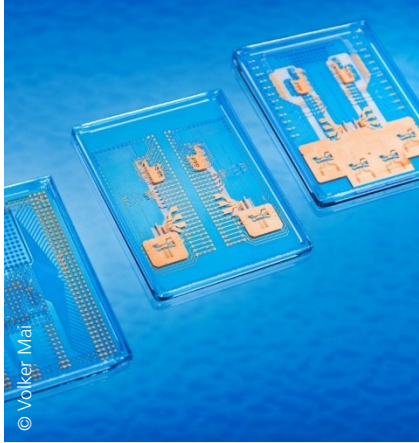


ITAD & Circular Electronics Track, June 17, 2026

From Energy Labels to Circular Trade-offs: Navigating EU Ecodesign Policies for Smartphones, Tablets, and Computers

Fraunhofer IZM – Bringing Microelectronic Innovation into Practice

Business fields and applications



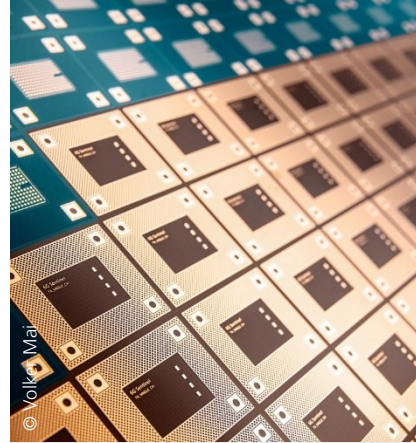
Medical Engineering

Supporting the makers of innovative medical devices with our microtechnology and integration process knowhow.



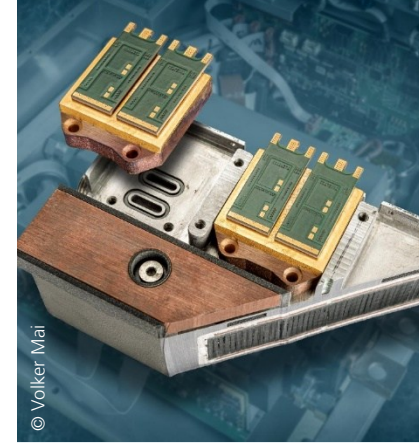
Industrial Electronics

Integrating robust, miniaturized, reliable, safe, and secure electronics into products.



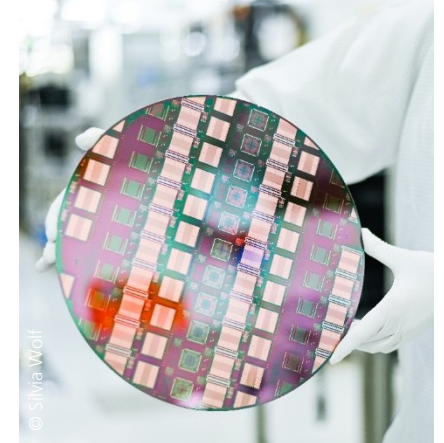
ICT

Building the highly dynamic networks for sharing and storing data and digital networking.



Mobility

Working with OEMs and tier 1 manufacturers, and their suppliers for the rapid and complete electrification of vehicles.

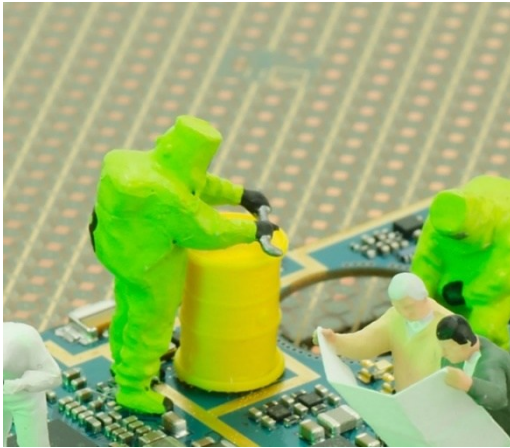


Semiconductors

Designing complex and heterogeneous system-in-package (SiP) solutions with 3D component integration.

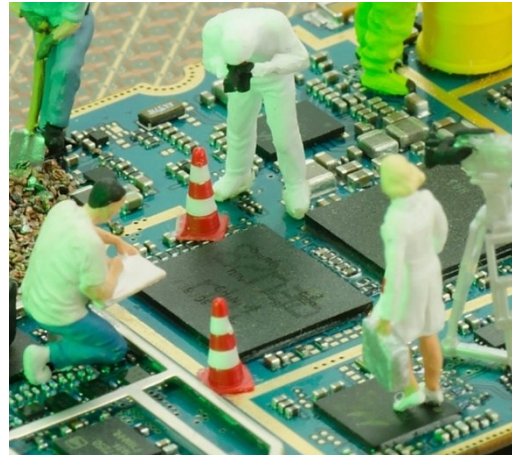
Fraunhofer IZM – Bringing Microelectronic Innovation into Practice

