How far does the current methodology used for Ecodesign and Energy Labelling cover systems – could it do more?

René Kemna, VHK

Ecodesign seminar “System Approaches in Product Policies”, Brussels, 4 Feb. 2014

System Aspects in the

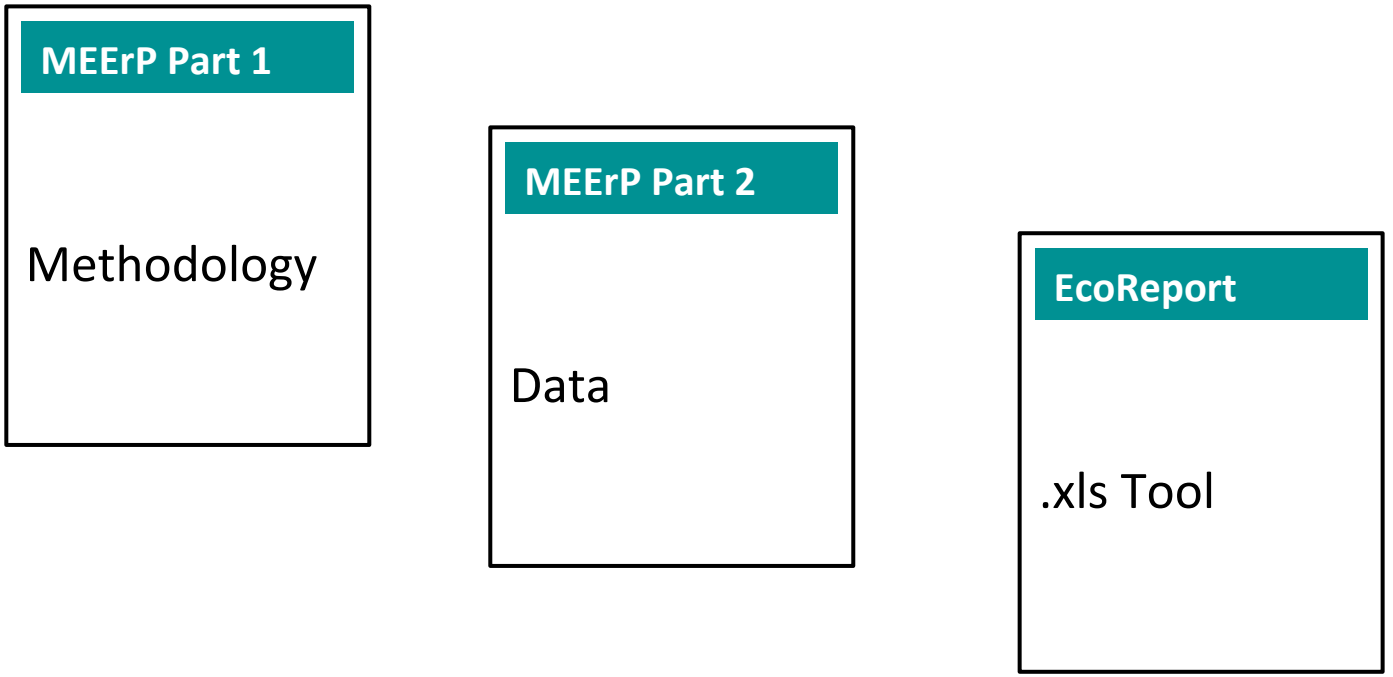
CURRENT METHODOLOGY

METHODOLOGY FOR ECODESIGN OF ENERGY-RELATED PRODUCTS (MEERP)

