High Efficiency Electronics Cooking System

Work Package 2

System concepts, requirements and standards

Deliverable D2.2

Review of existing standards: gaps and constraints

■ **Document Type**	: Deliverable
■ **Document Version**	:released
■ **Document Preparation Date**	:02 September 2011
■ **Classification**	: Public
■ **Author(s)**	: Hakan Carlsson
■ **File Name**	: HEECS-D2.2M6

■ **Project Ref. Number**	: 270716-2
■ **Project Start Date**	: 01 March 2011
■ **Project Duration**	: 36 months
■ **Website**	: www.heecs.eu

eniac JOINT UNDERTAKING

Project funded by **ENIAC Joint Undertaking**
Agreement Number **270716-2**

This report summarizes the work done at WHRSE regarding current efficiencies of Microwave Ovens, test methods used, and proposed techniques to improve these methods that might in future enable energy labelling for Microwave Ovens.

If you have any comment to make, please feel free to contact the author.

author	Hakan Carlsson
company	**Whirlpool Sweden AB**
department	Advanced Development Cooking
address	PO Box 763 SE-60117 Norrkoping Sweden
email	Hakan_Carlsson@whirlpool.com
tel.	(+46)11 154397
fax	(+46)11 154001

Document history

REV.	Content	Resp. partner	Date

MANAGEMENT SUMMARY

This report is dealing with energy consumption for the active mode, heating food, in MWO.
This can be split in two major areas, Standardization (test method) and Regulation (minimum requirements or limits for energy classes).
Energy consumption for Standby, Off-mode and Cooling down are judged as negligible, less than 2% of the total energy consumption.

The current standards are “technology free” and nothing can be related to specific components or technology. The time to modify a standard is typically 5 – 10 years and new standards needs even longer time.

The potential future change of standards are related to test loads in EN 60705

This report does not deal with different frequency bands, since all domestic Microwave Ovens (MWO) used in Europe are using the free band 2400 – 2500 MHz for good reasons. Lower frequencies will make the sealing against leakage bulky. Higher frequencies will limit the penetration depth in food and will decrease the features related with MW cooking. This means that the heating with different frequency will reduce efficiency. See also Annex 7.

Several areas of interest have been identified that could be considered beneficial with respect to possible energy efficiency and energy consumption for Microwave Ovens.

- Currently no Energy label exists in Europe for Microwave Ovens
- The existing IEC test method does not represent typical usage criteria for a Microwave oven
- Some small incremental areas have been identified that could improve the efficiency of existing (Magnetron powered) Microwave products by a relatively small amount (>10%)

- An update of current standard for the test method, an Amendment, is planned to be released by 2012 and from a technical perspective that reflects more closely real usage criteria, since it includes several test loads.

- An adaptive matching network could enhance the improved efficiency for new test loads and a broad selection of food loads. Use of new technologies might be one enabler for this. The anticipated efficiency improvements could be > 20%.

Table of Contents

1. Introduction

The activities foreseen in this task are related to:

- Review of general applicable standards (RF, electrical, thermal, etc.) for MWO products. Gap and constraint analysis for solid state based MWOs, for example, to see to what extend 2002/40/EC and EN 50304 and EN 60705 can be used or adopted for MWOs.

- Review of general energy efficiency definitions / standards such as 92/75/EEC and 2010/30/EU. First assessment of the solid state MWO with respect to current definitions and comparison to available non-EU standards. Define recommendations on improvement of energy efficiency definitions for the EU.

- Assessment of real world usage criteria.

- Review of ongoing EU study of energy consumption of MWO, amendment of standard EN 60705 and new test method for energy consumption

2. Current international standard

A list of Standards including their validity, see Annex 1.

Those Standards and Directives that are relevant are,

- 2010/30/EU, DIRECTIVE 2010/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 19 May 2010, on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

- IEC60705:1999, Household Microwave Ovens – Methods for measuring performance

There is no standard or Directive that deals with what kind of technology is used in the appliances, nothing mentioned and no preference. This means that nothing is mentioned how the electromagnetic energy is generated and what components are used. So nothing specific prescribed for solid state components.

