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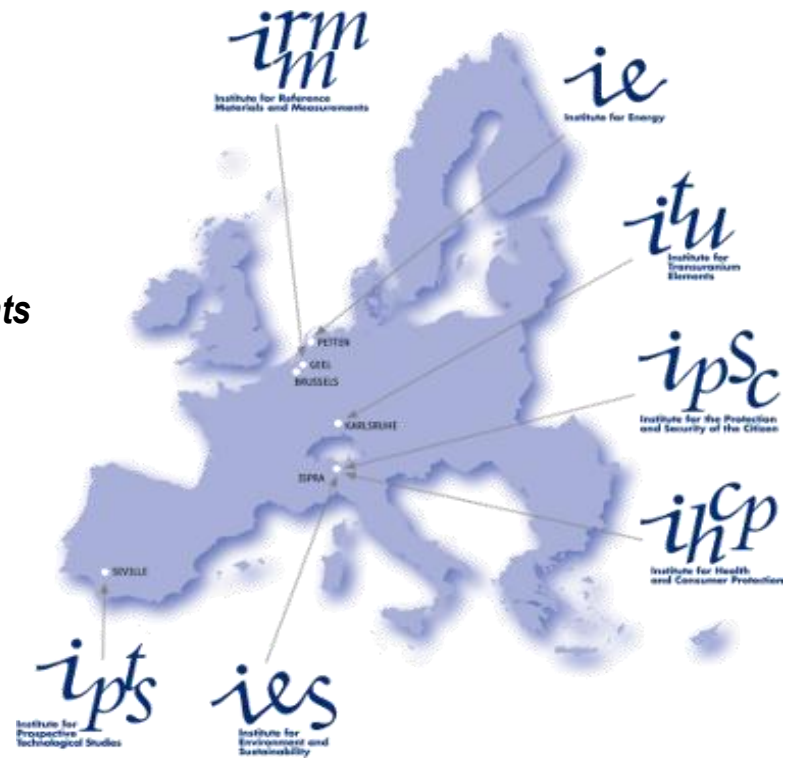

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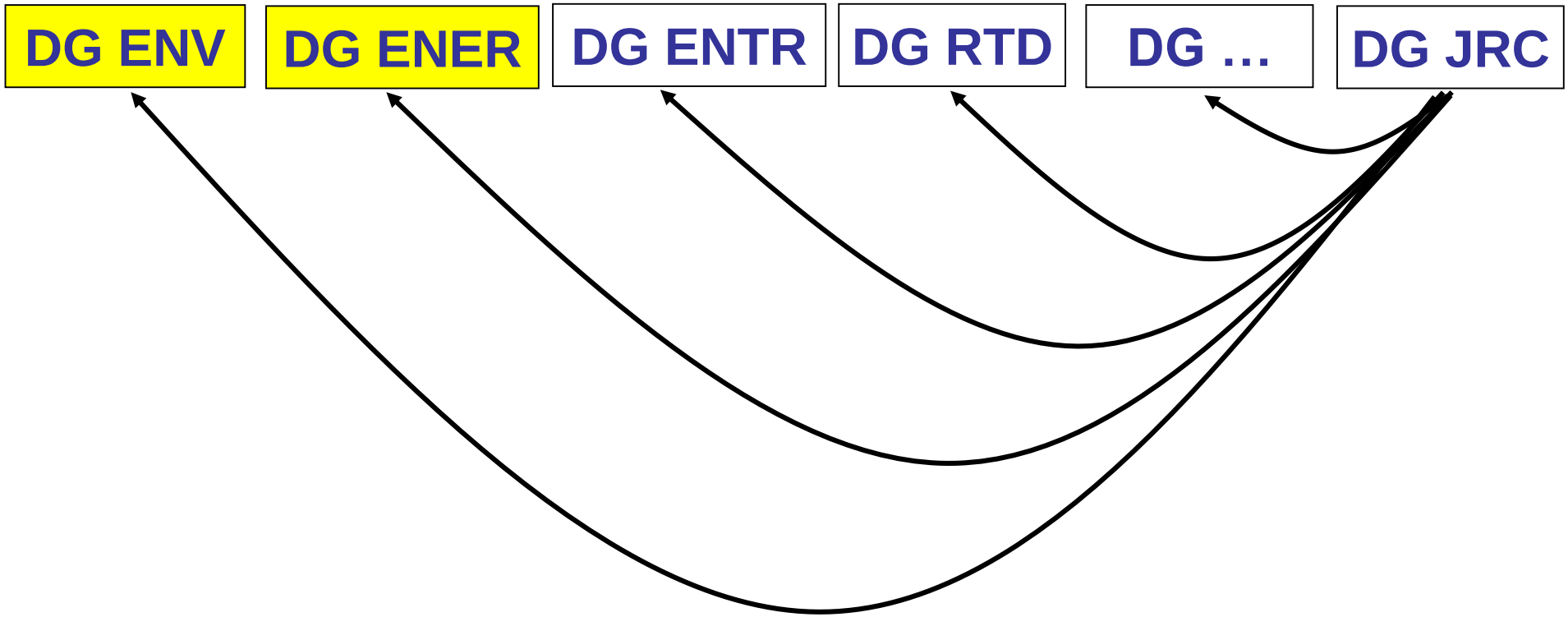
Joint Research Centre in the context of the European Commission:



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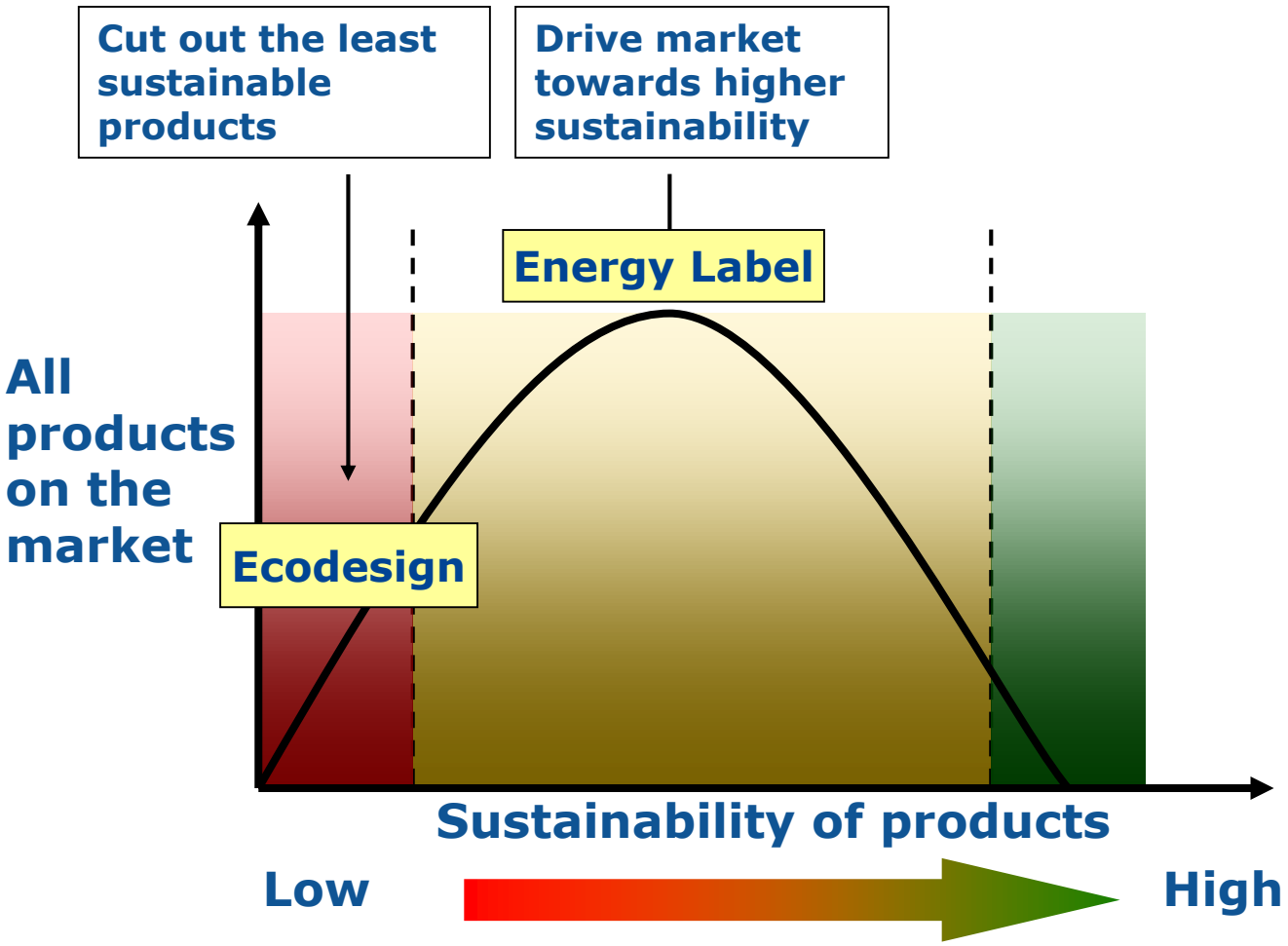
Activities in support of Product Policy

IPTS supports the **development and implementation of environmental product policies**, amongst them the EU Ecolabel Regulation, the Green Public Procurement Communication, the Energy Related Products Directive and the Energy Labelling Directive.

This includes the **techno-economic research** as well as the operational management particularly of the **stakeholder consultation**.


Cut out the least sustainable products
Drive market towards higher sustainability
Energy Label
All products on the market
Ecodesign
Sustainability of products
Low
High

Revision of ED/EL requirements for household Washing Machines and Washer-Dryers

1st TWG meeting

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Stimulating innovation
Supporting legislation

Seville, 24 June 2015

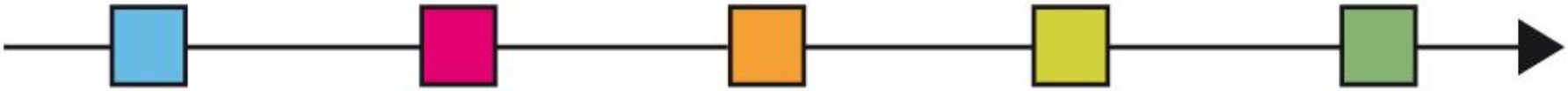
Objectives

Developing an **evidence base** to prepare the revised Ecodesign and Energy Label regulations.

MEErP compliant and representative Technical, Economic, Environmental analyses

Independent, neutral, science-based research with strong stakeholder involvement (Technical Working Groups)

Ecodesign process



1. Product study completed

A study for each product group examines market data, technological status and other relevant issues.

When the study is completed, the Commission formulates a proposal (working document) taking the findings and recommendations of the study into account.

2. Consultation Forum and proposal

The proposal (working document) from the Commission is communicated to experts, stakeholders and Member States. These parties meet in the Eco-design Consultation Forum to discuss the proposal.

Based on the Consultation Forum and the impact assessments, the Commission formulates a draft regulation.

3. Draft regulation

When the Commission has formulated a draft regulation, it is submitted to the Eco-design Regulatory Committee, which is composed by one representative from each EU Member State.

4. Approved by Regulatory Committee

After the proposed regulation is adopted by a majority of the Regulatory Committee (the voting power of each Member State is weighted based largely on each state's population) it is sent to the European Parliament for scrutiny. It is also notified to the World Trade Organisation.

5. Final regulation

The regulation is formally adopted by the Commission and published in the Official Journal of the European Union (OJ) before it enters into force.

The most likely legal form of the implementation is "regulation", which means that it takes direct legal effect in all Member States.

Preparatory study overview

Task 1: Product group definition and scope, standards and legislation,

Task 2: Market analysis

Task 3: User behaviour and system aspects

Task 4: Technologies

Task 5: Environmental and economic assessment

Task 6: Design options

Task 7: Policy scenarios analysis

Past activity

- Analysis of Lot 14 preparatory studies, CF working documents, IA
- Desk reasearch, Omnibus study, IA harmonisation
- Questionnaire of March 2015 and follow-up
- Plant and lab visits (BSH, Indesit/Whirlpool, Miele, VDE)
- Bilateral meetings (CECED)
- First draft of the preparatory study (PDF, HTML) with the support of Oeko and Uni Bonn
- In parallel: User survey for WM and WD (Uni Bonn)

Next steps

- 1st Stakeholder meeting: 24 June
- Standardisation issues meeting: 25 June
- Feedback collection in BATIS (31 July 2015)
- Additional questionnaire T5-T7 of MEErP + EoL (Sep 2015, tbc)
- Additional Plant visits (Electrolux, Gorenje) and recycling plants
- 2nd Stakeholder meeting: 18 November
- Q1 2015 Final preparatory study

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Goal of today's meeting:

- Present status of knowledge - preparatory study draft
- Key discussion points highlighted - Identify key implications for the EL&ED revision
- Identify data gaps and where to find this data

How?

- Refresh briefly key issues of the preparatory study draft
- Discuss openly
- Task-by-task, followed by a future outlook

TASK 1: SCOPE

- Product definitions and scope
- Legislation and standards
    - Ecodesign, energy efficiency and other performance characteristics
    - Material resource efficiency
- Discussion

EU legislation and standards for ecodesing and performance characteristics

- Mandatory legislation in EU on ecodesign and performance:
  - Regulations 1015/2010 and 1061/2010 for WM
  - Directive 96/60/EC for WD)
- Based on EU standards (performance, safety, noise, EM):
  - EN 60456:2011 "Clothes washing machines for household use. Methods for measuring the performance"
  - EN 50229:2007 "Electric clothes washer-dryers for household use. Methods of measuring the performance" (International: IEC 62512)
  - EN 62301:2005 "Household electrical appliances - Measurement of standby power"
- Other elements pointed out in the report

Revision needs

- Regulations 1015/2010 and 1061/2010 foresee an update 'in light of technological progress' and mention specifically an assessment of verification tolerances, ecodesign requirements on rinsing and spin-drying efficiency and the potential for hot-water inlet.

- Status, need for future standardisation, and international comparability of requirements and standards have been recently assessed in:
  - The "Omnibus" Review Study (VHK 2014)
  - The study "Improving Global Comparability of Appliance Energy Efficiency Standards and Labels" (CLASP and The Policy Partners, 2014))

- WD inclusion

- Stakeholders consultation

Product scope and definitions

- Scope and revised scope of Ecodesign Regulation 1015/2010 for household washing machines (similar for Energy Label Regulation 1061/2010):
- *This Regulation establishes Ecodesign requirements for the placing on the market of electric mains-operated household washing machines and electric mains-operated household washing machines that can also be powered by batteries, including those sold for non-household use and built-in household washing machines.*

Product scope and definitions

- Scope and revised scope of Ecodesign Regulation 1015/2010 for household washing machines (similar for Energy Label Regulation 1061/2010):
- *This Regulation establishes Ecodesign requirements for the placing on the market of electric mains-operated household washing machines ~~and electric mains-operated household washing machines that can also be powered by~~ **batteries**~~, including those sold for **non-household use** and **built-in** household washing machines~~ and household **washer-dryers***

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Product scope and definitions

Proposal for revised definitions of Regulations 1015/2010 and 1061/2010 for household washing machines and washer-dryers:

- *'Household washing machine' means a~~n automatic washing~~ machine which cleans and rinses textiles by using water,* chemical, mechanical and thermal means; *which also has a spin extraction function and which is designed ~~to be used principally for non-professional purposes.~~* in a way principally intended for domestic use as stated by the manufacturer in the Declaration of Conformity (DoC).
- *'Built-in household washing machine' and 'Automatic washing machine': OUT*
- *'Household combined washer-dryer' means a household washing machine which includes both a spin extraction function and also ~~a~~ means for drying the textiles~~, usually~~ by heating and tumbling.*

Niche or special purpose products

Niche/special products identified for exclusion by stakeholders:

- Battery or continuous current appliances (lack of data and products on the market)
- Micro-washing machines (< 1 kg, test standards for 1 kg and above)
- Water heated appliances (heat exchanger, no test methods, phased-out because it could not reach A class washing performance).
- Waterless washing machines (excluded by the current definition, different technology)

Niche/special products of interest according to stakeholders:

- Alternative heated appliances
- Smart-grid ready appliances

Discussion points 1.1: Scope

a) Do you agree with the proposed revised scope?

Discussion point 1.2: Definitions

a) Do you agree with the revised definitions?

b) Could the definition *'drying the textiles by heating and tumbling' be* too restrictive about the means of drying (any risk of hindering technical innovation of alternative drying options)?

Other points of discussion

a) Do you agree with the identified niche / special products?

Energy Label Regulation 1061/2010 on washing machines

Information to provide to consumers:

- **7 energy eff. classes** based on EEI: from A+++ to D (Coloured arrows)
- **Annual energy consumption** (220 cycles + standby consumption)
- **Pictograms** highlighting:
  - Noise emissions in decibels
  - Spin-drying efficiency class
  - Capacity in kilograms
  - Annual water consumption in litres
- Measurement and calculation methods set in **EN 60456:2011**, on the basis of: 60° C cotton programme at full (3 cycles) and partial (2) load, 40° C cotton programme at partial load (2), left-on mode and in off-mode

Energy efficiency class	Energy Efficiency Index (EEI)
A^{+++}	EEI < 46
A^{++}	46 ≤ EEI < 52
A^{+}	52 ≤ EEI < 59
A	59 ≤ EEI < 68
B	68 ≤ EEI < 77
C	77 ≤ EEI < 87
D	EEI ≥ 87

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

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Ecodesign Regulation 1015/2010 on washing machines

- **Energy Efficiency Index (EEI)**: since 1 Dec 2013, for all WM ≥ 4 kg it must be < 59 (Energy Label class A+ or better), for the others <68.
- **Water consumption (W_t)**: has to be ≤ 5 x $c_{1/2}$ + 35 ($c_{1/2}$ is the lowest rated capacity btw standard 40/60° C cotton programmes at partial load)
- **Washing Efficiency Index (I_w)**: for WM > 3 kg it must be greater than 1.03 (class A of the former Energy Label: Commission Directive 95/12/EC), for the others > 1.00
- Availability of a **cold wash programme** (max. 20° C)
- **Further requirements**

  - calculation of the energy consumption and other parameters

  - booklet of instructions ((a) standard 40/60° C cotton programmes, (b) power consumption of the off-mode and of the left-on mode; (c) indicative information on the programme time, remaining moisture content, energy and water consumption for the main washing programmes at full or partial load, or both; (d) recommendation on the type of detergents to use).

Energy Label Directive 96/60/EC on washer-dryers

- Exempted from the scope of Regulation 1061/2010.
- The label contains:
  - **Energy consumption per cycle** (washing and drying / washing only)
  - **Washing performance** – with a class from A to G
  - **Max spin speed**
  - **Tot cotton capacity** (washing and drying separately)
  - **Water consumption for a full load** washed and dried (condenser dryers may use significant amounts of water on the drying cycle)
  - **Noise** in dB (A) (separately for washing, spinning and drying)
- The energy efficiency scale is based on the energy consumption 'C' in **kWh per kg** of complete operating cycle (washing, spinning and drying) using standard 60 ° C cotton cycle, and 'dry cotton' drying cycle

Energy efficiency class	Energy Consumption (C)
A	$C \leq 0.68$
B	$0.68 < C \leq 0.81$
C	$0.81 < C \leq 0.93$
D	$0.93 < C \leq 1.05$
E	$1.05 < C \leq 1.17$
F	$1.17 < C \leq 1.29$
G	$1.29 < C$

Test standards

- **Continuous work** at standardisation level (e.g. CENELEC TC59X WG1) for producing reliable, repeatable and reproducible results
- **Differences** btw European standards and Regulations (low-power modes in formula, rounding)
- Assessment of expanded uncertainty and definition of verification tolerances possible after a **round-robin test** (ring test)
- **CENELEC TC59X WG1** is gathering data on "Uncertainty and tolerances" for "Household and similar appliances" (No round-robin test for WD)
- **Current tolerances** have been indicated to fit well. A stakeholder suggests that tolerances could be smaller, about 6%.
- Some testing procedures require a testing effort that might not be in line with their added value (e.g. **low-power modes**)
- **Other characteristics** might be relevant (e.g. textile care/ gentleness of action, rinsing performance, hygiene assessment)
- Procedure for measuring the **rinsing performance** is under investigation within CLC/TC 59X/WG 1
- IEC/PAS 62958 Ed.1: "Clothes WM for household use – Method for measuring the **microbial contamination reduction**" published in 2015

Worldwide situation

- Many countries have implemented energy and other environmental requirements for washing machines, although with different approaches (e.g. the US legislation refers to the volume of the drum)
- Some of them include elements not currently addressed in the EU, e.g.:

  - The US DoE introduced a 5% bonus in the energy star regulation if the product offers smart grid connection capability.

  - The Australian standardisation body has announced its willingness to adopt the IEC rinsing method
- Further details in the report

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Discussion areas

Scope and definition	1.1 Revision of the scope
	1.2 Proposal for definitions
Energy efficiency and performance	1.3 Energy efficiency tested in the most commonly used programmes
	1.4 Protocol for testing: full/half loads, 40˚ C/60˚ C
	1.5 Capacity measurement
	1.6 Inclusion rinsing performance and measurement of hygiene
	1.7 Simplification of low power management
	1.8 Specify consumption values per cycle
	1.9 Avoidance of damage to textiles
	1.10 Temperature testing
	1.11 Verification of the level of uncertainty of all measured values
	1.12 Demand-response enabled appliances
	1.13 Improvement of rounding methods
	1.14 Performance of washer-dryers
Material efficiency	1.15 Material resources and end-of-life requirements
Additional issues	1.16 Any other issues on standards and legislation

Discussion areas

Scope and definition	1.1 Revision of the scope
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	1.4 Protocol for testing: full/half loads, 40° C/60° C
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	1.6 Inclusion rinsing performance and measurement of hygiene
	1.7 Simplification of low power management
	1.8 Specific consumption values per cycle
	1.9 Avoidance of damage to textiles
	1.10 Temperature testing
	1.11 Verification of the level of uncertainty of all measured values
	1.12 Demand-response enabled appliances **(see 3.5)**
	1.13 Improvement of rounding methods
	1.14 Performance of washer-dryers
Material efficiency	1.15 Material resources and end-of-life requirements
Additional issues	1.16 Any other issues on standards and legislation

After T3/4

Any misleading/missing info on legislation and standards detected in the report?

TASK 2: MARKETS

1st (current) phase: MEErP

- EU production and trade volumes
- Sales and stock data (physical units, sales growth rates)
- Trends: product type market shares.
- Market channels and structure (actors nature and size)
- Consumer expenditure data: purchase, operation costs (energy, water, detergent), reparation/maintenance, disposal

2nd phase: Impact Assessment

Estimation of energy use impacts of the new label. Stock model. Economic impacts on industry, retailers and consumers.

EU production and trade volumes

3 main sources:

- Eurostat Prodcom statistics
- Eurostat Trade statistics
- Direct manufacturer's data

Prodcom and trade statistics differ in category definitions:

Prodcom:

- **Code 27511300:** WM + WD, but also clothes dryers altogether in one single code

Trade:

- **Code 84501110:** WM ≤ 6 kg, 2 subcodes: top-load and front-load,
- **Code 84501190:** WM >6 kg X ≤ 10 kg, top-load and front-load together
- **Dryers: specific, separate code**

Washer-dryers: assumed in one of the above. Which?

EU production and trade volumes

Key figures:

EU Production 2013: ~20.5 million units yearly
Worth EUR 4.5 billion in 2013
~28 million units in 2007 (EUR 6.3b)

Total exports from EU : EUR 0.83b (to the EU and overseas)
Total imports to EU :EUR 0.97b (from EU or overseas)

Net Intra-EU trade 2014:
≤6kg ~ + 66 000 units
>6kg ~ - 44 000 units
Net Extra-EU trade 2014:
≤6kg ~ + 3.7 m units
>6kg ~ + 2.6 m units

2013/14:

20.5m produced - 3.7m - 2.6m (net export overseas) = **~ 14 units sold in the EU**

BUT:

20.5m produced **include** WDs (~1m units) and TDs (~ 4.5m units, Lot 16 prep study)

6.3m trade **includes WD**?

EU sales and stock data

Key figures:

EU28 sales: ~13-14 m units yearly (2013). Needs refinement.

EU28 stock (IA Lot 14, 2009): 185-195m units

EU28 unit purchase price (incl VAT): EUR 460-470

No similar information on WD (not part of lot 14). No stock analysis available.

Stock and sales data are fundamental for the IA. Data collection and refinement needed.

