RE-THINKING HUNTS POINT

Small steps Big changes

by Hanna Kamenschek

MASTER'S THESIS

RE-THINKING
HUNTS POINT
Small steps Big changes

MASTERARBEIT
zur Erlangung des akademischen
Grades einer Diplom-Ingenieurin

Studienrichtung:
Architektur

Name der Autorin:
Hanna Kamenschek

Technische Universität Graz
Erzherzog-Johann-Universität
Fakultät für Architektur

Betreuer: Brian Cody, Univ.-Prof.
B.Sc.(Hons). CEng MCIBSE
Institut für Gebäude und Energie

January 2015

Deutsche Fassung:
Beschluss der Curricula-Kommission
für Bachelor-, Master- und Diplomstudien
vom 10.11.2008 Genehmigung des Senates am 1.12.2008

Englische Fassung:

TU Graz
Graz University of Technology
Senat

EIDESSTATTLICHE ERKLÄRUNG

Ich erkläre an Eides statt, dass ich die vorliegende Arbeit selbstständig verfasst, andere als die angegebenen Quellen/Hilfsmittel nicht benutzt, und die den benutzten Quellen wörtlich und inhaltlich entnommenen Stellen als solche kenntlich gemacht habe.

Graz, am ....

....
(Unterschrift)

STATUTORY DECLARATION

I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

Graz, ...

....
(signature)

TABLE OF CONTENTS

Transformation 2030

Design Competition
2013-2014

High performance buildings.
Socially responsible design.

Presented by Autodesk, Architecture 2030, Majora Carter Group, Perkins Eastman, and the AIAS.

AUTODESK.

AIAS

architecture 2030

MAJORA CARTER GROUP Certified B Corporation

Perkins Eastman

The Autodesk Education team hereby congratulates

Hanna Kamenschek

for successfully completing the Autodesk Building Performance Analysis Certificate.

The recipient is now better prepared to apply building science concepts in the creation of high-performance buildings and put that knowledge into practice with Autodesk software.

BPAC v1.0 - August 2013
TOPICS: Intro to BPA, Climate, Energy Literacy
Sun and Shadows, Solar Radiation, Whole
Building Energy Analysis, Airflow, Daylighting
SOFTWARE: Autodesk Revit, Vasari, GBS

AUTODESK.

Carl Bass

Dec 04 2013

INTRODUCTION

This master thesis deals with the topic of planning energy efficient buildings by integrating building analysis into the design process. The master project was an entry of the Transformation 2030 Student Design Competition and is based on the competition specifications and targets. One of the main targets was to meet the Architecture 2030 Challenge by drastically reducing carbon emissions and fossil fuel consumption. By 2030, all new buildings in the United States should be carbon neutral.

2030 CHALLENGE

The carbon reduction goals to reach net-zero standards by 2030 are:
60% today
70% in 2015
85% in 2020
90% in 2025

The reduction has to be made from the national average carbon footprint, fuel use or energy use intensity of the specific building type.

SUSTAINABILITY WORKSHOP

Before taking part in the competition, participants had to complete the Autodesk Building Performance Analysis Certificate. This online course teaches design strategies for sustainable buildings and gives an introduction to Project Vasari, Revit and Green Building Studio.

MOTIVATION

The motivation for participating in this competition, was learning more about strategies to create high performance buildings and improving analysis skills. If buildings have to be carbon neutral in near future, architects have to increase their knowledge about sustainable design.

STRUCTURE

This book is divided into four chapters. The first chapter investigates the building site and its surrounding; followed by a chapter about the climatic context. The third chapter deals with part one of the competition: the conceptual massing of the overall development. A residential complex with about 400 living units and public functions is designed and analysed. The fourth chapter of the book is about part two of the competition: the design of a special event space with an adjacent catering kitchen. This spaces are planned and analysed in greater detail.

SITE ANALYSIS

HUNTS POINT

NEW YORK CITY

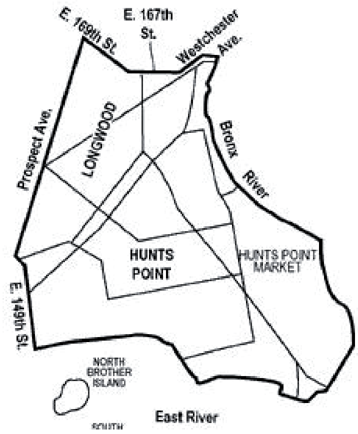
The site of the Transformation 2030 competition is located in Hunts Point (the Bronx), New York City.

[1] World map: NYC

Hunts Point Data
Coordinates: [40° 81´ N, 73° 89´W]
Zip Code: 10474
Population: 21.000 p/square mile[1]
Economy: 58,70% receive income support[2]
Land use: mainly industrial

The Hunts Point peninsula is located in the Southeast corner of the Bronx. It is naturally bounded by the Bronx River in the east and the East River in the south. The Bruckner Expressway delimits it to Longwood in the west and north. Hunts Point and Longwood are grouped together to the Bronx Community District 2 (BCD 2). [2]
Compared to the rest of New York City, BCD2 has a low density and a strong industrial character. Over half of the population lives in poverty and receives public assistance.[3]

Hunts Point plays a major role in New York's food related industry. It is home to the Hunts Point Food Distribution Center and the Fulton Fish market, some of the world's largest food distribution facilities. Due to food transportation, heavy truck traffic is crossing Hunts Point on a daily basis. Truck routes connect the Distribution Center and the Bruckner Expressway, passing by a dwelling zone. Today about 12.000 people live in the residential core, which is surrounded by light and heavy industry. The area has suffered from severe disinvestment and abandonment in the last decades. In the past few years, government and community investment have increased and led to an extension of public and green spaces. The South Bronx Greenway adds bike ways and trees to the streets, connecting small parks of the area. In order to further increase living quality, the city seeks to create a buffer zone between the residential neighbourhood and industrial zones.
In 2004 the Hunts Point Vision Plan was released to optimize land use and strengthen the residential community. It focuses on four categories: Optimizing Land Use, Implementing Workforce Solutions, Creating Connections and Improving Traffic Safety & Efficiency.[4]



[2] Bronx District 2: Borders of Hunts Point and Longwood

1 Cf. Perkins+Will 2013, 23.
2 Cf. NYC Department of City Planning 2013.
3 Cf. Canady, 2013.
4 Cf. City Council 2008.

[3] Map of New York City; Hunts Point

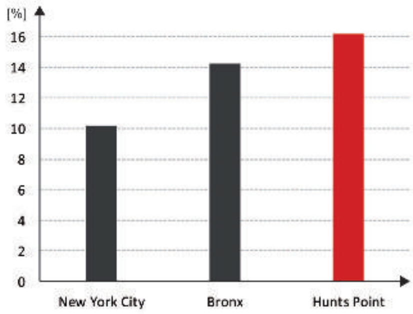
SOCIAL PROBLEMS

THE NEIGHBOURHOOD

There are high levels of social concern in Hunts Point. The area is prominent for prostitution, drug-related crimes, gang violence and burglary. According to Census, it is one of the poorest districts in the country with a median household income of only $ 23.297 per year. Compared to other parts of New York City, inhabitants of Hunts Point earn less than half of the income of average citizens.[5] [6]

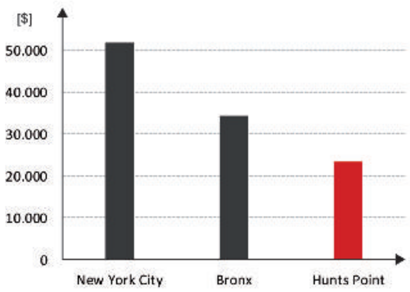
In the New York City Police Department crime statistics, Hunts Point ranks high compared to other parts of the city. The area belongs to precinct 41 with an average of 2, 6 crimes per 1000 residents. The top-ranking occurrences are felony assaults, robberies and grand larcenies.[6]

[4] Faces of Addiction; Hunts Point



[5] Percentage Unemployed: New York City, Bronx and Hunts Point

Large parts of the peninsula have low residential densities and offer space of anonymity. Especially the southern part is empty after working hours. The lack of social control and poverty are the main reasons for the high crime rates.



[6] Median Family Income: New York City, Bronx and Hunts Point

Faces of addiction

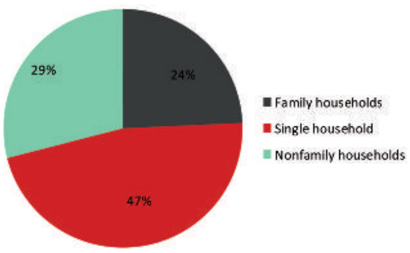
In a series of photographs the former Wall Street Trader Chris Arnade is capturing pictures and stories of drug addicts in Hunts Point. It is not a project about Hunts Point, but about addiction. However, tourists and people from other boroughs usually avoid going to the neighbourhood because of its bad reputation. The photographs give an insight into street life and raise awareness about the problems in Hunts Point. In his photojournalism, Arnade tries to show unconventional people in conventional pictures.[7]

“You can judge a lot about a culture by looking at the boundaries. When you look at homeless heroin addicts, that’s kind of one of our boundaries. We all don’t want to know what goes into making our life work.”

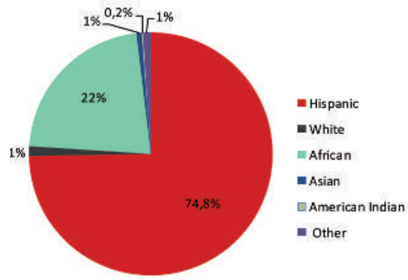
Chris Arnade in the Phoblographer[8]

The most frequent household type in Hunts Point is the single household consisting of an unmarried female or male householder, who lives alone or with children. Families with married couples only make up 24% of the households, while there is a high number of non-family households.[9] [7]

The US Census 2010 reveals that almost three-quarters of the population in BCD2 have Spanish origins. The remaining quarter is mostly of African origin, leaving only 3% with a different racial background. Compared to New York City where most of the population has a European background, the number of non-hispanic white people is very low.[10] [8]



[7] Percentage of Family, Single & Nonfamily Households in BCD2



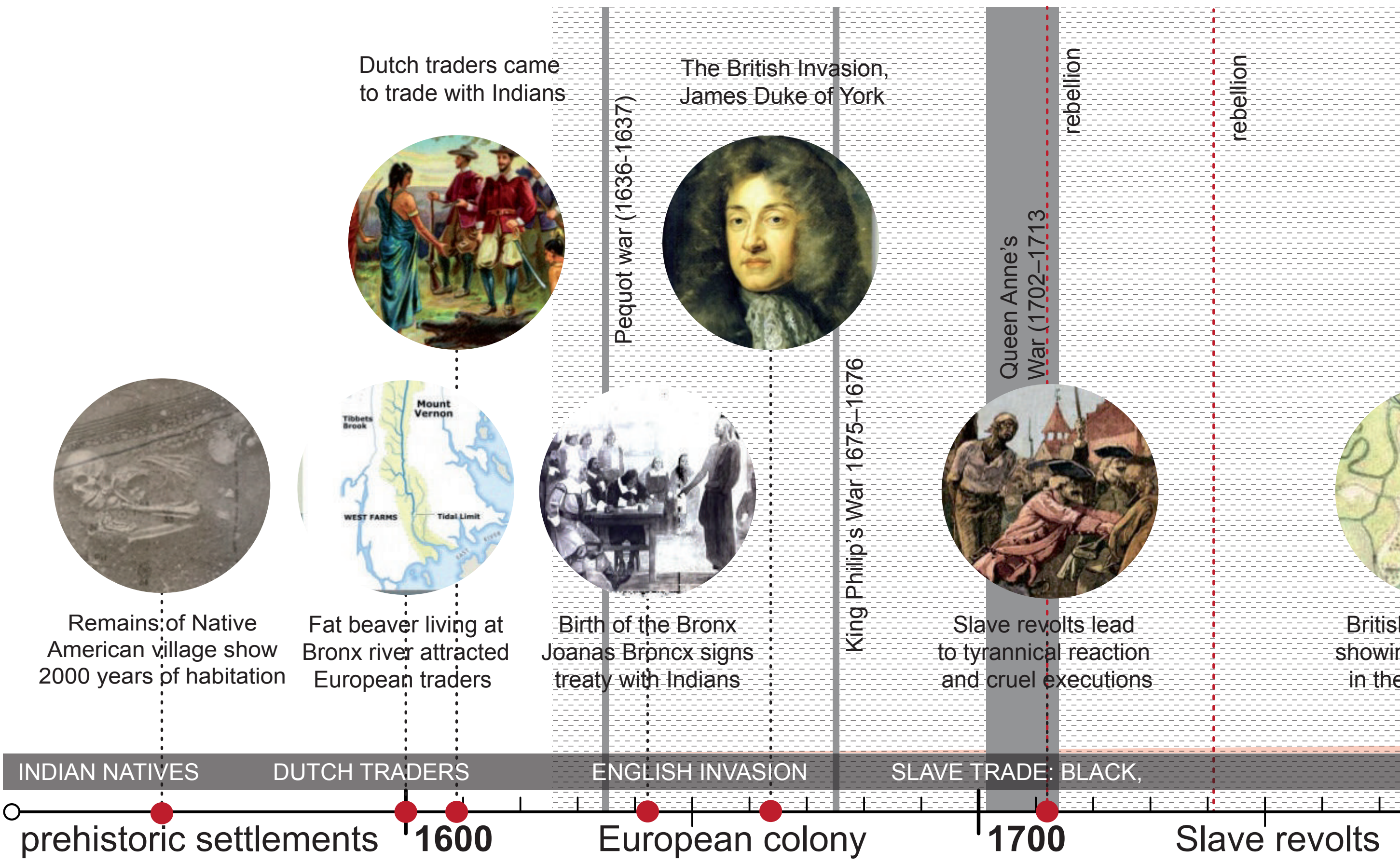
[8] Population Origin, BCD2

5 Cf. Census 2010.
6 Cf. NYC Crime Map, 2013.
7 Cf. Esser 2013.
8 Esser 2013.
9 Cf. Bx2profile 2010, 5.
10 Ibid.

HISTORY

TIMELINE

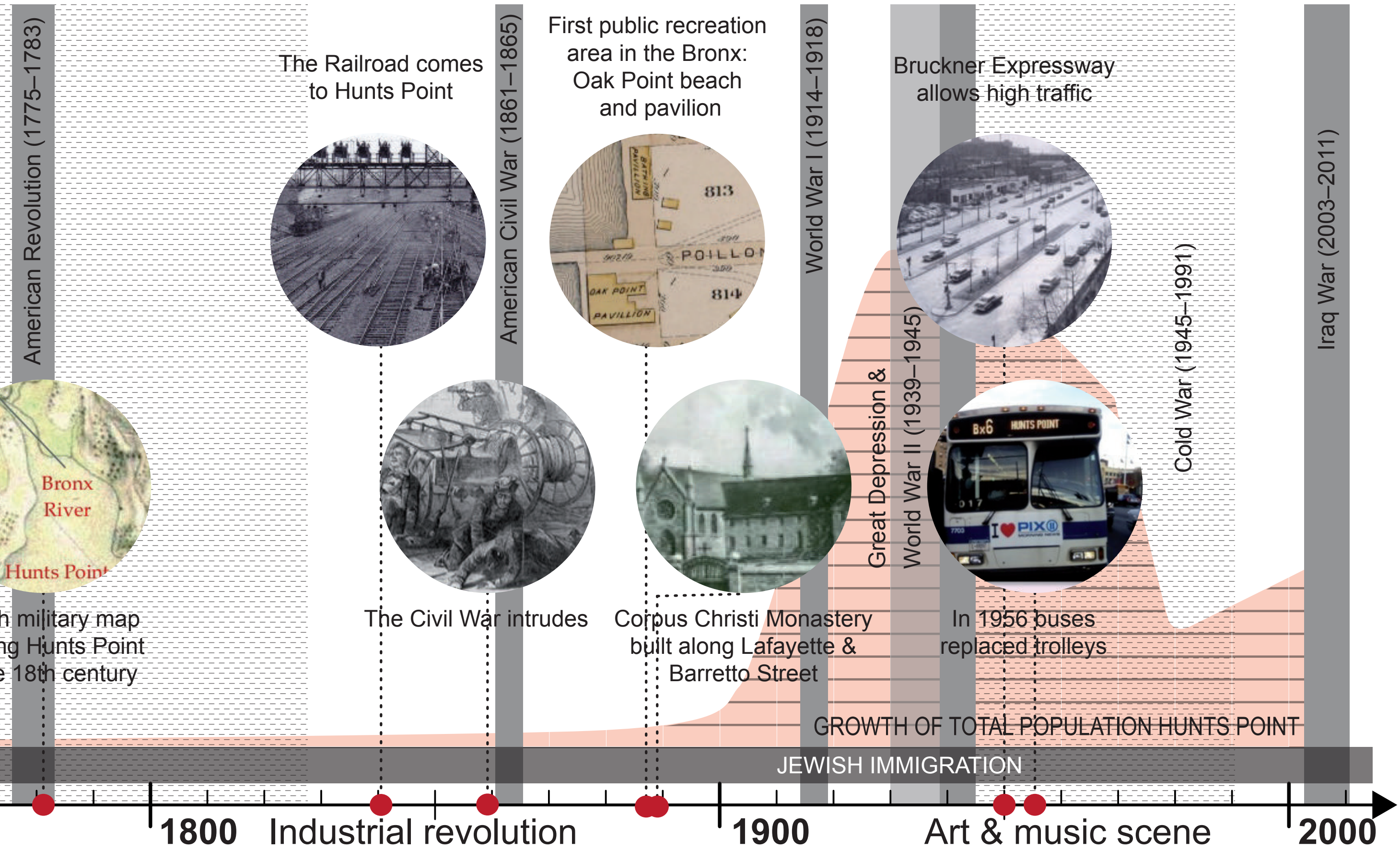
The timeline below gives a historical overview of the neighbourhood from prehistoric settlements to present time.



The Bronx River attracted Indians to live and hunt along the water a long time before it was discovered by Europeans. In the 16th century Dutch traders came to the area and began to deal in beaver furs. After some decades of peaceful co-existence and trading agreements with the Native Americans, European settlers started to move to the peninsula. Thomas Hunt, whom the area was named after, was one of the first settlers and owned large parts of land. Three wars followed aiming to evict the Indian population: the Pequot War, King Philip's War and Queen Anne's War.[11]

Slaves and raw materials were brought from colonies like Barbados and the Caribbean. Many of those slaves lived under poor conditions. Some tried to run away from their slaveholders, others started revolts and were punished in public executions.[12]
During the American Revolution, slaves could gain freedom for military service. In 1827 slavery was finally abolished in New York State.[13]

Due to the industrial revolution and the growing number of



factories in Hunts Point, urban problems began to overtake the neighbourhood. Once known as a prosperous location, masses of im-migrants came to settle down in Hunts Point in the 20th century. The area became a melting pot for different cultures.[14]

Bad smells and poor air quality led to dissatisfaction among the citizens. In 1887 the first public recreation area of The Bronx was built on the Oak Point bathing beach in Hunts Point.[15]

After World War II, a flourishing art and Latin music scene arose in the South Bronx. People from all over the city were attracted by the vibrancy and night life of the neighbourhood. It was a place of activity and creativity until the 70ies.[16]

[9] Timeline

11 Cf. DeRienzo 2009.
12 Ibid.
13 Cf. Harper 2003.
14 Cf. Canady 2014.
15 Cf. DeRienzo 2009.
16 Cf. Singer/Martínez 2013.

HISTORY

DEVELOPMENT

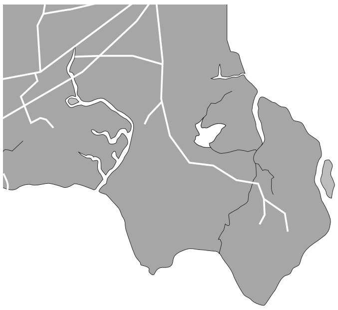
During the last four centuries the Hunts Point peninsula underwent several transformations.
Once, the place was characterized by two tongues of land and cut apart by an arm of Bronx River. The peninsula then grew in the south, east and west by draining land.

Before the masses discovered Hunts Point in the 20th century, it was a popular home and recreation area for the city`s elite. Prominent families placed their mansions on the peninsula.
One of them was the Casanova Mansion, the country seat of B. M. Withlock [11]. Today the street names and a few buildings are the only remains of the past.[17]

In 1889 the Corpus Christi Monastery was built between Lafayette and Barretto Street. It is the oldest Dominican monastery in North America. The abbey is surrounded by a park and cut off from the neighbourhood through huge walls.[18]

1781

1879



1897

[11] Home to the city's elite: Casanova Mansion
[12] Bruckner Expressway in the 50ies

[13] Corpus Christi Monastery

In the 50ies, the heavily-trafficked Bruckner Expressway was built next to the railway tracks. Several apartments had to be demolished for the multi-lane road. Two large produce markets opened in 1967 and 1974. The South of Hunts Point started becoming very industrial.[19]

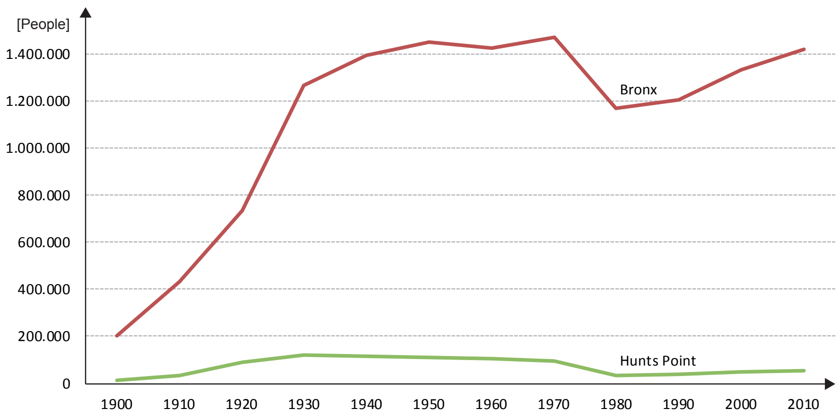
Population growth stagnated in the early 20th century and dropped down significantly in the 70ies and 80ies. Now Hunts Points' population is slowly re-generating, supported by political and community efforts. [14]

1982

2014

[10] Timeline with historical maps of the Hunts Point Peninsula

[14] Population growth of Hunts Point and the Bronx 1900 - 2010



17 Cf. Garcia 2011.
18 Cf. Corpus Christi Monastery 2013.
19 Cf. Walsh 2009

AERIAL VIEW

[15] Hunts Point View

STREET NETWORKS

URBAN PATTERNS

Analysing and comparing street networks of different urban situations helps understanding how they work and which influence they have on residents.

Inner cities are usually the oldest parts of a city and are characterized by short block lengths and high densities. Built areas, which were planned after 1920, are often shaped by car usage. Smog is a big problem in urban zones with high traffic levels. Creating a pedestrian and bicycle friendly network is the first step towards reducing carbon emissions. Walking distances of 150m to 300m are recommended to encourage going by foot. Access to public transportation is another important step to reduce car dependency.[20]

Comparing a city dweller who does not own a car to an average person living in the suburbs, the energy consumption of the suburbanite is about 10 times higher. Manufacturing cars and highways is not necessary for a car-free city dweller.[21]

Street orientation and layout have a huge impact on solar and wind access of buildings. Grids can be optimized according to their climate. In hot climates it is important to maximize shading by choosing narrow streets, while buildings in colder climates need solar access. A rotated orientation provides solar access for buildings, whereas street shading is increased. Wind patterns should be considered in order to orient streets allowing summer breezes in, while blocking cold winter wind.[22]

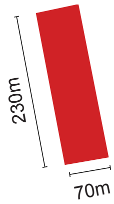
On the right side, four different urban areas are compared: Hunts Point, Manhattan, Barcelona and Graz. Block sizes are a good indicator to see how pedestrian-friendly a city is.

20 Cf. Yeang 2006,175.
20 Cf. Yeang 2006,172.
22 Cf. Brown/DeKay 2000, 102.

HUNTS POINT

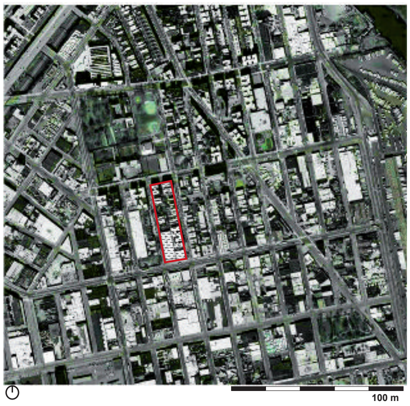
The blocks are more than twice the size of average blocks in Manhattan.

-not pedestrian friendly
-car oriented
-no urban mix



Hunts Point Residential Area
average block size:
70m x 230m

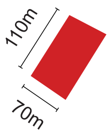
16.100 m²



MANHATTAN

Manhattan is characterized by a rectangular grid with short block lengths.

-short block lengths
-many crossing points to increase safety
-mixed use
-high level of activity on streets



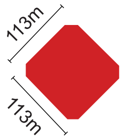
Manhattan Downtown
average block size:
70m x 110m

7.700 m²

BARCELONA

The famous Cerda grid is a regular square based network with short block lengths and good solar access.

-short block lengths
- pedestrian friendly
-mixed use
-high level of activity on streets



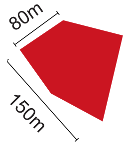
Barcelona Cerda Grid
average block size:
113m x 113m

12.769 m²

GRAZ

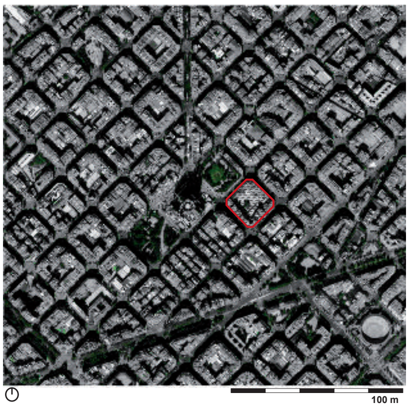
The urban pattern of Graz is less regular compared to Barcelona and New York City. The blocks have different sizes and shapes.

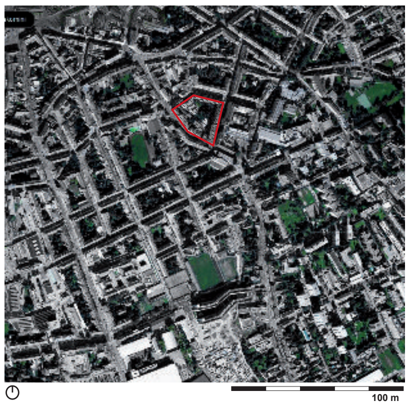
-car and pedestrian oriented
-bicycle friendly
-different block lengths



Graz Perimeter Block Development
average block size:
ca. 80m x 150m

12.000 m²





[16-19] Street view images

URBAN CONTEXT

SITE ANALYSIS Hunts Point - New York City

scale 100 m

Pulic Park
Subway 2/5
Bus
Private Green
Subway 6
Train
South Bronx Greenway
Summer Pool Bus

BUILDING FOOTPRINTS

By looking on the building footprints, a huge contrast between north and south can be recognized. In the southern part of Hunts Point the building coverage is low and dominated by large building shapes. On the contrary, the northern part is more residential and covered by buildings on a smaller scale. The industrial part of Hunts Point needs large parts of land for transportation and stocking around buildings. About half of the peninsula is covered with these low-density facilities. In the north, Bruckner Expressway and the railway are responsible for the low coverage. They are like a barrier between the neighbourhood in Hunts Point and the residential area in Longwood.

GREEN SPACE

There are several small parks which are connected through the South Bronx Greenway. Some public recreation spots were built along the waterfront recently. There is a big community effort to increase living quality by maintaining and extending green space. A huge Recreation Center offers baseball fields, a playground and indoor sport halls in Manida Street.

TRAFFIC

There is a great demand for a better public transportation network in Hunts Point. Nowadays, individual car- and truck traffic are the dominating means of transportation. Three subway lines stop in Longwood: Line 2, 5 and 6. There is only one regular bus route in Hunts Point. The route connects the markets to subway stations in Longwood. Another one is only run in summer, going from the residential part to the public pool on the beach. In the last years the South Bronx Greenway was extended to Hunts Point, bringing bike lanes and trees to the streets.

URBAN CONTEXT

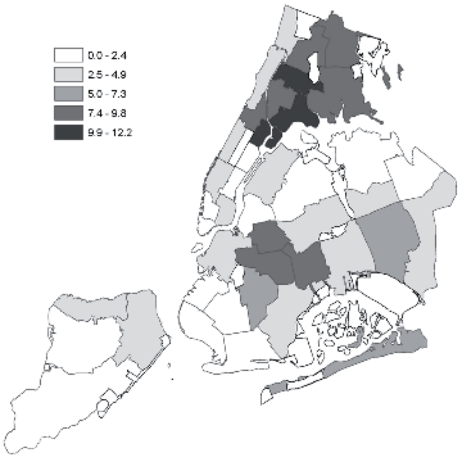
INDUSTRIAL BACKGROUND

There is a high number of industrial buildings in Hunts Point. Food distribution is the biggest sector but there are also other craft facilities like metal-working factories, recycling plants and a waste-water treatment plant. According to the United States Environmental Protection Agency (EPA), nine factories in Hunts Point produce, release or manage toxic chemicals.[23]

Truck routes have to connect the facilities to other parts of New York City. Tons of goods go in and out of Hunts Point every day. All main truck routes start from Bruckner Expressway and end at the Food Distribution Center. Tiffany Street and Randall Avenue are very close to the residential core of Hunts Point. The high levels of traffic cause discomfort among the locals. Street noise and poor air quality are problems the community has to deal with. Walking and bicycling safety is decreased by the high truck traffic.

ASTHMA RISK

Compared to the rest of New York City, the South Bronx has a much higher Asthma hospitalization rate. This can be related to the air quality and housing conditions in poor neighbourhoods. [20]



[20] Asthma Hospitalizations per 1.000 Children map

[21] Citizens protest for better air conditions

23 Cf. United States Environmental Protection Agency (EPA) 2012.


AIR POLLUTION MAP Hunts Point - New York City
scale
100 m
Toxic release inventory facility
Hazardous waste treatment, storage or disposal
Park
Major air pollution source
Truck route

LAND USE

RESIDENTIAL

Compared to the rest of New York City, Hunts Point is a low density neighbourhood. There is a compact residential core in the north of the peninsula surrounded by an industrial belt.

INSTITUTIONAL

There are some institutional buildings in and around the residential zone. A nursery, schools, the former prison, a post office, churches and some community organisations can be found.

COMMERCIAL

Only few small retail stores are located in the neighbourhood. They tend to be expensive and do not offer fresh food. Residents usually go outside the district to do their daily shopping.

INDUSTRIAL

Most of the area is industrial, leading to high truck traffic. Three large food markets are placed in the south of the peninsula. Many commuters come to work in Hunts Point and leave the neighbourhood after work.

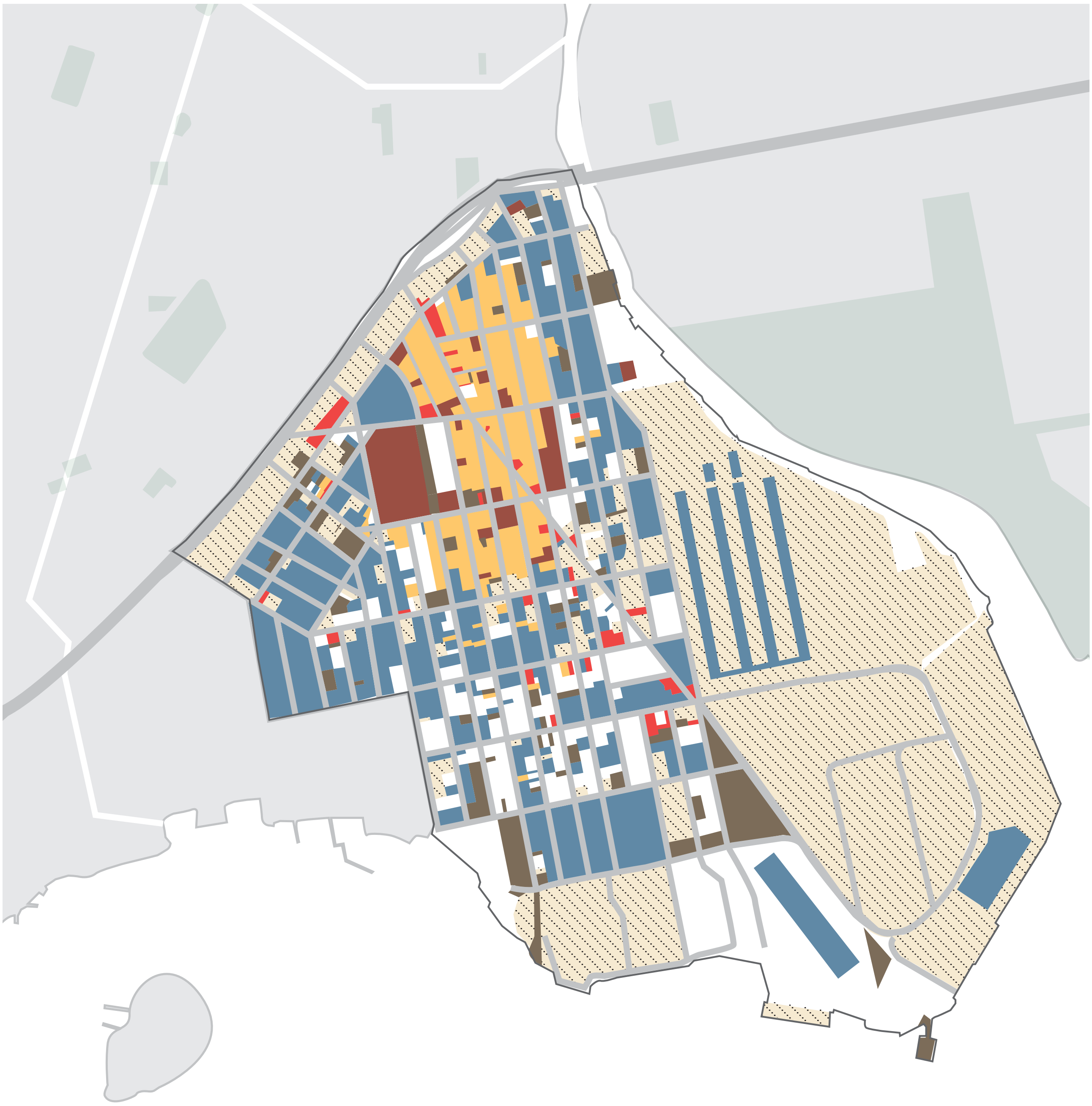
TRANSPORT/UTILITIES

Large parts of land are used for transportation. The food markets, the railway and Bruckner Expressway cause high traffic all day. There is a big wastewater treatment plant in the south. 40% of the city's waste is brought to waste management plants in the neighbourhood.[24]

VACANT

There is a lot of vacant land in Hunts Point. It is mostly located between industrial zones and offers great potential for future development. There are community and political efforts to increase living quality and raise the number of inhabitants.

