

Introducción al estándar Passivhaus



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"Elemental mi querido Watson"

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COACYLE/BURGOS

9 de Julio, 2013

¿Qué es esto del Passivhaus?



Fuente: www.plataforma-PEP.org

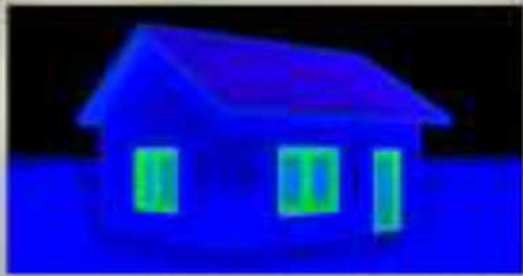
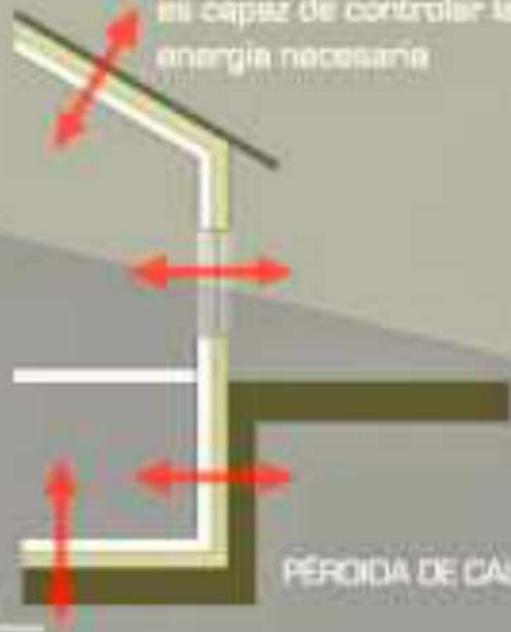


Imagen Térmica: El edificio
está capaz de controlar la
energía necesaria



YouTube

Fuente: www.plataforma-PEP.org

¿Dónde comienza la historia?

...long time ago



1886 - Fram Nanse



1974 - Lo-Cal Illinois



1977 - Saskatoon



1988 - Europe



1996 - Darmstadt



*Passive House
Institute*

...long time ago

Imagen: Jesús Menéndez



1886 - Fram Nanse



1974 - Lo-Cal Illionois

University of Illinois at Urbana-Champaign
Small Homes Council-Building Research Council

COUNCIL NOTES



C2.3 ILLINOIS LO-CAL HOUSE



THE "ILLINOIS LO-CAL HOUSE"

The increasing scarcity of fuels makes it imperative to include more energy-conserving features in our housing.

This publication describes the design, construction, and predicted performance of a house which uses about one-half the energy needed to heat a house of the same size which was built to meet 1974 insulation standards (U. S. Department of Housing and Urban Development standards for houses located in areas having a heating season of between 4500 and 8000 degree-days). Because of its low energy requirements for heating, it has been called the "Illinois Lo-Cal House." If the Lo-Cal House is compared to the typical house of 1930, the savings are even more dramatic.

A comparison with a house built to the 1980 HUD standards is also included. It should be noted that the level of insulation recommended in the new minimum standards is approaching the super-insulation recommended in the first Lo-Cal publication in 1976, which was considered extreme at the time.

The major features which account for the exceptional reduction in energy usage are:

- Superior insulation
- Solar orientation

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Original Edition by Wayne L. Shick and Richard A. Jones, FALA
Consultants: Wayne S. Harris and Scottie Kozak
Illustrations: John S. Szabrowski Design: Jane R. Zagowski
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All rights reserved. No part of this publication may be reproduced in any form without permission in writing from the publisher. Published quarterly by the Small Homes Council-Building Research Council, University of Illinois at Urbana-Champaign, One East South Main Street, Champaign, Illinois 61820. This publication is one of a series written for the homeowner. A complete list of publications is available upon request.

Of the reduction, about 90% is due to the extra insulation. The remaining reduction is due to the location of most of the windows in the south wall, where they act as solar collectors.

DESIGN AND CONSTRUCTION FEATURES

Insulation

- Heavy ceiling insulation
- Heavy wall insulation
- Improved floor and crawl-space insulation
- Triple-glazed windows
- Complete vapor retarder (barrier)
- Tight construction to minimize air leakage

Solar

- Major axis of house oriented east-west
- Roof overhang designed for solar control
- No windows on the east and west walls
- Major glass areas on the south wall

General Features

- Can be built with standard, readily available building materials
- No new technology or labor skills required
- Design conforms to current practice
- Design adapts to various lot orientations

Benefits

- Low-cost heating system
- Low energy use for heating
- Low-cost cooling system
- Low energy use for cooling
- Favorable ratios of benefit to cost
- Improved acoustic performance

CONSTRUCTION DETAILS

This design is considered appropriate for most areas of the United States having a heating season of 4500 degree-days or more.

1977 - Saskatoon



1988 - Europe



1996 - Darmstadt





*Passive House
Institute*

Envolvente

15 kWh/m² | 10 W/m² | 0.6 ach | 0.01 W/mK

Aislamiento

- Continuo
- Material vs grosor
- Sin huecos



Estanqueidad

- Infiltración y exfiltración
- Continua y única
- Cara interna
- Juntas
- Perforaciones

Puente-térmico



- Reducidos al mínimo
- Balcones, parapetos
- Elemento repetido en aislante
- Cambios de geometría +/-

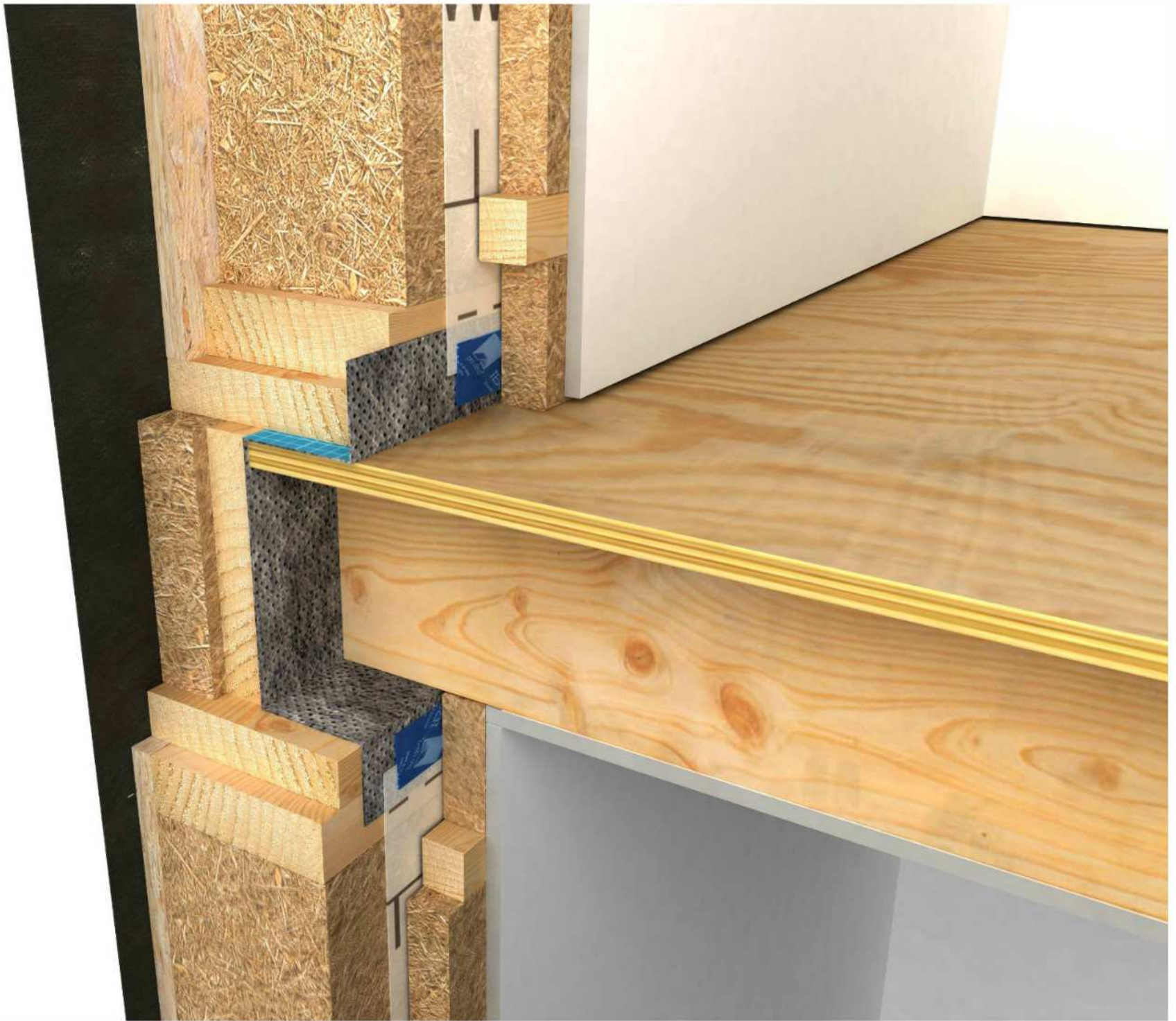
Aislamiento.

- Continuo. 
- Material vs grosor
- Sin huecos. 





