

# STANDARDIZED FORM FOR ENERGY AUDITS IN SCHOOL BUILDINGS

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**TEENERGY SCHOOLS**

ARPA Sicily, Province of Trapani, ITALY

*Secondary School for the Study of Sciences **Ruggeri** - **Building n. 7***  
**COASTAL AREA**

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## ABSTRACT SHEET: Building n. 7 "Ruggeri" MARSALA



**Total floor area [m<sup>2</sup>]:** 5663 m<sup>2</sup>

**Total Heated Floor Area [m<sup>2</sup>]:** 4243 m<sup>2</sup>

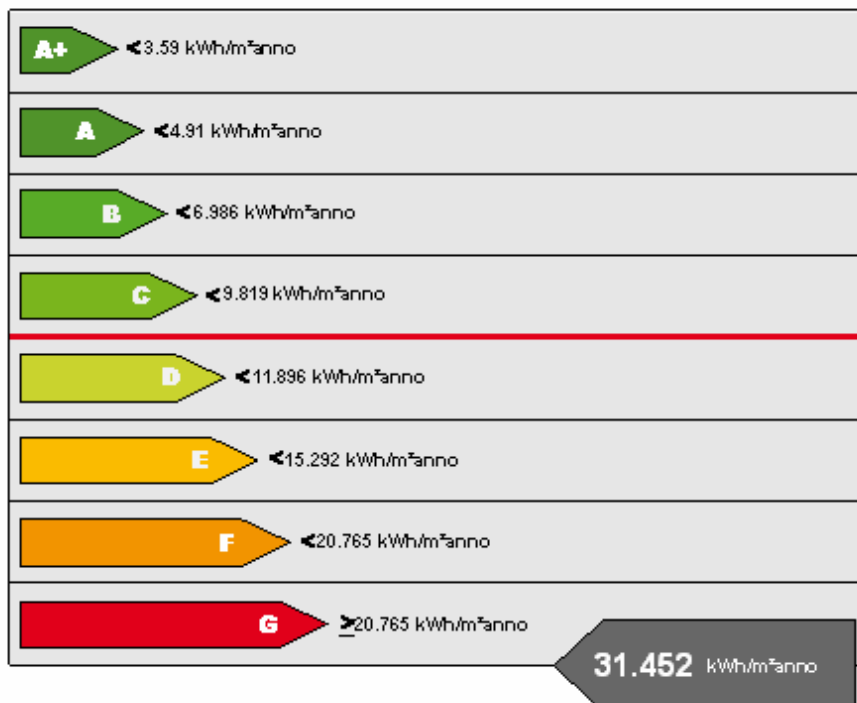
**Climatic Zone:** B

### OPERATING ASSESSMENT, CALCULATED ENERGY CONSUMPTION:

Electricity (YEARS: 2007/08-2008/09): 26,8 kWh/m<sup>2</sup> – 7,7 kWh/m<sup>3</sup>

**Heating (YEARS: 2007/08-2008/09): 5,6 kWh/m<sup>3</sup> - 20,7 kWh/m<sup>2</sup>**

### ENERGY CLASS SIMULATION OF THE BUILDING (SOFTWARE TERMUS):



**Energy consumption for heating : 31.45 kWh/m<sup>3</sup> year** Energy Performance Index **EPI LIMIT: 5.28 kWh/m<sup>3</sup> year**

**CO2 emissions: 6,08 kgCO<sub>2</sub>/m<sup>3</sup>year**

**SOFTWARE TERMUS (UNI TS 11300):**

- 24h/d \* 121 d/yr = 2904 h/yr
- Zone B: 1° December - 31° March

**SCHOOL HEATING:**

- about 5h/d \* 91 d/yr = 455 h/yr
- 1°Dicember - 31° March

**Termus result is about 6,4 times more than the operating results:**

$$31,45 / 6,4 = 4,9 \text{ kWh/m}^3 \text{ year}$$

**TRANSMITTANCES**

**Calculated Transmittance of the external walls:  $U=1,98 \text{ W/m}^2\text{K}$**

(Maximum U for walls:  $0,48 \text{ W/m}^2\text{K}$ )

**Calculated Transmittance of the ground floor:  $U=0,78 \text{ W/m}^2\text{K}$**

(Maximum U for floors to unheated rooms:  $0,49 \text{ W/m}^2\text{K}$ )

**Calculated Transmittance of the roof:  $U= 1,52 \text{ W/m}^2\text{K}$**

(Maximum U for horizontal structures:  $0,38 \text{ W/m}^2\text{K}$ )

**Calculated Transmittance of the typical window:  $U= 6,1 \text{ W/m}^2\text{K}$**

(Maximum U for windows:  $3 \text{ W/m}^2\text{K}$ )

The structures are not regulated under the Decrees 192/2005, 311/2006 and successive modifications and integrations, transposing in Italy the Directive 2002/91/EC, Energy Performance of Buildings (EPBD).

## 1. GENERAL INFORMATION

**School Building:** Secondary School for the Study of Sciences "Ruggeri"

**City:** Marsala

**Street:** Via G. Falcone, 14

**Zip Code:** 91025

**Phone:** 0923 718295

**Fax:** 0923 981730

**Contact person:** Clelia Casciola

**Web:** tps10000q@istruzione.it

**Year of construction:** 1985

**Climatic typology:**

- Altitude: 12 m
- Latitude: 37° 48' N
- Longitude: 12° 26' E
- Climatic Zone: B
- Degree day: 816
- Location: COASTAL
- Temperature Max: 26,2 °C (August)
- Temperature Min: 11°C (January)
- Maximum summer radiation (W/m2):

ora	Temperatura [°C]	Irradianza solare estiva massima [W/m <sup>2</sup> ]								
		Orizzontale	Sud	SE	Est	NE	Nord	NO	Ovest	SO
1	25,08									
2	24,70									
3	24,40									
4	24,18									
5	24,10	1	0	2	4	4	2	0	0	0
6	24,25	157	42	260	491	457	182	42	42	42
7	24,63	364	81	466	736	614	165	77	77	77
8	25,30	558	115	584	787	567	116	103	103	103
9	26,28	723	238	621	722	473	129	123	123	123
10	27,40	651	338	587	578	316	138	138	138	141
11	28,68	931	404	492	382	158	147	147	147	174
12	29,88	958	428	349	162	150	150	150	162	349
13	30,78	931	404	174	147	147	147	158	382	492
14	31,38	851	338	141	138	138	138	316	576	576
15	31,60	723	236	123	123	123	129	473	722	621
16	31,38	558	113	103	103	103	116	576	787	584
17	30,85	364	81	77	77	77	165	614	736	466
18	30,03	157	42	42	42	42	182	457	491	260
19	29,05	1	0	0	0	0	2	4	4	2
20	28,08									
21	27,25									
22	26,50									
23	25,90									
24	25,45									

## 2. BUILDING AREA/VOLUME

### 2.1 Description of the Building



The school building is located in the coastal area of Marsala, it was built in 1985.

