Working document

on

ecodesign and labelling implementing measures

for

WASHING MACHINES: main elements

Meeting of the EuP Consultation Forum 04/11/2008

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Scope and rationale

- Define ecodesign generic and specific requirements for washing machines
- Revise the energy labelling scheme (Directives 95/12/EC and 96/89/EC)
- Create a “package” of measures which will phase out less efficient models, and support the technological innovation and market transformation through the labelling scheme
- Covered products: electric mains operated household washing machines also where these are sold for non-household uses
- Exclusions:
  - washing machines with no spin capability
  - combined washer-driers (to be dealt separately)
  - washing machines that can use fuels (such as LPG, kerosene, bio-diesel, etc.)
  - washing machines that are only battery operated

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Definitions (I)

- “washing machine” means an appliance for cleaning and rinsing of textiles using water which may also have a means of extracting excess water from the textiles
- “automatic washing machine” means a washing machine where the load is fully treated by the machine without the need for user intervention at any point during the programme prior to its completion
- “rated capacity” means the maximum mass in kg of dry textiles, at **0,5 kg intervals**, which the manufacturer declares can be treated in the washing machine on the programme selected
- “capacity at partial load” means a half of the washing machine rated capacity
- “equivalent washing machine” means a model placed on the market with the same rated capacity, technical and performance characteristics, energy and water consumption and noise in washing and spinning of another model placed on the market under a different commercial code number by the same manufacturer

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Definitions (II)

- Low power modes (IEC 60456 5th Ed.):
  - » “off-mode’ is a condition where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a mains power source and used in accordance with the manufacturer’s instructions. Where there are no controls, the washing machine is left to revert to a steady state power consumption of its own accord
  - » “left-on mode” is the lowest power consumption mode that may persist for an indefinite time after the completion of the programme and unloading of the machine without any further intervention of the user

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WMs load (rated) capacity distribution

Source: technical database about models on the market in 2005 (reference year for the preparatory study)

Machine capacity (kg)	Models (number)	(%)
3,0	17	0,33
3,5	52	1,0
4,0	37	0,71
4,5	481	9,26
5,0	2 597	50,0
5,5	250	4,82
6,0	1 471	28,3
6,5	2	0,04
7,0	182	3,51
7,5	79	1,52
8,0	14	0,27
9,0	10	0,19
Total	5 192	100

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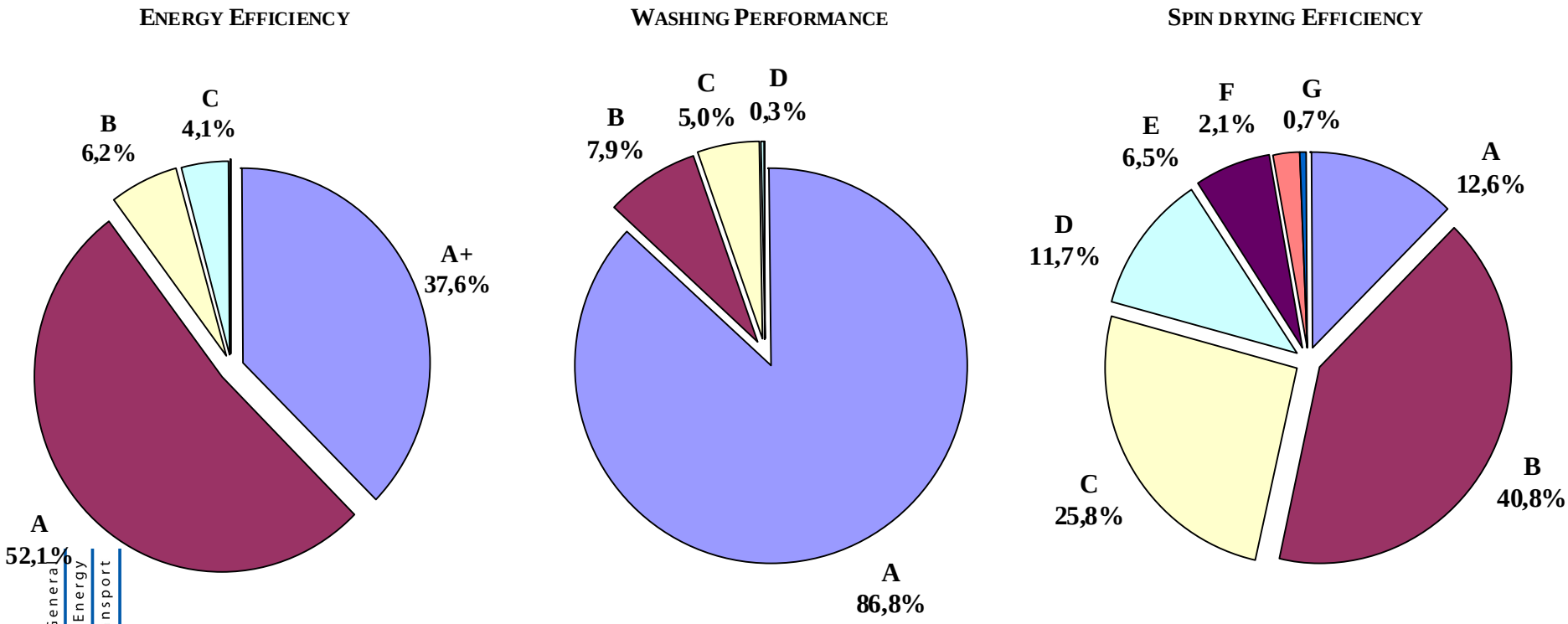
WMs current performance distribution

Source: technical database about models on the market in 2005



Note: - no low power modes consumption (energy efficiency)

- including manufacturing variability

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WMs benchmarks

- Indicative benchmarks are described in Annex II.
- Best performing products already on the market for:
  - 5kg, 7kg and 8kg
  - energy consumption in kWh/cycle and kWh/kg
  - water consumption in litre/cycle and litre/y
- Parameters not included:
  - EEI: can not be calculated due to lack of data about low power modes consumption and new measurement uncertainty
  - Noise (in washing and spinning): no sufficient reliable data available
  - Rinsing efficiency: not measurable at present (different measurement methods under study within EU and worldwide)
  - Other load capacity machines: small share of the market

