Waterloo Estate - Levels of Sustainability

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1. Introduction

For a city, a neighbourhood or a building, sustainability ambitions can be set at different levels. Not every aspect can always be realised at the maximum level and sometimes a higher level on one theme means another theme can only reach a lower level of sustainability.
Thinking in different levels of sustainability makes it possible to choose what kind of urban environment is desired and achievable. In this document three levels of sustainability are distinguished:

A. The ultimate level of sustainability in which the highest possible level will be realised. In general terms, this means that the use of resources is kept to a minimum, and the waste is reused/recycled, the ecological quality of the urban environment is high and the spaces designed are of high comfort and usability.
B. This is a moderate level of sustainability, which aims to realise certain sustainability measures that are advancing the current situation, such as a partly reuse of waste materials, partly recycling of water and other effluents, and a reasonable level of ecological quality.
C. This is the standard level, Business as Usual. Current practice is applied in the design of the city and in urban environments waste is treated elsewhere, or pollution is still occurring, and the ecological and spatial quality are minimally functional.

For every theme these levels imply different measures in the urban environment. The descriptions in this document give as concrete as possible the measures that fit with each ambition and illustrate the trade-offs of every choice. Moreover, the levels are illustrated with practical examples and images as applicable

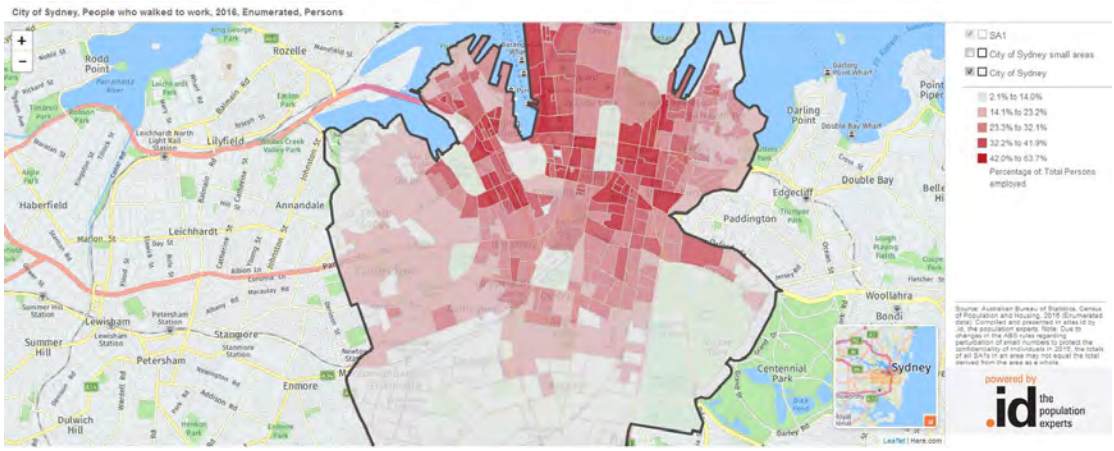
2. Traffic

2.1 Introduction

The highest level for traffic is to swap the hierarchy of importance from car-public transport-cyclist-pedestrian to give preference to pedestrians and cyclists, the delivery of goods and services over the car. Concretely this means for the design of the road to create more space for pedestrians and cyclists to move and spend time, and allowing the car in the street only to deliver people and goods to their houses. The parking then would be concentrated outside the Estate or neighbourhood. This principle is currently used in the London city centre in a combination with pricing the use of space (for car-use it is more expensive than public transport, and walking and cycling are free), and there are heaps of examples of car-free or car-guest neighbourhoods around the world.
Lower levels of sustainability would step-by-step increase the importance and appearance of the car in the public space of the neighbourhood, with the business as usual level being that everyone can park their car freely on their own doorstep.