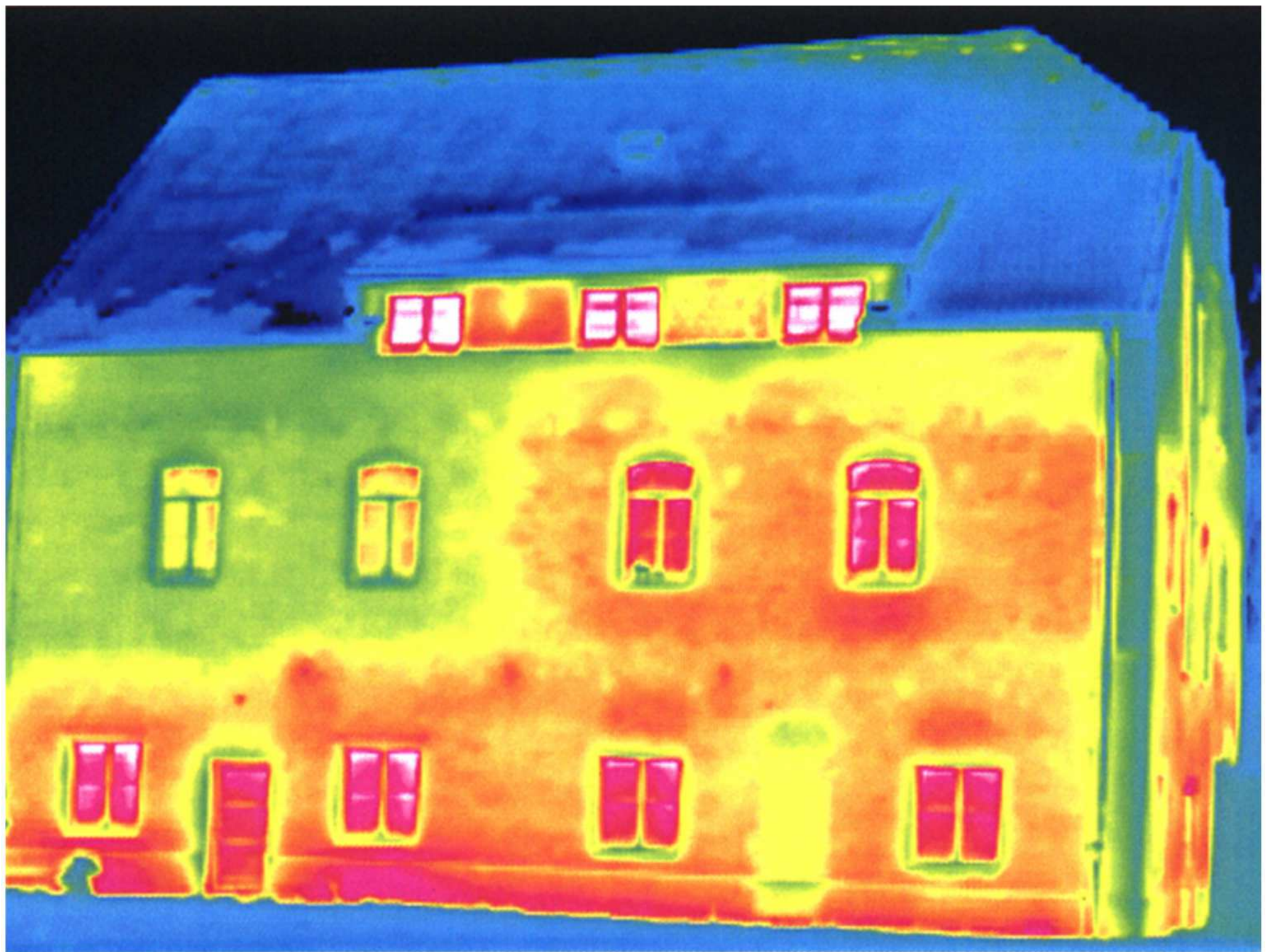
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Aislamiento.

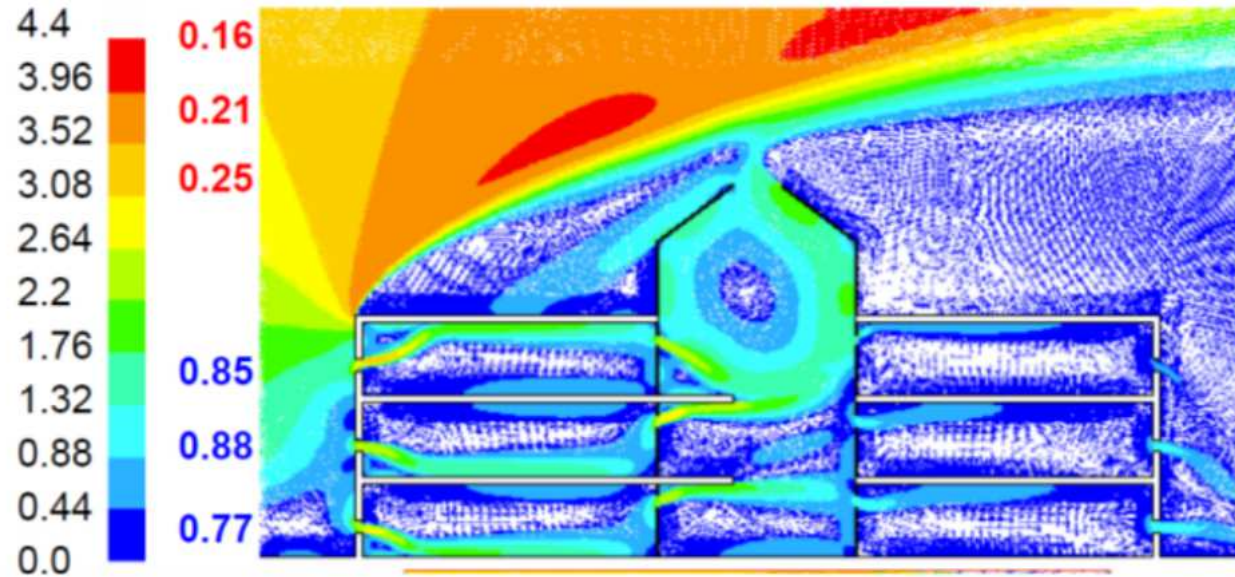
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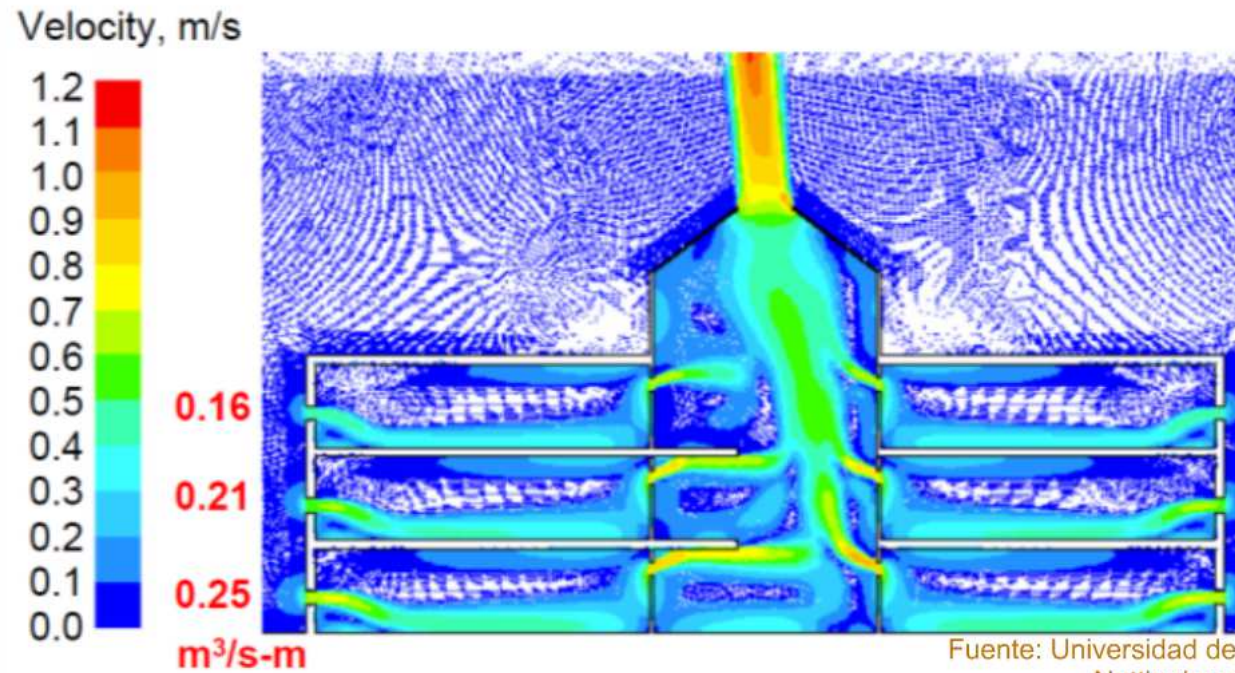
Estanqueidad

- Infiltración y exfiltración
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- Cara interna
- Juntas■
- Perforaciones