Sustainable Electronics



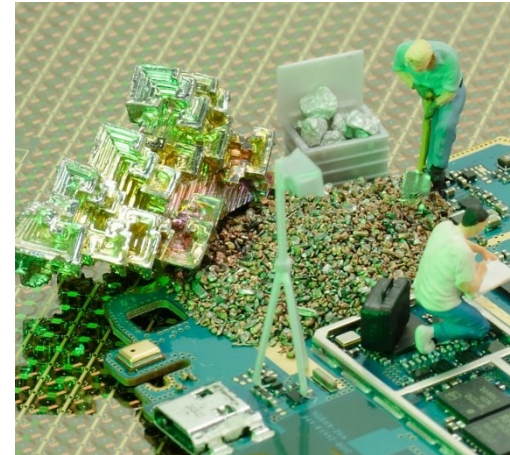
Regulation and Targets

Supporting companies in translating future regulations into design specs. Supporting policy makers to develop effective product policies



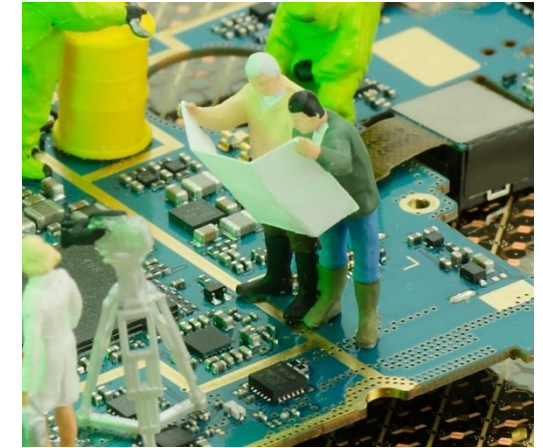