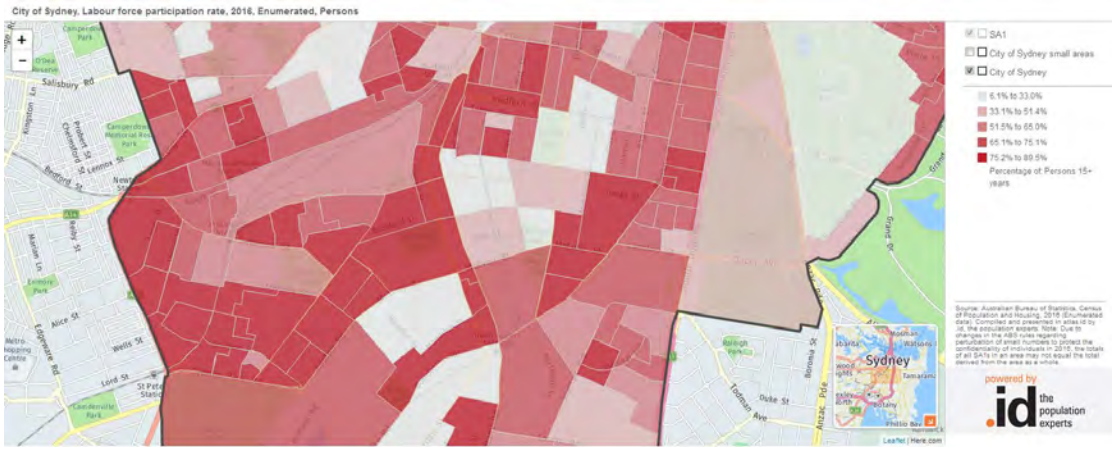
Current situation

2.1 Cycling to work modal share



2.2 Walking to work modal share

2.3 Households without a car



2.4 Labour force participation

2.2 Sustainability levels

2.2.1 Level A

- Car free public space. Within the neighbourhood there is no space for private parking or cars in the streets. Cars can come to the neighbourhood to deliver goods or people and in case of emergencies and daily services. All other cars remain outside the neighbourhood and are parked at the edge of the area. Inside the neighbourhood the streets are designed to accommodate cyclists and pedestrians. Distances are short and walkable to services and public space is designed so people feel comfortable and safe, and appreciate their environment
- Priority for pedestrians and cyclists: in the public space people who walk and/or cycle have the most prominent space in the streets, and have priority crossoing streets.
- No private car parking on streets: all cars are parked outside the neighbourhood, in parking garages, preferably these facilities are as small as possible, people use the car only for longer distances, and hiring a car then makes more sense (Go Cart!) or make use (in the future) of autonomous cars.

- Public transport close to every house; light rail system. Centrally through the neighbourhood frequent public transport is arranged, preferably a light rail system, that connects the neighbourhood with central station, the city centre and the airport
- Anticipating autonomous vehicles in street design. The design of streets is taking into account the potential of autonomous vehicles. These includes physical pointers to guide the vehicles, and hop-on, hop-off places.

2.5 Car free neighbourhood: GWL-area, Amsterdam

2.6 Internal block space, car free: GWL-area, Amsterdam

2.7 Car free spaces in Breisgau, Auban, Freiburg

2.8 Car free spaces in Vauban, Freiburg

2.9 Car free public space, Hammarby, Stockholm

2.10 Car free public space, Hammarby, Stockholm

2.11 Hammarby, Stockholm

2.12 Priority for public transport, lightrail, Vauban

2.2.1 Level B

- The car is guest, streets are designed with minimal space for the car. This means the car can reach every front door, but is a guest in the street. The streets are deliberately designed to slow down car speed and expect the cars to give space to cyclists and pedestrians on the road.
- Main streets have separate cycling space. Every major street is designed in a way a separate cycleway is part of the road, separated from the main street by physical barrier and a different coloured space (green or red).
- In 50% of the area no private car parking. The parking is solved for 50% in communal parking spaces and/or buildings, while the other 50% is available in the public space.
- Frequent bus services run trough main streets, and connect the neighbourhood with other parts of the city.

2.13 Car is guest in the street design, Vauban, Freiburg

2.14 Continuous cycleway, the Netherlands

2.2.1 Level C

- Car is welcome in every street. The car determines the way the street profile is designed. In most of the streets the car is central and can occupy the space it needs/wants.
- Cycling is possible in shared spaces on streets, noted by the cycle sign on the street surface.
- Private car parking in front of every house, and in every street. Everyone could have a private parking space in front of their entrance,

- Bus connections are available, but in a lesser frequency and connecting to lesser number of places in the city than level B.

3. Water

3.1 Introduction

A high level of sustainability for the theme water encompasses the accommodation of surpluses of rainwater to prevent flash-flooding and the cleaning and reuse of grey and black water from households. As we know the concrete in urban areas, roofs and pavements increase the problems of discharging rainwater. The water accumulates in the creek system, which cannot cope with it and this leads to flooding in the streets and buildings. This problem is relatively simple to overcome, but it requires smart design of the public space. If water can be stored on rooftops, streets and parks and other green spaces, even temporarily, it will be released slowly to the major creek system and not cause any flooding. Green roofs, temporary green basins and water squares are methods to capture water, store it and release it slowly. A famous example of a water square is the Rotterdam Benthem Square, where a public school ground is in use as a sporting court during normal circumstances, but once it starts raining this square fills up and stores the rainwater for a short period. After the rain has stopped the water is released into the bigger system.

Dealing with grey (all household water except toilet water) and black water (toilet water) requires well-controlled natural treatment. Grey water can be treated in public spaces and form a green strip in streets or parks, and can be reused inside homes after cleaning, for instance as toilet water. Water Sensitive Urban Design (WSUD), as practiced in the Netherlands and Australia, offer numerous examples of grey water treatment. Black water treatment is more sensitive, but could under the right circumstances also be applied in public spaces, such as the Portland City Council has proven.

