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Professional eco-efficient equipment and eco-responsible restaurants

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DESCRIPTION

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Abstract Nowadays, more and more restaurants are considered to be eco-efficient. Therefore, professional kitchen equipment has a great significance. The following research observes and tests different models of modern kitchen equipment in order to prove their eco-efficiency. The producer of chosen equipment is Metos. This company manufactures large list of various devices for professional kitchens. Thus, in the beginning, literature review of that equipment was fulfilled. Practical part of this thesis was conducted in the Talli restaurant, which has obtained Nordic Ecolabel. Each experiment was held in a training kitchen, where all necessary equipment is available. The research is based on the experiments that were done in approximately one month, during this time 8 diverse types of dishes were prepared. Different programs and settings of equipment, e.g. manual or automatic, and different ways of preparing the same dishes were combined so as to find out which method works better. All the data concerning electricity and water consumption, as well as about timing was taken down and analysed at the end. The stated aim was achieved, as the experiments proved that professional kitchen equipment is more efficient than conventional one. Furthermore, the research suggests recommendations that tell which kind of equipment is suitable for certain types of dishes. This research has some importance for the Hospitality sector, as it provides essential analysis of professional kitchen equipment that can be applied by restaurants, which are interested in reduction of electricity and water costs, and want to be eco-efficient.		
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1 INTRODUCTION

Nowadays, restaurants are considered to be insufficient if they do not pay attention to energy consumption and environmental impact of energy use. For these aims restaurants are trying to upgrade their equipment in order to make it more efficient and modern. Thus, they can contribute not only to the profitability of a company, but also to the protection of the environment.

Water is a very important natural resource too. Everyone knows that salt-water accounts for about 97 percent of all water on the planet and remaining 3 percent are related to inaccessible and frozen reserves. Applying of special equipment for water saving is a necessary step that has great significance for restaurants and for the environment as well. On the one hand, it will decrease owner's expenses, and on the other hand, will contribute to solving of water scarcity problem.

Ergonomics and timing – these are two significant aspects, when we are talking about production kitchen. In today's world, they play a big role due to everyone's desire to make greater profit with fewer costs. The producers of professional kitchen equipment have already updated their machines to satisfy this want. Modern equipment provides numerous options to decrease the time of cooking, as well as the number of machinery that is necessary for the process of food preparation.

The main aims of the following thesis are:

- Prove that modern equipment decreases energy and water consumption;
- Show that modern professional equipment is more efficient than usual cooking machinery;
- Verify that professional equipment saves time and is easy to use;
- Display that professional kitchen equipment has high level of ergonomics and greater safety.

These aims are very important, however, there are also some other objectives that should be reached:

- Reveal and describe major process cooking functions in professional equipment;
- Test Manual and Process settings of some modern efficient equipment and identify which way is better;
- Calculate cooking loss and understand how the presence of lid influence this number;
- Practice professional kitchen equipment and understand principals of its work;
- Practice the use of Tempnet service to identify water and electricity consumption;
- Acquire accurate and exact the results and time of experiments, then fill it in special sheet forms
- Analyze and understand received information

To achieve the goals and objectives that were stated, the theses will, firstly, provide theoretical information about professional kitchen equipment and, then, practical part will contain the description of all experiments and results of the research.

2 ENVIRONMENT AND RESTAURANTS

Nowadays, it is not a secret that the major part of restaurants in our society is not environmentally friendly. However, the world is changing now, global warming is coming, earth pollution is growing up with an increasing number of manufactures, plants and many others things that affect the atmosphere. Therefore, it becomes more difficult for the earth and nature to clean itself, thus it needs the help of people. The humanity ought to do everything that is possible and think about future of our planet before it is too late, and without doubts the first thing is – to decrease the pollution effect. Today, many restaurants start to be eco-friendly and the reason for this change is not only fashion, quite the contrary, it is a necessary step. There are many ways how restaurants can become eco friendly. Below you can see steps with the help of which some restaurants fulfill this approach:

- Interior of a restaurant (furniture, decoration) is made of recycled materials,
- Organic food, local ingredients, seasonal food,
- Different environmentally-friendly measurements (electricity and water consumption),

- Energy-efficient appliances,
- Biodegradable to-go cutlery,
- Recycled napkins, hand towels, tableware, trays,
- Non-toxic cleaning materials,
- Low-flow fixtures, that spend less water (toilets, faucets, service sinks),
- Full scale recycling program in place (sorting waste in restaurant),
- Sensors for monitoring the light, energy efficient lamps. (Green Restaurants Effectively Lowering Their Environmental Impact 2011.)

These are only some examples; there can be much more. Naturally, it is difficult to combine all those things together, however there is no need to do everything at once, selecting of one option is enough for the start. Some people think that it is much easier not to pay attention to this, but the results worth it, restaurants' holders will be proud of themselves due to the fact that they try to do something significant to save the nature, in addition, their customers will be respectful, and as a result greater number of visitors is guaranteed.

I want to show an example of a remarkable eco-friendly restaurant. This restaurant is situated in Washington's Penn Quarter in USA and is a part of Kimpton's chain. Robert Weland, Executive Chef, has done a lot for this restaurant. His innovations and ideas are presented below.

- One-site organic garden (almonds, cherries, herbs and other vegetables and fruits are grown there)
- One-site water purification (water ultraviolet filtration system that produces both carbonate and non-carbonate water)
- Sustainable seafood (the restaurant uses only fish that is not on the verge of disappearing or in danger)
- Composting (all organic waste is composted)
- Recycling cooking oil (the oil is filtered and can be used again but in different applications, for example, to warm greenhouses during winter)
- Using nose-to-tail and humanely-raised animals (firstly, the whole animal is used without leaving any waste. Secondly, quality of food in little family farms is better than in big commercial ones, which do everything automatically)

- In-house production (some food and ingredients are made right in the restaurant, for example sausages, vinegar and jam, therefore there is no need to buy those products)
- Wine on tap (restaurant do not serve wine in bottle, it is purchased in casks and glasses are filled directly from them)
- Biodegradable products (corn-based utensils are used in the restaurant)
- Market-to-Market dinners (all fresh products are bought by chef in local farms and at market places)

This is a great example of eco-friendly restaurant, and of people who try to do something to make their restaurants eco-responsible. (Kaplan, 2011.)As this thesis is based on the experiments that were conducted in one of Finnish restaurants, it is reasonable to mention about current situation in Finland in the field of eco-friendly restaurants. Finland today is one of highly ecologically responsible countries, and it encourages people to do everything to decrease pressure on the environment. Finnish government has already made, as well as, will make in the future numerous steps to save the remaining nature.

Special eco-efficient equipment, that saves water and electricity consumption is being used in many Finnish restaurants. Those try to be ecologically friendly and think about nature heritage. Special label was created to define the most eco-responsible restaurants; it is called Scandinavian environment symbol or Swan Eco label. On the picture 1 this symbol is presented. (Nordic Ecolabelling, 2009.)



PICTURE 1. Nordic ecolabel

To apply for the Nordic Ecolable license a restaurant should complete special criteria requirements. Talli and Dexi restaurants already held this procedure and received the label. Thus, as you can see eco-friendly restaurants become more real and necessary rather than unusual and expensive. Moreover, we should not forget that eco-friendliness saves not only natural resources, but also money; consequently this is the best way for investing resources in a restaurant. Today customers expect all companies with different sizes and capacity to use limited natural resources cautiously in order to minimize negative impact on the environment.

3 PROFESSIONAL KITCHEN.

The discussion about professional kitchens leads to a thought about kitchens in restaurants. There are many types of them, with different sizes, design, equipment and capacity; nonetheless there are some general features that should be present in each professional kitchen today.

Firstly, professional kitchens should be energy and water efficient. Nowadays, the bills for electricity become higher; this affects restaurant business too. According to the study of Electric Foodservice Council of USA restaurants use the great amount of energy. Even though this analysis was conducted in the USA, it still shows situation that can be applied to the whole world. (Katsigris & Thomas, 2009, 127.)

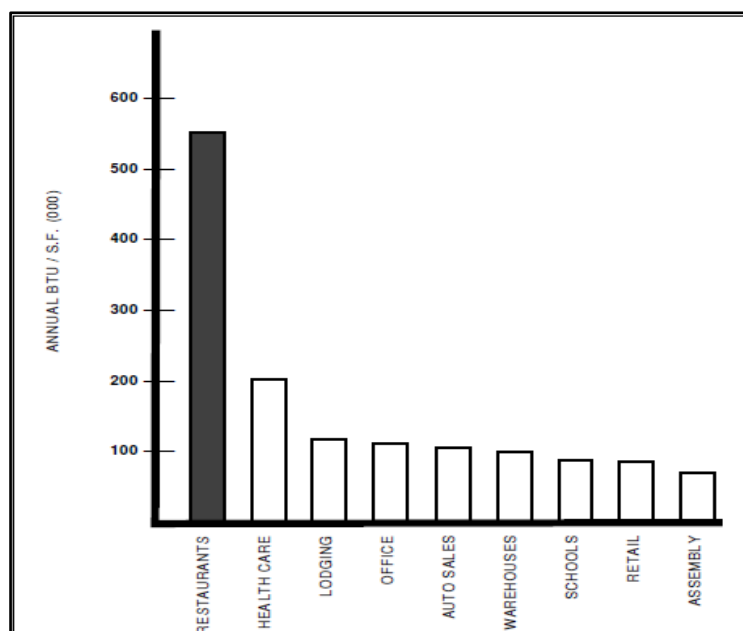


FIGURE 1. Consumption of electricity by sectors

The figure 1 above reveals that restaurant sector of business consumes the major part of electricity. Finland, currently, has 22 000 professional kitchens that produce 810 million of portions a year and their electricity consumption is 641GWh with cost of 65 million euro. (Tuovinen, 2013.) Getting more precise, kitchen is the place in a restaurant where the biggest amount of energy is spent. You can verify this by taking a look at figure 2 below. (Conger, 2013.)

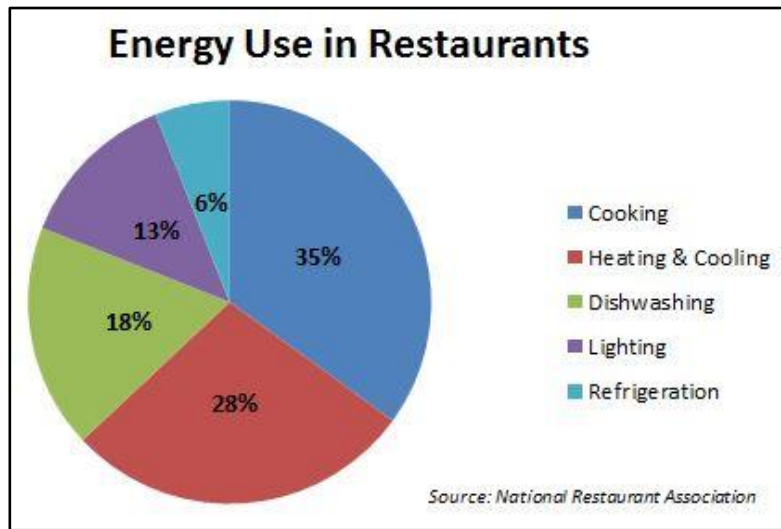


FIGURE 2. Energy use in restaurants

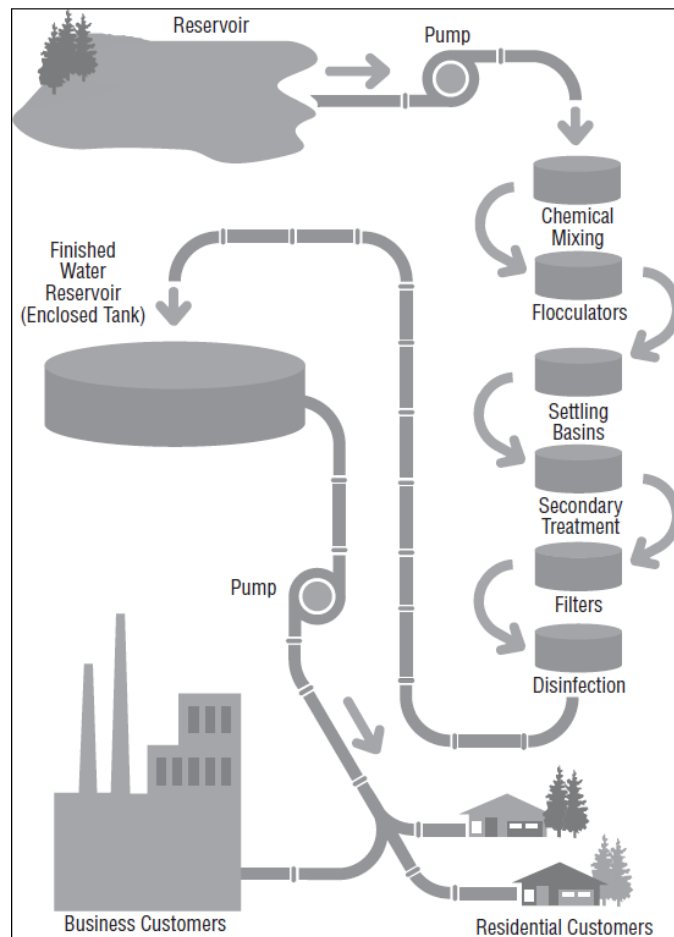
There is a number of steps to save energy in a professional kitchen. Here are some of them:

- Use of professional automated equipment,
- Shorter cooking time,
- Energy efficient as acquisition criteria,
- Educate your employees (users of equipment can affect energy consumption even by 60 percent),
- Make electricity measurements. (Tuovinen, 2013.)

Of course, these are not all steps, there can be much more of them, it depends only on a restaurant's holder, but every professional kitchen today must be energy-efficient.

Water efficiency is a problem number two today. There is a need to realize that 97 percent of water on the earth is salt and this should be taken into account during the

work in a professional kitchen. Process of water production is not cheap and the price for water becomes much more expensive. On the picture 2 below you can see how many steps it takes to get water from its sources. (Katsigris & Thomas, 2009, 185.)



PICTURE 2. Water extraction

Therefore, always think about it when you consume water in your restaurant. Some common steps will help you to decrease water consumption:

- Professional water efficient equipment,
- Low-flow fixtures,
- Shorter cooking time,
- Maintenance of all things that use water,
- Involve your employees,
- Use new technologies and innovations.

Second and very important part of the professional kitchen is modern equipment. In chapter that goes after this, we speak more in detail about it, and, of course, practical part is devoted to different equipment and its programs. As it was already mentioned, modern equipment should be, first of all, eco-friendly, and must decrease water and electricity consumption. Professional kitchen equipment saves time of employees. Furthermore, it does not require much space and one professional machine can replace several usual installments. In addition, this equipment is safer for personnel and it is easy to study how to manage it.

Third point is a design of a kitchen. It implies not only appearance; it also considers space allocation and steps for the increase of productivity and safety. Here are main points:

- Available space (how to organize place without losing work flow or speed),
- Personnel mobility (to organize space in a way that nobody of your personnel disturb each other, thus, there is more space for mobility, it is especially important during busy time, when everyone is in hurry),
- Health safety (observance of local health codes with certain stipulations when you plan and use your kitchen, for example do not put hot equipment close to each other as there should be some space between them),
- Ergonomics (your employees can manage with all tasks without moving to another places, it reduces injury, fatigue and discomfort of your personnel),
- Flexibility (your equipment will be useful even when a menu changes, or it can be easy replaced with the new modern equipment, and equipment can be easy moved for cleaning). (Rahm, 2011.)

All these things are very important for organizing place in a professional kitchen smartly. Do not forget that three points: eco-efficiency, modern equipment and design of kitchen should be organized in a way to complement each other. If all three things are available in a restaurant you can be sure that there is an eco-efficient professional kitchen.

4 PROFESSIONAL KITCHEN EQUIPMENT, PRINCIPLES OF WORK

4.1 Ranges

According to Katsigris& Thomas (2009, 337-348) typically home models of ranges consist of two parts: the range top and the range oven. In various models these parts are almost always located in the same machine. One of the distinguishing features between home appliances and professional equipment is that in the second one these two parts can be purchased separately. You can choose from different end large lists of models either range oven or top ranges, or both. Different sizes and capacity can be mixed depending on your kitchen needs.

Today at a market of professional kitchen equipment you can find multifunctional and efficient ranges that will be suitable for your kitchen. Two main resources that are consumed during a cooking process with the use of this machine are gas and electricity. Which type of ranges is used depends on many parameters, such as cost of these resources in a country of operation, type and capacity of a kitchen.

Before the discussion about ranges types, it is logical to mention principles of heating. Four types of heating exist: conduction, induction, convection and radiation.

1. Conduction – the simplest form of heat transfer, it is shifted from one item to another when they are in a straight contact with each other. Examples: boiling, simmering and poaching.
2. Induction – heat is created by electromagnetic field that moves and concentrates on the cooking vessel, as a result, this magnetic energy heats up the pot and, thus cooking starts. (Natural resistance of the metal pan). Induction top is not being heated, because the warm moves directly into the pan. This is the reason why a pan should be made of ferrous metals like stainless steel and iron cast. Electromagnetic field can be attained between pan made from aluminum and nonmagnetic cooper. At the end, when you remove cooking pan from induction top, the process automatically stops.
3. Convection – heat is spread by moving of liquid, steam or air. Convection method is quicker and in this way dish's placement has no significance, because hot air re-

duces the cool “boundary layer” at the top of a dish, thus it lets warmth to penetrate the food faster.

4. Radiation- type of heating reaction when waves of energy warm the food. There are two sorts of radiation that are usually used in the kitchen:

- Microwave
- Infrared

Our attention in this part is mostly concentrated on the range top, because different types of them will be applied in the practical part of this Thesis. The range top is multipurpose “King” of the kitchen and is a place of most operations. This equipment has a lot of functions in the professional kitchen process such as boiling, sautéing, simmering, deep-frying, braising and holding food warm. The number of ranges in a professional kitchen depends on its capacity. The table 1 below suggests quantity proportions.

TABLE 1. Range quantity proportion

Restaurant Range Needs	
Number of ranges/Size of space	Meals per day
2 ranges/ 182 cm	300
3 ranges/ 273 cm	500
4 ranges/ 364 cm	1000

The range tops can be situated and configured in many different ways. In general range’s types are the following:

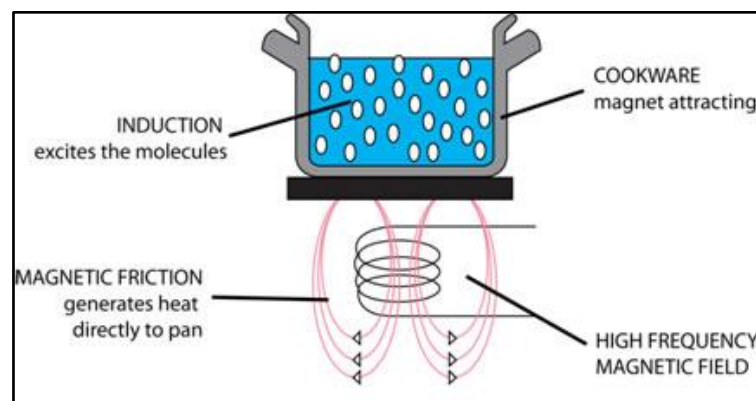
1. Medium-duty range (restaurant range, 6-10 open burners);
2. Heavy-duty ranges (part of the “hot line” or cooking center, includes several appliances);
3. Specialty ranges
 - Stockpot range (with large open burner used to heat stockpots)
 - Taco range
 - Wok range (Chinese range)

- Tabletop range.

