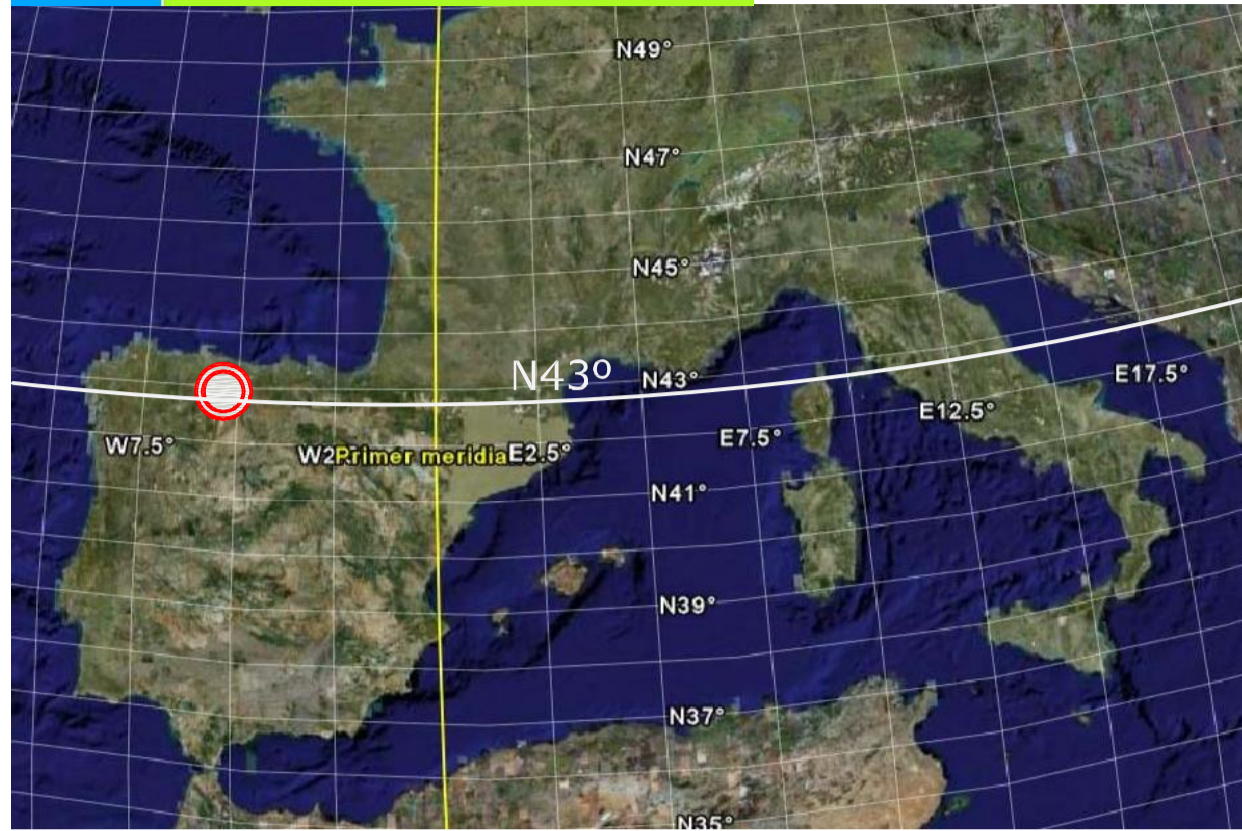
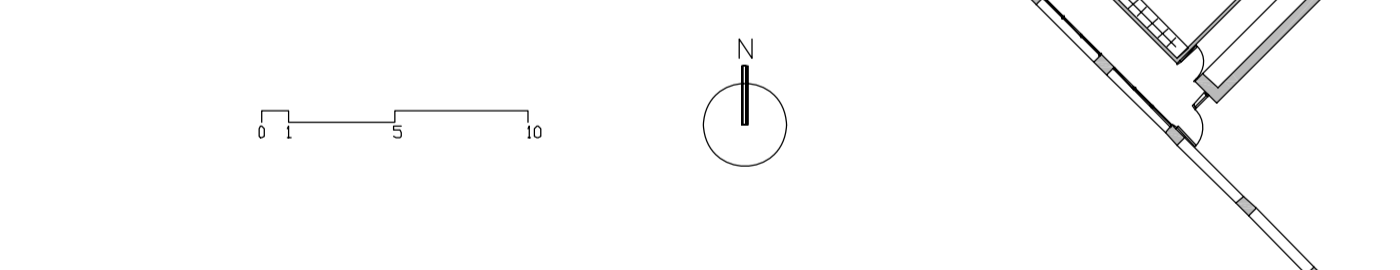
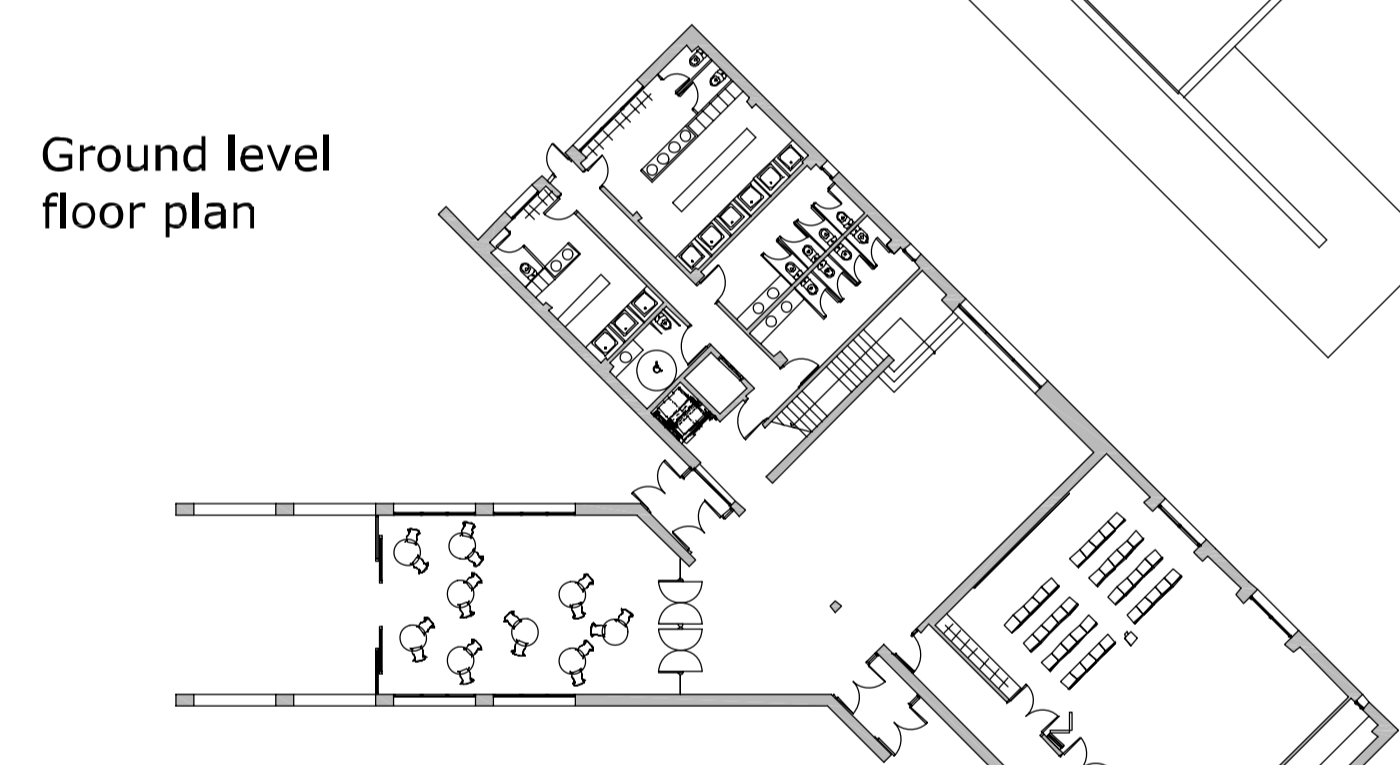
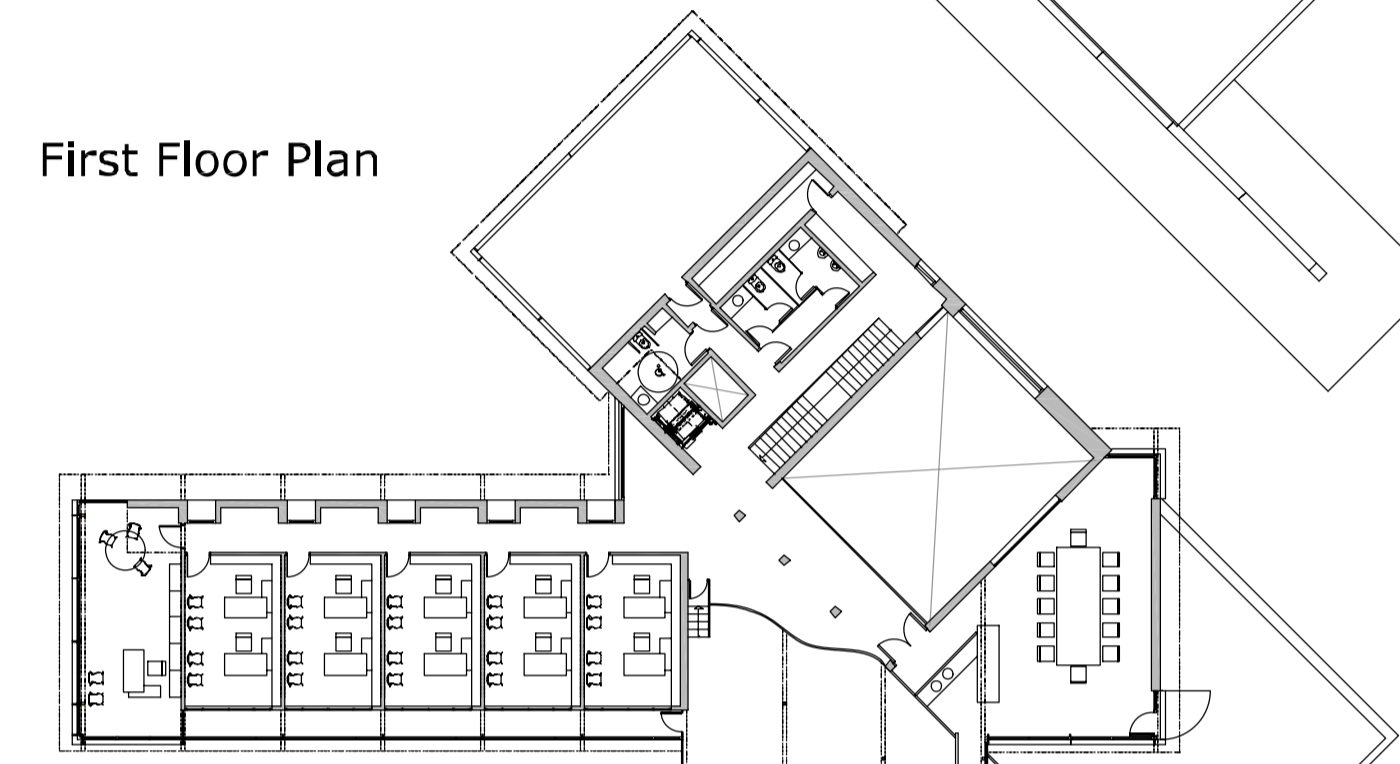
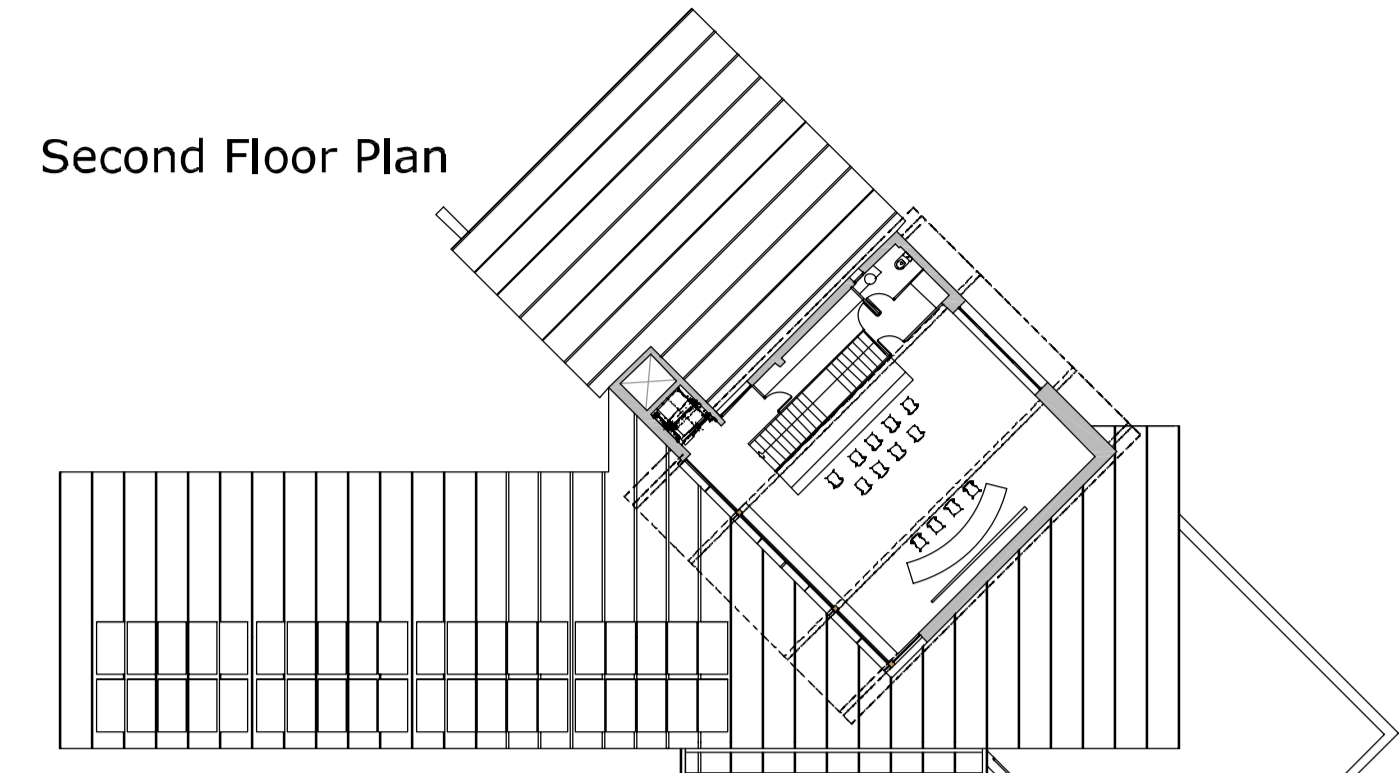


