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International Conference
"The prospects for introduction of "green" innovative energy efficiency technologies in the electric power industry of Turkmenistan"

SEIT building, 62 Bayram Khan st, Mary, 18 March 2024

International experience in certification of passive public buildings. Types of green certificates. Methods and basic criteria for certification

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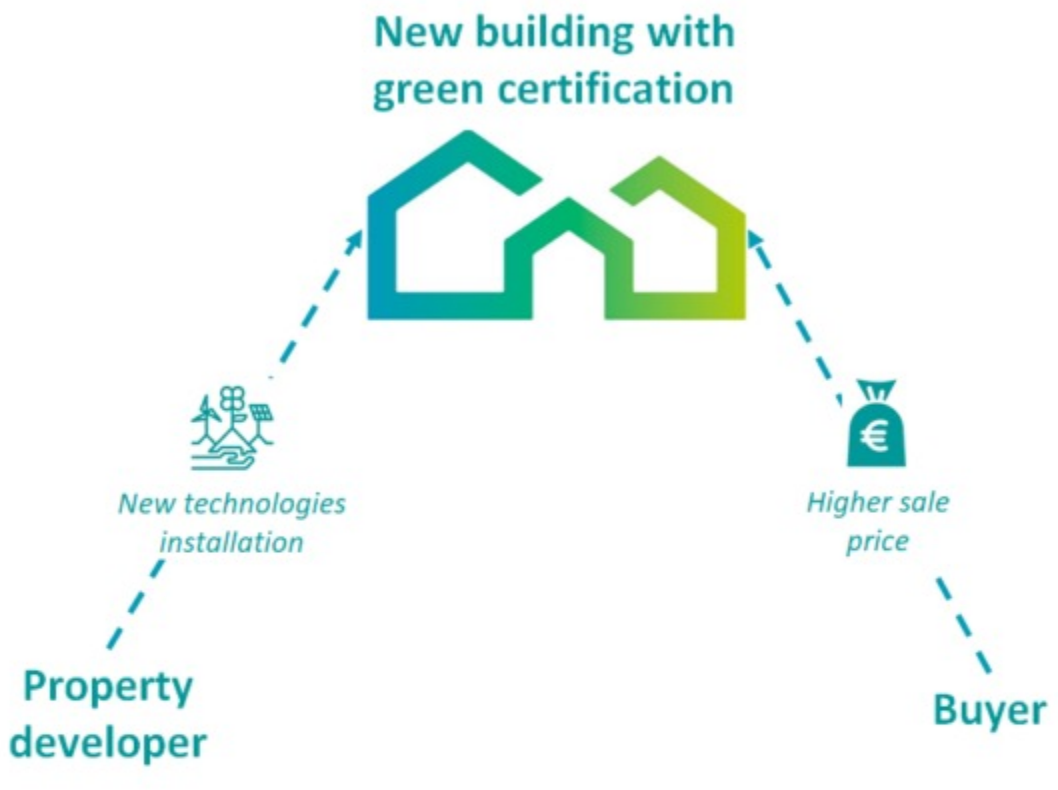
Stantec | intec | ACTED | European University Institute | FSR Energy Florence School of Regulation

Agenda

Examples of certification of two public buildings:

1. Passive house
2. BREEAM
3. New requirements and trends



Source: renovation-hub.eu

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Passive house certification

Certified Passive House Building

EnerPHit Retrofits

The EnerPHit certification serves as a proof of the specific values achieved for buildings that have either been consistently refurbished using **Passive House components** or **achieve a specific heating/cooling demand of 15kWh/m^{2}a**.

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Boarding Elementary school dormitory

Special Boarding Elementary school dormitory used to be inefficient soviet-era building that now meets **EnerPHit requirements**.

Treated Floor Area according to PHPP: 2191 m^2

Construction type: masonry construction

The heating energy consumption in this building was reduced about **8 times from 185 kWh/(m^2a) to 23 kWh/(m^2a).**

Air tightness: n_{50} = 0.91/h press test result

Annual heating demand: 23 kWh /(m^2a) calculated according to PHPP

Heating load 20 W/m^2

PE demand (non-renewable Primary Energy) 65 kWh /(m^2a) on heating installation, domestic hot water, household electricity and auxiliary electricity calculated according to PHPP

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Thermal envelope

Exterior wall:
Existing masonry walls [0,87 W/(mK)] insulated with 400mm mineral wool [0,037 W/(mK)]in the timber frame structure [9%], covered with wind mineral wool boards [0,037 W/(mK)], facades covered with rear-ventilated composite panels. U-value = 0.091 W/(m^{2}K)

Solution with timber frame structure, covered with wind mineral wool boards

Basement floor / floor slab:
220mm concrete floor slab with existing 100mm ceramsite layer [0,16 W/(mK)] U-value = 0.903 W/(m^{2}K)

Roof:
Upper floor 220mm concrete ceiling insulated with 600mm cellulose [0,041 W/(mK)], U-value = 0.067 W/(m^{2}K)

Frame: Rehau, Geneo
Uf-value 0.86 W/(m^{2}K)
U_w-value = 0.76 W/(m^{2}K)

Glazing: Triple-pane with argon filling
U_g-value = 0.5 W/(m^{2}K)
g -value = 49 %

Entrance door: Insulated PVC exterior door
U_d-value = 0.9 W/(m^{2}K)