**Number of Floors: 3**

**F0:** ground floor

**F1:** first floor

**F2:** second floor

**Total floor area** [m<sup>2</sup>]: 5663 m<sup>2</sup>

**Total heated floor area** [m<sup>2</sup>]

**Total heated net air volume** [m<sup>3</sup>]

<b>F0</b>	<b>F1</b>	<b>F2</b>	<b>TOT</b>
<b>1319</b>	<b>1462</b>	<b>1462</b>	<b>4243</b>
<b>4155</b>	<b>4605</b>	<b>4605</b>	<b>13365</b>

**Total Air-conditioned floor area** [m<sup>2</sup>]

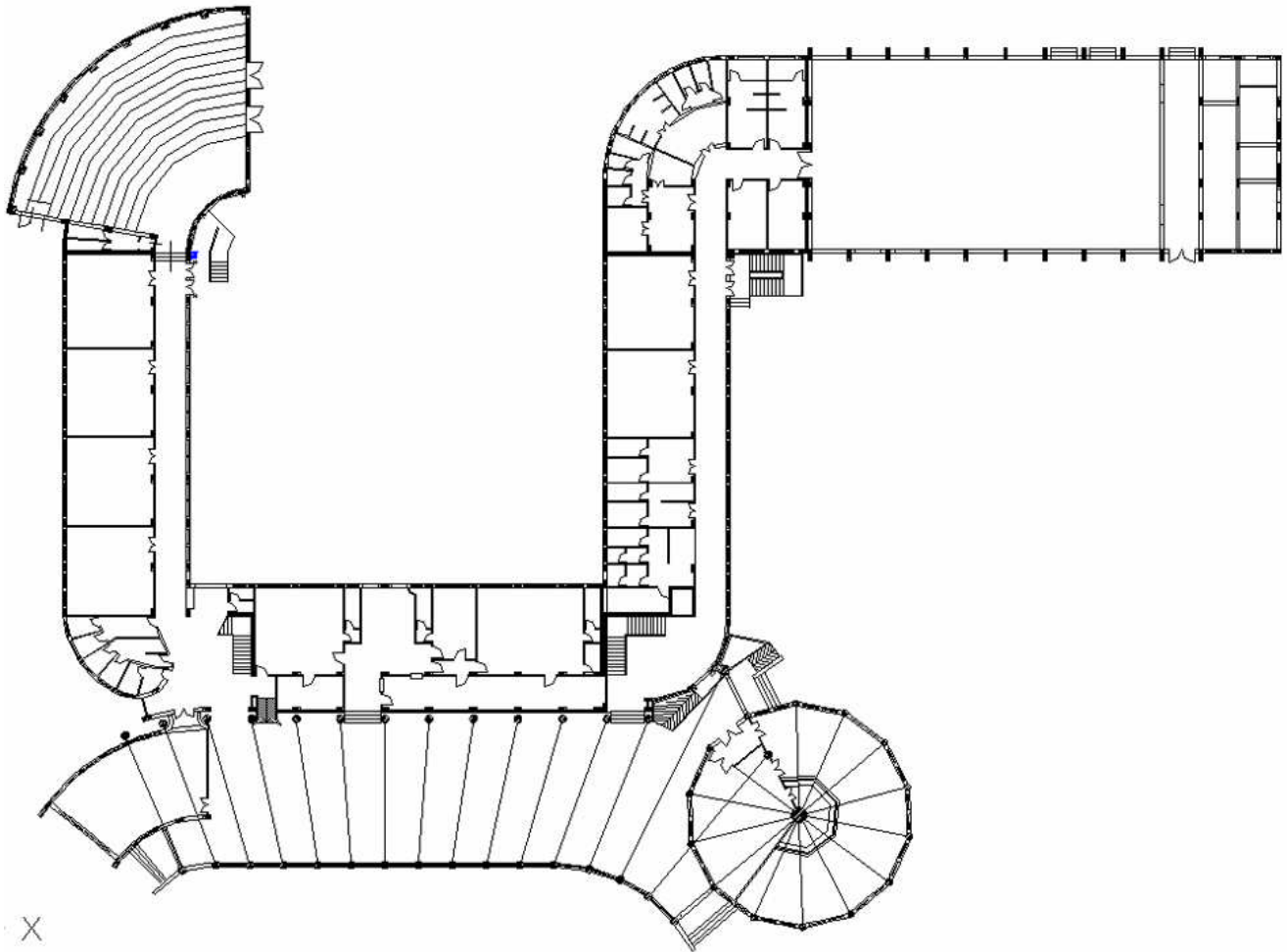
**Total Air-conditioned net air volume** [m<sup>3</sup>]

<b>F0</b>	<b>F1</b>	<b>F2</b>	<b>TOT</b>
<b>529</b>	<b>-</b>	<b>-</b>	<b>529</b>
<b>1666,4</b>	<b>-</b>	<b>-</b>	<b>1666,4</b>

## 2.2 Building Function

(List all primary spaces and their function, along with the occupied space or as a percentage of the total floor area of the whole building)

