PIME'S PROYECT 176 SALBURUA

Universidad del País Vasco · Euskal Herriko Unibertsitatea

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ENPLEGU ETA GIZARTE POLITIKETAKO SAILA · DEPARTAMENTO DE EMPLEO Y POLÍTICAS SOCIALES

enedi Grupo de Energética en la Edificación

Máquinas y Motores Térmicos UPV/EHU

THERMAL AREA | ÁREA TÉRMICA

LABORATORY FOR THE QUALITY CONTROL IN BUILDINGS OF THE BASQUE GOVERNMENT | LABORATORIO DE CONTROL DE CALIDAD EN LA EDIFICACIÓN DEL GOBIERNO VASCO

March 31, 2014

Imanol Ruiz de Vergara

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3. ENERGY CERTIFICATION

1. WHO ARE WE?

1. Who are we?

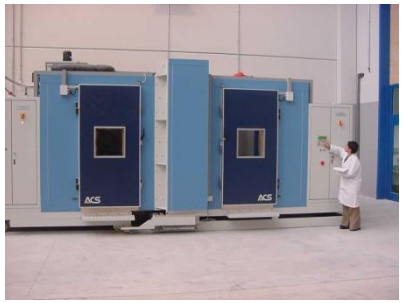
LABORATORY FOR THE QUALITY CONTROL IN BUILDINGS OF THE BASQUE GOVERNMENT

Mechanical Area | **Thermal Area** | Acustic Area

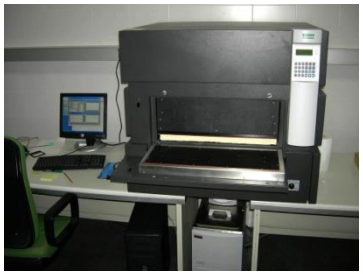
1. Who are we?

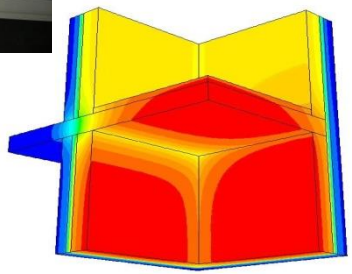
Where are we?

1. Who are we?



Thermal Area





2. STATE OF SPANISH LEGISLATION

2. STATE OF SPANISH LEGISLATION

National Standard → CTE DB-HE (technical building code – energy saving)

CTE CÓDIGO TÉCNICO DE LA EDIFICACIÓN

Energy Consumption: necessary energy to fill up the energy demand of the services of heating, cooling and hot water, taking into account the efficiency of the used systems.

Energy Demand	Winter climatic zones					
	α	A	B	C	D	E
$D_{cal, lim}$ (kWh/m²year)	15	15	15	20	27	40

Energy Demand: necessary useful energy that technical systems would have to provide to keep the building in conditions of comfort.

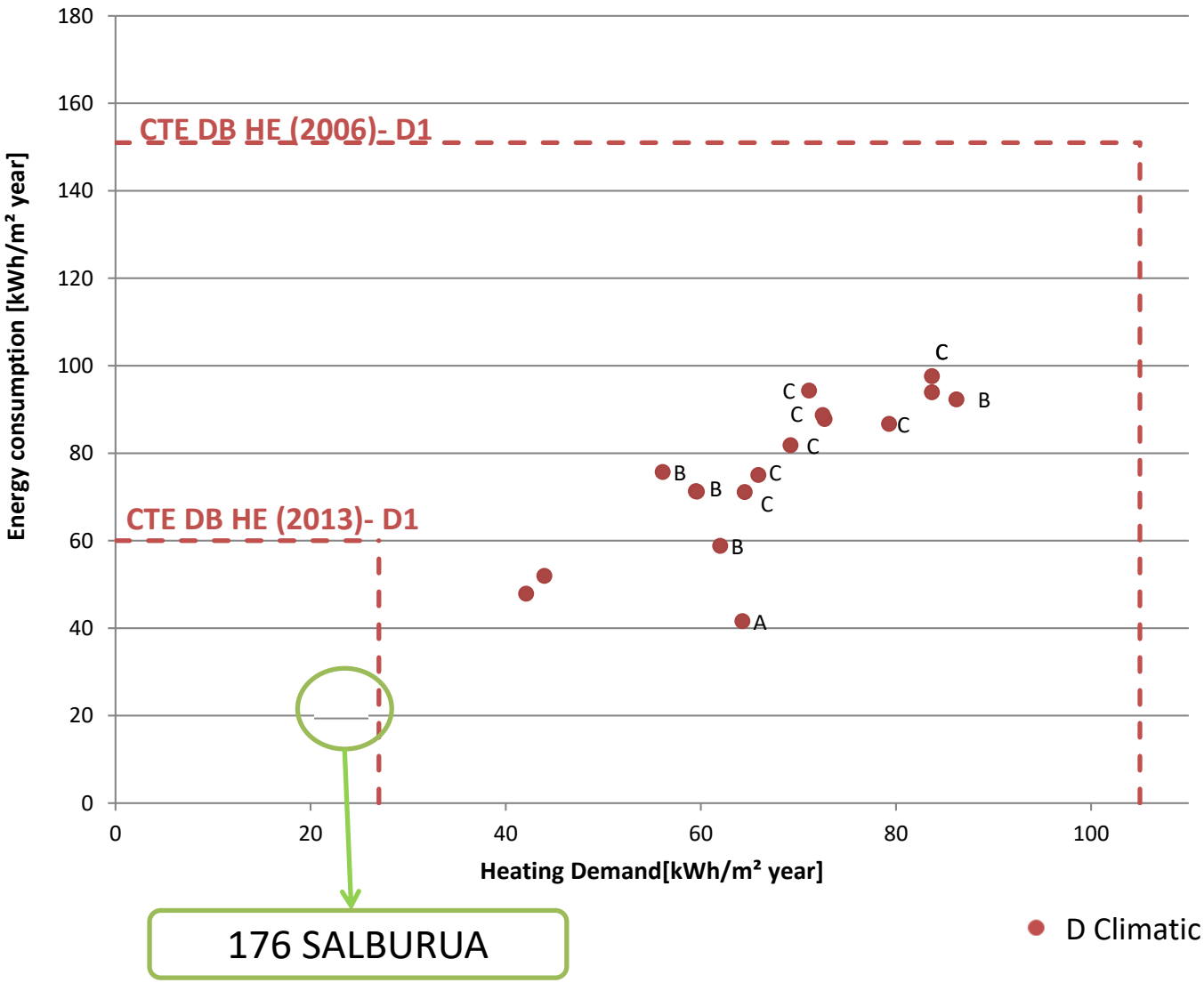
Energy Consumption	Winter climatic zones					
	α	A	B	C	D	E
$C_{ep, lim}$ (kWh/m²year)	40	40	45	50	60	70

WHO ARE WE?

STATE OF SPANISH LEGISLATION

ENERGY CERTIFICATION

2.1. State of the building



Studied buildings:

19

at Vitoria

2.2 Energy demand

Energy demand	Winter climatic Zone					
	α	A	B	C	D	E
$D_{cal, base}$ (kWh/m²year)	15	15	15	20	27	40

VITORIA-GASTEIZ → 176 SALBURUA

WHO ARE WE?

