Bringing the home in the lab:
Consumer relevant testing for household electrical products

Christoforos Spiliotopoulos

Rainer Stamminger

Hans-Paul Siderius

ECOS

universitätbonn

Netherlands Enterprise Agency

Overview

- Motivation
- What is consumer-relevant testing?
- Methodology
- Choice of examples
- General and specific observations
- Recommendations

Motivation

- Standards are used to support regulations
- Investigations by various stakeholders
- Political momentum and mobilization of standardization system

What is consumer-relevant testing?

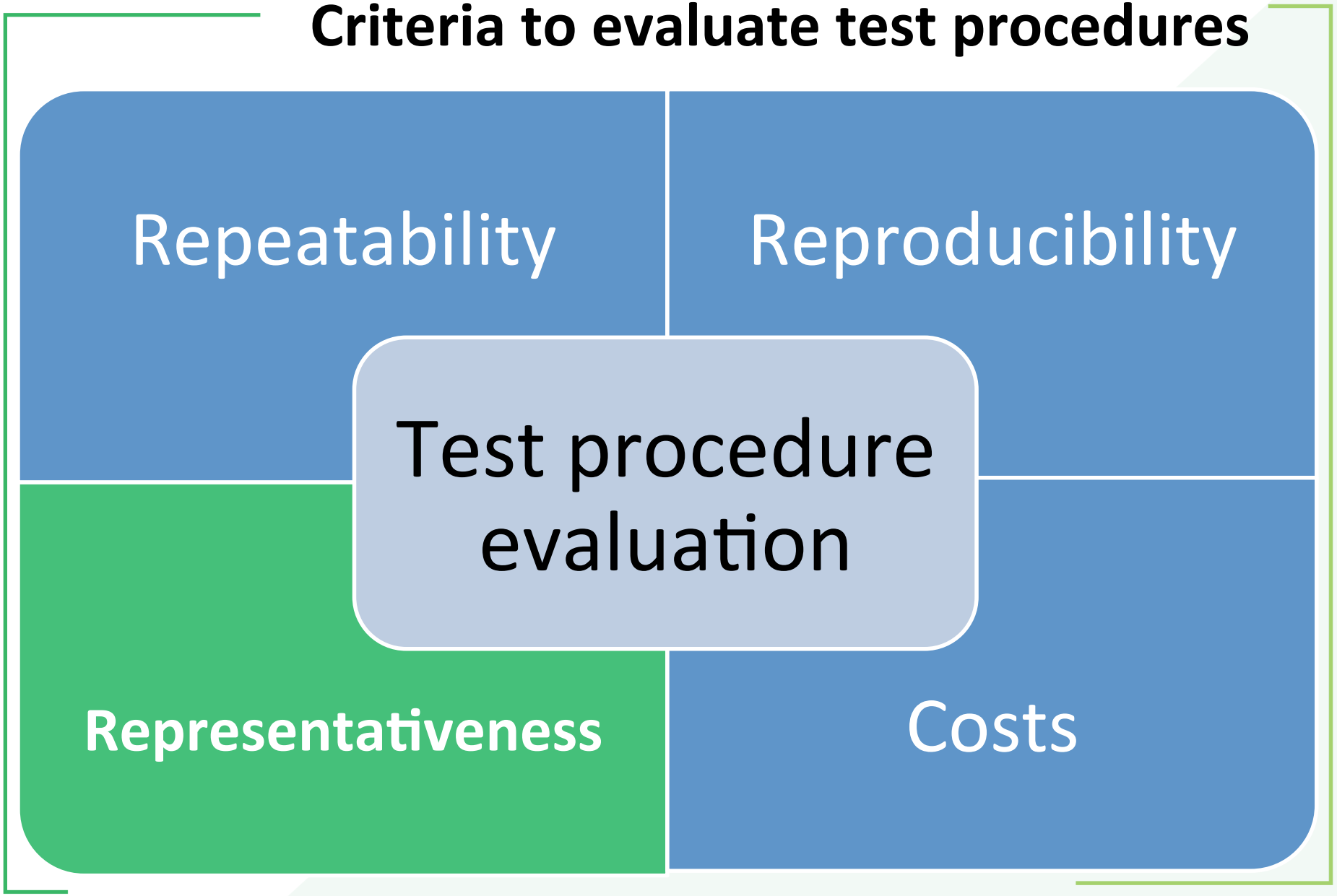
Consumer-relevant product testing

is product testing that provides results that correspond to results obtained when consumers use the product in practice