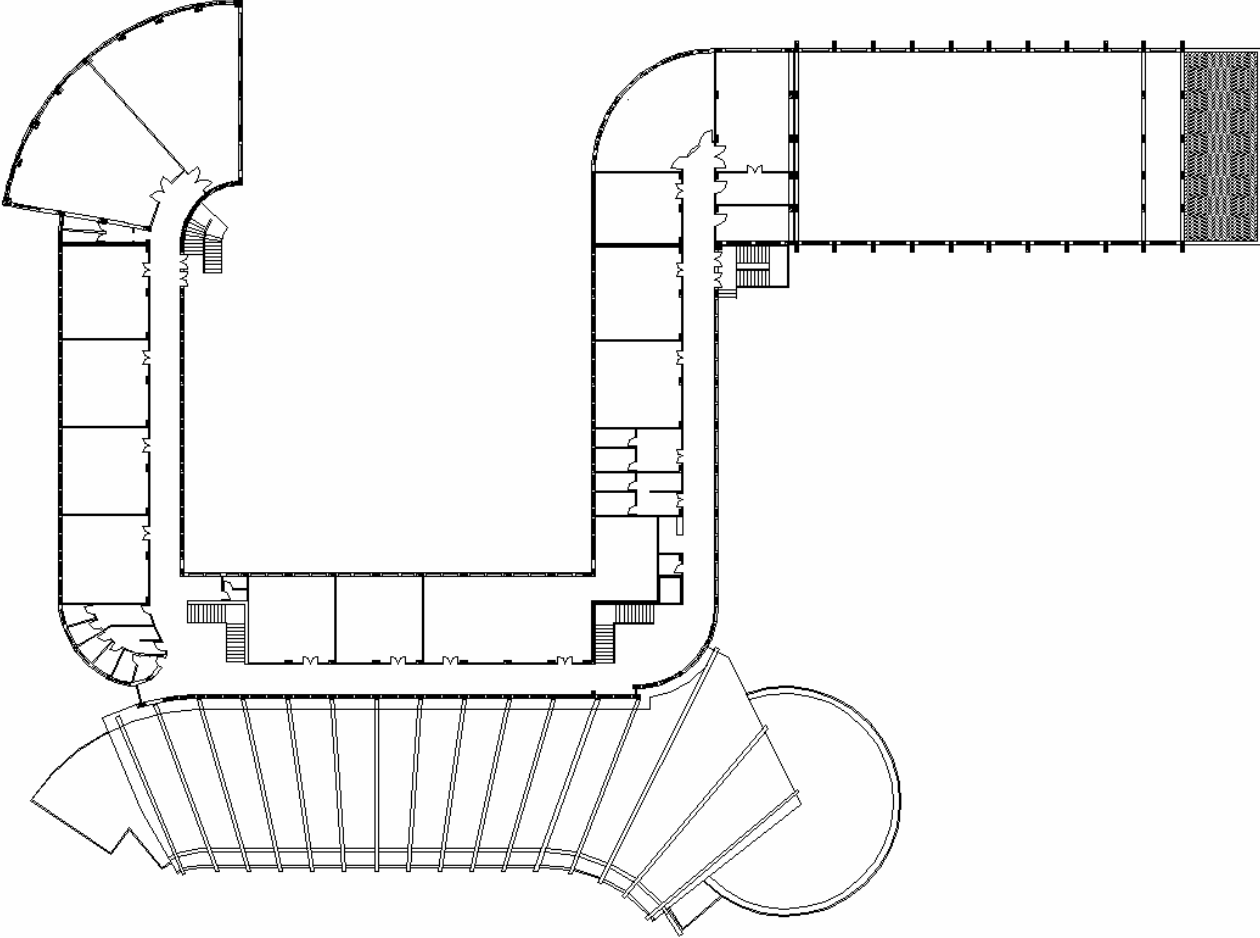
### AREA F0 GROUND FLOOR





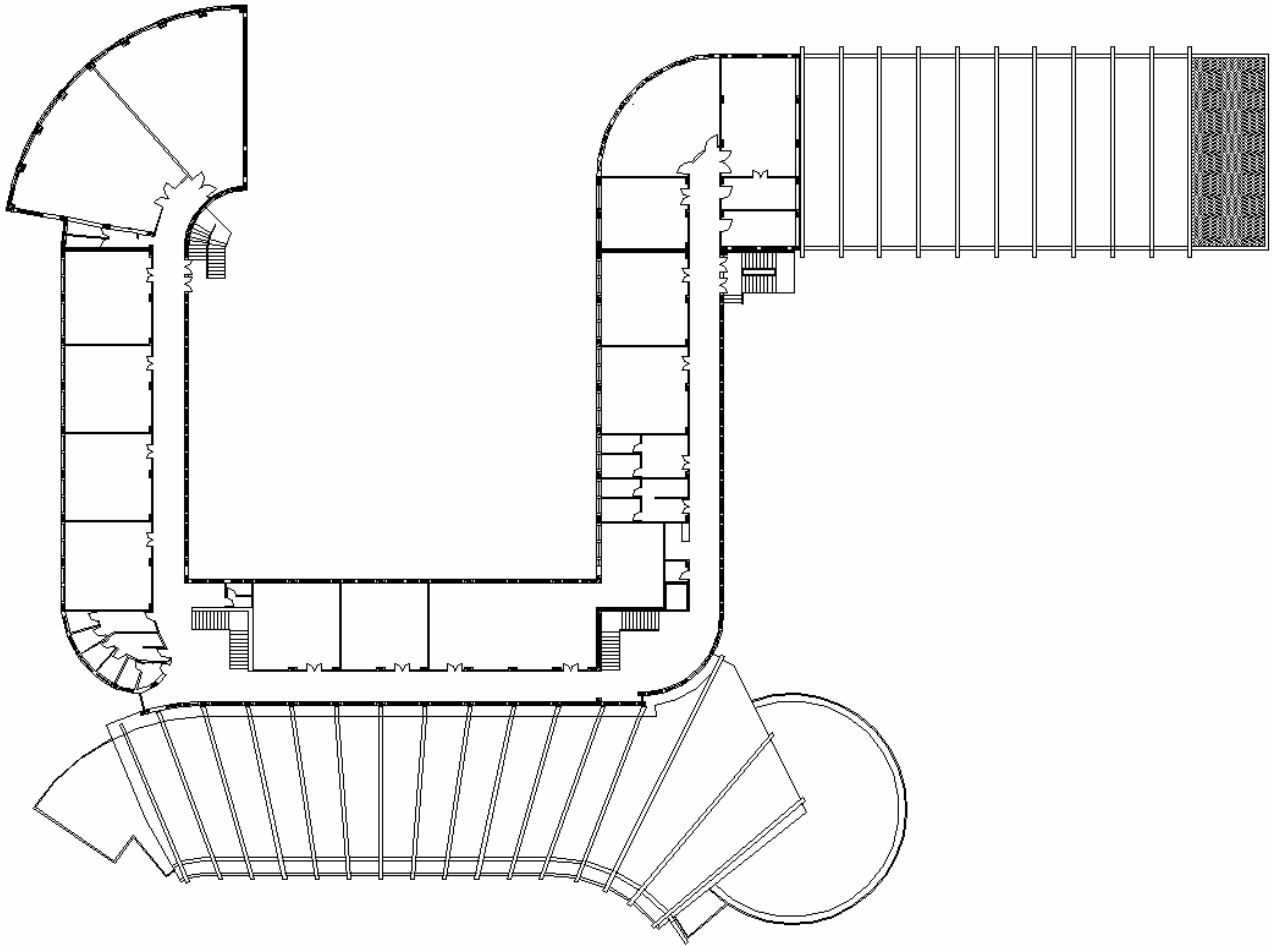
<b>Space F0</b>	<b>Number of rooms</b>	<b>Floor Area [m<sup>2</sup>]</b>	<b>% of Building Floor Area</b>
Classroom	4	203	7
Laboratory	1	73	3
Computer room	2	105	4
Teacher's room	1	94	3
Meeting room	1	245	9
Library	1	181,5	7
Offices	4	202	7
Archive	2	93	3
Deposit	3	44	2
Gymnasium	1	420	15
WC	7	212	8
Changing room	2	50	2
Caretakers room	1	19	1
Corridor	2	161	6
Entrance	1	513	19
Stairs	2	130	5
<b>Total area F0</b>	<b>27</b>	<b>2745</b>	<b>100</b>

**AREA F1  
FIRST FLOOR**



<b>Space F1</b>	<b>Number of rooms</b>	<b>Floor Area [m<sup>2</sup>]</b>	<b>% of Building Floor Area</b>
Classroom	19	898	62
Laboratory	1	40	3
Computer room	-	-	0
Teacher's room	-	-	0
Meeting room	-	-	0
Library	-	-	0
Offices	-	-	0
Archive	-	-	0
Deposit	-	-	0
Gymnasium	-	-	0
WC	3	103	7
Changing room	-	-	0
Caretakers room	1	3	0
Corridor	3	285	20
Entrance	-	-	0
Stairs	2	130	9
<b>Total area F1</b>	20	1459	100

**AREA F2  
SECOND FLOOR**



<b>Space F2</b>	<b>Number of rooms</b>	<b>Floor Area [m<sup>2</sup>]</b>	<b>% of Building Floor Area</b>
Classroom	16	800	55
Laboratory	2	138	9
Computer room	-	-	0
Teacher's room	-	-	0
Meeting room	-	-	0
Library	-	-	0
Offices	-	-	0
Archive	-	-	0
Deposit	-	-	0
Gymnasium	-	-	0
WC	3	103	7
Changing room	-	-	0
Caretakers room	1	3	0
Corridor	3	285	20
Entrance	-	-	0
Stairs	2	130	9
<b>Total area F2</b>	18	1459	100

**Number of Employees:**

<b>Teachers</b>	<b>69</b>
<b>Other employers</b>	<b>22</b>

**Number of Students:**

<b>Students</b>	<b>819</b>
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**Weekly Occupancy**

<b>Days of Week</b>	<b>Time of occupancy</b>	<b>Total amount of hours occupancy/day</b>
Monday	7,30 - 18,00	11,5
Tuesday	7,30 - 18,00	11,5
Wednesday	7,30 - 18,00	11,5
Thursday	7,30 - 18,00	11,5
Friday	7,30 - 18,00	11,5
Saturday	7,30 - 14,00	6,5
<b>Total amount of hours occupancy/week</b>		<b>64</b>

**Monthly Occupancy :**

<b>Months</b>	<b>Days</b>	<b>Hours/day</b>	<b>Totale Hours</b>
September	24	8	192
October	27	8	216
November	25	8	200
December	22	8	176
January	24	8	192
February	24	8	192
March	27	8	216
April	25	8	200
May	25	8	200
June	25	8	200
July	26	8	208
August	24	8	192
<b>Total Hours</b>			<b>2384</b>

### **Which sector needs improvement concerning energy consumption?**

- **Building insulation** (yes)
- **Heating system** (yes)
- **Cooling systems** (yes)
- **Air-conditioning system/Ventilation** (yes)
- **Installation of hot water** (yes)
- **Lighting** (yes)
- **Building Management System** (yes)
- **Occupants' awareness** (yes)

### **Specific problems of your building:**

The transmittance of the windows, the walls and the floors are not regulated under D.LGS. 311, Italian transposing of the Directive 2002/91/EC on energy performance of buildings.

