# European Commission (DG ENER)

Preparatory Studies for
Ecodesign Requirements of EuPs (III)

[Contract N° TREN/D3/91-2007-Lot 22-SI2.521661]

## Lot 22

## Domestic and commercial ovens (electric, gas, microwave), including when incorporated in cookers

## Task 1: Definition

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In association with

ERA TECHNOLOGY



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# INTRODUCTION

## The Ecodesign Directive

This study on domestic and commercial ovens (electric, gas, microwave), including when incorporated in cookers (the "ENER Lot 22 study"), is the preparatory study being carried out by Bio Intelligence Service for the European Commission (DG ENER) in the context of the **Directive 2005/32/EC on the Ecodesign of Energy-using Products**. This framework Directive does not directly introduce binding requirements for specific products, but defines conditions and criteria for setting, through subsequent implementing measures, requirements regarding environmentally relevant product characteristics.

According to the Directive, the implementing measures can be proposed for product categories which meet the following criteria:

- Significant volume of products placed on the EU market (indicatively > 200,000 units per year)
- Significant environmental impact (indicatively > 1,000 PJ/year)
- Significant potential for improvement (indicatively > 20%)

The implementing measures are to be based on an environmental assessment taking into account products characteristics and functionality, taking the technologies available on the market as a reference.

The first step, in considering whether and which eco-design requirements should be set for a particular product group, is a preparatory study recommending ways to improve the environmental performance of the product. The preparatory study will provide the necessary information to prepare for the next phases in the policy process (carried out by the Commission) and in particular the impact assessment, the consultation forum, and the possible draft implementing measures laying down ecodesign requirements for EuPs.

As in all Ecodesign preparatory studies, a common and coherent methodology (MEEuP)[1] is used for analysing environmental impact and improvement potential of the products and ecodesign options are analysed from life cycle costing perspective. This methodology consists of eight main tasks which will be conducted in an iterative manner:

- Task 1: Definition
- Task 2: Economic and market analysis

[1] VHK (2005) Methodology for Ecodesign of Energy-using Products (MEEuP), Final Report, European Commission (DG ENTR). Available at: ec.europa.eu/enterprise/eco_design/finalreport1.pdf

- Task 3: Consumer behaviour and local infrastructure
- Task 4: Technical analysis of existing products
- Task 5: Base-cases
- Task 6: Technical analysis of BAT
- Task 7: Improvement potential
- Task 8: Final analysis: scenario, policy, impact, and sensitivity analysis

# 1. TASK 1 – DEFINITION

The objective of this task is to discuss definition and scope related issues for the Ecodesign Lot 22 preparatory study. It consists of categorisation of the products that could fall into the domestic and commercial ovens product group and a correlation with classification scheme(s) used in existing Prodcom categories (used in Eurostat) and to other approaches such as EN standards. This task provides product definitions for the purpose of this study and of the overlaps with the Prodcom classification categories.

Further, existing harmonised test standards and sector-specific procedures for product-testing are identified and discussed, covering the test protocols for:

- Primary and secondary functional performance parameters (Functional Unit)
- Resource use (energy, etc.) during product-life
- Safety (electricity, EMC, stability of the product, etc.)
- Other product specific test procedures

Finally, this task identifies existing legislations, voluntary agreements, and labelling initiatives at the EU level, in the Member States, and in the countries outside the EU.

## 1.1. PRODUCT CATEGORY AND PERFORMANCE ASSESSMENT

The objective of the sub-task 1.1 is to define the categories of product that fall within the scope of the Ecodesign preparatory study Lot 22, from a broad functional and technical perspective. Additional sub-categories of products, based on finer technical differences may be defined in Task 4.

This scoping exercise is a crucial step, since there is no established agreement on the exact meaning of “Domestic and commercial ovens (electric, gas, microwave), including when incorporated in cookers”.

### 1.1.1. DEFINITIONS

As specified in the Terms of Reference, the scope of the study is limited to “commercial and domestic ovens (electric, gas, microwave), including when incorporated in cookers”. The definition of the scope is therefore based on the analysis of the four key features mentioned in this definition: product (oven, cooker), end user (domestic, commercial), energy source (gas, electricity), and use mode (e.g. microwave). These terms are discussed below in order to facilitate the scope definition.

- Oven: there exist several definitions for ovens.
    - General definitions specify ovens used for food preparation as in as "a closed box-like space, usually part of a cooker, which is heated for cooking food"[2] while some others, enlarge the scope beyond food: "an oven is defined as a chamber or enclosed compartment for heating, baking, or roasting food, as in a stove, or for firing, baking, hardening, or drying objects, as in a kiln"[3]. According to the Australian NAEEEC[4](National Appliance and Equipment Energy Efficiency Committee, "an oven is essentially an enclosed heated chamber in which baking or roasting can occur". Concerning food:
        - Heating is used for warming cooked food, provide necessary temperature for cooking, defrosting or heat up a product, etc.
        - Baking is a technique of prolonged cooking of food by dry heat acting.
        - Roasting is a cooking method that uses dry heat to both cook the food and cause caramelisation or Maillard browning of the surface of the food.
        - Drying is another food preparation method. It is also one of the oldest, maybe the oldest, method of conservation. It is a good way to preserve food by removing the water and thus preventing the growth of microorganisms[5].
    - There are also definitions giving a structural description of ovens: "The construction of a mass-produced oven's cooking compartment is essentially a pressed-steel cavity wrapped in thermal insulation, a hinged and often glazed door, and a vent or a flue. The oven temperature is regulated by thermostatic control of the gas"[6].
    - According to the standard EN 50304/60350:2009, an oven is an "appliance or compartment of a range cooker in which food is cooked by radiation, by natural convection, by forced air-convection or by a combination of these heating methods".

[2] Kernerman English Learner's Dictionary
[3] Collins Essential English Dictionary
[4] National Appliance and Equipment Energy Efficiency Program (2002), Options study-MEPS/Labelling possibilities for stoves&cook-tops, Final Report.
[5] DeLong, D(1992), How to dry food
[6] Bertoldi, P. et al (2001), Energy efficiency in household appliances and lighting

- According to European Committee of Domestic Equipment Manufacturers (CECED), an oven is an **appliance for heating food stuff in a compartment closed by a door.**
- **To summarise, an oven is an enclosed compartment where the power/temperature can be adjusted for heating, baking and drying food and used for cooking. For the purpose of this study, this definition is used.**

- Cooker:
  - A cooker is defined as a large metal device for cooking food using gas and/or electricity. A cooker usually consists of an oven and a gas and/or electric hob[7]. Hobs are covered in the Ecodesign preparatory study Lot 23[8], also when included in cookers. A cooker is also referred to in the study as a range cooker.
  - A unit for cooking, typically including an oven and surface heating units and usually operated by gas and/or electricity[9].
  - When a cooktop and an oven are combined in a single unit, the appliance is referred to as a range cooker[10].

**END USER**

- As the scope of the study covers domestic and commercial ovens, (assuming that it excludes industrial ovens[11]), it is important to differentiate them, and to draw a line between these categories of ovens. Domestic ovens are ovens primarily designed for use in households. However, they are sometimes used in commercial establishments, e.g. kitchens of small restaurants. The following definitions are used in this study:
  - Domestic oven: this category includes ovens that are designed to be used in households. EN 30-1-1 defines domestic cooking appliances as "used by private individuals in a domestic dwelling"
  - Commercial oven (e.g. impinger oven to cook pizza) include ovens that are designed to heat or bake product that are supplied directly to the end-customers such as in:
    - restaurants
    - hotels
    - bakeries

[7] Collins English definition-Thesaurus
[8] Project website: www.ecocooking.org
[9] Webster's New World College Dictionary
[10] Kreith, F and West, R.E. (1996), CRC handbook of energy efficiency
[11] Industrial and laboratory ovens and furnaces will be covered by another preparatory study being launched by DG Enterprise (DG ENTR lot 4).

- canteens (factories, offices, hospitals, etc.)
- retailers, e.g. supermarkets
- ...

- Industrial oven: this category includes ovens whose primary use is to be used in an industrial setting, i.e. manufacture food that is sold to shops or other businesses, and not directly to end-customers. Regarding the difference between "commercial" and "industrial", the study[12] to elaborate the first Working Plan 2009-2011 with priority products for Ecodesign requirements considered that industrial ovens are usually parts of a production line, typically for "Business to Business" products.

**ENERGY SOURCE**

- Electricity
  - Electric ovens: electric ovens represent the majority of ovens present on the market in terms of sales volumes[13]
  - Gas ovens: gas ovens burn gas to provide the required heat. Most consume natural gas (methane) but some use other gases such as propane or butane
- Dual: dual ovens use electricity and gas, typically in a range cooker. A small proportion of ovens can also use other fuels (coal, wood, oil).

**OPERATION MODES**

- Fan forced or convection mode: the fan activates the air in the oven. The moving air strips away the thin layer of air which otherwise would surround and insulate the food, which enables the food to cook faster. Convection ovens give more even temperature distribution in the oven and allow a lower temperature setting to be used and to save energy. Furthermore, fan forced mode allows to load the oven on several levels with food. Increasing the load capacity leads to reduced energy consumption for a single food stuff. It is said that these types of ovens cook faster and typically use 35% less energy than conventional ovens[14], even though the final energy consumption depends on the type of oven and its technical settings.
- Conventional mode: the top and/or bottom elements activate without any fan. They are less common now, as convection ovens are taking over.

[12] DG ENTR (2007), Study for preparing the first Working Plan of the Ecodesign Directive
[13] National Appliance and Equipment Energy Efficiency Program (2002) Options study-MEPS/labelling possibilities for stoves & cook-tops, Final report.
[14] Ha,T (2006), Greeniology, Hot to live well, be green and make a difference

- Grill mode: this is a form of cooking that involves dry heat from above or below. Heat transfer to the food when using a grill is primarily via thermal radiation.
- Microwave mode: this enables cooking or heating of food by so-called dielectric heating. This is accomplished by using microwave radiation. This radiation excites the polar molecules (water and, at a lesser extent, other polar molecules such as sugars and fats) and causes friction between the molecules that, in turn, cause the heating of the food. This friction is fairly uniform, leading to food being adequately heated throughout (except in thick objects), a feature not seen in any other heating technique[15].
- Steam mode: steam with high temperature is injected in the cavity enabling heat transfer to the food. The use of steam keeps the food moisture at high temperatures. Cooking time is usually lower while food retains vitamins and nutrients.
- Combined mode: this mode combines microwave mode with other modes described above. This is used in so-called combination ovens which include microwave energy and other heat sources.

### 1.1.2. OTHER CRITERIA FOR DEFINING THE SCOPE

There is a broad functional spectrum and technical diversity of ovens. Following are some key aspects which will be taken into account during the study.

**SIZE**

The size of ovens can vary a lot; domestic ovens can range from less than 5 litres for a roaster oven up to 120 litres for large ovens[16] whereas commercial ovens can go up to 700 litres and more. An example of classification is the one used in the Directive 2002/40/EC regarding energy labelling of household electric ovens that includes ovens that are part of larger appliances. It uses the heating function of oven (i.e. conventional and/or forced air convection and/or hot steam) for establishing different categories as well as the size determined as follows:

- small 12 l ≤ volume < 35 l
- medium 35 l ≤ volume < 65 l
- large volume ≥ 65 l

**APPLIANCE TYPE**

The oven can be described as free-standing or built-in:

- Free-standing ovens: this category represents ovens that are not part of a modular kitchen or a wall. According to the U.S. Department of Energy's

[15] Kreith, F and Goswami, Y(2007), handbook of energy efficiency and renewable energy
[16] Save II project (2000), Efficient Domestic ovens, Final report

Office of Energy Efficiency and Renewable Energy (EERE)[17], free-standing means the product is not supported by surrounding cabinetry, walls, or other similar structures. This category can be further sub-divided into portable and non-portable. In safety standard such as EN 60335-1, the limit below which an appliance is considered as portable is 18 kilograms.

- Built-in ovens: this category encompasses ovens that are incorporated in a wall for example or integrated in modular kitchens. According to the EERE, free-standing means the product is not supported by surrounding cabinetry, walls, or other similar structures[17].

### POWER CONSUMPTION

An important characteristic is the power rating of the oven, generally given in Watts, which indicates the maximum power the appliance is consuming when its most power using mode is used. Standard tests measure ovens performance to achieve certain function, and a relation between the power consumed and performance reached can be established. Some studies have shown considerable variations from one oven to another as far as pre-heat consumption (consumption in order to arrive at 200°C for conventional ovens, 175°C for forced convection ovens), steady state consumption (consumption in order to maintain 200°C for one hour for natural convection ovens, 175°C for forced convection ovens) and the brick test (explained in Task 1.2, p28). Technical data related to energy consumption will be presented in Task 4.

### NUMBER OF CAVITIES

Most ovens have one cavity, but some have 2 cavities in order to cook several dishes at the same time. In some cases, the source of energy used in the two cavities can be different, one using gas while the other uses electricity. Multi-cavity ovens are considered following the Energy Label Directive for Ovens, where each cavity is studied separately.

### OPERATING TEMPERATURES

Depending on the end use, ovens are designed to reach different temperatures, with maximum temperatures ranging from 230°C up to 500°C.

### OTHER FEATURES

Features such as self-cleaning ability, based on catalytic, pyrolytic and hydrolytic cleaning processes, are increasingly found especially in modern electric ovens.

A self-cleaning oven is an oven which uses high temperature (approximately 500°C for pyrolytic ovens) to burn off leftovers from baking, without the use of any chemical agents. A self-cleaning oven is designed to stay locked until the high temperature process is completed. Self-cleaning ovens usually have more insulation than standard ovens to reduce the possibility of fire and to avoid external surfaces becoming sufficiently hot to cause burns if touched. The insulation also reduces the amount of

[17] U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (1997), 10 CFR Part 430 Subpart B App I Appendix I to Subpart B of Part 430

energy needed for normal cooking although the self-cleaning process consumes additional energy. Overall, they are considered to have a lower net energy use[18] but this will depend on the frequency of self-cleaning.

Table 1-1 presents some of the main technical and functional parameters. They are added to the functionality of the appliance and have an influence on environmental performance.

**Table 1-1: Key product parameters**

| Electric | Gas |
|---|---|
| Cooking method and additional features | |
| • Microwave combined<br>• Energy input (Electrical connection rating (W); Current (A); Voltage (V); Frequency (Hz)) | • Energy input (Gas type; alternative gas type; Gas connection; Gas connection rating (W)) |
| Technical / functional parameters | |
| • Type of appliance (Free-standing; Built-in)<br>• Forced air convection (Energy consumption (kWh) for each cavity)<br>• Grill<br>• Steam function<br>• Self-cleaning function (catalytic, pyrolytic and hydrolytic cleaning processes)<br>• Energy consumption conventional (kWh) – for each cavity<br>• Dimensions of the product (mm)<br>• Number of cavities<br>• Usable volume (l)<br>• Pre-heating time (min) for each cavity and energy consumption for pre-heating<br>• Energy consumption per test cycle<br>• Temperature uniformity across the cavities, and as a function of the load in the oven | |
| Convenience factors | |

[18] Ha,T (2008), The Australian green consumer guide

| Electric | Gas |
|---|---|
| • Temperature control (Mechanical; Electronic; No control of the temperature)<br>• Time control (Mechanical; Electronic; No control of the time)<br>• Display options<br>• Type of control setting devices<br>• Time-setting options (Start; Stop; Start and Stop; No delay options)<br>• Safety device<br>• Interior Lights<br>• Window<br>• Grids<br>• Trays<br>• Motorised Rotary Spit | |

### 1.1.3. EXISTING PRODUCT CATEGORIES

#### PRODCOM CLASSIFICATION

Prodcom[19] classifies domestic ovens in the category NACE 27.51 – "Manufacture of electric domestic appliances" and NACE 27.52 – "Manufacture of non-electric domestic appliances". In its subcategories different types of ovens are listed, which are presented in Table 1-2.

