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Analysis of the environmental, economic, thermal and energy performances of green building technologies

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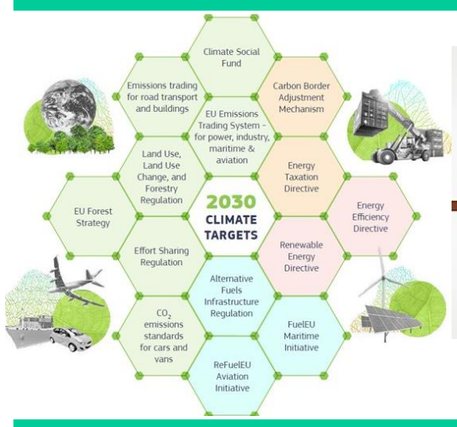
INTRODUCTION



- Environmental impact, high energy consumption and waste production connected to current building stock
- Need to adopt alternative and more sustainable green building technologies
- Avoid greenwashing

AIM AND METHODOLOGY

AIM & OBJECTIVES

To estimate the performances of various «green» construction solutions between them, and to compare them with a commonly adopted technology in Italian and European building scene.

METHODOLOGY

1. Literature review on the most commonly used materials and technologies in green building;
2. Selection of the construction technologies to be investigated;
3. Definition of the stratigraphies and performances assessment according to Italian legislation;
4. Multicriteria analysis (cost analysis, embodied carbon, indoor comfort, energy needs, building envelope)

GREEN BUILDING TECHNOLOGIES

WIDELY USED TECHNOLOGIES IN THE GREEN BUILDING MARKET

NOVEL TECHNOLOGIES IN THE GREEN BUILDING MARKET

CONVENTIONAL CONSTRUCTION TECHNOLOGY

Cross Laminated Timber (CLT)

Straw bale (SB)

Platform frame

COBBauge

SIREWALL

Sistema mixto (SM)

Mod_RE

Wood cement formwork (WCF) blocks

Porotherm + RC framing

ANALYSIS

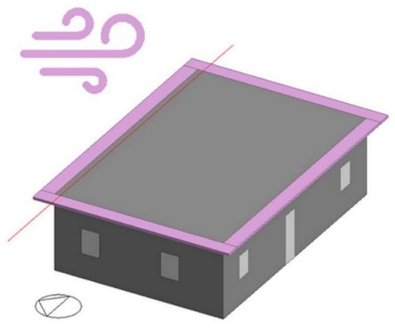
The multicriteria analysis was conducted with DesignBuilder software, using the optimization analysis tool. This tool allows the optimization of certain variables – in this case the walls and the roof constructions - in relation to the achievement of certain objectives.

The chosen objectives are:

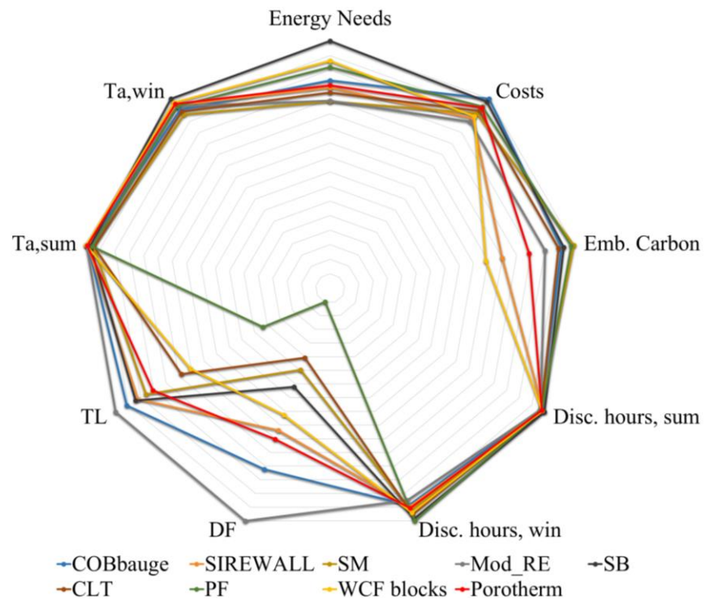
- Embodied carbon;
- Indoor comfort;
- Energy needs;
- Economic costs;
- Performance of the building envelope;
- Indoor air temperatures.

Mild temperate climate area (Csa - Koppen classification): Catania, 2020

The model used for the analysis provides for the presence of night cross ventilation and overhangs.