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Trends: product type market shares

Atlete II. 2012/13 picture of the market

	Average	Minimum	Maximum	valid data
Energy efficiency index (in %)	**49,91**	29,90	62,00	62
Standard annual energy consumption (in kWh)/year)	**351,14**	239,70	427,70	62
Weighted annual energy consumption (in kWh)	**173,87**	128,05	233,41	62
Average total energy consumption (in kWh)	**0,78**	0,56	1,04	62
Average power during post programme phase LU (in W)	**0,89**	0,18	2,93	62
Average power during post programme phase LO (in W)	**0,60**	0,02	1,66	62
Average power in off mode (in W)	**0,20**	0,02	0,52	62
Average programme time (in min)	**171,48**	108,00	235,00	62
Average total water consumption (in l)	**41,90**	26,00	63,00	62
Annual water consumption (in l)	**9.218,71**	5.720,00	13.860,00	62
Average value for the total water consumption for the treatment 60 with full load (in l)	**47,52**	33,00	68,00	62
Average value for the max. spin speed (in rpm)	**1.141,27**	909,00	1.595,00	62
Lowest value for the max. spin speed (in rpm)	**1.133,74**	816,00	1.594,00	62
Average remaining moisture content (in %)	**57,40**	45,00	74,00	62
Maximum remaining moisture (in %)	**58,06**	45,00	75,00	62
Nominal total load mass (in kg)	**6,37**	4,00	8,00	62
Washing Efficiency Index for the combined test series	**1,043**	0,994	1,11	62
Specific average total energy consumption (in kWh/kg):	**0,123**	0,073	0,153	62
Specific average programme time (in min / kg):	**27,225**	17,750	35,600	62
Specific average water consumption (in l / kg	**6,651**	4,875	9,800	62
Specific average value for the total water consumption for the treatment 60 with full load (in l / kg):	**7,530**	5,250	10,200	62

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Trends: product type market shares

Atlete II

Additional insight (2012/13) on cases of (non-)compliance of appliances

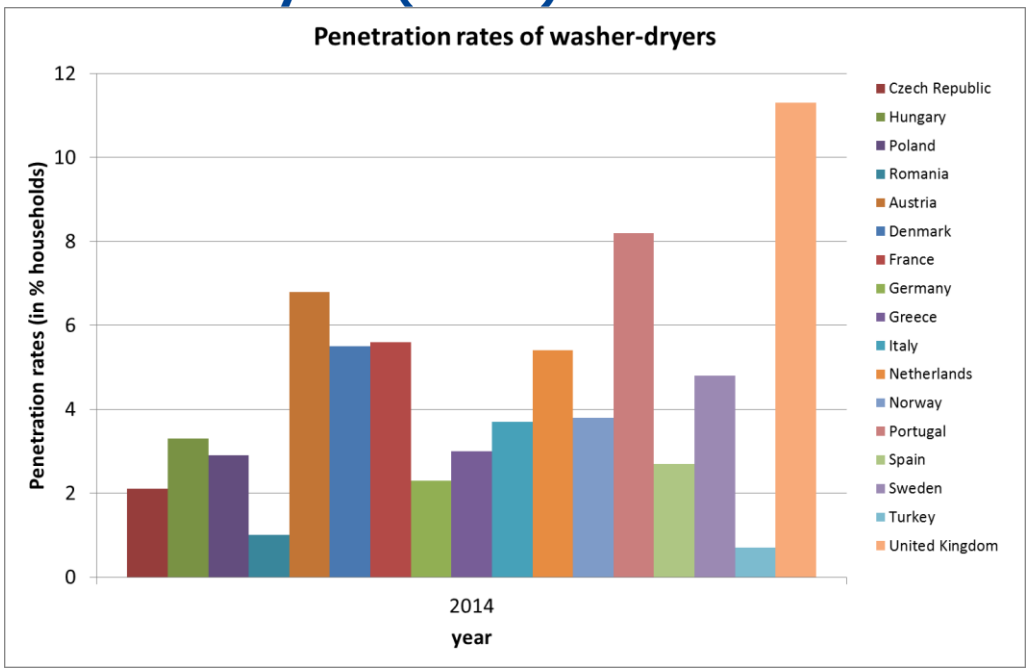
Non-compliance not on energy labelling or false performance, but essentially on details of labelling and information communication prescribed by the regulations

Penetration rates

- **Washing machines:**

2013: 92% in EU28, in 19 of the MS >90%.
SE, DK: 80% ES, AT, CZ: 99%

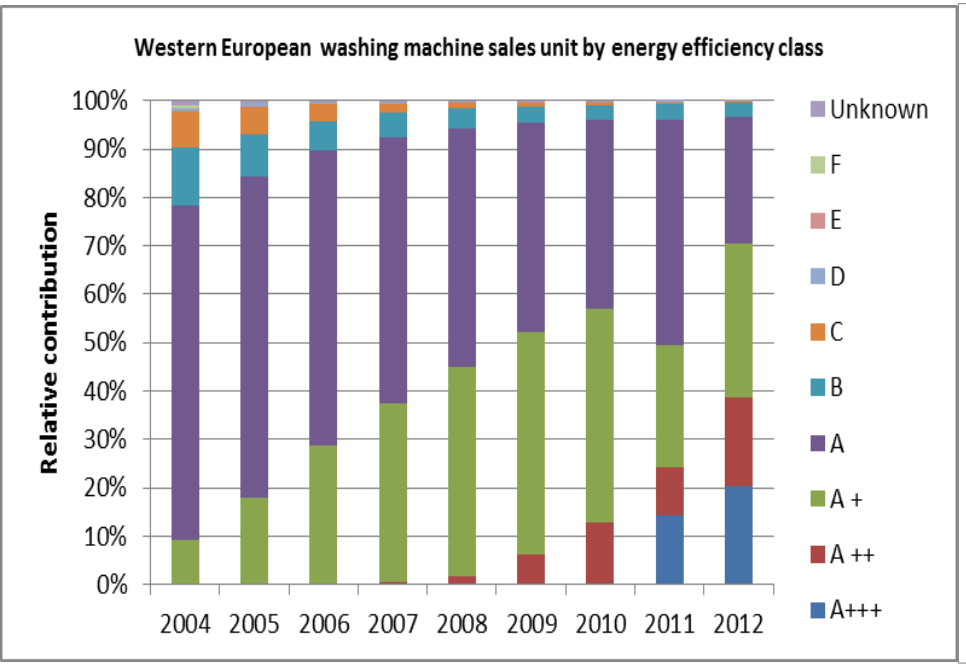
- **Washer-dryers (2014):**

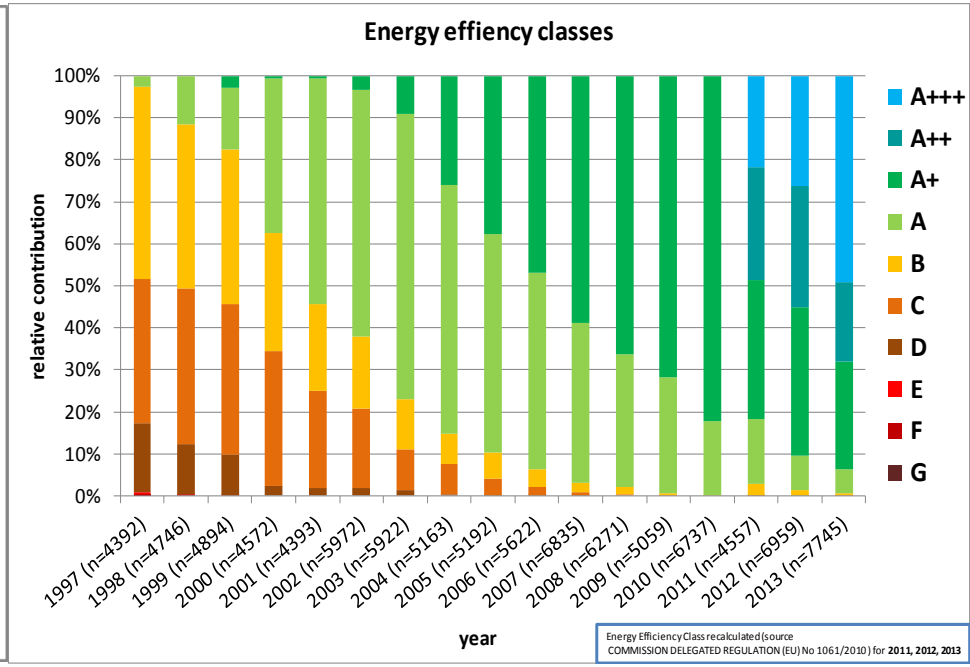


Avg ~4%

large variation, 1-11%,

WM : Distribution of sales by energy class





Sales samples 14 EU countries, GfK data

No of models produced in the EU countries, CECED data

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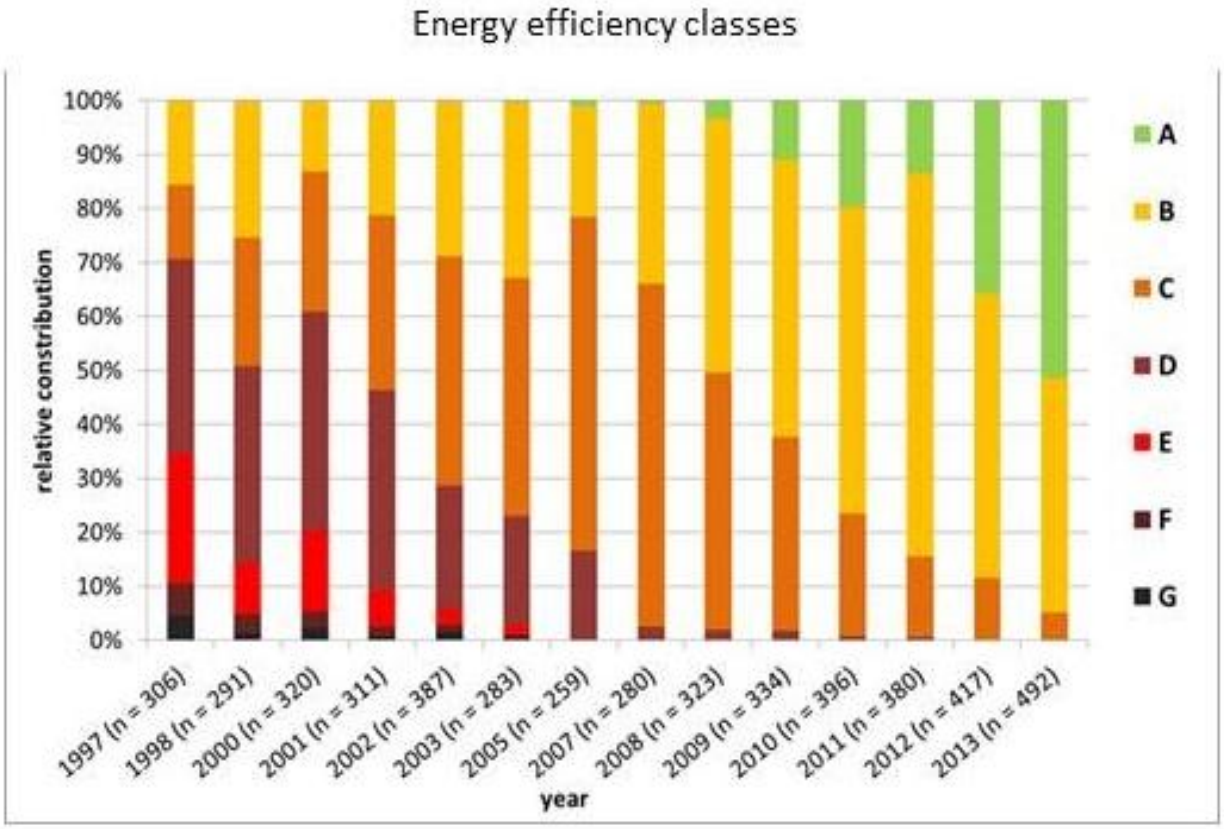
WD : Distribution of sales by energy class



No of models produced in the EU countries, CECED data

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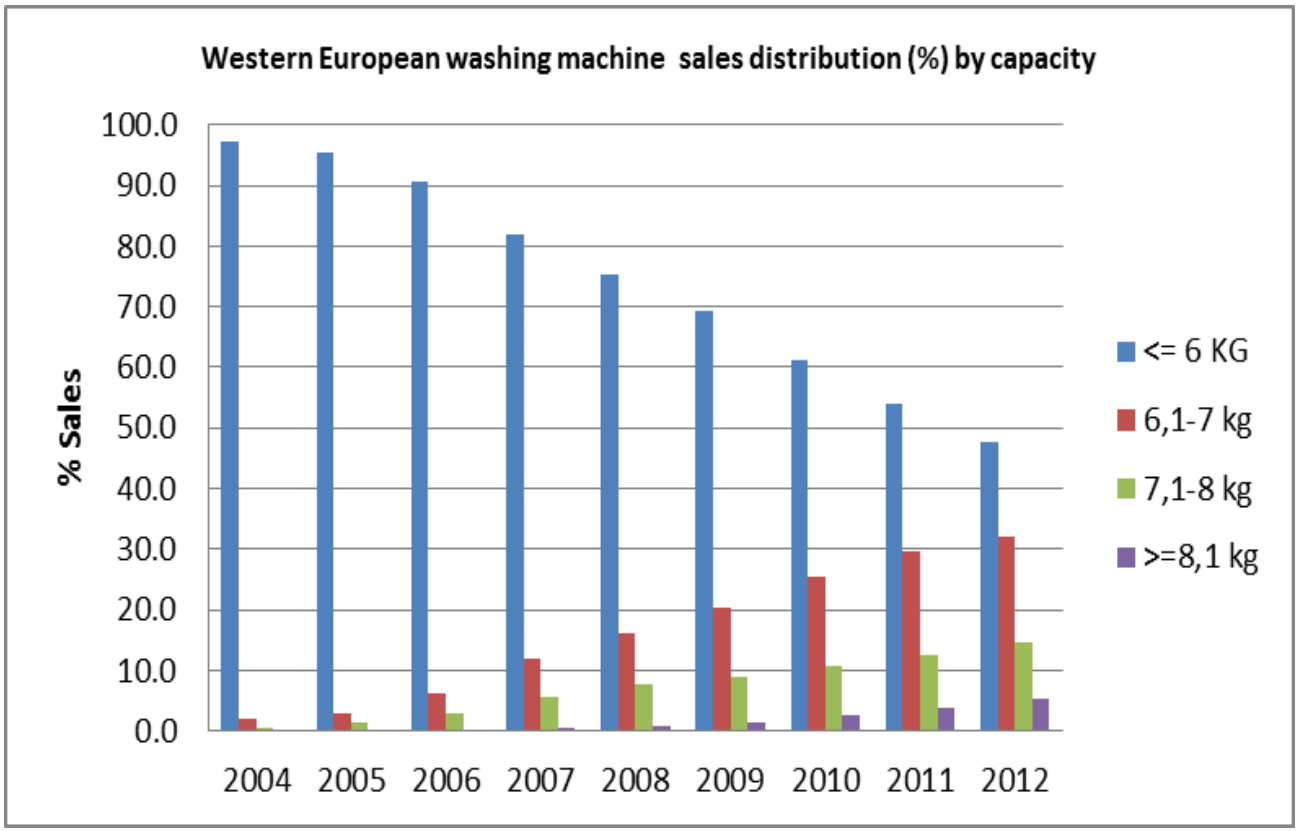
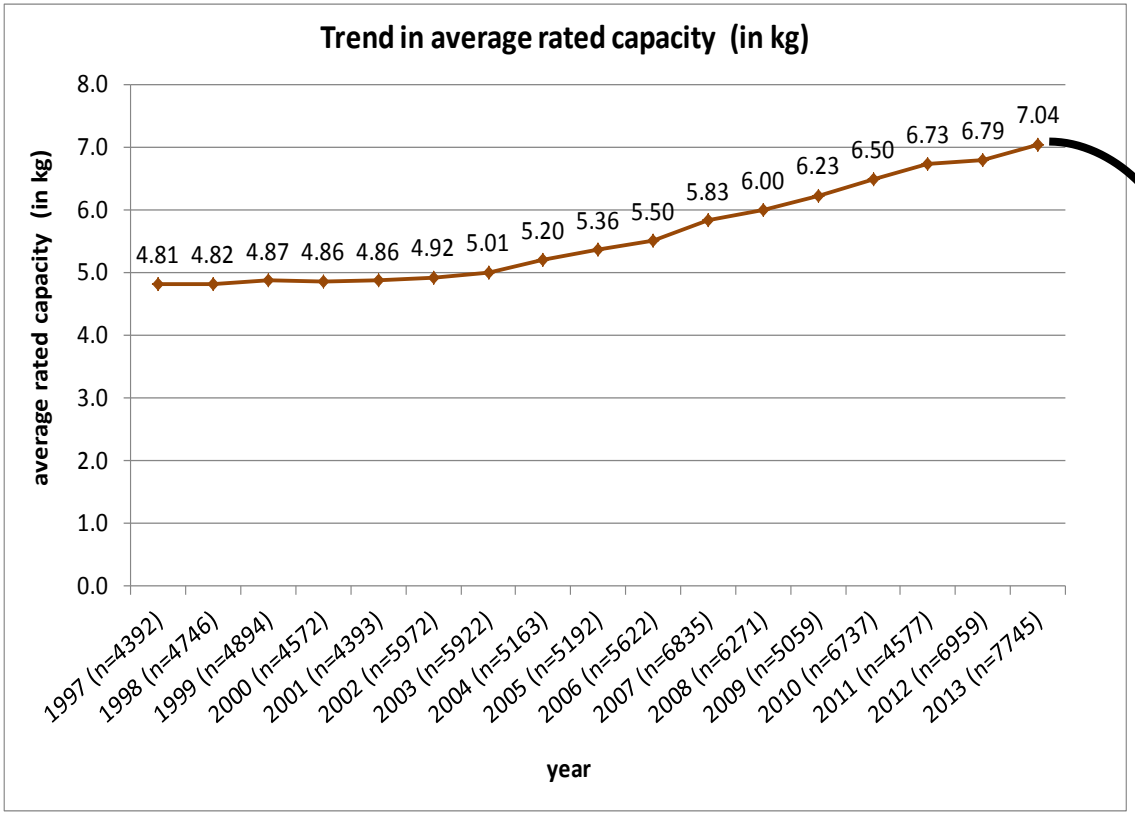
Distribution of sales of WM by capacity (kg cotton)

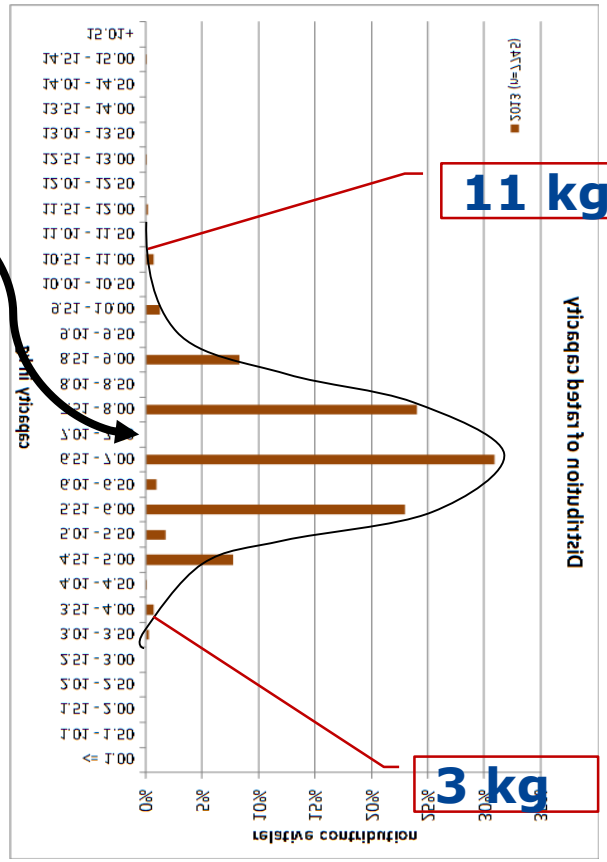


2013 and 2014 data from other sources confirms the trend:

Western Europe, GfK data, 2013

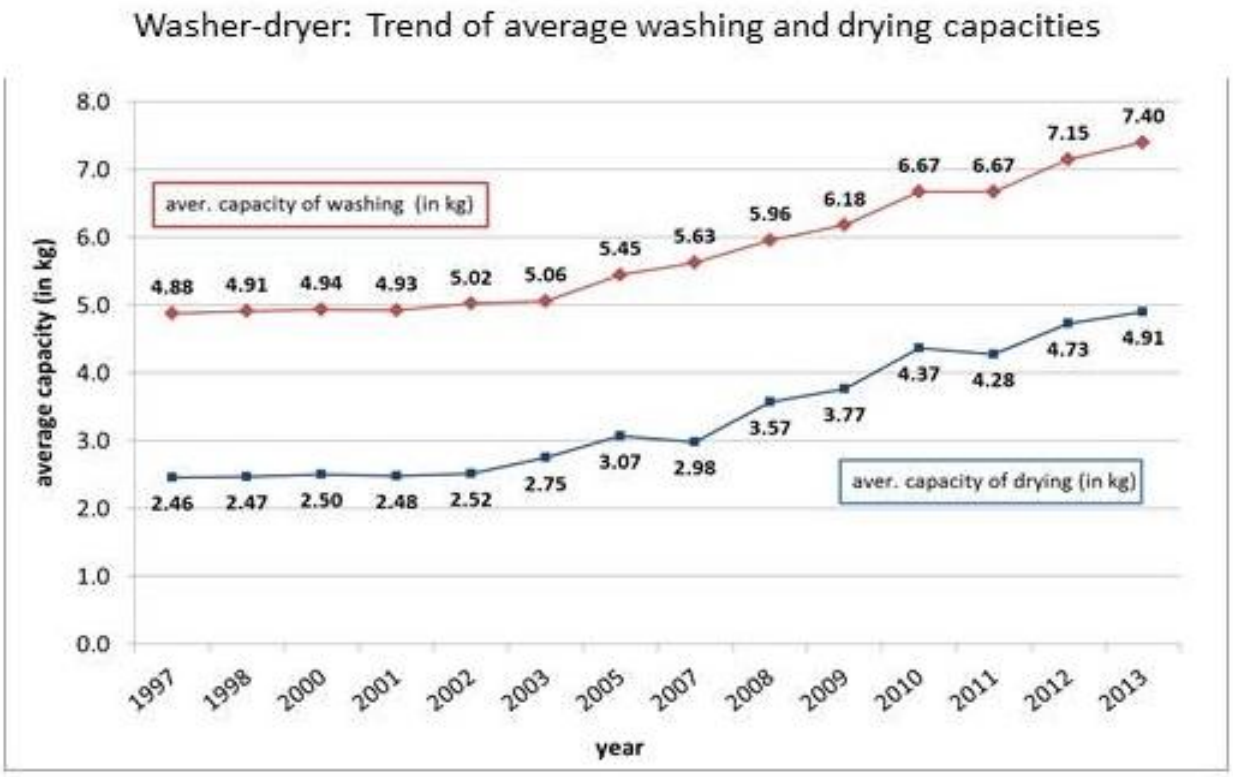
Distribution of sales of WM by capacity (kg cotton)





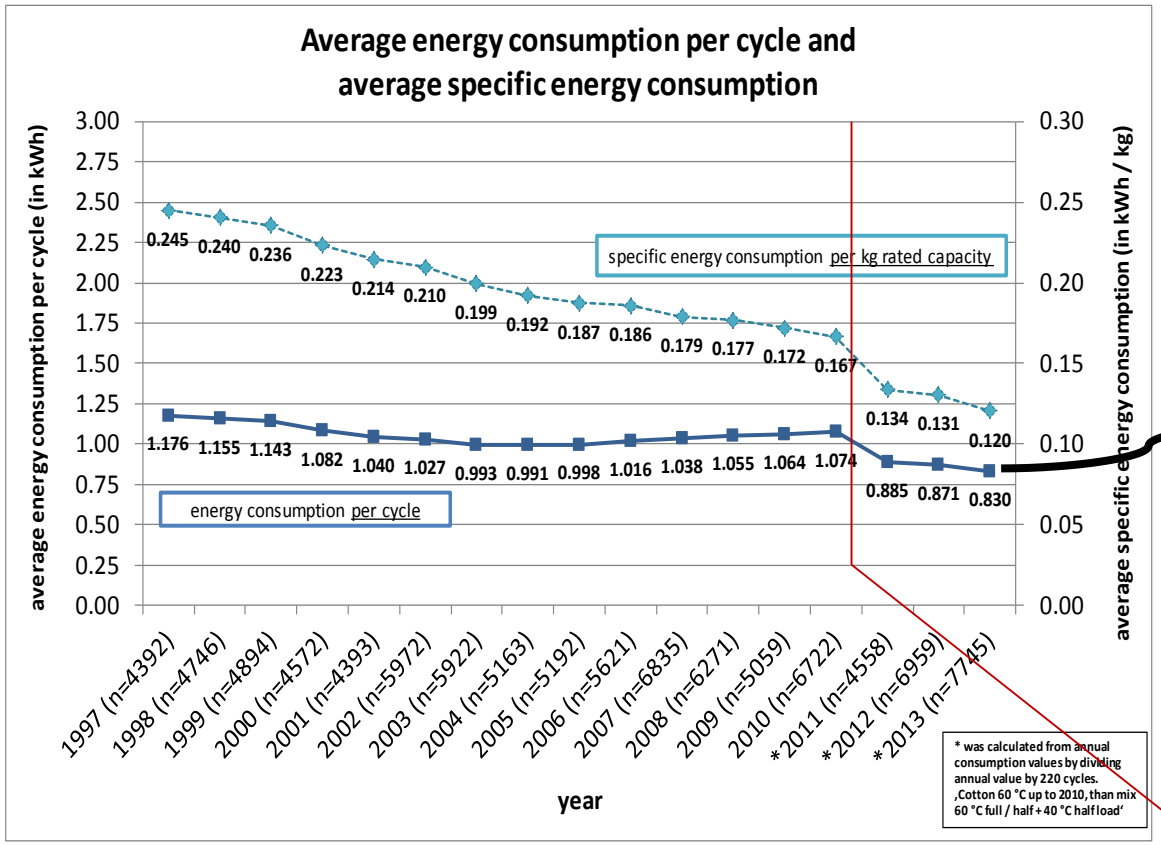
EU, CECED data, 2014

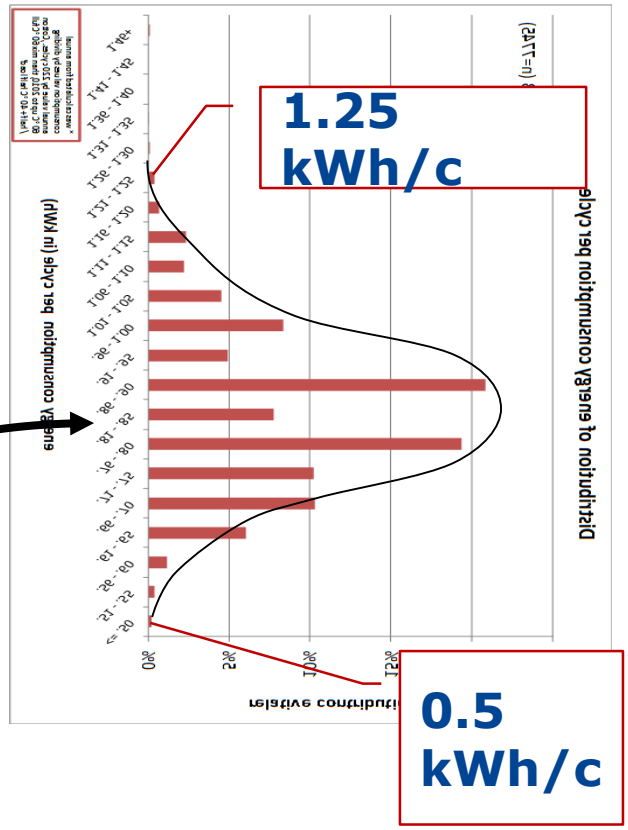
Washer-dryers: Capacity



CECED data, 2014

WM Average energy consumption (kWh/cycle and kWh/cycle/kg)

