ARCAS

New assessment Methodology for social, sustainable and eco-friendly housing. Climate architecture for the Sudoe's area

COMMUNICATION GUIDEBOOK

-

INTRODUCTION TO THE ARCAS PROJECT

ARCAS – Arquitectura para el Clima (arcassudoe.eu)

2023

Version 0.1

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ARCAS - New assessment Methodology for social, sustainable and eco-friendly housing. Climate architecture for the Sudoe's area,

Communication Guide : Introduction to the ARCAS project (Publication version 0.1)

Abstract

ARCAS focuses on the SUDOE's climatology and offers an instrument, based on key indicators, to allow the design of buildings, which maximize the energy efficiency and the air quality and promote the social well-being thanks to the use of the best available techniques.

This project has received funding from the European Union's Interreg Sudoe Programme under grant agreement no SOE3/P3/E0922

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I – ARCAS Communication guidebook

I.1 – Overview of the ARCAS project

I.1.1 – ARCAS project

The ARCAS project aims to develop an evaluation and design methodology for the rehabilitation of buildings and group of collective buildings for social interest housing, with the objective of addressing energy poverty and promoting sustainable rehabilitation, energy efficiency and health in the Sudoe territory. The project is based on the integration of three research axes:

- Energy autonomy / Efficiency
- Social quality / Energy poverty
- Air quality / Health

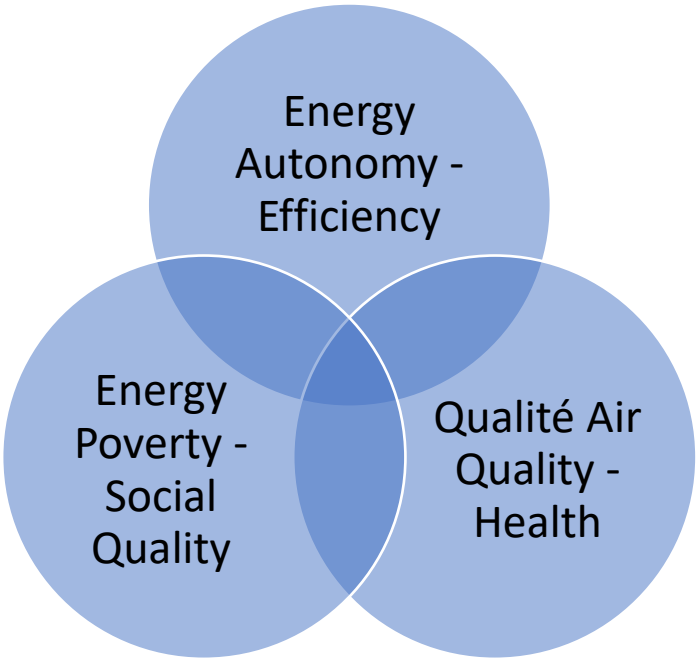

Figure 1 – ARCAS research axes

As a result of this integration, the aim is to determine the optimum relationship between the three axes mentioned and to obtain the best energy efficiency while maintaining social quality and the well-being of citizens.

ARCAS is based on the use of similar climatology in the South Atlantic Arc for the development of a tool that allows, through key indicators, the design of building architecture based on maximizing energy efficiency, air quality and thus promoting social welfare, making use of the best available techniques, including renewable energy sources.

This project brings together efforts to develop strategies and measures to facilitate national, regional and local governments to develop policies for the retrofitting of collective housing buildings with high autonomy and energy efficiency (Axis 1), with healthy air quality

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for the building occupants (Axis 3) and reducing the energy poverty so important in many European countries (Axis 2).

The ARCAS products will be applicable and replicable in the public and private institutions involved in the project and will be particularly useful for professional associations, manufacturers, builders and national, regional and local public administrations.

The Action Plans that will be developed in an integrated way on the three axes of the research project by the ARCAS beneficiaries, in collaboration with the ARCAS associated partners, constitute a key element that will ensure the transfer of knowledge to the whole Sudoe's territory, as well as the future sustainability of the ARCAS methodology.

I.1.2 – Interreg Sudoe Program

About Interreg Sudoe Program

Interreg Sudoe Program is part of the European territorial cooperation objective known as Interreg, which is financed by one of the European structural funds: the European Regional Development Fund (ERDF). The current programming period covers from 2014 to 2020. Its two previous program generations were Sudoe 2000-2006 and Sudoe 2007-2013.