ARFRISOL, Fundación BARREDO, Asturias, Spain



Brownfield regeneration



Experimental Lab and offices for Tunnel Safety Testing

Demonstration exercise of Bioclimatic Architecture coupled with solar absorption cooling for optimized operation. New construction.

The main items of the **bioclimatic design**, suited to the mild and humid climate of the location are:

- South glazing, shaped according to different space usage, for ventilation air preheating
- Shading devices to avoid direct solar radiation in midseason and summertime
- Increase of north facade insulation in order to reduce heat loss
- Narrow plans allow cross ventilation
- Design of curved free ventilated roofs to reduce solar gain
- Extensive use of wood in north facades and roof structure

The **conditioning equipment** consists of:

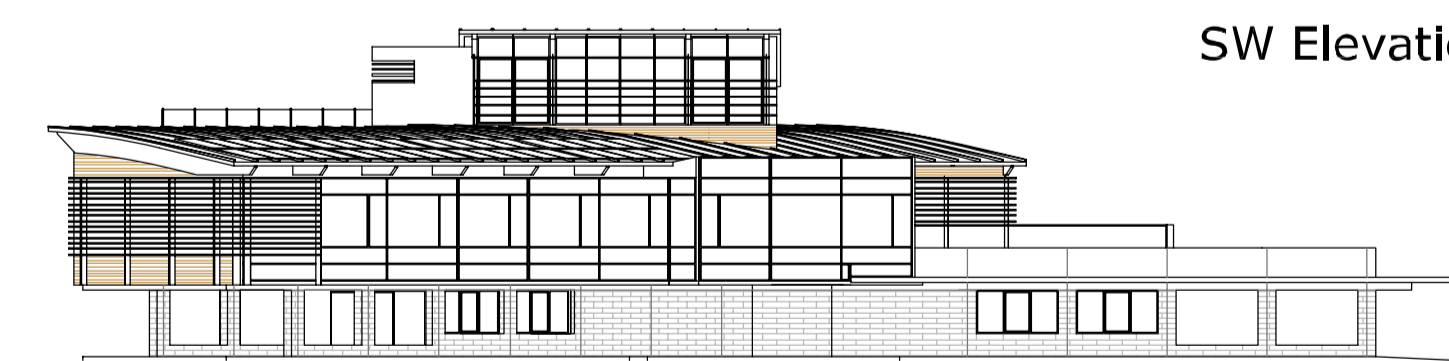
- Absorption cooler powered by solar collectors and a biomass furnace
- Vertical and horizontal water pipes to use geothermal energy as heat source and sink
- Radiant floors for basic sensible heating and cooling
- Distributed air handling units for latent cooling and humidity control

Basic Information

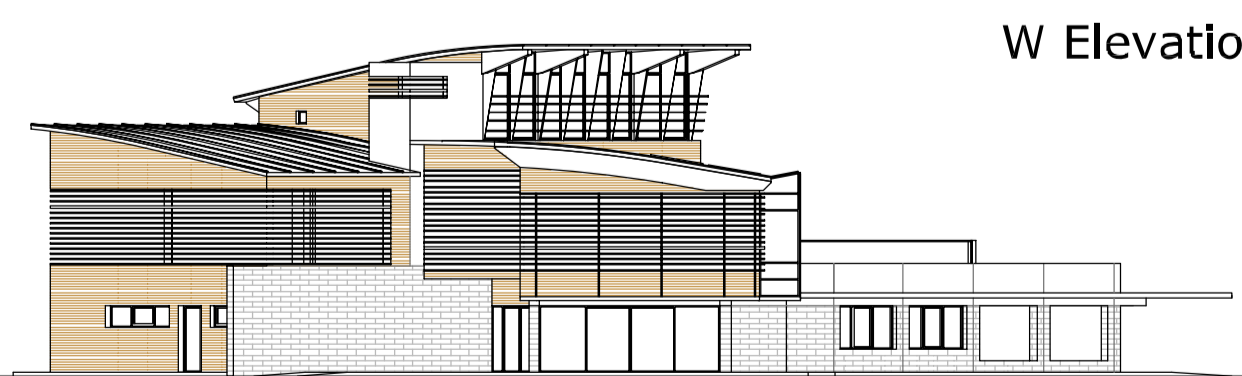
Building type: New Office Building
 Surface: 1350 m²
 Situation: Siero, Asturias, Spain
 Client: ARFRISOL, Fundación BARREDO
 Architect: ALIA, Arquitectura, Energía y Medio Ambiente:
 Emilio Miguel Mitre
 Carlos Expósito Mora
 Occupation: 2008