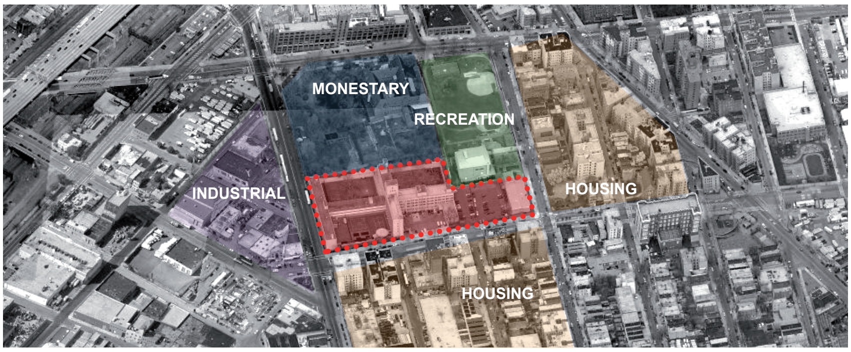
24 Cf. Perkins+Will 2013, 23.



LAND USE Hunts Point - New York City

- institutional
- commercial
- industrial
- transportation/utilities
- residential
- vacant

PROJECT SITE



COMPETITION GUIDELINES

The site which has to be used for the Transformation 2030 Design Challenge is located in the residential part of Hunts Point. Housing and industrial areas are surrounding the parcel; a monastery and a recreation center are neighbouring in the north. This functional diversity is typical for Hunts Point.

The aim of the competition is to design a residential complex with commercial and community spaces (part 1). After the general development, a catering kitchen and an event space, have to be planned (part 2).

There are two existing buildings on the competition site: the Bridges Juvenile Center on the area designated for the residential development and the Head Start Nursery School on the site for the culinary and event spaces.

SPOFFORD JUVENILE CENTER

The Spofford Juvenile Center, also called Bridges Juvenile Center, has been closed down in 2011, after several protests have criticised the bad conditions for inmates as well as the outdated infrastructure. Constructed in the late 1950s, the Center had to be closed down once before in the 90s and was reopened after renovation. It served as an intake facility; keeping children from the age of 10 to 15 while they waited for their trial.[25]
Now the city is looking for other ways to discipline juvenile criminals. The South Bronx has about 22% juvenile detention rate among its youth. Better education, community organisations and job opportunities will help to reduce this number in the future.[26]

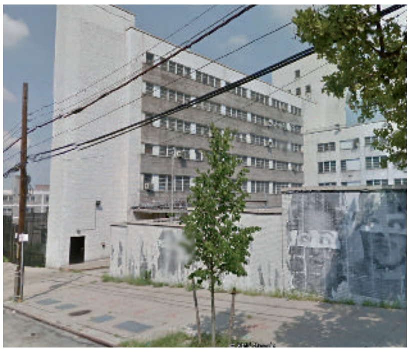
Shortly after the Center was closed down, its walls were used for a street art project in the South Bronx. Huge photographs of different faces in a collage with female eyes were placed in the streets. Those faces are watching the neighbourhood to remind citizens of the wisdom of their mothers and aim to make it a safer place.[27]

[22] A typical cell of the Juvenile Center
[23] Locals protest against the prison

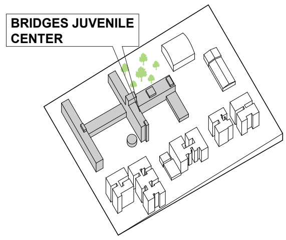
[24] In 2011, the prison was closed
[25] Street art on walls in the Bronx

25 Cf. Belmaker 2011.
26 Cf. Alvi 2011.
27 Cf. Daily News 2011.
28 Cf. Transformation 2030 Info Package 2013.

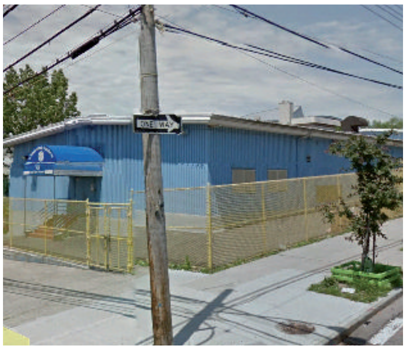
Spofford Juvenile Center:
The image on the right shows the Juvenile Detention Center, seen from Spofford Avenue in the South of the building complex.



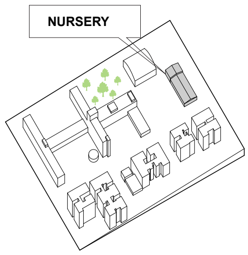
[26] The closed down Spofford Juvenile Center



Head Start Nursery School:
The school is located on the corner of Manida Street and Spofford Avenue. A huge car park is placed between the nursery and the Bridges Juvenile Center. The building consists of a corrugated steel structure, lacking windows and views.[28]

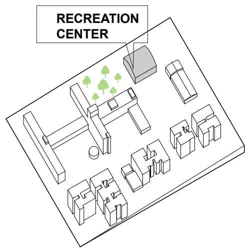


[27] Head Start Nursery School building: daylight and views are missing



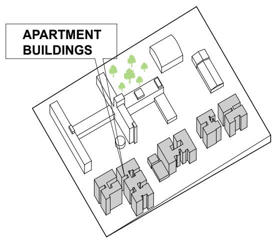
Hunts Point Recreation Center:
Located in the north-east of the competition site, the Recreation Center is one of the few sport facilities of the area.

[28] Recreation Center next to the competition site



Neighbouring buildings:
There are mainly residential apartment blocks along Spofford Avenue, while Manida Street is faced by small town houses.

[29] Residential apartment blocks in Spofford Avenue



CLIMATE ANALYSIS

MACRO CLIMATE

NYC CLIMATE

SUN, WIND & LIGHT

DESIGN GUIDELINES

MACRO CLIMATE

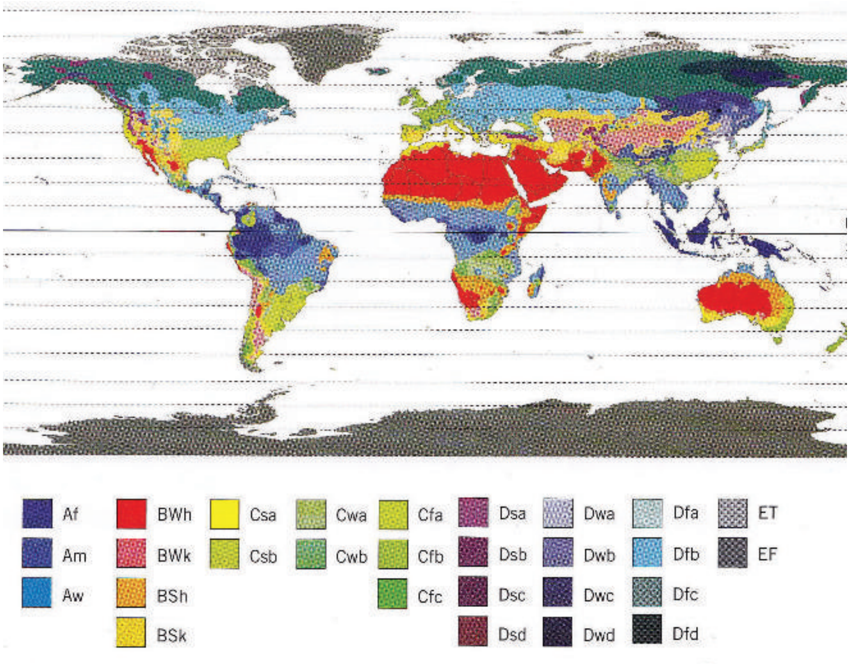
CLIMATE ZONE

Having a close look on the climate conditions of a project location is important to design an energy efficient building. Environmental conditions determine the heating or cooling loads of a building and give indications about which passive design strategies are useful.

The Koppen-Geiger Climate Classification Map on the right shows the world's major climate groups.

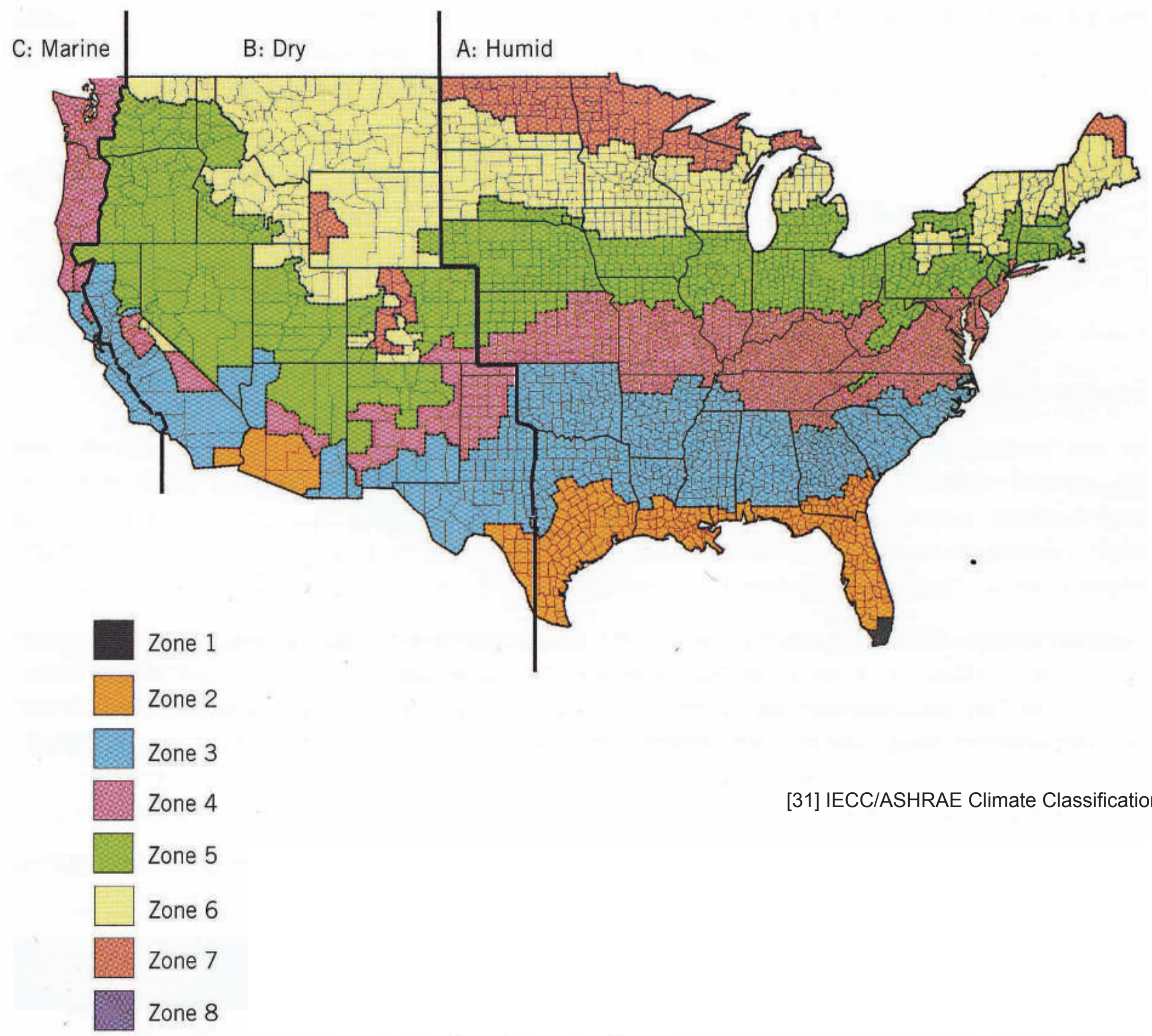
New York State as a whole is classified as Dfb. This is a code for specific information about the area. The first letter stands for the climate zone, the second for precipitation and the third for temperature. "D" implies a continental climate, "f" stands for significant precipitation during all seasons and "b" means warm summers. So New York State has a humid continental climate with warm summers and cold winters. Temperatures are averaging below 22°C in the warmest months and above 10°C for at least four months per year.[29]

Annual temperature differences are related to the latitude of a location. Proximity to the ocean has a balancing effect on temperature extremes. The annual mean temperature of seawater is 3,8°C. Water serves as thermal mass, taking more time to heat up and storing the heat for a longer time.[30]



[30] Koppen-Geiger Climate Classification Map

New York State's annual mean temperature varies from 4°C in mountainous areas to about 13°C in New York City. In winter, abundant snowfall is characteristic for the state, while coastal regions receive less snow. The climate features a lot of cloudy weather during the cold season. In summer the days are clearer, receiving up to 70% of the possible sunshine hours. Areas close to the coast receive more direct radiation throughout the year.[31]



[31] IECC/ASHRAE Climate Classification

While the Koppen-Geiger map provides information about general climate conditions, it does not include design recommendations for buildings. The International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) have developed a climate classification system which includes design guidelines for the different climate zones.[32]
The United States are divided into temperature-based climate zones and subzones based on humidity levels. New York is part of zone 4A, which is classified as mixed and humid climate.

In this zone, a balance between solar exposure and daylight access has to be found. On the one hand, buildings have to be protected from direct solar radiation during the warm season to minimize cooling loads. On the other hand, direct sunlight can be used to reduce heating loads in winter. Daylight access can be gained through increasing glazed areas protected by shading devices.[33]

29 Cf. Aksamija/Perkins+Will 2013, 5.
30 Cf. Hausladen/Liedl/Saldanha 2012, 26.
31 Cf. Cornell University 2013.
32 Cf. Aksamija/Perkins+Will 2013, 6.
33 Ibid, 10.

NYC CLIMATE

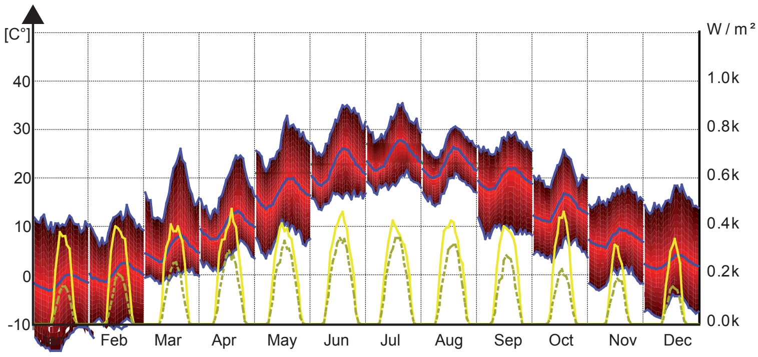
CLIMATE DATA

Latitude: 40,75°
Longitude: -73.98°
Height above sea level: 10m
Mean temperature: 12,40°C 1

The chart on the right side shows the Monthly Diurnal Averages for the South Bronx. Temperature ranges between 35°C and -18°C, so there is a big seasonal difference. Direct solar radiation is received all year at a constant level; there is more diffuse radiation in summer.

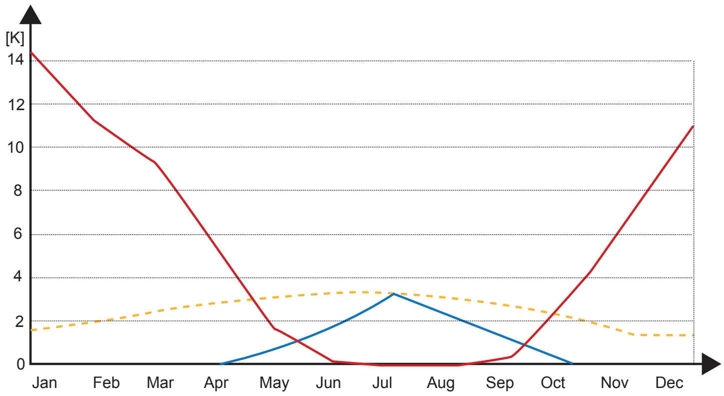
Annual degree hours are a good method for estimating energy consumption in a specific climate. Monthly heating degree hours are shown in red, summing up the difference between hourly temperatures and a base temperature of 18°C. Monthly cooling degree hours are represented in blue and based on 26°C. The dashed yellow line indicates solar excess degree hours, showing the potential for solar heating throughout the year. The graphic shows that heating systems are likely to consume a lot of energy in an average skin-load dominated building in New York City.

The map shows different weather stations around the project site. For Project Vasari and Revit analysis, the weather station in orange was used.



MONTHLY DIURNAL AVERAGES

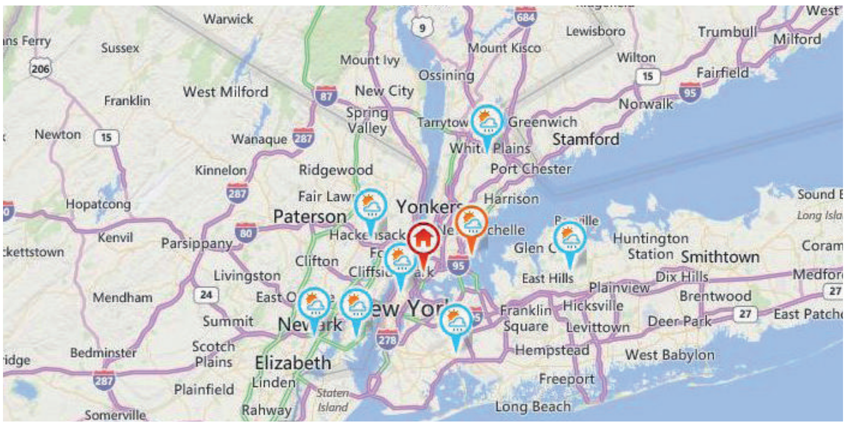
Temperature ---- Diffuse Solar
Direct Solar



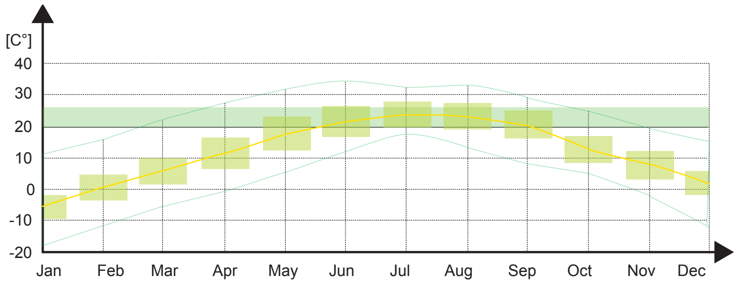
MONTHLY DEGREE HOURS

heating
sun
cooling

[32] Weather stations in NYC



Monthly Temperature Data: The average monthly temperature ranges from -5°C in January to almost 25°C in July. The human comfort zone is set between 20°C and 26°C; when the indoor temperatures differs from these values heating or cooling is needed.

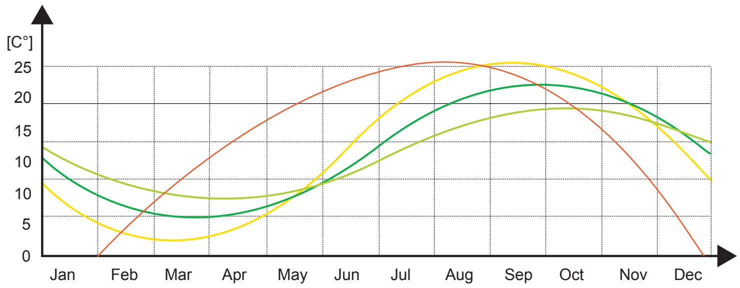


MONTHLY TEMPERATURE DATA

Monthly Average min/max — Mean Temperature

Comfort Zone — Extreme Temperatures

The monthly underground temperature of New York City varies much less than the outside air temperature. The deeper below ground it is measured, the closer it gets to the annual mean temperature. Pre-cooling or preheating air through underground ducts can reduce energy loads.

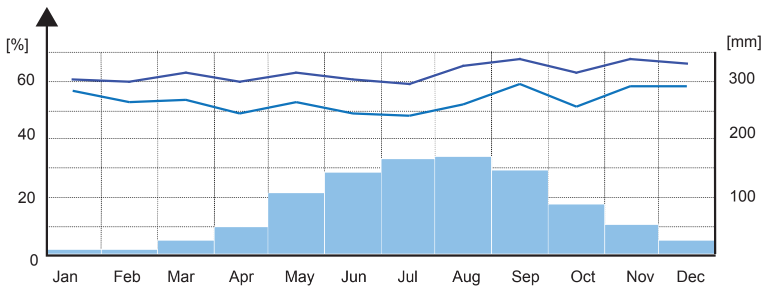


MONTHLY UNDERGROUND TEMPERATURE

- 0.5 meters — - 4.0 meters

- 2.0 meters — outside air

New York has very humid summers with about 150mm of monthly rainfall. In winter there is very little rainfall.



MONTHLY PRECIPITATION DATA

Average Rainfall in mm — Relative Humidity 9:00 am

Relative Humidity 3:00 pm

The graphs on this page are based on climate data accessed through the Ecotect weather tool, Climate Consultant and Project Vasari.

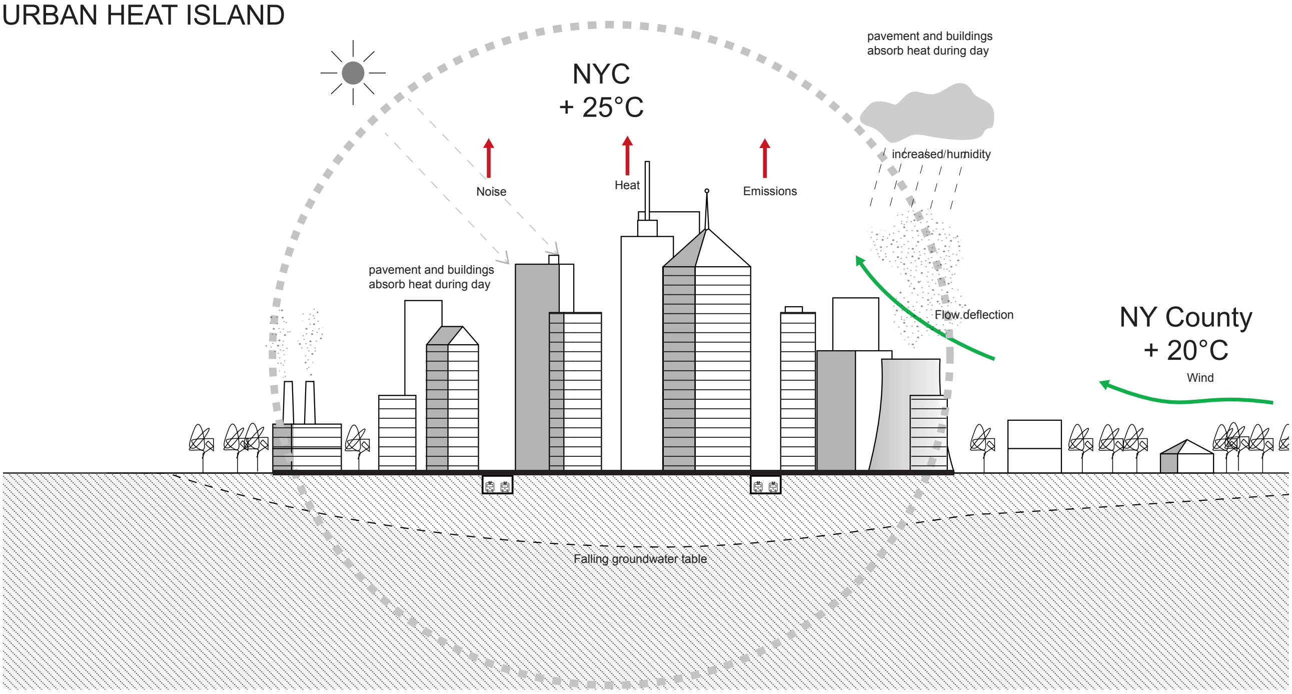
NYC CLIMATE

MICRO CLIMATE NEW YORK CITY

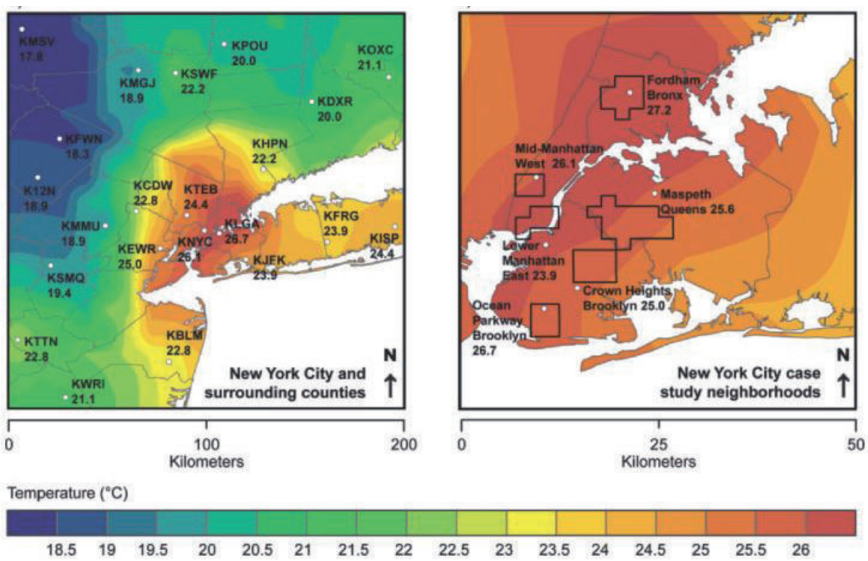
A City's climate is influenced by its geographical location, its elevation above sea level and the proximity to the ocean. Furthermore, density, building types, the degree of soil sealing, emissions and solar reflection play an important role.[34] New York City lies at the coast of the Atlantic Ocean. The huge body of water is the reason why its climate is milder than in the rest of New York State.

Another reason is the high density of buildings and soil sealing. They cause a significant temperature difference between New York City and the rural area surrounding it. During summer nights, temperature is about 4°C higher than around the city. During heat wave conditions, the difference can be up to 8 °C. Strategies to mitigate the urban heat island effect are shown in the illustration below. They include urban forestry, green roofs and high albedo surfaces.[35]

URBAN HEAT ISLAND



[33] City climate: Urban Heat Island Effect

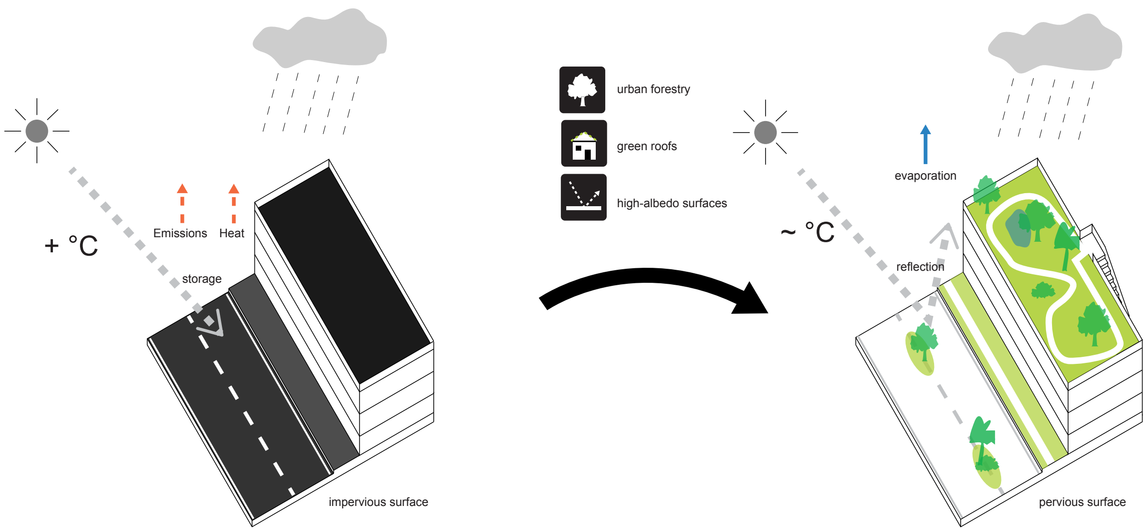


[34]Temperature Difference: New York City and surrounding

34 Cf. Hausladen/Liedl/Saldanha 2012, 12.

35 Cf. Rosenzweig a.o. 2009, 1297-1312.

MITIGATION STRATEGIES



SUN, WIND & LIGHT

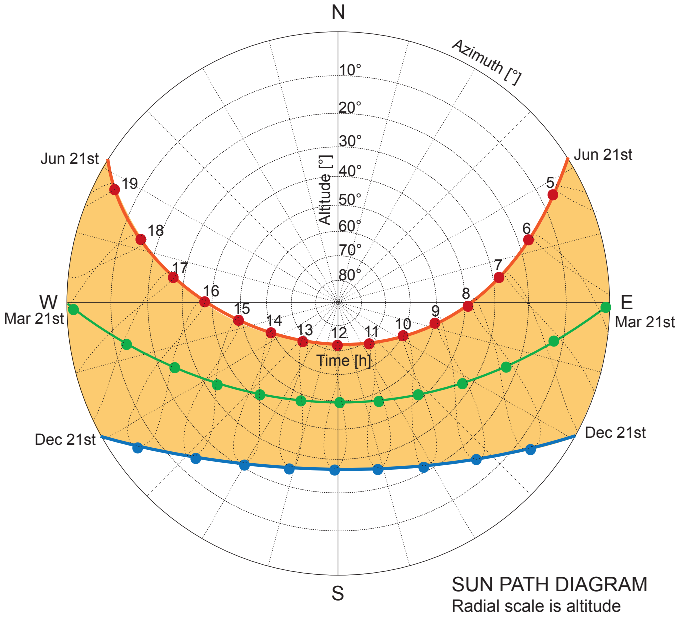
EXTERNAL FORCES

Analysing wind patterns, solar access and daylight availability is important to understand the micro climatic context of an area. The analysis helps designers to evaluate different locations for buildings and exterior spaces. It is the basis for developing specific design strategies to use natural forces.

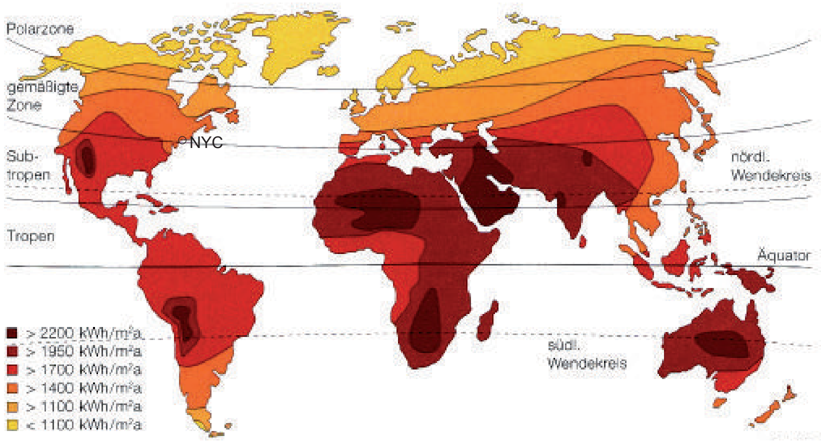
The Sun Path diagram of New York City shows the sun position in the sky dome for any hour of the year. The city is situated in the Northern Hemisphere. In winter, solar radiation comes mainly from the south. In summer, the sun's path is moving from northeast to northwest.

According to the analysis with Climate Consultant, New York City has a total annual cloud coverage of about 55%. The cloudiness level is similar all over the year. September and October are the months with the clearest sky.

Solar radiation is one of the important factors when it comes to the passive or active use of solar energy. The map on the right side shows the annual global radiation. New York City lies in the zone with more than 1400 kWh but less than 1700 kWh annual solar radiation per squaremeter.[36]

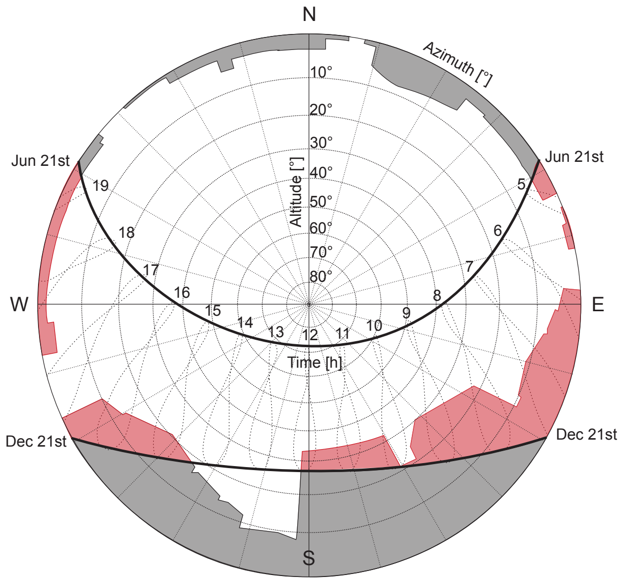


[35] This simplified stereographic diagram shows the annual sun path of New York City.



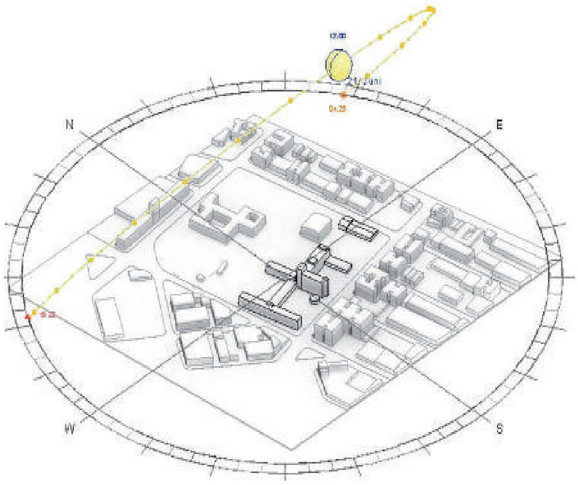
[36] Global radiation map

36 Cf. Energieatlas 2008, 51.

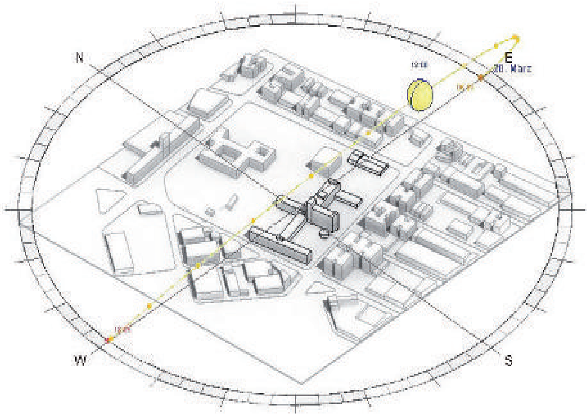


[37] Stereographic diagram showing the site overshadowing for the south facade (ground level). In winter the lower levels are shaded by the opposite buildings. Information source: Ecotect solar tool

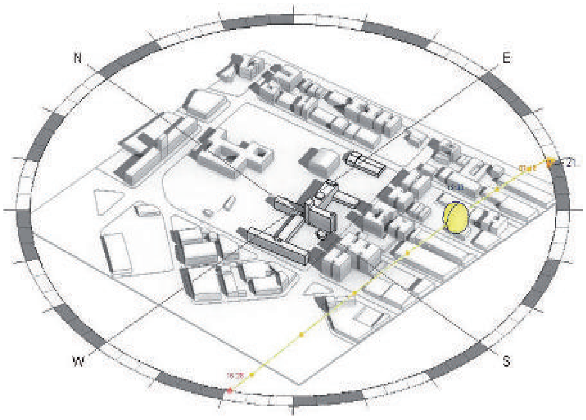
SURROUNDING
Site overshadowing
Drawing shadows
No impact



Summer Solstice, 12h



Spring Equinox,12h



Winter Solstice, 12h

MICRO CLIMATE

The climate of a specific site is influenced by its surrounding. High buildings around the site can obstruct the sun's light. A shadow diagram can be used to analyse if shadows from surrounding objects are cast on a selected viewpoint of the site. In this case it was interesting, whether the apartment buildings along Spofford Avenue draw shadows on the southern facade of the future building. In summer, there is little shadow, while lower levels are shaded in winter.