Viento




Flotabilidad

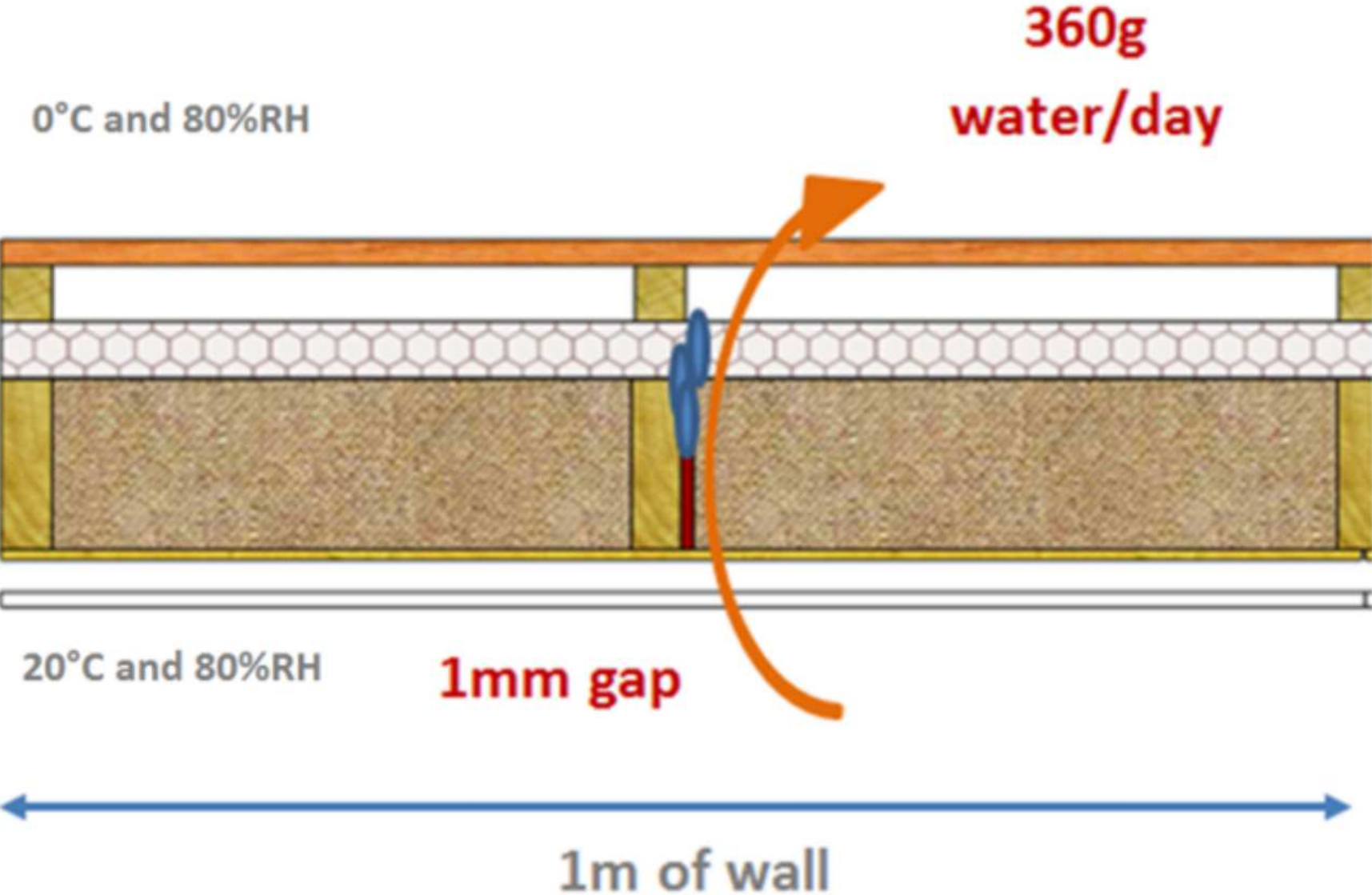


Fuente: Universidad de Nottingham

Estanqueidad

- Infiltración y exfiltración
- Continua y única 
- Cara interna
- Juntas■
- Perforaciones

Condensación



Única



Imagen: Jesús Méndez

Estanqueidad



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- Continua y única 
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- Perforaciones

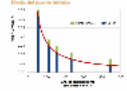


Imagen: Jesús Menéndez

Estanqueidad

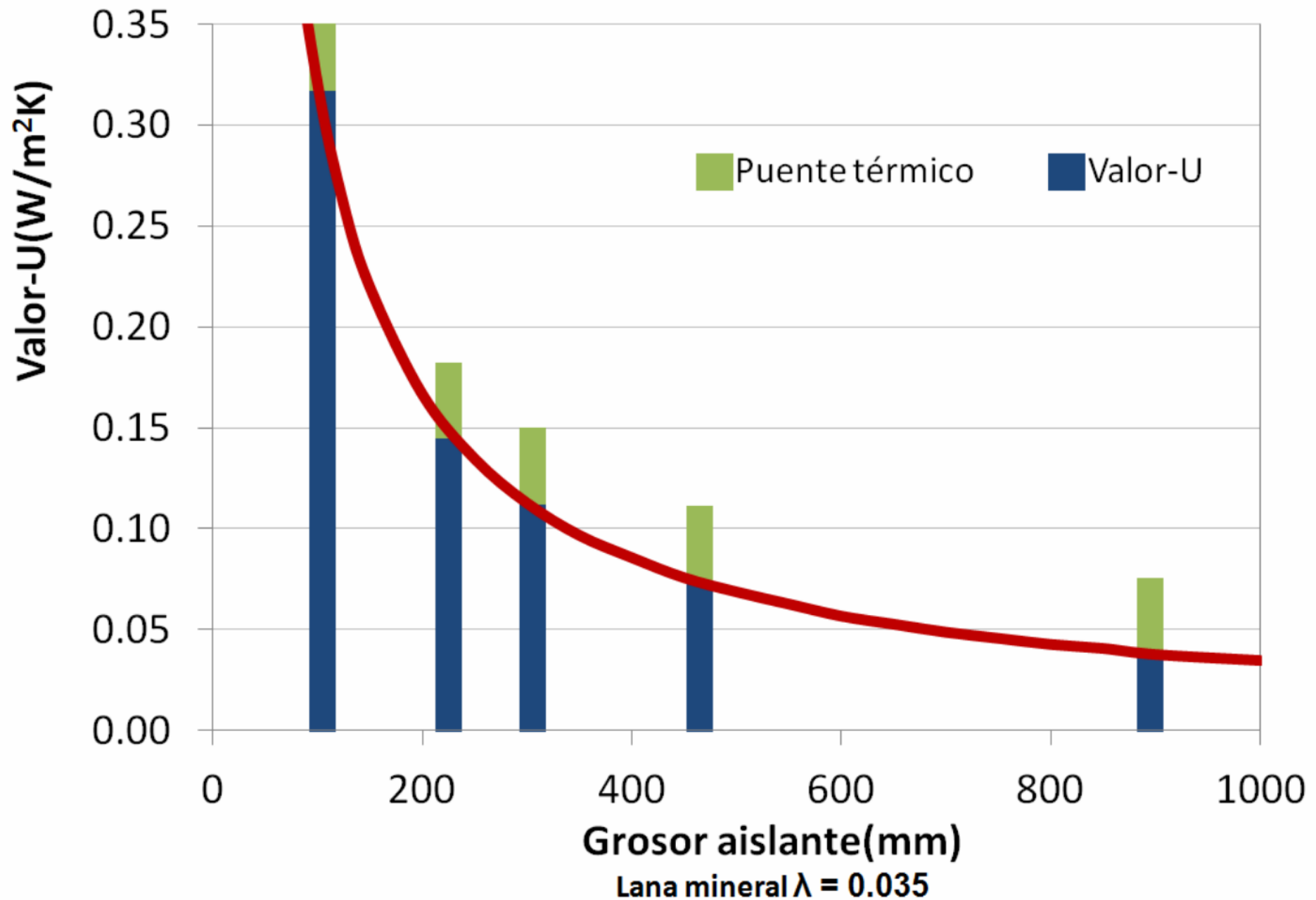
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Puente-térmico

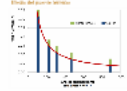


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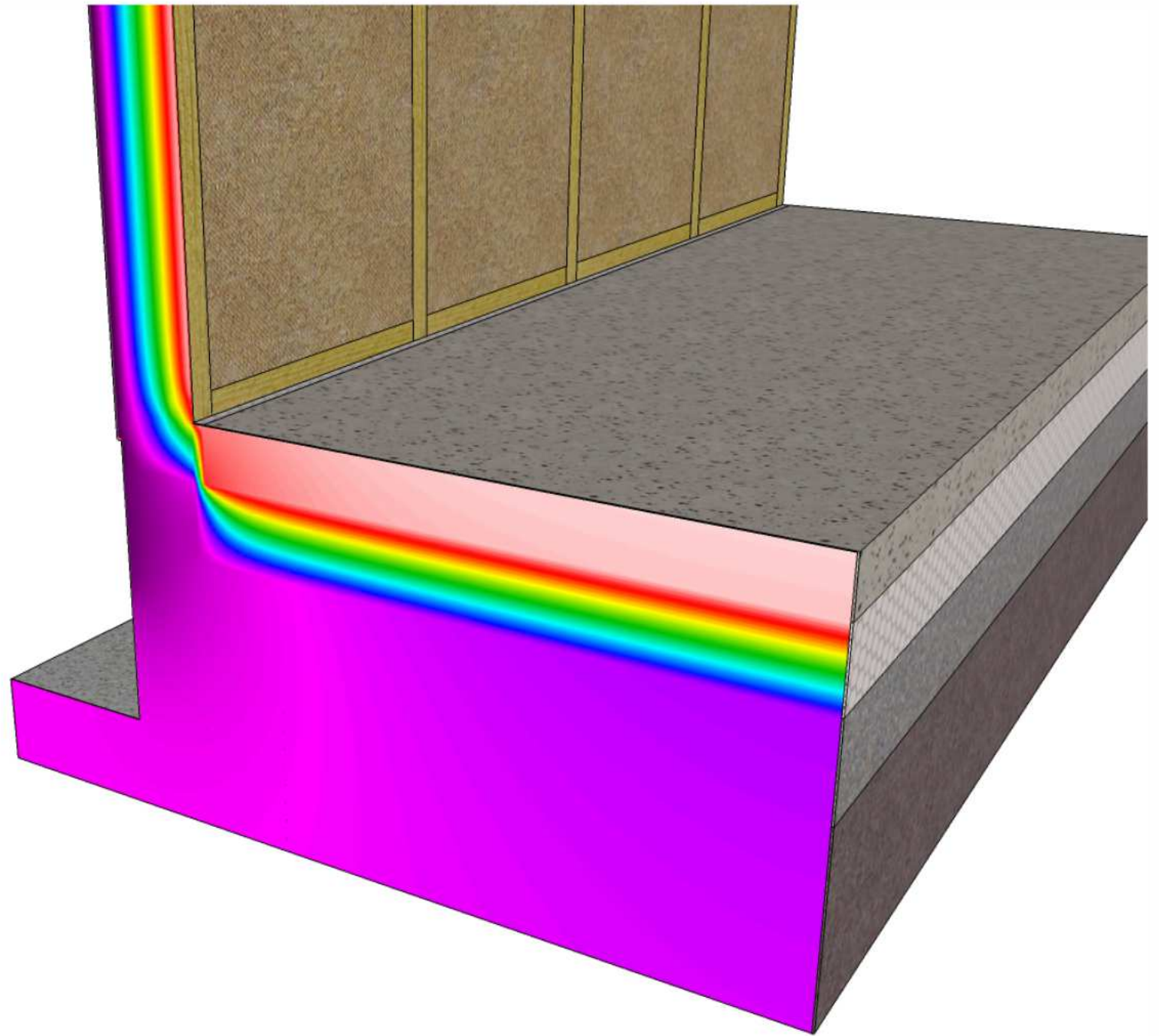
Efecto del puente térmico