### **General improvements:**

- **Wall and roof external insulation,**
  - **Low emissivity windows,**
  - **New Central Heating (Condensation Boiler),**
  - **thermostatic valves for each radiator,**
  - **LED lamps.**
-

### 3. BUILDING DESCRIPTION

#### 3.1 External photos of the building's facade.



photo A



photo B



### 3.2 Density of nearby construction

The school building is surrounded by an area of relevance used for the outdoor activities, beyond this lie the streets and the buildings.

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### 3.3 External wall description

Concrete Blocks ( )                      Double Concrete Blocks ( )                      Concrete ( )  
 Brick ( )                                      Double Brick / Air Gap ( )  
 Stone (X)                                      Other ( )  
 Insulated ( )                                Type of Insulation : \_\_\_\_\_

What is the exterior wall color?    Pale yellow

**Are the external walls insulated?**

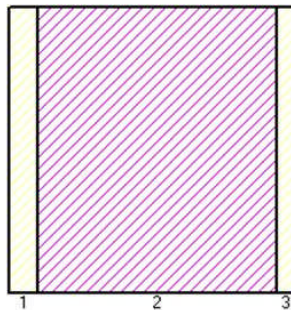
Yes ( )                      No (X)

**If yes, what is the location of the thermal insulation?**

Internal ( )                      External ( )                      In between ( )

**Describe the layers of the external wall construction:**

**Ground floor and First floor walls**

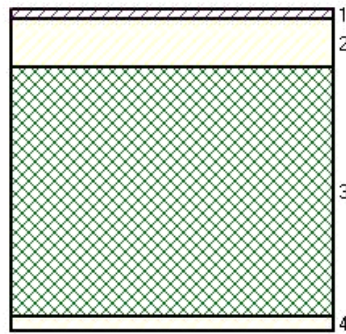


N	Description of wall layers	Thickness (m)
1	Lime cement plaster	0,03
2	Calcareous sandstone	0,25
3	Lime cement plaster	0,02

General data	
Thickness:	0,300 m
Surface mass:	765,00 kg/m <sup>2</sup>
Resistance:	0,5056 m <sup>2</sup> K/W
Transmittance:	1,9780 W/m <sup>2</sup> K
Dynamic parameters	
Attenuation factor:	0,1120
Offset:	11h 41'

Calculated Transmittance of the wall:  $U=1,98 \text{ W/m}^2\text{K}$ . Maximum Transmittance:  $0,48 \text{ W/m}^2\text{K}$ . The Structure is not regulated under 311/2006, transposing the Directive 2002/91/EC Energy Performance of Buildings (EPBD).

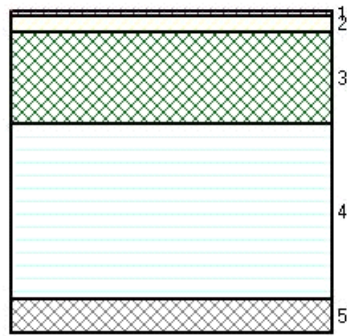
### 3.4 Intermediate floors description



N	Description of floor layers	Thickness (m)
1	tiles	0,01
2	Cement mortar	0,05
3	Brick based slab	0,24
4	Plaster of lime and gypsum	0,02

General data	
Thickness:	0,320 m
Surface mass:	370,00 kg/m <sup>2</sup>
Resistance:	0,6043 m <sup>2</sup> K/W
Transmittance:	1,6548 W/m <sup>2</sup> K
Dynamic parameters	
Attenuation factor:	0,3046
Offset:	8h 44'

### 3.5 Ground floor description

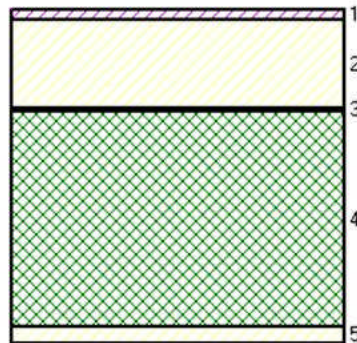


N	Description of ground floor's layers	Thickness (m)
1	tiles	0,1
2	Cement mortar	0,5
3	Brick based slab	0,24
4	Air layer	0,50
5	Light concrete layer	0,10

General data	
Thickness:	0,900 m
Surface mass:	471,50 kg/m <sup>2</sup>
Resistance:	1,2845 m <sup>2</sup> K/W
Transmittance:	0,7785 W/m <sup>2</sup> K
Dynamic parameters	
Attenuation factor:	0,1590
Offset:	11h 45'

Calculated Transmittance of the ground floor:  $U = 0,78 \text{ W/m}^2\text{K}$ . Maximum  $U$  for zone B:  $0,49 \text{ W/m}^2\text{K}$ . The structure is not regulated under DLGS 311/2006, transposing the Directive 2002/91/EC Energy Performance of Buildings (EPBD).

### 3.6 Roof description



N	Description of Roof layers	Thickness (m)
1	Tiles	0,01
2	Cement mortar	0,10
3	Waterproofing polymer	0,002
4	Brick based slab	0,24
5	Plaster of lime and gypsum	0,02

General data	
Thickness:	0,373 m
Surface mass:	472,80 kg/m <sup>2</sup>
Resistance:	0,6540 m <sup>2</sup> K/W
Transmittance:	1,5291 W/m <sup>2</sup> K
Dynamic parameters	
Attenuation factor:	0,2216
Offset:	10h 21'

Calculated Transmittance of the roof 1,52 W/m<sup>2</sup>K. Maximum U for zone C: 0,38 W/m<sup>2</sup>K. Structure not regulated under DLGS 311/2006, transposing the Directive 2002/91/EC Energy Performance of Buildings (EPBD).

**Problems related to the external walls.**

The external walls of the basement are damp, furthermore the concrete surface does not facilitate the transpiration of the wall.