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Ecodesign requirements: approach

- Generic and specific requirements
- IM revision after 7 years of entry into force
- Generic Requirements for:
  - » indications about the maximum dosage of the detergent that manufacturer recommends
  - » provisions about the indication of the standard cotton 60°C and 40°C washing programmes

- Specific Requirements, two Steps with a 5 year interval for:
  - » 1st Step: - maximum EEI and water consumption
    - minimum washing performance
  - » 2nd Step: - maximum EEI and water consumption
- If **no sensor based protection funtion(s)** is active (i.e. there is no need of extra power), WMs shall comply with the provisions of the Regulation on standby consumption

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Energy Labelling: approach (I)

- Directive revision after 7 years of entry into force
- Efficiency rating, two scales based on EEI:
  - » Energy efficiency ranking: absolute, remains fixed
  - » Energy efficiency class: relative, upgrades
- Time horizon: two Steps with a 5 year interval:
  - » 1st Step, one year after enforcement
  - » 2nd Step, six years after enforcement
- Rationale: WMs market is evolving at a medium speed, a more frequent upgrade is not appropriate because the improvements of energy efficiency are not feasible
- The two labelling Steps should be co-ordinated with the parallel ecodesign specific requirements

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Energy Labelling: approach (II)

- The labelling bandwidth is ~11-13%, providing sizeable differentiation in terms of annual energy consumption also for the «higher efficiency» part of the scale
- An overlapping of 3 months will be allowed for the transition between Step 1 and Step 2: i.e. the circulation of models with the old label (common background) will be allowed for 3 months after the end of the validity of the previous label
- Setting medium-term targets provides clear and predictable legal framework for investments and product development

- Final label layout depends on the outcome of the discussions withing the EELEP (labelling formation) and is not an issue for this Consultation Forum

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Other environmental aspects

- Performances, other than washing, are dealt within the labelling declarations
- Noise, in washing and spinning phases, is addressed within the labelling declarations
- Hazardous materials in production are dealt within the RoHs Directive (revisions on-going)
- End-of-life wastes are addressed in the WEEE Directive
- Other aspects such as recyclability/durability/etc. are difficult to define and verify

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Energy Efficiency Index (I)

- The energy efficiency index is the ratio between the Annual Energy Consumption and the reference Standard Annual Energy Consumption

$$EEI = \frac{AE_C}{SAE_C} \times 100$$

- EEI values define the maximum annual energy consumption thresholds (ecodesign specific requirements) and the energy efficiency ranking (energy labelling)
- The standard annual energy consumption is a linear function of the washing machine rated capacity
- The annual energy consumption depends on the number of cycles and includes the low power modes consumption

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Energy Efficiency Index (II)

- The Standard Annual Energy Consumption is:

$$SAE_C = 47{,}0 \times c + 51{,}7$$

rated capacity for the standard 60°C and 40°C cotton programmes

- The Annual Energy Consumption is given by:

$$AE_C = E_t \times 220 + \frac{\left[P_o \times \frac{525.600 - (T_t \times 220)}{2} + P_l \times \frac{525.600 - (T_t \times 220)}{2} \right]}{\ldots 0 \times 1 \ldots 00}$$

power consumption in the off mode

number of wa…

…ation of the standard

power consumption in the left-on mode

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Energy Efficiency Index (III)

- E_t is the weighted energy consumption for the standard washing programmes, in kWh and recorded to three decimal places, determined as:

$$E_t = (3 \times E_{t,60} + 2 \times E_{t,60½} + 2 \times E_{t,40½})/7$$

- The use of the weighted (3+2+2) values of the standard 60°C and 40°C cotton programmes at full load and partial load gives continuity with the current labelling scheme and the industry Voluntary Commitments, based on the standard 60°C cotton programme at full load
- This approach is in line with the results of the preparatory study: the survey on almost 2.500 consumers from 10 countries showed:
  - a 37% preference for the 40°C programmes, while the second most used temperature is 60°C (23%) and then 90°C (7%).
  - more than 50% of the consumers declared that cotton programmes are used always or often.

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Energy Efficiency Index (IV)

- Different weighing systems have been suggested for the calculation of E_t such as:

$$E_t = (1 \times E_{t,60} + 2 \times E_{t,60½} + 4 \times E_{t,40½})/7$$

$$E_t = (1 \times E_{t,60} + 2 \times E_{t,40} + 2 \times E_{t,60½} + 2 \times E_{t,40½})/7$$

- The use of the first alternative weighing factors will increase the weight of the partial load (better reflecting the actual machine load) and will result in a ratio 60°C: 40°C going from 5:2 to 3:4
- Unfortunately the new proposed approaches result also in a systematic under-estimation (either 15-20% or 10-15%) of the annual energy consumption when compared to the average consumption for the different washing cycles resulting from the preparatory study

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Energy Efficiency Index (V)

Comparison of different "weighing formulae"

								average	3+2+2	1+2+4	1+2+2+2	average	3+2+2	1+2+4	1+2+2+2	3+2+2	1+2+4	1+2+2+2	3+2+2	1+2+4	1+2+2+2
washing temperature	°C	20	**30**	**40**	50	**60**	**90**	45,9													
actual use	%	7	17	37	9	23	7	100											difference to average		
								kWh/cycle	kWh/cycle	kWh/cycle	kWh/cycle	kWh/y	kWh/y	kWh/y	kWh/y	kWh/y	kWh/y	kWh/y	%	%	%
machine 1	10kg		0,70	1,20		1,70	3,2	1,38	1,39	1,18	1,25	**304**	306	260	275	3	-44	-29	0,8	-16,9	-10,5
machine 2	8kg		0,61	0,94		1,65	2,73	1,21	1,30	1,04	1,10	**267**	286	229	241	19	-38	-26	6,6	-16,4	-10,7
			0,61	0,94		1,20	2,73	1,07	1,00	0,88	0,93	**235**	221	193	204	-14	-43	-31	-6,6	-22,1	-15,1
machine 4	7 kg		*0,65*	0,65		1,19	2,0	0,92	0,93	0,74	0,78	**202**	205	163	171	3	-39	-31	1,4	-24,1	-18,2
machine 3	4,5kg		*0,55*	0,55		1,00	1,4	0,75	0,78	0,62	0,65	**166**	172	137	144	6	-29	-22	3,7	-21,0	-15,2
			0,55	0,55		0,76	1,4	0,68	0,63	0,53	0,57	**149**	138	117	124	-11	-31	-25	-8,2	-26,8	-19,7

