

ACE General Assembly Berlin April 2016



ARCHITECTS' COUNCIL OF EUROPE
CONSEIL DES ARCHITECTES D'EUROPE



iNSPiRe Madrid Demo Building

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Le Corbusier

Mur neutralisant y respiration exacte (1933)
Moscu Consumers Union Building
Le Corbusier, in collaboration with engineer Gustav Lyon used a combination of two systems : curtain Wall (mur neutralisant) and exact breathing (respiration exacte), a mechanical ventilation of hot or cold air through a slim (... cms) double façade , to maintain constant circulating air at 35 °c.

Proposal for



Viipuri Library Alvar Aalto 1935



- Grills for supply and exhaust ventilation integrated into walls cavity
- Radiant ceiling pipes distribution for heating



Main lessons Learnt



- iNSPiRe effort, resources and results added to a traditional retrofitting process
10 dwellings block from 50's
- Opportunity to work with private owners
 - Feed back to results & prototypes
 - End user concerns and acceptance
 - Adaptation to market conditions

North Façade



Main lessons Learnt



- Great challenge to adapt developments to real conditions- products changes to fit owners requirements, suggestions, existing space...
- Social housing privately owned
 - Low income
 - Retired people)
- Living inside during the whole process

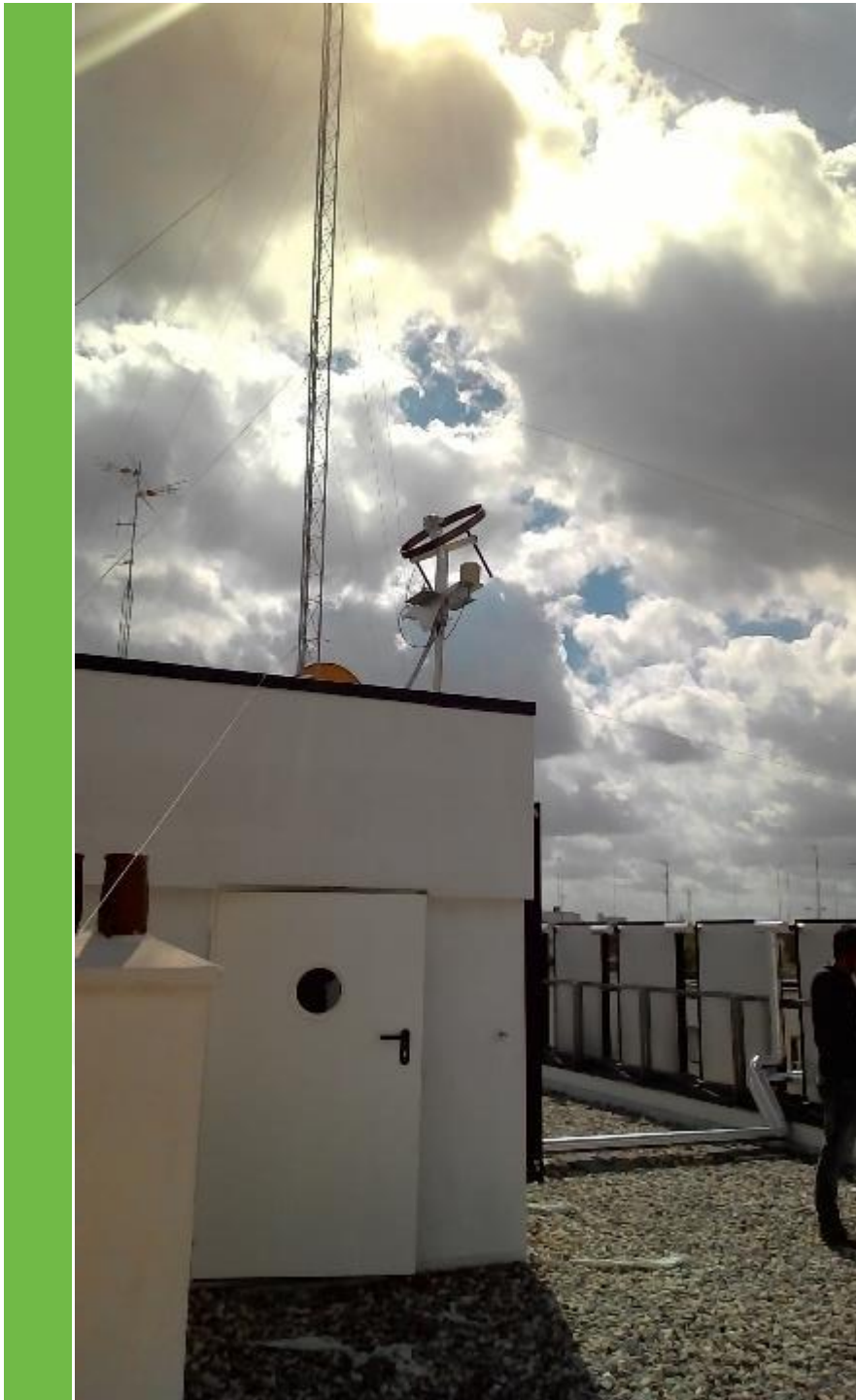
South Façade



Main lessons Learnt



- Replicability . Similar building stock in Madrid (60.000 dwellings)
- First time centralised energy production and renewables in retrofitting
- First low consumption retrofitted building in Madrid
 - Passive measures . Envelope upgrade. Fuel poverty
 - E.g. 18 °c inside-January sunny day-1°c outside. No heating

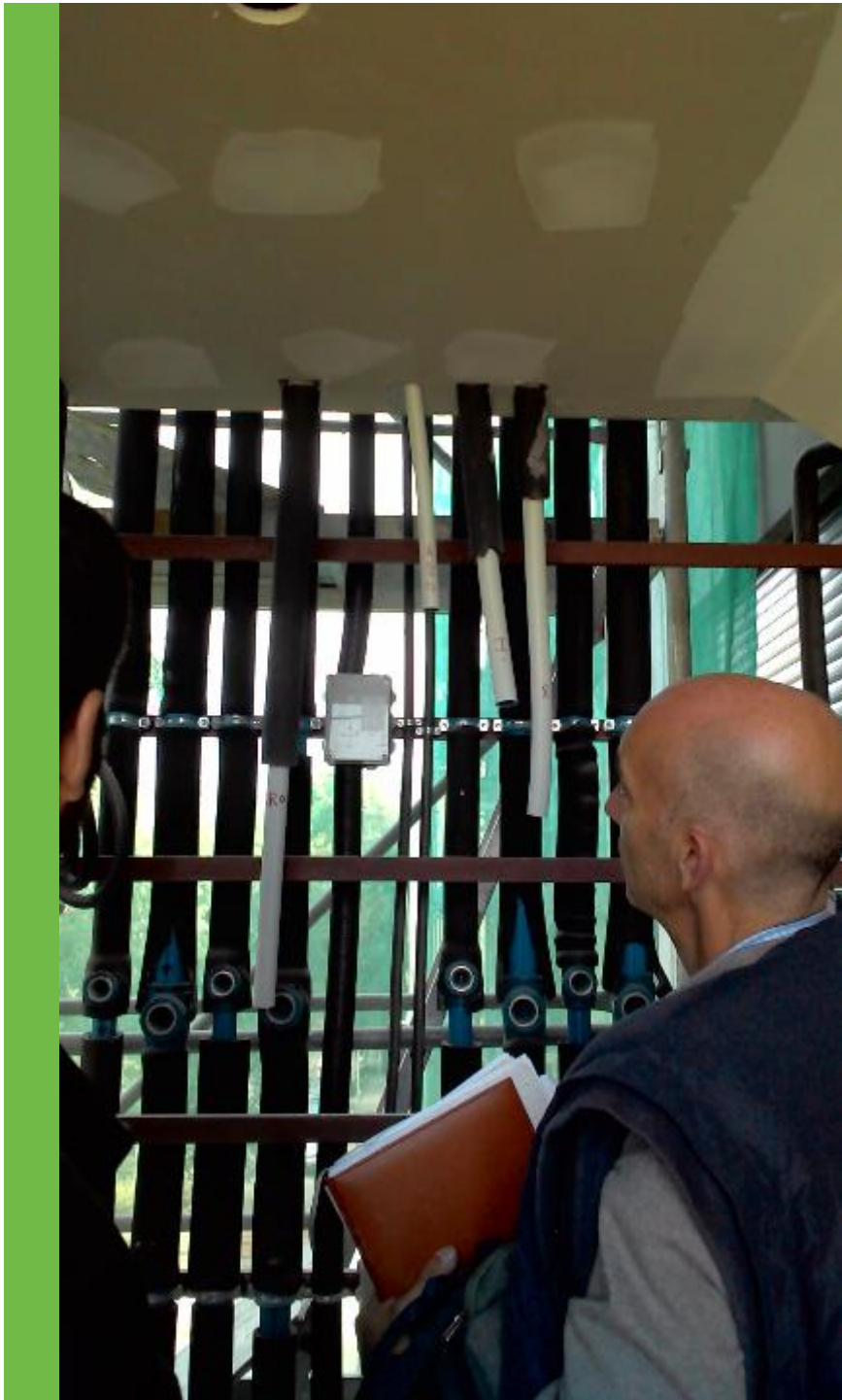


Main lessons Learnt



- Coordinator decided to implement systems for all dwellings - 10 instead of just 3 dwellings planned in the project - which has been relevant and contributed to understand the building energy retrofitting upgrading as a whole
- Tough process but great job from the R&D developers and engineering consultants of the project
- Good opportunity for architects to investigate new technologies and introduce them in a traditional process
- More work for all stakeholders Building contractor, architects, engineers, manufacturers, owners...
- Multidisciplinary meetings, discussions,
 - issues from all possible points of view

Roof Terrace



Main lessons Learnt



- ✓ License and administrative issues
- ✓ Different speed with the construction company in charge of the ongoing refurbishment ongoing
- ✓ Owners requirements and changes to reach acceptance



