Project for Energy and Environmental Technologies for building systems

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Project overwiev

- ➢ The objective of the project is to evaluate the variation of the annual energy consumption of a non residential building by changing: the location of the building, the stratigraphy of the external walls and the typology of the windows

- ➢ The non-residential building considered is a 3-storey commercial building located in cities with a very different weather: Milan, Reykjavik and Athens

- ➢ A comparison of the annual energy consumption of the building located in Milan will be made by considering low, standard and high performance external walls and windows

- ➢ Then the annual energy consumption of the building in each city will be compared, considering external walls and windows of standard performances
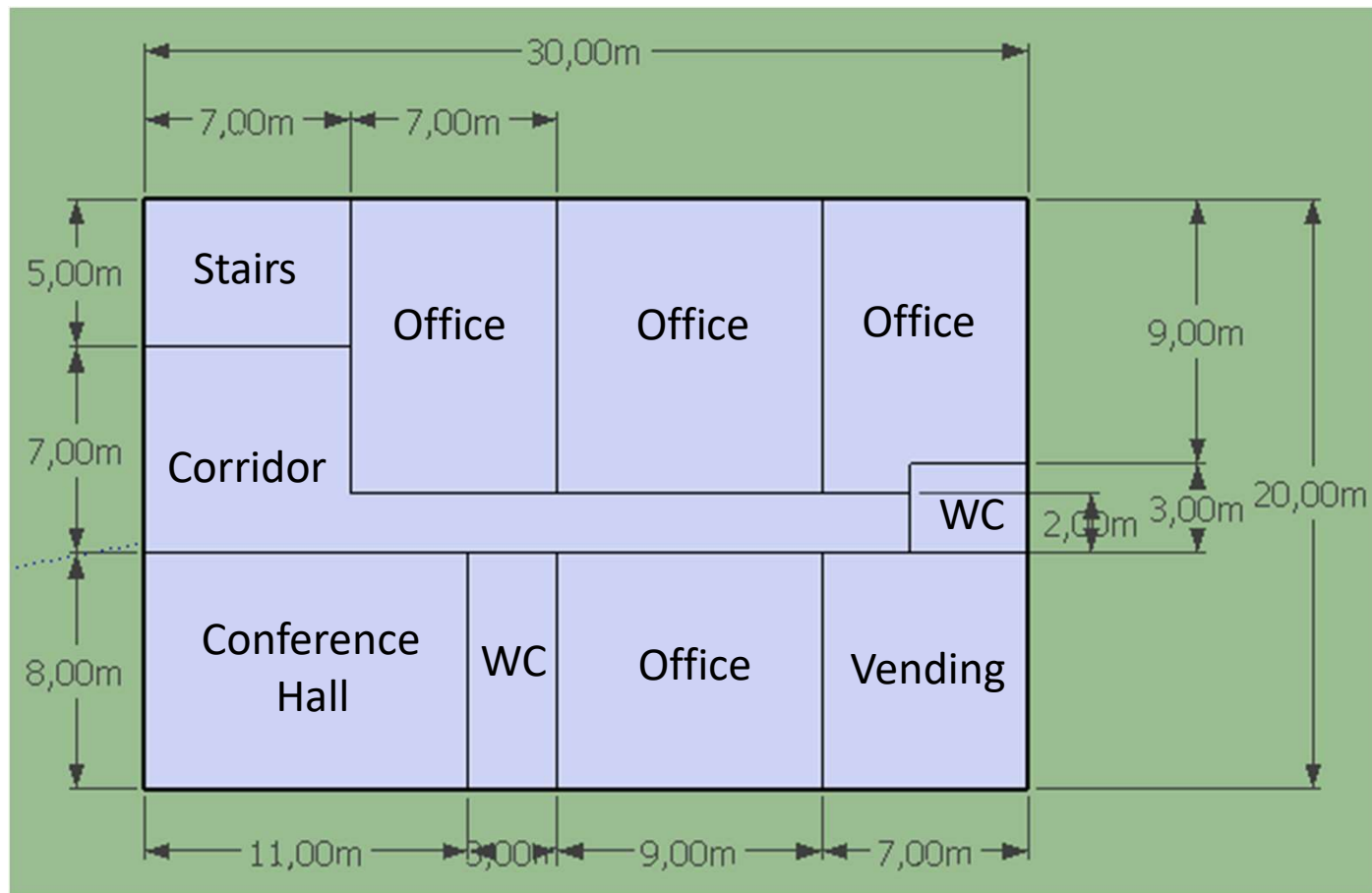
Plant of the building