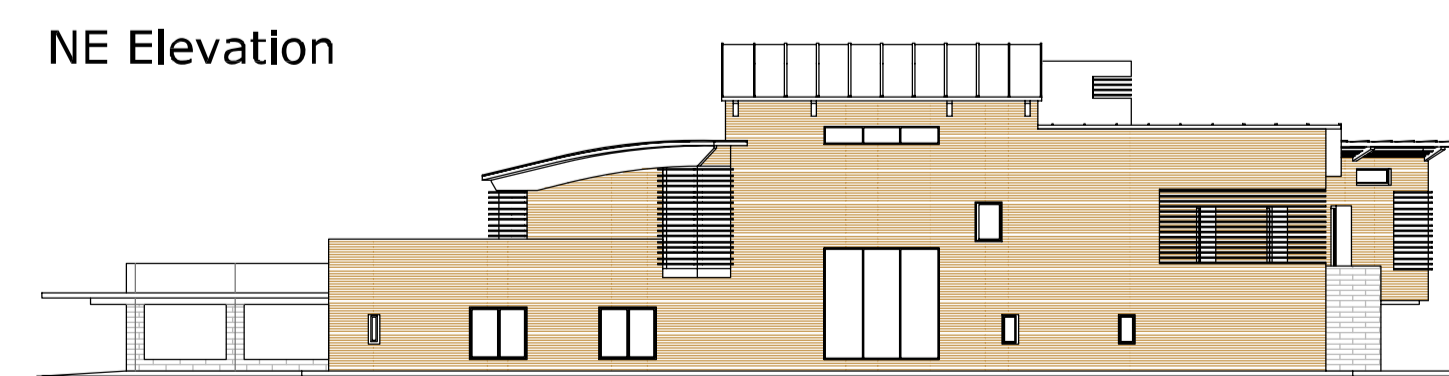
W Section



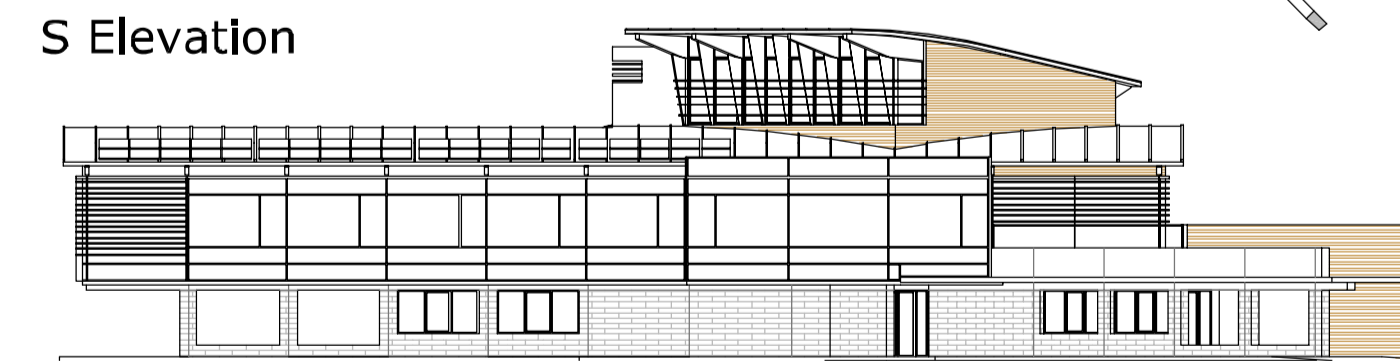
SW Elevation



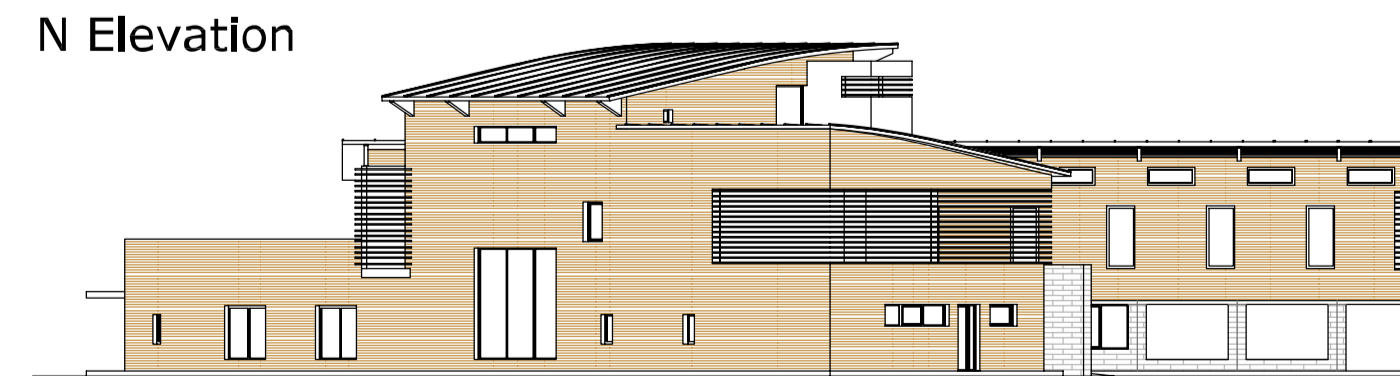
W Elevation



NE Elevation

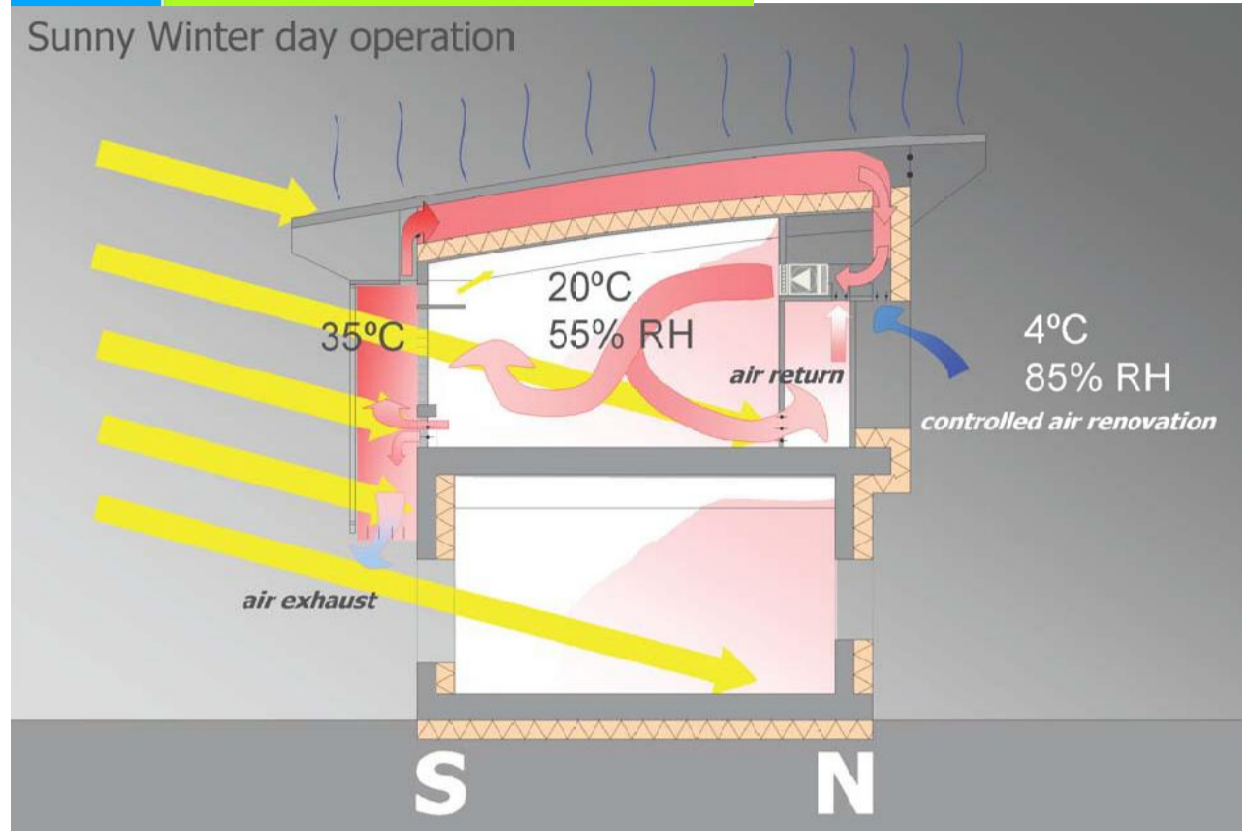


S Elevation



N Elevation