STATE OF SPANISH LEGISLATION

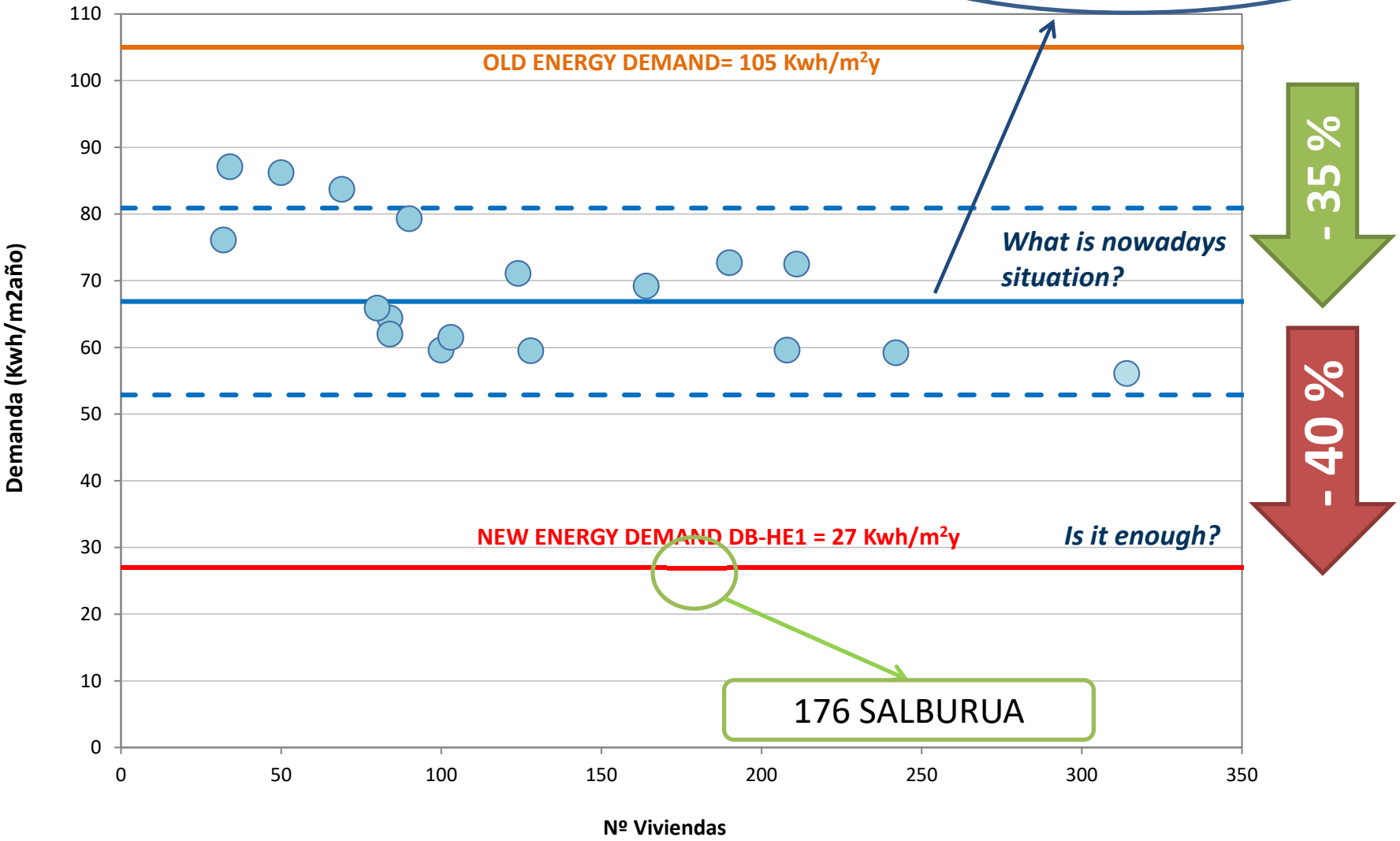
ENERGY CERTIFICATION

2.2 Energy Demand

VITORIA-GASTEIZ

D Climatic Zone

$D_{average}$ = 69,2 ± 10 Kwh/m²y

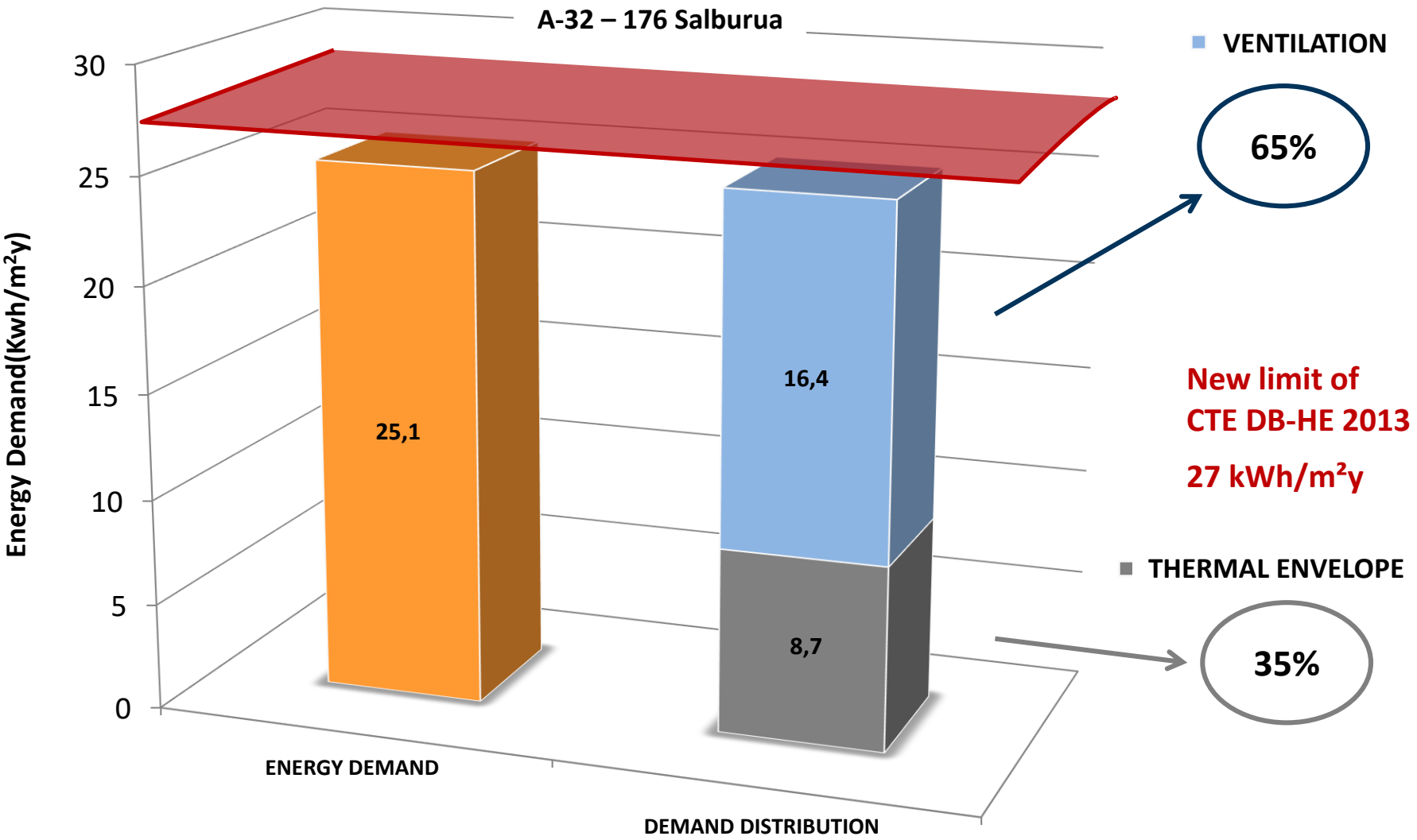


WHO ARE WE?