Puente-térmico

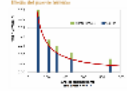


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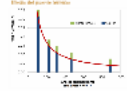


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Imagen: Jesús Menéndez



Puente-térmico



- Reducidos al mínimo ■■
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Diseño

Compacto | Integral | Estrategia solar



Compacidad

- Relación A/V
- Factor forma: A/TFA
- Minimiza pérdidas

Integral

- Equipo al principio
- PHPP^{*}
- Nivel de detalle^{AE}
- Rentable



Estrategia solar

- Maximizar ganancias
- Sobrecalentamiento verano
- Inercia térmica

Compacidad

- Relación A/V
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Integral

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- Nivel de detalle 
- Rentable

Passive House Verification



Building:	End-of-Terrace Passive House Kranichstein		
Location and Climate:	Darmstadt Kranichstein	Standard Germany	
Street:			
Postcode/City:	D-64289 Darmstadt		
Country:	Germany/Hesse		
Building Type:	Terraced House/Dwelling		
Home Owner(s) / Client(s):	Bauherrengemeinschaft Passivhaus		
Street:			
Postcode/City:	D-64289 Darmstadt		
Architect:	Prof. Bott/Ridder/Westermeyer		
Street:	Jahnstr. 8		
Postcode/City:	D-64285 Darmstadt		
Mechanical System:	öeb Dipl.-Ing. Norbert Stärz		
Street:	Bahnhofstr. 49		
Postcode/City:	D-64319 Pfungstadt		
Year of Construction:	1991		
Number of Dwelling Units:	1	Interior Temperature:	20.0 °C
Enclosed Volume V_e :	665.0 m ³	Internal Heat Gains:	2.1 W/m ²
Number of Occupants:	4.5		



Specific Demands with Reference to the Treated Floor Area					
	Treated Floor Area:	Applied:	Annual method	PH Certificate:	Fulfilled?
	156.0 m ²				
Specific Space Heating Demand:		14	kWh/(m²a)	15 kWh/(m ² a)	Yes
Heating Load:		10	W/m²	10 W/m ²	Yes
Pressurization Test Result:		0.2	h⁻¹	0.6 h ⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):		61	kWh/(m²a)	120 kWh/(m ² a)	Yes
Specific Primary Energy Reduction through Solar Electricity:			kWh/(m²a)		
Frequency of Overheating:		3	%	over 25 °C	
Specific Useful Cooling Energy Demand:			kWh/(m²a)	15 kWh/(m ² a)	
Cooling Load:		9	W/m²		

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

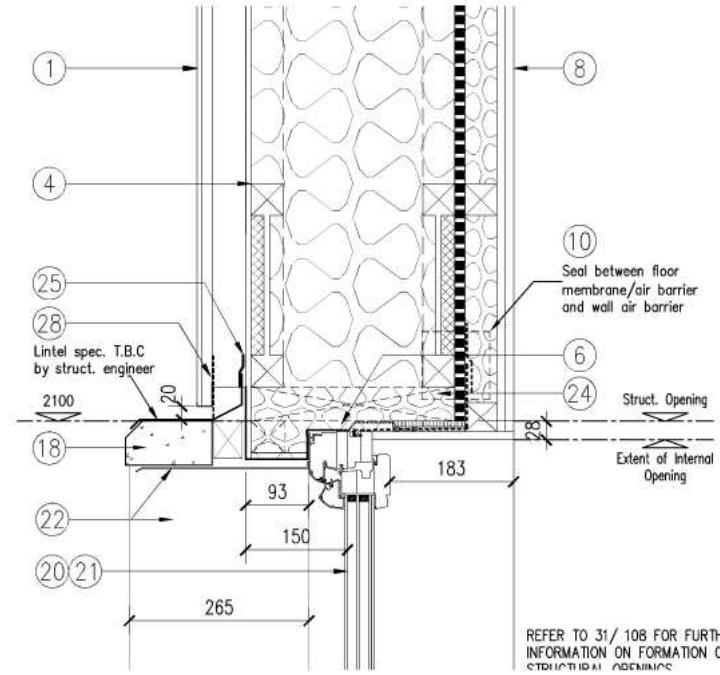
Issued on:

signed:

Integral

- Equipo al principio
- PHPP 
- Nivel de detalle 
- Rentable

DETAIL



NOTES:

1. Render finish on board on battens to form 50mm cavity (NBS: M20/160A)
2. 50mm clear cavity
3. —
4. Engineered 'I' studs at required centres (NBS: B15/110A & B15/240A)
5. —
6. Mineral wool insulation generally 10kg/m3 (min) thermal conductivity T.B.C lining whole area without sagging (NBS: P10/120)
7. 1no. layer gypsum board nominal 8kg/m2
8. 2no. layers of gypsum board nominal 24kg/m2 All joints in wall linings to be staggered (NBS: K10/205)
9. —
10. Seal all perimeter joints with tape or caulk with sealant and taped joints (NBS: P10/330, P10/335, P10/337, P10/340, P10/345, P10/350, P10/360, P10/360A)
11. Flexible cavity stop/closer fixed to one frame only (NBS: P10/410)
12. 5mm Flanking edge strip
13. Flexible acoustic sealant
14. Ties between studs to be not more than 40x3mm @1200mm horizontally, one tie per storey height vertically
15. 1000 gauge Visqueen DPM (NBS: J40/120)
16. s/s masonry wall ties (NBS: F30/210A)
17. Glass wool insulation 10kg/m3 (min)
18. Cast stone coping units & lintels (NBS: F30/765)
19. Facing Brickwork (NBS: F30/110)
20. Composite window unit (15mm tolerance to struct. opening) All to Manufacturers detailed specification (NBS: L10/400A)
21. Composite external door set: As above (NBS: L20/480A)
22. PC aluminium external sills & flashings generally
23. 30mm MDF internal window sill
24. 300 x 50 x 50mm framed timber opening @ =600mm c/c's
25. DPC
26. Code 4 lead on 25mm treated SW
27. 25 x 190mm treated, stained SW reveal liner
28. Insect Mesh

THERMAL BYPASS INSPECTION CHECKLIST

CHECKED BY:

AIRTIGHT CONSTRUCTION

- SM/ATC Check carefully that all wall/floor roof systems represented have an airtightness layer and that the design allows for these to be formed as a continuous layer, with properly formed junctions between different elements. (Any complex junctions should be brought to the attention of the design/construction team so that they can be reviewed.)
- SM/ATC Check that the wall and floor DPCs, DPMs and membranes can form an adequate air/vapour barrier (to enable this ensure good lapping that they extend min 250mm)
- SM/ATC Prior to installation of the timber frame check that the Foamglas Perinul SL is level (+/- 3mm over 10m) and that all joints are sealed. Levelling compound to be used if required.
- SM/ATC Check the sole plate is sealed using Pro-Clima sealants (available from Green Building Store) to the Perinul SL insulating foundation strip prior to installation of the timber frame cassette unit.
- SM/ATC Prior to installation of timber frame cassette ensure that the appropriate Pro-Clima sealant (available from Green Building Store) has been applied to the top of the sole plate.
- SM/ATC Ensure joints in the air/vapour barrier (which is formed using OSB and, at complex junctions, flexible polythene membranes) are sealed with Pro-Clima tapes and sealants.
- SM/ATC Check that the OSB air/vapour barrier is complete and that all joints have been sealed and that the material has not been damaged. Care will be needed to avoid the air/vapour being damaged. Any damage to the vapour barrier must be repaired using an approved methodology (consult design/construction team).
- SM/ATC Check that a membrane, which can tolerate any movement, is taped seals to both the OSB and the floor insulation prior to the screed being installed.
- SM/ATC Check that the window frame to wall junction is properly sealed and continuous with the wall airtightness layer, particularly at sills.
- SM/ATC Check that the window sills to window frame junction is properly sealed and continuous with the wall airtightness layer.
- SM/ATC Check that the 'settling' loop of the airtightness membrane, for all windows, doors and hatches, is sufficient (min 10mm) as striking plaster and building settlement will eventually lead to cracks.
- SM/ATC Check that expanded metal mesh, or a plaster stop bead, protects the airtightness membrane. To avoid the plaster cracking as the building settles/dries out ensure that the expanded metal is not bonded to the frame of either the window or the door.
- SM/ATC Check that the door frame to wall junction is properly sealed and continuous with the wall airtightness layer, particularly at sills.
- SM/ATC Check that all windows, doors and hatches have an appropriate weather/draft seal between the opening unit and its frame.
- SM/ATC Check that all corner junctions between the vertical and horizontal cheeks of the reveals have received careful attention and are sealed with an appropriate air seal.
- SM/ATC When dry lining, check that a continuous solid bead of plaster is formed around openings.
- SM/ATC External doors should be fitted with draught excluders.