In addition, ranges are separated by type of burners and by resource they use. Typically, there are three types of top ranges:

- Electric ranges,
- Infrared ranges,
- Gas ranges.

The most interesting and significant one for us is electric top range. As everything about simple electric ranges is clear, we will speak a little bit about electric induction range. Induction range is up-to-date and efficient equipment; in some way, it is a symbol of modern equipment. The principal of work of this equipment is electromagnetic field that was described earlier in this chapter. You can see the picture 3 below to understand this process more clearly. (Induction Cooking & Induction Cookware, 2013.)



PICTURE 3. Structure of induction range

Usually these ranges are made of tempered ceramic or glass with circular marker that shows where to place the pans. The most important feature in the equipment is that this range is highly efficient and requires less energy than all usual ranges. So this equipment should be a part of each modern professional eco-responsible kitchen.

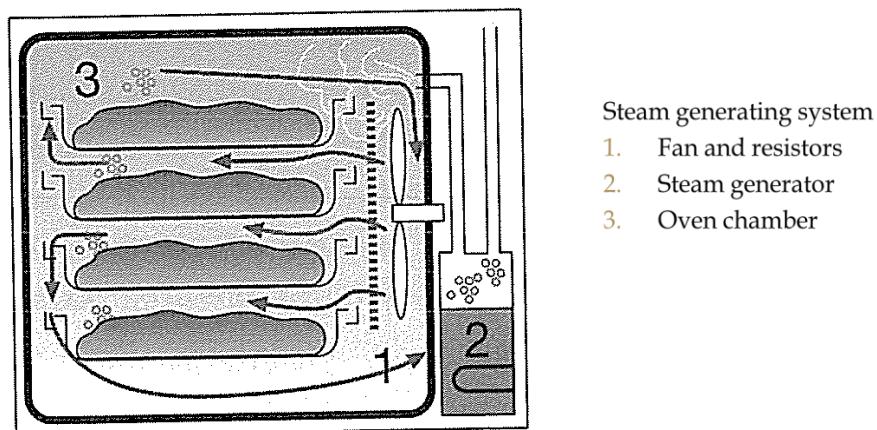
4.2 Combi-steamers

“Combi oven” – this term means combination of steamer and convection oven. These two processes can be used separately or together at once. Combi Ovens is technologi-

cal, modern and highly programmable equipment for professional kitchen. You can find variable humidity control in this equipment. The dish can be prepared atomically or with specific settings. However, in general there are three main combinations of different cooking methods:

1. “Steam”- imitate the speed of the pressure steamer without pressure;
2. “Hot air”- warming process with the use of different humidity’ levels (like convection oven);
3. “Combi Cooking”- combination of superheat and hot air together. (Katsigris& Thomas, 2009, 430-432.)

You can see a principal of work of a steam generating system in a picture 4 below. (Tuovinen, 2013.)



PICTURE 4. Steam generation system

The result of combining steamer’s humidity with convection heat is a moisture that makes products fresh and holds their life longer. This moisture saves flavor and nutrients inside the product. Moreover, due to the moisture browning takes place more evenly and faster.

The speed and large list of applications make this equipment an indispensable part of each professional kitchen. This machine is suitable for all types of dishes, from roast fish to steam broccoli, from desserts to soups. You can use this equipment for different sorts of baking and pastries. The most important fact is that there is a possibility

to prepare all food in advance and it is not necessary to stay and control the dish, equipment can manage everything itself. The first combi oven was electric and was invented in 1970 by Rational Cooking System in Schaumburg in Illinois, this company has more than 80 percent of patents for Combi-Steamers models and related inventions. Now you can find different types and models from floor and big Combi-Ovens to little and compact table models.

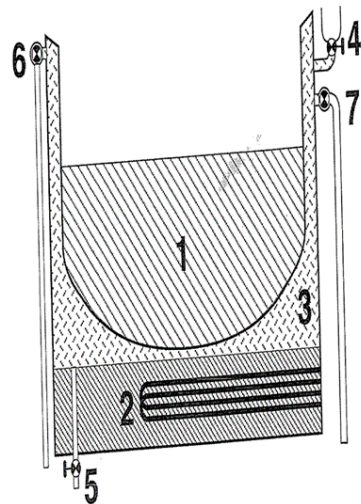
For us the most significant thing is eco-efficiency of this machine. It uses up to 60 percent less energy than traditional cooking appliances. Moreover, it is compact and does not take considerable space in a kitchen, and one Combi-Oven can replace a big part of usual kitchen equipment. This equipment saves time and is easy to use for employees.

4.3 Kettles

Today's market of kettles is very large; you can find different models with particular features and operation requirements, with the capacity from 30 to 600 liters. Kettles are supposed for preparing different dishes such as sauces, soups, stews, rice etc. The size of a kettle allows preparing huge amount of food at one time, for example, if there is a necessity to prepare 200 portions of stew at once, kettle can easily manage this.

The kettle's main and the most important that actually heats the food is a jacket of kettle. This steam-jacket works like a combination of double boiler and bain-marie. There are approximately 5 cm between two hemispheric bowls. Inside, bowl is connected along its top with another bowl (the jacket). In this jacket you can find special constructed baffles that deliver even distribution of warmth inside kettle. Pressure of steam can be altered depending on cooking needs; it can be increased for rapid cooking and decreased for slower one. Steam transfers its warmth to steel walls, so steam is not in direct contact with food, and consequently kettle's walls warm the food. The vital feature is that the heat is distributed in the jacket from the bottom to the walls and it is four times more efficiently than the same size cooking pot (because heat there is spread only through the top). Furthermore, kettle is always covered during the cooking and this makes the process faster as less heat escapes from the cooking equipment. (Katsigris & Thomas, 2009, 417-424.) In addition, the outer end of most kettles is

made from stainless steel and inside part - from acid-proof steel. There are a lot of different models of kettles with different structures, but principal of work is similar in each model, in the picture 5 below you can see the inside structure of a kettle more clearly. (Tuovinen, 2013.)



1. Food
2. Water-space and heating resistors
3. Steam chamber
4. Water filling
5. Testing valve (automatically with swimmer switch)
6. Air vent (open when temp < 100 degrees)
7. Pressure relief valve

electrically heated / steam heated

PICTURE 5. Structure of kettle

In modern kettle models, mixer with mixer tool can be found. Thus, kettle transforms into varimixer. With the help of this accessorize you can cook, for instance, mince from meat and many other things. New modern kettles are providing cook-chill option. With this function, you can cook and refrigerate the food. The only thing that is necessary is to connect it with the sauce of cold water or ice, so you can use it for cooling hot food, or make ice cream and cold salads.

Taking everything that is written above into account, kettle is one of the important professional kitchen equipment and each restaurant should use it. With the help of kettle, you can cook different types of food, and if you have an order for many lunches or a banquet, one kettle can help you to prepare food quicker and easier. This equipment is very safe, so your personnel can manage it, without fear to be burned, because whole process of heating is inside of a kettle's jacket. Moreover, this equipment is very eco efficient, circulation of steam inside a jacket saves huge amount of water, electricity consumption is reduced as well and if we think about amount of food that we can cook with this consumption, it results that this equipment saves environment and a lot of money to you restaurant.

4.4 COOK-CHILL technology

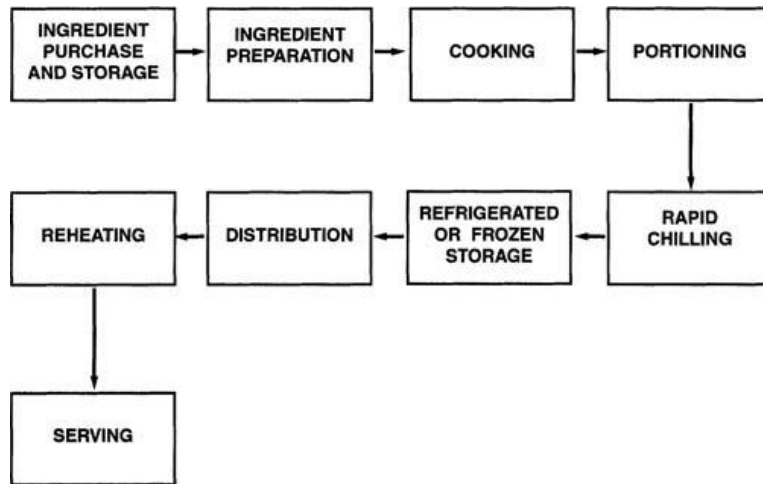
Cook-chill is one way of development for food preparation. This technology increases food safety, reduces waste and is being used in modernized production. Cook-chill is not just freezing of food, it is a process of quick cooling to prevent food from staying in a danger zone (from 5 to 57 degrees Celsius) and, as a result, protecting it from bacteria growth. After rapid chilling food is held in appropriate refrigeration (from 1 to 4 grades Celsius), which extends its shelf life and saves product at least for 5 days, and in some cases for 21 days before serving. This technology was firstly used in German hospitals more than 50 years ago. People often confuse cook-chilling with the old popular technic “ice shock” (when food is prepared and then immediately plunged into ice water), but these two methods are different processes.

Advantages of equipment with cook and chill technology:

- It is suitable for different sizes of operations (for example, in restaurants it can be useful for catering and banquet needs, or for saving extra food, you can prepare food in one day and serve in another. For chain restaurants or manufacturers it can be used in a center of production, and later food is distributed to the locations).
- Saves time and organizes it in an accurate way (you can cook all the dishes when business is slow and then use it in busy days, and your more professional personnel can prepare food, then your usual cooks should just reheat it and make portions)
- Other resources' economy (for example, ingredients can be purchased in big quantities, and it saves some money for you)
- More flexibility and diversity in menu (preparation of food in advance gives you more possibilities to change something or to create something new)
- Serve special needs (hospitals, schools)
- Increase food safety
- Service upgrading (you can offer greater variety of food and have more time to garnish etc.)
- Decreases waste, portion control

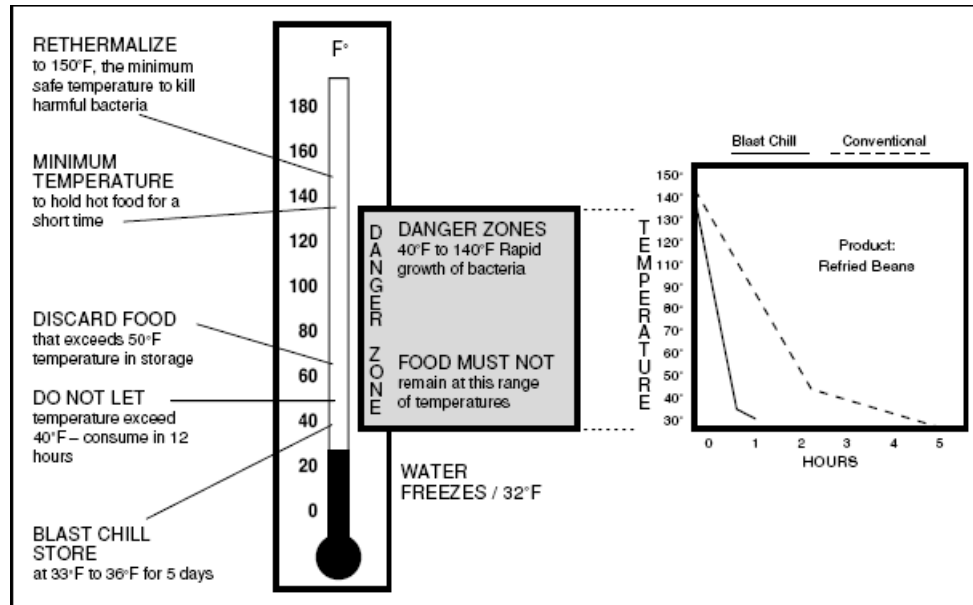
- More calm work atmosphere
- Increases profitability. (Katsigris& Thomas, 2009, 438-448)

In the picture 6 below you can see how this equipment works.



PICTURE 6. COOK-CHILL technology

Nowadays, you can find a lot of equipment with cook-chill function; usually it is in different models of blast chillers. However, sometimes, for instance, Electrolux Professional provides equipment that combines combi oven and blast chiller side-by-side, these innovation technologies can be useful, for example, in luxury cruises. I want to show you the picture 7 where you can see the big difference between conventional fridge and blast chiller.



PICTURE 7. Comparison of conventional fridge and blast chiller

This table is in Fahrenheit, but anyway it lets to see the difference. Left picture shows danger zones, but right picture is more significant for us, as it shows how quicker the blast chiller is and that it cools beans from 60 degrees Celsius to -1 degrees Celsius only in one hour considering the fact that products do not stay long time in danger zones.

Cook-Chill is a very good and modern technology. It makes products fresher, saves a huge amount of time and, without doubts, it is more cost effective. This equipment is very eco-efficient, and if a restaurant is considered to be eco-responsible, it should have and use this technology.

5 EQUIPMENT OF METOS

Metos produces large assortment of professional kitchen equipment. In Metos Company you can find the whole range of equipment for a restaurant. The variety of the assortment is high, from kettles, pressure cookers, fryers and ranges to slicing machines, circulators and accessories. Furthermore, the company offers bar equipment: blenders, juicers and coffee machines. Metos' kitchen furniture can be bought as well. Besides this, there are also special machines for cleaning of the equipment. Furthermore, Metos designed HACCP self-control system for measuring the temperature in

storages and refrigerators, this innovation helps to keep everything under control. All the produced equipment can be found in Metos' catalog.

This company has a rich history, and during the decades Metos has proved the quality of their equipment. From year to year the company launches innovations and dependable equipment. Huge part of this equipment is considered to be eco-efficient. Nowadays, Metos tries to arrange all its production in an ecologically friendly way.

This thesis project will cover only eco-efficient equipment of Metos', and equipment that is used for practical part: SCC, VCC, Kettles, Induction ranges. The attention will be concentrated on the machines and systems listed in the previous sentence; they will be carefully observed and compared with other models from their groups.

5.1 Metos SelfCooking Center (SCC)

According to Metos Catalogue (2012, 84-93) "Whiteefficiency" is a unique concept, introduced by Metos. It means that it is trying to get maximum efficiency from everything it uses; it can be water, energy or food. Therefore, the company introduced a SelfCooking Center (SCC). The objective of this system is to reduce energy, water and time consumption. Efficiency and ergonomics are the main points of SCC, because it can replace 50 percent of cooking equipment, such as kettles, grills, combi steamers, frying pans, ovens, etc. Below the functions of SelfCooking Center are presented:

- HiDensityControl function supports high level of cooking process quality by proportional and intense warmth and humidity in a working area;
- SelfCooking Center helps to automate the process of cooking. Special sensor device is used for detection of size and amount of food. Therefore, it is not necessary anymore to do it manually;
- Efficient LevelControl (ELC) is a technology, which can be useful for preparing dishes "A la Cart" and in processes where you need to be flexible. Instead of using oven, grill and kettle you can use only a SCC and cook everything at one time. For

instance, frying steak, baking pizza, grilling vegetables, frying fish at the same moment can be possible with this technology. This method reduces energy consumption and saves time;

- CareControl system is a smart program for automation of all processes related to the cleaning of the machine. The system defines quantity of water and detergent. It saves time and money;
- Notwithstanding the automation of the system, manual control is still possible, as deep customization of the process helps to make perfect dishes.

With MetosSelfCookingCenter “whiteefficiency” productivity increases by 30 percent. For instance, you can cook 320 croissants in 23 minutes, 400 chicken legs in 45 minutes, 240 escallops in 12 minutes, 60 kg of potatoes in 20 minutes, etc.

The leading points of MetosSelfCookingCenterare:

- High efficiency,
- Energy, water and time saving,
- Ease of usage,
- Automatic cleaning,
- Ergonomics,
- Safety.

The assortment of models is wide; there are a lot of floor table types with different characteristics and sizes. Several models from each category are presented below in table 2.(Metos, 2014.)

TABLE 2. Comparison of MetosSCC models

Name and type	Size mm (w * d * h)	Weight	Capacity	Technical information	Price
SelfCooking Center Me-	847 * 771 *	135,000KG	mobile oven rack,	400 V, 35 A, 19 kW,	13960,00 €

tosMSCC WE 101/8 MOR 400V(Table model GN1/1)	1042		run-in rail	FAS: 3N	
SelfCooking Center Metos MSCC WE 102 400V3N(Table model GN2/1)	1069 * 971 * 1042	182,000KG	10 x GN 2/1-65	400 V, 63 A, 36,7 kW, FAS: 3N	16,900.00 €
SelfCooking Center Metos MSCC WE 201/16 400V3N(Floor model GN1/1)	879 * 791 * 1782	258,000KG	16xGN 1/1 - 65, dis- tance 80 mm	400 V, 63 A, 37 kW, FAS: 3N	21,630.00 €
SelfCooking Center Metos MSCC WE 202/15 400V3N(Floor model GN2/1)	1084 * 996 * 1782	332,000KG	15 x GN 2/1-65	400 V, 100 A, 65,5 kW, FAS: 3N	29,690.00 €

As the table shows, prices are high. However, in relation to large-scale projects, this equipment saves a lot of electricity and water, reduces the amount of food needed, as well as timing of the cooking process. Moreover, with the use of this machine, the number of employees can be significantly decreased. To manage the equipment properly, there should be only one person and he/she does not have to be a professional, because the machine automates the whole process. There is also a matter of ergonomics; there is a choice whether to buy a lot of equipment or just one SCC.

5.2 MetosVarioCooking Center (VCC)

This equipment can be used for frying, deep-frying and boiling. It is small-sized, only one square meter, and both sides can be applied at the same time. For example, it is possible to boil pasta and cook Bolognese sauce on another side. However, models with one cooking side also exist. VCC allows dishes to be cooked by 50 percent faster than those that are prepared in usual kitchen equipment like fryer, cooking pot or frying pan. A good option is that this cooking center does not require any oil or water on the hot steal. Moreover, there are several automatic programs for cooking; parameters can be chosen manually if needed.

The leading points of MetosVarioCooking Center are:

- Reduction of energy consumption by 20-40 percent,
- Easy to use,
- Food loss is 10% less,
- Useful for huge amount of food,
- The scorching is impossible,
- Easy to clean. (Metos SCC and VCC Catalogue 2012, 6-7.)

Models: The assortment is big enough; there are about 20 models. There are 3 of them below, with all the characteristics as you can see in table 3.(Metos, 2014.)

