Second Technical Study to support the establishment of a common European scheme for rating the Smart Readiness of Buildings

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Smart technologies in buildings

A greater uptake of smart technologies is expected to result in significant energy savings in a cost-effective way, while helping to improve comfort and occupant satisfaction and enabling buildings to play a key role in smart energy systems.

There is a perceived need to:

- Increase the uptake of smart, energy-efficient technologies in the building sector across Europe
- Provide trustworthy insights and a common vocabulary to all stakeholders involved: occupants, investors, engineers, manufacturers, etc.

Smart Readiness Indicator in the EPBD

The revised **Energy Performance of Buildings Directive** (EPBD) (19 June 2018) requires the development of **an optional Common Union scheme for rating the smart readiness of buildings: the "Smart Readiness Indicator" (SRI)**.

*The indicator is intended to **raise awareness** about the benefits of smart technologies and ICT in buildings (from an energy perspective, in particular), **motivate consumers** to accelerate investments in smart building technologies and **support the uptake of technology innovation** in the building sector.*

2nd SRI study

ENER/C3/2018-447
"Support to the establishment of a common European scheme for rating the smart readiness of buildings"

Website https://smartreadinessindicator.eu/

Consortium vito, Energy Ville, Waide Strategic Efficiency

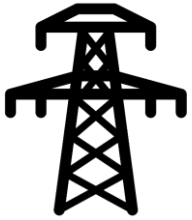
Aim Provide technical inputs to feed the establishment of the SRI of buildings by the European Commission and the related proposals for delegated and implementing acts, in accordance with the provisions of the revised EPBD.

Timeline **Dec 2018 – June 2020**

3 “Smart readiness” aspects in scope of the study & EPBD

The ability to adapt its operation mode in response to the needs of **the occupant** paying due attention to the availability of user-friendliness, maintaining healthy indoor climate conditions and ability to report on energy use

The ability to maintain energy efficiency performance and **operation** of the building through the adaptation of energy consumption for example through use of energy from renewable sources



The flexibility of a building's overall electricity demand, including its ability to enable participation in active and passive as well as implicit and explicit demand-response, in **relation to the grid**, for example through flexibility and load shifting capacities.

SRI METHODOLOGY
(WORK IN PROGRESS!)

Proposed SRI methodology

- STEP 1: Which smart ready services are relevant for this building?

  e.g. if there is no DHW, there is no need to inspect how this is controlled

- STEP 2: Inspection: assess the functionality level of each relevant service
- STEP 3: Lookup impact scores
- STEP 4: Calculate weighted overall score

  through multi-criteria assessment method

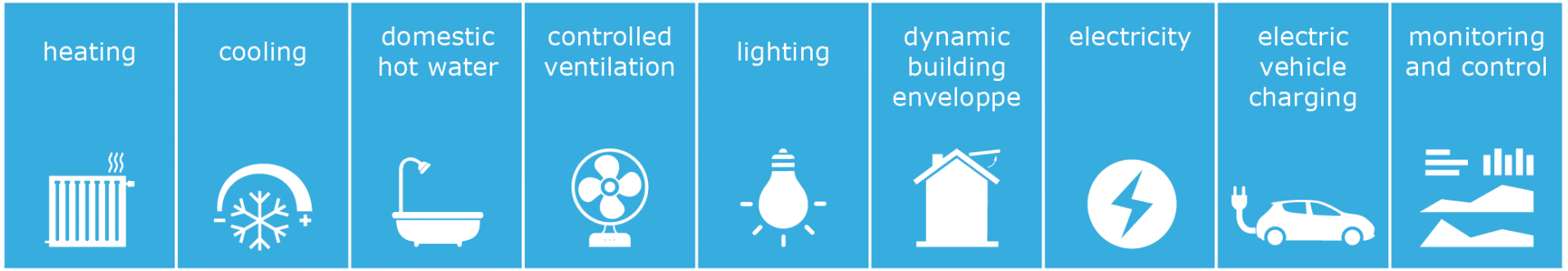
- STEP 5: Derive normalised SRI score

  compared to maximum obtainable score for specific building

Smart ready services

- Services are enabled by (a combination of) smart ready technologies, but are defined in a technology neutral way,
  e.g. *'provision of temperature control in a room'*.
- services are structured within nine **domains**