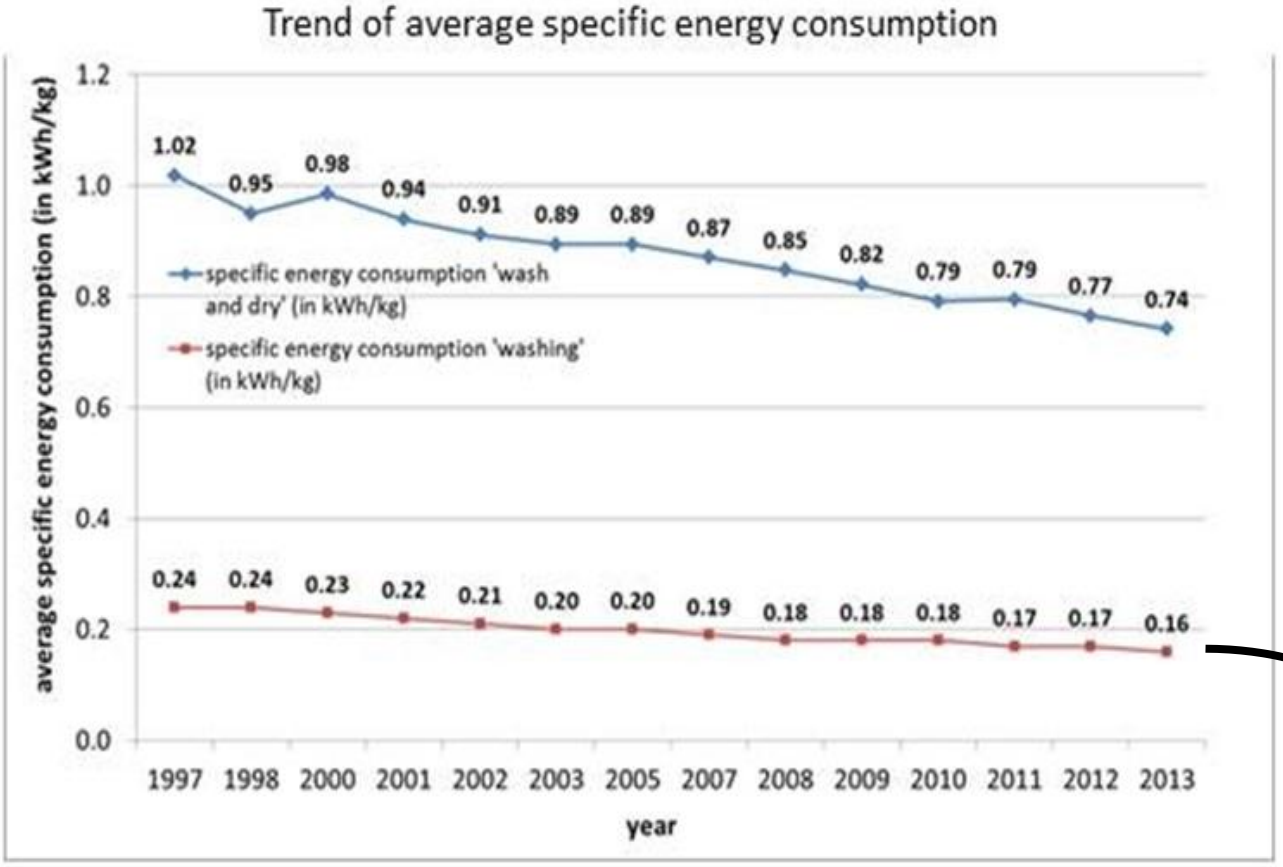




EU, CECED data, 2014

2011: change from 60°C full load to 40&60°C full and half loads

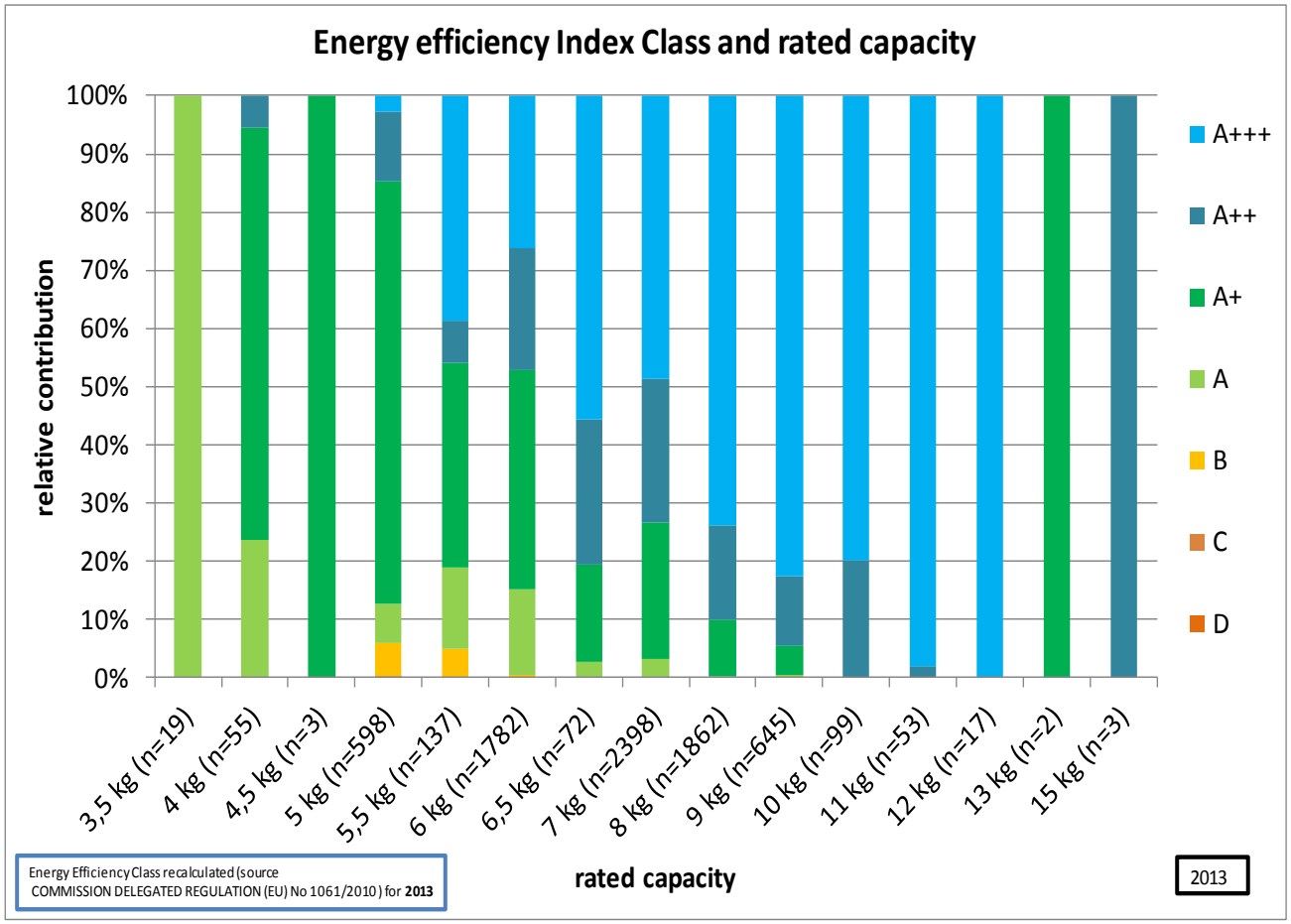
Washer-dryers: Energy use (kWh/cycle/kg)



Similar to WM before the 2011 std change

EU, CECED data, 2014

WM Capacity vs. efficiency (2013)



Larger machines more efficient?

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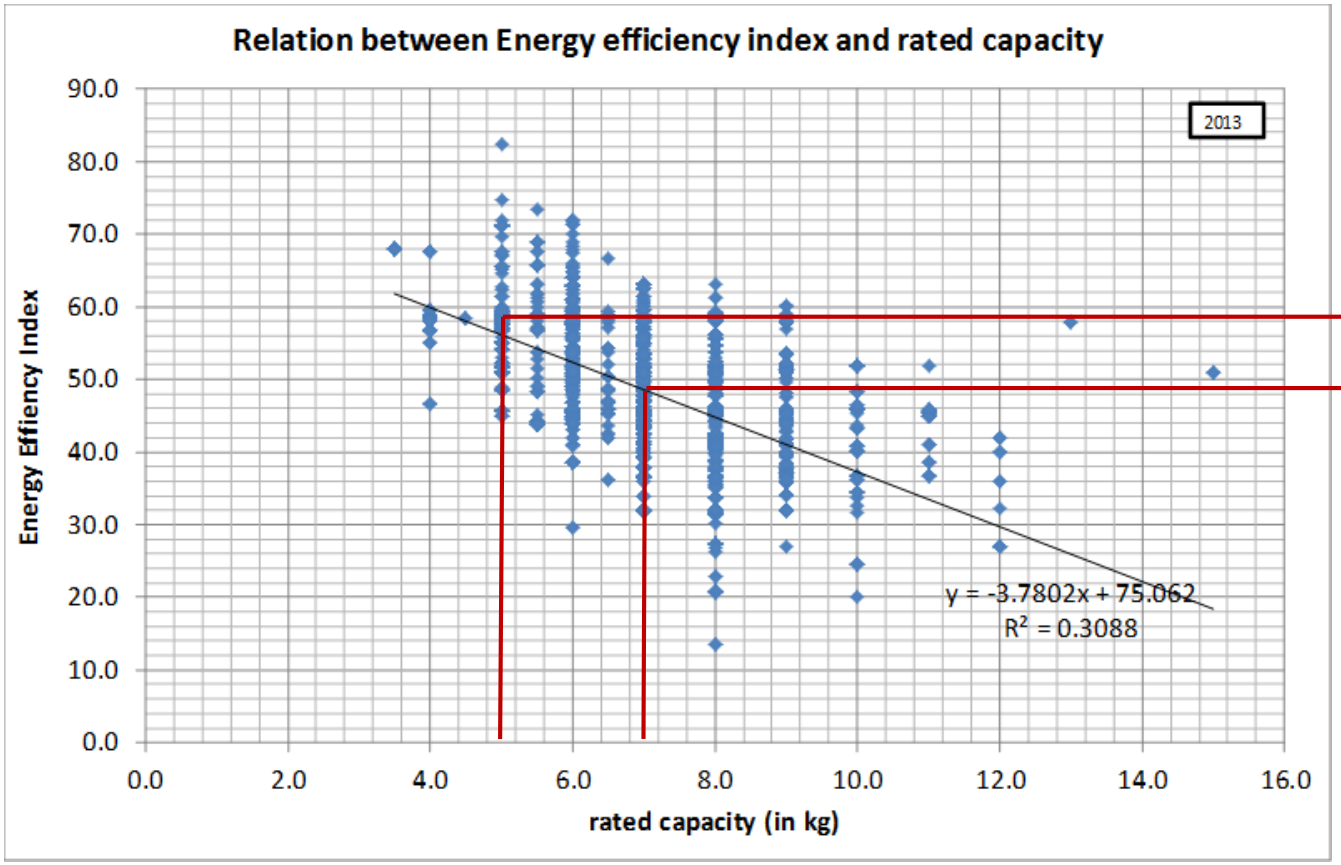
WM Capacity vs efficiency, 2013



20%

4.5kg vs. 7kg

Further clarifications needed to understand implications vs. real-life loading and no. of cycles

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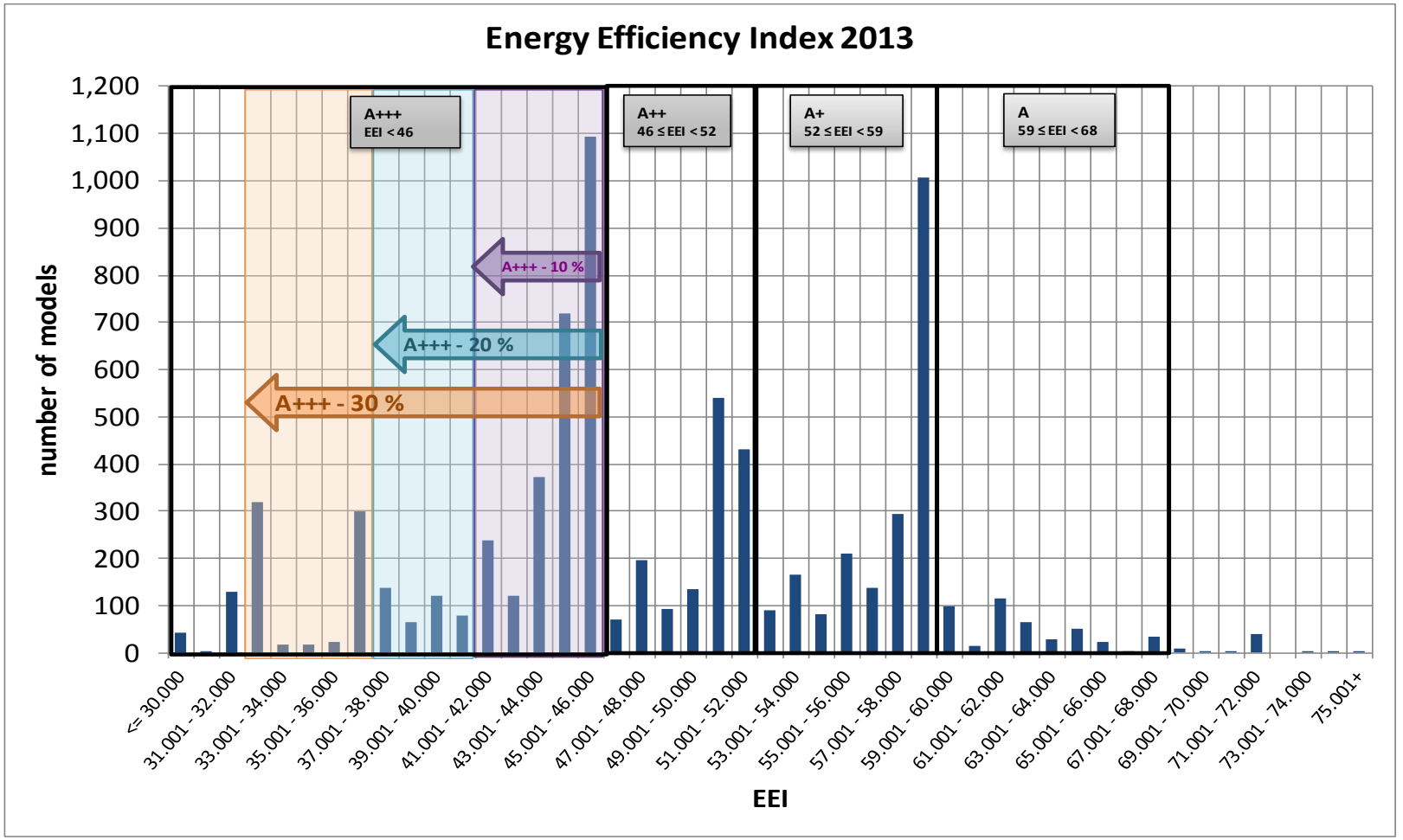
WM Distribution of models within energy classes



CECED data, 2014

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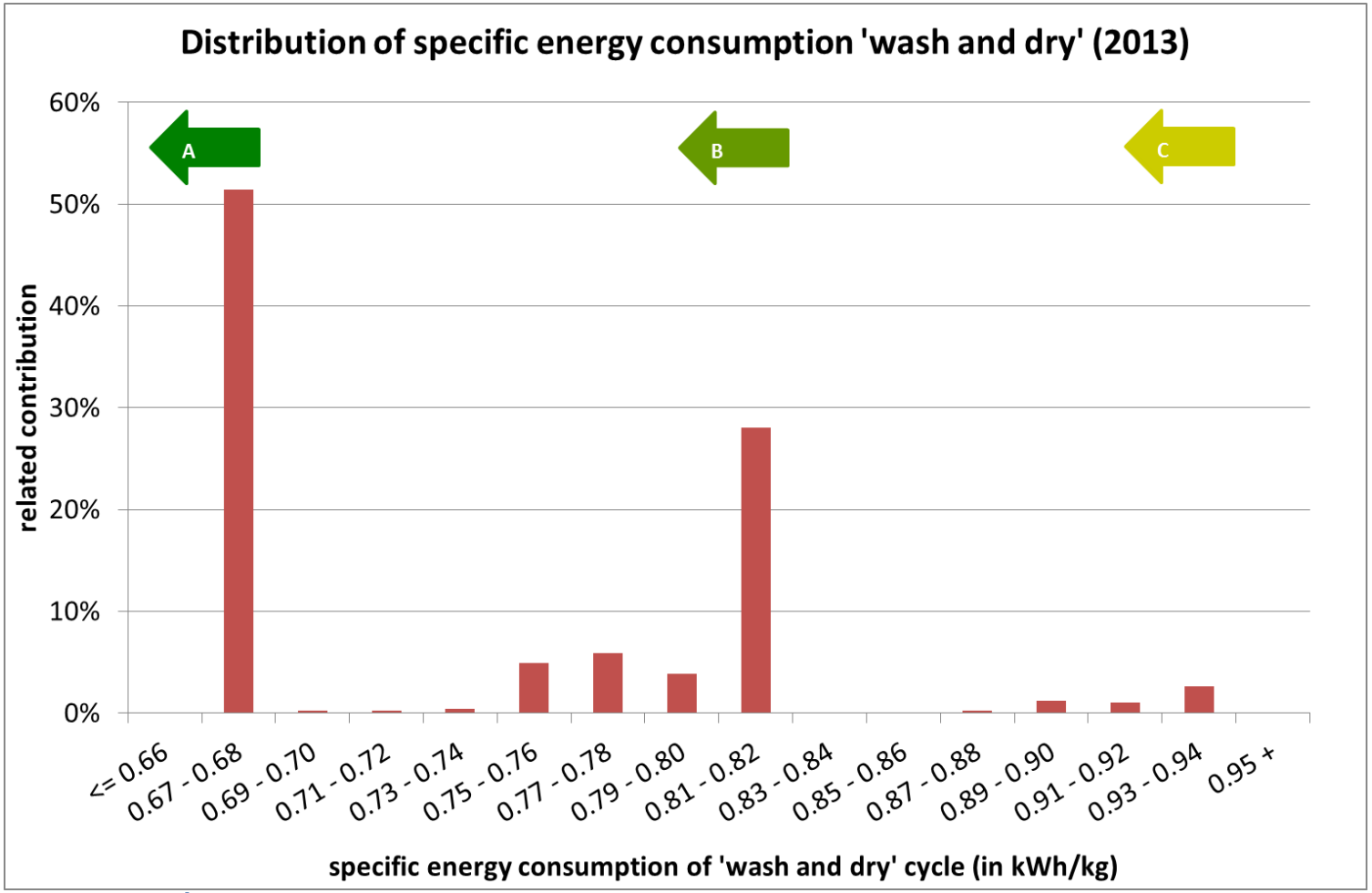
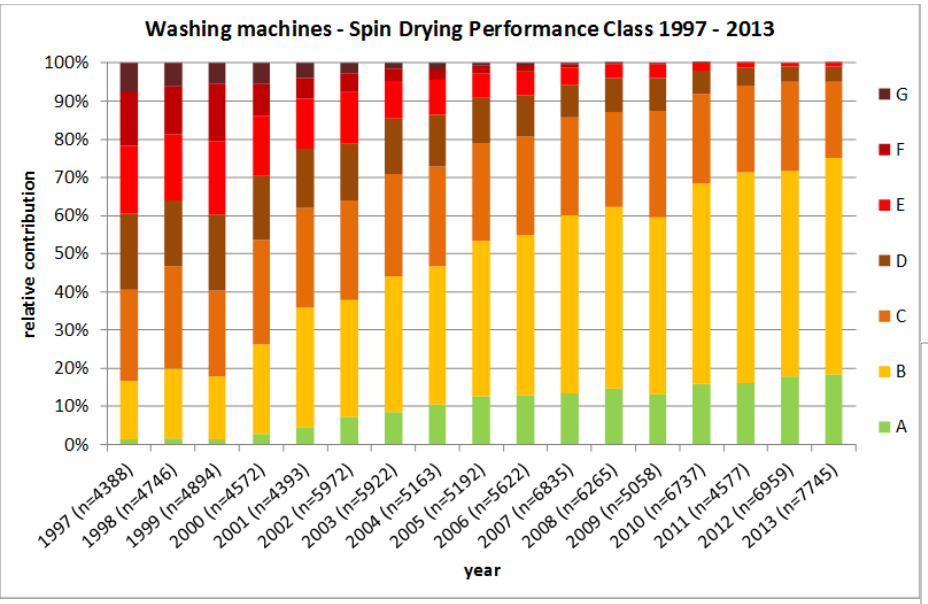
WD: Distribution of models within energy classes



CECED data, 2014

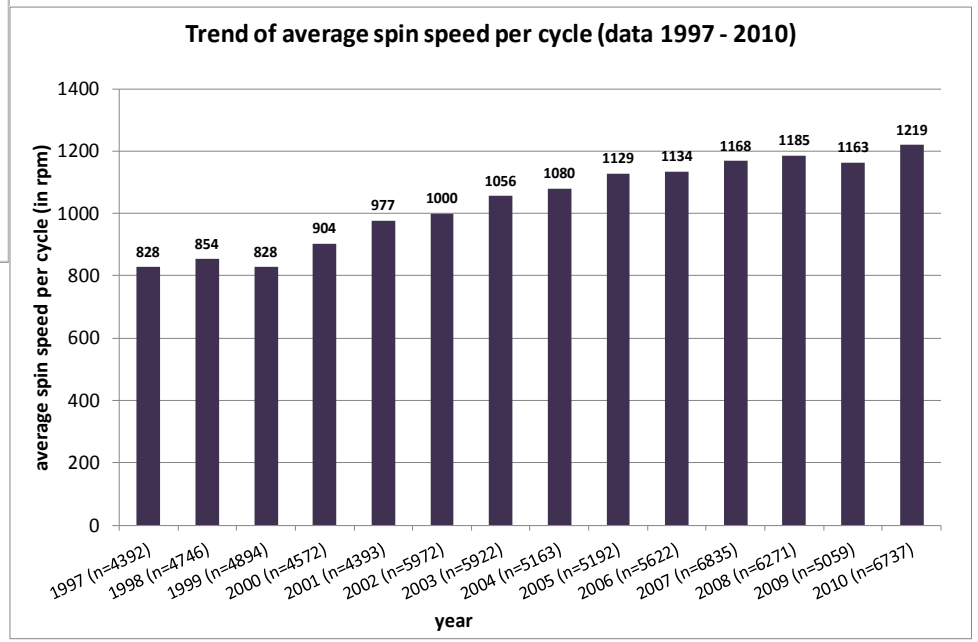
Joint Research Centre

WM Spin speed and performance



Stabilisation ~ 1200 rpm

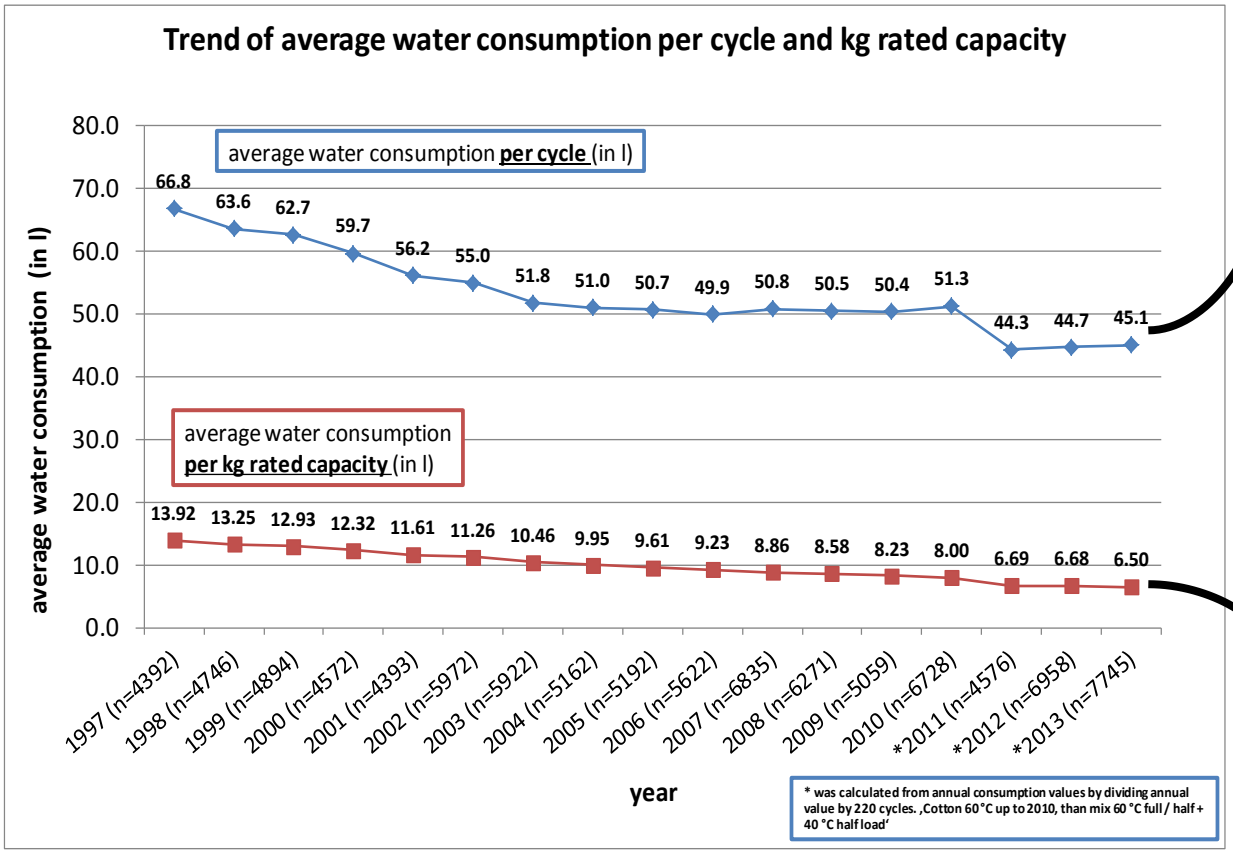
Real-life constraints: wrinkling, line-drying

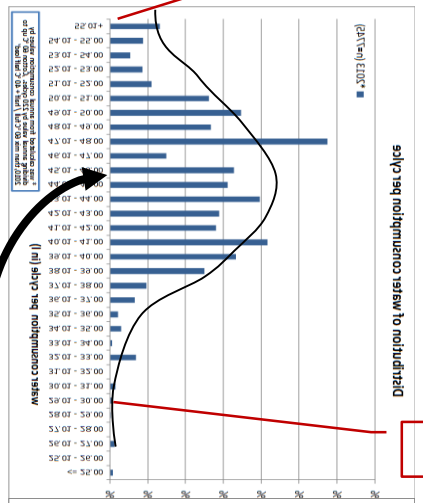


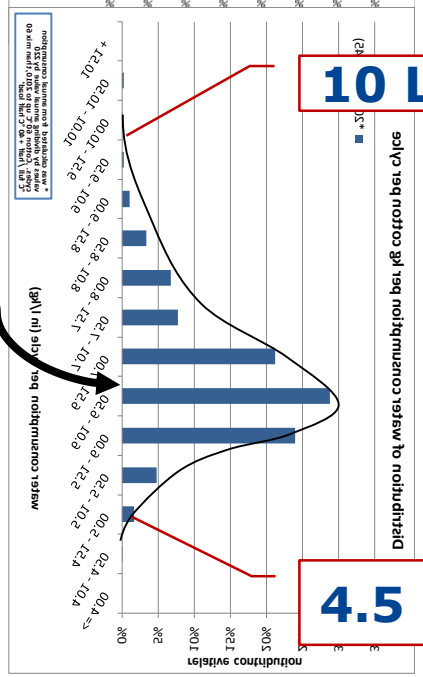
CECED data, 2014

European Commission

WM Water use (L/cycle and L/kg cotton)