## 4. WINDOWS

TYPE OF AREA FO	FLOOR AREA [m2]	NUMBER	ORIENTATION	TOTAL WINDOW AREA [m2]	GLASS TYPE	WINDOW'S STRUCTURE	TYPE OF WINDOW	PRESENT CONDITION
Gymnasium 21	420	9	S	48,6	single	aluminium	vasistas 1/3	good
		9	N	48,6	single	aluminium	vasistas 1/4	good
		2	S	18,8	single	aluminium	open	good
		2	N	18,8	single	aluminium	open	good
Meeting Room 1	245	1	N	6,5	single	aluminium	open	good
		20	S	39	single	aluminium	open	good
Classroom 2	56	4	E	7,8	single	aluminium	open	good
Classroom 3	49	4	E	7,8	single	aluminium	open	good
Classroom 4	49	4	E	7,8	single	aluminium	open	good
Classroom 5	49	4	E	7,8	single	aluminium	open	good
Laboratory 15	49	4	O	7,8	single	aluminium	open	good
Laboratory 16	56	4	O	7,8	single	aluminium	vasistas	good
Wc A	10	1	E	0,8	single	aluminium	vasistas	good
Wc B	45	4	N	3,4	single	aluminium	vasistas	good
Wc C	49	4	E	3,4	single	aluminium	open	good
Wc 17	100	12	S	7,7	single	aluminium	vasistas	good
Changing Room 18	50	1	S	3,6	single	aluminium	open	good
Deposit 19-20	30	3	N	6,8	single	aluminium	open	good
Corridor A	72	12	O	23,4	single	aluminium	open	good
		5	O	18	single	aluminium	open	good
Corridor B	92	16	O	31,2	single	aluminium	open	good
Teacher's Room 6	94	4	N	7,8	single	aluminium	open	good
		7	S	12	single	aluminium	open	good
Headmaster Room 8	72	4	S	7,8	single	aluminium	open	good
Office 12	70	5	S	10	single	aluminium	open	good
Office 10	42	2	S	6,5	single	aluminium	open	good
Office 11	37	2	S	4	single	aluminium	open	good
Archive 14	49	4	E	3	single	aluminium	open	good
Archive 13	45	4	N	4	single	aluminium	not open	good
Library 23	182	20	O	32	single	aluminium	open	good
Entrance 7	513	15	N	95	single	aluminium	open 2/3	good
		3	N	26	single	aluminium	open	good
		10	skylight oblo	18	single	aluminium	not open	good

Type Of Area F1	FLOOR AREA [m2]	NUMB ER	ORIENT ATION	TOTAL WINDOW AREA [m2]	GLASS TYPE	WINDOW'S STRUCTURE	TYPE OF WINDOW	PRESENT CONDITION
Classroom 1	50	4	O	6,3	single	aluminium	open	good
		6	S	9,5	single	aluminium	open	good
Classroom 7	50	4	S	6,3	single	aluminium	open	good
Classroom 6	100	8	S	13,5	single	aluminium	open	good
		2	N	3,9	single	aluminium	open	good
Classroom 2	56	4	E	7,8	single	aluminium	open	good
Classroom 3	49	4	E	7,8	single	aluminium	open	good
Classroom 4	49	4	E	7,8	single	aluminium	open	good
Classroom 5	49	4	E	7,8	single	aluminium	open	good
Wc A	9	1	E	0,8	single	aluminium	open	good
Wc B	45	4	N	3,4	single	aluminium	open	good
Wc C	49	4	E	3,4	single	aluminium	open	good
Classroom 20	64	3	O	5,9	single	aluminium	open	good
Classroom 19	30	5	S	6,8	single	aluminium	open	good
Classroom 18	30	3	O	6	single	aluminium	open	good
Classroom 17	30	5	O	7	single	aluminium	open	good
Laboratory 16	40	2	O	5,4	single	aluminium	open	good
Classroom 15	56	4	O	7,8	single	aluminium	open	good
Classroom 14	49	4	O	7,8	single	aluminium	open	good
Classroom 13	40	2	O	3,9	single	aluminium	open	good
Classroom 12	49	4	S	7,8	single	aluminium	open	good
Classroom 11	49	4	S	7,8	single	aluminium	open	good
Classroom 10	49	4	S	7,8	single	aluminium	open	good
Classroom 8	49	4	S	7,8	single	aluminium	open	good
Stair A	60	3	S	6	single	aluminium	open	good
		1	N/E	3,5	single	aluminium	open	good
		4	N	5	single	aluminium	open	good
Stair B	70	6	N N/O	7,5	single	aluminium	open	good
		16	O	31	single	aluminium	open	good
Corridor A	117	14	O	26,9	single	aluminium	open	good
		2	O	6,5	single	aluminium	open	good
Corridor B - Caretakers Room	93	16	O	31,2	single	aluminium	open	good
Corridor C	78	16	N	19,8	single	aluminium	open	good



TYPE OF AREA F2	FLOOR AREA [m2]	NUMBER	ORIENTATION	TOTAL WINDOW AREA [m2]	GLASS TYPE	WINDOW'S STRUCTURE	TYPE OF WINDOW	PRESENT CONDITION
Classroom 1	43	4	O	9	single	aluminium	open	good
Classroom 9	54	10	S	16,5	single	aluminium	open	good
Classroom 7	49	6	S	9,9	single	aluminium	open	good
Classroom 6	54	4	S	6,6	single	aluminium	open	good
Classroom 2	56	4	E	7,8	single	aluminium	open	good
Classroom 3	49	4	E	7,8	single	aluminium	open	good
Classroom 4	49	4	E	7,8	single	aluminium	open	good
Classroom 5	49	4	E	7,8	single	aluminium	open	good
Wc A	9	1	E	0,8	single	aluminium	open	good
Wc B	45	3	N	3,4	single	aluminium	open	good
Wc C	49	4	E	3,4	single	aluminium	open	good
Classroom 19 - 20 Laboratory	94	3	N	5,5	single	aluminium	open	good
		3	S	5,5	single	aluminium	open	good
		3	O	5,1	single	aluminium	open	good
Classroom 18	30	3	O	6	single	aluminium	open	good
Classroom 17	30	5	O	7	single	aluminium	open	good
Laboratory16	40	2	O	5,4	single	aluminium	open	good
Classroom 15	56	4	O	7,8	single	aluminium	open	good
Classroom 14	49	4	O	7,8	single	aluminium	open	good
Classroom 13 - 11 Laboratory	40	2	O	2,1	single	aluminium	open	good
	98	7	S	7,8	single	aluminium	open	good
Classroom 10	49	4	S	7,8	single	aluminium	open	good
Classroom 8	49	4	S	7,8	single	aluminium	open	good
Stair A	60	3	S	6	single	aluminium	open	good
		1	N	3,5	single	aluminium	open	good
		4	N	5	single	aluminium	open	good
Stair B	70	6	N	7,5	single	aluminium	open	good
		16	O	31	single	aluminium	open	good
Corridor A	117	14	O	26,9	single	aluminium	open	good
		2	O	6,5	single	aluminium	open	good
Corridor B - Caretakers Room	93	16	O	31,2	single	aluminium	open	good
Corridor C	78	16	N	19,8	single	aluminium	open	good

ORIENTATION	FLOOR	NUMBER	AREA (m <sup>2</sup> )	TOTAL (m <sup>2</sup> )
N	F0	46	226,3	314,1
	F1	33	43,1	
	F2	33	44,7	
O	F0	61	120,2	403,9
	F1	70	138,7	
	F2	75	145	
S	F0	65	167,4	308,6
	F1	42	73,3	
	F2	41	67,9	
E	F0	25	120,2	191
	F1	21	35,4	
	F2	21	35,4	

## **Conclusion:**

The windows have single glazing, the frames are in aluminum without thermal break and the shutter boxes are in poor condition. The transmittance of the windows is above the limit of **3 w/m<sup>2</sup>k** (maximum U for zone B ) established by DLGS 311, transposing of the Directive 2002/91/EC on Energy Performance of Buildings.



