

TIMEPAC

Academy

Session 6

BIM models to generate, validate and exploit EPC data

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Politecnico di Torino

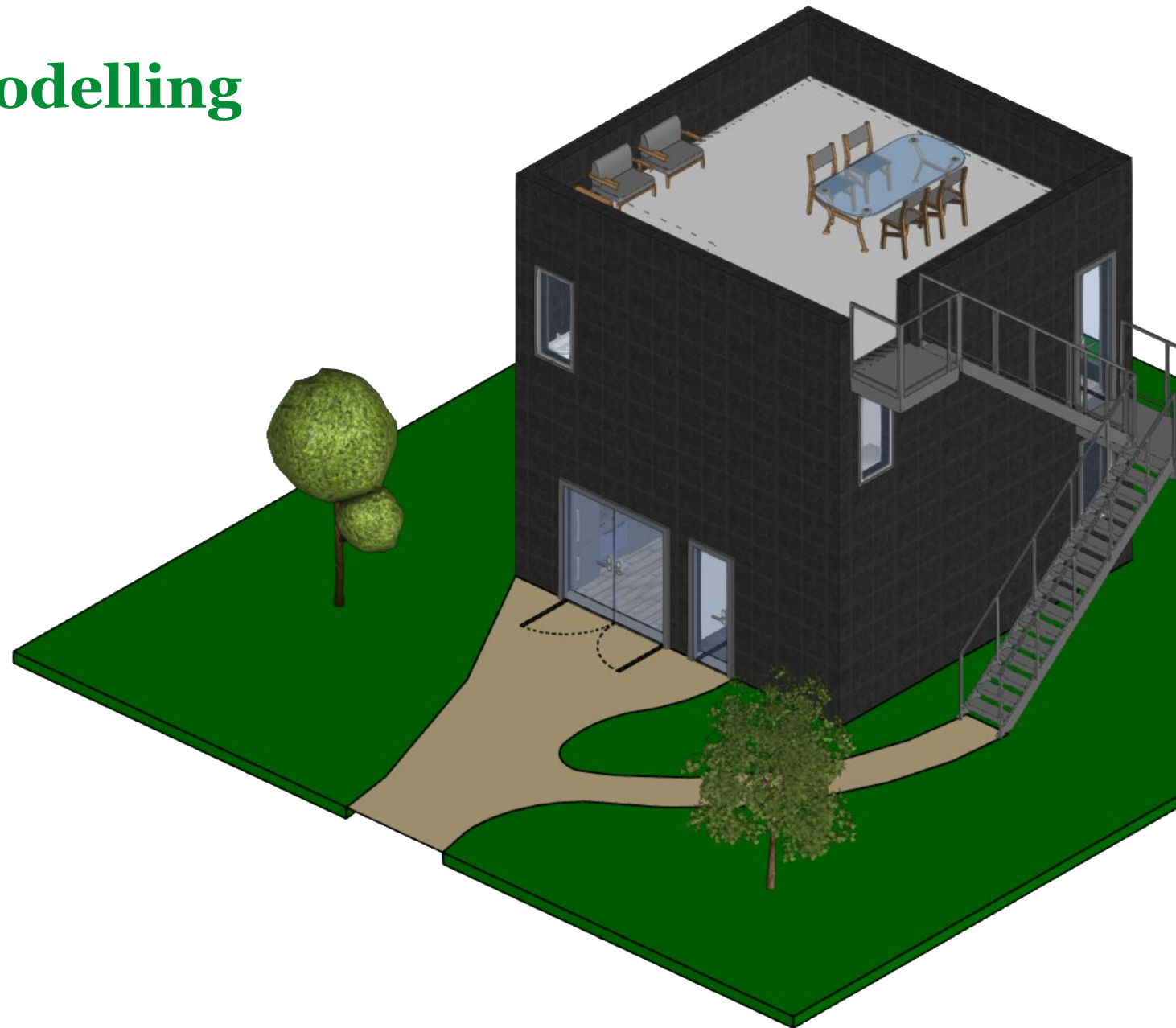


Building information modelling

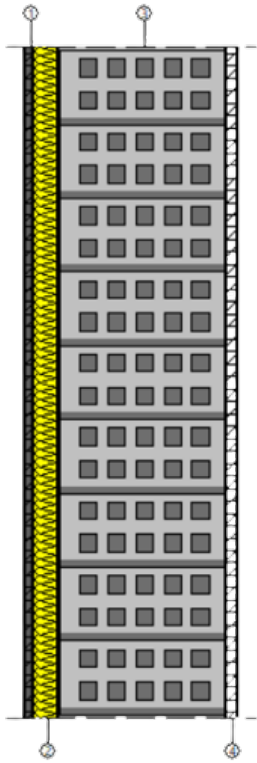
A **tool** and a **methodology**
for the AEC sector.