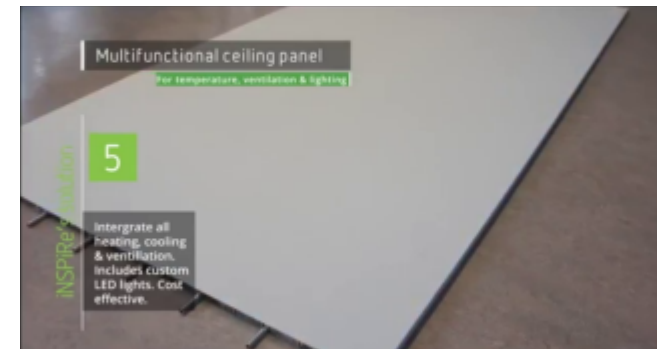
iNSPiRe

Systemic Energy Regeneration of Buildings

www.inspirefp7.eu



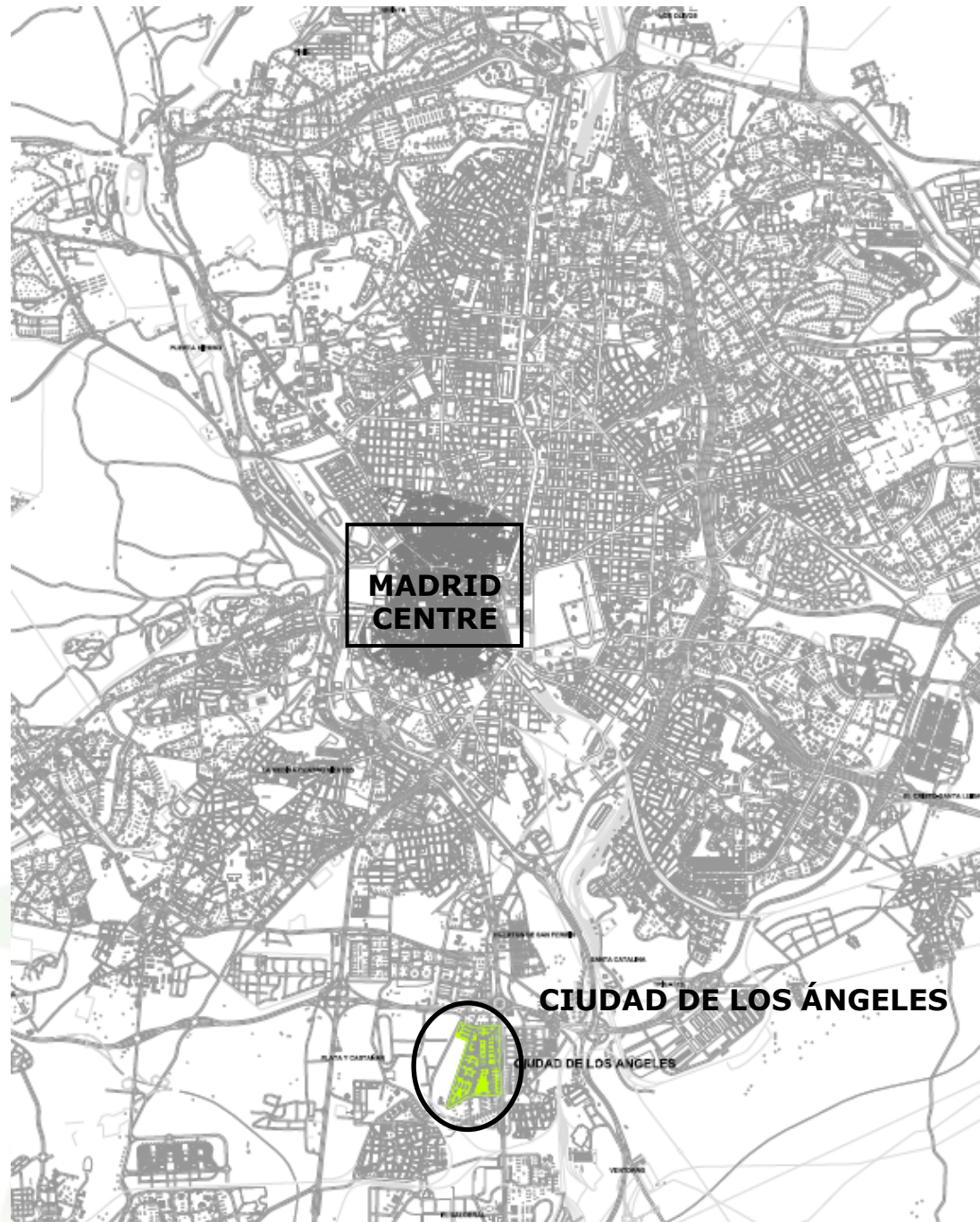
Energy Renovation Kits in Madrid



Radiant Ceiling
Heating+ Cooling/ Lighting



Distribution, Control & Energy Management for
Heating, Cooling & Hot Water



Demo Location

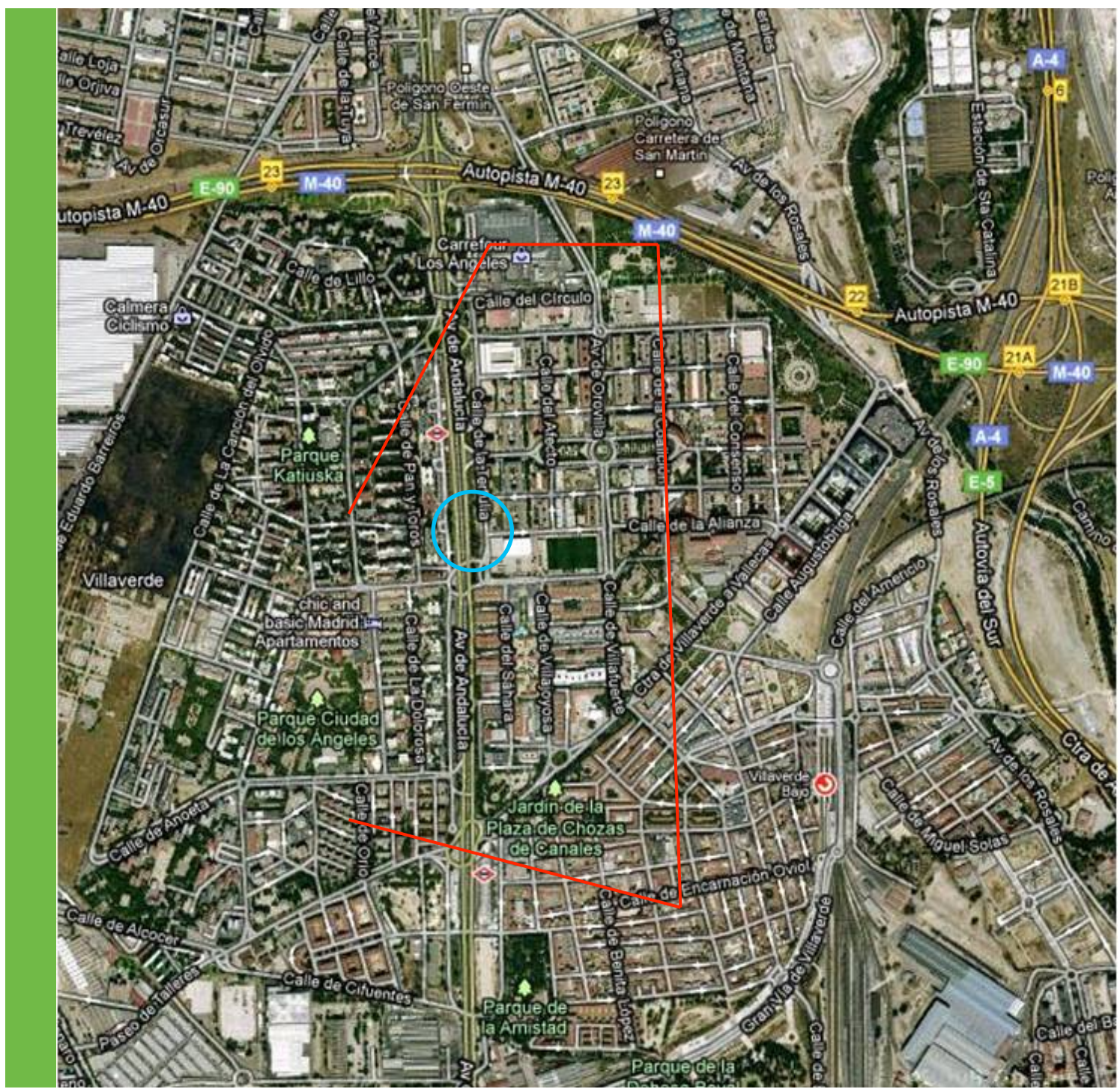
Madrid Spain

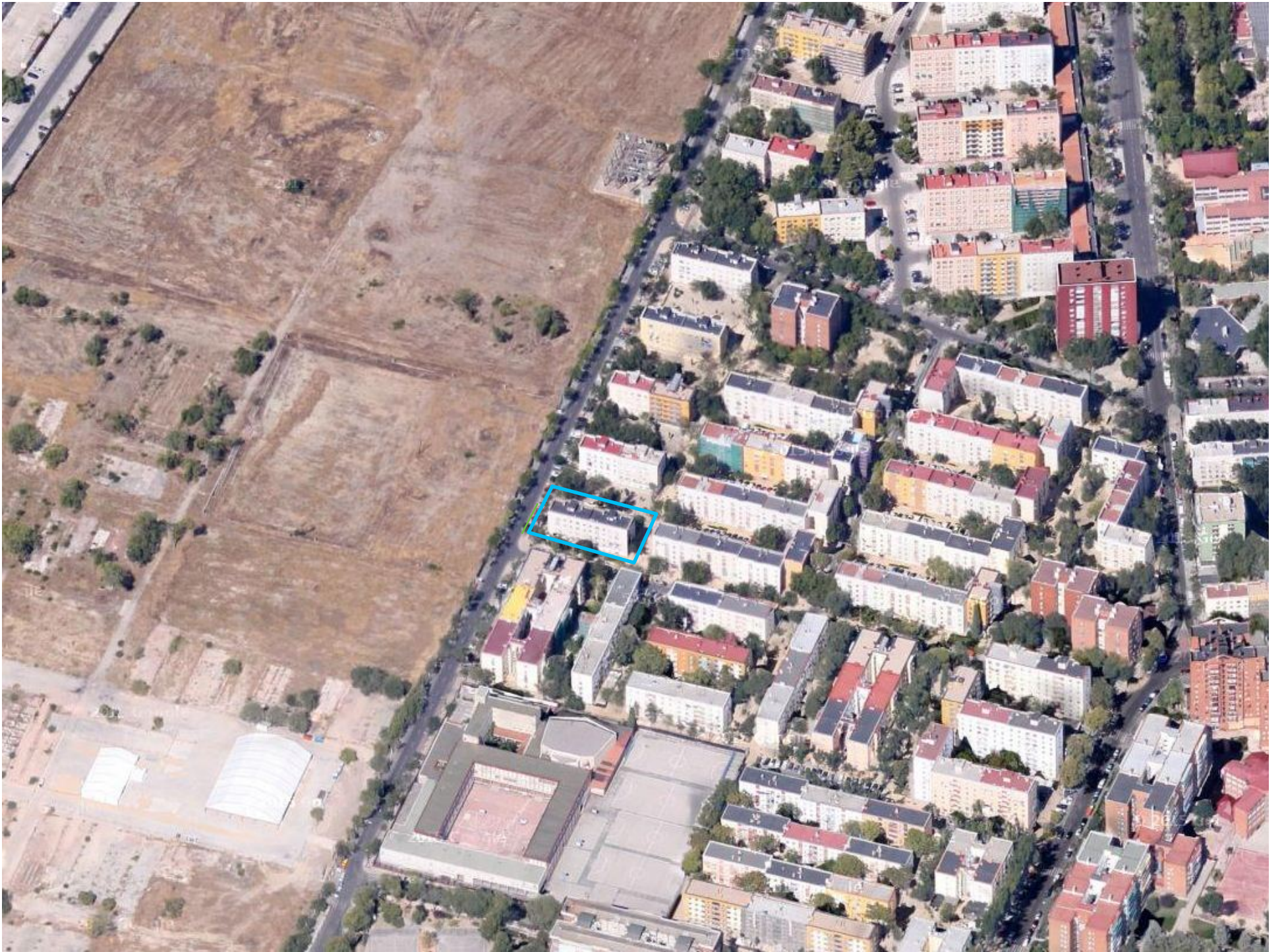


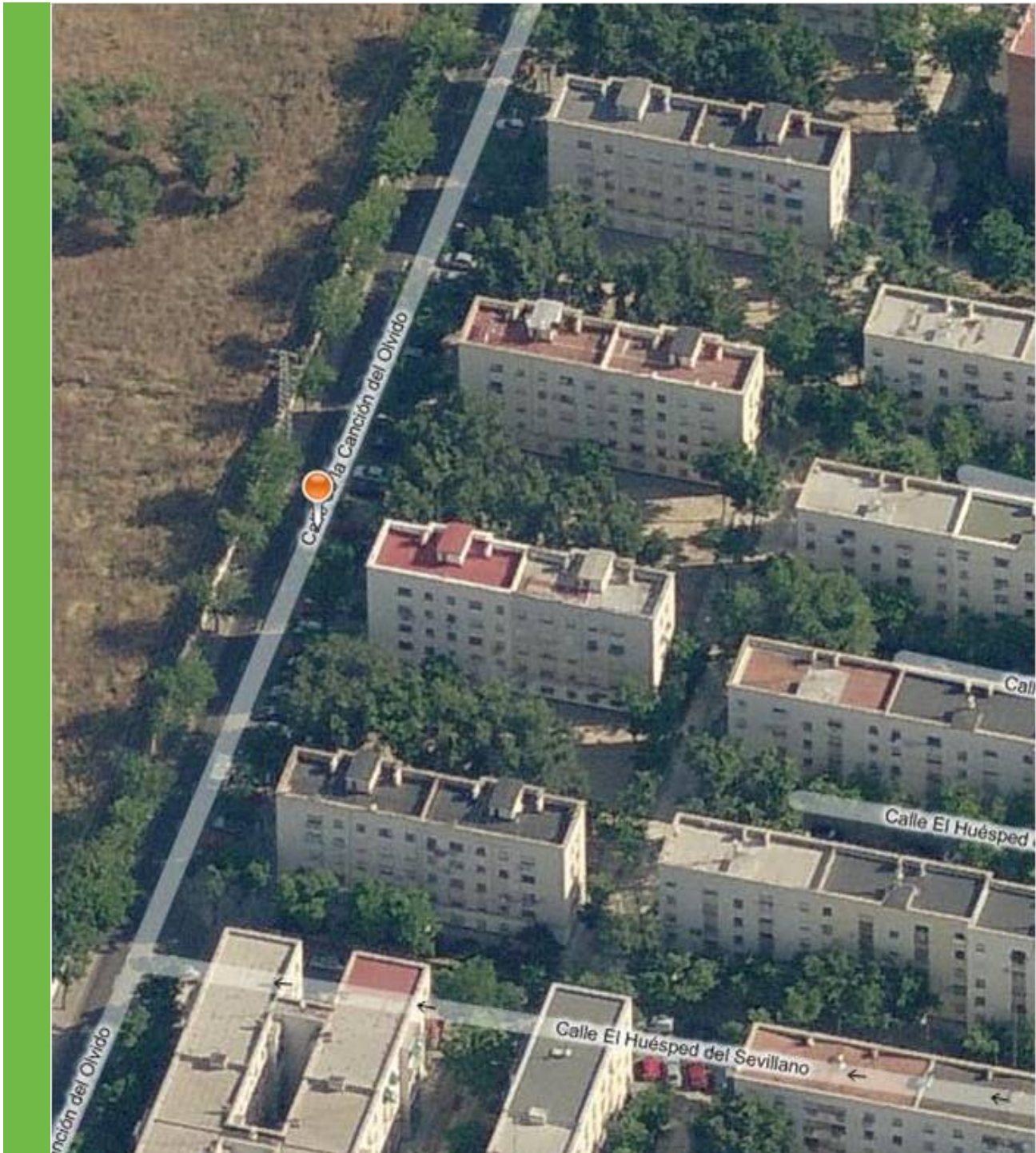
Location: Ciudad de los Ángeles
Outskirts of South Madrid, Spain
Canción del Olvido 45-47

Renovation of existing urban area from 40-50s´

- 25.000 inhabitants
- 8.000 dwellings
- Average Investment 30.000 euros /per dwelling
- Public funding 75% (up to 21.000€ per dwelling)
- iNSPiRe – Aprox. + 2.000€ pe dwelling











Block, with rectangular shape

Building renovation works foreseen traditional retrofitting

52% Buildings in the Area like this: 5 floors (10 dwellings) - No lift

North-South orientation

Façade walls: plain concrete wall (with or without cavity wall)

No insulation

Small dwellings: 65 m², with 3 bedrooms.

Owners- low income- Retired

Façades orientation: Entrance North/East- Lounges South/West

Two linear blocks (16.40mx10.50m each) with 2 staircases access

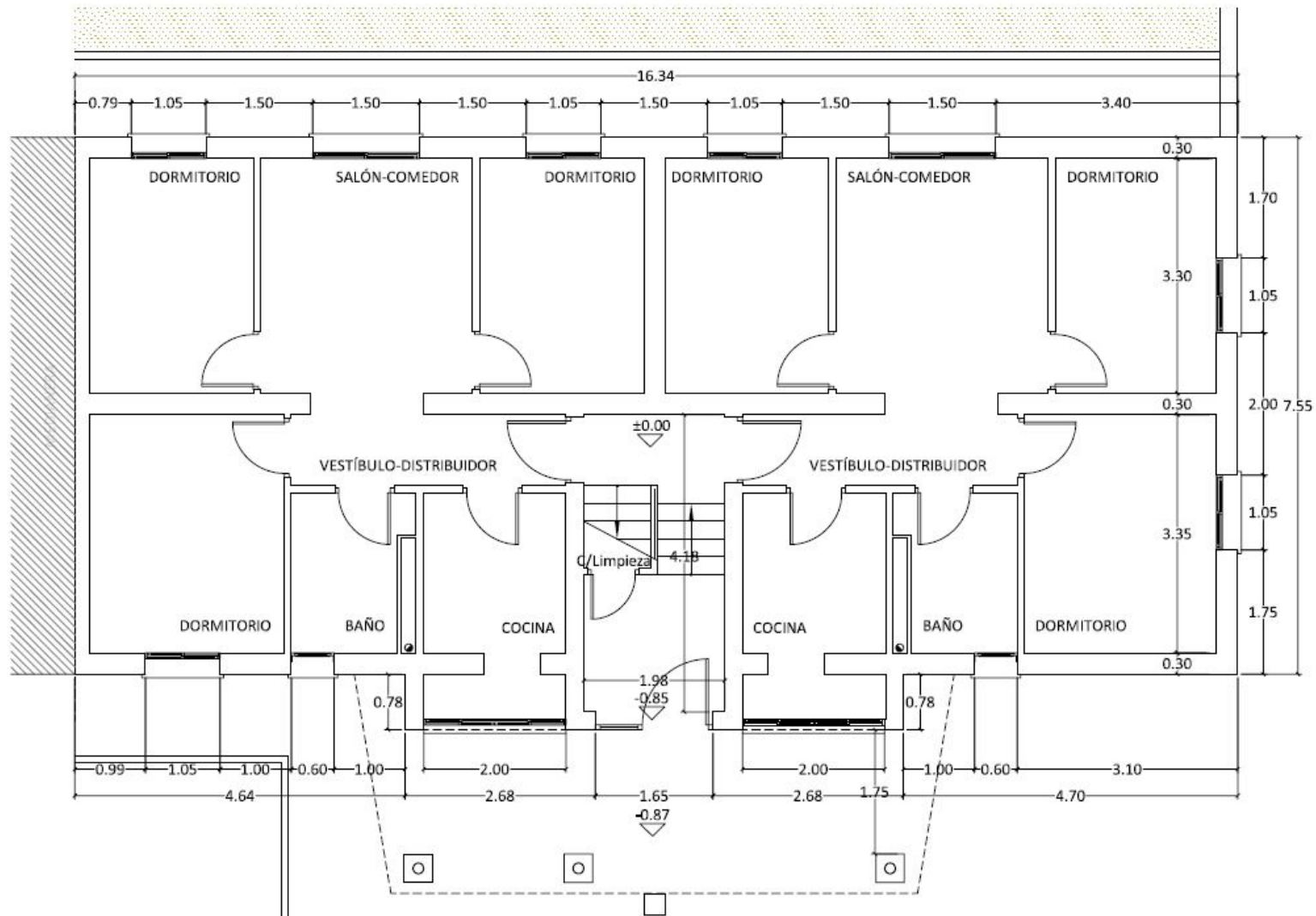
located at North façade

Renovation process

- Existing foundations reinforcement
- Lift installation
- Façade and roof renovation (insulation+Windows)
- New stairs structure to allow lift installation
- Services replacement (Electricity, plumbing....)