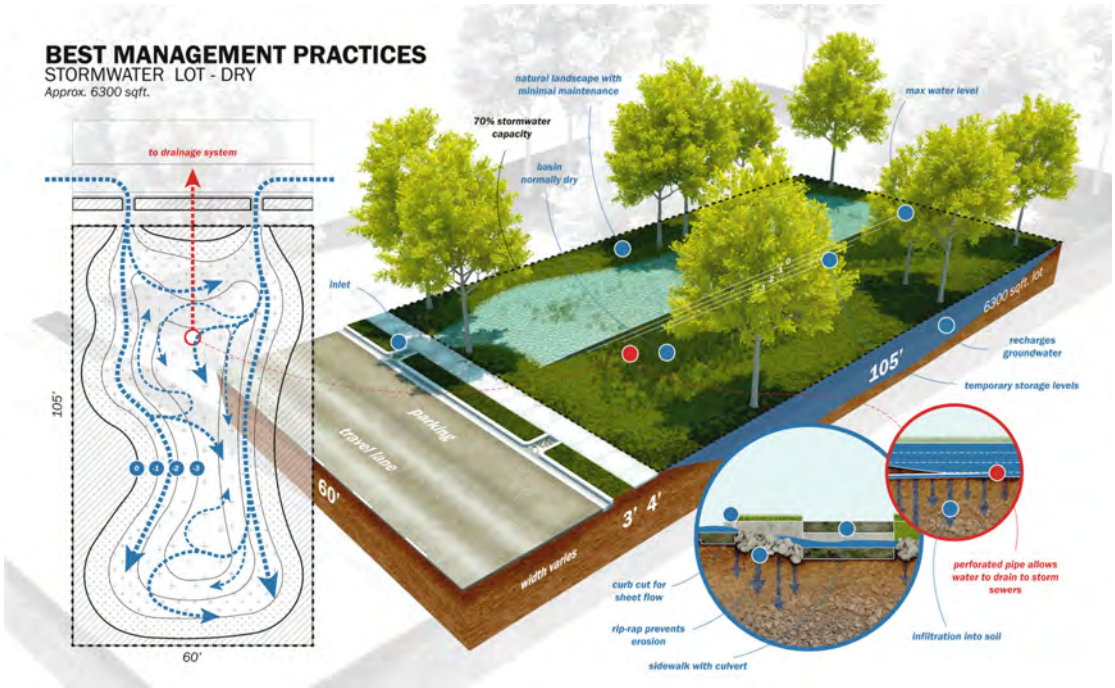
3.2 Sustainability levels

3.2.1 Level A

- Full Water Sensitive Urban Design (https://watersensitivecities.org.au).
- All the rain- and storm water is captured and stored in the area, and following storage the water is infiltrated in the soil or released slowly to the larger system of discharging water from the city, eg. the creek system (the city as a sponge).
- In every street there is space for capturing rainwater, treating it and storing it before it will be released to the soil or the larger water system (creek/river/Sea).
- Water squares are applied in the public space. Water squares are squares that in periods without rain are in use as a public function, such as a sporting feature, a school playground or other. Once it starts raining the water of the neighbouring buildings and public spaces is led to the water square, which slowly fills up and stores the water for a short period. After the rain has gone, the water is slowly released to the urban water system and discharge to larger water bodies.
- All grey and black water is cleaned onsite and reused. Grey water is the water that comes from all household uses except toilets, and this water can be cleaned in a natural way in the public space. This requires the public space be designed

with the facilities (fig 3.8) in the streets and squares. Black water requires cautious design, as this water can be cleaned organically, but must not get in contact with people using the public space.
- Green roofs (capturing water) on every building. These roofs can capture a great deal of rainwater and can play an important role in reducing the load of water entering the public space. It is not necessary for these green roofs to be accessible for the public, only for maintenance is sufficient.

3.1 Water boulevard, Baharash architects



3.2 Urban water retention in green space

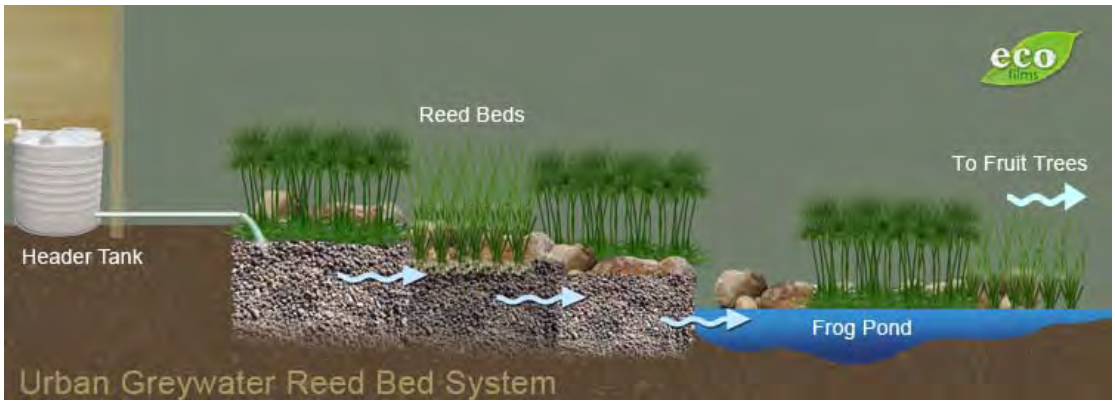
3.3 Water retention Piekenhoef, the Netherlands

3.4 Water sensitive urban design (WSUD), street design

3.5 Water square Rotterdam, Benthemplein

3.6 Grey water treatment garden

3.7 Inkerman Oasis Grey water treatment, Melbourne



3.8 Urban grey water reed bed

3.9 Blackwater treatment, Portland US

3.10 Black water treatment inside infrastructure

3.2.2 Level B

- 70% of the rain- and storm water is stored and captured in the area in a way similar to the description under level A.