Low power modes consumption is not considered in the calculations

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Energy Efficiency Index: transitory period

- **ONLY** in case no harmonised standard is available one year after the entry into force of the ecodesign IM and the labelling Directive, and unless this harmonised standard becomes available, the parameters for the standard 40°C cotton programme at partial load and the standard 60°C cotton programme at partial load are based on the standard 60°C cotton programme at full load.
- For example the energy consumption (E_t) is calculated through the formula:

$$E_t = (3 \times E_{t,60} + 2 \times 0{,}80 \times E_{t,60} + 2 \times 0{,}64 \times E_{t,60})/7$$

- Other proposed weighing factors will result in a lower energy consumption (E_t) and therefore in a lower EEI (i.e. a more efficient machine).
- By keeping ("artificially") the energy consumption (E_t) slightly higher, consumers are on the safe side

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Verification procedure for market surveillance checks (I)

- European standard EN 60456 describes a two-stage verification procedure, used for the EU labelling scheme.
- This staged procedure is in line with international practice
- It is acceptable for the verification of the ecodesign IM and the new labelling Directive:
  - » Stage I: one unit is tested, if non-compliant then
  - » Stage II: three additional units of the same model are tested, if non-compliant then
  - » the model **and all other equivalent washing machines** are considered not complying

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Verification procedure for market surveillance checks (II)

- The values of the measurement uncertainty has been reduced (e.g. for energy consumption from 15% to 10%), since the production variability is under manufacturers' responsibility
- Only for the washing performance index a higher uncertainty (than in the current EN standard) has been set on the basis of the latest available round robin test results
- Within the mandate to be issued to ESOs for the preparation of the EN harmonised standard, a specific request about the identification of the measurement variability sources and their evaluation through a Round Robin Test will be included.

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Ecodesign generic requirements (I)

Two years after the measure has come into force:

- The standard cotton 60°C/40°C programmes shall be:
  - » programmes for normal use, to clean normal soiled cotton laundry
  - » clearly identifiable on the appliance programme selection device/display and
  - » named “60°C cotton eco-programme” and “40°C cotton eco-programme”
  - » indicated in the booklet of instructions with the same name and with the specification that they are suitable for normal use, to clean normal soiled cotton laundry and that they are the most efficient programmes from the combined energy and water consumptions point of view for washing cotton laundry

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Ecodesign generic requirements (II)

- Indications about the maximum dosage of detergent that manufacturers recommend not overcoming, in the form of a scale in the dispenser and a complementary informative table in the booklet of instructions including:
  - information about dosage for at least traditional powder, compact powder and liquid detergents
  - per degree of laundry soiling
  - for the washing programmes in the washing machine
  - a correlation with the scale in the dispenser

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Ecodesign specific requirements (I)

- 1st Step, one year after enforcing:
  - EEI < 68
  - washing performance index W_P > 1,03 for WM > 3 kg
  - washing performance index W_P > 1,00 for WM ≤ 3 kg
  - water consumption $W_{t,60}$ for the standard 60°C cotton programme at full load:

$$W_{t,60} \leq 5 \times c + 35$$

- 2nd Step, six years after enforcing:
  - EEI < 59 for WM ≥ 4kg
  - water consumption $W_{t,60}$ for the standard 60°C cotton programme at partial load lower than:

$$W_{t,60} \leq 5 \times c_1 + 35$$

rated capacity for the standard 60°C cotton programme

partial load for the standard 60°C cotton programme

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Energy Labelling (I)

Start of label: EEI=100 is the threshold between ranking 2 and 3

Energy Efficiency Ranking	Energy Efficiency Index	Energy Efficiency Cass	
		Step 1	Step 2
10	EEI <40	--	--
9	40 ≤ EEI <45	--	--
8	45 ≤ EEI < 52	--	A
7	52 ≤ EEI < 59	A	B
6	59 ≤ EEI < 68	B	C
5	68 ≤ EEI < 77	C	D
4	77 ≤ EEI < 87	D	E
3	87 ≤ EEI < 100	E	F
2	100 ≤ EEI < 113	F	G
1	EEI ≥ 113	G	--

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Energy Labelling (II)

- The Label is not language neutral
- The Label contains easy-to-understand parameters which are the most relevant for the WMs ecoprofile:
  - » annual energy consumption (kWh/year)
  - » annual water consumption (litre/year)
  - » spin drying efficiency (ranking)
  - » airborne acoustical noise in washing/spinning (dBA)
- The Label (in the presented layout) will be delivered by the manufacturer in two pieces:
  - » the common background, including the validity period
  - » the ''Strip'' with the declared values of the parameters, being a sort of «passport» of the model

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Energy Labelling (III)

- The Annual Water Consumption (AW_c) is calculated following the same approach than for the energy consumption for 220 cycles:

$$AW_C = W_t \times 220$$

- The weighted water consumption for the standard washing programmes (W_t) is:

$$W_t = (3 \times W_{t,60} + 2 \times W_{t,60½} + 2 \times W_{t,40½})/7$$

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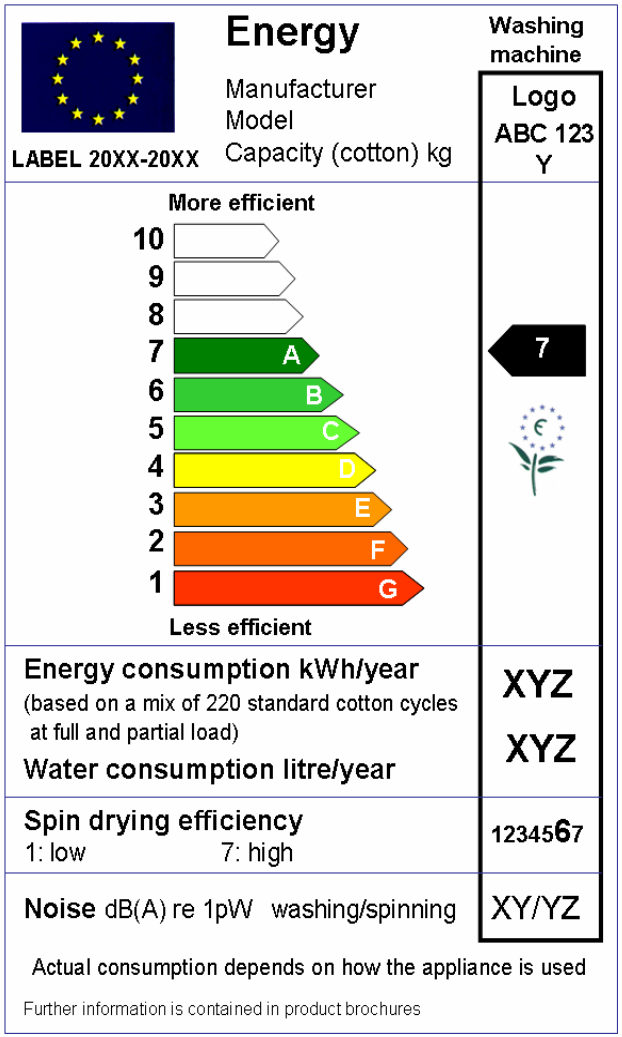
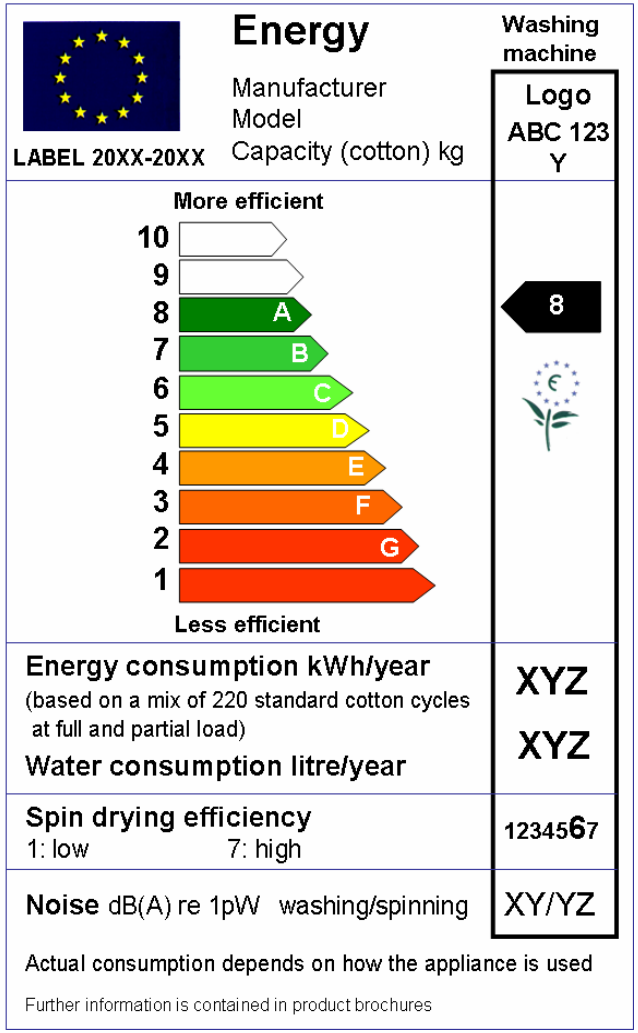
Energy Labelling (IV)



Step 1

5 years



Step 2

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Ecodesign and Energy labelling impact

- Source: technical database 2005
- Overall impact of the Ecodesign specific requirements (EEI, water consumption and washing performance), depending on the hypothesised conditions [low power modes efficiency & degree of internalisation of manufacturing variability] :
  - » Step 1: phase out of about 16 - 62% of the models
  - » Step 2: phase out of about 85 -100% of the models
- Impact of Energy labelling: depending on the hypothesised conditions in Step1 most of the models in ranking 4 (or 3 and 4) and almost no models in ranking beyond 6

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Ecodesign impact (I)

Estimated number of phased out washing machines (2005 database) due to specific ecodesign requirements of Step 1

Models	Washing machine rated capacity (60°C cotton)											
	3	**3,5**	**4**	**4,5**	**5**	**5,5**	**6**	**6,5**	**7**	**7,5**	**8**	**9**
(%)**	52,9	100	100	85,4	76,2	72,0	31,4	100	14,3	72,2	92,9	100
(%)*	52,9	61,5	13,5	37,2	20,6	7,6	3,7	0,0	0,5	7,6	21,4	100
Tot. (n)	17	52	37	481	2.597	250	1.471	2	182	79	14	10