Prodcom classifies commercial ovens in the category NACE 28.21– "Manufacture of ovens, furnaces and furnace burners". Furthermore, industrial ovens are listed in the category NACE 28.93 – "Manufacture of machinery for food, beverage and tobacco processing". In its subcategories different types of ovens are listed, as presented in Table 1-3.

It can be observed that a first distinction can be made between domestic and non-domestic ovens. For household ovens, the main criterion is the source of energy (electric and non-electric) and a distinction is made between microwave ovens and other types of ovens. For the category "Other ovens", the criteria used to identify different types of products include the appliance type (i.e. built-in or free-standing) and functionality to a certain extent (e.g. electric cookers with oven, grills and roasters, etc). Other criteria could be the volume and the number of cavities.

**Table 1-2: Prodcom classification of household ovens**

| Prodcom code | Prodcom category |
|---|---|
| **27.51** | **Manufacture of electric domestic appliances** |
| **27.51.27** | **Microwave ovens** |
| **27.51.28** | **Other ovens; cookers, cooking plates, boiling rings; grillers, roasters** |
| 27.51.28.10 | Domestic electric cookers with at least an oven and a hob |

[19] PRODCOM Classification: List of PRODucts of the European COMmunity

| Prodcom code | Prodcom category |
|---|---|
| | (including combined gas-electric appliances) |
| 27.51.28.50 | Domestic electric grills and roasters |
| 27.51.28.70 | Domestic electric ovens for building-in |
| 27.51.28.90 | Domestic electric ovens (excluding those for building-in, microwave ovens) |
| **27.52** | **Manufacture of non-electric domestic appliances** |
| **27.52.11** | **Domestic cooking appliances and plate warmers, of iron or steel or of copper, non electric** |
| 27.52.11.13 | Iron/steel gas domestic cooking appliances and plate warmers, with an oven (including those with subsidiary boilers for central heating, separate ovens for both gas and other fuels) |

**Table 1-3: Prodcom classification of commercial ovens**

| Prodcom code | Prodcom category |
|---|---|
| **28.21** | **Manufacture of ovens, furnaces and furnace burners** |
| 28.21.13.30 | Electric bakery and biscuit ovens |
| 28.21.13.57 | Electric infra-red radiation ovens |
| **28.93** | **Manufacture of machinery for food, beverage and tobacco processing** |
| 28.93.15.30 | Bakery ovens, including biscuit ovens, non-electric |
| 28.93.15.80 | Non-domestic equipment for cooking or heating food (excluding non-electric tunnel ovens, non-electric bakery ovens, non-electric percolators) |
| 28.93.17.13 | Industrial bakery machinery (excluding non-electric oven) |

### GENERAL CLASSIFICATION

Ovens have been classified under three main categories[20]:

- Conventional ovens
- Fan forced (or convection) ovens
- Microwave ovens

### CLASSIFICATION IN THE DIRECTIVE 2002/40/EC

The Directive 2002/40/EC regarding energy labelling of household electric ovens includes ovens that are part of larger appliances. It uses the heating function of oven

[20] Ha,T (2006), Greeniology, How to live well, be green and make a difference

(i.e. conventional and/or forced air convection and/or hot steam) for establishing different categories as well as the size determined as follows[21]:

- small 12 l ≤ volume < 35 l
- medium 35 l ≤ volume < 65 l
- large volume ≥ 65 l

### CLASSIFICATION ACCORDING TO THE SAVE II STUDY

The Save II Project classified domestic ovens into 12 categories according to three main parameters:

- Oven fuel type
  - Gas
  - Electric
- Appliance type
  - Free-standing
  - Built-in
- Oven useful volume
  - <40 l
  - 40-60 l
  - >60 l

Combinations of these three characteristics give 12 subcategories to classify gas and electric ovens.

### CLASSIFICATION ACCORDING TO AHAM

AHAM (Association of Home Appliance Manufacturers) has recommended the adoption of five classes of microwave ovens, as follows:

- Free-standing microwave only with a total cavity volume of less than 0.8 cubic feet (22.6 litres)
- Free-standing microwave only with a total cavity volume of 0.8 (22.6 litres) to 1.19 cubic feet (33.7 litres)
- Free-standing microwave only with a cavity volume of 1.2 (33.7 litres) cubic or more
- Free-standing microwave with a convection mode
- Built-in (Fixed)

Further, AHAM differentiates 4 types of ovens:

[21] Microwave Ovens are excluded from this directive

- Electric oven with self-cleaning ability
- Electric oven without self-cleaning ability
- Gas oven with self-cleaning ability
- Gas oven without self-cleaning ability

### 1.1.4. CONCLUSIONS: SCOPE OF THE STUDY[22]

Ovens represent a very wide and very fragmented product group, with many options for sources of energy, sizes, functions, end-uses. It is necessary to determine the precise scope of the study in terms of products to be analysed.

It is important to note that the scope, based on the analysis presented in the above sections, can be further refined when market and use data are investigated in Tasks 2 and 3, respectively. **Further sub-categorisation may also be introduced based on the technical considerations that will be looked at in Task 4.**

Based on the considerations of 1.1.1., the scope will be limited to domestic and commercial ovens, using electricity and/or gas a fuel, whose main purpose is to heat, bake, dry or roast food. It means that ovens used for applications other than food will not be considered.

#### 1.1.4.1 Appliances within the scope of the Lot 22 study

As already stated, ovens cover a wide range of products. The following section describes the appliances within the scope of the Lot 22 study. As domestic and commercial appliances are designed differently, they are presented separately.

- **DOMESTIC OVENS**

  - **Domestic range Ovens**

Range cookers are available with a large variety of features. A range cooker has a hob on top and an oven beneath. Range cookers can include two full sized ovens and a separate grill or just one oven. It is possible to have a conventional oven and a second convection (or fan-assisted) oven. This allows roasting, baking and grilling different foods, which require different temperatures, at the same time. This type of oven can use gas, oil, electricity. Moreover, as it includes both an oven and a hob function, a range cooker fulfils the criteria of both Lot 22 and Lot 23, and therefore only the oven part of the range cooker will be considered in this study. The hob part of the cooker will be studied in Lot 23.

[22] Please note that pictures included in this section are for illustration and are not intended to favor products by certain manufacturers

Figure 1-1: Typical range ovens from Indesit (left) and Bosch (right)

- **Conventional domestic ovens**

Conventional ovens have a gas burner or an electric element(s) for cooking. As hot air rises, the highest temperature is found towards the top of the oven. This can limit the amount of food which can be cooked at the one time. These types of ovens are not commonly available anymore except as a smaller oven in double oven units. Conventional ovens can be single or double ovens. Double ovens can also combine a smaller capacity oven with a grill and a larger oven. They have the advantage of allowing cooking different food that needs different temperatures at the same time.

Figure 1-2: Typical conventional ovens from Moffat

- **Domestic fan-forced (or forced convection) ovens**

This type of oven has a built-in fan which circulates heated air inside the oven. This results in an even temperature throughout the entire oven, allowing all shelves to be used simultaneously. Fan-forced ovens heat more quickly than conventional ovens and so can cook food at lower temperatures.


Figure 1-3: Typical convection oven from DeLonghi

- **Domestic microwave ovens**

A microwave oven uses microwave radiation to cook food. They are generally available as a free-standing unit to be placed on a bench top or shelf but can also be built-in. Microwaves are available in a broad range of designs with a host of convenient features: rotating plates for more consistent cooking, digital timers, auto-programming capabilities and adjustable levels of cooking power that enable defrosting and warming, among other functions. Microwave energy heats only the food, and very little is wasted in heating cooking utensils or the oven itself.


Figure 1-4: Typical domestic microwave oven from Whirlpool

- **Combination Microwaves**

Microwave and thermal or convection heating combines the features of a microwave oven and a conventional or convection oven. The advantage of combination microwaves is that food can be browned/crisped on the outside using convection cooking, while the microwave energy reduces the actual cooking time.


Figure 1-5: Typical combination microwave from Sharp

- **Toaster/Grill Ovens**

Toaster ovens are smaller capacity counter top ovens with a variety of uses. They generally consist of an electric oven and combined grill and can be used not only for toasting and warming but also for cooking and grilling foods such as fish, meat, burgers, and pizza. Other features include an internal light, timer, indicator light, adjustable thermostat, and automatic shut off. Most toaster ovens are significantly larger than toasters, but are capable of performing most of the functions of electric ovens, albeit on a much smaller scale.

Figure 1-6: Typical toaster/grill oven from Mia (left) and DeLonghi (right)

- **Domestic steam ovens**

Some steam ovens use super-heated steam at up to 300°C, in order to grill, bake, defrost and reheat. These ovens are plumbed into the water supply and cook food quickly under high pressure and temperature[23]. There are also other types, including steamers with tank, which work at boiling temperature (~ 100°C), and steamers combined with microwave ovens, among others.

[23] Roberts, J (2006) Good green kitchens


Figure 1-7: Typical steam oven from Sharp

- **Dehydrators**

Home-food dehydrators are meant to dry out food products, e.g. to enhance their conservation as well as for food preparation. Most of the models fit on a countertop, but larger models are free-standing. Dehydrators typically remove air with a fan (i.e. mechanically) or through rising air (i.e. convection).

Figure 1-8: Typical dehydrator from Excalibur

- **Roaster ovens**

A roaster oven for the heating of foodstuffs has an outer housing with an opening and a heating element disposed near an interior surface for heating thereof. It is used to roast food.

Figure 1-9: Typical roaster oven from Rival

- **Halogen oven**

The halogen oven uses a halogen cooker and fan to combine the mechanisms of infrared radiation and convection cooking. The halogen oven makes it possible to cook a wide variety of food, although certain food such as pastries or functions such as baking are very limited. The bowl is made out of glass and is typically around 10 litres.

Figure 1-10: Typical halogen oven from JML

## COMMERCIAL OVENS

- **Commercial static ovens**

Static ovens are the most traditional type of ovens. The heat is diffused by the heating element, without the assistance of a fan. Most of the static ovens currently sold are gas powered, and consumers appreciate them for their simplicity.

Figure 1-11: Static oven from Moffat

- **Commercial forced-convection ovens**

Commercial convection ovens use a fan to circulate the air inside the cooking chamber.

Figure 1-12: A commercial forced-convection oven from Angelo Po

- **Commercial combi-steamer ovens**

Combi-steamer ovens are mainly designed for commercial use. In a combi steamer oven, hot air and steam can be used separately, together or in sequence in a temperature range from 30°C to 300°C and a moisture range from 0 percent to 100 percent. Low-temperature steaming below 100°C enables the operator to cook delicate items, such as poached eggs, shrimp, lobster and other seafood. You can also dial down the humidity, raise the temperature to 300°C and grill meats.


**Figure 1-13: Typical combi-steamer oven form Rational**

Bakery ovens, which use steam only short time and at the same time with heating methods other than steam, are not regarded as combi-steamer.

- **Deck oven**

Deck ovens are bakery ovens usually designed with several baking chambers allowing large volumes of products to be baked. Each chamber has a floor (deck) upon which food is cooked. On some models, the cooking surface is made out of stone. Heat is created through elements or burners located at the top and bottom of the chamber. The floor, walls and ceiling absorb heat and radiate that heat back, allowing for an even cooking temperature.

**Figure 1-14: Typical deck oven from Bongard**

- **Rotary rack ovens**

A rotary rack oven consists of a chamber, two to three meters high. It can be loaded with a rack, usually a wheeled steel framework supporting a vertical array of shelves.


**Figure 1-15: Typical rotary rack oven from Revent**

- **In-store bakery convection oven**

In-store bakery ovens are forced-convection ovens used to bake bread and other pastries. They are designed so the client can see the baking process, and can smell the fresh bread.

Figure 1-16: Typical in-store bakery oven from Wiesheu

- **Commercial microwave oven**

Commercial microwave ovens are usually larger and more powerful than their domestic equivalents. They are mainly used for defrosting and reheating pre-cooked food.

Figure 1-17: Commercial microwave oven from Amana

- **Impinger oven (conveyor ovens)**

A form of convection oven is the commercial impinger oven. This type of oven is often used to cook pizzas and for continuously cooking food in restaurants. Impinger ovens have a high flow rate of hot air from both above and below the food. The air flow is directed onto food which usually passes through the oven on a conveyor belt. Air flow rates can range between 1-5 $m^3/s$. Impinger ovens can achieve a much higher heat transfer than a conventional oven.

Figure 1-18: Typical impinger oven from Star

### 1.1.4.2 Appliances outside the scope of the Lot 22 study

**Industrial ovens** (Prodcom product category 28.93.17.13), which are heated chambers used for a variety of industrial applications, including drying, curing, or baking components, parts or final products are not included in the scope of this study. Industrial ovens can be used for large or small volume applications, in batches or continuously with a conveyor line, and a variety of temperature ranges, sizes and configurations. Such ovens are used in many different applications, including chemical processing, food production, and even in the electronics industry, where circuit boards are run through a conveyor oven to attach surface mount components.

Some common types of industrial ovens include:

- Curing ovens: curing ovens are designed to cause a chemical reaction in a substance once a specific temperature is reached. Powder coating is one common curing oven use.
- Drying ovens: drying ovens are designed to remove moisture or solvents. Typical applications are pre-treating and painting. Such ovens are also sometimes known as kilns, though they do not reach the same high temperatures as are used in ceramic kilns.
- Baking ovens: baking ovens combine the function of curing and drying ovens.
- Batch ovens: batch ovens are also called cabinet or Walk-in/Truck-in ovens, batch ovens allow for curing, drying or baking in small batches using wheeled racks, cars or trucks. Such ovens are often found in large-volume bakeries in places such as supermarkets.
- Conveyor, tunnel or continuous ovens: they are typically part of an automated conveyor processing line, conveyor ovens allow for higher volume processing.

Figure 1-19: Typical tunnel oven from Sveba Dahlen

- Clean room ovens: clean room ovens are designed for applications requiring a particulate free environment, such as semiconductor manufacturing or biotechnology processes.

As only domestic and commercial ovens are to be considered within the framework of the current study, industrial ovens will fall out of the scope and might be considered in another preparatory study.

#### 1.1.4.3 Mapping of product groups covered by Lot 22 with Prodcom categories

A classification of different products that could be covered within the scope of the Lot 22 study mentioned above is presented in Figure 1-20 below including their Prodcom categories. It also shows potential overlaps with the Lot 23 on domestic and commercial hobs and grills. It can be seen that Lot 22 appliances are commercial and domestic appliances, which can be categorised according to their likely end use and according to the existing product definitions in EN standards.

#### 1.1.4.4 Functional unit for domestic and commercial ovens

The functional unit of an oven is basically to convert energy (electricity, gas, etc.) into heat to cook food at a certain temperature for a given time.