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Today:
MEErP

Methodology for Ecodesign of Energy-related Products (MEErP)*



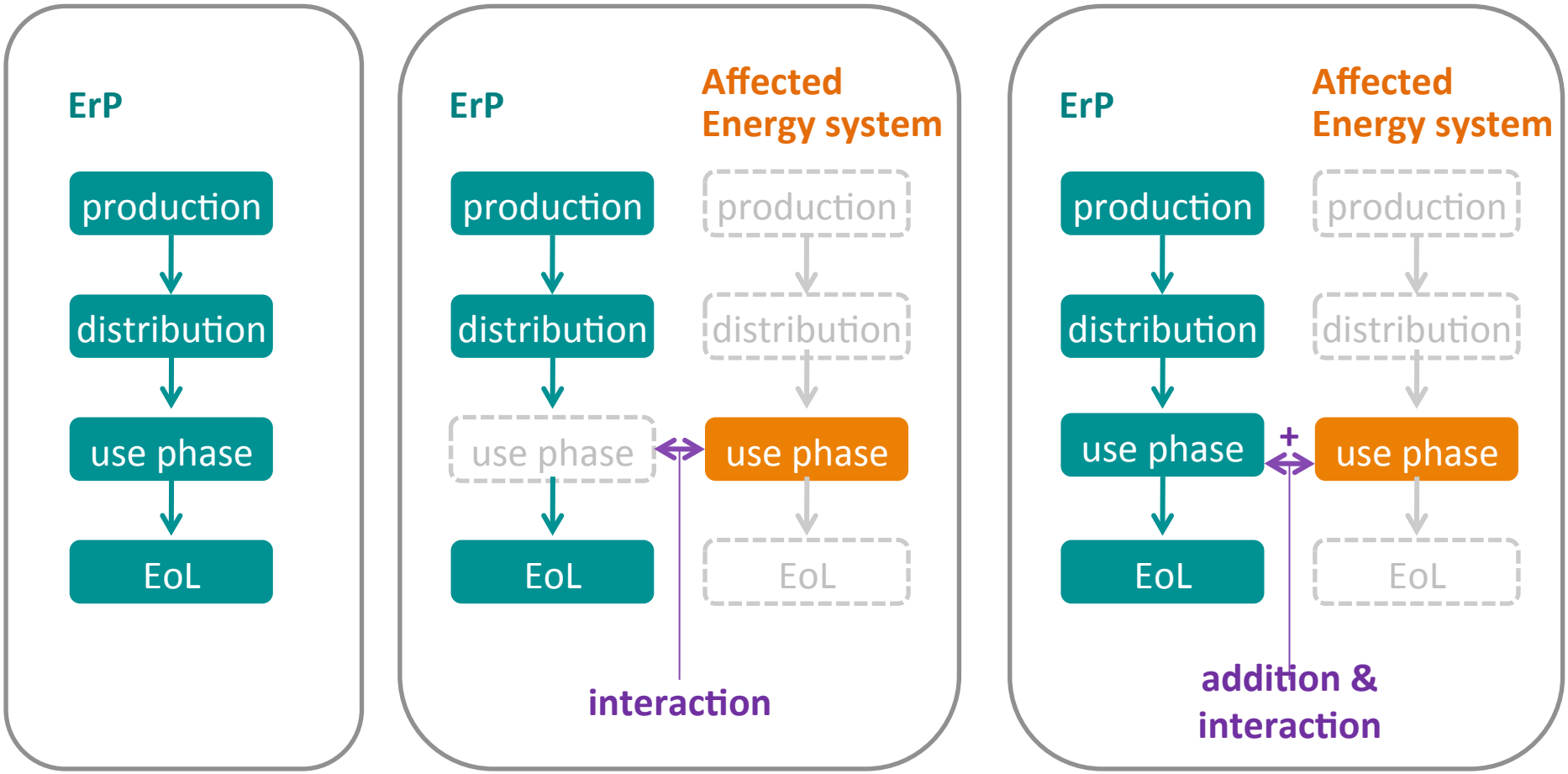
download at www.meerp.eu

*=Prepared by VHK for the European Commission, DG Enterprise and Industry, **Nov. 2011**

Today:
MEErP Part 1

Current Methodology, Task 3 [basic definitions]

ErP with direct impact **ErP with indirect impact** **ErP with direct + indirect impact**



Today:
MEErP Part 1

System aspects use phase, for ErP with direct impact

3.2.1 **Strict** product/ component scope : e.g. at steady state operation, nominal load

3.1.2 **Extended** product approach, i.e. anticipating real-life use: e.g. part loads, misc. operating modes, frequency of use, best/worst use, power management settings)

3.1.3 **Technical systems** approach, i.e. interaction with other products with similar function ('hybrids), controls, distribution components (ducts, pipes), local components (in case of central systems), synergies or disadvantages from combined functionality, consumer interaction (e.g. comfort)

3.1.4 **Functional systems** approach : Compare technical system with THIS ErP with technically different configurations to fulfil the same function (stepwise innovation)