BIM is a key component of the
development of the **digital
twin** of a building

BIM is a valuable asset during
the entire **life-cycle** of the
building.

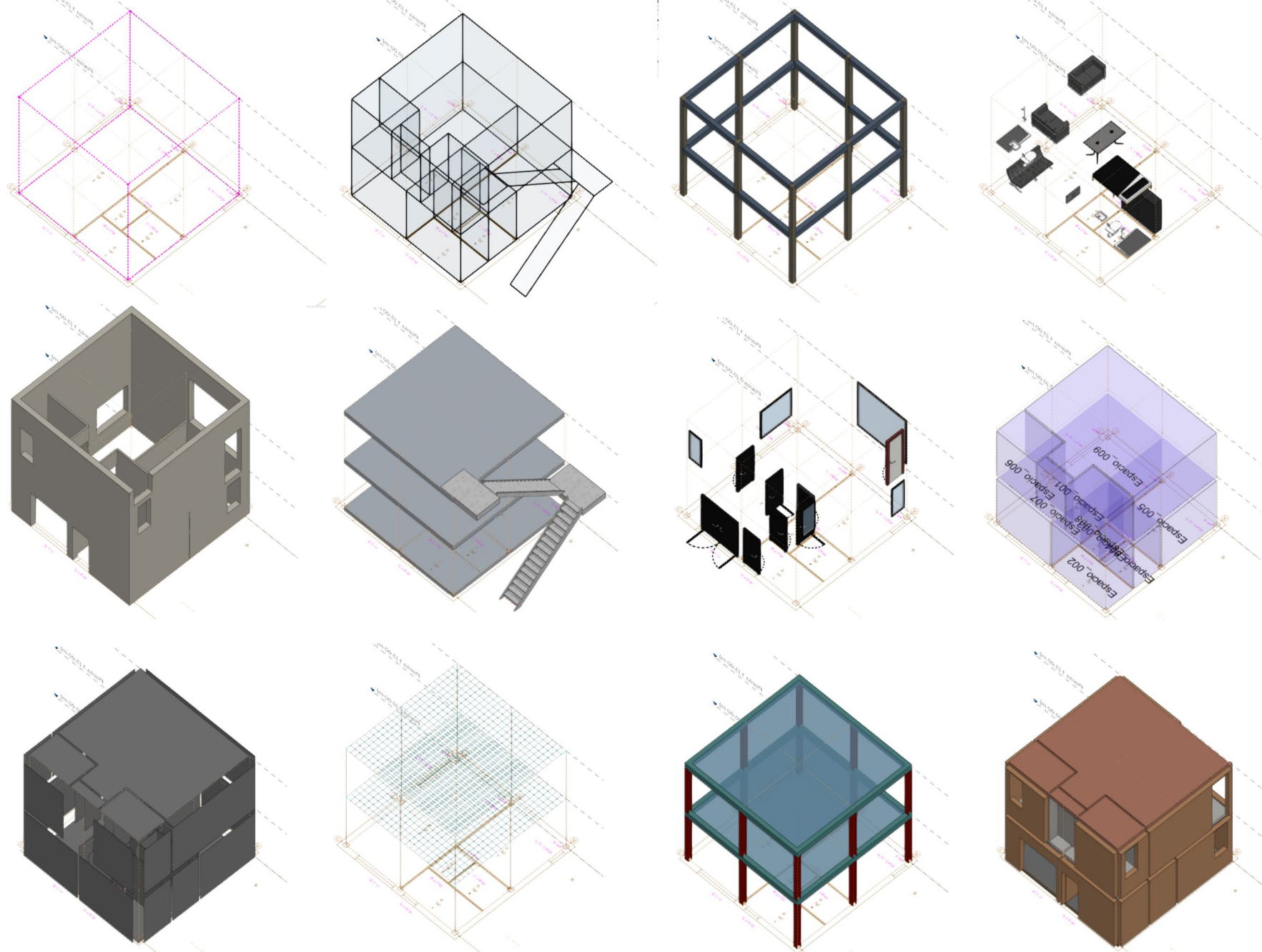


BIM models are composed of a **3D geometry with data about the physical characteristics.**



