



B.Sc.(Hons) in Built Environment Studies
BEN 3102 – Design Workshop
Occurrence D - A nearly Zero Energy residence

Unit Co-Ordinator:

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Tutors:

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Specific Instructions:

Date Assignment Set: 14th November 2024

Submission Date: 15th January 2024

Presentation Date: To Be Announced

Deliverables: Concept Drawings, Detail Drawings, Calculations, Design Strategy, Portfolio of Drawings and Visuals.

Credits Assigned: 3 ECTS

Method of Assessment: Portfolio Assessment, Viva presentation.

Description of Assignment:

Background

Various building typologies present different constraints in terms of what can be done to ensure that the building is sustainable from an energy point of view. Nevertheless, the guiding principles behind building energy sustainability remain the same. Residential building sustainable design is generally driven by client demands as well as policy requirements. At times there may be conflicting demands between the two and the role of the professional tasked with the project is to find the best possible solution.

The Setting

You are engaged to design a semi-detached residential villa set on two storeys, a ground floor and a

first floor on top of a semi-basement. The main facade overlooking the road faces East, the detached side facade faces North while the back facade faces West. The south facade abuts an abutting property. The owner of the villa requires the following spaces to be included:

- An open plan kitchen-living-dining
- A ground floor bathroom
- A study
- Two bedrooms
- An ensuite bathroom in one of the bedrooms
- A first floor bathroom
- A washroom on the roof
- A games room
- A music room to be used primarily during evening hours for the teaching of small music classes
- An outdoor pool
- A garage
- A workshop in the semi-basement

The property is to be sited over a (vacant plot/existing building to be demolished) measuring of 10m x 23m. The only planning constraints that you need to consider are the following:

- The indoor footprint floor area (not total area) should not exceed 40% of the total land area;
- The side garden should be 3m wide (minimum) from the building side facade to the third party wall;
- A front garden needs to be present with a minimum of 3m from the building to the perimeter line of the property; and
- The amount of vegetation should be 20% of the total land area.

Environmental Concerns

As per Legal Notice 47 of 2018 related to the Energy Performance of Buildings Regulations, since 2020 new buildings should be nearly zero-energy buildings, and you are to base your design strategy on this requirement. This means that the building should be both energy-efficient, and have enough on-site renewable energy-generation to offset the remaining energy requirement of the building. In this context the *Technical Document F Part 1: Dwellings Minimum Energy Performance and Building Envelope Requirements*¹ should be used as the starting guideline towards achieving the aims set in the brief.

¹ <https://bca.org.mt/wp-content/uploads/2023/06/Technical-Document-F-Part-1-Dwellings-Minimum-Energy-Performance-requirements-and-building-envelope.pdf>

Additionally, the following design considerations must be made:

Natural Ventilation

The villa needs to be appropriately ventilated using natural ventilation. Windows should be strategically placed so as to exploit this effect. No calculations are required, however you are expected to show basic best practice of how natural ventilation in a building may be enhanced.

Lighting and Building Materials

In accordance with Maltese legislation, the building envelope characteristics are to be at minimum compliant with *Technical Document F Part 1*. A careful consideration of building materials needs to be made. In order to minimise the use of artificial lighting, a careful qualitative consideration of natural lighting needs to be made.

Acoustics

The music room presents an important challenge to be considered in this design. Appropriate sound insulation is required to ensure that neighbours are not disturbed. In addition, the music room acoustics should be optimised. You need to perform some basic research on how such rooms are acoustically designed (no calculations are expected but qualitative considerations need to be made). Highlight also the type of insulating material that needs to be used for acoustic insulation.

Renewable energy

In order to satisfy the nearly Zero Energy Building requirement you need to consider the use of renewable energy sources particularly roof photovoltaics, provided that their visual satisfies the requirements of P48 of the DC 2015. Less mainstream renewable energy systems may also be considered, including small scale wind energy but careful research should be done prior to proposing these solutions.

