3.2 ENERGY AND ENVIRONMENTAL COMFORT

Next to water, energy is one of the most important considerations in the Concept Plan. Reducing energy demand is the first step toward implementing a sustainable design strategy for a building or a site. Only after reducing the demand can systems be efficiently designed to supply the buildings or public spaces with power and cooling.

The massing of building structures becomes critical in providing access to daylight, natural ventilation and access to direct sun for both buildings and public spaces as a way of promoting energy efficiency whilst maintaining high levels of environmental comfort. The intention is to facilitate the implementation of passive design principles of future buildings within the site.
A sustainable approach to public energy uses such as public lighting is also envisaged as a way of reducing energy demand of the public domain.

3.2.1 Base Strategies

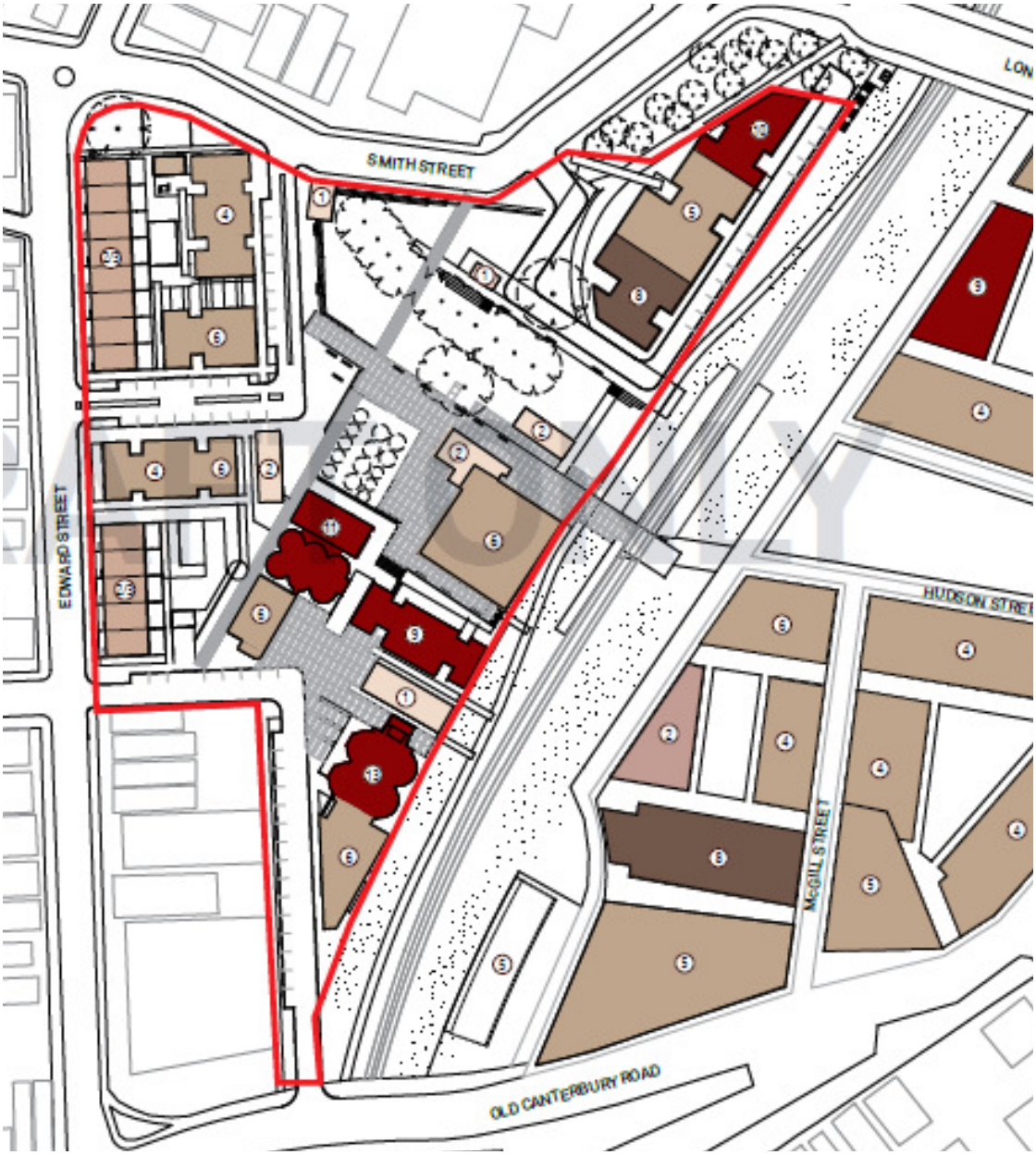
The following measures are considered as Base Strategies concerning the overall sustainability aspects of the Concept Plan:

SOLAR ACCESS AND DAYLIGHT TO RESIDENTIAL DWELLINGS AND PUBLIC SPACES

The massing and building heights as proposed by the Concept Plan takes into consideration the need for residential dwellings and public spaces to have access to direct sun throughout the year, especially in winter, when the need for heating becomes critical to maintain thermal comfort.

