A2PBEER – Affordable and Adaptable Public Buildings through Energy Efficient Retrofitting

Train the Trainer Workshop

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TECNALIA

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Technologies

Type of Technologies

There are four types of technologies:

1. State of the art technologies
2. Innovative building solutions already available for the market at small scale that still require validation in Demo Buildings
3. *"technologies which have already been proven at a small scale and need a larger scale demonstration."* (RTD activities are needed to evolve from lab prototype to building solution)
4. New Technologies for the world

Location / Domain	Technologies/ Retrofitting Strategies	Cost effectiveness	Compatible with continued operation	Replicability in Public District	Advantages and Disadvantages	Needs of innovation for specific use in Public district retrofitting	A²PBEER approach
FAÇADE	Replace all facade	Low	Very Low	Low	It is very intrusive and unsustainable.	None	Considered suitable for limited cases
	Ventilated façade	High	Very high	High	Easy to install. Require large thicknesses of insulation. Good for buildings aesthetics	Reducing the thickness in any environment.	Development and demonstration of a ventilated facade based on VIPs (1)
	ETHICs façade	High	Very High	High	Easy to install and lightweight. Depends on building type.	None	Recommendations and guidelines through the methodology
	Projected Insulation	Low	High	Medium	Easy to install but the projected products are unsustainable.	None	Considered suitable only for limited applications.
	Internal insulation	High	High	High	It is compatible with protected facades. Large thicknesses requirement and the system can be intrusive.	Reducing the thickness in any environment. Industrialised solution is required to reduce the impact in the building users.	Development of internal insulation system based on VIPs (1)
	Core Insulation	Medium	Medium	High	Very intrusive and the homogeneity of insulation is not been guaranteed	New expansive materials	Considered suitable only for limited cases
	Solar Wall	Medium	Low	Low	It is a singular system that requires specific conditions	Industrialization of the system	Considered suitable only for limited cases

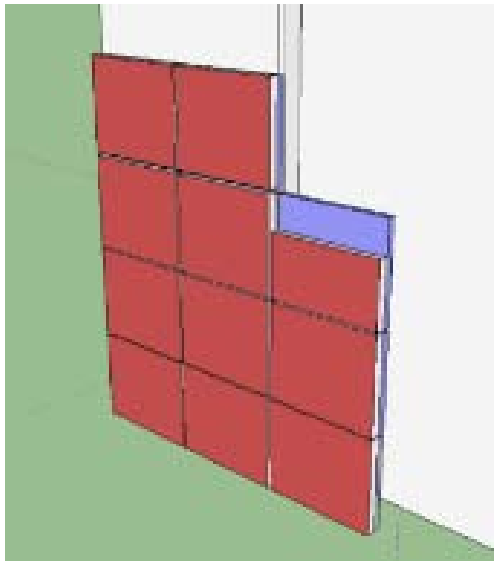
OPENINGS	Duplication	Low	Very High	Medium	Not suitable for “Deep retrofitting”	None	Considered suitable only for cases with low budget
	Existing window improvement	Medium/ Low	High	Medium	Improvement of the tightness but not the thermal conductivity.	None	Considered suitable only for limited application but not for deep retrofitting
	Multi-layer glazing	High	High	High	It is a good solution for improving the energy efficiency of buildings.	None	Recommendations and guidelines through the methodology
	Low e-glass	High	High	Very High	It is not possible to separately optimize solar gains for heating and cooling seasons	Adaption of its filtering capability to the climatic conditions of environments and to the thermal loads	Development of a reversible window system (1)
	X-chromic windows (Photo, electro,..)	Low	High	Low	High price and for very specific situations	None	Considered suitable only for limited cases
	Static shading elements	High	Very High	High	Regulations hampers the implementation	Innovation is not demanded	The methodology will include it
	Dynamic shading elements	Medium	Very High	High	Regulations hampers the implementation	Innovation is not demanded	The methodology will include it
ROOF	Roof insulation	High	Very High	Very High	There are a lot of demonstrated technologies	None	The methodology will include it
	Roof covering	Medium	Very High	Very High	There are a lot of demonstrated technologies	None	The methodology will include it
INTERIOR	Optimizing natural lighting sources	Very high	High	Very High	There are several natural lighting systems but they are quite expensive and very intrusive.	Development of a solution kit that combines natural lighting systems, efficient artificial lighting and management.	Set Solution that combines natural light systems, efficient artificial lighting and management control system. (2)
	Efficient artificial lighting sources	Very high	Very High	Very High	There are a lot of technologies in the market	Innovation is not demanded	
	Lighting systems control	Very high	Very High	Very High	Regulation of artificial lighting without taking into account the specific needs of each end user	Design a lighting system control improving the energy efficiency of the lighting system.	