The actual standard for MWO, IEC60705: 1999, covers the performance of microwave ovens with the primary heating function defined as heat transfer exclusively by electromagnetic energy in the ISM band frequency band 2400 - 2500MHz, for heating food and beverages in the cavity. ISM frequency bands are the electromagnetic frequencies established by the ITU and reproduced in CISPR 11.
This standard includes test method for measuring overall efficiency when heating 1000g water with 10 degrees temperature increase. This test method has been accepted by several economies and countries, e.g.

- Brazil
- China
- Russia

In Japan there is a complete other test method defined in JIS C 9250 and the so called Top Runner approach.

Up till now, 2011, MWO do not have any energy declaration or regulation for energy consumption in microwave ovens, but there are such regulations for traditional ovens since several years.
In Europe (27-EC) and USA, the current test method (1000g, 10 degrees temperature increase) for efficiency has been challenged, since several disadvantages have been identified. Several initiatives have been taken in Europe, on the directives from EC, European Commission. A study of Energy using Products, EuP, was started June 2009 for cooking products, where Ovens including MWO was included in Lot 22[1] . The USA has decided to wait for the results of the European study to decide a course of action.

[1] Similar products are clustered in groups called Lots. E.g. Lot 14 for Washing machines and Dishwashing, Lot23 for Hobs and Grills, Lot 25 for Coffee machines

To release a new or amended international standard takes 5 – 10 years. Time depends on the complexity in the scope of such change. Concerning energy consumption, it is rather complex and the longer time, 10 years, is applicable.
Also the cycle time for regulation is approximately 10 year, based on experience. The EuP study takes 2 years, followed by work with regulation during 1 year and a 1 year voluntary period.
In some countries, this cycle time can be shorter, due to more power by the authorities. One example of such country is China.

3. CENELEC work in Europe

CENELEC is the French abbreviation for Comité Européen de Normalisation Électrotechnique, i.e. European Committee for Electrotechnical Standardization

In CENELEC / TC59X/ WG9 a standardization work is in progress to determine the energy consumption for electric household microwave ovens, MWO, and more precise limited to the MW-function. This work is initiated by Council Directive 92/75/EEC which lays down the legal basis for a compulsory system of energy labelling and information. Directive 2002/40/EC of the European Parliament and of the Council is establishing a framework for the setting of Ecodesign requirements for energy-using products (EuP), now changed to energy-related products (ErP).

Today a method for standardized determination of energy consumption for household MWO within EN 60705, same as IEC60705, is missing.

In the current EN 60705: 1999, clause 8 – 9, prescribes how to measure the efficiency for a relative large load to be heated with 10 degrees temperature increase, 1000g from 10 to 200C. This method has low correlation with normal use, both with respect to amount of food and finish temperature. In addition, the result of the test is not energy consumption, but only the efficiency in percentage.

Normal food portions and beverage for average consumers are of smaller amounts and need to be heated to a higher and a safe temperature to be consumed.

The scope of this working group - established in June 2009 but with origin from 2002 (Directive 2002/40/EC) – is to determine a method to measure energy consumption of electric household microwave ovens covered by EN 60705 for the MW-mode with the following targets:

1. Create a method that is representative of a real use of the MW-function in a MWO, i.e. reheating of ready made food portion, beverage/liquid, defrost food and prepare meals from raw.

2. The test load shall be easy to find and have identical properties independent of geographical location and season of the year. The weight and shape of this test load shall have a good correlation to real use

3. The method must fulfil requirements of repeatability and reproducibility (crucial for energy measuring purposes). The method shall allow differentiation in terms of energy consumptions among products.