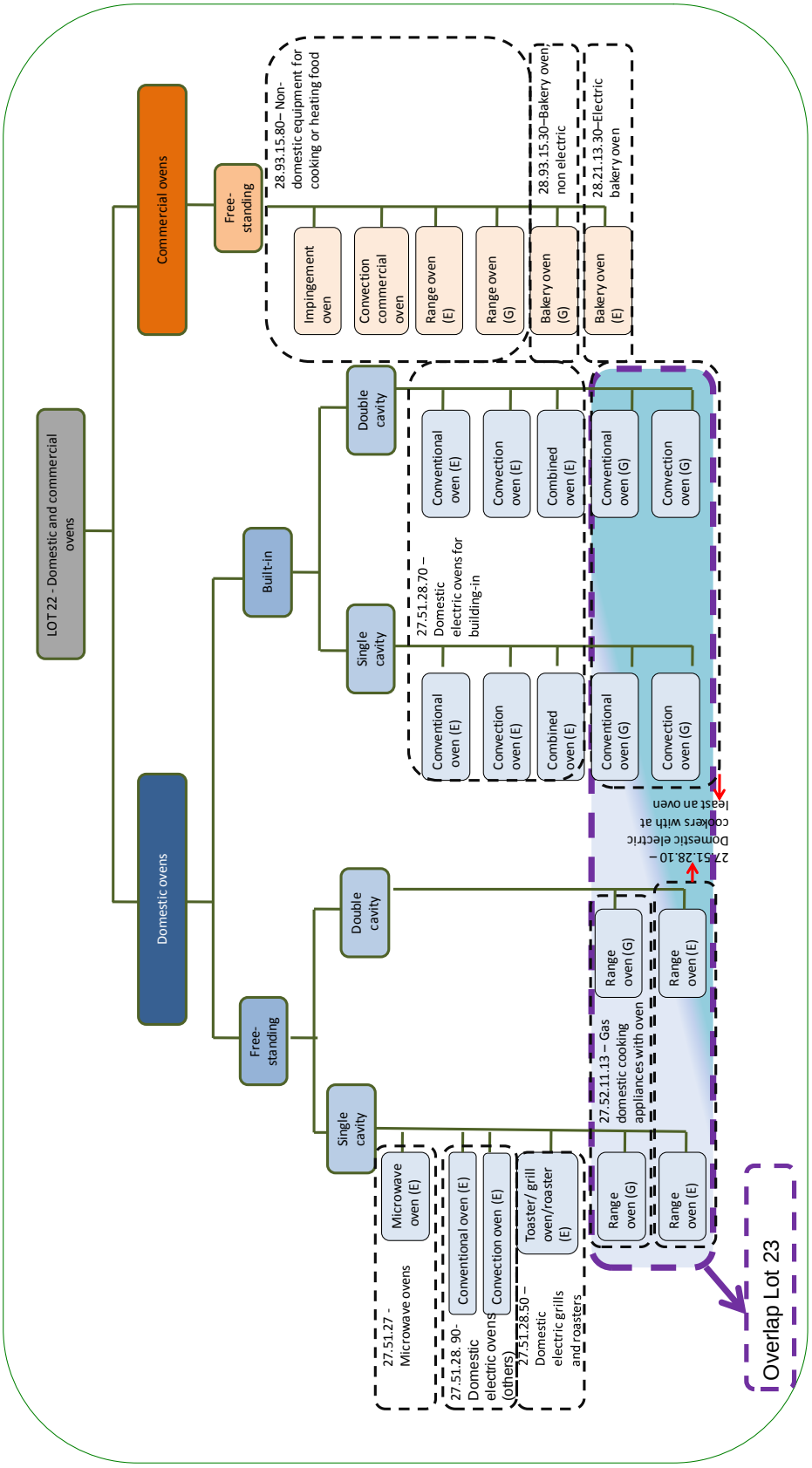


**Figure 1-20: Overview of the main product groups projected to be covered in Lot 22 (E stands for electric devices and G stands for gas devices)**

## 1.2. TEST STANDARDS

### 1.2.1. STANDARDS AT EUROPEAN COMMUNITY LEVEL

This subtask analyses the important tests standards for ovens. Product standards establish requirements relating to the design, manufacturing, construction, performance (energy efficiency and emissions of pollutants), safety use instructions, marking and also provide test methods type testing of appliances. At the moment, there are standards covering energy efficiency for domestic and commercial ovens, in some cases. The gaps will be identified in this section. However, currently most European standards that concern ENER Lot 22 products address safety issues. These standards fall under EU Directives such as 2002/40/EC with regards to energy labelling of household electric ovens. Many EN standards on ENER Lot 22 products also correspond to international standards. European standards relevant to the study have been listed below.

Energy consumption and efficiency of ovens are defined by different European test standards which determine appliance energy use for the following categories:

- Gas ovens
- Electric ovens
- Microwave ovens

**GAS OVENS**

For domestic gas ovens, the applicable European standards are of two types:

- EN 30 2.1 for natural convection ovens and EN 30 2.2 for forced convection ovens which measure the net volume in litres, the energy consumption for pre-heating and the energy consumption per test cycle.
- The brick test EN 15181:2009. This test might be replacing EN 30 2.1[24].

The EN 30 2.1 and EN 30 2.2 standards are carried out with an empty oven, while EN 15181:2009 is carried out using the brick test, i.e. measuring the gas needed to heat up a chilled wet brick from 5°C to 60°C.

For commercial gas ovens, the applicable European standard that includes an energy use test is EN 203-2-2. This test measures gas consumption to maintain the temperature of an empty oven at 195°C above ambient temperature except for bakery ovens which must maintain 230°C above ambient temperature.

[24] Lane K, Environmental Change Institute, University of Oxford Labelling domestic ovens (Save study 4.1031/D/97-047)

## ELECTRIC OVENS

Until the end of the 90s, the efficiency of ovens was compared with reference to consumption measured in the so-called 'empty' oven test. For domestic electric ovens, the test (CENELEC HD-376S2-1998) was based on measuring the energy need to pre-heat the oven to 200°C (or 175°C for forced convection ovens) and maintain it at that temperature for one hour. This standard has been replaced by the 'chilled wet brick' test, EN 50304/60350:2009, which was considered to be more representative of actual oven usage. In this test procedure, a saturated chilled wet brick is raised in temperature from 5°C to 60°C, the energy used to perform this task being the important measure.

To determine electricity consumption, a brick test load is prepared by soaking overnight. The empty oven cavity is pre-heated to calibrate the temperature controls, and the test load is heated at three different oven thermostat settings in accordance with the precise specification in EN 50304. The final energy consumption from the three runs is calculated by regression theory, where a straight line of 'best fit' is found mathematically. This gives the final energy consumption in kWh and an A to G class is assigned according to the size of the oven.

A sampling test made within a study carried out by the Working Group on Efficient Domestic Ovens within the framework of the SAVE II Programme in 1998-1999[25] showed little correlation between the energy values measured by these two different testing procedures.

EN 61817:2001 is a similar test for portable ovens. Tests are very similar to those in EN 50304/EN60350:2009 and cover the more common types of portable appliance including grills, hobs and ovens. However, the brick test is not included in this standard.

No specific tests for commercial electric ovens have been identified.

## MICROWAVE FUNCTION

The microwave standard (EN 60705:1999) covers microwave ovens and the microwave function of combination microwaves. These appliances may also use thermal cooking means as employed in conventional cooking ovens. They may also incorporate a browning function. This standard applies to combination microwave ovens when used in the microwave generating mode only. For safety of microwave ovens, EN 60335-2-25 and EN 60335-2-90 are used. Current standards for microwave ovens do not include a test for energy consumption as they do for ovens.

Other safety and environmental requirements for domestic and commercial ovens are presented in Table 1-4, and a presentation of each standard is provided in the following paragraphs.

[25] Save II project (2000), Efficient Domestic ovens, Final report

Table 1-4: Other European standards relevant for ovens

| Standard | Type of Standard | Type of Oven |
|---|---|---|
| EN 1673:2000 | Safety | Electric (commercial) |
| EN 203-1:2005+A1:2008 | Safety/peformance | Gas (professional) |
| EN 203-2-2:2006 | Safety/performance | Gas (professional) |
| EN 30-1-1:2008 | Safety | Gas (domestic) |
| EN 30-1-2:1999 | Safety | Gas forced convection (domestic) |
| EN 30-2-1:1998 / A2:2005 | Performance | Gas (domestic) |
| EN 30-2-2:1999 | Performance | Gas forced convection (domestic) |
| EN 60335-1 | Safety | Electric |
| EN 60335-2-6:2003 | Safety | Electric (domestic) |
| EN 60335-2-9:2008 | Safety | Electric portable (domestic) |
| EN60335-2-25:2005 | Safety | Electric (domestic) |
| EN 60335-2-36:2002 + A2:2008 | Safety | Electric (commercial) |
| EN 60335-2-42:2003 + A1 | Safety | Electric (commercial) |
| EN60335-2-90:2002 | Safety | Microwave (commercial) |
| EN 60350:2005 superseded by EN50304/EN60350:2009 | Performance | Electric (domestic) |
| EN60705:1999 | Performance | Microwave (domestic) |
| EN 50304/EN60350:2009 | Performance | Electric (domestic) |
| EN15181:2009 | Performance | Gas (domestic) |
| EN 61817:2001 | Performance | Electric portable (domestic) |

- **EN 1673:2000** Food processing machinery - Rotary rack ovens - Safety and hygiene requirements.

**Prepared by:** CENELEC Technical Committee MCE/3, safeguarding of machinery, to Subcommittee MCE/3/5, Food industry machines – Safety.

**Implemented date:** Approved 11 June 2000, published September 2000.

**Description:** This is a safety standard which covers the design and use of rotary rack ovens intended for food only used in factories and shops. Domestic appliances are

excluded. The main aspects are prevention of hazards such as mechanical, electrical and thermal. It gives very specific design requirements for this specific type of product.

- **EN 203-1:2005+A1:2008** Gas heated catering equipment – Part 1: General safety rules

**Prepared by:** CEN Technical Committee GSE/19, Catering equipment (gas).

**Implemented date:** Approved 21 April 2005, amendment approved 5 March 2008, current version published May 2008.

**Description:** This is a safety standard for all types of professional catering equipment heated by gas. It includes definitions used by the rest of family of standards, specifies materials that can be used and design for safe use and hygiene. It also specifies maximum carbon monoxide concentration in emissions and provides comprehensive and detailed standards.

- **EN 203-2-2:2006** Gas heated catering equipment – Part 2-1: Specific requirements – ovens

**Prepared by:** CEN Technical committee GSE/19, Catering equipment (gas).

**Implemented date:** Approved 24 May 2006, published June 2006.

**Description:** This safety standard for professional equipment should be used in conjunction with EN 203-1:2005. It gives specific requirements for commercial ovens. It specifies maximum gas consumption rates in kW. The definition of maximum gas consumption rate from this standard is: the consumption of gas in kilowatts (kW) required to maintain the steady temperature shall not exceed: $0.22 \times V^{2/3}$, where V is the usable volume of the oven.

EN 203-2-2 tests the gas consumption to maintain the temperature at 195°C above ambient temperature except for bakery ovens which must maintain 230°C above ambient temperature.

- **EN 30-1-1:2008** Domestic cooking appliances burning gas - Part 1-1: Safety - General

**Prepared by:** CEN Technical Committee GSE/35, Gas cooking appliances (domestic).

**Implemented date:** Approved 1 July 2008, published September 2008.

**Description:** This is a very detailed standard covering the design and performance of domestic ovens, grills, hotplates and other appliances. It includes electrical thermal, stability and gas safety issues. It describes various tests related to safety issues. Maximum CO content of outlet gases = 0.1 – 0.2%. The standard is designed to ensure products are safe to use. Energy efficiency is not considered. It specifies that oven taps must be able to operate at least 5000 times.

- **EN 30-1-2:1999** Domestic cooking appliances burning gas - Part 1-2: Safety - Appliances having forced-convection ovens and/or grills

**Prepared by:** CEN Technical Committee GSE/35, Gas cooking appliances (gas).

**Implemented date:** Approved 15 April, published September 2008.

**Description:** This safety standard is to be used with EN 30-1-1 and provides additional test and safety requirements for ovens and grills that utilise forced convection. In most circumstances, EN 30-1-1 applies.

- **EN 30-2-1:1998 / A2:2005** Domestic cooking appliances burning gas - Part 2-1: Rational use of energy – General

**Prepared by:** CEN Technical Committee GSE/35, Gas cooking appliances (domestic).

**Implemented date:** Approved 18 January 1997, published March 1998. First amendment published September 2003 and second April 2005 .

**Description:** This is a gas energy efficiency test standard for open and covered gas burners and gas ovens. Test methods are based on EN 30-1-1 and the amount of gas to maintain temperature of oven should be inferior or equal to 0.93 + 0.035v kW, where *v* is the oven volume (in litres).

Tests are based on a single mode of use only but are useful to compare the energy efficiency of different models. The oven test result is expressed in kW.

- **EN 30-2-2:1999** Domestic cooking appliances burning gas - Part 2-2: Rational use of energy - Appliances having forced-convection ovens and/or grills

**Prepared by:** CEN Technical Committee GSE/35, Gas cooking appliances (domestic).

**Implemented date:** Approved 15 April 1999, published December 1999 .

**Description:** This is a gas energy efficiency test standard for domestic forced convection ovens based on EN 30-2-1.

The gas to maintain the temperature of oven should be inferior or equal to 0.93 + 0.035v kW, where *v* is the oven volume (in litre).

- **EN 60335-1** Household and similar electrical appliances — Safety — Part 1: General requirements

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of household and similar electrical appliances.

**Implemented date:** Originally approved 2 July 2002, several amendments, current version published November 2008.

**Description: This** is a safety standard for domestic appliances to show conformity with the Low Voltage Directive. The scope is appliances intended for household use and appliances used by the layperson in shops, light industry, etc.

- **EN 60335-2-6:2003** Safety of household and similar electrical appliances – Part 2-6: Particular requirements for stationary range cookers, hobs, ovens, and similar appliances.

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of electrical appliances, to Subcommittee CPL/61/07, Safety of electrical appliances — Heated appliance group.

**Implemented date:** Adopted March 2003 and amended in February 2005.

**Description:** This is a safety-related standard derived from IEC 60335-2-6:2002, based on EN 60335-1 with applicable additions, modifications and replacements for domestic electric range cookers, hobs and ovens. The test loads for rotating spits, hotplates and induction hotplates are specified.

- **EN 60335-2-9:2008** Safety of household and similar electrical appliances – Part 2-9: Particular requirements for grills, toasters and similar portable cooking appliances

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of electrical appliances, to Subcommittee CPL/61/07, Safety of electrical appliances — Heated appliance group.

**Implemented date:** The amended version derived from IEC 60335-2-9:2002 was published in November 2007.

**Description:** It is a safety-related standard based on EN 60335-1 with applicable additions, modifications and replacements for domestic electric potable cooking appliances such as grills, breadmakers, ovens, portable hotplates, rotisseries and toasters. The safety test conditions are specified such as maximum surface temperatures.

- **EN60335-2-25:2005** Safety of household and similar electrical appliances - Part 2-25: Particular requirements for microwave ovens

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of household electrical appliances, to Subcommittee CPL/61/2, Safety of microwave ovens.