HVAC	Mechanic ventilation	Low	Medium	High	Improved indoor air quality and economizer operation	Minimize installation process impact on building operation	Considered suitable only for limited cases
	Mechanic ventilation with Heat recovery	High/ medium	Medium	High	Improved indoor air quality and reduction of energy consumption linked to ventilation	Minimize installation process impact on building operation	Recommendations and guidelines through the methodology.
	Heating/cooling generation systems	High	High	High	Improvement of performance. Operation cost reduction	Minimize installation process impact on building operation	Development of a flexible and modular system (at building and district scale) that optimises thermal network taking into account the building systems, district systems, RES and the management systems. (2)
	CHP	Very High	High	High	Energy cost and environm. impact reduction through distributed electricity generation.	Improved integration with district thermal network. Bidirectional building node	
	Absorption	Very High	High	High	Energy cost and environm. impact reduction through solar cooling and integration with smart thermal network.	Improvement in the integration with solar installations and district thermal network.	
	Short term Thermal Energy storage	Very High	High	Medium	Optimization of the integration and performance of the solar cooling system and the thermal network	Minimize installation process impact on building operation. Improvement the integration with solar cooling system and with thermal network	
	Heating /cooling distribution/emission subsystem	High	Medium	High	Improved energy performance. Comfort and performance improvement through low T^{o} systems and optimization of thermal zoning	Minimize installation process impact on building operation.	
	Biomass boiler	Medium	High	Medium	Environmental impact reduction through renewable fuel use	Minimize installation process impact on building operation.	
RES	Photovoltaic	Medium	High	High	Energy cost and environmental impact reduction through renewable used for electricity, heating and cooling.	Improved building integration	
	Solar thermal	High	High	High		Improved integration with building heating and cooling systems	
	Solar concentrator	Medium	High	Low		Verification of applicability and improved integration with building CHP and heating and cooling systems	
MGT	BEMS	High	High	Very High	Improved comfort and energy performance. Operation cost reduction	Integration of building scale control and Thermal network control	

A2PBEER Technologies

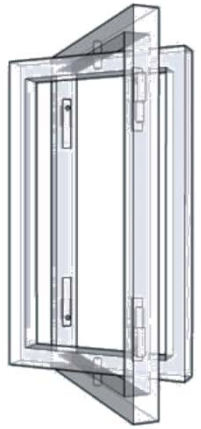
kit 1. HIGH PERFORMANCE RETROFITTING ENVELOPE

1. 1 DEVELOPMENT A SUPER-INSULATED **FAÇADE** RETROFITTING SYSTEM (External and internal)



The project proposes the development, evaluation and demonstration of a solutions kit based on a Super-Insulated industrialized façade retrofit system. This KIT will be adaptable and affordable for each type of Public Building and climate, and will take into account the different building restrictions.

