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# Approach of case studies

## 1. Spanish Case Study Approach

Spanish case study consists of analysing the energy demand, energy consumption and CO2 emissions of the current situation of the building, as well as proposing alternatives that improve its energy efficiency, of an existing single-family house, type terraced house, located in the municipality of Ceutí, Spain.

The economic cost of the proposed improvements will be studied, as well as the decrease in energy consumption and CO2 equivalent emissions produced by these improvements.

The proposed improvements will be of three types:

1. Improving the thermal properties of the building's thermal envelope
2. HVAC System Improvements
3. Installation of local renewable energy generation systems

### 1.1. Description of the single-family house for Spanish Case Study

The terraced single-family house consists of a basement, first floor and second floor. The roof of the house is a flat roof. This building was built in 2023.

The basement has a space of 60 $m^2$ for vehicle parking and a storage room of 12 $m^2$.

The first floor has an interior usable area of 56 $m^2$, not including stairs. The spaces on the first floor are a bedroom, a living room, the kitchen and a bathroom. On the outside of the first floor, the house has a terrace of 13 m2 where the main door of the house is.

On the second floor it has an interior usable area of 54.6 $m^2$, not including the staircase. This floor consists of 3 bedrooms, and a bathroom. On the outside of this floor, one of the bedrooms has a balcony of 3 $m^2$ useful.

The width of the façade of this terraced house is 7.71 m and the depth is 11.64 m. On the main façade of the house has a fenced plot of 36 m2 where the ramp is located to go down to the basement with the vehicle.

**Figure 1:** Terraced houses in Spain

## 2. Lithuanian Case Study Approach

Lithuanian case study consists of analysing the energy demand, energy consumption and CO2 emissions of the current situation of the building, as well as proposing alternatives that improve its energy efficiency, of an existing muti-storey dormitory building, located in Vilnius, Lithuania.

The economic cost of the proposed improvements will be studied, as well as the decrease in energy consumption and CO2 equivalent emissions produced by these improvements.

The proposed improvements will be of three types:

4. Improving the thermal properties of the building's thermal envelope
5. HVAC System Improvements
6. Installation of local renewable energy generation systems

### 2.1. Description of the muti-storey dormitory building. Lithuanian Case Study

Dormitory building is located in Staneviciaus g. 108, Vilnius, Lithuania .

The geographical coordinates of this building are:

Latitude: 54°43'52.7"N

Longitude: 25°15'14.8"E

It is a 5-storey building for residential use. Main entrance (front facade) of the dormitory is located on the East side of the building, facing Stanevičiaus Street.

**Figure 2:** Dormitory building in Vilnius

## 3. Romanian Case Study Approach

Romanian case study consists of analysing the energy demand, energy consumption and CO2 emissions of the current situation of the building, as well as proposing alternatives that improve its energy efficiency, of an existing school building, located, Romania.

The economic cost of the proposed improvements will be studied, as well as the decrease in energy consumption and CO2 equivalent emissions produced by these improvements.

The proposed improvements will be of three types:

7. Improving the thermal properties of the building's thermal envelope
8. HVAC System Improvements
9. Installation of local renewable energy generation systems

### 3.1. Description of the School building. Romanian Case Study

The Romanian case study is a primary and lower secondary school, built in 1962 and located in Petrindu/Cuzăplac village, Sălaj County, Romania.

The building has one ground floor and a total built area of 512 square metres, with a total useful area of 413.8 square metres. It comprises 3 classrooms, 1 kindergarten room, two hallways, a teaching materials storage, an office, three storage rooms, a toilet and a technical room.

The building has a structure consisting of continuous foundations made of stone and concrete, walls made of solid brick or stone masonry, attic floor made of wooden beams and a wooden roof with covering made of bituminous corrugated boards. The interior walls were finished with washable paint or tiles, while the exterior was enhanced with decorative plastering. Concrete floors are covered with parquet or tiles. The building is not insulated. The windows are PVC with doble glazing.

The cold water supply is derived from the local network. The building is heated by a solid fuel thermal plant and a boiler, which are connected to steel radiators. The lighting system is comprised primarily of neon fluorescent tubes. The building lacks a ventilation or air conditioning system

**Figure 3:** School Building in Romania