ARFRISOL, Fundación BARREDO, Asturias, Spain



Existing chimney



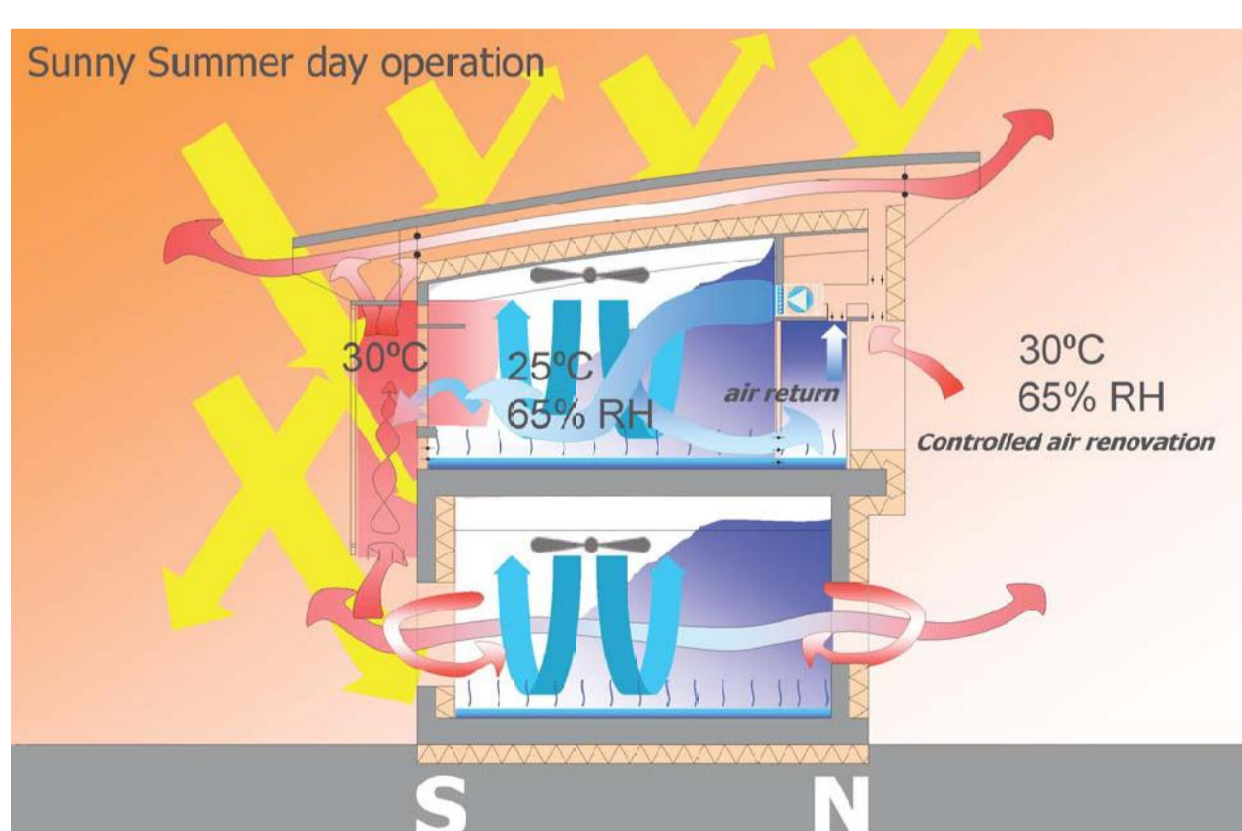
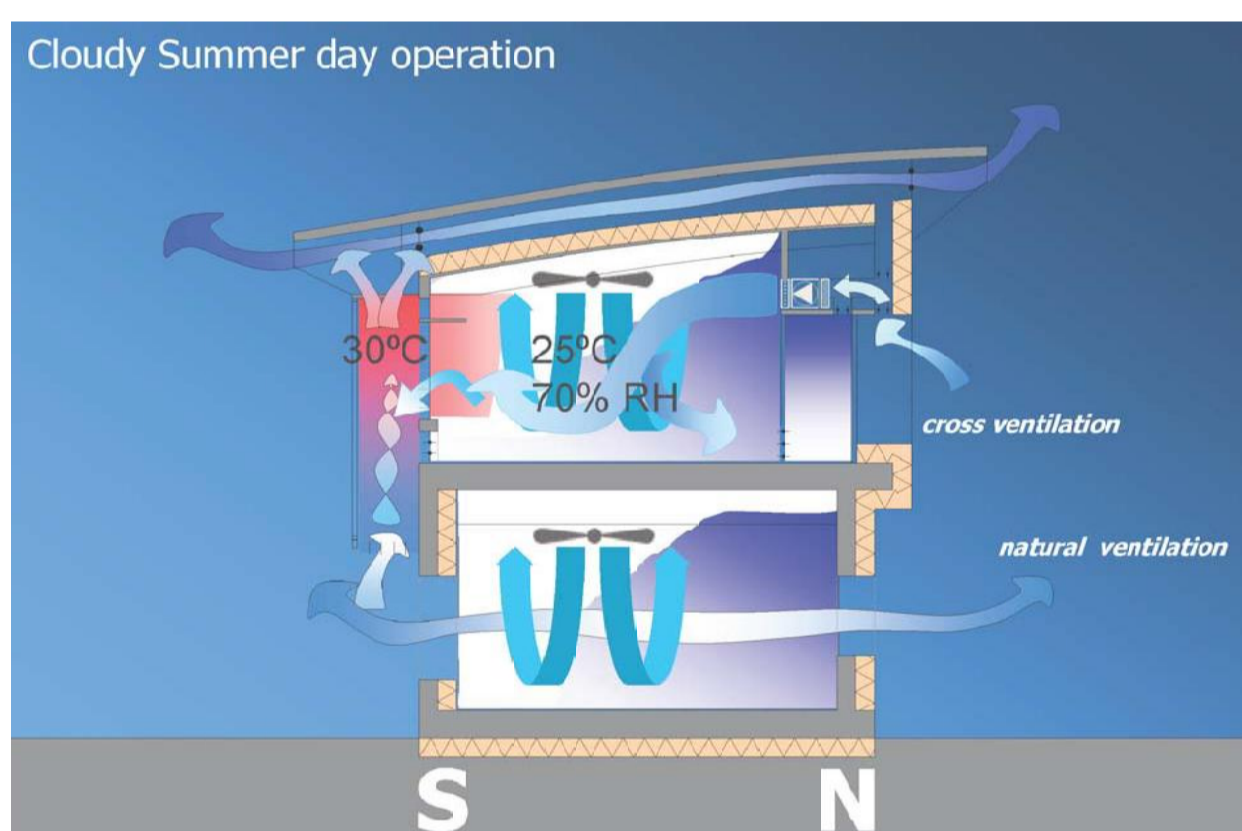
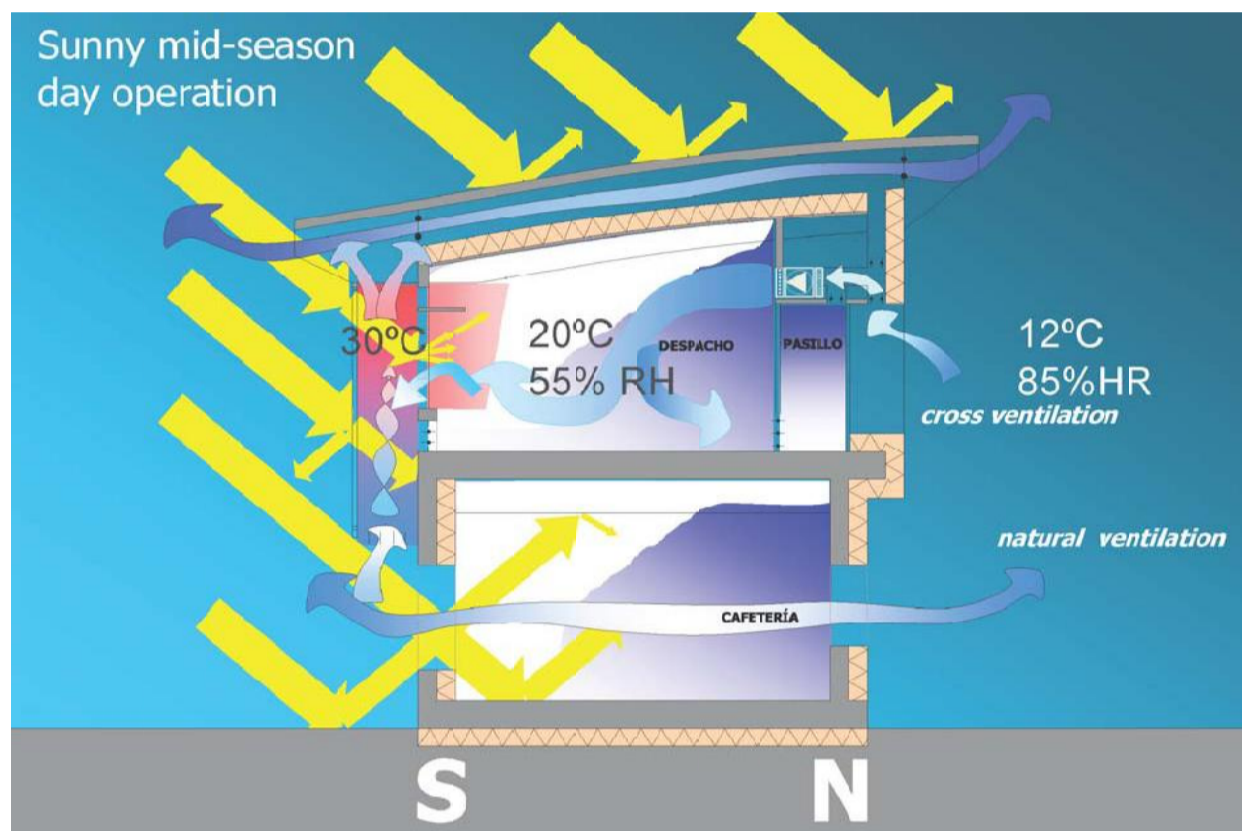
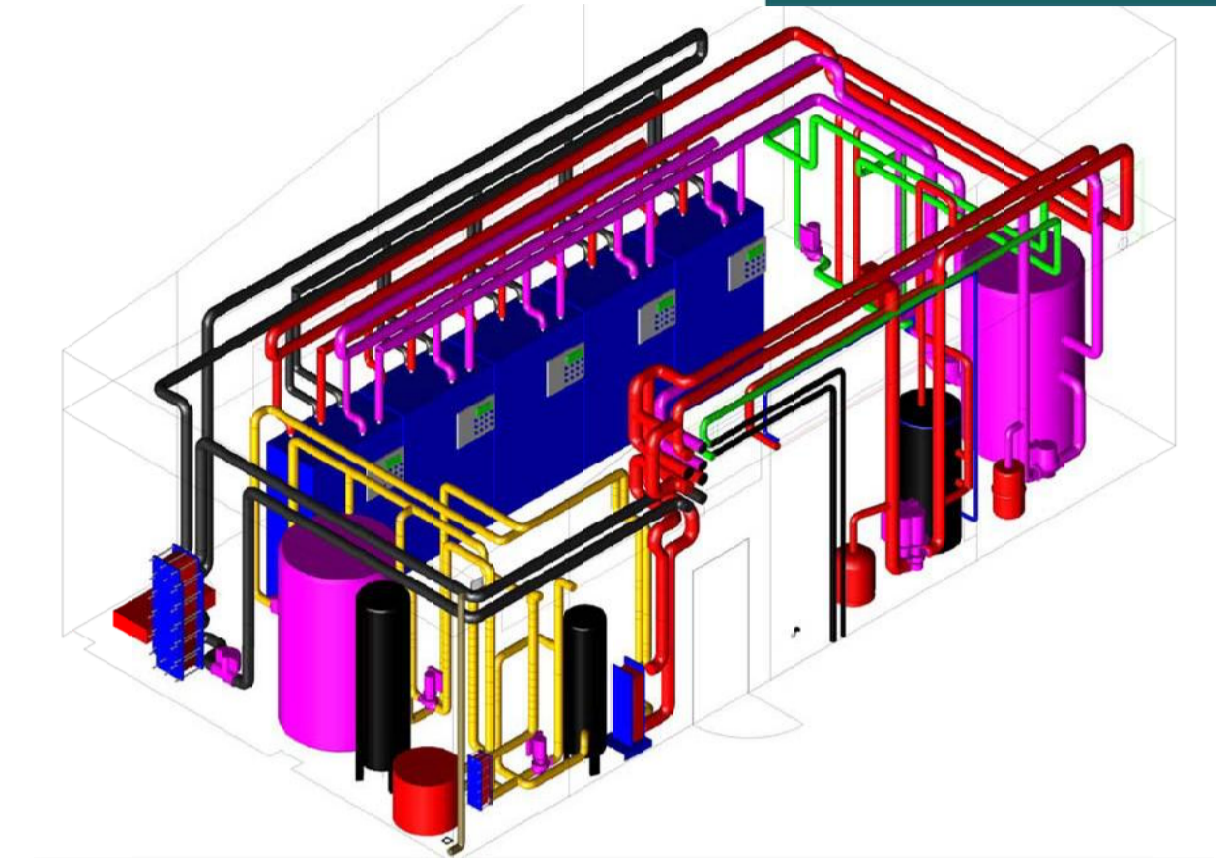
Pellets furnace and spiral conveyor