STATE OF SPANISH LEGISLATION

ENERGY CERTIFICATION

2.2. Energy Demand

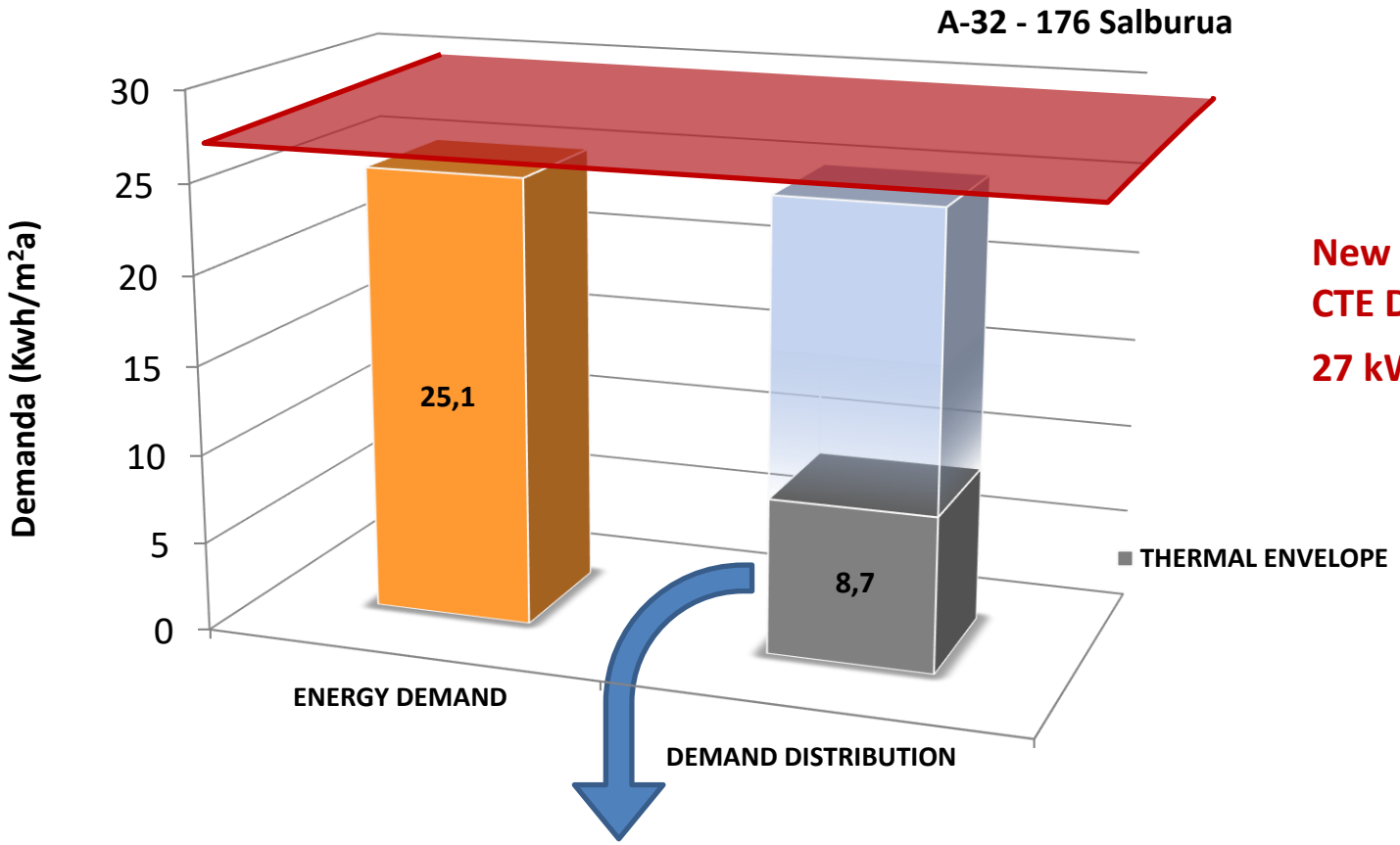


WHO ARE WE?

STATE OF SPANISH LEGISLATION

ENERGY CERTIFICATION

A. Thermal Envelope



New Limit of CTE DB-HE2013

27 kWh/m²a

-OPAQUE ENVELOPE

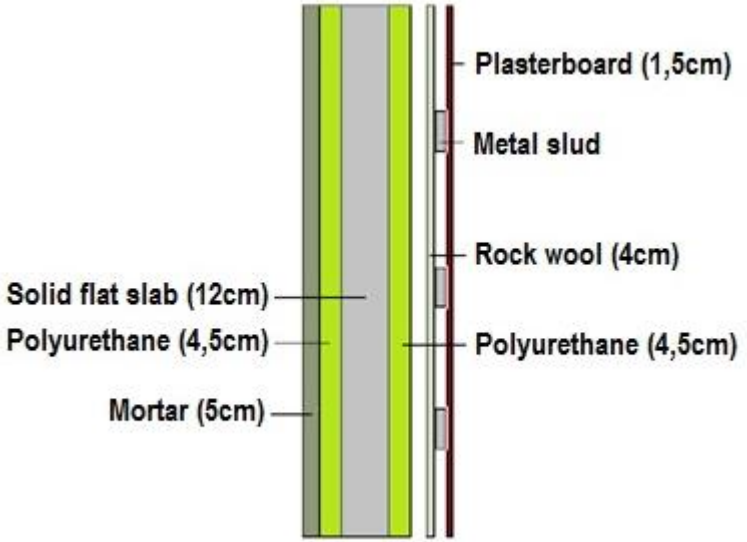
-WINDOWS

-THERMAL BRIDGES

a1- Roof

VISESA

PROPOSED SOLUTION



LIMIT TRANSMITTANCE FOR THE PROPOSAL< 0,24 W/m^{2}k

a1- Roof

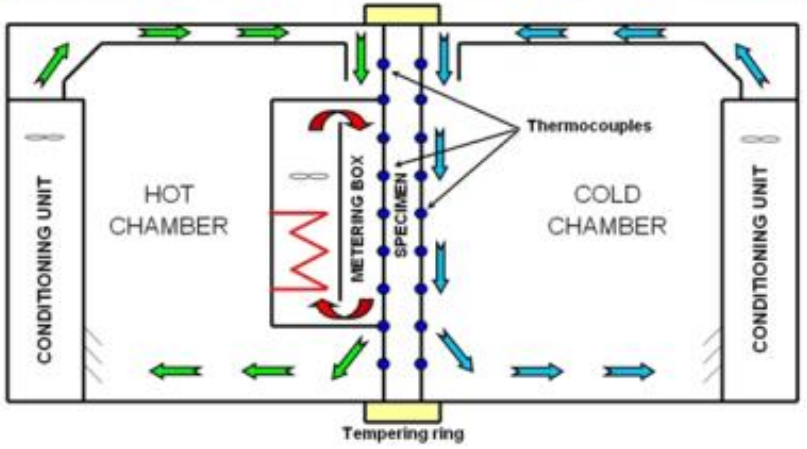
VISESA

THERMAL TESTS

a1- Roof

a1- Roof

UNE-EN ISO 8990:1997



R_{test} = 5,40 [m²K/W]

U_{roof} = 0,18 [W/m²K]

a1- Roof

- **Not the same conditions in the lab than in the work!!**

In situ tests

WHO ARE WE?