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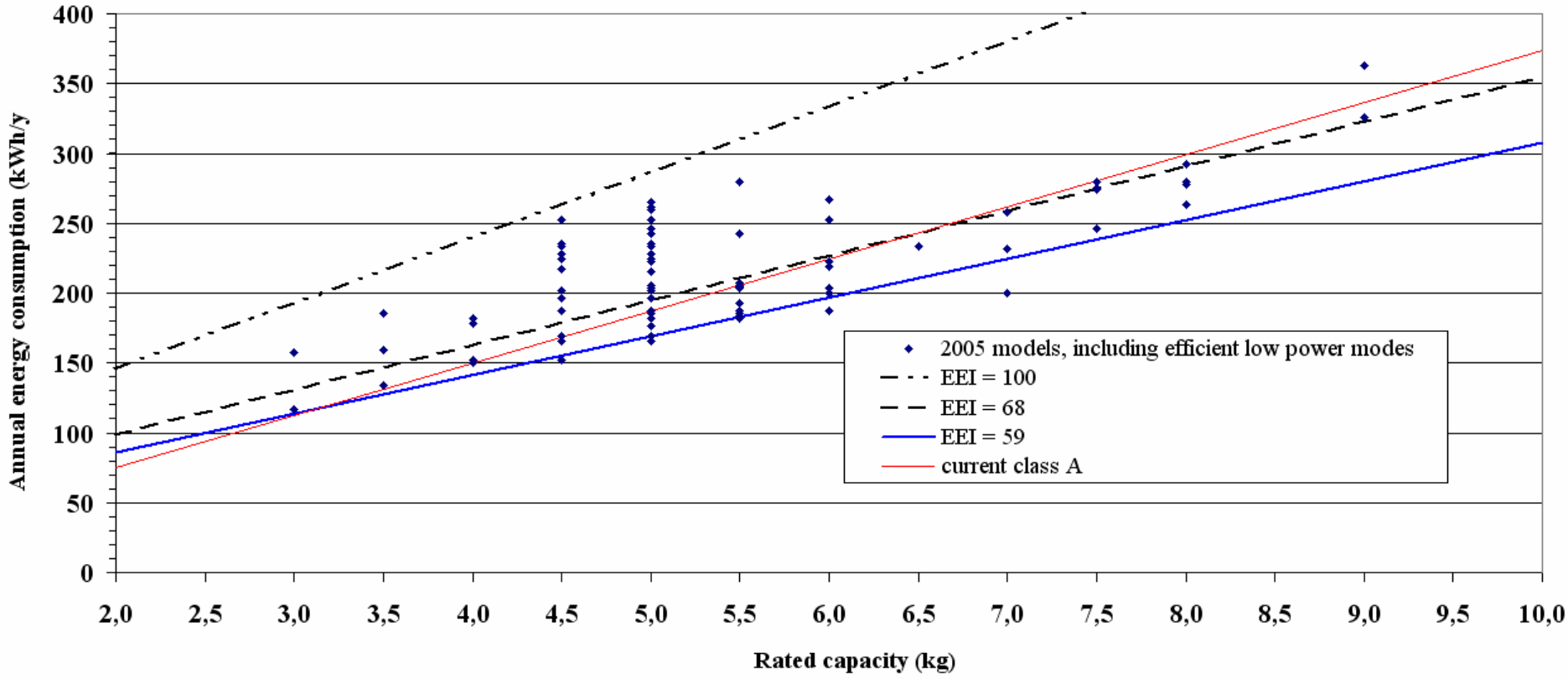
*best-case scenario: considering the energy consumption of efficient low power modes (1W off mode and 2W left-on mode)

**worst-case scenario: considering the 5% decrease in measurement uncertainty and less efficient low power modes (2W off mode and 3W left-on mode)

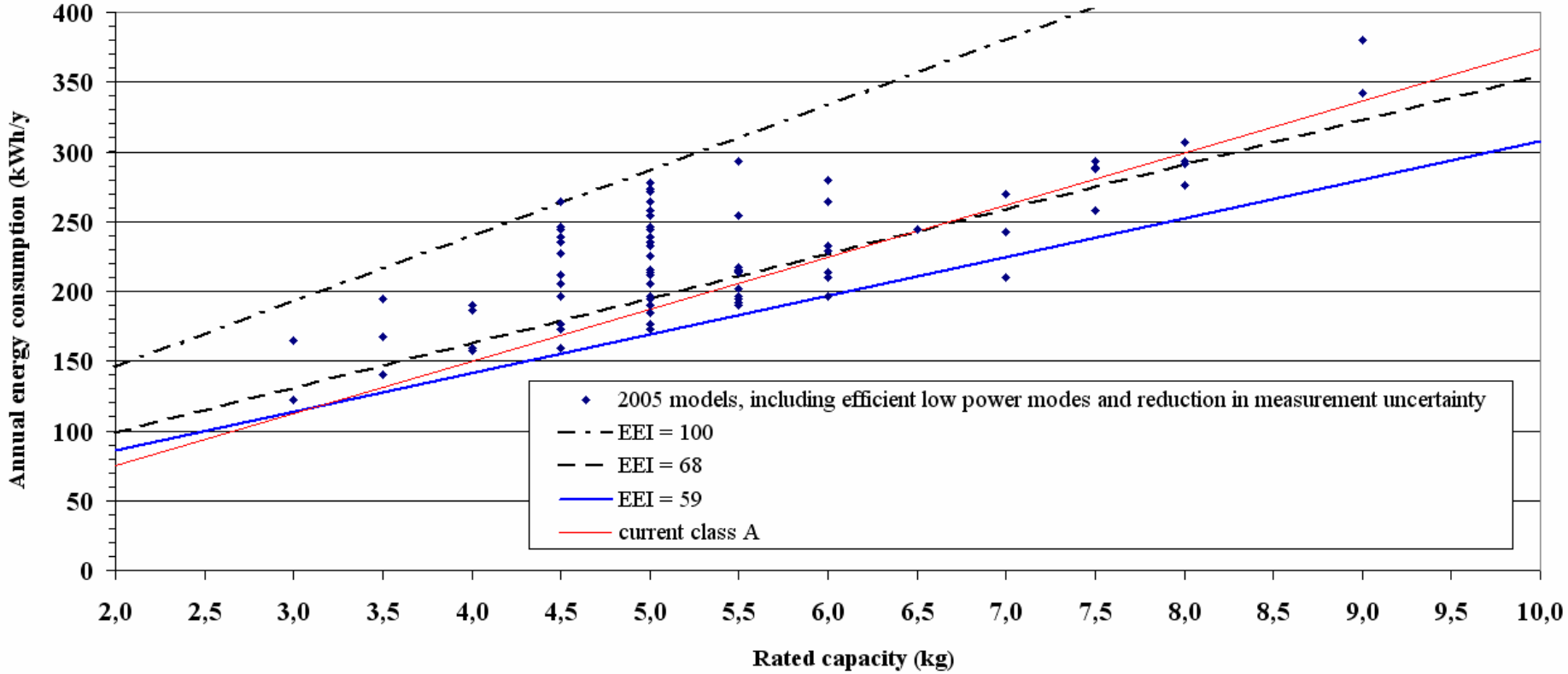
Ecodesign impact (IIa)

EEI threshold impact, Steps 1 & 2 (best-case scenario)