Wall	
Reference	Wall_014
Level	L1
Layer	Arch_Walls-2
Description	Concrete brick wall
Properties	
Height	3.00 m
Thickness	0.25 m
Category	External façade

Layers	
1 - Cement sand	1.00 cm
2 - I01 - 25 mm insulation board	3.00 cm
3 - M03 - 200 mm LW concrete block	20.00 cm
4 - Gypsum insulating plaster	1.00 cm
Total thickness	25.00 cm



BIM for an enhanced EPC

- Energy simulation of buildings
- Sensor data assessment

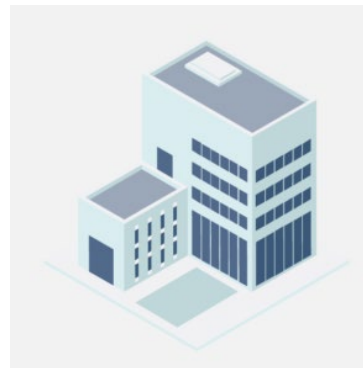
The image displays a comprehensive workflow for energy simulation and sensor data assessment using BIM. Key components include:

- 3D Model:** A detailed architectural rendering of a multi-story building with a cutaway view, showing internal spaces and a staircase.
- Data Logger:** A window titled 'Data logger' showing a 'Complete log' of temperature data. The log includes columns for Date, Temperature (°C), and a 'Sensor (S1)' configuration window showing details like Manufacturer (Siemens), Model (QPA2060), and Space ID.
- Energy Simulation Results:** A 'MONTHLY RESULTS' section featuring a bar chart showing energy demand over time. Below it, a detailed report titled 'ENERGY DEMAND CALCULATION SUMMARY' and 'ANNUAL ENERGY BALANCE OF THE BUILDING' provides numerical data and descriptive text.
- Environmental Data:** A 'Comfort' window showing real-time metrics for Humidity, CO2, and Temperature. An 'Energy' window displays ActiveEnergyConsumption and AverageVoltage for various rooms.
- Simulation Tools:** A 'Simulation' window with multiple graphs, including a line chart for temperature fluctuations, a wind rose diagram, and a thermal map.

