Commercial Passive “House” Buildings in Europe:
Materials, Systems, Insights

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Summary

• General comments.

• Common practice in European non-single family home bldgs:
  – Envelope
  – Lighting and plug loads
  – HVAC
  – Materials
Foreword

- Over 220 non-residential buildings PH certified in Europe (30% of all PH by sqft),
- Significant number of PH certified bldg components available,
- Project cost range: $150-270/sqft (1,000-1,800 euro/m2),
- Stronger regulatory requirements, higher energy costs, and incentive programs,
- Critical importance of integrated design and construction process.
Envelope

- Wall / roof / floor R-values: 35-50
  - EIFS systems (stucco) (polystyrene, mineral wool, wood fiber board / adhered or anchored)
  - Rainscreen façade
    - Rockwool or fiberglass / lattice,
    - Blown-in cellulose / TJI or Larson truss systems.
  - Vacuum Insulated Panels.
Envelope

- Airtightness at PH levels
  - Cast-in-place or masonry,
  - Special tapes,
  - Boots, membrane seals.
Envelope

- **Windows / doors**
  - Always PH certified
  - Triple-pane (R-5.8)
  - Dual or triple-seal, tilt-turn/hopper/etc. or fixed.
  - Curtain wall systems
Lighting, Plug-Loads

- Extensive daylighting (and daylight controls),
- Sophisticated, automated control of heat gain and glare.
Lighting, Plug-Loads

• Electric lighting:
  – light levels at/below IESNA recommendations (space-type specific),
  – T5 fluorescent, D/ID, task lighting,
  – e.g., 0.6 W/sqft for 30fc average.
• LCD monitors,
• Laptops or fanless desktop computers.
HVAC, ventilation

- Heat/energy recovery ventilation (85%+, wheel or plate HX)
  - Predominantly central units,
  - Cascading ventilation,
  - Tempering of outside w/earth-tube or brine HX,
  - Defrost with brine or electric resistance,
  - “Plug-and-play” duct systems (metal and plastic) w/all accessories,
HVAC, heating

- **Heating**
  - Predominantly decoupled from ventilation,
  - Hydronic systems (floor, baseboard),
  - Sources:
    - District htg systems,
    - Wood pellet boilers (& solar hot water),
    - Nat Gas boilers / Wtr heaters (& solar hot water),
HVAC, cooling

- Cooling
  - Prevention\(^3\) and expanded comfort range
  - “Natural cooling” only (no chillers, DX, or GSHP)
    - Earth-tubes, OA economizer,
    - Night flush of hollow-core floors (and spaces),
    - Brine-cooling of floor slabs
Materials

• Emergence of bio-based materials:
  – Wood-framed windows,
  – Wood-fiber/hemp/cork insulation (board, loose-fill),
  – Wood framing (structural and non-str.),
• Mix of post-beam and mass-wall constr.,
• Exterior: stucco, cement board, wood, metal,
• Floors predominantly concrete.
Materials

Thermal breaks at structural elements:
- Foamglass (and XPS),
- Aerated concrete (AAC),
- Point loading and pillar insulation,
- Stainless steel and fiberglass (reinforcements and anchors).
Retrofits

- Can follow prescriptive path (EnerPHit),
- Exterior and interior insulation,
- Near complete replacement of lighting and HVAC systems.
Questions…

The End
(or the beginning?)

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