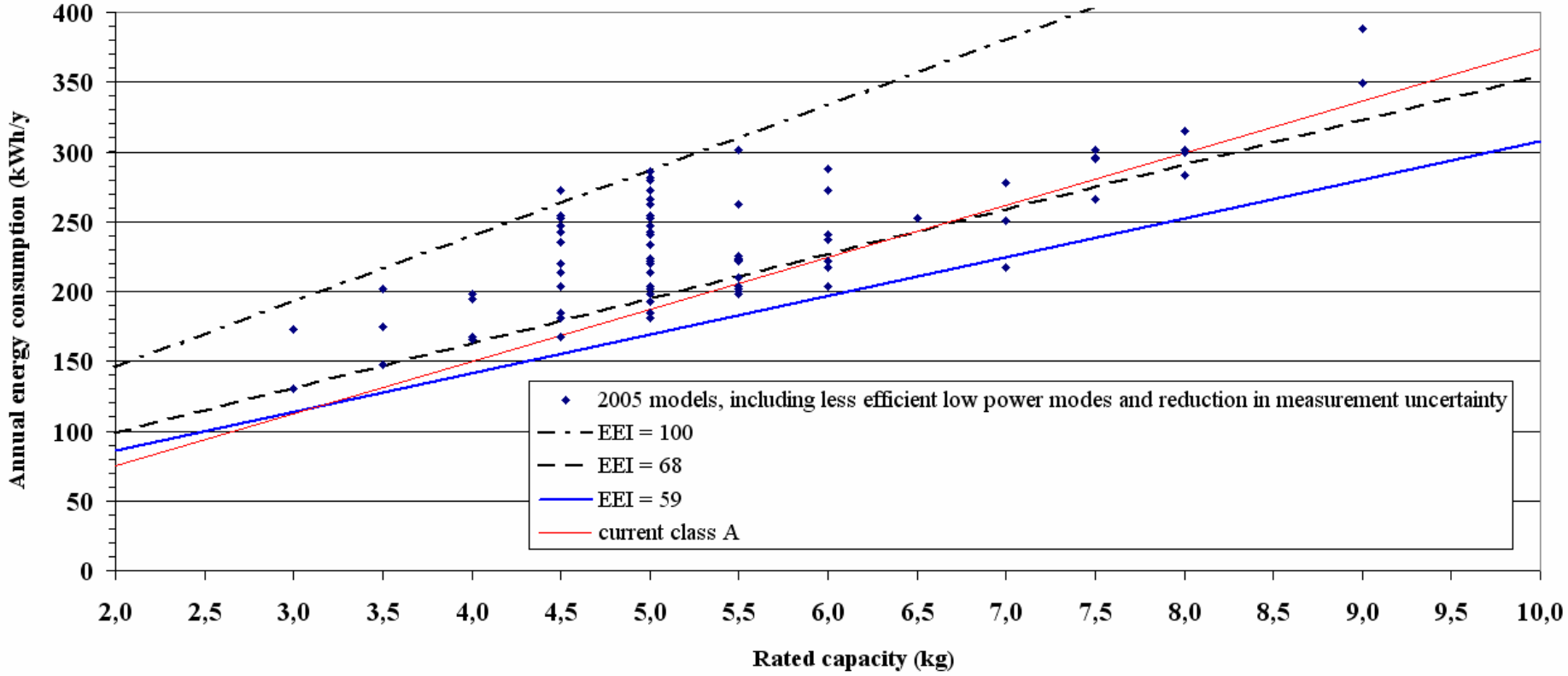
Ecodesign impact (IIb)

EEI threshold impact, Steps 1 & 2 (intermediate scenario)



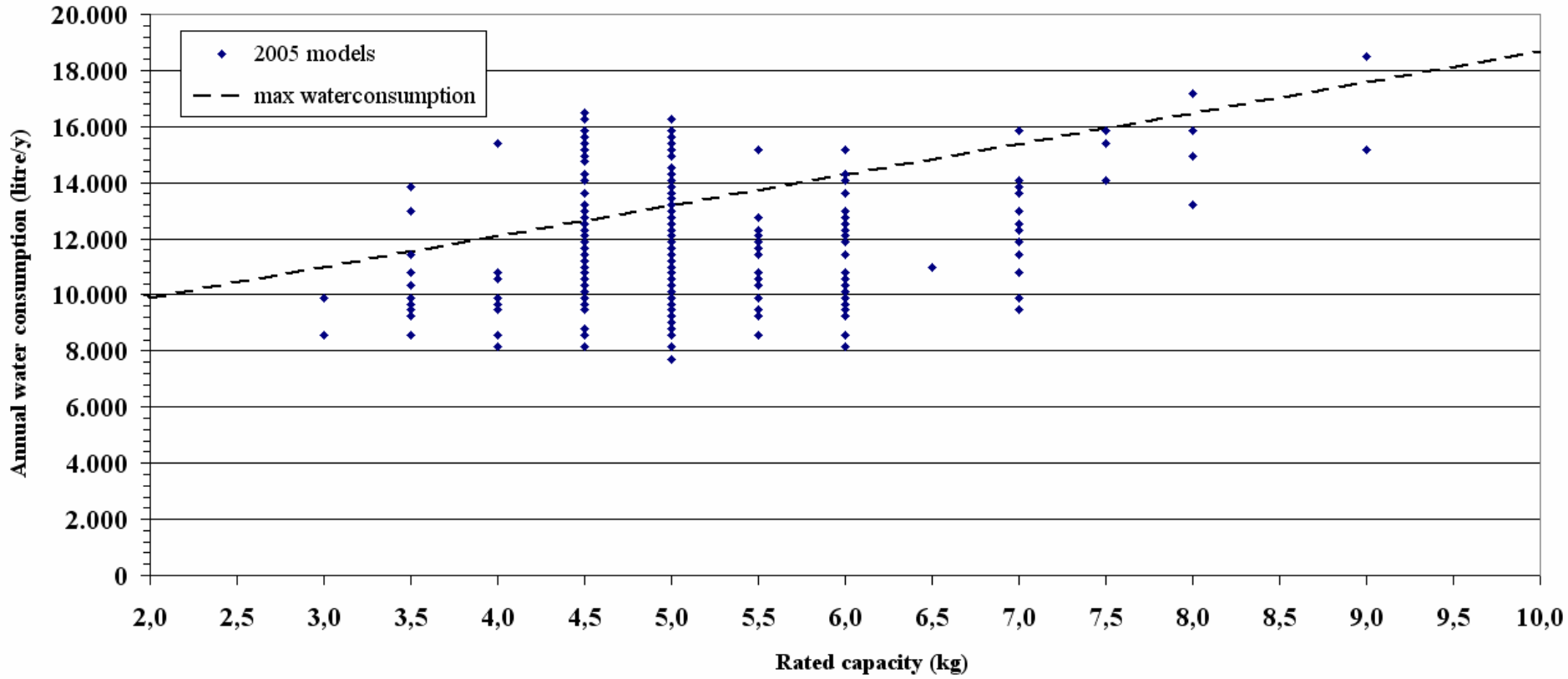
Ecodesign impact (IIc)