TABLE 3. Comparison of Metos VCC models

Name and type	Size mm (w * d * h)	Weight	Capacity	Technical information	Price
VarioCooking Center Metos VCC ME 112 F05	1200 * 777 * 1100	205,000KG	2 x 16 l	400 V, 32 A, 19,4 kW, FAS: 3NPE	23,150.00 €
VarioCooking Center 211+	1157 * 914 *	265,000kg	100 l	400 V, 50 A, 28.2 kW,	27,900.00 €

VCC 211+	1100			FAS: 3N~ Cold water inlet: 3/4"	
VarioCooking Center Metos 311+ VCC ME 311+	1535 * 914 * 1100	335,000KG	150 l	400 V, 80 A, 45 kW, FAS: 3NPE	35,600.00 €

The prices of VCC are high, however, there is a number of positive points that this equipment gives to professional kitchen, like ergonomics, efficiency, money saving and protection of external environment.

5.3 Kettles

Kettles of Metos are represented by “Proveno”, “Culino” and “Viking” kombi kettles. They are similar, except of some special functions. In this thesis attention will be concentrated on “Proveno” kettles. These model can be useful for schools, hospitals, pharmacy, food production and HORECA sector. There are many automatic programs for mixing; the number is close to 99 variations. There is also a manual option. Special program “TempGuard” controls the temperature of products and automatically changes it. “Proveno” can also be useful for proofing in baking process. Numerous dishes, such as smash potatoes, soups, pastry, batter etc., can be cooked with the help of this machine. Moreover, this equipment decreases energy and water consumption, as it usually works in half of power and has closed water circulation. Function “Cook to cool & cook to cook” helps to leave food for night with low temperature and heat up the dish in the morning. This equipment can bring significant improvements to a big producer, as numerous portions can be prepared.

The leading points of Metos Proveno kettles are:

- Efficiency,
- Energy and time saving,
- Wide spectrum of applications,
- Automatic chilling,

- Automatic control of temperature. (Metos Catalog 2012, 60-65.)

The list of different types of kettles is long, as it contains a lot of items. There are many different sizes and models. There is table 4, which is based on the prices presented on Metos website (Metos, 2014) with two “Proveno” medium models, one of them is new, it has a chilling function, and another one is standard.

TABLE 4. Comparison of Metos "Proveno" kettles

Name and type	Size mm (w * d * h)	Weight	Capacity	Technical information	Price
KombipataProvenoChillPro 100S DCE	1144 * 690 * 1280	298,000KG	100 L	230 V, 16 A, 1 kW, FAS: 1NPE KV: 15 LV: 15	45300,00 €
ProvenoCombi Pro 100S	1144 * 690 * 1280	257,000KG	100 L	400 V, 50 A, 28.2 kW, FAS: 3N~ Cold water inlet: 3/4"	20400,00 €

5.4 Ranges

Metos provides large spectrum of ranges. Three main types are presented: Ardox C electric model with stainless top, Ardox I,C models with ceramic top induction, and Metos Futura RP and Metos Minor models with cast iron top. You can find table and floor models with different size. Metos' ranges are ecologically responsible equipment: it is faster than usual electro ranges, where more than 90 percent of spent energy goes exactly to heating up of the cooking equipment. (Metos Catalogue, 2012, 132-137.)

The list of tables and floor models is wide enough, as there are many different options. For example, in the table 5 below there are floor models with four cooking zones from each category (Metos, 2014).

TABLE 5. Comparison of Metos ranges

Name and type	Size mm (w * d * h)	Weight	Capacity	Technical information	Price
Range MetosArdox S4 400V3N~(Flat-top range)	800 * 800 * 900	93,000 KG	4 cooking zones	400 V, 35 A, 14 kW, FAS: 3NPE	4660.00 €
MetosArdox C4 400V3NPE(Ceramic range)	800 * 800 * 900	60,000 KG	4 cooking zones	400 V, 25 A, 13 kW, FAS: 3PE	4280.00 €
MetosArdox I4 400V50/60Hz3NPE(Induction range)	800 * 800 * 900	60,000 KG	4 cooking zones	400 V, 25 A, 14 kW, FAS: 3NPE	9870.00 €
MetosFutura RP4 400V3N~ 202/15 (Iron cast range)	800 * 800 * 900	75,000 KG	4 x plate	400 V, 32 A, 12,0 kW, FAS: 3NPE	2990.00 €

All models are quite similar, but this table demonstrates that the prices are different. As it can be seen, the most expensive one is induction range. This equipment is modern and eco-efficient, it takes only two minutes to boil water in this range, and frying pan heats oil just in several seconds, as a result cooking can be started immediately. It saves a lot of energy. The cheapest one is iron cast range but it is very slow and uses much more energy.

5.5 Blast chiller and shock freezer

Safety of food has great significance in professional cooking process. According to Metos Catalogue (2012, 298-300) Metos' Blast chiller and shock freezer cabinets

help to decrease temperature of prepared and raw products with a great speed and effectiveness, at the same time it preserves their quality and freshness. The equipment follows all hygiene norms provided by HACCP.

With the help of special electronic panel, which is located in Chiller and Freezer cabinets, it is possible to choose various modes and programs for blast chilling or shock freezing regime. Furthermore, this panel provides soft mode for delicate products. Special program automatically monitors temperature of products during the whole process of cooling and adjusts temperature of cooling air. During cooking cycle the program protects microstructure of products and prevents them of losing vitamins, nutrients and humidity. Besides this, it has a function for creation of consumer's own program of cooling. An important fact is that both cabinets do not use Freon, which can be poisonous for health.

The producers have added a useful option into this machine. Chiller and Freezers cabinet can be connected with a computer; thus, a user is able to observe process of cooling and save the data. Moreover, all information can be printed via printer, which is built into the cabinet.

The full assortment of Metos' Chiller and Freezers can satisfy the needs of many types of kitchens. One floor model and one table compact model are presented in the table below (Metos, 2014).

TABLE 6. Comparison of Metos Blast Chillers

Name and type	Size mm (w * d * h)	Weight	Capacity	Technical information	Price
Mini blast freezer Metos CF031 AG	560 * 700+35 * 520	47,000KG	8kg/+70... +3,5kg/+ 70...-18	230 V, FAS: 1N	3030.00 €
Blast chiller	790 * 800 * 1950	185,000KG	55kg/+70. ..+3,36kg/	400 V, FAS: 3NPE	8100.00 €

cabinet			+70...-18		
Metos					
BF161					
AG-P					

6 COOKING PROCESS IN MODERN PROFESSIONAL EQUIPMENT

Nowadays, many types of professional cooking equipment have the function, which called “Processes cooking”. It allows to cook various dishes with greater ease and time efficiency. You can usually find a large list of dishes that can be prepared with the use of this automatic program. You can bake, fry, boil and fulfill many other tasks with the help of these Processes. There is also a possibility to cook such food as fish, meat, and poultry in different styles. This program is merely the same in all equipment; there can be only little differences between them. The principal of work is the following: you choose a program suitable for a dish, then little adjustments like preferable color are made, after that the equipment implements everything by itself.

The main and very important option that is available in all types of equipment is core temperature probe. This tool is used for preparation of almost all types of food; it can be applied when thickness is 1 cm or more. There are some basic rules when you use core temperature probe:

- Do not let the core temperature probe hang out of the equipment as it can be damaged by the doors of equipment or it can damage probe cable, as well as for hygiene reasons;
- Slightly cool the probe with the hand shower before putting it into food, it helps to prevent discoloration around an insertion hole;
- Do not insert temperature probe from one product into another during cooking;
- Take a look at display before starting cooking, because display often shows how to insert probe inside a product in selected Process in a proper way;
- If probe is inserted incorrectly, you will see special picture on a display, after special signal you can reinsert it. (Cookbook SelfCooking Center of Rational, 2011, 4)

6.1 Cooking processes in SelfCooking center

According to Cookbook SelfCooking Center of Rational (2011, 5-69) SCC provides different Processes that are suitable for different types of dishes. Some process programs are briefly described below.

TABLE 7. SCC “ROAST” process of cooking

Universal roasting	<p>Suitable for:</p> <p>Pork: neck, leg, saddle, stuffed shoulder, cured pork or ham in bread-dough, rolled roast, mincemeat roast, meat loaf</p> <p>Veal: stuffed breast of veal, knuckle, veal joint</p> <p>Beef: Roast beef, good stock</p> <p>Not suitable for:meat of low fat content, small diameter, meat with rind</p>
Roasting with cracking	<p>Suitable for: belly of pork, leg, cured stuffed belly of pork, Chinese belly of pork, traditional glazed ham, suckling pig</p> <p>Not suitable for: browning bread crust, vegetables,herbs or similar, methods ultimately incompatible with high temperatures</p>
Soft roasting	<p>Suitable for:</p> <p>Beef:sirloin, whole fillet, topside, fore rib, rump, pot roast, braised pickled beef</p> <p>Lamb: leg, saddle, shoulder, Game: haunch, saddle, shoulder of venison and wild boar</p> <p>Veal: loin of veal with kidney, whole fillet, saddle Pork: spare ribs, saddle</p> <p>Braised dishes: stuffed cabbage rolls, roulades, ossobucco, leg of rabbit, oxtail, goulash, ragouts, Japanese nimonos</p>
Soft cooking	<p>Suitable for: cured pork, brisket of beef, beef chuck, tongue, ham, terrines (poultry, fish, meat),head of veal, belly of pork, Japanese beef with radish</p>
Overnight	<p>Suitable for:sirloin, pork roasts with and without crackling, whole and</p>

roasting	jointed geese, whole ducks, braised dishes like pickled beef, ossobuco, roast beef, meat loaf Not suitable for: game dishes, pan fried meat such as steaks
Overnight cooking	Suitable for: beef chuck, brisket of beef, beef for making stock, cured ham, cured pork knuckle, stews without onions

TABLE 8. SCC “PAN FRIES” process of cooking

Breaded	Suitable for: All types of escalope (pork, veal, poultry, vegetable), sweetbreads, cordon bleu, breaded fish fillets, vegetables, shrimps, crab
Natural	Suitable for: Lamb: boned saddle, cutlets, hamburgers, mince steak Pork: fillet, neck steaks, escalopes, loin steaks, cutlets Beef: fillet, rump steak, flank steak, tournedos Poultry: turkey escalopes, medallions, chicken breast, breast of Barbary duck, ostrich Veal: medallions, cutlets, saddle, escalopes, fillet Game: elk, chamois Not suitable for: unthawed frozen products, meat or poultry cut into slices or strips
Marinated	Suitable for: Pork: fillet, neck steak, escalopes, loin steak, cutlets Poultry: turkey escalopes, medallions, chicken breast, breast of Barbary duck, ostrich Veal: medallions, cutlets, saddle, escalopes, fillet Beef fillet, rump steak, flank steak, tournedos Not suitable for: small diameters (better cooked as Minute Grills), pure oil marinade
Minute grills	Suitable for: beef, veal, pork, poultry, lamb: in strips, slices, marinated or seasoned Not suitable for: minute grills in sauce, serve sauce separately
Finger food	Suitable for: Mediterranean grilled vegetables, minute steaks, kofta, satays, scallops, mini spring rolls, baked won tons, frozen breaded prawns

TABLE 9. SCC “POULTRY” process of cooking

Roasted chicken	Suitable for chicken or poultry weighting approx. 250-2000 g, capon, poussin, pheasant, partridge
Marinated chicken	Suitable for: chicken or poultry weighting approx. 250-2000 g, capon, poussin, pheasant, partridge
Chicken pieces	Suitable for: marinated or seasoned, half chickens, legs, thighs, breasts, wings, drumsticks, goose breast or leg Not suitable for: quail, breast of Barbary duck, wild duck, breasts and legs, duck legs
Duck/ goose	Suitable for: duck, whole Barbary duck, wild duck
Turkey	Suitable for: 1.5-18 kg turkey Not suitable for: unthawed frozen product

TABLE 10. SCC “FISH” process of cooking

Baked fish	Suitable for: fillets or whole fish, tuna, Pike-perch, sole, plaice, perch, gurnard, catfish, monk fish, turbot
Steamed fish	Suitable for: Whole fish: Pike-perch, sole, plaice, gurnard, red mullet, catfish, sea bream, squid, octopus
Convenience roasted	Suitable for: All products specially suited to hot air units/Combi- Steamers e.g. fish fingers, nuggets, fish fillets with toppings, breaded products, in batter, in flaky pastry
Convince steamed	Suitable for: Seafood, fish roulades, rolled sole, various fish fillets with toppings

TABLE 11. SCC “BAKING” process of cooking

Sweet baking	Suitable for: Tray bakes, muffins, brownies, scones, currant buns, milk rolls, strudel with sweet fillings, croissants with sweet fillings, apple turnovers
Savoury bakery	Suitable for: Bagels, flaky pastries, strudel with savoury fillings, pizza, quiche, loaves, croissants, crisping up rolls, defrosted pretzels
Prove and bake	Suitable for: unrisen fresh dough, yeast pastry, plaits, yeast dumplings, stollen, yeast dumplings, savarins, white bread, raisin bread, plum cake,

sweet	toasting bread, milk rolls, nut croissants, cinnamon whirls Note: Insert CT probe only when requested
Prove and bake savour	Suitable for: unrisen fresh dough, white bread, wholemeal bread, rolls, croissants Note: Insert KT probe only when requested

TABLE 12. SCC “SIDE DISHES” process of cooking

Convenience	Suitable for: Frozen calamares, cod croquettes (Buniuelos de Bacalao), vegetable cutlets, hash browns, breaded vegetable croquettes, potatoes duchesse, rösti, croquettes, wedges, potato balls Not suitable for: Raw products, products must be prefried or pre-blanching in oil
Gratin/Quiches	Suitable for: potato gratin, lasagne, vegetables au gratin, fruit or semolina soufflés, Japanese vegetables in marinade, salmon-vegetable bake, Spanish omelette, paella with fish or poultry, stuffed pancakes au gratin, artichokes with bacon, paella with pasta, pasta bake
Dumplings/potatoes	Suitable for: jacket potatoes, shaped, peeled, sliced potatoes, potato dumplings, bread dumplings, sweet dumplings
Steamed rice	Suitable for: all types of rice, grain, semolina etc.
Steamed side dishes	Suitable for all types of vegetable prepared in Moist Heat or in boiling water. Cauliflower, pakchoi, mange-tout, peas, carrots, broccoli, kohlrabi, radish, sweetcorn, spinach, pumpkin, spring onions, sweet peppers, leeks, white or green asparagus, beetroot, potatoes cut up small (diced or sliced), all types of frozen vegetable, steamed dim sum variants, e.g. haw gao, show mai and many others

As the tables 7-12 show, Processes cooking is very important function of SelfCooking center. It is almost impossible to cook all those products without this function. For example, it will be quite difficult to cook Spanish risotto, using manual program.

6.2 Cooking processes in VarioCooking Center

Processes of cooking in VCC are approximately the same, as in SCC and it will be good totake a brief look at them. According to Application Manual VarioCooking Center Multificiency (2012, 14-116), processes are the following:

TABLE 13. VCC processes of cooking

Type of food	Program of cooking
Meat	Braise, boil, overnight braising, overnight boiling, fry natural+breaded, ragout+cutlets, overnight ragout, deep fry, infuse sausages
Fish	Fry, poach, deep fry, fry seafood, boil seafood
Vegetables and side dishes	Fry, braise and stew, boil, deep fry, boil potatoes, cook pasta, boil rice, polenta, risotto+paella
Egg dishes	Boil eggs, fried eggs, scrambled eggs, omlette, pancakes, kaiserschmarm
Soups and sauces	Soups, beachamel + veloute, convenience, clarity, sauce, stock, boil down
Dairy products and desserts	Boiling milk, puddings+sauces, rice pudding, boiling fruits, boiling sugar, crepers, kaiserschmarm

7 RESEARCH

7.1 Place of research

Talli is one of three restaurants at campus of Mikkeli University of Applied Sciences. This restaurant was opened on the 13th of September in 2004. It is located in an old building that used to be a barn. However, nowadays, it is a beautiful, stylish and at-

tractive restaurant. Talli's menu contains a list of various dishes a la carte; the restaurant also offers buffet lunch menu, take-away food and different wines.

The hall of the restaurant is light and spacious, with attractive design and cozy atmosphere. Its area allows accommodating 120 people. Three meeting areas of different sizes are located on two floors; these rooms can be reserved for different conferences or other events. Christmas parties or festive dinners can be also organized there; all wishes and suggestions of customers will be taken into account. The restaurant works from 10 am to 3 pm on Monday – Tuesday and from 10 am to 10 pm on Wednesday – Saturday.

Talli is a very ecologically responsible restaurant; it pays attention to protection of natural resources and cares about environment. For these reason it measures the whole process of cooking and declares the results. Talli's kitchen provides a large cooking space. It is separated into two zones: one is for Talli's employees and the second one is for studying. Both areas are equipped with modern and efficient machinery such as VCC, SCC, Kettles and other professional kitchen equipment. Staff of Talli as well as students can use both areas, because sometimes it is necessary to use equipment, which is located in another zone.

The kitchen for studies is the largest place in the whole restaurant, and it has three big working zones. In the kitchen there are tools with different sensors for measuring of water and energy consumption. Moreover, this part of the restaurant has a special room with computers for students' needs and a room for discussions and conferences. Not long time ago this training kitchen was the best one in Europe and now it is one of the best in Finland. The following research was conducted in this kitchen, as it has all the necessary equipment, as well as tools for data measuring.

7.2 The main idea and plan of the research

The main idea of this research is to show that modern equipment is more efficient and faster than traditional one. It does not require any special knowledge or experience in cooking, as it provides a consumer with numerous automatic programs. Thus, it saves time and is simple to use. Furthermore, this equipment has high level of ergonomics,

because it does not take much space, and as a result, one item can replace several traditional installations.

The most significant and useful point of this research is to show that the modern equipment decreases electricity and water consumption. The practical part will prove this by comparing traditional and new ways of preparing different kinds of food. Besides this, different programs and settings of equipment, e.g. manual or automatic, and different ways of preparing the same dishes will be combined to find out which method works better.

This experiment was conducted in approximately one month, during this time 8 different types of dishes were prepared. They were separated into pairs by methods of cooking and components (table 14).

TABLE 14. Dish pairs for the experiment

Number of pair	Name of the dish	Ways of cooking
First pair	Salmon in Russian style	Manual and Process (SCC)
	Oven baked salmon with tomato pesto sauce	Manual and Process (SCC)
Second pair	Creamy soup with lake pike	New way: Induction range Old way: Electric range
	Spinach soup with boiling organic eggs	New way: VCC Process Old way: Electric range
Third pair	Paper cheese with smoked pork	Process SCC (Cooking loss)
	Pork neck with paper	Process SCC (Cooking loss)
Fourth pair	Broiler pesto lasagna	Process, different settings (SCC)
	Chicken gratins	Manual and Process (SCC)

During all those experiments, sauces for the dishes are cooked with the use of different equipment like induction range, VCC and kettle. The overall amount of dishes is estimated for 40 persons (20 dishes for each method). In special occasions, for exam-

ple, when big amount of sauce is needed for the dish, only one method will be used for all 40 portions.