The sun path analysis of the different seasons shows how shadows change troughout the year. While shadow is useful in summer, it should be avoided in winter.

SUN, WIND & LIGHT

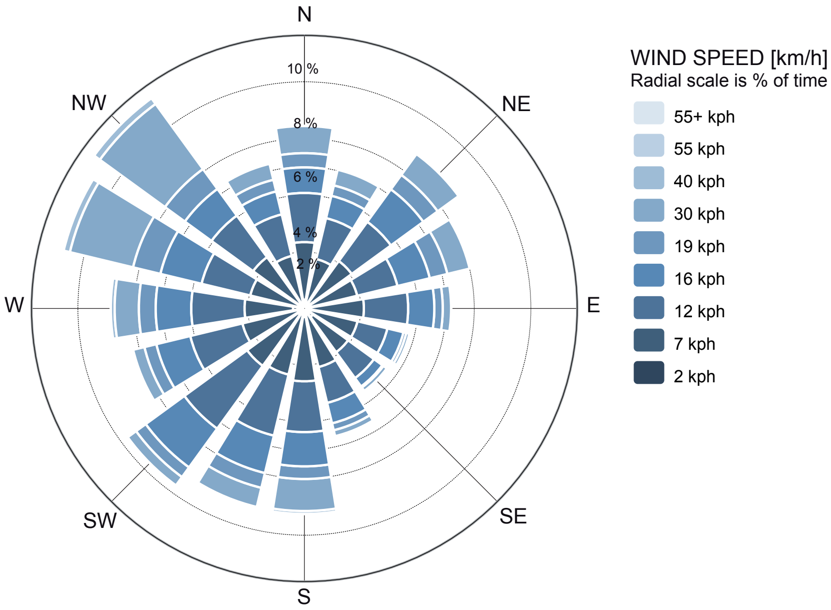
WIND PATTERNS

A wind rose gives information about wind directions, speed and frequency.
The wind rose to the left shows the annual wind speed distribution of the South Bronx. It indicates that wind is predominantly blowing from northwest and west-northwest. These are also the directions with the highest wind speed.

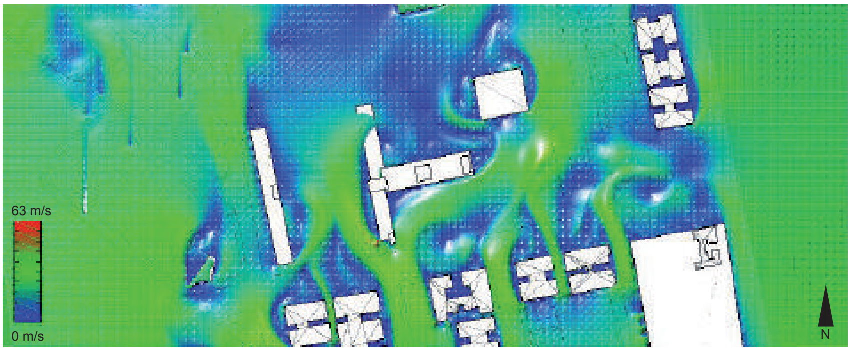
The monthly wind roses shown in blue colours, give specific information about the frequency distribution each month. Winter wind is mainly coming from northeast directions. In spring the wind direction changes from northwest to south. Summer wind is predominantly coming from the south. In autumn the wind is coming from many directions.

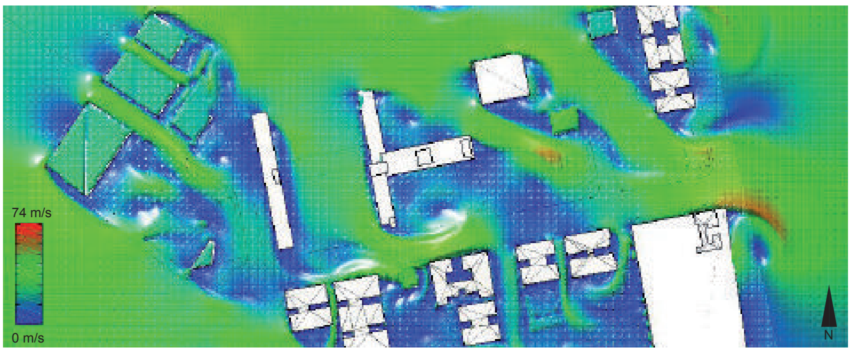
Cold winter winds should be blocked while chilling summer breezes can be used for natural ventilation

Wind flow is influenced by terrain, buildings and plants. When wind hits an object, pressure increases on the windward side of the object and creates a low pressure zone on the leeward side. Velocity is increased above and on the sides of the object .When wind flows through a gap of buildings it is accelerated.[37]



[38] Annual wind rose (Speed Distribution), Hunts Point
Source: Project Vasari Analysis

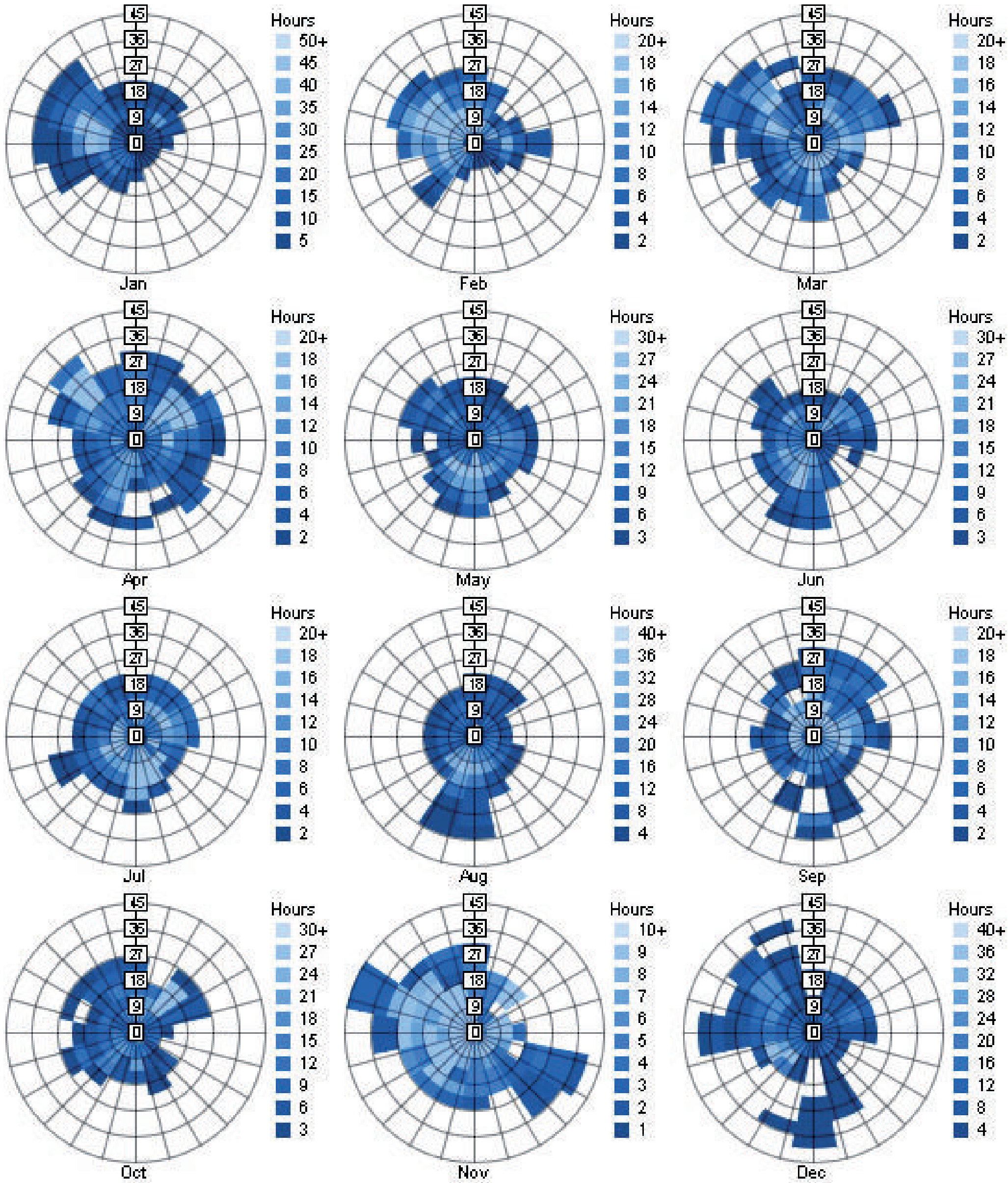




[39] Above: Wind flow on site, Summer
Source: Project Vasari Analysis

[40] Below: Wind flow on site, Winter
Source: Project Vasari Analysis

37 Cf. Brown/DeKay 2000, 17.



[41] Monthly Wind Frequency Roses, Hunts Point
Source: Project Vasari Analysis

DESIGN GUIDELINES

OPTIMUM ORIENTATION

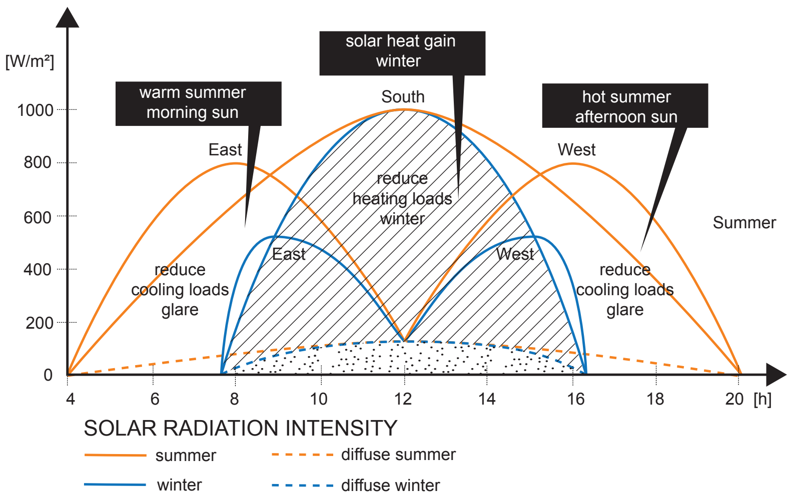
The orientation of a building determines its access to solar radiation and wind.

A buildings solar exposure is influenced by the sun's path. Solar radiation on a facade is continually changing throughout the year and during the day.[38]

In New York, the sun moves from northeast to northwest in summer and from southeast to southwest in winter. This means that in the hot season, south, east and west facades receive a lot of solar radiation, while in winter months the sun is predominantly shining from the south. The solar radiation intensity diagram shows the difference between summer and winter radiation. [42]

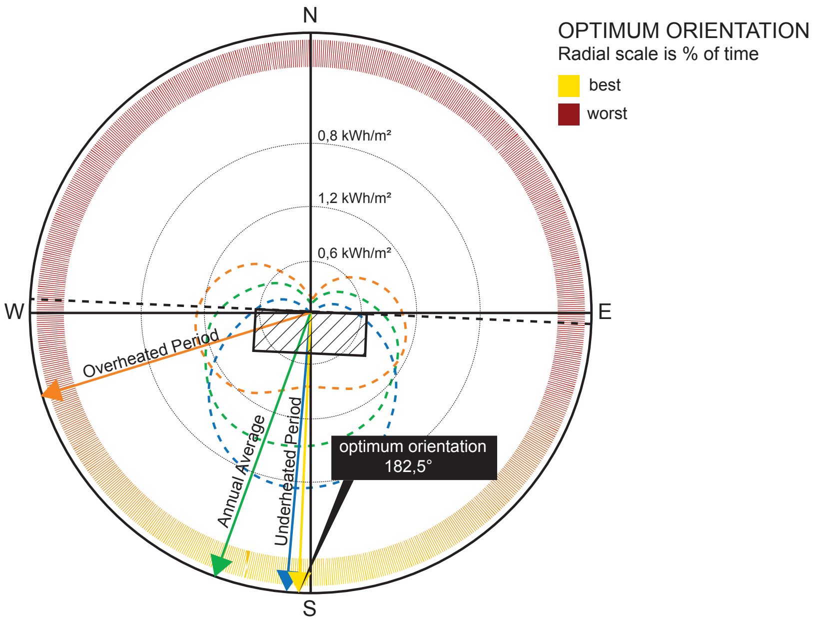
When using passive strategies, the sun plays a big role. In a climate with cold winters, solar heat gain can help reducing heating loads, whereas using shading devices during the warm season can help to keep indoor temperatures comfortable.

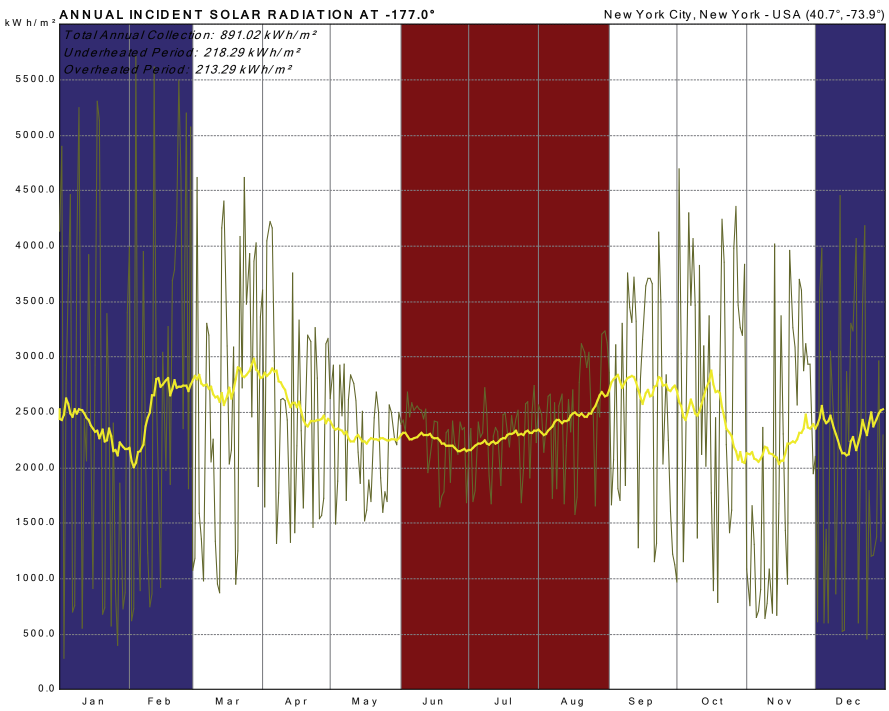
The optimum orientation for an average skin-load dominated building in New York City is south. Sun coming from the south is high in summer and can be easily shaded through blinds or overhangs. The eastern and western facades are more difficult to shade because the sun's position is lower. In winter, the southern facade receives most of the solar radiation and can be used for solar heat gain. The annual incident radiation diagram shows how the optimum orientation influences the solar access of a building. Radiation is maximized in winter and reduced in summer, resulting in a continuous access.



[42] Solar Radiation Intensity: Summer & Winter

38 Cf. Aksamija/Perkins+Will 2013, 19.





[43,44] Stereographic diagram showing the site overshadowing for the south façade (ground level). In winter the lower levels are shaded by the opposite buildings. Information source: Ecotect solar tool

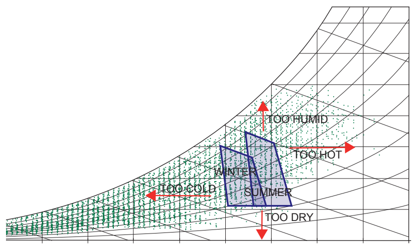
DESIGN GUIDELINES

HUMAN THERMAL COMFORT

The psychometric chart analysis was done with the software Climate Consultant, based on ASHRAE Handbook of Fundamentals Comfort Model 2005.

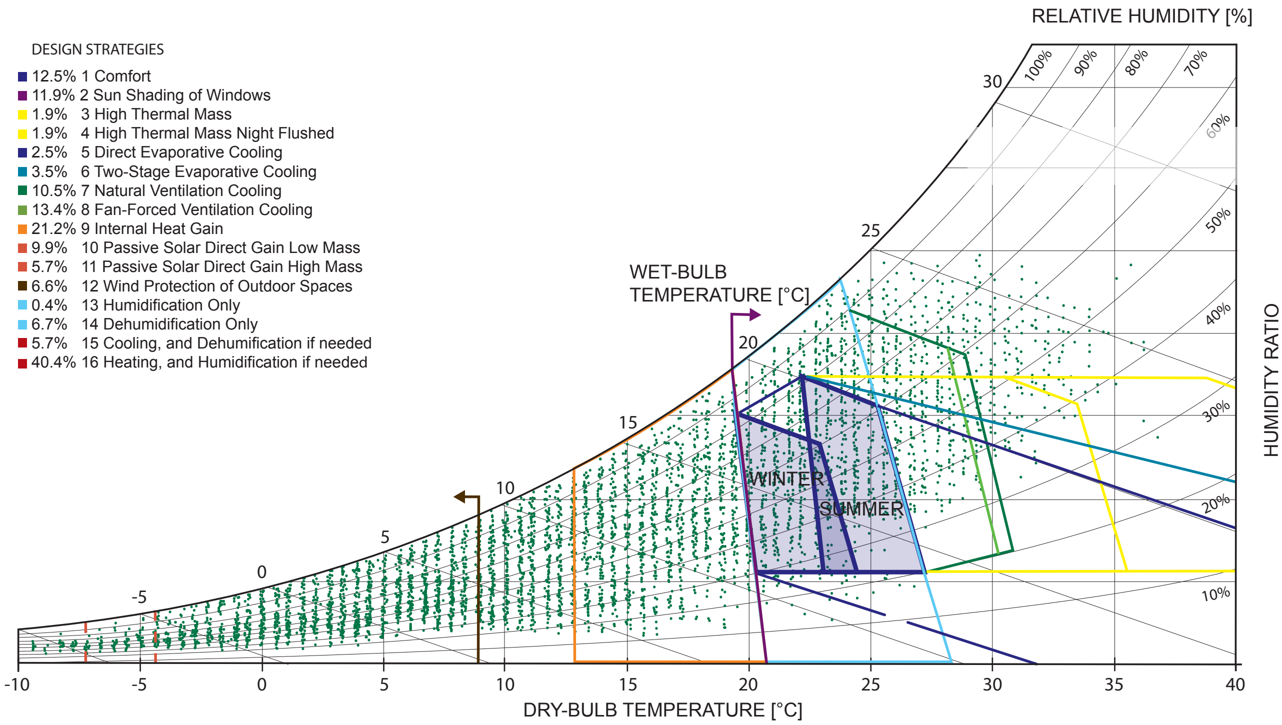
A psychometric chart shows the relationship between temperature and humidity for a given location. It helps to interpret occupant comfort and develop strategies to optimize a building.[39]

In the table below, different design strategies are listed and compared in their effectiveness. Without using any guideline, 12,50% of the hours per year lie in the comfort zone. The most important strategy in NYC is heating, it increases the comfort hours up to 80% . Fan-forced ventilation cooling in summer can increase the comfort hours to 92 %. Adding cooling and dehumidification when needed, leads to almost 100 % comfort hours. Solar heat gain can be used in addition to a heating system, but will not be enough to keep temperatures comfortable.

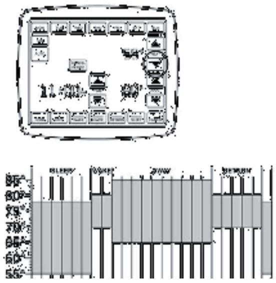


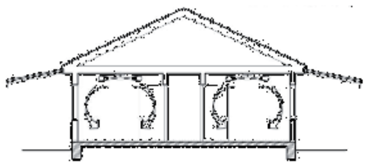
[45] Psychrometric Chart, Interpretation

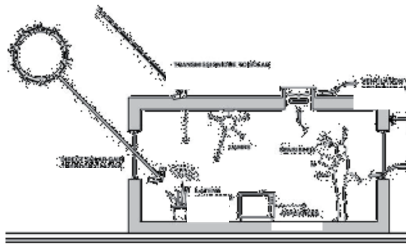
[46] Psychrometric Chart, NYC
with different design strategies
Information Source: Climate Consultant
Version 5.3



DESIGN GUIDELINES





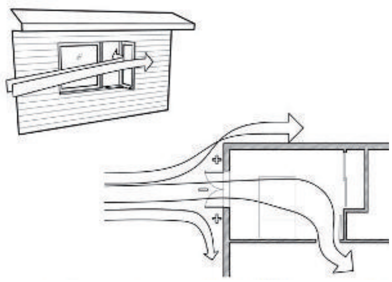


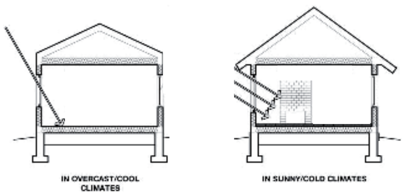
The design guidelines on this page are Climate Consultant's suggestions specific to New York City's climate. They were selected by choosing the most effective design strategies: heating, sun shading, internal heat gain, fan-forced ventilation cooling, natural ventilation and wind protection of outdoor spaces.

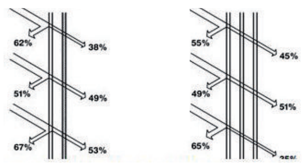
Lowering indoor temperatures at night reduces heating energy consumption.

Ceiling fans or indoor air motion can make it feel cooler by about 3°C. Thereby less air conditioning is needed and a lot of energy can be saved.

A well-insulated building guarantees that heat gain from equipment, lights, and occupants is kept inside in winter and reduces heating demands.







Natural ventilation can be used to reduce the need for air conditioning during hot seasons. Windows have to be well shaded and oriented to allow cross ventilation.

Thermal mass can help storing winter daytime solar heat gain and reduce cooling loads by using night-time ventilation in summer.

Choosing a glazing type with a small U-value is important to reduce conductive loss and gain.

[47-52] Design Guidelines, Climate Consultant

39 Cf. Hausladen/Liedl/Saldanha 2012, 38.

PART I

FULL SITE CONCEPT

MASSING

DESIGN OPTIONS

Different massing types were tested with the software Project Vasari, comparing their Energy Use Intensity (EUI) and CO_2 balance. Getting an idea of the relationship between EUI and building form was important to understand the most important parameters for reducing energy loads through massing.

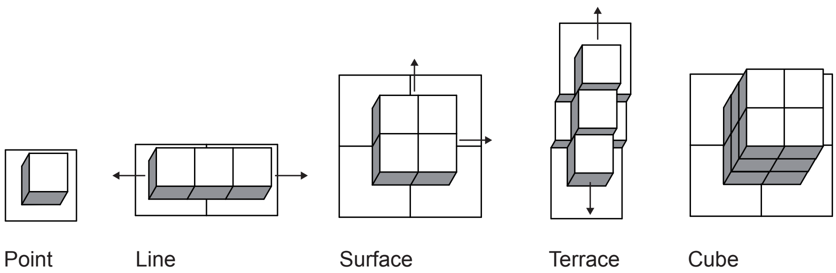
The options on the following pages show different possibilities to organize the given program.

There are five main residential building types:
-Point: free standing units;
-Line: linear bonded units;
-Surface: area-wise connected units;
-Terrace: terraced units;
-Cube: units connected vertically and horizontally.
Furthermore, there are many other building types, consisting of a composition of two or more main types.[40]

These building types were used as a base to develop the different design options. In order to be able to compare the different massing types equally, they are based on the same parameters.

GENERAL SETTINGS:

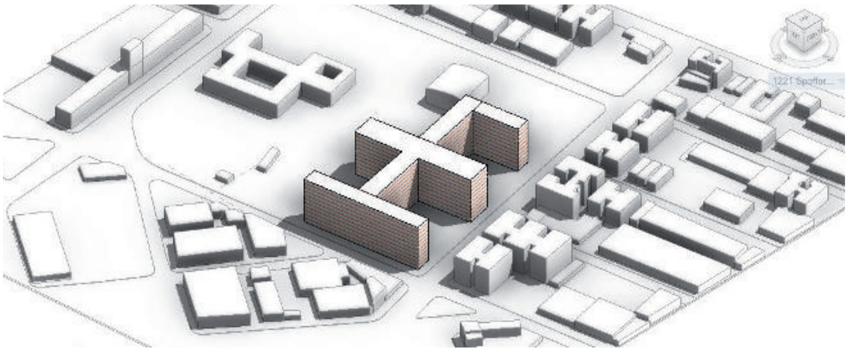
GFA: 50.000m²
Type: Multi Family
Percentage glazing: 40%
Insulation: typical cold climate
Shading: no shading
Height: 7-10 floors

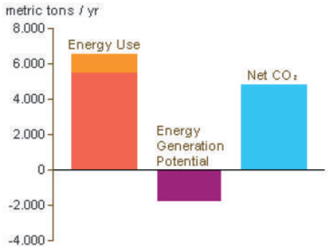


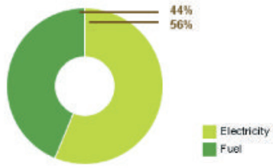
40 Cf. Geisendorf a. o. 1983, 42.

1: Existing, 10 floors

In option 1, the existing form is extended to 10 floors. There are huge courtyards on the South and on the North. The northern flats and courtyards have little solar access.



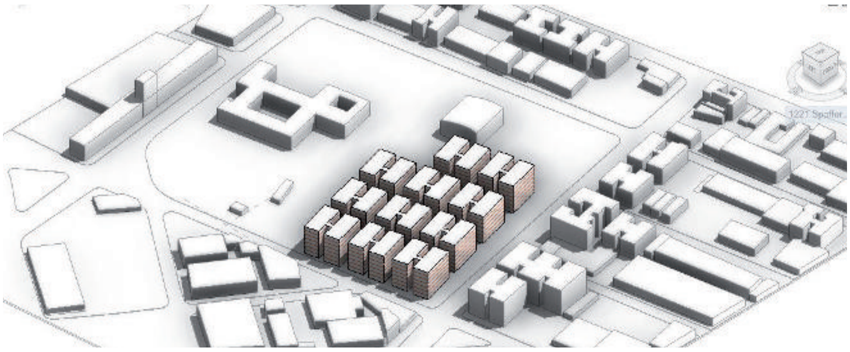


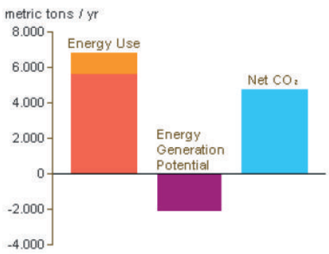


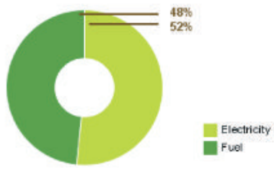
Option 1: Simplified Vasari model of the extended existing building. The function was changed to multi-family.

2: H-shape, 7 floors

In the 2nd option, the buildings use shapes similar to the residential blocks opposite the street. Using a height of seven floors, the buildings have to be placed very close together to achieve a GFA of 50.000m^2. The courtyards are too small to provide good daylighting.





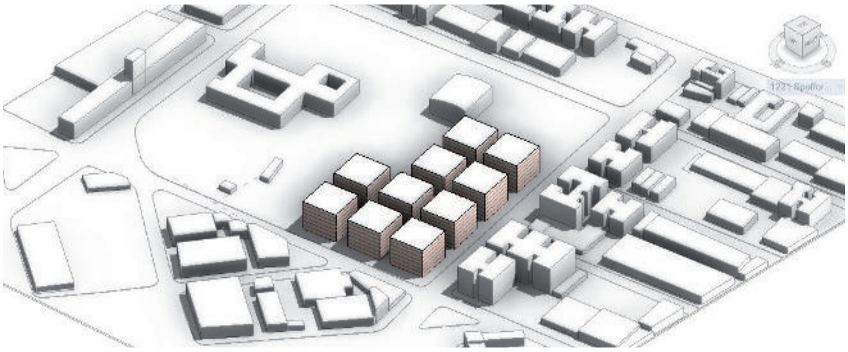


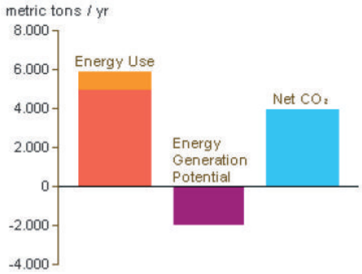
Option 2: H-shaped building types similar to the neighbouring residential blocks are tested.

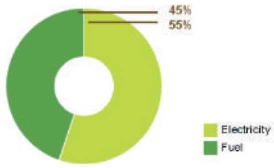
MASSING

3: Cube, 7 floors

In option 3, cubic shapes with 7 floors are tested. The forms are very compact, but they use most of the site, leaving little outdoor space. Floor plans are too deep for good daylight access. There is a huge core surrounded by single-oriented flats.



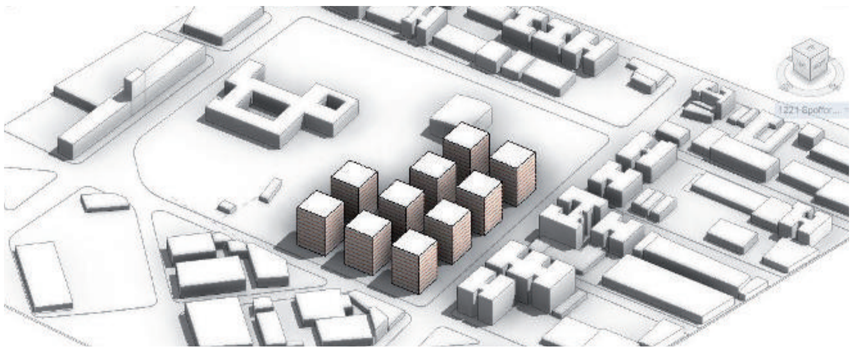


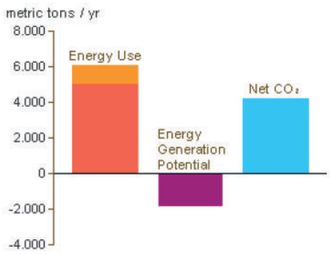


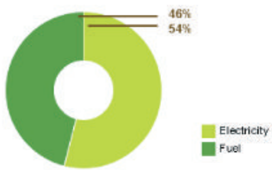
Option 3: Vasari model of compact point houses.

4: Cube high, 10 floors

Option 4 consists of rectangular buildings, taking advantage of the maximum building height. The buildings are similar to option 3, but they have better access to air and light because the space between the masses is bigger. However, the forms are less compact than the lower cubes.



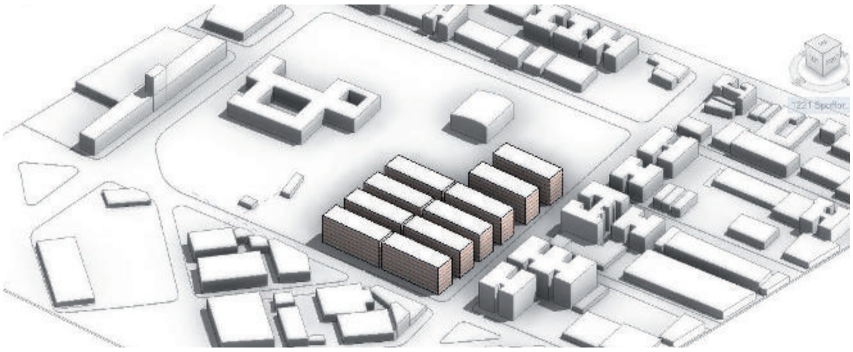




Option 4: Vasari model of rectangular buildings with the maximum heightof 10 floors.

5: Line South-North, 7 floors

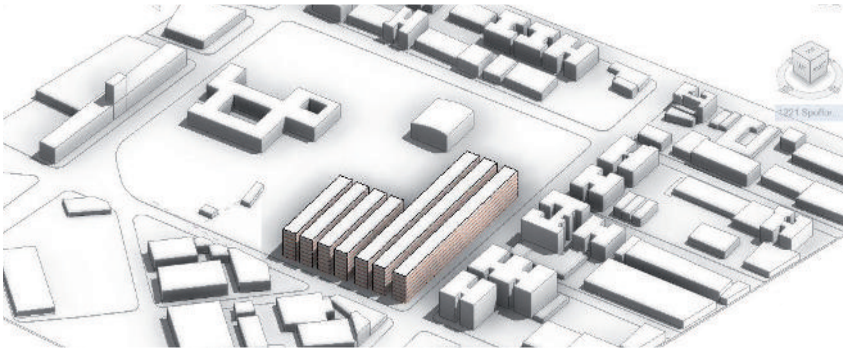
Option 5 analyses elongated buildings with east-west orientated flats. The inner buildings receive little light while the streets in between have solar access in summer and winter.

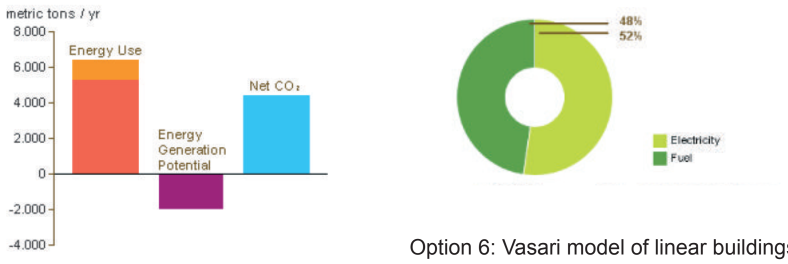


Option 5: Vasari model of buildings elongated along their south-north axis.

6: Line East-West, 7 floors

In option 6, elongated buildings with south-north orientated flats are tested. Solar access and cross ventilation are bad because the buildings block sun and wind from each other.