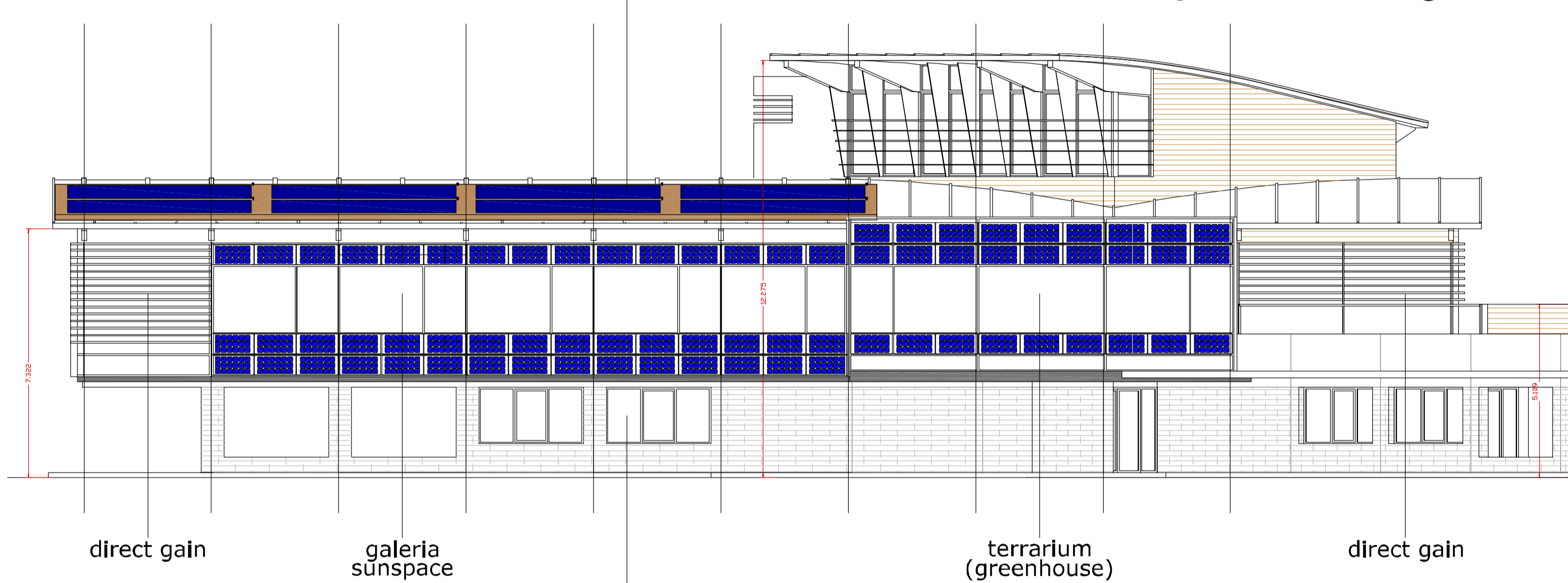
Biomass storage



Absorption chiller room

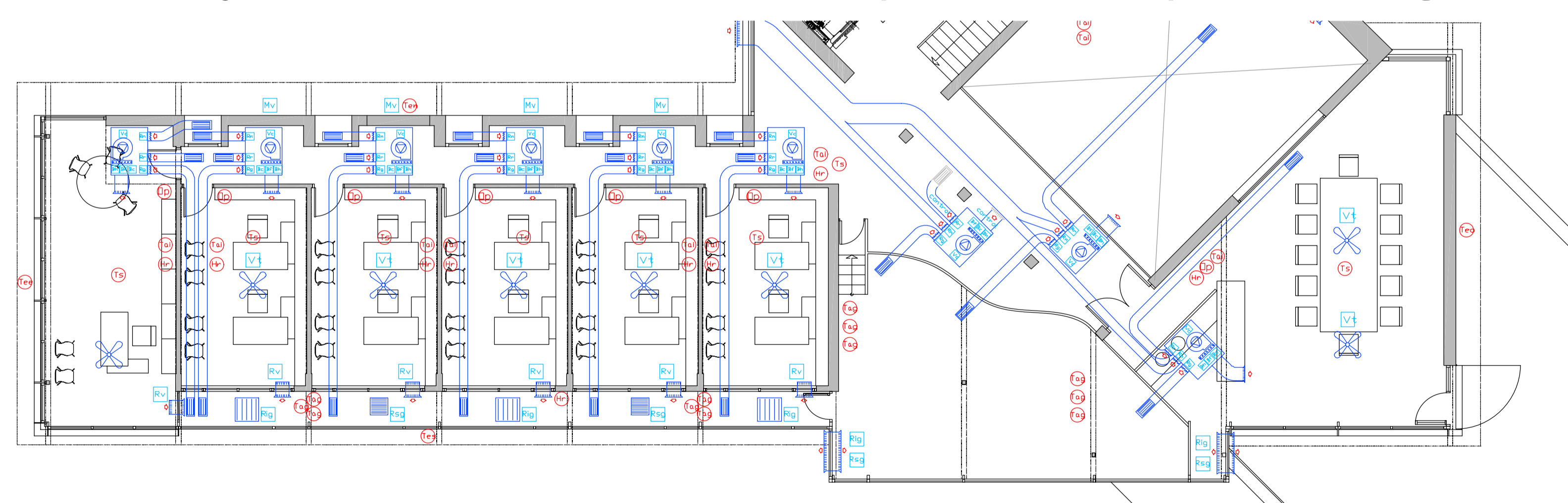


Solar thermal panels integration

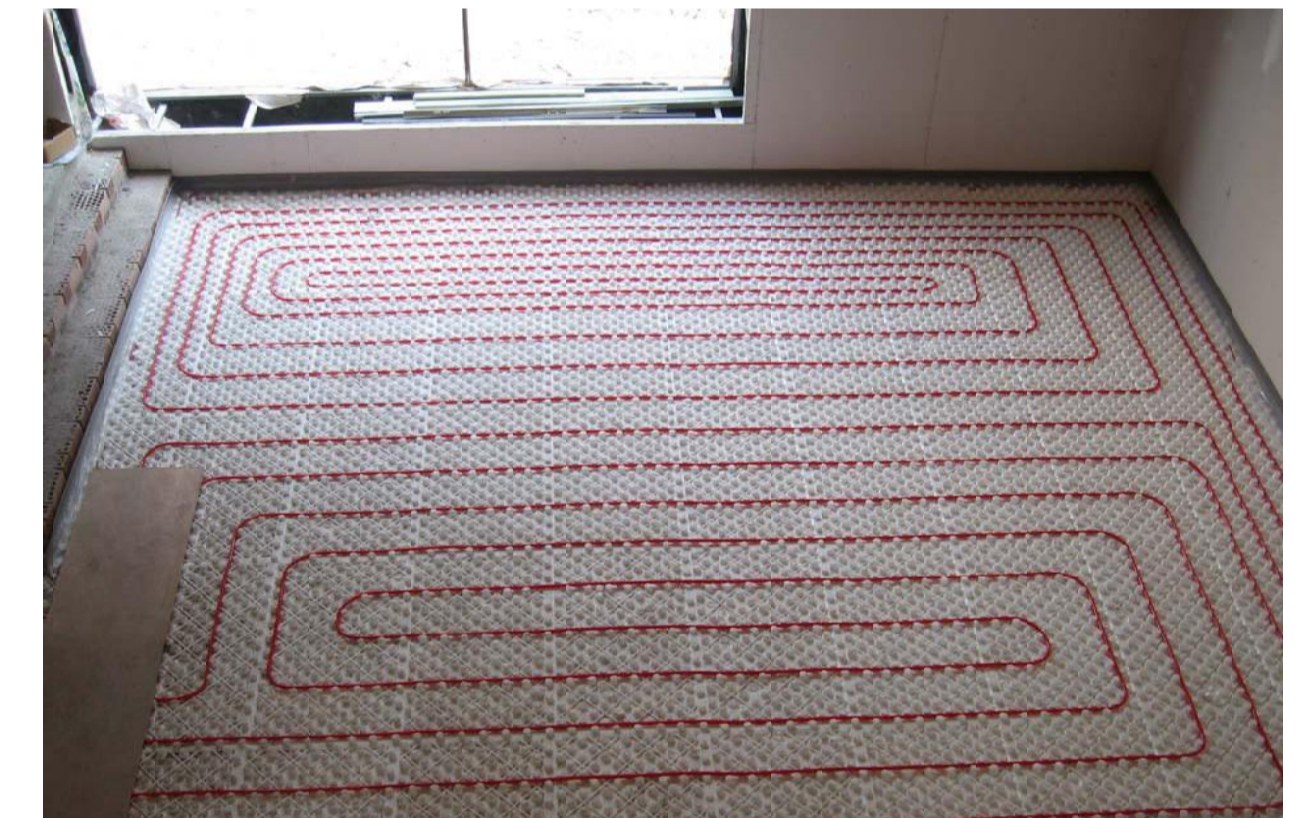


Control system

Solar photovoltaic panels integration



Handling units floor for latent cooling

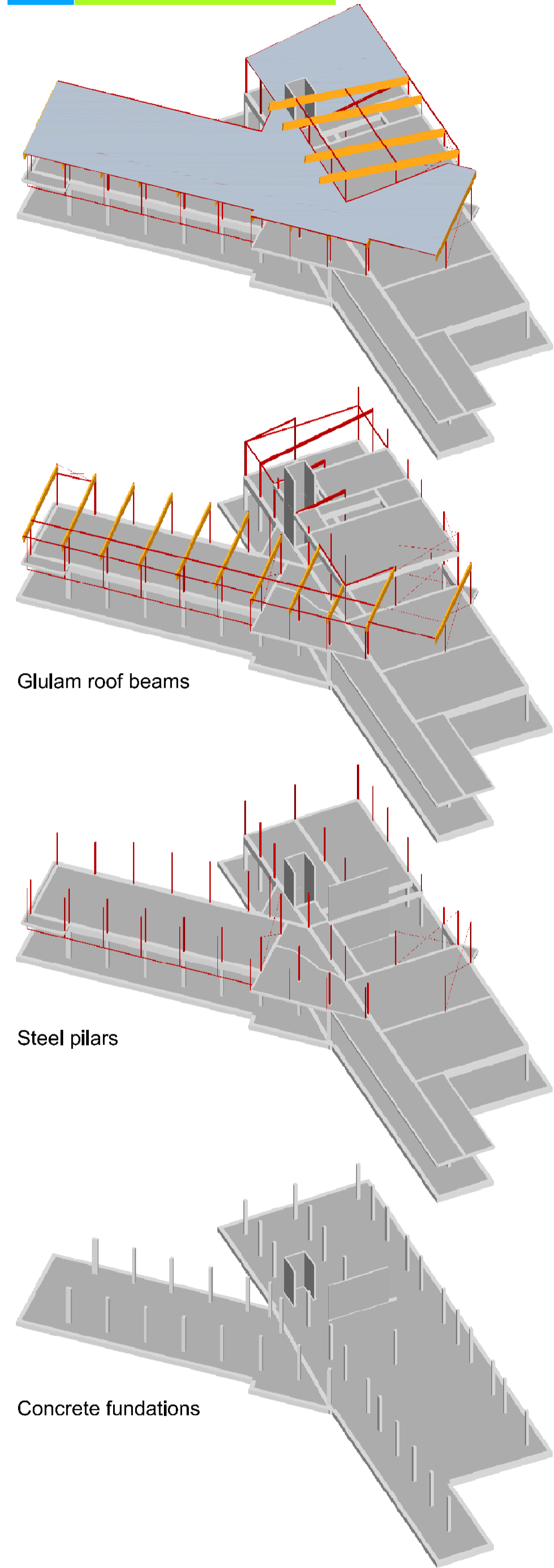


Radiant floor for sensible heating



Geothermal heat recovery

ARFRISOL, Fundación BARREDO, Asturias, Spain



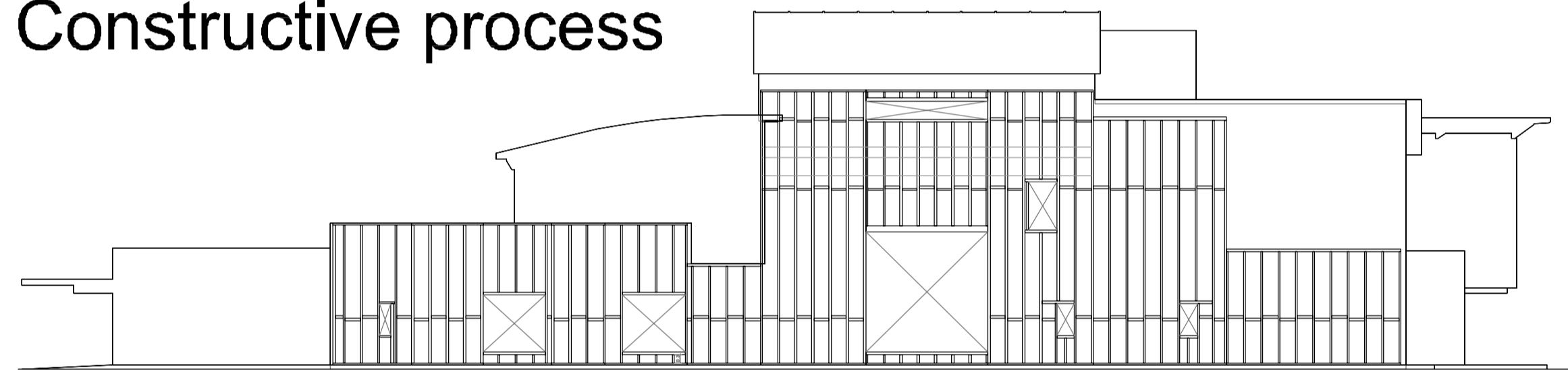
Glulam roof beams

Steel pillars

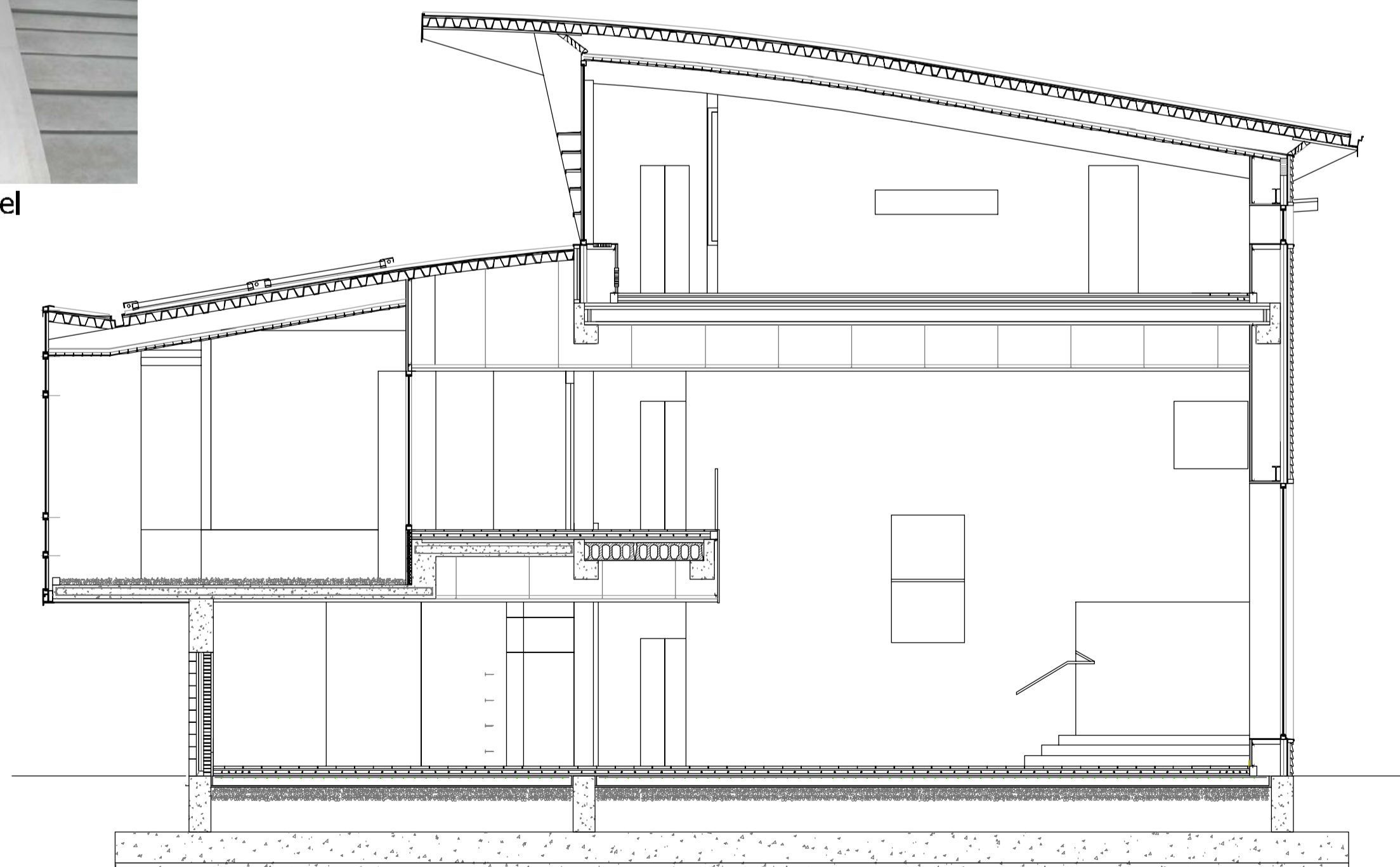
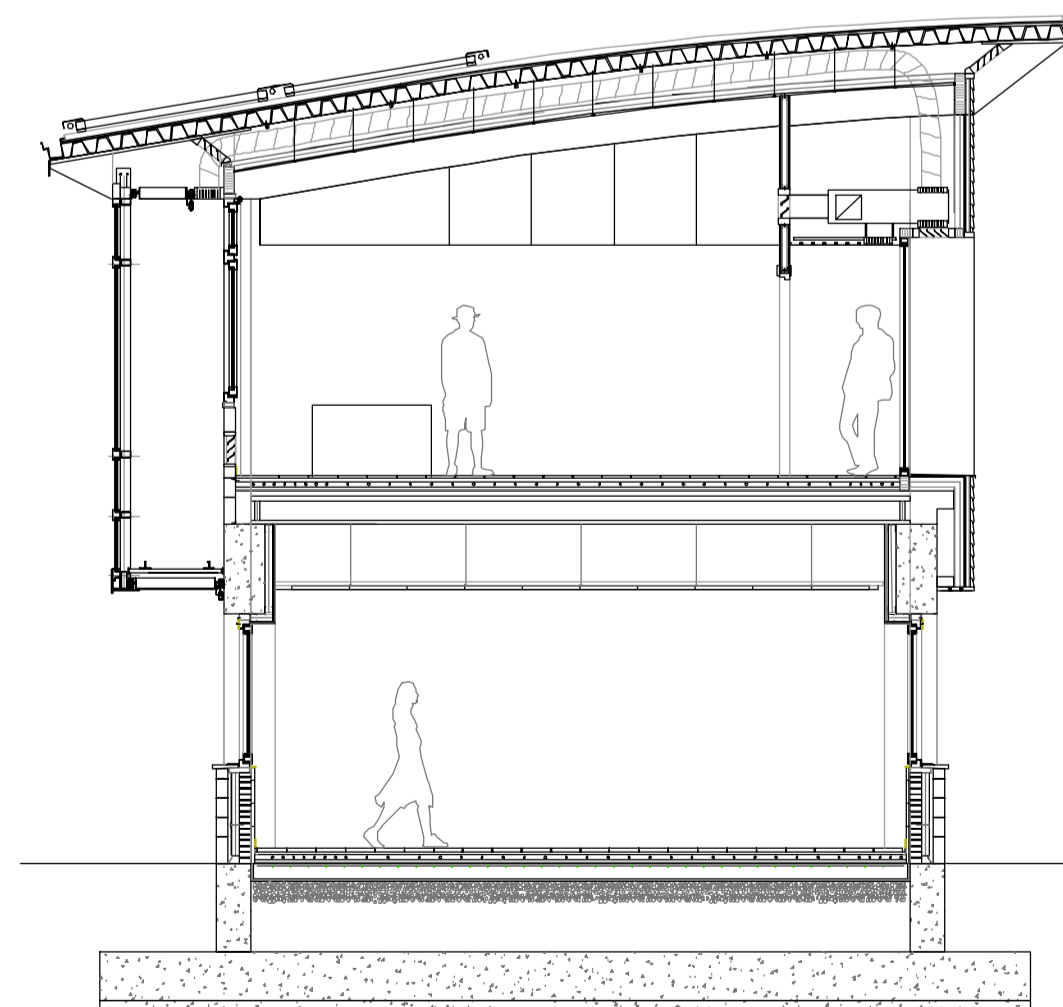
Concrete foundations