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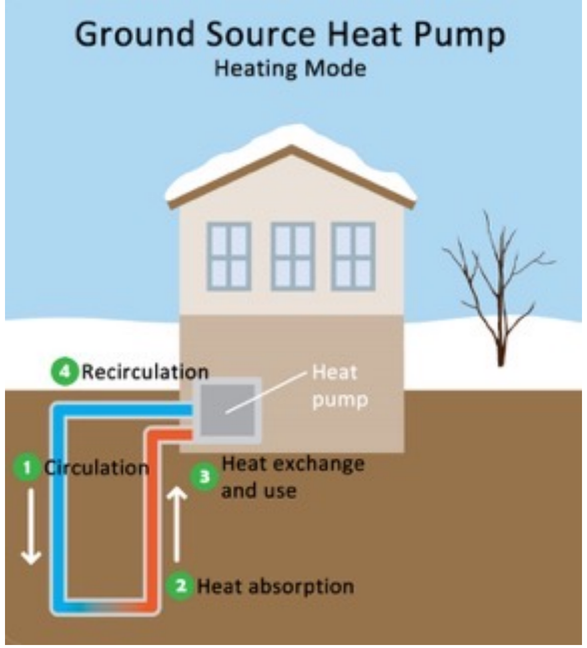
Mechanical systems

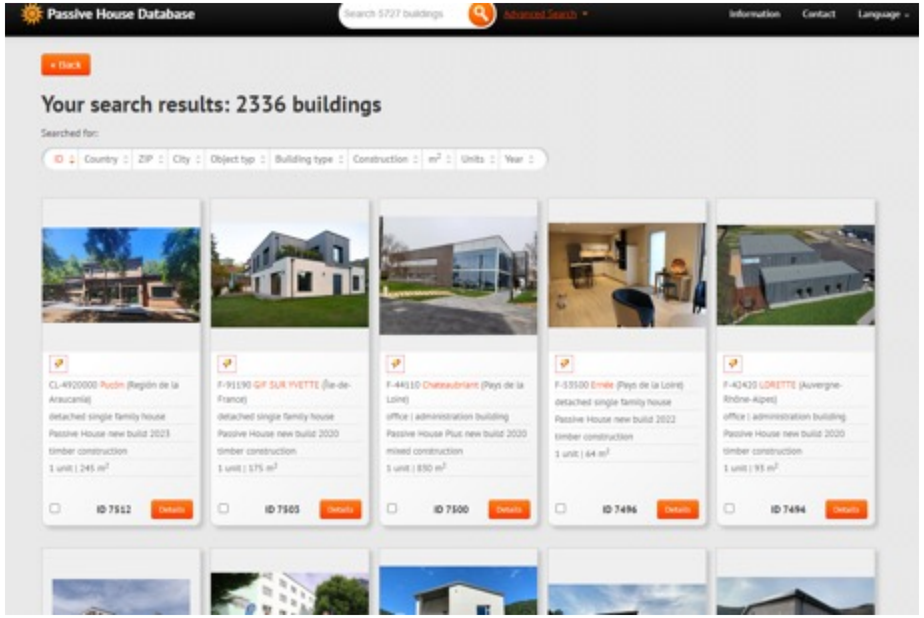
Ventilation:

PAUL Wärmerückgewinnung GmbH, novus 450 Heat recovery unit, additional Paul Maxi 2002 and Santos 570 eff. specif. HRE: 86%

Heating and hot water systems:

Ground Source Heat pump, radiators





https://passivehouse-database.org

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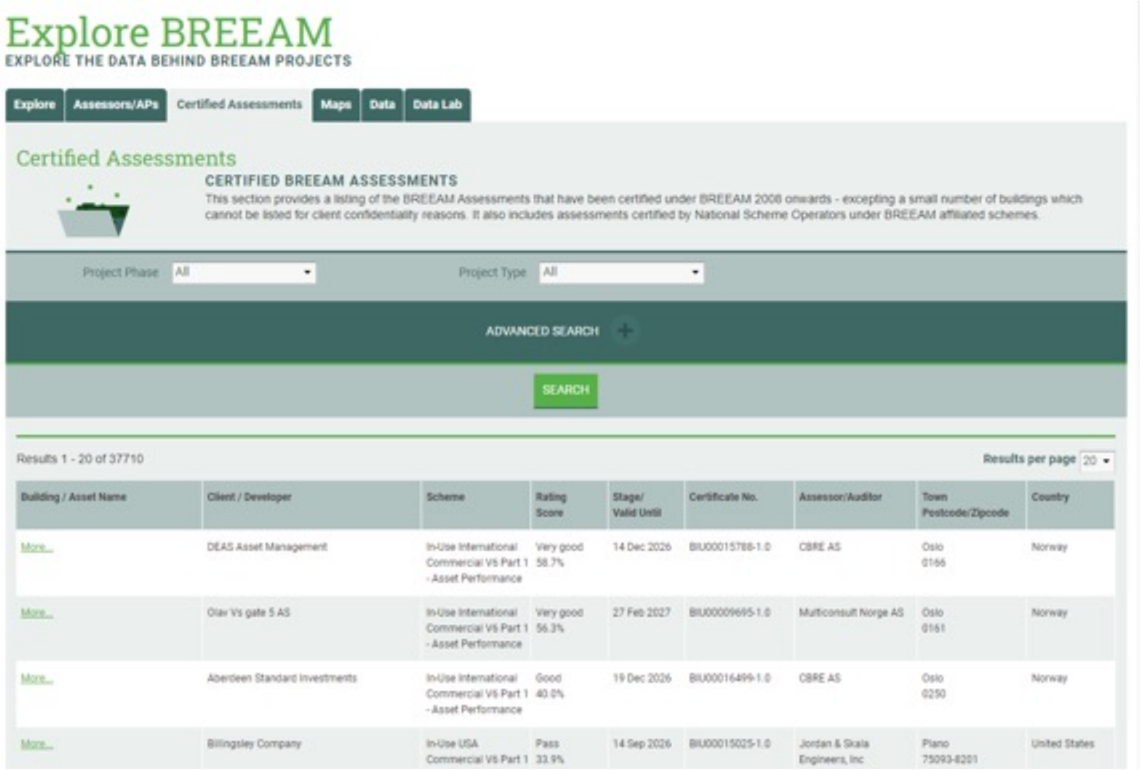
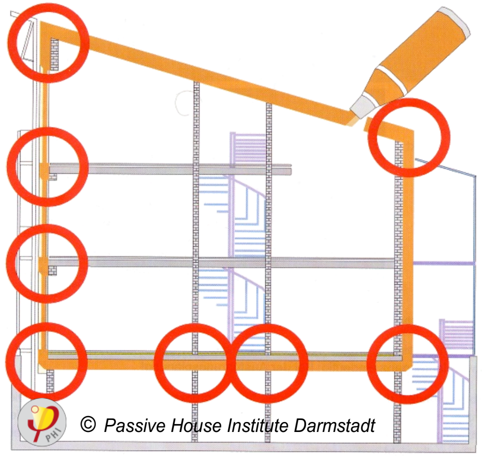
BREEAM building database