Energy simulation of buildings

Concepts

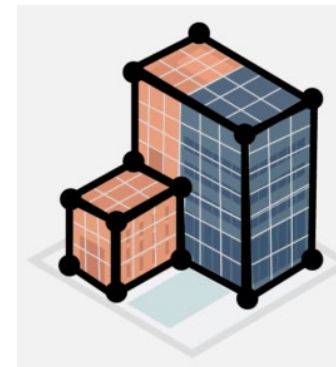
ARCHITECTURAL MODEL



- ✓ Walls, slabs, windows...
- ✓ Model composed by solids

VS

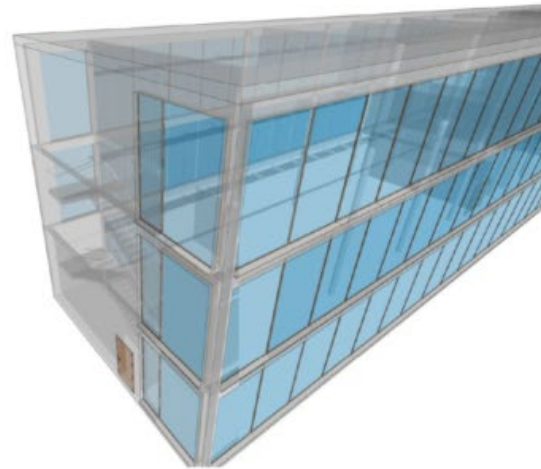
ANALYTICAL MODEL



- ✓ Surfaces, edges, adjacencies...
- ✓ Model composed by simplified geometries

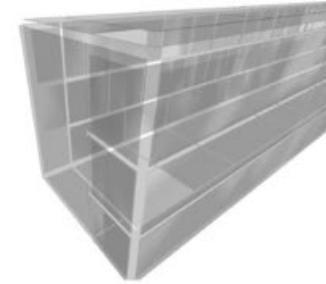
Energy simulation of buildings

Concepts

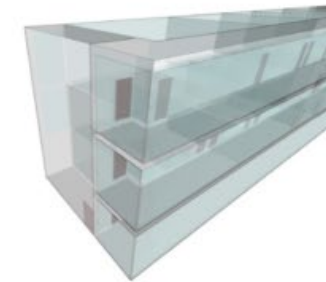


ARCHITECTURAL MODEL

ANALYTICAL MODEL
External Surfaces



ANALYTICAL MODEL
Internal Surfaces

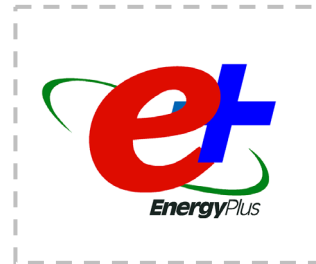


ANALYTICAL MODEL
Edges



Energy simulation of buildings

Interoperability



Energy certification of buildings

Software tools for energy certification in BIM

The screenshot shows the CYPETHERM HE Plus v2024.b interface for a residential building. The main window displays a list of building components under 'Edificio' and 'Zonas'. A detailed view of a wall cross-section is shown, listing the following layers (from exterior to interior):

- 1 - Panel industrializado de hormigón convencional de $d = 2400 \text{ kg/m}^3$; 6.00 cm
- 2 - Aislamiento continuo. XPS expandido con HFC. 0.039 W/(mK) ; 2.00 cm
- 3 - Aislamiento discontinuo. XPS expandido con HFC. 0.039 W/(mK) ; 10.00 cm
- 4 - Panel industrializado de hormigón convencional de $d = 2400 \text{ kg/m}^3$; 6.00 cm
- 5 - Cámara de aire no ventilada; 3.00 cm
- 6 - Lana mineral. 0.040 W/(mK) ; 4.80 cm
- 7 - Placa de yeso laminado; 1.50 cm
- Epesor total: 33.30 cm

Thermal characterization data for the wall:

- Transmitancia térmica (U): $0.40 \text{ W/(m}^2\text{K)}$
- Capacidad térmica: $15451.47 \text{ J/m}^2\text{K}$

Calificación energética del edificio

Zona climática: B4 Uso: Residencial privado

1. CALIFICACIÓN ENERGÉTICA DEL EDIFICIO EN EMISIONES

INDICADOR GLOBAL	INDICADORES PARCIALES	
	CALEFACCIÓN	ACS
Emissiones calefacción [kgCO ₂ /m ² -año]	0.50	3.05
Emissiones ACS [kgCO ₂ /m ² -año]		0.00
Emissiones globales [kgCO ₂ /m ² -año] ¹	1.48	0.00

Emisiones CO₂ por consumo eléctrico: 1.98 kgCO₂/m²-año
Emisiones CO₂ por otros combustibles: 3.05 kgCO₂/m²-año

2. CALIFICACIÓN ENERGÉTICA DEL EDIFICIO EN CONSUMO DE ENERGÍA PRIMARIA NO RENOVABLE

Por energía primaria no renovable se entiende la energía consumida por el edificio procedente de fuentes no renovables que no ha sufrido ningún proceso de conversión o transformación.

INDICADOR GLOBAL	INDICADORES PARCIALES	
	CALEFACCIÓN	ACS
Energía primaria calefacción [kWh/m ² -año]	2.96	11.57
Energía primaria ACS [kWh/m ² -año]		0.00
Consumo global de energía primaria no renovable [kWh/m ² -año] ¹	8.72	0.00