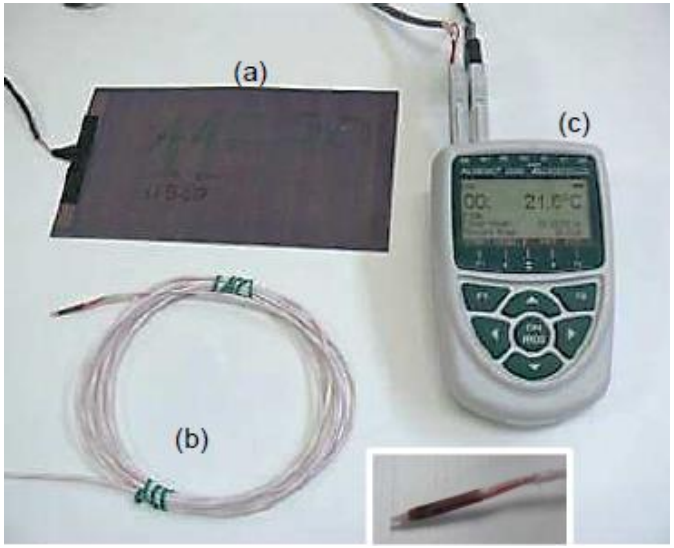
STATE OF SPANISH LEGISLATION

ENERGY CERTIFICATION

a1- Roof

In situ tests

ISO 9869:1998

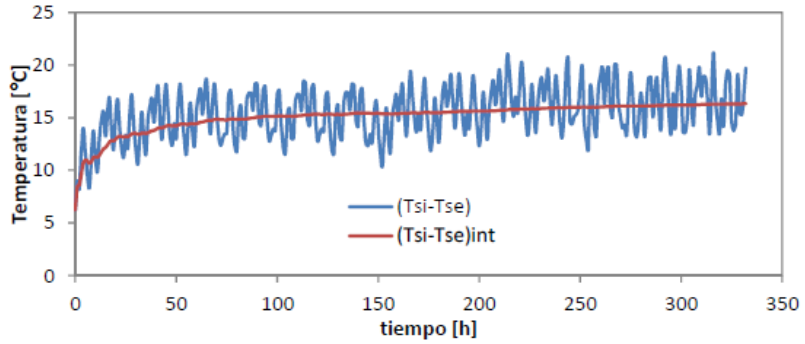


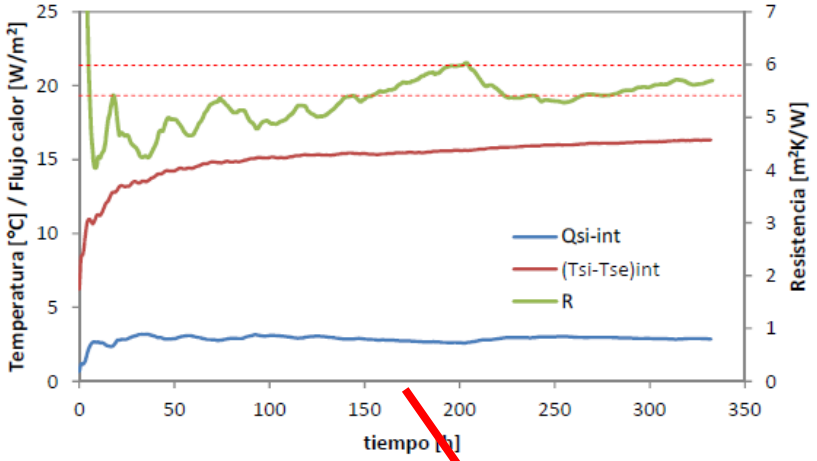
Used tools

a) Heat-flux meter
b) Temperature sensor
c) Data acquisition

a1- Roof

ISO 9869:1998





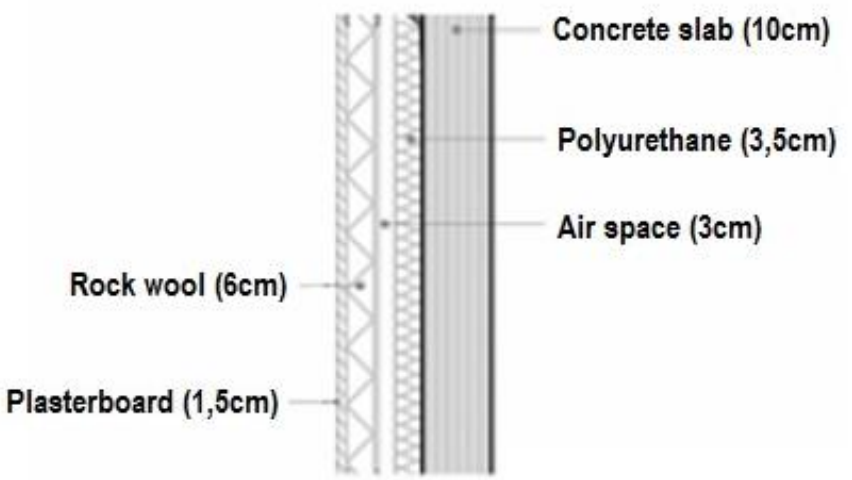
$R_{in\text{-}situ} = 5{,}21$ [m²K/W]

$U_{roof} = 0{,}19$ [W/m²K]

a2- Facade

VISESA

PROPOSED SOLUTION

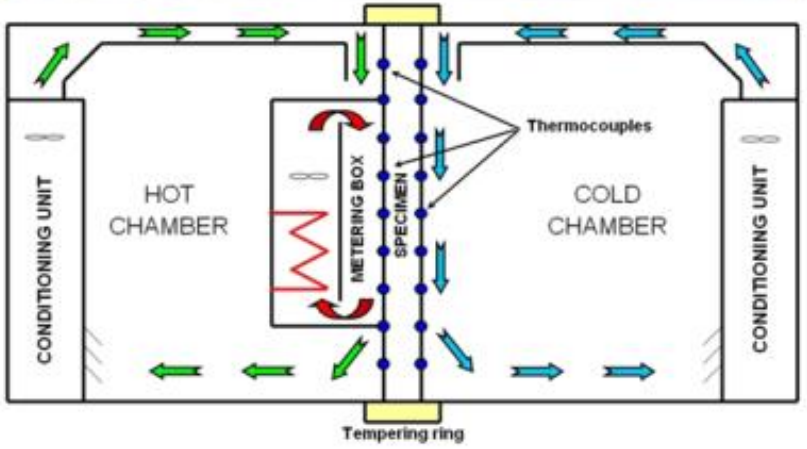


LIMIT TRANSMITTANCE FOR THE PROPOSAL< 0,35 W/m^{2}k

a2- Facade

a2- Facade

UNE-EN ISO 8990:1997



R_{test} = 3,15 [m²K/W]

U_{facade} = 0,30 [W/m²K]

WHO ARE WE?

STATE OF SPANISH LEGISLATION

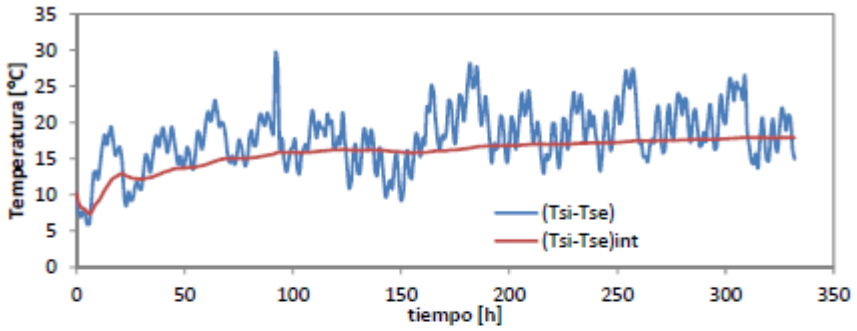
ENERGY CERTIFICATION

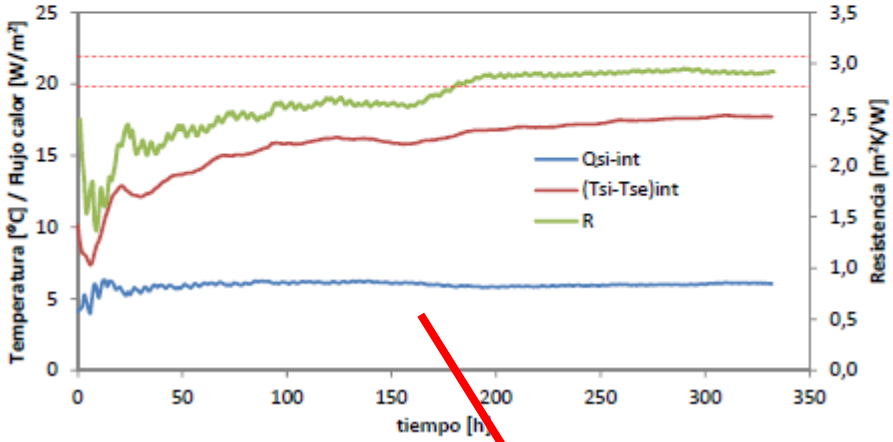
a2- Facade

In situ tests

a2- Facade

ISO 9869:1998





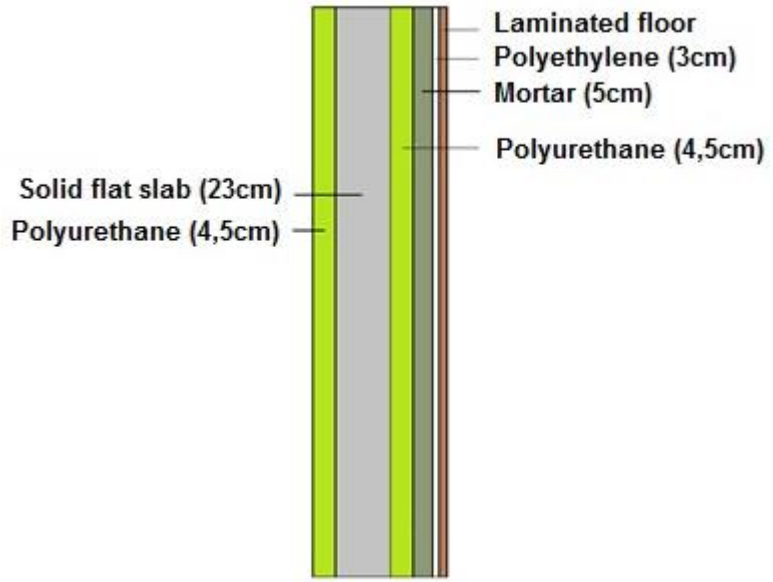
$R_{in\text{-}situ}$ = 2,84 [m²K/W]