**Windows with double door opening**

<b>Window with aluminium frame (dim. h1,8 m, l 2 m, area 3,6 m<sup>2</sup>)</b>	
Type of frame material:	Aluminum without thermal break
Type of glazing:	single
percentage of the frame area than in the entire window area:	30%
Thermal transmittance Uw:	6,1 W/m <sup>2</sup> K

## 5. SIMULATION OF BUILDING'S ENERGY CONSUMPTION

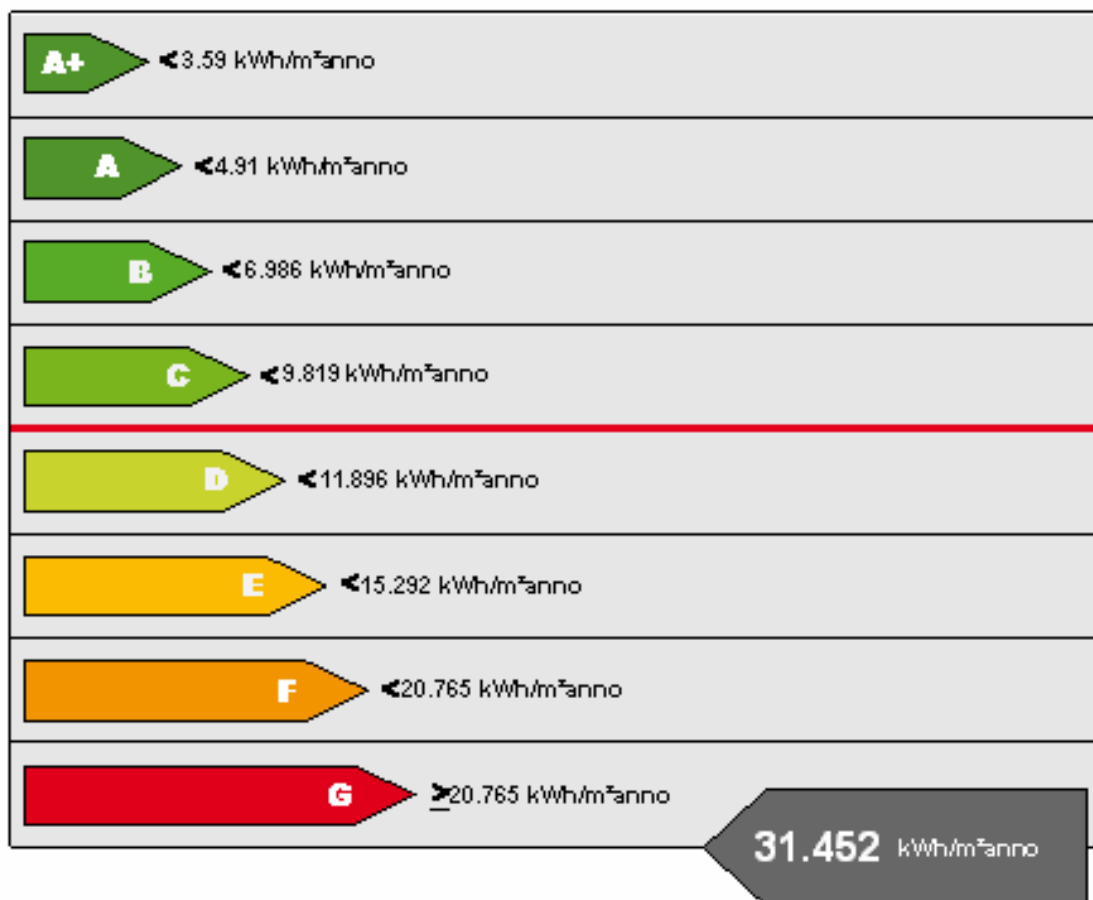
### 5.1. Simulation

For the Energy Class simulation of the building the software Termus was used. In Italy this Software is authorized for the elaboration of Energy Classification certificates. (Further indications concerning the common calculation methodology for the building's energy consumption will be given in order to guarantee comparable results throughout the partnership)

#### ENERGY CLASS SIMULATION OF THE BUILDING (SOFTWARE TERMUS):

**Energy consumption for heating : 31.45 kWh/m<sup>3</sup> year**

Energy Performance Index  $E_{p\_Lim\_CE}$ : 5.28 kWh/m<sup>3</sup> year



**CO2 emissions for heating = 6.08 kgCO<sub>2</sub>/m<sup>3</sup>year**

## 5.2 Natural Light Simulation

For the Natural Light simulation a selection of 3-4 types of classrooms should be made according to the windows' orientation and Selection of the most critical date of the year (**Date: 21/12 Hour: 10:00**)

### **Classroom A** - Windows' orientation to

*2D graphic that represents the incident light in the classroom*

- Average Daytime Factor of light
- Minimum Daytime Factor of light
- Maximum Daytime Factor of light

*3D graphic that represents the illumination measured in lux(Unit of measurement of light) of the classroom*

- Average unit of illumination
- Minimum unit of illumination
- Maximum unit of illumination

### **work surface**

### **Classroom B** - Windows' orientation to

*2D graphic that represents the incident light in the classroom*

- Average Daytime Factor of light
- Minimum Daytime Factor of light
- Maximum Daytime Factor of light

*3D graphic that represents the illumination measured in lux(Unit of measurement of light) of the classroom*

- Average unit of illumination
- Minimum unit of illumination
- Maximum unit of illumination

### **work surface**

### **Classroom C** - Windows' orientation to

*2D graphic that represents the incident light in the classroom*

- Average Daytime Factor of light
- Minimum Daytime Factor of light
- Maximum Daytime Factor of light

*3D graphic that represents the illumination measured in lux (Unit of measurement of light) of the classroom*

- Average unit of illumination
- Minimum unit of illumination
- Maximum unit of illumination

**work surface**



## 6. HEATING SYSTEM AND ENERGY SUPPLY

### 6.1 Description of heating system

Type of System	Units	Power [kW]	Heated Floor Area [m <sup>2</sup> ]	Daily Hours of Operation	Months of Operation
Central	2	305x2 = 610	4243		
Heat Pump	5	24 kW (82,000 BTU)	256		
Electric Heater					
Gas Heater					
Oil Heater					
Other					

Months*	Days/month	Hours/month (Total school area)
<b>November</b>	15	75
<b>December</b>	24	120
<b>January</b>	27	135
<b>February</b>	24	120
<b>March</b>	27	135
<b>Total</b>	<b>91</b>	<b>546</b>

\* Heating period from 1 December to 31 March, according to the operational limits for thermal plants in Zone B, UNI TS 11300

## 6.2 Condition of heating system

**Is the boiler insulated?** Yes (X) No ( )

**What is the condition of the insulation?** Good (X) Fair ( ) Bad ( )

Missing ( ) Damaged ( ) Other:

**Is the heat distribution system insulated?** Yes (X) No ( )

**What is the condition of the insulation?** Good ( X) Fair ( ) Bad ( )

Missing ( ) Damaged ( ) Other:

**Is temperature control available?** Yes (X) No ( )

### **Specify set temperature (C):**

80°C (boiler temperature); 19°C (radiators temperature)

### **Set temperature is set by :**

Space occupants ( ) ( Building manager)

Other: external company

Provision for temperature setback: Yes ( ) No ( )

Specify set temperature (C) : \_\_\_\_\_

### 6.3 Operating Schedule - Total school area

(List hours of operation of the heating system)

<b>Days of Week</b>	<b>Time Heating is Turned On</b>	<b>Total amount of hours heating/day</b>
Monday	07,00 - 12,00	5
Tuesday	07,00 - 12,00	5
Wednesday	07,00 - 12,00	5
Thursday	07,00 - 12,00	5
Friday	07,00 - 12,00	5
Saturday	07,00 - 12,00	5
<b>Total amount of hours occupancy/week</b>		<b>36</b>