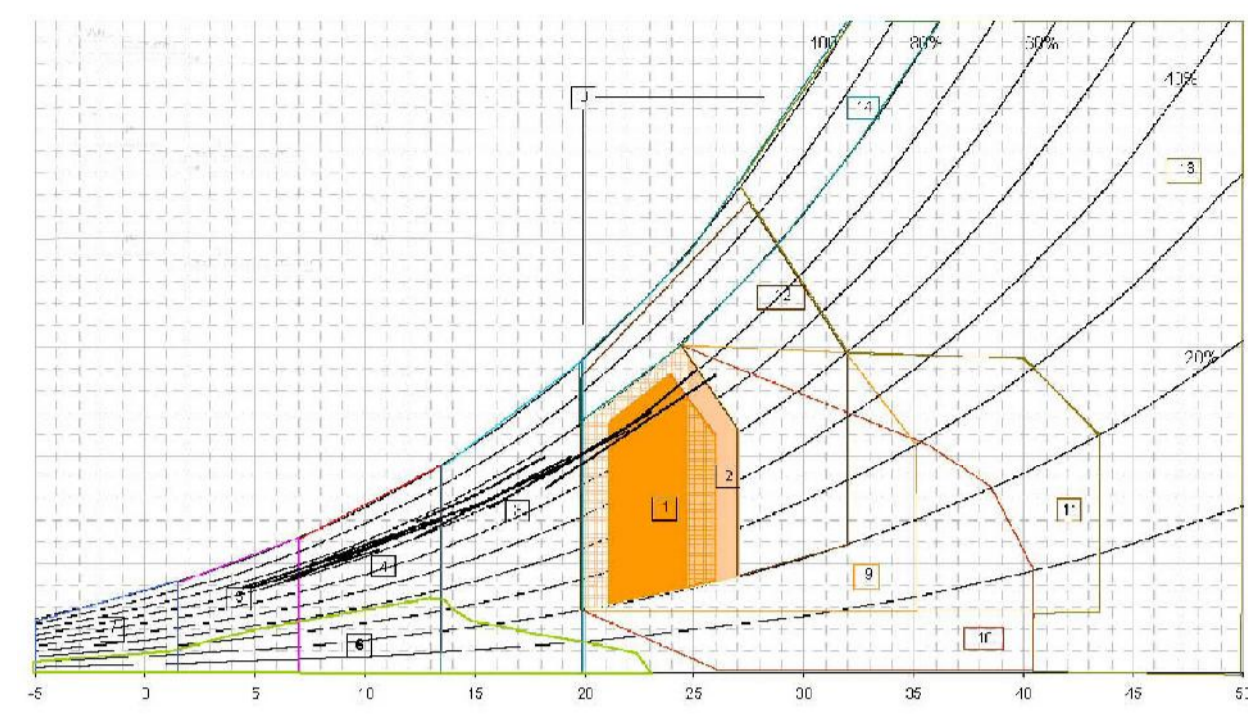
Constructive process



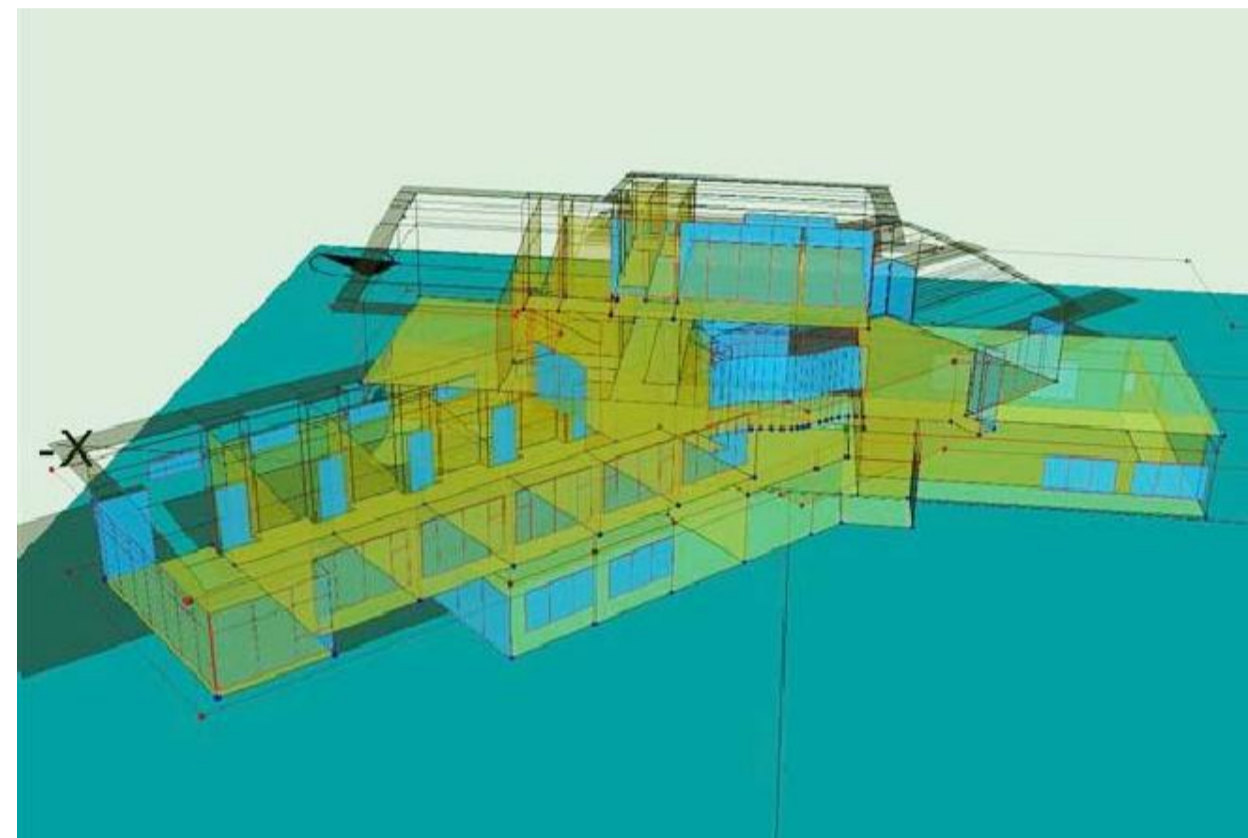
Covadonga red limestone Chestnut wood Steel



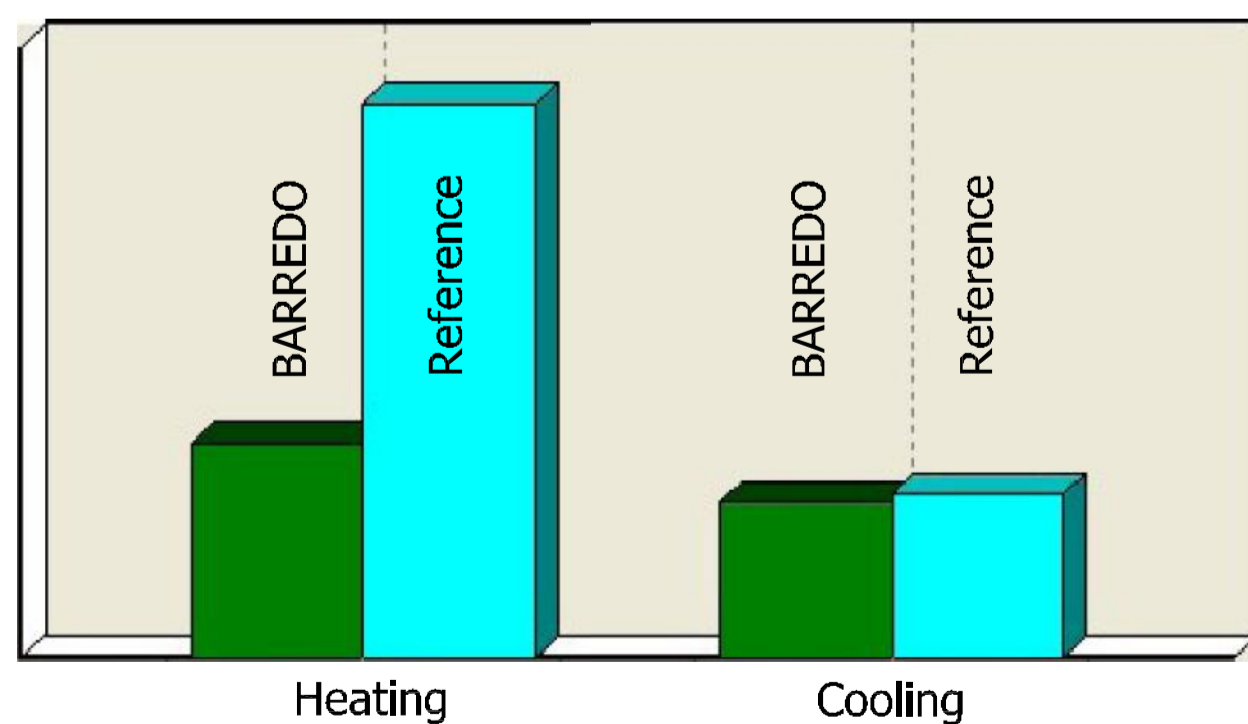
ARFRISOL, Fundación BARREDO, Asturias, Spain