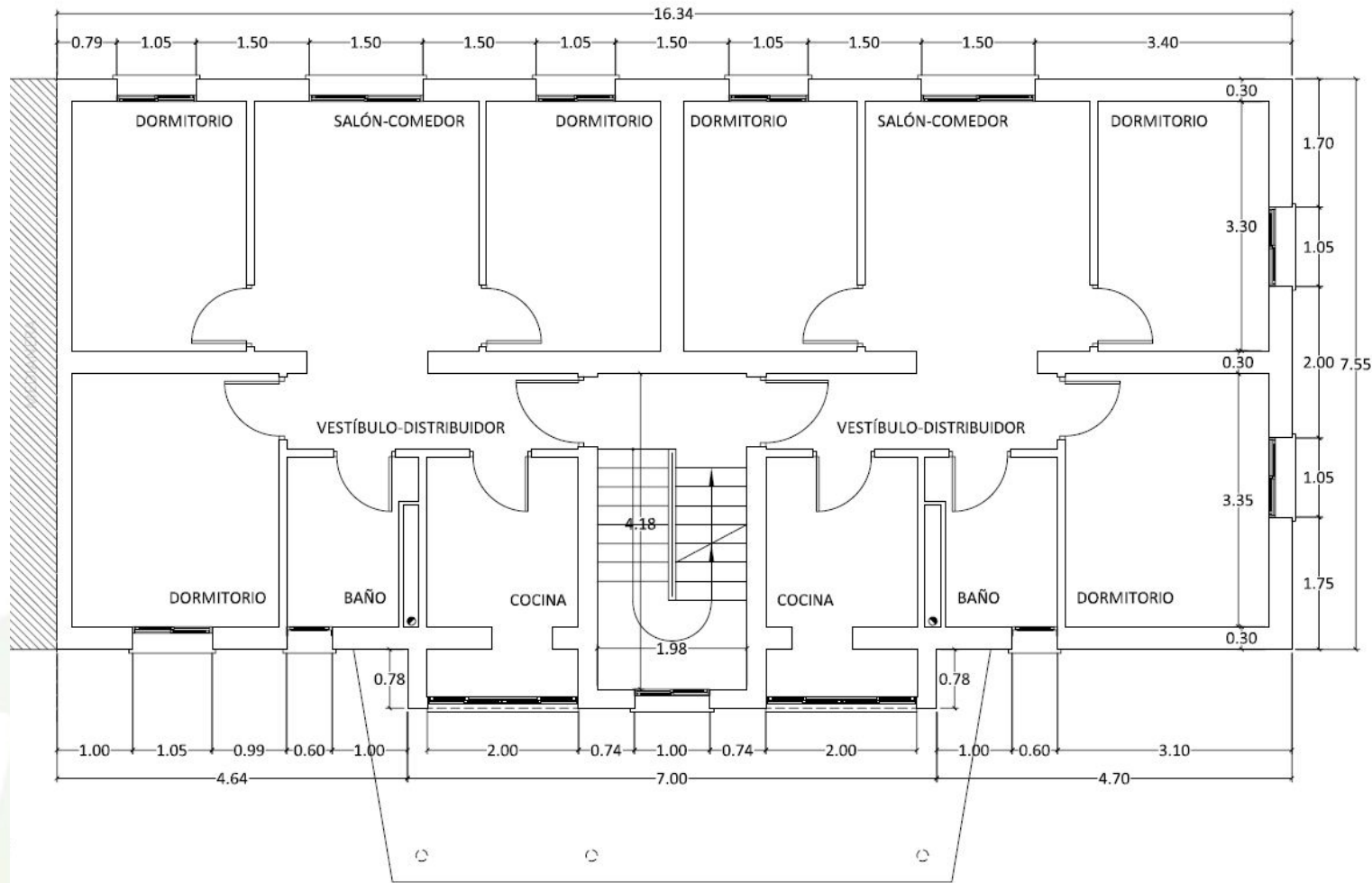
Madrid Demo Buiding Canción del Olvido 47



Ground Floor

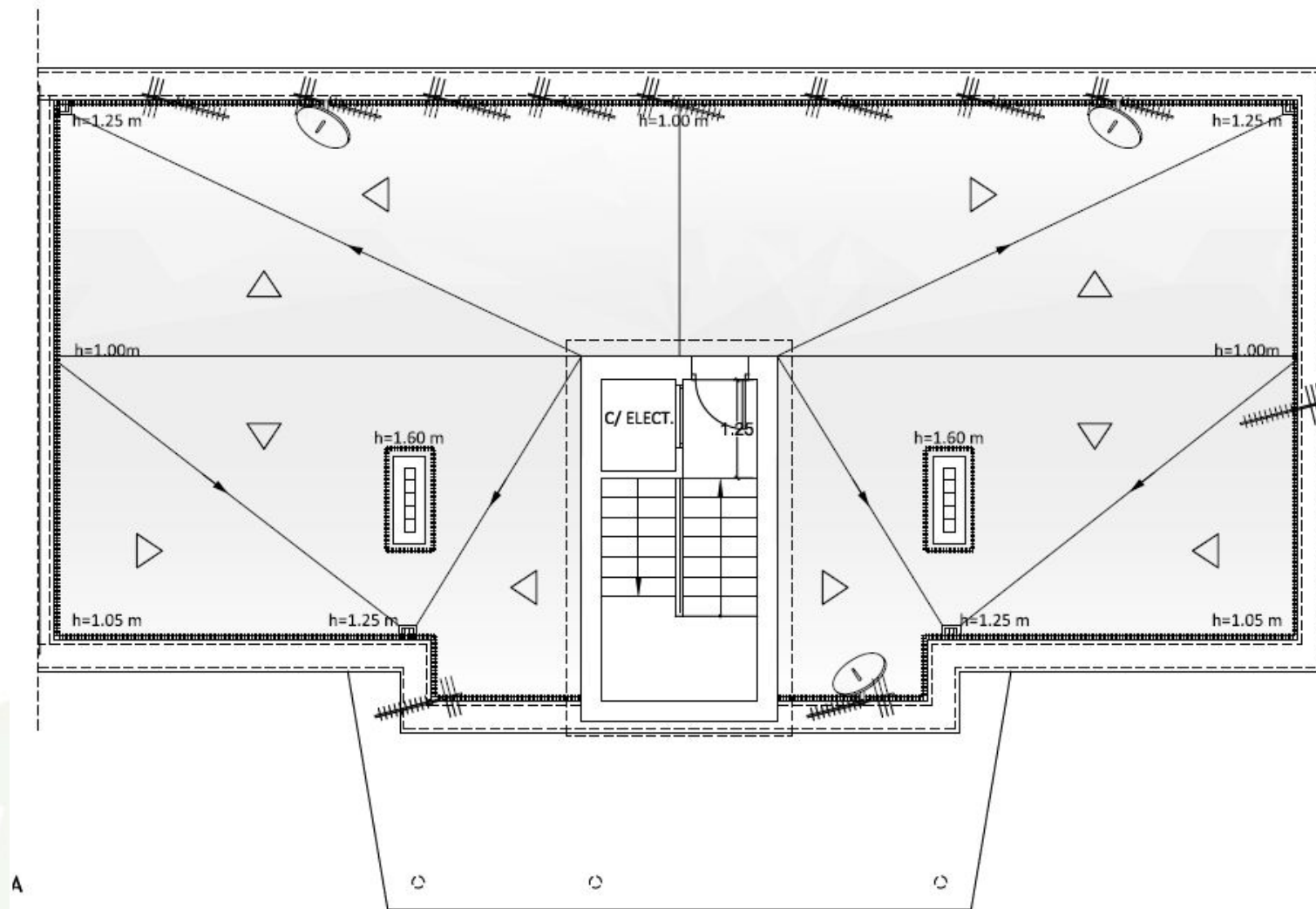


Madrid Demo Building Canción del Olvido 47



1st to 4th Floors





PLANTA CUBIERTA



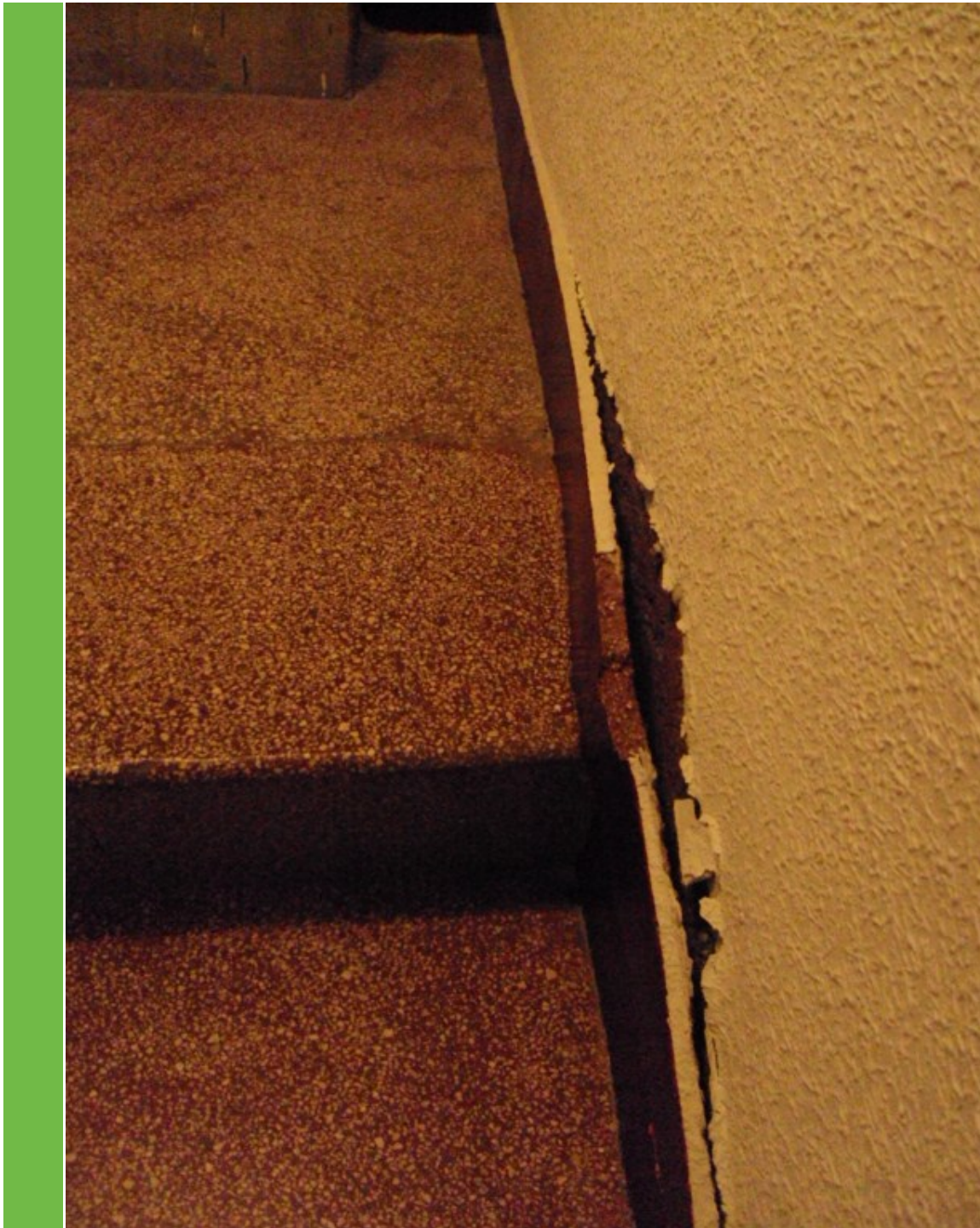












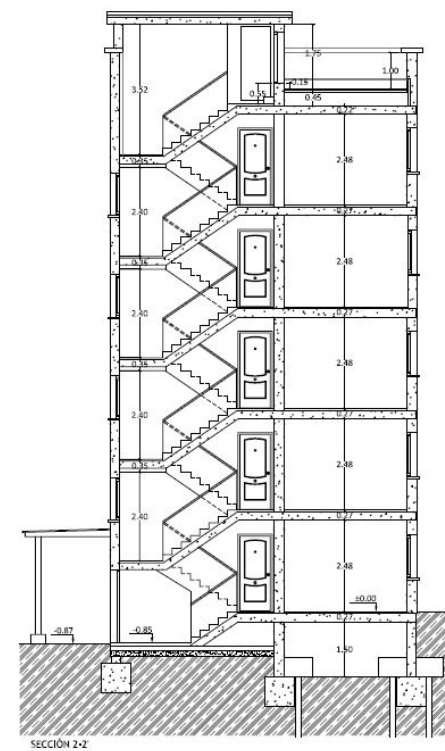
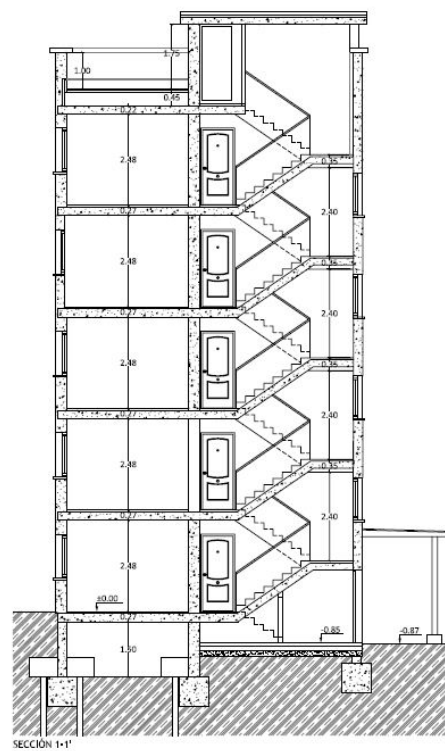
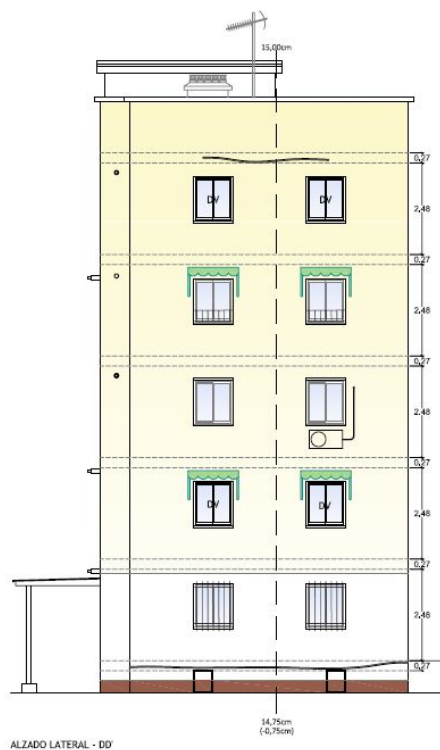