**Implemented date:** Published in December 2002 and amended in June 2005 and September 2006.

**Description:** This standard is identical to IEC 60335-2-25:2002: it is a safety standard based on EN 60335-1 with applicable additions, modifications and replacements for microwave ovens. It provides specific requirements for electrical, fire, microwave and mechanical safety. It also specifies test load but not the test method.

- **EN 60335-2-36:2002 + A2:2008** Safety of household and similar electrical appliances - Part 2-36: Particular requirements for commercial electric range cookers, ovens, hobs, and hob elements.

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of household and similar electrical appliances, to Subcommittee CPL/61/5, Commercial catering equipment.

**Implemented date:** Published in 2002 and amended in April 2008. It is identical to IEC 60335-2-36:2002.

**Description**: EN 60335-2-36:2002 is a safety standard based on EN 60335-1 with applicable additions, modifications and replacements for commercial electric range cookers, hobs and ovens.

- **EN 60335-2-42:2003 + A1** Safety of household and similar electrical appliances - Part 2-42: Particular requirements for commercial electric forced-convection ovens, steam cookers, and steam-convection ovens.

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of household electrical appliances, to Subcommittee CPL/61/5, Commercial catering equipment.

**Implemented date:** Published September 2008.

**Description:** Identical to IEC 60335-2-42:2002, this standard deals with the safety of electrically operated commercial forced convection ovens, steam cookers, steam-convection ovens and, exclusive of any other use, steam generators, not intended for household use. The standard is applicable to appliances with a rated voltage of no more than 250 V for single-phase appliances connected between one phase and neutral and 480 V for other appliances. Appliances within the scope of this standard are typically used in restaurants, canteens, hospitals and commercial enterprises such as bakeries, butcheries, etc. The electrical part of appliances making use of other forms of energy is also within the scope of this standard.

- **EN60335-2-90:2002** Safety of household and similar electrical appliances – Part 2-90: Particular requirements for commercial microwave ovens

**Prepared by:** CENELEC Technical Committee CPL/61, Safety of electrical appliances, to Subcommittee CPL/61/07, Safety of electrical appliances — Heated appliance group.

**Implemented date:** Approved 1 March 2006, published May 2006.

**Description:** This is identical to IEC 60335-2-90:2006**,** a safety-related standard based on EN 60335-1 with applicable additions, modifications and replacements for commercial microwave ovens.

- **EN 50304/EN60350:2009** Electric range cookers, hobs, ovens and grills for household use – Methods for measuring performance

**Prepared by:** CENELEC Technical Committee CPL/59, Performance of household electrical appliances.

**Implemented date:** Approved 1 December 2008, published March 2009.

**Description:** This standard includes and supersedes EN 50304:2001 and is almost identical to IEC 60350:1999 with slight modifications. This standard describes test methods for domestic electric range cookers, ovens, hobs and grills. Tests include performance tests that determine evenness of cooking, the so-called “small cakes test”

in ovens. Many tests are used to calculate the energy consumption such as ability to heat water on a hotplate and the wet brick test in ovens. Permitted tolerances are given. The wet brick test results are used for oven energy labelling but the hotplate and hob energy consumption are not used for energy labelling. There are also several tests for grilling uniformity (bread and burgers). Cleaning is also assessed. This standard includes a wide variety of tests that cover most ways that ovens, grills and hobs are utilised. The small cake test is probably the most reliable for evenness of cooking in ovens but small cakes are not a heavy load so other tests are also required to obtain a full assessment. This test is comparative only.

- **EN 60705:2009** Household microwave Corrigendum No. 1 ovens — Methods for measuring performance

**Prepared by:** CENELEC Technical Committee CPL/59, Performance of household electrical appliances, to Subcommittee CPL/59/9, Cooking and microwave appliances.

**Implemented date:** Approved 1 April 1999, and the subsequent amendments were approved in 2004 and 2006. Current version published March 2006.

**Description:** This standard is applicable to microwave function. The tests include heating water (1kg) in a cylinder and in a square tank (to determine energy efficiency) plus food cooking tests to determine performance, reproducibility, cooking uniformity, etc. The energy efficiency is calculated as a percentage. An MTP study[26] showed that the comparative energy efficiency of microwave and conventional ovens varies considerably depending on the food being cooked. However, this test is useful as a comparative test for assessing energy efficiency.

- **EN 50304:2001** Electric ovens for household use — Methods for measuring energy consumption

**Prepared by:** CENELEC Technical Committee CPL/59, Performance of household electrical appliances, to Subcommittee CPL/59/9, Cooking and microwave appliances.

**Implemented date:** Approved on 1 April 2000, published May 2001.

**Description:** This standard is completed by EN 60350:2009. This standard describes the method for measurement of energy consumption and heating time by the wet brick test. The energy consumed in kWh and time for heating the load are measured.

- **EN 15181:2008** Measuring method of the energy consumption of gas fired ovens

**Prepared by:** CEN Technical Committee GSE/35, Gas cooking appliances (domestic).

**Implemented date:** Approved 13 September 2008, published October 2008.

**Description:** This is the gas oven equivalent to EN 50304 and uses the standard wet brick test to determine energy consumption and heating time. This standard is

[26] MTP(2008) Briefing Note BNCK02: Energy label for domestic ovens.

applicable to gas ovens with fans (forced convection). The methods determine energy consumption in MJ as well as the heating time. The nominal heat input (in kW) is given by the equations:

Qn = 0.278 Mn.Hs

or Qn = 0.278 Vn.Hs

where: Mn is the mass flow rate of dry gas under reference conditions corresponding to the nominal heat input in kilograms per hour, Hs is the gross calorific value of the gas, given in megajoules per cubic meter or megajoules per kilogram and Vn is the volume rate of dry gas under reference conditions corresponding to the nominal heat input in cubic meter per hour.

The standard also gives equations for calculation of the reference conditions mass/volume of gas from the actual mass/volume and the pressure, temperature and gas density.

- **EN 61817:2001** Household portable appliances for cooking, grilling and similar use — Methods for measuring performance

**Prepared by:** CENELEC Technical Committee CPL/59, Performance of household electrical equipment, to Subcommittee CPL/59/7, Small kitchen appliances.

**Implemented date:** Approved 1 November 2001, latest version published in August 2004. This standard is equivalent to EN 50304/EN60350:2009 and is solely for household portable appliances.

**Description:** The methods for assessing performance are described but this standard is not concerned with performance requirements but does describe energy consumption measurement procedure (in Wh). The tests are very similar to those in EN60350:2009 and cover the more common types of portable ovens, but does not include an energy measurement for ovens.

Also applicable is the standard EN 60704-3 for the determination of airborne acoustical noise. It describes procedures for determining and verifying the declared values of the noise emitted by household and similar appliances. It applies to all categories of household and similar electrical appliances covered by IEC 60704-1 and IEC 60704-2 dealing with particular requirements for special categories of appliances.

The standards presented above are summarised in Figure 1-21. They are classified under three main categories: gas ovens, electric ovens, and microwave ovens that are, in turn, broken down into electric and domestic. They are all at the end classified under safety category and under performance category.

Regarding standards covering performance, domestic appliances are covered by different standards:

- The combination of EN 50304/EN 60350:2009 for non portable ovens, and EN 61817:2001 for portable ovens - for electric ovens

- The combination of EN 15181:2009, the gas equivalent of EN 50304/EN 60350:2009, and EN 30-2-1(1998/A2:2005 for conventional ovens and 1999 for forced convection ovens) - for gas ovens
- EN 60705:2009 - for microwave functions.

Standards EN 50304/EN 60350:2009 for electric ovens and EN 15181:2009 includes:

- Wet brick test for energy labelling (only for electric ovens)
- Small cake test for evenness of cooking
- Cleaning assessing.

This multi-criteria standard attempts to reflect the real life use, as it assesses the quality of the cooking as well as the energy performance in a realistic way, heating a brick representing a piece of meat taken from the refrigerator (i.e. at 5°C) and cooked to a high temperature (60°C). The brick test combined with the small cake test attempts to reflect the real-world use of the oven, from an energy point of view.

For microwave ovens, tests include heating water (1 litre) in a cylinder and in a square tank to determine energy efficiency as well as food cooking tests to determine performance, reproducibility, cooking uniformity, etc. Energy efficiency is calculated as a ratio of the energy output over the energy input, which gives a percentage. This seems to be fairly representing the real use. However, this standard only treats domestic applications; commercial applications are not covered.

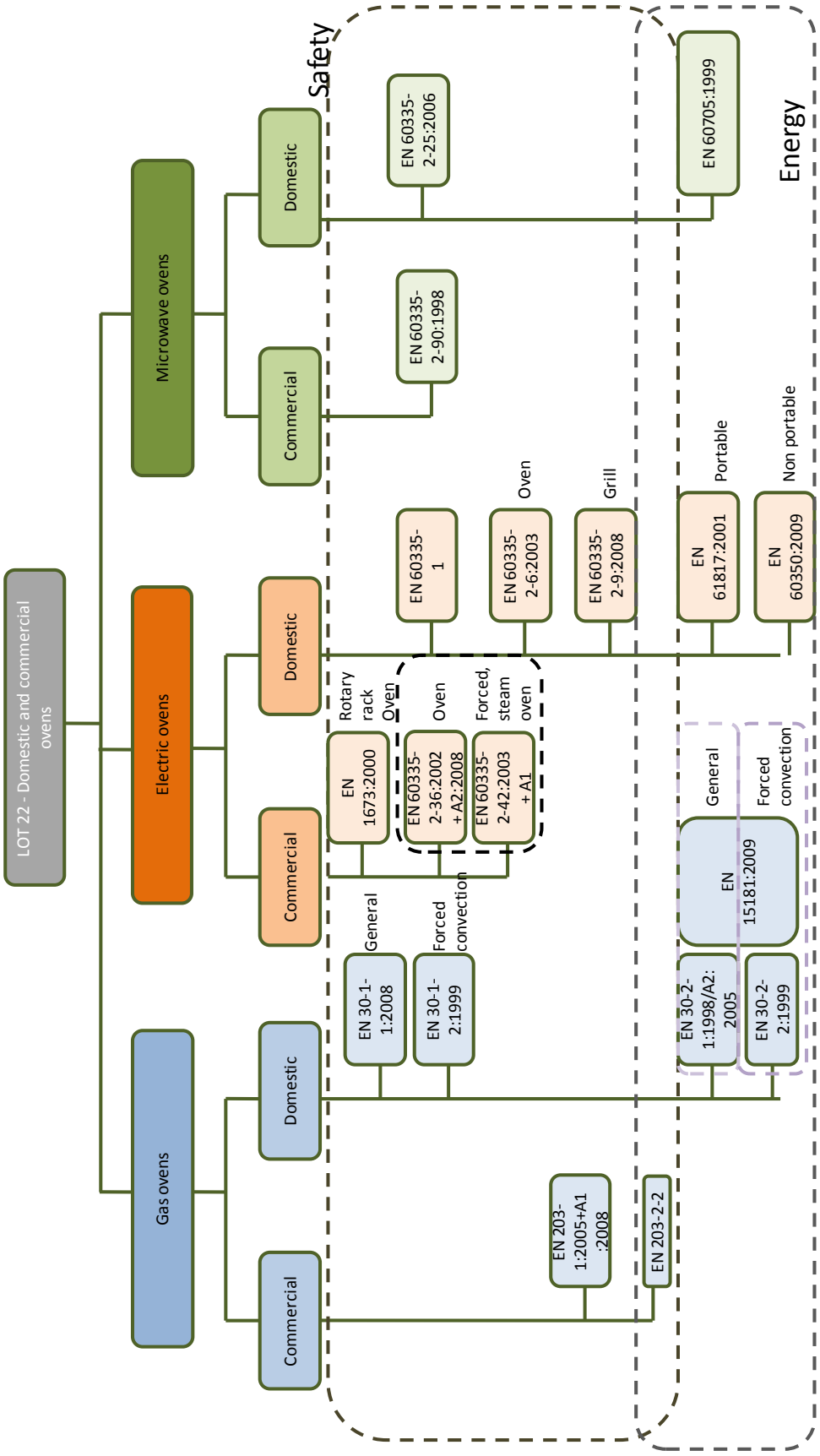


**Figure 1-21: Safety and Energy related standards for domestic and commercial ovens**

Table 1-5 identifies the gaps in current test standards, by showing which categories of ovens (included in the scope of the study) are covered by test standards, which ones are not, and in the case there exists a standard, whether is relevant or not.

**Table 1-5: EU standards covering performance**

| | Gas | | Electricity | | Microwave | |
|---|---|---|---|---|---|---|
| | Domestic | Commercial | Domestic | Commercial | Domestic | Commercial |
| Conventionnal | | | | | NA | NA |
| Fan forced | | | | | NA | NA |
| Toaster | NA | NA | | NA | NA | NA |
| Range | | | | | NA | NA |
| Microwave function | NA | NA | NA | | | |

Covered by a performance standard not approaching real use

Covered by a performance standard approaching real use

Not covered by any performance standard

On the commercial side, as seen in Table 1-5, it seems that standards are lacking for electric commercial ovens. EN 203-2-2 tests the gas consumption to maintain the temperature at 195°C above ambient temperature except for bakery ovens which must maintain 230°C above ambient temperature. However, it seems much less representative of the real life use than the brick test, but the brick test is only used for domestic applications.

Different types of ovens are present in different categories in Table 1-5. Cells are coloured in green if this type of oven is covered by a standard approaching real life use, orange if they are covered by a standard which is not approaching real life use and in crossed cells if it is not covered by any standards. It is apparent that commercial ovens are not covered in the same way as domestic ones are.

### 1.2.2. STANDARDS AT MEMBER STATE LEVEL

Standards published by EU Member States for ovens that do not have European equivalents are presented in Table 1-6 below.

Table 1-6: Member States standards for ovens without European equivalents

| Country | Number | Title |
|---|---|---|
| Netherlands | NEN NPR IEC 61902 | Household microwave ovens - visual clarity of see-through oven doors (equivalent to IEC 61902) |
| Germany | DIN 3360-4 | Gas-appliances; household cooking appliances for gaseous fuels; heating ranges |
| | DIN 3360-12 | Domestic cooking appliances burning gas - part 12: fitness for purpose |
| | DIN 8766 | Limits for waste gas heat losses of baking ovens |
| | DIN 18854 | Equipment for commercial kitchens - multiple deck ovens - requirements and testing |
| | DIN 18873-1 | Methods for measuring of the energy use from equipment for commercial kitchens – part 1: convection steamers |
| | DIN 30694-4 | Built-in appliances for lpg in vehicles; hotplates, ovens, grills, refrigerators and freezers; requirements and testing |
| France | NF CR 1472 | General guidance for the marking of gas appliances |
| | NFD 31 001 | Domestic economy - terminology of home kitchen stoves running of solid fuels, gas or electricity |
| Austria | ÖNORM S 3031 | Commercial catering equipment – range cookers and auxiliaries - definitions, dimensions, materials |
| Belgium | NBN C 73 802 | Methods to be used for measuring energy consumption of electric ovens for household use and for the purpose of informing consumers of it |
| UK | BS 7462:1991 | Specification for electrical safety of domestic gas appliances |

Furthermore, as for April 2011, two DIN standards are being developed to measure the energy efficiency of some types of commercial ovens:

- DIN 18873-4: Methods for measuring of the energy use from equipment for commercial kitchens – part 4: Convection ovens
- DIN 18873-7: Methods for measuring of the energy use from equipment for commercial kitchens – part 7: Multiple deck ovens

These standards should be finalised by the end of year and are intended to be proposed as EN standards.

