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Programme of the European Union



# ZEMedS: Implementation

Implementation

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# Implementation Case:

Emili Juncadella School, Barcelona, Catalonia  
(Spain)





## General data

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

### Name of the School

“Emili Juncadella” School



### Type of school



Elementary School

### Number of students



**214**

### Owner



**public**

### Location

12, Juan de Garay Street  
08041 Barcelona

### Year of construction



**1939**





## General data

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

Building typology

Heated area (m<sup>2</sup>)



3 floor building

1087,2 m<sup>2</sup>

Heating degree days (base 18): 1128

Cooling degree days (base 21): 354

Site



High density





## Current Situation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

### Renovation needs

High Priority: building envelop + solar shading + lighting+ heating system



### Building use

Schedule for high school:

Standard Use: From second week of September till last week of June

Standard Use (class): Monday, Tuesday, Wednesday, Thursday and Friday

09:00 to 12:00 and 13:45 to 16:00





## Current Situation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

### Building envelope: Walls

Brick Wall

No insulation

$$U = 1,69 \text{ W/m}^2\cdot\text{K}$$

### Building envelope: Roof (plane roof)

Roof with insulation and waterproofing

$$U = 2,27 \text{ W/m}^2\cdot\text{K}$$

### Building envelope: Groundfloor

Ground floor consists of concrete

$$U = 0,64 \text{ W/m}^2\cdot\text{K}$$



### Building envelope: Windows

Simple-glazed windows with wood frames

$$U_w = 5,7 \text{ W/m}^2\cdot\text{K}$$



## Current Situation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

<b>Airtightness:</b>	No measurements
<b>Heating/Cooling:</b>	Natural gas standard boiler
<b>Ventilation:</b>	Ventilation by opening windows in classroom
<b>Lighting:</b>	Fluorescent tubes T8 controlled by users
<b>Appliances:</b>	<i>Classroom:</i> PC, Hifi-video <i>Office:</i> PC, Printer, Copy Machine
<b>DHW:</b>	Standard boiler
<b>Cooking:</b>	Cantine with warm meals
<b>2013 final energy consumption kWh/m<sup>2</sup> conditioned area (from bills, metering etc.):</b>	*94 kWh/m <sup>2</sup> y for heating (estimation) *30 kWh/m <sup>2</sup> y for electricity (estimation) *Total = 124 kWh/m <sup>2</sup> per year (Bills)



## Current Situation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

### Equipment Age and Maintenance Needs

<b>Lighting :</b>	Fluorescent lamp T8 installed in build
<b>HVAC/ Boiler:</b>	Gas heating system controlled by users, water convectors
<b>HVAC/Distribution Network:</b>	no
<b>HVAC/other components</b>	Single flow ventilation on bathrooms
<b>HVAC/other components</b>	no
<b>Windows</b>	Simple glazed with wood frame dating from the construction
<b>Other Building Components</b>	no
<b>Other Maintenance Needs</b>	no
<b>Other Renovation Needs</b>	no





## Current Situation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

### Health & Comfort

**Summer comfort:** Lack of comfort in May, June and September

**Interior air quality:** No permanent ventilation

**Visual comfort:**

### Running Contracts and Management

**Running cost:** Energy: 134.624 €/year  
Water: No data  
Maintenance: no data

**Energy Supply Contract** Electricity

**Energy Management Contract** Municipality

**Building Maintenance** Municipality and local staff



# NZEB Renovation

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

## ZEMedS Goals:

- Requirement 1:  $C_{PE} - \text{Prod}_{RES} \leq 0$

Primary energy consumption yearly (heating, cooling, ventilation, DHW and lighting) is produced by local renewable energies.

- Requirement 2:  $C_{FE} \leq 25 \text{ kWh/m}^2 \text{ y}$

FE consumption yearly (heating, cooling, ventilation and lighting) per conditioned area

- Requirement 3: Indoor air quality guaranteed ( $\text{CO}_2 \leq 1000 \text{ ppm}$ ) and temperature above  $28^\circ\text{C} \leq 40$  hours yearly during occupancy

National factors for conversion in energy and  $\text{CO}_2$  have been taken into account (data 2014).