Ecodesign

Optimization of technologies, components, products and systems; Design4R; Combining life time, ageing and LCA (EcoReliability)



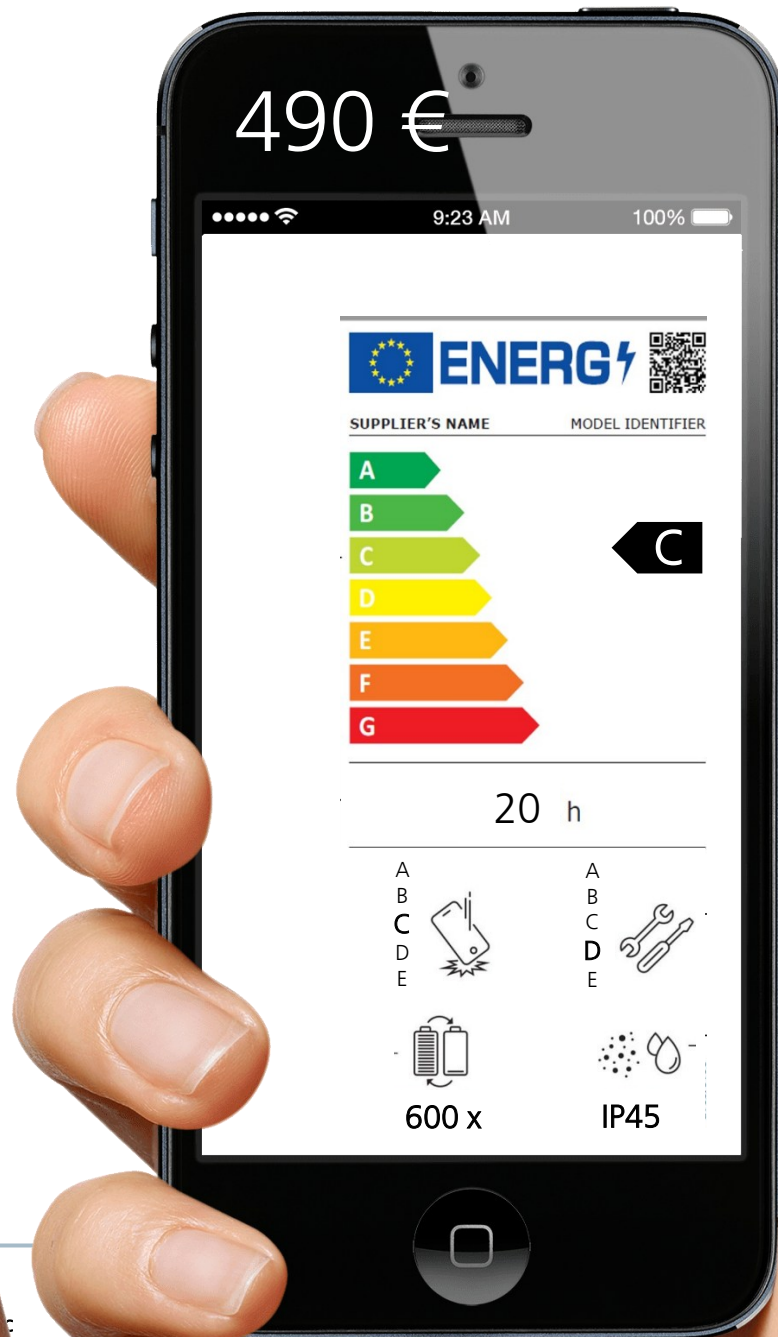
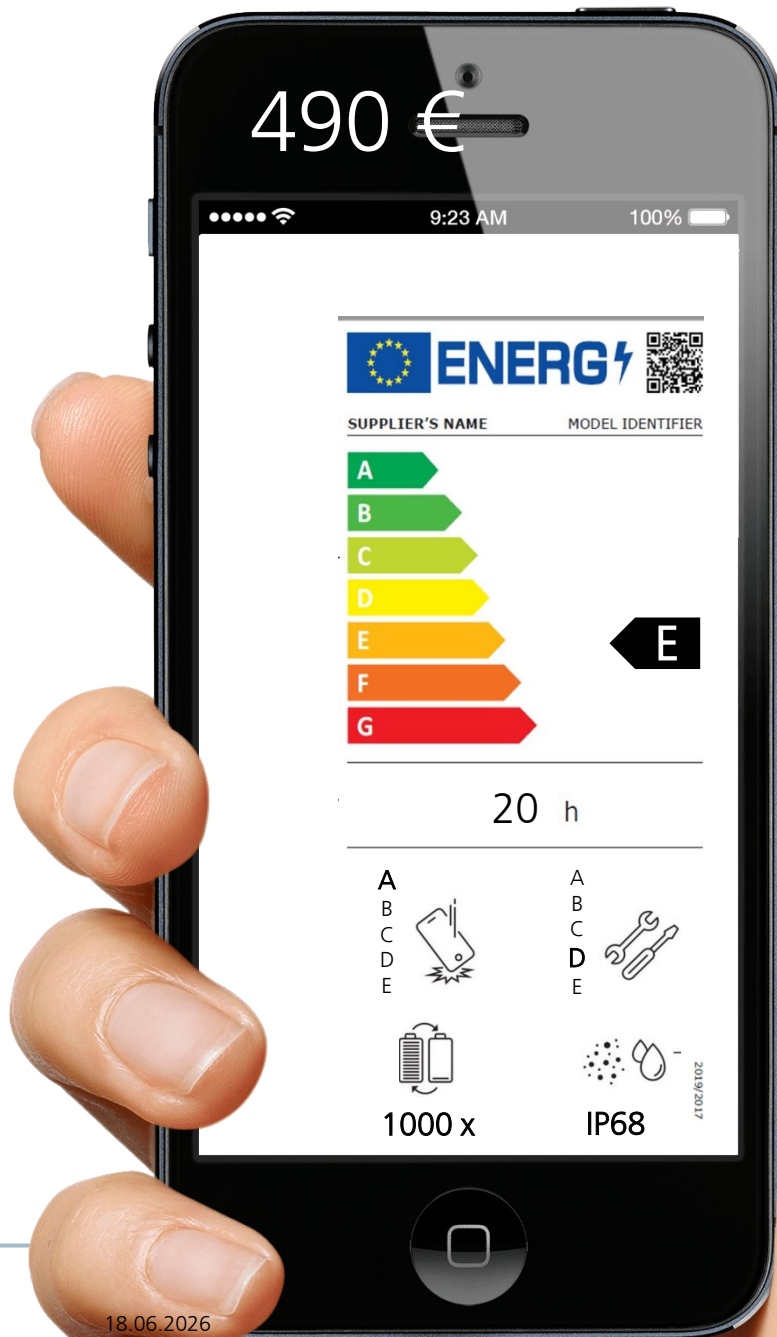
Life Cycle Assessment