Interreg Sudoe Program is one of the 15 2014-2020 programs included within Interreg B, which promotes transnational cooperation. In addition, there are 60 programs financed through Interreg A, which supports cross-border cooperation and 4 programs financed by Interreg C, which funds interregional cooperation.

What is Interreg Sudoe?

The Interreg Sudoe Program supports regional development in Southwestern Europe, financing transnational projects through the ERDF. The Program promotes transnational cooperation to solve common problems in the covered territory, such as low investment in research and development, weak competitiveness of the small and medium-sized enterprises and exposure to climate change and environmental risks.

The European Commission approved the Interreg Sudoe Program (abbreviation of Cooperation Program Interreg V-B Southwest Europe) on the 18th of June 2015, with a total budget of 141 million euros. The full text of the Cooperation Program is available in English, Spanish, French and Portuguese.

Eligible regions

The projects approved are based on partnerships of public and/or private partners from the regions covered by the Program. The eligible regions are all the Spanish Autonomous Communities (except Canary Islands), the Southwestern regions of France (Auvergne, Nouvelle Aquitaine, Occitanie), all continental regions of Portugal, United Kingdom (Gibraltar) and the Principality of Andorra.

Site web – Contact :

Interreg V Sudoe - Programme Interreg Sudoe - Accueil (interreg-sudoe.eu)

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I.1.3 – ARCAS Project description table

Title	New Evaluation Method for Social Interest, Sustainable and Energy Efficient Homes -Architecture for the Climate- in the Sudoe's area
Acronym	ARCAS
Code	SOE3/P3/E0922
Total eligible cost	1.316.911,38 €
FEDER FOUNDS	987.683,54 €
Duration	43 Months 01/10-2019 - 31/03/2023
Main beneficiary	Fundación Estudios Calidad Edificación Asturias
Other beneficiaries	Universidad del País Vasco/Euskal Herriko Unibertsitatea Escuela de Ingenieria de Gipuzkoa Máquinas y Motores Térmicos Université de La Rochelle Laboratoire des Sciences de l'Ingénieur pour l'Environnement – UMR 7356 CNRS TIPEE Universidade do Minho Escola de Engenharia Consejería de Obras Públicas y Vivienda del Gobierno de Cantabria
Sectors	1.- Environmental services (management and protection of risks and biodiversity) and energy (production, distribution and storage technologies from renewable sources) air quality and emission control 2.- Improvement of energy efficiency 3.- Use of renewable energies in homes
Specific goal	Improve energy efficiency policies in public buildings and housing through networking and joint experimentation. (Objective 4.C.1)
Program priority	Contribute to greater efficiency in energy efficiency policies
Thematic objective	Favor the transition to a low-carbon economy in all sectors. (AXIS 3: Low Carbon Economy))
Investment priority	Supporting energy efficiency, smart energy management and the use of renewable energy in public infrastructures, including public buildings and homes.
Field of intervention	014 – Renovation of the energy efficiency of existing buildings, demonstration projects and support measures

Table 1 – ARCAS Project Description

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I.2 - ARCAS Project Partners

I.2.1 – Main project partners

Fundación Estudios Calidad Edificación Asturias (FECEA)

The Estudios Calidad Edificación Asturias Foundation (FECEA) is a private, not-for-profit foundation that gathers in its governing board all the most important agents of the construction sector in Asturias.

The foundation is chaired by a representative of the Asturias Government, who most contributes to its budgets. Established in 1989, FECEA has acquired extensive experience on the sector since then by promoting several initiatives aimed at qualifying building systems and the use of materials, by establishing legislations, by developing a better technical and vocational training and by contributing to the improvement of local and regional policies in the area of energy and sustainability, either for buildings or for the city construction/reconstruction.

FECEA is the coordinator of the project and is responsible of the ARCAS computer tool design and development.

Project Manager :
Arturo Gutiérrez de Terán

Contact(s) :
Emilio Suárez
Manuel García

Universidad del País Vasco/Euskal Herriko Unibertsitatea

ENEDI research group (Energy in Buildings) of the Universidad del País Vasco / Euskal Herriko Unibertsitatea (UPV/EHU) focuses its activities on energy efficiency research in buildings, both in terms of wraparound and installations.