EEI threshold impact, Steps 1 & 2 (worst-case scenario)

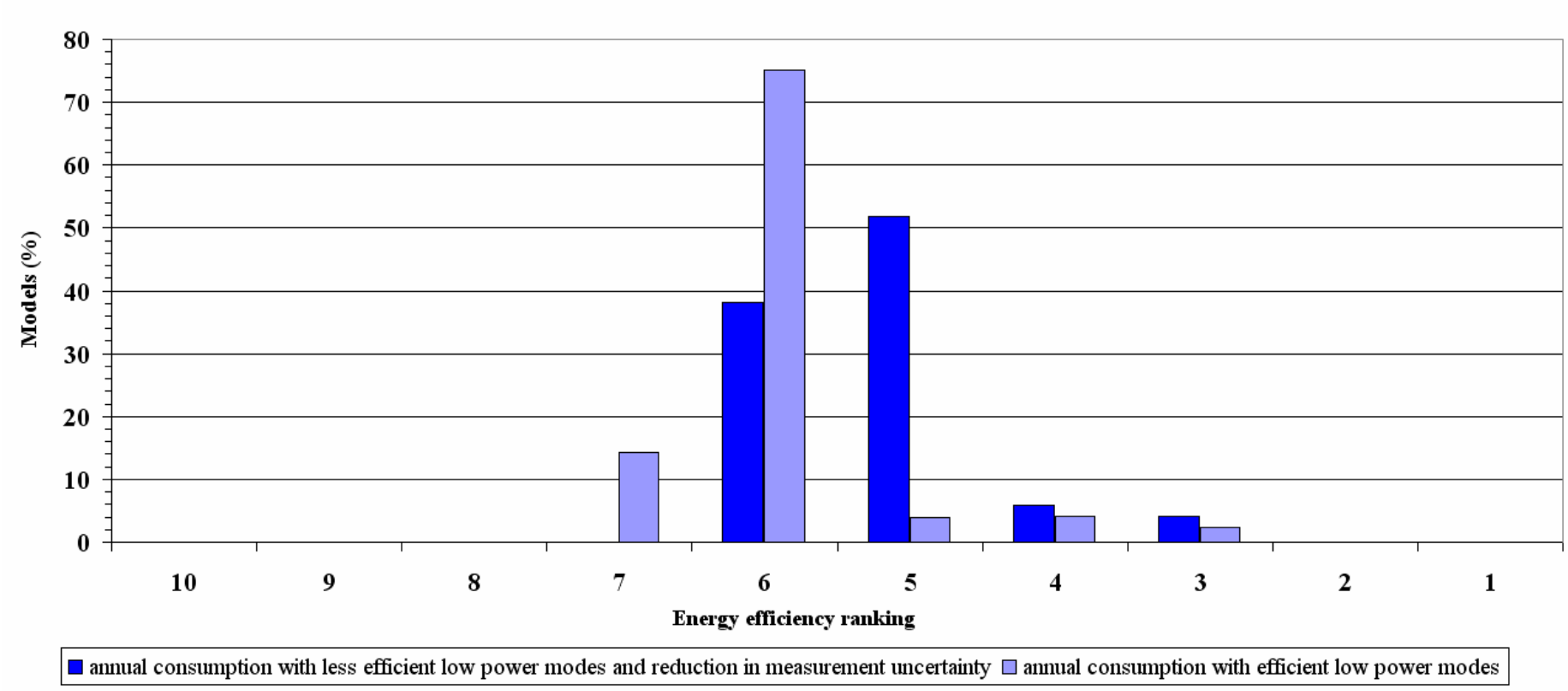


Ecodesign impact (III)