The actual result of the WG9 activity is a draft amendment (see ANNEX 3) of the EN60705:1999. Such document shall be developed by several manufacturers and test institutes for CENELEC. This means that all participants needs to be aligned and in agreement. WG9 has reached such agreement and considers this document to potentially fulfilling point 1 to 3 above. The test load is water, 3 different amounts, 1000g, 350g and 275g, and 3 geometries. The energy consumption shall be measured while heating these loads to reach a temperature increase of 50K. A weighted calculation of energy consumption is done for an average cooking cycle.

WG9 with the support and sponsorship of CECED has started a Round Robin Test procedure of this draft amendment to confirm requirements of repeatability and reproducibility and to estimate the standard deviation of the method itself. This test is planned to be completed by July 2011 and reported in September. Several technologies of MWO are taken into account (MW-Solo and MW-Combi; Built-In and Free-Standing; Different sizes of cavity; Turntable and shelf; Cavity material; Electronic and Mechanical controls) in 4 appliances to be tested by 10 labs.

The amendment of EN60705[2] is under consultation in national committees, and a draft expected to be published and circulated to all National Committees by September 2011 and

[2] Copy included in Annex 8

being translated and released as a new edition of EN60705 by end of 2012, i.e. 4 years active work by the working group started 6 years after the directive.

The potential future change of standard are related to test loads in EN 60705 and/or the weight factors for the defined test loads and the definition of one cooking cycle.

4. EuP Study in Europe and Regulation

4.1 EuP Study

The Study has taken 2 years. For the scope and content, see Annex 4.

The study has identified the following options for improvements using existing magnetron based microwave technologies.

Option	Description	Saving
0	Standby regulation	2,2W ➔1W 12%
1	Painted cavity	1,0%
2	Inverter power supply	1,5%
3	Good engineering work	3,5%
4	Cavity light	2%
5	Cooking sensors	5%,

4.2 Regulation

Based on potential energy savings, the study will provide recommendation to the European Commission on the need to introduce

- a label layout with the introduction of seven energy classes, A – G, maybe adding A+, A++, A+++ classes on top and eliminating the lower ones, G, F etc.
- and / or other mechanisms (like minimum requirement limits) to reach the expected savings
- "no label" is also one option

First feedback, based on the total EuP-study, from EC expected second half 2011 followed by work by/with Consultation Forum end 2011 or beginning 2012.

New regulation on energy consumption/EL for cooking products expected mid or end 2012 as on voluntary basis and mandatory 12 months later.

Most likely, the regulation will be based on energy consumption of one cooking cycle, and less likely annual energy consumption. A typical MWO with current design consumes 50 – 60 Wh per cycle, and 60 – 72 kWh annually with assumed 1200 cycles/year.

5. New test method for energy consumption

Tests with the proposed amended EN60705 in 26 different MWO´s with different designs is presented in the table in Annex 5. The measured parameter is the energy consumption to reach 50 degrees temperature increase. The data in the annex is presented for the energy consumption with the weight factors as well as recalculated to efficiency to allow comparison between different loads and finish temperature. The best ones are in green and the worst in red colour.
The weight factors are for the 1000g load is 0,182 (2/11), for 350g it is 0,545 (6/11) and for 275g it is 0,273 (3/11). These weight factors were based on a consumer research concerning usage of MWO. See Annex 6.

Based on these weight factors, the 1000g load contributes by 38%, the 350g load by 44% and the 275g load by just 18% of the total consumption for one cooking cycle. The Annual Energy Consumption (AEC) is calculated with 1200 such cooking cycles.

When looking at the average values, one can see that the 1000g load has the efficiency of 54% for the low temperature and 50% for the high temperature for the same load amount. This difference is just depending on load temperature. One could also see that the 1000g has a better efficiency than the smaller loads, 50% versus 46 or 43%, which is only depending on load amount and geometry. The last observation can be explained by the assumption that the major amount of MWO´s are optimized for the 1000g load, since that is the only one in the current standard.

However, there are 3 individuals in the test that shows that the smallest load can have better efficiency than the bigger one. There are MWO´s with efficiency of 51% for the smallest load, while the average is 43%. This difference, delta, is 8% and 8/43=0,186, which is almost an increase of 20% among available MWO´s with current technology.