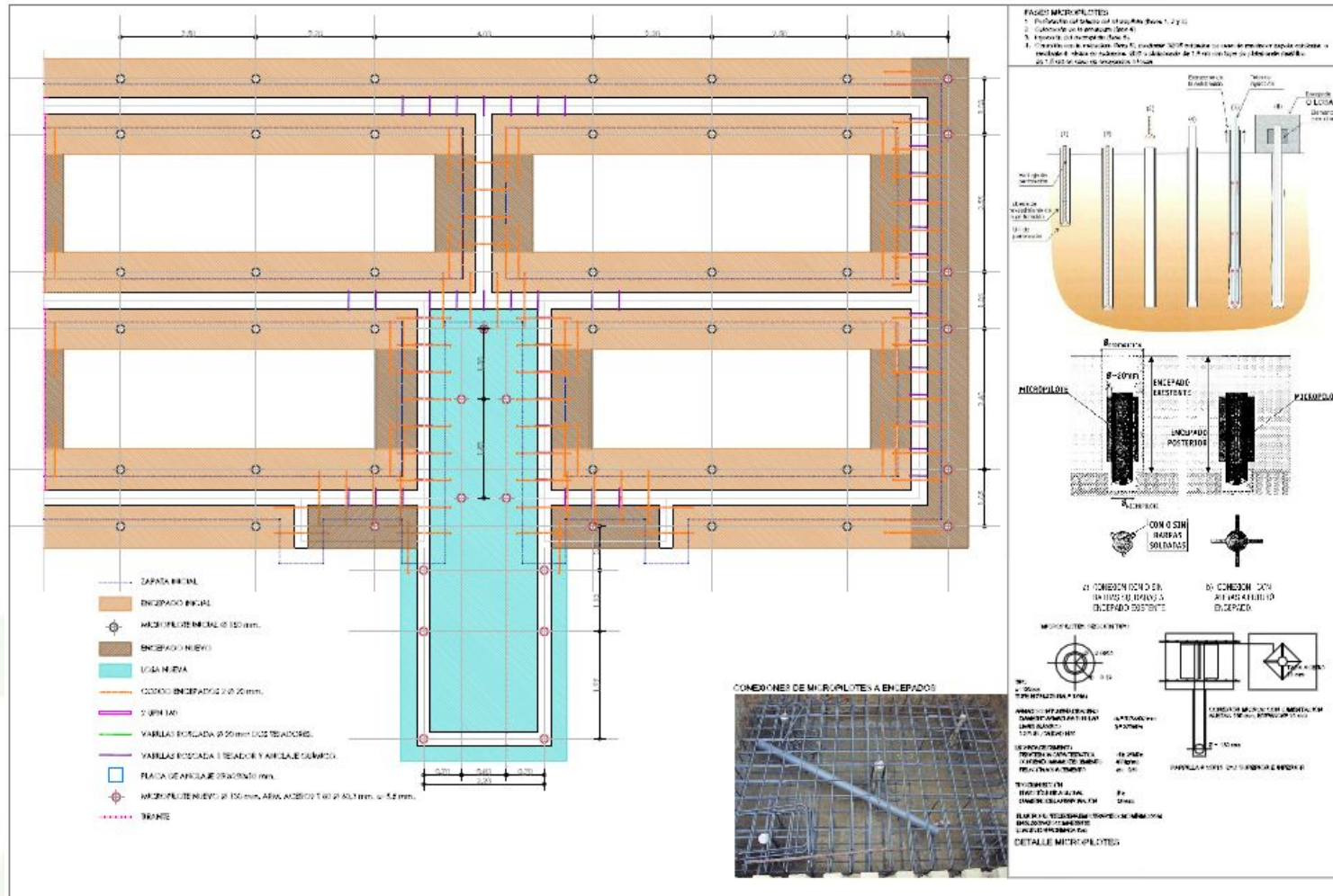


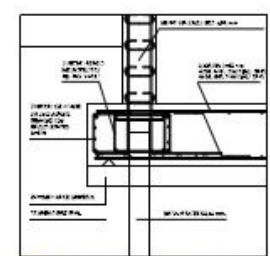
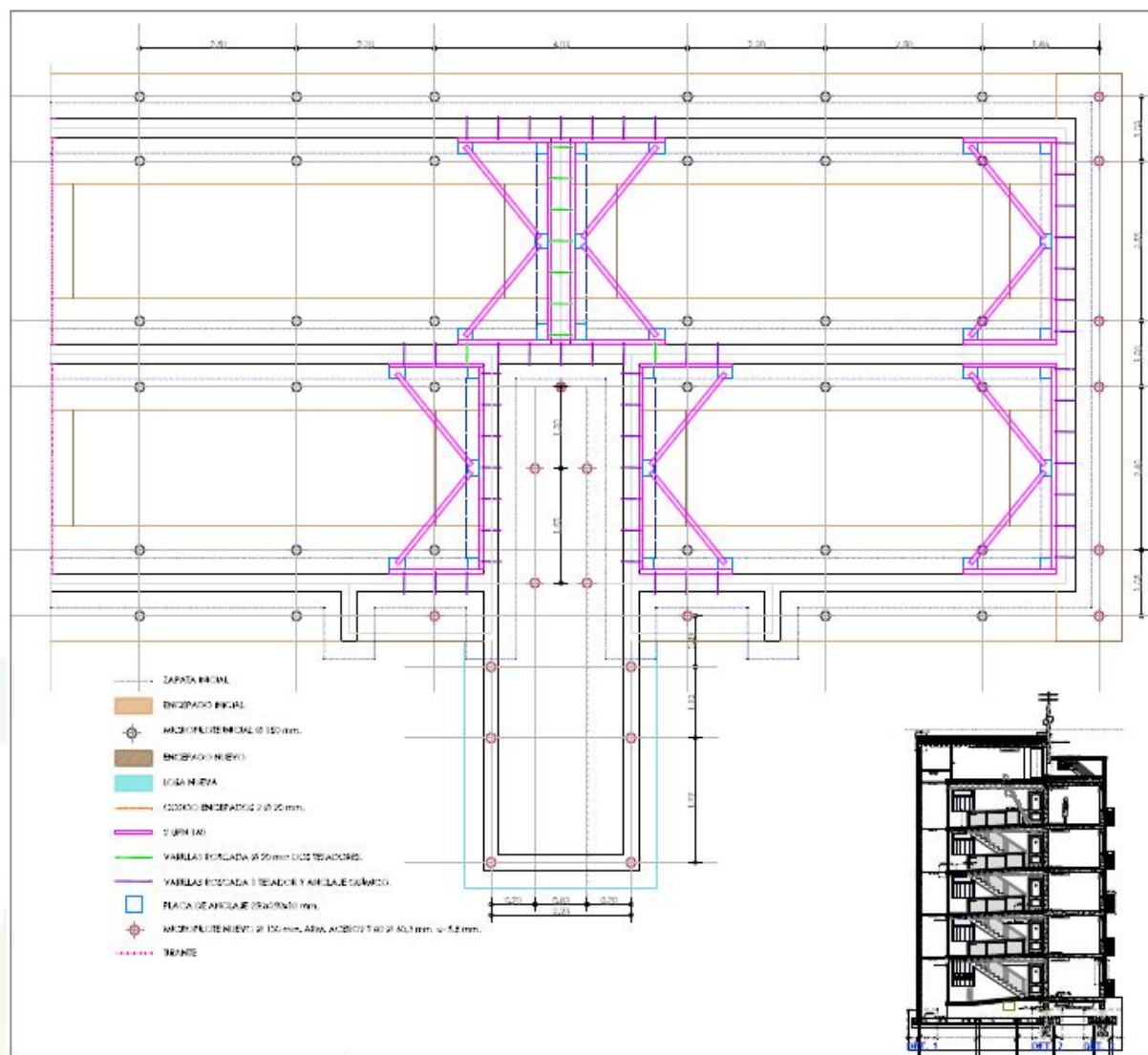
Staircase demolition
& rebuild
August 2015



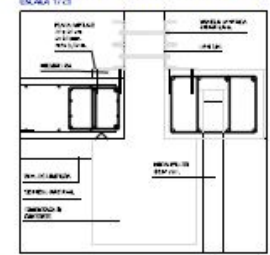




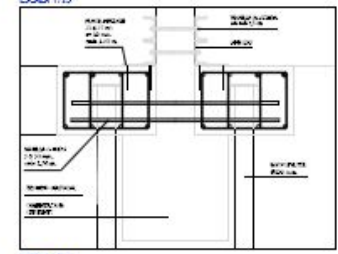




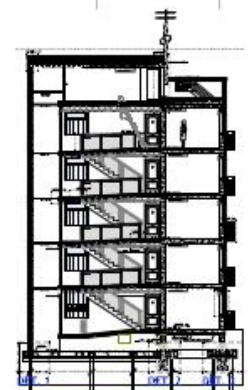
DETALLE 1
ENCUENTRO DE LOSA CON MURO DE HORMIGÓN
ESCALA 1/25



DETALLE 2
ENCUENTRO DE LOSA CON MURO EXISTENTE Y ENCEPADOS
ESCALA 1/25













DETALLE 3
ENCUENTRO DE ENCEPADOS CON MURO EXISTENTE
ESCALA 1/25




RENOVATION WORKS TO CONSIDER ON INSPIRE IMPLEMENTATION

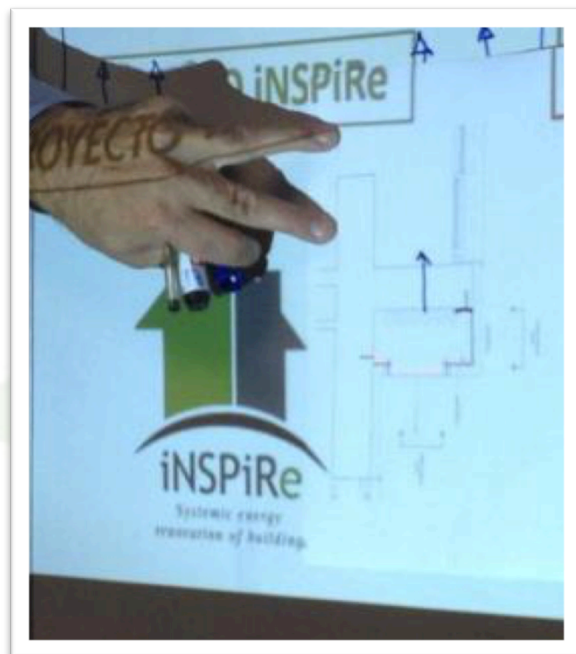


		INSTALLED DOUBLE-GLAZED WINDOWS		CLOTHES LINE		A/C		SATELLITE TV
SUNSHADING								
								

	GAS		WIRING
			

	REJA				DUCTS
					

Owners Meetings iNSPiRe



MAIN DOUBTS AND SOLUTIONS GIVEN



- **Functional:**
 - How does it work? -> explained (see presentations)

- **Financial:**
 - How much does it cost to them? -> explained, nothing.
 - Maintenance? -> INSPIRE partner until the end of the project (who??), 10-15 €/owner year, from the end of the project, depending on the energy manager contracted.

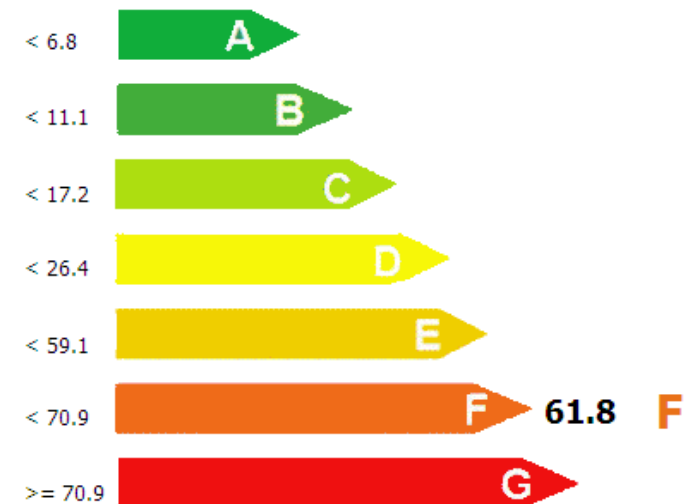
- **Practical/Aesthetical:**
 - Enough space in the kitchen for the EH?
 - Wardrobes (to open doors), lighting... -> we'll check each dwelling
 - If the panel is centered, instead of using a case covering the pipes, a passive panel can be installed
 - They can cover the rest of the ceiling with passive panels (tailored)
 - How is fixed to the ceiling) -> explained

iNSPiRe Energy Analysis



- ✓ Energy Audit- ACCIONA
- ✓ Simulation (TRNSYS) - EURAC
- ✓ Energy Consumption monitoring- CARTIF
- ✓ Energy bills- EMVS
- ✓ Energy Performance Certificate- EMVS

Indicador kgCO₂/m²



158 kWh/m²

Canción del Olvido 47 Audit

Heating/Cooling/HW individual systems



FLOOR	B		1		2		3		4	
DWELLING	D	I	D	I	D	I	D	I	D	I
Electric Radiators	17%			35%	35%	35%				
Moveable Gas Heater							50%			
Electric boiler for HW				100%			100%			
Gas boiler for HW					100%	100%				
Gas Boiler for HW & Heating	83%	100%	100%					100%	100%	100%
Splits R for cooling		35%				35%			50%	

Energy Bills Real info (December 2012-2013)	820€ L+H	545€ L+H+C	540€ L+H	573€ L+H	No info	320€ L+H 9 months no use	550€ L+H	No Info	820€ L+H+C	380€ L+H
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Energy consumption simulation	453€	538€	453€	831€	966€	881€	705€	453€	538€	453€
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MONITORING



3 Dwellings Monitored: 1°D, 3°D y 4°D



Madrid Monitoring August 2015 - September 2016



iNSPiRe

Development of Systemic Packages for Deep Energy Renovation of Residential and Tertiary Buildings including Envelope and Systems



MADRID: Weekly Report

DEMO BUILDING

In this section the electricity consumption, thermal demand and comfort conditions in the three dwellings of Madrid demo case are examined.



Log-Book

EU Project Info

Name: Development of Systemic Packages for Deep Energy Renovation of Residential and Tertiary Buildings including Envelope and Systems
Lead ben: CARTIF
Author: CARTIF and GIT
Monitoring: FaSystems (GIT)
Version: 1st Version

Project Phase

Building Characteristics

Owner: EMVS
Address: Cancion del Olvido 45-47, 28041 Madrid, Spain
Altitude: 650 m
Year of Construction: 1960
Location (coord.): 40.3569957, -3.6997391
Annual Degree Days: 1824 (heating 18°C), 1088 (cooling 18°C)
Building Type: Residential
Number of floors: 5
Number of dwellings: 20
Thermal Gross Area: 1307.22 m²
Thermal Gross Volume: 3542.82 m³
Number of occupants: 60
Form factors (S/V): 0.325
Energetic class: F [158 kWh/m² year]

Dwelling	Useful area	Occupancy
B2/F2/D1	50 m ²	2
B2/F3/D1	50m ²	3
B2/F4/D1	50m ²	2



Madrid CO47 Dwellings Monitored Sensors



KPI	Period	Sensor
Outdoor Temperature	15 min	✓
Outdoor Humidity	15 min	✓
Diffuse solar radiation	15 min	✓
Global solar radiation	15 min	✓

KPI	Period	Sensor
Indoor air quality (CO2) - each room	15 min	✓
Indoor temperature - each room	15 min	✓
Indoor air humidity - each room	15 min	✓

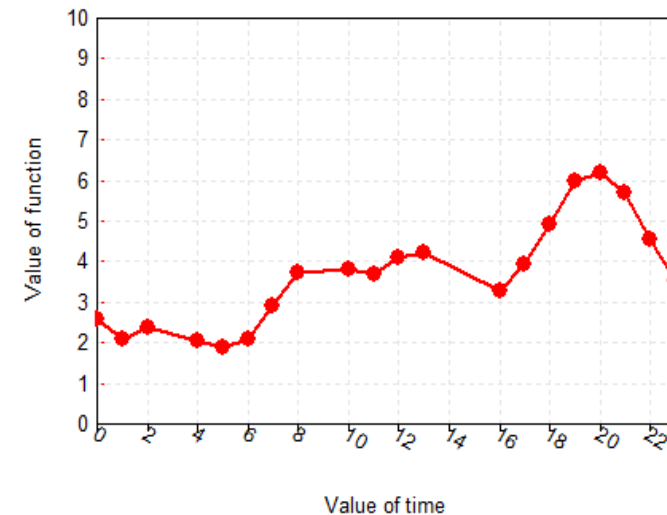
Energy Audit



1. Building characteristics
2. Building use
3. Energy consumption

Thermal characteristics of the envelope

Wall	Thickness	Heat transfer coefficient (U _{value})
	[m]	[W/m ² K]
External wall 1	0.35	1.51
External wall 2	0.32	1.57
Roof	0.68	1.51
Ground floor	0.27	2.19
Adjacent wall	0.25	1.54