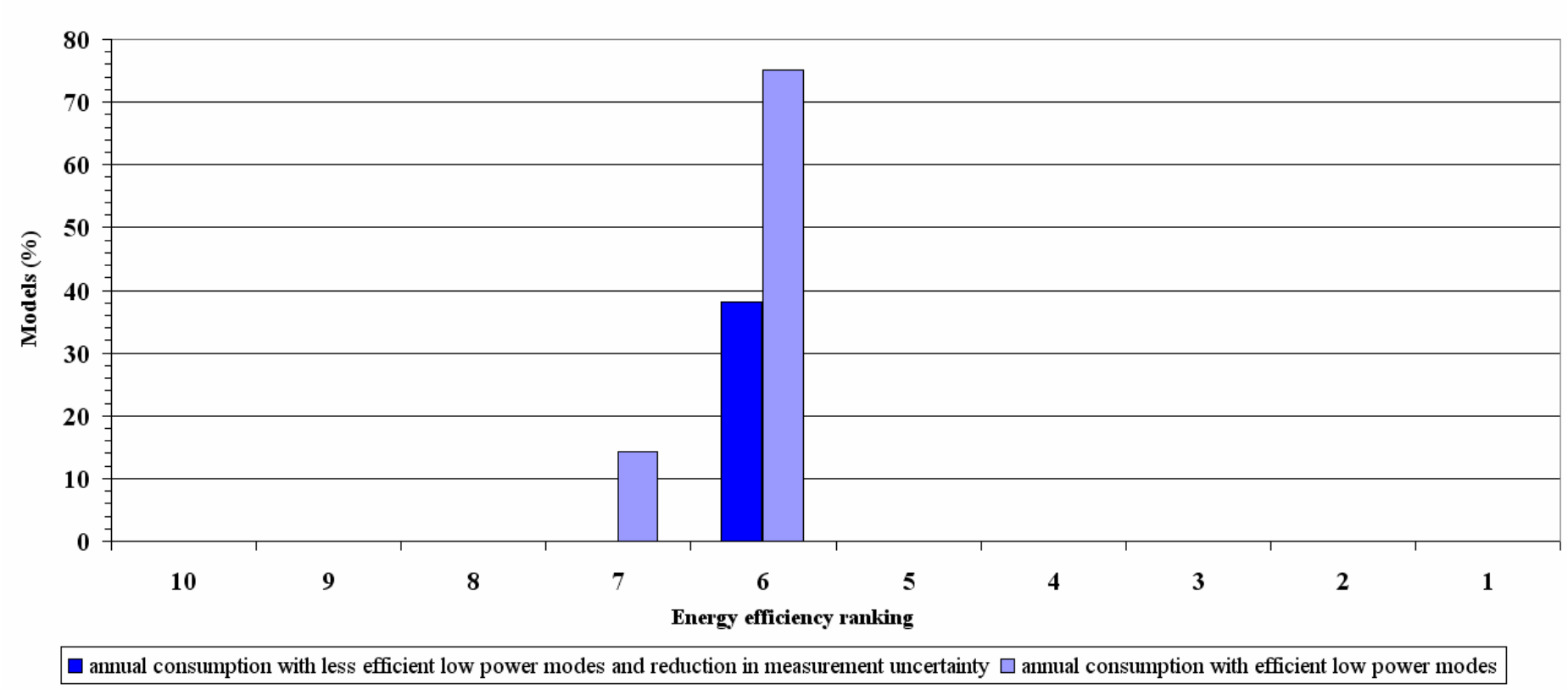
Water consumption threshold impact, Step 1



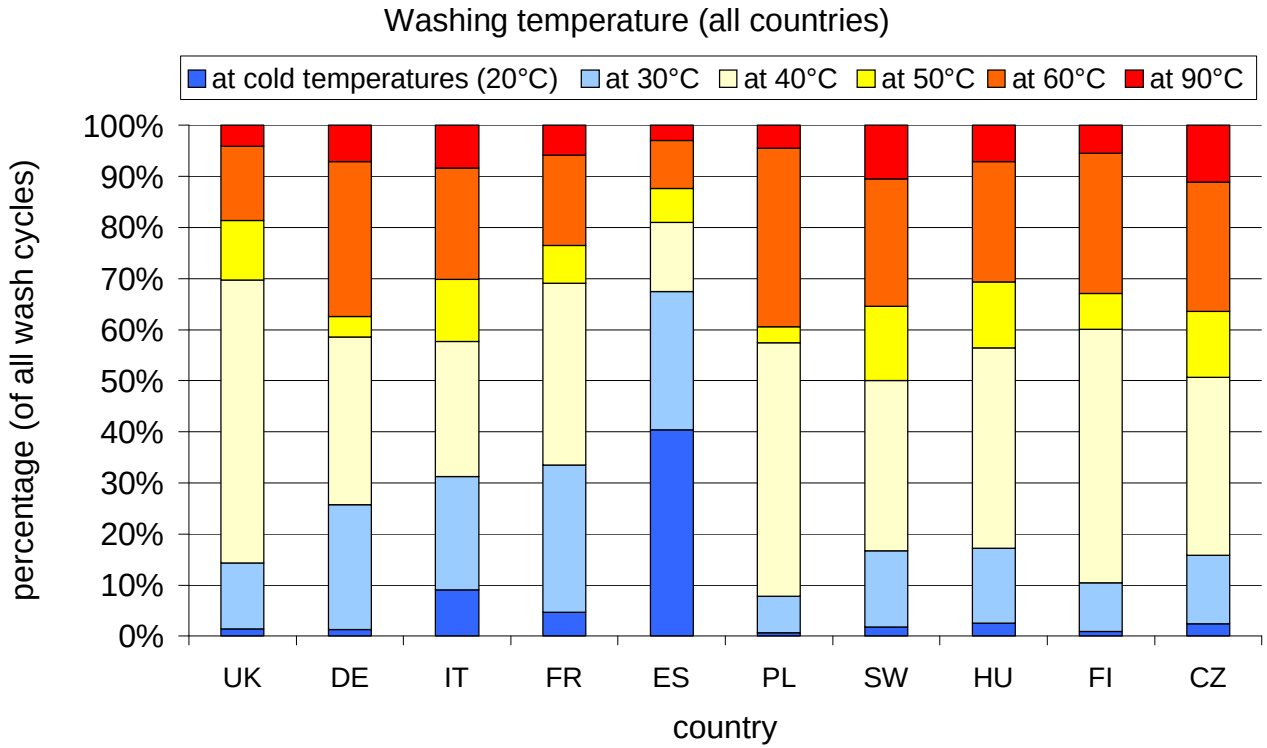
Energy labelling impact



Ecodesign and Energy labelling combined impact



Cold wash (20°C) use in EU



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- People would have to accept the need for pre-treatment products and perhaps lower their expectations for whiteness
- Cold washes may be found to be more effective in summer than in winter because of the difference in the temperature of the incoming water

Hot fill: a real issue ?

- There are two main benefits gained from using cold fill only (source: MTP, BNW15: Washing machines – efficient use FAQs, 2008):
  - » controlled heating, which leads to better cleaning and less likelihood of damaging colours and delicate fabrics
  - » only the required volume of water is heated
- The amount of water used in a typical 6 kg washing machine is about 17 litres (wash stage only), of which only 3 litres is hot.
- Using solar hot water for clothes washing actually saves very little energy because of the small amount of hot water used and the losses in the delivery system. It is most useful to use this water for baths and showers that consume relatively large quantities of hot water
- The difference will only really be significant on high-temperature (60°C or 90°C) washing programs (Which? Reviews, 2008)
- Avoiding the need for an extra inlet valve and connecting hose on the machine helps to keep down manufacturing costs and to save raw materials.

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