https://tools.breeam.com/

Ogre city central Library
Sustainable technologies used

- **Rainwater:** An excellent, biologically active resource for automatic green wall irrigation.
- **Primary energy efficiency** in buildings includes heat pump and renewable energy technologies (solar PV).
- **Heat pump for energy,** significantly more efficient than standard solutions, supporting ventilation heating and hot water preparation. Water-to-air heat pump linked with the city's sewage, maintaining 12-18°C for higher operational efficiency. This system supports heating, cooling, and summer freecooling mode.
- Building Management System (BMS) - display in the building to show heat exchange data, symbolizing the gained energy.
- **Experimental solar panel** placement in the courtyard allows parking space below, maximizing sun exposure without affecting the building's aesthetics.
- **Ensuring air tightness** in passive building constructions concept



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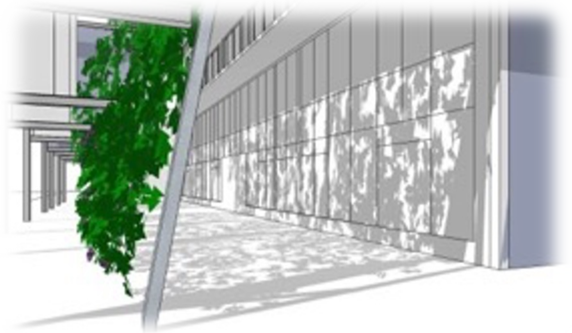
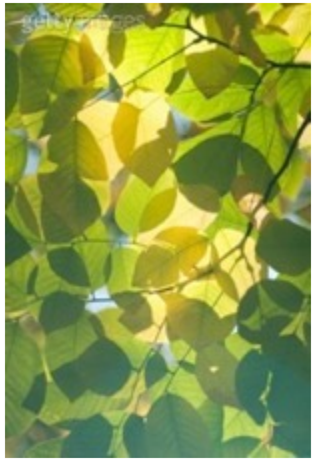
Ogre city central Library – shading using nature based solutions





- West side features automatic blinds. East side uses **climbing plants on the facade to reduce solar impact**.
- Plants act as a passive solution: providing shade in summer and allowing solar warmth in winter.
- Emphasizes the importance of sharing experiences among Latvian low-energy building designers, highlighting both successes and areas for improvement.

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Smart lighting adjusts brightness based on room depth and proximity to windows.

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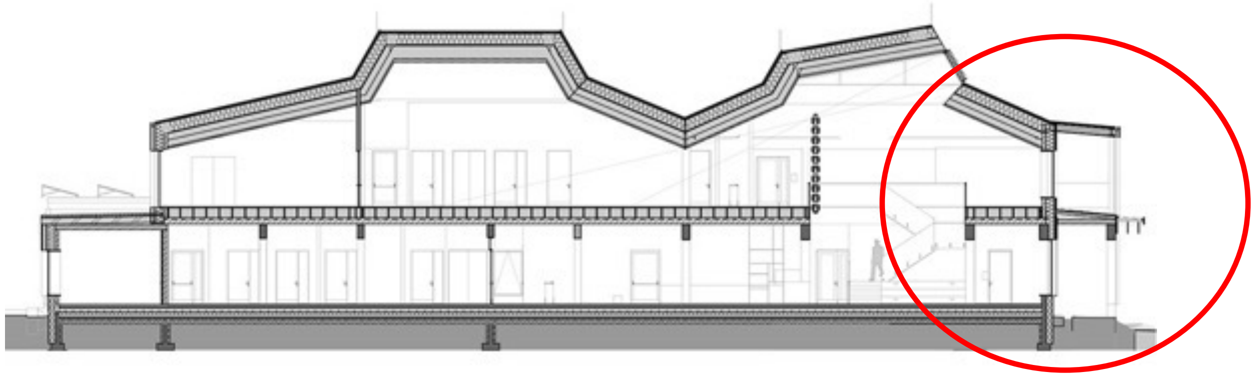
- **South-facing large glass facade** designed for unobstructed outdoor views.
- To prevent overheating, initially considered installing blinds, but **extensive overhangs** were chosen as a better solution.