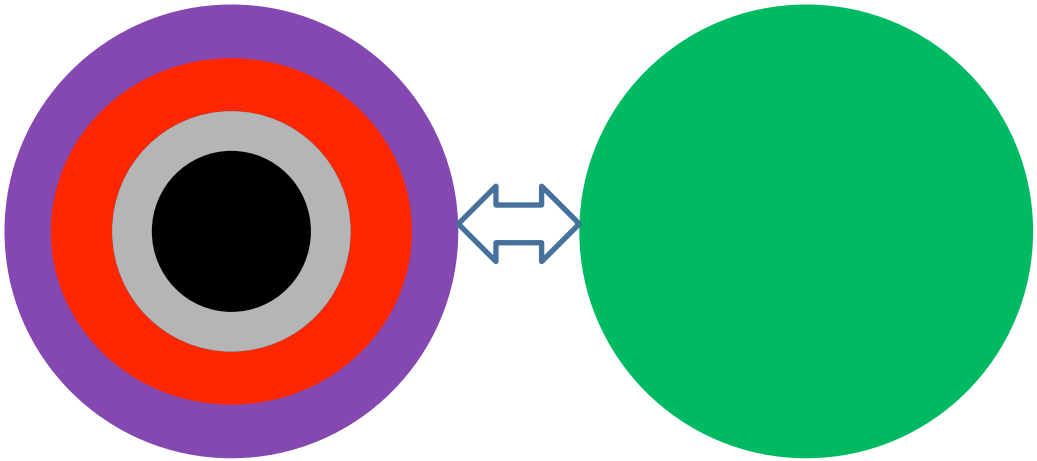
NEW:
EuP → ErP

Today:
MEErP Part 1

Example System Aspects

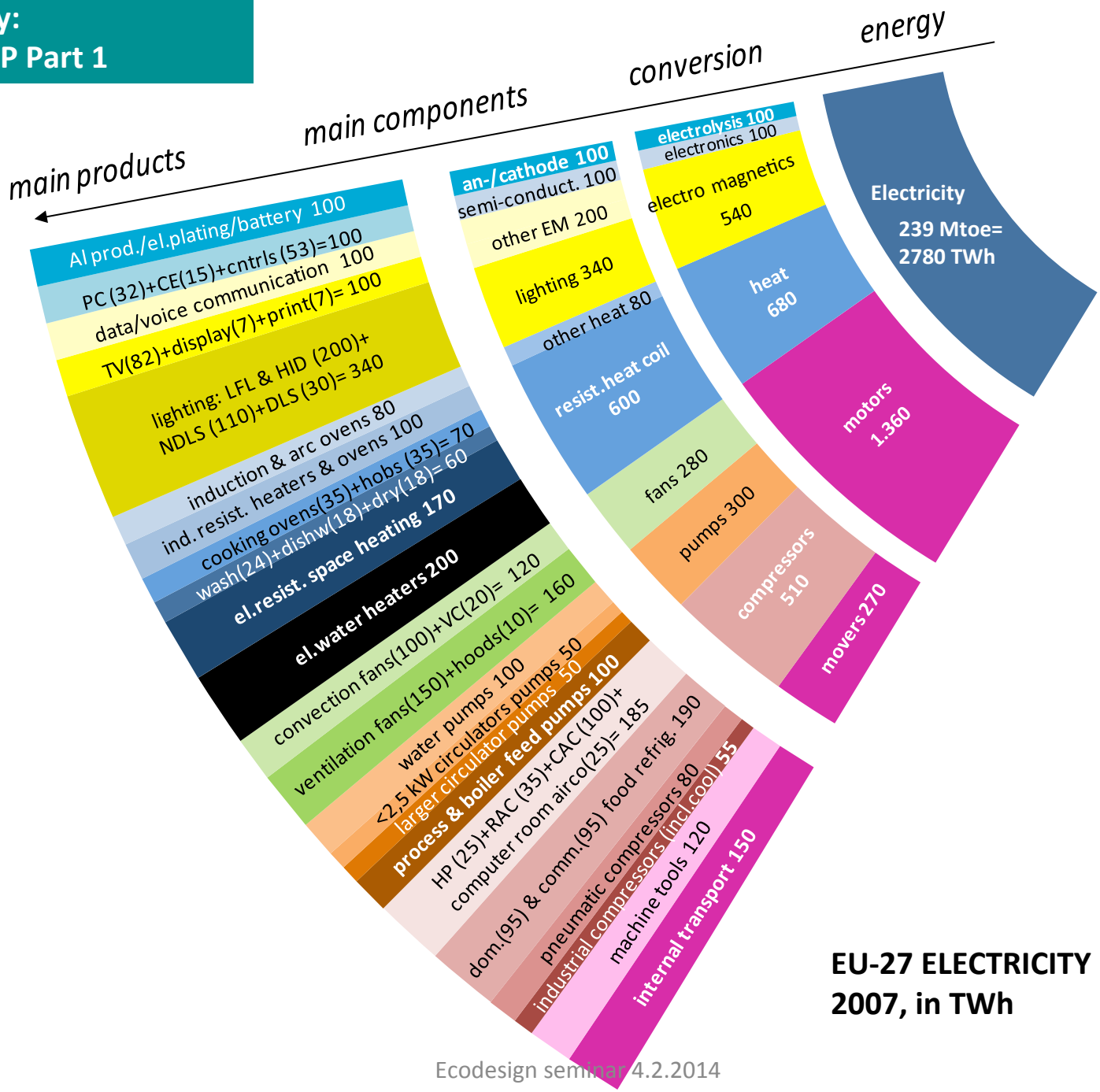
EXAMPLE: Ventilation from product=strict to product=systems