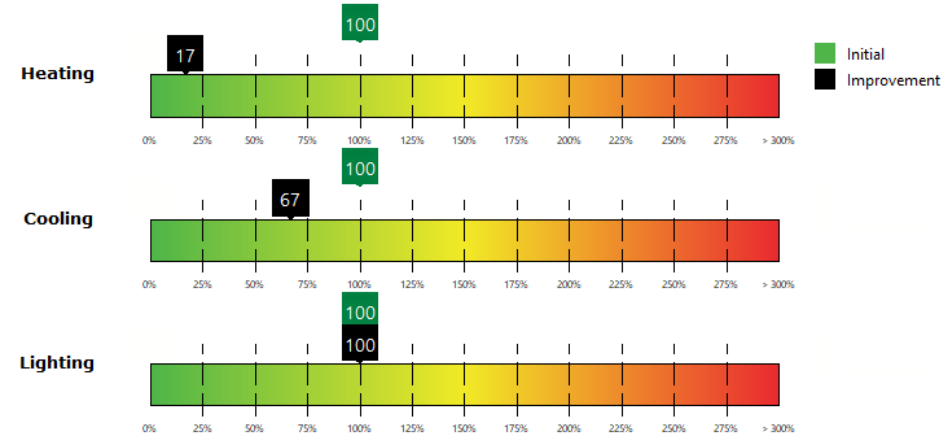
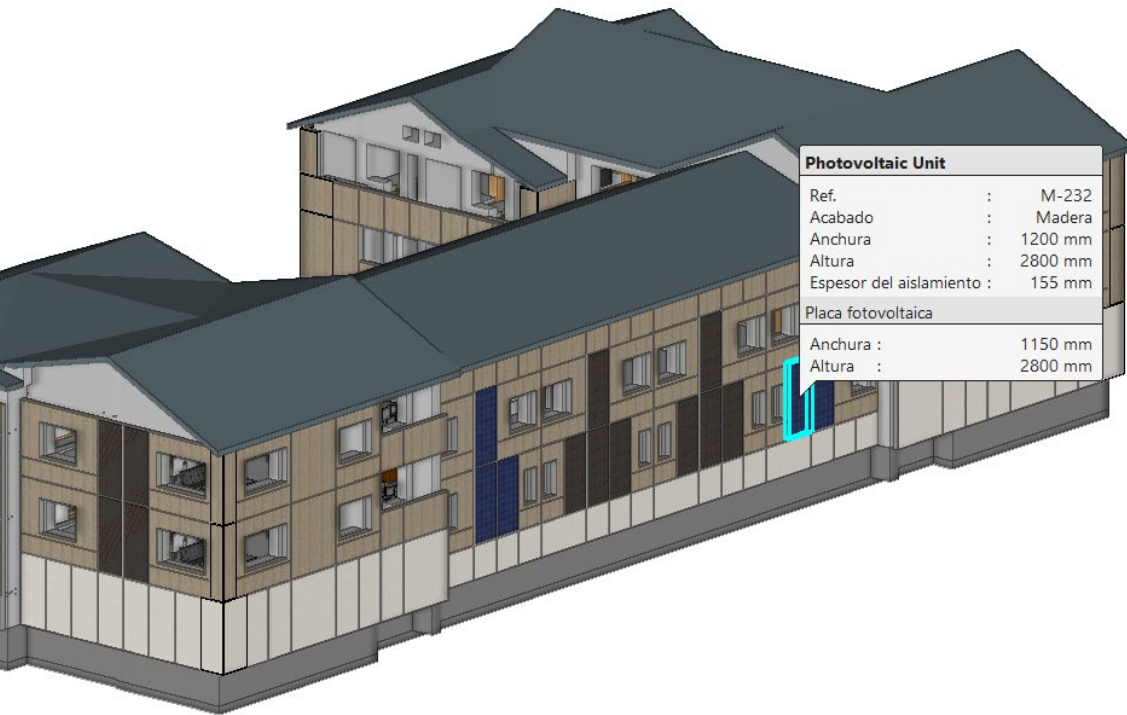
3. CALIFICACIÓN PARCIAL DE LA DEMANDA ENERGÉTICA DE CALEFACCIÓN Y REFRIGERACIÓN

La demanda energética de calefacción y refrigeración es la energía necesaria para mantener las condiciones internas de confort del edificio.

DEMANDA DE CALEFACCIÓN	DEMANDA DE REFRIGERACIÓN
Demanda de calefacción [kWh/m ² -año]	Demanda de refrigeración [kWh/m ² -año]

1 El indicador global es resultado de la suma de los indicadores parciales más el valor del indicador para consumos auxiliares, si los hubiera (sólo edificios terciarios, ventilación, bombos, etc...). La energía eléctrica autoconsumida se descuenta únicamente del indicador global, no así de los valores parciales.