U_{facade} = 0,32 [W/m²K]

a3- Floor

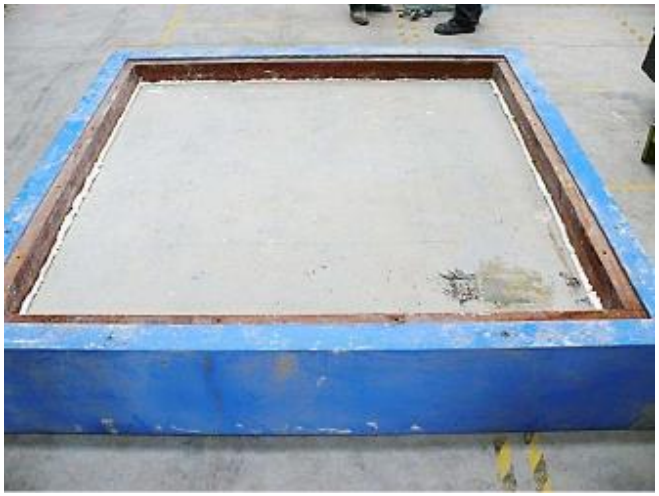
VISESA

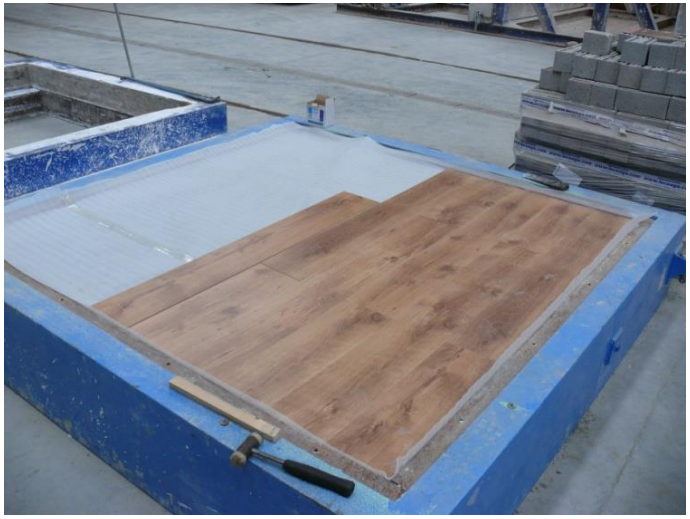
PROPOSED SOLUTION



LIMIT TRANSMITTANCE FOR THE PROPOSAL< 0,30 W/m^{2}k

a3- Floor





a3- Floor

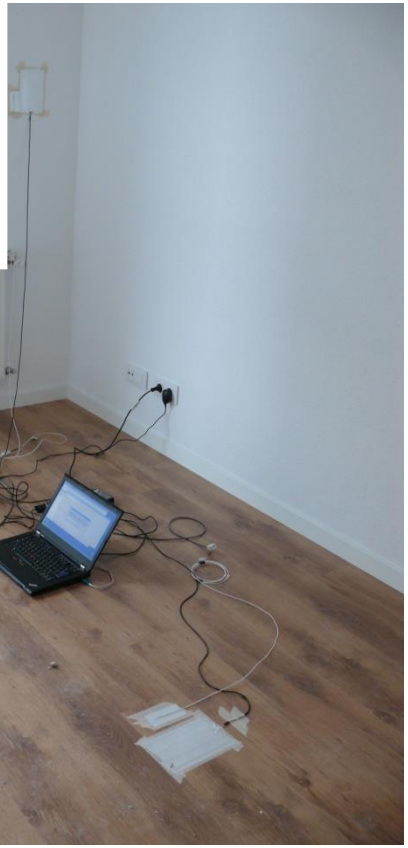
UNE-EN ISO 8990:1997

$R_{test} = 4,21$ [m²K/W]

$U_{floor} = 0,22$ [W/m²K]

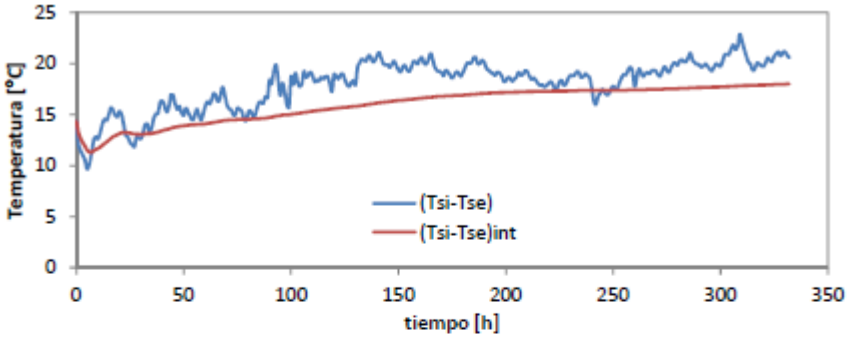
a3- Floor

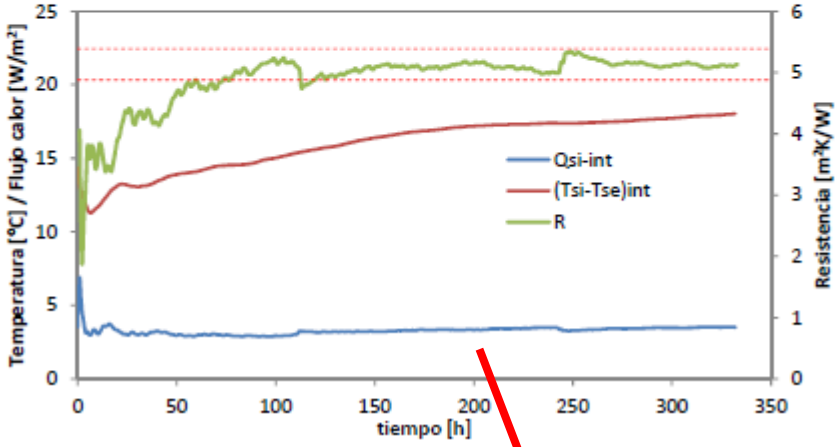
In Situ tests



a3- Floor

ISO 9869:1998





$R_{in\text{-}situ}$ = 4,21 [m²K/W]

U_{floor} = 0,22 [W/m²K]

a4- Windows

- SHUTTER BOX
$U_{mín} \approx 2.7\ W/m^2K$

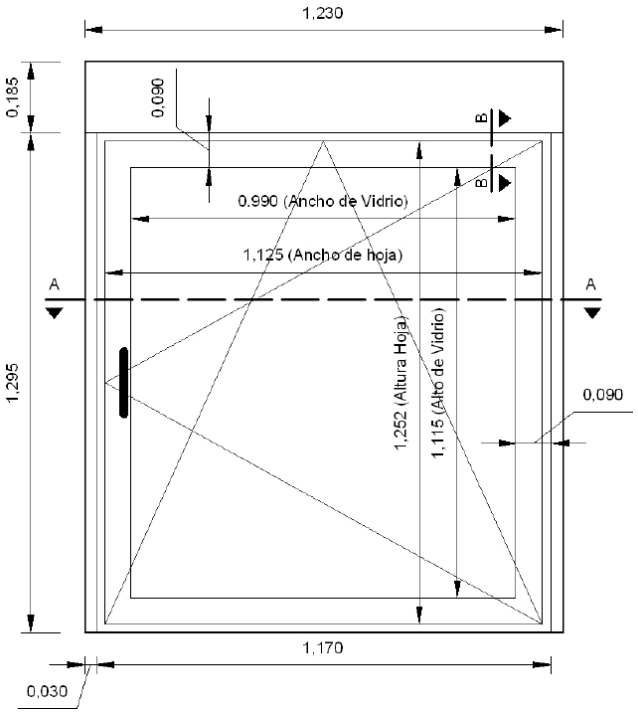
- GLASSES 4/12/6
$-U_{glasses} \approx 2\ W/m^2K$