➢ Plant of the building - story 1
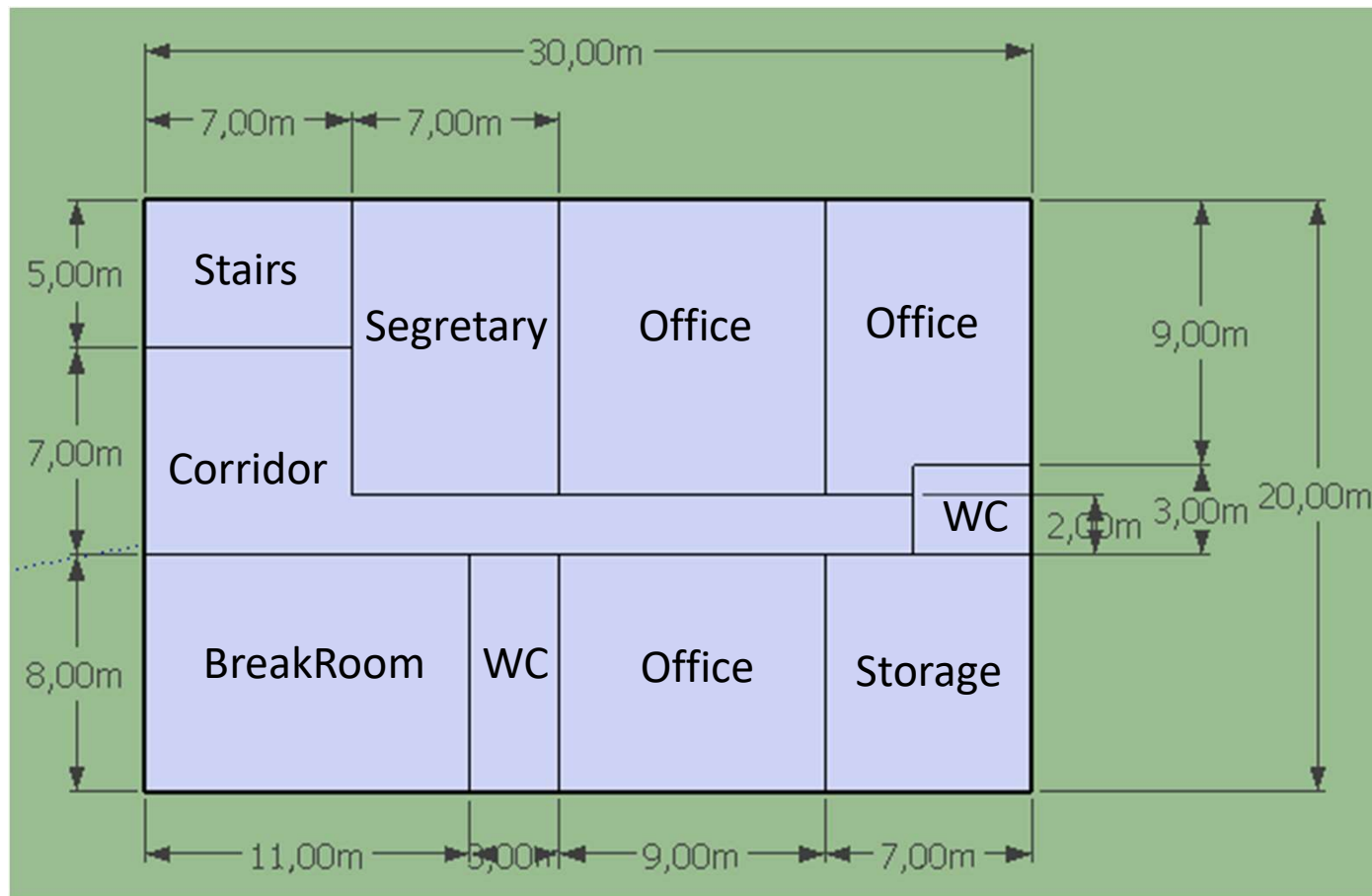