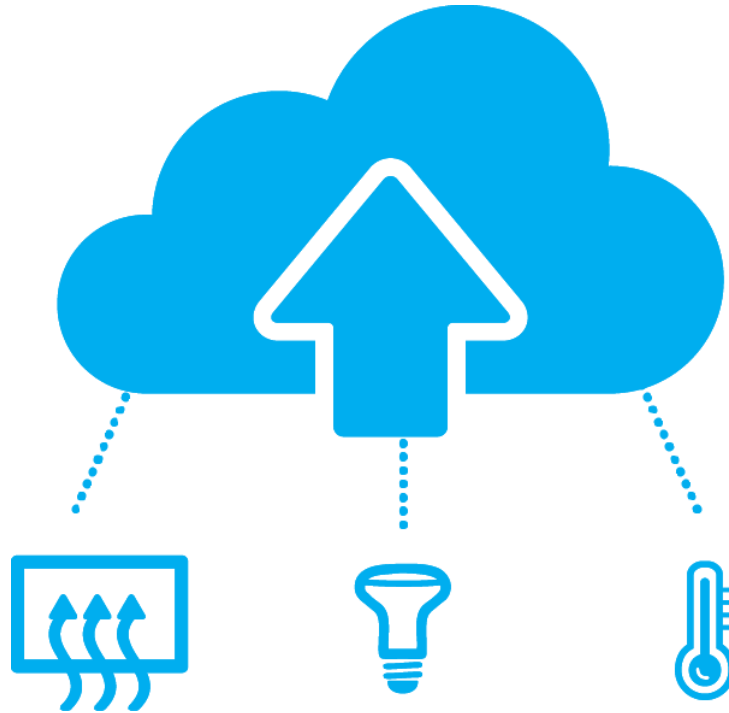
The total price of this research, including money that is spent for products, will be paid separately: one part is taken by the University, another one - by the Talli restaurant. The price of the following research was decreased, because dishes were prepared for the customers of Talli. In this way, two goals are received, the dishes for Talli are prepared, so the restaurant receives some profit, and the research is conducted in a proper way.

7.3 Methods

This research is based mostly on scientific methods. Different ways of cooking were combined and all the notes related to the process were taken down. Particular recipes in Finnish language were, firstly, translated into English. All dishes were estimated for 20 or 40 portions, depending on a dish type and method used.

Special field books for measuring data were used for taking notes. Such parameters as start and end time, start and end mass, time of cooking and all information about pre-heating were written there in appendix 1. All these field books are different for each type of equipment.

For measuring ingredients mass, as well as total and end mass of food different types of scales were applied. Furthermore, as it was already mentioned, Talli's equipment has different sensors for measuring consumption of electricity or water. When all the experiments were conducted, special Internet tool "TempNet" was used. Tempnet is a cloud service, which is provided by Finnish company Sensire. It records all measurements of water and electricity consumption and exact equipment that was used, then sends it in cloud service (picture 8).



PICTURE 8. Cloud Service

Then you can login in special website of Tempnet where you all information about consumption for a year, month, day, hour and minute is available. You can see how this measurements look likes in appendix 2. After that, the data is analyzed, thus, it helps to make a conclusion about each experiment. Furthermore, calculator and special EXCEL table were used to analyze the data received. All this factors show that my research is primary quantitative.

8 EXPERIMENTS

8.1 Day One

During the first day “Salmon in Russian style” was prepared with the use of SCC (Metos Company). This dish was cooked in two ways: firstly, with manual settings and, then, with automatic cooking program of SCC. The preparations made before putting fish in SCC were quite simple. In the beginning, fish was defrosted, then cut into similar pieces approximately for twenty persons. After that, ceramic container was oiled with special oil spray and pieces of salmon were placed there. In the next step the fish pieces were spiced with salt and paper, then cucumbers (that were cut before), dill and strong cheese were added on the top of the fish. In the end the whole

dish was drowned with the cream, and then it was ready for cooking. For this fish four ceramic GN 1/1-65 containers were used (two for each process). In several days it was revealed that the fish should be pilled from the skin first, before cutting it into piece, so it was the first mistake of the research.

8.1.1 Manual Settings

For the first part of the experiment SCC (Metos Company) was used. The mass of ceramic GN-65 containers was the following: GN-1 mass 4, 204 kg and GN-2 mass 4, 224 kg. The start mass of food was 3,372 kg in GN-1 and 3,268 kg in GN-2. All additional information is available in the table 15 below.

TABLE 15. Day 1 - manual settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time (minutes)	Cooking loss (%)	Inside temperature
Manual: Temperature 160 °C, 30 minutes	Warm	2	28	GN1-8,6 (290g) GN2-8,8 (288g)	68,71 °C

In this table you can see all basic information, like settings that were used for the experiments, condition of equipment before cooking was started, cooking time, cooking loss and inside temperature. The end mass of the dish was 3,082 kg in GN-1 and 2,980 kg in GN-2, cooking loss in percent is also presented. At the end of cooking the dish looked good and attractive, the amount of sauce was good too. The fish was tasty, soft and juicy. The spices and all ingredients were combined in a perfect way.

8.1.1.1 Electricity and water consumption

Pre-heating of 2 minutes took 0,266 kWh of electricity, the cost was 0,02 € for all amount of food. If we separate this consumption by 20 portions it will be 0.01330 kWh of electricity and total cost will be 0.001 € for each portion. There was no water consumption during the preheating process.

As it was already mentioned, the whole process lasted for 28 minutes. The total amount of energy spent was 1,476 kWh, the electricity cost was 0,10 €. Water consumption accounted for 1 liter. Total cost was 0,11 €. This result should be separated for 20 portions; thus, it is 0.0738 kWh of energy consumption per one portion. The total price for one portion was 0,005 €.

8.1.2 Automatic Process

For the second part of the experiment, the same SCC but with automatic program was used. Ceramic containers were GN-1 - 4,204 kg and GN-2 - 4,224 kg. The total mass of food before cooking was 3,348 kg in GN-1 and 3,552 kg in GN-2. Some results and settings that were used can be observed in the table 16.

TABLE 16. Day 1 - automatic process settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)	Inside temperature
Process: Fried fish	Warm	6	28	GN1-12,4 (416g) GN2-11,6 (414g)	75 °C



PICTURE 9. "Salmon in Russia style" - automatic process

The cooking time was the same as in previous method. Moreover, in this experiment pre-heating was used and equipment was warm like in previous test. After the process total mass of food was 2,932 kg in GN-1 and 3,138 kg in GN-2, the cooking loss is available in the table. Inside temperature is a little bit higher than in previous method. The dish looked satisfactory, more sauce went out in this experiment. The fish was very juicy and delicious, but the top was slightly burned, and did not look perfect, you can see it in the picture 9 below.

8.1.2.1 Electricity and water consumption

Pre-heating lasted for 6 minutes, and as a result we have 1.342 kWh of energy consumption with a price of 0,09 €. After separation of this result by 20 portions it became 0,0671 kWh of energy and 0.005 € price per portion. The water was not spent for the pre-heating process.

The process itself took 28 minutes, total electricity consumption was 1.855 kWh with cost of 0.13 €. Water expenditure was 5 liter with cost of 0.02 €. If we separate it by 20 people it accounts for 0.09275 kWh of energy with cost of 0.01 € and amount of water equal to 0.2 Liter. Price for one portion was 0.007 €.

8.1.3 Comparison of methods

Manual method's dish looks more attractive because the top of a dish, which was cooked with automatic program, is a little burned (appendix 3). If we speak about dish's taste, it was good in both cases, but in automatic process method, fish was juicier because more sauce has penetrated the fish (picture 9). In addition, cooking loss was bigger in the second experiment with the use of automatic settings, as can be seen in figure 3.

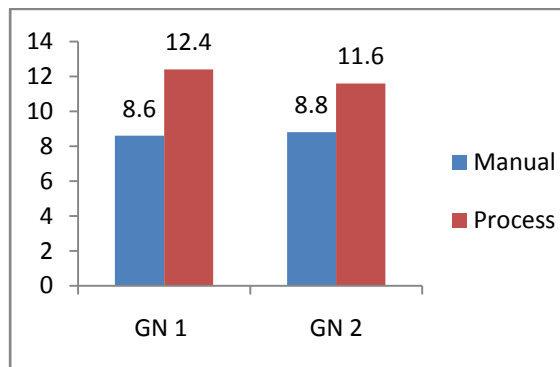


FIGURE 3. Day 1 - comparison of cooking loss (in %)

Results according to electricity consumption are presented in figure 4. In the pre-heating part of automatic process method we had a huge number of spent energy, as the time was 6 minutes. However, time for pre-heating in manual method was only 2 minutes.

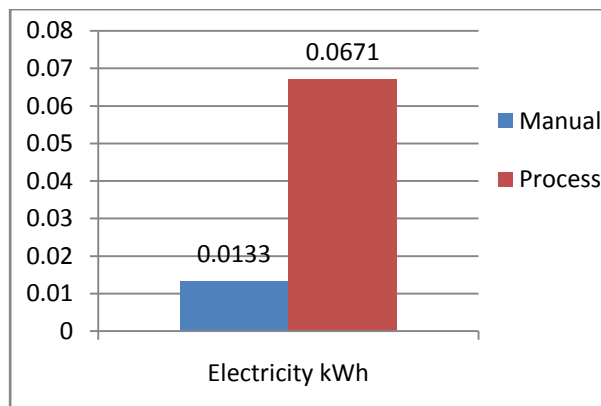


FIGURE 4. Day 1 - comparison of electricity consumption during pre-heating

All time of cooking without pre-heating accounted for 28 minutes in both methods. Let's take a look on electricity consumption in figure 5.

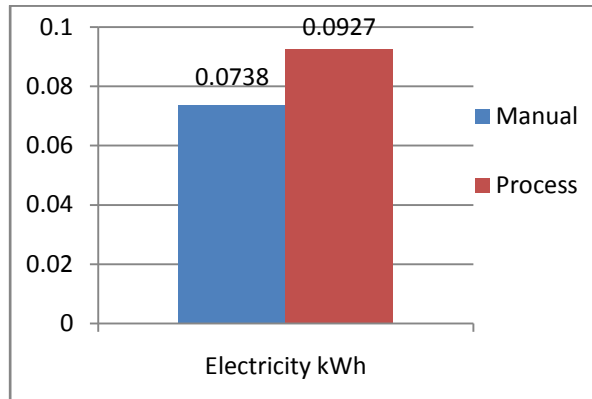


FIGURE 5. Day 1 - comparison of electricity consumption during cooking process

As a result, we can see that automatic process is not so efficient as manual (in this case). Furthermore, in automatic process method 5 liters of water were spent and in manual - only 1. If we compare money costs for all cooking procedure with pre-heating, we will reveal the following:

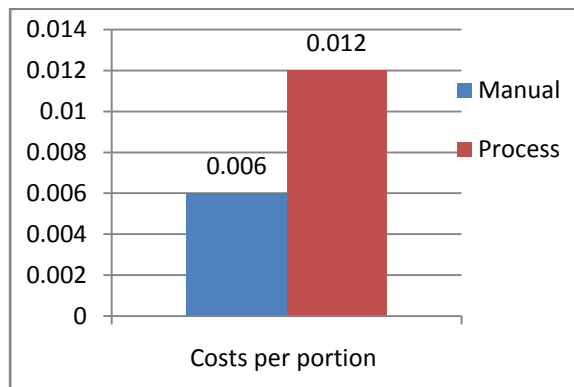


FIGURE 6. Day 1 - comparison of costs per portion (€)

Overall, we can see that it is proven that manual method in this case was better and two times more efficient in decreasing of natural resources' consumption.

8.2 Day Two

During the second day creamy soup with lake pike was prepared. It was cooked in two ways: firstly, with modern induction range, and then with electric range. Metos Company produced both of them. Before cooking, all ingredients for the soup were prepared. Potatoes and onion were cut into little cubes and put into the cooking pot, after that salt and vegetable bouillon was added. The soup was smashed and mixed, then, cheese, cream and other ingredients like dill, salt, paper and chives were added. At the end of cooking, lake pike, which was defrosted and cut before, was added, and soup was boiled.

8.2.1 Electric range

In this way I used electric range of the Metos Company. This range is very slow; it took a lot of time to warm it and then to cool, when there was a need to change the temperature. Starting mass was 4,177 kg and at the end it was 3,950 kg, cooking loss is available in the table 17. The temperature of water is presented in this table too.

TABLE 17. Day 2 - electric range settings

Temperature of water before start	Cooking time(minutes)	Cooking loss (%)	Inside temperature
18,6	75	5,4 (227g)	80 °C

The starting time was 10:59 am, and the maximum power setting six was used, then at 11:19 am the setting was changed to 3, and finally it was switched to 5 at 11:57 am, thus, soup was ready at 12:14 am. The overall time of cooking and after cooking inside temperature are available in table 17. The dish looked perfect and was tasty (picture 10). There were some difficulties with preparing of this fish, because soup did not boil and fish did not get ready for a long time, this is a reason why the temperature was increased at the end.



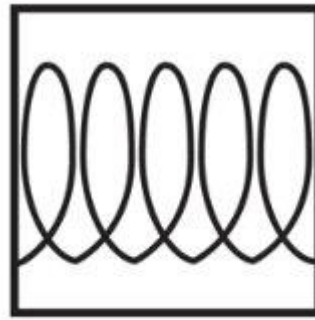
PICTURE 10. Creamy soup with lake pike - electric range

8.2.1.1 Electricity consumption

All process of cooking took 75 minutes. Total electricity consumption was 1.93 kWh with the cost of 0.14 €. This consumption was separated for 20 portions, so it is 0.0965 kWh and 0.007 € per each.

8.2.2 Induction range

For this test, I used induction range produced by the Metos Company. This equipment is fast both in heating and cooling. There are some rules before using it. You should use special pots, because induction range does not “see” some of them. You can find special mark (picture 11) (Rathey Kirby, 2012) on the bottom of the cooking pot, which shows that this equipment works with induction range.



Induction

PICTURE 11. Induction range mark

In the beginning, the heat was on the maximum level (12), at 12:24 am it was switched to 8, and remained the same until the end. Dish was ready at 12:58 am. During the process of cooking, once cooking pot was taken away from the induction range to smash and mix the soup, it happened at 12:47 am, you can see this in the Tempnet list(appendix 4), as the line went down at this moment. Water temperature before the start is available in table 18 below.

TABLE 18. Day 2 - induction range settings

Temperature of water before start	Cooking time(minutes)	Cooking loss (%)	Inside temperature
18,3	39	3,2(136g)	88 °C

In the table you can see that time of cooking was less than in previous method, the same situation was with cooking loss. Moreover it reveals that inside temperature was higher than in previous experiment. At the end the dish looked good, the taste was good too. You can see photo of the dish in the appendix 5.

8.2.2.1 Electricity consumption

As the cooking lasted for 39 minutes, total electricity consumption was 0.767 kWh. The cost equaled to 0.05 €. Total consumption was separated by 20 portions, so it is 0.03835 kWh with cost of 0.003 € per portion.

8.2.3 Comparison of methods

The soups tasted and looked absolutely similar. Induction range is surely fast, it is two times faster than usual electric range. We can assume this according to the time of cooking: 39 minutes with modern way against 75 minutes with old way. For this time, cooking loss was more in electric range than in induction one, and we can see it in figure 7.

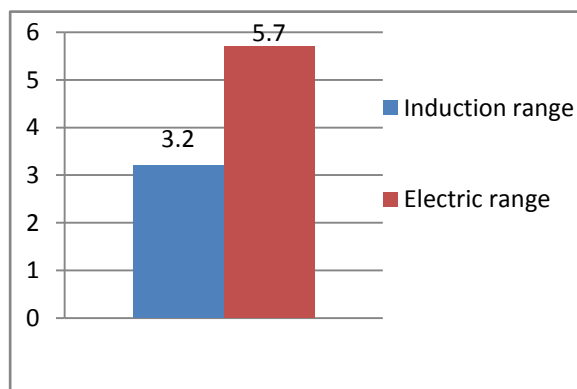


FIGURE 7. Day 2 - comparison of cooking loss (in %)

It is logical, that while comparing cooking loss we see that in electric range it was more. It happened because water goes away from the dish in process of cooking. Therefore, if we spend more time to cook it, we will have greater cooking loss. If we compare electricity consumption, we will see the following:

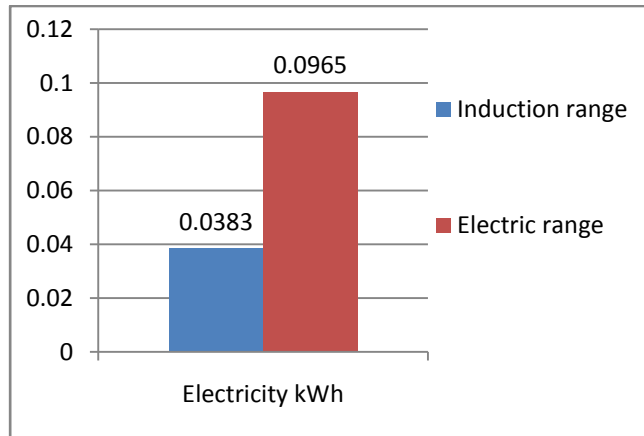


FIGURE 8. Day 2 - comparison of electricity consumption during process of cooking

The graph shows that electric range consumed more than two times more energy than the induction one. If we take a look at figure 9 where cost per portion are shown, we again reveal big difference between new way and old way of cooking. As a result, cooking with modern kitchen equipment is two times cheaper than with old one.

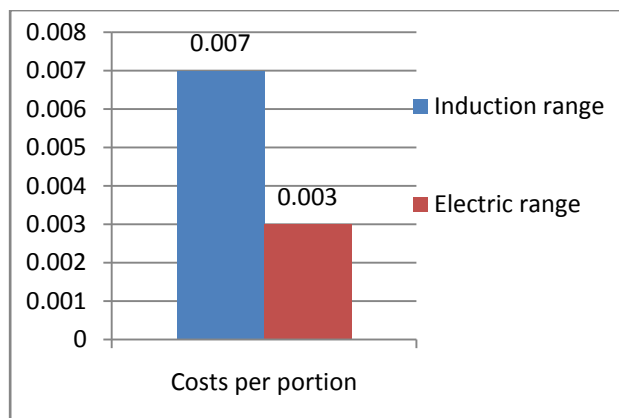


FIGURE 9. Day 2 - comparison of costs per portion(€)

8.3 Day Three and Day Eight

These days are combined together because the dish was similar, and the same receipt and method of cooking were used. 2 GN 1/1 65 containers were applied for both dishes. The chosen equipment is SCC, which is produced by the Metos Company. Preparations before cooking were not difficult. Meat (pork) was put into container and rubbed with salt, pepper and spices, such as thyme and rosemary (appendix 6). Meat was separated in two similar parts for each container, then, one of them was covered

with lid, and another one remained open. This dish was not separated in 20 portions; all 40 plates were cooked with the use of one method. For both dishes the following settings were set: overnight roasting, first color, 78 grades inside. The main idea of both experiments is to get to know cooking loss with lid and without it.