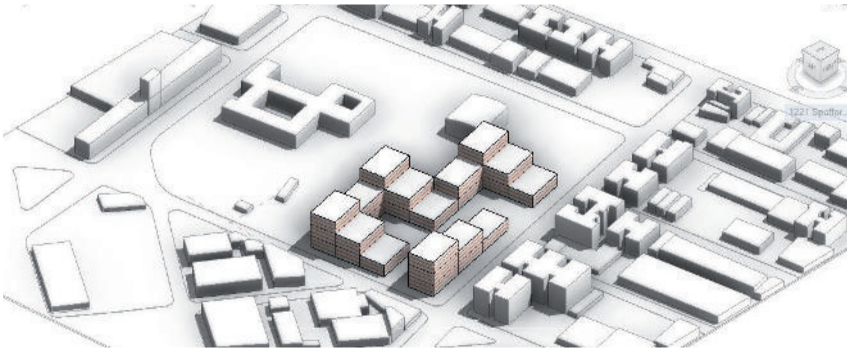


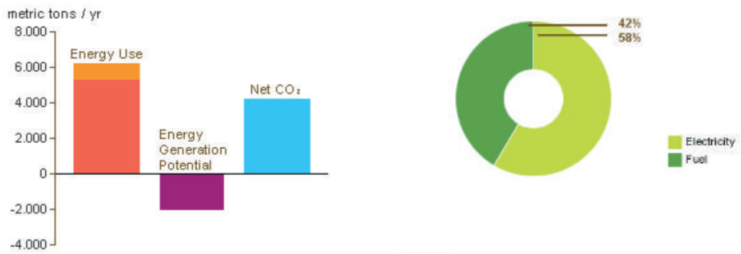
Option 6: Vasari model of linear buildings elongated along their east-west axis.

MASSING

7: Terrace, 3-9 floors

In Option 7, a terraced building type was tested. The EUI is lower than in the options analysed before. In this case, the terraced type is very compact because the buildings are connected to each other. Huge courtyards allow daylight and ventilation access.

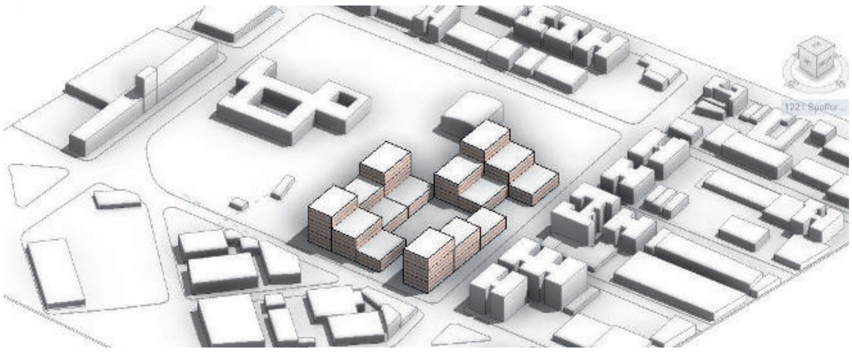


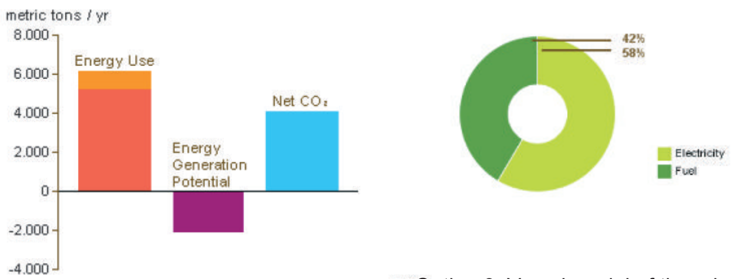


Option 7: Vasari model of terraced buildings with 3 to 9 floors.

8: Terrace/Surface, 3-9 floors

At last, in Option 8 a mixed type was tested. It is similar to Option 7 but a mixture of the terraced and the surface type. There are some parts with very deep floor plans, reducing the potential of using this shape for residential functions. The EUI is the same as in option 7.



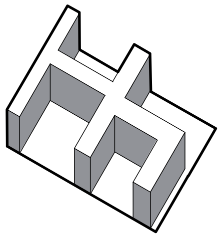


Option 8: Vasari model of the mixed terraced type with 3 to 9 floors.

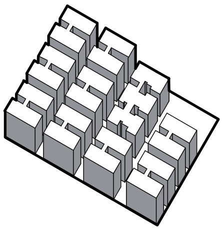
CHOOSING A FORM

The building form can have a big influence on its energy performance. The graphics to the right show a summary of the different massing types and their percentage change of the total EUI. The extended existing building serves as a starting point; the other building options have a range between +16% and -14% total EUI compared to option 1.
There is a difference of 68 kWh/m^2 per year between the best design option (terraced type) and the worst option (H-shapes).

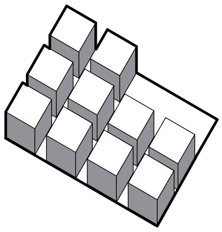
Terraced forms use less fuel in relation to electricity and have smaller HVAC loads. The height between 3 and 9 floors allows a high density with solar and wind access.



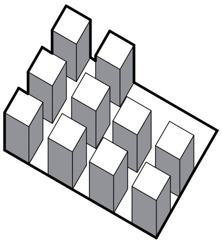
+- 0% Total EUI



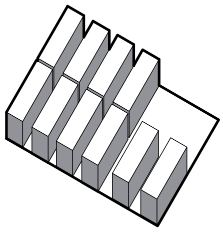
+ 16% Total EUI



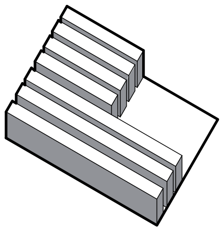
- 2% Total EUI



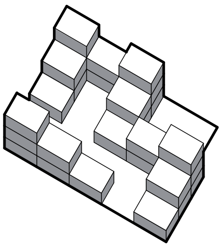
+ 3% Total EUI



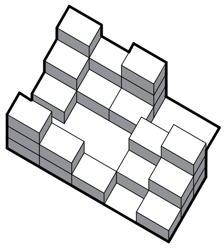
+ 7% Total EUI



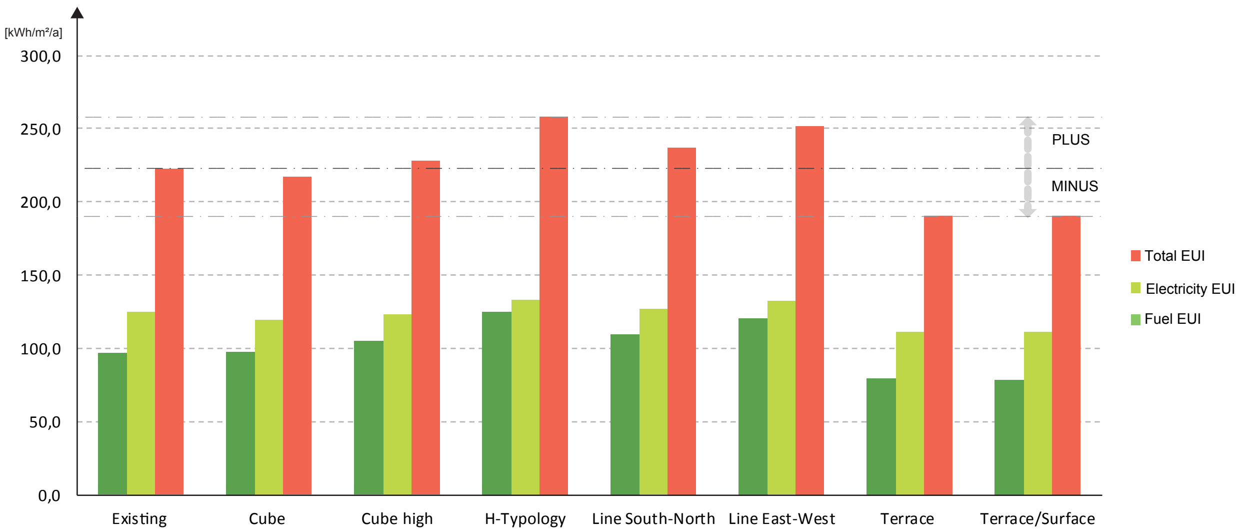
+ 13% Total EUI



- 14% Total EUI



- 14% Total EUI



A comparison of all design options:
Total, Electricity & Fuel Energy Use Intensity

DESIGN STRATEGIES

PALETTE 2030

"The 2030 Palette is an interactive online tool that puts the principles behind low-carbon and resilient built environments at the fingertips of architects, planners and designers worldwide."
Edward Mazria in Inhabitat[41]

Selecting a minimum of five Swatches from the 2030 Palette for each project part, was one of the competition requirements.

The elements are organized in five categories: Region, City/Town, District, Site and Building.

CHOSEN SWATCHES:
City/Town:

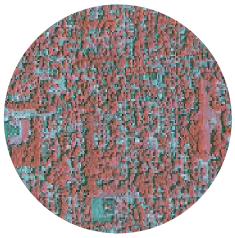
Heat Island Mitigation:
The heat island effect can be reduced by using light-coloured surfaces, increasing tree canopy and increasing vegetation on and around buildings.[42]

Parks:
Parks add value to residential areas and offer a habitat for animals and biodiversity.[43]

Urban Bikeways:
Travelling by bike reduces CO_2 emissions, noise and air pollution.[44]

District:

Street Networks:
Using block lengths with a maximum of 150m encourages street-level activity. Pedestrian pathways can be used to reduce the lengths of bigger blocks.[45]



[53] Heat Island Mitigation
City of Ann Arbor Urban Tree Canopy Analysis

[54] Parks
Darling Quarter Sydney, ASPECT Studios

[55] Urban Bikeways
Zurich Cyclists

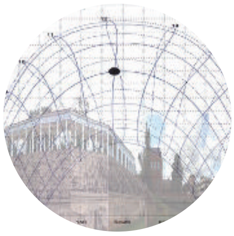
[56] Street Networks
Barcelona Cerda Grid

Residential Densities:
High residential densities with mixed use facilities encourage the development of public transport services. Shopping areas within walking distance decrease car usage.[46]

[57] Residential Densities
Barcelona El Clot District Pedestrian Zone

Site:

Solar Access:
In cold and temperate climates, sunny outdoor spaces and parks are most popular. Buildings with solar access can use the sun for heat gain and energy generation. Physical and digital modelling helps to analyse the solar access of buildings.[47]



[58] Solar Access
Orthographic Shading Analysis, Lambeth Field

Sustainable Sites:
Creating advantageous micro-climatic conditions is the goal of using sustainable sites. Increasing pervious surfaces and capturing rainwater helps to reduce storm-water runoff. Preserving native vegetation protects soils and biodiversity. Trees can be used to block winter winds and provide shade in summer.[48]

[59] Sustainable Sites
Kensington Performing Arts High School
SMP Architects / SRK Architects

Green Roofs:
Using green roofs increases insulation and noise protection of buildings, while reducing ambient air temperatures. They retain rainwater and filter pollutants. Green roofs can be used as community space like in the picture on the right.[49]

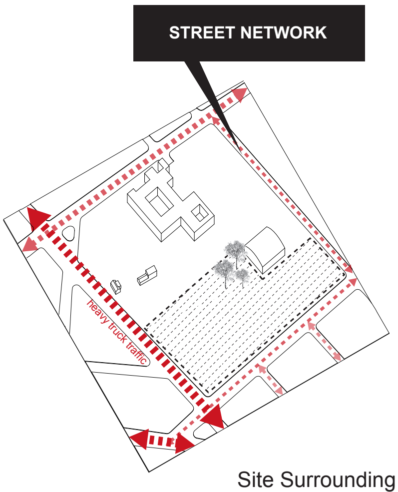
[60] Green Roof
TU Delft Library
Mecanoo Architecten

41 Michler 2014, 1.
42-49 Cf. 2030 Palette 2013.

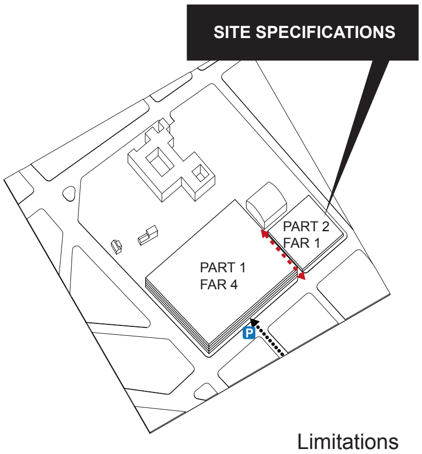
CONCEPT

MASSING STEPS

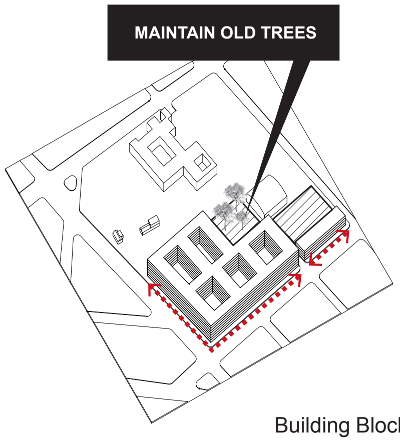
The graphics below show how the conceptual massing has been developed. The competition requirements and the urban context served as basic limitations.



Site Surrounding



Limitations



Building Block

URBAN SITUATION

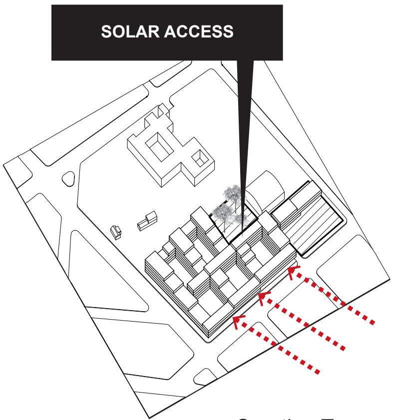
The site is bordered by low-traffic streets in the east and south, while a road with heavy truck traffic is situated along its western boundary. Three streets end at the site of the former Juvenile Center. The block length is three times bigger compared to the residential blocks opposite the street. There are some old trees in the upper right corner of the site.

SITE SPECIFICATION

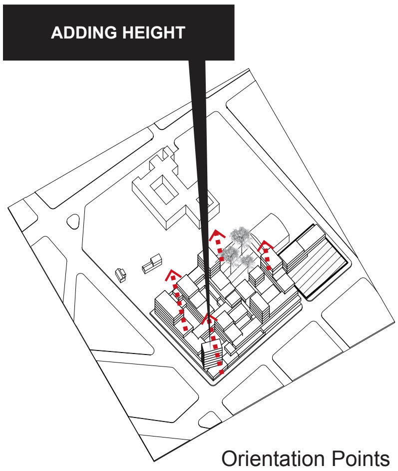
Floor-to-area ratios (FAR) were pre-set in the competition guidelines: a FAR value of 4 in the area designated for part 1 and a FAR value of 1 in the area provided for part 2. The site is zoned as R7 (7 floors), but can have up to 10 floors. A pedestrian street with a place for pick up and drop off has to be placed between the residential development and part 2.

COURTYARDS

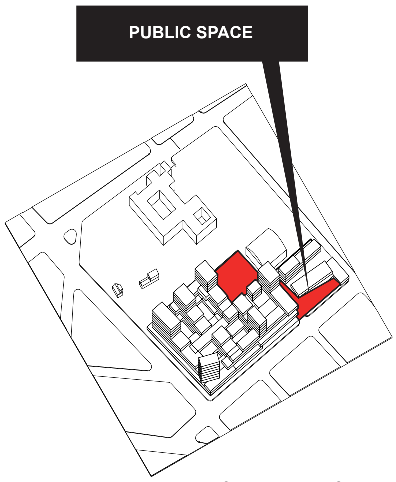
The housing development has to be clearly separated from sidewalk traffic because of safety issues. Instead of using walls or a fence, the building is used as separating element. Five courtyards are placed inside the building block. They serve as social space and give access to daylight and fresh air. The area with the trees is preserved and used as a small park.



Creating Terraces



Orientation Points



Community Space

SOLAR ACCESS

In order to increase solar access and to use summer breezes for cross ventilation, the building complex is terraced. The building height increases from south to north, allowing direct sunlight into the courtyards. The terraces are used as public and private outdoor space. The buildings with north-south oriented flats are narrower than the others.

LANDMARKS

The corner between Tiffany Street and Spofford Avenue is important for the development. It is the link between Hunts Point's industrial area and the residential core. The fresh foods grocery with the adjacent cafe will be located at this corner. A tower is placed above the grocery and serves as an orientation point. The (summer) bus stops opposite the corner.

COMMUNITY SPACE

A public space will be placed at the beginning of the pedestrian street. Roofs and courtyards will serve as community space. The park will be open to public and can be accessed through the pedestrian street and from the courtyards. Pedestrian paths will go through the block and connect the streets to each other.

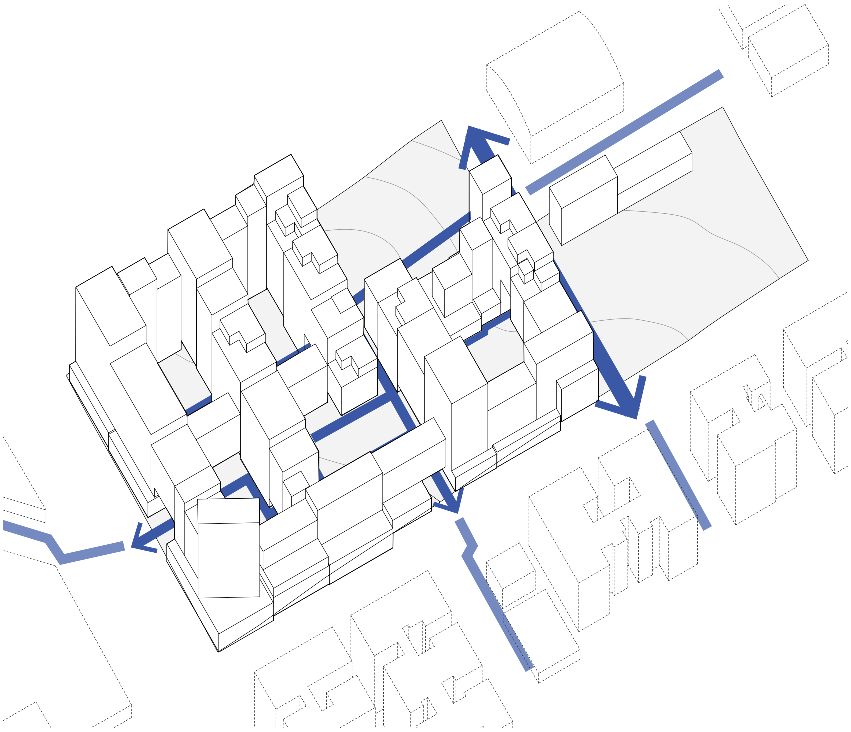
CONCEPT

MICRO CLIMATIC CONDITIONS

Hunts Point has a very high Asthma rate compared to the rest of New York City, therefore it is important to improve the air quality. Stricter regulations for industrial buildings combined with urban greening and a reduction of traffic levels, will provide cleaner air. The South Bronx Greenway already brought more green space into the area. This residential complex will be part of the development and provide recreational space for its inhabitants. Planted courtyards, a park and green roofs offer green space and mitigate the urban heat island effect.

The buildings are lower in the south to allow summer breezes and sun into the complex. Winter winds are blocked by the higher northern and western building groups.

Solar panels are installed on some of the roofs and integrated in south and west facades. Shading panels are used for the building integrated modules. Roof panels are tilted to optimize the energy output.



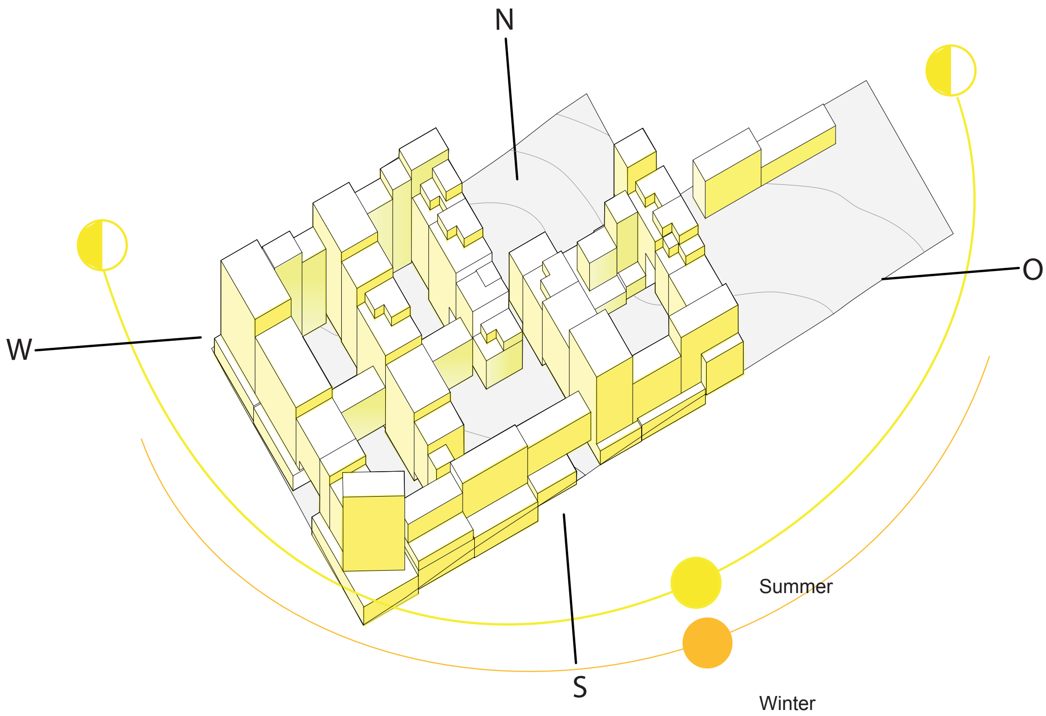
PEDESTRIAN CONNECTIONS

The existing pedestrian connections are extended to keep walking distances short and increase street level activity. Several footpaths connect the buildings to their surrounding. A pedestrian street leads to the Recreation Center and the neighbourhood park. At the beginning, there is a place where pick-up and drop-off is allowed.

FUNCTIONAL DISTRIBUTION

Public functions are placed on the ground floor. The fresh foods grocery and the adjacent cafe are located on the corner of Tiffany Street and Spofford Avenue. The nursery is moved deeper into the site and close to the park. The performance will be connected to the event space to have enough space for big events. Offices are available close to the performance space and above the grocery. They will be used for on-site administration and available for rent. In addition, a Youth Job Center and a Health- & Fitness Center are added to the program.

SOLAR ACCESS



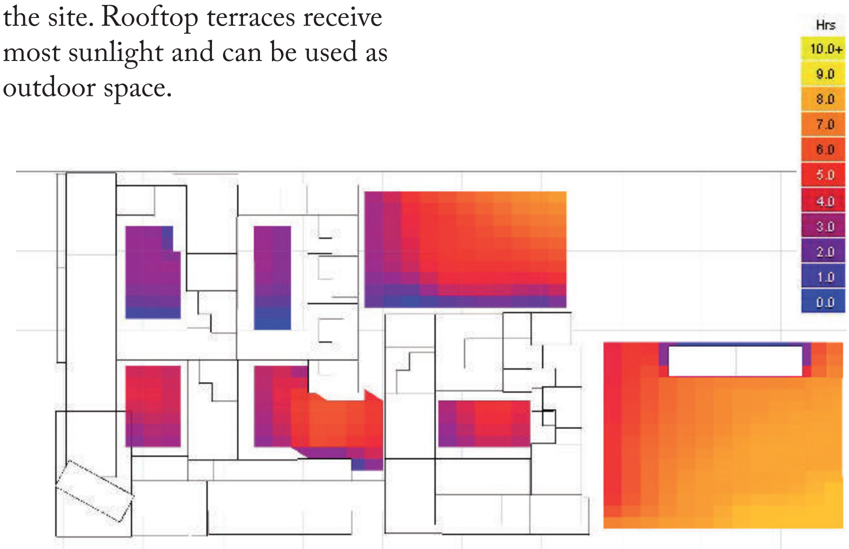
ORIENTATION

In winter, the flats oriented to the south receive more sunlight and benefit from solar heat gain.

COURTYARDS

By terracing the buildings, the courtyards and the park receive direct sunlight most of the year.

From March to November, the time when the outdoor space is used most frequently, there are between 3 and 7 sunlight hours in the courtyards. In summer, the solar access is best. Trees shade the outdoor spaces and improve the microclimatic conditions. In spring and autumn, the shadow range is bigger and less sunlight is received. The southern yards receive more light, because the buildings are lower. In winter, most of the site is shaded because of the high density required on the site. Rooftop terraces receive most sunlight and can be used as outdoor space.



Average sunlight hours in the time when most of the outdoor activity happens: March to November

SUMMER

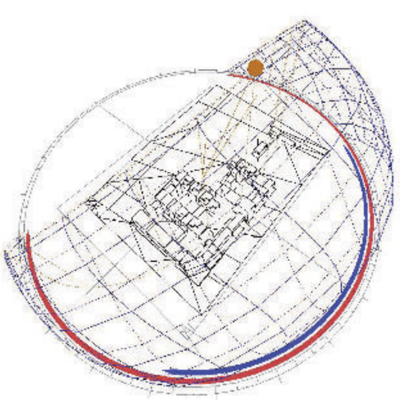
SPRING / AUTUMN

WINTER

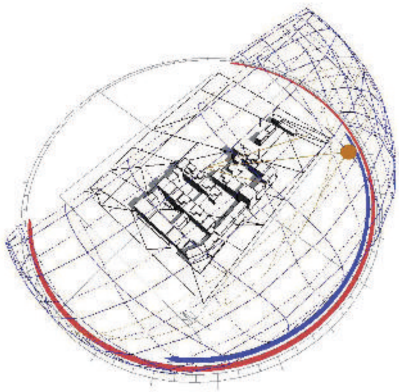
Shadow Range: 21st June [9.00 am - 17.00 pm]

Shadow Range: 21st March [9.00 am - 17.00 pm]

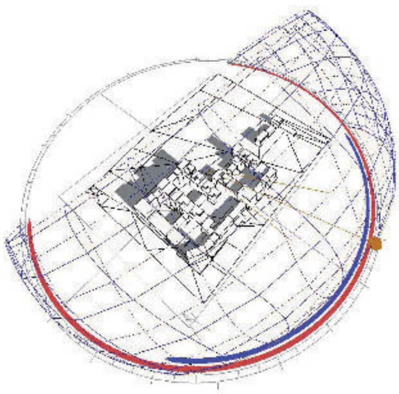
Shadow Range: 21st December [9.00 am - 17.00 pm]



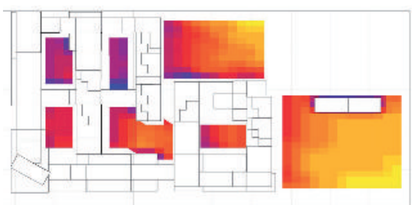
Summer Solstice, 12H



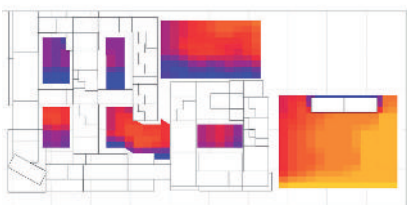
Spring Equinox, 12H



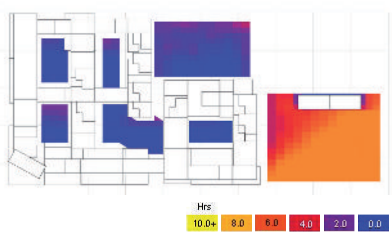
Winter Solstice, 12H



One day study: Summer Solstice



One day study: Spring Equinox



One day study: Winter Solstice

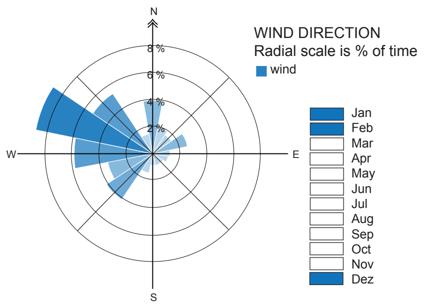
WIND & VENTILATION

WINTER WIND

The prevailing wind direction in the three coldest months (Dezember, January, February) is west-northwest. High wind speeds and cold temperatures are characteristic for winter winds. Because of the high temperature difference between indoor and outdoor air, exchange rates are high and no cross ventilation is required.

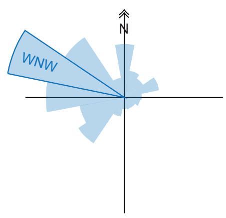
Buildings should be protected from high wind speeds to minimize infiltration. Massing and landscaping can be used to deflect winter winds. Outdoor spaces should be protected to make them more comfortable.

In this case, the northern and western buildings block wind from the rest of the development. Courtyards are calm and can be used without the discomfort of harsh winds.



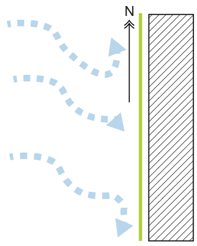
COLD WINTER WIND
prevailing winds in the 3 coldest months

WINTER WINDS



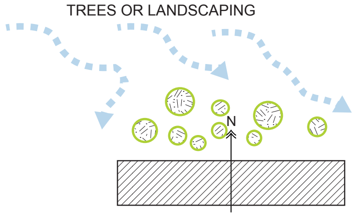
prevailing winds from December to February

WIND PROTECTION THROUGH A SECOND SKIN

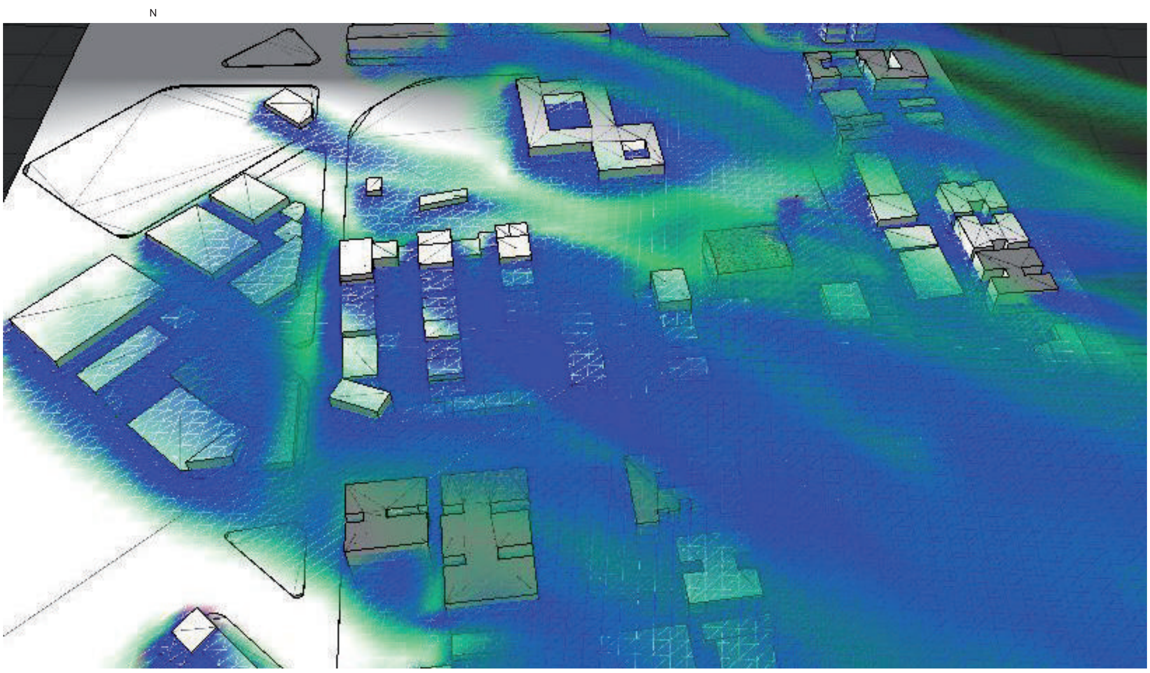


- minimizing infiltration
- reducing wind pressure on the construction
- blocking uncomfortable winds from outdoor spaces

WIND PROTECTION THROUGH TREES OR LANDSCAPING



- reducing wind speed
- reducing wind pressure on the construction
- obstructing wind before it hits the building

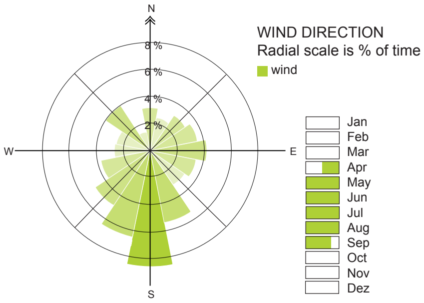


Prevailing winter winds (NNW)
Source: Project Vasari Analysis

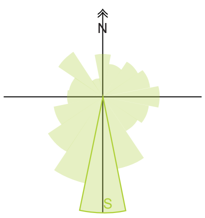
CROSS VENTILATION

The prevailing winds from mid of April to late September come from the south. During this time, cross ventilation can be used for quick air exchange. In summer, a low wind speed inside buildings increases comfort and makes people feel cooler. Orientating buildings perpendicular to prevailing winds and designing shallow floor plans, encourages cross ventilation. Inlet openings should be placed lower than the opposite outlet openings to provide fresh air in the whole room. To encourage air flow, outlet windows should be equally big, or bigger than inlet openings.

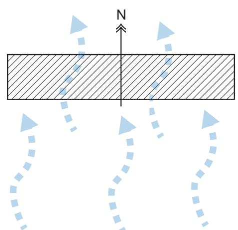
In the wind analysis below, an average north-south oriented unit of the residential development is tested.



