Periodic Reporting for period 1 - ABC 21 (Africa-Europe BioClimatic buildings for XXI century)

Reporting period: 2020-09-01 to 2021-08-31

Summary of the context and overall objectives of the project

During the second half of the 20th century, an increase in user expectations as well as thermal comfort and indoor air quality standards has been observed, creating a scenario where buildings are only able
to meet comfort expectations by using large amounts of energy. Europe and Africa are facing challenges in the building construction and housing sector. Europe is struggling with an ageing building stock, whose rapid and radical transformation is needed to meet the goals of reducing energy use and protecting the climate. African countries are facing an acute housing shortage, with the continent’s population projected to double by 2050, and the fastest urbanization rate in the world. Various forms of climate disruption and prolonged heat waves are affecting the planet. These effects are significant in the South of Europe and severe in Africa. New constructions and retrofit interventions should be designed following concepts that will make buildings robust against expected climatic changes during their lifetime, the next 50 to 100 years. In this context, there is a growing need for comfortable and affordable building space with high environmental performance. In particular, there is renewed interest in bioclimatic principles and use of bio- or geo-sourced local building materials in both Continents. Further, continuous development of software models is bringing increased precision and reliability to design-phase predictions of bioclimatic building performance.

With the goal of increasing the energy performance, quality of life and sustainability of West-African buildings, ABC 21 will pursue the following four interconnected objectives: (1) Identify and document African and European affordable bioclimatic designs and local materials; (2) Perform exchange activities for policy makers on low-cost and effective bioclimatic construction; (3) Develop sustainable and cost-effective supply of local construction materials produced by local businesses; (4) Promote innovation on state-of-the-art surface finishings and future weather files.

The consortium partners have collected a great deal of information about the regulatory and policy framework regarding energy efficiency in buildings and support of bioclimatic design and training infrastructure in both the EU and North-West Africa. The project has also investigated local construction materials supply chain and technical characteristics, primarily bio-geo based and low energy embedded. These findings are presented in a series of public reports (D2.1 D2.2 D2.3 D2.4). A series of reports were published detailing concepts and definitions about energy, indoor environmental quality and energy flexibility in buildings. D3.1 presents a critical review of the energy performance indicators available in the literature and international standards to identify suitable KPIs that can be used to assess the energy performance of bioclimatic buildings. D3.2 provides a clear framework about the available methodologies, standards, tools and indicators to evaluate IEQ (i.e. thermal, acoustic, visual comfort and air quality) targeted for bioclimatic architecture. D3.3 explores the topic of building energy flexibility with a focus on warm climates. It is worth highlight that the literature analysis shows a lack of insights into indicators and example of application related to cooling dominated climates. The results in D2.3 and D3.7 indicate that local construction materials, bio-geo based and low energy embedded materials may contribute to building sector decarbonization, showing good thermal performance.

During the first 12 months, 12 case studies in Africa and Europe have been identified to document existing experiences of bioclimatic design. They are collected in D3.8 along with technical and design aspects and energy and comfort performance characterization. These selected cases have been analysed to promote the replication of the bioclimatic principles to a broader audience. The study of
future weather is also being addressed in reports D3.4 and D3.5. to assist in designing buildings and solutions that will be resilient to climate change scenario.

The partners have participated in critical debates concerning policy, techniques, and other aspects that may support disseminating the bioclimatic approach. We have organised webinars explaining the concept of energy and comfort indicators in buildings and their applicability in regulations. In COP26, we have presented the technical aspects of local materials for buildings and their potential to decarbonise the sector, sharing the experiences in Europe and Africa.

**Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)**

With the goal of making buildings robust against expected climatic changes during their lifetime, ABC 21 is developing a database of future weather files for selected locations in West Africa and Europe considering the periods 2040-2060 and 2080-2100. The future weather files will be new and freely available to the worldwide building design community. These files are being developed with state-of-the-art Morphing methodologies using the latest available results from regional climate models. They are being used in building design examples to test the resilience capabilities of bioclimatic solutions in different climate change scenarios. ABC 21 will also analyse the applicability of state-of-the-art selective emissivity surface finishings that can be applied in innovative bioclimatic solutions.

Moreover, the measurements of indoor parameters and the post occupancy evaluations in selected bioclimatic buildings in Africa will provide valuable feedback about actual indoor thermal comfort. This data for African countries is currently poorly available in literature and can contribute effectively to the amelioration of building design and occupant’s satisfaction.

Our efforts are also towards disseminating the activities and findings to a large scope of stakeholders in Africa and the EU. We have set a dedicated website, which is easy to navigate and load (especially in low-speed internet areas) and we are active on social media (LinkedIn and Twitter). The engagement of social media and website have been good so far, which were fundamental for connecting the general audience to our most recently publications. We have also used well-established web platforms to disseminate project events and news, such as BuildUp, Construction 21. The partners have been actively participating on workshop, conferences and other international events presenting some of the work developed and findings, thus supporting even more the project reach and impacts.

Overall, the project will contribute significantly to increased use of adequate locally adapted bioclimatic approaches by providing updated state of the art information on the best technologies. Even if this two years project cannot aspire to produce directly a very large impact via the designers and investors directly inspired by the project communication and training tools, the goal is to contribute to creating the conditions for a wave of policy initiatives involving the nations that are partners of ABC 21, the nations inspired by UN-Habitat forums, and the nations influenced by our allies ECREE-ECOWAS and GBC Africa. At the same time the lessons learned by the pioneering work in N-W Africa on development of techniques and certification for geo and bio sourced materials could help Europe to retrofit its ageing building stock without a high burden in terms of embodied energy.
ABC 21 - Project Objectives and Case Studies

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