6. Conclusions

The conclusion from this study is that an improved efficiency by 20% is not unrealistic. A better consumer study could be valuable and be a better base for other weight factors and maybe keep the defined test loads as defined in amendment of EN 60705. To do this, a second study, EuP, would be needed as well as work within CENELEC.

7. Annexes

Annex 1. Energy efficiency standards definition

Standard	Source	
2002/40/EC	ENIAC BIO	COMMISSION DIRECTIVE 2002/40/EC, of 8 May 2002, implementing Council Directive 92/75/EEC with regard to energy labeling of household electric ovens
0304	ENIAC BIO	Electric ovens for household use, Method for measuring the energy consumption. Replaced by EN 60350.
92/75/EEC	ENIAC	Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances. This is replaced by 2010/30/EU This do not include MWO.
2010/30/EU	ENIAC BIO	DIRECTIVE 2010/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 19 May 2010, on the indication by labeling and standard product information of the consumption of energy and other resources by energy-related products
IEC60705:1999 EN60705		Household Microwave Ovens – Methods for measuring performance
EN60705:2009	BIO	
EN60350	BIO	Performance standard for Electrical ovens. The new edition (coming) will include the measurements of energy consumption (the old EN50304)
AS/NZS 2895.1:2007	BIO	Australia and New Zealand Based on EN60705
GB 4706.22 GB24849-2010	BIO	China Efficiency in MWO according to IEC60705 (the old one)
10 CFR Part 430, Subpart B Appl	BIO	USA Reference IEC60705 Waiting for the work ongoing in EU (Source AHAM/DOE)
JIS C 9250 Top Runner	BIO	A voluntary labeling program, including MWO in Japan The best product, "Top Runner", sets the standard

Decreto n° 6.275, de 28 de novembro de 2007,		Brazil Efficiency in MWO according to IEC60705 (the old one)
Order of the Ministry of Industry & Commerce of Russia, Dated April 29, 2010. No. 357		Russia Efficiency in MWO according to IEC60705 (the old one)
IEC 1275/2008 2005/32/EC IEC62301		Stand by Jan 2010: Stby with display <2,0W; Off <1,0W Jan 2013: Stby with display <1,0W; Off<0,5W

Annex 2. Standards outside Europe and USA

Japan Top Runner

Top Runner is a Japanese programme in which energy consumption of microwave ovens, among other products, is tackled. The product on the market with the highest energy efficiency (Top Runner) sets the standard. The Top Runner Programme triggers the race for the top among manufacturers. The necessity of meeting the Top Runners Programme provided companies with an incentive to use the technologies, which they may otherwise have waited to commercialise. Manufacturers and importers are under the obligation to comply with the standards by Energy Consumption Law. Enforcement within the Top Runner Programme relies on "blame and shame" which works well in Japan.

The test method consists of energy consumption for 4 amounts of water loads heated from 4 to 700C with weight factors that sum up to yearly consumption. The formula, in a simplified version, is E = [(580.8*AV285 + 66*AV245 + 571.1*AV125 + 205*AV185) + 31*B + 6400*C]/ 1000.[3]

The "constants", are derived from a mix of refrigerated, frozen and perishable food as well as drinks; e.g. 571.1 = (NA4 + K3 * NA5 + K4 * NA6). It is a complicated test method and calculation method.

The target values varies from 60 to 78 kWh/year, depending on cavity size, and type of heating functions (MW-Solo and MW-Combi).

