



Student **Green-Up** Artments

Monash University | Mixed Use MultiFamily

2020 Solar Decathlon

Project Report



Project Introduction

Victoria's Climate Change Act 2017 legislates for the state to reach net zero greenhouse emissions by 2050. The Premier and the climate minister have also set interim targets for the years 2025 and 2030. With targets being established for the state, major towns and suburbs within Victoria had gradually implemented schemes to help fast-tracking to achieve net-zero operations.

Glen Eira's City Council has a goal of achieving net zero emissions from city operations by 2030, and net zero emissions from the community by 2050. Green-Up Design Inc (GUDI) is committed to be a part of the green-evolving movement through providing a market ready housing design to meet the council's goals as well as the US Solar Decathlon's criteria.

The Glen Eira's City Council recognized the need to ensure all future housing projects to be **highly energy efficient** in order to accelerate the region's progress to achieve net-zero emissions.

With the increasing influx of international students and interstate students into our State of Education – Victoria, GUDI has partnered with a private investor to develop **Australia's first net-zero student apartment** at an available land lot located at Hawthorn Road, Caulfield South to not only meet the growing demand of student accommodations, but also **pioneering the new market for net-zero housing in Australia.**

The new building – Student Green-Upartment (SGU), is equipped with cutting-edge technologies to improve the building's performance. Unique operations are designed to incentivise residents to be more energy conservative, thus creating a more eco-conscious community. Built with varying room plans, SGU welcomes students from all financial backgrounds to have the opportunity to experience living net-zero.



**GLEN EIRA
CITY COUNCIL**

Project Summary

Student Green-Upartment (SGU) is a mixed-use multifamily student apartment located at Hawthorn Road, Caulfield South, Victoria. It provides ecofriendly student housing for predominantly international students and interstate students who are pursuing tertiary education in Victoria. Our design team, Green-Up Design Inc (GUDI), consisting of students from multidisciplinary backgrounds have designed SGU to be a 5-storey net-zero student apartment that accommodates 73 dwellings with varying apartment unit types on the 2nd level – 5th level. SGU's entirely commercial ground level unit is comprised of 3 different businesses, one of which is proposed to be a minimarket run by Independent Grocery Alliance (IGA), that provides convenient access to food supplies and everyday items for residents of SGU as well as the community living close-by. A skill development training centre and a language centre occupy the remaining commercial units, providing the platform for skill-polishing to the community.



Figure 1. **SGU Exterior street View**



Figure 2. **SGU Exterior render**

Design Strategy

Our project team has focused on applying many sustainability features to Student Green-Upartments. The architectural design of the multifamily building adopts Passivhaus principles, maximizing passive daylight, seasonal shading, and natural cross-ventilation air while maintaining symmetry of floorplans to enable modularity. Methods to improve building performance include high R-value insulation for envelope, incorporating highly efficient heating, cooling and ventilating technologies, and centralizing utilities to minimize transmission loss and materials costs, and deploying innovative operational strategies. SGU also leverages from different on-site renewable and recycled source through integrating solar photovoltaic (PV) system, rainwater harvesting system and grey water recycling system.

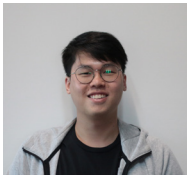
Project Specifications

Site	Location:	371 Hawthorn Road, Caulfield South VIC 3162, Australia
	Climate Zone:	6 (closest equivalent US Climate Zone: 3)
	Lot Size:	1500 m ² (16146 ft ²)
	Building Footprint:	1188.54 m ² (12793 ft ²)
	Total Building Floor Area:	6254.96 m ² (67328 ft ²)
Occupancy	Housing Type:	Mixed-Use Multifamily Housing
	Stories:	1 commercial ground level; 4 residential upper levels
	Dwelling Units	73 dwellings (41 studios; 22 two-bedrooms; 10 four-bedrooms)
	Target Market	International and interstate tertiary students
Energy Score	HERS Index Average	Without PV system: 31.9 ; With PV system: -3.1
	EUI Rating:	Target EUI - 86 kBtu/ft ² .year Source EUI - 13.4 kBtu/ft².year (passed)
Costs	Construction Cost	18.8M \$AUD (11.45M \$USD) // Highest estimation
	Utility Cost	72 \$AUD/unit.year (45 \$USD) // Average

Technical Specifications

Building Science	Foundation Insulation:	R34
	Slab Insulation:	R20
	Wall Insulation:	R39
	Roof Insulation:	R62
	Window:	Type - Triple glazed windows with Argon (Ar) gas filling Performance - SHGC: 0.246; U-Value: 0.18
Heating, Cooling, Ventilating	Heating/Cooling Source (Water & Space):	Air-source heat Pump (Steibel Eltron)
	Ventilation	HRV (Steibel Eltron)
	Space Heating / Cooling Method:	Hydronic Heating (Steibel Eltron)
On-site Generation	PV System Capacity:	161kW
	Inverter Capacity	165kW
	Battery Capacity	135kW
	Rooftop Water Storage	3000L Rainwater & Greywater Overhead Tank

Team Profile



Aeon (Sing onn) Lee, Leader

Bachelors of Environmental engineering (Honours)

Aeon is a fourth year environmental engineering student who has a keen interest in sustainability, built-environment and team coordination. He specializes in the air environment in this project with his experiences in local air pollution and passive design for building sustainability.