CHECKED BY:

WINDTIGHT CONSTRUCTION

- SM/ATC Ensure that a windtight building fabric has been achieved through sealing of external joints with sealant and mechanically fixing a batten over the joint at max. 150mm c/s so as to compress the sealant (sealant: by Pro-Clima or may be polyurethane moisture curing wood glue to seal applied using mastic gun and cartridges.)
- SM/ATC Rainscreen to have a pressure-equalisation void. There needs to be an airtight layer installed infront any insulation; the windtight layer needs careful detailing and sealing at junctions with windows, doors and other interfaces (junctions between panels and materials).
- SM/ATC Check that a windtight pressure-equalised cavity has been formed by installing a cavity barrier at all corners (both vertically and horizontally at each storey.) This is required to reduce the wind pressure from gusts of wind, to reduce the subsequent ventilation heat losses and help prevent insulation being dislodged.
- SM/ATC Ensure that no fibrous insulation remains unprotected from the wind (ensure all fibrous insulation is encapsulated).

CHECKED BY:

THERMAL INTEGRITY

- SM/ATC Continuity Rule: Check to ensure the thermal envelope has not been interrupted and that there are no gaps (ZERO). NOTE: Only after inspection should foam insulant received taped joints
- SM/ATC Penetration Rule: Check that, where an interrupted insulating layer is unavoidable, the thermal resistance in the insulation plane is as high as possible; this is indicated by use of e.g. lead bearing insulants (e.g. Foamplate Perinul SL sealed blocks etc.)
- SM/ATC Junction Rule: Check that insulating layers meet without any gaps, interruption or misalignment. Special efforts should be made to check the junctions between building elements. Should any gaps over 3mm occur at junctions between elements then they shall be painted with a low expansion foam.
- SM/ATC Void Rule 1: Check that there are no voids/cavities on the warm side of the insulation (so as to prevent convective thermal looping).
- SM/ATC Void Rule 2: Check that at corners, insulation boards are tightly butted together (to avoid convective thermal looping).
- SM/ATC Workmanship: Check that insulation boards are cut square with a sharp knife or saw.
- SM/ATC Foam insulation: Ensure that the maturation/shrinkage period has been observed prior to installation (insulation shrinkage will require joints to be painted, this is time consuming and costly and should therefore be avoided).
- SM/ATC Check that the specified insulation type, thickness and conductivity has been used (SM to request manufacturers data). See services section also.
- SM/ATC Masonry walls: Check that a batten is being used to keep the cavity clear of mortar.
- SM/ATC Masonry walls: Check that mortar spots are cleaned off when the batten is being removed/repainted.
- SM/ATC Masonry walls: Check that the specified type of wall tie and retaining clip has been used. Ensure drip is central in the cavity and that tie falls towards the external face.
- SM/ATC Check that insulation boards are fixed with vertical joints staggered. (Timber frame manufacturer to manage offsite aspect of this requirement)
- SM/ATC Check that boards are cut to fit around openings and built-in, leaving no gaps (do not compress the insulation by pushing it into a cavity).

APPROVAL TO PROCEED:

The above indicative guidance illustrates good practice for the design and construction of interfaces only in respect to ensuring thermal performance and air barrier continuity. The above guidance must be implemented with due regard to all other requirements imposed by the Building Regulations, Preliminary reference documentation and Pre-operation checks of Airtightness and Thermal Integrity specifications.

© COPYRIGHT. ALL RIGHTS RESERVED. THIS DRAWING MUST NOT BE REPRODUCED WITHOUT PERMISSION.	C1	28.08.09	PG	Revised Construction Issue
	C2	23.04.10	PG	Drawing annotation & dims. coordinated with timber frame details

DO NOT SCALE. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING DIMENSIONS WHICH ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

SITE MANAGER/ SUPERVISOR

SITE NAME

PLOT No.

DATE

KEY: ATC = Air Tightness Champion SM = Site Manager SE = Services Engineer E = Struct. Engineer LD = Lead Designer

Client Centoo

Project Racecourse



Drawing BRICKWORK WALL HEAD DETAIL

Scale	Date	Project No.	DWG No.	Rev	Drawn By	Checked By
AZ 1:5	22/12/08	5475	/31-103	/C2	PG	MS

Milkey House Dean Street Newcastle-upon-Tyne NE1 1UF T: 0191 2332650 F: 0191 2332651



Integral

- Equipo al principio
- PHPP 
- Nivel de detalle 
- Rentable

Estrategia solar

- Maximizar ganancias
- Sobre calentamiento
verano
- Inercia térmica

Componentes

Ventanas | Pozo canadiense | Biomasa

Triple acristalamiento

- Calidad ■■
- Factor solar
- Emisividad
- Instalación ■

Intercambiador tierra/aire

- Funcionamiento
- Entrada del aire
- Clima mediterráneos

Estufas de biomasa

- Instalación
- Desventajas
- Huella de carbono

Triple acristalamiento

- Calidad  
- Factor solar
- Emisividad
- Instalación 



8/10

MI TAPE

Ruban Adhésif Universel

TESCON

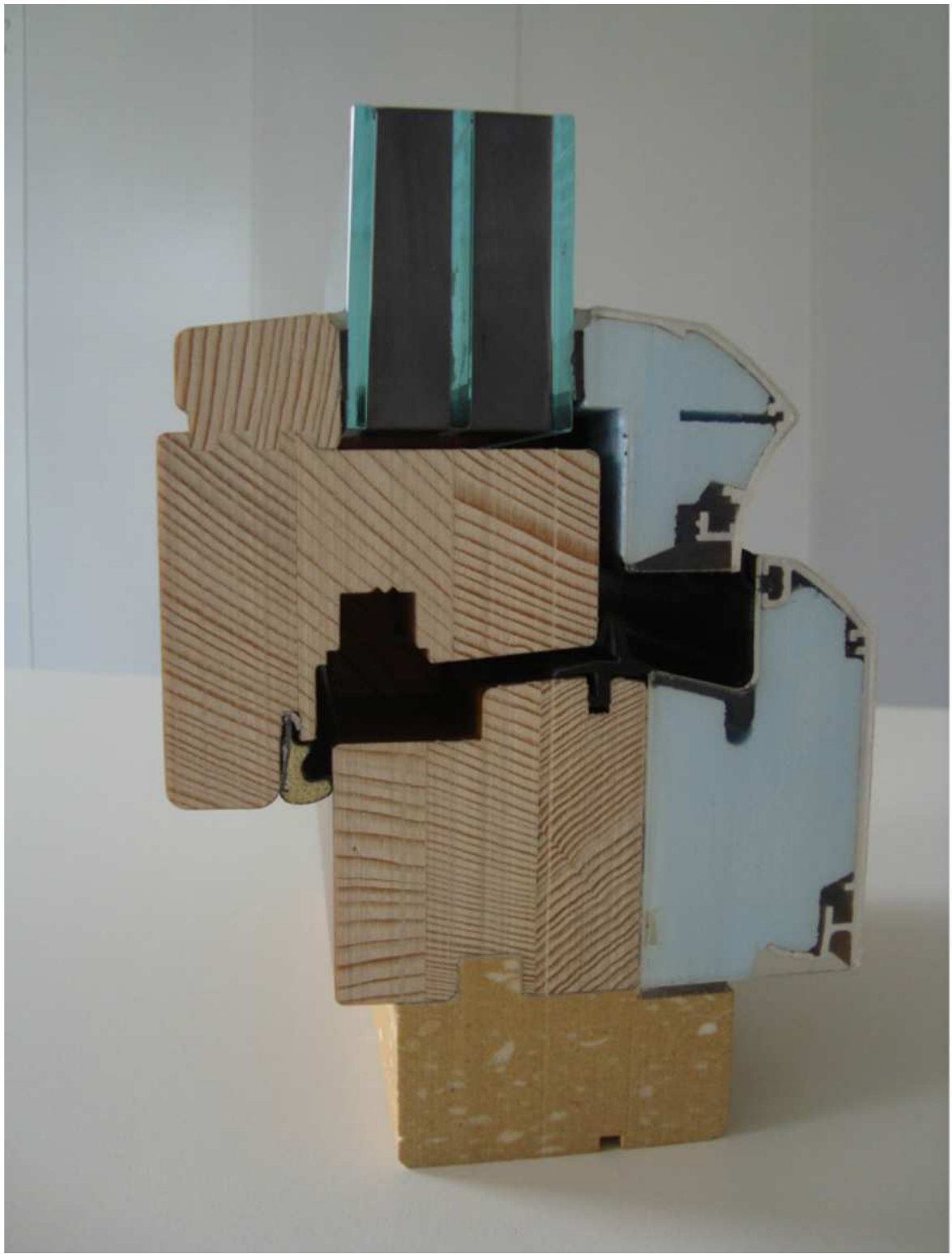
pre clima
Ruban Adhésif universel
pour les Angles

TESCON PROFIL

TESCON PROFIL
Ruban Adhésif universel
pour les Angles

MI TAPE

pre clima
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pour les Angles



Triple acristalamiento

- Calidad  
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Imagen: Jesús Menéndez

Intercambiador tierra/aire

- Funcionamiento
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- Clima mediterráneos