- **Motor**
- **Drive + Motor**
- **Fan + Drive + Motor**
- **Central Ventilation Unit: Casing, Filters, Unit Controls, Heat exchanger (recovery), Fan(s) +Drive(s) +Motor(s)**
- **Mechanical Ventilation System: Central Ventilation Unit(s) + Ductwork + Terminals + Distribution controls + possibly additional functionality (pre-heat, humidification, etc.)**
- **Natural Ventilation (or hybrid) Systems ←→Mechanical ventilation systems**



Example ventilation

Today:
MEErP Part 1



EU-27 ELECTRICITY END-USE, 2007, in TWh

Today:
MEErP Part 1

System aspects use phase, for ErP with indirect impact

NEW

3.2.1 Identify and describe **affected energy system**(s), including -generically- interaction

3.1.2 **Repeat Tasks** 1.2, 1.3 (test standards, legislation) and 2 (market) for affected energy system, but only for technical parameters relevant for interaction with ErP

3.1.3 Data retrieval of **use phase energy consumption (and related emissions) of affected energy system** (=Task 3.1 repeat for affected system)

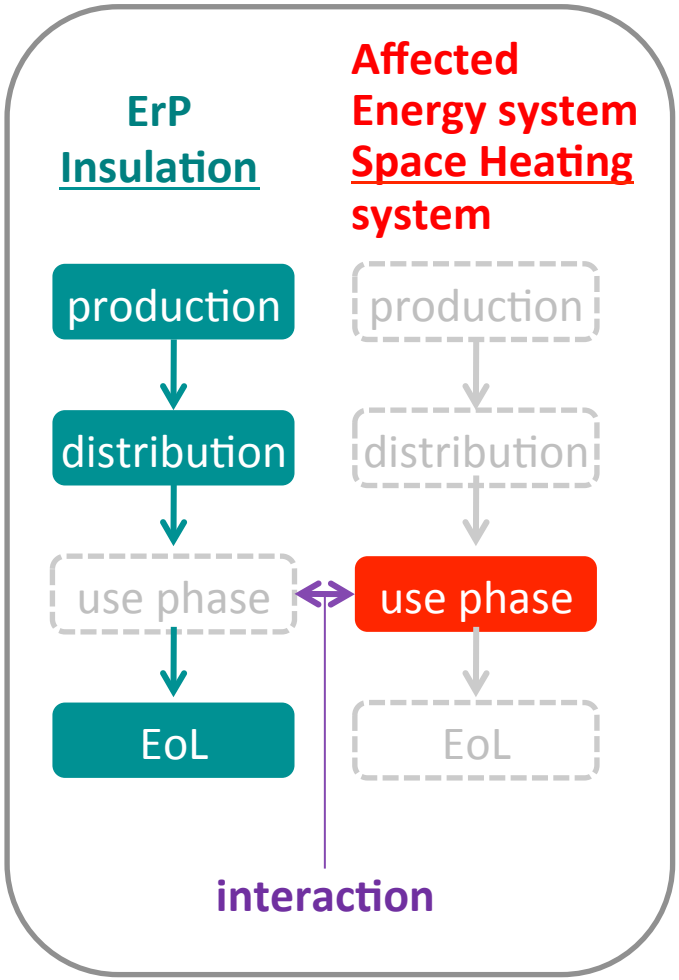
3.1.4 Technical detailed description of **interaction between ErP and affected system** (backed up by statistics, field data)

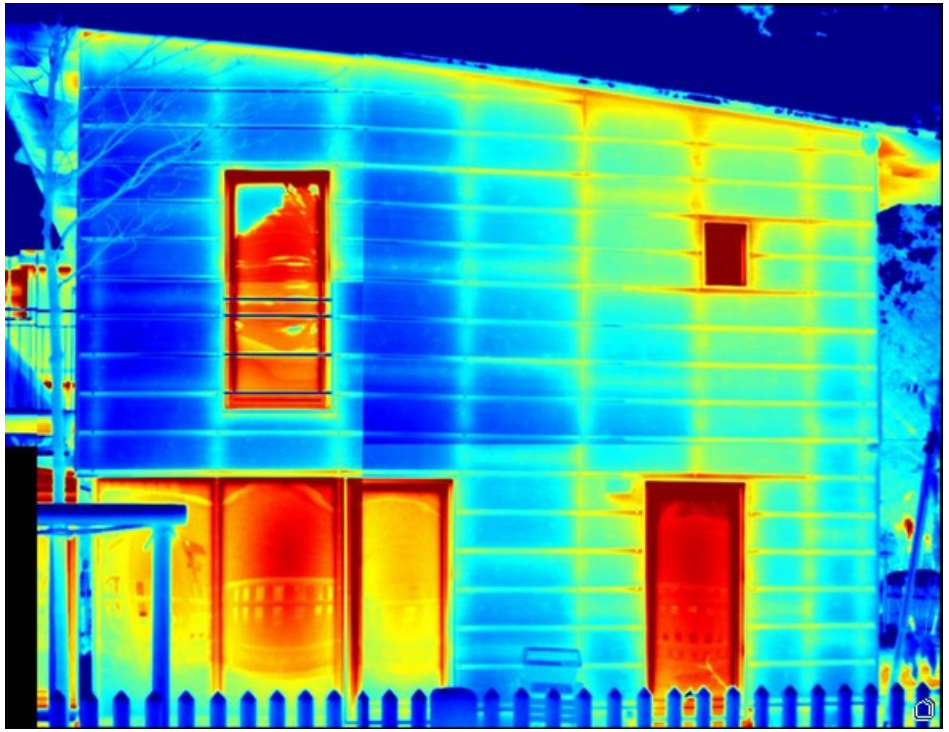
3.1.5 **Quantify energy use** and related environmental impacts of the affected energy system during the use phase, in as much as it depends on the interaction with the ErP