Primary Energy from non-renewable energy sources covered by renewable energy

0  
kWh/m<sup>2</sup>.year  
(annual balance)

Final energy consumption (all uses except DHW & cooking)

$C_{FE} \leq 25$   
kWh/m<sup>2</sup>.year

Overheating limited to

40 hours over  
28°C annually

Indoor Environmental Quality (IEQ) is guaranteed

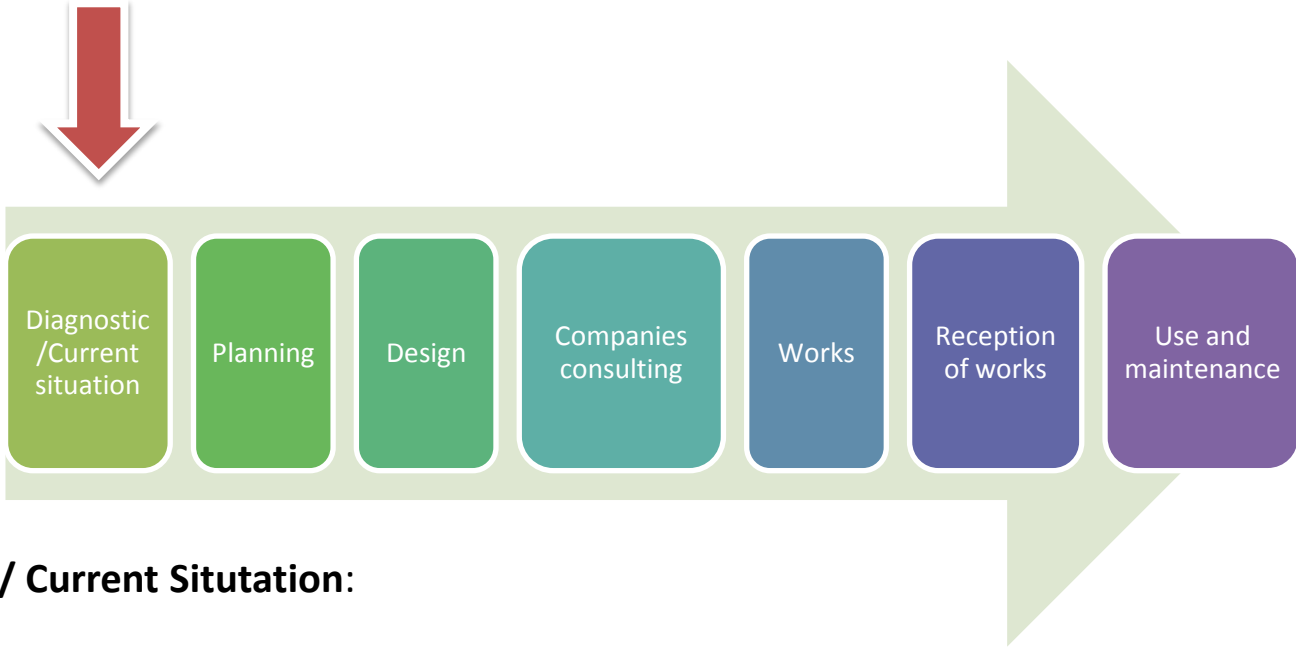
$\text{CO}_2 \leq 1000$   
ppm



# NZEB Renovation Status

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

Actual status referring to the the foreseen ZEMedS Renovation Process



## Diagnostic/ Current Situation:

A preliminary energy consumption analysis has been done by Ensenyament. There is no previous analysis nor simulations.

Ensenyament has done several face to face meeting in order to define the users needs of improvement.



# Energy Saving Potential

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

## Actual Final Energy Consumption

### *Consumption by Bills*

Natural Gas: 101.657 kWh/year = 94 kWh/m<sup>2</sup>.year

Electricity: 32.967 kWh/year = 30 kWh/m<sup>2</sup>.year

Other Fuel: no

Total: 134.624 kWh/year = 124 kWh/m<sup>2</sup>.year

### *Estimation:*

Specific Electricity Consumption (not including Lighting): 11 kWh/m<sup>2</sup>.year

Domestic Hot Water Consumption: 1 kWh/m<sup>2</sup>.year

Expected Total Consumption after successful ZEMedS Renovation:

40.226 kWh/year = 37.0 kWh/m<sup>2</sup>.year

## ZEMedS Target

Final energy consumption (all uses except DHW & cooking)

$C_{FE} \leq 25$   
kWh/m<sup>2</sup>.year

Heating/Cooling  
and Ventilation:  
 $C_{HVAC} \leq 20$   
kWh/m<sup>2</sup>.year

Lighting:  $C_{lght} \leq 5$   
kWh/m<sup>2</sup>.year

**Total Energy Saving Potential**

Theoretical Saving  
94.398 kWh.year

Theoretical Gain  
70 %



# Renewable Energy Source Potential

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

System	Considerations and Recommendation	Potential Production
Photo Voltaic System		<b>XX</b> kWh/m <sup>2</sup> .year
Solar Thermal for DHW		<b>XX</b> kWh/m <sup>2</sup> .year
RES Heat Pump		<b>XX</b> kWh/m <sup>2</sup> .year
Others		<b>XX</b> kWh/m <sup>2</sup> .year