[3] Wherein E, A_{V285}, A_{V245}, A_{V125}, A_{V185}, N_{A1}, N_{A2}, N_{A3}, N_{A4}, N_{A5}, N_{A6}, N_{A7}, B, N_B, C, and H_C 17 shall represent numeric values listed below:
E: Energy consumption efficiency [kWh/year]
A_{Vxyz}: Energy consumption per use of microwave function to heat dummy-load of 285, 245, 125 and 185[g] [Wh/time]
N_{Ax}: Annual heating time [time/year] of different food categories and amount
K_1: Heating coefficient of different food categories and amount
B: Energy consumption per use of oven function [Wh/time]
N_B: Annual heating time [time/year] by oven function = 31
C: Standby energy consumption per hour [Wh/h]
H_C: Annual standby hour [h/year] = 6400

Brazil

The current IEC60705, the efficiency testing, has been adopted together with the following regulation for energy classes. This is not yet mandatory

Classe	Índices de Eficiência Energética
A	Eficiência ≥ 54 %
B	49 % ≤ Eficiência < 54 %
C	45%< Eficiência < 49 %

Tabela I - Classificação de Eficiência Energética

China

The current IEC60705, the efficiency testing, has been adopted together with the following regulation for energy classes that is in forse since January 2011

Energy efficiency grades of microwave ovens	Efficiency values (%)
1	62
2	60
3	58
4	56
5	54

Please note the inconsistency in limits in China and Brazil when using same test method!

Image1 - Example of Energy Label in China

Annex 3. Proposed amendment of EN 60705

Energy consumption for heating 3 loads, 1000g, 350g and 275g

Test procedure to measure energy consumption to reach 50K	
	see EN 60704 Ed 4.0:2010-04 for details
Output power and efficiency, § 8	
1	Measure the output power and efficiency with 1000g
Stand-by power, for RRT	
2	Measure power in Stand-by mode (Off-mode)
Energy consumption in cooking mode, § 9	
3	Room temperature 23 ^{0}C ± 2 ^{0}C
4	Water is pure tap water
5	MWO and container at room temperatur
6	Water lower than 10 ^{0}C (8 - 9 ^{0}C will simplify to reach 10 ^{0}C when water is in beaker))
7	Measure the weight of the empty container (appr 400g, 200g resp 200g)
8	Pour water into beaker, stir water, check/adjust first the temperature within 10 ^{0}C ± 0,5 ^{0}C and then the weight within ± 1g
9	Note the initial values, weight of container, actual weight of water, actual initial temperature of water (when in the container)
10	MWO setting: Use max power of the MW. Note if Boost power is used. Guidelines for cooking time: A proposal time for 1000g is (t_{high}) calculated based on output power measurements (adjustment might be needed). Difference between t_{high} and t_{low} should be 10 - 15%. Times for the smaller loads can be calculated in proportion to load mass, 350/1000 resp 275/1000, but adjusted to little longer times
11	Two measurements of energy consumption, one temperature rise within 45 - 50K and one within 50 - 55K. Compensation for energy absorbed in the glass and weight deviation of water is taken care of in further calculations.
12	After heating, remove the beaker with one hand (140 and 85 mm) or by two hands (190 mm) with gloves by touching the glass beaker only on the upper rim above the water. Put the beaker on a thermal insulation plate.
13	Stir the water minimum 5 seconds with a thermometer and read the temperature at 20 seconds after finished heating
14	Note the final temperature, the heating time and related energy consumption (energy input)
15	Do the tests for each load, 1000g, 350g and 275g reaching both high and low temperature interval. This makes in total 6 runs.

Annex 4. EuP, Study of Energy using Products

The study is split in 8 areas, and reports are made available for the first 7, and the last one expected within weeks. The areas are:

Task 1 - Definition

1. Product category and performance assessment
2. Test standards
3. Existing legislation

Task 2 – Economic and Market analysis

1. Generic economic data
2. Market and stock data
3. Market trends
4. Consumer expenditure base data

Task 3 – Consumer behaviour and local infrastructure

1. Real life efficiency
2. End-of-life behaviour
3. Local infrastructure

Task 4 – Technical analysis of existing products

1. Production phase
2. Distribution phase
3. Use phase, product
4. Use phase, system
5. End of life phase
6. Recommendations on mandates for measurement standards