8.3.1 Day three

In the table 19, which is located below you can see the main settings that I used in this day, and also some result.

TABLE 19. Day 3 - settings

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)	Mass of liquid (kg)	Inside temperature
Process: Overnight roasting meat, first color, 78 °C inside temperature	Warm	816	GN1-32 (1334g) GN2-35 (1534g)	GN1- 1,421kg GN2- 0,459 kg	65 °C

Mass of containers was 0,964 kg - GN-1 and 0,936kg - GN-2. The first container was with lid. The equipment started cooking without pre-heating. Mass of the dish before cooking amounted for 4,194 kg in GN-1 and 4, 364 kg in GN-2. The time when dish started preparing is 17:53 pm and it finished at 7:29 am. Meat was cooked during the whole night. Overall cooking time and end inside temperature you can see in the table 19. The end mass of food was 2, 860 kg and 2, 830 kg , cooking loss and mass of liquid are available table 19. You can see the difference of liquid mass in container with lid (appendix 7.1) and without it (appendix 7.2) . Meat looked good in both containers. The one without lid was drier, and almost all liquid has evaporated (appendix 7.2). Meat with lid was very soft, because of this it was difficult to cut it and easy to ruin, furthermore it looked more white than meat without lid (appendix 7.1). Tastes of meat

were a little bit different, but both were good, one was soft and juicy, another one was dry and hard, it depends on your taste what kind of meat you like more.

8.3.1.1 Electricity and water consumption

The whole process of cooking took 14 hours 36 minutes, for this time total electricity consumption amounted to 7.562 kWh of energy with cost of 0.53 €, and water consumption was 2 liters with cost of 0.01 €. These results should be separated by 40 portions, and we receive the following: electricity consumption per portion was 0.1890 kWh, and cost of one portion was 0.013 €.

8.3.2 Day eight

The meat was put in GN containers: one with lid and another one without it, exactly like in Day Three experiment. Masses of both containers were the same - 1,204 kg. First GN-1 container was with lid. Process of cooking started without pre-heating.

TABLE 20. Day 8 - settings

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)	Mass of liquid (kg)	Inside temperature
Process: Overnight roosting meat, first color, 78 °C inside temperature	Warm	927	GN1-34 (1316g) GN2-36 (1464g)	GN1- 0,900kg GN2- 0,426kg	70 °C

Cooking began at 16:46 pm and process took whole night and finished at 08:13 am. Overall cooking time and end inside temperature are available in table 20. Start mass of meat was 3,846 kg in GN-1 and 4,014 in GN-2 and after cooking it turned into 2,530 kg in GN-1 and 2,550 in GN-2. The cooking loss and mass of liquid you can find in table 20 too.

Taste and structure of meat after cooking were exactly like in previous experiment (appendix 8). In the first container, meat was soft and juicy and in the second, which was without lid - dry and hard.

8.3.2.1 Electricity and water consumption

Process of cooking took 15 hours, for this time total electricity consumption amounted to 8.079 kWh of energy with cost of 0.57 €, and total water consumption was 1 liter. After separation of these results by 40 portions, we received 0.2019 kWh of energy. Cost of one portion equaled to 0.014 €.

8.3.3 Comparison of days

The dishes were similar and results were close to each other. The time of cooking in the second case was longer for approximately two hours, this is not program's mistake, it happened because the cooking started earlier than another, and it was not a totally automatic process, you must finish it by yourself, so the overall time is different due to these reasons.

Water consumption was also different: in the first case, it was 2 liters and in the second one it made up to 1 liter. There is no explanation why this happened, as the program of cooking was absolutely identical, as well as the equipment. Moreover, the second case took more time, but spent less water. Electricity consumption was approximately the same as seen in figure 10.

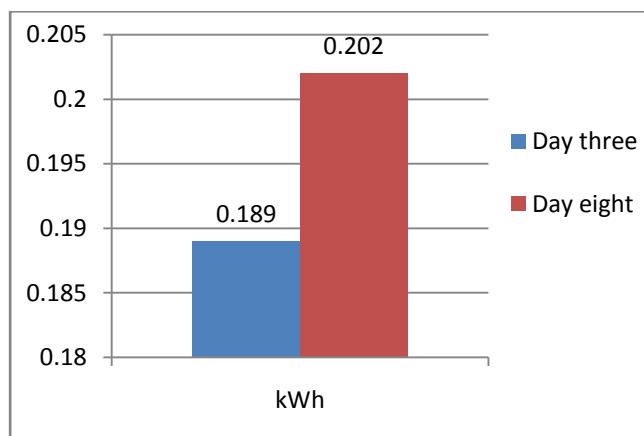


FIGURE 10. Day 3&8 - comparison of electricity consumption per portion

The reason of difference in consumption occurred due to earlier start and later finish of cooking process. This also influenced the cost of portion. Nevertheless, these numbers are still quite similar as seen in figure 11.

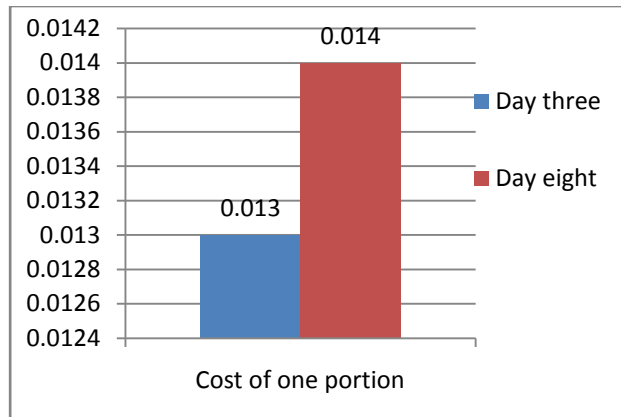


FIGURE 11. Day 3&8 - comparison of costs per portion(€)

The cooking loss was the main point of these experiments. In both cases, cooking losses were quite similar and predictable as well: more in the container without lid and less in the one with it. Nonetheless, the most interesting fact is the difference between meats masses while cooking with lid and without it, it accounted for some two or three percent. It was not predictable in this case. All in all, it is not so important whether you cook with lid or without it; cooking loss will be approximately the same (figure 12).

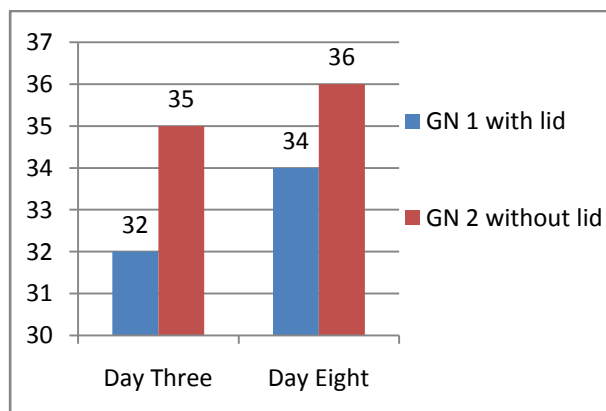


FIGURE 12. Day 3&8 - comparison of cooking loss (in %)

The masses of liquid were different: while cooking with lid there was a huge amount of liquid, without it the amount was two times less, however, it was predictable. In the first case, we had liquid's mass equal to 1,421 kg with lid and 459 gram without lid. In the second case it accounted for 900 grams in container with lid and 426 grams in container without lid. We can see the difference between the first case and the second one. In the first one there was three times more liquid mass in container with lid and in the second one - only two times more. There were two reasons for this: first of all, the time of cooking in the second case was two hours longer, secondly, different lids were used during the cooking, in the second case the lid was not closed so hermetically as it was during the first experiment.

8.4 Day four

The dish of the fourth day was "Oven baked salmon with tomato pesto sauce". SCC machine produced by Metos was used for this experiment. This dish was cooked in two ways, firstly, with manual settings and then with automatic process setting. Induction range of Metos Company was also used for preparation of the sauce. There are some steps, which should be done before cooking this dish. First, defrost the fish and pill it. Then, cut into pieces (approximately 10 for each container), oil ceramic container with special oil spray and put fish there. The sauce was prepared with basil dried, blue cheese, cream, fish bouillon, water and pesto sauce. After that, all vegetables and spices that was prepared before should be put into the dish, sundried tomatoes and usual tomatoes' slices should be located on the top, then, it everything ought to be covered with the sauce that was cooked before and put into VCC. The container used was GN 1/65 from ceramic, two for each process.

8.4.1 Sauce settings

Sauce was prepared with induction range; the whole amount for 40 portions was cooked in one cooking pot. The cooking started at 9:59 am and finished at 10:13 am, all time spent accounts for 14 minutes. The starting mass was 2.466 kg, but sauce was thin and to make it thicker maize mixed with 100 milliliters of water was added, so the starting mass became 2, 566 kg, after cooking it turned into 2,482 kg. According to these results cooking loss was 3,2%.

8.4.1.1 Electricity consumption

The overall cooking time was 14 minutes. Thus, total electricity consumption amounted to 0.358 kWh with cost of 0.03 €. If we separate results for 40 portions, we receive 0.00895 kWh per portion with price equal to 0.001 €.

8.4.2 Manual settings

The dish was prepared in SCC produced by the Metos Company. All settings that we used and some results can be found below in table 21.

TABLE 21. Day 4 - manual settings

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)	Inside temperature
Manual: Temperature 160 °C, inside temperature 65 °C, humidity 20%	Warm	21	GN1-6,3 (178g) GN2-5,6 (163g)	69 °C

Mass of containers was GN-1 - 4,206 kg, GN-2 - 4,222kg. Process of cooking started without pre-heating. The starting time point is 13:02 pm and the dish was prepared at 13:23 pm. Overall cooking time you can find in the table 21. Starting mass of food was 2,812 kg in GN-1 and 2,928 kg in GN-2, ending mass was 2,634 kg in the first container and 2,762 in the second one. Dish looked attractive, however dried tomatoes slightly burned on the top (picture 12). The taste of the fish was juicy and nice.



PICTURE 12. Oven baked salmon with tomato pesto sauce

8.4.2.1 Electricity consumption

Overall time of cooking was 21 minutes, for this time total electricity consumption was 2.351 kWh of energy with cost of 0.16 €. Water consumption was 5 liters. The result should be separated in 20 portions, as a result, we receive 0.11755 kWh per portion and 0.009 € cost of portion.

8.4.3 Process settings

The dish was prepared in SCC of Metos Company. The settings that were used and some results are available in the table 22 bellow.

TABLE 22. Day 4 - process settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)	Inside temperature
Process:	Warm	7	14	GN1-8,5	63 °C

Fried fish, 60°C inside temperature				(248g) GN2-10 (286g)	
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Mass of containers: GN-1 - 4,218 kg and GN-2 - 4,612 kg. The cooking process started at 12:53 pm and finished at 13:07, overall time and time of pre-heating you can find in the table 22. Start mass of food was 2,910kg in GN-1 and 2,644 kg in GN-2, at the end the mass was 2,662 kg in GN-1 and 2,378 kg in GN-2. As a result, the dish looked better than in the previous method (picture 13). Furthermore, the taste of fish was juicy and good.



PICTURE 13. Oven baked salmon with tomato pesto sauce - process settings

8.4.3.1 Electricity and water consumption

Taking into account that time of the pre-heating was 7 minutes, total electricity consumption was 1,544kWh with total cost of 0,11 €. No water was spent for pre-heating. Total consumption was separated by twenty portions, thus the expenditure for 1 portion equaled to 0.0772kWh with the price of 0.005 €.

Overall cooking time was 14 minutes, and total electricity consumption amounted for 1.494 kWh with cost of 0.10 €. 3 liters of water were spent during the process, its cost

was 0.01 €. If we separate this number for twenty portions, the result will be 0.0747 kWh per portion with the cost of 0.006 €.

8.4.4 Comparison of methods

Both dishes looked good. However, the time spent for cooking differed. In process method it took only 14 minutes to prepare the dish, and it was 30 percent less than in the manual method, where overall time equaled to 21 minutes, but if we count the time for pre-heating, then the total time will be the same in both methods. Comparing cooking loss, we can see in figure 13 that it was greater with the process program.

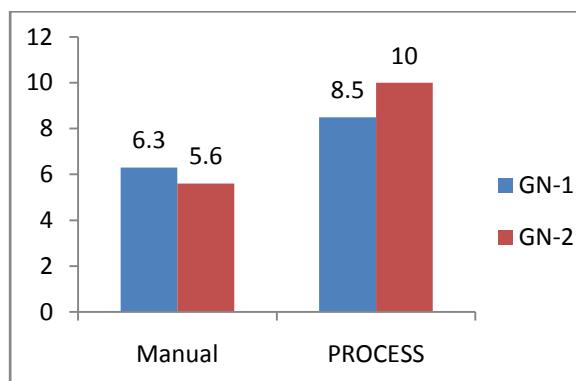


FIGURE 13. Day 4 - comparison of cooking loss (in %)

Water consumption was higher in the manual method and accounted for 5 liters, while process program took only 3 liters. As pre-heating was necessary only for process method and it took 0.0772 kWh per portion, this number plus cooking consumption per portion resulted into total consumption of 0,1519 kWh per portion (figure 14). However, manual method needed less energy: 0.1175 kWh per portion and 0.009 € cost of portion as seen in figure 14 and figure 15.

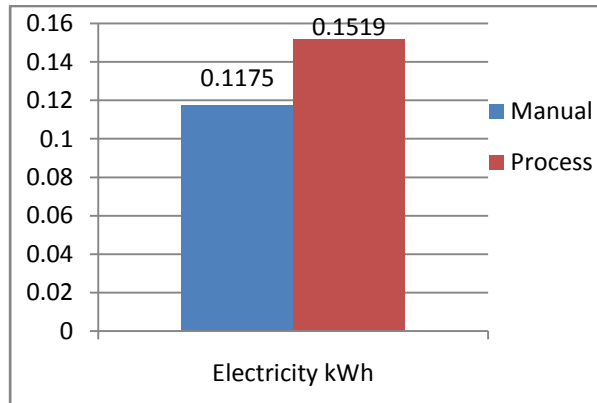


FIGURE 14. Day 4 - comparison of electricity consumption per portion

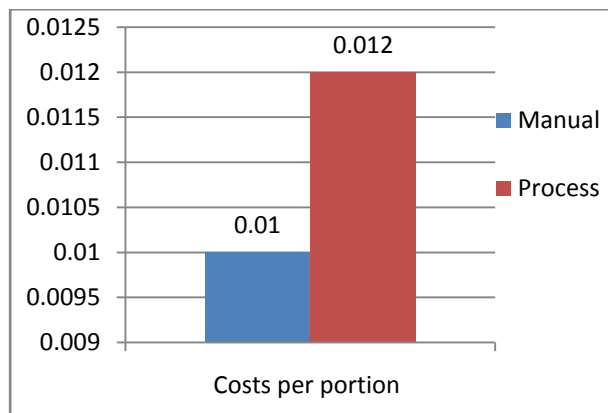


FIGURE 15. Day 4 - comparison of costs per portion(€)

In this case manual method is better. However, difference is not so huge. If we cook this dish with process method but without pre-heating, it will be two times more effective than manual method.

8.5 Day Five

Day 5 was devoted to “Spinach Soup”. For this dish two cooking methods were used: new one (using VCC of the Metos Company) and old (with using electric range, which is also produced by the Metos Company). This dish was easy to cook. Firstly, you need to defrost spinach. During the next step you should put spinach in a cooking pot (first method) or in VCC (second method) and fry it with rapeseed oil, then you add water, cream, vegetable bouillon, salt and white pepper. In the end, you should put cornstarch to make sauce thicker.

8.5.1 Electric range

As it was already mentioned, electric range was used for this experiment. The process of cooking started at 10 am with number 6 in tumbler that changes power of range heat, because it spent a lot of time to pre-heat it. Tumbler was changed to 4 at 10:19 am, then to 3 at 10:24 am and the last change was to 4 at 10:29 am.

TABLE 23. Day 5 - electric range settings

Cooking time(minutes)	Cooking loss (%)	Inside temperature
35	2(150g)	74°C

Process of cooking finished at 10:35 pm, overall time of cooking is available in table 23. The total mass of dish when process started was 7,610 kg, at the end it turned into 7,460 kg, the cooking loss result and inside temperature after cooking you can see in the table. As a result, the soup was good and tasty. You can find the picture in appendix 9.

8.5.1.1 Electricity consumption

Total time of cooking accounted for 35 minutes. According to this time electricity consumption was 2.395 kWh with cost of 0.17 €. The result was separated into 20 portions, so we receive 0.11975 kWh per portion with price equal to 0.008 €.

8.5.2 VCC settings

The equipment was cold before the process of cooking started. Pre-heating began at 9:03 am and finished at 9:05 am. Process of cooking started at 9:05 am and ended at 9:28 am. All information about pre-heating and total cooking time can be found in table 24. Start mass of food was 7,348 kg, at the end it amounted for 6,800 kg, total cooking loss and after cooking inside temperature can be seen in the table.

TABLE 24. Day 5 - VCC settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)	Inside temperature
Process: Temperature 160 °C, 30 minutes	Cold	2	23	7,4 (548g)	78 °C

During the cooking process there was a problem with frying, because spinach started to burn, however, button that changes process did not work. Therefore, cooking loss was huge, as the spinach burned a little bit at the bottom of VCC. The soup was not perfect, you can see the picture in appendix 10.

8.5.2.1 Electricity consumption

For the pre-heating of 2 minutes electricity consumption was 0.178 kWh with cost of 0.01 €. It is 0.0089 kWh of electricity per portion with the price equal to 0.001 €. Process of pre-heating did not require any water consumption.

Total cooking time was 23 minutes, which required 1.057 kWh of electricity with cost of 0.07 €, and 4 liters of water with cost of 0.02 €. As a result, total cost of the dish was 0.09 €. The whole consumption was separated into 20 portions, thus, we receive 0.052849kWh with total cost for one portion of 0.004 €.

8.5.3 Comparing results

The dish, which was prepared with the range, looked better and was tastier, however the reason is not the equipment. It happened because of lack of experience of working with the VCC. Reason number two is the fact that many people washed the bottom of the machine with the metal sponge and, thus, ruined the anti-burning protection layer at the bottom of VCC, because it was not the first time when dish started to burn in this equipment. Furthermore, due to this problem the cooking loss was higher as can be seen in figure 16.