CONCLUSIONS



WINTER CONDITIONS

- The **minimization** of the **discomfort hours** is achieved with the **straw bale** technology.
- The **energy needs** for heating **are minimized** with the **straw bale** technology.
- The best mean **indoor air temperatures** are found for the **straw bale** technology.

SUMMER CONDITIONS

- The **minimization** of the **discomfort hours** is achieved with the **straw bale** technology.
- The **energy needs** for cooling **are minimized** with the **straw bale** technology.
- The **Mod_RE** construction technology has excellent envelope performances: it has the best **decrement factor** and **time lag** values.
- The best mean **indoor air temperatures** are found for the **wood cement formwork blocks** and the **Mod_RE** technologies.

COSTS

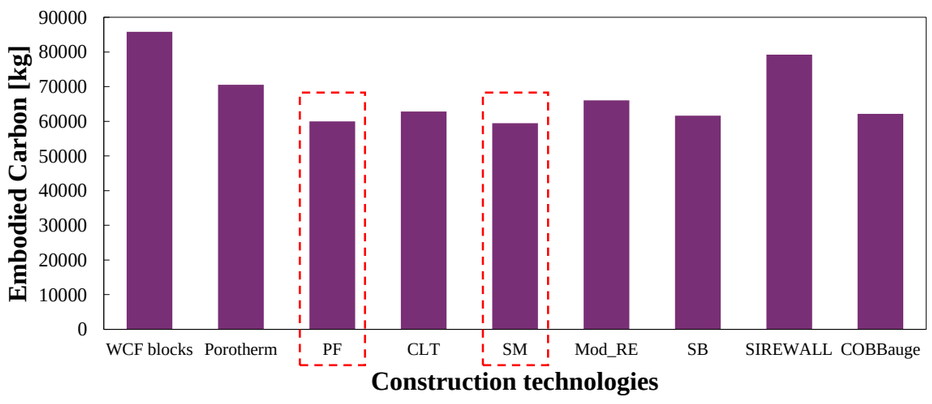
The **COBBauge** was found to be the best for the minimization of economic costs.

EMBODIED CARBON

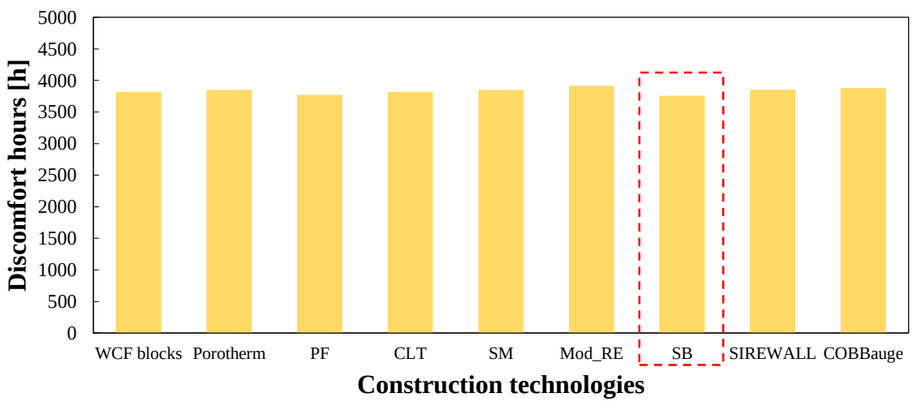
Sistema mixto has the lowest embodied carbon.