Task 5 – Definition of Base Case

1. Product-specific inputs
2. Base-Case Environment Impact assessment
3. Base-Case Life Cycle Cost
4. EU Totals
5. EU-27 Total System Impact

Task 6 – Technical analysis BAT

1. State-of-the-art in applied research for the product, prototype level
2. State-of-the-art at component level
3. State-of-the-art of best existing product technology outside EU

Task 7 – Improvement potential

1. Options
2. Impacts
3. Cost
4. Analysis LLCC and BAT
5. Long term targets (BNAT) and system analysis

Task 8 – Scenario, Policy, Impact and Sensitivity analysis

1. Policy and scenario analysis
2. Impact analysis industry and consumers
3. Sensitivity analysis of the main parameters

Based on potential energy savings, the study will provide recommendation to the European Commission on the need to

- introduce a label layout with the introduction of A+, A++, A+++ classes scheme
- and / or other mechanisms (like minimum requirement limits) to reach the expected savings
- “no label” is also one option

First feedback, based on the total EuP-study, from EC expected second half 2011 followed by work by/with Consultation Forum end 2011 or beginning 2012 New regulation on energy consumption/EL for cooking products expected mid or end 2012 as on voluntary basis and mandatory 12 months later.

Annex 5. Test result, energy consumption and efficiency in 26 MWO

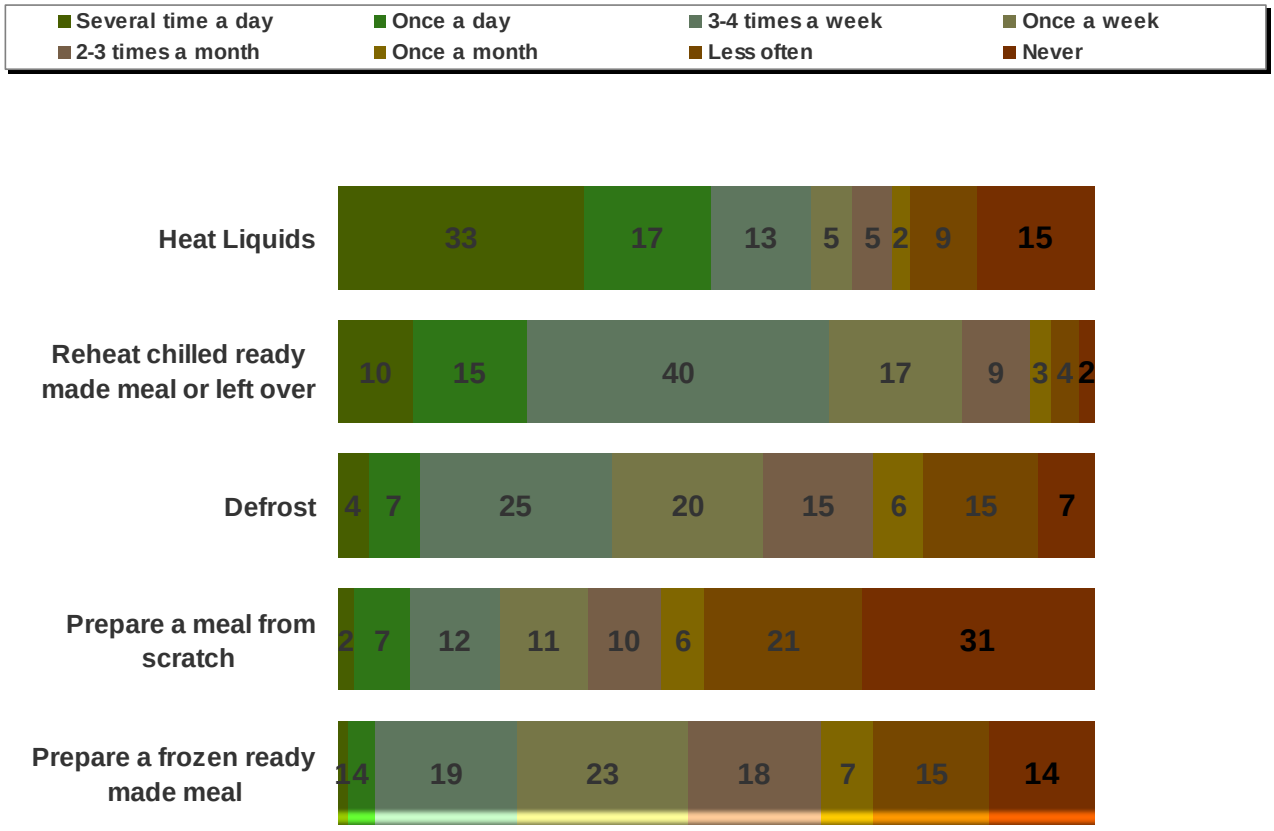
Data is given for the energy consumption with the weight factors (red circle) as well as recalculated to efficiency to allow comparison between different loads and finish temperature. The best ones are in green and the worst in red colour.