DOMAINS



FUNCTIONALITY LEVELS

- For each of the services, 2 to 5 **functionality levels** are defined. A higher functionality level reflects a “smarter” implementation of the service, which generally provides more beneficial impacts to building users or to the grid

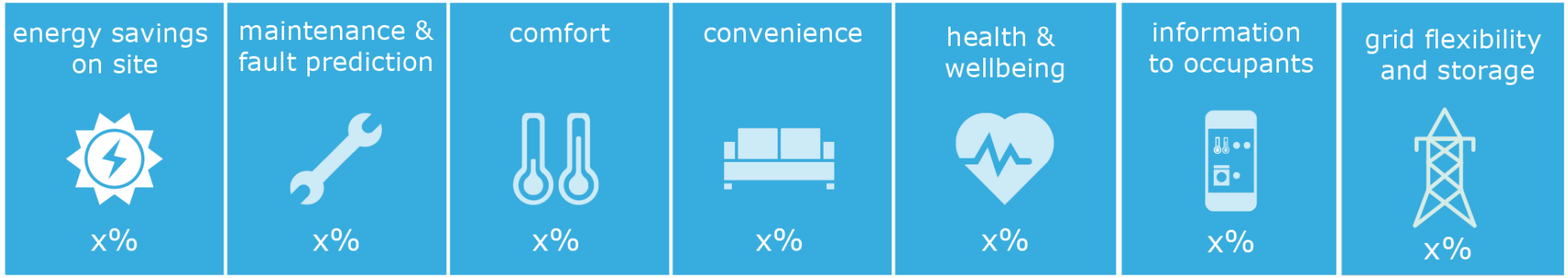
EXAMPLE SERVICE:

Service	Functionality level 0 (as non-smart default)	Functionality level 1	Functionality level 2	Functionality level 3	Functionality level 4
Heat emission control	No automatic control	Central automatic control (e.g. central thermostat)	Individual room control (e.g. thermostatic valves, or electronic controller)	Individual room control with communication between controllers and to BACS	Individual room control with communication and presence control