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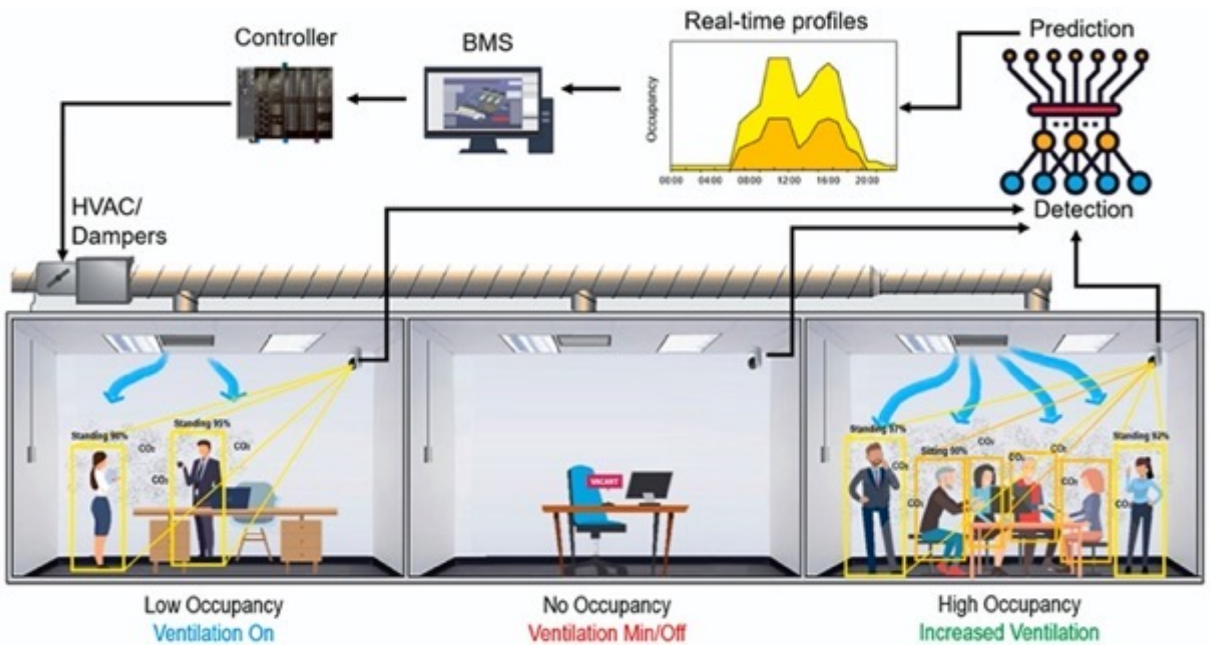
•**CO_2 sensors control ventilation based on occupancy**, ensuring optimal air quality.



Conceptual approach with CO_2 sensors control ventilation based on occupancy

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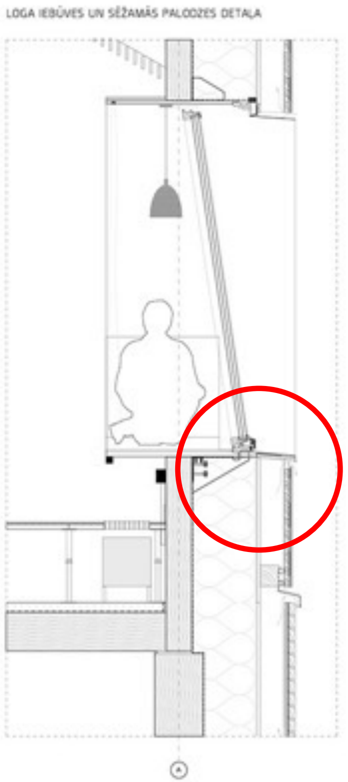
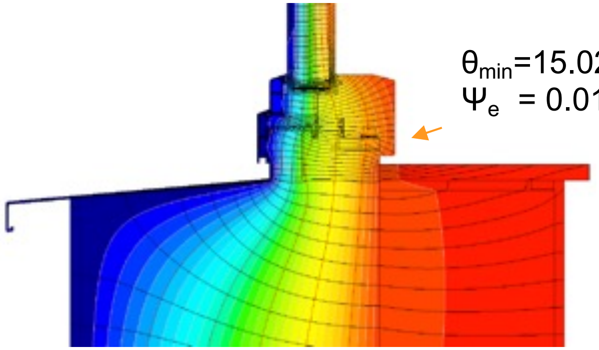
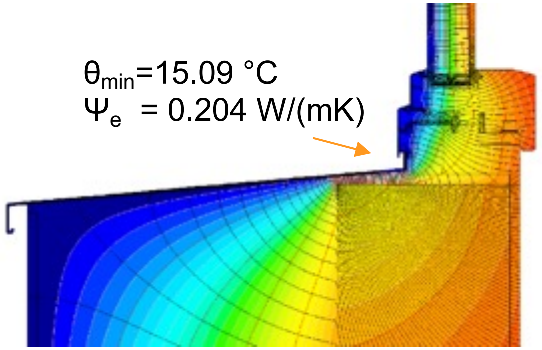
Good thermal insulation and thermal bridge free construction