### 1.2.3. THIRD COUNTRY STANDARDS

National energy performance testing standard exist in Australia, Brazil, Canada, China, Russia, and USA. Some of them are briefly described below.

- **AUSTRALIA/NEW ZEALAND**

  - **AS 1549-1983** Performance of household electrical appliances - Ranges, built-in cooking tops and wall-mounted ovens

The standard AS 1549-1983 specifies requirements for household electric range cookers, both fixed and portable, intended for operation by direct or alternating current at low or medium voltage, including independent ovens and cooking tops. The standard includes provisions related to the construction and finishing of the product and standard methods of testing.

  - **AS/NZS 2895.1:2007** Performance of household electrical appliances - Microwave ovens - Methods for measuring the performance of microwave ovens for household and similar purposes

This standard specifies the reproducible performance measurements of the microwave function for domestic applications from IEC 60705, Ed. 3.2(2006). In particular the principal performance characteristics and procedures for determining external dimensions, useable cavity volume, useable cavity dimensions, microwave power output, efficiency, uniformity of heating and heating of beverages.

  - **AS/NZS 2895.3:2007** Performance of household electrical appliances - Microwave ovens - Part 3: Construction, quality and cooking tests

This standard sets out requirements for microwave cooking appliances using electromagnetic energy in the ISM frequency band 2450 (frequency band around 2.45 GHz, which is the most common frequency for microwave ovens). It specifies requirements for the design and construction, marking and accompanying information, and performance of microwave ovens intended for domestic use. It also describes subjective tests for gauging the cooking and defrosting performance. The cooking and defrosting tests are identical to those of IEC 60705 Ed. 3.2:2006.

This standard deals with the safety of microwave ovens for household use, their rated voltage being not more than 250 V.

- **AS/NZS 3350.2.6:2006** Safety of household and similar electrical appliances - Safety - Particular requirements for stationary range cookers, hobs, ovens and similar appliances

This standard deals with the safety of stationary electric range cookers, hobs, ovens and similar appliances for household use, their rated voltage being not more than 250 V for single-phase appliances connected between one phase and neutral, and 480 V for other appliances. Examples of appliances which are within the scope of this standard are stationary grills; pyrolytic self-cleaning ovens; induction hobs; steam ovens; the electrical part of appliances supplied with energy other than electricity.

- **AS/NZS 4052:1992** Guidance on the use of the substitution method for measurements of radiation from microwave ovens for frequencies above 1 GHz

This standard describes a method of measurement for small microwave ovens (largest dimension less than 1 m) and a separate method of measurement for large microwave ovens (largest dimension exceeding 1 m).

- **AS/NZS 60335.2.25:2002 and its amendments published in 2005, 2006 and 2007** Household and similar electrical appliances - Safety - Particular requirements for the microwave function - IEC 60335-2-25 Ed 5.2

This standard deals with the safety of microwave ovens for household use, their rated voltage being not more than 250 V. This standard also deals with combined microwave ovens.

- **AS/NZS 60335.2.90:2006** Household and similar electrical appliances - Safety - Particular requirements - Particular requirements for commercial microwave ovens

This standard deals with the safety of microwave ovens with a cavity door intended for commercial use, their rated voltage being not more than 250 V for single-phase appliances connected between one phase and neutral and 480 V for other appliances.

- **AS 1681-2002** Safety requirements for electrically heated Type 1 ovens (electrically heated ovens in which the temperature does not exceed 540°C) in which flammable volatiles occur

This standard sets out the requirements for the design, construction and ventilation of electrically heated Type 1 ovens. It also provides guidelines for the location and operation of such ovens.

- **HB 295.3.15-2008 (Australian Handbook)** Product Safety Framework - Melting and dissolving of materials - Microwave oven resistance

This standard is designed to enhance the safe supply, sale and use of microwaves ovens. It provides a verification process that allows for validation. It thus provides a generic hazards-based approach rather than focussing on specific products.

- **CANADA**

The Canadian standard CAN/CSA-C 358-03 establishes the energy consumption test methodology for household electric range cookers with ovens. For ovens, a small test block (at room temperature) is inserted at the geometric centre of the oven. The oven is turned on to normal bake at a temperature rise of 180°C (nominal temperature setting of 205°C). The energy and temperature of the block are noted during the test. The oven is allowed to operate for a full thermostat cycle after the temperature rise has reached 130°C. The energy consumption is then estimated by taking into account the energy consumed during the thermostat cycles before and after the temperature has reached 130°C. The thermal efficiency is determined from the temperature rise of the block (130°C) and the energy used to heat it. The annual energy service (useful output) delivered by an oven is based on US research and is assumed to be 47.09 kWh of delivered heat per year. The oven energy consumption during use is calculated as this value divided by the efficiency determined during the test. The total energy consumption of an oven includes energy during use, energy consumed during self-cleaning (assumed to be 11 times per year) and electric clock energy (measured separately).

- **CHINA**

According to the Asia-Pacific Economic Cooperation, one test standards exist in China for ovens for domestic use:

- **GB 4706.22** Safety of household and similar electric appliances-Particular requirements for stationary range cookers, hobs, ovens, and similar appliances

- **JAPAN**

MEPS also exist in Japan as shown below:

- **JIS S 2103**(gas cooking appliances for home use) is a standard that provides a method for measuring the heat efficiency. It gives energy efficiency standards such as:
  - The maximum energy for built-in ovens should be calculated as follows: 18.6Vo + 83.3 Wh
  - The maximum energy for free-standing ovens should be calculated as follows: 18.6Vo + 306 Wh.

  These are measured with an empty oven raising the temperature by 180°C then maintaining for 20 minutes.

- **RUSSIA**

According to the Russian Federal Agency on Technical Regulating and Metrology, three test standards exist in Russia for household ovens:

- **GOST 14919-83** this standard deals with household electric range cookers, cooking plates and cooking ovens. General specifications (amended on January 1985, February 1985, July 1987, January 1990, July 1991, January 1997, March 1999) include maximum power consumption (in watts).
- **GOST 28398-89** this standard deals with household electric range cookers, cooking plates and cooking ovens. Methods for measuring the performance (related to IEC 60350)
- **GOST 30587-98** this standard deals with electrically operated household food preparation appliances. Measuring methods of operating characteristics (related to IEC 60350 and IEC 60619)GOST R 50696-2006 sets energy performance requirements of domestic cooking appliances using gas. The standard is applicable to appliances with nominal heating capacity of no less than 1.16 kW and no more than 4.2 kW.
    - Performance index of open gas burners should be no less than 52%.
    - Performance index of closed gas burner should be no less than 25% if a cold appliance is tested, 35% if a warm appliance is tested

**SWITZERLAND**

In Switzerland, the tests for commercial steamer ovens are carried out with a standard wet brick and an empty oven, including tests without steam through the ENAK standard. The ENAK standard uses the brick test but for commercial steamer ovens only, not for domestic application as in EN 15181:2009. The ENAK standard includes various tests without steam. The tests are carried out with standard wet brick and empty.

**USA**

The test methods in the USA use aluminium test blocks for oven (and hob) testing. The test is similar to the wet brick test method but uses an aluminium block instead. The oven tests are based on a test block temperature increase of 130°C. The same test method is used for gas and electric ovens. The self-cleaning energy consumption is also tested. Microwaves are tested using a container of water (as specified by IEC 60705). This is measured with an empty oven raised by 180°C then maintained at this temperature for 20 minutes.

### 1.2.4. STANDARDS AT INTERNATIONAL LEVEL

International standards exist for all major appliances, typically originating from industry standards, government agencies, or professional societies, and are eventually adopted by a national or international standardisation body. The leading international

standardisation bodies are the International Standardisation Organisation (ISO) and the International Electrotechnical Commission (IEC).

The performance test standard for electric ovens is included in IEC 60350 (Electric range cookers, hobs, ovens and grills for household use – Methods for measuring performance). Future editions of IEC 60350 will include a performance measurement that could be used for the EU energy label. This standard defines the principal performance characteristics of these appliances and describes the standard methods for measuring these characteristics. This standard does not apply to microwave ovens which are covered by IEC 60705.

### AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM International, originally known as the American Society for Testing and Materials (ASTM), is one of the largest voluntary standards development organisations in the world. It differs from organisations such as BS, DIN and AFNOR, in that it is not a national standards body, that role being taken in the USA by ANSI. Four standards are relevant in the frame of this study:

- **ASTM F 1495-05** Standard Specification for Steam Oven Electric or Gas Fired. This specification covers the material, design, and performance requirements pertinent to the manufacture of commercial forced-air gas-fired and electric steam ovens capable of baking, roasting, rethermalizing, and atmospheric pressure steaming, including low-temperature and bio-steaming.
- **ASTM F2092 - 01(2007)** Standard Specification for Convection Oven Gas or Electric. This specification covers forced air convection ovens for baking, roasting or rethermalizing which utilize gas or electrical heat sources, or both for cooking food in the commercial and institutional food service establishments.
- **ASTM F1639 - 05** Standard Test Method for Performance of steam ovens. The energy input rate test and thermostat calibration are used to confirm that the steam oven is operating properly prior to further testing and to ensure that all test results are determined at the same temperature. Preheat energy and time can be useful to food service operators to manage power demands and to know how quickly the steam oven can be ready for operation. Idle energy rate and pilot energy rate can be used to estimate energy consumption during non-cooking periods. Cooking-energy efficiency is a precise indicator of steam oven energy performance under various loading conditions. This information enables the food service operator to consider energy performance when selecting a steam oven. Production capacity can be used by food service operators to choose a steam oven that matches their food output requirements. Water consumption characterization is useful for estimating water and sewage

costs associated with combination oven operation. Condensate temperature measurement is useful to verify that the condensate temperature does not violate applicable building codes.

- **ASTM F1496 - 99(2005) e1** Standard Test Method for Performance of Convection Ovens.
    - Thermostat Calibration. This test is conducted to ensure that all test results are determined at the same oven cavity air temperature. The results of the following tests can be used by an operator to select a convection oven based on its energy consumption performance or its cooking performance. Also, the results allow an operator to understand an oven's energy consumption.
    - Energy Input Rate. This test is used to confirm the test oven's rated input and to ensure its proper operation during all testing
    - Fan and Control Energy Rate. Information from this test can be used to estimate the cost of electricity required to operate a gas oven. This cost can be added to the cost of gas consumed to estimate the total cost of energy necessary to operate the oven.
    - Pilot Energy Rate. This test provides a measure of a gas oven's energy consumption rate during periods when its burner is not on.
    - Preheat Energy Consumption and Time. This test provides a measure of time and energy required to preheat the oven cavity from ambient temperature to the thermostat set point temperature.
    - Idle Energy Rate. This test provides a measure of an empty oven's energy consumption at a typical cooking temperature setting. It also provides an indicator of the combined effectiveness of components of the oven's design (for example, insulation, door seals, and combustion efficiency) that influence its energy consumption.
    - Cooking Energy Efficiency. This test provides a measure of the oven's energy efficiency while light, medium, and heavy loads are being cooked.
    - Production Capacity. This test provides information that allows an operator to select an oven that matches food output requirements.
    - Cooking Uniformity. This test provides information regarding the oven's ability to cook food at the same rate throughout the oven's cavity.

- White Sheet Cake Browning. This test provides information regarding the oven's ability to brown white sheet cakes uniformly through its cavity.

## 1.3. EXISTING LEGISLATION

The aim of this subtask is to give an overview of existing legislation and voluntary programmes for domestic and commercial ovens included in the Lot 22. Further, this subtask includes a comparative analysis of such legislation in the context of possible future Ecodesign implementing measures.

### 1.3.1. LEGISLATION AND AGREEMENTS AT EUROPEAN COMMUNITY LEVEL

- **EUROPEAN LEGISLATION**

A screening to identify the most relevant EU legislation is presented in Table 1-7 below.

**Table 1-7: Relevant European Legislation identified**

| Scope | Legislation |
|---|---|
| **Environmental Legislation** | |
| Entire Product | Waste Electrical and Electronic Equipment Directive 2002/96/EC |
| | Restriction of the use of certain Hazardous Substances in electric and electronic equipment Directive 2002/95/EC |
| | The REACH regulation, 1907/2006 (superseding the Marketing and Use Directive regarding substance restrictions) |
| **Energy Legislation** | |
| Entire product | Directive 2002/40/EC of 8 May 2002 implementing Council Directive 92/75/EEC, with regard to energy labelling of household electric ovens. |
| Standby and off mode power consumption | Commission Regulation (EC) No 1275/2008 of 17 December 2008 (only for domestic appliances) |
| **Legislation related to Safety** | |
| Entire product | General Product Safety Directive 2001/95/EC |
| | Low Voltage Directive 2006/95/EC |
| | Electromagnetic Compatibility (EMC) Directive 2004/108/EC |
| | Materials and articles intended to come into contact with foodstuffs – Regulation 2004/1935/EC |
| | Appliances burning gaseous fuels 2009/142/EC (ex-90/396/EEC) |

- **WEEE Directive 2002/96/EC**

*Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)*

The Directive applies to the categories of electrical and electronic equipment which are dependent on electric currents or electromagnetic fields in order to work properly and

equipments for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1000 V for alternating current and 1500 V for direct current. Hence, microwave ovens and ovens fall within the scope of this regulation, as the categories "microwaves" and "cooking" are both included in Category I (Large household appliances).

The Directive 2008/34/EC, amending Directive 2002/96/EC, also encompasses the categories "microwaves" and "cooking" in Category I, without major changes for these two categories.

- **RoHS Directive 2002/95/EC**

*Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)*[27]

The Directive applies to the categories of electrical and electronic equipment that are covered by the WEEE directive with the exception of medical devices, and monitoring and control instruments. Microwave ovens and ovens fall within the scope of this regulation, as the categories "microwaves" and "cooking" are both included in Category I (Large household appliances) of Directive 2002/96/EC which is included in the scope of 2002/95/EC. Therefore they must be designed respecting the prescriptions of the RoHS directive.

The directive requires the substitution of four heavy metals (lead, mercury, cadmium, and hexavalent chromium) and two classes of flame retardants; brominated flame retardants (polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)) in new electrical and electronic equipment put on the market from 1 July 2006. The amendments 2005/618/EC, 2005/717/EC, 2005/747/EC, 2006/122/EC, 2008/385/EC, 2009/428/EC, 2009/443/EC, provide new exemptions for applications of lead, cadmium, mercury and hexavalent chromium (some of these exemptions have subsequently expired or been deleted).

- **REACH regulation 1907/2006/EC**

*Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).*

REACH is a new European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. The new law entered into force on 1 June 2007.

The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. At the same time, innovative capability and competitiveness of the EU chemicals industry should be enhanced. The benefits of the REACH system will come gradually, as more and more substances are comprehensively tested as a result of the registration requirements of REACH and restrictions on the most hazardous substances are phased into REACH.