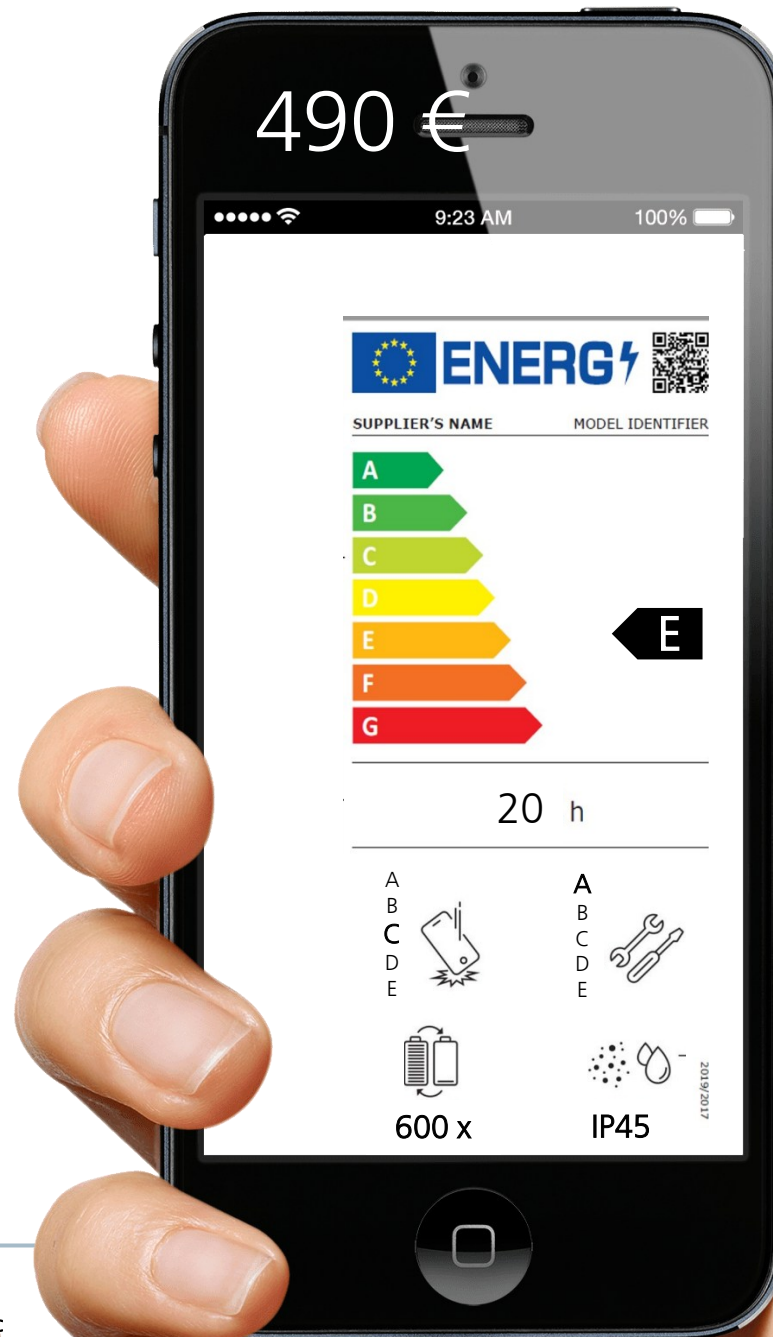
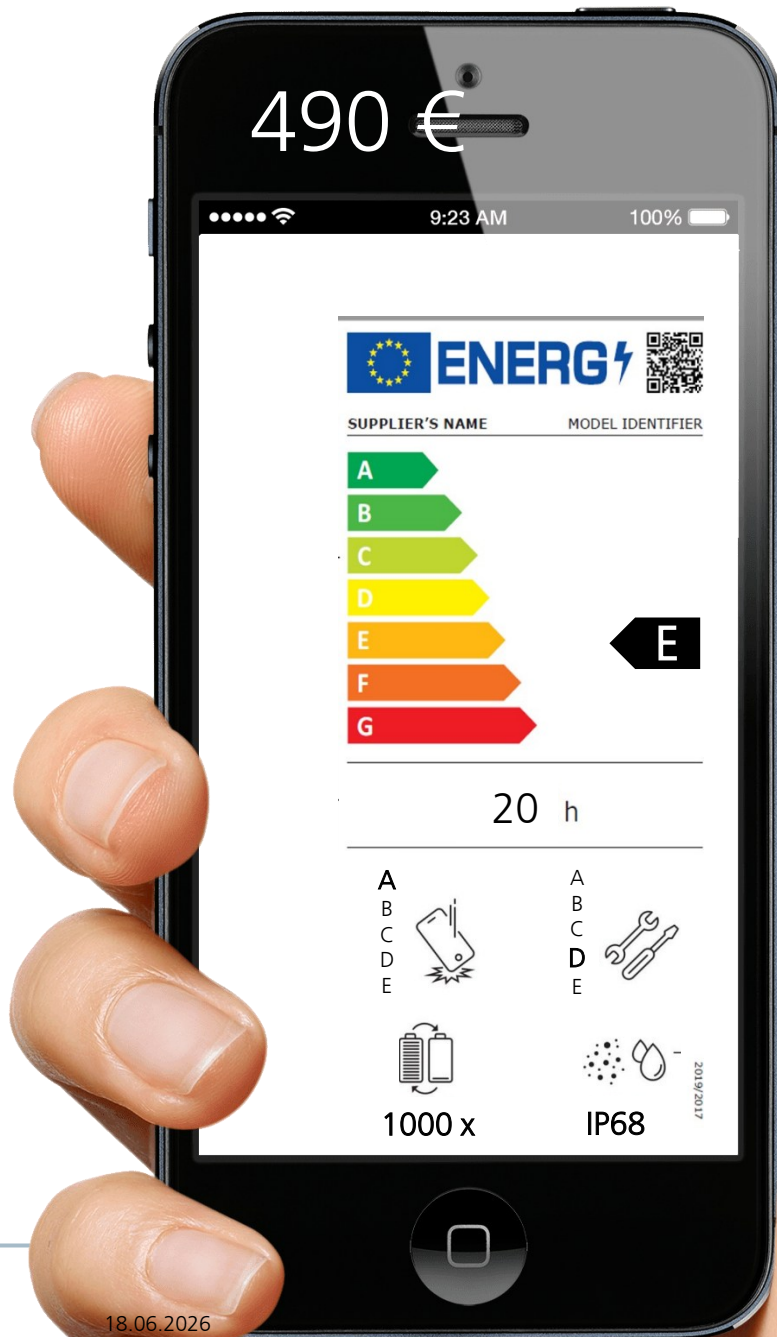
Assess the environmental impacts and benefits of new technologies; non carbon footprint impacts, such as water footprint and toxicity; methodology development