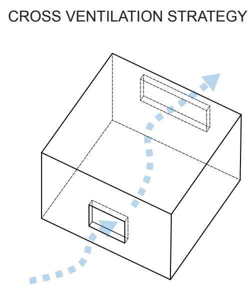
NATURAL VENTILATION & COOLING
prevailing winds from mid April to late September



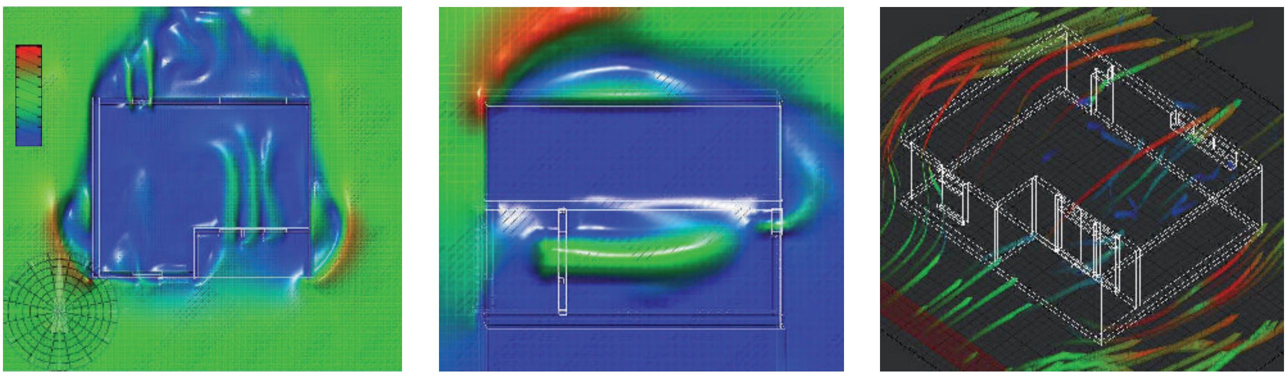
prevailing winds from mid April to late September



- perpendicular to wind direction
- shallow layout



- lower inlet & higher outlet to distribute the fresh air inside
- bigger outlet opening to encourage airflow
- no furniture disturbing the airflow



Cross ventilation: floor plan, section and 3D of an average N-S oriented room
Source: Project Vasari Analysis

UNIT MIX

REQUIREMENTS

The competition asks for including different types of living units in the development. Rental apartments, co-ops, duplexes and 2-4 story townhouses shall be mixed in order to attract different social classes. On the one hand, the development should not be luxury, on the other hand, it should not only be "affordable housing".[50]

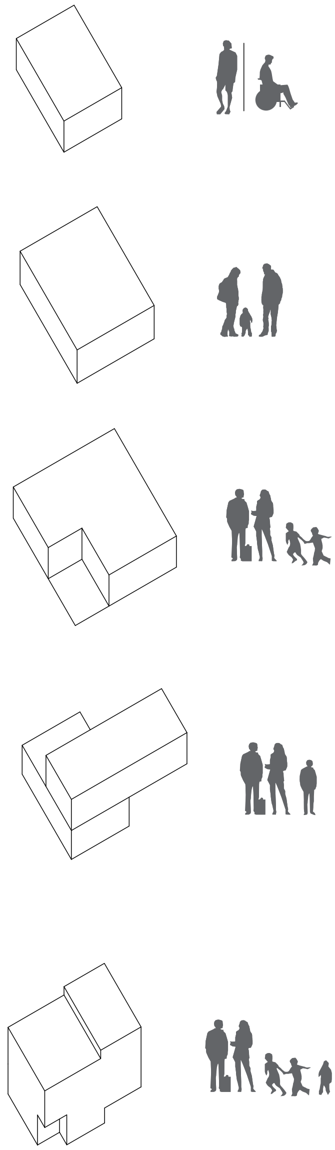
A number of about 400 units has to be included in the residential buildings. Open space should be integrated and extend the private space.

HOUSING TYPES

- Studio
- Apartment
- Courtyard House
- Duplex
- Townhouse

Five different housing types for specific target groups have been developed. The intention was to offer a residential mix for different social groups. The residential complex sets to attract locals as well as people from outside Hunts Point. Low-income families will be mixed with middle- and higher-income households. Different sizes of the flats lead to a mix of singles, couples and family households. Handicapped and older people are attracted by the adaptability for accessible housing. Community space will be included to encourage social interaction. Successful people will no longer leave the neighbourhood, as soon as they can afford to livesomewhere else. The new development will become a center for the residential core of Hunts Point.

The 2030 targets are met by the use of natural ventilation, daylight access and solar heating in winter. Renewable energy is integrated in the facade and on the roof. Floor-to-ceiling windows and shallow floor plans allow daylight penetration. A maximum of 14 metres floor plan depth and opposite windows encourage cross ventilation. All flats have solar access and shading devices or overhangs to reduce heat gain during summer time. Street noise along Tiffany Street is blocked by a circultation zone.

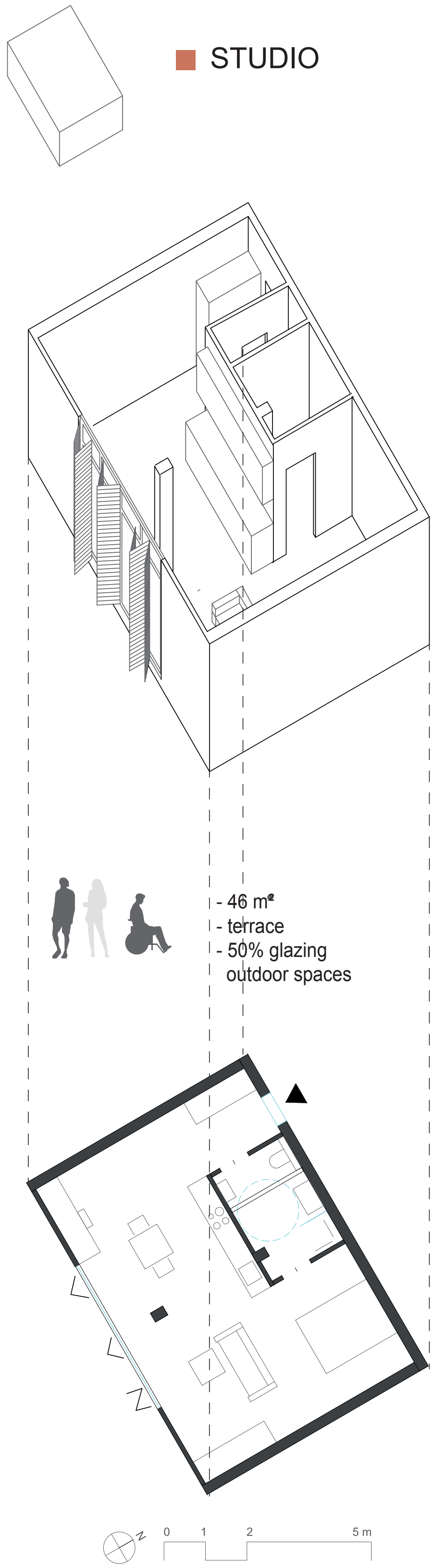


50 Cf. Transformation 2030 Info Package 2013.

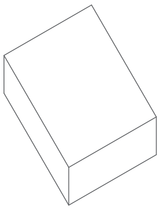
STUDIO

Target group: singles/young couples

The 46m² studio is designed as a one-bedroom unit. A maximum of two people can occupy the flat. It is oriented one-sided and consists of a single room. A wet room divides the studio into an entrance, eating, living and sleeping zone. The toilet and the bathroom are separated by a non-bearing wall, which allows adaption to get handicapped accessible. A terrace enlarges the flat. Floor-to-ceiling glazing and a shallow floor plan maximize daylight penetration. In the cold months of the year, solar gains can be used to reduce heating loads. In summer, the shading devices have to be used to avoid overheating. The shading panels are building-integrated photovoltaic modules.



UNIT MIX

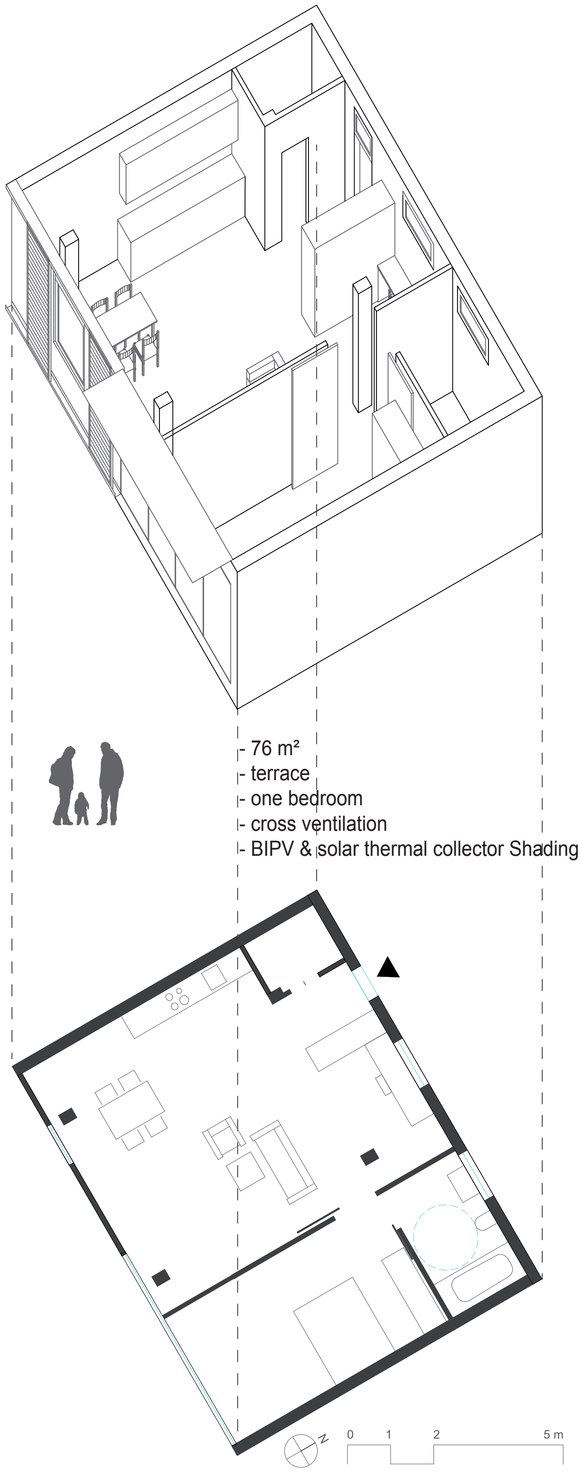


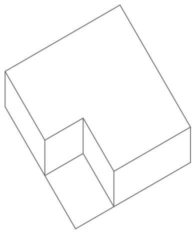
■ APARTMENT

APARTMENT

Target group: childless couples

The apartment type is a 76m² flat for two people. South-north orientation and a shallow floor plan encourage cross ventilation. The flat can be accessed from an arcade, which also serves as a social space. The unit consists of a cooking, eating and living zone with a working area, a storeroom, a bedroom and a bathroom. Secondary rooms are placed on the northern side. The flat is accessible for handicapped people. The southern terrace connects the bedroom and the living area. An overhang allows solar access in winter and minimizes overheating in summer. Photovoltaic panels serve as sliding shading elements.



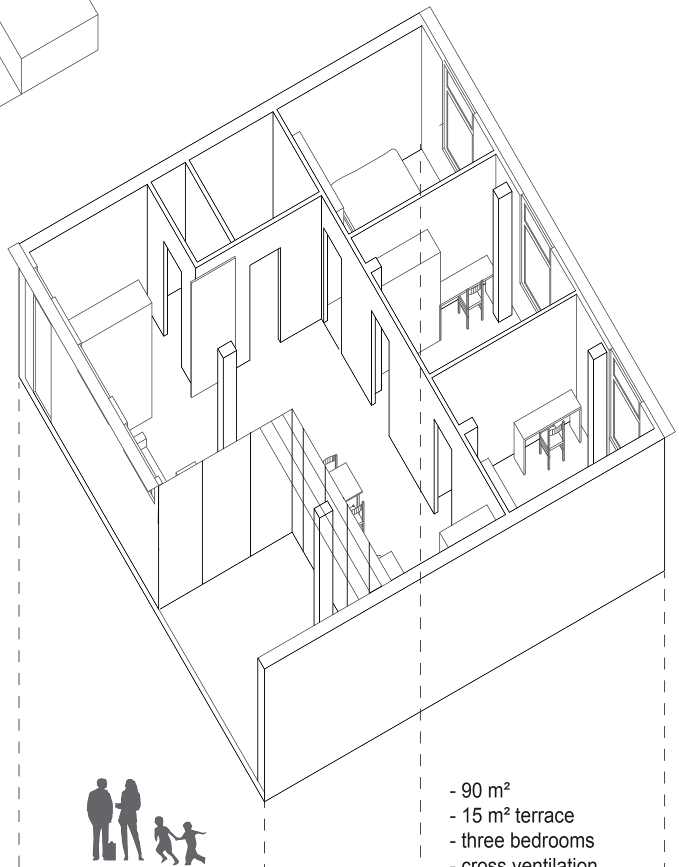


COURTYARD APARTMENT

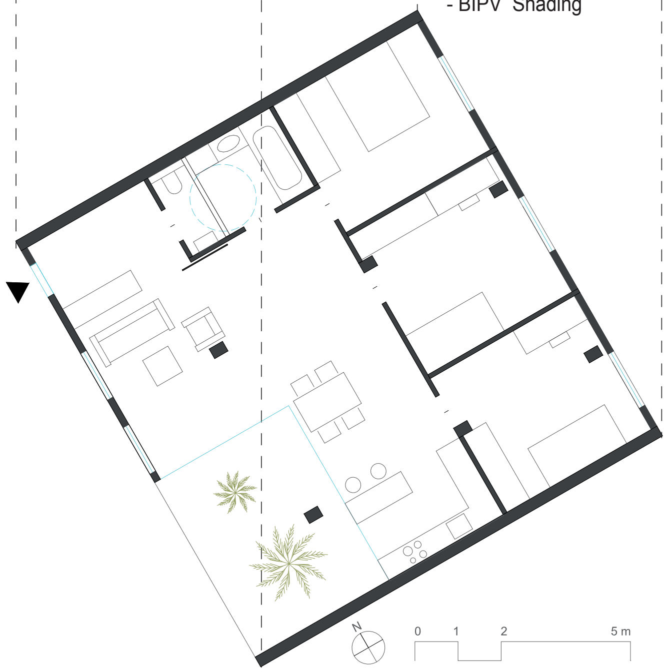
COURTYARD HOUSE

Target group: families

The courtyard type consists of a 90m² flat with a huge terrace. It is designed for a maximum of 4 people and includes 3 bedrooms. The east-west orientation allows a sleeping zone in the east and a living zone in the west. Secondary rooms are located in the middle. The courtyard allows daylight access into the inner rooms. Cross ventilation is possible.



- 90 m²
- 15 m² terrace
- three bedrooms
- cross ventilation
- BIPV Shading

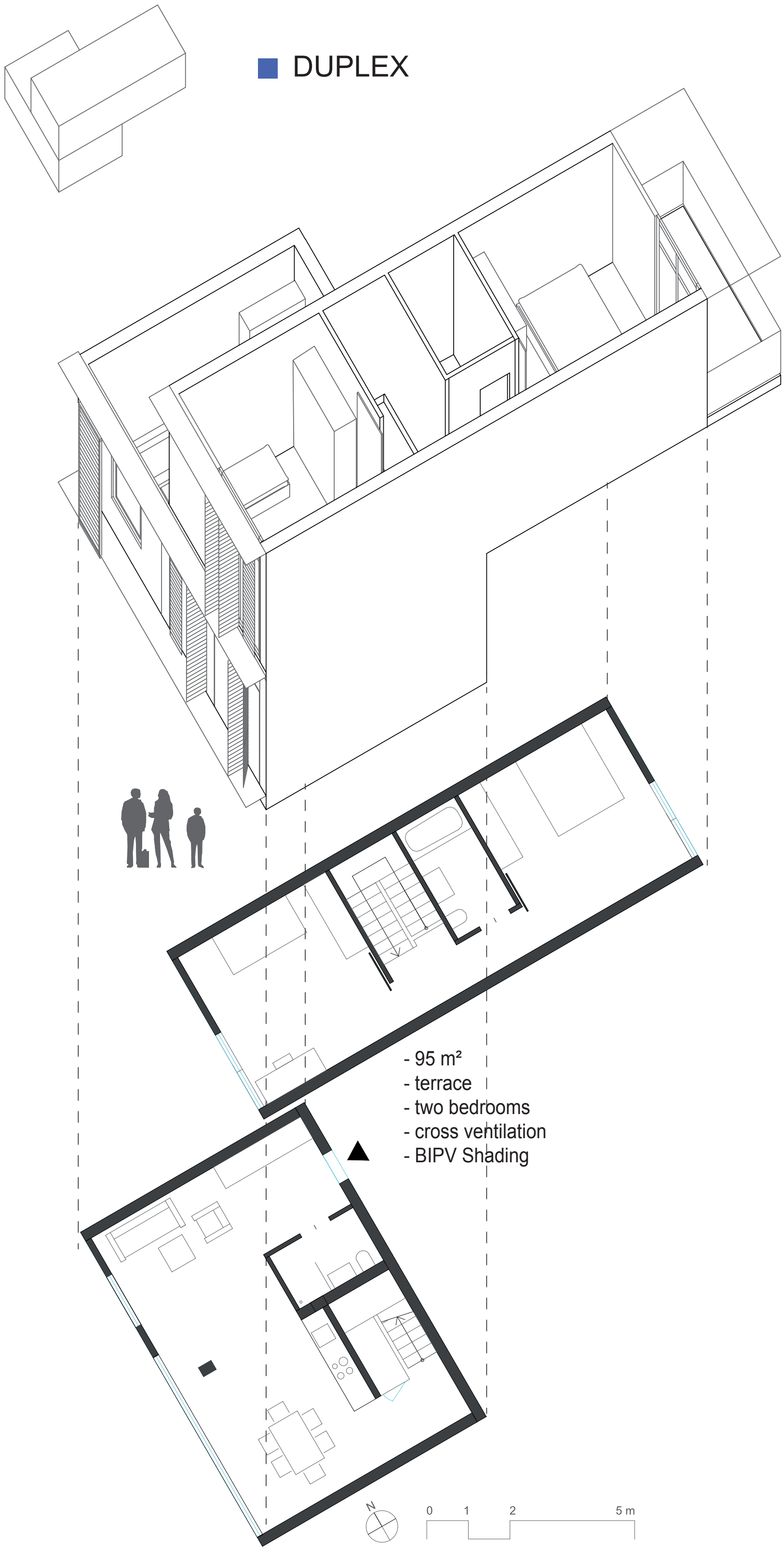


UNIT MIX

DUPLEX

Target group: families

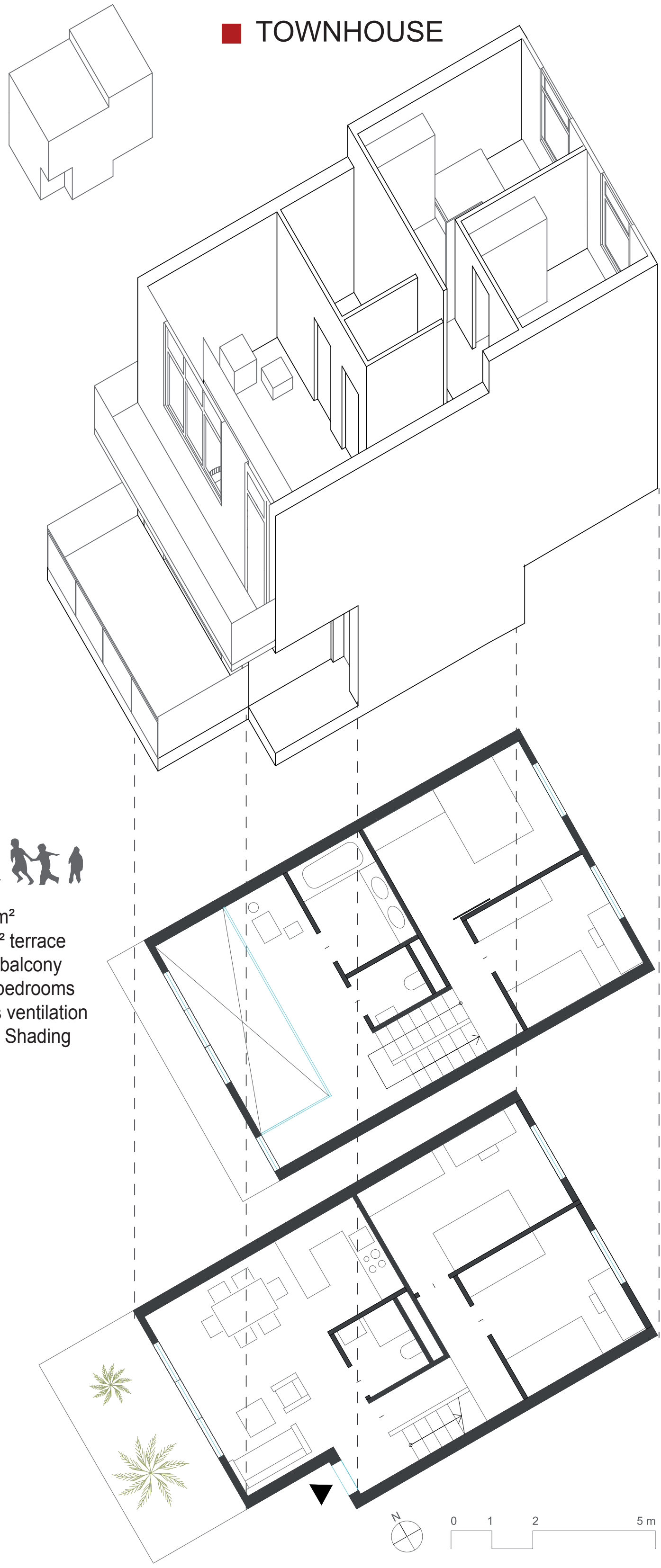
The 95m² duplex is designed for three occupants. There are two levels: the lower floor consists of living, cooking and eating zones, the upper floor includes private rooms.
The entrance is located in the first floor and can be accessed from an indoor corridor. The floor plan is shallow, so daylight penetration and natural ventilation are possible, even though this level is oriented one-sided.
The second floor is oriented double sided. Cross ventilation is possible and allows a deeper floor plan.
Moveable shading devices use the sun and minimize heat gain in summer.



TOWNHOUSE

Target group: families

The townhouse covers 105 m² of living space on two floors with split-levels. Four bedrooms offer enough space for a family with three children. A 13 m² terrace and a 6 m² balcony link interior and exterior space. The entrance is located in the lower level, which includes cooking, eating and living zones. The first split-level is used for two bedrooms. The second floor covers a playing area and a gallery. The next split-level includes the other two bedrooms. Cross ventilation is possible and is assisted by the stack effect, created through height difference. The house is oriented east-west. Sleeping zones are set in the east and living and exterior zones in



- 105 m²
- 13 m² terrace
- 6 m² balcony
- four bedrooms
- cross ventilation
- BIPV Shading

EXPLODED DIAGRAM

DESIGN STRATEGIES

The Palette 2030 strategies are used as a base for the design strategies applied in the project.

Bike lanes increase safety for cyclists and encourage more people to go by bike. For short distances, bikes can be rented at a city bike station.

Community greenhouses are placed on the roofs of the complex. Local food production raises awareness and can be used for job training.

All trees of the Juvenile Detention Center are preserved. A park offers recreation space for the neighbourhood and mitigates the heat island effect.

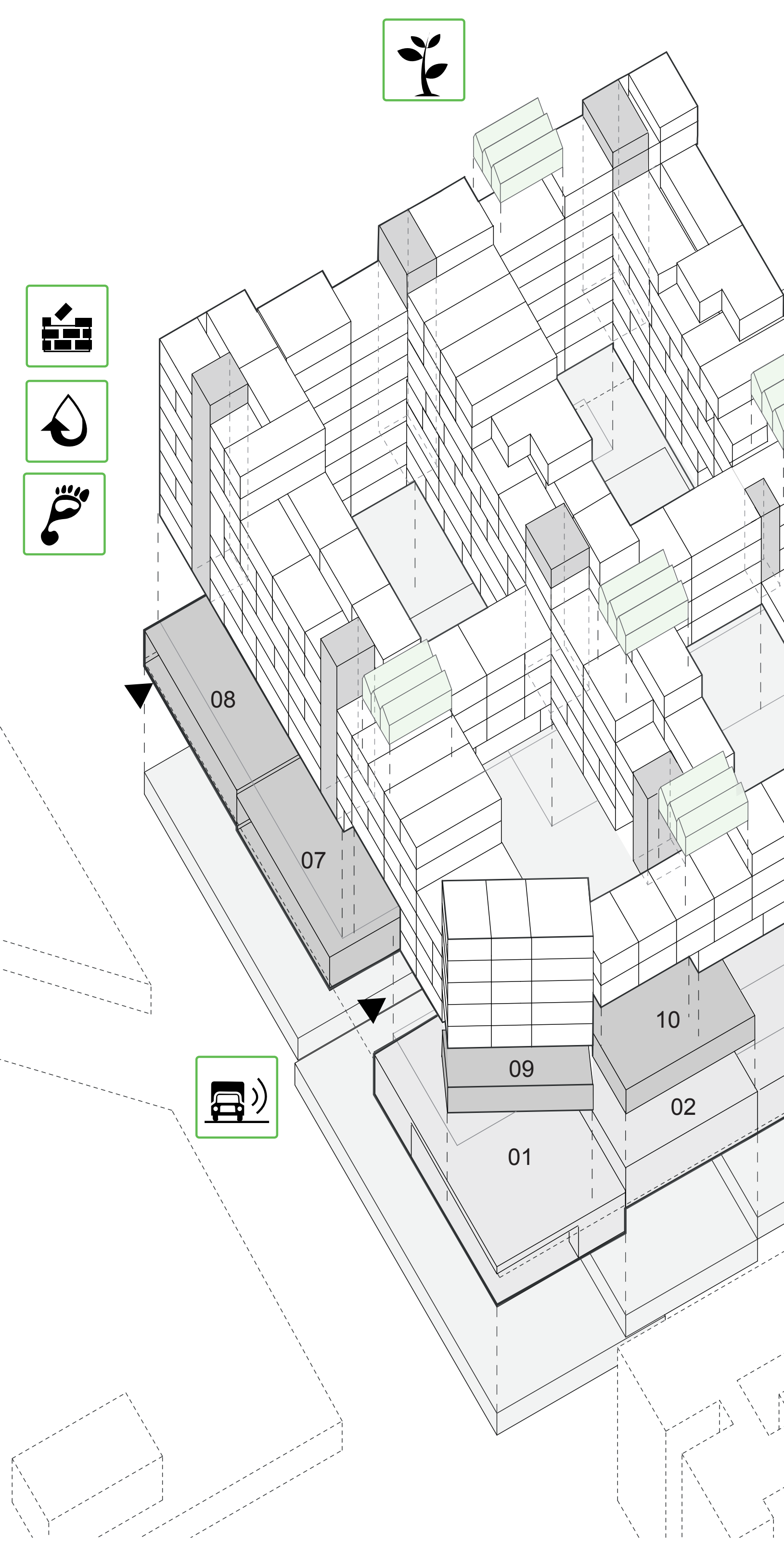
The CO_2 footprint of residents is minimized by using passive and active design strategies to reduce energy loads.

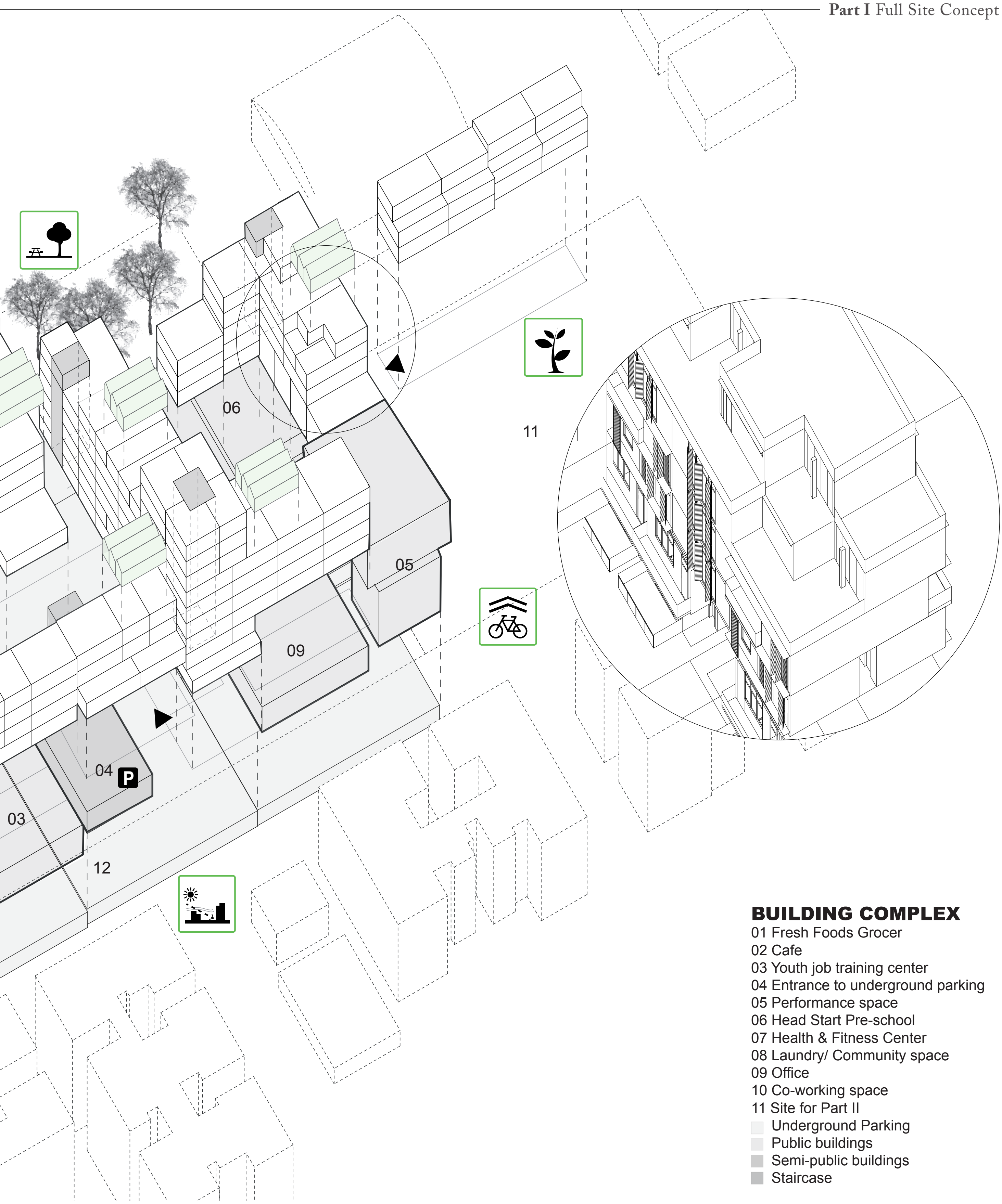
Solar access and cross ventilation is increased by reducing building heights in the south. Southern summer breezes are used for natural ventilation.

Rainwater catchment reduces storm-water runoff and can be used for irrigation and toilet flushing. Grey-water from the buildings can be reused.

Most of the materials of the Spofford juvenile Center can be reused in the new development. This reduces waste and saves natural resources.

The high traffic levels of Tiffany Street generate street noise. Winter-gardens, noise insulating windows and acoustic louvres reduce indoor noise.





BUILDING COMPLEX

01 Fresh Foods Grocer
02 Cafe
03 Youth job training center
04 Entrance to underground parking
05 Performance space
06 Head Start Pre-school
07 Health & Fitness Center
08 Laundry/ Community space
09 Office
10 Co-working space
11 Site for Part II
Underground Parking
Public buildings
Semi-public buildings
Staircase

COMMUNITY SPACE

RECREATION

Hunts Point has a lack of green space and recreational areas. The designed residential development includes a park for the neighbourhood. It is connected to the close-by Recreation Center and extends the green of the monastery garden. The existing plants and soils are preserved. Some of the trees are over a 100 years old and have to be retained.

Community space between and within the buildings will engage social interaction. Courtyards and rooftop terraces offer outdoor space for the residents.

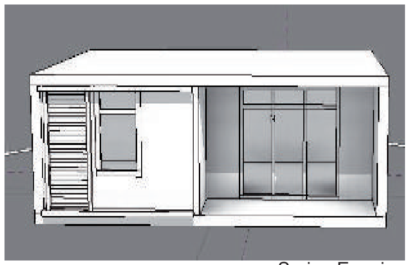
COMMUNITY FACILITIES

The Spofford Juvenile Center imprisoned criminal teenagers, without improving the social problems in Hunts Point. The new development will reverse this approach and include public facilities to give opportunities to young people. A "Youth Job Center" will provide help when searching for a job or internship in the area. The new facilities will create more jobs and increase the number of inhabitants.

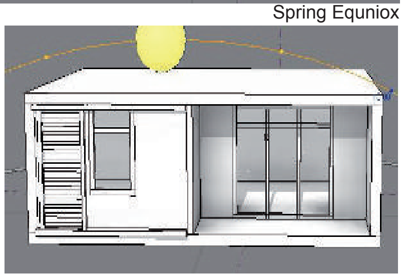
Street level activity will increase and make the area a saver place. The fresh foods grocery will be the only supermarket in the area and will attract people from all over Hunts Point to do their daily shopping.

A Health- & Fitness Center placed along Tiffany Street will encourage residents to do sports. It will be an extension of the Recreation Center and offer different sport programs.

The nursery will be placed next to the park. Daylight will come from multiple sides and from rooftop glazing. A huge playground will offer safe outdoor space for the children.



Spring Equniox



Winter Solstice

Summer Solstice

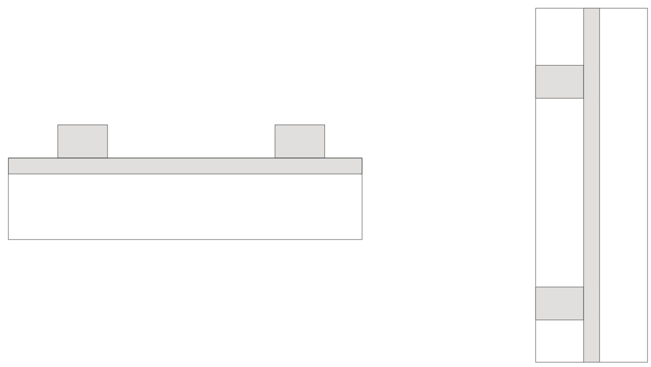
Shadow study of a residential unit: Overhangs block sun in summer and allow direct sunlight in winter.

INNER COURTYARD

Courtyards between the complex will be used to access the residential buildings. Each courtyard is designed with a topic(meet, play, relax, discover) to create a diverse environment and increase the identity of the space.

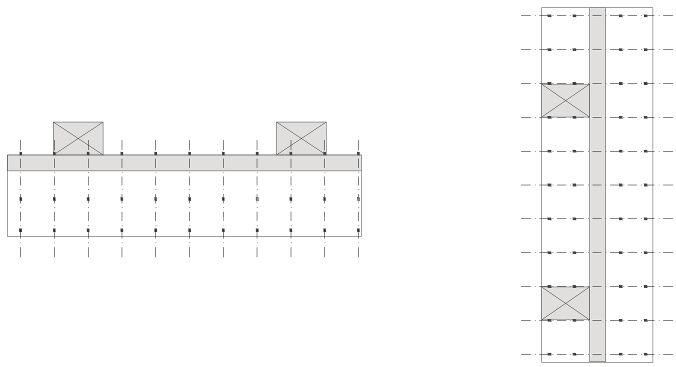
SITE PLAN

ORGANISATION



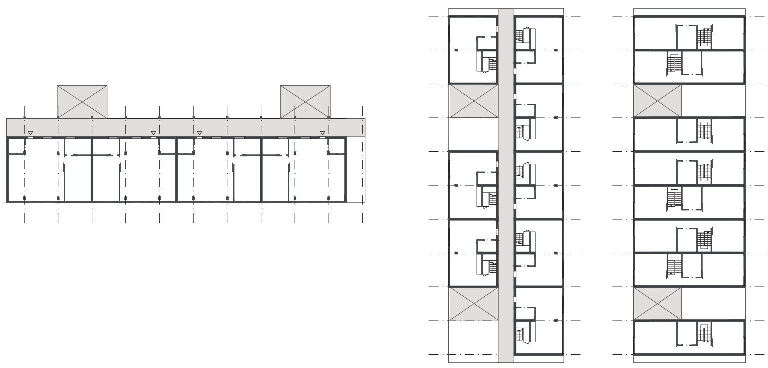
CIRCULATION

Buildings elongated along the east-west axis are oriented to the south and use an access balcony on the northern side. Buildings elongated along the south-north axis, use an inner corridor to access the flats.