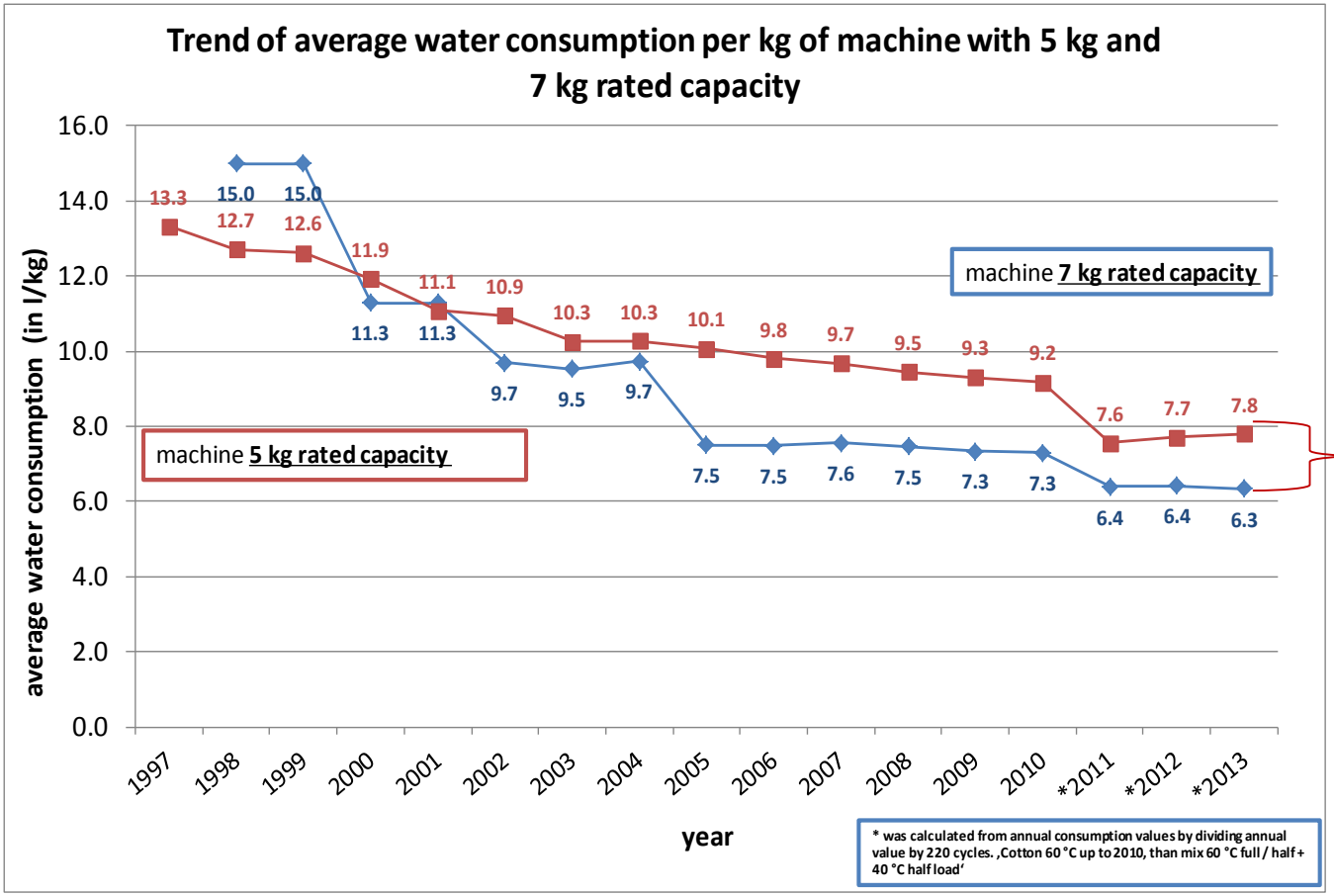




EU, CECED data, 2014

Joint Research Centre

WM Water use (L/kg cotton) and capacity



Larger machines have some benefit

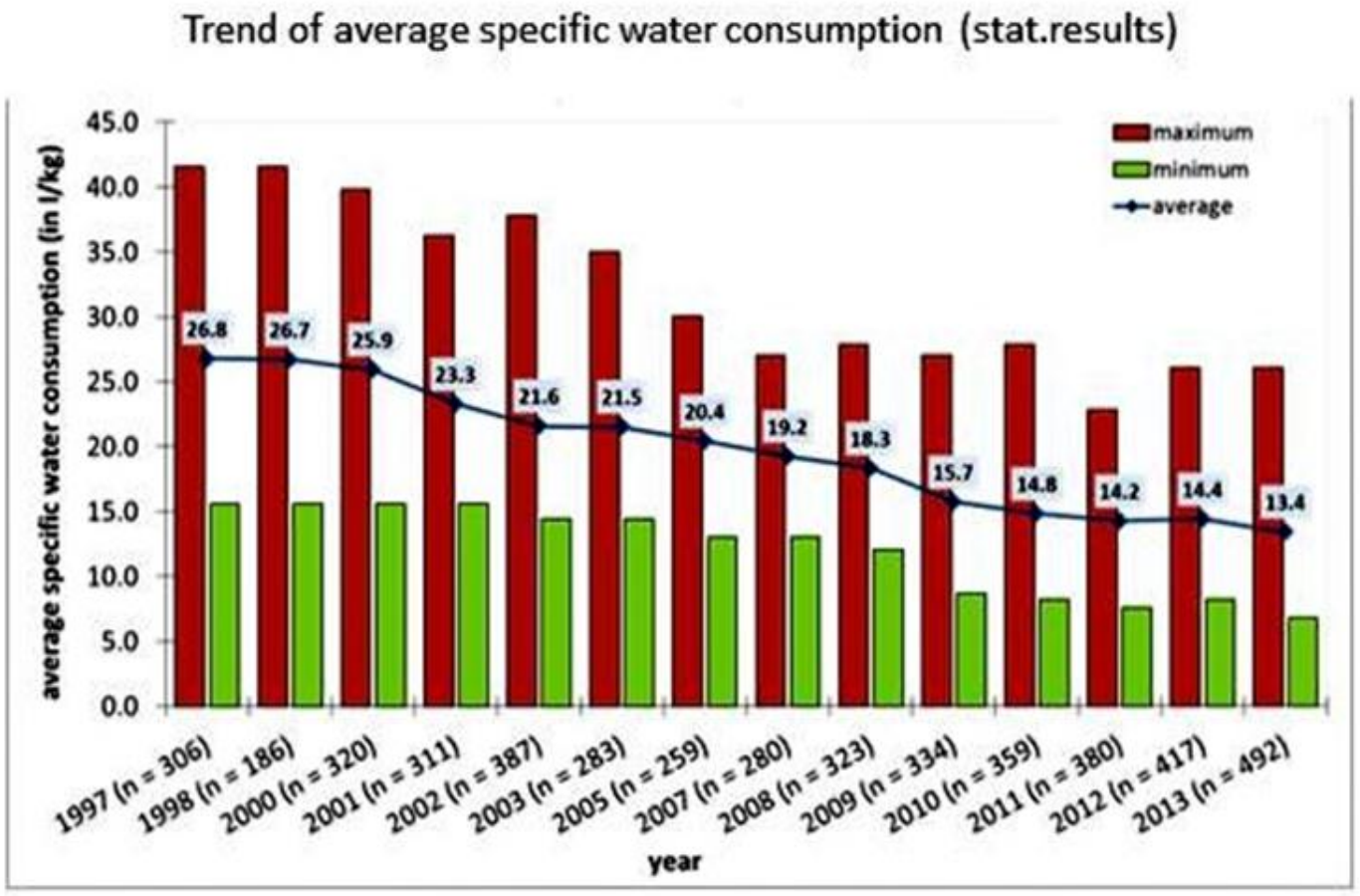
=

There is a minimum water use for filling up piping and bottom deposit

EU, CECED data, 2014

Joint Research Centre

WD Water use (L/kg cotton)

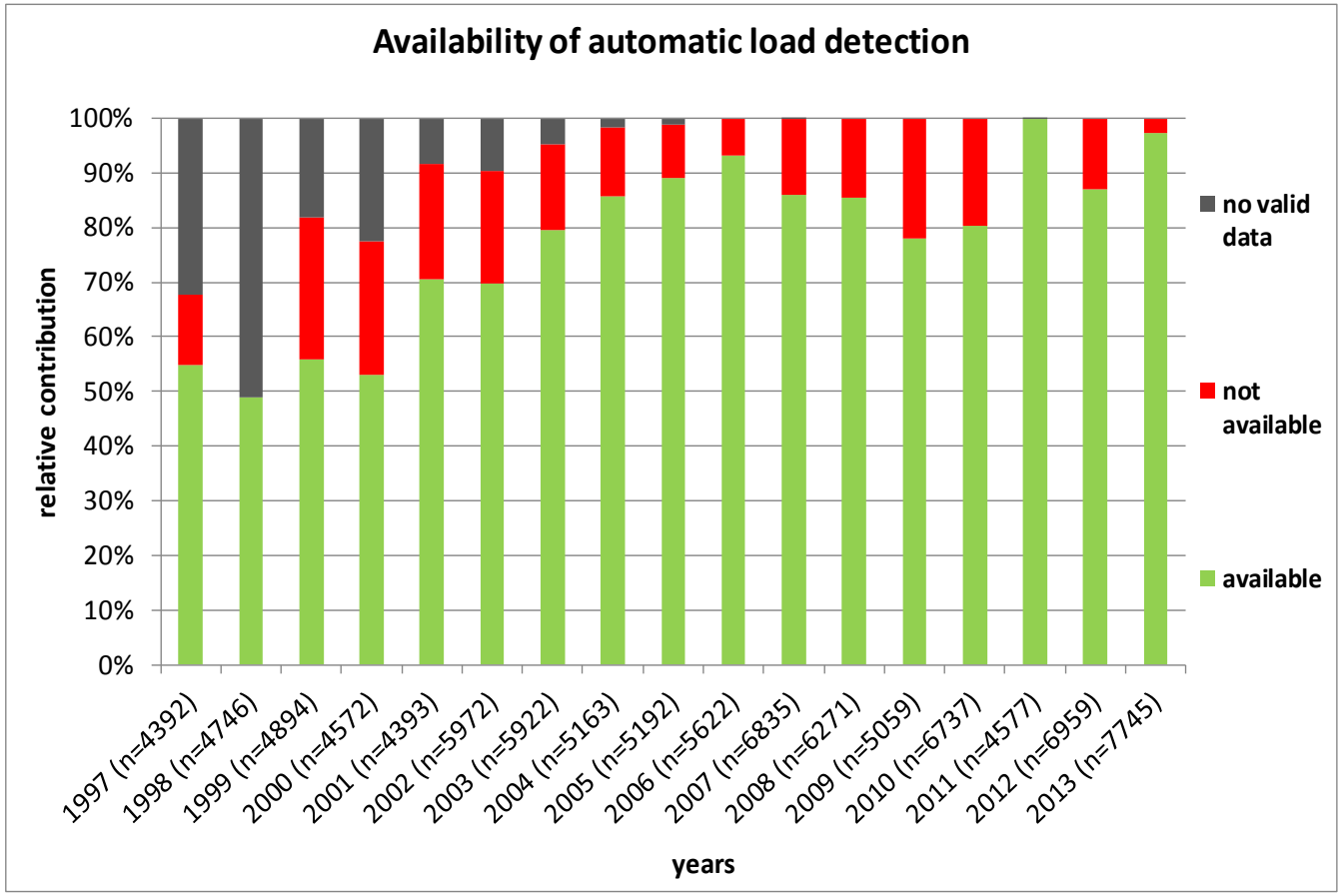


WM:
6-8 L/kg

(Reasons: full load, condenser, other?)

EU, CECED data, 2014

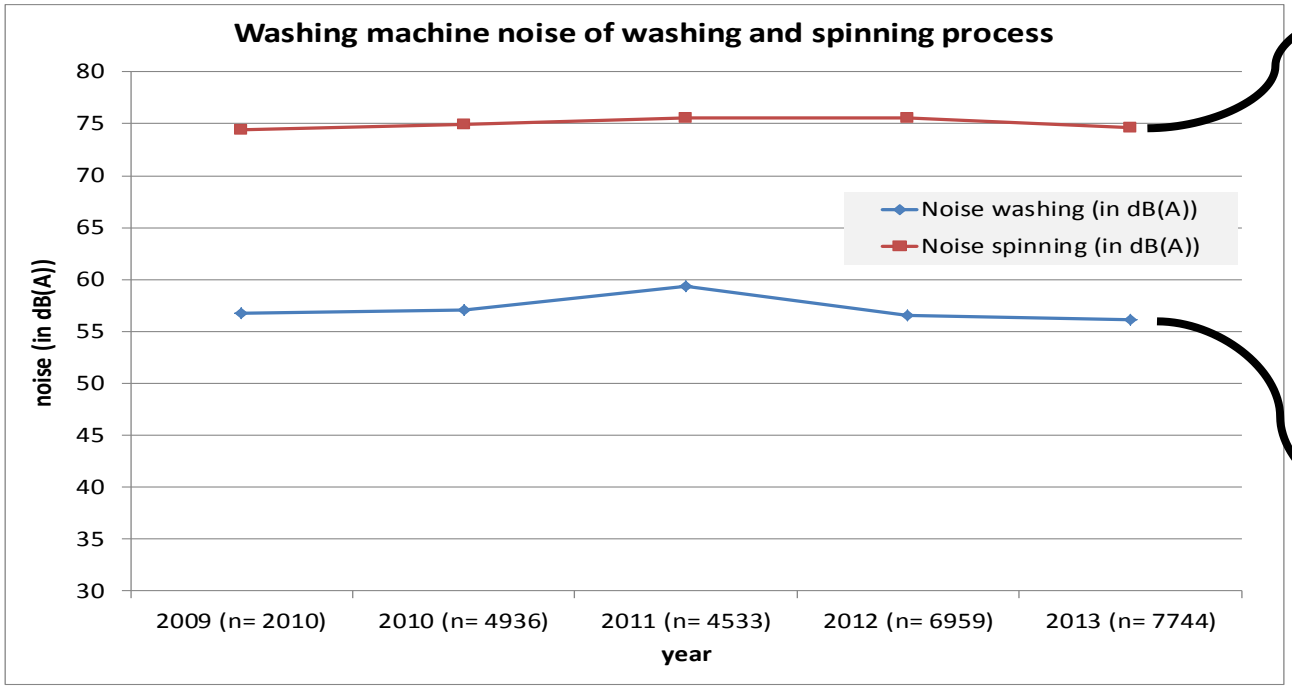
WM Availability of load detection

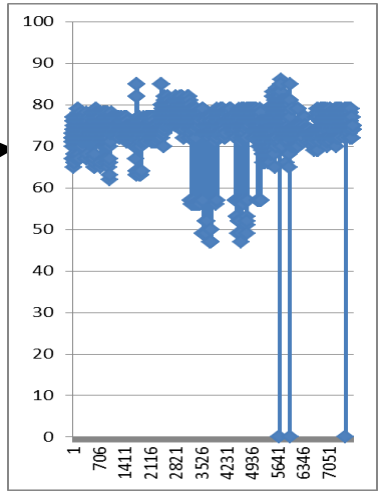


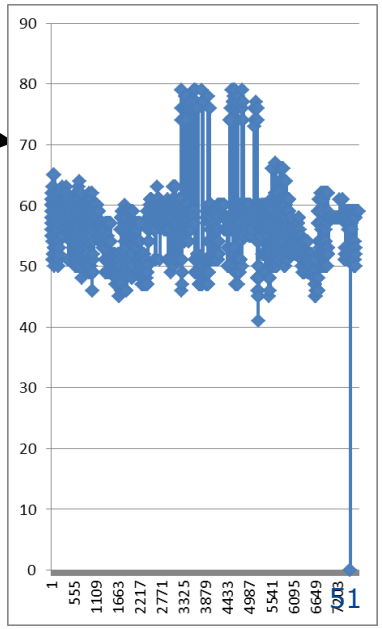
Implications for the potential energy savings of standard programmes vs. other programmes

EU, CECED data, 2014

WM Noise (dB(A))



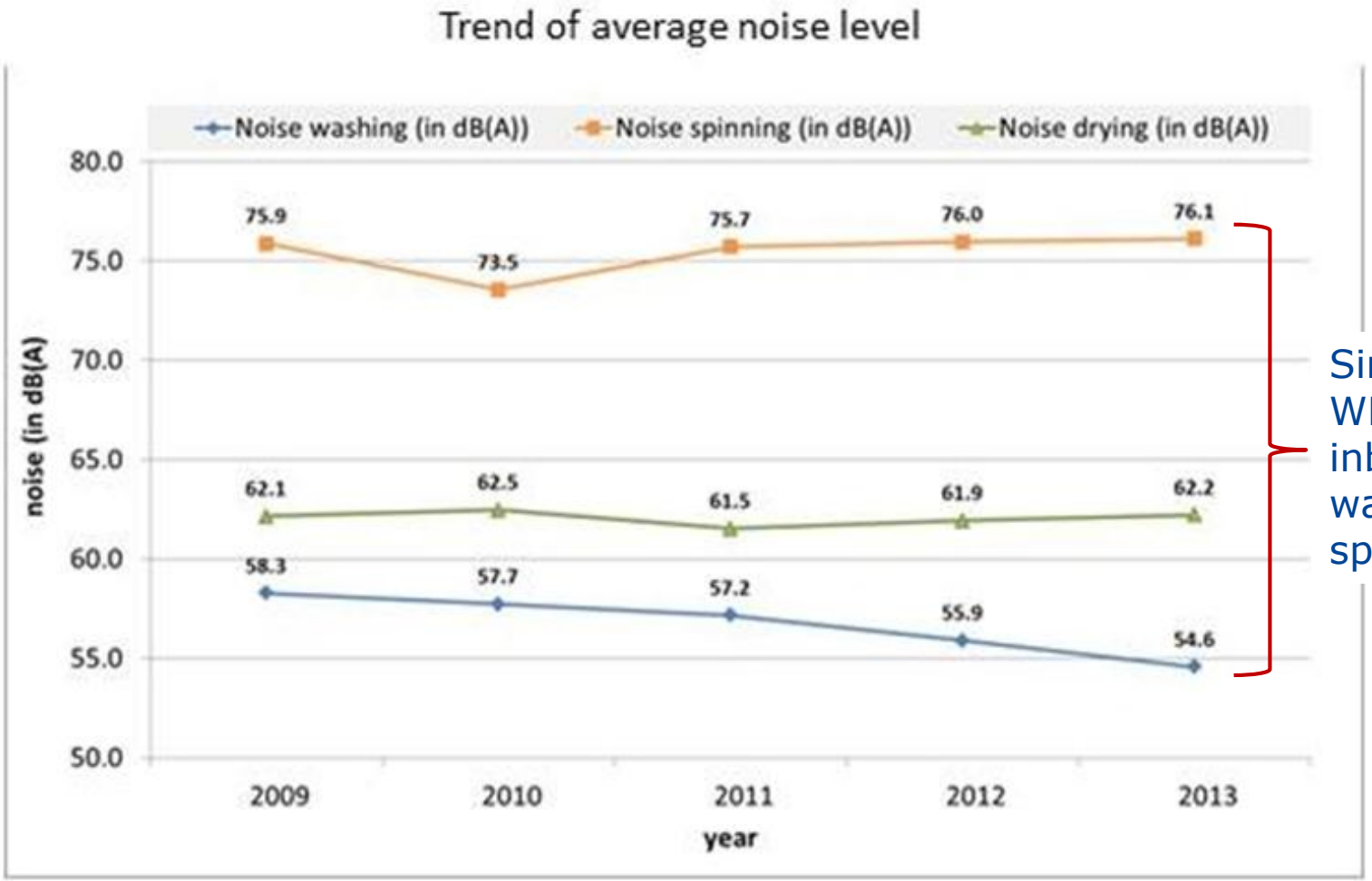




Large differences ⇒ clear differentiation factor

EU, CECED data, 2014

WD Noise (dB(A))



Similar to WM, drying inbetween washing and spinning

EU, CECED data, 2014

WM programme duration

Ratio [cotton 60°C /std cotton 60°C] (%)

At full load, 25 most sold WMs, 2013

	average	max	min
Energy	138%	185%	92%
Water	134%	176%	105%
Time	83%	103%	58%

Example, AEG L89495FL, 2014

Programmes	Load (Kg)	Energy consumption (kWh)	Water consumption (litre)	Approximate programme duration (minutes)	Remaining moisture (%)[1]
Cottons 60 °C	9	1.55	79	170	52
Cottons 40 °C	9	0.97	79	164	52
Synthetics 40 °C	4	0.55	54	120	35
Delicates 40 °C	4	0.60	59	89	35
Wool/Hand wash 30 °C	2	0.35	58	60	30
Standard cotton programmes					
Standard 60 °C cotton	9	0.64	57	226	52
Standard 60 °C cotton	4.5	0.34	41	185	52
Standard 40 °C cotton	4.5	0.34	40	199	52

[1] At the end of spin phase.

~3h

~4h

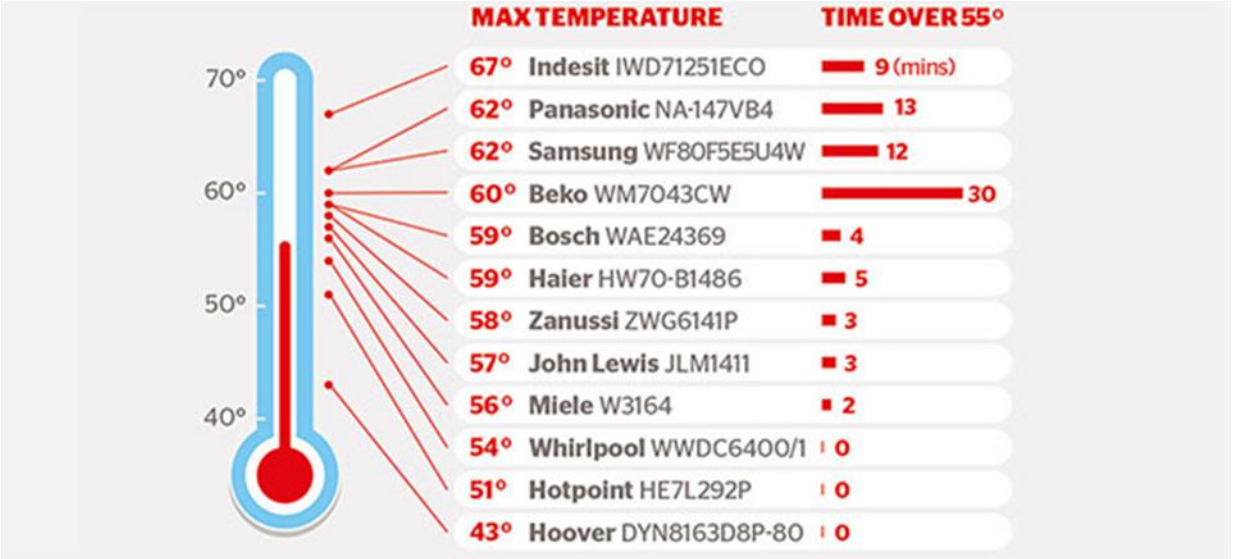
⇒ **Clear strategy of most std programmes to reduce energy and water use by programme duration extension (mechanical action)**

WM temperature value and duration limitation

Recent research shows cases where the temperature in the programme name is not reached, or is reached for a very short time

Example:
60°C cotton programme

Source:
Which? 2013



⇒ **No prescriptions in the current standard**

⇒ **Temp prescriptions currently misleading, highly problematic when hygiene is essential**

Detergents

2012 market analysis EU (sales volume %)

34% powder
19% liquid
4% tablets
31% conditioners
6% stain remover and additives
2% fresheners
4% other

Trends

- More liquid detergents
- Decrease in powder detergents
- More concentrated products
- Products for lower temperature (enzymes-polymer-surfactant systems)
- New products/concepts (liquid pods, tablets) and formats (automatic dispensers built in machines)

Price range

EUR 0.1-0.32 per cycle
~25% of the total life-cycle costs of washing for consumers

Consumer expenditure

1. Purchase prices:

2014

- **WM purchase average in the EU ~ EUR 430-450**
- **Larges sales in volumes of the lower end (EUR 220-380)**
- **Factory gate: avg EUR 220 (Eurostat, 2013)**
- **WD: EUR 400-630**

2. Installation price

EUR 0-50

3. Maintenance

EUR 0-150 per repair, max 2 repairs/lifetime

European Commission

Consumer expenditure

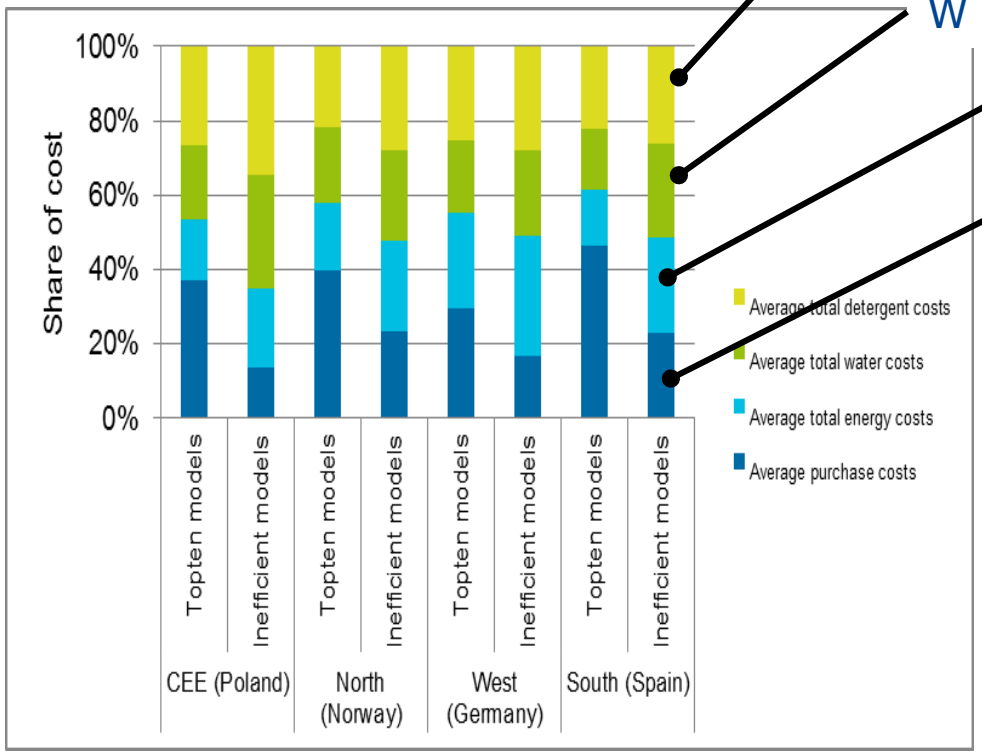
4. Life-cycle costs (no repair or maintenance assumed)