- Proper window placement in insulation & well-insulated frame → Ψinstallation < 0 W/(mK).
- Extended frame insulation improves thermal performance.
- Incorrect installation → Ψinstallation > 0.05 W/(mK).
- U-value deteriorates significantly with higher Ψinstallation.
- Thermal bridge effect varies with window position in wall/insulation





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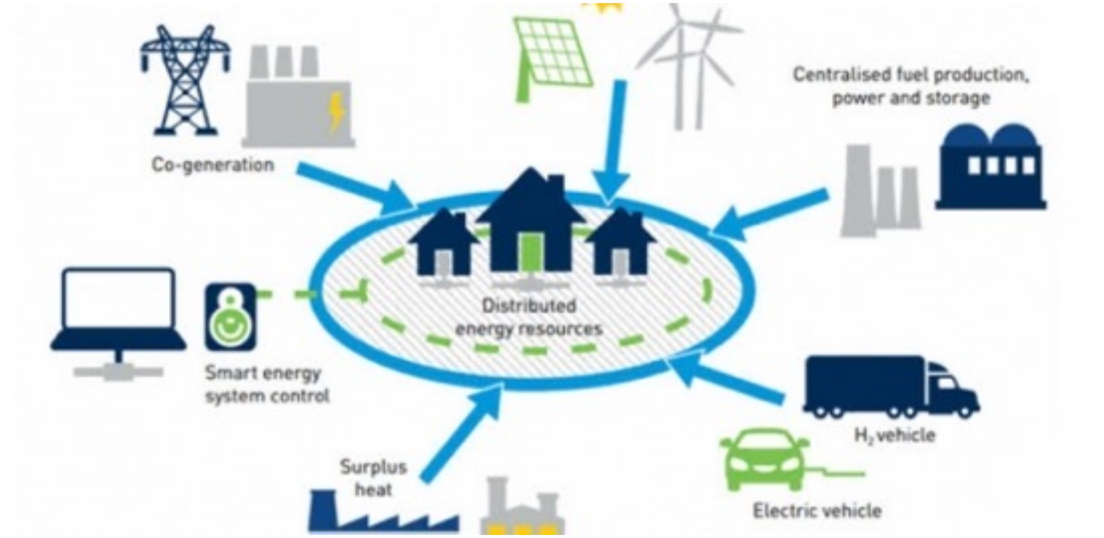
EU legislative requirements

- SRI – Smart Readiness Indicators
- Energy Performance certificates and minimum energy efficiency requirements
- CO_2 life cycle perspective



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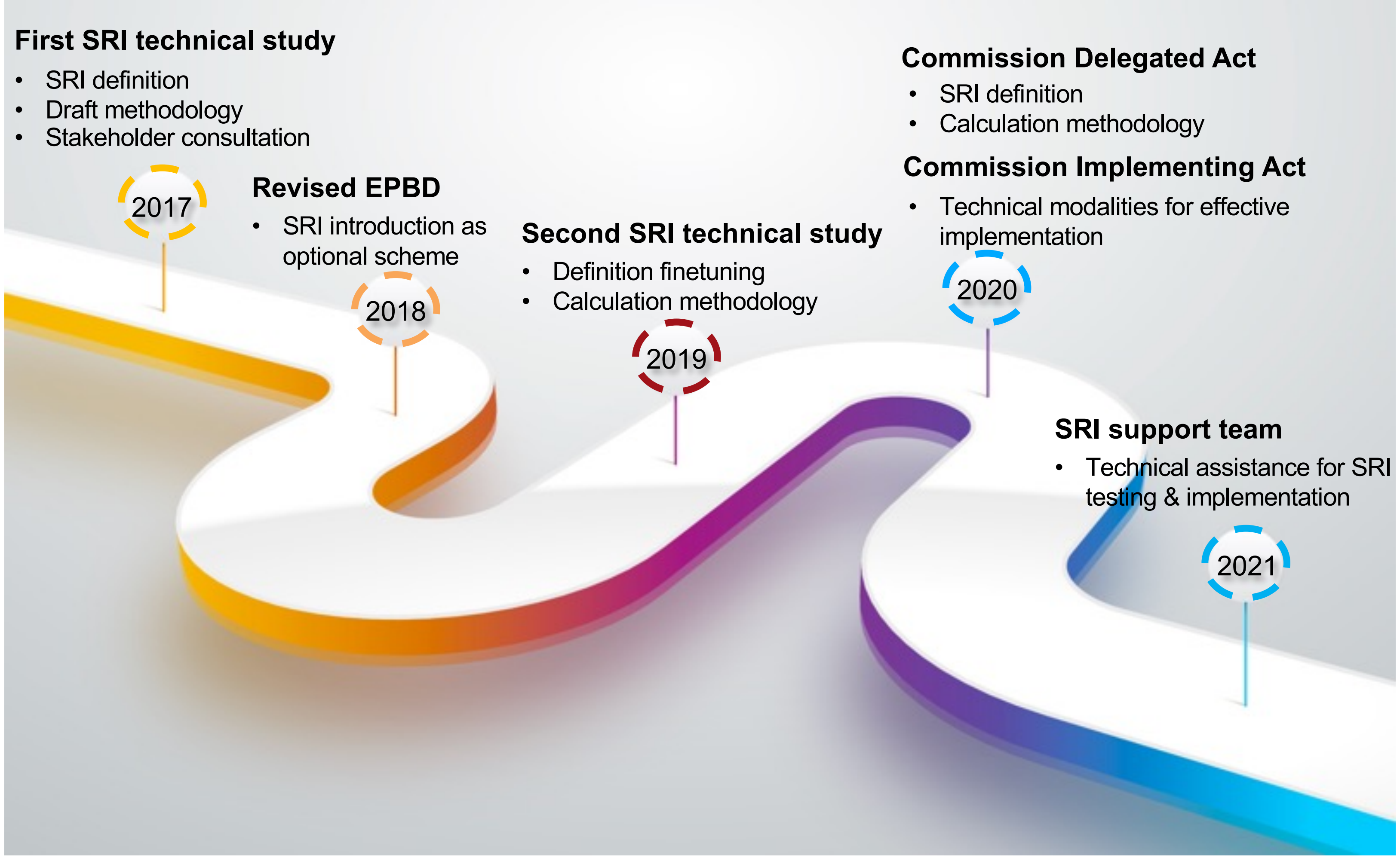
In a nutshell