RESULTS

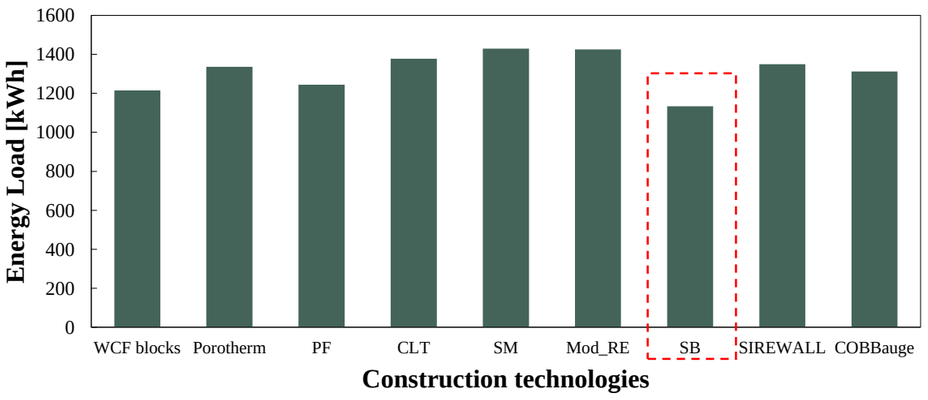
Embodied carbon



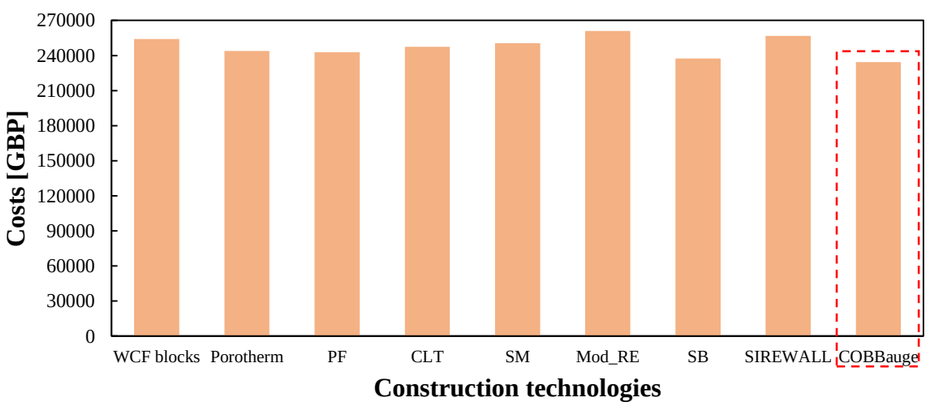
Indoor comfort analysis



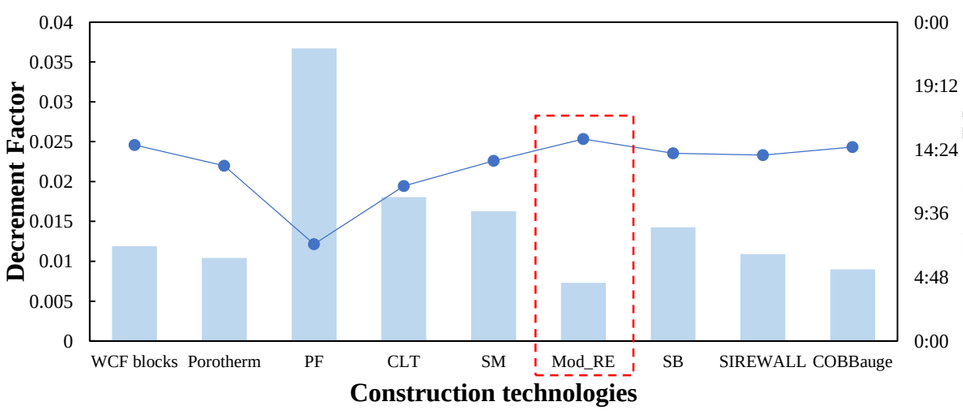
Energy needs analysis



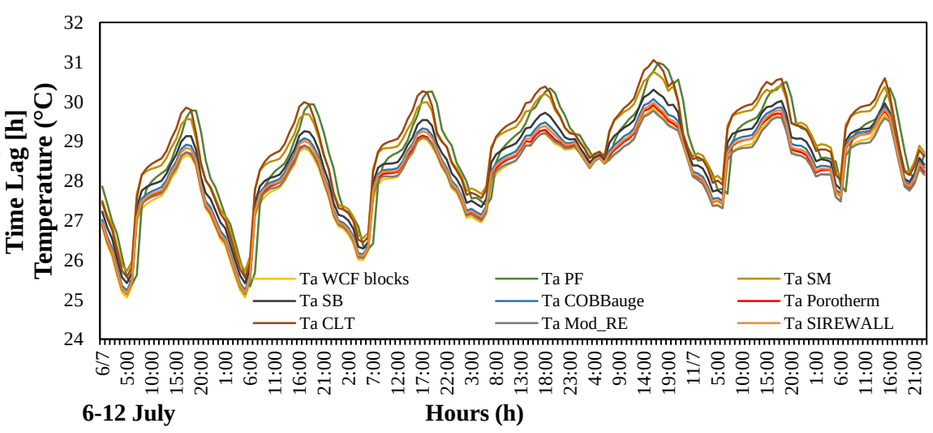
Costs analysis



Building envelope performance



Indoor air temperature profiles



FURTHER DEVELOPMENTS

- **LCA** of green building construction system
- **Cost** assessment comprising **local** construction and production costs

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