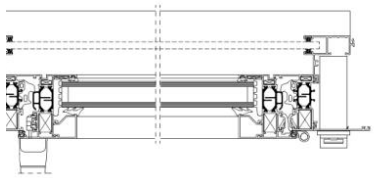
- ALUMINUM FRAME
$U_{min\ frame} \approx 3.2\ W/m^2K$

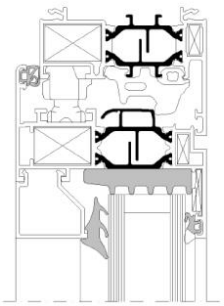
a4- Windows

VISESA

PROPOSED SOLUTION





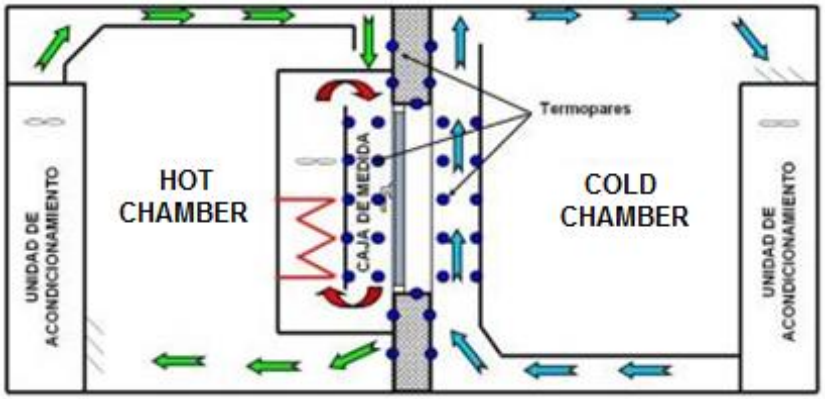


LIMIT TRANSMITTANCE FOR THE PROPOSAL< 2 W/m^2k

a4- Windows

UNE-EN ISO 12567-1:2001

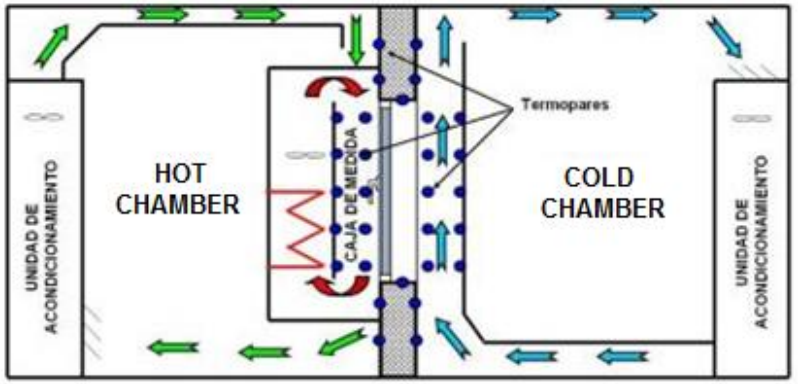
- Glasses: 4+4/16/5+5[mm]
- Air chamber with Argon
- Low emissivity glasses



$U_{glasses} = 1,16$ [W/m²K]

a4- Windows

UNE-EN ISO 12567-1:2001



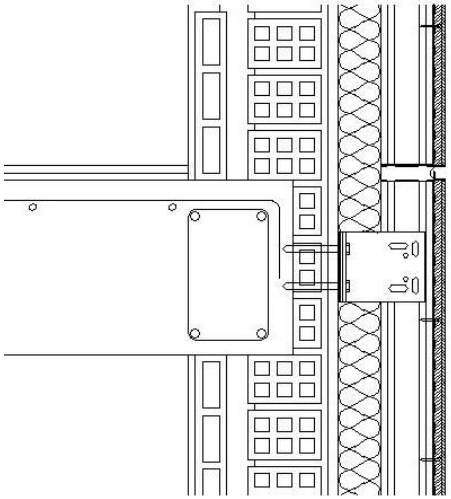
$$U_{window} = 1,89 \ [W/m^2K]$$

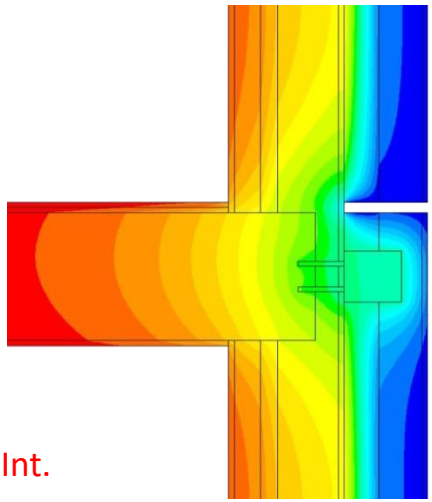
Summary of the transmittances

	$U_{proyect}$ [W/m²k]	$U_{tested\ in\ lab}$ [W/m²k]	$U_{tested\ in\ situ}$ [W/m²k]
ROOF	< 0,24	0,18	0,19
FACADE	< 0,35	0,30	0,32
FLOOR	< 0,30	0,22	0,22
WINDOW	< 2	1,89	-

B. Thermal Bridges

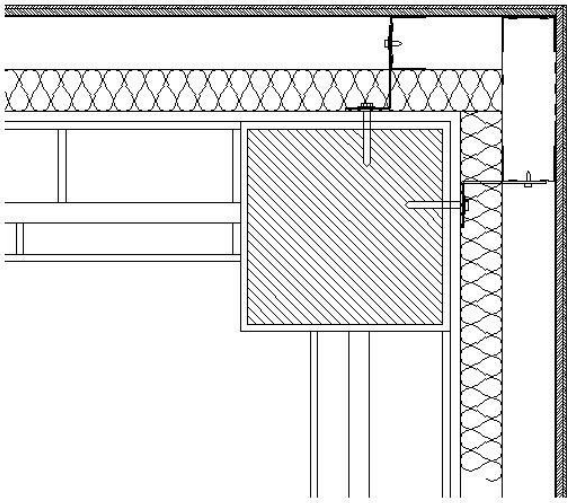
Frente de Forjado





Int. Ext.