Business Models and Value Chain

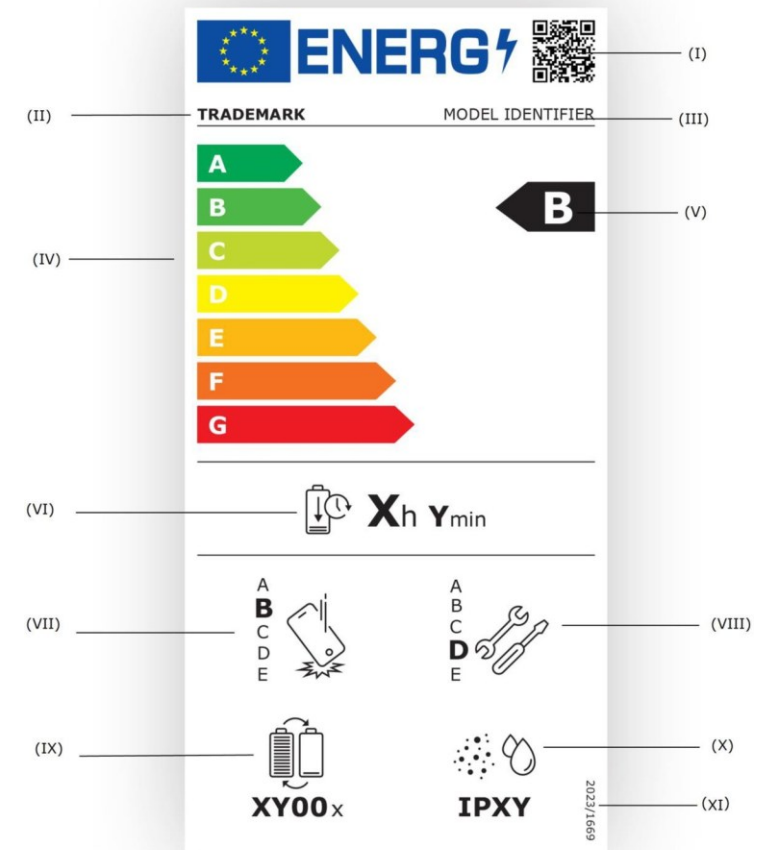
Adapting (circular) business models; coordination and data exchange through the supply chains





