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U.PORTO

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Methodology for the integration of solar active systems in the building envelope

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Motivation

- Environmental policy
- Non-renewable resource scarcity
- Sustainable development goals

↓

- Social awareness
- Legislation and regulation

↓

Buildings { Improve energy efficiency
Reduce non-renewables dependence

{ Energy certification of Buildings (SCE)
Promotion of domestic hot water
Net-Zero Energy Buildings
Incentives for small scale decentralized electricity production
(…)

↓

Direct and indirect need to use solar active systems:

solar thermal collectors and **photovoltaic modules**

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Motivation

- The need of an urgent change in the energy performance of buildings is not followed in the project/conception phase in a comprehensive way.
- Solar active systems are frequently just considered in the final stage of design. Therefore they are added to the pre-designed building only fulfilling one function: power generation.

Building added systems

vs.

Building integrated systems

State of the art and objective

- In recent years there has been a growing dedication in the R&D of multifunctional solar active systems for building integration (products and performance) and even more recently in their sustainability assessment.
- However the sustainability assessments are product oriented and not building oriented. Also, there is no relationship between integration strategies and sustainability indicators (which would make sense for the importance that renewable energy generation generally has on a sustainability assessment).

- Therefore the main research objective is to develop a decision support methodology for the **design phase**, through the verification of the solar active systems **integration** options in the various dimensions of **sustainability** throughout the **building life cycle**.

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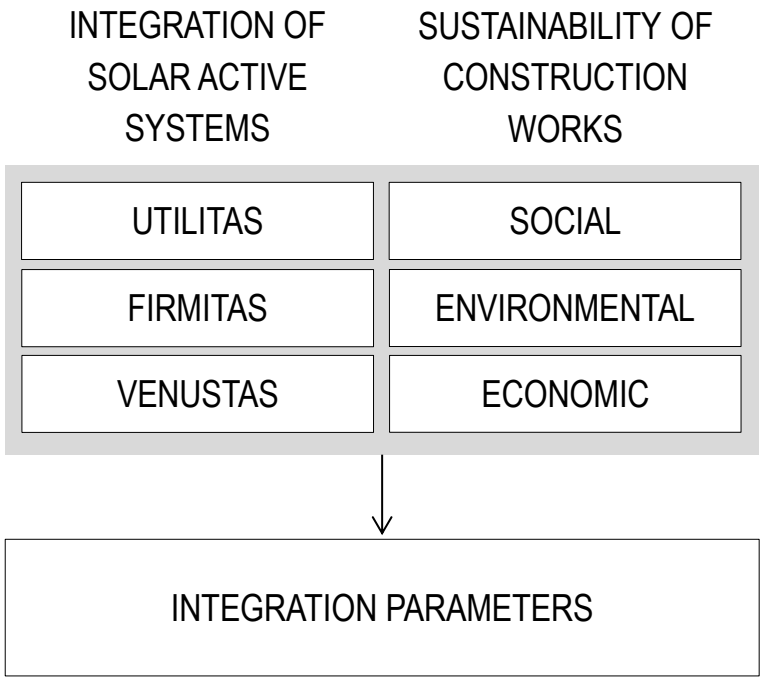
Methodologic approach

BASIC REQUIREMENTS FOR CONSTRUCTION WORKS
-
REGULATION (EU) 305/2011 for the Marketing of Construction Products



CEN/TC 350 Sustainability of construction works

- **A - ENERGY INTEGRATION**
- **B - SOLAR ACTIVE SYSTEMS DESIGN CRITERIA**
- **C - BUILDING INTEGRATION**
- **D - AESTHETIC INTEGRATION**
- **F - ENVIRONMENTAL INTEGRATION**
- **G - OPERATION AND MAINTENENCE**
- **H – ECONOMIC ASPECTS**