[27] Official Journal(2003) L 37p. 19-23

The REACH Regulation places greater responsibility on industry to manage the risks from chemicals and to provide safety information on the substances they put on the market. Manufacturers and importers will be required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database run by the European Chemicals Agency (ECHA) in Helsinki. The Agency will act as the central point in the REACH system: it will manage the databases necessary to operate the system, co-ordinate the in-depth evaluation of suspicious chemicals and run a public database in which consumers and professionals can find hazard information.

The Regulation also calls for the progressive substitution of the most dangerous chemicals when suitable alternatives have been identified.

REACH provisions are being phased-in over 11 years. Companies can find explanations of REACH on the ECHA website, in particular in the guidance documents, and can contact national helpdesks.

- **Energy Labelling Directive 2002/40/EC**

*Directive 2002/40/EC of 8 May 2002 implementing Council Directive 92/75/EEC, with regard to energy labelling of household electric ovens.*

From all the categories identified in subtask 1.1 and to be covered by Lot 22, electric ovens are the only category currently covered by mandatory energy labelling requirements as set out in Directive 2002/40/EC. The label applies to mains operated household electric ovens, including ovens that are part of larger appliances. It does not include ovens that do not qualify according to the test method because they use alternative energy sources, or those that are small and portable, and it also excludes microwave ovens with combination heating functions. The label shows energy class A to G (for one of the cooking modes) and energy consumption in kilowatt hours (kWh) per cycle for each appropriate mode of heating (conventional, forced air and steam), and the volume of each cavity, as shown in Table 1-8. Other functions (e.g. forced air or hot steam) require a further three runs each. The energy class is selected from the best performing function and appropriate internal volume table (small, medium or large)[28].

[28] MTP(2006) Briefing Note BNCK03: Energy test methodologies for domestic ovens.

Table 1-8: Energy class and Energy Index for electric ovens

| | Small cavities<br>12 to 35 liters | Medium cavities<br>35 to 65 liters | Large cavities<br>Greater than 65 liters |
|---|---|---|---|
| **Energy efficiency class** | **kWh (Energy Index)** | **kWh (Energy Index)** | **kWh (Energy Index)** |
| **A** | <0.60 | <0.8 | <1.0 |
| **B** | 0.6-0.8 | 0.8-1.0 | 1.0-1.2 |
| **C** | 0.8-1.0 | 1.0-1.2 | 1.2-1.4 |
| **D** | 1.0-1.2 | 1.2-1.4 | 1.4-1.6 |
| **E** | 1.2-1.4 | 1.4-1.6 | 1.6-1.8 |
| **F** | 1.4-1.6 | 1.6-1.8 | 1.8-2.0 |
| **G** | >1.6 | >1.8 | >2.0 |

In addition to helping consumers compare appliances, energy labels can also help to drive improvements in product performance through market competition. Currently, there is no mandatory EU label for gas ovens. There is a review of the EU energy labelling Directive within the EU and the expectation is that gas ovens might be a prime candidate for a new energy label. The question of whether the label will be able to provide a direct comparison between gas and electric ovens also needs to be analysed. A straight comparison of the kWh consumption would give an impression that gas ovens are less efficient. On the other hand, a comparison of $CO_2$ emissions would show gas appliances to be more carbon efficient mainly because they use a primary energy source[29].

Furthermore, a horizontal measure on standby power consumption adopted under the Ecodesign Directive includes electric ovens. Action to reduce standby power consumption in ovens, which the UK MTP estimates to be at around 5 watts for 60% of new appliances, to 1 watt by 2015 would give a saving of 191 GWh in 2020[30].

- **Standby and off mode power consumption Regulation 1275/2008**

*Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment*

The Directive 2005/32/EC sets ecodesign requirements by the Commission for energy-using products representing significant volumes of sales and trade, having a significant

[29] MTP(2006) Briefing Note BNCK02: Energy label for domestic ovens.
[30] DEFRA (2008) « Policy Brief: Improving the energy performance of domestic cooking products", available at:www.mtprog.com/spm/files/download/byname/file/2006-07-10%20Policy_Brief_Domestic_Cooking%20fin.pdf

environmental impact and presenting significant potential for improvement in terms of their environmental impact without entailing excessive costs.

This Regulation establishes ecodesign requirements related to electric power consumption in no-load condition and average active efficiency of external power supplies. It sets a few specifications for the maximum Power Output for different power output categories, as well as specifications the measurements, as shown in Table 1-9.

**Table 1-9: Ecodesign requirements for standby and off mode electricity consumption**

| | | January 2010 | January 2013 |
|---|---|---|---|
| **Standby mode** | **Reactivation function only function** | 1.00 W | 0.50 W |
| | **Reactivation function and status display** | 2.00 W | 1.00 W |
| **Off mode** | | 1.00 W | 0.50 W |

Only domestic appliances are covered by the Standby Regulation.

- **General Product Safety Directive 2001/95/EC**

*Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on General Product Safety*

The purpose of this directive is to ensure that products placed on the market are safe. The GPSD 2001/95/EC is designed to protect consumers from unsafe products. These harmonized standards and essential requirements must be met for products to be placed in the European Economic Area. Some examples of products that fall under this directive include sports equipment and household products. Specifically, any product that will be used by consumers or may be used by them unintentionally must comply with this directive.

A "safe" product is defined in this directive as any product, when used under normal circumstances, that does not contain any risk to the users or the risks are minimized that is compatible with the product's use. The product will undergo a safety assessment, and only when the product is deemed ''safe'' will it be allowed to be placed in the European Economic Area. Along with this, producers must provide the necessary information on the product warning the user of the risks associated with the product.

- **Low Voltage Directive (LVD) 2006/95/EC**

*Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to Electrical Equipment designed for use within certain voltage limits.*

The Directive applies to all electrical equipment designed for use with a voltage rating[31] 50 – 1000 V ac and 75 – 1500 V dc. It requires products to have protection against hazards that could arise from within the product itself or from external influences. All risks arising from the use of electrical equipment, including mechanical, chemical, and all other risks. Noise and vibration, and ergonomic aspects, which could cause hazards, are also within the scope of the directive.

- **Electromagnetic Compatibility (EMC) Directive 2004/108/EC**

*Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC*

This Directive regulates the electromagnetic compatibility of equipment. It aims to ensure the functioning of the internal market by requiring equipment to comply with an adequate level of electromagnetic compatibility.

- **Appliances burning gaseous fuels 2009/142/EC (ex-90/396/EEC)**

*Directive 90/396/EEC of 29 June 1990 on the approximation of the laws of the Member States relating to appliances burning gaseous fuels. Directive 2009/142/EC replaced the previous version of 1990 and entered into force on the twentieth day following its publication on 16 December 2009 in the Official Journal.*

European Council Directive 90/396/EEC ('the Gas Appliance Directive') relating to appliances burning gaseous fuels was adopted in 1990. It is based on the New Approach and contains essential requirements that an appliance must meet when it is placed on the European market. The Directive does not indicate how these requirements must be met, thus leaving flexibility to manufacturers as regards technical solutions to be adopted.

This Directive addresses the category of gas ovens.

- **Materials and articles intended to come into contact with foodstuffs – Regulation 2004/1935/EC**

*Directive 89/109/EEC of 21 December 1988 on the approximation of the laws of the Member States relating to materials and articles intended to come into contact with foodstuffs. The directive has been repealed by the recent Framework Regulation 2004/1935/EC (published in the EU Official Journal on 13 November 2004).*

This Directive applies to materials and articles which, in their finished state, are intended to be brought into contact with foodstuffs or which are brought into contact with foodstuffs and are intended for that purpose, referred to as 'materials and articles'.

[31] Voltage ratings refer to the voltage of the electrical input or output, not to voltages which may appear inside the equipment.

Covering or coating substances, such as the substances covering cheese rinds, prepared meat products or fruits, which form part of foodstuffs and may be consumed together with those foodstuffs, are not subject to this Directive.

This concerns, among others, metals and alloys, products that are part of the composition of an oven and could come into contact with food.

### 1.3.2. LEGISLATION AND AGREEMENTS AT MEMBER STATE LEVEL

This subtask identifies if some Member States have developed specific legislation and voluntary agreement for ovens. For example, in United Kingdom, the following programmes can be applicable to ovens:

- **GERMANY**
  - Blue Angel Ecolabel

The Blue Angel is the first and most well-known eco-label worldwide. Since 1978 it has set the standard for eco-friendly products and services selected by an independent jury in line with defined criteria. The Blue Angel is awarded to companies as kind of a reward for their commitment to environmental protection. They use it to professionally promote their eco-friendly products in the market. The Blue Angel is an ecological beacon showing the consumer the way to the ecologically superior product and promotes environmentally conscious consumption.

There are three Blue Angel label applicable to appliances under the scope of Lot 22:

- Blue Angel RAL-UZ 139, for stand-alone gas-fired cooking appliances
- Blue Angel RAL-UZ 143, for electric household ovens
- Blue Angel RAL-UZ 179, for microwave ovens and combination microwave ovens for household use.

The requirements of these three standards are available in Annex 1.

- **UNITED KINGDOM**
  - **Sustainable Products and Materials Programme (Market Transformation Programme)**

There are developments in progress to limit standby power of electric ovens (see Figure 1-22 for UK scenarios for standby power consumption of new electric ovens to be sold in the UK[32]).

[32] DEFRA(2008): Policy Brief: Improving the energy performance of consumer electronics products p. 10

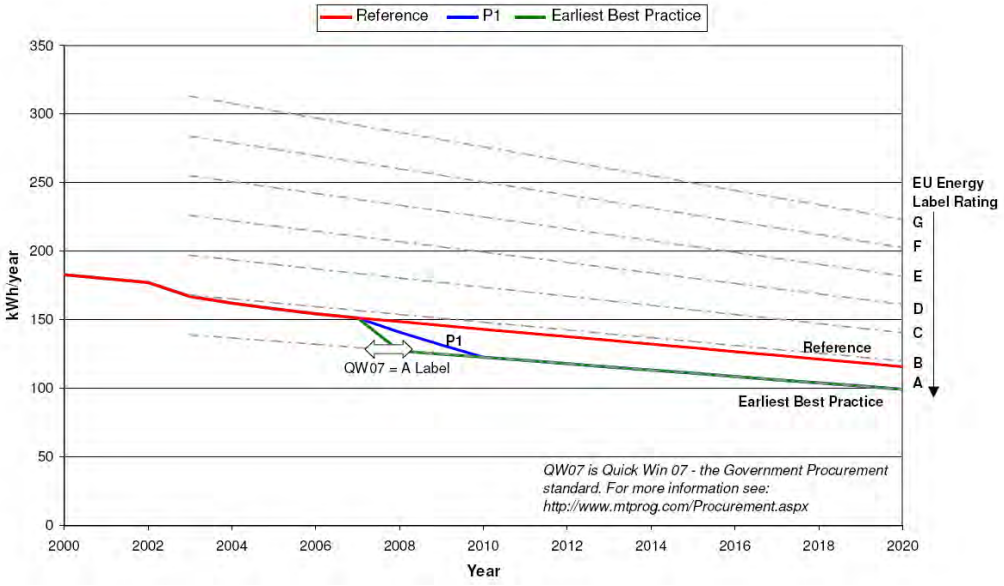


**Figure 1-22: Indicative average power consumption for new electric ovens (on mode, kWh/year)**

- **Energy Saving Recommended (ESR) scheme:** The Energy Saving Trust (EST)'s ESR scheme is a voluntary labelling scheme that endorses products that comply with specified product performance criteria. It serves as recognition of manufacturers' efforts towards efficiency best practice and as a straightforward consumer label. ESR aims to update all criteria annually to ensure the standards are moving with the market place. It currently only covers kettles and instantaneous water heaters, but might be extended to electric oven and microwave oven in the future[33].

### 1.3.3. THIRD COUNTRY LEGISLATION AND INITIATIVES

An overview of Minimum Energy Performance Standards (MEPS), labels, and test standards by economy is included in Table 1-10 (source: www.apec-esis.org).

**Table 1-10: Overview of MEPS, labels and test standards by country for ovens**

| Economy | Minimum Standard | Labelling | National Test Standard | Reference Test Standard |
|---|---|---|---|---|
| Australia | U | | AS 1549-1983 | |
| Brazil | Ym | Ym | | |
| Canada | Ym | Ym | CAN/CSA-C 358-95 | |
| China | | Yv | GB 4706.22 | |
| Chinese Taipei | | Yv | | |
| Costa Rica | Ym | Ym | | |
| Japan | Ym | Ym | JIS S 2103 | |
| Korea | | Yv | | |
| Russia | Yv | Yv | GOST 14919-83 | |

[33] Energy Saving Trust's(2008) available at: www.energysavingtrust.org.uk/energy_saving_products/

| Economy | Minimum Standard | Labelling | National Test Standard | Reference Test Standard |
|---|---|---|---|---|
| | | | GOST R 51388-99 | |
| USA | Yv | Yv | 10 CFR Part 430 Subpart B App I | IEC 60705 |
| California | | Ym | Appliance Efficiency Regulations | |
| International | Yv | Yv | | ASTM F 1495-05 ASTM F2092-01(2007) ASTM F1639 ASTM F1496 - 99(2005)e1 |

**Yv** = Yes, voluntary; **Ym** = Yes, mandatory; **U** = under consideration

Minimum energy performance standards are applied in Australia, Canada, Costa Rica, Israel and Chile (voluntary standards), Russia, and USA (mandatory). Most of the third country identified legislations are mandatory Minimum Efficiency Performance Standards (MEPS). The aim of MEPS is to remove the least efficient appliances from the market. Specific test standards for energy consumption measurement are sometimes imposed in these MEPS.

- **AUSTRALIA**

In Australia, in 2002, the Ministerial Council on Energy released "Money isn't all you're saving" a long-term strategy to address excessive standby energy used by consumer appliances and equipment. This strategy is also known as the "1 Watt" standby power plan. For the moment this covers microwave ovens and gas ovens. In accordance with the National Standby Strategy, the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) recommended to the Ministerial Council on Energy an 'interim' target, the purpose of which was to provide governments with confidence that Australian products would meet the ultimate target, of one watt in 2012. If the 'interim' target is not met in the specified year, government will commence dialogue with industry to explore other options, including the possibility of moving to Stage 2 mandatory measures[34].

- The interim target was a passive standby power consumption of less than 4 watts by 2007
- The ultimate target is a passive standby power consumption of less than 1 watt by 2012

This target applies to all microwave ovens brought into Australia for sale in that year.

[34] www.energyrating.gov.au/library/detailssb200304-microwaves.html

- **BRAZIL**

In Brazil, energy labelling is already implemented in a voluntary or mandatory mode for gas cooking appliances. The oven gas consumption index is calculated as follows:

Ic (%) = 100 * (measured gas consumption for oven 210 ºC temperature maintenance) / (maximum admissible gas consumption for oven temperature maintenance calculated by the standard). In the particular case of natural gas ovens, the gas consumption is the following:

Ic (%) = 100 * (C/0.0903) / (0.93+0.035*V) where C is the gas consumption in kg/h and V the volume in liters.

This gives a percentage that helps determining a category as shown in Table 1-11. Categories F and G have not been allowed to be produced since 2008.