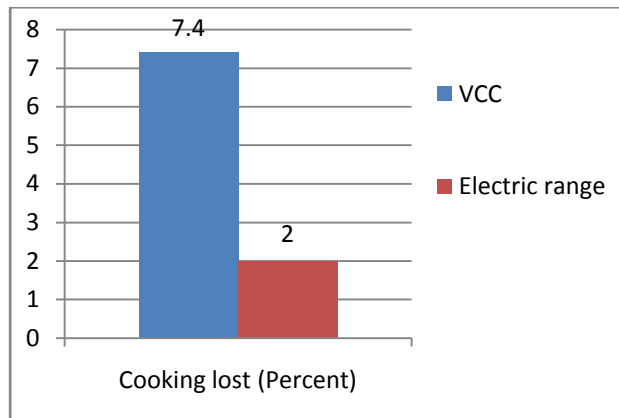


FIGURE 16. Day 5 - comparison of cooking loss (in%)

The VCC cooked the dish faster; the whole process took 25 minutes with pre-heating. The overall time in electric range was 35 minutes. Total electricity consumption in electric range is also higher than in VCC.

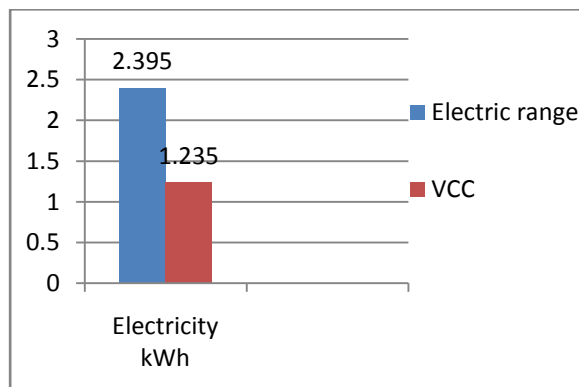


FIGURE 17. Day 5 - comparison of total electricity consumption

As you can see the VCC saves a lot of electricity. Total cost of one portion in figure 18 shows the same result.

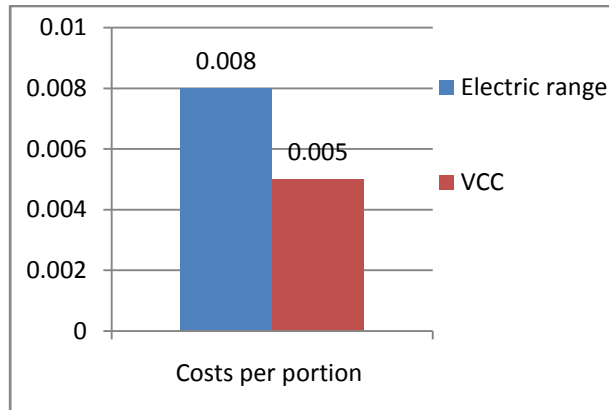


FIGURE 18. Day 5 - comparison of costs per portion(€)

8.6 Day Six

The dish of the sixth day was Lasagna. The SCC of Metos company was used to prepare it. This dish was cooked in two quite similar processes, it was casserole dish in both case, but settings of color were different. In the first case it was light color and in the second- medium color. This dish also requires sauce, which was prepared with the use of Metos' kettle. Moreover, broiler pieces (chicken) for this dish were prepared in the SCC (Metos) with Process settings. When you start to cook lasagna, you should, first of all, prepare little broiler pieces. In the second step, you cook the sauce using peeled onion, margarine, pesto sauce, cheese, vegetable wok, salt and pepper. After that, you should build lays of lasagna and put broiler pieces and sauce with vegetables on each level. At the end, you strew grated cheese on the top and put the dish in a combi oven.

8.6.1 Broiler pieces for lasagna – process settings

Broiler pieces for Lasagna were cooked in SCC of theMetosCompany. Two aluminum GN 1/1- 40 containers were used for this experiment; mass of both was 800 grams. In the table 25 below you can find the basicinformation about this experiment.

TABLE 25. Day 6 - Broiler pieces for lasagna - process settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)

Process:	Warm	2	13	GN1-13,9
Chicken pieces, 7 minutes				(416g) GN2-13 (414g)

Pre-heating started at 13:38 pm and finished at 13:40 pm, total time of pre-heating is available in the table 25. The cooking process itself began at 13:41 pm and ended at 13:54 pm, total time of cooking you can see in the table. However, it should be 7 minutes, but there was some misunderstanding with the equipment, because when the chicken pieces were put into SCC, a level where they had to be located was not chosen, thus process continued without this and took a little bit more time. The start mass of food was the same in both containers and equaled to 1,645 kg, end mass of food was 1,415 kg in GN-1 container and 1,430 kg in GN-2, you can see the cooking loss in the table. These numbers show us that cooking loss differs depending on which level in SCC the dish is situated. Nevertheless, despite of this little problem with process settings, broiler pieces were very good.

8.6.1.1 Electricity consumption

Pre-heating lasted for 2 minutes, for this time total electricity consumption was 0.615 kWh with cost of 0.04 €. Pre-heating did not require any water expenditure. The whole consumption was separated into forty portions, result is 0.015375 kWh with the price of 0.001 €.

As the cooking process took 13 minutes electricity consumption was 1.215 kWh with cost of 0.09 €, and water consumption was 12 liters with cost of 0.05 €, total cost equaled to 0.13 €. The result was separated into forty portions, thus, we reveal that the price of one portion is 0.003 €.

8.6.2 Sauce - Kettle settings

The sauce for Lasagna was prepared in the Kettle of the Metos Company. The settings that were used and some results can be found in table 26.

TABLE 26. Day 6 - Sauce - Kettle settings

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)
Manual: 110° C and 40r/min.	cold	37(833g)	9,56

The process began at 11:48 am and settings were the following: 110° degrees Celsius and 40r/min(rotate in minutes), the temperature was changed to 100° only during the last minutes of cooking. The process finished at 12:25 pm, you can see total time of cooking in table 26. Start mass of food was 8,708 kg, end mass turned into 7,875 kg, the cooking loss is presented in the table too. Sauce was good and tasty. During the process, some salt and pepper were added.

8.6.2.1 Electricity and water consumption

Total time spent for cooking of the sauce was 37 minutes, electricity consumption for this time amounted to 3.731 kWh with cost of 0.26 €. Water consumption was 18 liter, but we should deduct water, which was necessary for sauce, from the result. After this we receive 16,1 liters of water that equipment spent for preparing this dish. Total price of the dish accounted for 0.33 €. If we separate this result into forty portions, we would get 0.093275 kWh of electricity consumed for each portion, and the price will become 0.008 €.

8.6.3 Chicken Casserole – process settings (1)

The first way of cooking required the use of SCC (Metos) with settings that you can find in table 27. One GN-65 container was applied during this experiment.

TABLE 27. Day 6 - Chicken Casserole - process settings (1)

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)
Process: Casserole dish, light color	Warm	3	46(111)	GN-1,7

Pre-heating of the equipment began at 14:46 pm and finished at 14:49 pm, so the overall time you can find in the table 27. Process of cooking started at 14:50 pm and ended at 15:36 pm, the total time spent is available in the table. Start mass of the dish was 6,345 kg; end mass amounted to 6,234 kg, cooking loss is available in the table too. The dish looked good, however, the color on the top was a little bit light, and furthermore, there was a lot of oil (appendix 11). Taste of the dish was very good.

8.6.3.1 Electricity and water consumption

Pre-heating took 3 minutes of time, for this time electricity consumption was 0.856 kWh with cost of 0.06 €. The result was separated into twenty portions, and we receive 0.0428 kWh of electricity consumed for portion with cost of 0.003 €. No water was spent for the pre-heating.

Total time of cooking process was 46 minutes. For this period of time electricity consumption equaled to 2.339 kWh with price of 0.16 €, total water consumption was 25 liters with cost of 0.10 €, total cost accounted to 0.26 €. The results were separated by twenty portions, therefore, electricity consumption is 0.11695 kWh, water consumption – 1.2, total price of one portion - 0.013 €.

8.6.4 Chicken Casserole – process settings (2)

During the second way of cooking SCC (Metos) was also used, settings and some results can be observed in table 28. For this dish, only one GN-65 container was used.

TABLE 28. Day 6 - Chicken Casserole - process settings (2)

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)	Cooking loss (%)
Process: Casserole dish, medium color	Warm	2	39	GN-2,9(155g)

Pre-heating started at 15:21 pm and finished at 15:23 pm. Process started at 15:25 pm and finished at 16:04 pm. Total time of pre-heating and cooking is presented in the table. Start mass was 5,280 kg, end mass equaled to 5,125 kg, cooking loss you can see in the table 28. The dish looked more attractive than in the first experiment. You can see the difference between both in the next picture 14, left refers to the first experiment and right to the second. Top of the dish looked good. Taste was good too.

**PICTURE 14. Day 6 – Lasagna**

8.6.4.1 Electricity and water consumption

Pre-heating lasted for 2 minutes, for this time electricity consumption was 0.63 kWh with cost of 0.04 €, water consumption amounted to 1 liter, total cost equaled to 0.05 €. The result was separated by 20, thus, we receive 0.0315 kWh with cost of 0.002 € per portion.

The whole process accounted for 39 minutes, for this time electricity consumption was 4.003 kWh with cost of 0.28 €, and water consumption was 38 liter with cost of 0.15 €, total cost equaled to 0.43 €. Total consumption was separated by twenty, result: 0.20015 kWh of electricity consumed and 1,91 liters of water with cost of 0.021 € for one portion.

8.6.5 Comparison of methods

Both dishes were tasty and looked good, but the second dish, which was made with process “Casserole” and “medium color” looked more attractive. The tastes of both dishes were very good.

The total time spent for cooking was less in the second way (39 minutes), in the first way it was 46 minutes. The cooking loss was different as well. The figure 19 below shows cooking loss in all processes, including both ways that were used, chicken pieces program and sauce in kettle.

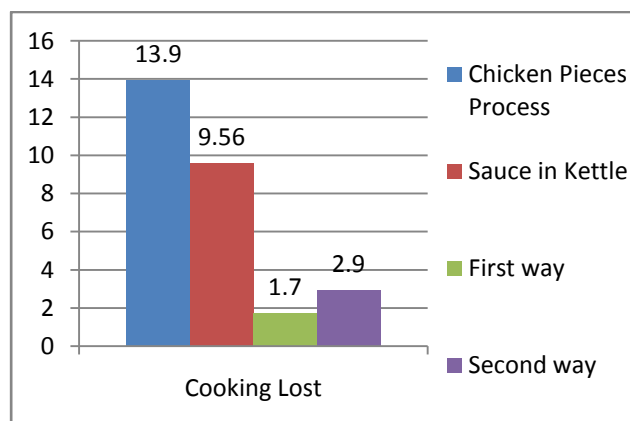


FIGURE 19. Day 6 - comparison of cooking loss (in %)

Comparing pre-heating we can see, that in the first way more electricity was spent, thus the total price was higher. Furthermore, in the second way we spent 1 liter of water, but this factor did not affect the end results so much. Pre-heating in the second way and during the preparation of chicken pieces took the same time (2 minutes), in the first way it equaled to 3 minutes. This can be seen in figure 20.

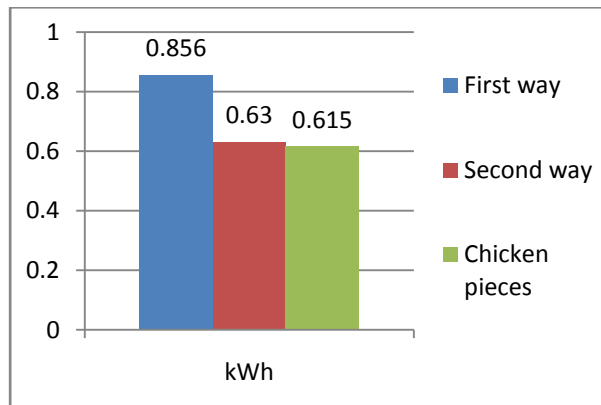


FIGURE 20. Day 6 - comparison of electricity consumption for pre-heating process

Total water consumption was also different. The figure 21 below provides all the information about water consumption during this experiment.

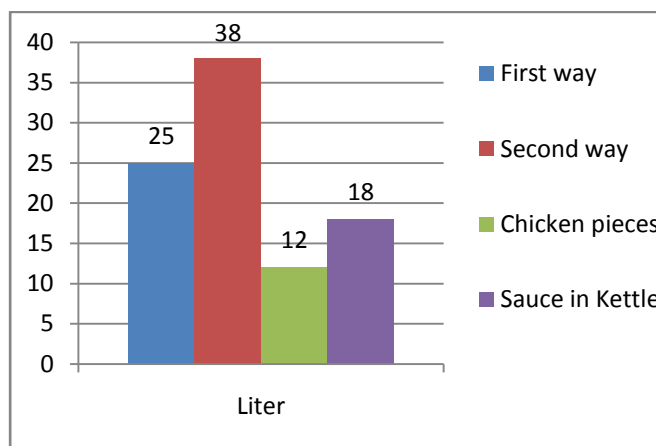


FIGURE 21. Day 6 - comparison of total water consumption

As you can see total water consumption in the second way is greater, the same situation is with electricity consumption. To calculate electricity consumption per portion we should sum up results of each way of cooking with consumption per portion during

sauce and chicken pieces preparation, moreover, we should add results of each pre-heating process.

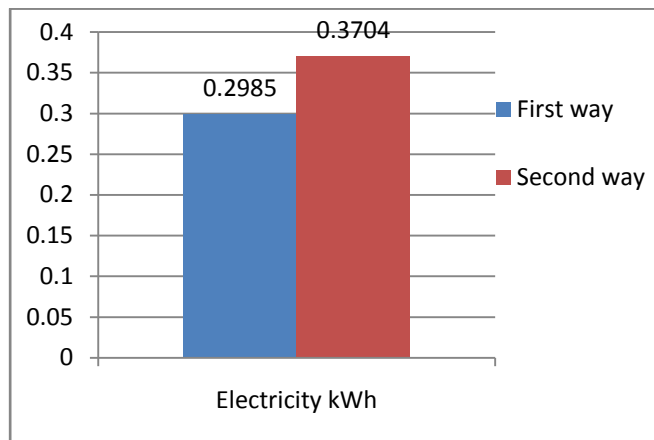


FIGURE 22. Day 6 - comparison of electricity consumption per portion

You can see that the second way required more water and electricity than the first one. You can also notice the difference between cost per one portion. To show this more precisely, all prices per portion for all cooking process, with pre-heating, sauce, etc. were calculated.

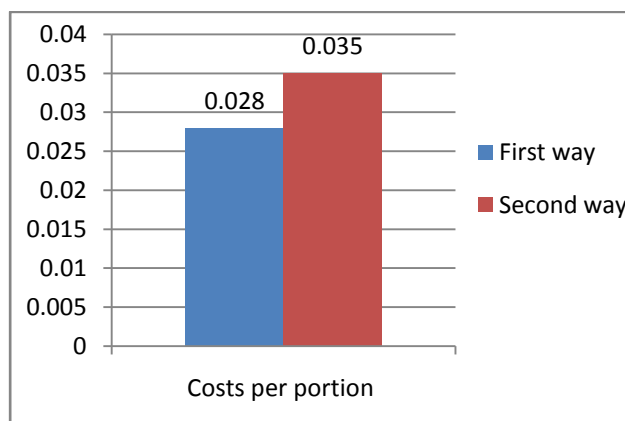


FIGURE 23. Day 6 - comparison of total cost per portion(€)

8.7 Day seven

During the seventh day Chicken gratin in wine sauce was prepared. This dish was cooked in two ways. Firstly, with manual settings: temperature 125°C, time 60 minutes, humidity 50%. Then, with process settings: “Chicken boil” and “90 °C inside temperature”. For both dishes SCC (Metos) was applied. For sauce preparation VCC

(Metos) with process “Sauce” was used. This dish was cooked in two steps. In the beginning marinade for chicken was prepared, this step was very easy, you just should take out the chicken and put salt, pepper and paprika powder on it, after that the whole chicken should be separated into two similar parts and put in SCC in different settings. The second part is sauce preparation. Sauce contains a lot of ingredients: firstly, you should fry onions, bacon cubes and mushrooms with canola oil in VCC, then you put other ingredients such as crushed garlic, tomato pure, red wine, water, bouillon and red wine vinegar. At the end you put maize to make sauce thick. When sauce is ready, it should be combined with prepared chicken.

8.7.1 Sauce – VCC settings

Sauce was prepared in VCC, all settings and results are available in table 29.

TABLE 29. Day 7 - Sauce - VCC settings

Settings	Equipment before cook	Pre-heating time (min)	Cooking time (min)	Cooking loss (%)
Process: Sauce, intense 3, medium	Cold	2	43	28(1,761kg)

Pre-heating started at 12:00 pm and finished at 12:02 pm, total time of pre-heating can be found in the table. The cooking process started at 12:03 pm and finished at 12:46 pm, overall cooking time is presented. Start mass of food was 6,105 kg, end mass became 4,344 kg; the cooking loss is in the table too.

The sauce results were satisfactory. However, it was very sour, the reason of this is a mistake with amount of red wine vinegar. To solve this problem more salt, pepper and sugar were added. That did not help so much, therefore, we added more bouillon. This made sauce better but it was still sour. At the end we added honey, it made sauce good, but not perfect.

8.7.1.1 Electricity and water consumption

Pre-heating lasted for 2 minutes, for this time total electricity consumption was 0.205 kWh with cost of 0.01 €. Water was not spent during this step. When 40 portions were separated, as the result, we received 0.00512 kWh necessary for one portion; the cost was 0 because it is very little amount of electricity.

The whole process took 43 minutes, for this time total electricity consumption was 1.691 kWh with cost of 0.12 €. The equipment did not require water for cooking sauce. The result separated by 40 portions is 0.042275 kWh with cost of 0.003 €.

8.7.2 Manual settings

Chicken was prepared in SCC (Metos) with settings that you can find in table 30 below. One ceramic GN-65 container was used; mass of this container is 4,608 kg.

TABLE 30. Day 7 - manual settings

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)
Manual: Sauce, intense 3, medium	warm	62	9,1(276g)

Cooking started at 10:46 am and finished at 11:48 am, total time is available in the table. Its start mass was 3,008 kg, end mass amounted to 2,732 kg. The chicken was very good, juicy and looked attractive.

8.7.2.1 Electricity and water consumption

For 62 minutes of cooking total electricity consumption accounted for 2.434 kWh with cost of 0.17 €, total water consumption was 21 liters with cost of 0.08 €, total price was equal to 0.25 €. The result was separated by 20 portions, thus, electricity

consumed to prepare one portion is 0.1217 kWh, cost is 0.01 €, water necessary - 1 liter, therefore, cost of one portion is 0.013 €.

8.7.3 Process settings

Chicken was prepared with process settings that you can find in the table 31 bellow.

TABLE 31. Day 7 - process settings

Settings	Equipment before cook	Pre-heating time (minutes)	Cooking time(minutes)
Process: Chicken boil, inside temperature 90 °C	Warm	2	33

The equipment was, firstly, pre-heated, the pre-heating started at 10:45 am and finished at 10:47 am, total time you can see in the table. The preparation of the dish began at 10:47 am and finished at 11:20 am, total time of cooking is presented in the table too.

Moreover, there was some problem with this experiment, as chicken was not prepared and was raw, thus the second part of cooking was continued with other manual settings that you can find in the table 32 bellow.