Building massing is proposed in a way to allow good solar access and views to the sky to residential developments in summer and especially winter, maximising access to direct sun and increasing the potential for passive heating, reducing energy associated with space heating (as shown on the next pages). This allows enough flexibility for these buildings to be designed based on passive design principles taking advantage of the local climatic conditions.
Guaranteeing solar access to public spaces, also more importantly in winter, contributes to the activation of these spaces during colder months, enabling year round outdoor activities and potentially attracting investment for local business opportunities, such as small scale service retail.

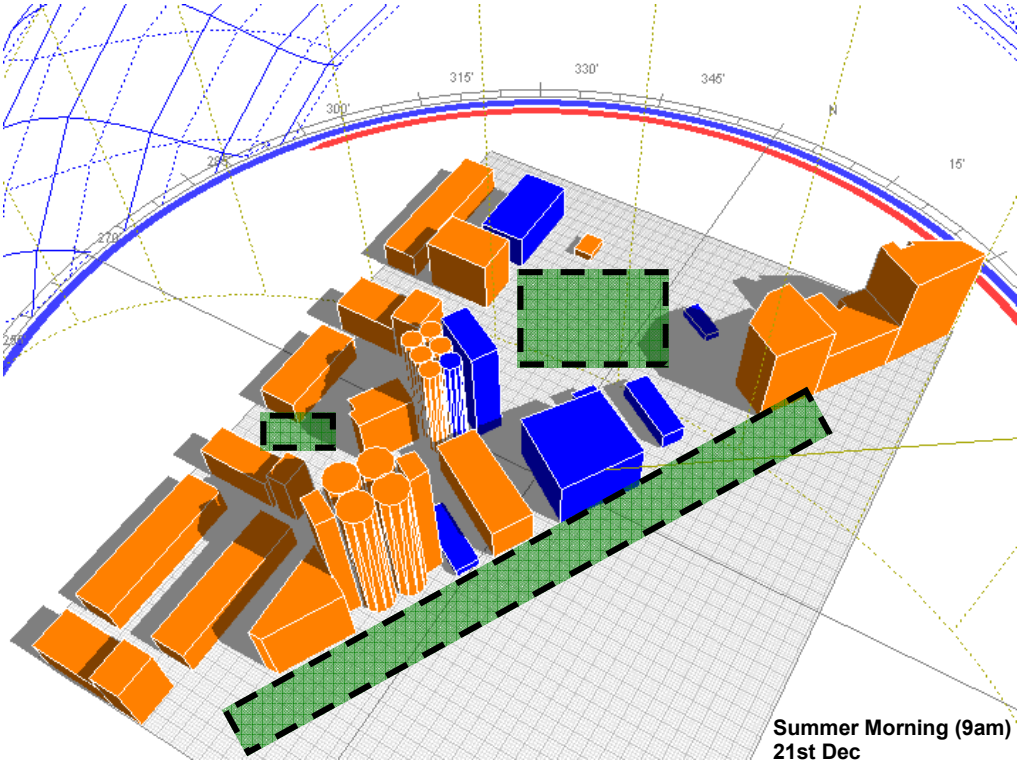
The proposed spacing between building structures maximises the access to views to the sky which increases access to diffuse daylight to occupied spaces. Daylight access can significantly reduce electrical energy use and operating costs by reducing the use of electric light. Daylight access can also reduce cooling loads because well-proportioned and shaded windows with the best orientation to the sun will both lower the use of electric light and reduce the amount of heat generated in spaces.