Corner Column



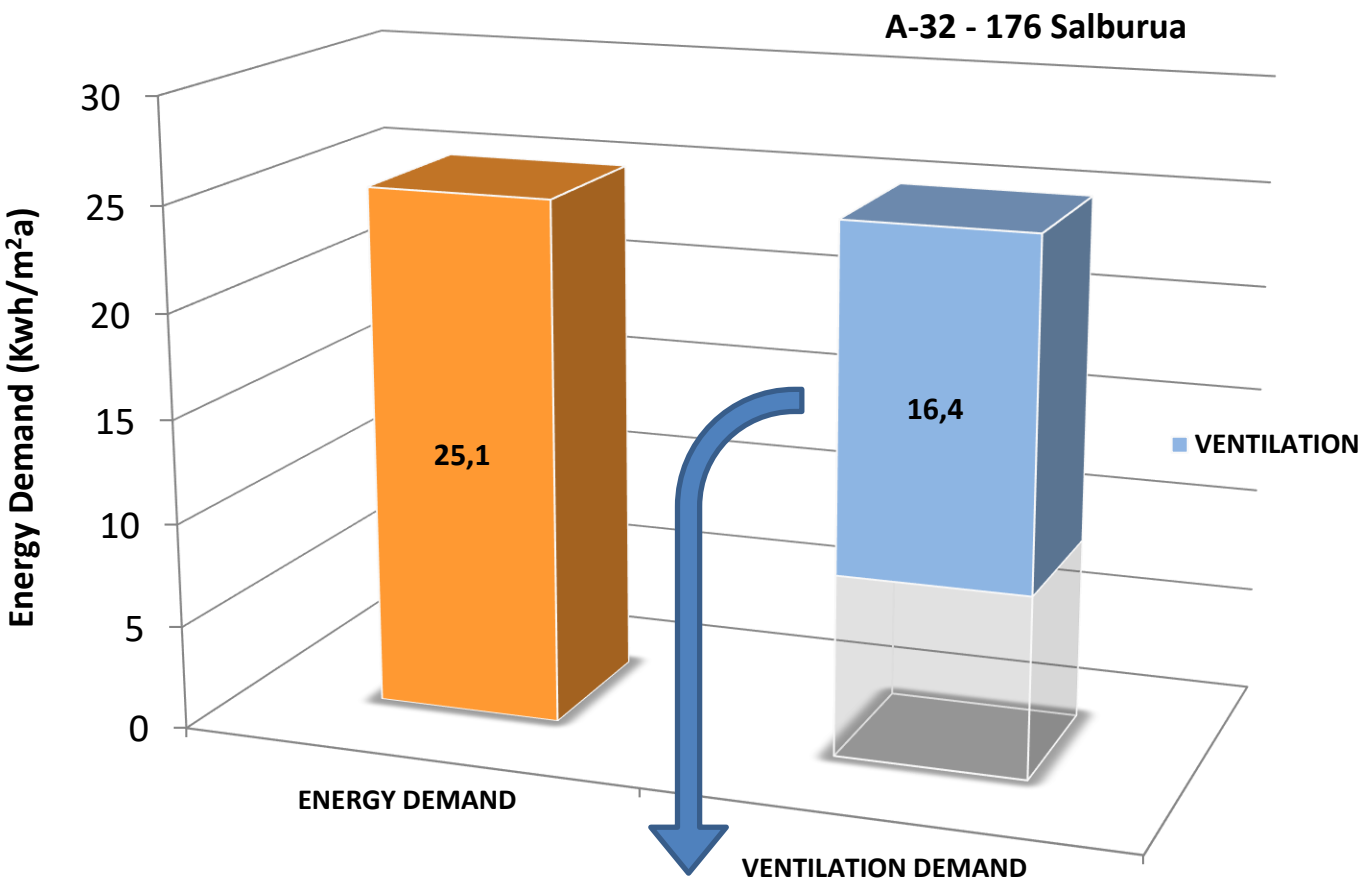
Int. Ext.

B. Thermal Bridges

FUTURE TEST→ THERMOGRAPHY

EN 13187:1998

C. Ventilation



-INFILTRATIONS

-VENTILATION SYSTEM

c.1. Infiltrations

BLOWER DOOR TEST → AIR TIGHNESS

- Current values:

  ≈ 3 air changes per hour [1/hr]

- Optimal values:

  1 - 2 air changes per hour [1/hr]

c.1. Infiltrations

Ensayos In Situ

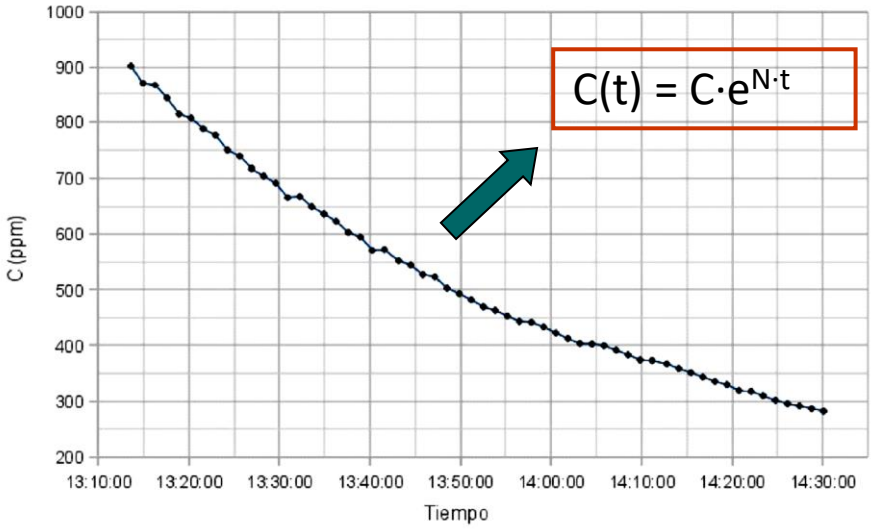
UNE EN 13829:2002

N_{50} = 2,01 [1/h]