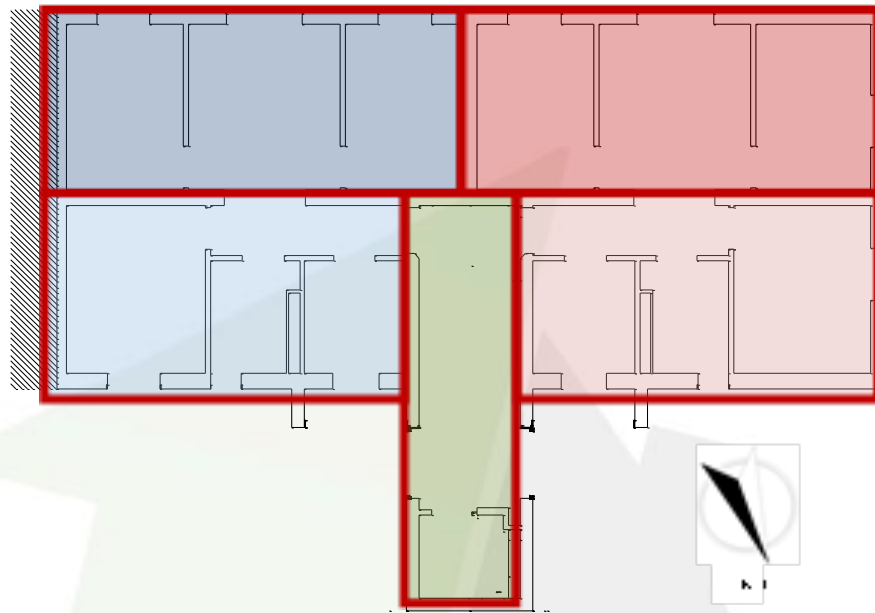


Use of electric devices during the weekdays

Previous Simulation



Geometry and Building Energy Model



Zonification



SketchUp

Retrofitted Buiding



Heat & cooling demand and energy power peaks at monitored dwellings: GF, 2^o y 4^o

Passive Measures

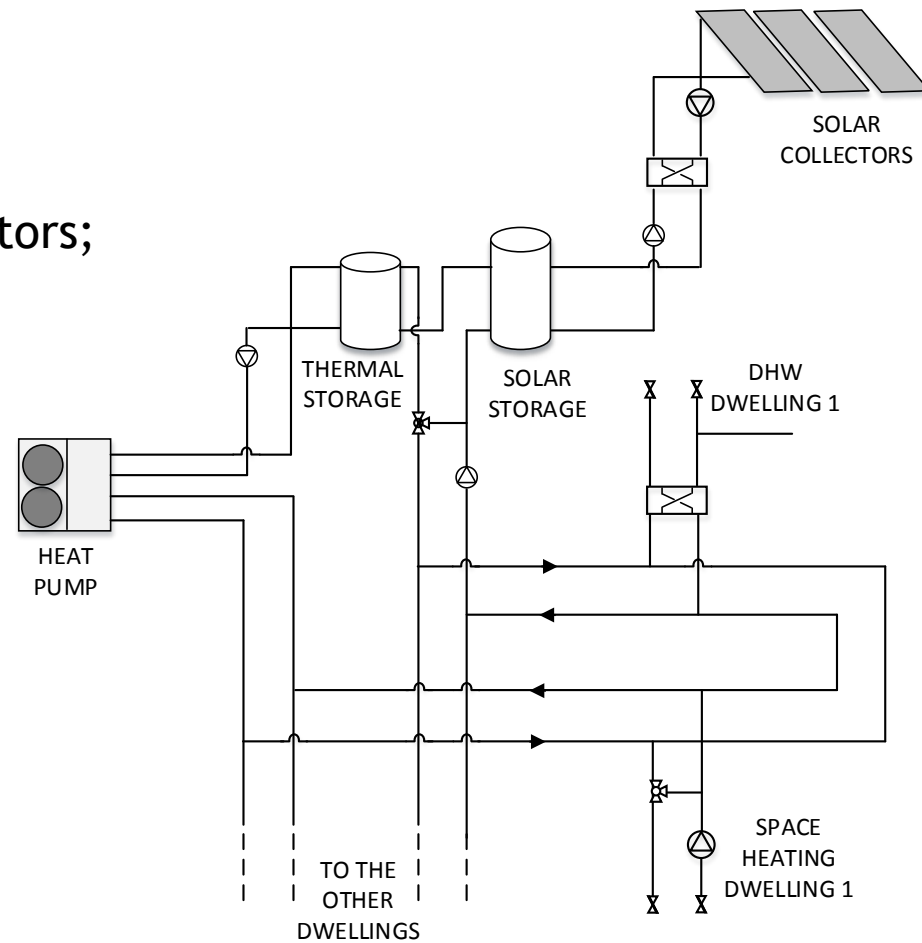
- Envelope insulation
 - Façade
 - Ground floor
 - Roof
- Double windows

	Heat Demand [kWh/m ² y]	Cool Demand [kWh/m ² y]	Heat peak power [W/m ²]	Cool peak power [W/m ²]
GF	29	20	25	25
2F	14	25	20	24
4F	31	24	29	27
BUI	20	24	29	27
	83%	16%	66%	47%

EDIFICIO REHABILITADO

Active measures

- 28 m² of flat plate solar collectors;
- 1000 l solar storage;
- 500 l thermal storage
- 20 kW air-to-air heat pump
- Radiant ceilings



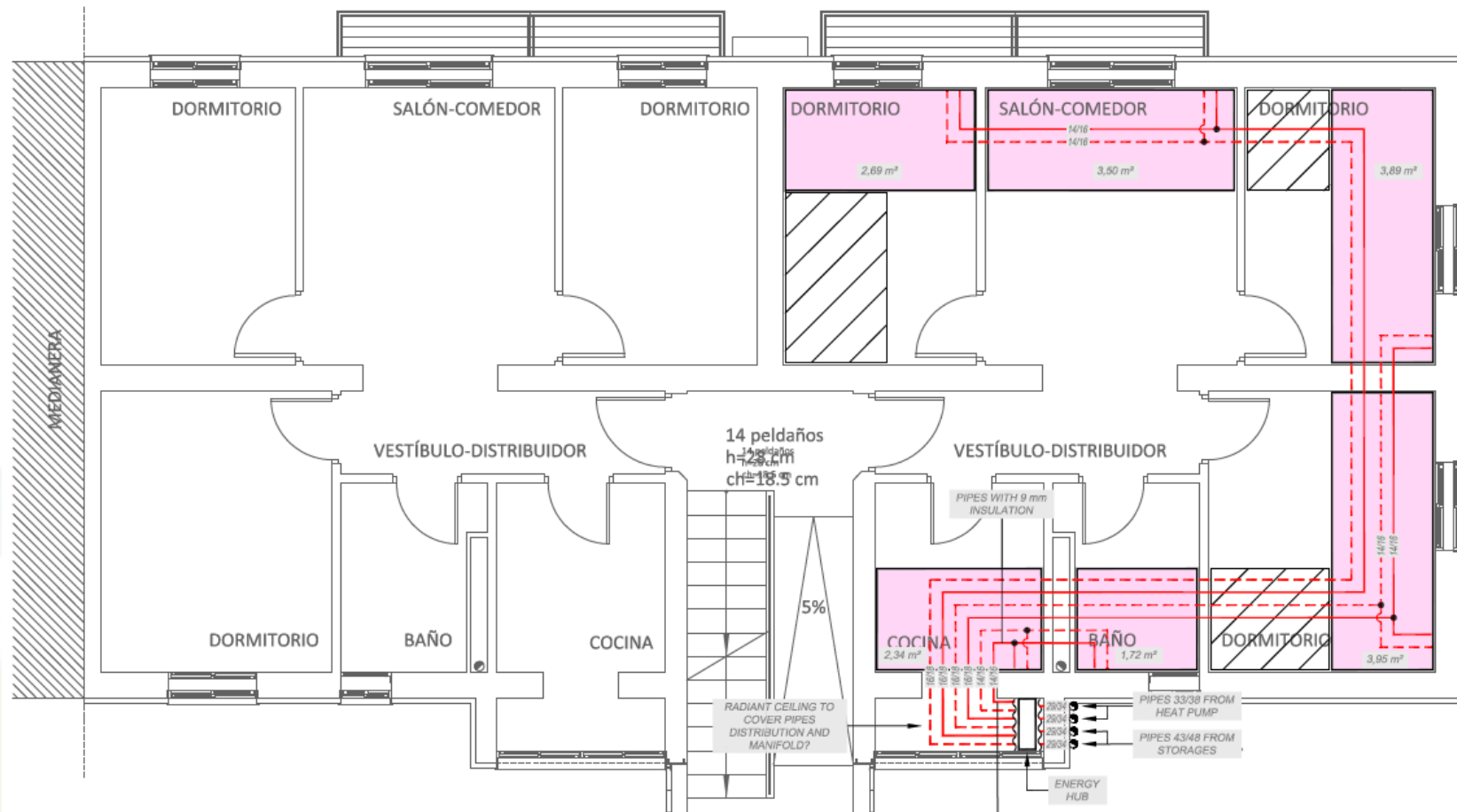
Centralised Heating/Cooling/HW



DIFFERENT OPTIONS FOR 3 DWELLINGS

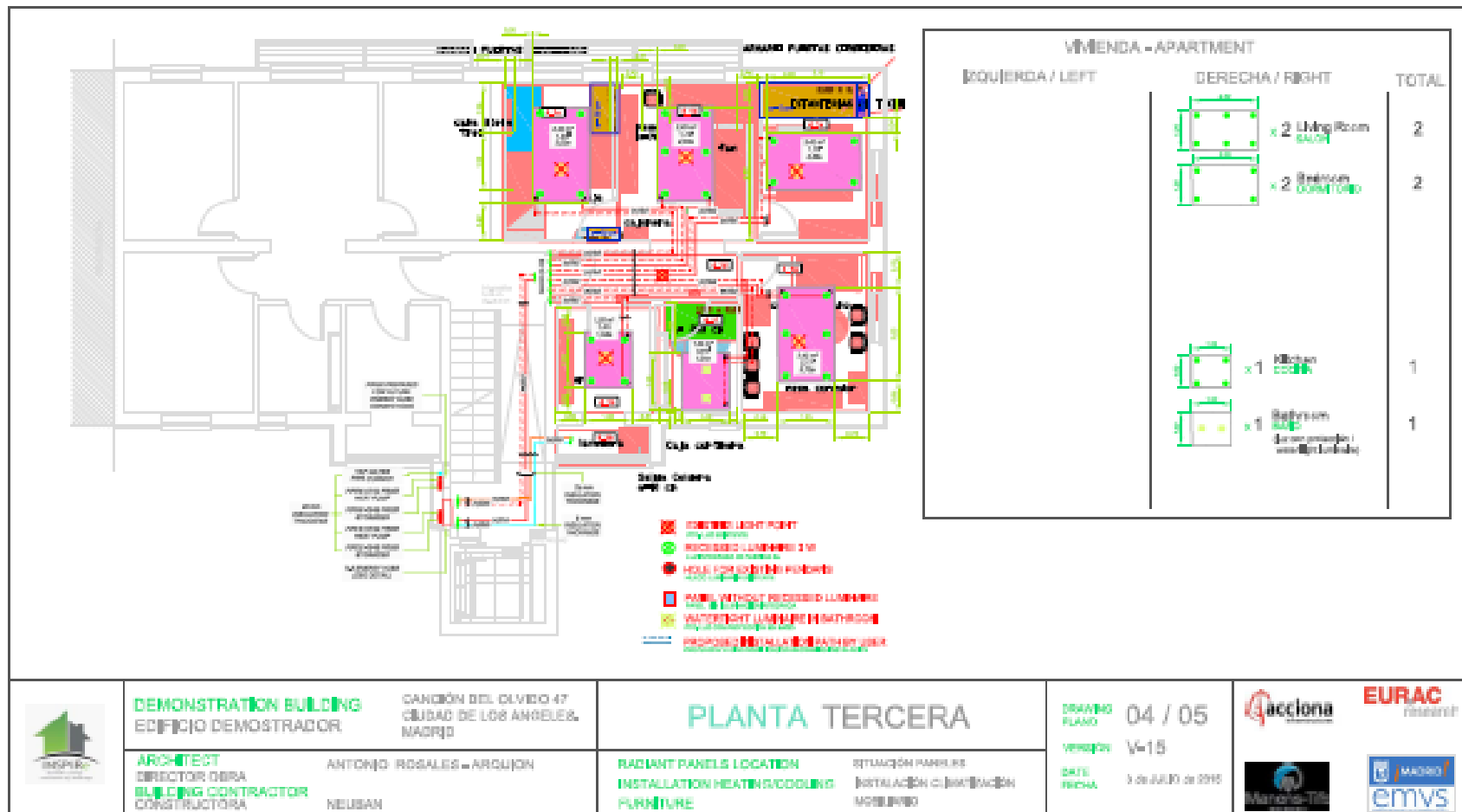
HW + HEATING + COOLING

- Radiator
- Radiant Ceiling
- Fancoils



Radiant Ceiling Panels

- Plans with existing furniture & potential obstacles for radiant panels Installation
- 6 panels per dwelling
- Size, position, lighting included