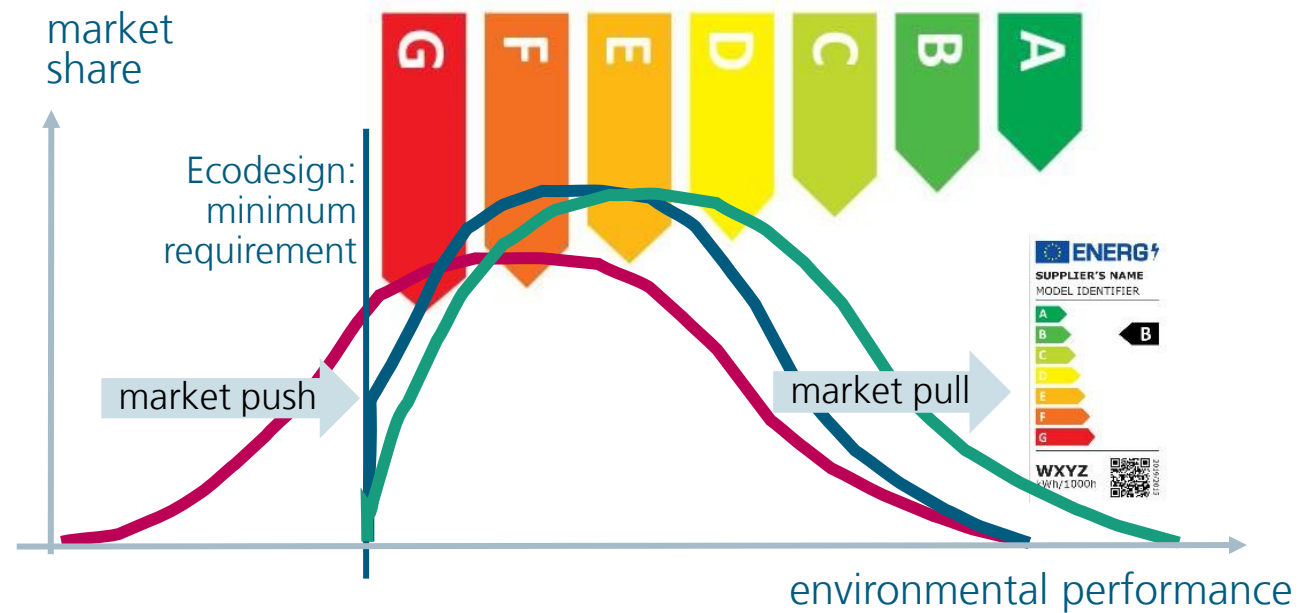
EU product policy trend

Going beyond energy efficiency



Interaction of Instruments

- Ecodesign (now ESPR) and Energy Labelling

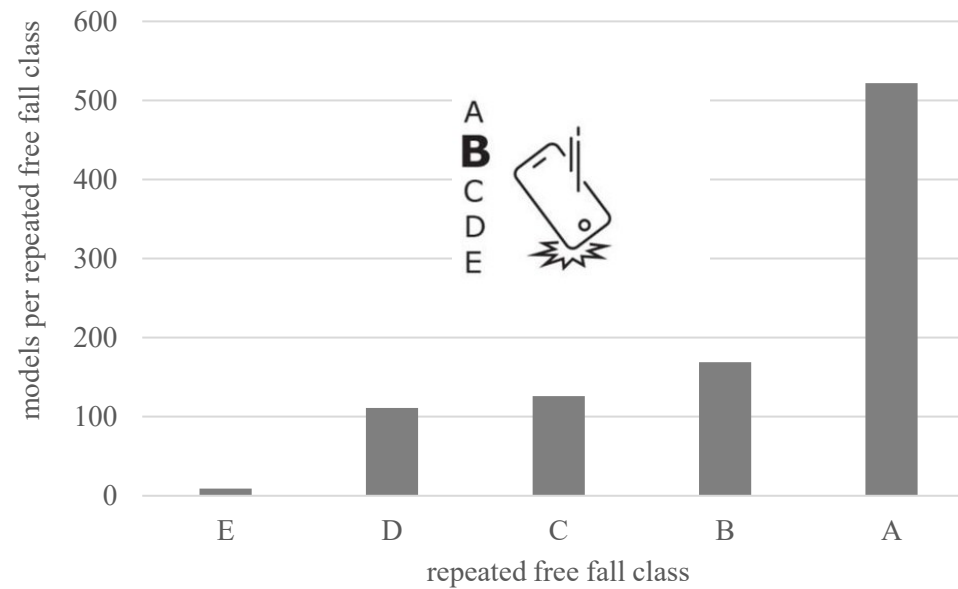


EPREL

Statistics on product performance

Smartphones

- EPREL statistics (registered models)

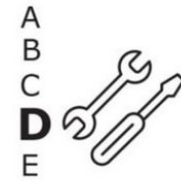


EPREL

Repairability vs. Water Ingress Protection – Any Trade-offs?

Smartphones

- EPREL statistics (registered models)



		Repairability class				
		E	D	C	B	A
Water ingress protection class	2			3	7	
	3			1	1	
	4		3	81	234	22
	5		1	24	10	2
	6			3	4	
	7		1	3	5	
	8	2	4	290	175	12

EPREL

Repairability vs. Drop Resistance – Any Trade-offs?

Smartphones

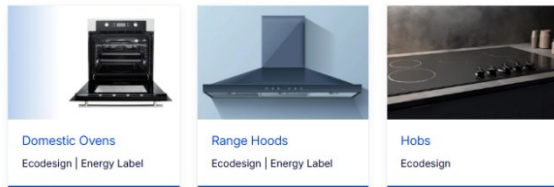
- EPREL statistics (registered models)



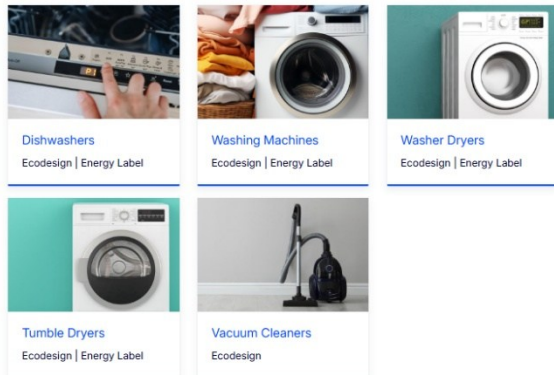
		Repairability class				
		E	D	C	B	A
Repeated Free Fall Reliability class	E		2	2	5	
	D	1	3	59	46	2
	C		10	42	72	2
	B		3	50	110	6
	A	1	2	271	219	29