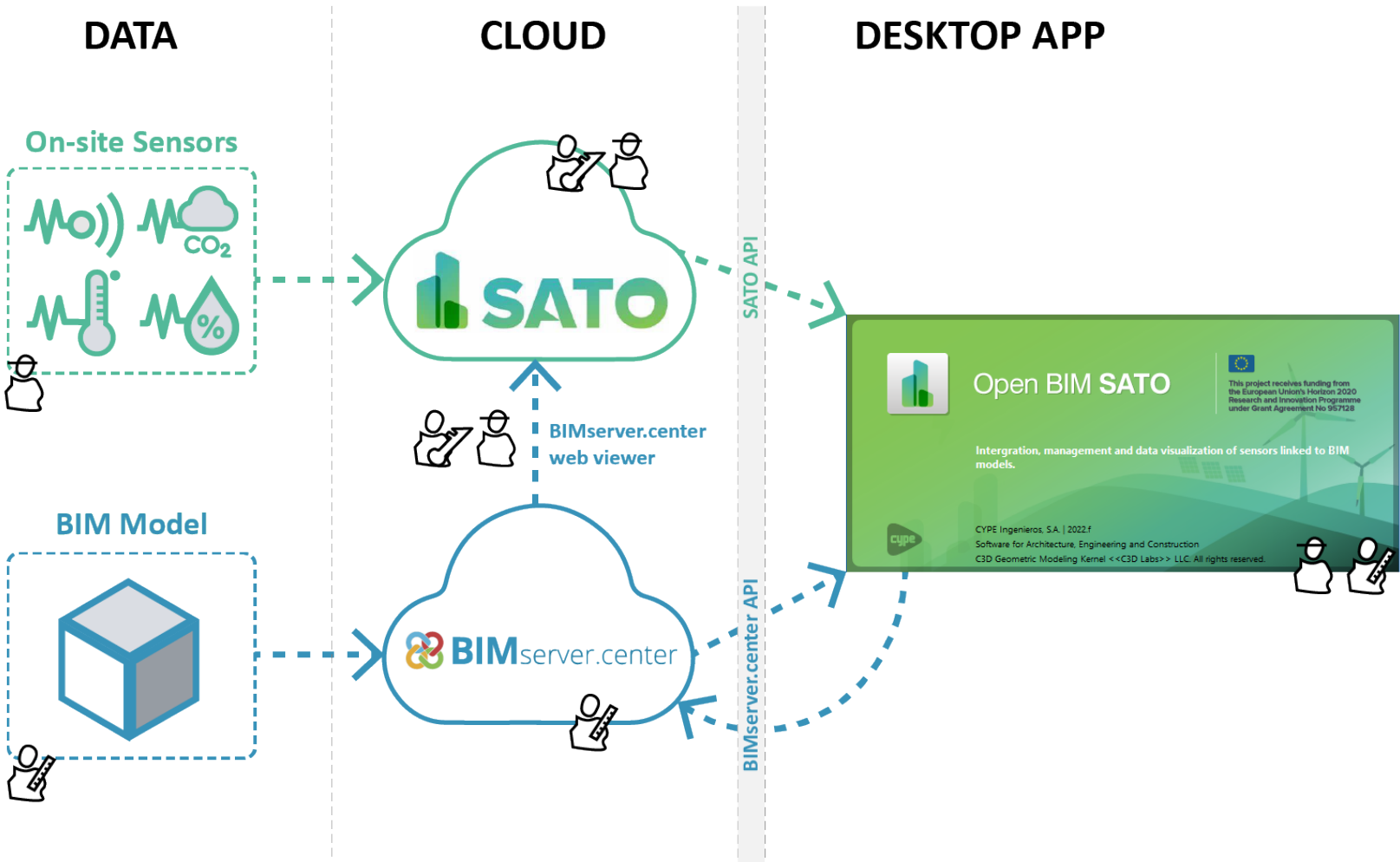
Speed up building renovations



Surface(Initial): 441.10 m²
 Surface(Improvement): 441.10 m²

Installations	Annual energy savings								
	Annual consumption of non-renewable primary energy					Annual energy cost			
	Initial		Improvement		Difference	Initial	Improvement	Difference	
	kWh/m ² ·year	%	kWh/m ² ·year	%	kWh/m ² ·year	€/m ² ·year	€/m ² ·year	€/m ² ·year	
Heating	18.45	20.47	3.11	5.01	15.34	1.51	0.27	1.23	
Cooling	38.60	42.83	25.90	41.72	12.70	3.36	2.25	1.11	
Lighting	33.07	36.70	33.07	53.27	0.00	2.88	2.88	0.00	
Total	90.12	100.00	62.08	100.00	28.04	7.74	5.40	2.34	

