Interreg Sudoe

3SqAir

European Regional Development Fund

SUSTAINABLE SMART STRATEGY FOR AIR QUALITY ASSURANCE IN CLASSROOMS

Deliverable

Case Studies (3.2.1)

Demo-site 2 - Spain University of the Basque Classroom 2.1

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SUMMARY

The 3SqAir project is a multi-partner and cross-border project. Its main goal is to design a “Smart” and “Sustainable” action plan, to ensure, through a common quality approach, the indoor air quality of French, Spanish and Portuguese educational buildings.

1-OBJECTIVES:

The Deliverable 3.1.2-Best Practices guidelines and criteria indicators for better Indoor Air Quality in classrooms - was developed within the scope of the Activity 3.1of the project 3SqAir. The objective of this technical report is to define and present feedback on a remarkable indoor air quality (IAQ) management operation, through a reference framework of IAQ criteria in order to assess the inclusion of IAQ in school buildings.

This reference framework was established as part of the task 3.1.2 of the 3SQAIR project, the deliverable of which can be downloaded from the project website www.3SqAir.com

The approach has a dual objective:

- improve stakeholder knowledge on how to manage IAQ in their own buildings;
- propose a common methodology for comparative studies on “best practice” case studies.

1.1 – Methodology:

The objective of the 3SQAIR project is to define **RIS3**[1] strategies to improve indoor air quality IAQ in classrooms. One of the levers to achieve this objective is to share best practices (BP) with all stakeholders in order to enhance their knowledge, and consequently, their practices. To this end, we propose to identify the major action criteria to help stakeholders to improve IAQ in educational buildings.

Our work consisted in drawing up a first state of the art of methodologies for assessing the IAQ in educational buildings. This first analysis made it possible to identify a list of IAQ improvement levers considering technical and organizational. And, we propose a simplified methodology assessing a synthesis profile of the IAQ for feedback from operations.

In fact, the characterization of IAQ has many components, themselves linked to the complexity of the life cycle of a building. Such an analysis must be holistic because the IAQ of a classroom also depends on organizational aspects (maintenance and management of real estate), sociological (behavior and comfort of the occupants), economic (available resources) and even political considerations (exemplary public policies for contractors).

We propose a baseline to define common criteria for promoting best practices in IAQ in classrooms, which also lays down common guideline settings for smart, sustainable and energy efficient IAQ solutions.

[1] RIS3 = Research and Innovation Strategies for Smart Specialisation

Through a selective bibliographic study and an in-depth presentation of the modeling of IAQ pollutants, we have identified 10 major indicators for the inclusion of IAQ, classified into 2 areas:

1) BUILDING FACILITIES: "TECHNICAL SOLUTIONS ON IAQ AND VENTILATION"

A) POLLUTANT SOURCES
B) INTAKE AND EXHAUSTS
C) FILTRATION
D) AIR RENEWAL SYSTEMS
E) AIR PURIFICATION

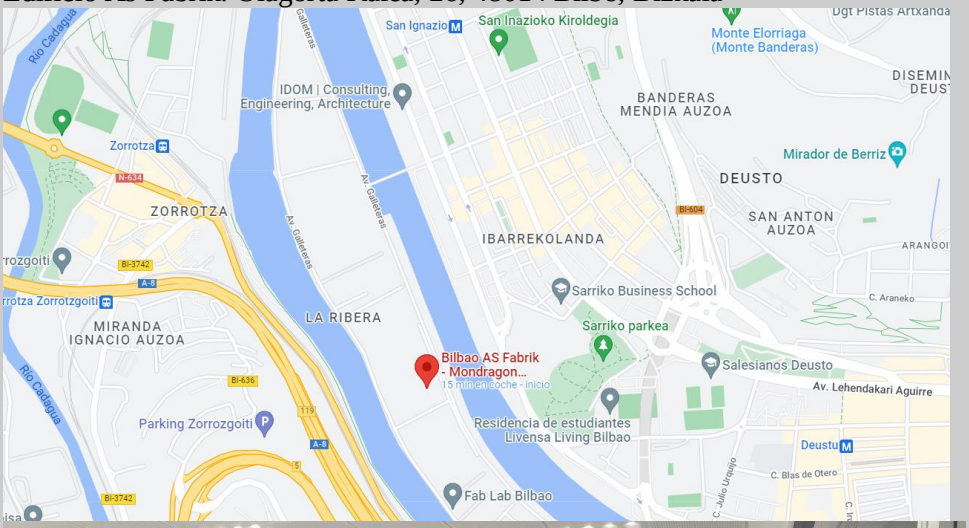
2) STAKEHOLDERS ORGANIZATION: "MANAGEMENT"