	CEE (Poland)		North (Norway)		West (Germany)		South (Spain)	
	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models	Topten models	inefficient models
Average purchase price	911 €	261 €	1.198 €	554 €	771 €	399 €	1.392 €	582 €
Average total energy costs	398 €	410 €	548 €	581 €	666 €	752 €	451 €	646 €
Average total water costs	490 €	588 €	609 €	577 €	506 €	544 €	496 €	644 €
Average total detergent costs	660 €	660 €	660 €	660 €	660 €	660 €	660 €	660 €
Average total costs	**2.459 €**	**1.919 €**	**3.015 €**	**2.372 €**	**2.604 €**	**2.355 €**	**2.998 €**	**2.532 €**
Min total costs Topten models	1.945 €		2.723 €		2.335 €		2.554 €	
Max total costs, Topten models	3.699 €		3.677 €		3.054 €		3.223 €	

Assumed lifetime: 15y
Source: Quack, 2010

Consumer expenditure

1. Life-cycle costs

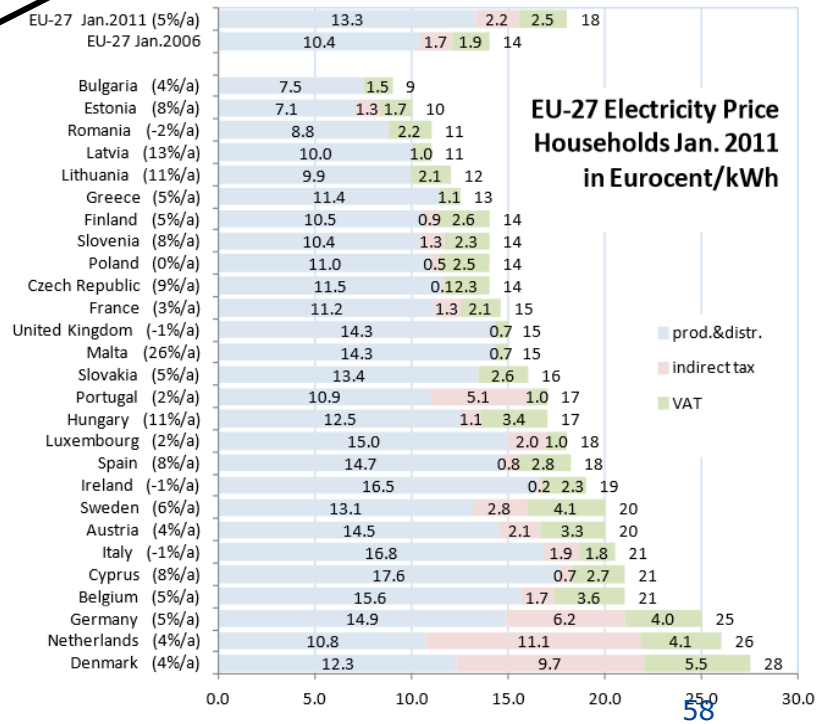


D ~25%

W ~20%

E ~10-30%

P ~15-50%



Assumed lifetime: 15y
Source: Quack, 2010

Market data in base cases (technologies in T4)

WM Base case(s)	Lot 14		Revision		
Capacity	**5kg**	**6kg**	**7kg**	**5kg**	**7-8kg**
Energy consumption (kWh/cycle)	0.956	1.057	~ 0.8	~ 0.75	<0.8
Energy class	**A**	**A+/A**	**A++/A+++**	**A+**	**A+++**
Water consumption (litres/cycle)	50.4	49.2	~ 40	~ 40	~ 40
Washing performance class	A	A	A	A	A
Drying performance	B/C	B/A	A	B?	A
Noise (spinning/washing)	70/53	70/53	≤70/53	≤70/53	≤70/53
WD Base case	Existing EL?		Revision		
Capacity (washing)			7 kg		
Capacity (drying)			4-5kg		
Energy consumption (kWh/cycle)					
Energy class			A/B		
Water consumption (litre/cycle)					
Washing performance class			A		
Drying performance					
Spinning performance					
Noise					

The information presented is essential for use in:

- The identification of failures of the existing regulations
- The selection of new base cases
- Task 6 (life-cycle costs) & Impact Assessment

Generic discussion point

2.1.a/2.2.a

Is the market information presented accurate? ⇒ have the most important sources of data in the EU been identified?

Specific questions

2.1.b

Penetration rates: correct?

- 90% WM. Stable
- 4% WD. Increasing. Rate?

2.1.c

Prodcom 27511300. Includes WDs and TDs? Any estimate of the breakdown into WMs, WDs, and drying machines?

Specific questions

2.1.d

Prodcom 27511300. Includes WDs? Any estiamte of the breakdown into WMs, WDs, and drying machines?

2.1.f

Trend of increasing spinning speed? Will it stabilise? Where?

WD similar to WM or any specificity?

2.1.h

Some WD are apparently wrongly declared as WMs. Any additional info?

Specific questions

Do market data support the exclusion of

2.4.a) battery-powered appliances?

2.4.b) <1kg appliances?

2.4.c) No heating element

2.4.e) Alternative heating (e.g solar water circuit and heat exchanger)

2.4.d) Waterless WMs

Market data support explicit inclusion of

2.4.f) smart-grid

2.4.g)

WD similar to WM or any specificity?

Impact Assessment (2nd ½ 2016)

- **Objectives:** Informing decision-makers and stakeholders on impacts (econ., env., social) of a proposal (max 4-5 policy options) in a balanced and proportionate way, identifying possible trade-offs and synergies. Making the policy development process more open and transparent to external stakeholders.

- **Is an extension of Tasks 5 and 6 of MEErP**

- **Procedure:**
  - Transparency of inputs and methodology: IA follow group, including stakeholders.
  - Identify (direct and indirect) economic, social and environmental impacts and how they occur (causality).
  - Identify who is affected (including those outside the EU) and in what way.
  - Define a baseline (no action), and assess the impacts against it in qualitative, quantitative and monetary terms. If quantification is not possible, explain why

European Commission

Impact Assessment

Specific expected quantitative outputs:

- Estimated environmental impacts, most notably potential energy saving (MWh/year)
- Estimated life-cycle costs, administrative costs, consumer expenditure, rebound effects
- Estimated social impacts (employment)

(1) Current picture (baseline scenario)
(2) 4-5 Policy scenarios, with detailed sunset date(s)

⇒ The preparation of the Impact Assessment (IA) will require the use of additional data:

Impact Assessment

Specific data needs will be (1):

- Confirmation/correction of the proposed characterisation of specific energy savings of the different technologies
- Estimated population of appliances in each category: (1) Current population, (2) Scenarios in the likely adoption, and sunset date(s)
- Average purchase price per product group
- Average appliance life-cycle costs
- Sector turnover (manufacture, retail, wholesale, recycling)
- Employment (within/outside the EU)

Impact Assessment

Specific data needs will be (2):

- Trade data (to estimate the impact of EU vs. non-EU industry)
- Historic sales data, needed for projections of sales to 2020-2025
- Estimated competitive benefits, and costs of discontinuing production of the non-compliant appliances.
- Additional data that may be used to estimate rebound effects, apart from energy and savings expenditure.
- EoL data: % appliance collection/reuse/refurbishment/recycling, and likely scenarios of EoL treatment

Markets

- We will be back in contact with the TWG members in the next ½ year to request additional data, via questionnaires and bilateral meetings.
- It is in mutual benefit that we can assess beforehand, with the highest precision possible, the potential impacts (positive/negative). Also to the affected industry, in order to maximise competitiveness potentials and minimise the potential negative impacts.
- Misjudgement due to imprecise information may result in larger actual costs, including to industry.

TASK 3: USERS

- User behaviour
  - Summary of preliminary results from the 2015 user survey
  - Complementary information
- Infrastructures
- Discussion areas (for Tasks 1 and 3)

User surveys

- Key importance to understand real use of technologies
- Existing ref. surveys (UniBonn 2011 for WM and WD, AISE 2011)
- 2015 update soon available for both WM and WD (UniBonn et al.)

➔ Summary of preliminary main results of the 2015 European survey on user behaviour for WM (Uni Bonn)

Consumer behaviour in laundry washing

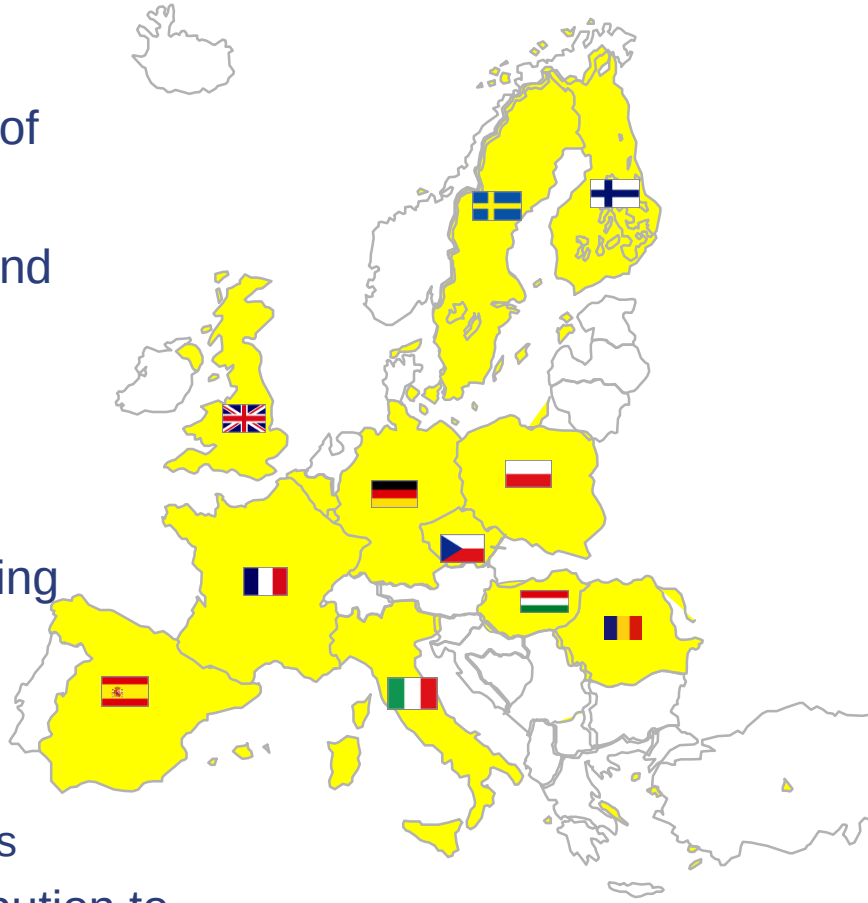
Preliminary short summary of survey of European behaviour 2015

Farnaz Alborzi
Angelika Schmitz
Rainer Stamminger

Recruiting of participants in 11 EU member states

By Toluna:

- Professional market research company
- Panels of registered consumers in most of the participating countries
- Responsible for translations, recruiting and fulfilling quotas for each country



Requirements for participants:

- All own washing machine
- Substantial involvement in laundry washing
- Gender: more than 50% women
- Household size and age:
  - 1-person-/ 2-/ 3-/ 4-/ >4-people household
  - 20 - 39 years / 40 - 59 years / 60 - 74 years
- Representative in hh-size and age distribution to national statistics (Eurostat)

Contribution of participating countries

Weighting

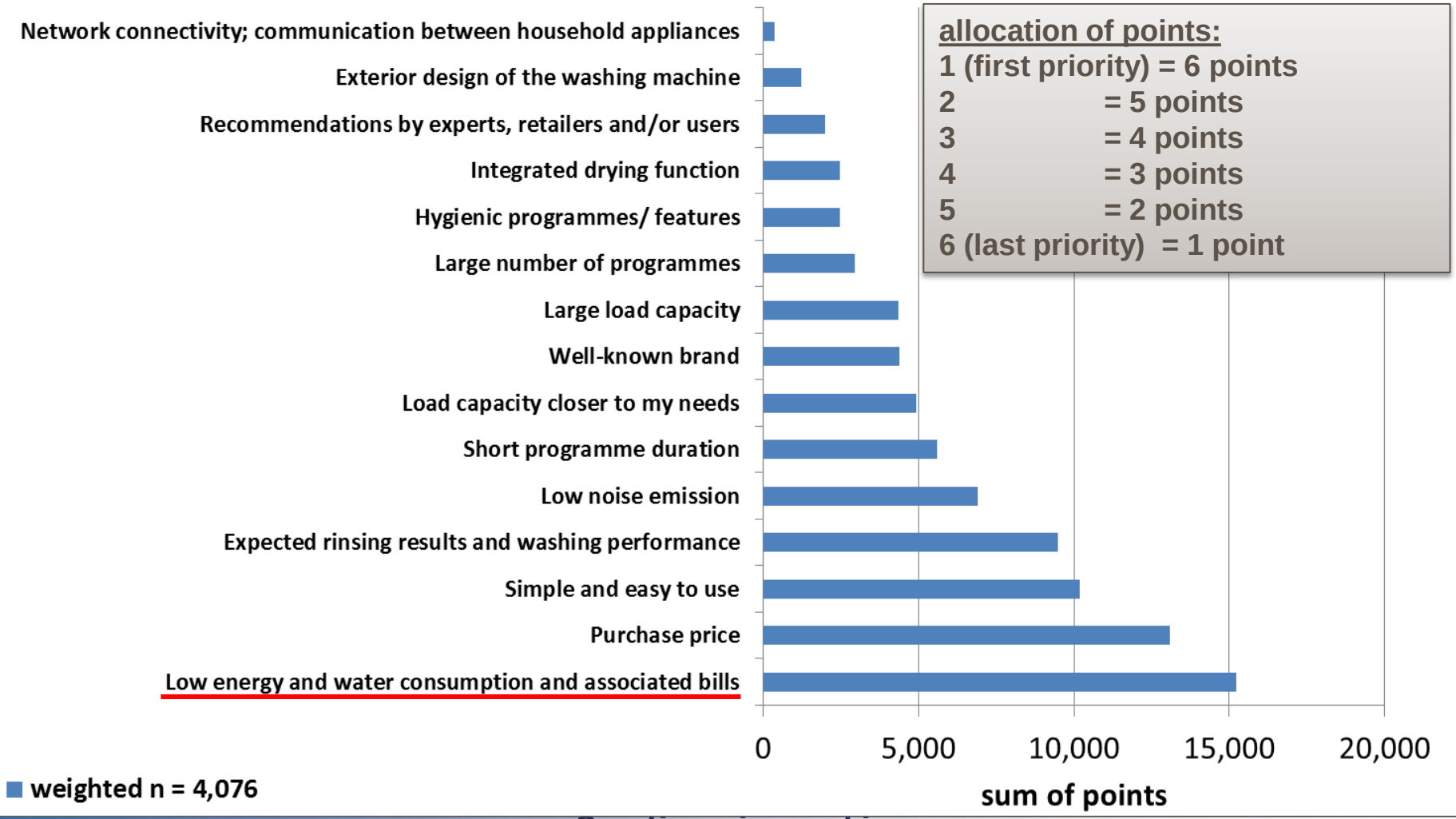
- According to the number of households of each country compared to the sum of all investigated countries
- Calculating EU average results

Country	Panel	Valid data*	Households (Total)	Contribution to total results %
Czech	300	240	4.502.431	3 %
Finland	300	267	2.579.781	1 %
France	600	530	27.106.517	16 %
Germany	600	508	40.656.000	23 %
Hungary	300	221	4.105.708	2 %
Italy	600	414	250.077.000	14 %
Poland	600	458	13.567.999	8 %
Romania	300	211	7.470.429	4 %
Spain	600	453	18.083.690	10 %
Sweden	300	272	4.725.279	3 %
UK	600	502	26.414.000	15 %
SUM	**5100**	**4076**	**174.218.834**	**100%**

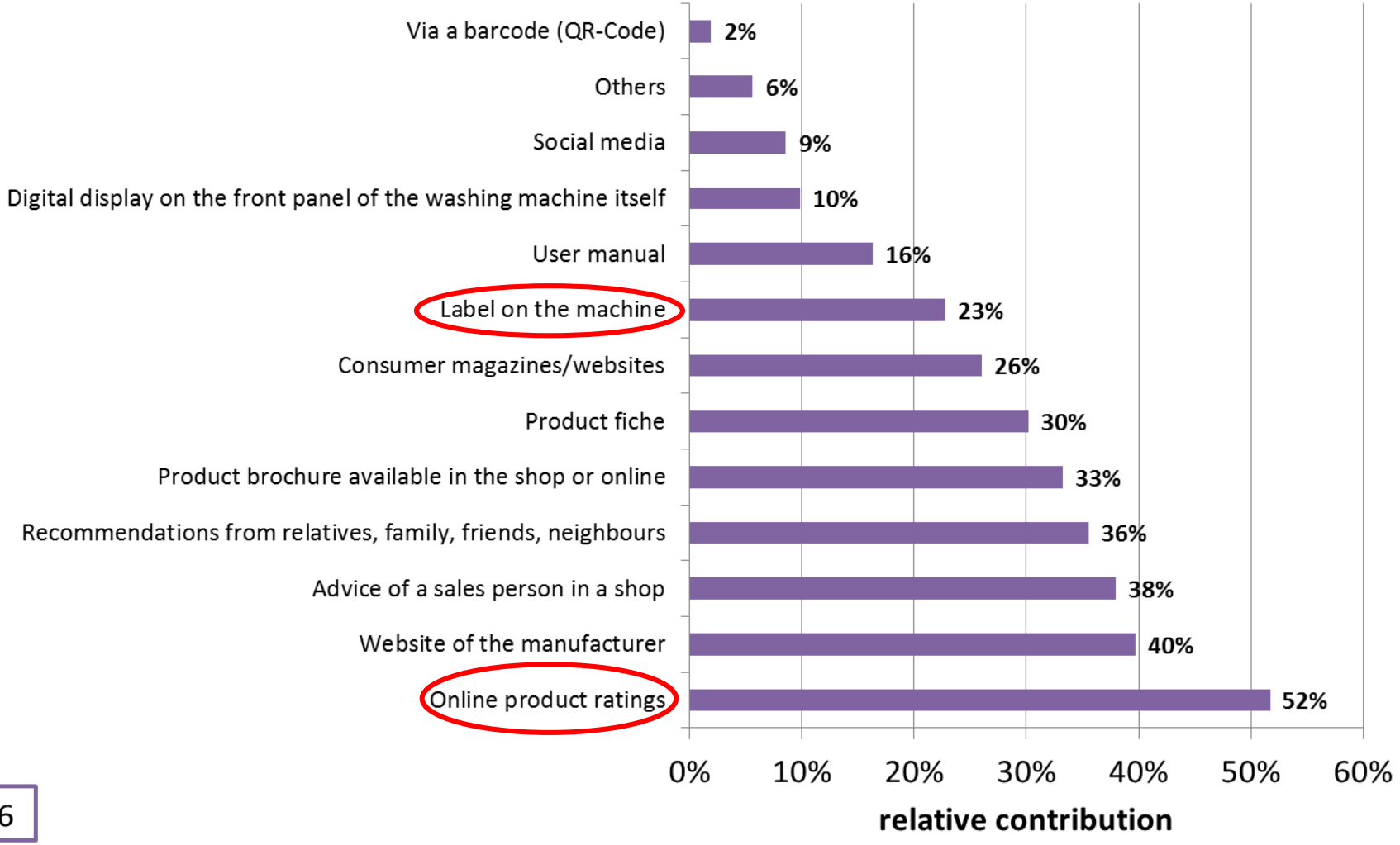
…to represent 82% of all households in EU-28

*** Consistency check (preliminary)**

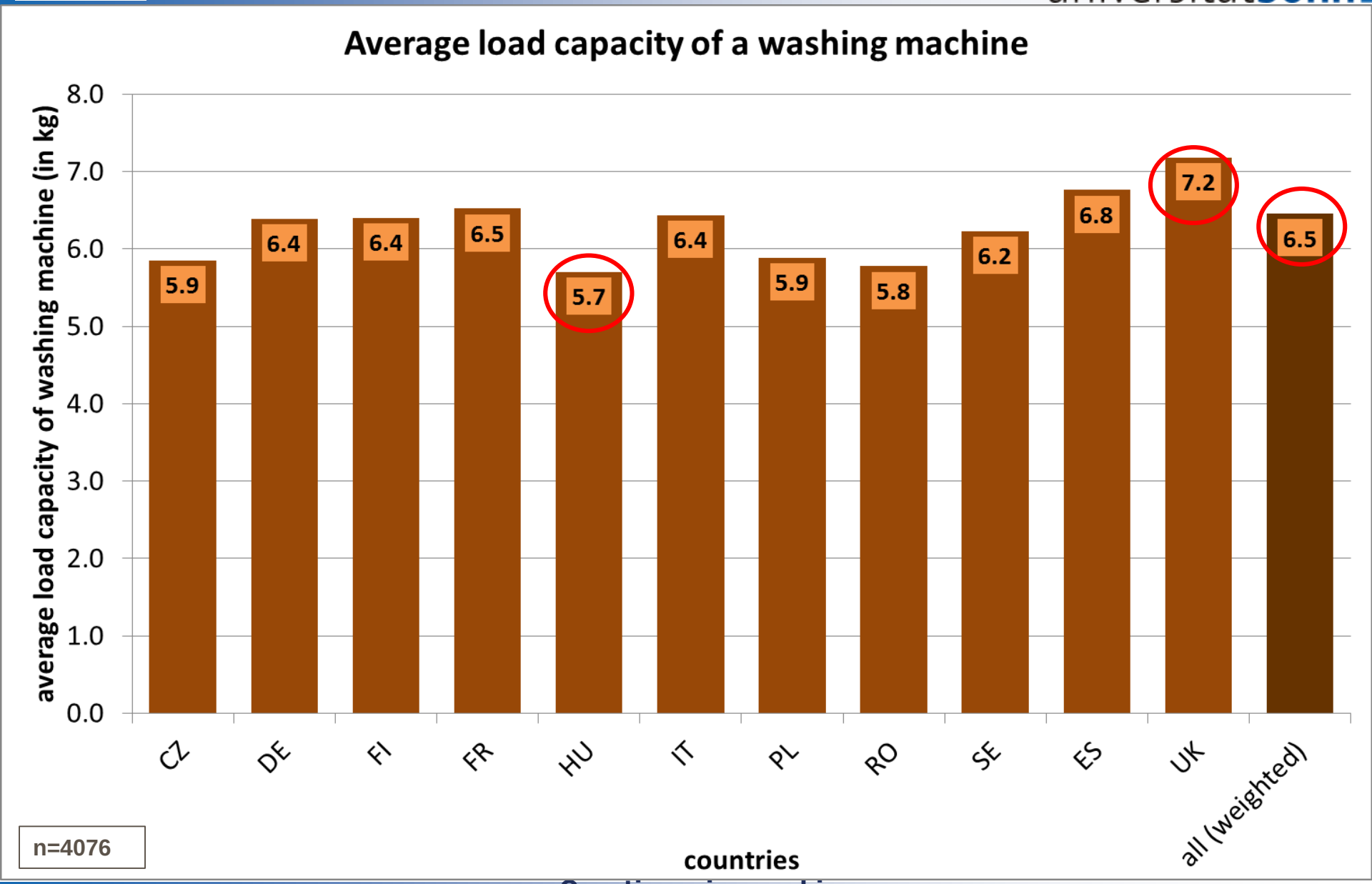
What are the main features you would take into consideration when buying a new washing machine? Please choose the six most important features and sort them based on importance from 1 to 6.