Its most outstanding competences for the ARCAS project are, i.a., the thermal characterization of materials, the energy monitoring of buildings, the improvement of energy efficiency and the integration of renewable energies, as well as the development of methodologies for energy assessment of housing.

Contact(s) :
Iván Flores Abascal
Moisés Odriozola

La Rochelle Université

One of the research axes of the Laboratoire des Sciences de l'Ingénieur pour l'Environnement (LaSIE) of La Rochelle Université (ULR) concerns quality of indoor/outdoor environments, which includes the study of adsorbent materials, energy efficiency of air conditioning systems and co-optimization of building and systems design.

Therefore, its scientific contribution to the ARCAS project is a key element for the energy efficiency of buildings and the quality control of inhabited environments.

Contact(s) :
Patrice Joubert
Jérôme Le Dréau

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- **Technological & Innovative Platform for Environmental Efficiency -Tipee**

TIPEE is a sustainable construction technology platform that trains, advises and guides professionals of intelligent construction, focused on indoor air quality, comfort, energy performance, and digital processes applied to buildings (BIM).

In addition, TIPEE is considered as a reference to buildings of high environmental quality assessment; main reason for its participation in the ARCAS project.

Contact(s) :
Jérôme Nicolle
Francis Allard

- **Universidade do Minho**

The Civil Engineering Department of the University of Minho has relevant expertise in evaluating energy efficiency and environmental performance both in new construction and in building renovation. The department has significant experience in building monitoring (indoor environment quality, thermal comfort, energy performance, and indoor air quality) and has been involved in various research initiatives related to the assessment of energy poverty.

In addition, the department has a recognized expertise in sustainability assessment and life cycle analysis in the construction sector. University of Minho participates extensively in the ARCAS project. It leads the work on indoor air quality and energy poverty/social wellbeing and is responsible for the Portuguese case studies of ARCAS.

Contact(s) :
Manuela Almeida
Ricardo Barbosa

Universidade do Minho

- **Gobierno de Cantabria**. Consejería de Obras Públicas, Ordenación del Territorio y Urbanismo

The Ministry of Civil Works, Regional Planning and Settlement of the Government of Cantabria exercises the powers assigned to the Ministry in the areas of renewable energies, energy efficiency and certification, energy saving and energy planning and policy, control and guidance of compliance with building and urban planning legislation.

Within the framework of the ARCAS project, it will contribute to the development of new regulations for building and urban planning, considering criteria of equipment and services, energy efficiency and energy poverty for the improvement of citizens' health.

Contact(s):
Enrique Alonso
Soledad Rodríguez
Ángela Nogués

GOBIERNO de CANTABRIA
CONSEJERÍA DE OBRAS PÚBLICAS, ORDENACIÓN DEL TERRITORIO Y URBANISMO

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I.2.2 – Secondary Partners

Colegio de Arquitectos Vasco Navarro
Ministerio de Fomento
Eusko Jaurlaritza / Gobierno Vasco
Asociación Sostenibilidad y Arquitectura
Consejo Superior de Colegios de Arquitectos de España
Gobierno del Principado de Asturias
Construcciones San Bernardo
Gobierno de Cantabria
Xunta de Galicia
Instituto para la Diversificación y Ahorro de la Energía
Confederación Asturiana de la Construcción
Asprocon
Colegio Oficial de Arquitectos de Cantabria
Colegio Oficial de Arquitectos de Asturias
Ministerio de la Transición Ecológica de España
Office Publique de l'habitat de la Comunnauté d'Agglomeration de la Rochelle
Cámara Municipal de Guimaraes Portugal
Cámara Municipal de Braga Portugal

I.3 – Recipients

This Project is intended for:

- Innovation and Technology Transfer Managers
- Actors of the environment and sustainable development
- Other public or social interest entities and NGOs

I.4 – The ARCAS document structure

This document is the communication guidebook for the ARCAS Project. This guidebook will allow you fully understand the objectives of the project as well as to understand the ARCAS calculation tool and finally it will help you to follow the different steps to obtain the ARCAS Certification.