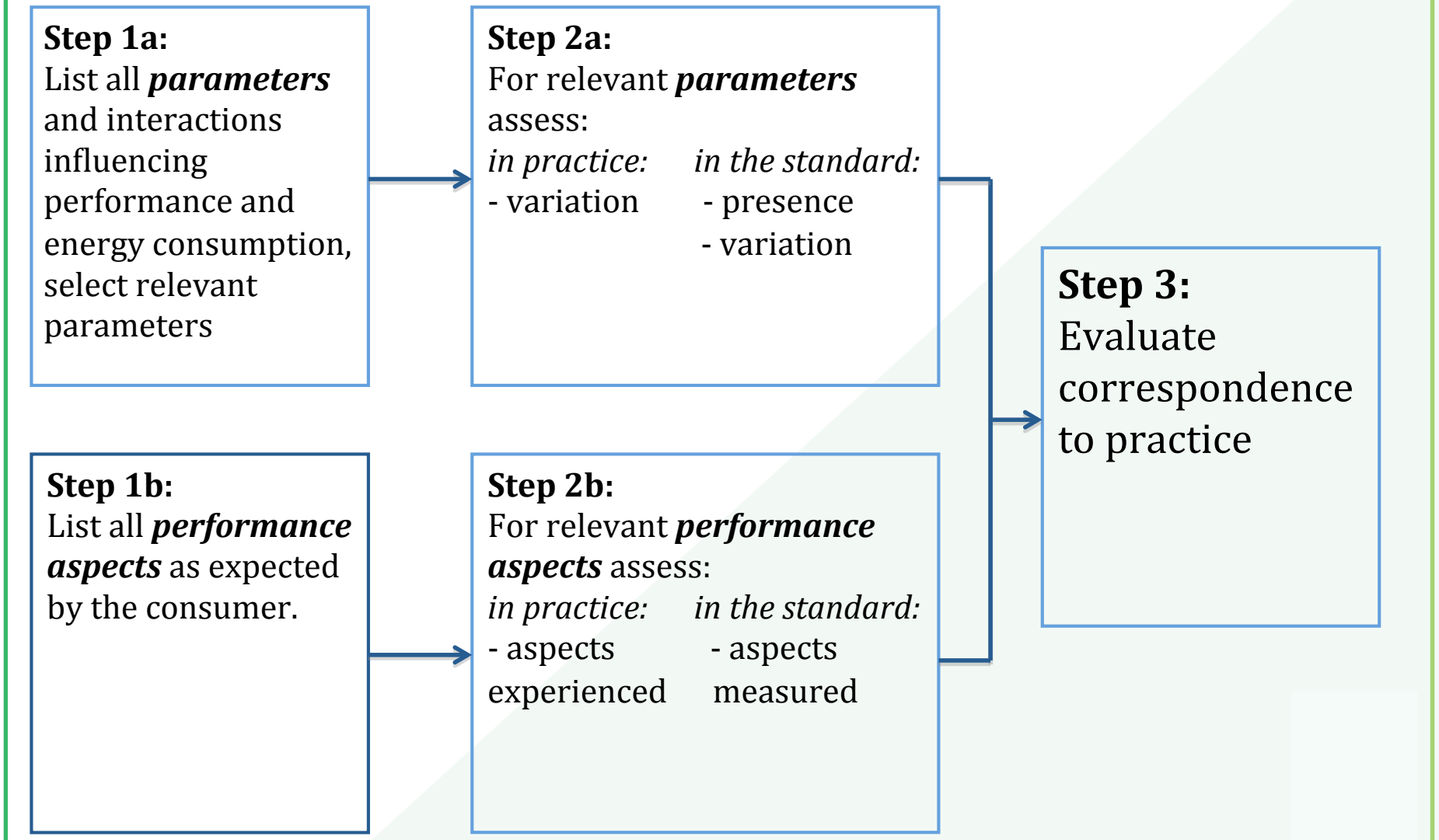
What it is **not**:

- (directly) circumvention / defeat devices
- ''Real-life testing''

Criteria to evaluate test procedures



Steps of the methodology



Evaluation of representativeness

Main evaluation aspects:

- Missing relevant parameters
- Variation of considered parameters
- Missing performance aspects
- Correspondence of measured performance with experienced performance