- Part (2/3) of the streets and parks are used to store water and include these facilities in the street design.
- 50% of all grey water is cleaned and reused on site in facilities that are part of the urban street design.
- Grey and black water is separated in every household and the black water is transported to the water treatment plant as a separate flow to be treated there.
- Green roofs appear on 50% of the buildings.

3.2.3 Level C

- One or two pilot projects of Water Sensitive Urban Design are realised in one-two streets.
- Grey and black water is not separated at household level and collectively discharged to the water treatment facility.
- Green roofs are realised on 10% of buildings.

4. Nature

4.1 Introduction

In an urban context it is hardly possible to create a complete natural situation, but there are many measures that can improve biodiversity and the quality of nature. In combination with the water features mentioned before the habitat for local species can be improved. Besides this, implementation of green roofs helps to increase the quality of nature. The main effort that can be made is to create green urban corridors connecting with the larger ecological grid of the city, in order for animals and plants to migrate to and from green spaces. Even though large green space may not be available, the connection of all smaller spaces and corridors creates an ecological system at a larger scale. Finally urban trees play an important role for the urban ecological quality, but, as they provide a lot of shade, they also mitigate the urban heat island effect, the effect that because of all the concrete and pavements in the city, urban temperatures can rise as much as 5-9 degrees above those in the countryside. The lesson here is to keep existing trees as much as possible, and plant many more in public spaces.

4.2 Sustainability levels

4.2.2 Level A

- The ecological values of the area are similar as to a natural environment. Though an urban area is never the same as a natural habitat, the ecological values can be comparable to natural environments.
- The biodiversity, eg. number of different species that are found in a certain area are equal to the biodiversity of a nature reserve.
- Creating a natural habitat in the city requires places and connections of ecological corridors. The places could be rooftops, parks and water features. The habitats realised in these spaces should be designed in a way that as many different species could occupy the space. A good example is the building in Central Park, where colonies of bees, frogs and several birds of prey nest and live.
- Use tree cover (shade) in every street and square. This is essential to create as much shade as possible to deal with future higher temperatures and the temperatures that rise in urban environments as a result of the amount of concrete and pavements. This is called the urban heat island effect and can lead to 5-9 degrees higher temperatures than in the countryside. Trees mitigate this effect by cooling the environment.
- Create ecological connections that are appearing in a dense network, so that animals and plants can easily migrate between corridors, and local ecological areas, in all directions.
- The realisation of urban nature measures in and/or on every building. These include nesting boxes for birds, nesting facilities, refuges for bats and green roofs, so these can be connected to other buildings and form a network of places

animals can migrate to and from there connect to other valuable ecological zones in and outside the city.