		Functions						Energy per year [kWh]			
	Unit #	Solo/Grill/ Combi	Cavity [Litres]	Efficiency [%]				0,182	0,545	0,273	1200
Load				1000g IEC	1000g 50K	350g 50K	275g 50K	1000	350	275	sum
1	B-A	Solo	12L	**57,0%**	52,4%	**52,2%**	46,8%	24,2	25,5	11,2	**60,9**
2	B-B	Solo	17L	54,0%	50,7%	44,6%	43,8%	25,0	29,8	11,9	66,8
3	B-C	Combi	31L	50,0%	47,1%	38,3%	38,5%	26,9	34,8	13,6	75,3
4	B-D	Combi	36L	56,0%	52,4%	45,1%	43,6%	24,2	29,5	12,0	65,7
5	B-E	Grill	21L	**57,0%**	**55,2%**	**51,7%**	49,1%	23,0	25,8	10,7	**59,5**
6	B-F84	Combi	35L	**43,0%**	**44,3%**	**35,7%**	**30,6%**	28,6	37,3	17,1	**83,1**
7	B-F86K	Combi	35L	**42,0%**	**40,0%**	**34,2%**	**25,9%**	31,7	38,9	20,2	**90,9**
8	B-F86P	Combi	35L	49,0%	44,9%	39,0%	**34,7%**	28,2	34,2	15,1	77,5
9	F-M2	Solo	26L Paint	56,2%	51,7%	**52,1%**	40,6%	24,5	25,6	12,9	63,0
10	F-M3	Solo	30L Paint	**57,3%**	52,8%	48,8%	45,2%	24,0	27,3	11,6	62,9
11	F-M4	Solo	35L Paint	**57,6%**	52,6%	45,8%	46,8%	24,1	29,1	11,2	64,4
12	L-A	Grill	21L	53,8%	47,7%	48,2%	38,5%	26,6	27,6	13,6	67,8
13	L-B	Grill	20L	54,2%	47,9%	44,5%	48,2%	26,5	29,9	10,9	67,3
14	L-C	Grill	24L	52,3%	49,9%	46,5%	44,2%	25,4	28,7	11,8	66,0
15	M-1	Combi	36L, shelf	56,8%	51,8%	43,7%	42,2%	24,5	30,5	12,4	67,4
16	W-A	Solo	13L Paint	55,3%	49,5%	48,9%	**50,8%**	25,6	27,2	10,3	63,2
17	W-B1	Solo	18L Paint	56,7%	50,9%	**50,4%**	45,7%	24,9	26,4	11,5	62,8
18	W-B2	Grill	18L Paint	55,6%	48,9%	46,4%	**50,8%**	25,9	28,7	10,3	65,0
19	W-C	Combi	31L SS	55,7%	50,2%	47,4%	39,6%	25,3	28,1	13,2	66,6
20	W-D	Combi	40L SS	**58,1%**	**53,4%**	46,2%	38,5%	23,8	28,9	13,6	66,2
21	W-E1	Solo	22L Paint	55,0%	51,6%	46,9%	48,5%	24,6	28,4	10,8	63,8
22	W-E2	Grill	22L SS	51,8%	48,3%	40,9%	43,3%	26,2	32,6	12,1	70,9
23	W-F	Combi	31L SS	52,6%	49,5%	45,9%	41,3%	25,6	29,0	12,7	67,3
24	W-G1	Solo	25L Paint	56,7%	51,7%	49,6%	49,1%	24,5	26,8	10,7	62,0
25	W-G2	Grill	25L Paint	**57,2%**	52,5%	**50,1%**	**51,9%**	24,2	26,6	10,1	**60,8**
26	W-H	Grill	27L PTFE	56,5%	52,6%	49,0%	44,7%	24,1	27,2	11,7	63,0
⇨	Average			54,1%	50,0%	45,9%	43,2%	25,5	29,4	12,4	67,3