What?	**Assessment of a building's capacity to accommodate smart ready services**
Why?	Raise awareness about the **added value of building smartness**, stimulate investment, support technology uptake
Who?	EU Member States (currently **optional, mandatory from 2026** for some building types)
How?	Structured methodology from the EC, **customisable** to the local context
So far?	7 EU countries – Denmark, Austria, France, Finland, Czech Republic, Croatia, Spain (enters the test phase soon)

History of the SRI



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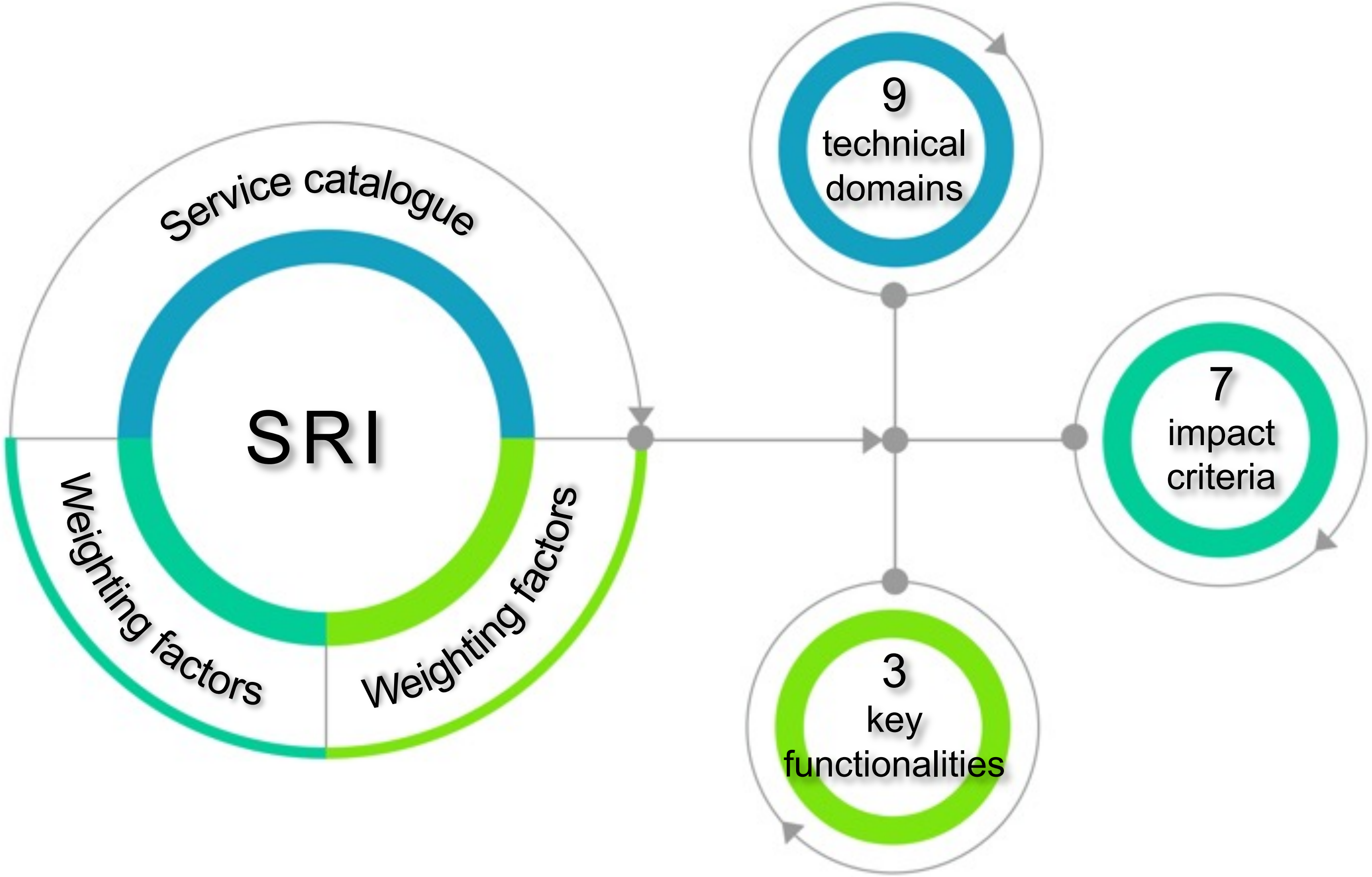
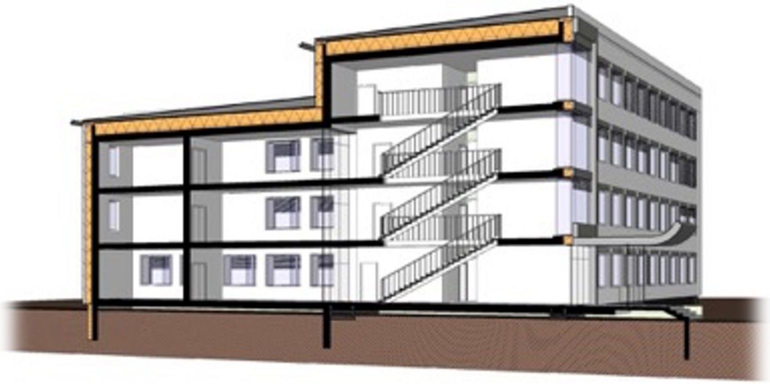
SRI features