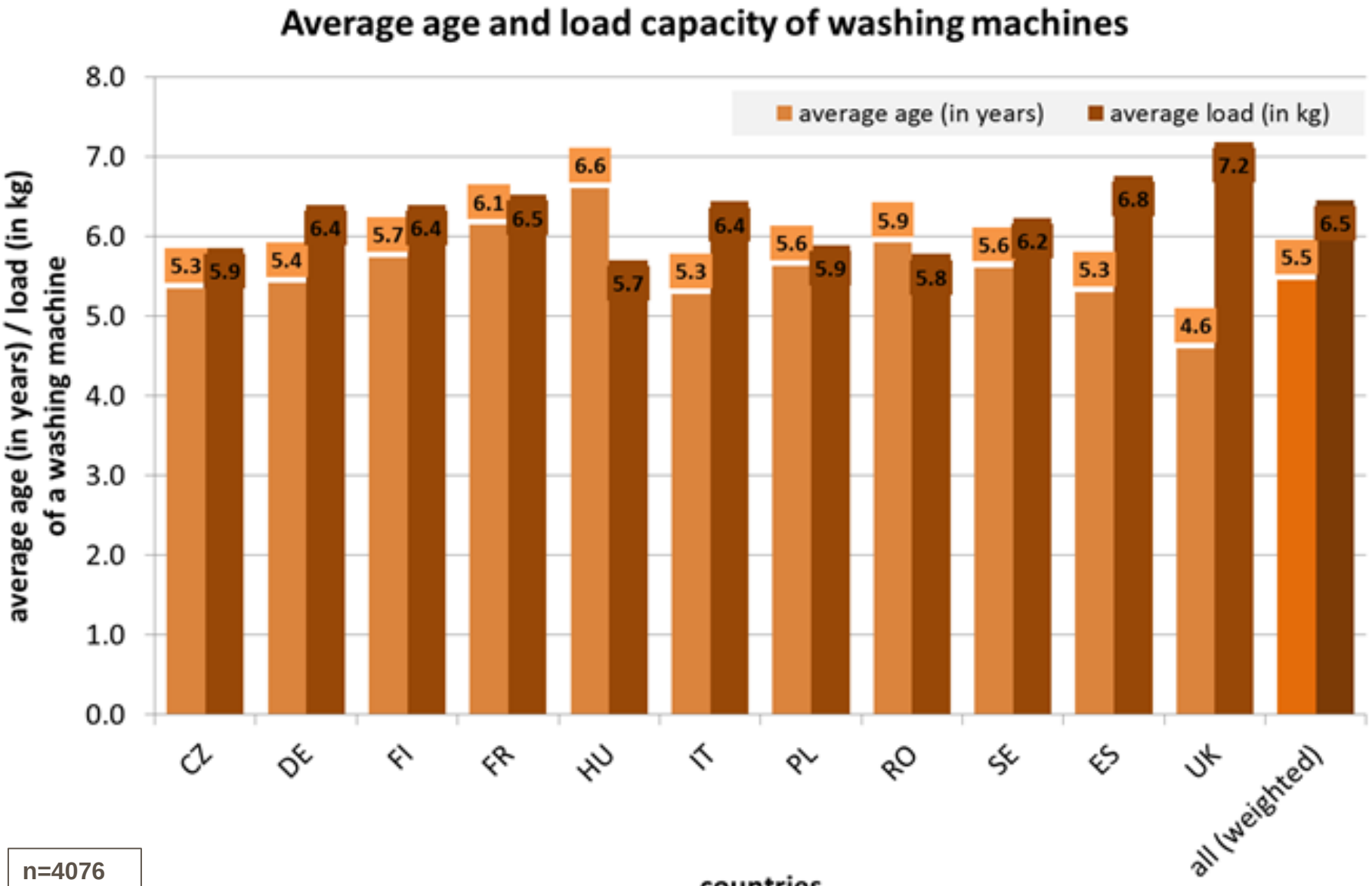
Where do you look for information before purchasing a new washing machine? (multiple answers allowed)



n = 4,076

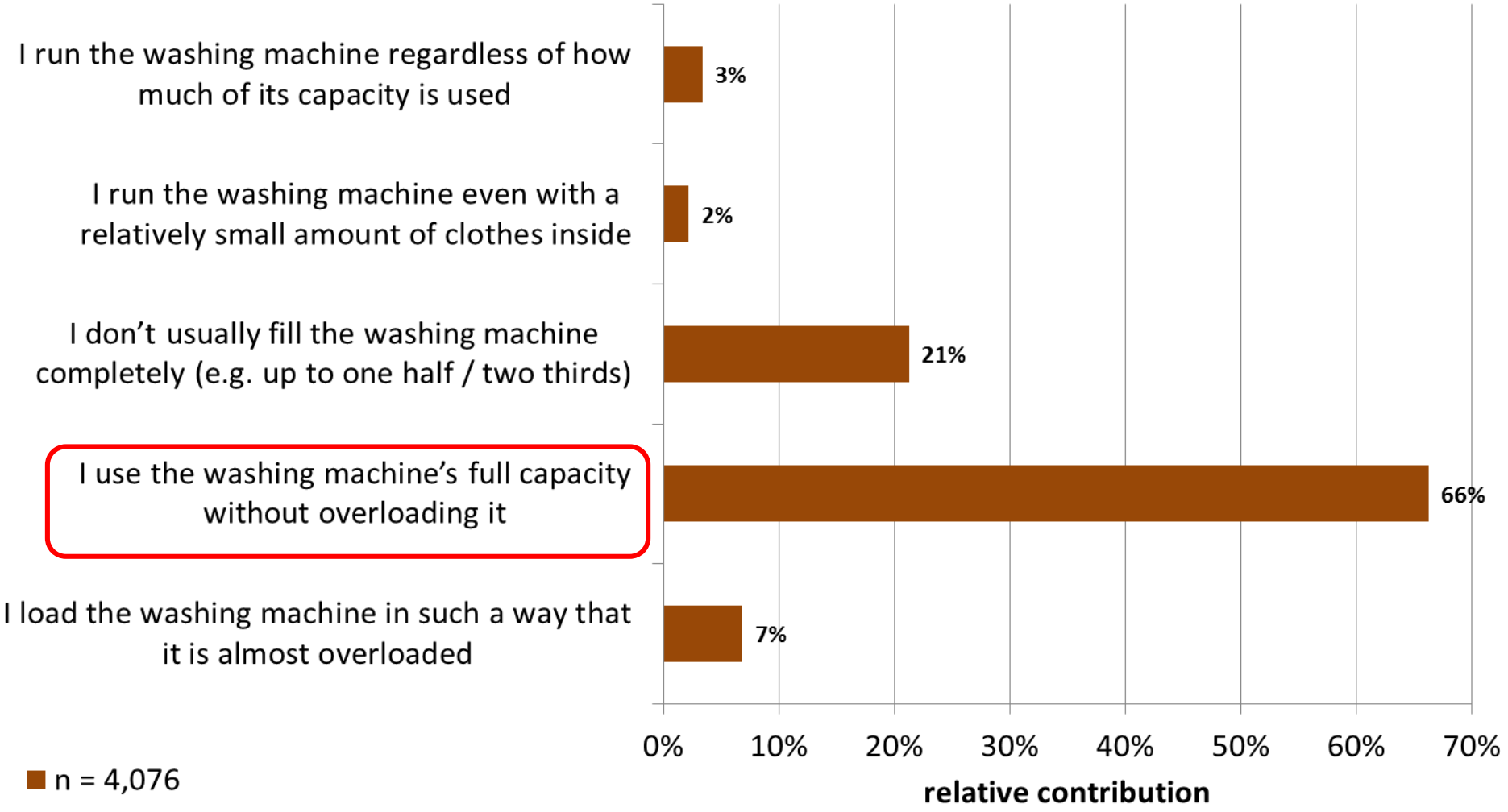

Average load capacity of a washing machine
average load capacity of washing machine (in kg)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5.9
6.4
6.4
6.5
5.7
6.4
5.9
5.8
6.2
6.8
7.2
6.5
CZ
DE
FI
FR
HU
IT
PL
RO
SE
ES
UK
all (weighted)
countries

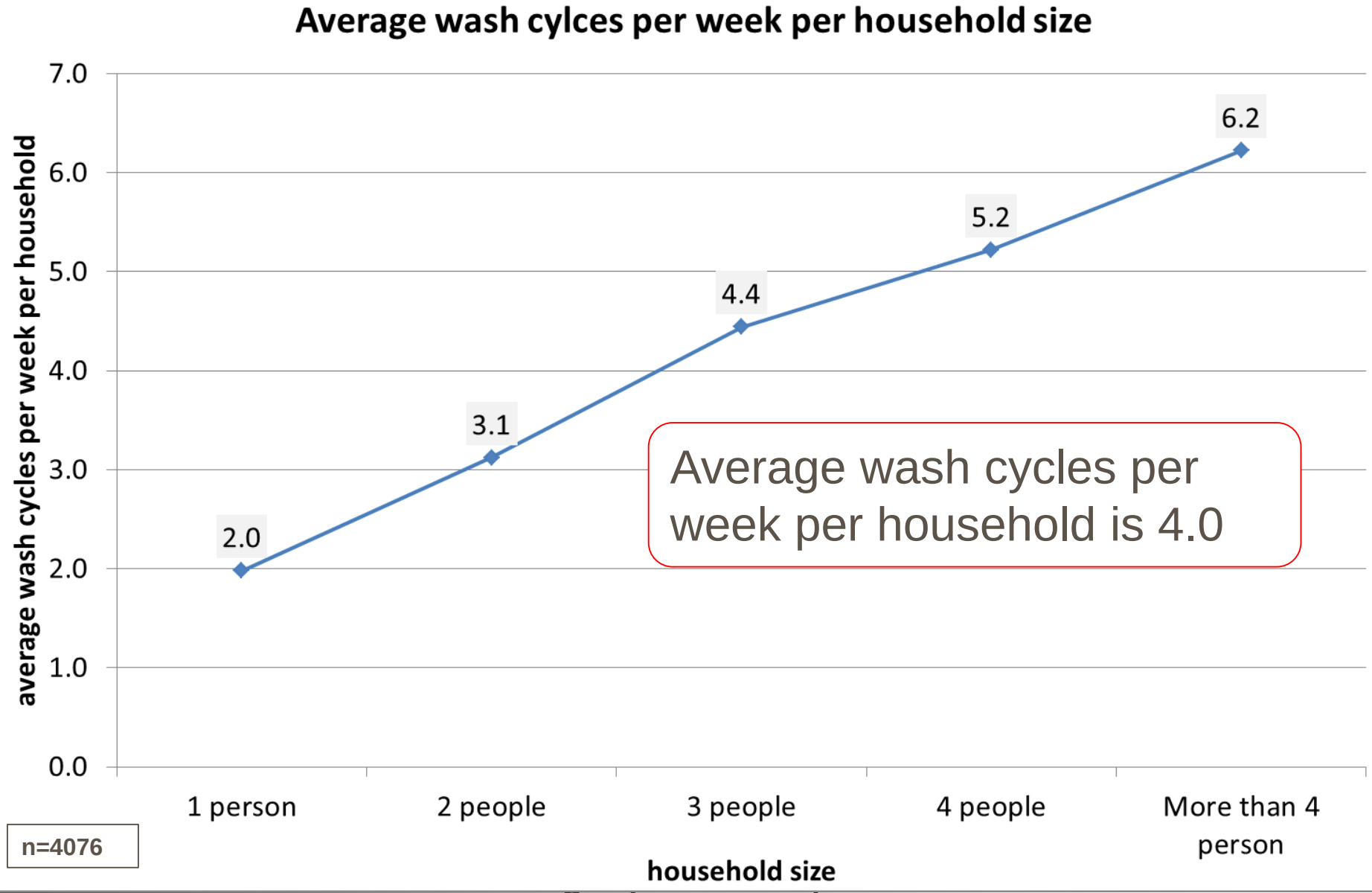
n=4076

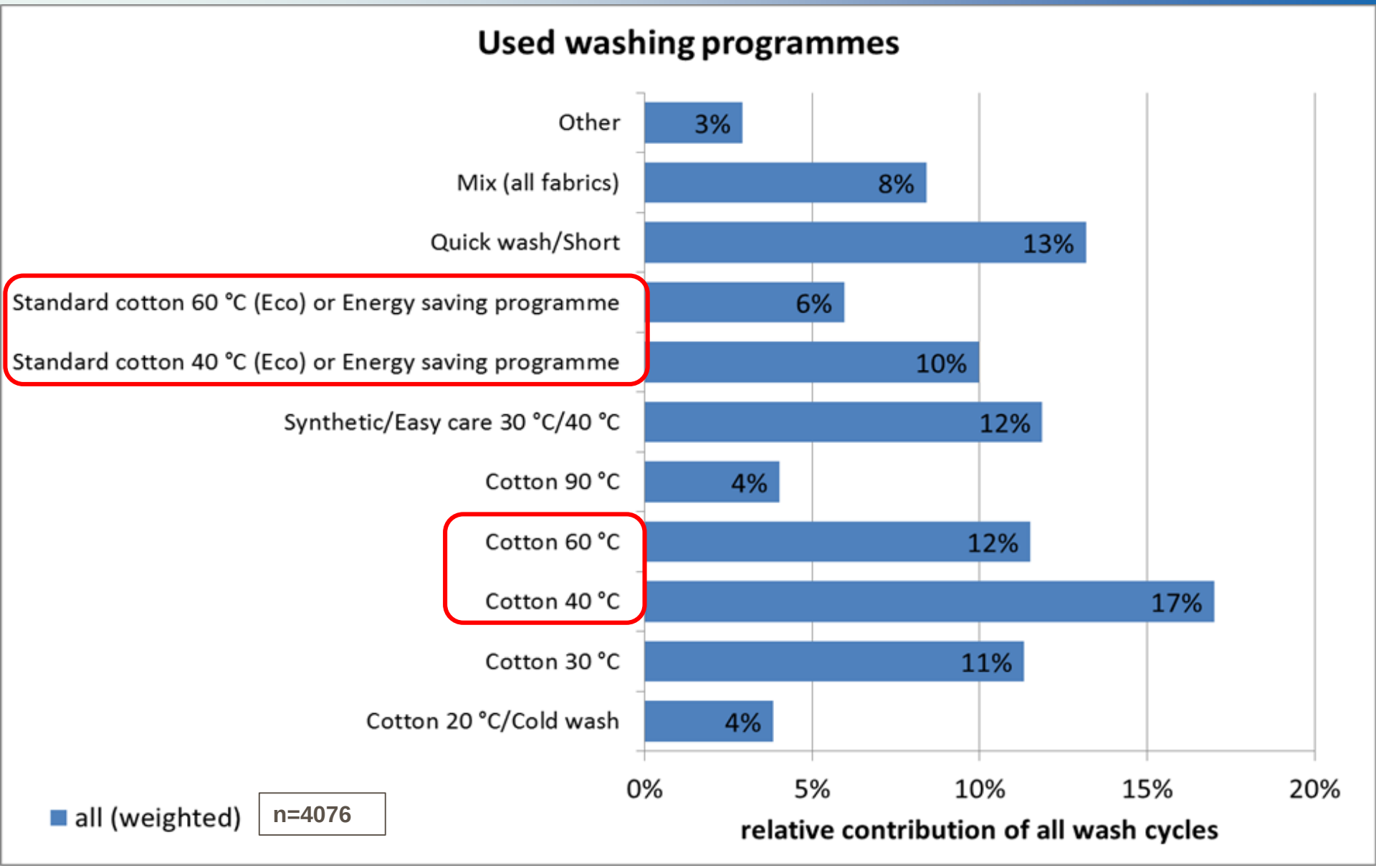

Average age and load capacity of washing machines
average age (in years)
average load (in kg)
average age (in years) / load (in kg) of a washing machine
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5.3 5.9
5.4 6.4
5.7 6.4
6.1 6.5
6.6 5.7
5.3 6.4
5.6 5.9
5.9 5.8
5.6 6.2
5.3 6.8
4.6 7.2
5.5 6.5
CZ
DE
FI
FR
HU
IT
PL
RO
SE
ES
UK
all (weighted)
countries

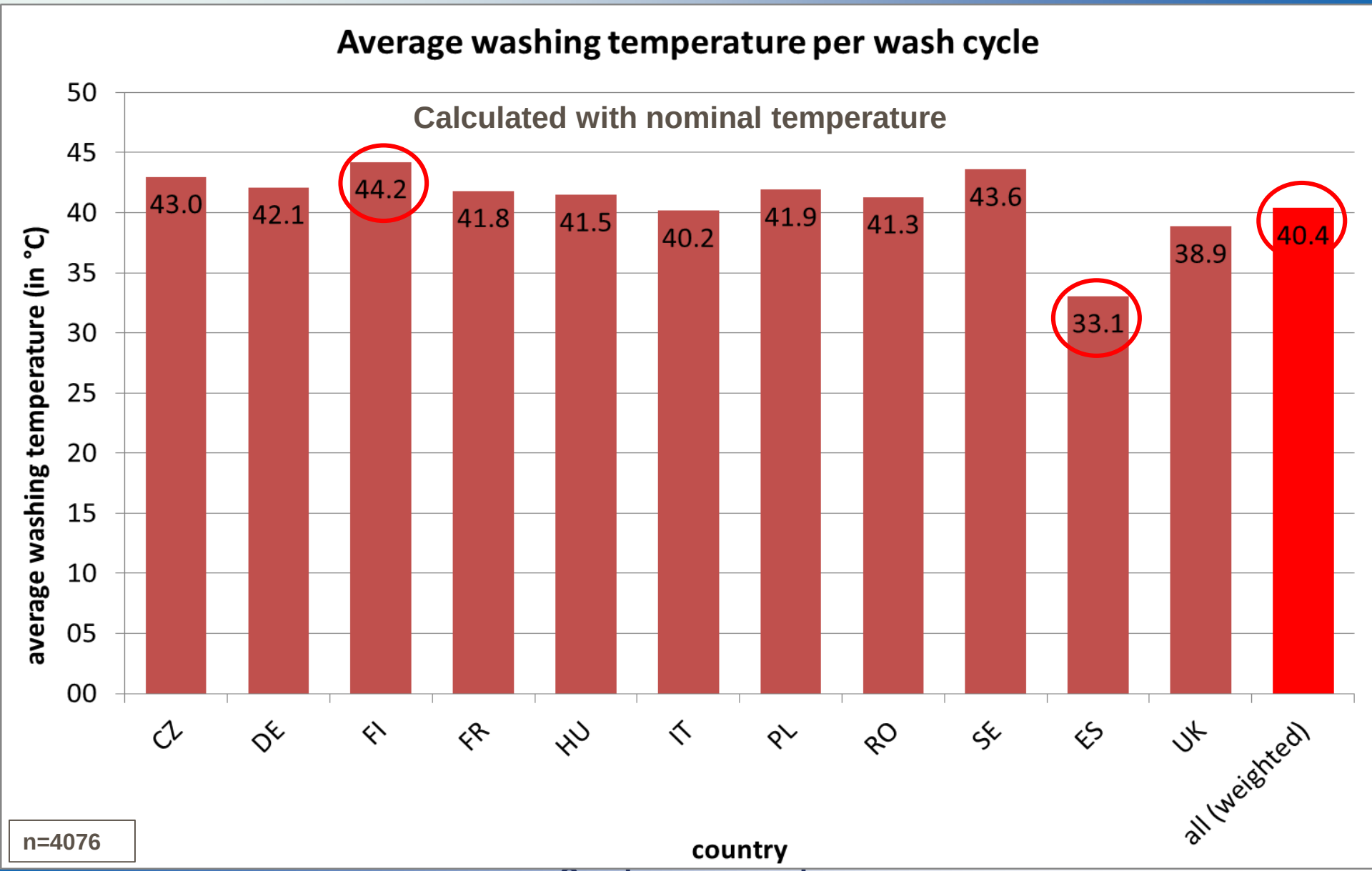
n=4076

How do you usually load your washing machine for a cotton wash?



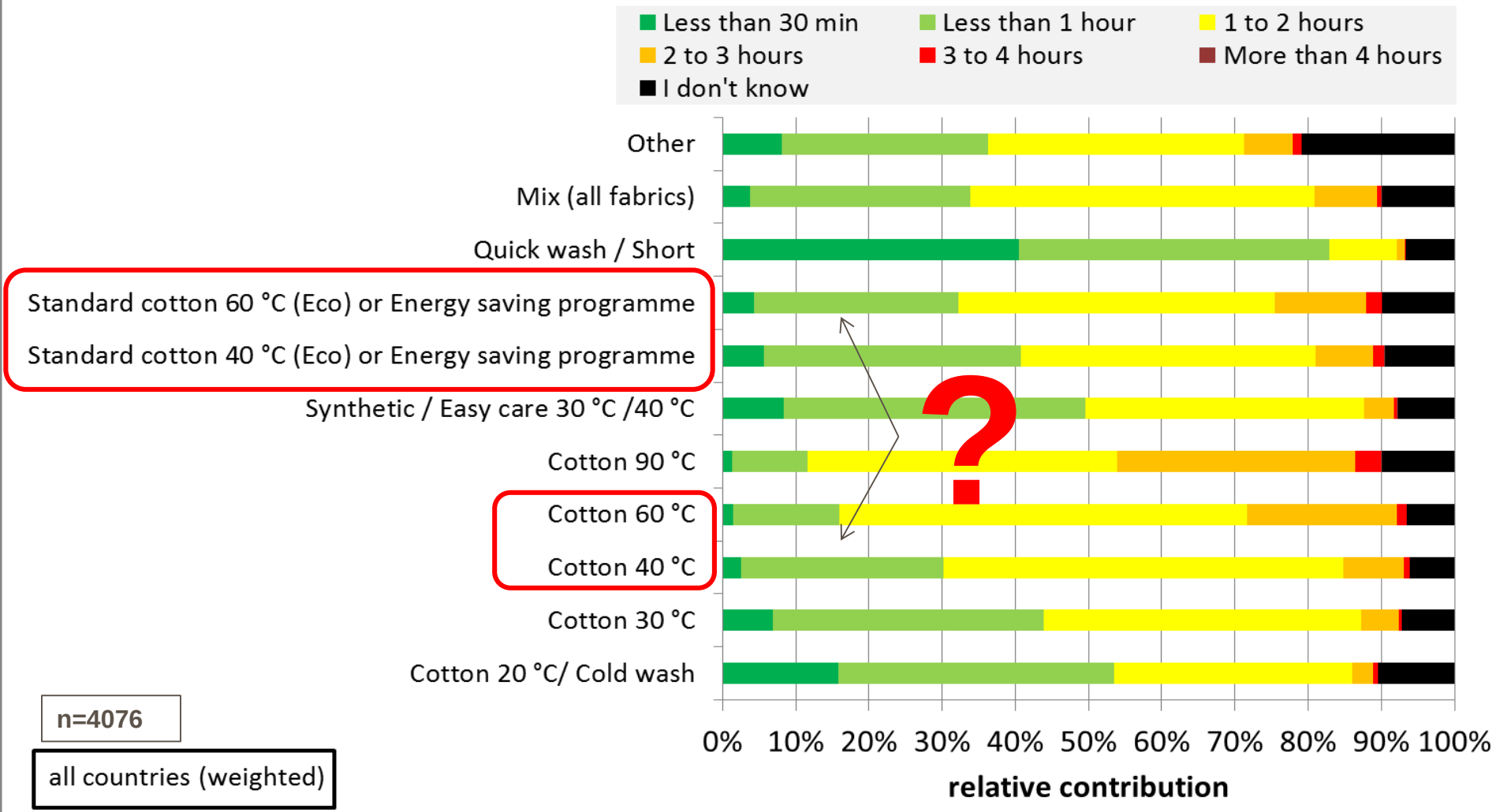

Average wash cylces per week per household size
average wash cycles per week per household
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2.0
3.1
4.4
5.2
6.2
1 person
2 people
3 people
4 people
More than 4 person
household size
Average wash cycles per week per household is 4.0
n=4076


Used washing programmes
Other
3%
Mix (all fabrics)
8%
Quick wash/Short
13%
Standard cotton 60 °C (Eco) or Energy saving programme
6%
Standard cotton 40 °C (Eco) or Energy saving programme
10%
Synthetic/Easy care 30 °C/40 °C
12%
Cotton 90 °C
4%
Cotton 60 °C
12%
Cotton 40 °C
17%
Cotton 30 °C
11%
Cotton 20 °C/Cold wash
4%
0%
5%
10%
15%
20%
relative contribution of all wash cycles
all (weighted)
n=4076


Average washing temperature per wash cycle
Calculated with nominal temperature
average washing temperature (in °C)
50
45
40
35
30
25
20
15
10
05
00
43.0
42.1
44.2
41.8
41.5
40.2
41.9
41.3
43.6
33.1
38.9
40.4
CZ
DE
FI
FR
HU
IT
PL
RO
SE
ES
UK
all (weighted)
country

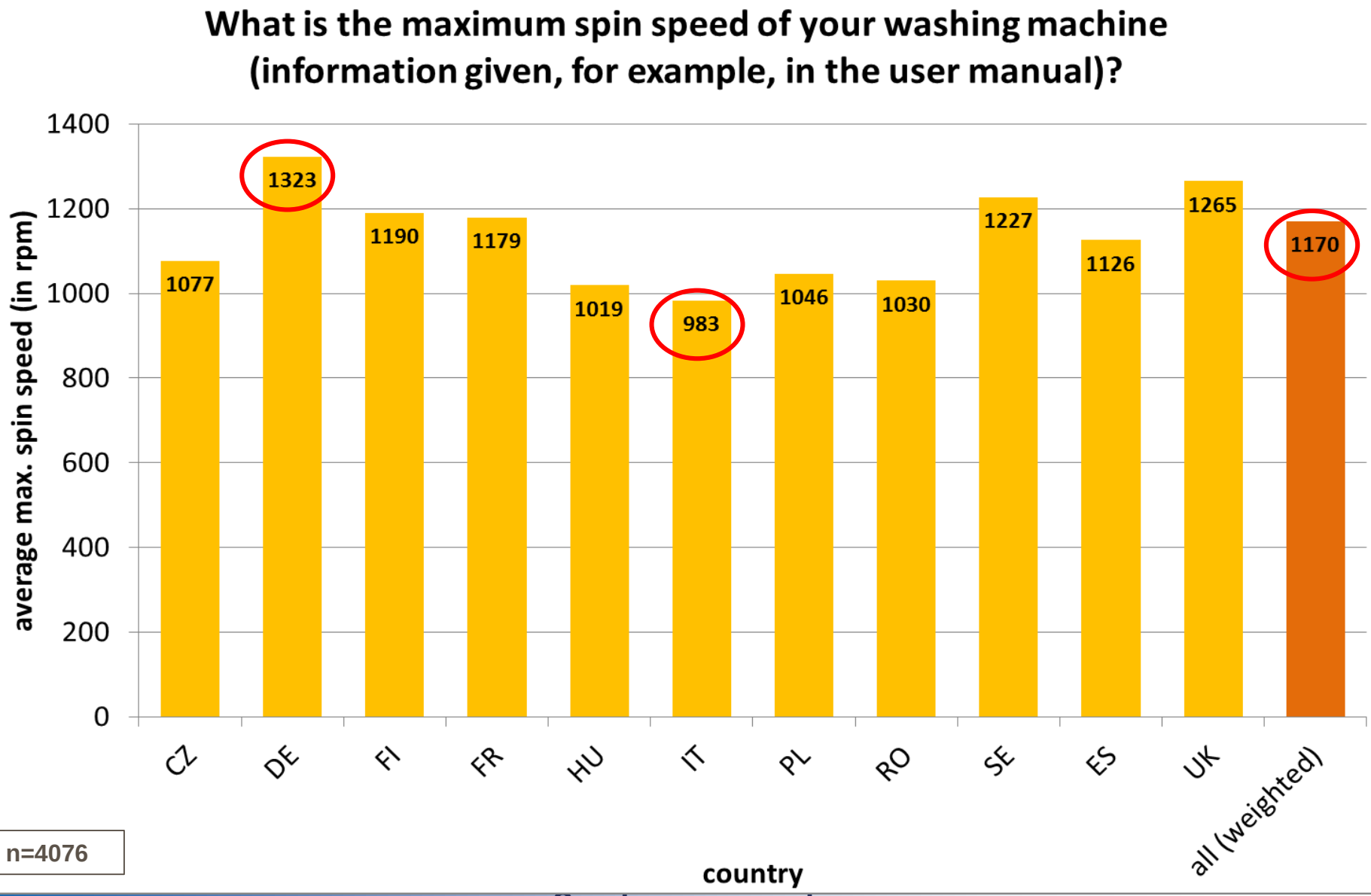
n=4076

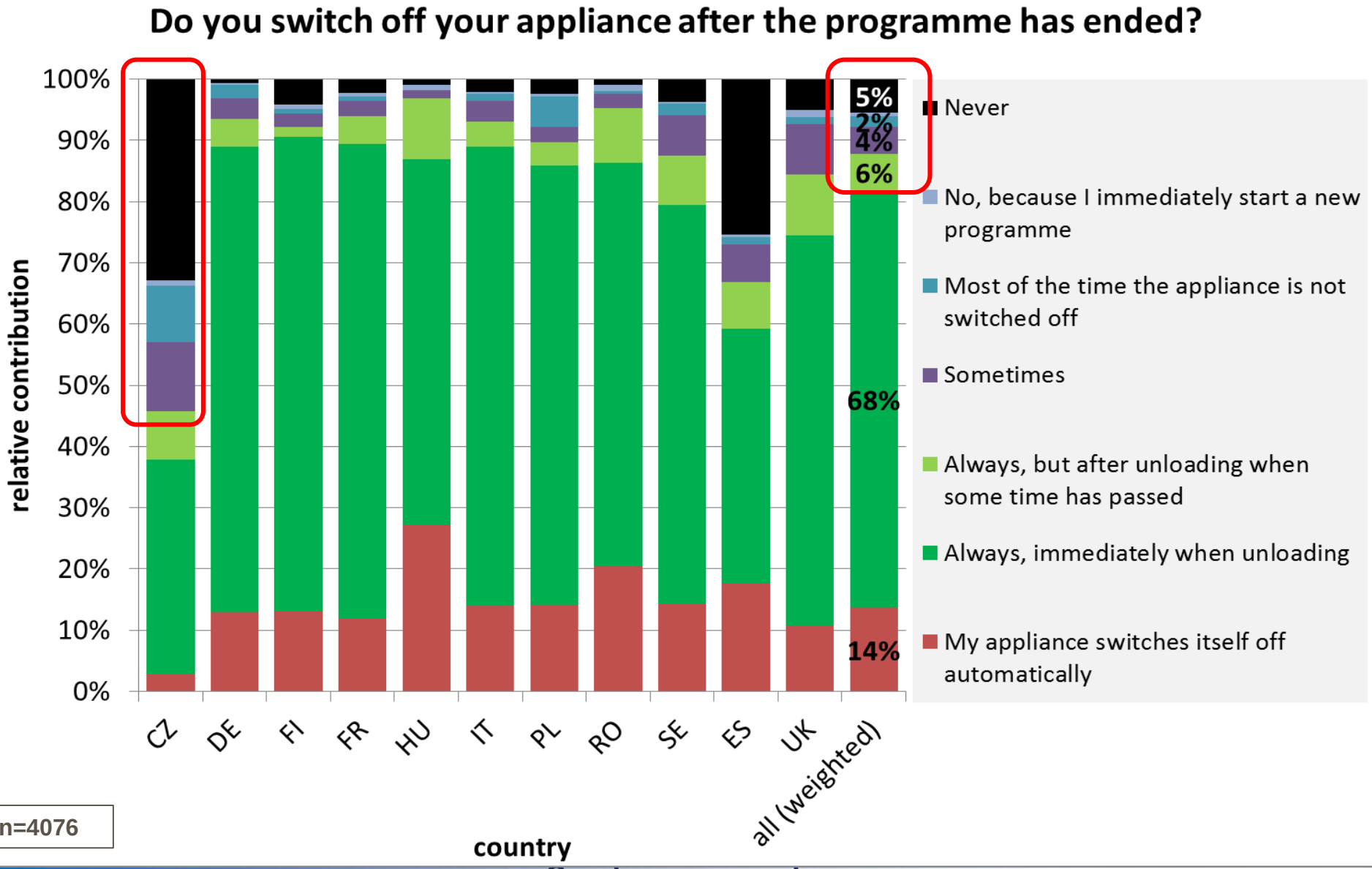
Please choose the approximate duration of washing programmes that you use from the list below.