Consisting of the 3 manuals:

I - Communication Guidebook
II - User's Guidebook
III - Certification Guidebook

This guidebook will allow you to better navigate between the different parts, to find your way around, and to accompany you when you will encounter difficulties with ARCAS. It is a general directory of the project, composed with the aim of helping users and all the people contributing to obtain and/or develop the ARCAS Certification.

We wish you a good reading.

Kind regards,

The entire ARCAS team.

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I.5 – How this ARCAS Guidebooks works?

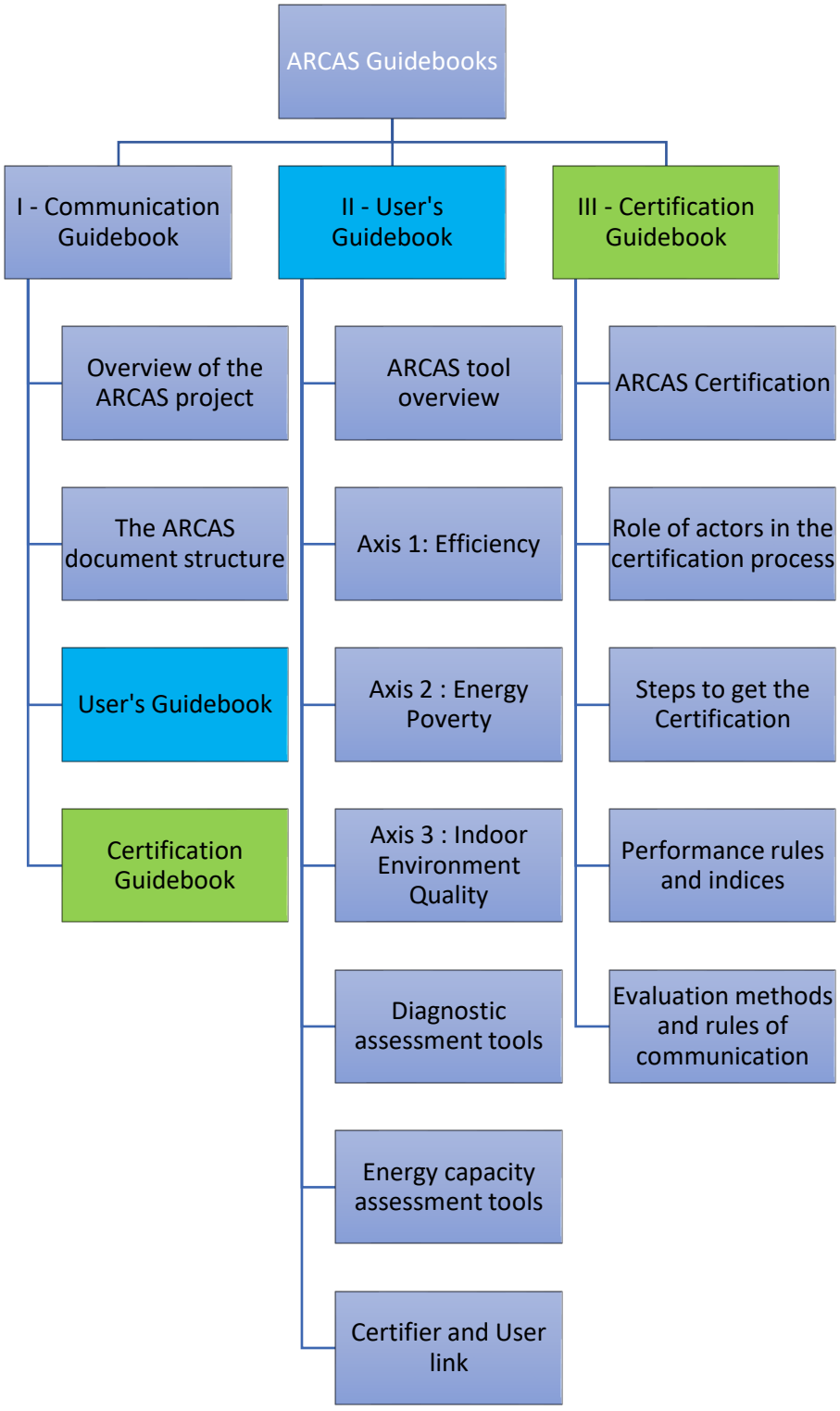

Figure 2 – ARCAS guidebooks structure description

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II - User guidebook

II.1 - ARCAS tool overview

II.1.1 – Who can make use of this guidebook ?