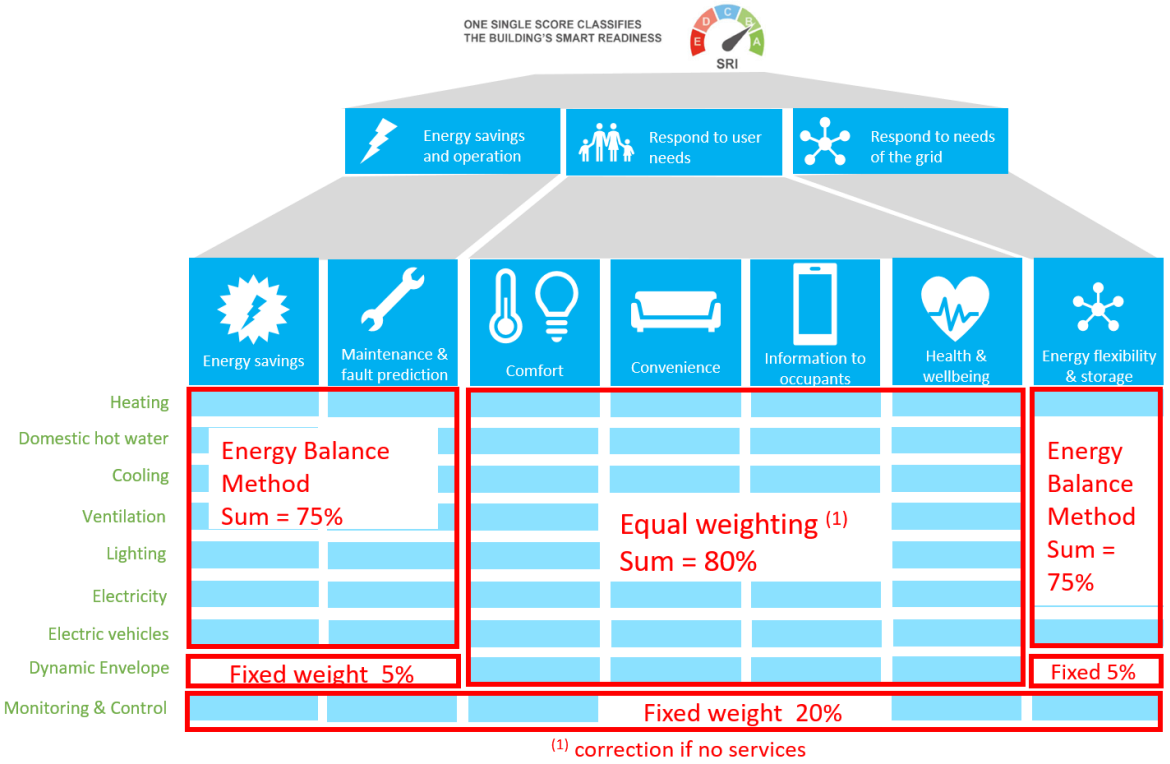
IMPACTS

- For each of the functionality levels of each of the services, the impacts are defined according to 7 impact categories

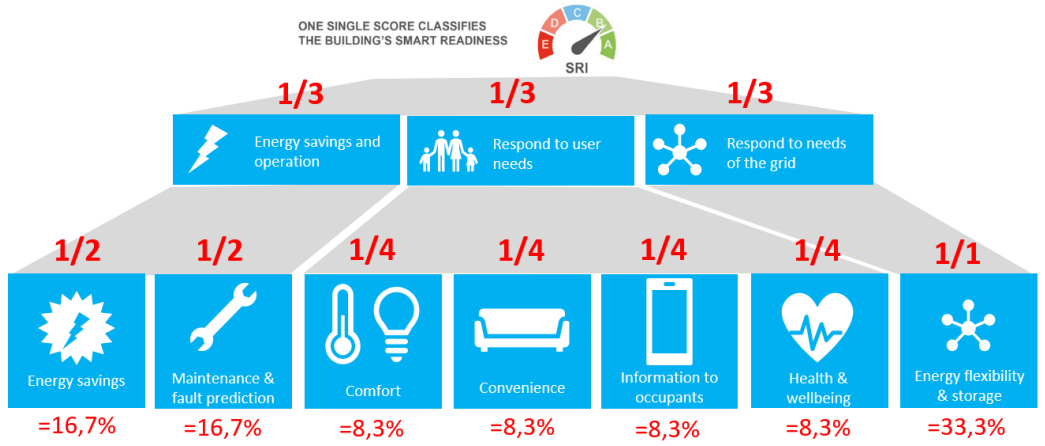
IMPACT CATEGORIES



WEIGHTING FACTORS to aggregate to overall score



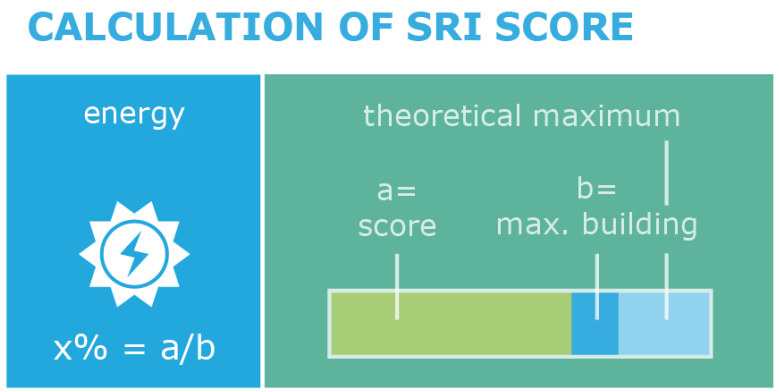
DOMAIN WEIGHTING



IMPACT WEIGHTING

NORMALISATION and TRIAGE

- Normalisation: triage process affects the ‘maximum obtainable score’, as it would be unfair to penalise a building for not providing services that are not re



- Triage: identify the relevant services for a specific building
  - Relevant because they are present
  - Relevant because they should be present (policy perspective)

SRI - CALCULATION METHODOLOGY

SRI

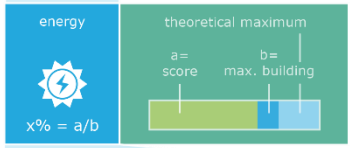
ONE SINGLE SCORE CLASSIFIES
THE BUILDING'S SMART READINESS

7 IMPACT CRITERIA

The total SRI score is based on average of total scores on 7 impact criteria.