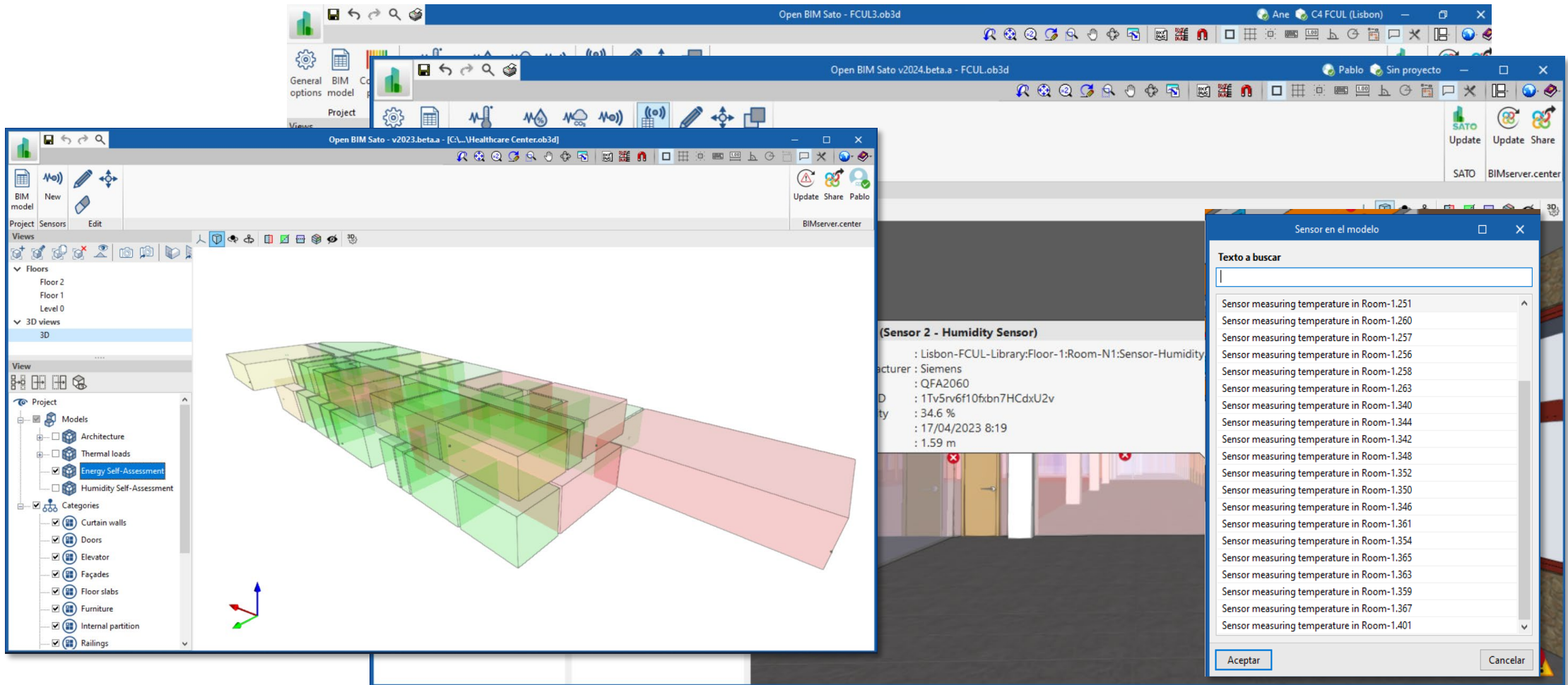
Sensor data assessment



Sensor data assessment



Sensor data assessment



**If you would like more information,
please visit www.timepac.eu or contact us at
ane.ferreiro@cype.com**

Thanks for your attention!