**Table 1-11: Energy labels for gas ovens according to gas consumption.**

| Energy Efficiency | Oven Gas Consumption Index *Ic* (%) | Label Classification Levels |
|---|---|---|
| More Efficient | ≤ 51 | A |
| | ≤ 55 | B |
| | ≤ 59 | C |
| | ≤ 63 | D |
| Less Efficient | ≤ 67 | E |

- **CANADA**

Canada has mandatory Minimum Energy Performance Standard (MEPS) applied to household range cookers that are:

- free-standing appliances equipped with one or more surface elements and one or more ovens
- built-in appliances equipped with one or more surface elements and one or more ovens
- built-in appliances equipped with one or more ovens and no surface elements wall-mounted appliances equipped with one or more ovens and no surface elements
- counter-mounted appliances equipped with one or more surface elements and no ovens.

Canadian MEPS do not cover the following:

- microwave cooking appliance
- appliances designed for an electrical supply of 120 volts
- household appliances with one or more tungsten-halogen heating elements.

The Canadian MEPS are as shown in Table 1-12 below:

Table 1-12: Canadian legislation for ovens

| Product category | Maximum E (August 1, 2003) |
|---|---|
| **Range cookers:** Free-standing or built-in cookers with one or more surface elements and one or more ovens | 2.0*V + 458 |
| **Ovens:** Built-in or wall-mounted range cookers without surface elements and with one or more ovens | 2.0*V + 200 |

Where:

V = Volume of oven in litres

E = Maximum allowable energy consumption in kWh/year

Furthermore, the EnerGuide Program for Cooktops & Ranges/Ovens was introduced in 1995. For the purposes of energy efficiency labelling, it is mandatory that the annual energy consumption value, which will appear on the EnerGuide label for electric range cookers shall be determined using the CAN/CSA-C358-95 energy performance test procedure.

- **CHINA**

The State Economic and Trade Commission (SETC) and the China State Bureau of Quality and Technical Supervision (CSBTS) together established the China Certification Centre for Energy Conservation Product (CECP) to promote advanced energy conservation technology and the wide use of high efficiency products on October 1998. The name of the organization was changed to China Standards Certification Center in 2005. In 2008, certification authority passed to the China Quality Certification Center.

The basic requirement for certification is to meet the product requirements in quality, safety and environment standards etc. Microwaves are within the scope of this voluntary labelling programme.

- **Chinese Taipei**

The Green Mark Program was launched in 1992 by Taiwan's Environmental Protection Administration as a voluntary and positive ecolabeling program. The mission of the Green Mark is to "promote the concept of recycling, pollution reduction, and resource conservation." The program is currently administered by the Environment and Development Foundation (EDF), a private institution. The program applies to household microwave ovens which are used for heating food using a microwave source at 2450MHz. The following criteria apply:

1. Products shall have a power output less than 1.5kW, and include products with either internal electrical heating elements or steam generation devices.
2. Products shall have an energy efficiency (E.F.) equal to or greater than 55%.
3. Products shall pass an electromagnetic field uniformity test. The test shall be carried out by heating four beakers filled with 500ml water each for a definite

period of time. The difference between the highest and the lowest measured temperature readings from these four beakers shall be equal to or less than 2°C.

4. Products shall have a maximum allowable microwave leakage equals to or less than 0.4mW/cm$^2$.
5. The product or the packaging material shall bear a seal reading "energy saving".
6. The name and address of the Green Mark user must be clearly printed on the product or on the packaging material. For non-manufacturing Logo users, the manufacturer's name and address shall also be shown.

- **COSTA RICA**

The Direccion Sectorial de Energia del Ministerio de Ambiente y Energia MINAE (Energy Department in the Ministry of Environment and Energy is responsible for the program. The Ministry inspectors or those from the Ministry of Economy, Industry and Commerce (MIEC) carry out testing of products. Labels must be placed on products prior to leaving the factory or customs. Non-compliance results in a fine of 25% of the product sale price. The label displays the products' energy consumption and the required MEPS level for that appliance.

- **JAPAN**

Top Runner is a Japanese programme in which energy consumption of domestic gas cooking appliances and microwave ovens, among others, is tackled. The product on the market with the highest energy efficiency (the Top Runner) sets the standard. The Top Runner Programme triggers the race for the top among manufacturers. The necessity of meeting the Top Runner Programme provided companies with an incentive to use the technologies, which they may otherwise have waited to commercialise. Top Runner is mandatory but is not a MEPS (Minimum Efficiency Performance Standard). Manufacturers and importers are under the obligation to comply with the standards by Energy Conservation Law. Enforcement within the Top Runner Programme relies on "blame and shame" which works well in Japan with Japanese manufacturers and importers. Most appliances and vehicles in Japan are provided by Japanese domestic manufacturers and importers. For non compliance, the following penalties are executed:

- Publication of the name of the company
- A fine.

There is a mandatory labelling programme in the frame of the Top Runner Programme. The following information shall appear on the label:

- Fiscal year of the label
- Manufacturer and model
- Expected annual electricity bill with the concerned device

- Energy rating system.

### KOREA

The “e-Standby Program” has been implemented since April 1, 1999 for the purpose of enhancing the spread of energy-saving products that provide a decreased electricity consumption in standby mode. This is a voluntary labelling scheme supported by the Ministry of Commerce, Industry and Energy (MOCIE) and the Korea Energy Management Corporation (KEMCO). Microwave ovens are one of the 18 product groups covered by this programme. The e-Standby Program is managed according to the long-term road map, “Standby Korea 2010,” which details the three stages of the “1W initiative,” that is designed to reduce standby power usage to below 1W by 2010. The first stage was the “Voluntary 1W Policy”, implemented from 2005 to 2007, under which manufacturers were encouraged to adopt the standard under their own volition. The second stage is the “Preparation for Transition to a Mandatory 1W Policy” from 2008 to 2009, during which manufacturers will be prepared to adopt the standard as compulsory. From 2010, the “Mandatory 1W Policy” - the ultimate goal of the road map - will be implemented as the final stage.

The programme encourages the adoption of energy saving modes while the appliances are idle and the minimization of standby power. An Energy Boy label is attached to those products that meet the standards for standby power. It is the core programme to reduce standby power below 1W by 2010.

Currently, it is a voluntary programme however, from 2010 onwards, when the amendment of the Rational Energy Utilization Act is completed, the amended Act will include provisions that make standby power reporting mandatory as well as the mandatory indication of warning labels on appliances that fall below the standby power standards.


**Figure 1-23: Korean Energy-Saving Label – “Energy Boy”**

### RUSSIA

GOST R 51388-99 (Energy conservation - Informing of consumers about energy efficiency of equipment in the residential sector - general requirements) lays down the rules for delivering the information about energy performance of domestic electric appliances to consumers. The standard determines general requirements, rules and

volume of the information to be delivered to consumers as well as energy performance classes, indices of saved energy costs, and other parameters of appliances. Electric range cookers and ovens are in the list of domestic electric appliances which require a labelling scheme. Information about efficiency performance is delivered by providing an energy performance label, which contains indicators of energy efficiency and data on compliance of these indicators with requirements of respective standards. Energy Labels are assigned to the appliances for a period of three years at maximum. The indicators of energy performance of appliances are described in GOST R 51541-99 (Energy conservation - Energy efficiency - Composition of indicators - Basic concepts).

GOST 14919-83 sets energy performance requirements of domestic electric range cookers, cooking plates and cooking ovens. An average consumed power can be calculated according to a formula that includes the size, the number of cycles and the time.

- **USA**

Executive Order 13221 Energy Efficient Standby Power Devices, signed July 31, 2001, requires that Federal agencies purchase commercially-available products with low standby power. The DOE's Federal Energy Management Program (FEMP) therefore issues standby power recommendations for microwave ovens, presented in Table 1-13.

**Table 1-13: FEMP Recommendations for Microwave Ovens**

| Microwave Oven Classification | Standby Power (W)* |
|---|---|
| Standard Microwave Oven | ≤ 2 |

* Based on test procedures specified in IEC 62301

- **CALIFORNIA (USA)[35]**

On top of the national programme, the California Energy Commission adopted the Appliance Efficiency Regulations on October 10, 2007. The Appliance Efficiency Regulations include standards for both federally-regulated appliances and non-federally-regulated appliances. The standards within these regulations apply to appliances that are sold or offered for sale in California, except those sold wholesale in California for final retail sale outside the state and those designed and sold exclusively for use in recreational vehicles or other mobile equipment. Microwave ovens, domestic ovens and commercial convection ovens are included in California's Appliance Efficiency Regulations.

For consumer products, the following information needs to be displayed:

- Type
  - Conventional range cooker,
  - Conventional oven,

[35] California Energy Commission(2007), Appliance Efficiency Regulations

- Microwave oven,
- Microwave/conventional range cooker.

- Energy Source
  - Gas,
  - electric,
  - microwave.
- Electrical Supply Cord (for gas models only)
  - Yes
  - No
- Constant Burning Pilot Light
  - Yes
  - No
- Annual Cooking Energy Consumption
- Annual Self-Cleaning Energy
- Consumption (for conventional ovens only)
- Total Annual Energy Consumption (for conventional ovens only)
- Clock Power Consumption (for gas conventional ovens only)
- Pilot Light Consumption (for gas conventional ovens only)
- Consumer Product
- Annual Secondary Energy Consumption(for gas conventional ovens only)

For commercial convection ovens, the following information needs to be displayed:

- Energy Input Rate
- Idle Energy Consumption Rate

### 1.3.4. SUMMARY OF INTERNATIONAL LEGISLATION

Table 1-14 below gives an overview of the different legislations regarding ovens.

**Table 1-14: Comparison of legislation by country**

| Economy | Year adopted | Product category | Performance criteria | Test Standard | Performance value |
|---|---|---|---|---|---|
| Australia | 2002 | Microwave ovens<br>Gas ovens | Standby power | | 2007 : 4W<br>2012: 1W |

| Economy | Year adopted | Product category | Performance criteria | Test Standard | Performance value |
|---|---|---|---|---|---|
| Brazil | 2001 | Gas ovens (mandatory) Microwave ovens (voluntary) | Gas energy consumption | NBR 13723: 2003 (Part 2) | Ic(consumption index)<br>A: Ic<51<br>B:51<Ic<55<br>C:55<Ic<59<br>D:59<Ic<63<br>E:63<Ic<67 |
| Canada | 1995 | Range cookers/ovens | Energy consumption (test) | CAN/CSA-C 358-95 | Maximum energy:<br>Range Cookers:<br>E=2*V+458<br>Ovens: E=2*V+200 |
| China | | Yv | | GB 4706.22 | |
| Chinese Taipei | 1992 | Microwave ovens | Energy efficiency | | Output<1.5 kW<br>Efficiency>55% |
| Costa Rica | 1996 | Ovens | | | |
| Japan | 2003 | | Energy efficiency | JIS S 2103 | Minimum energy efficiency requirements:<br>with no ovens: E=60.1<br>with oven:<br>exposed heater: E=73.4 if V<30l and E=76.2 if V>30l<br>without:<br>E=70.4 if V<30l and<br>E=79.6 if V>30l<br>fan forced: E=73.5 |
| Korea | 1999 | Microwave ovens | Standby power | | 1 W |
| Russia | 1983 | Cooking ovens, range cookers | Average consumed power(test) | GOST 14919-83 GOST R 51388-99 | Total power consumed (W) no more than 3 to 9 W (depending on the dimensions and features), no more than 2 to 8 W (depending on the dimensions and features) |
| USA | 1998 | A:Electric ovens, with self-cleaning function B:Electric ovens, with self-cleaning function C:Microwave ovens | Annual energy consumption | 10 CFR Part 430 Subpart B App I , IEC 60705 | Annual energy consumption |
| California | 2007 | Microwave ovens Conventional | Total Annual Energy Consumption (for conventional | | |

| Economy | Year adopted | Product category | Performance criteria | Test Standard | Performance value |
|---|---|---|---|---|---|
| | | ovens<br>Convection ovens<br>Range cooker | ovens only)<br>Clock Power Consumption (for gas conventional ovens only)<br>Pilot Light Consumption (for gas conventional ovens only)<br>Annual Secondary Energy Consumption (for gas conventional ovens only)<br>Energy Input Rate<br>Idle Energy Consumption Rate | | |

There are obvious differences between all these standards. The scope, focus, and test standards of the different legislations are different which make any comparison impossible.

## 1.4. CONCLUSIONS TASK 1

The scope is defined in Subtask 1.1 in order to determine which appliances are covered by Lot 22, and products which have an overlap with other Lots (e.g. grill ovens could also be in Lot 23). The preliminary scope boundary for the lot 22 study is restricted to commercial and domestic ovens using electricity (including microwaves) and gas. The scope of products investigated in this study will be further refined on the basis of Tasks 2 and 3 and will be finalised in consultation with the Commission and the stakeholders.

Most test standards related to ovens deal with safety and environment. A first analysis of the existing test standards reveal that standards are lacking for commercial ovens. EN test standards for domestic ovens will be used in the framework of this study.

Various legislations exist throughout the world but a direct comparison between these is difficult as the scope and applicable test standards are different.

## ANNEX I – BLUE ANGEL LABELS

- **BLUE ANGEL RAL-UZ 139:**

These Basic Award Criteria apply to domestic stand-alone gas-fired cooking appliances (gas burner on a stainless-steel or steel-enamel hob or on a glass ceramic cooktop) as well as to appliance combinations of gas-fired cooking appliance and gas oven and those of gas-fired cooking appliance combined with an electric oven using natural gas (type H). Exempt from the award of an Blue Angel eco-label under these Award Criteria are: gas-fired cooking appliances with the gas burner arranged underneath a glass ceramic plate. The Blue Angel eco-label for gas cookers and gas-fired cooking appliances may be awarded to apparatuses featuring the following environmental properties:

- ENERGY CONSUMPTION OF THE APPLIANCES: The power consumption of the cooker or cooking appliance in Off mode and in standby mode shall not exceed 1 watt. If, however, the apparatus provides a continuous information or status display (e.g. timer or clock), possibly combined with a reactivation function, power consumption shall not exceed 2 watts. The product documentation shall give the appliance's energy consumption data in each mode.
- ENERGY CONSUMPTION OF GAS COOKERS/GAS-FIRED COOKING APPLIANCES: The appliances must meet the requirements of DIN EN 30-2-1 and DIN EN 30-2-2 with regard to a rational use of energy. In addition, the burner shall provide an efficiency of at least 55%.
- ENERGY CONSUMPTION OF ELECTRIC OVENS: If a gas-fired cooking appliance is combined with an electric oven it must meet the energy consumption requirements for appliances rated A in energy efficiency class as specified in EU Directive 2002/40/EC and provide a circulating-air or hot-air function. In addition, the average energy consumption in conventional and circulating-air/hot-air heating modes in kWh – based on standard load in accordance with DIN EN 50304 - shall not exceed the following values:
  - Average-sized ovens: 35 l ≤ volume < 65 l: 0.84 kWh
  - Large-sized ovens: 65 l ≤ volume: 1.00 kWh
- LONGEVITY: The applicant undertakes to make sure that the supply of spare parts for a repair of the appliances is guaranteed for at least 12 years following the termination of production. Spare parts are functional parts and components for direct operation. Aesthetic components shall be exempt from this requirement. The product documentation shall include information on the above requirements.
- PLASTICS (CASES AND CASE PARTS): The plastics must not contain as constituent parts any substances classified as:

  a) carcinogenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

b) mutagenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

c) reprotoxic in categories 1 and 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

d) persistent, bioaccumulative and toxic (PBT substances) or very persistent and very bioaccumulative (vPvB substances) according to the criteria of Annex XIII to the REACH Regulation or particularly alarming for other reasons and included into the List (so-called list of candidates) set up in accordance with REACH, Article 59, paragraph 1.