energy savings on site	maintenance & fault prediction	comfort	convenience	health & wellbeing	information to occupants	grid flexibility and storage
x%	x%	x%	x%	x%	x%	x%

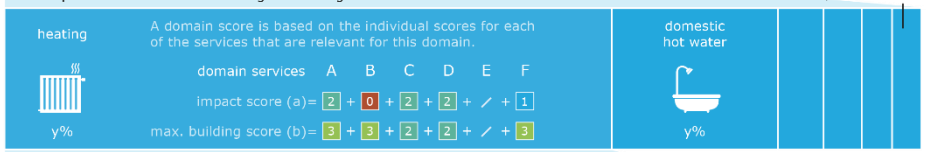
An impact criterion score is expressed as a % of the maximum score that is achievable for the building type that is evaluated.



9 DOMAINS

One impact criterion score is the weighted average of 9 domain scores.

not every domain is considered to be relevant for each impact criterion



DOMAIN SERVICES

All relevant domain services are scored according to their functionality level.

service A	service B	service C	service D	service E	service F
Functionality 0 0	Functionality 0 0	Functionality 0 0	Functionality 0 0	Functionality 0 0	Functionality 0 0
Functionality 1 1	Functionality 1 1	Functionality 1 0	Functionality 1 1	Functionality 1 1	Functionality 1 1
Functionality 2 2	Functionality 2 2	Functionality 2 1	Functionality 2 2	Functionality 2 2	Functionality 2 2
Functionality 3 3	Functionality 3 3	Functionality 3 2	Functionality 3 2	Functionality 3 3	Functionality 3 3

Depending on the building type or design some services are not considered relevant.

Most of the services will affect also the other impact criteria's as shown in this overview matrix.

service A							
Functionality 0	0	1	0	0	0	0	0
Functionality 1	1	2	1	1	0	1	1
Functionality 2	2	3	2	1	0	2	2
Functionality 3	3	3	3	2	0	3	3

EXAMPLE APPLICATION

Example building: EnergyVille I office, Genk, Belgium

Nov 2013 – June 2016

22 September 2016

Genk, Belgium (Thor science and business park)

Atelier Kempe Thill

Office + laboratory for 250 EnergyVille researchers

- Highly insulated, triple glazing
- “Living lab”, test ground for demand response, battery storage, fourth generation district heating, DC grid (±500 VDC, 35 kW), …
- Ground sourced heat pumps and combustion boilers
- Seasonal thermal energy storage
- 350 sensors for monitoring energy consumption and comfort
- 1070 PV-panels

Example building: EnergyVille I office, Genk, Belgium

Example building: EnergyVille I office, Genk, Belgium

- STEP 1: Triage: which smart ready services are relevant for this building?

  e.g. if there is no domestic hot water storage, services on controlling such storage are irrelevant for this building

For the EnergyVille I building, 44 services remain to be assessed after the triage

Example building: EnergyVille I office, Genk, Belgium

- STEP 1: Triage: which services are relevant for this building?

  e.g. if there is no DHW, there is no need to inspect how this is controlled

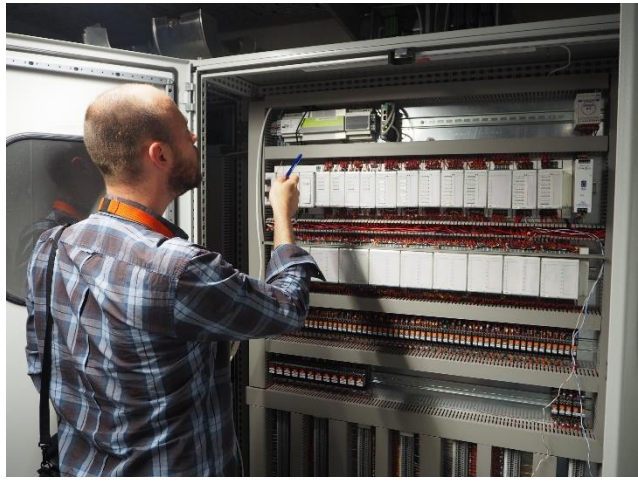
- STEP 2: assess the functionality level of each service

example:

Service	Functionality level 0 (as non-smart default)	Functionality level 1	Functionality level 2	Functionality level 3	Functionality level 4
Occupancy control for indoor lighting	Manual on/off switch	Manual on/off switch + additional sweeping extinction signal	Automatic detection (auto on / dimmed or auto off)	Automatic detection (manual on / dimmed or auto off)	

Example building: EnergyVille I office, Genk, Belgium

inspecting the various services



Example building: EnergyVille I office, Genk, Belgium

	IMPACTS						
	Energy efficiency	Maintenance and fault protection	Comfort	Convenience	Health and well-being	Information to occupants	Energy flexibility & storage
Ordinal impact score case study building	**54**	**16**	**34**	**42**	**13**	**20**	**18**
Maximum obtainable score for the case study building	**73**	**23**	**45**	**61**	**19**	**30**	**25**
Relative score	**74%**	**70%**	**76%**	**69%**	**68%**	**67%**	**72%**

Overall score after weighting: **77%** of the potential smartness impacts can be achieved

ONGOING WORK & NEXT STEPS

METHODOLOGY

- Finetuning the service catalogue, impact scores and weighting factors
- Open public beta test to probe the feasibility of the approach
- Investigate additional assessment of interoperability and cybersecurity
  - *Implicit approach / Explicit approach / Informative approach*

A	B	C
Simplified online quick-scan	**Expert SRI assessment**	***In-use smart building performance***
Checklist approach with limited, simplified services list	Checklist approach, covering full catalogue of smart services	*Measured / metered data (potentially restricted set of domains)*
Online self-assessment (no certification) OR On-site inspection by Third-party qualified expert	On-site inspection e.g. by third-party qualified expert	*In-use buildings, metered data Part of the commissioning?* *TBS self-reporting their actual performance*
15 minutes	Few hours	*Gather data over a long period (e.g. 1 year)*
Residential buildings (+ small non-residential building)	Non-residential (+ also residential?)	*Residential and non-residential Restricted to occupied buildings (not in design phase)*

Not in first version of SRI, dedicated topical group will investigate potential

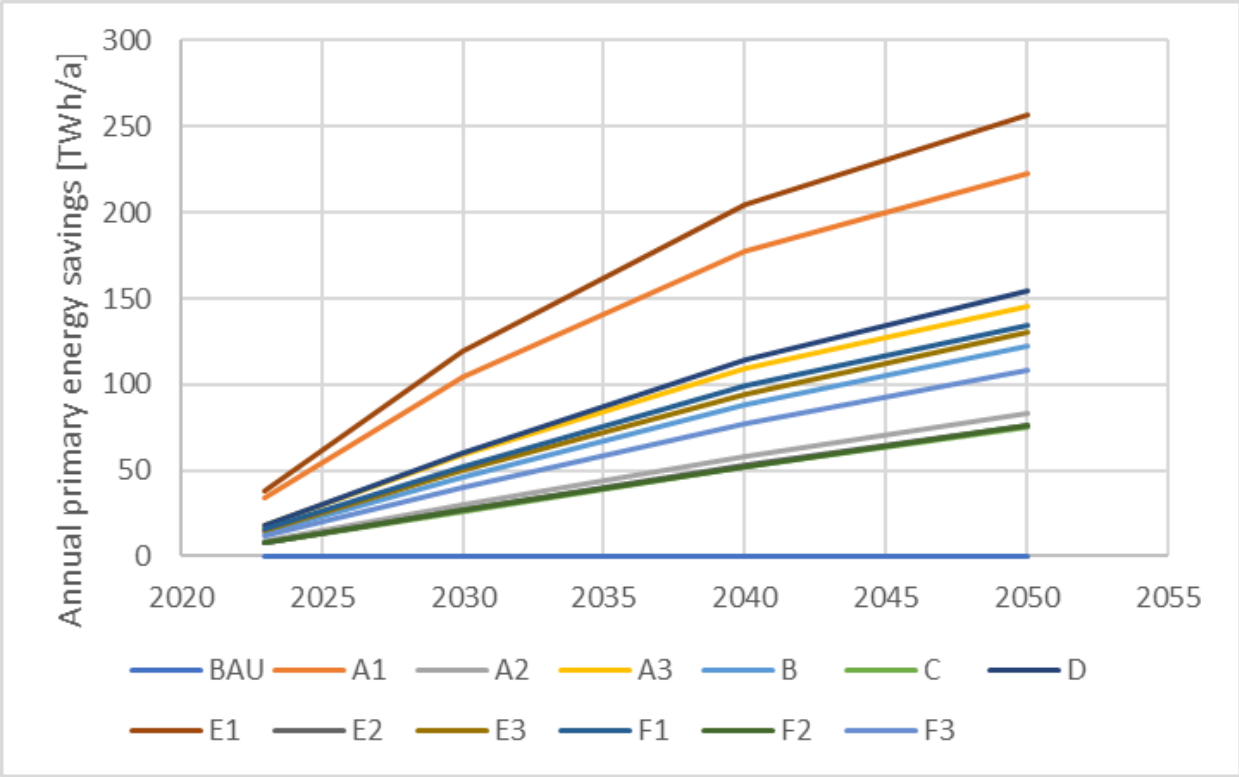
Potential SRI implementation pathways include:

A. Linkage of the SRI to the EPC (potentially in a mandatory way) so an assessment would be offered each time an EPC is conducted
B. Linkage of the SRI to new buildings and major renovations so that each time a new build/or renovation is undertaken it would be a requirement
C. A market-based voluntary scheme where self-assessment is supported by on-line tools and 3rd party certified assessment is offered to those willing to pay for it
D. As option **C.** but with 3rd party assessments supported, or subsidized, by the state and/or utilities seeking to roll out flexibility, energy efficiency, electromobility and self-generation measures
E. Linkage to the TBS/BACS deployment trigger points in Articles 8, 14 & 15 in the EPBD
F. Linkage to smart meter deployment
G. A mosaic of the aboves

ANALYSING THE IMPACT OF THE SRI

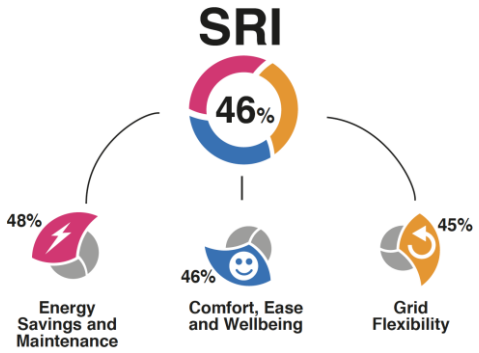
- Various implementation pathways are tentatively explored

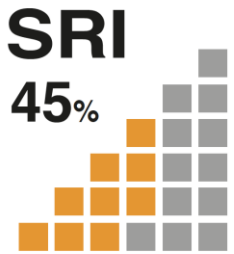
- The first results of the impact assessment reveal that on top of the savings resulting from retrofitting and strict building standards for new constructions, the **SRI can unlock up to 5% higher final energy savings by 2050.**

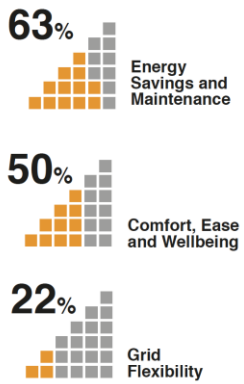


EXPLORING THE SRI FORMATTING

- The consortium is exploring some simple mnemonic notions with consumer focus groups







IMPACTS

DOMAINS	Energy efficiency	Maintenance and fault protection	Comfort	Convenience	Health and well-being	Information to occupants	Energy flexibility & storage	SRI
Total	39%	18%	60%	71%	48%	59%	51%	46%
Heating	32%	18%	62%	55%	24%	74%	100%	
Sanitary hot water	17%	0%	45%	70%	67%	83%	0%	
Cooling	65%	51%	78%	72%	61%	55%	0%	
Controlled ventilation	41%	0%	55%	60%	34%	44%	-	
Lighting	85%	14%	90%	100%	83%	15%	-	
Dynamic building envelope	10%	0%	31%	56%	22%	46%	-	
Electricity	10%	0%	-	-	-	68%	0%	
Electric vehicle charging	-	38%	-	82%	-	84%	25%	
Monitoring and control	52%	43%	62%	72%	45%	64%	14%	

- The SRI format could also provide additional information, e.g. on interoperability or cybersecurity of the technical building systems

Thank you for your attention

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Additional information

- https://smartreadinessindicator.eu/
- https://ec.europa.eu/energy/
- www.vito.be
- www.energyville.be