Today:
MEErP Part 1

Example 1

EXAMPLE: Building Insulation Materials (BIM)





VIP: 0,15 W/m².K

Today:
MEErP Part 1

Example 1 c'td

EXAMPLE: Building Insulation Materials (BIM)

$$\textit{Affected Energy } AE = \frac{\textit{Transmission losses buildings } QT}{\textit{Efficiency Central Heating system } \eta}$$

$$AE = \frac{U \times A \times T \times season}{\eta}$$

with

AE is affected energy consumption in Wh

U is the average insulation value in $W/m^2.K$ ← ErP

A is non-transparent building shell surface in m^2

T is average temperature difference indoor-outdoor over the season in degree Kelvin (K)

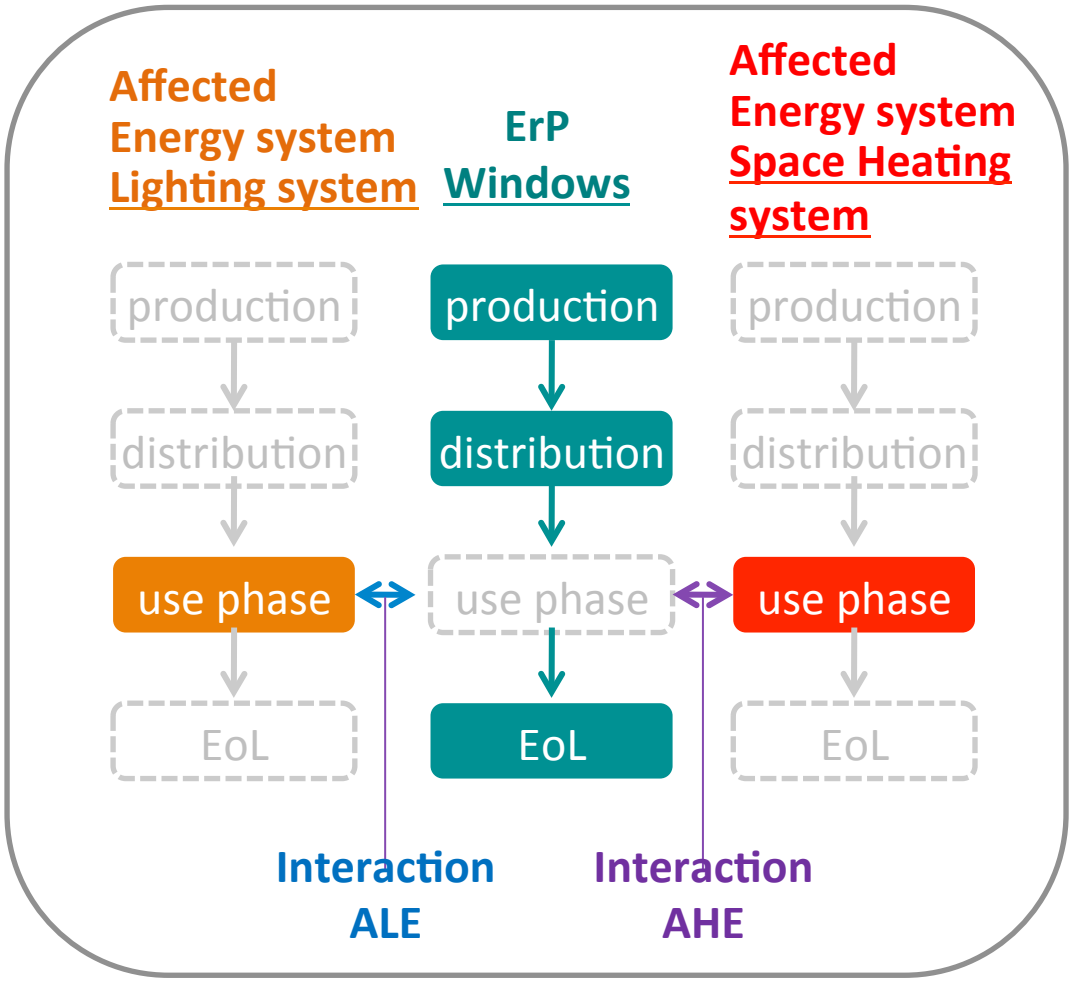
$season$ is time period of heating/cooling season in h