Halogenated polymers shall not be permitted. Neither may halogenated organic compounds be added as flame retardants. Moreover, additions of flame retardants labelled with the Risk Phrase R 50/53 pursuant to Table 3.2 of Annex VI to EC Regulation 1272/2008 shall not be permitted. The following shall be exempt from this rule:

- process-related, technically unavoidable impurities;
- fluoroorganic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent;
- plastic parts weighing less than 25 grams.

- ORGANIC SOLVENTS IN PAINTS AND VARNISHES USED FOR CASE COATINGS: Moreover, the organic solvent content of paints and varnishes used in case coatings must not exceed 250 mgl. Calculation shall be based on the following formula:

$$VOC\ value\ [g/l] = \frac{mass\ of\ volatile\ components\ [g] - mass\ of\ water\ [g]}{volume\ of\ coating\ material\ [l] - volume\ of\ water\ [l]}$$

The volatile organic compounds (VOC) content of coating materials equals the mass of volatile components without water in relation to the volume of the coating material minus the volume of the water contained therein. The VOC value refers to the ready-touse coating material, including the dilutions prescribed or recommended by the varnish manufacturer. The terms are defined in accordance with DIN 55945 "Paints and varnishes - Terms and definitions for coating materials". Painting plants equipped with waste-gas treatment systems meeting the requirements of TA Luft (German Technical Instructions on Air Quality Control) shall be exempt from these requirements.

- INSULATING MATERIALS: With respect to the fibrous insulation materials used (mineral wool, glass wool, rock wool) according to DIN 51001 a test certificate shall be presented proving that the carcinogenicity index of the products concerned KI equals or exceeds 40 and, hence, the insulating materials used need not be classified as carcinogenic or suspected of causing cancer according to the current classification scheme of TRGS 905. Ceramic mineral fibres, i.e. glassy

(silicate) fibres with an alkali metal oxide and earth alkali metal oxide content ($Na_20 + K_20 + Ca0 + Mg0 + Ba0$) of less than or equal to 18 weight percent must not be used.

- FORMALDEHYDE EMISSIONS OF OVENS: When heating the oven for the first time the formaldehyde concentration must not exceed 0.3 ppm in the indoor air (air change rate: 1h), and it must not exceed 0.1 ppm during repeated heating. If the formaldehyde concentration does not exceed 0.2 ppm during the initial heating no second heating cycle will be required.
- SAFETY: Ovens with a viewing window must not pose a safety hazard due to window surface temperatures being too high. The glass viewing window must meet the requirements of DIN 60335.
- CONSUMER INFORMATION ON ENERGY-EFFICIENT COOKING AND BAKING: Comprehensible and detailed printed Operating Instructions and Product Information shall be enclosed with the product.
    - The energy consumption of the appliances greatly depends on the user behaviour. In addition to the above-mentioned information, the product documentation shall analogously at least include the following instructions for an energy-efficient use of the appliance or energy-efficient cooking and baking, respectively:
    - The diameter of the cookware should match the diameter of the respective cooking zone. Cook with a lid on the pot and – depending on the cooking method – with as little liquid as possible.
    - Use a pressure cooker for dishes requiring long cooking times.
    - Information on energy-saving preheating of the oven.
    - The circulating-air/hot-air function of the oven should be used, where possible.
    - Make use of the residual heat and turn off the oven about 5 to 10 minutes before the end of the cooking or baking time.
    - To ensure the readability of the consumer information (font size, spacing, etc.) it should comply with DIN EN 62079.

**BLUE ANGEL RAL-UZ 143:**

These Basic Award Criteria apply to Electric Household Ovens. The Blue Angel eco-label for electric ovens may be awarded to appliances featuring the following environmental properties:

- POWER CONSUMPTION IN STANDBY AND OFF MODE: The power consumption of the oven in standby and Off mode shall not exceed 0.5 watts.
- ENERGY CONSUMPTION IN ON MODE: The oven shall meet the energy consumption requirements set forth in EU Directive 2002/40/EC for appliances rated energy

efficiency class A and provide both the conventional heating function and the forced-air circulation function. Moreover, the average power consumption in the conventional heating mode an in convection/hot-air circulation mode in kWh shall not exceed the following values:

- small ovens: 12 l ≤ volume < 35 l: 0.62 kWh
- medium ovens: 35 l ≤ volume < 65 l: 0.82 kWh
- large ovens: 65 l ≤ volume: 1.00 kWh

- LONGEVITY: The applicant undertakes to make sure that the provision of spare parts for appliance repair is guaranteed for at least 10 years following the termination of production. Spare parts are those parts which, typically, may break down within the scope of the ordinary use of a product - whereas those parts which normally exceed the life of the product are not to be considered as spare parts. Aesthetic components shall be exempt from this requirement. The product documentation shall include information on the above requirements.
- MATERIAL REQUIREMENTS FOR PLASTICS USED IN CASES, CASE PARTS AND OPERATING CONTROLS: The plastics must not contain as constituent parts any substances classified as:

  a) carcinogenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/20087,

  b) mutagenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

  c) reprotoxic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

  d) persistent, bioaccumulative and toxic (PBT substances) or very persistent and very bioaccumulative (vPvB substances) according to the criteria of Annex XIII to the REACH Regulation or particularly alarming for other reasons and included into the List (so-called list of candidates8) set up in accordance with REACH, Article 59, paragraph 1.

  Halogenated polymers shall not be permitted. Neither may halogenated organic compounds be added as flame retardants. Moreover, additions of flame retardants labelled with the Risk Phrase R 50/53 pursuant to Table 3.2 of Annex VI to EC Regulation 1272/2008 shall not be permitted. The following shall be exempt from this rule:

  - process-related, technically unavoidable impurities;
  - fluoroorganic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent;
  - plastic parts weighing less than 25 grams.

- ORGANIC SOLVENTS IN PAINTS AND VARNISHES USED FOR CASE COATINGS: Moreover, the organic solvent content of paints and varnishes used in case coatings must not exceed 250 mgl. Calculation shall be based on the following formula:

$$VOC\ value\ [g/l] = \frac{mass\ of\ volatile\ components\ [g] - mass\ of\ water\ [g]}{volume\ of\ coating\ material\ [l] - volume\ of\ water\ [l]}$$

  The volatile organic compounds (VOC) content of coating materials equals the mass of volatile components without water in relation to the volume of the coating material minus the volume of the water contained therein. The VOC value refers to the ready-touse coating material, including the dilutions prescribed or recommended by the varnish manufacturer. The terms are defined in accordance with DIN 55945 "Paints and varnishes - Terms and definitions for coating materials". Painting plants equipped with waste-gas treatment systems meeting the requirements of TA Luft (German Technical Instructions on Air Quality Control) shall be exempt from these requirements.

- INSULATING MATERIALS: With respect to the fibrous insulation materials used (mineral wool, glass wool, rock wool) according to DIN 51001 a test certificate shall be presented proving that the carcinogenicity index of the products concerned KI equals or exceeds 40 and, hence, the insulating materials used need not be classified as carcinogenic or suspected of causing cancer according to the current classification scheme of TRGS 905. Ceramic mineral fibres, i.e. glassy (silicate) fibres with an alkali metal oxide and earth alkali metal oxide content ($Na_20$ + $K_20$ + Ca0 + Mg0 + Ba0) of less than or equal to 18 weight percent must not be used.

- FORMALDEHYDE EMISSIONS OF OVENS: When heating the oven for the first time the formaldehyde concentration must not exceed 0.3 ppm in the indoor air (air change rate: 1h), and it must not exceed 0.1 ppm during repeated heating.

- SAFETY: Ovens with a viewing window must not pose a safety hazard due to window surface temperatures being too high. The glass viewing window must meet the requirements of DIN 60335.

- CONSUMER INFORMATION: Comprehensible Operating Instructions and Product Information in print form shall be enclosed with the product. The energy consumption of the appliances greatly depends on the user's behaviour. Therefore, the product documentation shall at least include, in addition to the oven's energy consumption data, the gist of the following instructions for an energy-efficient use of the appliance or energy-efficient baking, respectively:

  - Information on the non-necessity of preheating the oven on the basis of a cooking and baking time table.
  - In convection/hot-air circulation mode meals can be prepared on several levels.

- In order to use the residual heat during baking and roasting turn off the oven about 5 to 10 minutes before the end of the cooking or baking time.
- Instructions for proper and energy-saving use of the pyrolytic self-cleaning function, if available.

**BLUE ANGEL RAL-UZ 149:**

These Basic Award Criteria apply to microwave ovens and combination microwave ovens for household use. The Blue Angel eco-label for microwave ovens may be awarded to appliances featuring the following environmental properties:

- EFFICIENCY OF THE MICROWAVE FUNCTION: The efficiency of the microwave function shall not fall below the following values:
  - Microwave ovens and combination microwave ovens without conventional heating function and forced-air function: 59 %;
  - Combination microwave ovens with conventional heating function and/or forced-air function: 54 %;
  - Combination microwave ovens with conventional heating function and/or forced-air function, provided that the appliance is equipped with a rotating plate that cannot be deactivated: 59 %.
- ENERGY CONSUMPTION IN BAKING OVEN MODE: Additional requirement for combination microwave ovens with a rotating plate that can be deactivated and those without rotating plate: Combination microwave ovens with conventional heating function or forced-air function shall meet the energy consumption requirements set forth in EU Directive 2002/40/EC for baking ovens rated energy efficiency class A:
  - 12 l ≤ volume < 35 l < 0.6 kWh
  - 35 l ≤ volume < 65 l < 0.8 kWh
  - 65 l ≤ volume: < 1.0 kWh.
- POWER CONSUMPTION IN STANDBY AND OFF MODE: Power consumption of the microwave oven or combination microwave oven in standby or Off mode (according to EC Regulation 1275/2008/EC) shall not exceed 0.5 watts without display and 1.0 watt with display. The respective value shall be specified.
- INTERIOR LIGHT ON WHEN DOOR IS OPEN: If the interior light of a microwave oven or combination microwave oven is activated after opening the door it must automatically switch off within a period of 20 minutes. The product documentation shall include information on the above requirement.
- RADIATION LEAKAGE: Radiation leakage of the microwave oven or combination microwave oven shall not exceed 1 W/m².
- REPARABILITY: The applicant undertakes to make sure that the spare parts provision for appliance repair is guaranteed for at least 5 years from the end of production. Spare parts are those parts which, typically, may break down within the scope of

the ordinary use of a product - whereas those parts which normally exceed the life of the product are not to be considered as spare parts. Aesthetic components shall be exempt from this requirement. The product documentation shall include information on the above requirements.

- RECYCLABLE DESIGN: Blue Angel eco-labelled appliances shall meet the following requirements for recyclable design:
  - The appliances shall be so designed as to allow an easy disassembly for recycling purposes to make sure that case plastics and metals can be separated as fractions from materials of other functional units and, if possible, be recycled.
  - The appliances shall be so designed as to support specialist disassembly by intelligently designed connections or allow disassembly by use of ordinary tools.
  - Specialist firms hired by the manufacturer to recycle the appliances shall receive information for appliance disassembly.
  - The appliance recycling strategy developed with respect to the above points shall be published on the internet.
- MATERIAL REQUIREMENTS FOR PLASTICS USED IN CASE, CASE PARTS AND OPERATING ELEMENTS: The plastics must not contain as constituent parts any substances classified as:

  a) carcinogenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

  b) mutagenic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

  c) reprotoxic in categories 1 or 2 according to Table 3.2 of Annex VI to EC Regulation 1272/2008,

  d) persistent, bioaccumulative and toxic (PBT substances) or very persistent and very bioaccumulative (vPvB substances) according to the criteria of Annex XIII to the REACH Regulation or particularly alarming for other reasons and included into the List (so-called list of candidates) set up in accordance with REACH, Article 59, paragraph 1.

  Halogenated polymers shall not be permitted. Neither may halogenated organic compounds be added as flame retardants. Moreover, additions of flame retardants labelled with the Risk Phrase R 50/53 pursuant to Table 3.2 of Annex VI to EC Regulation 1272/2008 shall not be permitted.

  The following shall be exempt from this rule:

  - process-related, technically unavoidable impurities;

- fluoroorganic additives (as, for example, anti-dripping agents) used to improve the physical properties of plastics, provided that they do not exceed 0.5 weight percent;
- plastic parts weighing less than 25 grams.

- ORGANIC SOLVENTS IN PAINTS AND VARNISHES FOR CASE COATINGS: Moreover, the organic solvent content of paints and varnishes used in case coatings must not exceed 250 g/l. Calculation shall be based on the following formula:

$$VOC\ value\ [g/l] = \frac{mass\ of\ volatile\ components\ [g] - mass\ of\ water\ [g]}{volume\ of\ coating\ material\ [l] - volume\ of\ water\ [l]}$$

The volatile organic compounds (VOC) content of the coating material equals the mass of volatile components without water in relation to the volume of the coating material minus the volume of the water contained therein. The VOC value refers to the ready-touse coating material, including the dilutions prescribed or recommended by the varnish manufacturer. The terms are defined in accordance with DIN 55945 "Paints and varnishes - Terms and definitions for coating materials". Painting plants equipped with waste-gas treatment systems meeting the requirements of Annex III No 8.1 to the 31st BImSchV (Federal Immission Control Ordinance) and TA Luft (German Technical Instructions on Air Quality Control) shall be exempt from these requirements.

- INSULATING MATERIALS: If fibrous insulation materials (mineral wool, glass wool, rock wool) according to DIN 51001 are used in the microwave oven or combined microwave oven the carcinogenicity index of the products concerned KI equals or exceeds 40 and, hence, the insulating materials used need not be classified as carcinogenic or suspected of causing cancer according to the current classification scheme of TRGS 905. Ceramic mineral fibres, i.e. glassy (silicate) fibres with an alkali metal oxide and earth alkali metal oxide content (Na20 + K20 + Ca0 + Mg0 + Ba0) of less than or equal to 18 weight percent must not be used.

- FORMALDEHYDE EMISSIONS: When first heating the appliance the formaldehyde concentration must not exceed 0.2 ppm in the indoor air (without air change), and it must not exceed 0.1 ppm during repeated heating.

- CONSUMER INFORMATION: Comprehensible Operating Instructions and Product Information in print form shall be enclosed with the product. The energy consumption of the appliances greatly depends on the user behaviour. The product documentation shall at least include the gist of the following instructions for an energy-efficient, safe and gentle use of the microwave oven or combination microwave oven, respectively:
  - Information on particularly energy-saving cooking methods, e.g. in the form of cooking time tables;
  - Information on particularly gentle cooking with even heat distribution, e.g. in the form of cooking time tables;

- Instruction to keep the door seals clean for low radiation leakage.

Combination microwave ovens shall additionally meet the following criterion set forth in the Basic Award Criteria for "Electric Ovens for Household Use – RAL-UZ 143":

- Information on the non-necessity of preheating the oven on the basis of a cooking and baking time table.
- If available: In convection/hot-air circulation mode meals can be simultaneously prepared on several levels.
- In order to use the residual heat during baking and roasting turn off the oven about 5 to 10 minutes before the end of the cooking or baking time.
- Instructions for proper and energy-saving use of the pyrolytic self-cleaning function, if available.