Choice of examples

- **Refrigerators** (EN 62552:2013 + notes on IEC 62552 under dvlpmt), amongst appliances that perform continuously
- **Washing Machines** (EN 60456), amongst appliances that perform per cycle
- **Vacuum Cleaners** (EN 60312), appliances where continuous consumer interaction is necessary to deliver the performance

Example: refrigerators

Parameters	Relevance for energy consumption (E) or performance (P)*		Range; average at consumer[#] (Source: VHK (2015))	Setting / variation in standard (Source: EN 62552: 2013, impact of IEC62552:2015)	Assessment of correspondence	Explanation of differences between standard and practice
Humidity	Low (if no door openings)	E, P	?	< 75 % r.h.		Humidity is of limited relevance in test if doors closed. But it is of higher significance in real use where doors are opened regularly. Hence, typical EU ambient humidity should be considered
Air flow	Low (if no door openings)	E	No evidence identified on what is a typical air speed in EU kitchens	Air flow ≤ 0.25 m/s.		Zero/low speed air is expected in a home most of the time. Also, the condenser is close against a partition and so the air flow is of little direct impact on condenser effectiveness. Air flow would have far more impact if door is opened.
Placing of the appliance during use / test	Medium		Refrigerators often pressed close against wall and between cabinets. Some are 'Built-in' type. No evidence identified on what is the most common arrangement in EU homes.	Placing against partition at rear unless specified (max. 50mm from partition and 300mm from sides, no partition above). Built-in appliances enclosed per manufacturer instructions.	Correspondence is reasonable for rear position, although most fridges in real use are pressed in from side without 300mm gap to any partition.	Close fitting side panels would impact thermal performance of appliance walls and reduce reproducibility. This could explain 300mm gap introduced.
Inputs						
Voltage	Low	E	207 - 253 V	230 V ± 1%	Average corresponds, variation not	Rated voltage in Europe
Frequency	Low	E	49 - 51 Hz	50 Hz ± 1%	Average and variation correspond	Rated frequency in Europe
Harmonic distortion	Low	E	Distorted	Plane sinus	No correspondence	
User behaviour						
Load: - Type (heat capacity) - Temperature - Amount	High	E, P	Various liquid and solid foods, input at various temperatures (5 °C to 40 °C)	No inserted heat load for EU regulation tests.	Appliance always has food or other loads in reality, but test for EU regulations is with appliance empty. Correspondence is poor, but compensation made via higher ambient test temperature	(Warm) load insertion under normal usage for energy label purposes (the energy efficiency test) is emulated by using higher ambient temperature than EU typical)
Door openings	Low	E	20 per day.	Currently not, but possible future simulation option via 'load processing efficiency test': loading with bottles of ambient temperature water (in one opening operation)		Door openings are emulated by higher ambient temperature (around 25 0C) and effect of door openings is small

General observations

- Variation of situational conditions is often not captured in standards (combination of costs and reproducebility reasons)
- Assessment of correspondence of performance aspect is difficult:
  - Performance in the standard measured through instruments, in practice by human observations/senses.
  - Important parts of user behavior are implemented as “artificial”.
- Representativeness is not only dependent on correspondance of parameters in standards, but also choices made in the regulation, e.g.
  - The choice of programme for the testing of washing machines, and a single efficiency indicator for the label is used.
  - Allowances for the no-frost function of refrigerators.

Specific Observations

- **Refrigerators**
  - Door openings and entry of food (load) compensated by higher ambient temperature
  - For refrigerator volume and load content, higher repeatability prioritized over correspondence to practice
- **Washing Machines**
  - Artificial soil types used show variation intended to reflect practice
  - Detergent co-determines the correspondence to practice; detergent composition kept constant
  - Variety of washing programmes (and temperatures) can be captured in principle, but determined by regulation
- **Vacuum Cleaners**
  - Variation of the dust particle size used smaller than in practice
  - Consumer feedback on force needed or dust picked not considered in the standard when measuring performance

Recommendations

- **Quantitative** assessment can be explored
- **Defeatability** as a criterion for future examination
- Application on **other products** with different specificities
- **Systematic consideration** of consumer relevance for standards supporting Ecodesign legislation
- **Improvements** in aspects considered of low representativeness
- When low representativeness is compensated, assumptions should be re-evaluated to see whether **a more balanced prioritisation** of criteria is feasible or desirable
- **Consumer-behaviour studies** to acquire better understanding of typi product usage at home should be promoted

Thank you for your attention!

Christoforos Spiliotopoulos

Senior Policy Officer

chris.spiliotopoulos@ecostandard.org

+32 2 894 46 39

ECOS