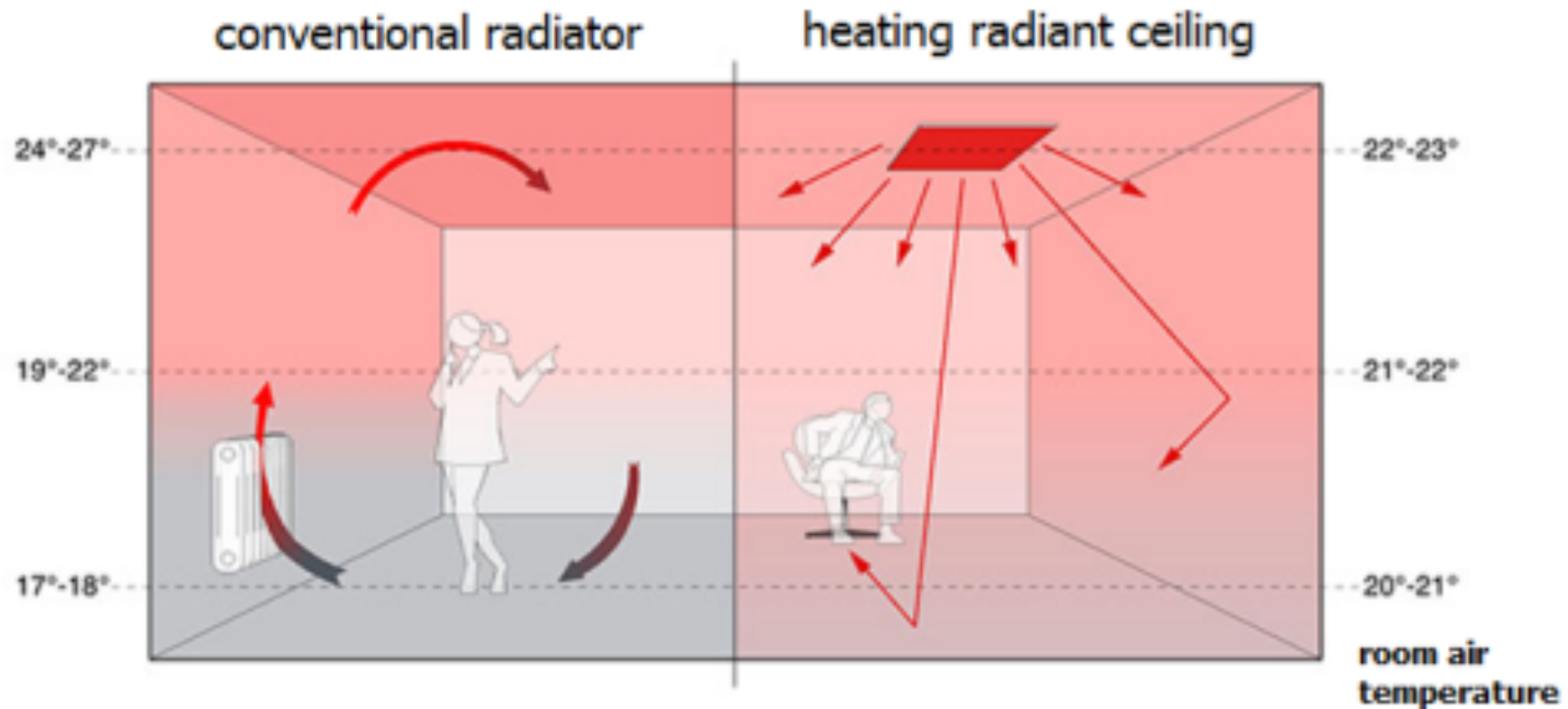


Radiant Ceiling Mock up

April 2015



TECHO RADIANTE





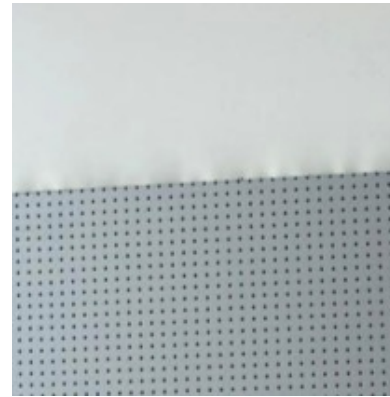


falsa viga

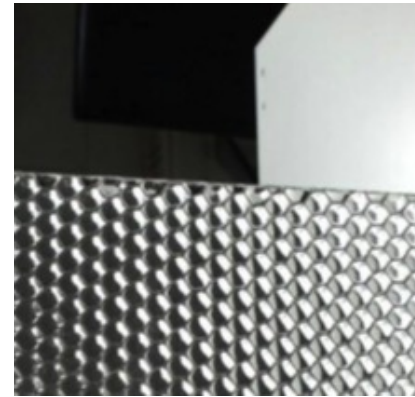
juntas



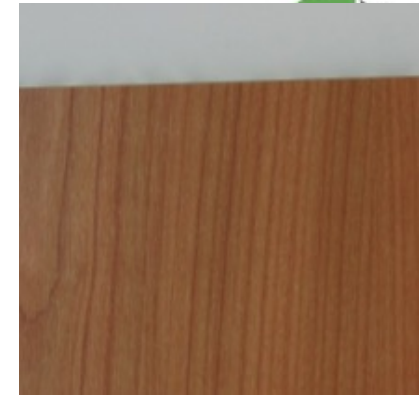
white projected plaster



perforated aluminum

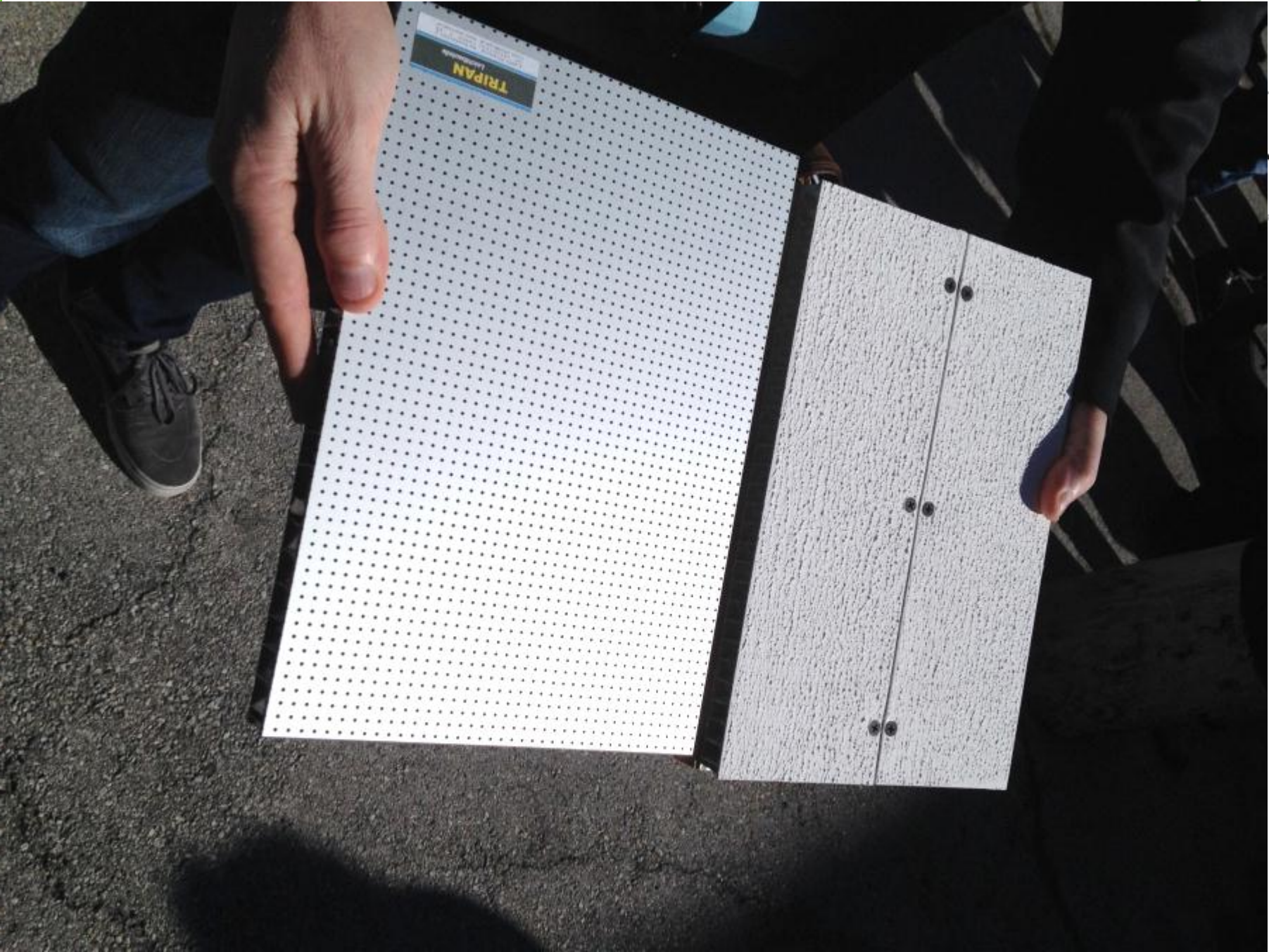


transparent surface
(visible honeycombs)



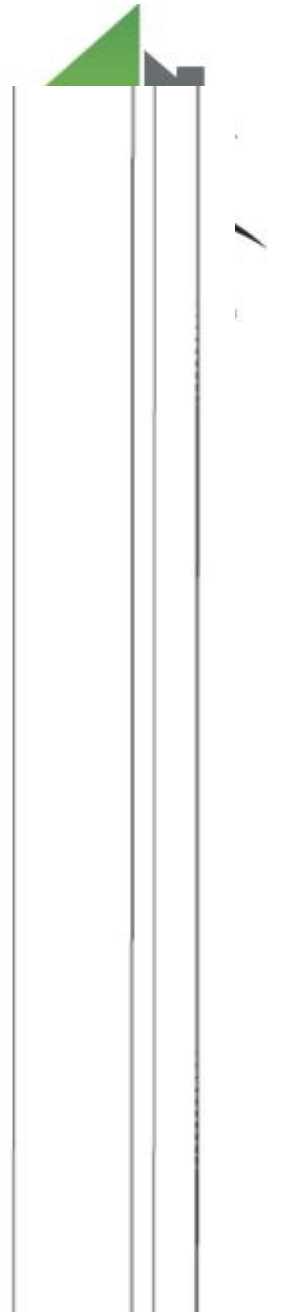
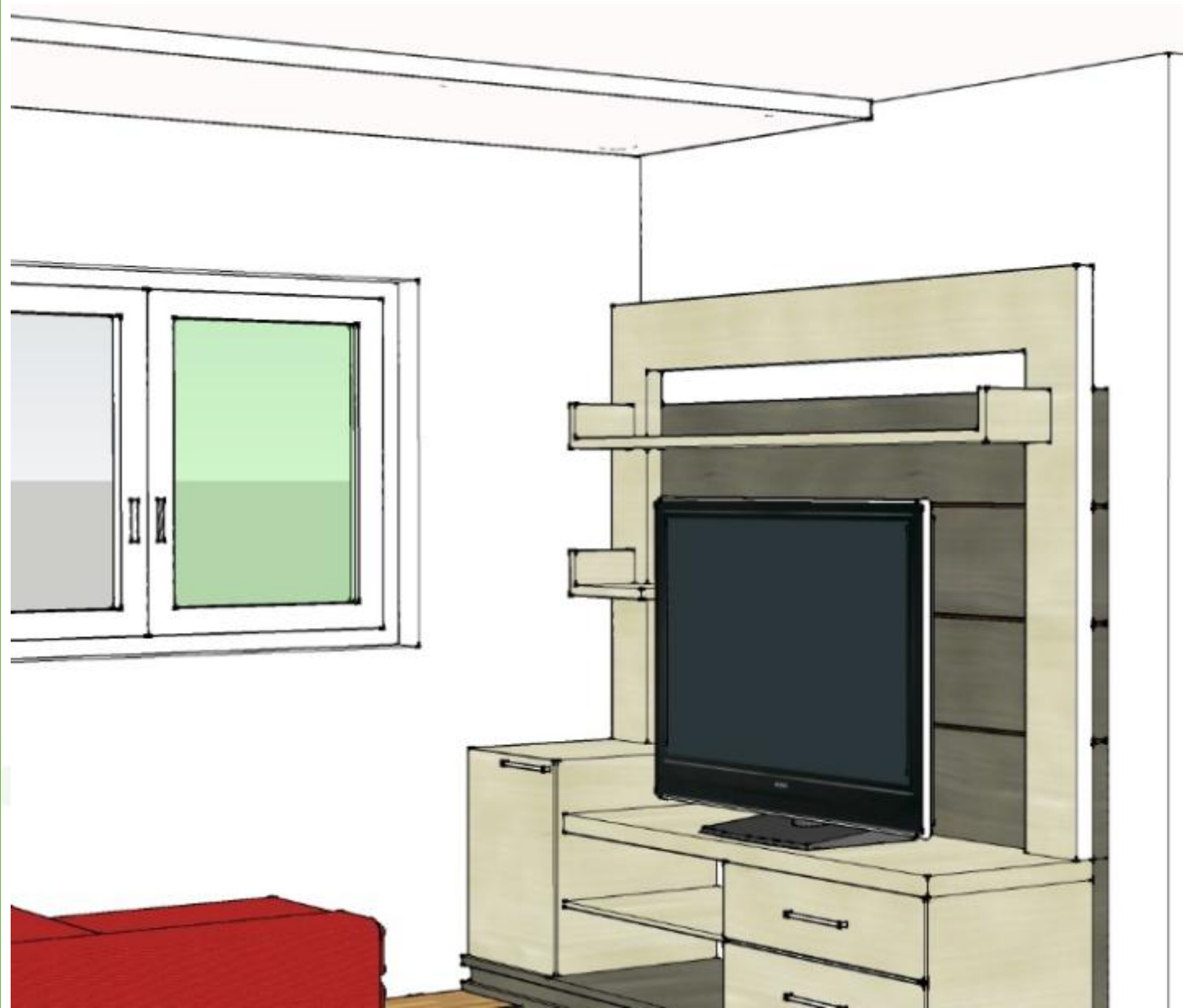
wood surface





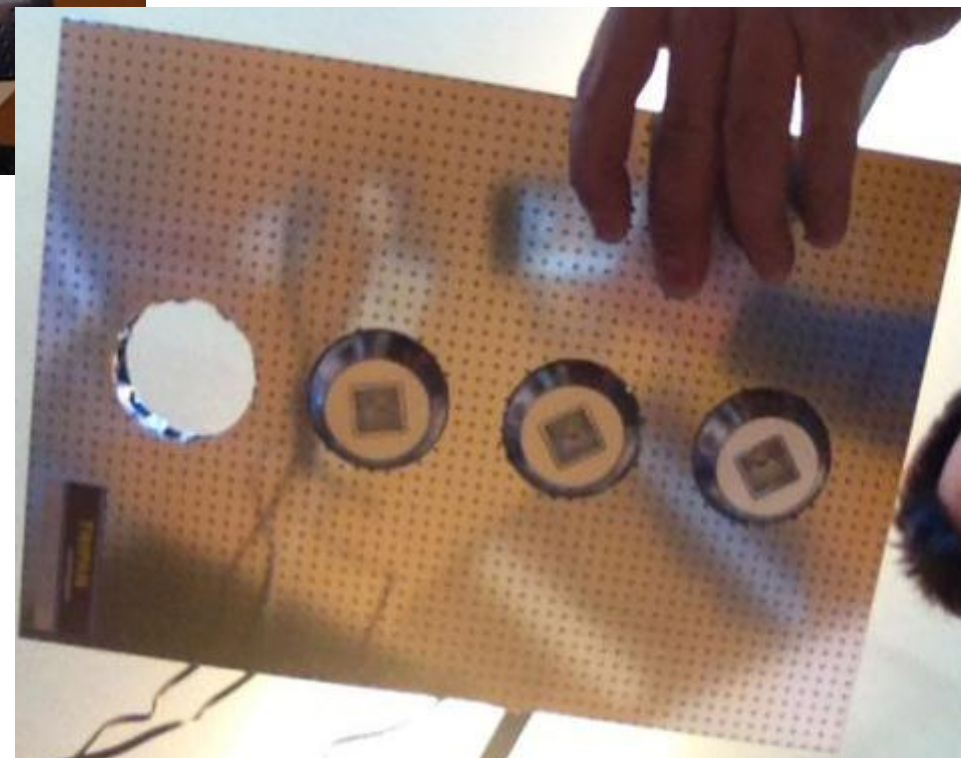
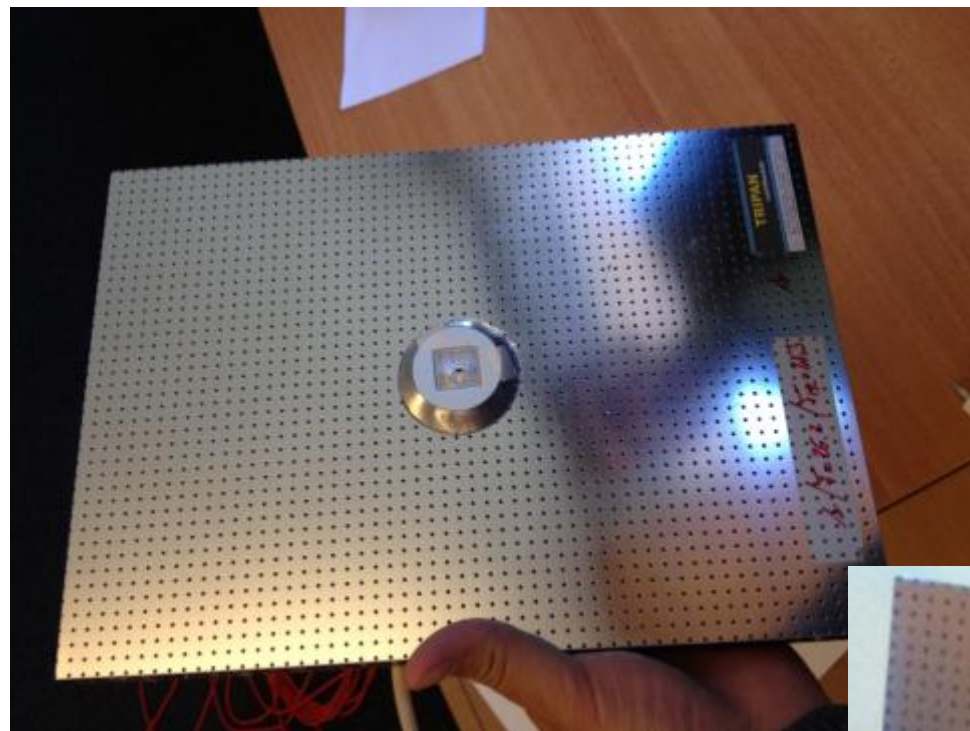