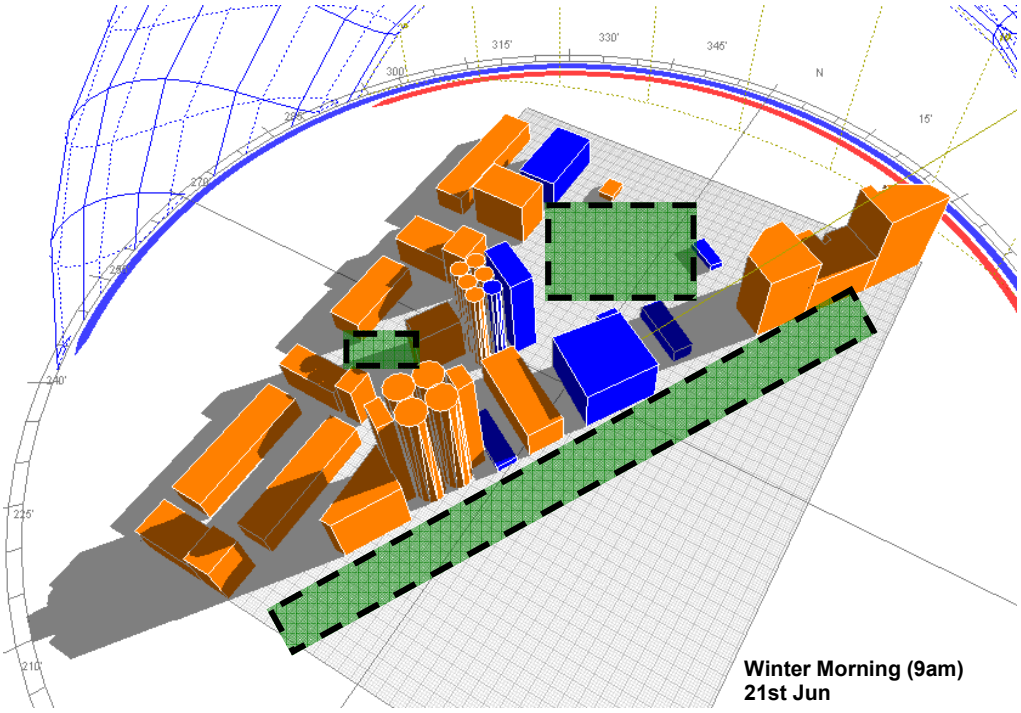
The massing and building heights are arranged in a way that allows good solar access to residential developments in summer and winter, maximising access to daylight and increasing the potential for passive heating, reducing energy associated with space heating. The image on the left shows the proposed heights for building structures and dwellings

Solar access study shows residential buildings (shown in orange) with good solar access both in summer (top) and winter (bottom) mornings with minimal overshadowing, which contributes to passive heating of dwellings, reducing energy consumption associated with space heating (images taken for 9am).

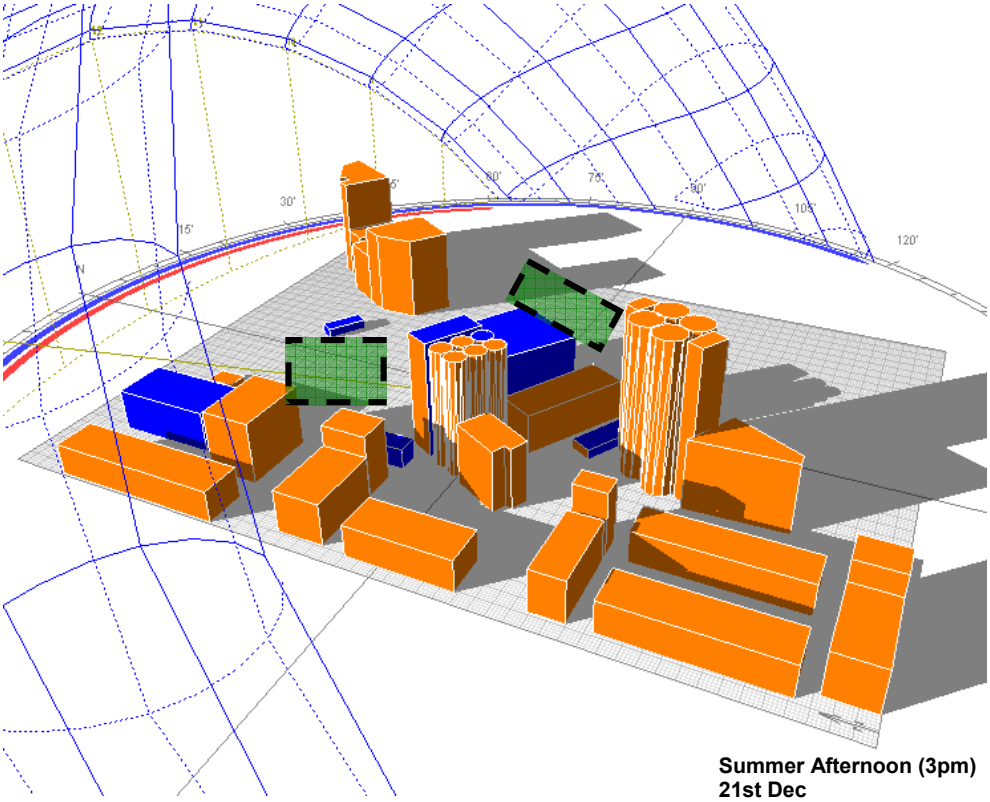
Good solar access is also achieved to major public spaces (shown in green), contributing to amenable microclimate and outdoor thermal comfort, stimulating outdoor activities amongst the community