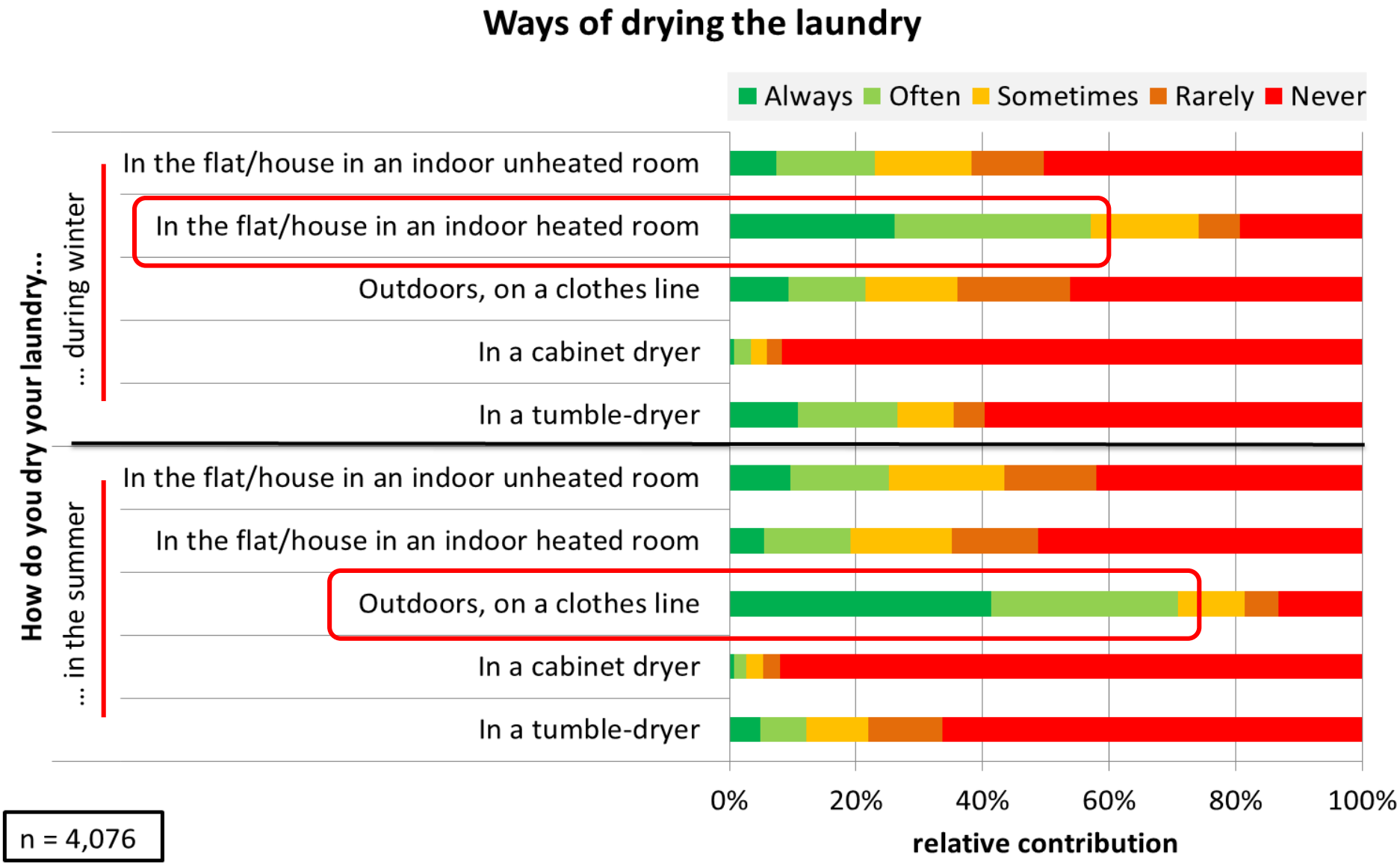


n=4076

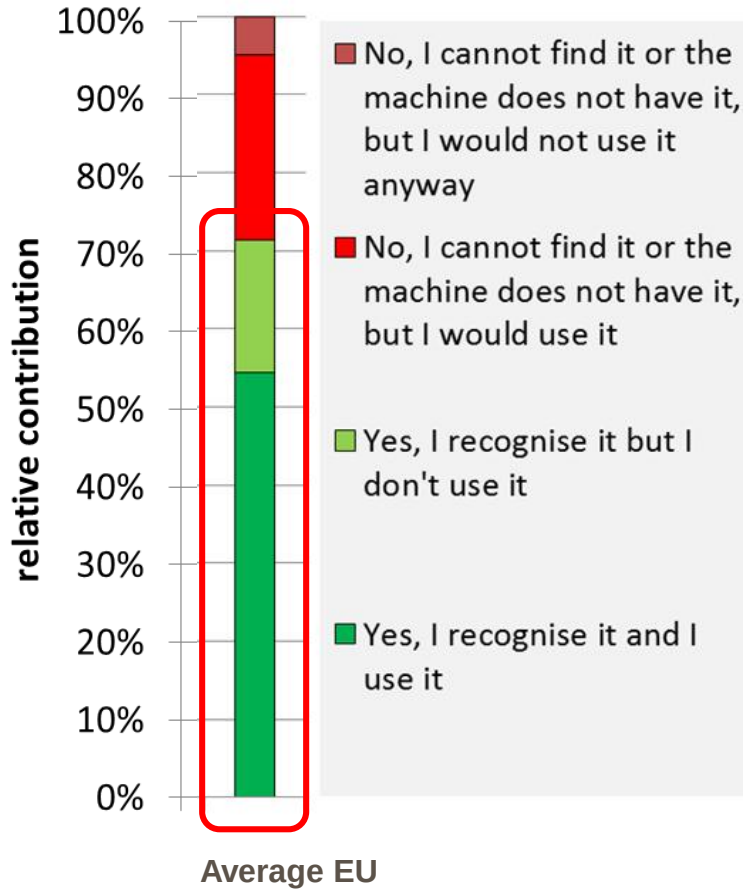
all countries (weighted)


What is the maximum spin speed of your washing machine (information given, for example, in the user manual)?
average max. spin speed (in rpm)
1400
1200
1000
800
600
400
200
0
1077
1323
1190
1179
1019
983
1046
1030
1227
1126
1265
1170
CZ
DE
FI
FR
HU
IT
PL
RO
SE
ES
UK
all (weighted)
country
n=4076


Do you switch off your appliance after the programme has ended?
relative contribution
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5%
2%
4%
6%
68%
14%
CZ
DE
FI
FR
HU
IT
PL
RO
SE
ES
UK
all (weighted)
country
Never
No, because I immediately start a new programme
Most of the time the appliance is not switched off
Sometimes
Always, but after unloading when some time has passed
Always, immediately when unloading
My appliance switches itself off automatically
n=4076

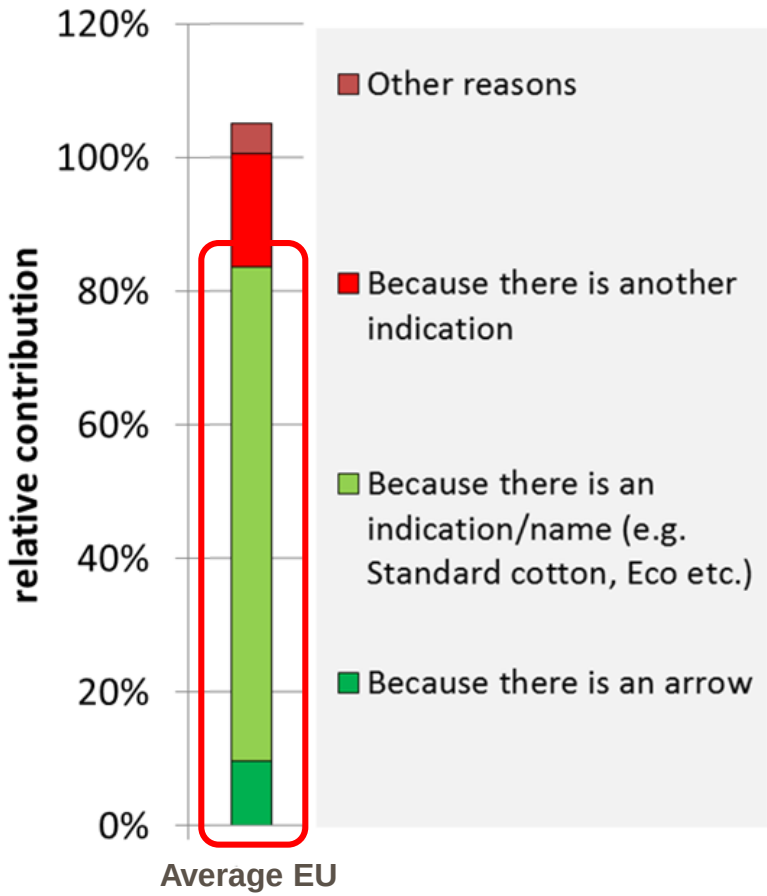

Ways of drying the laundry
Always
Often
Sometimes
Rarely
Never
How do you dry your laundry...
... during winter
In the flat/house in an indoor unheated room
In the flat/house in an indoor heated room
Outdoors, on a clothes line
In a cabinet dryer
In a tumble-dryer
... in the summer
In the flat/house in an indoor unheated room
In the flat/house in an indoor heated room
Outdoors, on a clothes line
In a cabinet dryer
In a tumble-dryer
0%
20%
40%
60%
80%
100%
relative contribution
n = 4,076

Can you recognise energy saving programme on your washing machine?



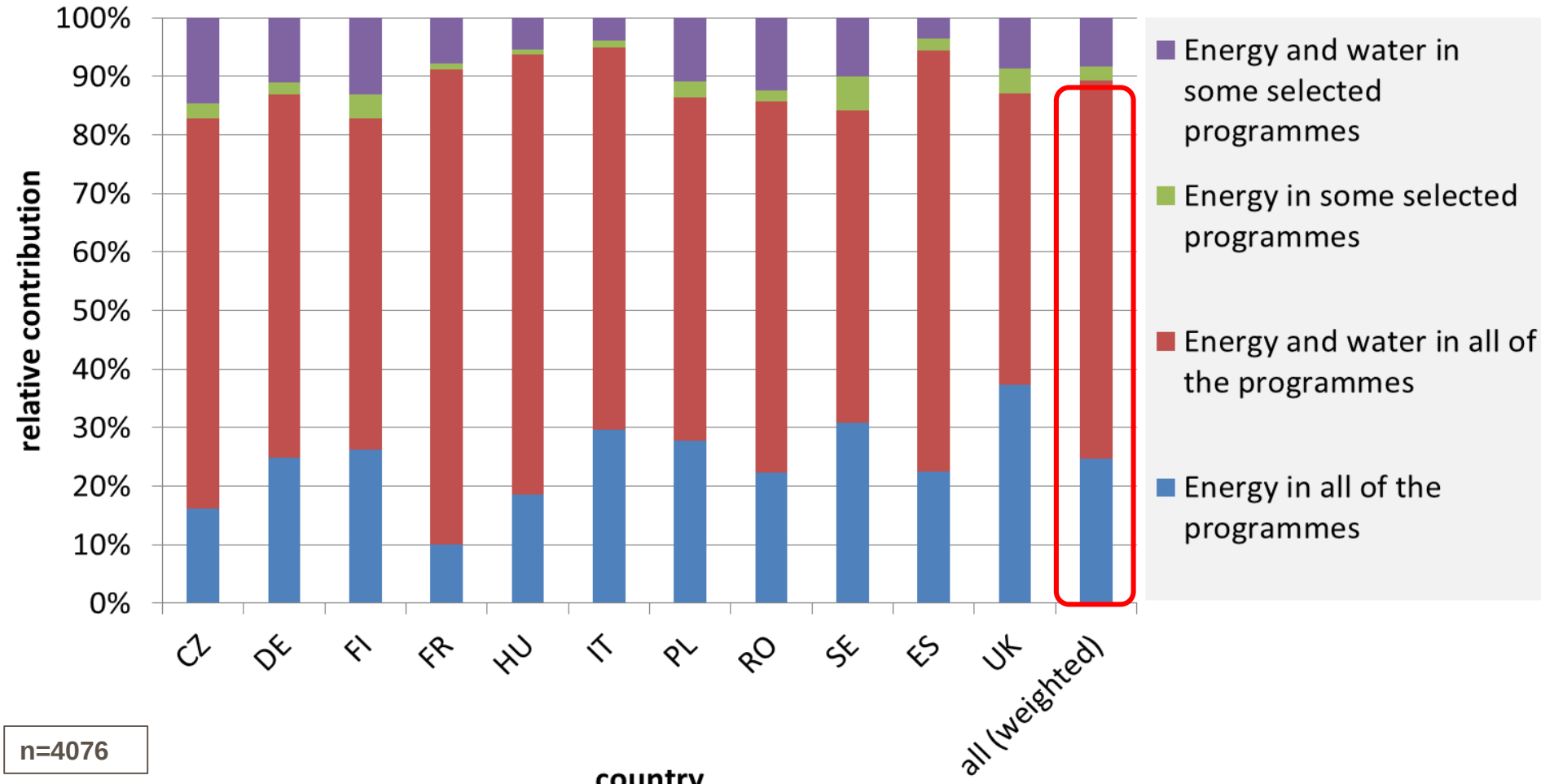
n=4076

How do you identify the energy saving programme? (Muliple answers allowed)



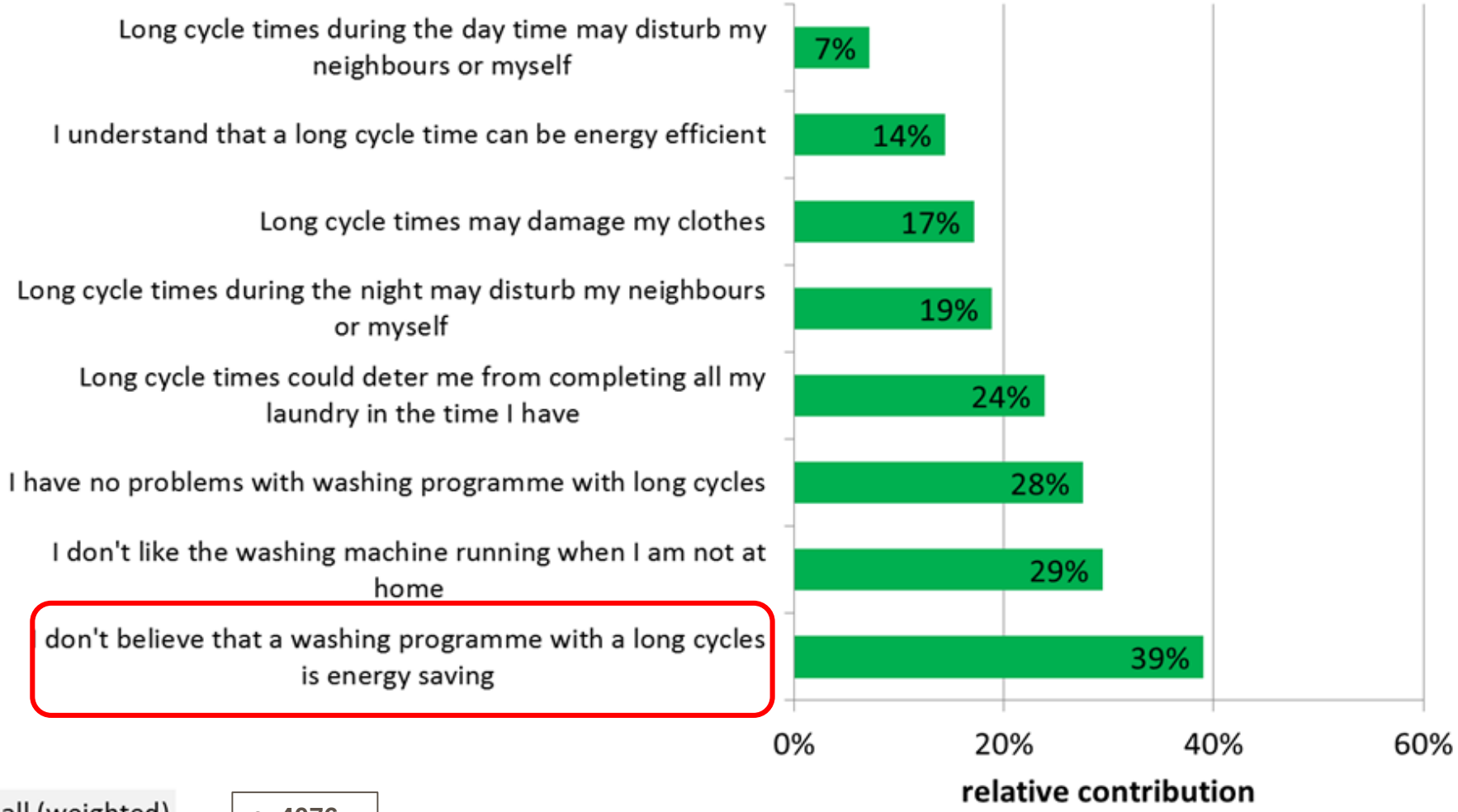
n=4076

I would expect a washing machine with the highest energy label efficiency class available on the market to be able to help make savings on...

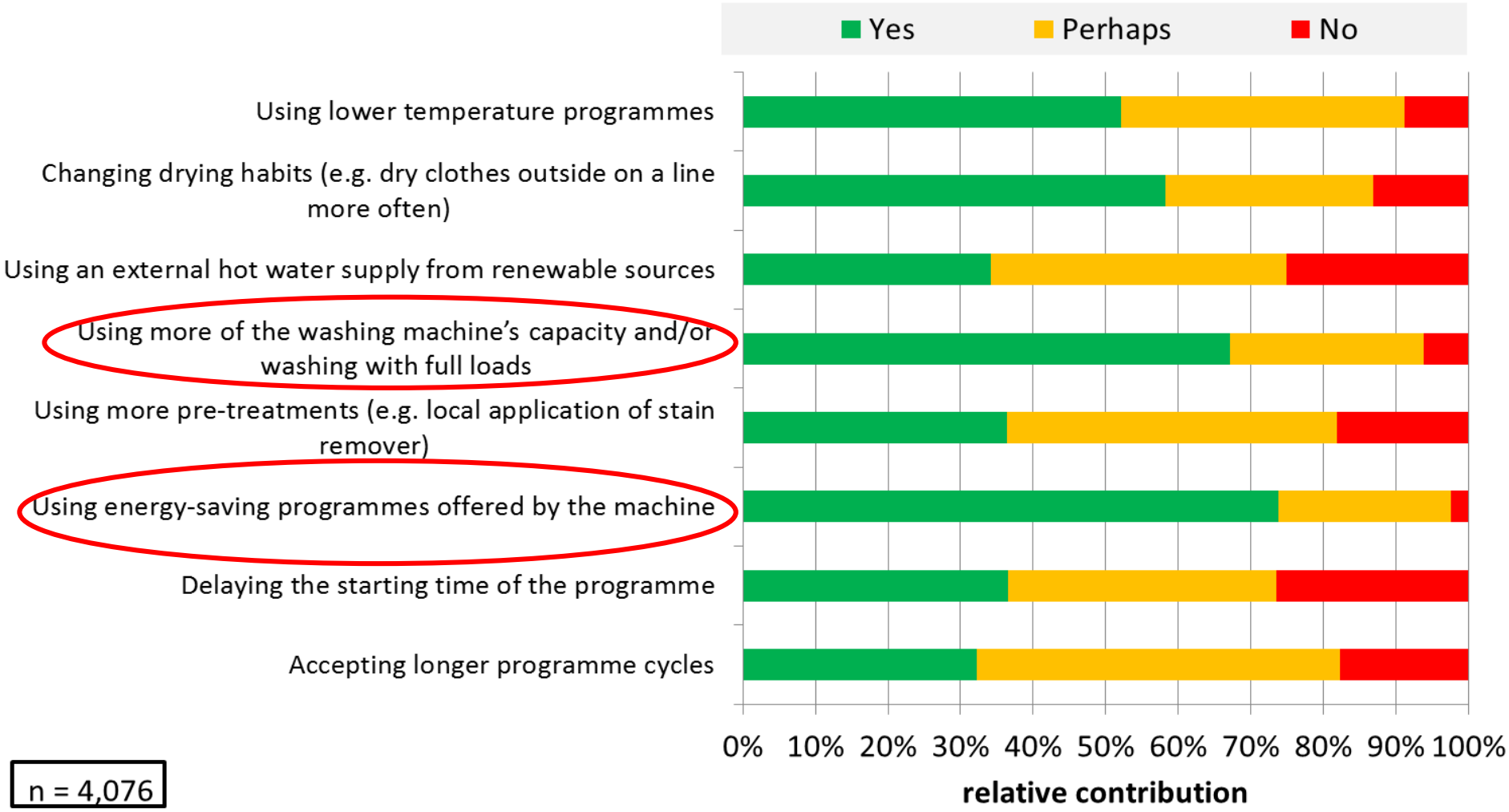


n=4076

What is your opinion on washing programmes with long cycles? (multiple answers possible)

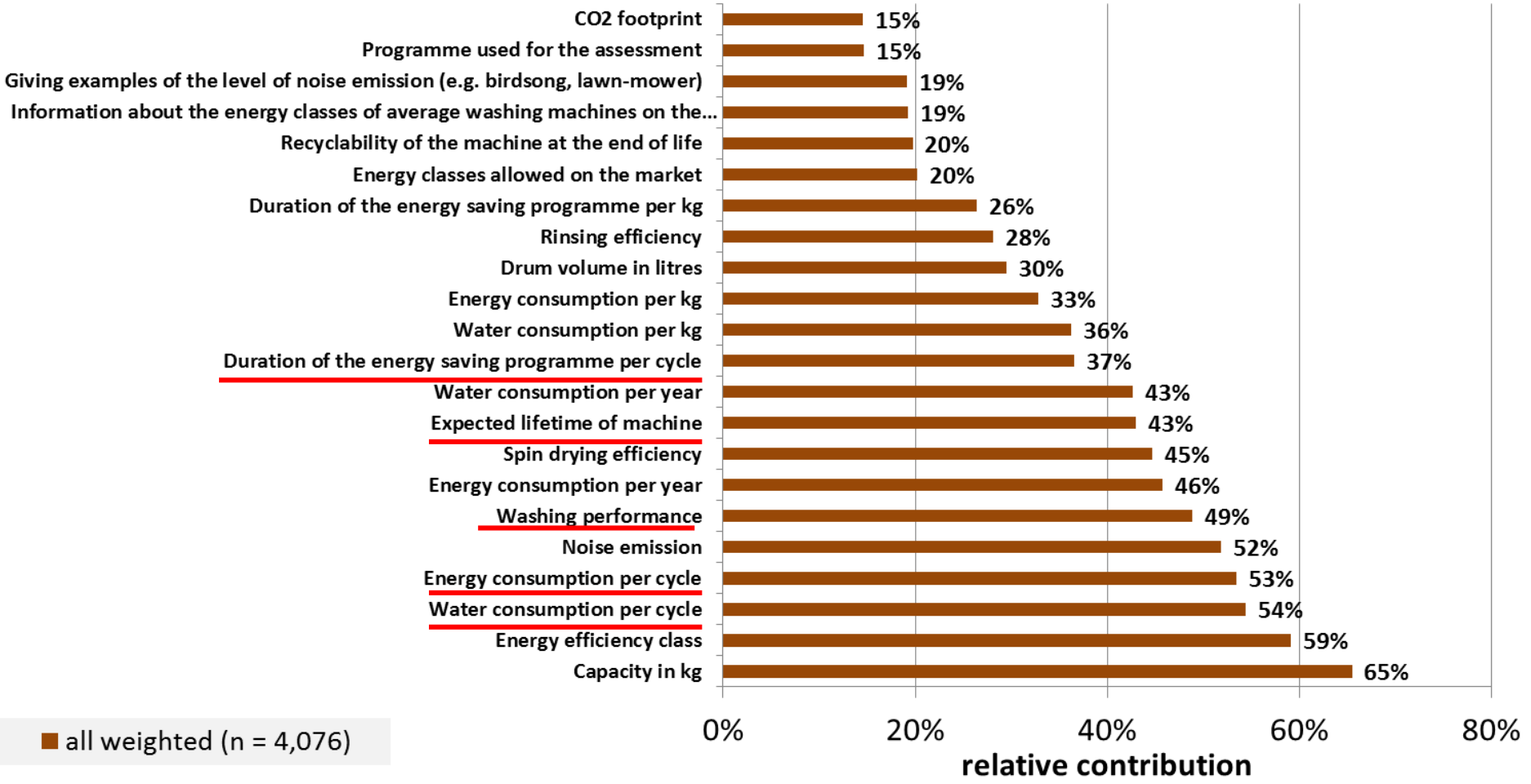


Which of the following options would you use if doing so would enable you to save energy and/or money?



n = 4,076

In your opinion, which of the following pieces of information are important to be indicated on a future energy label? (multiple answers allowed)



Summary

- Most important features of a washing machine
  - Low energy and water consumption and associated bills
  - Purchase price
  - Simple and easy to use
  - Expected rinsing results and washing performance
- Average load capacity of washing machine is 6.5 kg
- Average wash temperature per cycle is 40.4 °C
- 64% of all washes are cotton wash programmes
- Eco programmes' are 16% of the total number of programmes, but about 1/3 of all cotton 40 °C and 60 °C programmes
- 54 % of household in average use energy saving programme
- A lot of misunderstanding of what energy saving programme can deliver
- Consumers are interested on finding washing performance and consumption values per cycle additionally on the label. Some interest also on life time of the machine.