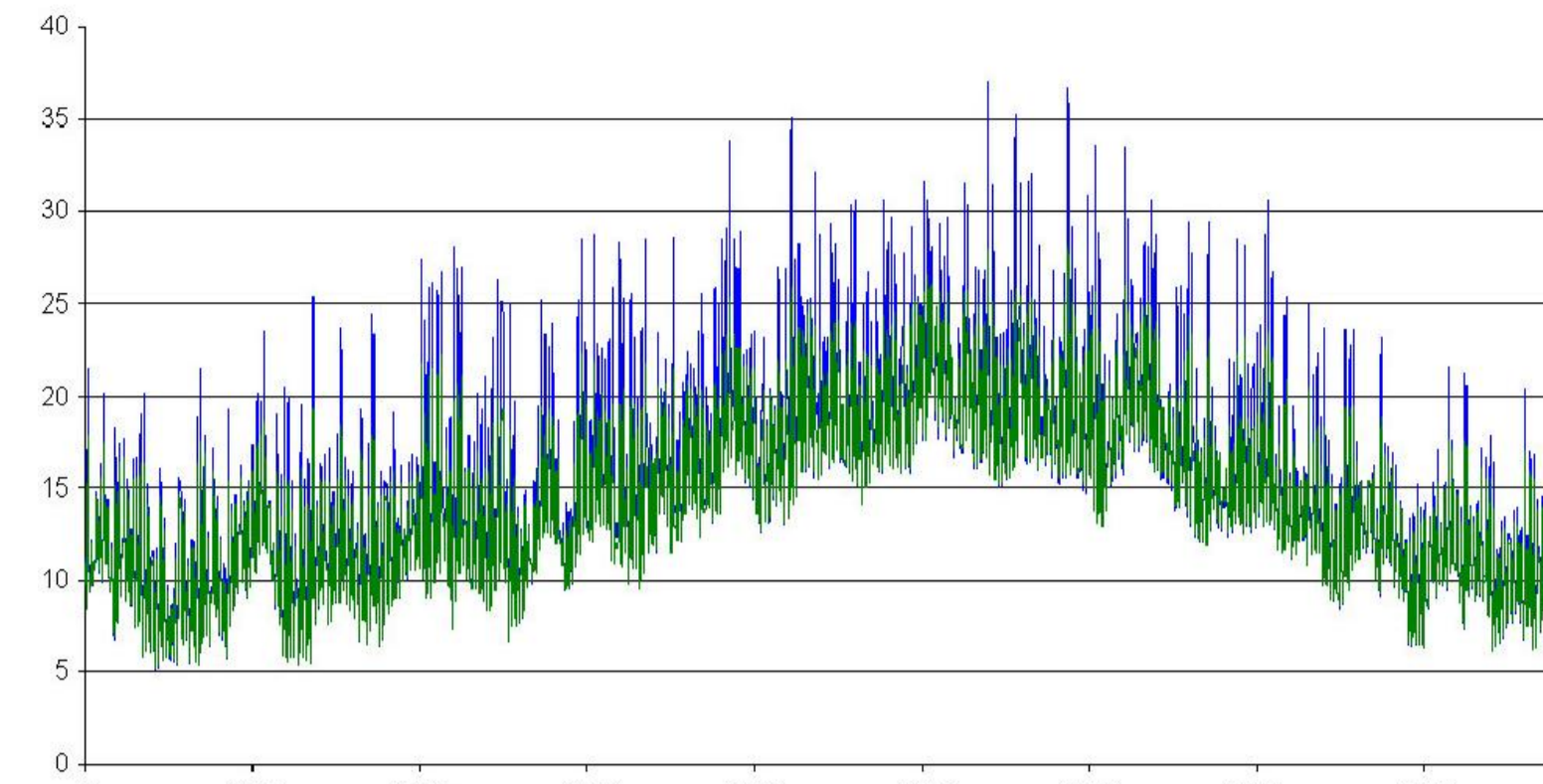
Climate characterization



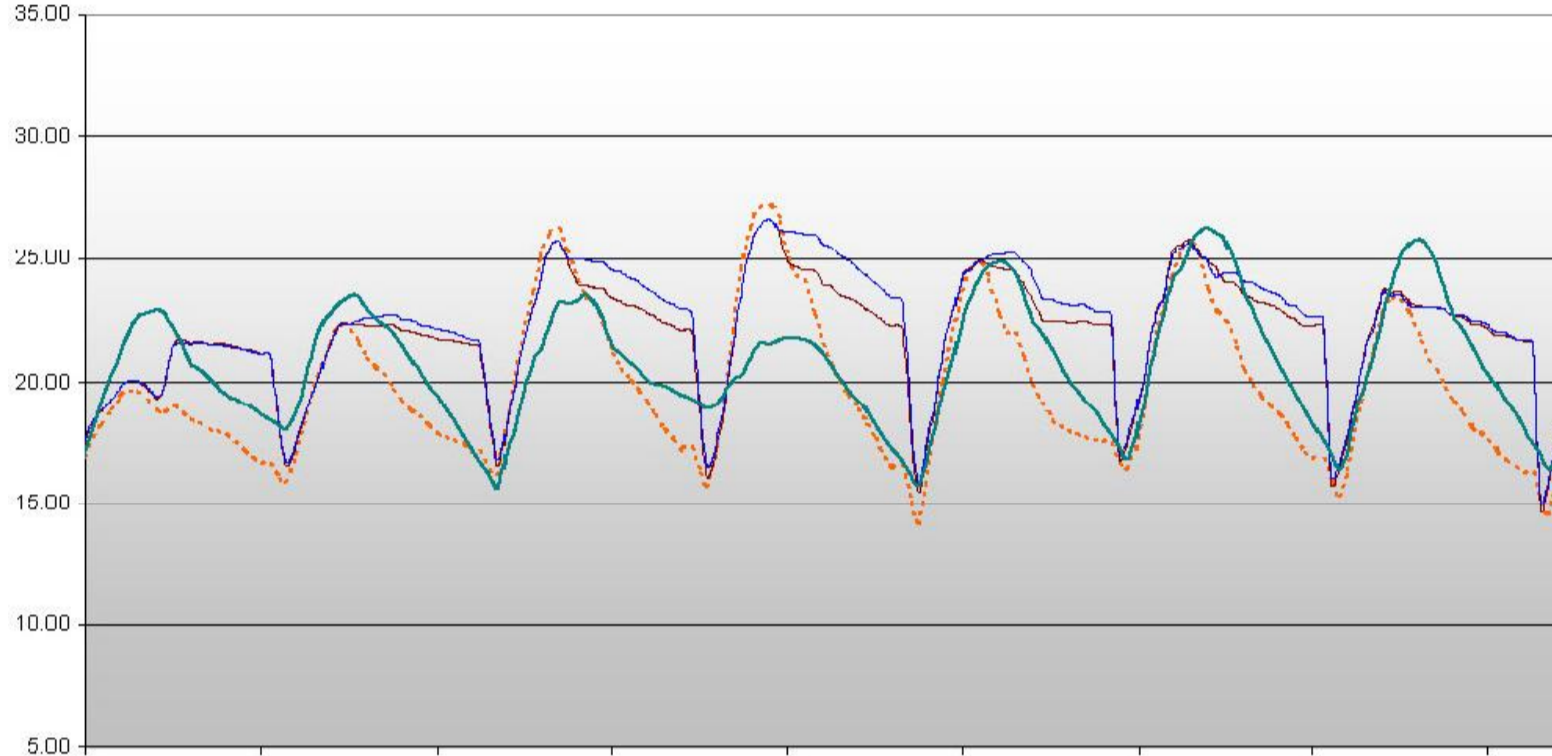
LIDER, 3D Model



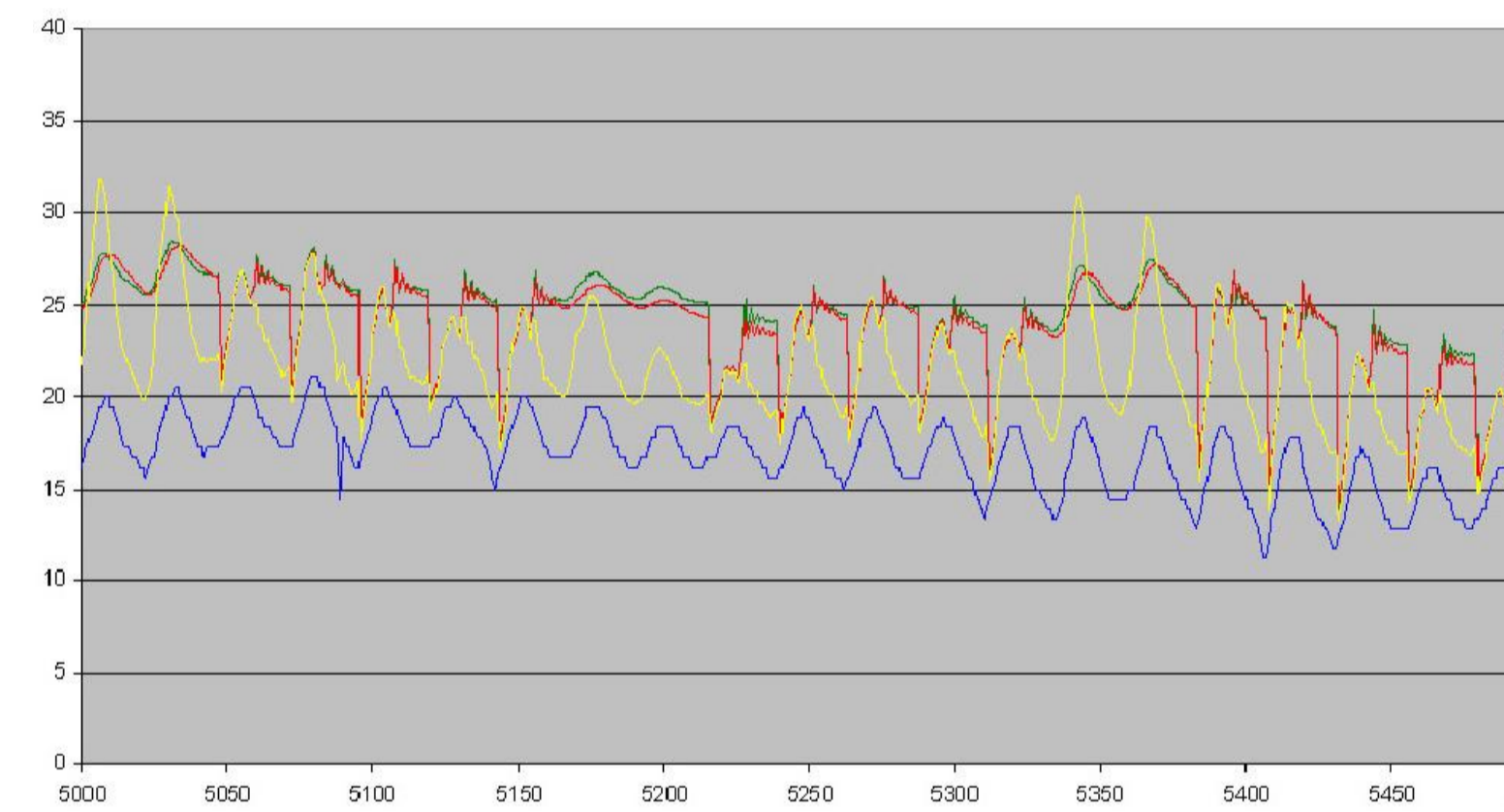
LIDER, Demands results



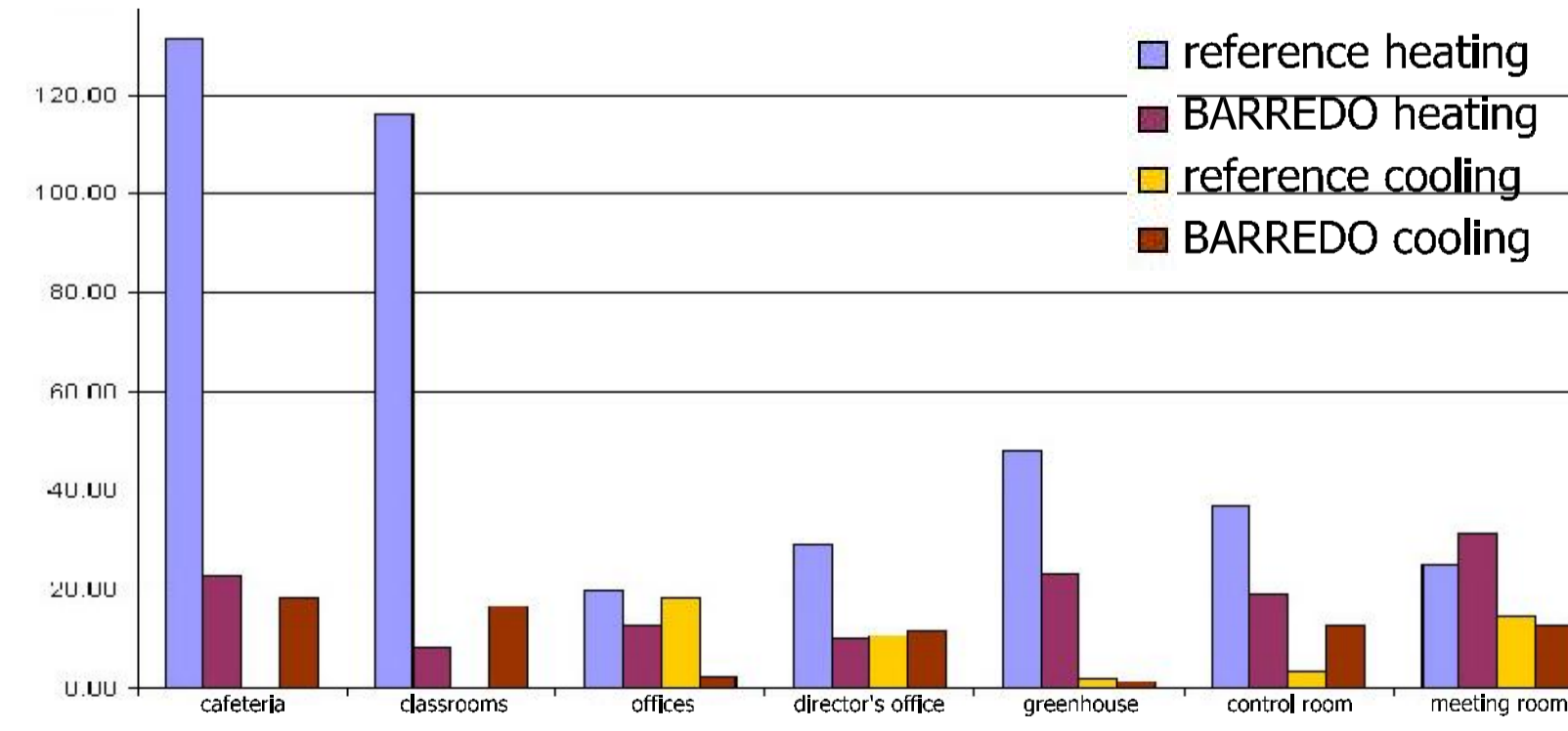
TRNSYS, Working spaces temperature control by cross ventilation and hybrid systems operation of the galeria



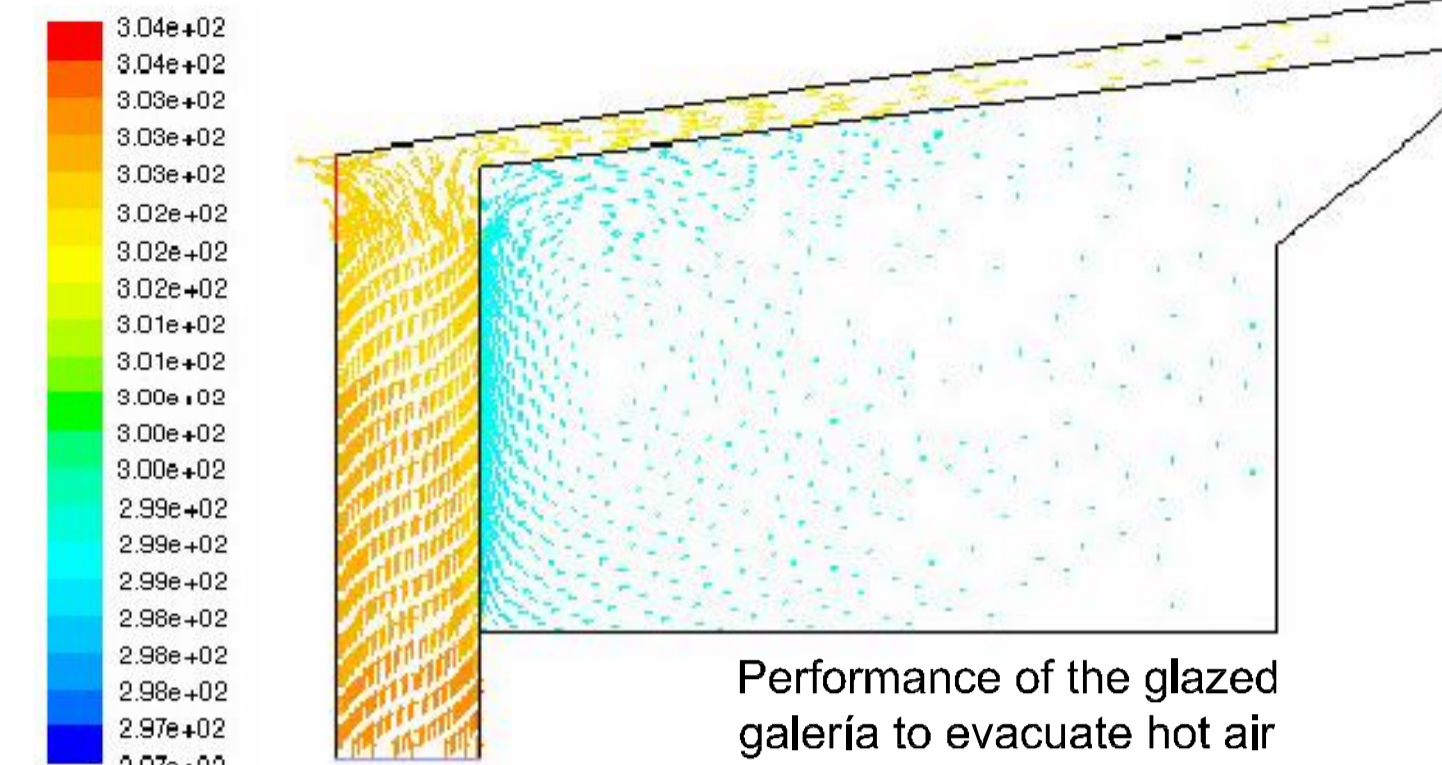
TRNSYS, Working spaces temperature control by cross ventilation



TRNSYS, Director's office temperature moderation due to shading devices



TRNSYS, Heating and cooling demands comparison in different zones of the building



Performance of the glazed galeria to evacuate hot air

FLUENT, Computational Fluid Dynamics

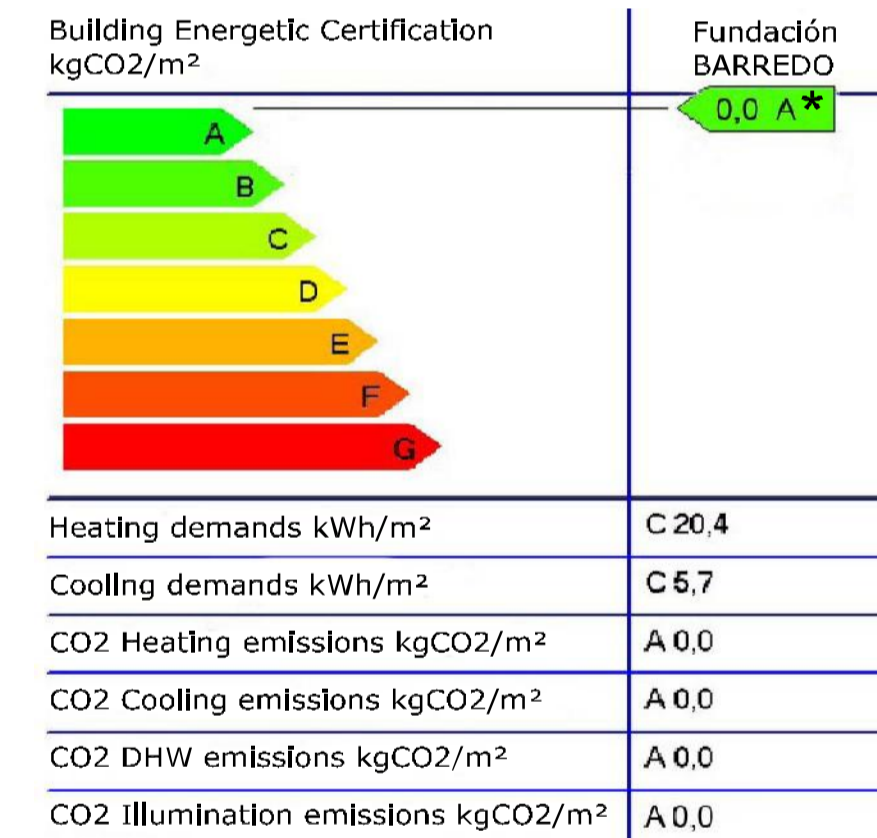
Demands (kWh/m²)	Fundación BARREDO	Reference
Heating	20,4	39,0
Cooling	5,7	7,3

Final Energy Consums (kWh/m²)	Fundación BARREDO	Reference
Heating	22,6	49,2
Cooling	0,4	1,7
DHW	0,5	9,4
Illumination	15,8	115,8
Total	39,3	176,2

Primary Energy Consums (kWh/m²)	Fundación BARREDO	Reference
Heating	22,6	53,2
Cooling	0,4	4,5
DHW	0,5	24,6
Illumination	41,1	301,4
Total	64,6	383,7

CO ₂ Emisiones (kgCO ₂ /m²)	Fundación BARREDO	Reference
Heating	0,0	14,1
Cooling	0,0	1,1
DHW	0,0	5,1
Illumination	0,0	75,2
Total	0,0	96,5

CALENER, Results



CALENER, Energetic Qualification

Resultados de la evaluación Relativa				EVALUACIÓN	
IMPACTOS: Los datos esan basados sobr las puntuaciones obtenida en la Auto-evaluación	Pesos	IMPACTO EVITADO	Impacto residual (criterio)		
1 Cambio climático	25,0%	4,67	0,33		
2 Incremento de la radiación UV a nivel del suelo	3,0%	5,00	0,00		
3 Pérdida de vida acuática	8,0%	4,24	0,76		
4 Pérdida de fertilidad	10,0%	4,97	0,03		
5 Agotamiento de los recursos no renovables	20,0%	4,16	0,84		
6 Degradación del suelo y las aguas	10,0%	3,42	1,58		