Ecodesign Directive / ESPR and Energy Labelling

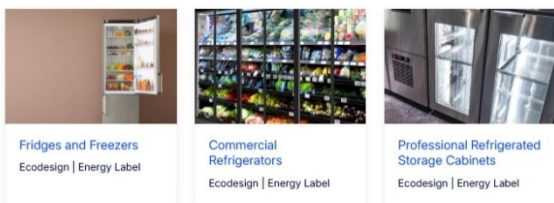
Cooking



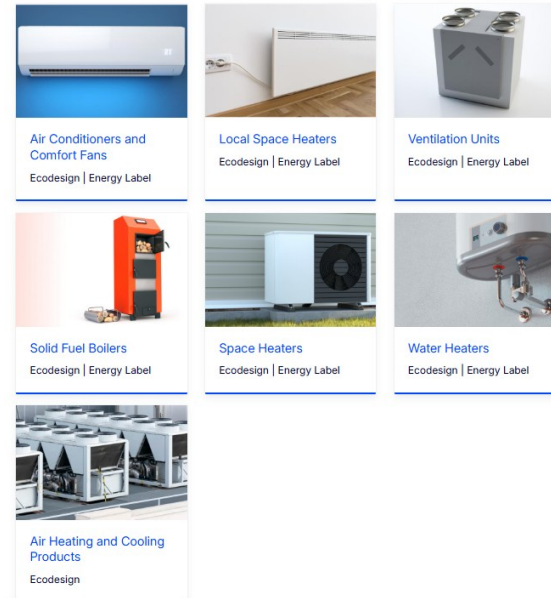
Cleaning and Drying



Refrigeration

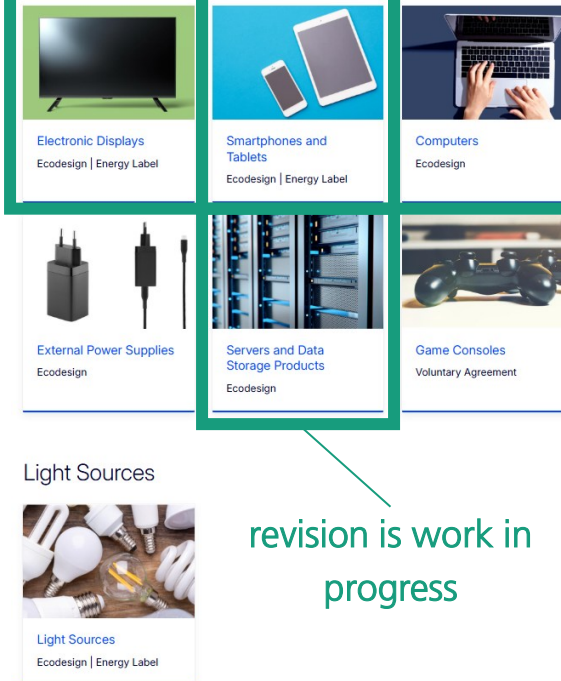


Heating, Cooling and Ventilation



revision expected 2027

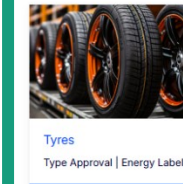
Electronic Products



applies since 2025

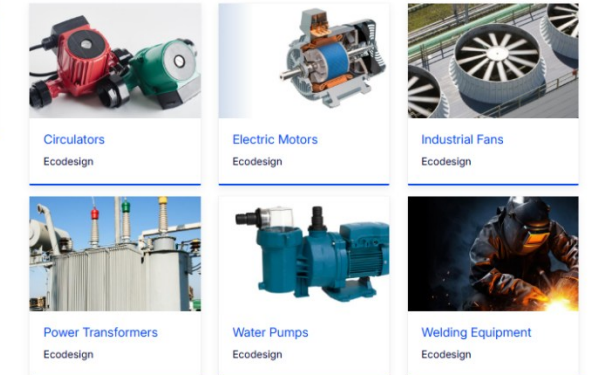
revision is work in progress

Tyres



revision expected late 2026
(new: Energy Label)

B2B Products



Horizontal Measures

Standby, Networked Standby and Off Mode
Ecodesign

Energy Smart Appliances
Voluntary Agreement | Labelling

Source: https://energy-efficient-products.ec.europa.eu/product-list_en

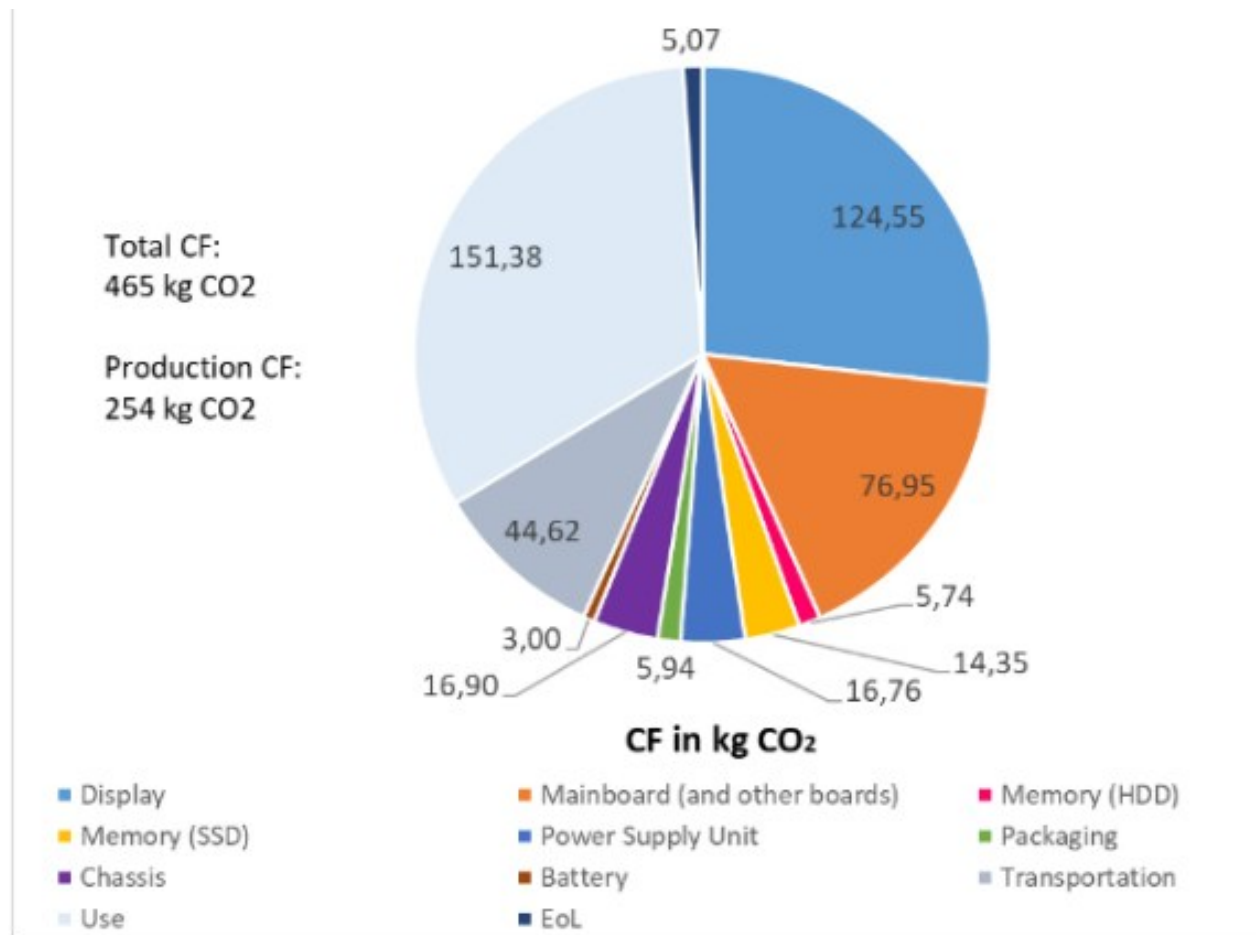
Why a focus on lifetime extension as decarbonization strategy?