F) COST
G) OCCUPANTS' COMFORT AND BEHAVIOR
H) COMMUNICATION AND QUALITY MANAGEMENT SYSTEMS
I) MAINTENANCE
J) SUSTAINABILITY (ENVIRONMENTAL IMPACT & ENERGY EFFICIENT STRATEGIES)

This report offers a common reference simplified methodology to establish comparative studies on IAQ in educational buildings. This methodology constitutes a basis for the practical resource (best practices experience feedback case studies) for stakeholders that have to be produced within the 3SqAir project, through the eponymous online platform website. It will be used to build an analysis framework for the 12 operations that are the subject of experience feedback as part of task 3.2.1 of the 3SQAIR project.

2-CASE STUDIES: [name of operation]

2.1 – General Description

Demo-site / Name	
Location	Edificio As Fabrik. Olagorta Kalea, 26, 48014 Bilbo, Bizkaia  
Year building / Renovation	Year building 1950 /Renovation 2020
Number of building	As Fabrik – Beta II
Total occupancy	750
Surface	9000 m2
Educational stage	University

2.1.1 – BUILDING FACILITIES: TECHNICAL SOLUTIONS ON IAQ AND VENTILATION

A) POLLUTANT SOURCES:

The Outdoor Environmental Zone			**The Indoor Environmental Zone**		
	Yes	No		Yes	No
Urban area	X		Maintenance products used for interior cleaning	X	
Rural area		X	Room's Activity	X clasrooms	
Industrial area nearby	X		Wall and floor coverings	X Floor: phenolic raised floor Wall: painted pladur and glass	
Nearest gas station (less than 1km)		X	Luminaire type	X Led	
Commercial zone		X	Heating method	X Mechanical ventilation with heat recovery VHR with post-heating and cooling battery + fan coils with water tank	
Parking lot	X				
Presence of electromagnetic waves	X High voltage tower and telephone antenna				

B) INTAKE AND EXHAUSTS:

8 circular 60 cm diameter grilles for heating and cooling fan coil and 4 ventilation grilles for heat recovery 60x60cm without flow regulator inside the classroom.

Intake and Exhausts Information's	
Self-adjusting	no
MECHANICAL VENTILATION	
humidity-controlled air inlets	Humidity and temperature sensors in heat recovery units.
humidity-controlled air outlets	
NATURAL VENTILATION	
Air entry/evaluation through openings	Windows. Possible to open but limited due to the energy efficiency of the building.

C) FILTRATION:

Filtration Information's	
AIR CONDITING	
Type of maintenance	Periodic
Upkeep	Change of filters
Frequency	6 months
VENTILATION	
Type of maintenance	Periodic
Upkeep	Change of filters
Frequency	6 months
HEATING	
Type of maintenance	Same system as air conditioning
Upkeep	
Frequency	

D) AIR RENEWAL SYSTEMS:

Air Renewal System Information's	
Planned air change rates	Planned 45 m3/person.
Possibility opening windows	[X] yes Limited [ ] no
Windows operability	[X] single-hung [ ] French window (casement) [ ] slinding [ ] tilt and turn [ ] pivot [ ]
Air renewal system	[X] natural ventilation [ ] single-flow [X] double-flow [ ] over-ventilation at night
Air System	[ ] mechanical [X] programmed [ ] automated [ ]
Flowrate	Instalaciones existentes: 1 MVHR with heating and cooling battery 25000m3/h – classrooms 2 MVHR with heating and cooling battery 10000 m3/h – classrooms 1 MVHR with heating and cooling battery de 6500 m3/h – coffee shop 1 MVHR with heating and cooling battery de 5000 m3/h - auditorium 1 MVHR with heating and cooling battery 1500 m3/h - office
Ventilation protocol	Classrooms – from 7:00h to 20:00h For common areas the timetable changes depending on the use
HEATING MODE	
Summer	Off
Winter	On – target temperature 19 ºC
Air conditioning	On (summer) – target temperature 27 ºC

Example:

The buildings are equipped with dual-flow ventilation systems from CALADAIR in educational buildings and France AIR, MODULYS DP 12/12 for the restoration room achieving:
•2700 m3/h air flow in building 7,
•4730 m3/h air flow in building 4 (kitchen and restoration room),
•3120 m3/h air flow in buildings 5 and 6.

Renewable energy generation is also in place:
•2x Viessmann Solar 25-60 solar panel on building 4,
(Since COVID-19 pandemic, 1 or 2 windows are always open in tilted position at presence of the students)

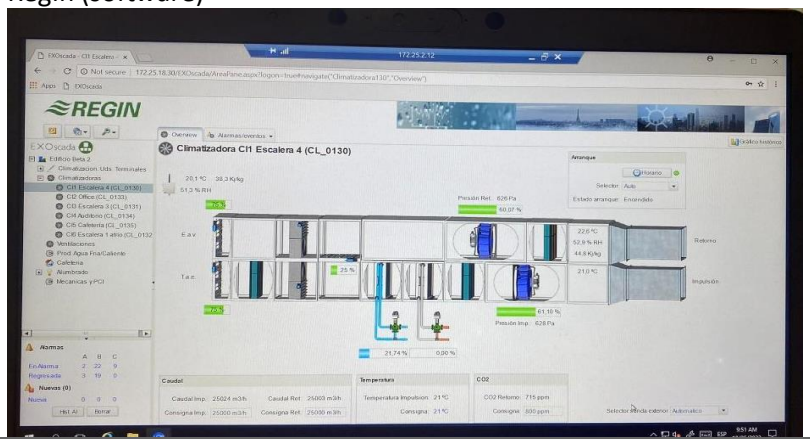
E) AIR PUTIFICATION:

Air Cleaning Information's	
Use and type of purifier	no
Mode of operation	no

2.1.2 ORGANIZATION OF STAKEHOLDERS – BUILDING MANAGEMENT:

Indicate the maintenance manager(s) of the site's various systems and the service providers.
Explain their role and importance in the decision chain.

The building management is done by the maintenance person of the building, and there is a external provider for the specific maintenance of each machine.

Building Management Information's	
Type of system	BMS – Used by the responsible for maintenance and energy management of the building.
Companies	Regin (software) 

F) COST

Cost Information's	
Consumption (kWh)	2021-2022 Course Winter: 30.000 Kwh. Spring: 20.000 Kwh 2022 Course Autumn: 27.600 Kwh (increase expected due to increase in heated usable area)
Surface building (m^2)	9.000 m2
Price (€)	Comsuption sept 2022: 6.429+IVA / 1697+IVA High voltage
Energy (Type of energy is the site using)	Electric
Energy's comsuption	

This is to quantify the building's energy cost. Any piece of information on the cost of air renewal will be of interest.