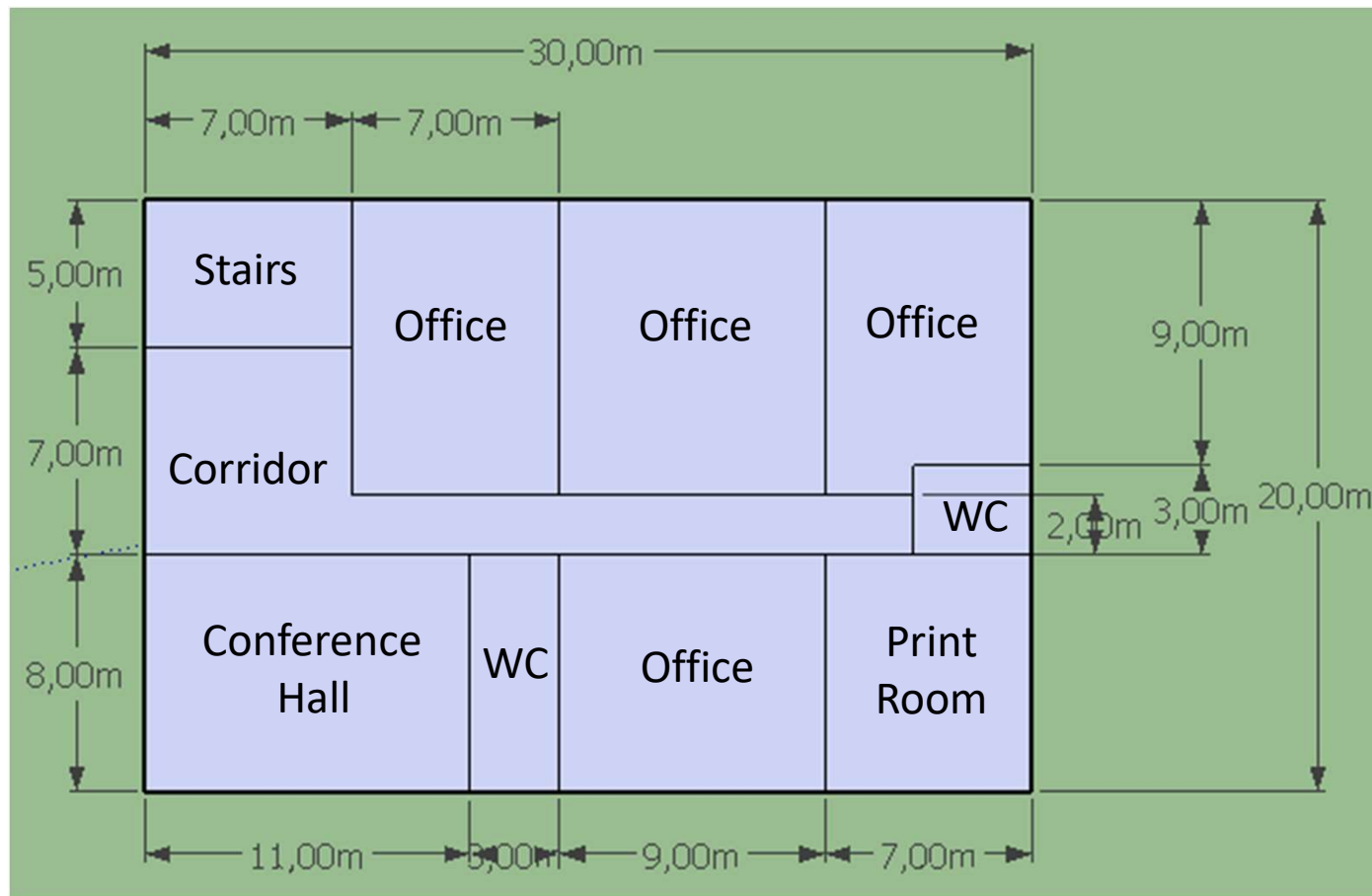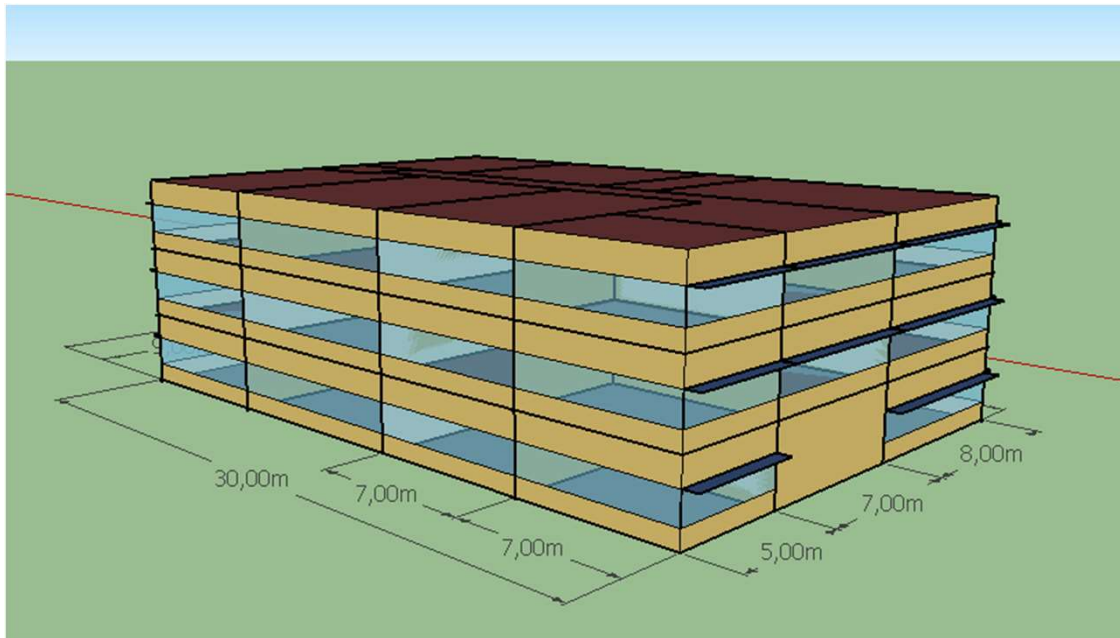➤ Plant of the building - story 2