7 Confort	10,0%	4,75	0,25		
8 Salud e higiene	8,0%	5,00	0,00		
9 Impactos socio económicos	6,0%	5,00	0,00		
Total impact avoided		4,50	0,50		

Resultados de la evaluación Absoluta				IMPACTO EVITADO	
Los datos estan basados sobr las puntuaciones obtenida en la Auto-evaluación	Edificio de Referencia	Edificio Objeto	% of Absolute Reduction	4,30	
1 Emisiones anuales neta de G-HG en kg CO ₂ equivalente por m ² año	106,05	3,16	97%		
2 Emisiones anuales de sustancias destructoras de la capa de ozono en kg. CFC-11 equivalente por m ² año	0,887	0,000	100%		
3 Eutrofización de las aguas en kg. de PO ₄ equivalente por m ² año	2,89	0,21	93%		
4 Emisiones de gases acidificantes en kg de SO ₂ equivalente por m ² año	222,70	0,00	100%		
5 Agotamiento de los recursos no renovables	5176,02	2334,81	55%		
6 Generación de residuos peligrosos y no peligrosos en kg por m ² año	17,77	0,00	100%		
7 Mejora de las condiciones de confort en porcentaje			88%		
8 Salud e higiene			100%		
9 Reducción de los costes de construcción y operación en EUR por m ² año	37,68	15,11	60%		

SBtool Verde, Total impact avoided results

Summary of Key Performance Indicators (KPI)

A Primary Energy of Non Renewable Energy Sources	[kWh/m ² GFA]	43
B Final Energy / Primary Energy of Renewable Energy Sources	[kWh/m ² GFA]	27
C Total Energy, (A+B) annual data	<input checked="" type="checkbox"/> predicted <input type="checkbox"/> monitored [kWh/m ² GFA]	70
D CO ₂ Emissions (CO ₂ equivalent)	[kg/m ² GFA]	11
E Potable Water Demand/Consumption, annual data	l/pers <input type="text" value="2"/> [l/m ² GFA]	91
F Construction Cost, price level 2007	[EUR/m ² GFA]	2000
G Operating Costs, annual, price level 2007	[EUR/m ² GFA]	26

A* Primary Energy of Non Renewable Sources on site [kWh/m²GFA] 43