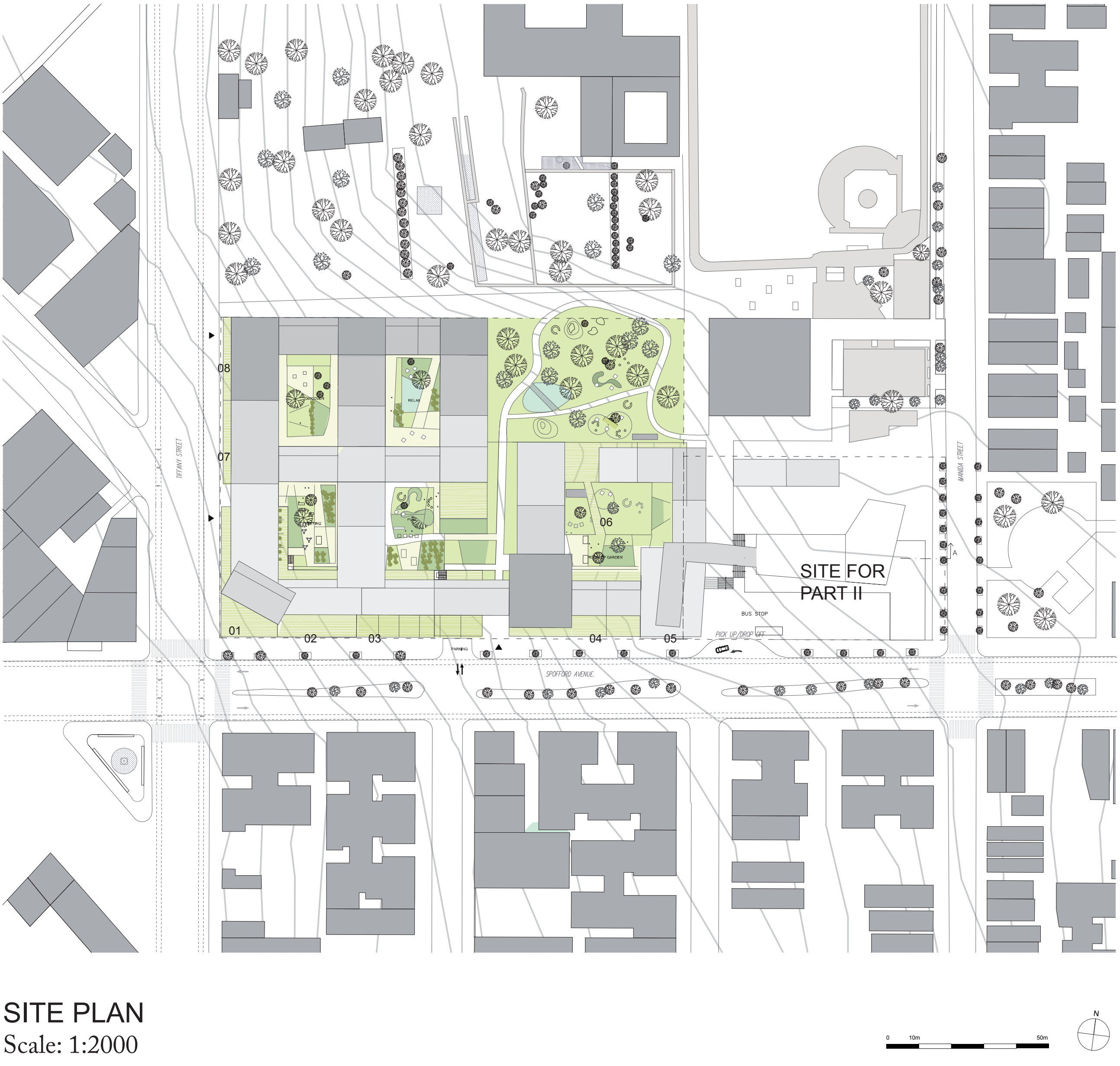
STRUCTURE

A grid is used to organise the structural elements of the buildings. The distance of the grid is 4,25m. Columns are used to bear the loads, so walls can be changed in the future.



UNITS

The different units fit into the structural grid. The units oriented to the south are simplex flats. Some of the flats with east-west orientation are duplexes. The duplexes are accessed on one level, so there is no corridor on the next level.



SITE PLAN
Scale: 1:2000

PUBLIC & COMMUNITY FUNCTIONS

01 Fresh Foods Grocer
02 Cafe
03 Youth job training center
04 Entrance to underground parking
05 Performance space
06 Head Start Pre-school
07 Health & Fitness Center
08 Laundry/ Community space
09 Office

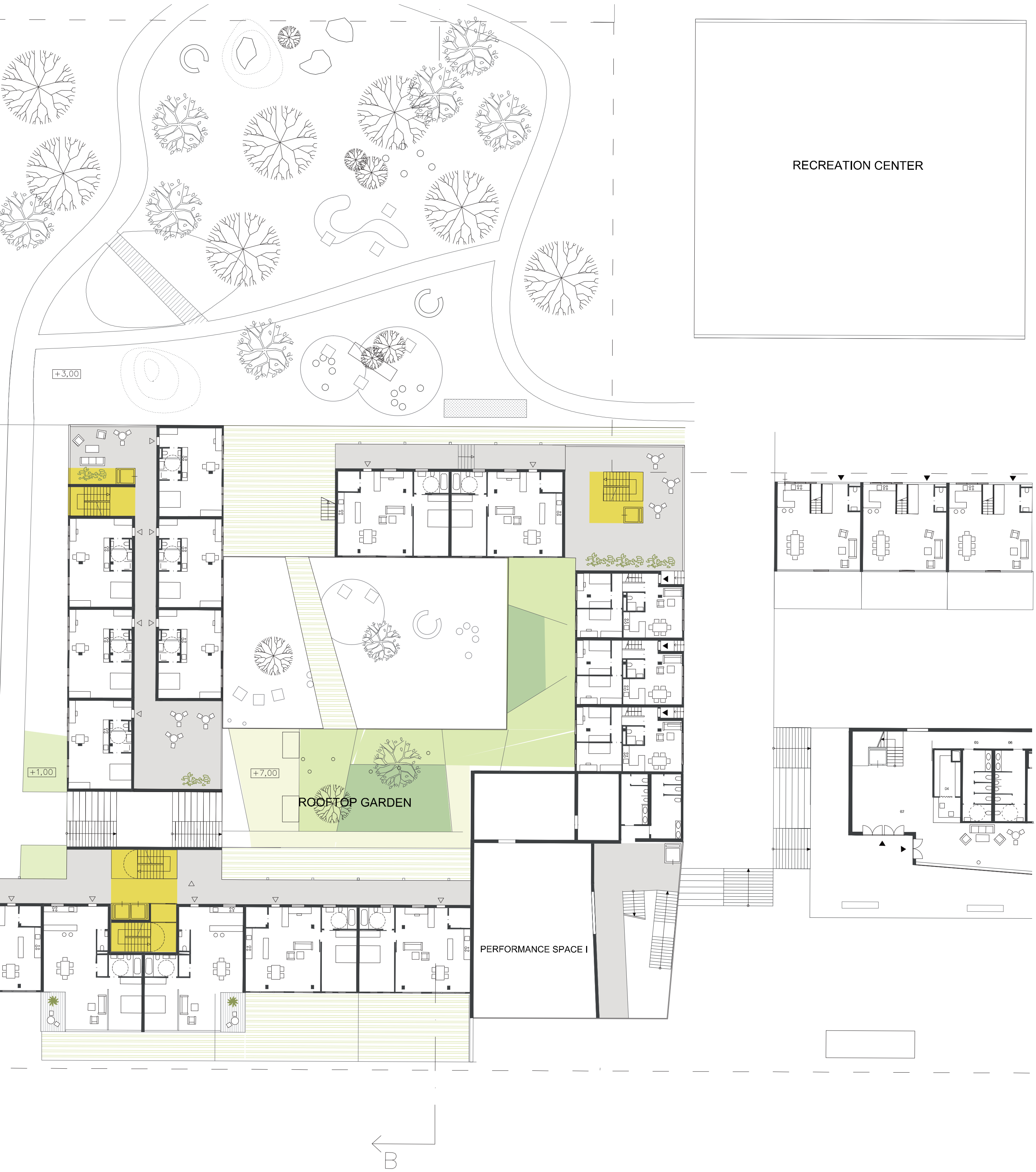
FLOOR PLAN

LEVEL 0
Scale: 1:500


RECREATION CENTER
NEIGHBOURHOOD PARK
m²
WATER
+6,00
+3,00
GATE
GROUP 1
GROUP 2
GROUP 3
GROUP4
GROUP 5
GROUP 6
GROUP 7
GROUP 8
BASEMENT
+2,00
ATRIUM
STORAGE
KITCHEN
+3,00
CIRCULATION ZONE
MULTI-PURPOSE ROOM
WARDROBE
ADMINISTRATION
LOBBY
RECEPTION
CATERING KIT
PERFORMANCE SPACE
CITYBIKE STATION
BUS STOP
HEAD START PRESCHOOL
B

FLOOR PLAN

LEVEL 1
Scale: 1:500


RECREATION CENTER
+3,00
+1,00
+7,00
ROOFTOP GARDEN
PERFORMANCE SPACE I
B

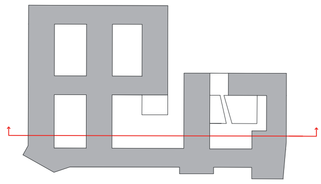
FLOOR PLAN

TYPICAL LEVEL
Scale: 1:500


B
ACTORS
PERFORMANCE SPACE II
STUDIO
STUDIO
B

SECTION

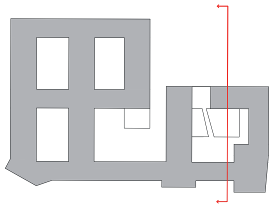
SECTION A-A
Scale: 1:500




PATHWAY
RESIDENTIAL BUILDING
RESIDENTIAL COURTYARD
RESIDENTIAL BUILDING
CONNECTION BRIDGE
CATERING KITCHEN / EVENT SPACE E
PERFORMANCE SPACE
HEAD START PRESCHOOL
KITCHEN
STORAGE

SECTION

SECTION B-B
Scale: 1:500



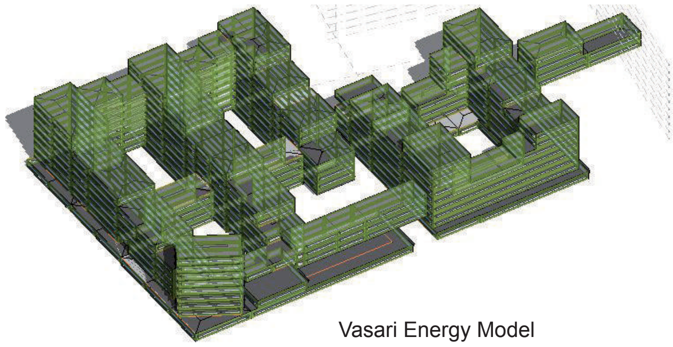

ERY COURTYARD
RESIDENTIAL BUILDING
NEIGHBOURHOOD PARK
MONASTERY PARK
ATRIUM
GROUP ROOM
STORAGE

VIEW

ENERGY ANALYSIS

BUILDING PERFORMANCE ANALYSIS

In order to estimate the energy performance of the building complex, a mass model was used for a conceptual energy analysis in Project Vasari. The building features typical cold climate insulation, high performance double glazing and a heat pump HVAC system.

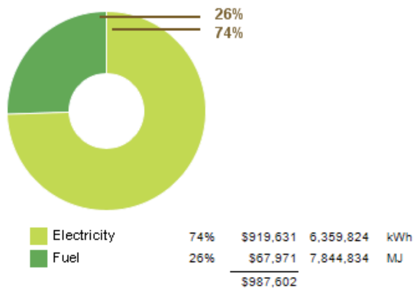


Vasari Energy Model

BUILDING PERFORMANCE FACTORS

Location:	Bronx, NY
Weather Station:	50958
Outdoor Temperature:	Max: 35°C/Min: -18°C
Floor Area:	47,445 m²
Exterior Wall Area:	28,962 m²
Average Lighting Power:	7.53 W / m²
People:	1,305 people
Exterior Window Ratio:	0.40
Electrical Cost:	$0.14 / kWh
Fuel Cost:	$0.91 / Therm

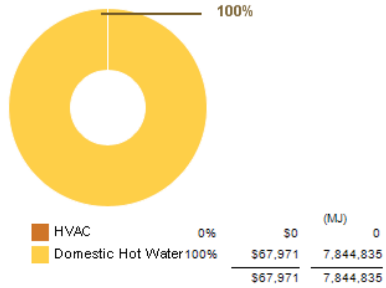
ANNUAL ENERGY USE/COST



ENERGY USE INTENSITY

Electricity EUI:	123 kWh / sm / yr
Fuel EUI:	151 MJ / sm / yr
Total EUI:	593 MJ / sm / yr

ENERGY USE: FUEL

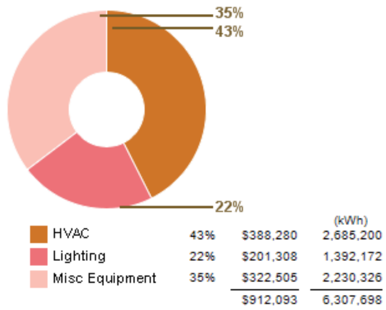


LIFE CYCLE ENERGY USE/COST

Life Cycle Electricity Use:	190,794,720 kWh
Life Cycle Fuel Use:	235,345,029 MJ
Life Cycle Energy Cost:	$13,451,134

*30-year life and 6.1% discount rate for costs

ENERGY USE: ELECTRICITY

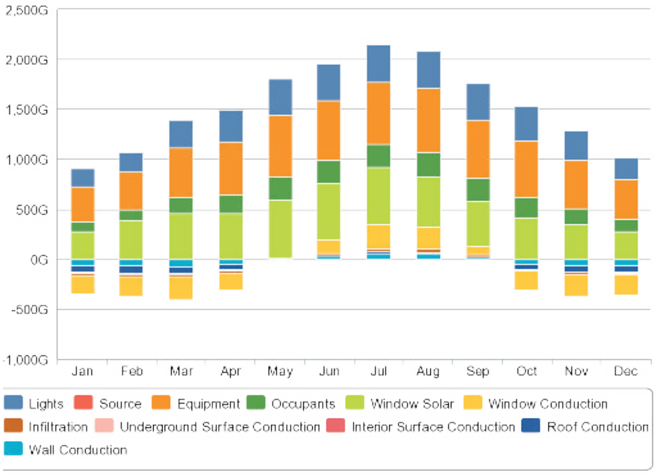


RENEWABLE ENERGY POTENTIAL

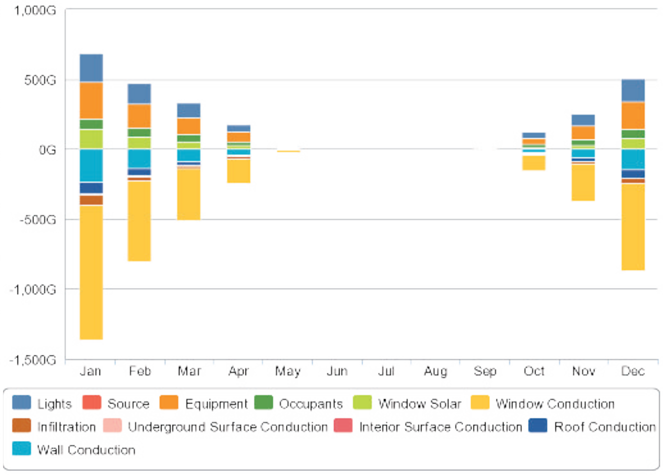
Roof Mounted PV System (Low efficiency):	650,632 kWh / yr
Roof Mounted PV System (Medium efficiency):	1,301,263 kWh / yr
Roof Mounted PV System (High efficiency):	1,951,895 kWh / yr
Single 15' Wind Turbine Potential:	1,247 kWh / yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high

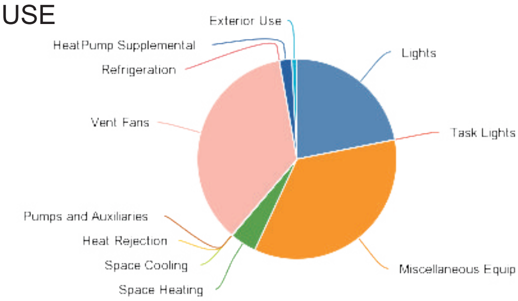
MONTHLY COOLING LOADS



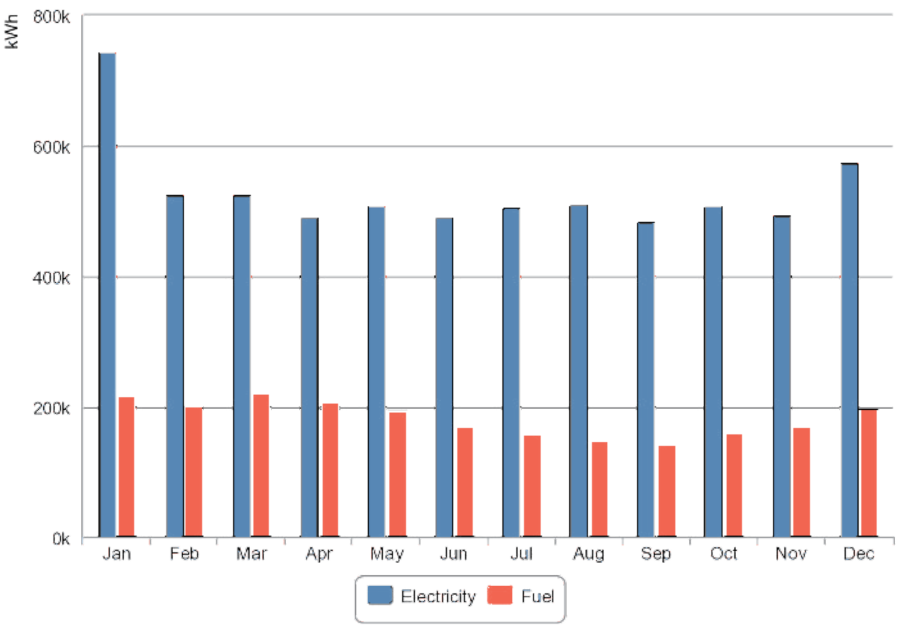
MONTHLY HEATING LOADS



ELECTRICITY USE



MONTHLY ELECTRICITY/FUEL USE

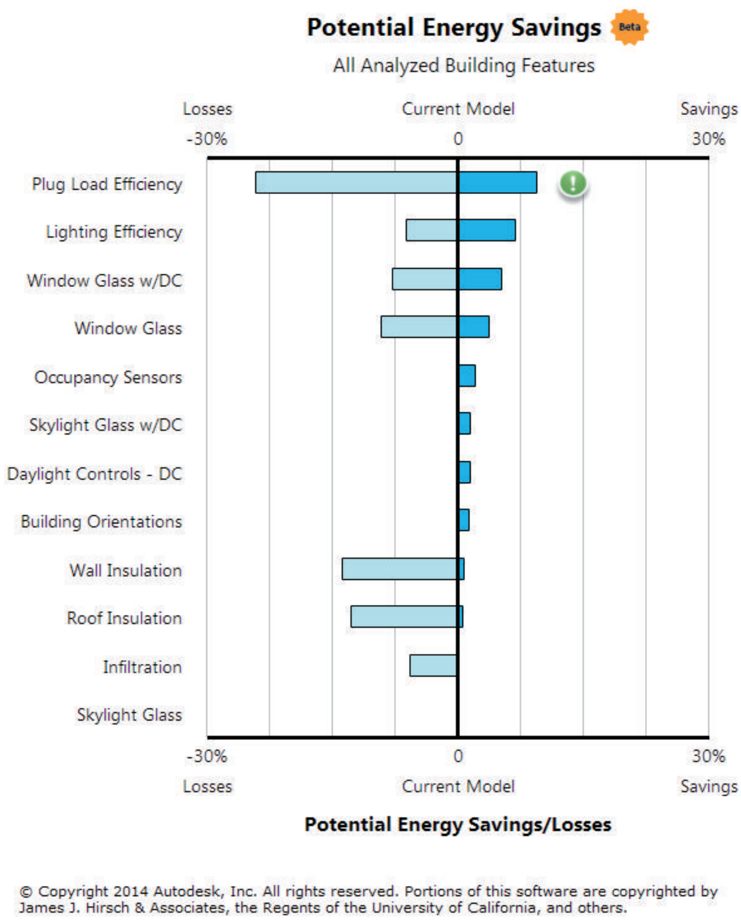


ENERGY ANALYSIS

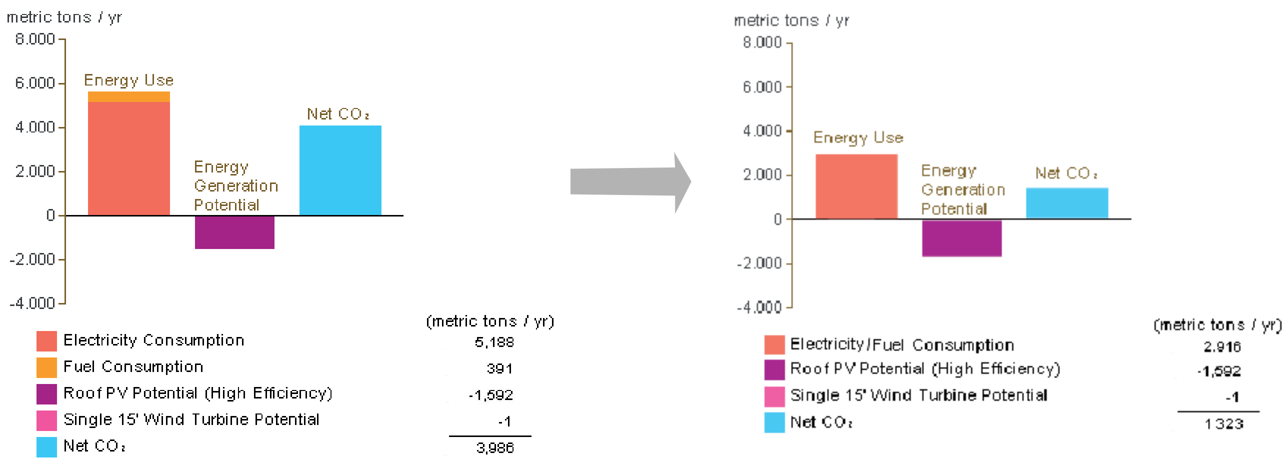
POTENTIAL ENERGY SAVINGS

There are only limited options to optimize the performance of a building in Project Vasari. The Potential Energy Savings chart gives information on how sensitive the design is to changes of certain parameters. In this case, plug load efficiency, lighting efficiency and window glass properties offer the highest potential to reduce energy use intensity.

Green Building Studio allows to go deeper into the analysis. After opening the Vasari results, different building settings were tested and analysed. By optimizing the building, the carbon footprint could be reduced from 3.986 tons/a to 1.323 tons/a. So the net annual carbon emissions are reduced by 67%. The optimization process is described on the right page.

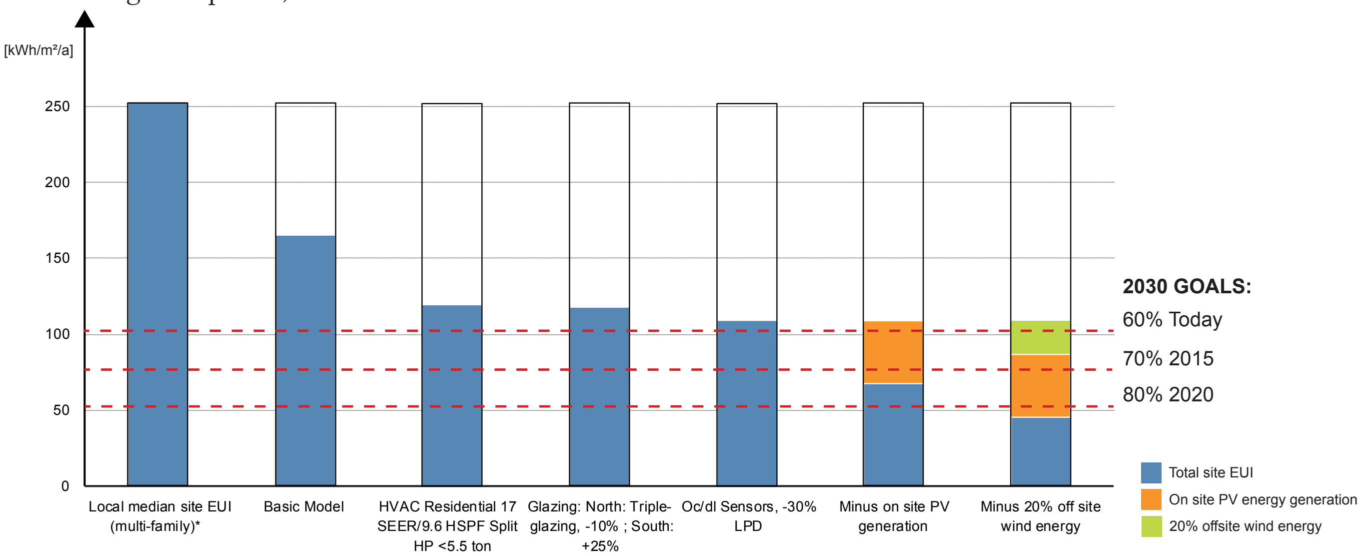


ANNUAL CARBON FOOTPRINT



2030 CHALLENGE

The building performance was improved by changing the HVAC system to an efficient geothermal heat pump system (not available in Green Building Studio, so the most efficient air source heat pump was chosen). The glazing ratio of 0,4 was changed to 0,3 on the northern facade and 0, 65 on the southern facade. In the north, triple glazing is used to reduce heat loss in winter. Lighting efficiency was reduced by using more efficient equipment and installing occupancy and daylight sensors. 41 kWh/a electricity can be produced on site by using rooftop PV modules (15% eff.). Additional energy is produced by the facade integrated panels, but not taken into account in the vasari analysis. Through generating renewable energy, the 2015 goal (70% reduction) is reached. The challenge allows to buy 20% off site renewable energy, whereby the 2020 goal is reached.



EUI REDUCTION PROCESS

Building	Total EUI	2030 Goal reached	% of median	% Reduction
Local median site EUI (multi-family)*	253 kWh/m²/a	FALSE	100 %	0 %
Basic Model	165 kWh/m²/a	FALSE	65 %	35 %
HVAC Residential 17 SEER/9.6 HSPF Split HP <5.5 ton	119 kWh/m²/a	FALSE	47 %	53 %
Glazing: North: Triple-glazing, -10% ; South: +25%	118 kWh/m²/a	FALSE	47 %	53 %
Oc/dl Sensors, -30% LPD	108 kWh/m²/a	FALSE	43 %	57 %
Minus on site PV generation	67 kWh/m²/a	TRUE	27 %	73 %
Minus 20% off site wind energy	46 kWh/m²/a	TRUE	18 %	82 %

PART II EVENT & CULINARY SPACES

DESIGN STRATEGIES

CONCEPT

PLANS

DAYLIGHT ANALYSIS

ENERGY CONCEPT

VIEW

ENERGY ANALYSIS

DESIGN STRATEGIES

PALETTE 2030 SWATCH-ES

For the second part of the competition, swatches from the building category had to be chosen and implemented in the design.

CHOSEN SWATCHES:
Building:

Stack Ventilation:
In public spaces, inlet and outlet openings have to be located a minimum of 4 to 5 meters apart in height to achieve a stack effect. The higher the distance, the better the removal of heat works.[51]

Top Daylighting:
Skylights can be used to allow daylight into deep floor plans. It is more consistent than side daylight and offers access to the entire sky dome. To reduce heat gain in summer, it has to be shaded.[52]

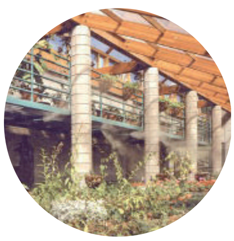
Solar Shading:
In climates with hot summers and cold winters, overhangs can be used to block direct light in summer. In winter, the sun is lower and direct light comes in. The size of the overhang has to be about one third of the opening at 40°L.[53]

Solar Greenhouse:
In cold and temperate climates, greenhouses should face the equator. Thermal mass is used to store the daytime heat.[54]

[61] Stack Ventilation
British High Commission
Richard Murphy Architects Ltd
Source: http://2030palette.org/

[62] Top Daylighting
Green Lighthouse Copenhagen
Christensen & CO Architects
Source: http://2030palette.org/

[63] Solar Shading
Clock Shadow Building
Continuum Architects + Planners
Source: http://2030palette.org/



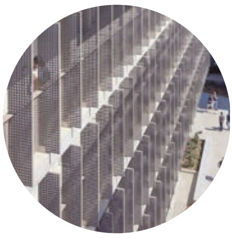
[64] Solar Greenhouse
Sol y Sombra
Mazria Inc.
Source: http://2030palette.org/

East/West Shading:
In summer, a lot of sun comes from the east and west. The morning and evening sun is low in the sky hence difficult to block. Seasonal trees or vertical fins can block the sun in summer. If the fins are angled towards south, they admit sunlight in winter.[55]

Form for Daylighting :
Buildings elongated along the east-west axis offer the best conditions for controlled daylighting. Glare can be avoided by shading the southern facade. Low buildings can have any form as the roof is available for daylighting.[56]

Direct Gain/Heat Storage:
Floors, walls and ceilings can be used as thermal masses and store daytime heat to release it at night. The mass has to have a minimum thickness of 10cm. The ratio of thermal mass surface to solar glazing has to be a minimum of 3:1.[57]

Cool Roof:
Light coloured roofs reflect the sunlight and absorb less heat. They are important to mitigate the urban heat island effect and keep indoor temperatures comfortable.[58]



[65] East/West Shading
Charles David Keeling Apartments
KieranTimberlake Architects
Source: http://2030palette.org/

[66] Form for Daylighting
Heifer International Headquarters
Polk Stanley Wilcox Architects
Source: http://2030palette.org/

[67] Direct Gain: Heat Storage
Connecticut State University Student Center
Holzman Moss Bottino Architecture
Source: http://2030palette.org/

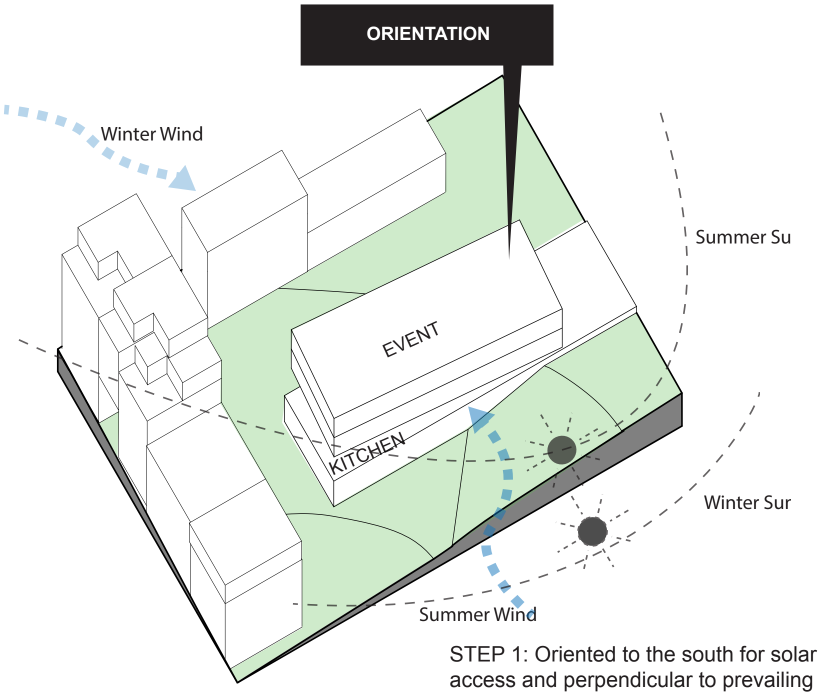
[68] Cool Roof
Oslo Opera House
Snøhetta
Source: http://2030palette.org/

51-58 Cf. 2030 Palette 2013.

CONCEPT

BUILDING SHAPE

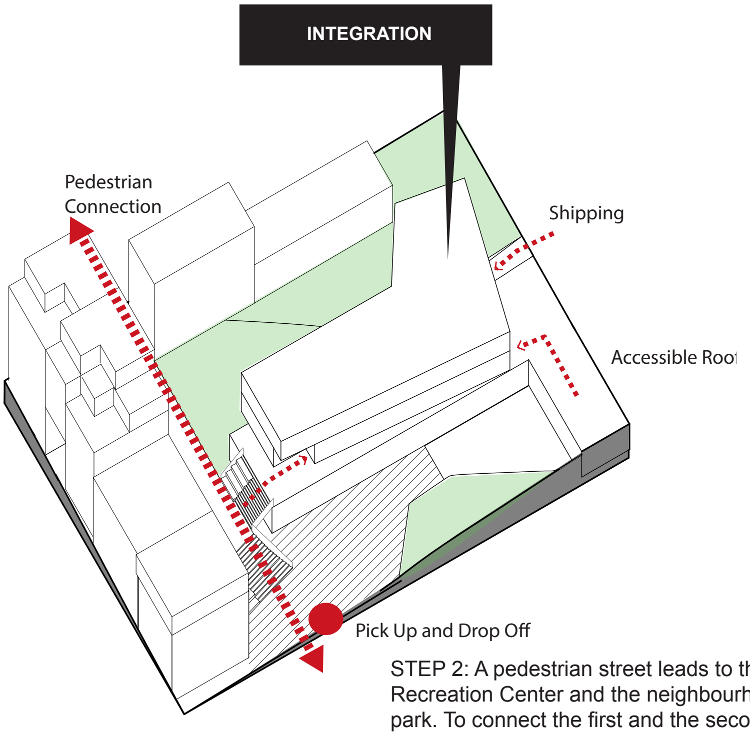
In Step 1, the basic building form is specified. The buildings are elongated along their east-west axis and stacked atop each other. Winter wind is blocked by the town houses in the north. Summer wind can be used for natural ventilation. The southern orientation allows solar heat gain in winter.



STEP 1: Oriented to the south for solar access and perpendicular to prevailing summer winds.