TABLE 32. Day 6 - manual settings (2)

Settings	Equipment before cook	Cooking time(minutes)	Cooking loss (%)
Manual: Temperature 160 °C, 30 minutes	Hot	30	7,7(232g)

The second part of cooking started without pre-heating. Cooking was immediately after the first part, when we realized that chicken is not being prepared. Cooking started at 11:20 am, and finished at 11:50 am, the total time cooking process can be seen in the table. Speaking about cooking loss, we did not know mass of food between the first and the second part of cooking, so we just took the start mass of the first part and end mass of the second process, results are available in the table. Moreover, overall cooking time should be combined. Therefore, total time of pre-heating was 2 minutes; total time of cooking was 63 minutes. Start mass of food was 2,976 kg, end mass was equal to 2,744 kg, cooking loss was 7,7 %.

The chicken was bad after the first part of cooking was conducted, because it was not prepared with process settings. When the settings were changed, results became better and chicken was juicy and tasty. You can see in the picture 15 the difference between them, left is the first part of the experiment and right is the second one. In this picture you can see that left result looks darker and more sauce was gone that in the right one.



PICTURE 15. Chicken gratin in wine sauce

8.7.3.1 Electricity and water consumption

As the process of pre-heating lasted for 2 minutes, electricity consumption was 0.269 kWh with cost of 0.02 €. If we separate the results by twenty portions, we receive 0.01345 kWh with cost of 0.001 €. Electricity consumption for cooking process is calculated by summing up the first and the second part together. Total electricity consumption for cooking was 4,577 kWh with cost of 0,32 €, total water consumption was 45 liters with cost of 0,18 €, total cost was 0,49 €. As a result, it is 0, 2279 kWh, 2,2 liters of water and 0,025 € per portion.

8.7.4 Comparison of methods

In this experiment process method did not work well, and due to this chicken pieces were not prepared, thus, the program was changed to another. There was also a problem with sauce, it was sour, it happened because of mistake in the recipe, where the wrong amount of red wine vinegar was stated. In the sauce preparing cooking loss was great with the use of process method, but if we compare two ways process and manual, in general, we can see that in manual cooking loss was more than in process, however, time was the same as seen in figure 24.

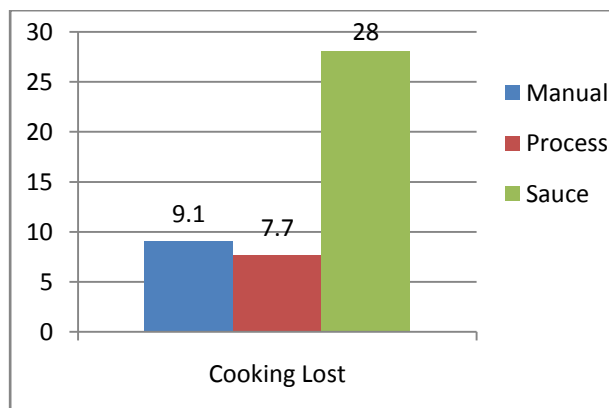


FIGURE 24. Day 7 - comparison of cooking loss (in %)

As pre-heating was necessary only in process method, we can just add it to the total consumption of the Second way. There was also a pre-heating process during preparation of sauce, if we compare it with Manual in SCC, we can see the difference between pre-heating for VCC and SCC.

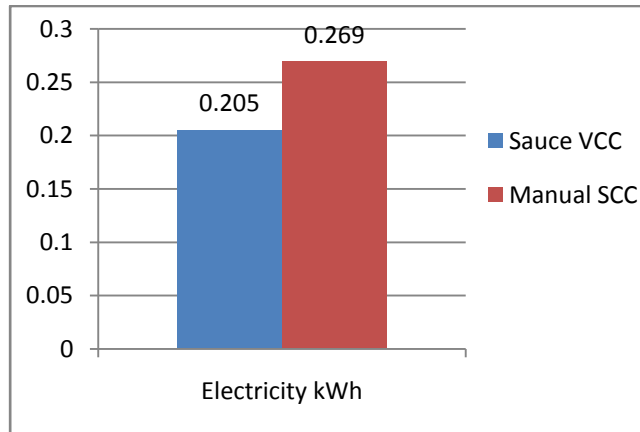


FIGURE 25. Day 7 - comparison of total consumption of electricity for pre-heating

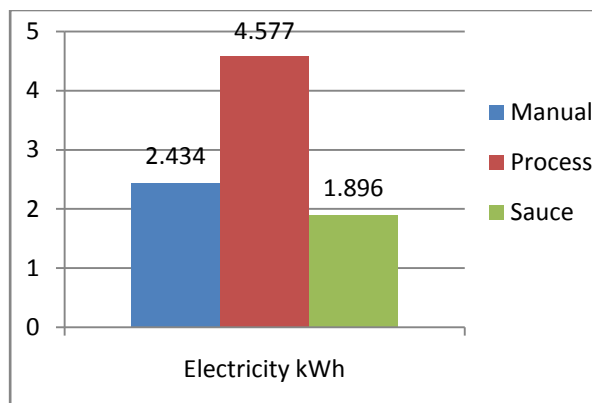


FIGURE 26. Day 7 - comparison of total electricity consumption

Total electricity consumption was very high in Process setting due to necessity to repeat the procedure of cooking. Water consumption looks similar to electricity consumption.

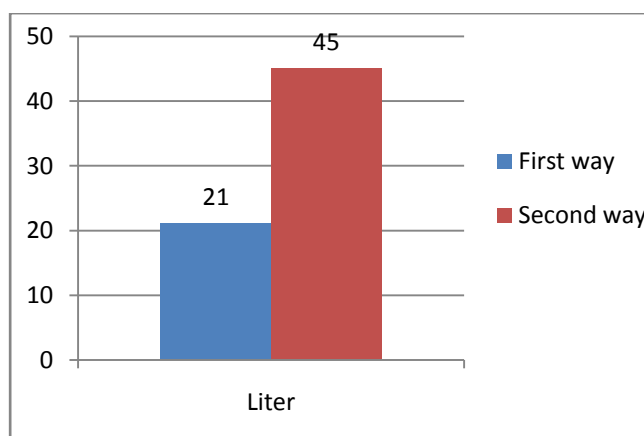


FIGURE 27. Day 7 - comparison of total water consumption

To find out total consumption of electricity per one portion, we should sum up all pre-heating processes and sauce processes results for both methods.

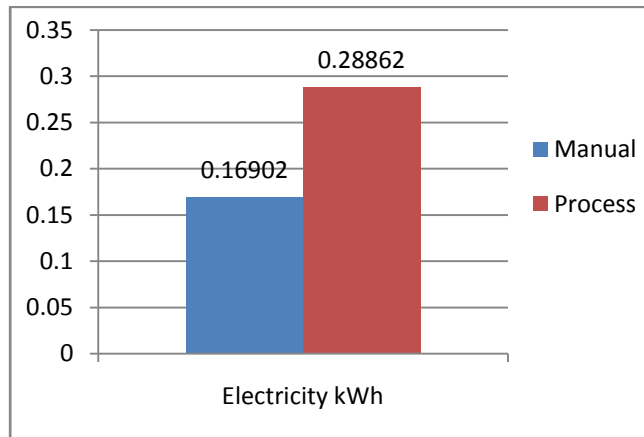


FIGURE 28. Day 7 - comparison of total electricity consumption per portion

To calculate the price of one portion we should sum up costs of all pre heating and sauce processes for both methods.

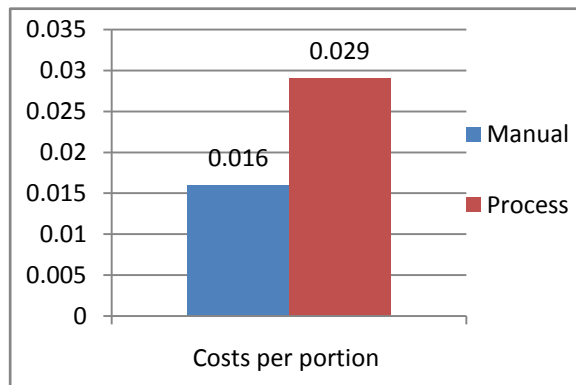


FIGURE 29. Day 7 - comparison of total cost per portion (€)

9 RESULTS

When all results are found, we can reveal the main point of the following research. In the beginning, we compare results by pairs. We start with the first pair “Salmon in Russian style” and “Oven baked salmon with tomato pesto sauce” which was cooked using Process and Manual options of the equipment.

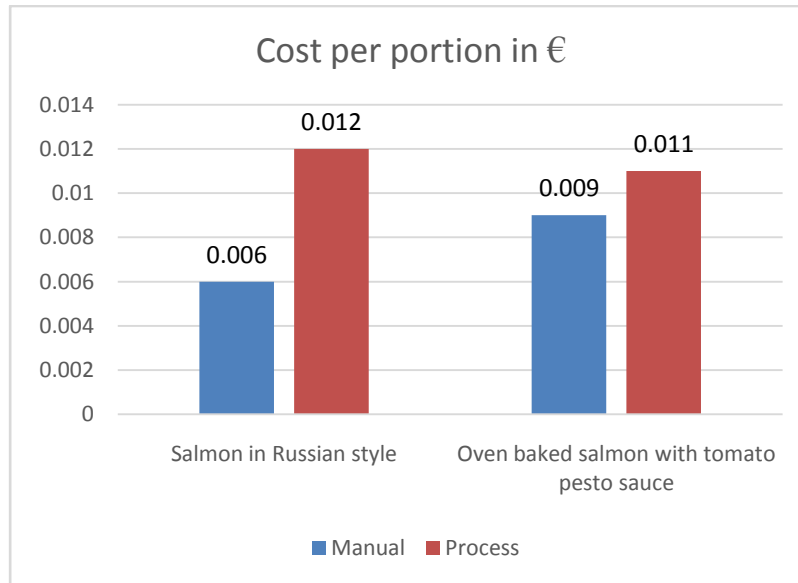


FIGURE 30. The first pair - cost per portion

As we can see, Process is more modern technology, but this example shows us that it is not so effective. It spends more water and electricity. Furthermore, cost per portion is higher in Process method than in Manual. Therefore, in this case it is better to use Manual settings.

The second pair was “Creamy soup with lake pike” and “Spinach soup with boiling organic eggs”. This comparison allows to understand the main point of the experiment - which equipment is more efficient: modern or usual cooking machinery. So take a look at figure 31.

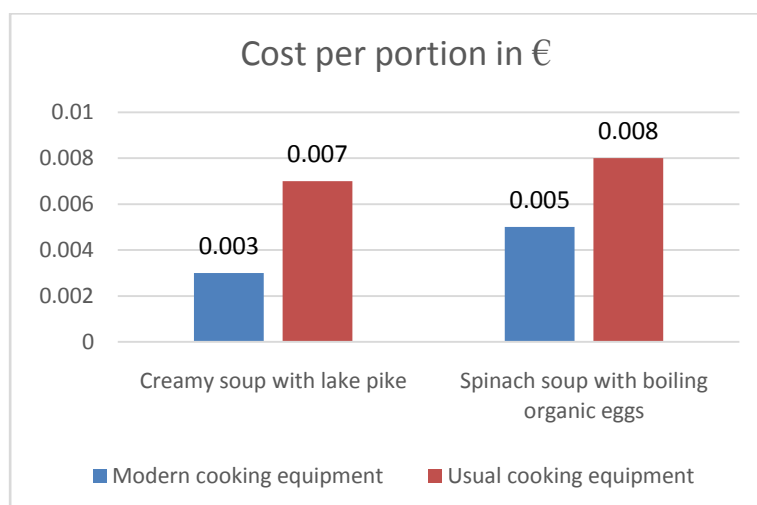


FIGURE 31. The second pair - cost per portion

According to the figure 31 we can suppose that modern equipment is approximately two times more effective and energy efficient than usual one. Traditional equipment in both experiments was represented by electric range of the Metos Company. It turned out to be very slow, the speed of heating and cooling was low. Induction range (modern equipment of Metos), which was used in the first case, is quite the contrary very fast and effective. VCC of Metos that was used in the second way is very effective too; furthermore, it is easy to use it. Electricity consumption of VCC was a little higher than in the induction range, but it can be explained by the fact that induction range can prepare only that amount of food, which can be placed in a cooking pot. VCC allows to cook 16 liters of soup on each side (there are two of them), thus if there is a big amount of food that has to be prepared, VCC is more effective than induction range. However, if there is a necessity to cook a little amount of food in a short period of time, induction range is the best choice.

The third pair was “Broiler pesto lasagna” and “Chicken gratins”, these dishes were the most difficult to cook, because the cooking process consisted of many steps. In this experiment, manual and process programs were tested only in “Chicken gratins” because in “Broiler pesto lasagna” different settings in Process cooking were applied. To find the cost per each portion a lot of calculations were made, then all steps of cooking were combined and now we can take a look at the results.

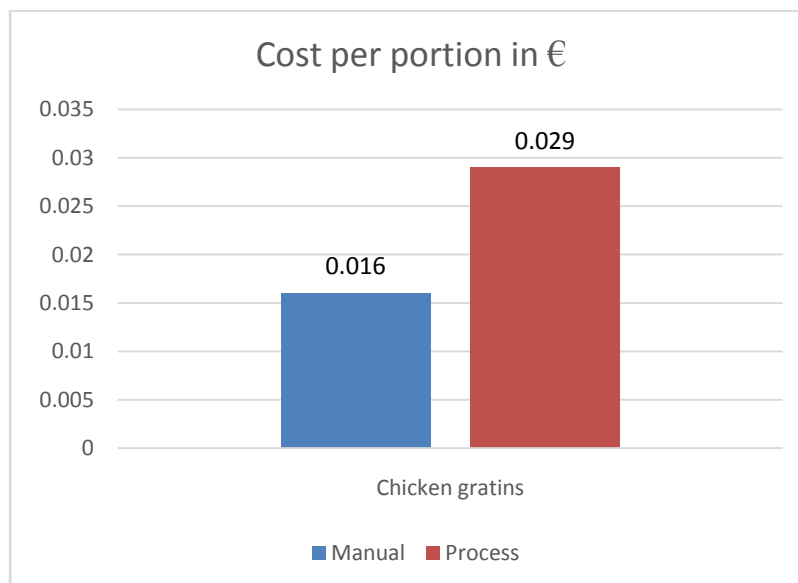


FIGURE 32. The third results - cost per portion

As you can see, process settings lose against the manual ones. In the second one, consumption was less. Moreover, as it was said in previous chapter: process settings did not work good enough in the “Chicken gratins” process experiment, thus we had to start cooking again with a different program. This is the reason of such a big difference between manual and process cooking. However, if we look at results that were calculated without the second part of the second case, and without sauce, we can see again the same results: manual - cost per portion equal to 0,013 € and process - 0,014 €. Manual is cheaper than process.

In our experiment, we used different equipment for the sauce preparation, and we can find out which equipment is the most suitable for this type of cooking. Sauce for “baked salmon with pesto sauce” was prepared with induction range, sauce for “lasagna” - with Kettle and sauce for “chicken gratin” - with VCC. Cooking time was different: 15 minutes in induction range, 37 minutes in Kettle and 43 minutes in VCC. Costs per portion are presented in the figure 33 below.

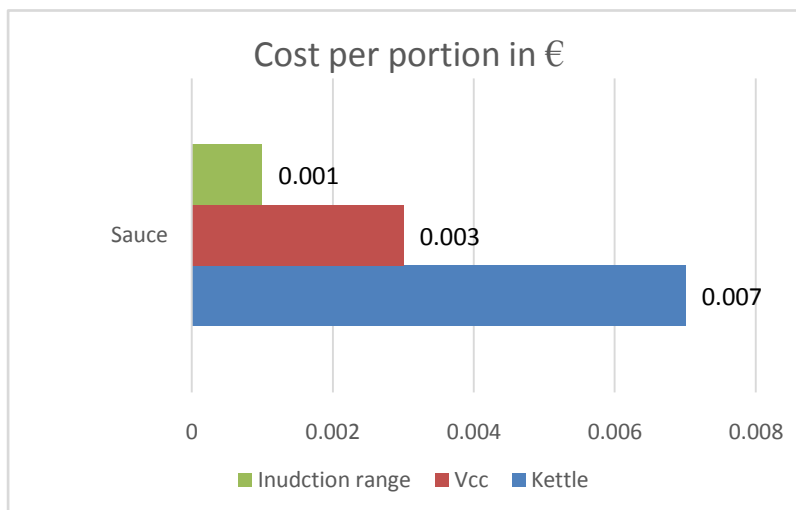


FIGURE 33. Sauce - cost per portion

As the figure 33 tells, induction range is the most energy efficient. However, if we take into account time of cooking, we can understand that VCC has approximately the same level of energy efficiency, because it spent small amount of electricity for three times longer cooking time. In general, all this equipment is energy efficient but it should be used in full operation and for different tasks. For small amounts, for exam-

ple, for the dish that is in a menu of a restaurant, it will be good to use induction range. For the main dish or some dish from a buffet, it will be better to apply VCC. For bigger quantity of food, for instance, in case of a banquet, or for large buffet it will be more suitable to use Kettle. An interesting and important point is to see how much electricity each machine spends for preparation of one kilogram of food. We can reveal these numbers in figure 34 below.

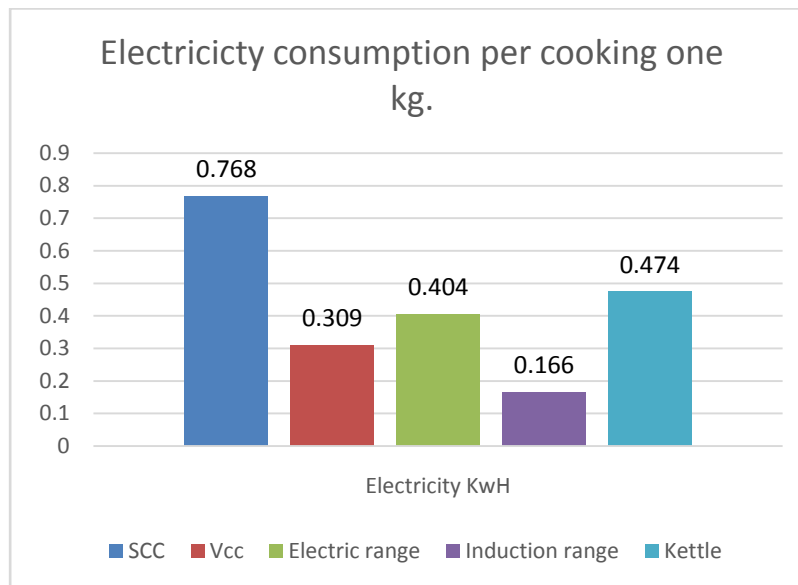


FIGURE 34. Electricity consumption per kg

As you can notice, the results are quite contradictory. The figure actually does not tell that SCC or Kettle use more energy than all other equipment. The reason is that we did not use full capacity of that equipment, if we return to our experiments, it is understandable that we usually used only 1 or 2 GN- 1/1-65 containers in SCC. This is only 10 and in some cases 20 percent of all fill ratio of this device, because full capacity of SCC is 10 GN 1/1-65 containers. Kettle is also very capacious machine; as a result, we used only 13 percent of equipment's capacity. VCC was used in half of its power, because we usually cooked 6-7 liters of food there (however, its capacity is 16 liters). Electric and Induction ranges were used in full operation, because cooking pot completely occupies the cooking zone of the equipment. Overall, now we cannot see the results of the full capacity usage, but we can say without doubt that SCC, VCC, and Kettle, if they are used in full operation, will be more efficient than electric and induction ranges.