4.1 Green roof, use of abundance of flowers

4.2 Full tree cover at square/park

4.3 Ecological corridor Gent, Belgium

4.4 Under roofs gaps for nesting birds

4.5 Spaces for bats in buildings, Office building Zeist (WWF)

4.6 Tree cover

4.7 Street trees

4.8 NYC street trees

4.9 Sydney street trees

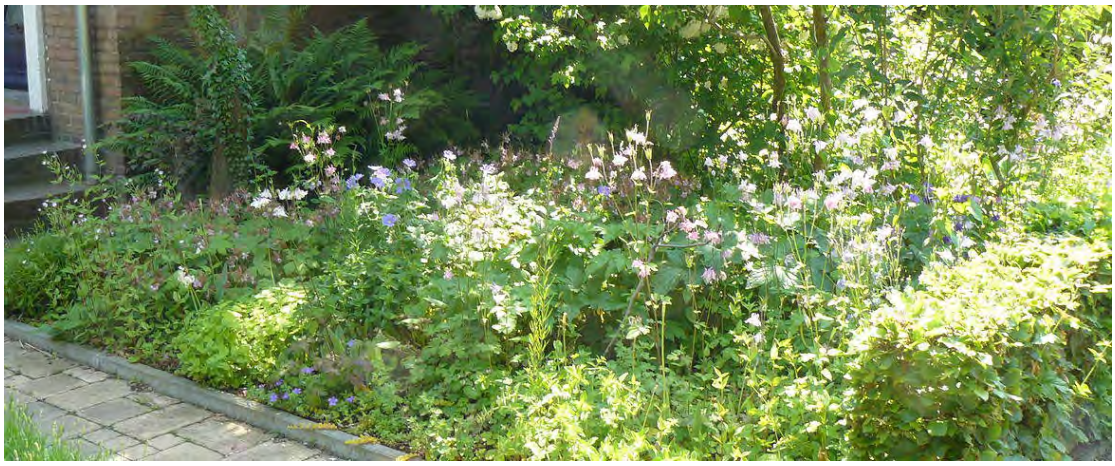
4.10 Figs, Napier St. Paddington

4.2.2 Level B

- An ecology that mainly consists of species, which are easily adapted and adaptable to urban living conditions, so-called urban nature. The areas that provide these habitats could consist of transformed urban infrastructure such as the high-line in New York.
- The biodiversity can evenly be high in this situation, but contains mostly species that are adapted to the urban context.
- 70% of the streets and squares have total tree cover.
- At this level several ecological connections are established with main ecological zones, inside the city or in the surrounding countryside.
- Urban nature measures, such as nesting boxes and other provisions are integrated in 50% of the buildings.

4.11 High Line, New York

4.12 Korea-Seoul-Cheonggyecheon



4.13 Breaking concrete in front gardens

4.2.3 Level C

- Nature is restricted to few specific and relatively small areas, such as parks and green spaces, which are not specifically in use as ecology, but also as recreational, sometimes traffic spaces. These areas are, from an ecological perspective rather isolated.
- 25% of streets and squares have full tree cover.
- None or very few connections are established with the broader ecological network.
- No urban nature measures are integrated in buildings.

5. Waste

5.1 Introduction

Looking at waste, the highest possible sustainability level is that all waste is separated from other fractions of waste and everything is recycled, or reused within the area. The reuse of materials like plastics, tin, iron, glass, paper, and hardware and old appliances could form the basis for small enterprises and shops, which create new products out of waste materials. Organic waste can be centrally collected and used to generate energy after bio-fermentation (bio-gas or bio-electricity). At first glance it could prove impossible to score 100% waste recycling, but local initiatives for these small enterprises could be subsidised and stimulated and slowly grow in number. On the longer term a high percentage of recycling materials is certainly possible.

5.2 Sustainability levels

5.2.1 Level A

- All waste produced in households and industries, as well as in the public space (e.g. green maintenance) is recycled and reused within the area.
- In order to do this all waste is separated and collected in reusable fractions (paper, plastic, tin, glass, organic) and everything is recycled.
- Set-up small and local recycling businesses, which produce new products using waste materials. These businesses require starting capital to be able to start their business.
- All organic waste is collectively processed on-site and turned into compost for reuse in public green spaces and bio-fermented in biogas, and eventually bio-electricity, which can be fed back into the grid, providing households with gas and electricity.

5.1 Recycling all fractions

5.2 ChristianReyes and Felix Rodriguez founded “Resight,” making sunglasses out of recycled material (Puerto Rico).

5.3 Recycling glass-tile materials

5.4 Recycled paper (Nigeria)

5.5 Composting organic waste, feed to worms and turn into compost, South Africa

5.6 Recycled plastic turned into street furniture, Amsterdam, the New Raw (AMS)

5.2.2 Level B

- Only paper, glass and plastic are separated and recycled. All other garbage is transferred to waste treatment facility.

5.2.3 Level C

- All waste is collected and transported to waste treatment facility.

6. Energy

6.1 Introduction

The highest sustainability level for energy means to use as little as possible, and if energy is used supply it from a renewable source. Most energy is used in buildings and by cars. When buildings are retrofitted, as the Waterloo Estate is, energy demand can be brought back to a minimum. In Europe there are already buildings been retrofitted that provide energy to the grid, such as the Prêt-a-Loger-project in Delft, the Netherlands. Insulation and the way buildings are build is essential to keep the homes cool in hot summers and warm in colder periods in winter. Additionally, a heat and cold storage system, pumping water down into low surface earth layers and pump it back up to provide a steady temperature in the homes is a good way to achieve this. Currently, one of the most energy demanding functions in a house are the electric appliances. A simple way to provide the electricity for those is to install solar panels on the roof, which will provide the electricity needed. Should there be more energy needed than can be provided by renewable source onsite it may be necessary to obtain renewable energy from outside the area, supplied through wind-parks or solar farms.
When it comes to energy use of cars the future is electric and the number of electric cars, autonomous or not, will increase over the next decennium. Provided that the electricity used for these cars is obtained from renewable resources (wind, solar), electric cars emit much less carbon than conventional cars. More importantly, the use of an electric car is much cheaper as the energy from the grid costs much less than petrol.