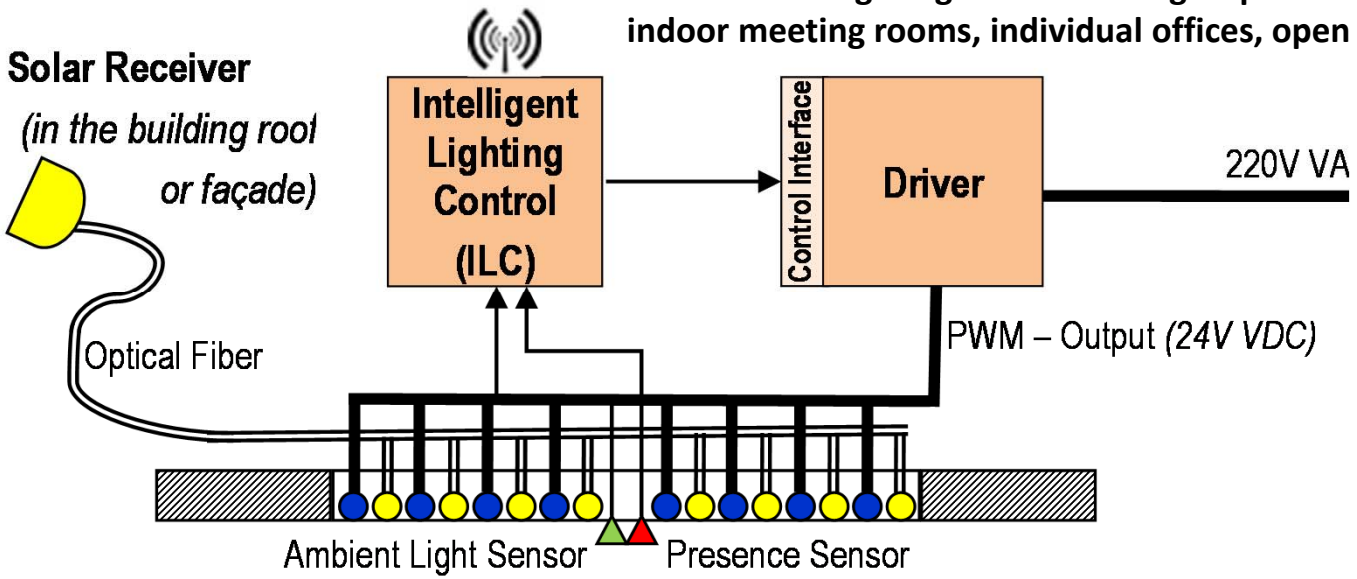
1. 2 SMART RETROFITTING **WINDOW**



A new windows kit solution will be developed into the project based on a new fitting system.

kit 2. SMART LIGHTING SYSTEM

The developed Kits will consist on a Set of solutions enabled to cover the different lighting needs existing in public buildings. For instance, indoor meeting rooms, individual offices, open spaces, corridors,…



Four types of systems are envisaged:

- The luminary with just **LED** lighting. The cheapest and most simple one. It is suitable for buildings where the sun lighting is not enough and the users control lighting.
- The luminary with **LED + Intelligent System**. This one will integrate a presence and lighting control, extending the previous one by controlling the presence in the lighting area.
- The luminary with **Optical fiber + LED**. It would be the current L2Hybrid. Nevertheless the improvement could be a lighting control in order to automatically compensate the lack of natural lighting throw the fiber with the artificial lighting through LEDs.
- The luminary with **Optical fiber + LED + Intelligent System**. This one will integrate a presence and lighting control, extending the previous one by controlling the presence in the lighting area.

kit 3. SMART DUAL THERMAL NETWORK

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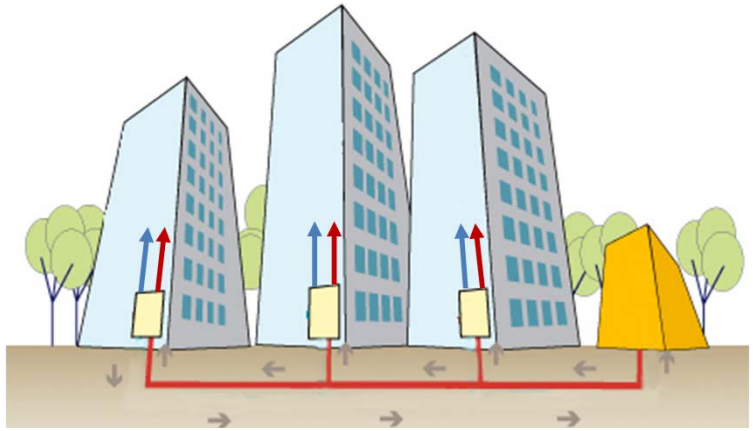

The A²PBEER project will make use of the already available hot water generation and distribution system, to meet the cooling requirements of the district. In order to implement such approach it will be necessary to deploy at building scale absorption technologies and solar thermal systems with short term storages. Building scale short term storage integration will enable to maximize the use of available **free solar energy**.

At the same time, and to take advantage of the possible complementarity of the different usage patterns of the buildings of the district, **bidirectional heat exchange** will be implemented between the buildings and the district heating system. **bidirectionality** will allow optimizing the solar production and the storage capacity at district scale, enabling the arrangement of the individual solar thermal collector systems and their associated storages in a virtual centralized plant. The functionalities necessary to implement the double transition from existing unidirectional heating networks to bidirectional heating and cooling networks in which heating and cooling can be provided to the building from a single connection to the district network, and the direction of the energy flow is optimized according to the instantaneous balance of the building and the network, are provided by the innovative and multifunctional approach of the building **Smart Dual Thermal Substation**.

Thank you for listening!