Plant of the building

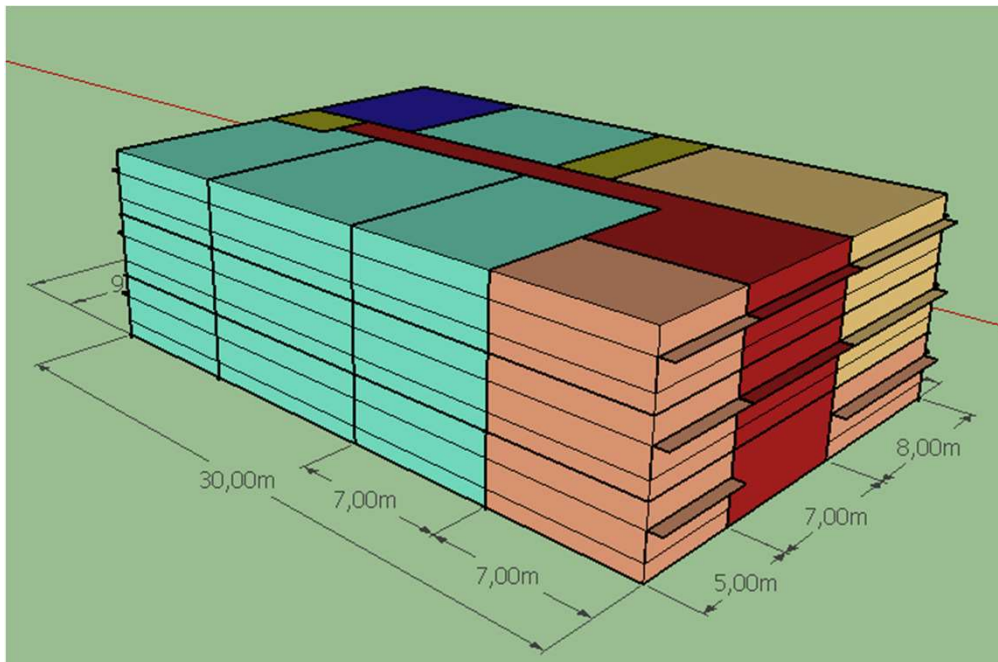➢ Plant of the building - story 3

SketchUp overview

➤ Overview of the building on SketchUp

➤ 3 storey

➤ Surface matching

➤ Adding windows

➤ Adding shading (not North)