Estufas de biomasa

- Instalación
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Aire

Ventilación | Calidad interna del aire | Humedad

MVHR

- Funcionamiento
- Ubicación ■
- Eficiencia
- Conducciones



Aire fresco

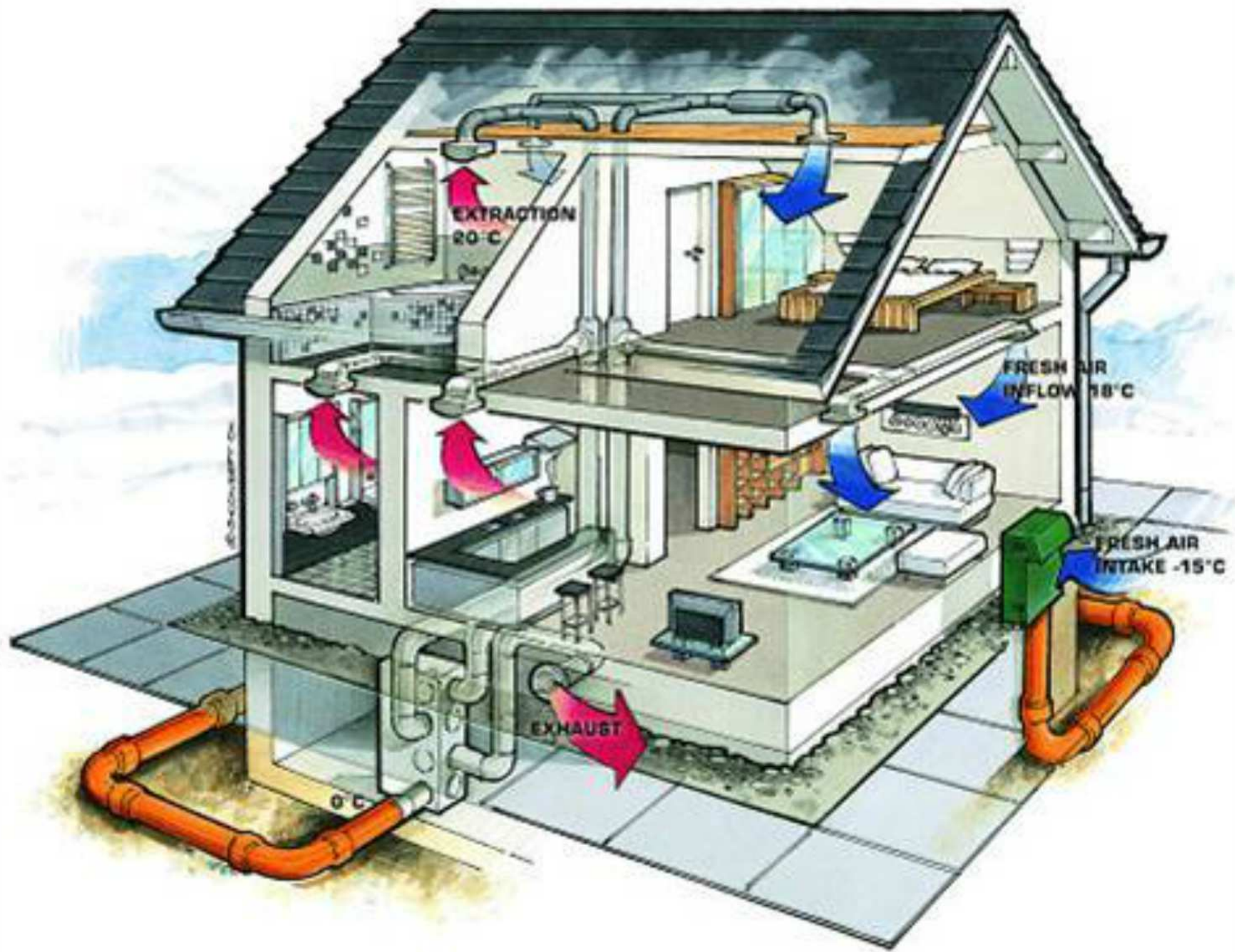
- Renovación constante
- Entrada y salida
- Intensificador
- Filtros y mantenimiento .

Aire seco

- Beneficios
- Baja humedad relativa
- Estrategias

MVHR

- Funcionamiento 
- Ubicación 
- Eficiencia
- Conducciones



MVHR



- Funcionamiento 
- Ubicación 
- Eficiencia
- Conducciones



Imagen: Jesús Menéndez



Imagen: Jesús Menéndez



MVHR

- Funcionamiento 
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Aire fresco

- Renovación constante
- Entrada y salida
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Imagen: Jesús Menéndez



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Aire seco

- Beneficios
- Baja humedad relativa
- Estrategias

Calidad

Control | Certificación | Valor



Control y calidad

- Objetivo común
- Fase de diseño
- Productos certificados
- Garantía "Passivhaus"
- Proyectado = Ejecutado
- Perdurable

Certificación

- Planos
- Cálculo puentes térmicos
- Energía primaria
- Presunciones
- Certificados
- Imágenes

FAQs

- MVHR: ruido y filtros
- Tarifa eléctrica
- Humedad relativa
- Coste
- Precio - Valor

Control y calidad

- Objetivo común
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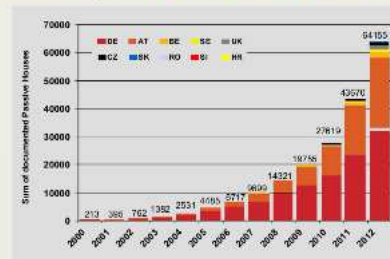


FAQs

- MVHR: ruido y filtros
- Tarifa eléctrica
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- Coste
- Precio - Valor