Client's Brief

As a young professional, you are commissioned to propose the sustainable design of this semi-detached villa. Aesthetic considerations can be made but the purpose of your assignment is to optimise the building's sustainability and thermal comfort.

The preliminary site indicated by the Client is situated as shown in Figure 1 below.

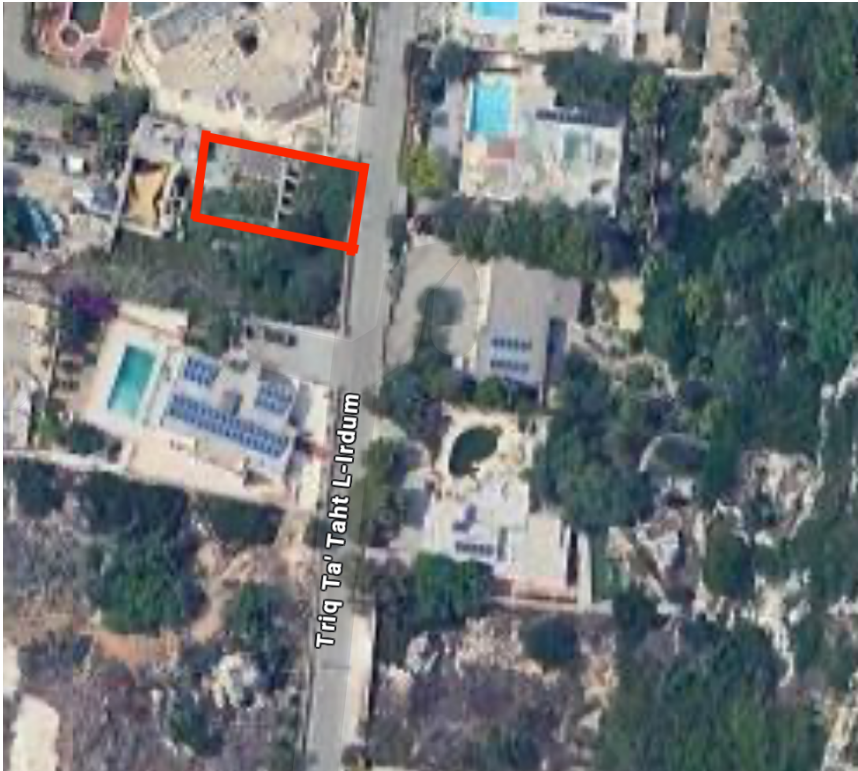


Figure 1 – Selected Site (co-ordinates 35.964396, 14.369107) - [Google maps](#)

Outcomes Envisaged / Assessment Criteria:

- Concept drawings including all floor plans and elevations and at least two sections.
- Detail drawings including at least a cross-section of one external wall, the roof construction, windows and apertures used and any shading devices.
- Calculations & technical report (10 pages max) including a description of the design strategy you are proposing for your building design.
- Portfolio of drawings and visuals.

Detailed Tasks:

- Floor plans, sections, elevations; and
- 3-D visuals or working model.

In addition, in the technical report the following is also to be presented:

Descriptions and calculations (where applicable) highlighting how the required environmental considerations are being addressed. Specifically, the following calculations need to be presented:

- *Indicative amount kWp installed and annual onsite generated electricity (kWh);*
- *A non-quantitative description of the salient features used by the building to enable/enhance natural ventilation;*

- *U-Value of external walls, glazing and roof, together with cross-sectional drawings, detailing the materials utilised. Calculations need to specifically show the thickness of the insulation material to be installed, based on the specification of the material selected;*
- *A non-quantitative consideration of natural lighting; and*
- *A non-quantitative consideration of room acoustics for the music room*

Mark distribution:

Site analysis	10%
Concept Drawings and 3D visuals	25%
Detail drawings	35%
Reporting and calculations	30%

Suggested Further Reading & Tools:

Online PV Calculator Software Tool

<https://photovoltaic-software.com/pv-softwares-calculators/online-free-photovoltaic-software/pvgis>