven manufacturer and chimney builder has to be managed, otherwise too much secondary air will pass through the chimney and oven thus affecting the energy consumption significantly.

+ Meyer: Today the oven manufacturer determines to a certain extent the draught by slides and fans. If the draught is too large, it does not work. In this case even the steam is removed from the process.

+ German: This can even happen with the steam slide closed, because these slides are not really tight. This is invisible and must be determined by measurement. Then, either the operator has to do the retrofitting or all personnel concerned must be

put into the same boat when a new oven shall be purchased.

+ Gebhardt: Our set-up plans include specifications on the chimney draft for each oven type. This can be taken into consideration by the chimney engineer for each new installation. In already existing chimney installations with too much draught, suitable regulation flaps can be used to provide the requested underpressure.

In case of chimney installations with too low or heavily deviating draught, under-pressure controlled flue gas deflectors on the chimney can be used to adjust the required draught. Here the control electronics modify the fan speed of the flue gas deflectors ensuring a constant underpressure at the oven preset by the controller. If the oven is turned off, the flue gas deflector also switches off.

+ Meyer: The operator is the one paying and if he is concerned with the use of metrology and also displays certain sensitivity for this subject, then a lot of energy can be saved in the baking process by cooperation.

+ Keil: Pre-requisite is that the oven manufacturers provide more information for their customers on important aspects, such as where to measure and what, on guide values as well as on maintenance and checking schedules. Gentlemen, thank you for this discussion. +++

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