6.2 Sustainability levels

6.2.1 Level A

- Energy demand is minimised. Existing homes are retrofitted as net energy positive buildings, see the Prêt-a-Loger example from Delft (fig. 6.1).
- Smart solutions to reduce electricity use of appliances are implemented in each household. This gives people the opportunity to direct use of electric appliances to start, stop and save energy on every given moment. An example is to be able to put the AC on 10 minutes before you arrive at home, instead of having it on the entire day, or automatic turning off the stand-by after 15 minutes of inactivity.
- The rest of energy that is still required for living is provided through renewable energy sources, such as rooftop solar panels (PV), small wind-turbines on the roof, and through connections of the neighbourhood with solar farms or wind parks outside the city.
- The electricity in the homes is mainly provided by solar panels. The cooling/heating of the houses is arranged through heat-&cold storage (geothermal), in the upper layers of the subsoil. Water is pumped to the warm subsoil and after being brought at a certain temperature is pumped back into the house, cooling, resp. heating the spaces to a comfortable temperature (fig. 6.6).

- All cars that are used in the neighbourhood are electric, and the electricity is generated through renewable sources, such as solar or wind.

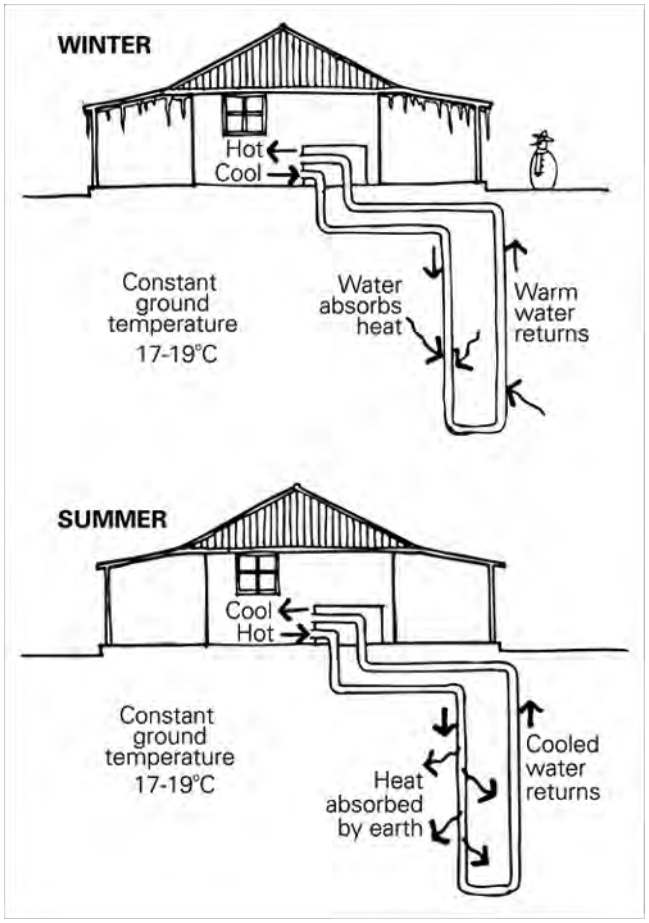
6.1 The Prêt-a-Loger building, retrofitted energy-positive house (TU Delft, the Netherlands)

6.2 Energy positive buildings, Germany

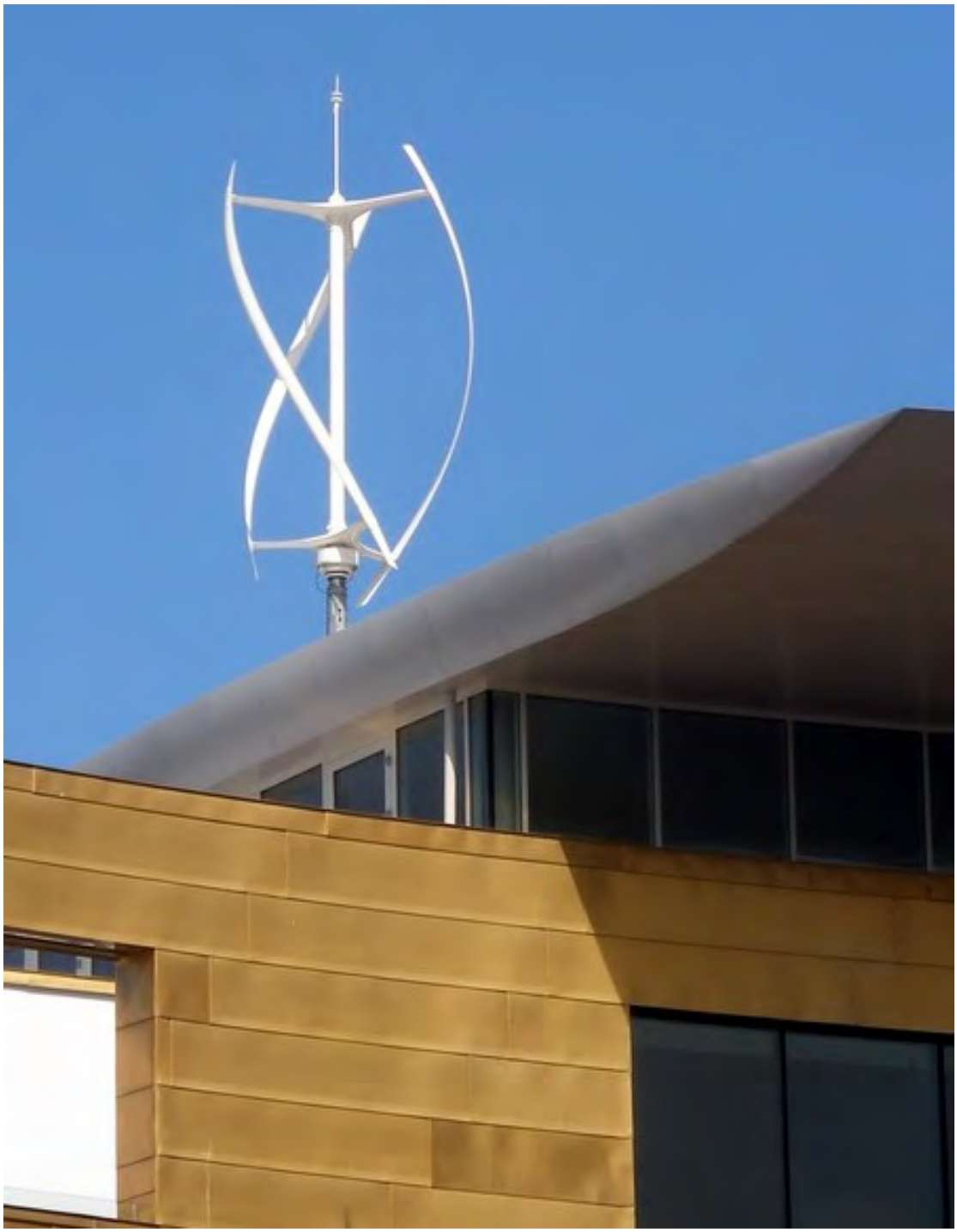
6.3 Energy positive house, Solcer House, UK