ACCESS & PUBLIC SPACE

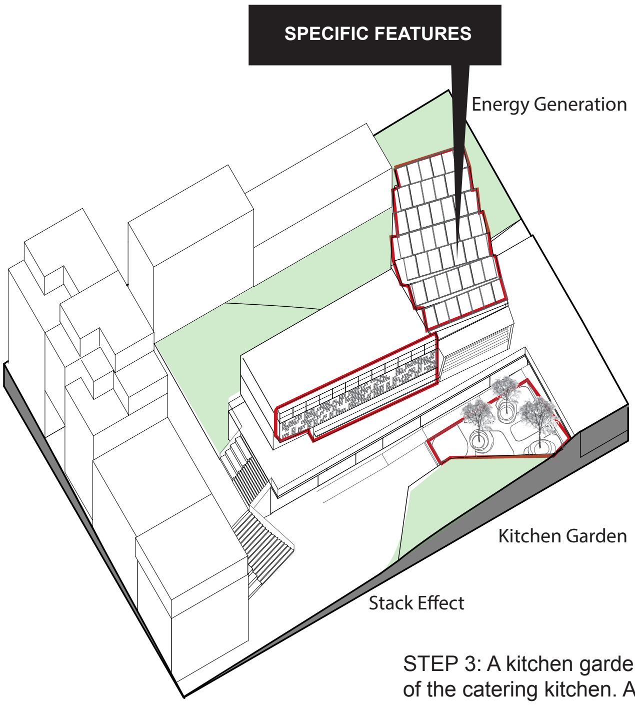
The building can be accessed from the kitchen roof or from stairs at the public space. The space is placed between the Performing Arts Center and the Event Space. Seating steps, a bus station and an area for drop off and pick up are placed around the public space. Children use the public stairs to get to the nursery school.
A ramp is placed behind the catering kitchen and used for shipping activities.



STEP 2: A pedestrian street leads to the Recreation Center and the neighbourhood park. To connect the first and the second part, a public space is placed between the Event Space and the Performing Arts Center.

FEATURES

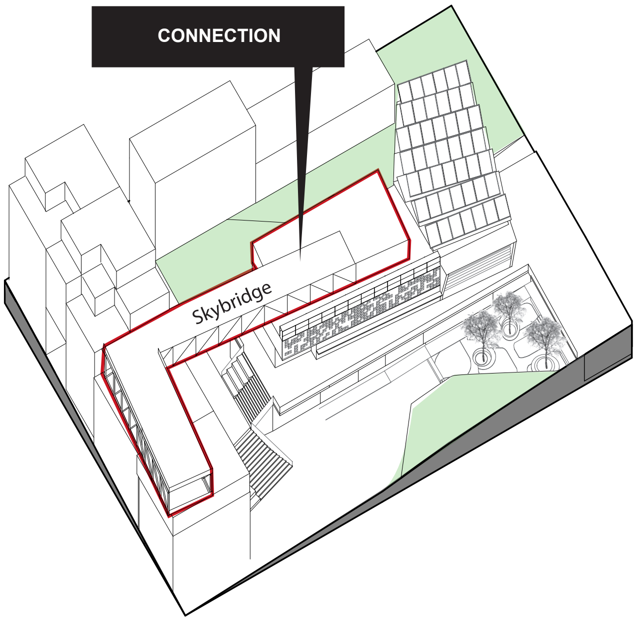
In Step 3, a garden is added to the catering kitchen and placed in the flattened area in the south. Photovoltaic and solar hot water panels on the roof of the event space produce on-site renewable energy. A double-height space along the southern facade is used to create a stack effect and allows natural ventilation for the occupied spaces. The main event space is ventilated through the folded roof. The southern facade is glazed and shaded through overhangs and fins. Northern daylight enters the room from the roof and provides consistent natural light without glare.



STEP 3: A kitchen garden is added in front of the catering kitchen. A sun space and a PV-roof are added to the event space.

SKY BRIDGE

A sky bridge connects the Event Space to the Performing Arts Center. The bridge is used as a terrace in summer and as a winter garden in the cold season. Visitors have a great view over Manhattan when they go to the western end of the sky bridge.



STEP 4: The Event Space and the Performing Arts Center are connected through a sky bridge.

CONCEPT

EXPLODED DIAGRAM

The diagram shows the design strategies as well as the spatial and functional relations within the building.

A Citybike station is placed close to the new bus station. It allows people to rent a bike and bring it back to any City-bike station in New York City.

The kitchen has a big garden for planting local vegetables and fruits. It can be used for job training.

The catering kitchen includes three greenhouses. They are used for planting herbs all year and act as a buffer zone between inside and outside.

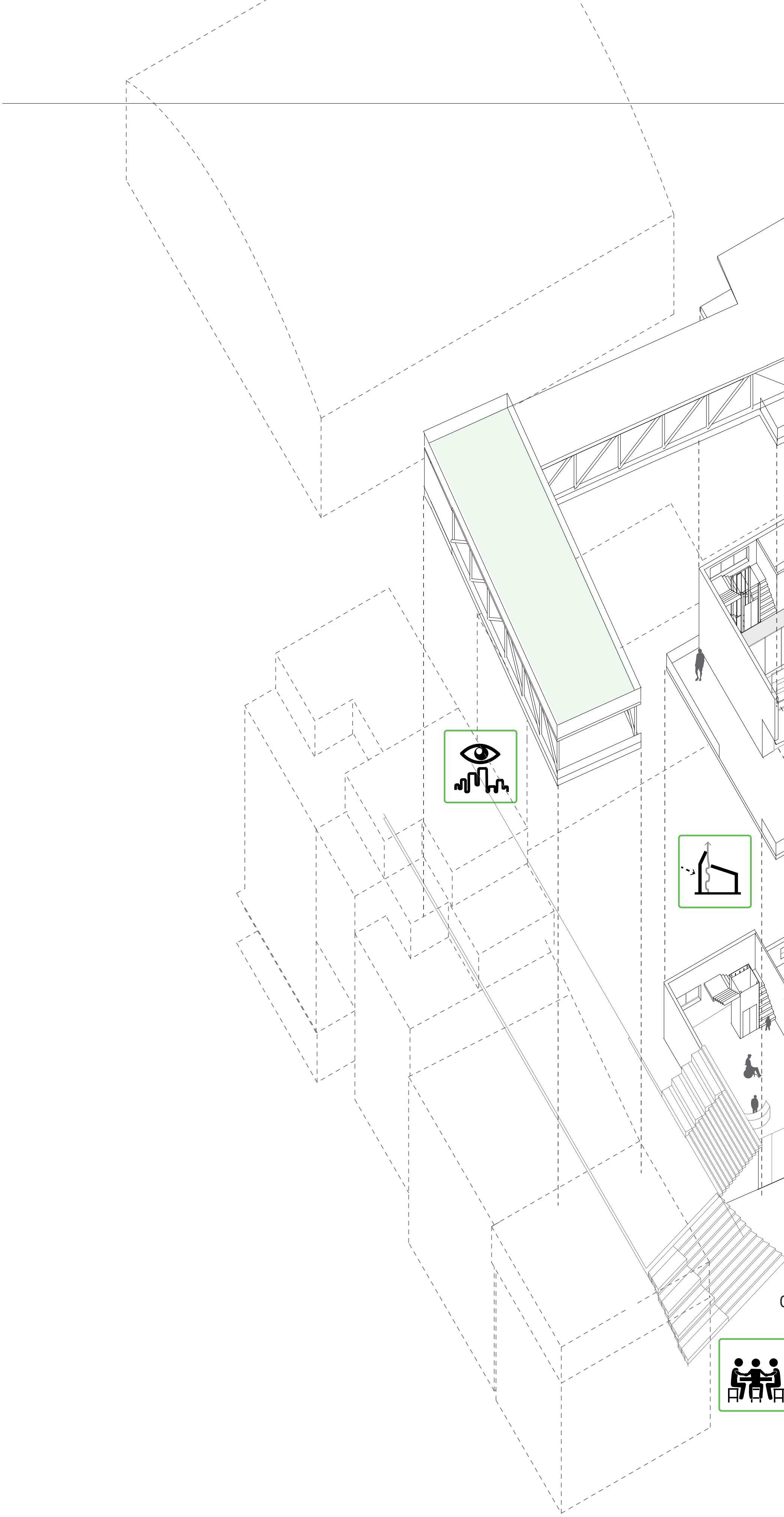
In winter, Solar heat gain is used to warm up the space. Thermal mass can store the heat and release it later.

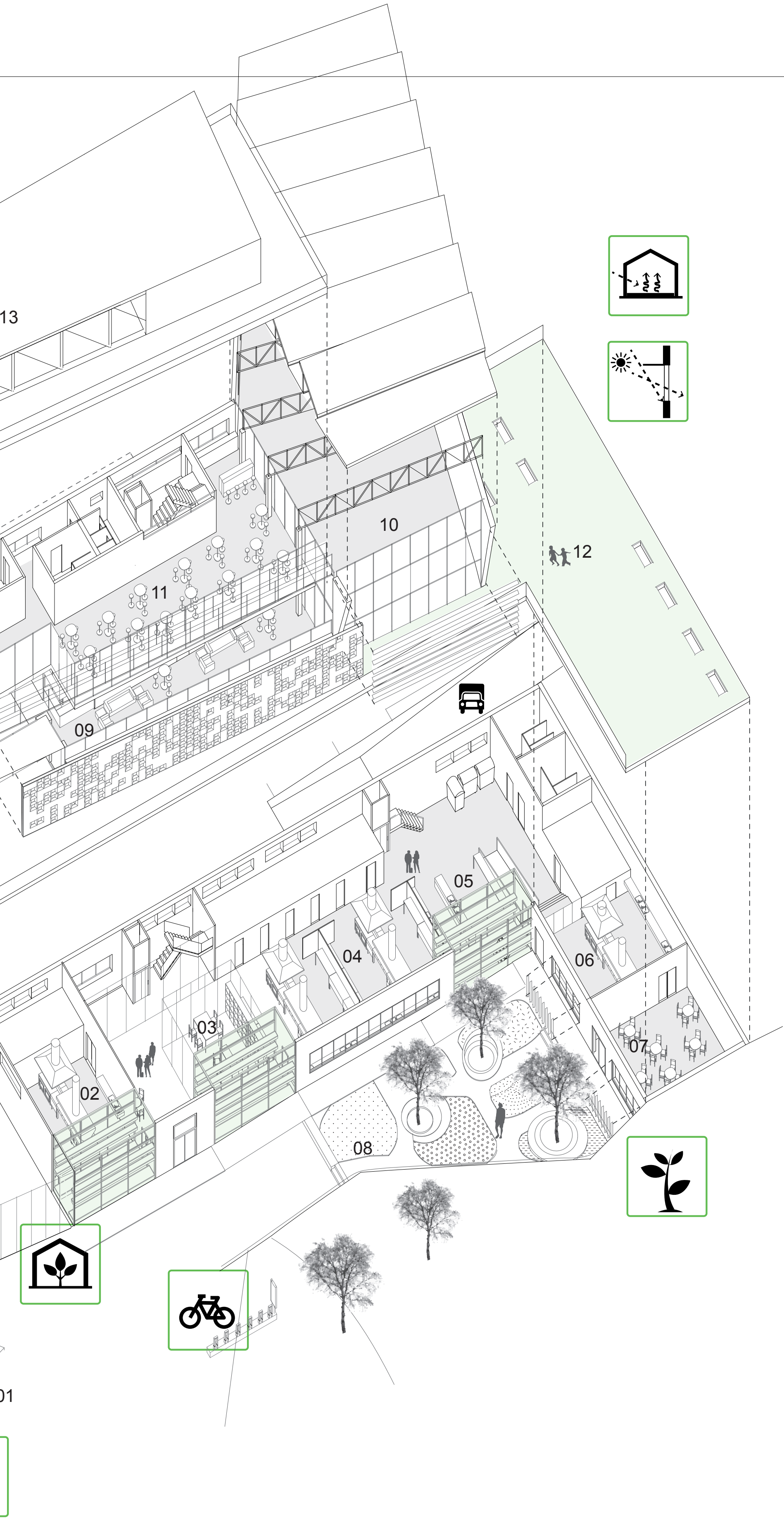
Overhangs block unwanted summer sun and allow the deeper winter sun into the space. They do not obstruct views.

The stack effect is used to naturally ventilate the building. It does not rely on outdoor wind conditions and is comfortable for the occupants.

The connection to the Performing Arts Space is used as a viewpoint. Because of the hill, large parts of Manhattan can be seen.

The public space strengthens the local community. This will be the center of Hunts Point, which is missing nowadays.





EVENT & CULINARY SPACES

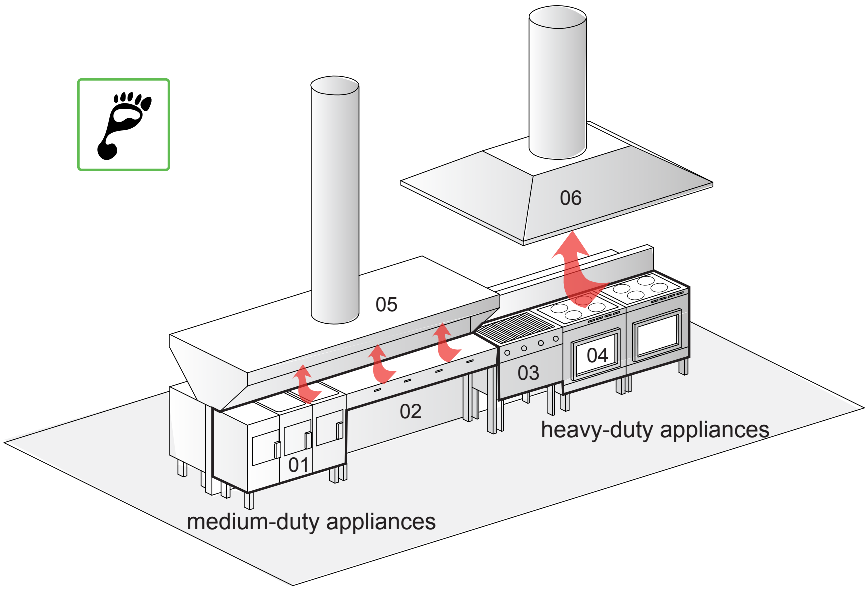
01 Public Space
02 Kitchen for Event Space
03 Office
04 Rental Kitchens
05 Dish Washing and Shipping
06 Learning Kitchen
07 Dining Room
08 Kitchen Garden
09 Welcome Space
10 Main Event Space
11 Secondary Event Space
12 Terrace/Rooftop Garden
13 Skybridge

KITCHEN UNIT

The kitchen units are optimized to improve the energy performance of the commercial kitchen. While other spaces can be naturally ventilated only, a commercial kitchen needs a mechanical ventilation system to keep the indoor air quality high. Natural ventilation should be used in addition.

Energy can be saved by planning an efficient ventilation system.

Equipment is divided into different groups, based on the strength of their thermal plume and the amount of grease and smoke they release during the cooking process. Medium-duty appliances (deep fat fryers, griddles) are grouped together under a backshelf hood. Heavy-duty appliances (charbroilers, convection ovens, cookers) are grouped together under a canopy hood.[59]



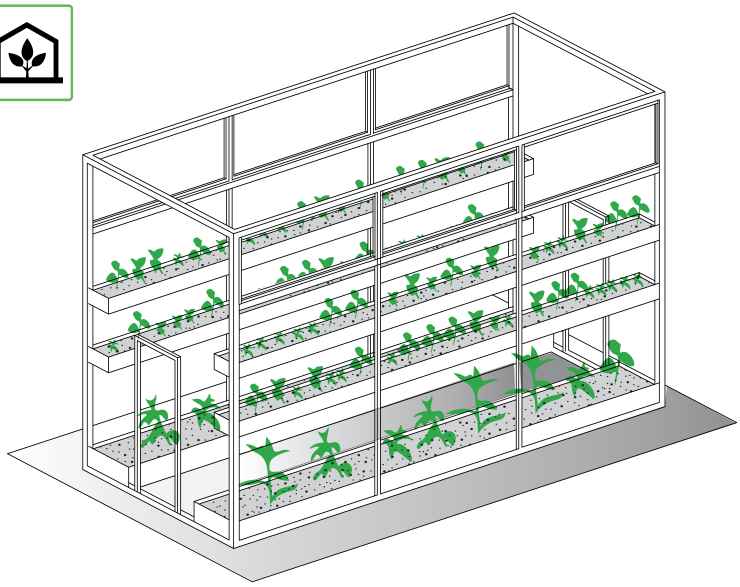
OPTIMIZED KITCHEN UNIT
Based on: http://www.fishnick.com/ventilation/designguides/

01 Deep fat fryers
02 Griddle
03 Charbroiler
04 Convection oven/Cooker
05 Backshelf hood
06 Canopy hood

59 Cf. Kitchen Ventilation Designguide, 2013.

GREENHOUSE UNIT

The greenhouse unit consists of a simple rectangular form with plant boxes on the long sides. Each unit has about 20 m². There is one greenhouse for the event kitchen and one for the learning kitchen. The 4 rental catering kitchens share a greenhouse. The glass boxes are used for gardening, but also bring a lot of filtered daylight into the space. In winter, they act as buffer zone between outdoor and indoor temperatures. In summer, they are constantly naturally ventilated to avoid overheating.



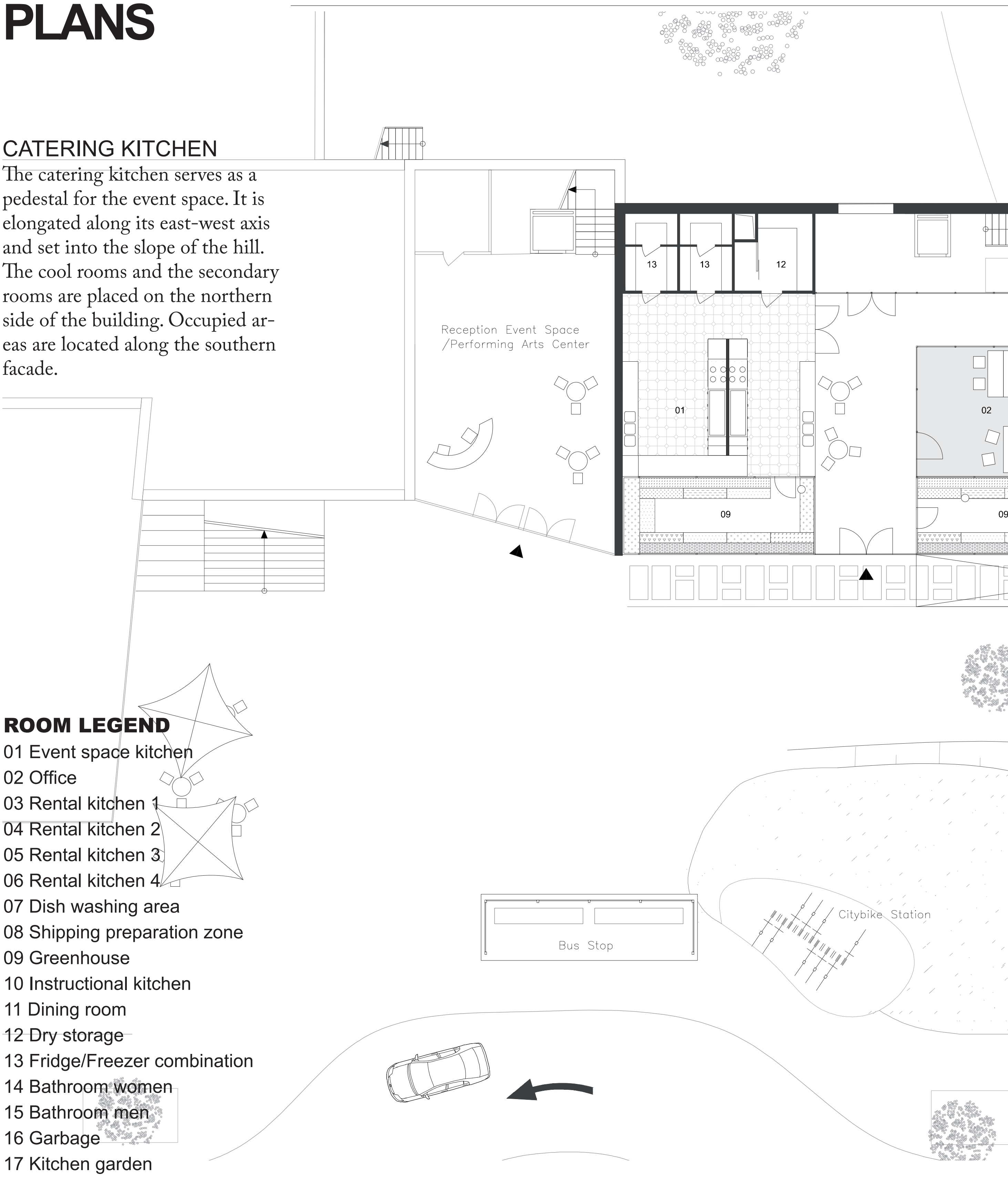
KITCHEN GARDEN

The kitchen garden offers the possibility to grow seasonal vegetables and fruits. It is placed in front of the building and offers a nice view for the people working in the kitchen.

PLANS

CATERING KITCHEN

The catering kitchen serves as a pedestal for the event space. It is elongated along its east-west axis and set into the slope of the hill. The cool rooms and the secondary rooms are placed on the northern side of the building. Occupied areas are located along the southern facade.



ROOM LEGEND

01 Event space kitchen
02 Office
03 Rental kitchen 1
04 Rental kitchen 2
05 Rental kitchen 3
06 Rental kitchen 4
07 Dish washing area
08 Shipping preparation zone
09 Greenhouse
10 Instructional kitchen
11 Dining room
12 Dry storage
13 Fridge/Freezer combination
14 Bathroom women
15 Bathroom men
16 Garbage
17 Kitchen garden
18 Shipping/Receiving

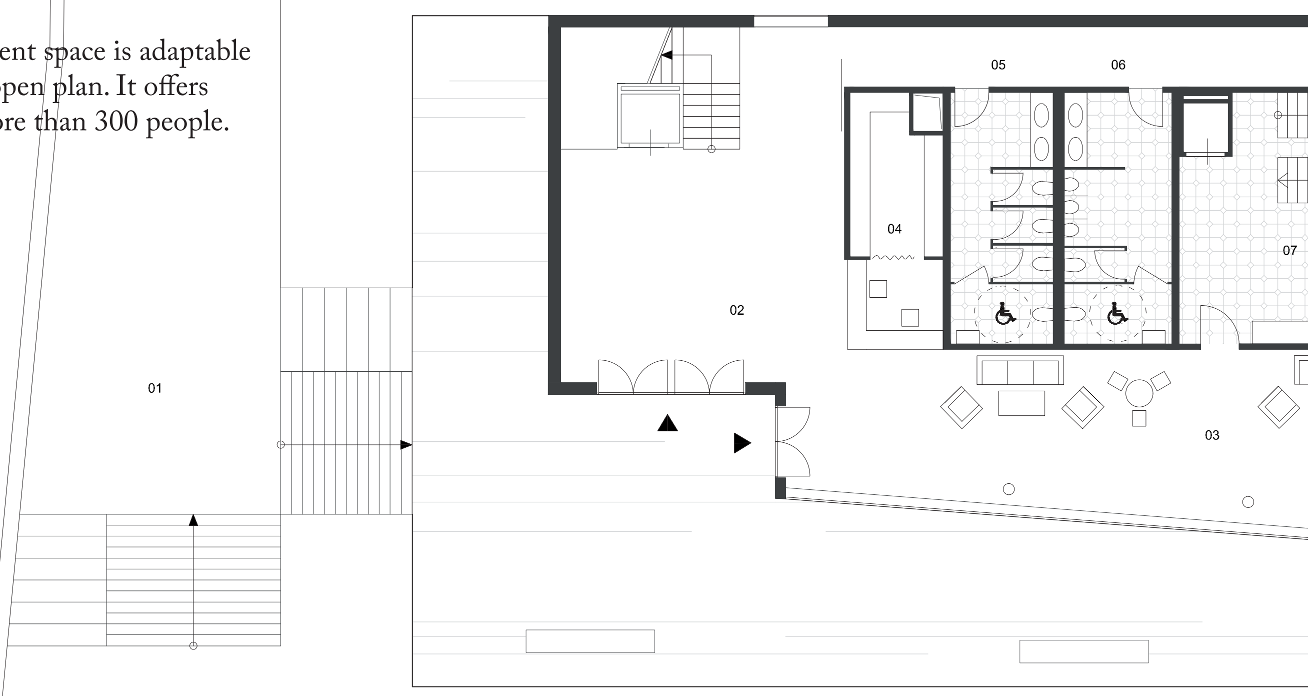
LEVEL 0

FLOOR PLAN 1:200

PLANS

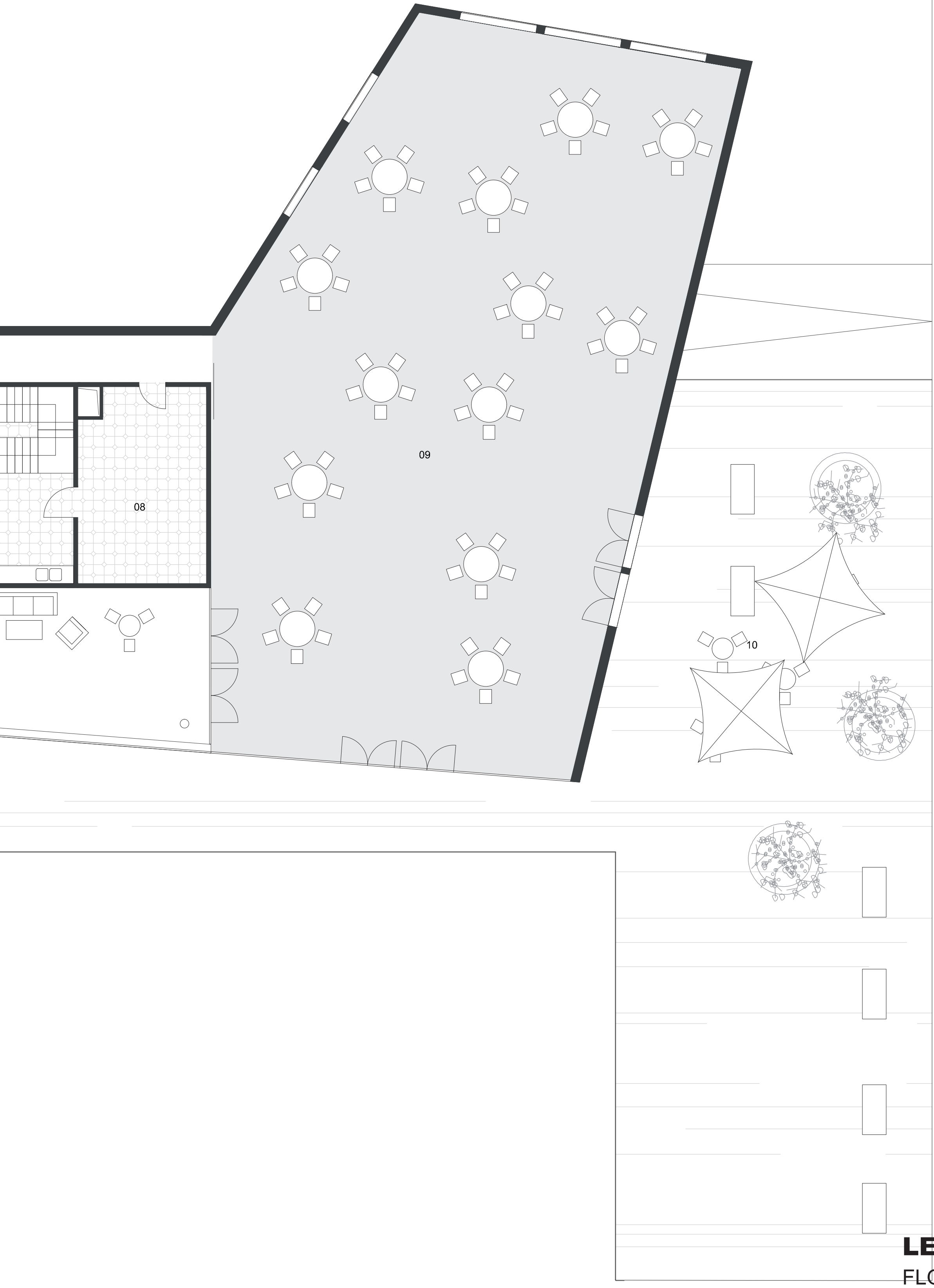
EVENT SPACE

The event space can be accessed from the public space or from the kitchen roof.
The secondary rooms are placed as a core. The different zones are separated through the core. A double-height transitional space connects the lobby and the main event space.
The main event space is adaptable and has an open plan. It offers space for more than 300 people.



ROOM LEGEND

01 Pedestrian Street
02 Lobby
03 Transitional space
04 Cloakroom
05 Bathroom women
06 Bathroom men
07 Preparation room
08 Storage/Utility room
09 Main space
10 Terrace/Rooftop Garden



LEVEL 1
FLOOR PLAN 1:200

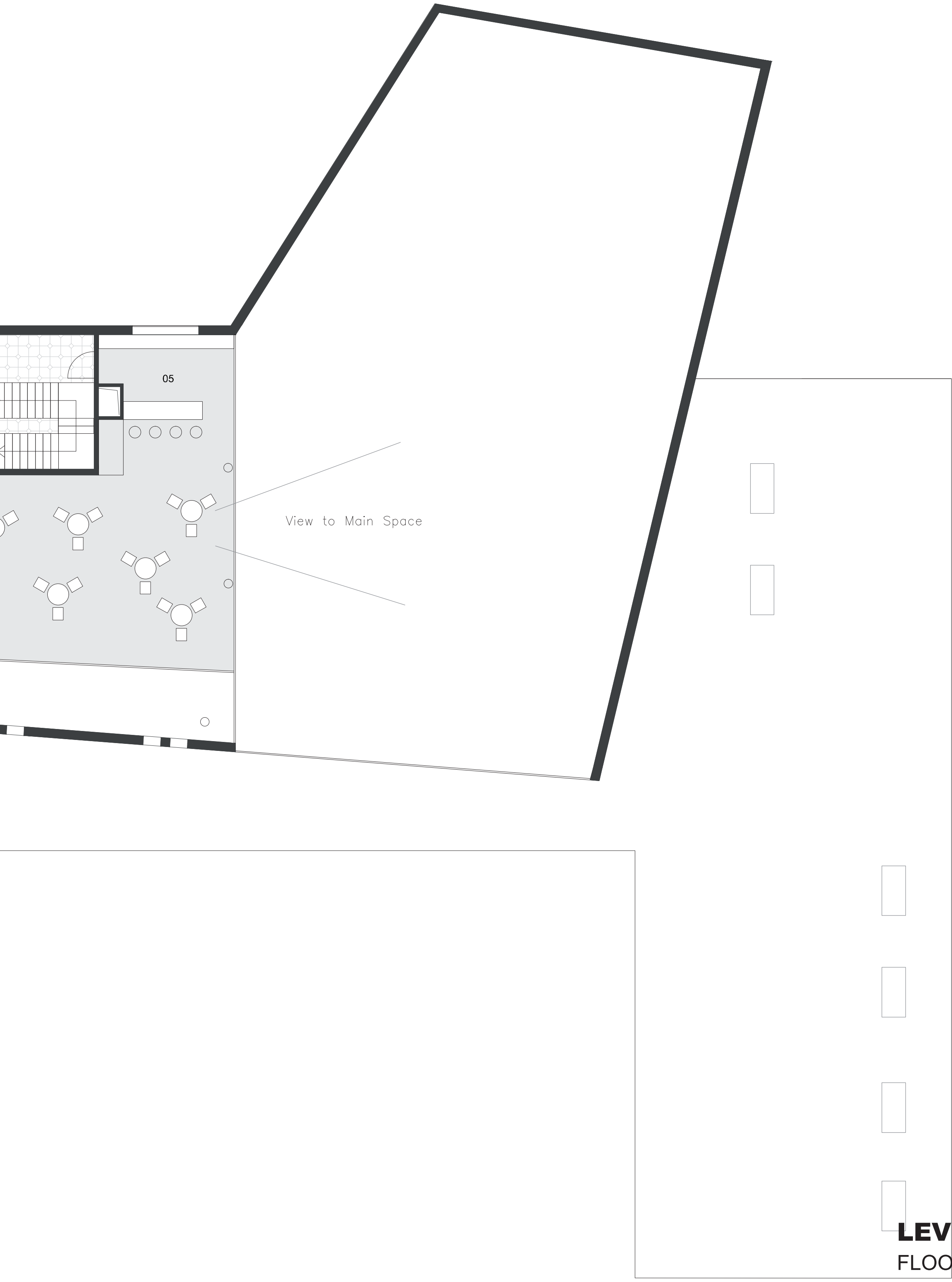
PLANS

EVENT SPACE

The second level of the Event Space includes a cocktail space for up to 140 people. Secondary rooms are placed on the northern side. The space has a special atmosphere with filtered light from the south and rooftop skylights. There is a visual connection to the main event space.