- Property administradors
- Building maintainers
- Building owners and users
- Public Administrations.
- All technicians involved in the design, execution and maintenance of buildings, mainly architects, engineers, technical architects.

II.1.2 – How the ARCAS tool works?

The ARCAS project aims to develop an evaluation and design methodology aimed at the rehabilitation of buildings and groups of collective buildings of social housing, with the aim of addressing energy poverty and promoting sustainable rehabilitation, energy efficiency and health in the Sudoe territory.
As a result of this integration, it is intended to determine the optimal relationship between the 3 axes mentioned and obtain the best energy efficiency while maintaining social quality and the well-being of citizens based on the use of similar climatology in the South Atlantic Arc.

This project joins forces for the development of strategies and measures that facilitate national, regional and local governments to develop policies for the rehabilitation of collective buildings of housing of great autonomy and energy efficiency (axis 1), with a healthy air quality for the occupants of the buildings (axis 3) and reducing energy poverty so important in many European countries (axis 2).
The result is a traffic light that indicate the evaluation of the building according to the ARCAS project.

The ARCAS project defines two profiles:

- User profile

The technician checks the initial situation of the building by estimating the indicators that define the 3 indicated axes.

Knowing the initial situation of the building, the tool allows to simulate possible changes by providing a comparison between the initial situation and the different simulations. These benchmarks help decision-making in the measures to be implemented.

- Certifier profile

For the certification of the building with the ARCAS method, the values that are measured or calculated are introduced in the tool, the estimation of these is not valid.

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Once known the initial state of the building with the measured values, the simulation is performed, with the calculated values, of the project to be developed defining the proposed measures according to the 3 axes that define ARCAS. This project proposal results in a Pre-certification in the ARCAS tool, which will allow access to possible grants, financing, etc.

Once the works are completed, the indicators that define the 3 axes, are measured, thus obtaining the final situation of the building rehabilitated in ARCAS. The tool provides a comparison between the initial situation of the building before the works and the current situation completed the works.

After a period of time to define the useful life of the building, measuring again the indicators, the final certification is obtained in ARCAS.

II.2 – Axis 1: Energy Efficiency

These indices presented bellow will be developed in the User's Guidebook.

II.2.1 – Energy Efficiency Indicators

Axis 1 of the ARCAS tool represents all the indices used to express the positioning of a building in relation to energy efficiency.

The indicators are :

a.- Primary energy consumption : Total primary energy consumption of the building due to heating, cooling, domestic hot water, lighting, and auxiliary services, obtained by direct measurement methods.

b.- Coefficient of heat loss : Total thermal losses of the building through the envelope obtained by direct measurement methods.

c- Energy needs : The heat needed to maintain the regulatory temperature conditions of the building, obtained through the Energy Efficiency Certificate.

d.- Consumption of renewable energy :Description of the building's renewable energy consumption.

e.- Coefficient of self-sufficiency of renewable energy : Relation between the consumption of renewable energy and the total consumption of primary energy of the building.

f.- Production of Renewable Energy : Description of the building's renewable energy production.

g.- Consumption ratio of Renewable Energies : Relation between the consumption of renewable energy and the production of renewable energy in the building.

h.- Global Warming Potential : Reduction of the carbon footprint of the building achieved with the remodelling.

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II.3 – Axis 2: Energy Poverty

II.3.1 – Social Quality and Energy Poverty Indicators

Defined as, to allocate to the payment of the energy of the housing a money amount greater than 10% of the current family's net income.

II.4 – Axis 3: Indoor Environment Quality

Implemented during the ALDREN project in 2017, the TAIL index is an index that measures different elements of indoor environmental quality in a building. It consists of four different domains, which define the acronym of the index:

- T : Thermic Confort
- A : Acoustic Confort
- I : Indoor Air Quality
- L : Luminous Confort

For these four areas we will assign them a quality category, the latter will be determined in relation to various factors predetermined according to the measures. These 4 levels will be represented by Roman numerals (which can easily be replaced by letters ABCD) So we have the following 4 categories:

- I : Good Quality
- II : Normal Quality
- III : Moderate Quality
- IV : Poor Quality

A Category I building means that the environment is good or even optimal. The environment is healthy and there will be nothing to change in the future

A Category II building means that the environment is normal, the environment is quite liveable but it could be improved

A category III building has a moderate environment, the building remains viable but with a certain risk all the same present.