10 DISCUSSION

Due to a theory part, it is easy to understand general aspects about the equipment: how it works, why it is eco efficient and why many restaurants must use these modern technologies. There are many types of different eco-efficient equipment, with different capacity, functions, and principals of work, however, one thing consolidates all these machines – they reduce water and electricity consumption, and this is their major advantage.

Moreover, this equipment has high level of ergonomics, and this has great significance for professional kitchen. All models are compact and do not take much space in a kitchen, furthermore, they can replace several conventional kitchen machines. According to the catalogue of the Metos Company we can conclude, that these equipment is not cheap, but their benefits cost this money. All equipment have different functions and applications, there is a possibility to cook different dishes with the use of only one equipment item.

In the practical part of this Thesis, we have tested different programs of equipment and some results were not predictable. For instance, equipment with Manual settings cooks faster and spends less energy than the one with Process settings. The same results were in all experiments where Manual and Process settings were tested. This is interesting, because all companies speak about their efficient automatic cooking programs, but in real life, we observe the opposite results. These programs do not work well, for example, in one of the experiments the dish was not prepared at all with the use of Process settings, conversely, equipment with manual settings manage with food very well. The Metos Company ought to do something with their process programs because it must work properly and be more efficient. Nevertheless, Process is very important and unreplaceable function of modern professional equipment and it is difficult to imagine it without this function. Despite of the problems, Process cooking function has many important pluses that replace all the drawbacks. Some of them are listed below.

- It is fast and easy to set,

- Large list of dishes that can be cooked automatically,
- Flexible settings,
- You do not need to choose temperature, humidity and others settings, everything is made automatically,
- Very easy to use for beginning cooks, however, some training is necessary.

Quite interesting situation was also formed with cooking loss, the experiments revealed the following:

- Cooking loss depends on a level where a container is placed in Combi Steamer,
- Cooking loss increases with cooking time,
- The mass of food always decreases because water evaporation,
- Influence of lid on a cooking loss is not so significant, it influences mass of liquid, but mass of food remains almost the same.

The main research's idea about electricity and water consumption was proved: professional cooking equipment is more efficient than usual one. Firstly, it was assumed in a theory part, and then verified in a practical one. Professional equipment like kettles, VCC, SCC and induction range are modern and important devices for any professional kitchen. Here are the main points that help to use professional equipment more efficiently:

- Try to prepare more food at one time, and use full capacity of equipment,
- Use each equipment for a certain task, like it was in situation with sauce,
- Try to find good settings of cooking, that spend less time, but do not influence the quality,
- Good knowledge of certain equipment, of programs, functions and using skills.

11 CONCLUSION

During this thesis project, many calculations were made and a lot of reading material was observed. With the help of theory, I showed how eco-efficient restaurants look like today, what the main points are, and how important it is to reduce electricity and

water consumption. In a theory chapter, I have tried to explain and present what eco-efficient kitchen is, and the significance of professional equipment there.

Several types of professional equipment were presented; furthermore, their principals of work were described. It is definitely only a small part of eco-efficient machinery, that exist, but I wanted to show the most useful and important functions. Moreover, Processes cooking programs, which are considered significant for professional kitchens, were observed and all the possibilities for cooking different types of food were presented.

The Metos Company produced the equipment that was described in a theory part of the thesis; the same machines were applied during the practical part. I had an intention to show the most important functions and advantages of that equipment, I also defined the prices, capacity and gave a comparison of some models. Of course, it would be more informative, if I showed all the companies in Finland that produce modern professional equipment for kitchens, but I decided to concentrate attention on a company and on models that I used during my practical part, where I tried to test principals of work and different functions of this equipment.

The main objective of this research was to prove that modern professional equipment is eco-efficient and it spends less energy than conventional one, and this goal was achieved according to the final results. It would be more suitable to make further experiments, for example, to combine usual oven and modern SCC, but I was restricted by certain models of equipment that are presented in the Talli restaurant, besides that, not all conventional equipment in Talli's kitchen has tools for measuring water and electricity consumption. This was the reason why I decided to combine only modern induction range and old electric range, however, in my opinion, the results show everything clearly and I am sure that, if I make more tests with more equipment, the results will be the same.

Testing of Process and Manual cooking processes in professional kitchen equipment was a significant part of my research. All four experiments show us that with the use of Manual settings electricity and water consumption is less than with automatic programs. The reason of this can be in gaps of these processes, they have to be fixed or

improved. Unfortunately, I can review those programs only by my results, and to be surer, additional experiments should be conducted, but I cannot ignore the received results.

One another interesting part of my practical work was testing of cooking loss. Considering the results, we understand what exactly has an influence on cooking loss. It was time, temperature and a little lid – these all has impact on the liquid mass. This is based on significant and accurate measurements.

Some additional goals were also achieved during my research. For example, type of professional equipment, which is more suitable for sauce, was found. I made a conclusion that it depends on amount of food that you want to cook, because, in any way, all equipment is efficient. Another interesting result was with electricity consumption per kg of food, it turned out that induction range and old electric range consume less electricity than SCC, but I have analyzed the way these measurements were done and concluded that the results are not so clear. We should understand that the major part of professional equipment (except of ranges) was not used in full operation.

Electricity consumption of modern professional equipment in comparison with usual one shows that modern equipment is more efficient and eco responsible. All my results prove that this equipment is an important part of each professional kitchen. My work can be used to understand the principles of work of professional kitchen equipment, as well as the ways to manage it. All pluses of the equipment, like ergonomics, eco-efficiency, safety and other important things were presented. The results of Process and Manual cooking test can be used for the companies to improve the work of their professional kitchen equipment and reveal its disadvantages. Of course, I would like to do more experiments, to show you results that are more interesting, maybe to test another professional kitchen equipment, but my research is going to an end, and I did what I could. I think my paper will be useful for some people who have eco-efficient restaurants or who want to open one. Furthermore, it will be interesting for those who think about the environment and want to save natural heritage for the next generations.

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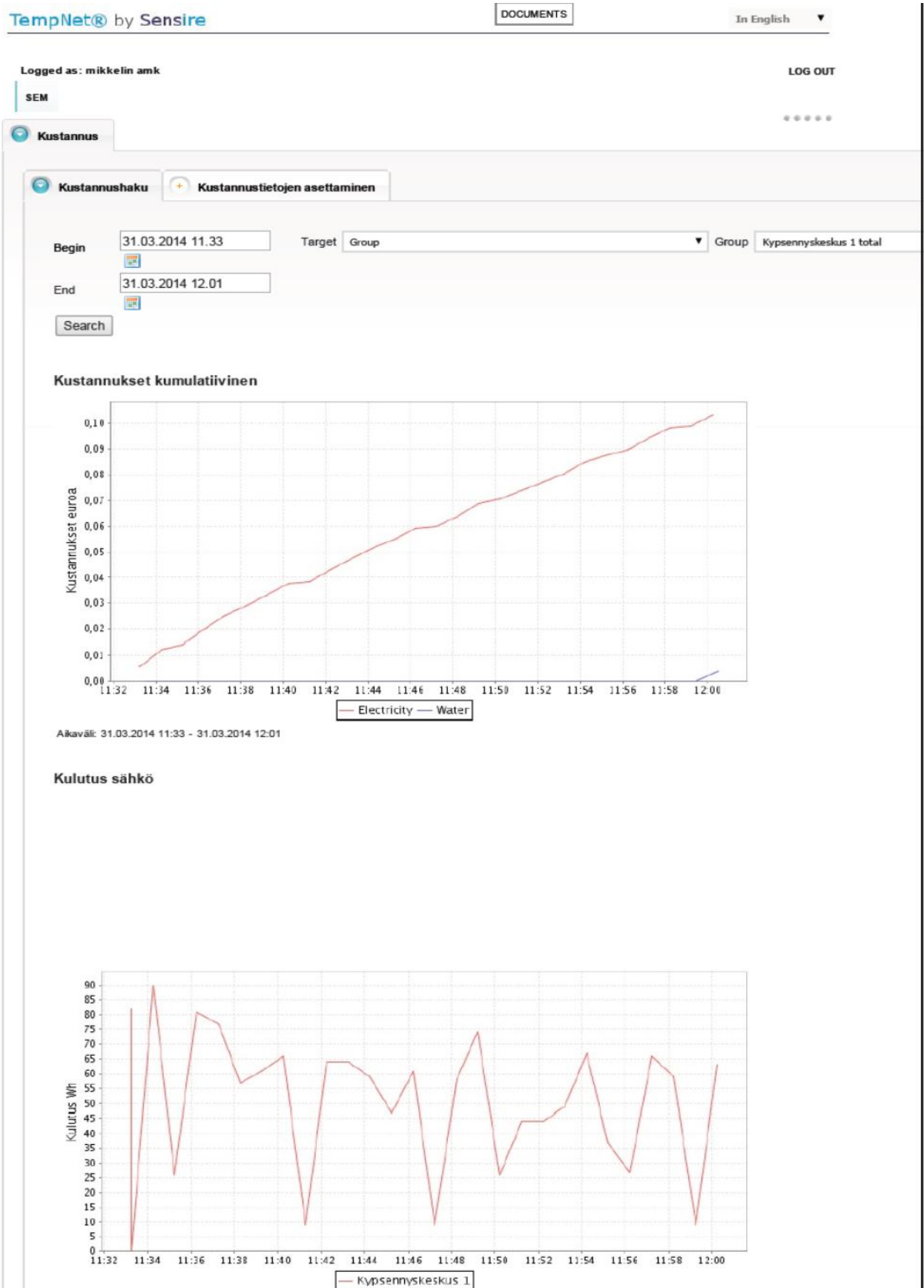
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Example of field book for measurement data.

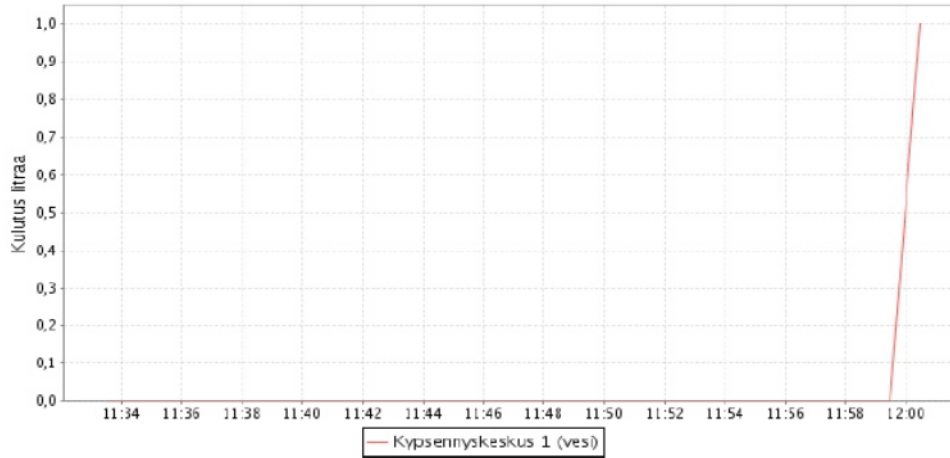
Date	07.04.2014	Researcher	Alexey Goretsky		
Food	Oven baked salmon with tomato pesto sauce				
Device: SCC	SCC1 _____	SCC2 _____	<input checked="" type="checkbox"/>	SCCres _____	
Start mass	<u>2.812kg</u> <u>2.928kg</u>				
Dish for cooking	_____ number of pieces GN 1/1 -65 _____ number of pieces GN 1/1 -100 <input checked="" type="checkbox"/> some other dish, what <u>ceramic GN 1/1 -65</u>				
Before cooking appliance	cold _____ warm <input checked="" type="checkbox"/>				
pre-heating	yes _____	no <input checked="" type="checkbox"/>	pre-heating started	_____	
			pre-heating ended	_____	
Cooking started	<u>13:02</u>				
Cooking ended	<u>13:23</u>				
Cooking method	Manual Temp <u>160</u> Inside temp <u>65°C</u> Time _____ Humid % <u>20</u>				
Ready process	Process name _____ Choices of process _____				
Cooking loss	End mass <u>2.634kg</u> inside temp <u>69 °C</u> <u>2.762kg</u>				
chilling	yes _____	no _____			
chilling started time	_____	ended time _____	inside temp _____	°C	
name of the process	_____				
choices of the process	_____				
observations	The fish is softer and more delicious. Mass of container GN-1 - 4,206 kg, GN-2 -4,222kg				

TempNet – electricity and water consumption data.



Aikaväli: 31.03.2014 11:33 - 31.03.2014 12:01

Kulutus vesi



Aikaväli: 31.03.2014 11:33 - 31.03.2014 12:01

Luo XLS

Time	Target	Määrä
31.03.2014 11:33	Kypsennyskeskus 1	82 Wh
31.03.2014 11:34	Kypsennyskeskus 1	90 Wh
31.03.2014 11:35	Kypsennyskeskus 1	26 Wh
31.03.2014 11:36	Kypsennyskeskus 1	81 Wh
31.03.2014 11:37	Kypsennyskeskus 1	77 Wh
31.03.2014 11:38	Kypsennyskeskus 1	57 Wh
31.03.2014 11:39	Kypsennyskeskus 1	61 Wh
31.03.2014 11:40	Kypsennyskeskus 1	66 Wh
31.03.2014 11:41	Kypsennyskeskus 1	9 Wh
31.03.2014 11:42	Kypsennyskeskus 1	64 Wh
31.03.2014 11:43	Kypsennyskeskus 1	64 Wh
31.03.2014 11:44	Kypsennyskeskus 1	59 Wh
31.03.2014 11:45	Kypsennyskeskus 1	47 Wh
31.03.2014 11:46	Kypsennyskeskus 1	61 Wh
31.03.2014 11:47	Kypsennyskeskus 1	9 Wh
31.03.2014 11:48	Kypsennyskeskus 1	58 Wh
31.03.2014 11:49	Kypsennyskeskus 1	74 Wh
31.03.2014 11:50	Kypsennyskeskus 1	26 Wh
31.03.2014 11:51	Kypsennyskeskus 1	44 Wh
31.03.2014 11:52	Kypsennyskeskus 1	44 Wh
31.03.2014 11:53	Kypsennyskeskus 1	49 Wh
31.03.2014 11:54	Kypsennyskeskus 1	67 Wh
31.03.2014 11:55	Kypsennyskeskus 1	37 Wh
31.03.2014 11:56	Kypsennyskeskus 1	27 Wh
31.03.2014 11:57	Kypsennyskeskus 1	66 Wh

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Yhteenveto

Sähkönkulutus: 1.476 kWh
 Sähkön kustannukset: 0.10 €
 Veden kulutus: 1.0 Litraa
 Vesikustannukset: 0.00 €

Kokonaiskustannukset: 0.11 €

Annosmäärä

Sähkönkulutus: 0.0738 kWh
 Sähkön kustannukset: 0.01 €
 Veden kulutus: 0.0 Litraa
 Vesikustannukset: 0.00 €

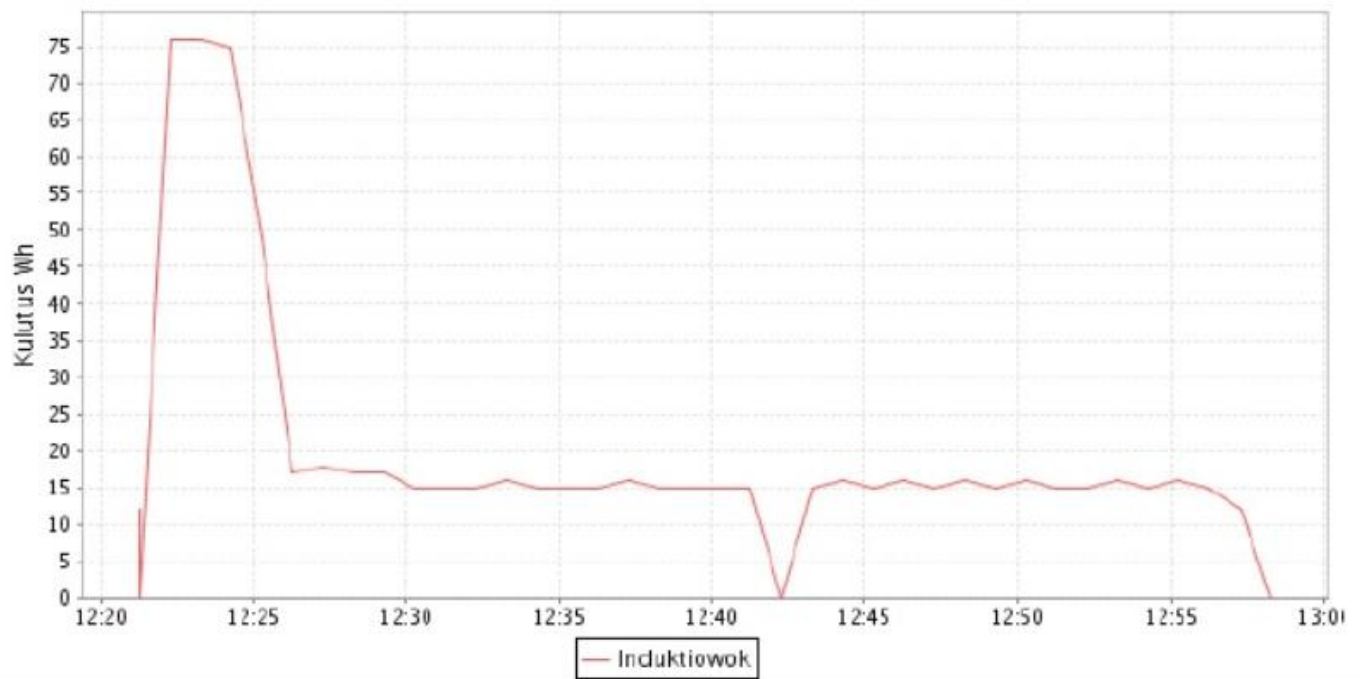
Kustannukset / annos: 0.005 €

Laskennassa käytetyt arvot

Sähkön hinta 0.07 €/kWh
 Veden hinta 3.88 €/m³

Salmon in Russian style



Tempnet induction range.

Creamy soup with lake pike – induction range.



Day 3&8 raw meat (pork) in a container.



Day 3 meat prepared with lid.



Day 3 meat prepared without lid.



Day 8 meat prepared without lid and with lid.



Spinach soup – electric range.



Spinach soup – VCC.



Chicken Casserole – process settings.