Ejemplos

Proyectos Pasisvhaus. Absoluto

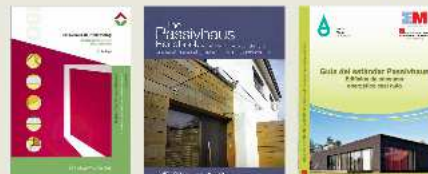


Fuente: Pass-NET

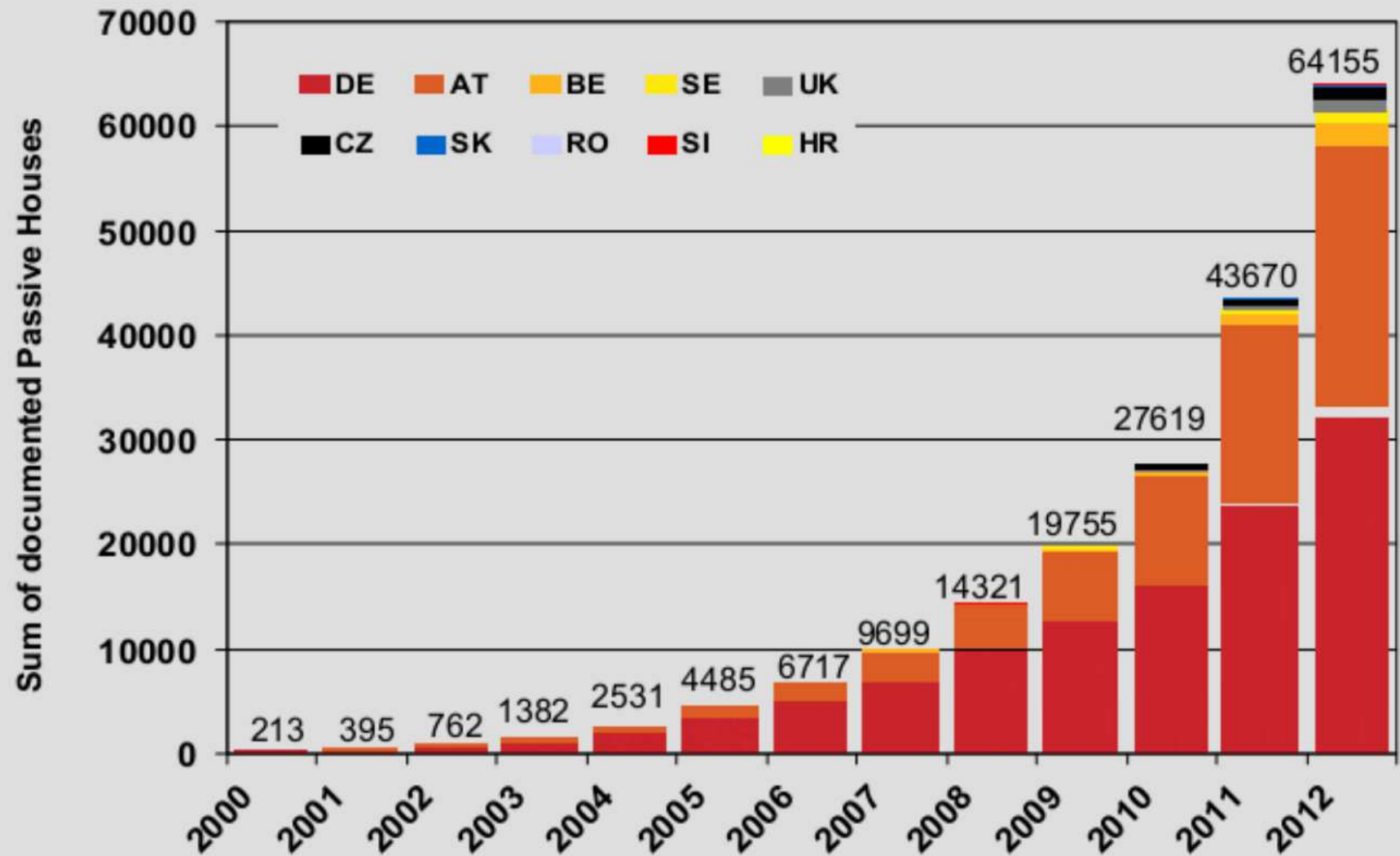


+ información

www.passiv.de
www.plataforma-pep.org



Projectos Pasisvhaus. Absoluto



Fuente: Pass-NET

Imagen: Jesús Menéndez

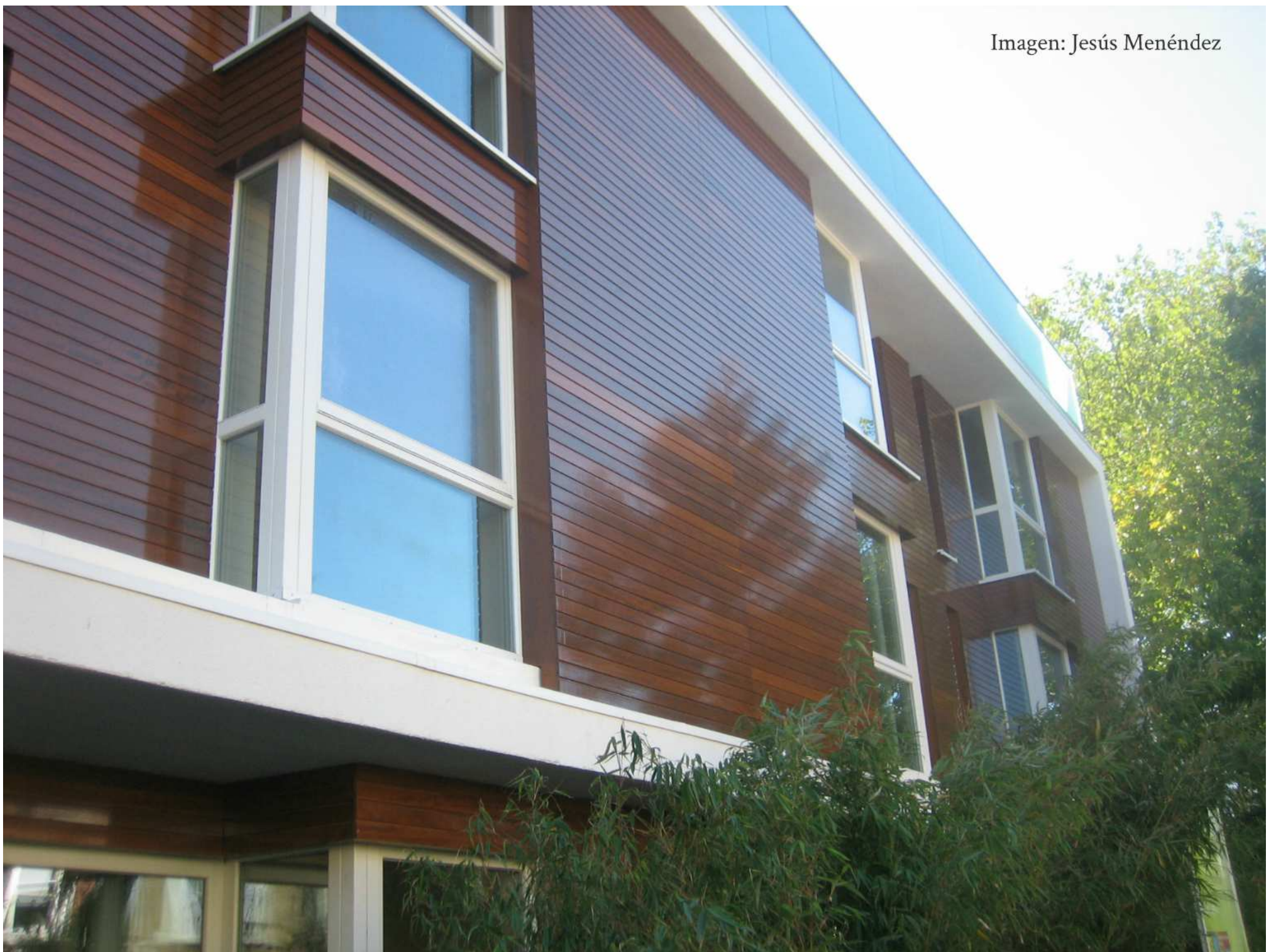


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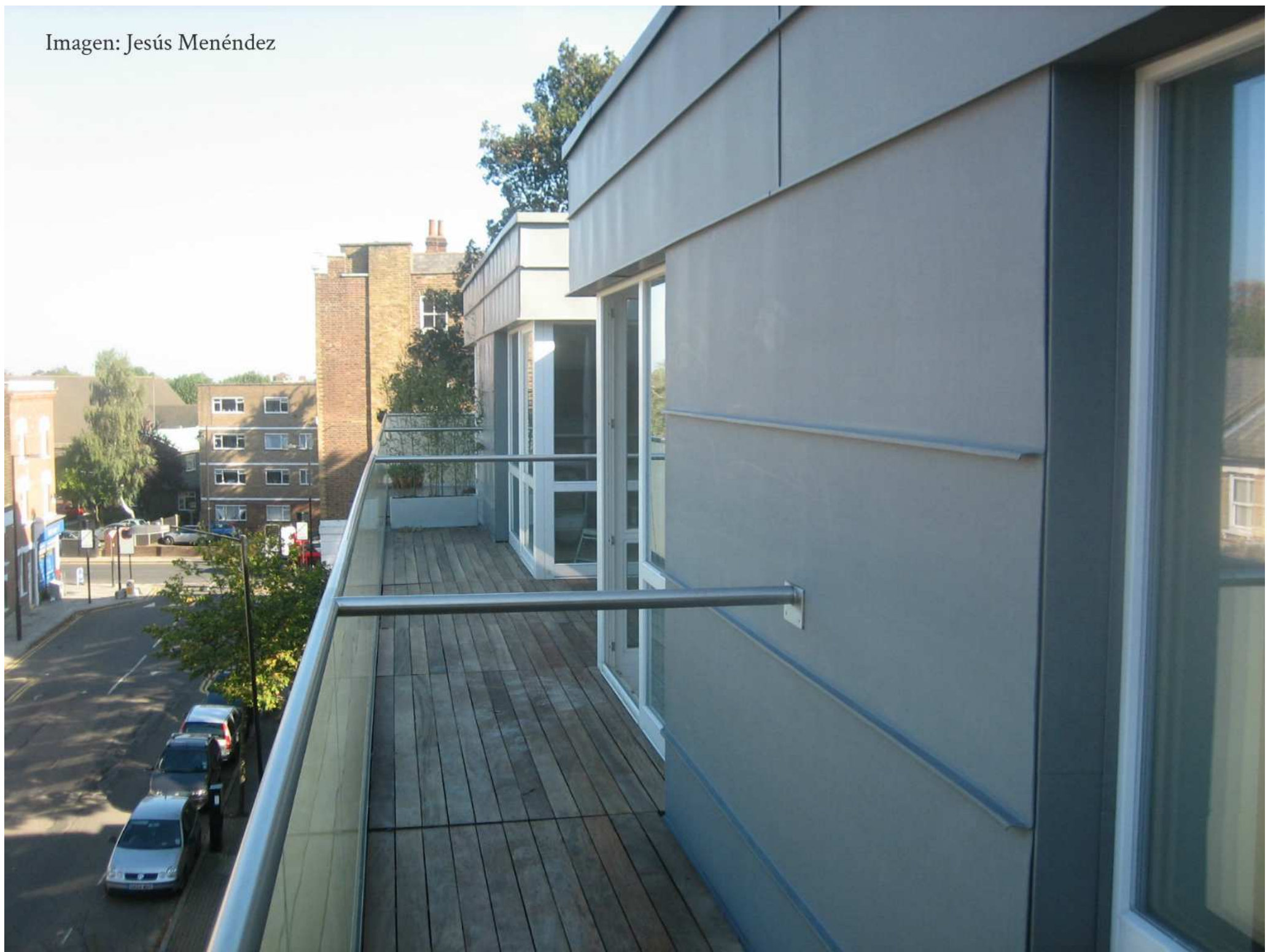




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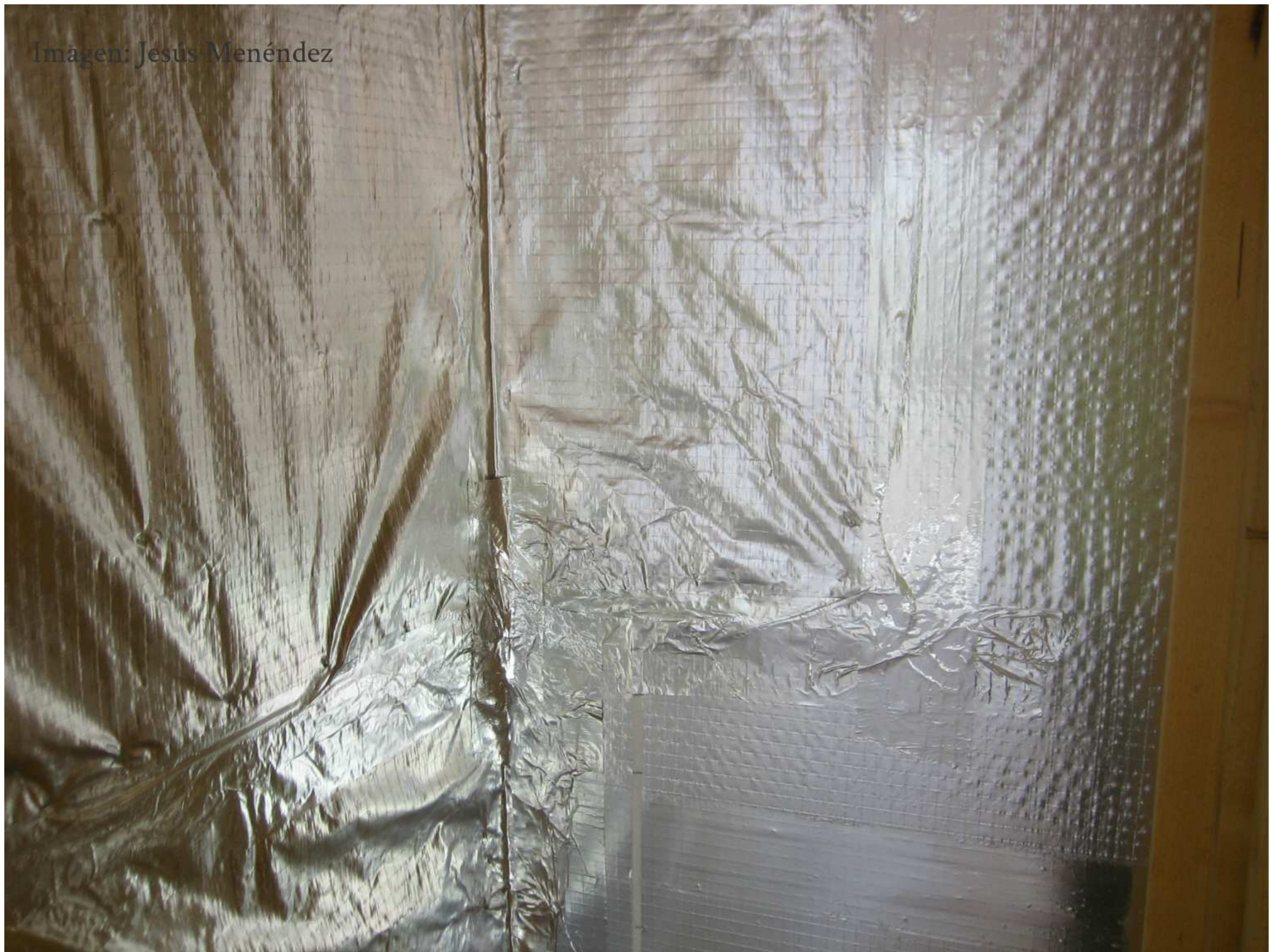