Annex 6. Market study of consumer behaviour.

Data from study in Spain, Italy, France, Germany and United Kingdom, 2000 consumers

How often do you do this type of preparation with your microwave ?



Definition of weight factors for each load and one cooking cycle

Result from work in EuP study

Result from a consumer study, 2000 persons in 5 countries

Estimations and calculations

What food do they prepare?	Average times per week		Estimasted duration per time, [seconds]	Energy: Energy input per time [Wh]	Energy: Energy consumption per week; [Wh]	Energy: Yearly energy consumption; [kWh]	Average input power
Heat liquids	6,3	40%	100	40,0	252,0	13,1	1440
Reheat chilled ready made meal	4,1	25%	120	60,0	246,0	12,8	1440
Reheat frozen ready made meal	1,5	10%	480	192,0	288,0	15,0	1440
Defrost	2,3	15%	540	64,8	149,0	7,8	432
Prepare a meal from scratch	1,5	10%	660	264,0	396,0	20,6	1440
	15,7			84,8	1331,0	**69,2**	

Observation

Appr 89% of consumers does never cook baby food — **Neglected**

One cook cycle		Weight factor	Energy per time [Wh]	Energy per cycle [Wh]	Yearly energy consumption; [kWh]
275g	Heat liquid	3	40	10,9	13,1
350g	Reheat chilled ready made meal Reheat frozen ready made meal	6	45	24,5	29,5
1000g	1000g to represent defrost and prepare meal from scratch.	2	120	21,8	26,2
	Sum weight	11			
Cycles per year		1200			
				57,3	**68,7**

From a consumer research in France, SIDLER from 1999, the following has been reported
0,069 kWh per use
1087 cycles per year
75 kWh consumption per year
These data is in line with the cycle and yearly consumption in the defined cycle above

Annex 7. ISM band

The **industrial, scientific and medical (ISM)** were originally reserved internationally for the use of radio frequency energy for industrial, scientific and medical purposes other than communications.

The ISM bands are defined by the ITU-R in 5.138, 5.150, and 5.280 of the Radio Regulations. Individual countries' use of the bands designated in these sections may differ due to variations in national radio regulations. Because communication devices using the ISM bands must tolerate any interference from ISM equipment, these bands are typically given over to uses intended for unlicensed operation, since unlicensed operation typically needs to be tolerant of interference from other devices anyway. In the United States of America, uses of the ISM bands are governed by Part 18 of the FCC rules, while Part 15 contains the rules for unlicensed communication devices, even those that use the ISM frequencies.

The ISM bands defined by the ITU-R are:

Frequency range	Center frequency [Hz]	Availability
902–928 MHz	915 MHz	only for America, not Europe
2.400–2.500 GHz	2.450 GHz	
5.725–5.875 GHz	5.800 GHz	
24–24.25 GHz	24.125 GHz	

Annex 8. Amendment of EN60705

The proposed amendment of the standard EN60705 is attached

TC59X_22332_vot3E
.pdf