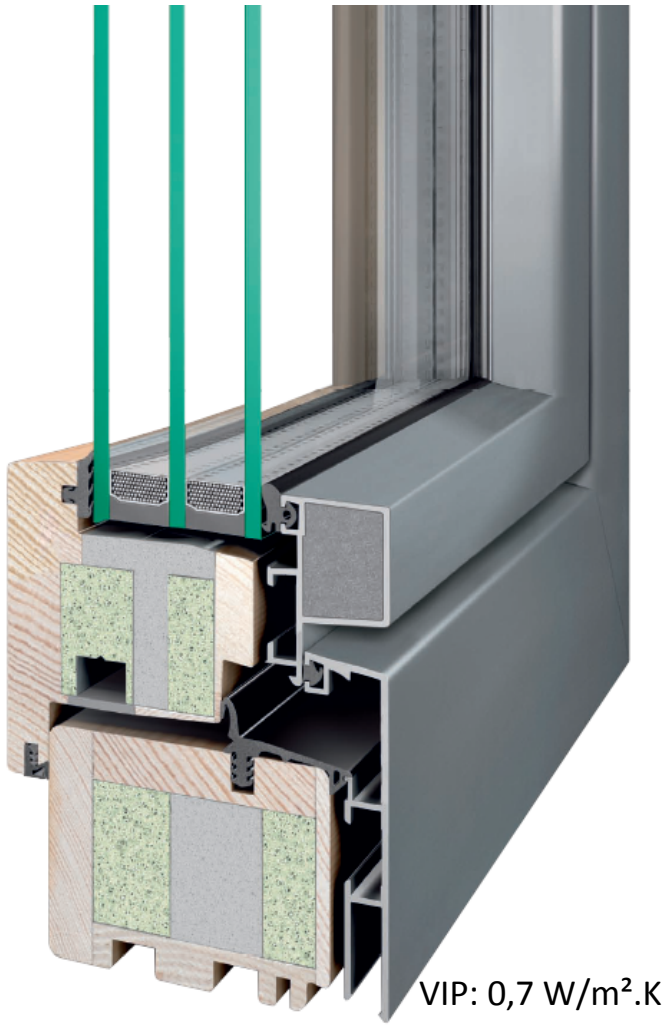
η is efficiency central heating system

Today:
MEErP Part 1

Example 2

EXAMPLE: Windows





VIP: 0,7 W/m².K

Example 2 c'td

EXAMPLE: Windows (continued, interactions*)

$$\textit{Affected Light Energy } ALE = \frac{\textit{Total light demand } \Phi tot - \textit{ Daylight supplied } \Phi day}{\textit{Efficacy artificial lighting } \eta}$$

with Φtot and Φday in Tlmh (Tera lumen hour = 10^{12} lmh) and η in lm/W primary energy

Interactions:
[A_{glass}/A_{window}] & [visible light transmittance t_{vis}]→ Φday

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$$\textit{Affected Heat Energy } AHE = \frac{\textit{Transmission losses buildings } QT - \textit{solar gains } g}{\textit{Efficiency Central Heating system } \eta_{CH}}$$

ErP

with QT (as BIM but for transparent shell components) and g in Wh per period and η_{CH} dimensionless

Interactions:
[U_{window}] → QT
[total transmittance t_{tot}] & [shading] & [A_{glass}/A_{window}] → g

*= simplified, e.g. not addressing semi-transparent solutions, possible infiltration/ventilation issues