6.4 Solar village, Freiburg

6.5 Solar roofs, Vauban, Germany



6.6 Heat and cold exchange geothermal heat principle



6.7 Quietrevolution Bristol, small windturbine

6.8 Electric car, BMW, in the UK

6.9 Tesla, all electric

6.2.2 Level B

- The energy demand in all households is brought down with 50%
- 80% of the required energy is provided using renewables and the rest is supplied by traditional, coal-fired, power plants.
- The renewable sources could be off-site (wind and solar farms outside the city).

- 25% of the cars are all electric, 50% are hybrid and 25% are conventional petrol cars.

6.2.3 Level C

- The energy demand is brought down with 10%.
- The use of renewable sources is 50% of the total energy use and the rest is supplied from traditional, coal-fired, power plants.
- The renewables sources used in the neighbourhood are provided from locations outside the city.
- There are no electric cars, 50% of the cars are hybrid and 50% are conventional petrol cars.

7. Food

7.1 Introduction

The production of food is currently invisible and takes often place behind closed doors, by multinationals that transport goods over enormous distances to the (super)markets. A more sustainable food system is one that is producing the majority of the food closer to where it is consumed, and could even involve local people in the production process. The places in the neighbourhood that are suitable for food production are rooftops, community gardens and trees. If edible trees are planted in the right places (eg. not above car parks …..) fruit could be picked from the street. More extensive examples of food production are found on rooftops and in community gardens where people plant, manage, grow and harvest agricultural products. These places become a haven for people to meet each other in social hubs, but they also increase biodiversity. People in the neighbourhood could consume their own produce, but a system by which the products collectively grown are sold in local markets also means the economic benefits stay inside the community.