➤ Adding thermal zones
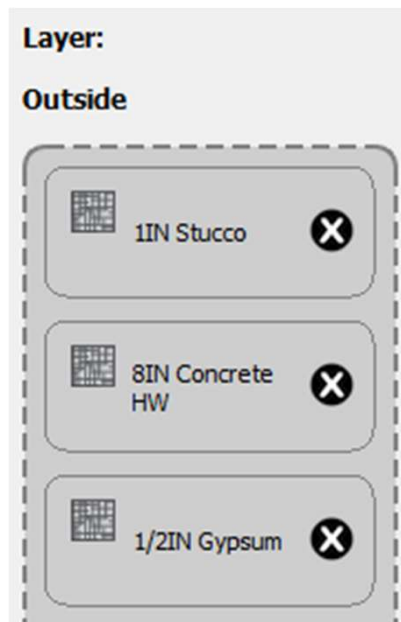
SketchUp overview

➢ Overview of thermal zones

➢ 9 Thermal zones:

- Thermal zone 1: BreakRoom
- Thermal zone 2: RestRoom (WC)
- Thermal zone 3: Office
- Thermal zone 4: Storage
- Thermal zone 5: Stairs
- Thermal zone 6: Corridor
- Thermal zone 7: Conference Hall
- Thermal zone 8: Vending
- Thermal zone 9: PrintRoom

Choice of the features

➢ External walls stratigraphy

Low Performance case

Layer:

Outside

- 1IN Stucco
- 8IN Concrete HW
- 1/2IN Gypsum

Standard case

Layer:

Outside

- 1IN Stucco
- 8IN Concrete HW
- Wall Insulation [31]
- 1/2IN Gypsum

High Performance case

Layer:

Outside

- 1IN Stucco
- 8IN Concrete HW
- F04 Wall air space resistance 1
- 8IN Concrete HW 1
- Wall Insulation [44] 1
- 1/2IN Gypsum 1

Choice of the features

➤ Windows typology
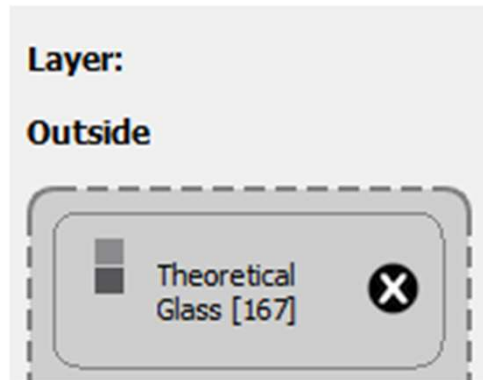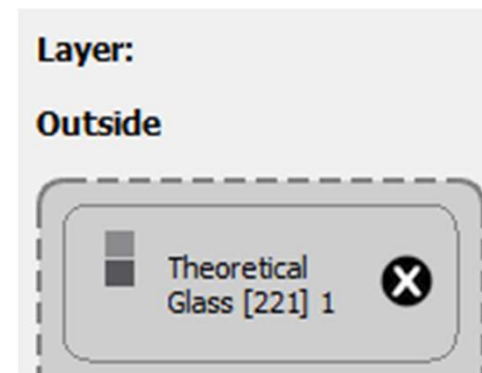
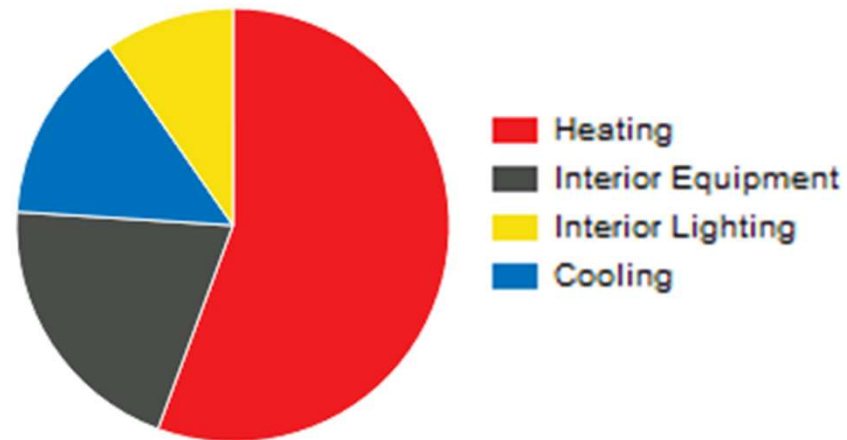|	
Layer: **Outside** ■ Theoretical Glass [167] ⊗	**Layer:** **Outside** ■ Theoretical Glass [221] 1 ⊗
Low and Standard case	High Performance case