Today:
MEErP Part 2

Report with reference data & policies

Materials

Recycling

Energy

Water

Waste

Emissions

Other impacts

EcoReport Unit Indicators

Climate, Energy & Buildings

People

FOCUS: Facilitate system approach and broad resources efficiency

Today:
MEErP EcoReport

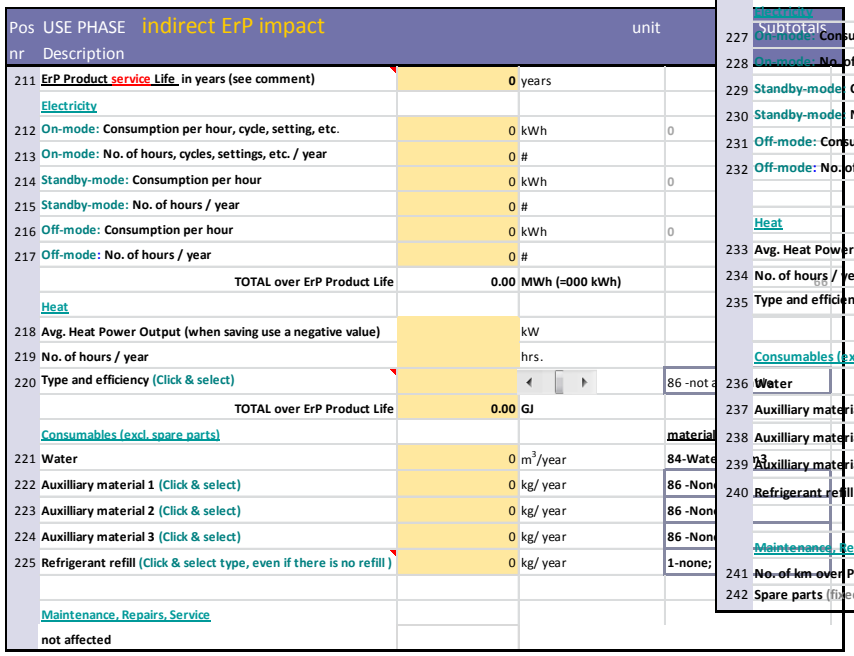
ECOREPORT tool

Extended to accomodate

a) Direct ErP and/or

b) Indirect ErP impact

c) More flexible EoL etc.



Pos nr	USE PHASE indirect ErP impact			unit
211	ErP Product service Life in years (see comment)	0	years	
	Electricity			
212	On-mode: Consumption per hour, cycle, setting, etc.	0	kWh	0
213	On-mode: No. of hours, cycles, settings, etc. / year	0	#	
214	Standby-mode: Consumption per hour	0	kWh	0
215	Standby-mode: No. of hours / year	0	#	
216	Off-mode: Consumption per hour	0	kWh	0
217	Off-mode: No. of hours / year	0	#	
	TOTAL over ErP Product Life	0.00	MWh (=000 kWh)	
	Heat			
218	Avg. Heat Power Output (when saving use a negative value)		kW	
219	No. of hours / year		hrs.	
220	Type and efficiency (Click & select)			86 -not a
	TOTAL over ErP Product Life	0.00	GJ	
	Consumables (excl. spare parts)			material
221	Water	0	m^3/year	84-Wate
222	Auxilliary material 1 (Click & select)	0	kg/ year	86 -Non
223	Auxilliary material 2 (Click & select)	0	kg/ year	86 -Non
224	Auxilliary material 3 (Click & select)	0	kg/ year	86 -Non
225	Refrigerant refill (Click & select type, even if there is no refill)	0	kg/ year	1-none;
	Maintenance, Repairs, Service			
	not affected			

Pos nr	USE PHASE direct ErP impact			unit	Subtotals
226	ErP Product (service) Life in years	0	years		
	Electricity				
227	On-mode: Consumption per hour, cycle, setting, etc.	0	kWh		0
228	On-mode: No. of hours, cycles, settings, etc. / year	0	#		
229	Standby-mode: Consumption per hour	0	kWh		0
230	Standby-mode: No. of hours / year	0	#		
231	Off-mode: Consumption per hour	0	kWh		0
232	Off-mode: No. of hours / year	0	#		
	TOTAL over ErP Product Life	0.00	MWh (=000 kWh)		66
	Heat				
233	Avg. Heat Power Output	0	kW		
234	No. of hours / year	0	hrs.		
235	Type and efficiency (Click & select)				86-not applicable
	TOTAL over ErP Product Life	0.00	GJ		
	Consumables (excl. spare parts)				material
236	Water	0	m^3/year		84-Water per m3
237	Auxilliary material 1 (Click & select)	0	kg/ year		86 -None
238	Auxilliary material 2 (Click & select)	0	kg/ year		86 -None
239	Auxilliary material 3 (Click & select)	0	kg/ year		86 -None
240	Refrigerant refill (Click & select type, even if there is no refill)	0	kg/ year		3-R404a; HFC blend; 3920
	Maintenance, Repairs, Service				
241	No. of km over Product-Life	0	km / Product Life		87
242	Spare parts (fixed, 1% of product materials & manuf.)	0	g		1%

Download from www.meerp.eu

Do More?

System Aspects:

COULD METHODOLOGY DO MORE?

YES and NO…

- The new **methodology** is comprehensive and flexible enough to handle a wide array of product-systems, but…
- An effective system approach is more complex than what (co-) decision makers are used to, both technically and commercially, and requires investment in **capacity building** to use the methodology in designing and implementing appropriate legislation;
- There is a lack of comprehensive and robust **reference data** on the relevant systems and a need for harmonisation of system boundaries and definitions;
- There are serious deficiencies in available **test- and calculation methods** (standards) that would allow product-optimisation in a system context; progress is being made but slowly.