PiRe
e energy
of buildings



ILUMINACIÓN



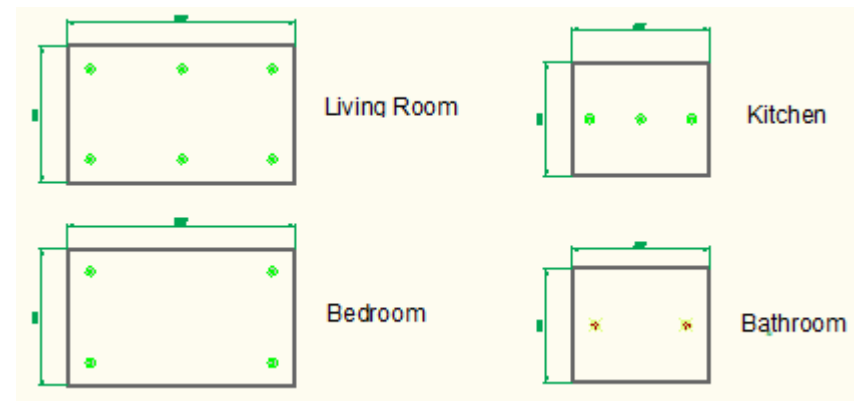


iNSPiRe Demo Madrid



Inside the dwellings (Design)

- ✓ Radiant Panels integrates recessed LED luminaries
- ✓ Three different sizes
- ✓ Illuminance requirements by type of zone (Bartenbach)

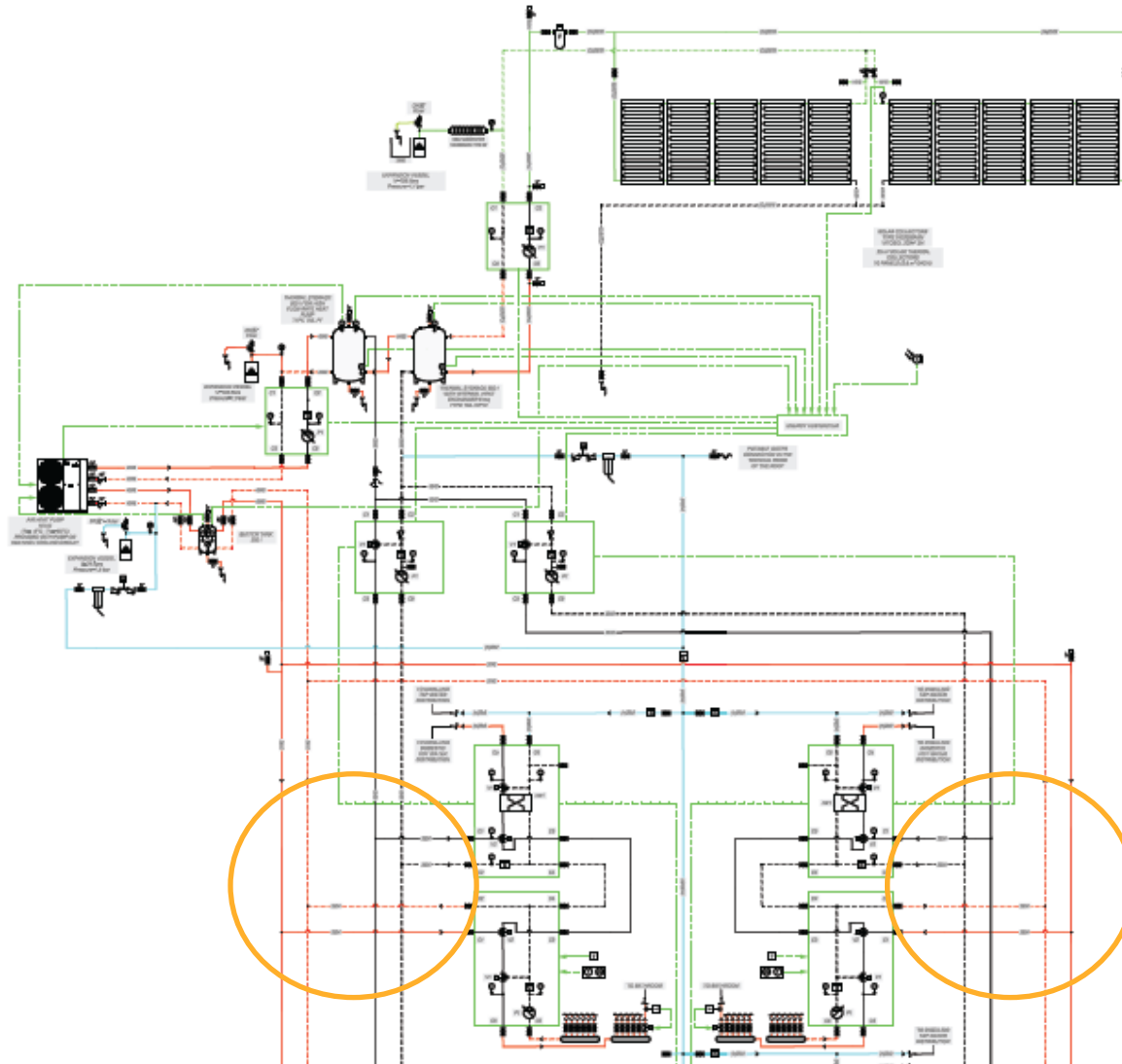






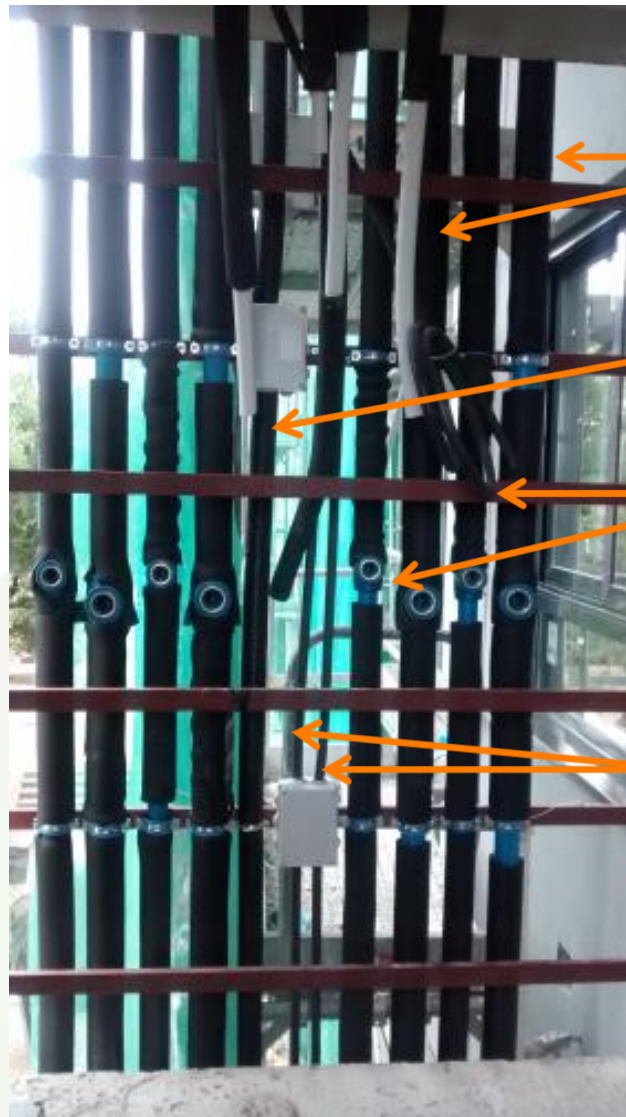
iNSPiRe Demo Madrid

1. PROGRESS. Vertical piping



iNSPiRe Demo Madrid

1. PROGRESS. Vertical piping



DHW Pipes

220 V Wiring

Heating / Cooling Pipes

Communication Bus and 24 V Wiring

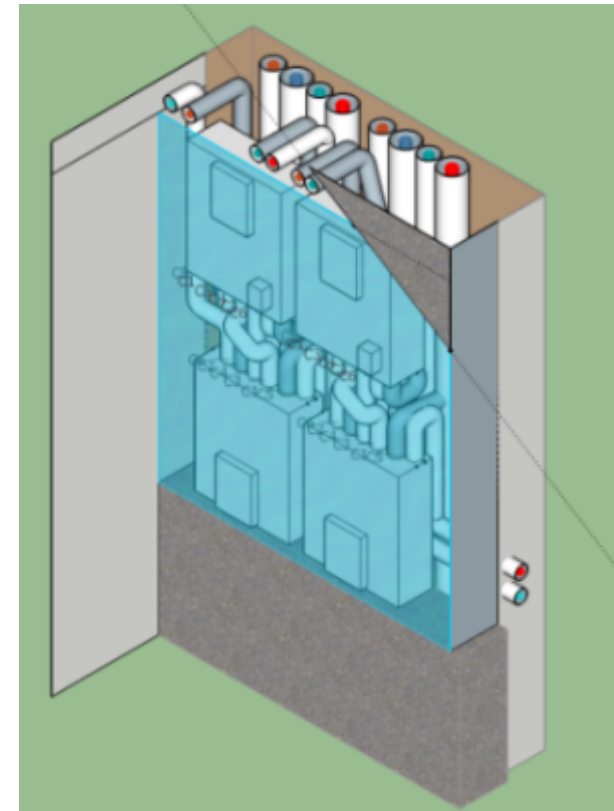
iNSPiRe Demo Madrid

1. Vertical Distribution

✓ 4 EH per floor.

□ 2 DHW

□ 2 Heating / Cooling

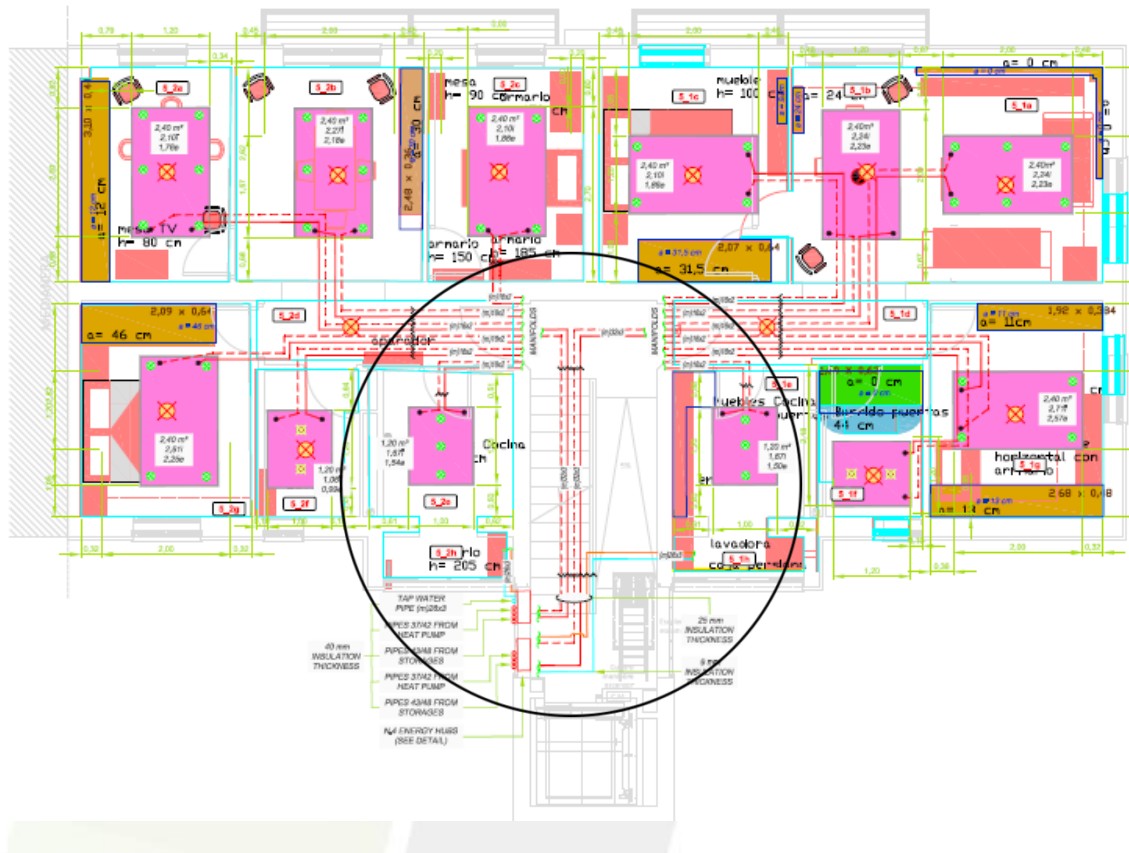




iNSPiRe Demo Madrid

1. Horizontal distribution

- ✓ Heating / Cooling piping (Above main door)
- ✓ DHW and cold water piping (Through Kitchen)



iNSPiRe Demo Madrid

1. PROGRESS: Horizontal Piping distribution



iNSPiRe Demo Madrid



PROGRESS: Inside the dwellings



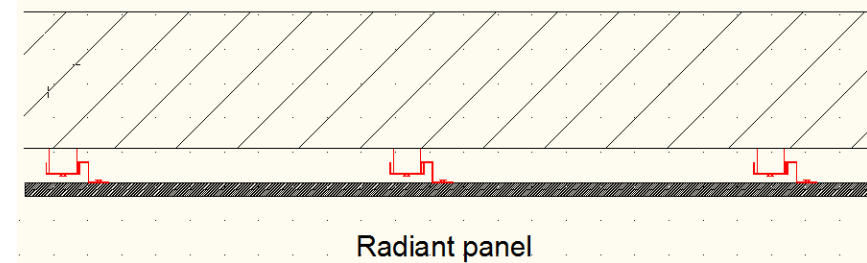
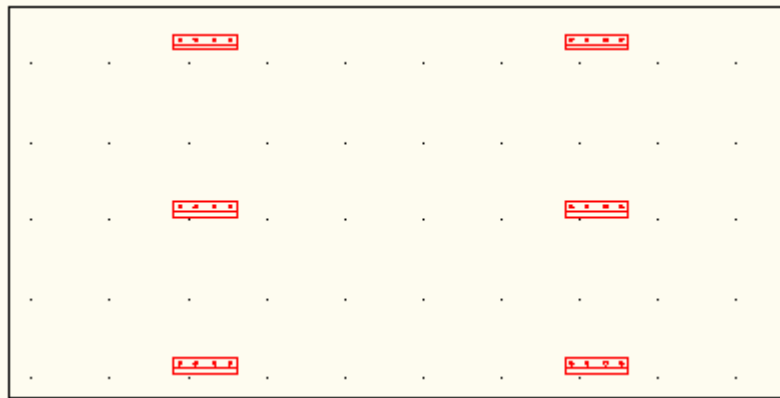
- ✓ Piping distribution in the corridor
- ✓ Manifold installed inside the dwelling



iNSPiRe Demo Madrid



✓ Fixing system



✓ Panels in island

✓ Different sizes of covers



iNSPiRe Demo Madrid



1. PROGRESS: Solar Panels



✓ Solar Panels distribution:

- ❑ 8 on the building façade
- ❑ 2 on the wall of the technical room

✓ Integration in façade with ETICS

✓ Design of an Metal structure

✓ Minimum space between them for maintenance



Inversión realizada en el edificio



ENERGY HUBS			
	Número	Edificio	Por vivienda
EH calefacción/refrigeración	8	18.400 €	2
EH ACS	8	18.400 €	2
EH regulación de temperatura	2	3.600 €	
EH bombeo	2	3.600 €	
Energy Manager	1	1.500 €	
Instalación EHs y distribución		11.200 €	
	21	56.700 €	7.088 €