Energy source Information's	
Type	Electric
Nominal power	4,50 Kw
Annual Electric consumption	300.000 Kwh
Annual thermal consumption	Non-unbundled consumption
Renewable energy power	Geothermal 
Annual electric generation	No

G) OCCUPANTS' COMFORT AND BEHAVIOR

Occupants' Comfort Informations		
Description of activities	Classrooms	
Frequency of site occupancy	From 8:00h to 20:00h	
Accommodation capacity	40 persons	
Presence of vegetation	[ ] yes	[x] no
Ability for occupants to control:		
Ventilation equipment	[ ] yes	[x] no
windows	[ ] yes	[x] no

H) COMMUNICATION AND QUALITY MANAGEMENT SYSTEMS

No elements

Quality Management Systems Information's	
Certification 1 -	
Date of last acquisition	
Support procedures have been put in place	
Certification 2 -	
Date of last acquisition	
Support procedures have been put in place	
Certification 3 -	
Date of last acquisition	
Support procedures have been put in place	

I) MAINTENANCE

Empresa a cargo del mantenimiento: Ondoan

Maintenance Frequency Information's	
Ventilation	six-monthly
Filter	six-monthly
Air inlets	six-monthly
Extractions	six-monthly
Room cleaning	Daily
Exterior	-
Vegetation	-

J) SUSTAINABILITY (ENVIRONMENTAL IMPACT AND ENERGY EFFICIENCY STRATEGIES)

Sustainability refers to the ability to maintain or support a process continuously over time. Sustainability seeks to prevent the depletion of natural or physical resources, so that they remain available over time.

Sustainability Information's	
CO2 emissions reduction	
Material and equipment life cycle analysis	
Means implemented to ensure the sustainability of the facilities	
IDENTITY CARD	
Actions	
Resources	
Objectives	

Actions: *how to protect, how to restore and manage?*

Resources: *production and consumption mode*

Objectives: *ex: energy saving - use of solar panels*

3-CONCLUSION AND PERSPECTIVES

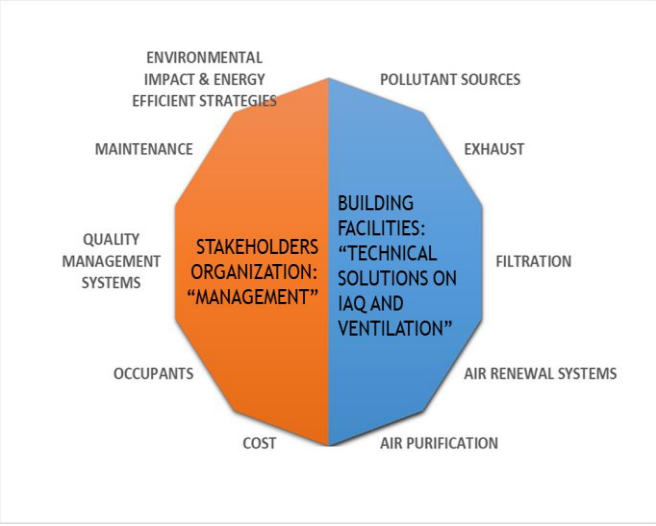
This work proposes a methodology for evaluating the IAQ in educational buildings. Through a deliberately simplified approach, we have defined a baseline based on two domains describing the building's facilities and the organization of the whole stakeholder chain actors.

A summary of the multi-criteria analysis for this operation is presented in the form of a radar made up of the 10 benchmark indicators, established in task 3.1.2 of the 3SqAir project.