Annual energy consumption

➢ Milan – Low Performance case

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	905.03	1131.29	1131.29
Net Site Energy	905.03	1131.29	1131.29
Total Source Energy	2817.24	3521.55	3521.55
Net Source Energy	2817.24	3521.55	3521.55

Annual energy consumption

➤ Milan – Standard case

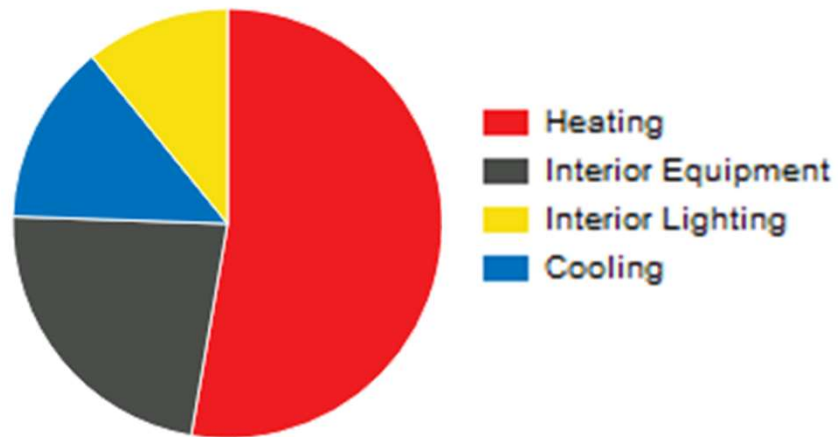**Site and Source Energy**

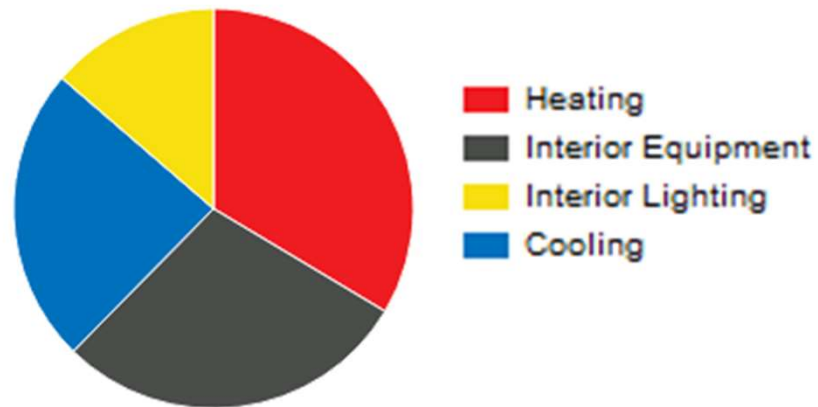|	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	807.13	1008.92	1008.92
Net Site Energy	807.13	1008.92	1008.92
Total Source Energy	2514.29	3142.86	3142.86
Net Source Energy	2514.29	3142.86	3142.86

Annual energy consumption

- ➢ Milan – High Performance case

Site and Source Energy

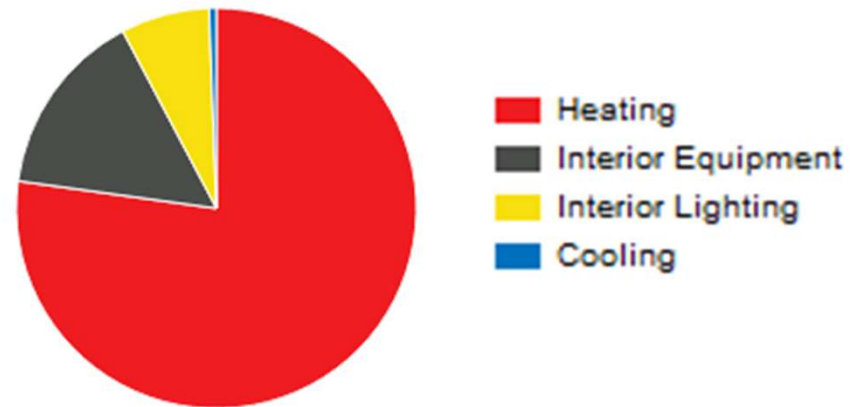|	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	640.38	800.47	800.47
Net Site Energy	640.38	800.47	800.47
Total Source Energy	1800.18	2250.23	2250.23
Net Source Energy	1800.18	2250.23	2250.23