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Overall

Technical domains	Heating	Cooling	Domestic hot water	Ventilation	Lighting	Dynamic building envelope	Electricity	Electric vehicle charging	Monitoring & control

Impact criteria	Energy efficiency	Maintenance & fault protection	Comfort	Convenience	Health, well-being & accessibility	Info to occupants	Energy flexibility & storage

Key functionalities	**Energy Performance & Operation**	**Responds to the needs of occupants**	**Energy flexibility**

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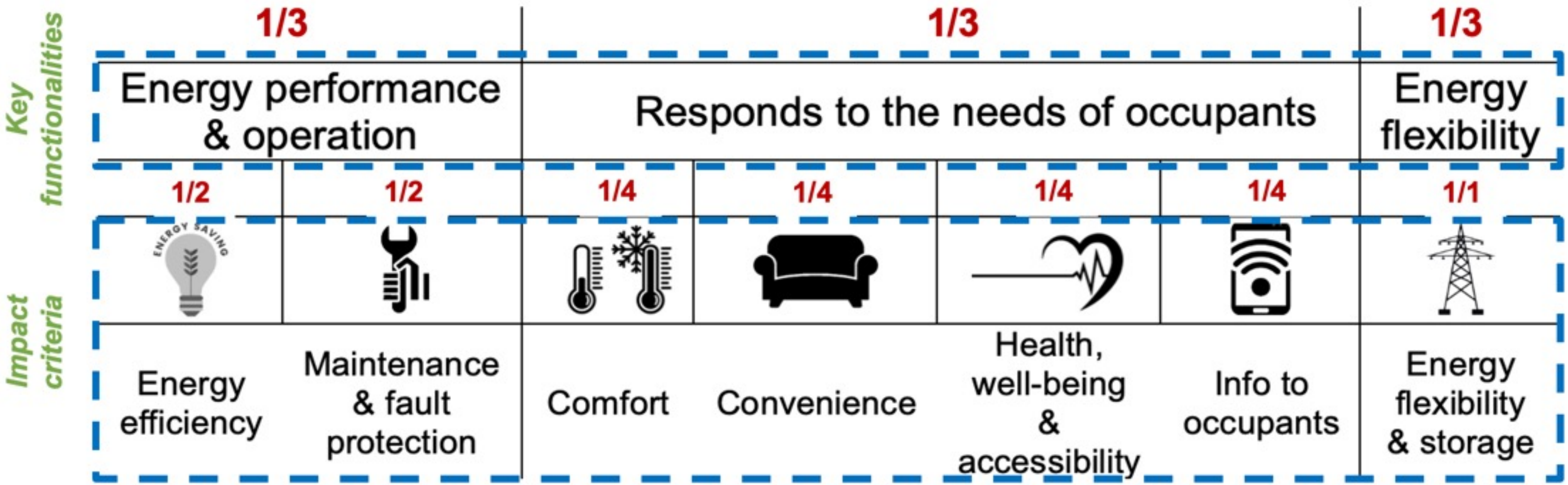
Weighting Methods (1/2)



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Weighting Methods (2/2)

Key functionalities → / Impact criteria → / Technical domains ↓	Energy performance & operation		Responds to the needs of occupants				Energy flexibility
	Energy efficiency	Maintenance & fault protection	Comfort	Convenience	Health, well-being & accessibility	Info to occupants	Energy flexibility & storage
Heating	%	%	16%	10%	20%	11.4%	%
Cooling	%	%	16%	10%	20%	11.4%	%
Domestic Hot Water	%	%		10%		11.4%	%
Ventilation	%	%	16%	10%	20%	11.4%	%
Lighting	%	%	16%	10%	20%		%
Electricity	%	%		10%		11.4%	%
Dynamic Building Envelope	5%	5%	16%	10%	20%	11.4%	
Electric Vehicle Charging				10%		11.4%	5%
Monitoring & Control	20%	20%	20%	20%		20%	20%
Sum of weights	100%	100%	100%	100%	100%	100%	100%