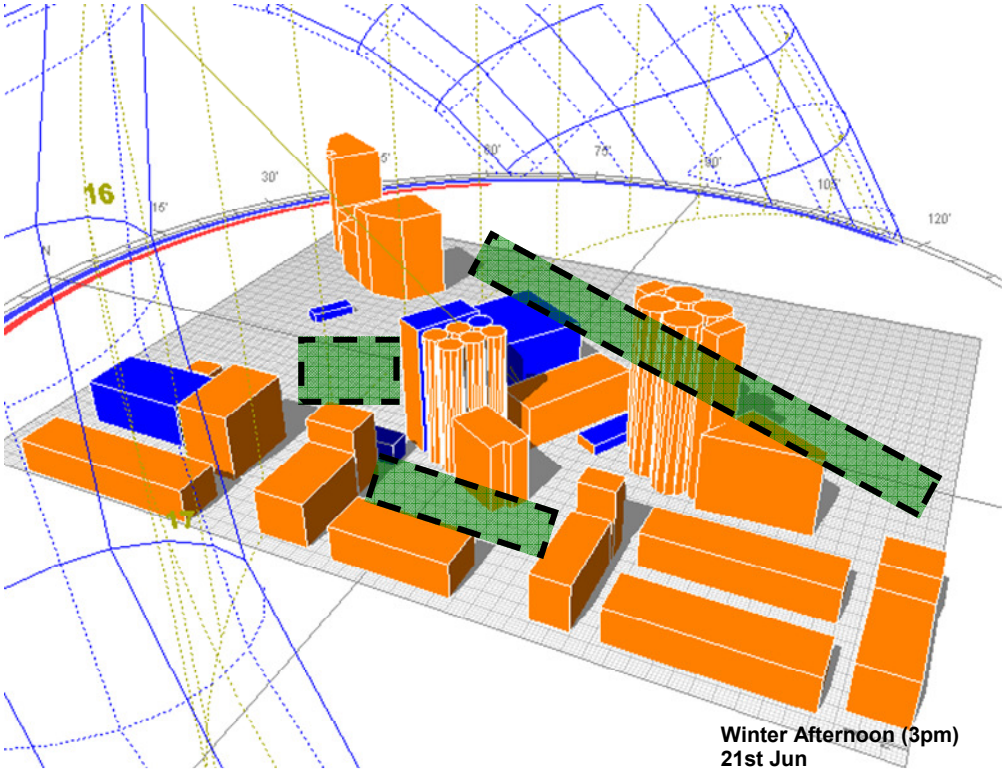
Summer Morning (9am)
21st Dec



Winter Morning (9am)
21st Jun



Summer Afternoon (3pm)
21st Dec



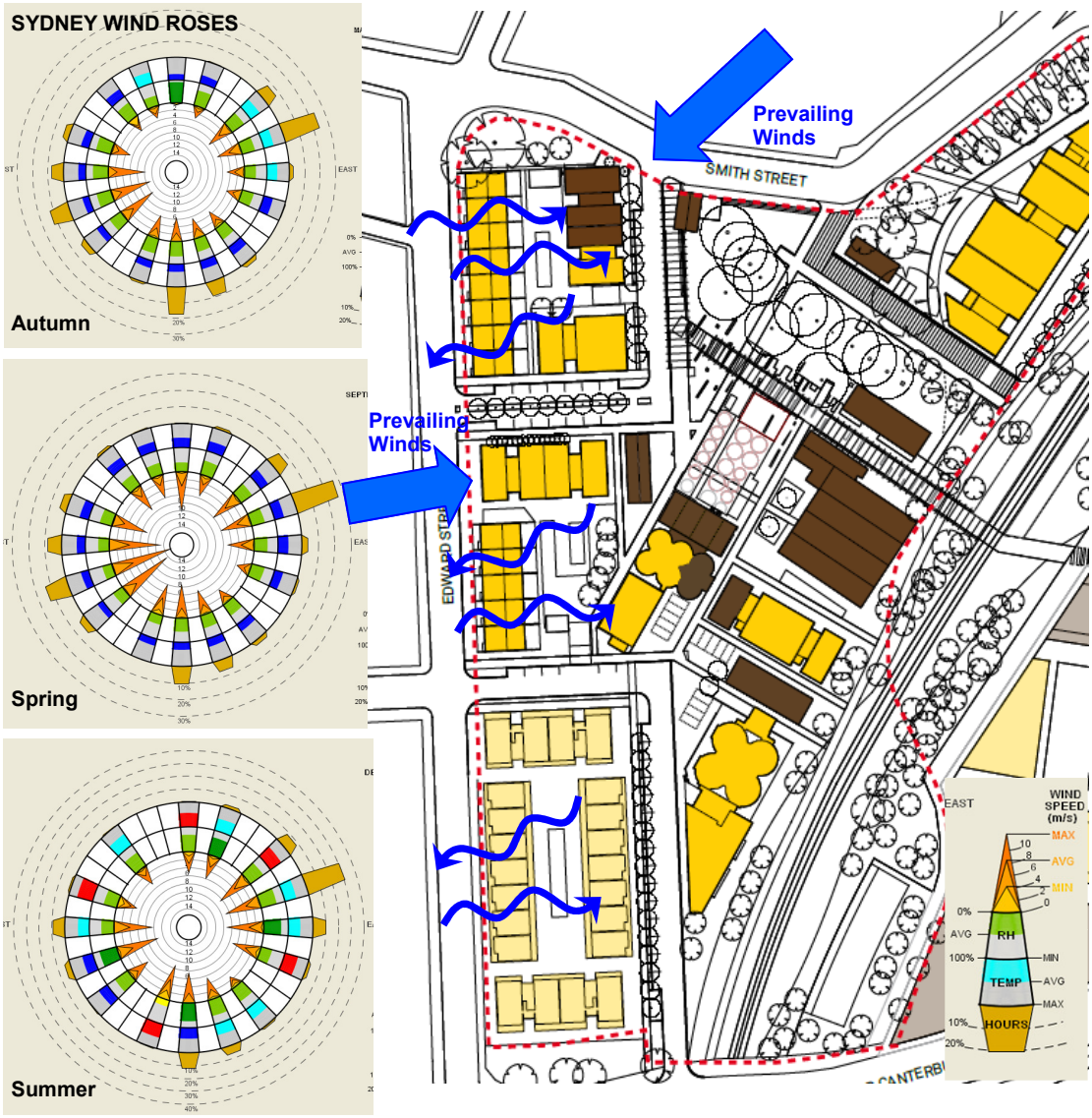
Winter Afternoon (3pm)
21st Jun

Solar access study shows residential buildings (shown in orange) with good solar access both in summer (top) and winter (bottom) afternoons with minimal overshadowing, which contributes to passive heating of dwellings, reducing energy consumption associated with space heating (images taken for 3pm).

Good solar access is also achieved to major public spaces (shown in green), contributing to amenable microclimate and outdoor thermal comfort, stimulating outdoor activities amongst the community

POTENTIAL FOR NATURAL VENTILATION AND MICROCLIMATE COMFORT

Building orientation and site planning help maximise prevailing wind capture and minimise the dependence on mechanical cooling systems to deliver thermal comfort. It was observed that there is the potential to achieve effective natural ventilation to a significant proportion of the residential units within the development given their orientation, location and massing. Prevailing winds come mostly from the West and North East during warmer periods of the year at relatively low temperatures. This could benefit the double sided dwellings that, according to the Concept Plan face the direction of prevailing winds, as demonstrated in the figure below:



At a whole-of-site level, it is acknowledged that noise from traffic and aircraft may impose limitations to conventional openable windows allowing natural ventilation. Potential solutions for future investigation will be conducted on an individual dwelling or group of dwellings basis and may include options such as noise baffled ventilation openings or trickle ventilation. The feasibility and implementation of natural ventilation shall be evaluated on an individual basis during future stages of the design, but is implicit in the configuration of buildings in the concept plan.