c.1. Ventilation

FUTURE TEST→ TRACER GASES TEST

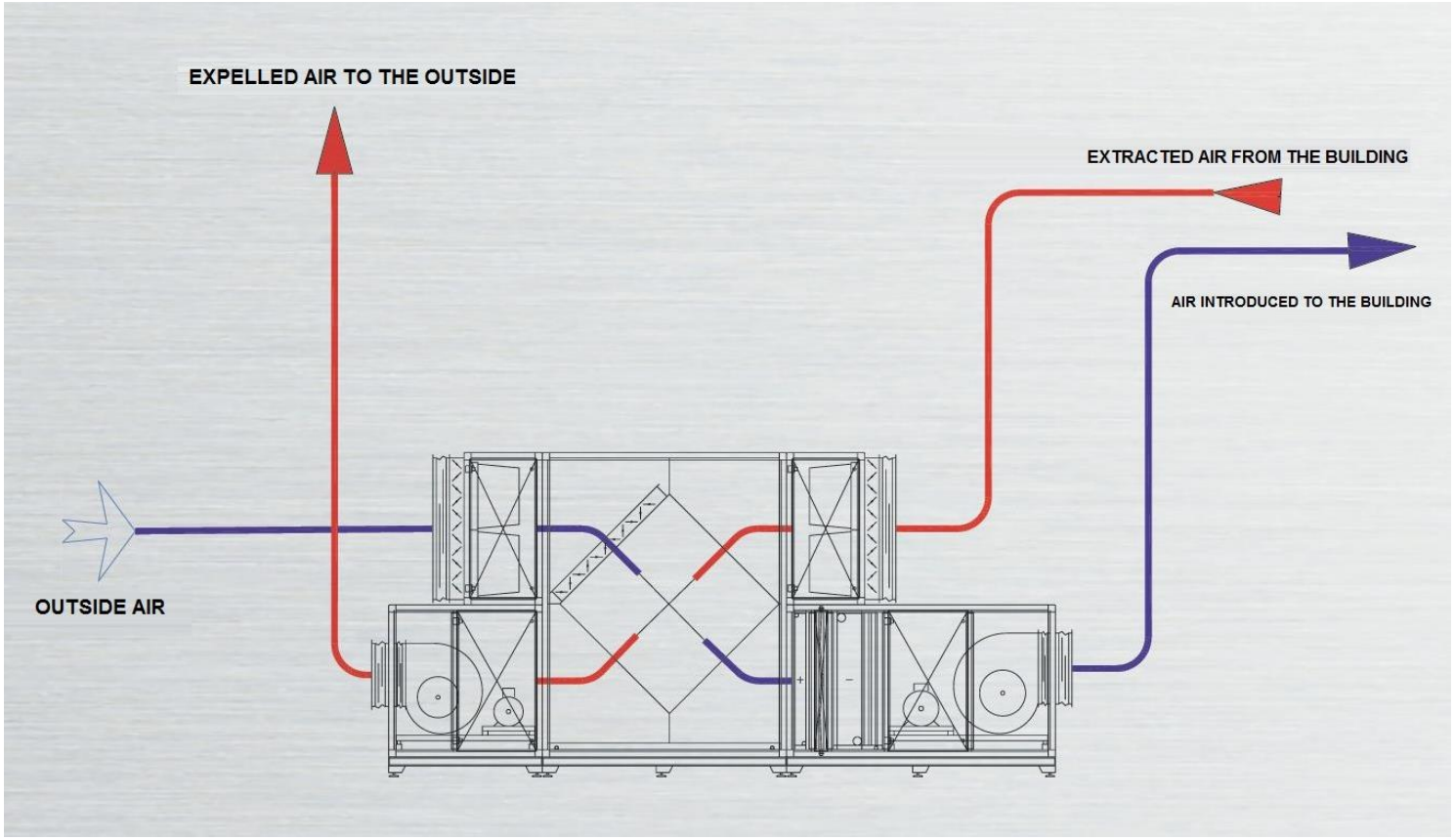
EN ISO 12569:2012



- Complementary measures

c.2. Ventilation system

➲ HEAT RECOVERY SYSTEM

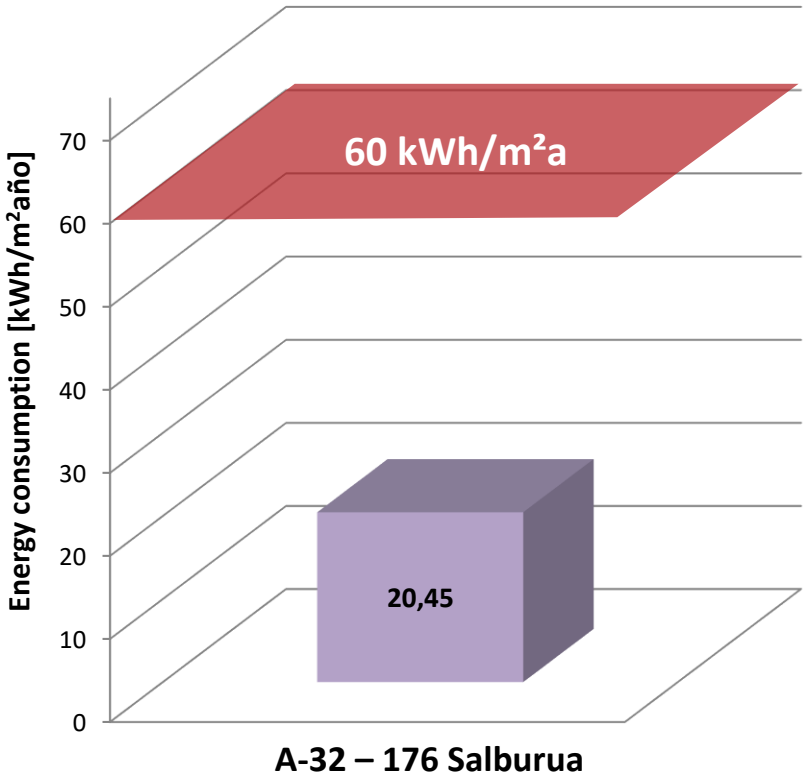


2.3 Energy consumption

Energy Consumption	Winter climatic zone					
	α	A	B	C	D	E
$C_{ep,\ base}$ (kWh/m²year)	40	40	45	50	60	70

VITORIA-GASTEIZ → 176 SALBURUA

2.3 Energy consumption



New limit of CTE DB-HE2013 D Climatic Zone

D.FACILITIES
d1. Cogeneration

COGEN España

aiguasol

176 SALBURUA

Datos del proyecto			
Provincia	Alava	Superficie útil calefactada	1529 m2
Ciudad	Vitoria-Gasteiz		
Tipo edificio	Bloque		
Zona Climatica (HE1)	D1		

Sistema de Cogeneración			
Tipo de equipo	Genérico	Modelo	Genérico
Potencia Elec. Equipo	5,5 kW	Nº Equipos	2
Potencia Elec. Total	11 kW	Condensación	Sí
Volumen de inercia	3 m3	Combustible	Gas natural
Volumen de ACS	3 m3		

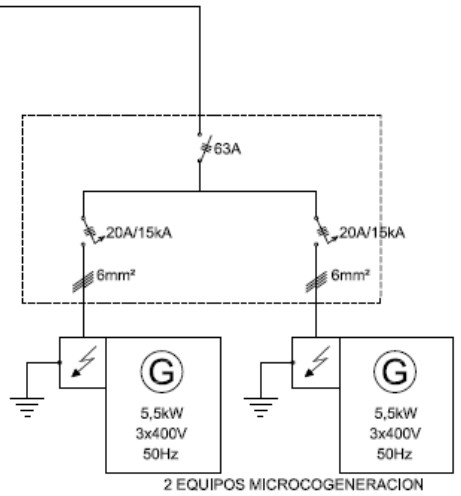
Sistema de apoyo			
Tipo	Caldera convencional	Combustible	Gas natural

Demandas de Calefacción y ACS				
Fichero de demandas	176salburua_sistema3_DH.csv			
Demanda de Calefacción	654.953 kWh/año	428,35 kWh/m2.año	97,0%	
Demanda de ACS	19.918 kWh/año	13,03 kWh/m2.año	3,0%	

Ahorro 88.984 kgCO2/año -41% respecto a referencia

Consumos de Energia Final Equivalentes

Calefacción 598.941 kWh ACS 18.215 kWh



Emissions reduction	
Original emissions	**6,30** kCO²/m²*year
PostCog emissions	**4,78** kCO²/m²*year

D. FACILITIES

d2. Photovoltaic panels

226 panels

PV Estimation | Monthly radiation | Daily radiation | Stand-alone PV

Performance of Grid-connected PV

Radiation database: Climate-SAF PVGIS [What is this?]

PV technology: Unknown/Other

Installed peak PV power 58.688 kWp

Estimated system losses [0;100] 14 %

Fixed mounting options:

Mounting position: Free-standing

Slope [0;90] 60 ° Optimize slope

Azimuth [-180;180] 180 ° Also optimize azimuth

(Azimuth angle from -180 to 180. East=-90, South=0)

Tracking options:

Vertical axis Slope [0;90] 0 ° Optimize

Inclined axis Slope [0;90] 0 ° Optimize

2-axis tracking

Horizon file Examinar... No se ha seleccionado ningún archivo.

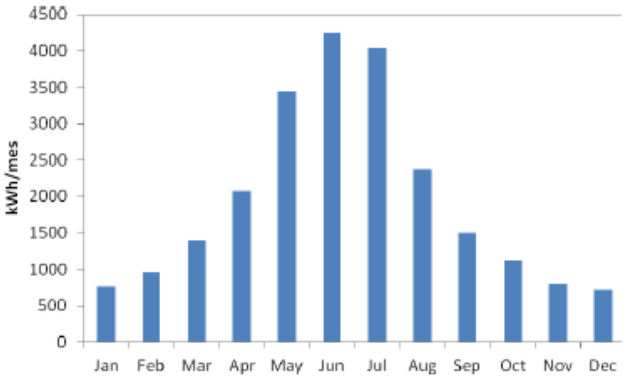
Output options

Show graphs Show horizon

Web page Text file PDF

Calculate [help]

Fixed system: inclination=60°, orientation=180°				
Month	E_d	E_m	H_d	H_m
Jan	24.5	761	0.56	17.3
Feb	34.4	962	0.78	21.9
Mar	45	1400	1.02	31.8
Apr	69.3	2080	1.65	49.4
May	111	3440	2.75	85.3
Jun	142	4250	3.45	103
Jul	130	4040	3.25	101
Aug	76.8	2380	1.95	60.4
Sep	49.9	1500	1.14	34.2
Oct	36.5	1130	0.83	25.7
Nov	26.9	808	0.61	18.4
Dec	23.1	717	0.53	16.3
Yearly average	**64.3**	**1950**	**1.55**	**47.1**
Total for year		**23500**		**565**



Emissions reduction	
Original emissions	**4,78** kCO^2/m^2*año
Final emissions	**4,17** kCO^2/m^2*año

3. ENERGY CERTIFICATION

3. ENERGY CERTIFICATION

	Clase	kWh/m²	kWh/año
Demanda calefacción	B	25,1	327164,3
Demanda refrigeración	-	-	-
	Clase	**kgCO2/m²**	**kgCO2/año**
Emisiones CO2 calefacción	A	5,9	76949,8
Emisiones CO2 refrigeración	-	-	-
Emisiones CO2 ACS	A	0,4	5216,9
Emisiones CO2 totales	A	6,3	82166,8
	Clase	**kWh/m²**	**kWh/año**
Consumo energía primaria calefacción	B	29,4	383919,5
Consumo energía primaria refrigeración	-	-	-
Consumo energía primaria ACS	A	1,9	24329,9
Consumo energía primaria totales	A	31,4	410075,6

Calificación: **A**

Consumo energético final anual [kWh/año]	267.071
Emisiones de CO_2 anuales [$kgCO_2$/año]	54.386

Consumo energético final anual [kWh/m^2año]	20,45
Emisiones de CO_2 anuales [$kgCO_2/m^2$año]	4,17

PIME'S PROYECT 176 SALBURUA

Thank you very much for your attention

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