A category IV building shows poor environment, in the long term this can lead to serious sequelae on the health of users, so it must be quickly remedied.

We will choose the most unfavourable case of the 4

II.5 –Diagnostic assessment tools

The availability of climate indicators for the ARCAS area is subject to the density of monitoring stations, their availability and the frequency and time continuity of the measurements.

II.5.1 – Climatological Indicators

In accordance with the requirements of ARCAS and in relation to the axes of Energy and Air Quality, a set of variables of interest have been identified to achieve the objectives that have been set.

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- Air temperature: it is described by the monthly and annual averages of the daily maximum and minimum temperatures corresponding to the same reference period.
- Rain: it includes rain, hail, snow, and some deposits such as dew drops, and other less frequent deposits.
- Air humidity: The moisture content of the air is the amount of water vapor that is dissolved in a given amount of dry air.
- Wind : This variable can be formulated as the monthly or annual speed average, expressed in km/h;
- Insolation and radiation : insolation refers to the time that the solar disk shines against the background of the sky, which causes shadows behind illuminated objects. Global celestial radiation is defined as solar radiation received on a horizontal surface and includes radiation directly from the solar disk, as well as diffuse celestial radiation scattered through the atmosphere.
- Air quality variables : Variables derived from the following pollutants related to air quality have been considered:
    - $PM_{2.5}$: can come from all kinds of combustion, such as cars, trucks, factories, wood burning, agricultural burning, and other activities. They are considered as atmospheric pollutants due to their harmful effects on health.
    - CO_2 : Carbon dioxide
    - CO : Carbon monoxide

II.5.2 – Best technologies available in Renewable Energies and Intelligent Energy Management Indicators

The objective of this section is to present a methodology to identify the best available technologies for the renovation strategy of social collective housing in the ARCAS project climate zone. It includes the definition of indicators and the production of guidelines for the selection and design of passive or active HVAC systems, focusing on those that use renewable energy.

The method consists, from the characteristics of the envelope and HVAC systems of an existing building, to develop a bioclimatic approach, to identify and implement passive heating, ventilation and cooling solutions adapted to the climates of the ARCAS-SUDOE area.

Two main steps can be identified:

1. Establish a catalogue of usual bioclimatic design solutions and the best passive heating, ventilation and cooling solutions adapted to the climates of the ARCAS-SUDOE zone

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2. Propose indicators for energy efficiency, technical and economic aspects, health quality for active systems with a focus on those which use renewable energy.

This method can of course also be used in the design phase for a new construction project.

At the building scale, we can distinguish different items:

- aspects related to the orientation and morphology of the building,
- quality of the envelope, which will allow to minimize the losses/ thermal loads by making the best use of the free resources (solar in particular) while guaranteeing a good comfort of use in all seasons.

- ***Orientation and morphology of a building***
- ***Envelope characteristics and performances***
- ***Reducing the thermal discomfort***
- ***Energy needs and Bioclimatic factor***
- ***Discomfort indicators***
- ***General considerations on HVAC systems***
- ***Energy source or energy vector*** *(Fossils fuels, Electricity, Biomass , Thermal solar, Ground, Water)*
- ***Key factors for the HVAC system selection and pre-sizing***

II.6 – ARCAS tool

The initial situation of the building is checked by estimation of the proposed indicators and the ARCAS tool indicates through a traffic light, the starting point. The tool allows us to simulate different situations by modifying the values of the indicators.

The generation of traffic lights according to the different simulations proposed allows a comparison between the initial situation of the building and the final ; and then to take decisions regarding the measures to be implemented.

Develop the rehabilitation project according to the optimal measures obtained in the ARCAS tool, a pre-certificate ARCAS that allows to apply for different grants and subsidies of the Public Administrations is issued.

Once the rehabilitation is completed according to the project, the building is monitored for a period of time. After it is verified that the consumption results are within the range indicated in the rehabilitation project, the final certification is obtained in ARCAS.