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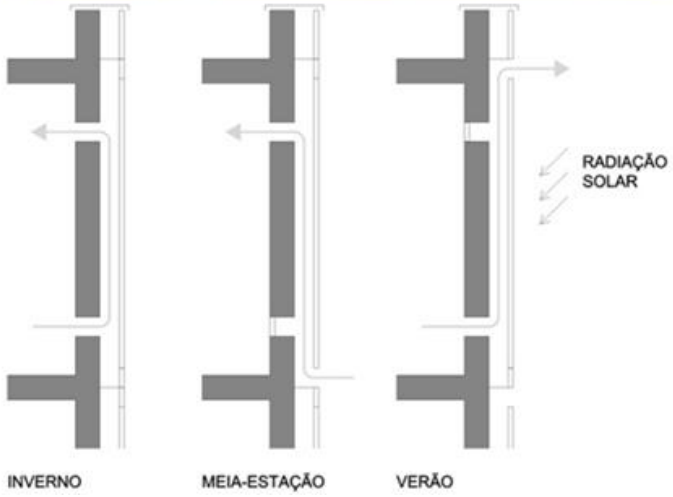
Integration parameters

A - ENERGY INTEGRATION
A.1 - Generated energy/demands (%)
A.2 – Security of utility supply (electricity backup, heating)
A.3 - Contribution to the building energy performance
B - SOLAR ACTIVE SYSTEMS DESIGN CRITERIA
B.1 - Orientation (orientation, inclination, shading, dirt)
B.2 – Albedo factor.
B.3 - Temperature (PV)
C - BUILDING INTEGRATION
C.1 – Integration level
C.2 – Support
C.3 – Control
C.4 – Distribution
C.5 - Adaptability
D - AESTHETIC INTEGRATION
D.1 – Urban integration
D.2 – Surface
D.3 – Component
D.4 – Complementary parts
E - ENVIRONMENTAL INTEGRATION
E.1 – Environmental aspects
E.2 - CO2 balance (%)
E.3 – Recycling
F - OPERATION AND MAINTENCE
F.1 - Operability
F.2 - Adaptability
F.3 – Maintenance
G – ECONOMIC ASPECTS
G.1 – Cost
G.2 – Financial value (cost + revenues)



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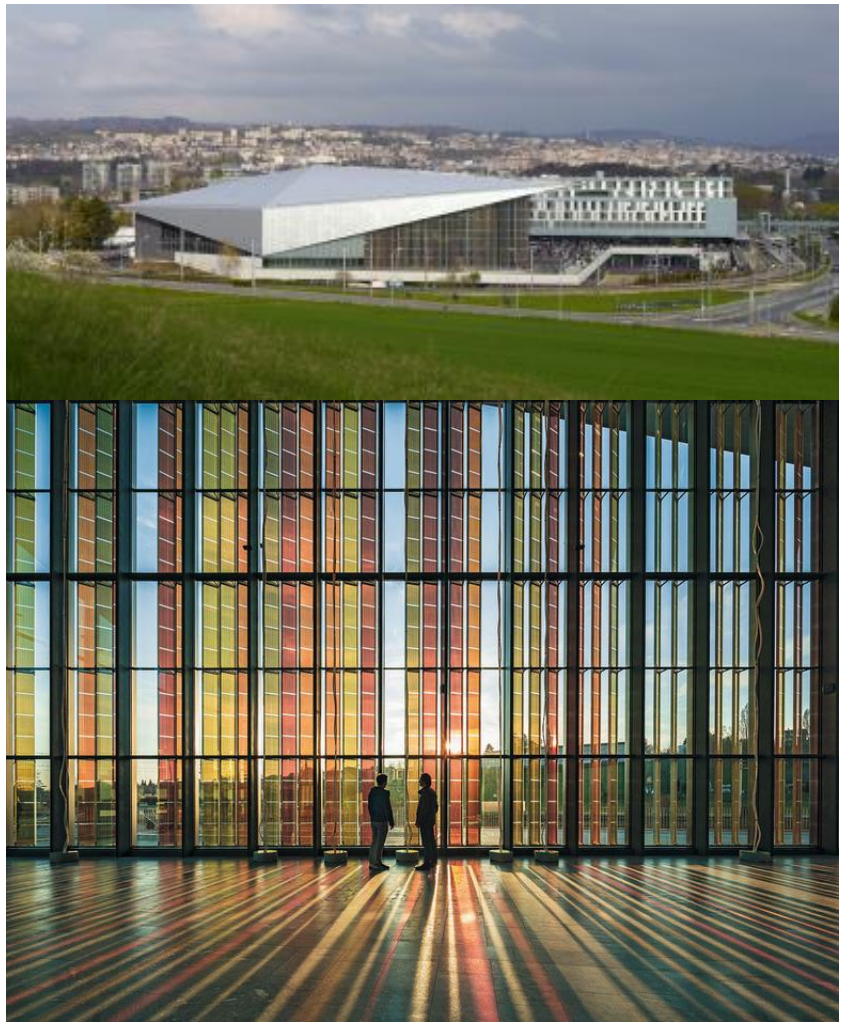