**RES Potential**  
**In primary energy**

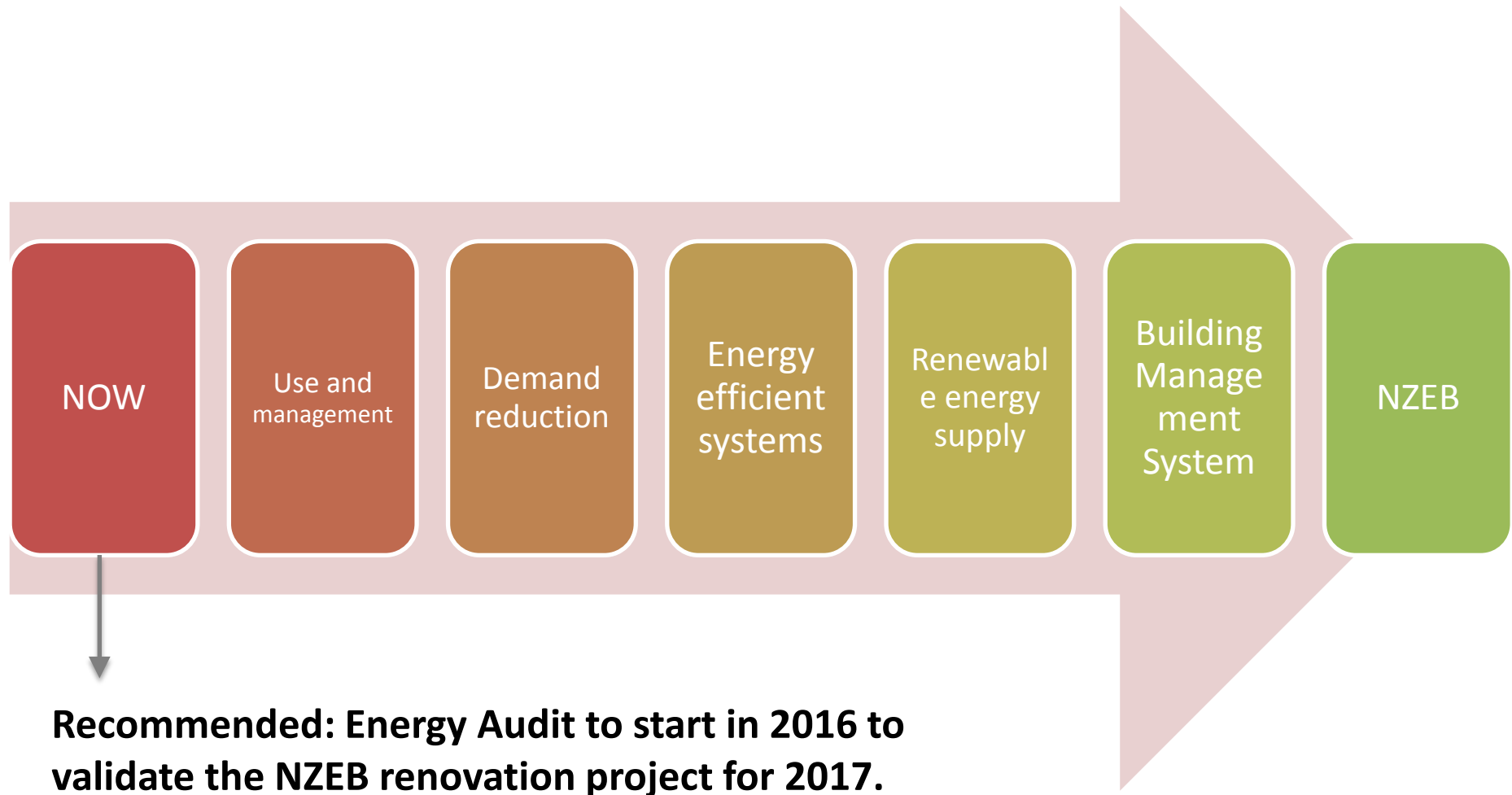
RES Production Potential  
**XX kWh/m<sup>2</sup>.year**





## Recommended Measures

“Emili Juncadella” School, BARCELONA, Catalonia, Spain





## Recommended Measures

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

<b>Measure</b>	<b>Why is recommended and what</b>
Windows replacement	Energy savings, comfort (acoustic, thermal)
Improvement of Solar protection	Comfort (visual, overheating)



## Specific Features and Remarks

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

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### Specific Remarks

No Specific Remarks.



# Funding Opportunities

“Emili Juncadella” School, BARCELONA, Catalonia, Spain

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## Relevant Information:

- Need a political validation and audit information
- Budget estimation: To define

## Funding Potential:

- Self funding: to define
- Regional Initiatives: to define
- National Funding: to define
- European Direct Funding: to define