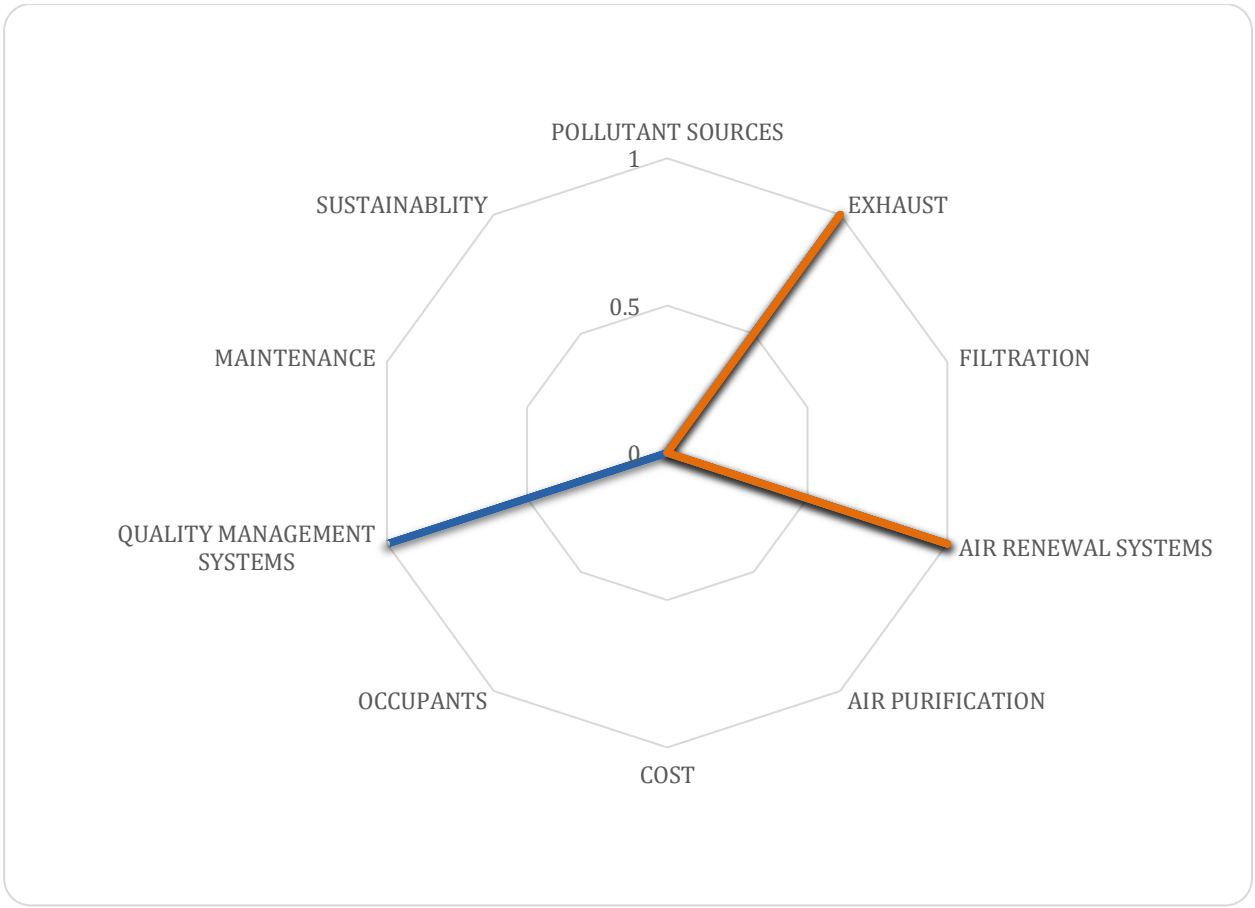
We have previously indicated that this type of analysis requires a transversal (holistic) approach, since all these criteria are interconnected and influence each other. In order to determine the relevance of taking into account the IAQ of a building, we propose to carry out a two-step approach:

1)First, an analytical approach: characterization of each of the 10 criteria separately, through a qualitative or quantitative approach;

2)Secondly, a global synthesis, through a graphic representation in the form of a "3SqAir profile", with a radar representation, according to the a “basic” or “thorough” rating scale (see below, an example of fictive radars on the basis of a 1-5 scale, with a representation mode).



For operation Eraikune Classroom 2.1 UPV/EHU, the result is as follows:



This result was established after a collective analysis of all operations, during the workshop held in Coimbra (Portugal) on 08/11/2022. During this workshop, the partners presented the 12 feedbacks and voted collectively to define the level of performance for each criterion and establish the corresponding radar profile.