INSTALACIÓN HIDRÁULICA			
	Número	Edificio	Por vivienda
Bomba de calor + Tanque 500l.	1	19.100 €	
Bomba de calor Resto equipos		10.000 €	
Colectores solares	10 ud.	8.300 €	
Almacenamiento ACS solar 800l.	1	4.100 €	
Instalación Solar Resto equipos		8.300 €	
Instalación eléctrica		6.800 €	
		56.600 €	7.075 €

Inversión realizada en el edificio



DISTRIBUCIÓN POR TECHO RADIANTE			
	Número	Edificio	Por vivienda
Techos radiantes	144 m2	14.400 €	18 m2
Distribución en vivienda		14.500 €	
Falsos techos (pladur)		12.000 €	
		40.900 €	5.113 €

OTROS CONCEPTOS			
	Número	Edificio	Por vivienda
PEM y legalización		1.200 €	
Dirección de obra, visado, seguros		7.500 €	
Modificaciones al proyecto original		15.000 €	
		23.700 €	2.963 €

TOTAL CENTRALIZACIÓN INSPIRE	Edificio	Por vivienda
	177.900 €	22.238 €





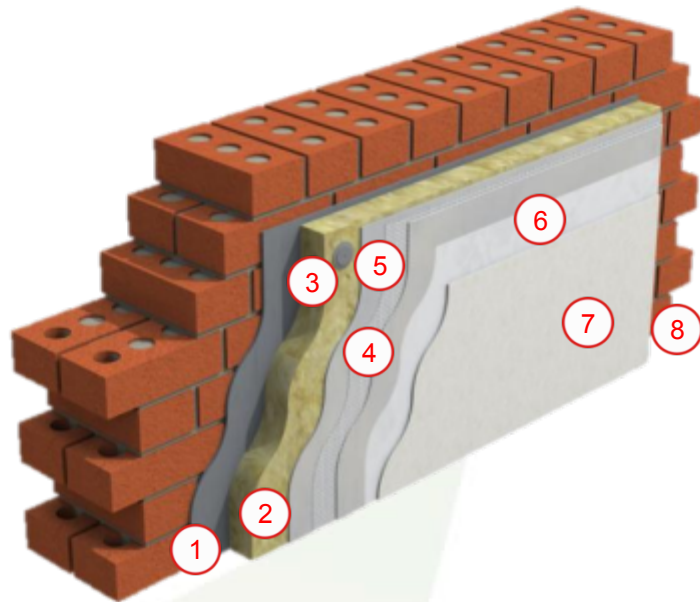






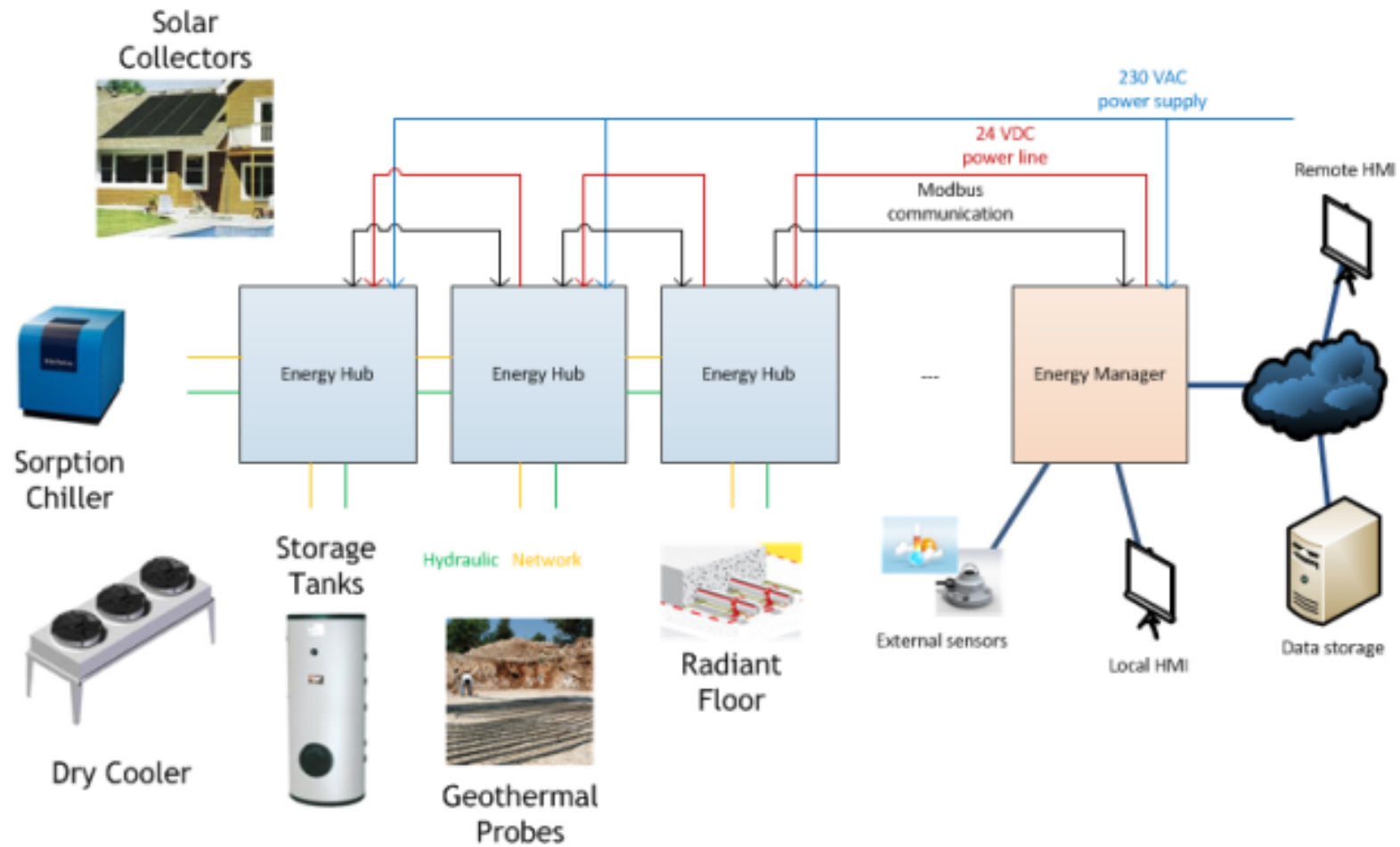
Propuesta rehabilitación_ Sistemas pasivos

Sistema **REDArt®**



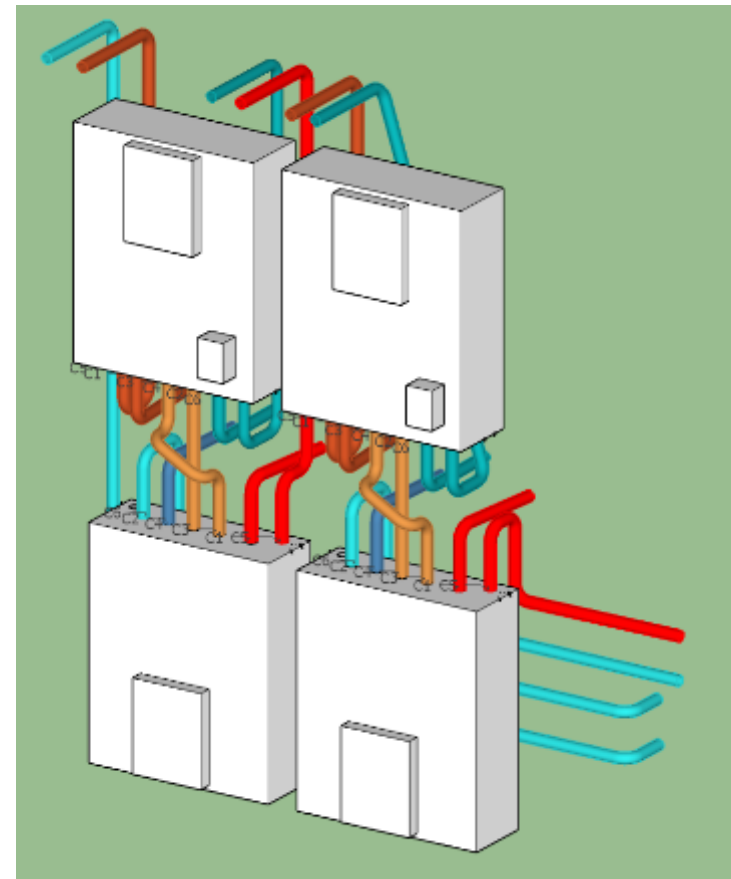
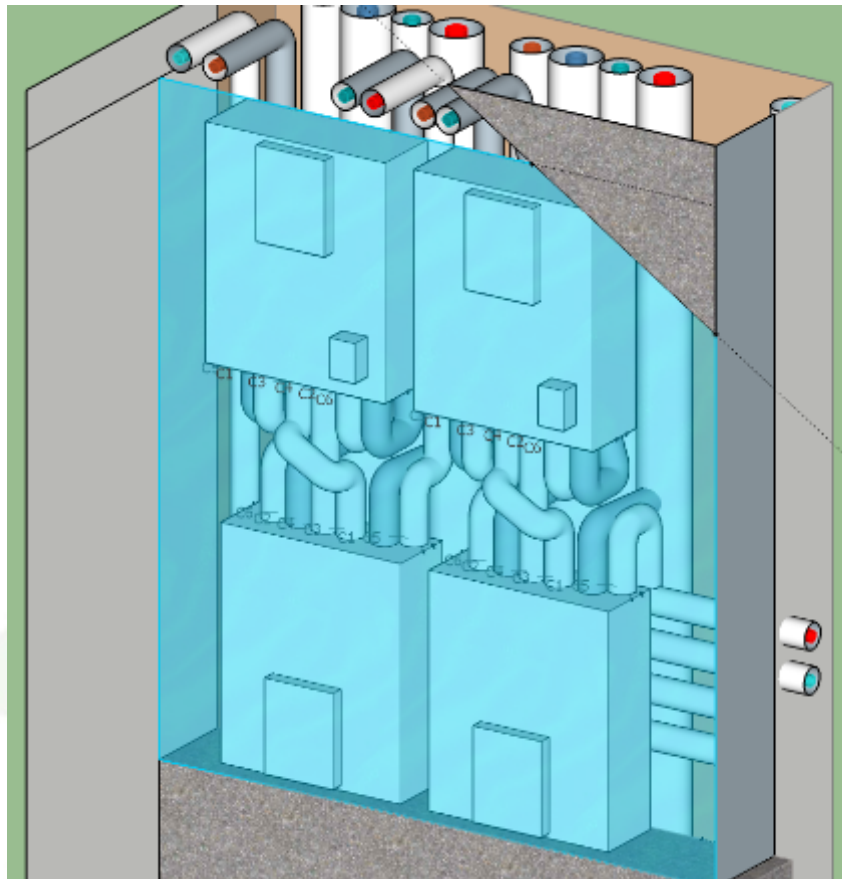
- 1 [REDArt Adhesivo](#)
 - 2 Gama RockSATE
 - 3 [Fijaciones mecánicas, 2 tipos](#)
 - 4 [REDArt Capa base](#)
 - 5 [Malla de refuerzo ,2 tipos](#)
 - 6 [REDArt Imprimación ,2 tipos](#)
 - [REDArt imprimación para Silicato](#)
 - [REDArt imprimación para Silicona](#)
 - 7 [REDArt acabado,2 tipos](#)
 - [REDArt acabado Silicato](#)
 - [REDArt acabado Silicona](#)
 - 8 [Perfiles](#): 16 tipos, las más usadas: 5 tipos
- **REDArt acabado Silicato:**
Tipo de grano 1 - 1,5 y 2 mm
 - **REDArt acabado Silicona:**
Tipo de grano 1 – 1,5 y 2mm

Energy Management Network (EMN)



DISTRIBUCION Y GESTION ENERGIA

Energy Hubs



Sistema de distribución, control y gestión de energía para calor/frío y ACS por planta: dos viviendas

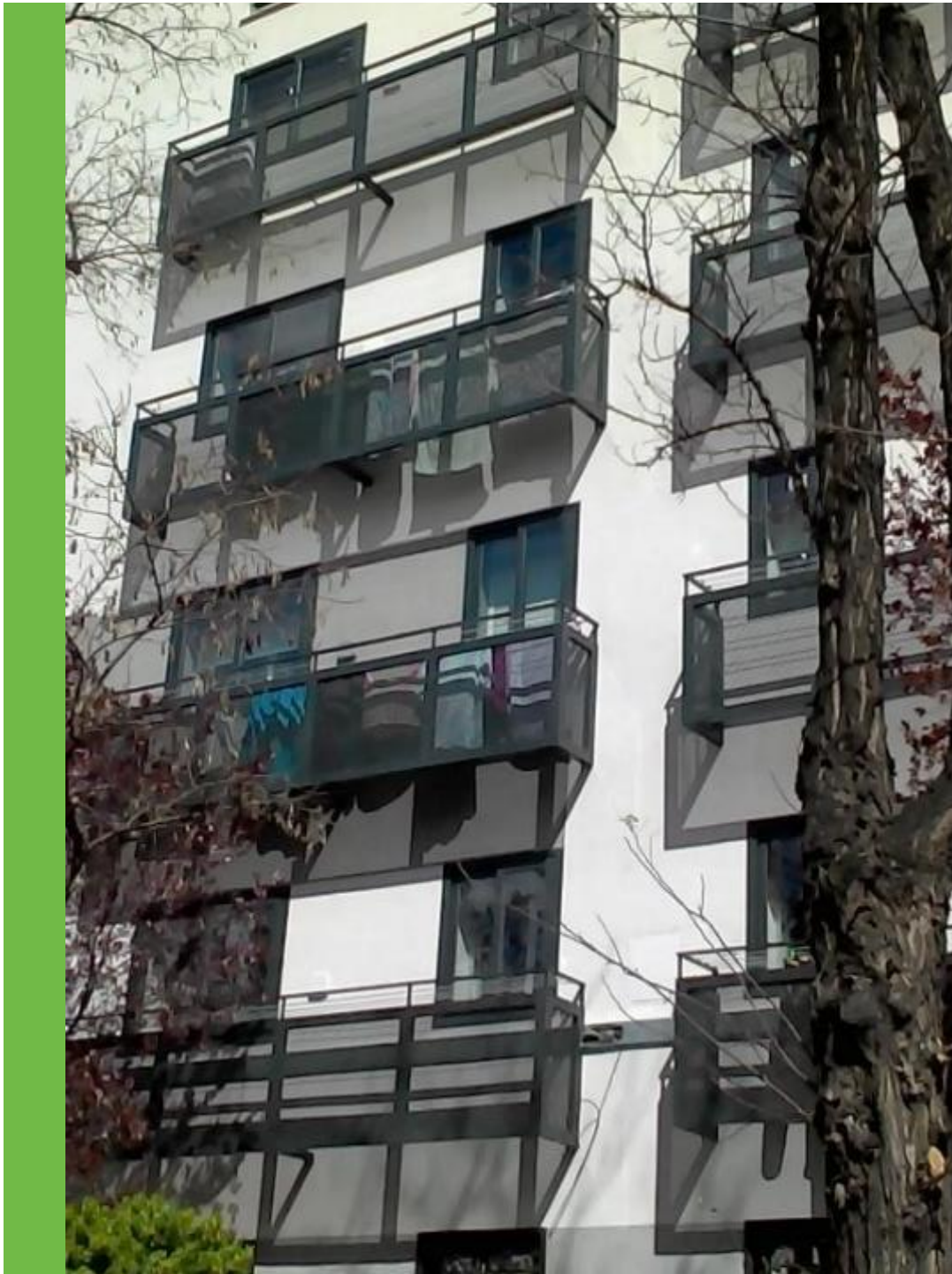












Danke schon

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