Step 1:
Fixed weights

Step 2:
Equal weights

Step 3:
Energy balance
(depending on climate zone & type of building)

Climate zones	Countries
Northern Europe	Finland, **Sweden**, Denmark
Western Europe	UK, Ireland, **Germany**, Austria, France, Belgium, Luxembourg, The Netherlands
Southern Europe	Portugal, Spain, Cyprus, Malta, **Italy**, Greece
North-Eastern Europe	Estonia, Latvia, Lithuania, **Poland**, Slovakia, Czech Republic
South-Eastern Europe	Slovenia, Croatia, Hungary, Bulgaria, **Romania**

5 climate zones

(Northern Europe, Western Europe, Southern Europe, North-Eastern Europe, South-Eastern Europe)

6 building types

(single-family houses, small multi-family houses, large multi-family buildings, offices, wholesale and retail buildings, and educational buildings)

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Examples

THE BUILDING:

Building type	Non-residential (office building)
Location	Bettembourg, Luxembourg
Surface area	2200 m^2 **Construction year** 2014
Specificities	The NeoBuild building is a pilot project for environmental performance and renewable energy production. It allows testing novel technologies, materials and building components

MAIN TECHNICAL CHARACTERISTICS:

- EPC* class A
- Heat pumps (ground to water & air to air)
- Solar panels (thermal & PV) on the roof and on several sides
- Energy storage on site
- No active cooling

HOW THE SRI WAS ASSESSED:

Assessment carried out by LIST. Use of the detailed service catalogue available in the SRI assessment package (available on request at https://ec.europa.eu/eusurvey/runner/SRI-assessment-package).

OUTCOMES OF THE SRI ASSESSMENT:

Overall SRI score: 67%

Scores per impact criteria:

Energy efficiency	81%
Maintenance and fault prediction	52%
Comfort	75%
Convenience	61%
Health, well-being and accessibility	62%
Information to occupants	59%
Energy flexibility and storage	68%

Scores per technical domains:

Heating	74%
Cooling	-
Domestic hot water	57%
Ventilation	60%
Lighting	85%
Dynamic building envelope	45%
Electricity	43%
Electric vehicle charging	0%
Monitoring and control	60%

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ASPECTS POSITIVELY IMPACTING THE EVALUATION:

- Heating control by zone
- Variable velocity circulation pump and smart control
- Predictive control of hot water storage (for heating)
- Smart DHW management in conjunction with PV generation
- Air quality indicators per zone
- Lighting: smart actuation with presence sensors
- Smart blinds system management and fault detection
- Smart electric energy storage, optimisation of self-consumption
- Photovoltaic production
- Energy reporting via a common application
- Single platform for smart management of HVAC, blinds & lighting

** DHW = domestic hot water*
** HVAC = heating, ventilation and air conditioning*

IMPROVEMENT POTENTIAL:

To increase the overall SRI score from 67% to 91%:

DECISIONS	Smart grid implementation: building systems responding to electric grid signal	Intelligent charging stations on at least 10% of parking spaces (user indication of charge and control at vehicle level)	Predictive management & occupant feedback for blinds, heating, DHW, ventilation and battery charging. Smart control depending on occupancy and weather conditions
ACTIONS	Involvement of the DSO and configuration of systems	Installation of a sufficient number of adequate EV charging stations	Data analysis and prediction models to develop and deploy
IMPACTS	Increased energy flexibility and storage	Better convenience, improved information to occupants, increased energy flexibility and storage	All SRI impact criteria improved by such a broad action

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Smartness levels of services

Functionality levels of smart ready service A		Pre-defined scores (between 0-3) per smart ready service						
		Energy efficiency	Maintenance and fault protection	Comfort	Convenience	Health, well-being and accessibility	Information to occupants	Energy flexibility and storage
Level 0	Non-smart	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]
Level 1	…	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]
Level 2	…	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]
Level 3	…	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]
Level 4	Maximum smartness	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]	[0-3]

Domain	Smart ready service	Functionality level 0	Functionality level 1	Functionality level 2	Functionality level 3	Functionality level 4
Heating	Heat emission control	No automatic control	Central automatic control	Individual room control	Individual room control with communication between controllers	Individual room control with communication and presence control

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Implementation pathways

- Linkage of the **SRI to the EPC** so that an SRI assessment is triggered each time an EPC is about to be issued
- Linkage of the SRI to the construction of **new buildings and major renovations**
- **Market-based voluntary scheme** based on self-assessment and supported by on-line tools and 3rd party certified bodies for **those willing to pay**
- **Market-based voluntary scheme** based on self-assessment and supported by on-line tools and 3rd party certified bodies **subsidised by the state/utilities** in the context of promoting flexibility, energy efficiency, self-generation, etc.
- Linkage to the **Building Automation and Control Systems (BACS) and Technical Building Systems (TBS) deployment**, drawing from Articles 8, 14 and 15 of the EPBD
  - Article 8 provisions the installation, upgrade, and replacement of TBS and measures to encourage the deployment of automatic temperature regulation and zoning
  - Articles 14 (heating inspections) and 15 (cooling inspections) require all **non-residential buildings** with equivalent rated capacity for heating/cooling > 290 kW to have BACS by 2025
- Linkage to the **roll-out of smart meters**
- **Mix of the above** based on subsidies, financial instruments, etc.

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