Jordan (Jia Theng) Lim, Co-Leader

Bachelors of Environmental Engineering (Honours)

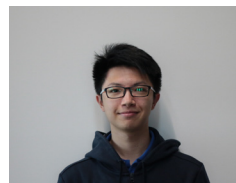
Jordan specialises in energy and built environment in his engineering degree. He has a one-year-long experience working in a solar project company as a student engineer and has completed an 8-week professional training course on net-zero building conceptual design provided by Delft University.



Logan Lay Operations Contest Lead

Bachelors of Civil Engineering and Finance

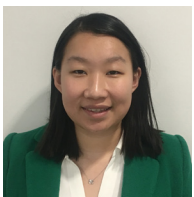
Logan is a third year engineering student who has joined the team in order to gain an experience of building construction and team management. He has had teamwork experience before in student club committees but overall is fresh to the processes required in net-zero construction.



Wei-Chih Lin (William)

Bachelor of Mechanical Engineering (Honours), 4th Year

Wei-Chih is a final year mechanical engineering student who has a broad field of interests. He focuses his studies on researching fluid dynamics and mechanical systems. His contributions to the project are on household appliances selection, green wall design, and assisted on building management system design. provided by Delft University.



Bec Lin, Architecture Lead

Bachelor of Civil Engineering & Architecture, 6th Year

Bec is a final year student with a strong passion for innovative and sustainable design. She has worked in both Architecture and Engineering industries and has a particular interest in the dialogue between disciplines, as well as the integrated holistic design process. Her contribution to the project was centred around the architectural design.



Manasa Marimakanahalli Krishnareddy

Masters in Advanced Civil (Infrastructure Systems) Engineering

Manasa is a final year Masters student who is interested in designing and analysing building structures. Her contributions to the project was designing the groundwater system and building envelope (footing, floor slab and ceiling) of the mixed-use multifamily building.



Sai Sowmya Asadi

*Master of Advanced Civil engineering.
(Infrastructure systems)*

Sowmya is in her final year of civil engineering course and showcases a variety of skills. Her interests mainly include, design and analysis of structures. Her contribution in the project was in the design of building envelope and science, performing technical drawings and assisted in the water system of the design.



Sai Nallamaddi (Alok)

Master of Advanced Mechanical Engineering

Alok is in his final year of mechanical engineering course. He has experience in working in building and logistics industries. His interests include additive manufacturing and industrial engineering. His contribution in this project was in the design of building envelope components in accordance with the building science guidelines.



Nikhil Ghanshyam Kathe

Master of renewable and sustainable energy engineering

Nikhil is pursuing his degree in renewable & sustainable energy engineering and has been gaining professional experience while interning in the energy industry. His emphasis is on adapting clean energy technologies and making a real impact on carbon emissions.



Russell Farmer Pres. lead

Bachelor of Civil Engineering (Honours) & Architecture, 3rd Year

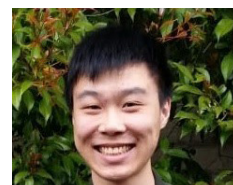
Russell is an Engineering and Architecture student who has an interest in the social impacts of innovative design. His major contribution to this report has been through the graphic design, and input on the narrative and architecture decisions shaping the project.



Angel Cao

Bachelor of Mechanical Engineering, 3rd Year

Angel is a mechanical engineering student, joining the team due to her interest in green energy and sustainable design. Her main contribution has been assessing the demographic and surveying the site of construction.



Alvin Yeung

Bachelor of Mechanical Engineering & Finance, 4th Year

Alvin is a student studying both Mechanical Engineering and Finance and joined due to his interest in pushing the world towards a greener future. His main input into the project has been in the design and specification mechanical systems such as HVAC and water heating.

Faculty Support



Brandon Winfrey (Faculty Lead)
Dept of Civil Eng., Lecturer
(Water Eng.), PhD Environmental
Science & Tech.

Brandon is a current lecturer and an associate professor in Monash University. His current research focuses on the nexus of ecology and engineering, specializing in sensitive urban design, ecological engineering, wastewater management, novel passive treatment systems and ecosystem services. His expertise in water and ecological engineering has greatly assisted our team in designing our project's water system and infrastructure's sustainability.



Victor Bunster (Technical Advisor)
Dept of Civil Eng., Faculty of Arts
& Archt., Future Building Initiative
Lab Research Fellow

Holding a PhD in Architectural Science and Technology from University of Melbourne, Victor was a registered architect in Chile for the low-income housing construction industry, and a FONDECYT Postdoctoral Research fellow at the Centre for Sustainable Urban Development (CEDEUS), Pontifical Catholic University of Chile. During the design stage, Victor has mentored our team in energy modelling and building science.

Industry Engagement

STIEBEL ELTRON Stiebel Eltron

Stiebel Eltron is a future driven company that has a track record in manufacturing innovative, efficient and reliable hot water systems, storage, heap pumps, filtration systems, and ventilation systems with heat recovery. Partnered with our design team, Stiebel Eltron provided essential guidance in areas of mechanical equipment and duct layouts.

JACOBS

Jacobs Engineering Group

Jacobs engages in the provision of diverse range of technical, professional, and construction services to large industrial and commercial projects. Committed to sustainability, Jacobs emphasizes in ensuring long-term business resilience while positively contributing towards the economy, society and the environment. The Sustainability Department of Jacobs (Melbourne) has provided us guidance in constructing a design plan during the early stage of our design



NEFIN Group is a solar development company that delivers solar projects across the APAC region. The company designs, finances and manages constructions of commercial scale to large scale solar systems, focusing on clients who are committed to the RE100 global initiative. One of our design team member is a student employee from NEFIN and the company has helped the team in reviewing solar system layout and provided advices to optimize solar generation