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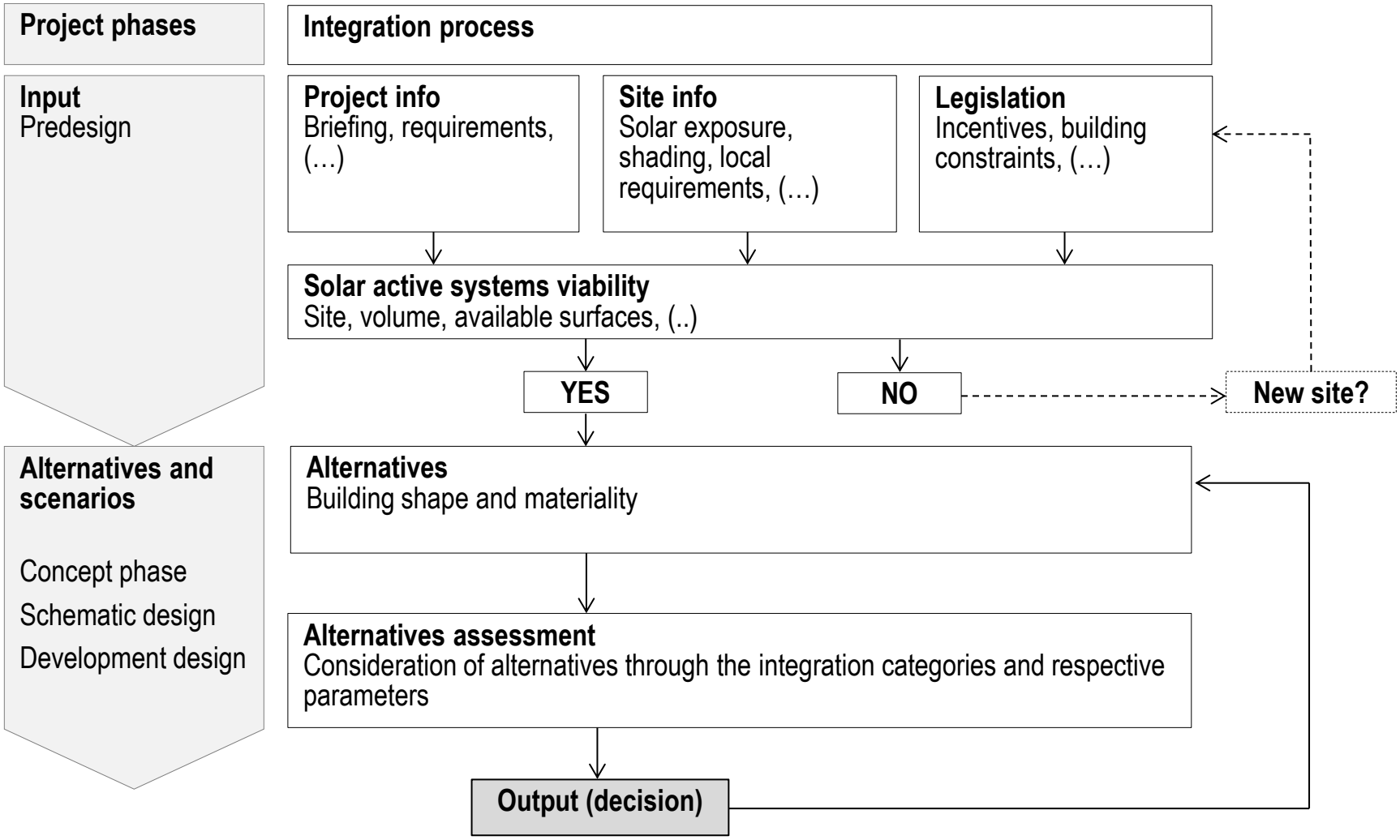
Integration process



Conclusions

The inclusion of active solar systems in the early stages of design through parameters that meet integration and sustainability criteria enables:

- To reduce the discrepancy between technological development, regulatory goals and the design process;
- The evaluation of alternative solutions in the early stages of design and a improved result regarding the envelope performance and the sustainability of construction works.