### 6.4 Use of Renewable Energies

**Does the building have any passive solar heating systems?**

Yes  No

**Does the building have any other solar energy system?**

Yes  No

**Does the building have any other renewable energy system?**

Yes  No



## 7. COOLING SYSTEM

Type of System	Units	Power [kW]	Cooled Floor Area [m <sup>2</sup> ]	Daily Hours of Operation	Months of Operation
A/C split unit	5	2,4 kW	256		
A/C split unit	3	2,6 kW	243		

**Is temperature control available?** Yes (X) No ( )

**Specify set temperature (C):** 26°C

**Set temperature is set by:**

Space occupants (X) Building manager ( ) Other: \_\_\_\_

Provision for temperature setup  
Specify set temperature (C): \_\_\_\_

**Operating Schedule** (List hours of operation of the cooling system):

Days of Week	Time A/C Turned On	Time A/C Turned Off
Monday	data not received	data not received
Tuesday	data not received	data not received
Wednesday	data not received	data not received
Thursday	data not received	data not received
Friday	data not received	data not received
Saturday	data not received	data not received

**Does the building have any passive cooling systems?**

Yes ( ) No (X)

## 8. LIGHTING SYSTEM

TYPE OF AREA F0	FLOOR AREA [m2]	TYPE OF LIGHTS1	NUMBER OF LIGHTS	WATTS/LAMP	TOTAL WATTS	TOTAL W/m2	FIXTURE MOUNTING2
Gymnasium	420	SFL	54	54	2916	7	ATT
Meeting Room 1	245	SFL	30	54	1620	7	ATT
Classroom 2	56	SFL	8	54	432	8	ATT
Classroom 3	49	SFL	8	54	432	9	ATT
Classroom 4	49	SFL	8	54	432	9	ATT
Classroom 5	49	SFL	8	54	432	9	ATT
Laboratory 15	49	SFL	8	54	432	9	ATT
Laboratory 16	56	SFL	8	54	432	8	ATT
Wc A	10	SFL	2	54	108	11	ATT
Wc B	45	SFL	6	54	324	7	ATT
Wc C	49	SFL	4	54	216	4	ATT
Wc 17	100	SFL	16	54	864	9	ATT
		SFL	6	18	108	1	ATT
Changing Room 18	50	SFL	8	54	432	9	ATT
Deposit 19-20	30	SFL	8	54	432	14	ATT
Corridor A	72	SFL	10	54	540	8	ATT
Corridor B	92	SFL	18	54	972	11	ATT
Stair A	62	SFL	4	54	216	3	ATT
Stair B	70	SFL	4	54	216	3	ATT
Teacher's Room 6	94	SFL	16	54	864	9	ATT
Headmaster Room 8	72	SFL	12	54	648	9	ATT
Office 12	70	SFL	12	54	648	9	ATT
		SFL	2	10	20	0	ATT
Office 10	42	SFL	6	54	324	8	ATT
Office 11	37	SFL	4	54	216	6	ATT
		SFL	2	10	20	1	ATT
Archive 14	49	SFL	4	54	216	4	ATT
Archive 13	45	SFL	4	54	216	5	ATT
Library 23	182	SFL	20	54	1080	6	ATT
Laboratory 24	73	SFL	6	54	324	4	ATT
Caretakers Room 9	19	SFL	3	54	162	9	ATT
Entrance 7	513	SFL	74	54	3996	8	ATT

<b>TYPE OF AREA F1</b>	<b>FLOOR AREA [m2]</b>	<b>TYPE OF LIGHTS</b>	<b>NUMBER OF LIGHTS</b>	<b>WATTS/LAMP</b>	<b>TOTAL WATTS</b>	<b>TOTAL W/m2</b>	<b>FIXTURE MOUNTING2</b>
Classroom 1	50	SFL	12	54	648	13	ATT
Classroom 7	50	SFL	12	54	648	13	ATT
Classroom 6	100	SFL	24	54	1296	13	ATT
Classroom 2	56	SFL	8	54	432	8	ATT
Classroom 3	49	SFL	8	54	432	9	ATT
Classroom 4	49	SFL	8	54	432	9	ATT
Classroom 5	49	SFL	8	54	432	9	ATT
Wc A	9	SFL	2	54	108	12	ATT
Wc B	45	SFL	6	54	324	7	ATT
Wc c	49	SFL	4	54	216	4	ATT
Classroom 20	64	SFL	8	54	432	7	ATT
Classroom 19	30	SFL	8	54	432	14	ATT
Classroom 18	30	SFL	12	54	648	22	ATT
Classroom 17	30	SFL	8	54	432	14	ATT
laboratory 16	40	SFL	8	54	432	11	ATT
Classroom 15	56	SFL	8	54	432	8	ATT
Classroom 14	49	SFL	8	54	432	9	ATT
Classroom 13	40	SFL	4	54	216	5	ATT
Classroom 12	49	SFL	8	54	432	9	ATT
Classroom 11	49	SFL	8	54	432	9	ATT
Classroom 10	49	SFL	8	54	432	9	ATT
Classroom 8	49	SFL	8	54	432	9	ATT
Stair A	60	SFL	4	54	216	4	ATT
Stair B	70	SFL	4	54	216	3	ATT
Corridoio A	117	SFL	14	54	756	6	ATT
Corridor B - caretaker room	93	SFL	12	54	648	7	ATT
Corridor C	78	SFL	10	54	540	7	ATT

TYPE OF AREA F2	FLOOR AREA [m2]	TYPE OF LIGHTS	NUMBER OF LIGHTS	WATTS/LAMP	TOTAL WATTS	TOTAL W/m2	FIXTURE MOUNTING2
Classroom 1	43	SFL	12	54	648	15	ATT
Classroom 9	54	SFL	8	54	432	8	ATT
Classroom 7	49	SFL	6	54	324	7	ATT
Classroom 6	54	SFL	8	54	432	8	ATT
Classroom 2	56	SFL	8	54	432	8	ATT
Classroom 3	49	SFL	8	54	432	9	ATT
Classroom 4	49	SFL	8	54	432	9	ATT
Classroom 5	49	SFL	8	54	432	9	ATT
Wc A	9	SFL	2	54	108	12	ATT
Wc B	45	SFL	6	54	324	7	ATT
Wc C	49	SFL	4	54	216	4	ATT
Classroom 19 - 20 Laboratory	94	SFL	16	54	864	9	ATT
							ATT
Classroom 18	30	SFL	12	54	684	23	ATT
Classroom 17	30	SFL	8	54	432	14	ATT
laboratory 16	40	SFL	8	54	432	11	ATT
Classroom 15	56	SFL	8	54	432	8	ATT
Classroom 14	49	SFL	8	54	432	9	ATT
Classroom 13 - 11 Laboratory	40	SFL	20	54	648	16	ATT
	98	SFL					
Classroom 10	49	SFL	8	54	432	9	ATT
Classroom 8	49	SFL	8	54	432	9	ATT
Stair A	60	SFL	4	54	216	4	ATT
Stair B	70	SFL	4	54	216	4	ATT
Corridor A	117	SFL	14	54	756	6	ATT
Corridor B - caretaker room	93	SFL	12	54	648	7	ATT
Corridor C	78	SFL	10	54	540	7	ATT

**There are no spaces that need continuous electrical lighting**

**Lighting Schedule** (List hours of operation of the lighting system) **data not received**

Days of Week	Time Lights Turned On	Percent of area with Lights Turned On	Total hours of lighting
Monday to Saturdays			

**<sup>1</sup> (Use the following codes)**

SI: Standard Incandescent  
SFL: Screw -in or compact Fluorescent  
EEI: Energy Efficient Incandescent  
HID: High Intensity Discharge  
(High pressure sodium, metal halide or mercury vapour)  
Other: \_\_\_\_\_

**<sup>2</sup>(Use the following codes)**

RGD: Recessed with glass diffuser  
RPD: Recessed with plastic diffuser  
SUS: Suspended  
ATT: Attach

## 9. HOT WATER SYSTEM

Type of System	Thermostat (C)	Volume (lt)	Power (kW)	Units	Daily Hours of Operation	Months of Operation
Electric heater	60°C	30	1,2	3		
Electric heater	60°C	50	1,5	1		
Electric heater	60°C	15	1,2	1		
Electric heater	60°C	10	1,2	1		
Solar collector* FOR		1000				

\* For Solar Collector instead of power enter collector surface area (m<sup>2</sup>) : **data not received**

**Hot Water Uses: data not received**

Application	Hours/Period of Operation	Location	Estimated Consumption [It]	Estimated Number of People Using it
General Use	8	WC - bar		

## 10. OTHER EQUIPMENT

List all energy equipment (other than lighting, air conditioning, heating, and domestic hot \ that is greater than 2 kW input or is used more than 2 hours per day or both.