Imagen: Jesús Menéndez







Imagen: Mark Siddall / www.leap4.it

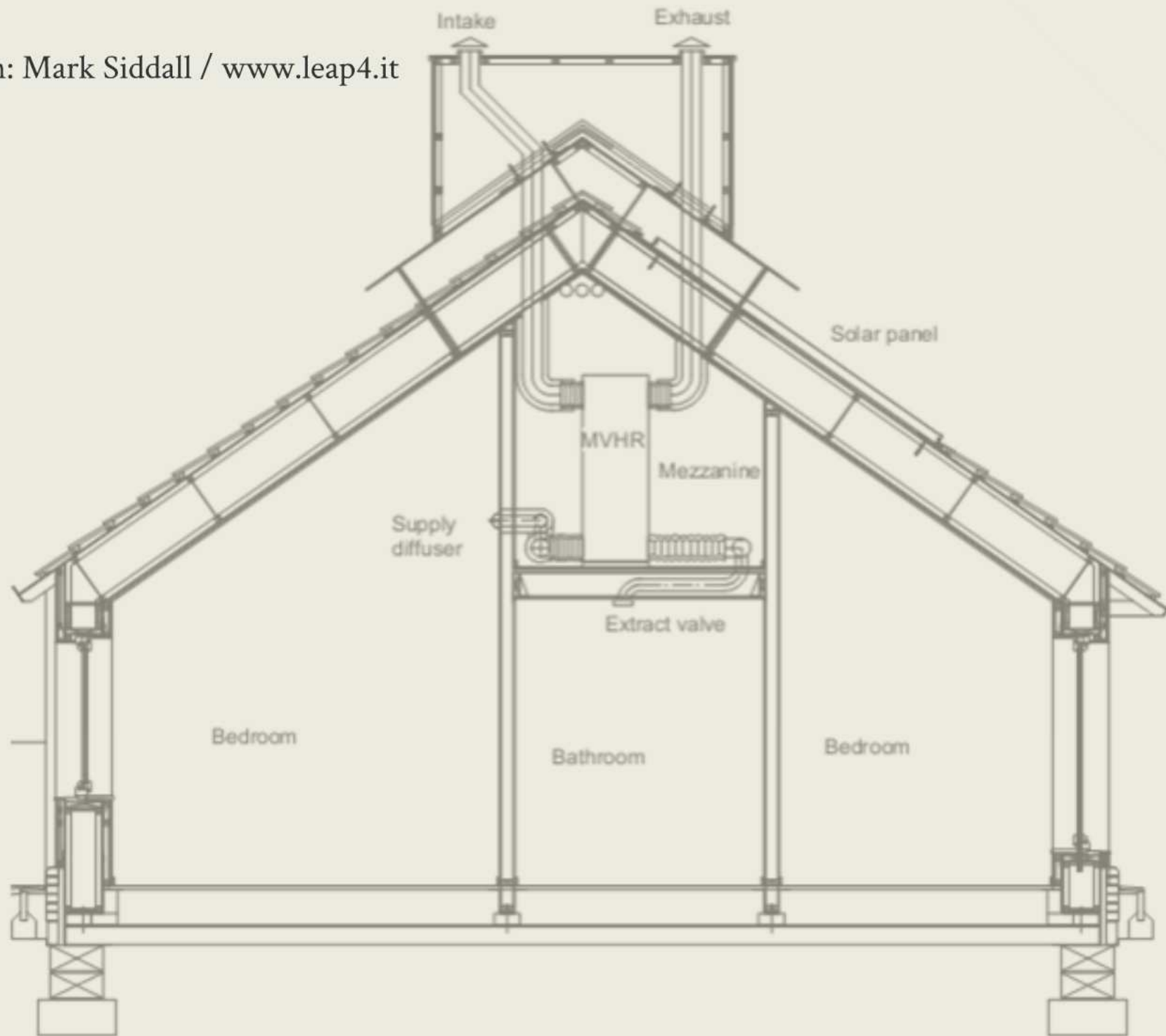




Imagen: Mark Siddall / www.leap4.it



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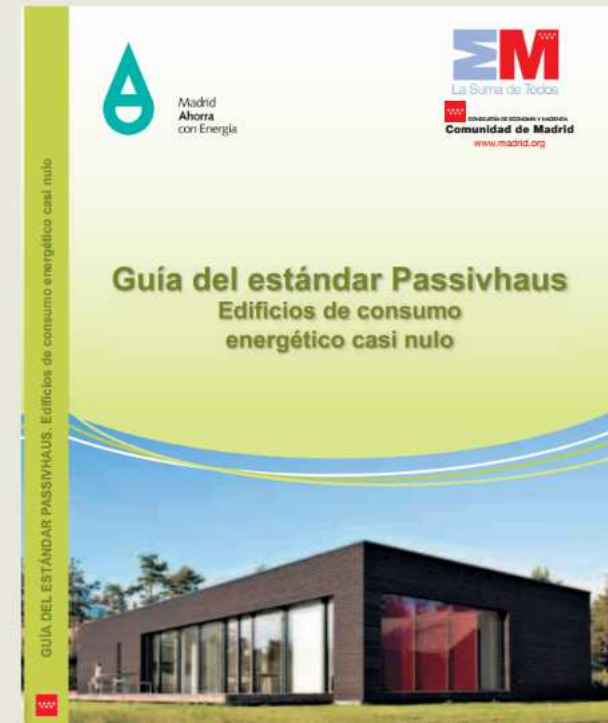
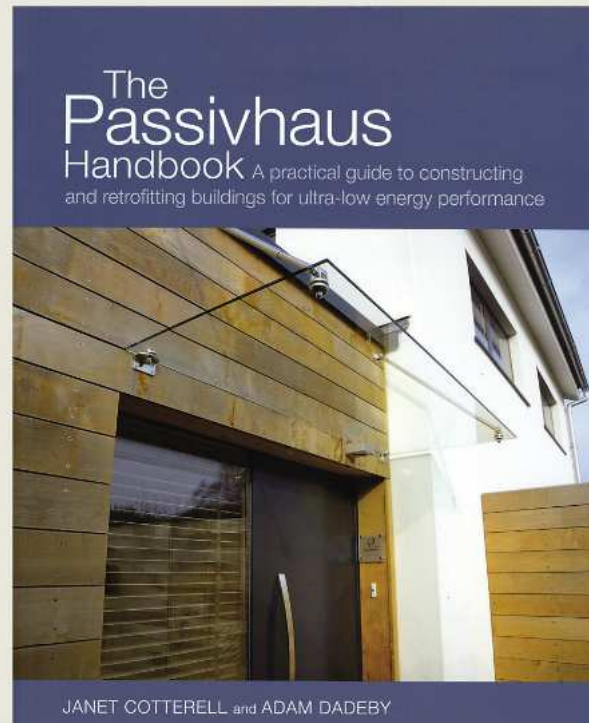
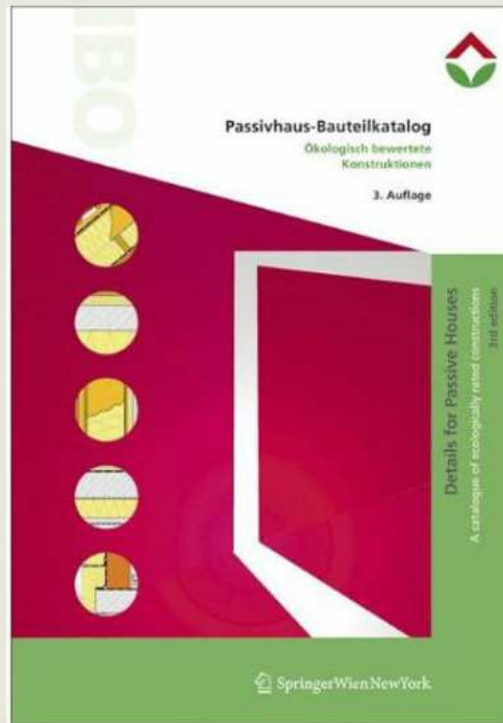


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