ICT life cycle GHG emissions typically dominated by manufacturing



Carbon footprint of a typical integrated desktop computer ('All-in-one')

Intel Free Press, 2012, [Creative Commons Attribution-Share Alike 2.0 Generic](#)



Why are products taken out of service when?

Lifetime data

Notebooks

- Priority parts (see EN 45554)
- Average service lifetime 5 years
- Average repair rate ~40% (but much higher in first years, much lower later on)
- Annual defect rates:
 - Drop/fall damage: 1%
 - Battery defects: 0,3%
 - Water/moisture damage: 0,2%

Relevance value		Failure likelihood		
		Low	Medium	High
Functional relevance	High	Mainboard	RAM*	Keyboard Display Battery Storage
	Medium	Touchpad Switch Power supply Fan	Connectors	
	Low			Housing

* typically an upgrade issue for memory / storage with a very low capacity

Modelled lifetime extension effect of policy measures

Lifetime related policy measures under consideration for computer products

	Notebook	Integrated Desktop Computer	(other) Desktop Computers
Ecodesign measures (minimum requirements)			
Reparability	+0.1 years	+0.11 years	+0.13 years
Resistance to accidental drops	+0.04 years	n/a	n/a
Water ingress protection	+0.01 years	n/a	n/a
Battery endurance	+0.05 years	n/a	n/a
Battery management	+0.03 years	n/a	n/a
Key abrasion resistance	+0.01 years	n/a	n/a
Operating System updates	+0.3 years	+0.31 years	+0.3 years
Energy Labelling measures			
Repairability Index	+0.1 years	n/a	n/a
Drop resistance classes	+0.04 years	n/a	n/a
Battery endurance indication	+0.05 years	n/a	n/a
Liquid ingress classes	+0.01 years	n/a	n/a

(preliminary data; does not include combination of options, which extends modelled lifetime further)

Modelled GHG emissions effect of policy measures

Lifetime related policy measures under consideration for computer products

Life Cycle GHG emissions per unit per year of use (kg CO₂e)

Policy Option / measure	Notebook	Integrated Desktop Computer	(other) Desktop Computers
1 Business as Usual (BAU)	55.57	99.03	86.13
2 Self-Regulatory Initiative (SRI)	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
3 Ecodesign			
Reparability	54.86	97.98	85.16
Resistance to accidental drops	55.20	99.03	86.13
Water ingress protection	55.48	99.03	86.13
Battery endurance	55.14	99.03	86.13
Battery management	55.31	99.03	86.13
Key abrasion resistance	55.48	99.03	86.13
Operating System updates	53.21	95.79	83.93
4 Energy Label			
Repairability Index	54.86	99.03	86.13
Drop resistance classes	55.20	99.03	86.13
Battery endurance indication	55.14	99.03	86.13
Liquid ingress classes	55.48	99.03	86.13

(preliminary data; does not include combination of options, which reduces carbon emissions further)

Conclusions

Lessons learnt and heads up

- **For computers similar requirements as for smartphones and slate tablets likely** — e.g., EU repair score for laptops and reliability requirements, on top of energy efficiency classes
- **Regulation is supposed to make life easier for repair and refurbishment businesses** — access to repair instructions, tools, spare parts and simplified repair processes, and more durable devices.
- **Reliability requirements require a larger test sample and extended testing time** — test becomes a major cost driver.

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