7.2 Sustainability levels

7.2.1 Level A

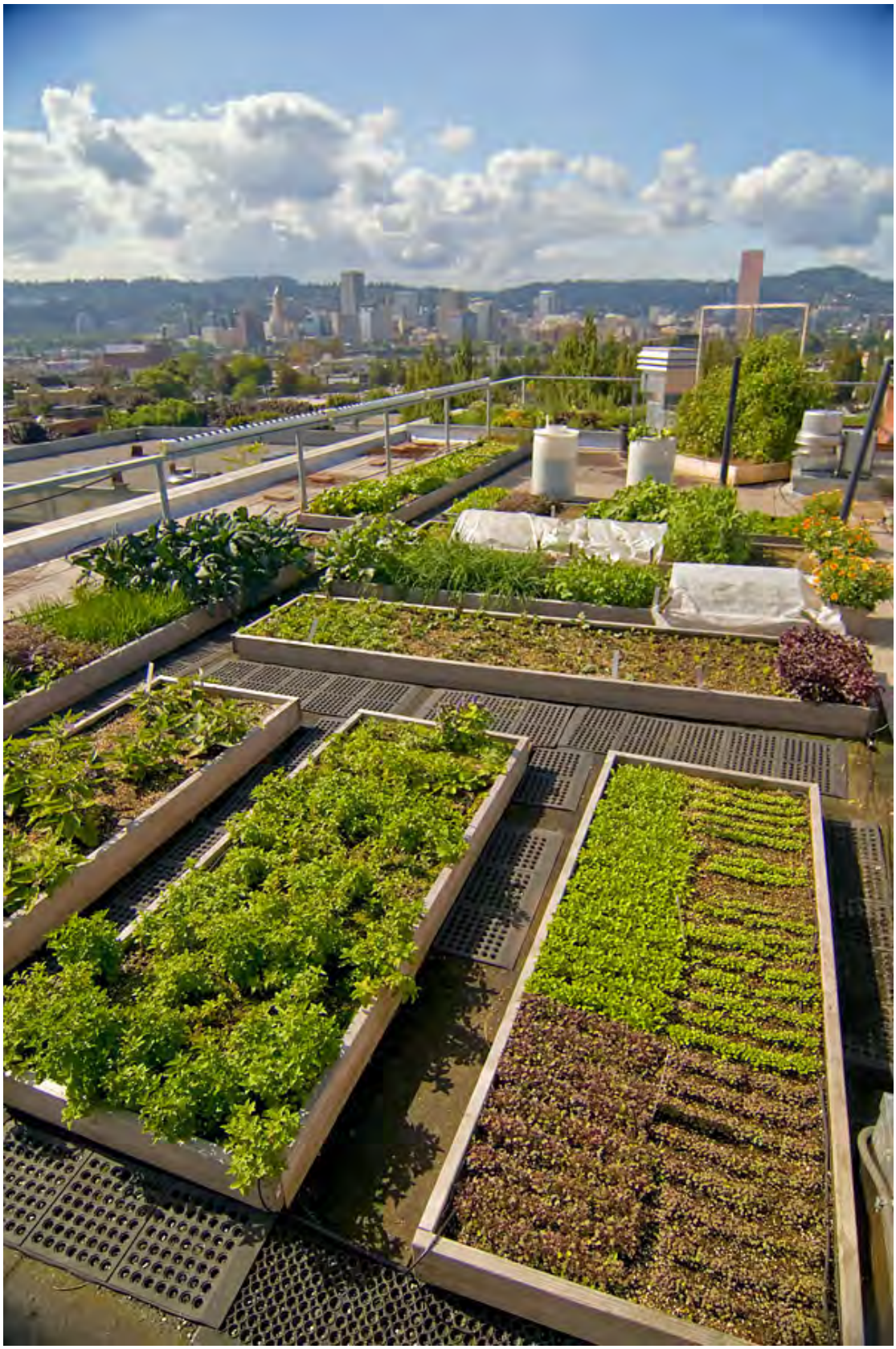
- The community produces 50% of its own food consumption by growing crops in their own neighbourhood.
- 50% of the trees are edible. Edible trees can give a great atmosphere to the neighbourhood. In spring these trees blossom, while in autumn residents can harvest all kinds of fruit from these trees. The smell and look of edible trees add to the experience of people living in these streets.
- On 50% of the rooftops a garden with food growing crops is realised. These rooftop gardens could be accessible for a specific group of people who work in and maintain the garden. Specific events can be organised to involve the neighbourhood into the 'food-roofs of Waterloo', such as collective planting or harvesting celebrations.
- A community garden is realised in every block. In a community garden people come together to grow food as a community. Everyone who wants to become part of a community garden group can become a member. Member plant, maintain and harvest the garden, and have the right to eat the products. The community can also decide to sell crops at the local market. It is important to establish a good organisation with responsibilities for everyone to keep the communal responsibility for the garden high.
- One local food market is held every week (in season) in the neighbourhood. At this food market local products, produced in the neighbourhood can be sold to the public. Depending the amounts, the market can be open for local farmer that produce crops on their farms in the countryside near to the city.

7.1 Strawberry tree

7.2 Hawthorn, edible fruit tree Crataegus_phaenopyrum

7.3 NSW sugar plum tree

7.4 Fairmont Rooftop garden, Montreal



7.5 Portland, Noble Rot rooftop garden

7.6 Chicago, Rooftop farm

7.7 Soradofarm, above metro station, Tokyo

7.8 Daly City community garden, California

7.9 Jon Peterson community garden, Chicago

7.10 Community garden, Rodales Organic Life

7.11 Farmers market, UK

7.12 Shafiq Malik farmers market, Lahore

7.13 Markthal Rotterdam, daily foodmarket

7.2.2 Level B

- The community produces 25% of its own food consumption by growing it in gardens or rooftops in their own neighbourhood.
- 25% of the trees in the neighbourhood are edible.
- On 25% of the rooftops a food-growing garden is realised.
- One community garden is realised for every two blocks in the neighbourhood.
- Once every month a local food market is held (in season) in the neighbourhood.

7.2.3 Level C

- The community produces 5% of its own food consumption by growing it in rooftop or community gardens in their own neighbourhood.
- 5% of the trees in the neighbourhood are edible.
- On 5% of the rooftops a food-growing garden is realised.
- There is one community garden in the neighbourhood.
- No local food market is being organised in the neighbourhood.