Motivation for promoting new technologies for envelopes and facades

New regulations regarding energy consumption of buildings:

- EPB regulations leading more or less to passive buildings;

- BREEAM, LEEDS, MINERGIE, HQE labels trying to promote low energy consumption buildings and sustainable construction;

A trend among architects and a move among developers or owners to build innovative and sustainable buildings;

Public or private initiatives to promote new possibilities to renovate ancient buildings in terms of energy cost efficiency:

- In Brussels, for instance, AIM-ES initiative to upgrade the envelopes of existing buildings and to translate recommendations in a Guideline
Workgroup to establish recommendations and to translate these recommendations in a Guideline

Why is this important?
## Grid of criteria and performances

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The main systems in wood construction

Wood caissons
To be compare with unitized systems in aluminum or steel profiles

Industrial manufacturing process; Placement of finished frames; High performances achieved regarding:
- Air and water-tightness;
- Wind resistance;
- Energy behavior
On-site assembly
To be compared with sick systems with aluminum or steel profiles

Manufacturing in factory but placement on site;
High performances achieved regarding:
- Air and water-tightness;
- Wind resistance;
- Energy behavior
Comparison of wood and metal “curtain wall” systems:
Performances and prescriptions

Stability:
- NBN EN 1995-1-1;
Durability:
- STS 31 et STS 04.08;
Airtightness:
- No document to define the performances except 3 French Guidelines (Grenelle);
- Performances inspired by EPB regulations or Passive Buildings Recommendations;
Water-tightness:
- Regarded as a wall;
- Rainscreen to be foresee, no quantitative performances

Stability:
- Depending on material: for aluminum: NBN EN 1999-1-1, for instance;
Durability:
- Depending on material: systems with thermal break profiles have to achieve a Technical Approval based on European Standards, for instance;
Air and water-tightness:
- NBN B25-002-1, § 5.2.2. Windows and 5.2.3. Light Facades

Energy behavior: both systems have to satisfy the EPB regulations
Possible sources of pathologies

Design:

- Stability;
- Definition of airtightness plans;
- Prescriptions: unclear defined performances;

Behavior of materials and systems:

- Humidity or moisture transfer through the walls;
- Hygrothermal behavior of light wood construction;
- Sensitivity to moisture during the works;

Execution on site:

- Requires a enhanced follow of the works mainly regarding the airtightness and the continuity of the insulation
Design and execution

Static of façade: cantilever beam

Panel 1
- Panel 1 level high

Superior panel

Inferior panel
Site execution: points of attention
Site execution: points of attention
Junctions between panels: Insulation and airtightness defects
High rise building with wood caissons

Due to a short timeframe for the completion of the works, the execution of the “facades” has followed the concrete construction by a very short time.
High rise building with wood caissons: a challenge?
Outside view of the masonry works

Positioning and fixing of the masonry wall: fixings need to go through the rainscreen and a second membrane has been placed.

Management of the fixings of the scaffolding to avoid water leakage.
Junction between caissons and curtain walls or windows: gluing of membranes (rainscreen, EPDM)
Inside views of the works at different stages
Inside views of the works including the finishing (the building is not yet watertight !)
Junctions between curtain walls or windows inside: management of the membranes and the continuity of the airtight plan
To understand the pathologies encountered during the works:
Left: closed side of the building

Right: open side of the building
Water falls from floor to floor and finds its way to the edges of slabs and thus, the caissons
Investigations undertaken to determine the scale of damage: wet cellulose wadding, settlement of wet cellulose wadding.
Materials: membranes showing problems due to a bad fabrication
Weak points regarding the airtightness
Possibility of improvement for air and water-tightness (curtain wall system)
Fire protection: tests or no tests?
Conclusions: does the use of wood caissons lead to new pathologies?

Nor walls neither light facades:
- How to define the requirements in order to obtain air and water-tightness, wind resistance and energy and thermal behavior leading to low energy consumptions and comfort?
- How to establish prescriptions that lead to no pathologies?
New and innovative technologies?
- Is it a step forward or backward?
Do we understand all the implications associated with these techniques?
- Design management:
  Management of airtight plans;
  Management of insulation and water-tight plans;
- Work management:
  Phases of works to be coordinated (injection of cellulose wadding);
  Management of precautions in order to protect the caissons from bad weather conditions;
- Life of the building;
  How to live in such a building?

To conclude:
Technology such as wood caissons could lead to pathologies and need a relearning of “ancient techniques”