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III – Certification guidebook

III.1 – ARCAS Certification

The ARCAS tool is developed with the aim of providing:

- A common methodological framework
- A multi-criteria methodology thanks to the ARCAS tool
- A link between Certifier and User

III.1.1 – This guidebook is for…

All technicians involved in the design, execution and maintenance of buildings, mainly architects, engineers, technical architects.

III.1.2 – How to obtain the ARCAS Certification?

The steps to follow to obtain the ARCAS building certification are:

1.- To know the initial state of the building. To do so, the measured or calculated values must be introduced into the ARCAS tool; for the ARCAS certification of the building the option to estimate the required values is not valid.
These values can be measured on site in the building or calculated using accredited programs.
2.-Knowing the initial state of the building, the technician responsible for the rehabilitation drafts the project with the proposed measures. In the project and according to the three axes of the ARCAS tool, the values that the building will obtain once the rehabilitation has been carried out will be calculated.
Precertification is obtained in the ARCAS tool, which will allow access to possible grants, financing, etc.
3.-Executed the works according to the drafted project, the building is monitored to measure the indicators that define the 3 ARCAS axes.
After a period -to be defined- of monitoring the useful life of the renovated building according to the ARCAS tool, the final certification is obtained.

III.2 – Role of actors in the certification process

The certification process may involve:

Final customer: that can be a community of owners or public administration as owner of the building. They will be the beneficiaries of energy improvements in the certified building.

Competent technicians: they write the rehabilitation project, make the study of the building in its initial state, supervise the works, issue the final certificate of work.
General Government: Grants or grants with the ARCAS Pre-Certification.
Certification authority: Checks and keeps the documentation sent by the technicians. They issue the ARCAS certificate. They provide training for technicians to use the ARCAS tool.

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III.3 – Steps to obtain the certification

STEP 1.- Initial status report of the building

To make the report of the building in its current state, all indicators must be measured with calibrated and characterized equipment in Annex or calculated with a tool accredited in ARCAS.

- AXIS 1: Energy Efficiency
- AXIS 2: Energy Poverty
- AXIS 3: Indoor Environment Quality

Step 2.- Project proposal for energy rehabilitation of the building

The rehabilitation project of the building will include a report of improvements according to the tool ARCAS, indicating the state of the building once the works are finished.
The Pre- Certificate is issued in ARCAS.

Step 3. –End of work Certificate

Once the works are finished, the competent technician issues the Certificate of Completion. The technician will record and custody all the technical sheets of the materials placed on the building, as well as the photos of execution and placement of these materials on the building, where material thicknesses, technical characteristics, correlation with the projected constructive detail, etc. can be checked.

Step 4. – Building monitoring

With the launching of the rehabilitated building, the building is monitored, calculating, or characterizing each of the indicators of the three AXIS, with the same equipment and calculation tools used in the initial stage.

After one year of monitoring, if the results coincide with those reflected in the improvement measures report with the ARCAS tool, the certification authority issues the ARCAS certificate.

III.4 – Rules and performance index

When considering each indicator in the ARCAS tool, 4 categories have been established, with category IV being the worst and category I the best. Specifically for the proposed indicators in the field of energy efficiency, the ranges within each category are shown below.

Category	I	II	III	IV

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III.5 – Evaluation methods and communication rules

The communication with the certification authority will be done through the web, according to the following communication protocol:

Documents will be sent by e-mail in. pdf format to the following email address: certificacionarcas@fecea.org

PHASE 1.- Includes steps 1 and 2 of the certification process. The initial report issued by the ARCAS tool will be sent as well as the ARCAS characterization report of the project to be developed. Documentation to be provided in pdf format:

- Initial ARCAS report.
- ARCAS Report with the execution project measures.

After checking the data of these certificates by the certification authority, this will issue the ARCAS Pre-Certified.

PHASE 2.- Includes steps 3 and 4 of the certification process. Once the works have been completed and after a year of monitoring, the certificate of completion will be sent to the certification authority, as well as all the technical data sheets of the materials and photos of their execution and commissioning. The measurement reports for each indicator will also be sent.

Documentation to be provided one year after the end of the works:

- Certificate of completion
- Technical data sheets for materials placed on the building
- Inform with photos of the process of execution and commissioning of materials.
- Report with measurements of all indicators during the past year.

Once the documentation provided has been verified and the measurement report data has been reviewed, the certification authority will issue the ARCAS Certificate.

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