PUBLIC DOMAIN LIGHTING

Sustainable developments should take into consideration the concept of “dark sky,” which is the terminology used to describe the minimisation of light pollution. Light pollution can occur when an outdoor light fixture throws unwanted light onto neighbouring properties or up into the sky. In dense urban areas light pollution has all but obscured the brightest stars from visibility. In addition, light pollution affects the migratory, predatory, and mating behaviours of several species. The design team will attend to diurnal patterns and biodiversity by minimising dark sky issues by proposing **low cut-off luminaires that direct light on surfaces** and not toward the sky. The team will also design site lighting in accordance with Australian Standard 4282-1997 (Control of Obtrusive Effects of Outdoor Lighting) and target that at least 95 percent of outdoor spaces do not exceed the minimum requirements of AS1158 for illuminance levels.

In order to minimise energy consumption by public domain lighting, **PV powered lamp posts** will be considered as a potential solution for public lighting. These lamps are emission-free and provide a visible reference to sustainable design features incorporated into the development.

LED fixtures can also provide high efficient lighting for public spaces such as steps and walkways, being also very attractive from an ESD perspective due to their long lifespan.

3.2.1 Active Strategies

The following measures are considered as Active Strategies concerning overall sustainable aspects of individual buildings and structures open for refinement during the design.

ROOFTOP PHOTOVOLTAIC PANELS

Although the current cost of PV cells is quite high in comparison to other options, the expense of a PV system has been declining and is likely to continue to do so. The on-going maintenance and operation costs of PV are relatively low for an energy source that is considered “carbon neutral.” In addition, PVs are a highly visible sustainable strategy that would make a bold statement about the environmental commitment of the new site and broader community. The electricity generated from PV cells can be used for common area lighting or exterior lighting and car park lighting. It is for these reasons that provisions for future PV integration will be considered in the design of building structures. The feasibility of that shall be evaluated on an individual basis under financial and environmental considerations.

The Concept Plan includes amongst the proposed buildings relatively large available roof areas, that may be appropriate for future installation of PV panels integrated with the building's cladding system. The massing and heights of proposed buildings allow several hours of solar access to rooftops, which enables the installation of PV panels with high efficiency. Some of the taller buildings to the East of the site, may take advantage of unobstructed facades for the installation of the panels.

SMART METERS

The installation of smart meters for each dwelling is suggested so that occupants can determine real-time consumption for electricity, water and gas, as well as peak demand pricing (if feasible), to future-proof the development for the Australian adoption of smart grid infrastructure. The system may allow future monitoring of site-wide energy consumption. The feasibility of installing smart meters shall be evaluated on an individual basis under financial and environmental considerations.

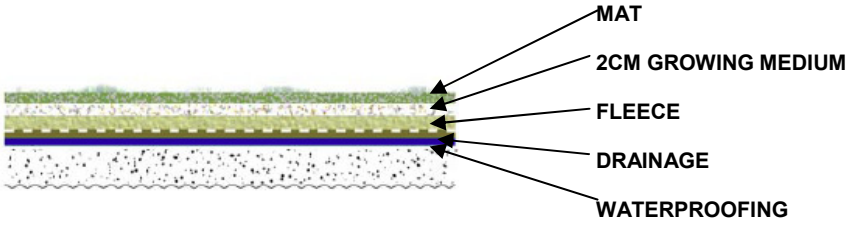
TOP LEFT Standard light fixture that can be energised with solar photovoltaics installed on the fixture itself. There are many such fixtures currently on the market.

TOP RIGHT The BedZED (Beddington Zero) residential development in the UK has a whole of site approach to PVs installed over 86 homes. Contributing to its Carbon Zero objectives and providing a strong visual sustainability statement

RIGHT LED light fixtures can provide highly efficient, directed light for walkways and steps throughout the site. The color temperature of white LEDs has improved significantly in the past few years and new fixtures are increasingly available on the market. LEDs are particularly attractive since they have long life spans, sometimes as long as 12-15 years without needed replaced.

GREEN ROOFS

The benefits of green roofs include adding aesthetic value, roof protection, improvement in micro-climate, contribution to nature, biodiversity, reduction of the "heat island" effect, and integration with local surroundings. Studies have indicated that green roofs can reduce cooling loads by decreasing the solar gain on a building's roof. The project will consider the inclusion of green roofs and roof gardens on proposed buildings and the technical feasibility shall be evaluated on an individual basis.



ABOVE There are many proprietary modular green roof systems on the market. Some investigation would be necessary to determine what type of system would work best each building. A modular system such as the one shown in this photograph eases green roof installation, with pre-manufactured substrates, aluminium trays to protect against root encroachment, and recommended soil and plant varieties, depending on climate. This is a typical diagram of a built-up sedum mat green roof sys-