Thanks to …

… for supporting this research.

Complementary results from previous user surveys - summary

- **Frequency of operations:**

  - UniBonn (2011): the average number of washing cycles in Europe has decreased from 4.0 to 3.8 cycles per week in 2011 (variation range: 3.5 – 4.1). **For WD: 4.3 washing cycle per week and 1.1 "wash+dry" cycle per week (To be updated)**

  - AISE (2011): 3.2 washing cycle per week

  - Water Energy Calculator: 4.7 washing cycle per week (5.5 previously)

  - Results for WM in 2015 confirming about 4 washing cycles per householdper week in Europe

- **Selected programme temperature**

  - UniBonn (2011): around 40% of washes at 40° C, 19% at 60° C (5% at 90° C), high variability among countries. Average nominal washing temperatures is 43.3° C

  - AISE (2011): average washing temperature is 41.0° C

  - Average temperature of the wash cycle has decreased (IKW: from 63° C in 1972 to 46 ° C in 2010)

  - Similar results for WD (UniBonn, 2011): 32.3% of washes at 40° C, 20.4% at 30° C, 18.2% at 60° C

  - Lower temperatures more important, **results for WM in 2015 aligned**

- **Loading**

  - UniBonn (2011): almost 60% of wash cycles at full capacity

  - AISE (2011): majority of consumers load their washing machines from 75 up to 100% full

  - confirmation from results for WM in 2015

- **Spin speed and drying behaviour (UniBonn, 2011):**

  - Average spin speed in WM: 941 rpm (**1170 rpm from results for WM in 2015)**

  - For WM: 55% drying outside in clothes lines in summer and 40% in winter (51% in a heated room inside the house)

  - For WD: 70% drying outside in clothes lines in summer and 16% in winter (66% in a heated room inside the house)

  - Drying function of WD is typically used only sometimes, rarely or never (77% in summer and 57% in winter)

Programme duration

- Cycle duration is an important programme **selection parameter**
- **Users willing to wait not longer than 3 hrs**
- **Increasing nr. of eco-programmes > 4 hrs**
- **Acceptance of eco-programmes might increase** when consumers are informed

Tested programme(s)

- **Standard programmes** are currently **not always chosen** by consumers (duration, real temperature, identification)
- **Most selected programmes** should be tested: cotton programmes at 40 ° C and 60 ° C, with a trend to a lower temp.
- **Cold wash programmes (20° C)** are required by Ecodesign but are not tested. Additional regular maintenance cycles at high temperature (e.g. 90° C) may be needed.
- **Choice btw "standard" and "non-standard"** programmes might results in an overall higher energy use
- **Programmes tested and relative weight** (for energy calculation) may be to revised to follow user-behaviour trends (e.g. more importance to 40 ° C)
- **Differences btw nominal and real temperature** can be a problem at about 60° C (hygiene, soiling reasons)

Capacity

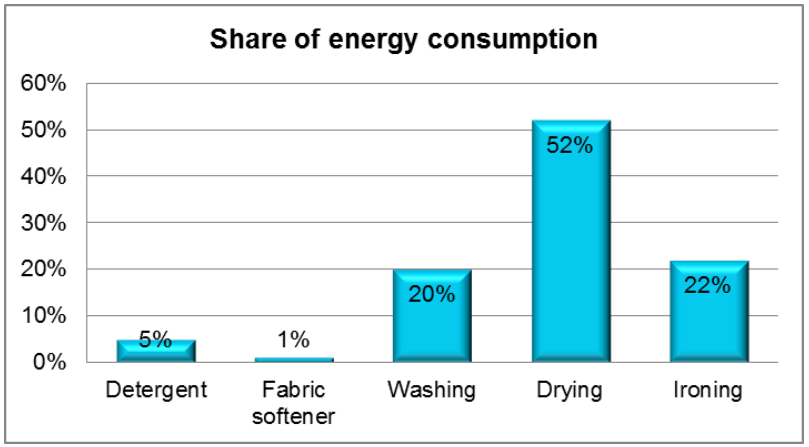
- The **rated capacity has increased** in the last decade but the average amount of **laundry loaded is <4kg** cotton (3-3.5 kg).
- Current measurement methods make use of **half loads that may not represent real use** conditions for larger machines
- Most WMs have **automatic load detection programmes** while others use the same amount of energy and water for half/full loads
- Half load tests should deliver **realistic energy and water saving** compared to full load tests (e.g. 25-30%)

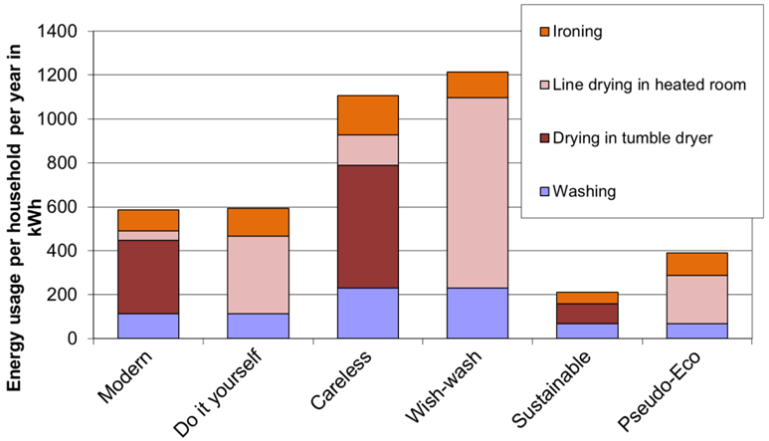
Consumption values of programmes and information to consumers

- At the **point of sale**: energy and water consumption values in the energy label for **standard programmes**
- **Pros and cons** btw values per cycle/year
- Providing **information for other programmes** (e.g. in user manuals) might be useful to take better informed decisions
- Information about the energy use could be provided also through **pictograms and/or indicated directly** on the appliance.
- Such options are **already implemented** by some manufacturer
- On the other hand, **risk to overload users** with too complex information and to generate confusion

The "Washing, drying and ironing" system

- Optimal **detergent dosage** depends on different factors (e.g. water hardness, soiling, textile, load) which usually are not taken into account (90% of users according to Sanner 2011)
- Overall consumption of resources during the laundry process = washing + pre-treatments + drying + ironing
- Great influence of user behaviour but the **highest amount of energy (52%) for tumble drying** (IKW 2009)





Joint Research Centre

Infrastructure – Energy, water and smart appliances

- **Hot water supply** could be used to feed the appliance. Potential measures for its diffusion:
  - indication about appliance fitness for hot water connection
  - specific instructions in the user manual (e.g. max temperature of the how water inlet)
- **Water saving** potentially possible through avoidance of extra-rinse programmes and use of grey water and rainwater
- **Demand-response enabled appliances** follow energy production and supply fluctuations and use it when more convenient:
  - Still a niche market,
  - Promotion of such appliances might support diffusion of more energy efficient systes

Shared washing machines and washing services

- **Communal washing rooms and washing machine renting services** are also available in parts of the EU.
- **Communal washing machines** are normally **heavy duty machines**, i.e. professional or semi-professional machines.
- **Little information** is available on the characteristics and market relevance of **rented machines**, or the provision of washing services (in relation or not with repair services)

Discussion Areas

- Clarifications on 2015 User Survey
- 6 specific issues for the revision from T1 (requirements/standards)
- 3.1 Programme duration
- ~~3.2 Facilitate the selection of tested programme(s) (under point 1.3)~~
- ~~3.3 Consumption values of all programmes information to consumers (under points 1.6/1.7)~~
- 3.4 Use of hot-water
- 3.5 Supporting demand-response enabled appliances
- 3.6 Shared washing machines and washing services

Discussion points 1.3, 1.4 and 1.10: Testing of programmes and temperature

a) Which programmes should be tested?
b) Should the standard programme(s) be selected by default?
c) Which name should be given to the energy saving programme(s)? (e.g. Eco?)
d) How to handle the difference btw nominal and real temperature? -
   - e.g. removal of the standard 60° C cotton programme
   - declaration of the max temp (± 2° C)
   - min temp for a certain time
a) Where and how to measure the temperature?
b) Same approach for WM and WD?

Discussion point 1.5: Capacity measurement

a) Is it true that the declared rated capacity can vary depending on manufacturer/country?

b) Can harmonisation be achieved by referring to standard IEC 60456?

c) How to adjust the share of half-loads?

d) How to deal with automatic load detection programmes?

e) Would you agree with the introduction of minimum energy saving rates for half-load (e.g. 35%) compared to full load?

f) Should the formula for the calculation of the Standard Annual Energy Consumption (SAEC = 47.0 × c + 51.7) be updated?

g) Same approach for WM and WD?

h) Are there any conflicts/special issues to point out with respect to the different approaches in the EU and in the USA?

Discussion points 1.7 and 1.8: Energy consumption and low-power modes

a) Energy consumption values per cycle vs per year?

b) Indicate values of every programme in the user manual AND/OR expected/actual values directly on the machine?

c) How important is the energy contribution of low power modes for WM/WD?

d) Could the energy consumption from low-power modes increase if not part of the ED/EL regulations?

e) How to handle low-power modes (e.g. excluded from the EEI calculation but separate requirements)?

f) Same approach for WM and WD?

Discussion point 1.6: Inclusion of rinsing performance and measurement of hygiene

a) How to handle the measurement of the rinsing performance?

b) How to handle the hygiene issue (e.g. measurement of the reduction in the residual microbial contamination of the laundry)?

c) Same approach for WM and WD?

Discussion point 1.9: Avoidance of damage to textiles

a) How concerning is this damage to textiles due to prolonged mechanical action?

b) If so, how to handle it?

c) Same approach for WD?

Discussion points 1.11: Verification of the level of uncertainty of all measured values

a) Which is the uncertainty associated with the performance level measurements for WM and WD? how tolerances should be set to reflect such uncertainties?

Discussion point 1.13: Improvement of rounding methods

a) Is rounding an issue of concern? Would the method from ISO 80000-1 (round up) be a solution?

b) Same approach for WM and WD?

Discussion point 1.14: Performance of WD

- EN 50229 is currently being updated, to align with washing machines and tumble-dryer standards
- The energy use test procedure overrates the drying function (ratio washing to drying = 1:1 instead than 4:1)
- Only cotton 60° C with rated capacity is tested

a) **Is such analysis correct?**
b) **Any specific proposals to use in the standard update process?**

Discussion Point 3.1: Programme duration

a) Would consumers select longer programme times if they were better informed that longer cycles can have lower energy consumption values?

b) How should the consumer be informed about this?

c) Should duration time be limited/indicated?

Discussion Point 3.4: Use of hot-water

a) Should possibility of hot water supply be indicated on the label?

b) Which additional information to ensure energy saving and protecting the functioning of the appliance?

c) Are there any additional constraints?

Discussion Point 3.5: Demand-response

a) Should demand-response enabled appliances be promoted for WM/WD?

b) Can info about the availability of such feature be of any value?

Discussion Point 3.6: Shared washing and services

a) Do you have specific information/examples of machine rental/leasing and the operation of washing services?

b) Do you have any information about their current diffusion, their frequency of use and the expected trends for the future

TASK 4: TECHNOLOGIES

- Technical description of products (base cases, "top models", potential improvement options)
- Description of production, distribution, use, end-of-life
- Key discussion points

General information on products

- Washing based on combination of 4 parameters: time, temperature, mechanical action, and chemistry (**Sinner Circle)**
- **4 main phases** in a washing cycle: pre-rinse, main wash, main rinses, pre-drying (spinning)
- **Many programmes**
  - Main: quick wash/short; cotton 30-40-60^{o}C (non-eco & eco)
  - Additionally: Cold wash /Cotton 20^{o}C; Synthetic/Easy care 30-40^{o}C, Wool/Hand wash, Mix/automatic (all fabrics), other
- **Installation configurations**
  - Front/top load
  - Normal dimensions: h 85-96.5cm, w 59.5-60cm, d 55.5-64.5cm
  - Design options: freestanding, under counter, integrated

Base cases and Design Options

- Appliance configurations representative of the **average level of technology** on the EU market.
- **Reference** for modelling improvement design options
- **Procedure:**
  1. Definition of one (or more) base cases for WM/WD
  2. Identification of feasible design options (e.g. optimised hydraulics, more efficient motor, improved drenching, heat pump drying, increased durability)
  3. Identification (pros/cons) of design options, and quantification of main parameters (energy, water & material use vs. life-cycle costs (payback time), EoL issues)

WM Base cases – Preliminary data

	Lot 14		Revision (?)			Topten benchmark ~ BAT
Capacity	5kg	6kg	7kg	5kg	7-8kg	7-8kg
Energy consumption (kWh/cycle)	0.956	1.057	~ 0.8	~ 0.75	<0.8	~ 0.4-0.5
Energy class	A	A+/A	A++/ A+++	A+	A+++	A+++ -50%
Water consumption (litres/cycle)	50.4	49.2	~ 50	~ 50	~ 50	~ 45
Washing performance class	A	A	A	A	A	A
Drying performance	B/C	B/A	A	B?	A	A
Noise (spinning/washing)	70/53	70/53	~ 75/50	~ 75/50	~ 75/50	71/47

WD Base cases – Preliminary data

WD Base case	Lot 14	Revision	Topten benchmark ~ BAT
Capacity (washing)	-	7-8 kg	9
Capacity (drying)	-	4-5kg	6
Energy consumption W (kWh/cycle)	-	~ 1	1.1
Energy consumption W+D (kWh/cycle)	-	~ 6	3.7
Energy class	-	A/B	A
Water consumption (litre/cycle)	-	~ 100	69
Washing performance class	-	A	A
Drying performance	-		
Spinning performance	-		
Noise	-	~ 75/50	71/47

Design trends

Technology innovations in general introduced **every 8-10 years** depending on market and technological evolution

Much effort on **reducing energy and water use**

Additional elements of environmental concern (partially regulated through other legislation):

- **Noise emission** levels (especially in spinning)
- **Material resource efficiency**

- **Indicative energy breakdown:**

  - (I) Water heating (55-68%), (II) motion and pumping, (III) other aspects (e.g. controls and low-power modes – 2%)

  - Drying very important for WD

Recorded strategies to reduce energy consumption (I)

Strategy	Barriers/observations
New **low-temperature detergents** → Reduce temperature with/without extending washing cycle duration	Hygiene concerns in clothes and WM water circuit
Longer washing time → Increase mechanical action on textiles	Waiting time >3h may not be satisfactory for consumers. Increased clothes wear and tear, currently not tested
Reduce the amount of (heated) water used: 1. Sensors adapting water consumption to partial loads / soiling	Not activated in all programmes (e. g. standard programmes)
2. Improved drenching of the laundry (direct spray systems)	-
3. Reduction of the number of rinse cycles	Concerns of insufficient detergent removal (allergies)

Recorded strategies to reduce energy consumption (II)

Strategy	Barriers/observations
Heat recovery (e.g. water recirculation, heat exchangers)	Bacterial growth in water circuits?
Optimisation of the drying process 1. higher spin speeds	Limited by (a) larger wrinkling and (b) use drying
2. use of heat pumps	Cost
Machine size increase	Machine size offer ≠ average user demand
Reduction of the **time at which the temperature is ≥ nominal programme temperature**	Hygiene concerns for bacterial/virus removal (e.g. textile nappies, clothes of sick persons)

Improvement options

1. Machine construction
   - Tub-drum geometry
   - Increased rated capacity
   - Multi-drum washing machine
   - Fiberglass drum construction
   - Increased durability
   - Use of recycled plastic (washing machine)
2. Increased motor efficiency
   - High efficiency motors
   - Optimised materials in motors
3. Time-temperature trade off
   - Decrease of reached temperatures in the washing programmes
   - Low temperature programmes: introduction of 20°C cycle
   - Programmes handling hygienic aspects
4. Improved thermal efficiency
   - Design optimisation
   - Washing machines with heat pump technology
   - Washer-dryer with heat pump technology
5. Alternative heating systems
   - Hot-fill-feature:
   - Heating by hot water circulation loop ("heat-fed machines")
6. Reduction of water consumption
   - Rinsing optimisation
   - Use of rain/well water
   - Water recycling
7. Optimised mechanical action
   - Ecobubble™technology
   - Internal water circulation
   - Spray-technology
8. Spin speed and alternative drying systems
   - Alternative drying systems
   - Increase of spin speed
9. Sensors and automatic controls
   - Unbalance control
   - Automatic load detection
   - Automatic detergents dosage systems
10. Anti-crease mechanisms
    - Steam Care/Steam finishing
    - Anti-crease systems
11. Alternative washing systems
    - Ultrasonic cleaning technologies
    - Polymer bead technology
12. Consumer feedback mechanisms
    - LCD with actual load indication
    - Display of consumption of resources
13. "Smart" appliances
    - Internet connectivity
    - Electronic update of the programmes /diagnostics:
    - Smart grid ready (SG ready) products
14. Others
    - Noise reduction
    - Single stain removal system
    - Delay start
    - Voice controlled appliances
    - Mixed appliances.

Expected feedback

Further characterisation of technologies needed

Input on technologies shall contain briefly:

- Confirmation / proposal of alternative classification
- Working principle
- Qualitative (if available quantitative) description of benefits (savings of energy, water or materials). If applicable, drawbacks or trade-offs (costs, complexity, other impacts at material level)
- State of implementation, expected market trends (qualitative, if possible quantitative)
- Relevance for Base Cases or as BAT/BNAT for Design Options.
- Examples of products (also with indications of the effects in terms of Bill of Materials, energy performance, water consumption, costs, impact on end of life, etc.)

- **Based on that: definition of technologies in Base Cases, and in Design Options (both WM and WD)**

Examples of data for LCA/LCC assessment of Base Cases and Design Options

	Base Case	Design Option A	...
Technology description			
Market relevance (%)			
Rated capacity			
Energy Class (EEI)			
Energy consumption (kWh/cycle) - washing - drying (for WD)			
Water consumption (L/cycle) - washing - drying (for WD)			
Other performance levels - washing - spinning (for WM) - drying (for WD) - noise			
Product cost - product - installation, maintenance, repair			
BoM (and EoL issues)			
Expected lifetime			

- Combinations of different technologies
- Examples of possible options:

- Devices with balance weights from steel

- Permanent-magnet synchronous motors

- Heat pumps

- Automatic dosage systems

- Other improvement options...

Product packaging and distribution

Packaging: about 1 – 4 kg

Materials used: EPS, other plastics (e.g. PS, PE), cardboard

Average weight / volume:

- Lot 14 (5 kg WM): 72.3+1.9 kg / 360 L
- WM (stakeholders): 61+1 kg / 319 → 447 L
- WD (stakeholders):84+4 kg / 320 → 450 L

Transportation: trucks (e.g. 40%), rail (e.g. 33%), sea (e.g. 27%)

Default Ecoreport tool mix used

Discussion point 4.1: technology characterisation

a) **Is the list of technologies presented comprehensive?** Please complement, update or revise

b) Some sources indicate that **front load machines** are more efficient than top load machines. Do you have supporting evidence of this?

c) According to Topten, the **highest EEIs** are currently obtained through a limited list of technology options, including:

- inverter driven motors and permanent magnet motors
- heat pump technology
- high load capacity
- lower washing temperatures than the nominal ones
- extension of programme duration.
- load sensors that enable to adjusting the water and energy consumption.

Would you agree with such analysis? Are there other technologies playing a key role?

Discussion issues

4.1 Technology characterisation
4.2 Packaging
4.3 Base Cases, Design Options and Scenario definition
4.4 Product lifetime and durability
4.5 EoL management

Discussion point 4.2: Packaging

a) Do you agree with the ranges of packaging volume, weight and composition outlined above?

Discussion point 4.3: Base Cases, Design Options and Scenario definition

a) Do you agree with the base case proposal outlined above for washing machines?
b) Do you have any suggestion and/or preference for Base Cases and Design Options to assess in the next tasks?
c) How should the base cases for washer-dryers defined?
d) What has been changed material wise between 2007 and 2015?

Durability and End of life

Durability

- 15 yrs (3300 cycles @ 220/yr) in Lot 14
- Prakash et al. (2015): only 55.6% of products replaced due to a defect in 2012! (57.6% in 2004)
- first useful service life of WM: from 12.7 yrs in 2004 to 11.9 yrs in 2012/2013.
- lifetime of WM replaced due to a defect: from 13.5 yrs in 2004 to 12.5 yrs in 2012/2013
- Reused WM are typically 4-5 years old in the UK. Refurbishment can extend lifetime by 6 years or 1500 cycles (WRAP 2011).
- Increasing nr. of still functioning replaced appliances: 14% of replaced WM were less than 5 years old in 2012 (10% in 2004)
- 10yrs equivalent to 1800-3000 cycles. Number of cycles might be a better indicator?
- Technical and environmental parameters can influence the product lifetime negatively (humidity, power supply, water hardness)

Examples of common failures (I)

Based on OCU, RReuse, WRAP, stakeholders:

- Door rubber seals, hinges and iterlocks (items caught in seals, rubber deterioration)
- Filter and pump blockage
- Motor and drum bearings and shock absorbers (underdimensioning of bearings, overloading)
- Inlet and outlet hoses and water leakage;
- Water inlet valves and level sensors (membrane of pressure switches (pressostat) can degrade over time)

Examples of common failures (II)

- Water heating elements (especially with hard water)
- Motors (particularly from wear on brushes, overload / burn out)
- Soap drawer (misuse, or detergent solidifying)
- Electrical failures (particularly Printed Circuit Board and timer, caused by poor design, no protection against power supply fluctuations, humidity, vibrations).
- Dampers (noise and vibration)

Examples of measures to improve reparability:

Design phase
Design for disassembly for repair (e.g. removable seals on electronic boards and removable casing of the drum)
Potential standardisation of components
Improved durability of components (e.g. bearings and shock absorbers, drum shaft seals, door hinges, motors)
Protection of electronic and mechanical components

Repair service
Extended warranties
Repair technical assistance service provided by manufacturers.
Spare parts available 10-15 years after production

Discussion point 4.4: product lifetime and durability

a) Is the presented average product lifetime (15 yr, 3300 cycles) correct, or shall it be modified? If so, which value shall be used instead? Why?
Is it also representative of washer-dryers?

b) Are there any specific parts not mentioned above that are particularly critical, and result in breakdown/failure of the machine? Are these costly parts? Could you identify any simple and inexpensive design option that could enhance

1. durability of appliances?
2. Easy identification and repair?

c) Are there any ecodesign requirements related to resource efficiency from other product groups which could be interesting to look at for washing machines and washer-dryers? Please explain which ones and why.

End-of-life practices

Cat. 1 “Large household appliances” of the WEEE-Directive

Collection rate target: min 45% from 2016, min 65% from 2019

Covered by producer responsibility schemes in MS. Collection rate: 32% in 2010 (now: 33-40%)

Real collection rate: 87-90% (recycling driven by secondary resource value due to metal content)

WMs and DWs have currently a net positive resource value

End-of-life practices

Appliances collected within the WEEE-producer responsibility system in the EU undergo recycling treatments:

1) Preparation for reuse;
2) Pre-processing / dismantling (including depollution);
3) End-processing and final disposal.

2.1) Removal of haz components (Large accessible printed circuit boards > 10 cm^2, Capacitors with a height >25mm and a diameter >25mm, LCD displays > 100cm^2, devices containing volatile hydrofluorocarbons (HFC) or hydrocarbons (HC))

2.2) Separation of valuable materials (Steel, Stainless-steel, Aluminium, Copper (insulated or liberated), precious metals, rare earth components

Discussion point 4.5: End of Life management

a) In your view, are there any other components of concern from an End-of-Life perspective than the ones outlined?
   1. depolluting: permanent magnet motors, PCB capacitors, printed circuit boards, displays, refrigerants of heat pumps
   2. valuable materials (copper, steel, gold)?

b) The data collected indicate that the current recycling of plastics in these appliances is not extended. The use of recycled plastics in new machines is not common either. Could you characterise the main types of plastics used in washing machines and washer-dryers? Have you explored the possibility of using recycled plastics for those applications? Which are the main hurdles for using recycled plastics?

Discussion point 4.5: End of Life management

c) Do you have any concise information about the 2nd hand market of this product group, e.g. the share and characteristics of the products reused, and the estimated "first" and "second" product life times, and the percentage of collected items that is reused?

d) Could you identify any simple and inexpensive design option that could enhance the easier identification and removal of

- printed circuit boards and displays
- permanent magnets.

European Commission

NEXT STEPS AND AOB

Joint Research Centre

Next steps

- 1st Stakeholder meeting: 24 June
- Standardisation issues meeting: 25 June
- Feedback collection in BATIS (31 July 2015)
- Additional questionnaire T5-T7 of MEErP + EoL (Sep 2015, tbc)
- Additional Plant visits (Electrolux, Gorenje) and recycling plants
- 2nd Stakeholder meeting: 18 November
- Q1 2015 Final preparatory study

Discussion point 1.16: Other issues

Additional discussion issues from stakeholders:

1. Washing performance for each treatment and not as an average?
2. Streamlining methods for water preparation for cost-saving
3. Tolerances for the EMPA-certificates are too small
4. Different measurement of remaining moisture content in ED (single programmes) and EL (weighted average)
5. For WD two separate labels/scales might be needed
6. Minimum requirement for spin-drying efficiency?

a) Any comments, proposals or other issues to discuss?

Thank you!

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