Capacity Building

- Ecodesign (pushing from the bottom) and Labelling (pulling from the top) aim to promote innovative, more efficient energy-related products/ functional-systems.
- Amongst others this means designing legislation that

a) **Challenges the smartest technical minds** in research & development (R&D) to come up with better ideas.

b) **Prepares and mobilizes buyers and market forces** to be ready for these new ideas.

c) **Makes industry want to invest**, as a result of a) and b), in cost-effective mass-production and mass-marketing of these new products.

There is nothing 'simple' about that. It requires more than layman's knowledge of the products and systems at hand. It requires a legal vehicle that does not shy away from technical complexity when needed.

Reference data

- In a systems-approach, compared to a simple (simplified) product as we know it today, the **data requirements** for preparatory/ impact studies of Commission and stakeholders **tend to explode**, as the impacts are so vast and multiple. In order to make the preparation of a real systems-approach manageable, a generic body of robust reference data.
- In MEErP Part 2 a beginning was made to bring together the latest statistics on resources flows, buildings, climates, etc. so that preparatory and impact studies could benefit by making a simple reference.
- However, it is not just about more data-volume, but to aggregate data in a correct and understandable way for policy makers and the general public: The **Top Down** approach.
- At the same time, these aggregated models need to be amply supported by the detailled data at the lowest manageable level: The **Bottom-Up** approach.

Reference aggregations: Examples

- **'The Reference EU Building System'** for better regulation of HVAC products weighted against potential changes to the building shell.
- **'The Reference EU Food System'** for better regulation of food preservation, warehouse logistics, cooking and cleaning (dishes etc.) also weighted against the impacts of producing the food.
- **'The Reference EU Textiles System'** for better regulation of washing machines, driers, irons also weighted against the impact of making clothes and other textiles.
- **'The Reference EU Information & Communication System'** for better regulation of data centers, gateways, computers, phones, electronic displays alo weighted against physical transport and changes in the work environment.

Test standards

Traditionally, test-standards foresaw 1 test for both the (max.) capacity and the energy consumption, i.e. at full capacity.

Making products that fit in a system-approach usually means that they

- Are **able to adapt** to relevant changes in circumstances
- Are **able to detect**, and/or are at least able to **process** information about, changes in those circumstances

In order to verify and prescribe minimum capabilities of the products to be regulated requires test- and calculation methods

- Tests that measure efficiency at **multiple (partial load) test points or duty cycles**
- Tests or assessments that verify the product's **capabilities to detect and process** relevant changes in the environment
- Calculation methods that **aggregate test results to real-life** efficiency forecasts

Needless to say: They will be **more complex** to develop (slower) and **cost more.**

Test standards: Progress but slow

Electronic displays (TVs, monitors): Static (test image)→Dynamic testing (video)

Took >8 years

Washing machines: 1 full-load test at 60 °C → tests at full- and half-load, 40 & 60 °C (with minimum wash performance)

Took >6 years

Vacuum cleaners: no test (just electric wattage) → carpet & hard-floor energy and performance test (dust pick-up)

Took >15 years

Water heaters: single max. capacity tests and/or sometimes local tapping patterns, different for electric and fossil fuel → same tapping pattern(s) for testing EU-wide (but still local habits die hard)

Took >20 years

etc.

Do More?

Summary: Problems

Methodology is not the problem, but compared to regulating single products, the system approach

- Is technically much more complex,
- Requires more specialist (technical) know-how and creativity from all actors
- Requires more information and more communication effort for responsible decision making
- Requires speeding up the development of new test standards and calculation methods
- Will probably not succeed in one go, most remain focus at every review
- Will not be easy to understand for the general public
- In the implementation depends heavily on the know-how and motivationof installers, lighting designers

Summary: System approach opportunities

'All for one, one for all'

Right functional system: No suboptimisation at the level of components, subassemblies and/or related products. Synergy (1+1=3). All working together to one goal

'Low exergy when you can, peak performance when you must.'

Right design approach: low (heating) temperature, low (fan/pump) speed, high/low energy recovery, hybrid solutions (1 for peak, 1 for normal),.

'Less is more'

Right performance (tuned to comfort and functional improvement) at the

Right amount,

Right place and the

Right time

Do More?

Examples

‘All for one, one for all’ (Right functional system)

There are plenty of single speed motors, but there are almost no real-world single speed motor-applications (→ variable speed/capacity)

Information & communication is for humans, not for boxes → (Functional convergence, miniaturisation, etc.)

‘Low exergy when you can, peak performance when you must.’

Closer to ambient temperature is more efficient than high/low temperature (floor heating: low temperature + high capacity emitters. washing machines: low temperature + longer time/ better mechanical & chemical action)

Low speed is more efficient than high speed (large slow-speed fan/pump impellers, large ducts, ‘fan laws)

‘Less is more’

Local, demand controlled heating, cooling, lighting, ventilation, communication

Do More?

Thank You