Type of System Floor 0	Location	Units	Total Power (kW)	Daily Hours of Operation	Months of Operation
Computers Lcd	Meeting room 1	1	0,49	2	Sept- June
Computers Lcd	Teach. Room 6	2	1,58	6	Sept- June
Computers Lcd	Classroom 8	1	0,49	4	Sept- June
Computers Lcd	Classroom 12	6	2,94	6	Sept- June
Computers Lcd	Classroom 11	2	1,58	6	Sept- June
Computers Lcd	Classroom 20	1	0,49	6	Sept- June
Computers Lcd	Classroom 16	28	13,72	2	Sept- June
Computers	Classroom 16	2	0,7	24	Sept- June
TV	library 23	1	0,6	2	Sept- June
TV	Meeting room 1	2	0,4	0,5	Sept- June
Dries	WC B, WC 13	2	4	0,5	Sept- June
Copying Machines	Classroom 13, 12	3	4,5	6	Sept- June
Coffee/Snack Machines	Meeting room 1, 13	2	1,3	6	Sept- June
Elevator		1	4	2	Sept- June
Fridge	Classroom 13,20	2	1,6	24	Sept- June
Projector	Meeting room 1, library 23	1	1		Sept- June
Heater	library 23	1	2	0,5	Sept- June
Air Compressor	Classroom 14	1	1,5	0,5	Sept- June
Water Lifting Pumps	pump room		1,7	15	Sept- June
Autoclaves	pump room		13,5	6	Sept- June
Hot Water Circulation Pumps	boiler room		6	10	Sept- June
Pump Shaft	well		1,5	2	Sept- June

Type of System Floor 1	Location	Units	Total Power (kW)	Daily Hours of Operation	Months of Operation
Computers Lcd	Classroom 6	6	3,54	2	Sept- June
Computers Lcd	WC B	1	2	0,5	Sept- June

Type of System Floor 2	Location	Units	Total Power (kW)	Daily Hours of Operation	Months of Operation
Computers Lcd	Laboratory 11	4	2,68	2	Sept- June
Computers Lcd	Classroom 20	1	0,79	2	Sept- June
Dries	WC B	1	2	0,5	Sept- June

## 11. INFORMATION ON ENERGY CONSUMPTION

### Electricity consumption - Results from the bills

2007/2008	Month	Electricity (kWh)
	September '07	8749
	October '07	14255
	November '07	13738
	December '07	13250
	January '08	16856
	February '08	15817
	March'08	15331
	April '08	16049
	May '08	15718
	June '08	10662
	July '08	8490
	August '08	6041
	<b>Total</b>	<b>154956</b>

2008/2009	Month	Electricity (kWh)
	September '08	9707
	October '08	14749
	November '08	15706
	December '08	13845
	January '09	15407
	February '09	13488
	March'09	15577
	April '09	12681
	May '09	13214
	June '09	10039
	July '09	9124
	August '09	5772
	<b>Total</b>	<b>149309</b>

Average value of the last two years: **152132,5 kWh**

**Gas consumption - Results from the bills**

<b>2007/2008</b>	<b>month</b>	<b>Gas (m3)</b>
	September '07	
	October '07	
	November '07	460
	December '07	522
	January '08	675
	February '08	729
	March'08	452
	April '08	165
	May '08	129
	June '08	
	July '08	
	August '08	
	<b>Total</b>	<b>3132</b>

<b>2008/2009</b>	<b>month</b>	<b>Gas (m3)</b>
	September '08	
	October '08	
	November '08	443
	December '08	559
	January '09	587
	February '09	762
	March'09	640
	April '09	222
	May '09	147
	June '09	
	July '09	
	August '09	
	Balance 2008/2009	10406
	<b>Totale</b>	<b>13766</b>

**Average value of the last two years: 8449 m<sup>3</sup>**



**Source of Data:** Utility [] Bills [] Other: \_\_\_\_\_

**Annual Energy Consumption / Cost of all forms of energy**

Type	Quantity	Units	Cost	Monetary Units
Electricity	kWh	kWh	_____	_____
Diesel	_____	lt	_____	_____
Oil	_____	lt	_____	_____
Gas	m <sup>3</sup>	kg	_____	_____

**Source of Data:** Utility [] Bills [] Other: \_\_\_\_\_

**What features (if any) do you think make this building more (or less) energy efficient than others (please specify and check all that apply):**

- Design or structural features \_\_\_\_\_
- Building envelope features \_\_\_\_\_
- Air conditioning features \_\_\_\_\_
- Lighting features \_\_\_\_\_
- Controls \_\_\_\_\_
- Operations and maintenance \_\_\_\_\_
- Operator training \_\_\_\_\_
- Occupant behavior \_\_\_\_\_
- Other \_\_\_\_\_

**How important is the cost of energy (compared with other costs) in determining how the building is operated?**

Very important (  ) Important (  ) Average (  ) Not important (  ) Don't know (  )

**Overall, has total annual energy consumption (not cost) changed in your building in the last five years?**

Increased overall (  ) Decreased overall (  ) About the same (  ) Don't know (  )

**If there has been a change in total energy consumption not due to energy conservation measures, why do you think it has occurred?**

- Change in building functions Yes (  ) No (  ) Up (  ) Down (  )
- Change in building operations Yes (  ) No (  ) Up (  ) Down (  )
- Change in occupied floor area Yes (  ) No (  ) Up (  ) Down (  )
- Change in building codes Yes (  ) No (  ) Up (  ) Down (  )
- Other \_\_\_\_\_

**What energy conservation opportunities (ECOs), including no-cost/low-cost measures, you have taken or plan to take (check all that apply)**

Energy Conservation Measures (ECOs)	Date Installed	Planned (next three years)

BUILDING ENVELOPE Solar Barriers		
Insulation		
Windows (reflective films)		
Windows (all other ECOs)		
Other openings:		
Manual Adjustments		
Other:		
CONTROLS / AIR-CONDITIONING Time clocks		
Computer based energy management systems		
Other :		

MECHANICAL (AIR-CONDITIONING) Air-Conditioning		
Distribution system (pipes/ducts)		
Distribution system modifications (other ECOs)		
Domestic (service) hot water		
Manual adjustments		
Energy recovery devices		
Fuel conversions		
Other :		
HEATING Boiler		
Burner		
Distribution system		
Thermal storage		
Other:		
ELECTRICAL / LIGHTING Lighting conversion		
Lighting modifications		
Manual adjustments		
RENEWABLE ENERGY SOURCES Solar collectors		
Passive systems (specific)		