Annual energy consumption

- ➤ Reykjavik – Standard case

Site and Source Energy

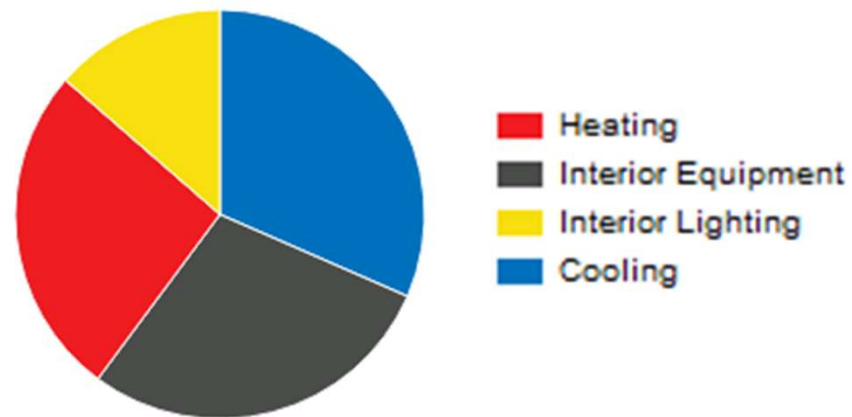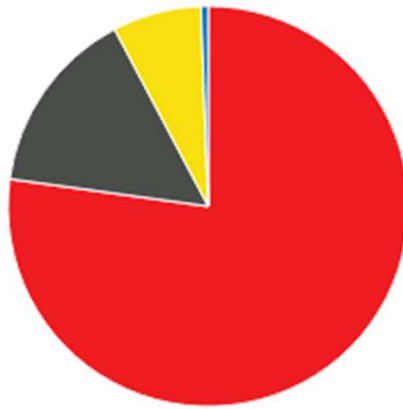|	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1222.17	1527.71	1527.71
Net Site Energy	1222.17	1527.71	1527.71
Total Source Energy	4276.86	5346.07	5346.07
Net Source Energy	4276.86	5346.07	5346.07

Annual energy consumption

➤ Athens– Standard case

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	644.19	805.24	805.24
Net Site Energy	644.19	805.24	805.24
Total Source Energy	1686.39	2107.99	2107.99
Net Source Energy	1686.39	2107.99	2107.99

Annual energy consumption: comparison

➤ Standard cases comparison

Reykjavik

Milan

Athens

🟥	Heating
⬛	Interior Equipment
🟨	Interior Lighting
🟦	Cooling
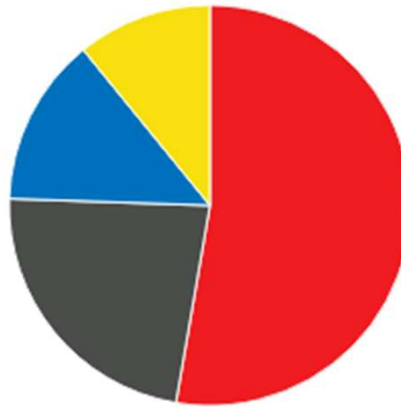
Annual energy consumption: comparison
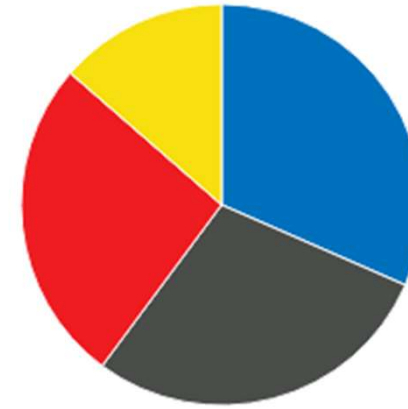
Site and Source Energy

Reykjavik

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1222.17	1527.71	1527.71
Net Site Energy	1222.17	1527.71	1527.71
Total Source Energy	4276.86	5346.07	5346.07
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Site and Source Energy

Milan

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	807.13	1008.92	1008.92
Net Site Energy	807.13	1008.92	1008.92
Total Source Energy	2514.29	3142.86	3142.86
Net Source Energy	2514.29	3142.86	3142.86

Site and Source Energy

Athens

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	644.19	805.24	805.24
Net Site Energy	644.19	805.24	805.24
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