ROOM LEGEND

01 Secondary Event Space
02 Bathroom men
03 Bathroom women
04 Preparation room
05 Cocktail bar
06 Storage



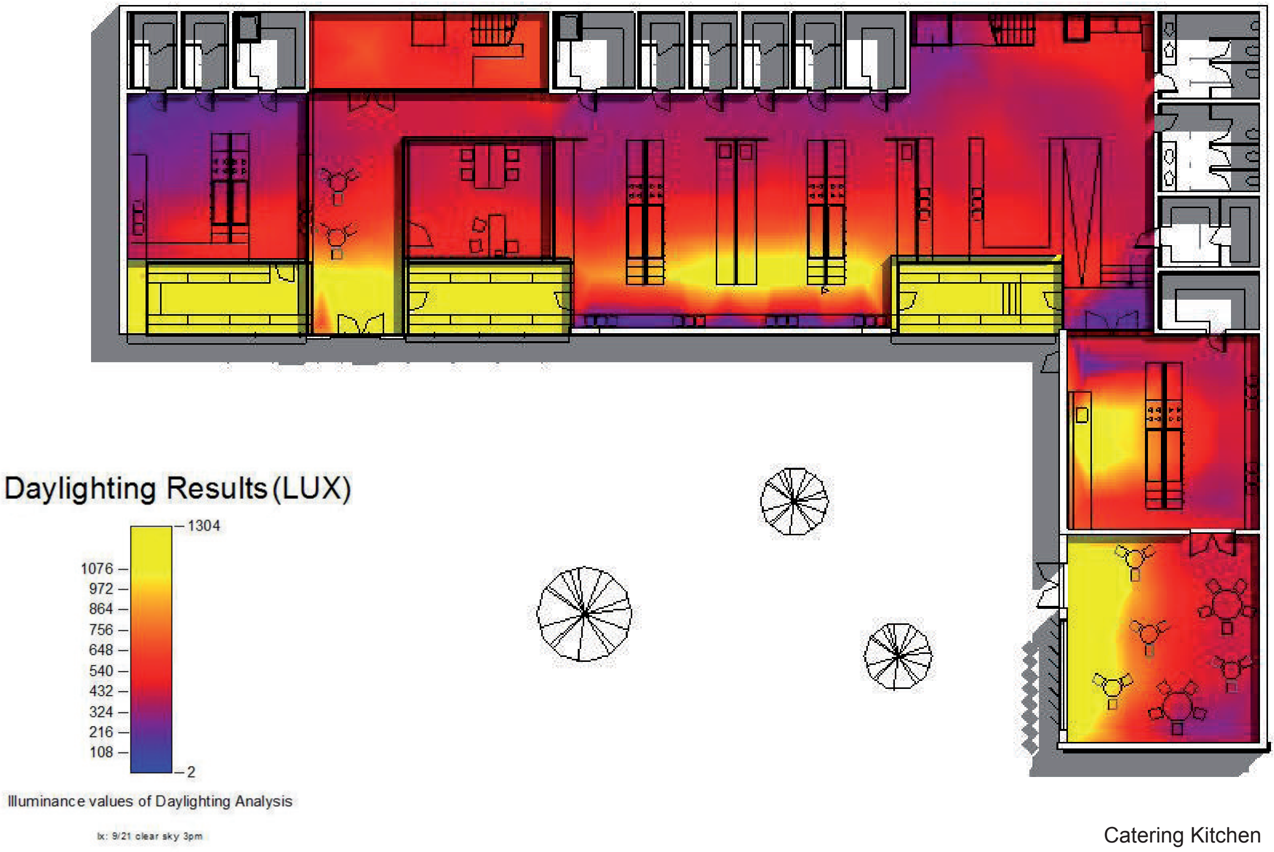
LEVEL 2
FLOOR PLAN 1:200

DAYLIGHT ANALYSIS

INDOOR LIGHT LEVELS

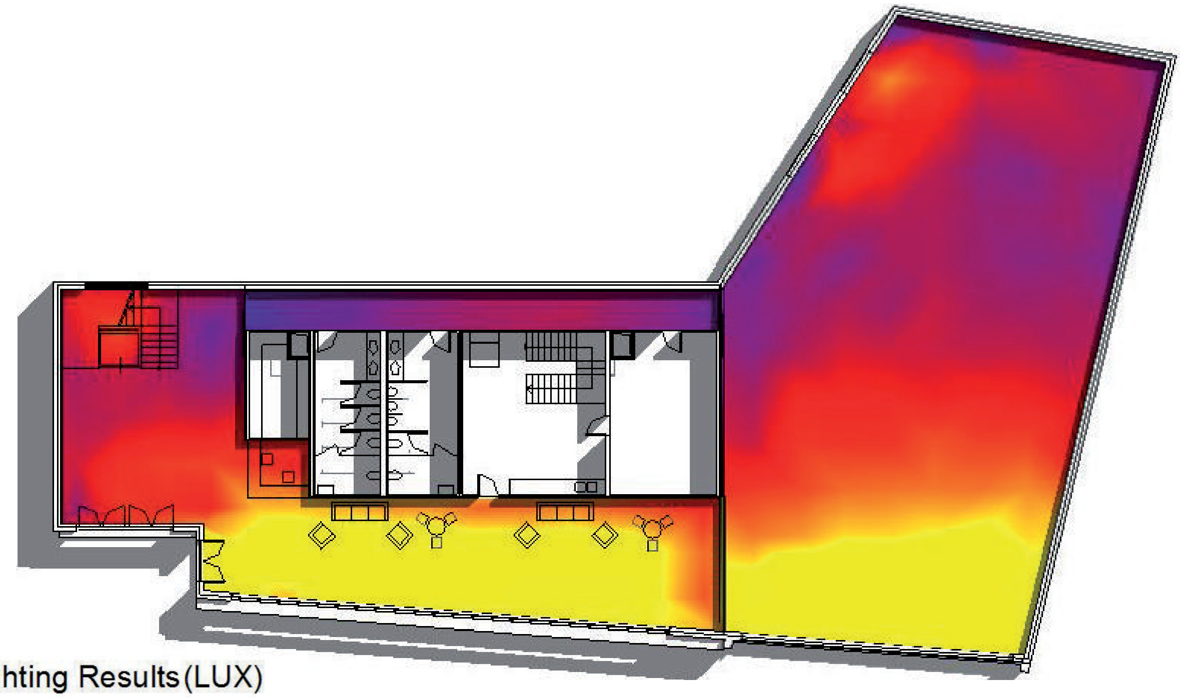
In order to save energy on electric lighting, it is important to offer good access to daylight. Kitchens have a moderate demand for visual acuity and need an illumination level of about 500 Lux. Event halls need about 300 Lux to have comfortable lighting conditions. 1

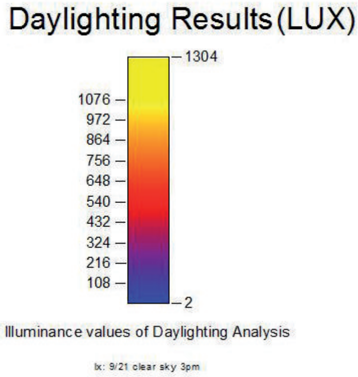
The following analysis was done with the Revit Leed Lighting Analysis tool. The tool analyses indoor light levels on the 21st of September at 9 am and 3 pm. 75 % of the regularly occupied spaces have to provide daylight levels between 300 and 3000 Lux to pass the Leed analysis. More than 2000 Lux can result in glare and visual discomfort.[60]



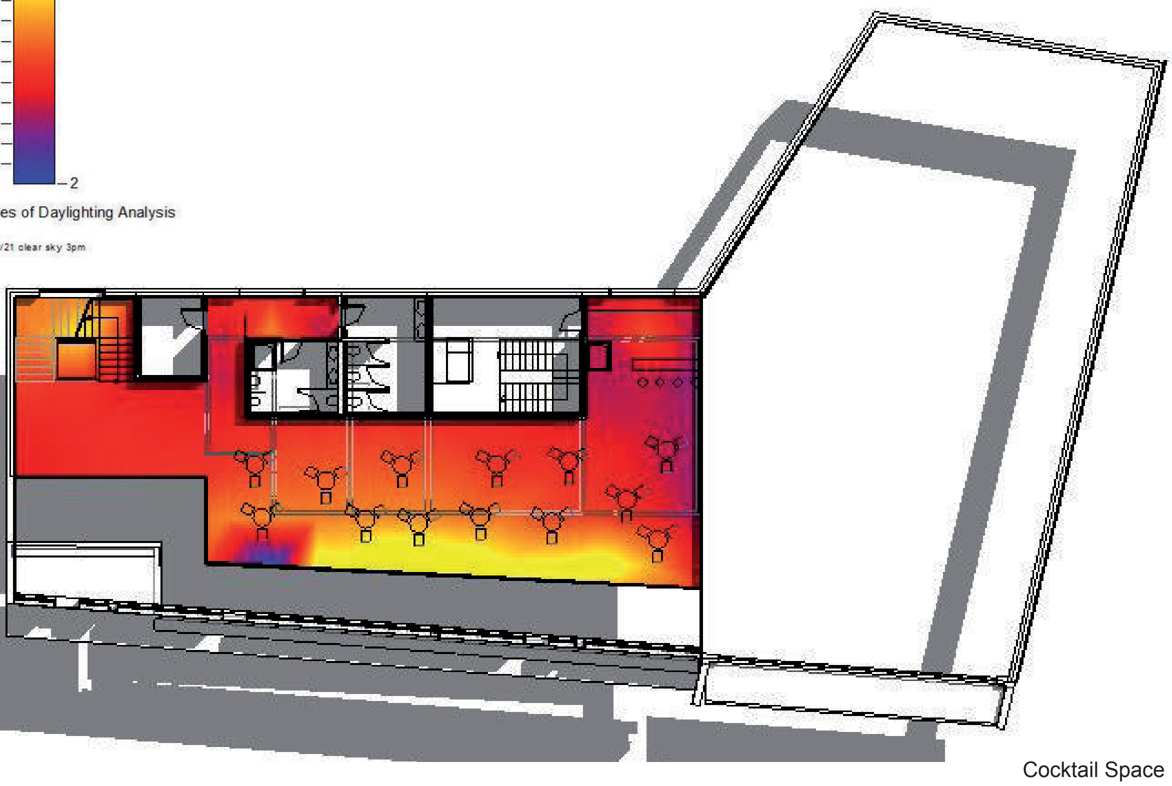
Catering Kitchen
Autumn Equinox, 15h

60 Cf. Sustainability Workshop, 2014.





Event Space
Autumn Equinox, 15h



Cocktail Space
Autumn Equinox, 15h

ENERGY CONCEPT

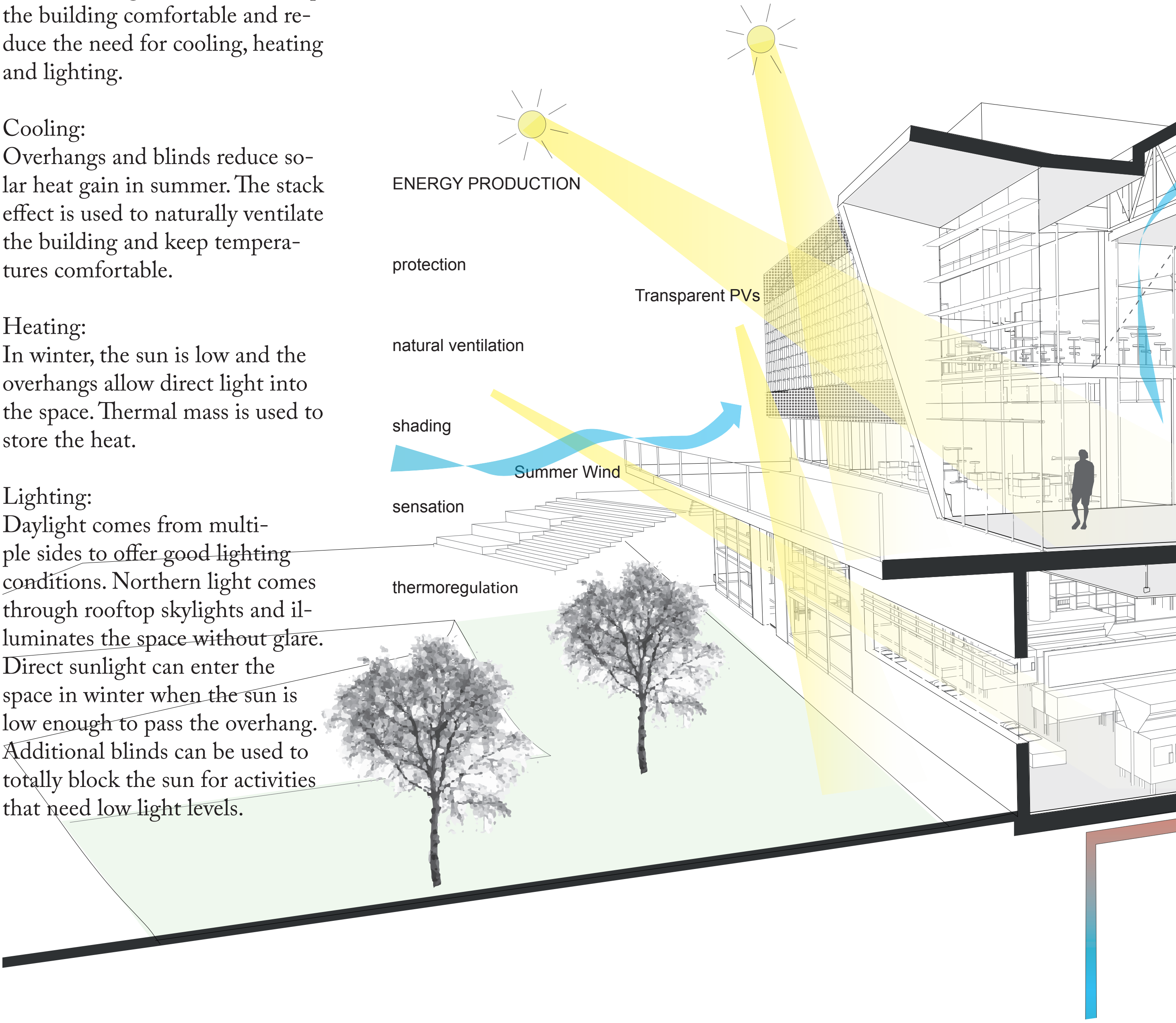
CONCEPTUAL SECTION

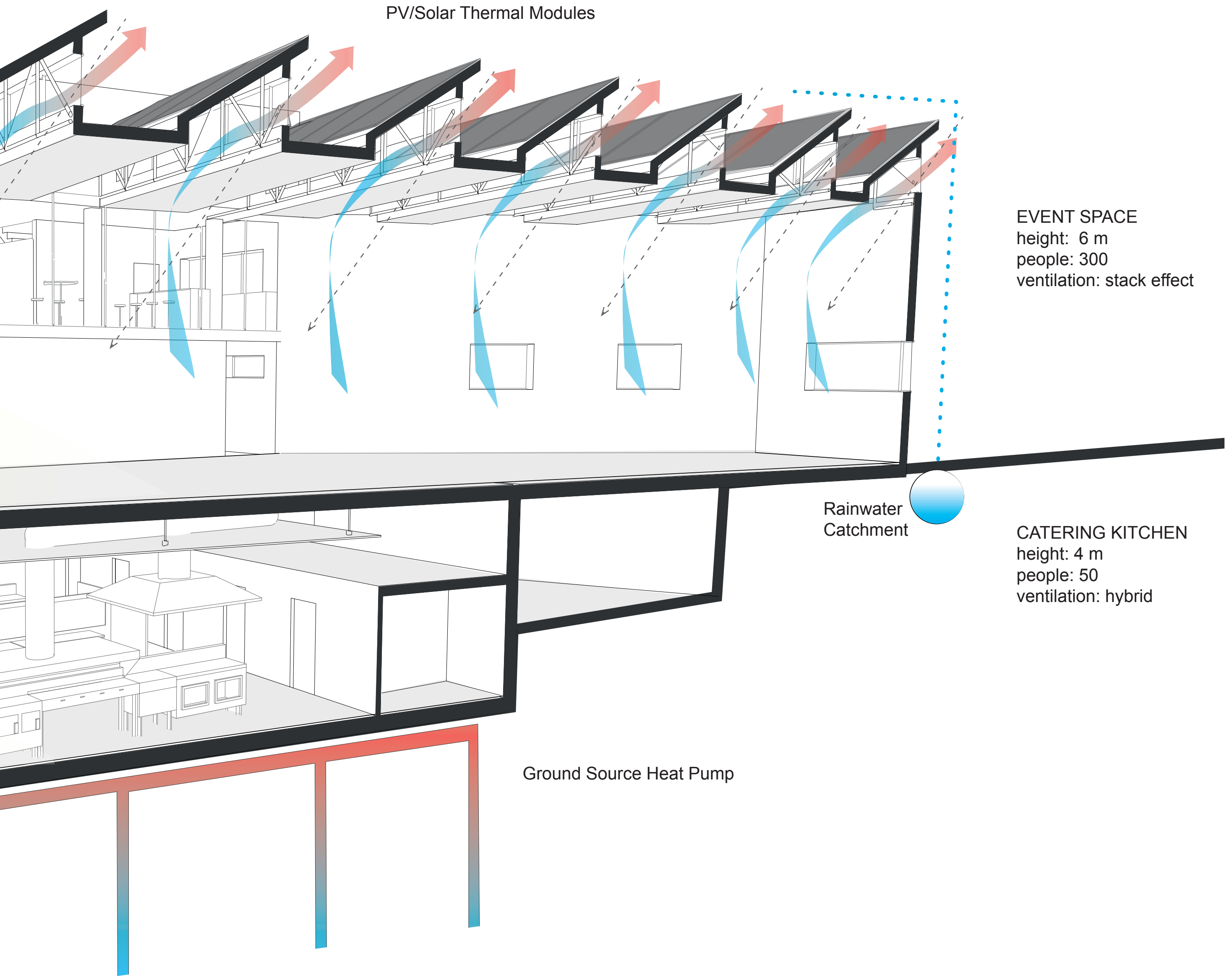
Several strategies are used to keep the building comfortable and reduce the need for cooling, heating and lighting.

Cooling:
Overhangs and blinds reduce solar heat gain in summer. The stack effect is used to naturally ventilate the building and keep temperatures comfortable.

Heating:
In winter, the sun is low and the overhangs allow direct light into the space. Thermal mass is used to store the heat.

Lighting:
Daylight comes from multiple sides to offer good lighting conditions. Northern light comes through rooftop skylights and illuminates the space without glare. Direct sunlight can enter the space in winter when the sun is low enough to pass the overhang. Additional blinds can be used to totally block the sun for activities that need low light levels.




PV/Solar Thermal Modules
EVENT SPACE
height: 6 m
people: 300
ventilation: stack effect
Rainwater
Catchment
CATERING KITCHEN
height: 4 m
people: 50
ventilation: hybrid
Ground Source Heat Pump

VIEW

URBAN SITUATION

The image on the right shows the new development viewed from the corner of Spofford Avenue and Manida Street.

The new situation is open to the neighbourhood and includes public space. Hunts point does not have a center in its residential area. The zone between the Event Space and the Performing Arts Center will be the new neighbourhood center. Big sitting stairs at the beginning of the pedestrian street and street furniture are used to invite people to stay and sit down. The pick up and drop off zone also serves as bus station for a new bus route.

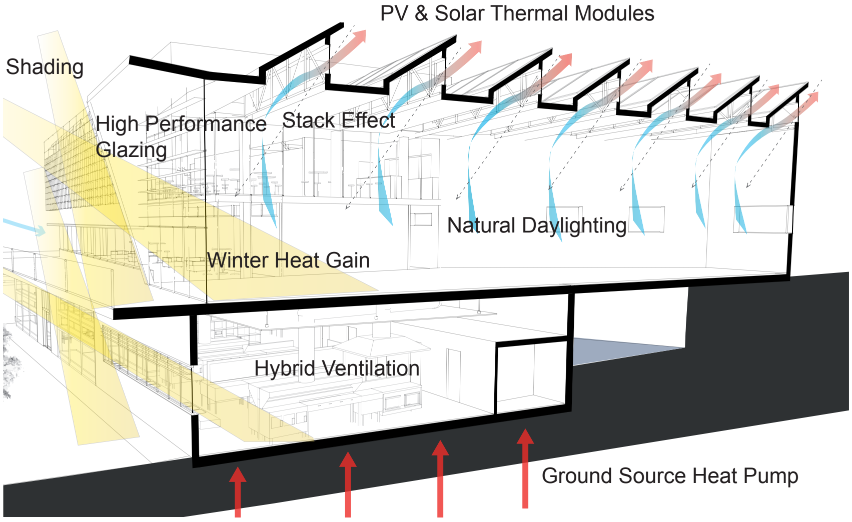
Before: Google Street View, 2013


EVENT
CENTER
KITCHEN
ORMING
ER
Tramp
Zest

ENERGY ANALYSIS

WHOLE BUILDING ANALYSIS

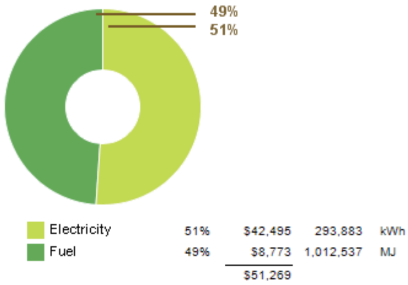
The following analysis was done with the Revit whole building analysis tool. The building function was set to restaurant/cafeteria. The building is well insulated and has high performance double glazing. The HVAC was set to an air source heat pump system.



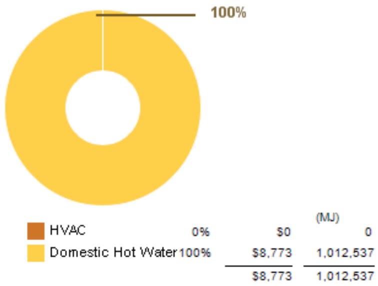
BUILDING PERFORMANCE FACTORS

Location:	Bronx, NY
Weather Station:	50958
Outdoor Temperature:	Max: 35°C/Min.: -18°C
Floor Area:	1.606 m²
Exterior Wall Area:	1.130 m²
Average Lighting Power:	15.07 W/m²
People:	529 Personen
Exterior Window Ratio:	0,55
Electrical Cost:	0,14 $/kWh
Fuel Cost:	0,91 $/Therm

ANNUAL ENERGY USE/COST



ENERGY USE: FUEL



ENERGY USE INTENSITY

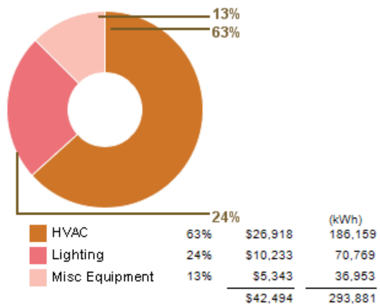
Electricity EUI:	221 kWh / sm / yr
Fuel EUI:	763 MJ / sm / yr
Total EUI:	1,560 MJ / sm / yr

LIFE CYCLE ENERGY USE/COST

Life Cycle Electricity Use:	8,816,490 kWh
Life Cycle Fuel Use:	30,376,111 MJ
Life Cycle Energy Cost:	698.278 $

*30-year life and 6.1% discount rate for costs

ENERGY USE: ELECTRICITY

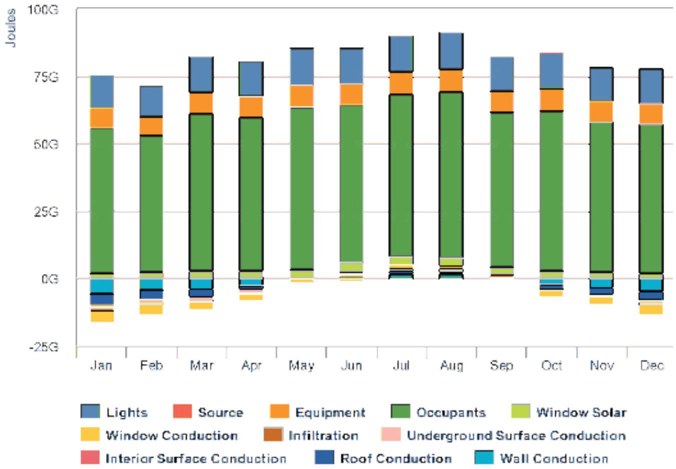


RENEWABLE ENERGY POTENTIAL

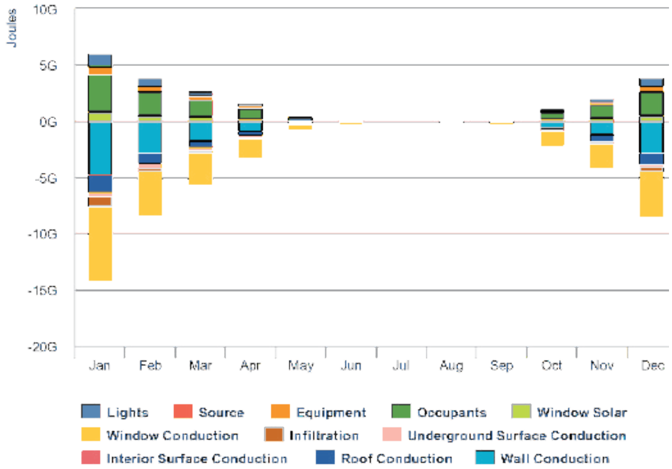
Roof Mounted PV System (Low efficiency):	63,954 kWh / yr
Roof Mounted PV System (Medium efficiency):	127,908 kWh / yr
Roof Mounted PV System (High efficiency):	191,862 kWh / yr
Single 15' Wind Turbine Potential:	1,247 kWh / yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high

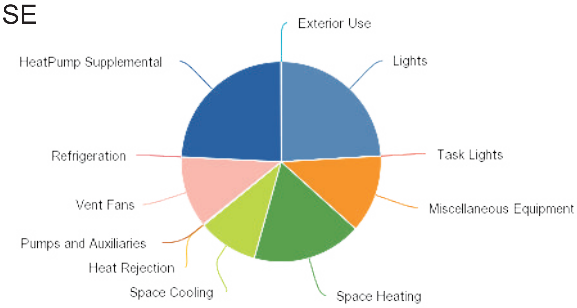
MONTHLY COOLING LOADS



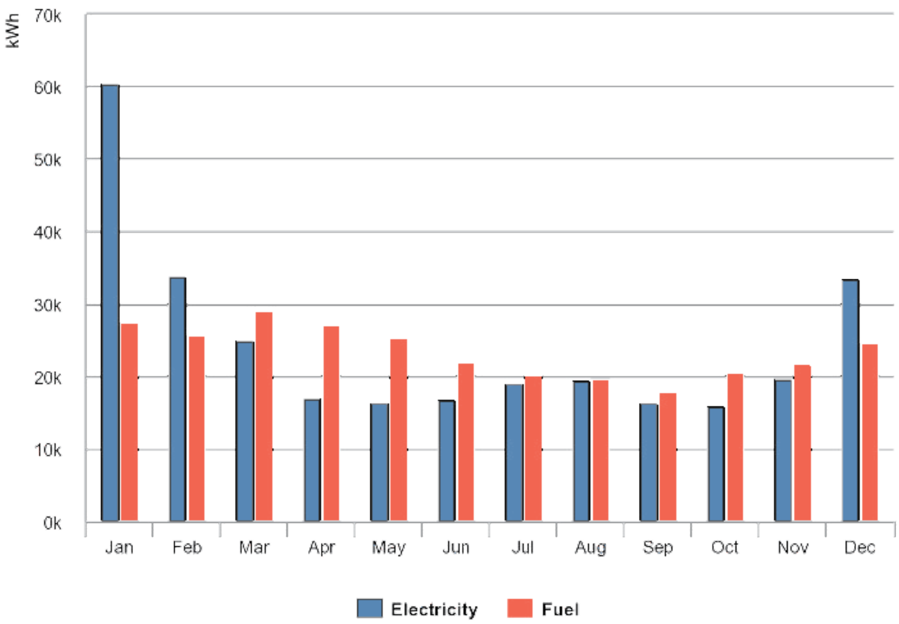
MONTHLY HEATING LOADS



ELECTRICITY USE



MONTHLY ELECTRICITY/FUEL USE

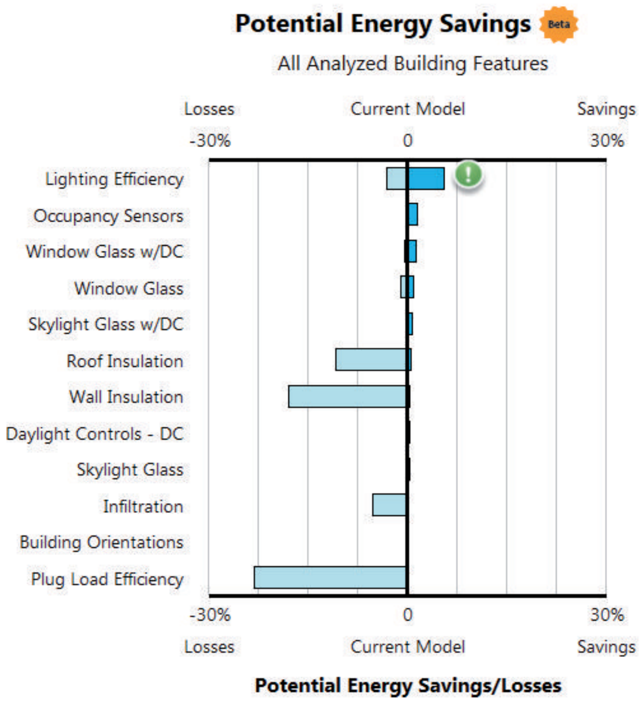


ENERGY ANALYSIS

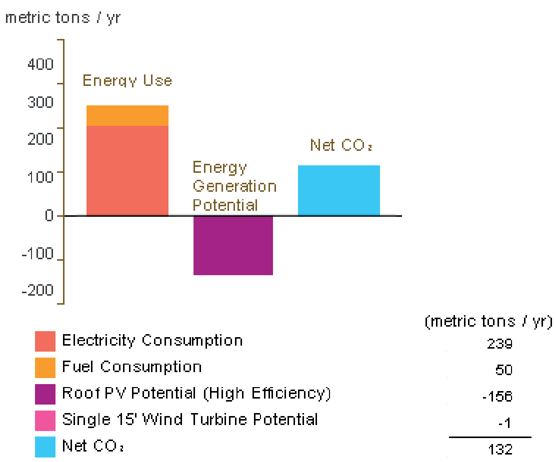
OPTIMIZATION PROCESS

The Potential Energy Savings chart shows that there are only few possibilities to further achieve energy savings. Increasing lighting efficiency by using high performance equipment and installing occupancy and daylight sensors, offers the biggest potential to reduce energy use intensity.

The annual carbon footprint of the building is 132 tons carbon dioxide per year. Tests in Green Building Studio show that the development can get carbon neutral by implementing more sustainable strategies and increasing equipment efficiency,. The consumption of fossil fuel is eliminated by using a geothermal heat pump for heating and cooling; solar thermal panels are used for producing hot water. Natural ventilation should be used whenever outdoor air conditions allow it.



ANNUAL CARBON FOOTPRINT



CARBON NEUTRAL POTENTIAL

Carbon Footprint

Alternate Run Carbon Neutral Potential

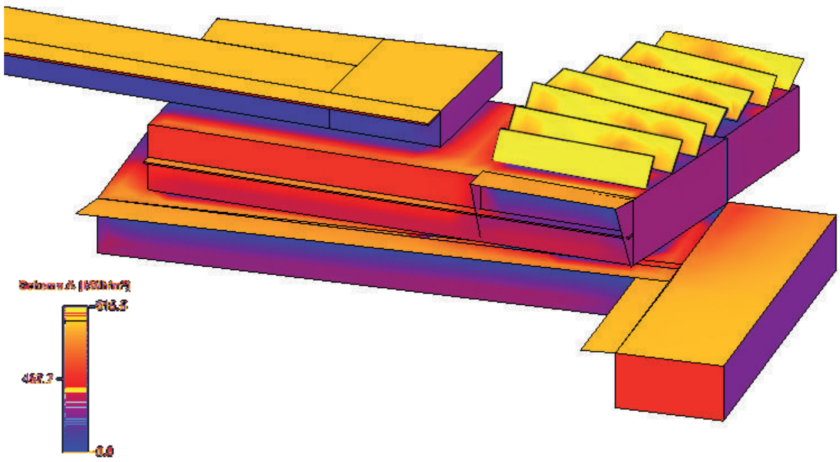
Annual CO_2 Emissions	Mg
1 Base Run	290.3
2 Alternate Run	216.9
Onsite Renewable Potential	-170.6
Natural Ventilation Potential	-18.9
Onsite Biofuel Use	-50.5
Net CO_2 Emissions	-23.2

Net Large SUV Equivalent: -2.3 SUVs / Year

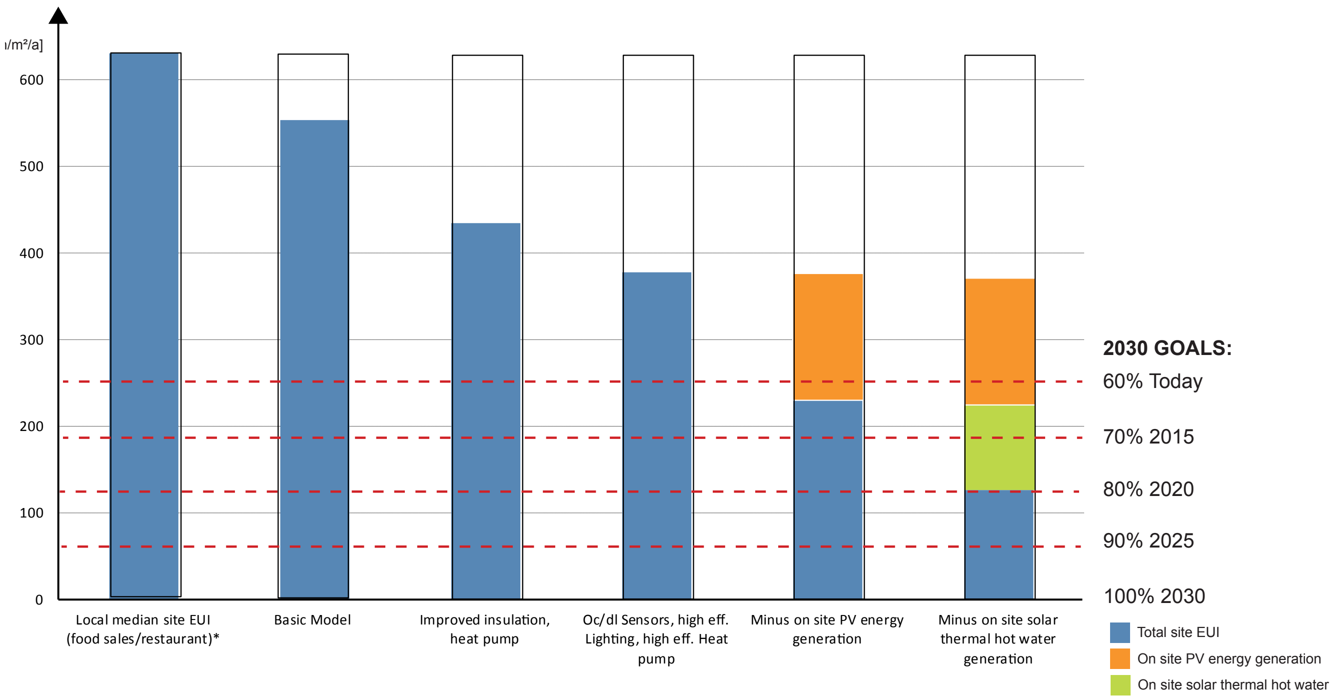
Assumptions

2030 CHALLENGE

The 2030 challenge is met by using several steps to increase energy efficiency and by producing on site renewable energy. The basic model with standard insulation uses 12% less energy than the local median of that type. By improving insulation, choosing an efficient HVAC system and high performance equipment, the EUI is reduced by 40%. By including PV and solar thermal panels on the roofs and on the southern facade, a reduction of 80% can be achieved.



Solar Radiation Analysis:
whole year solar study, 9-19h



EUI REDUCTION PROCESS				
Building	Total EUI	2030 Goal reached	% of median	% Reduction
Local median site EUI (food sales/restaurant)*	630 kWh/m²/a	FALSE	100 %	0 %
Basic Model	553 kWh/m²/a	FALSE	88 %	12 %
Improved insulation, heat pump	433 kWh/m²/a	FALSE	69 %	31 %
Oc/dl Sensors, high eff. Lighting, high eff. Heat pump	377 kWh/m²/a	FALSE	60 %	40 %
Minus on site PV energy generation	232 kWh/m²/a	TRUE	37 %	63 %
Minus on site solar thermal hot water generation	126 kWh/m²/a	TRUE	20 %	80 %

THANKS

ACKNOWLEDGEMENT

I want to thank my parents for supporting me during this thesis and during the last 6 years.

Thanks to my brother Maximilian for reading the work and giving me advice.

Thanks to Professor Brian Cody for giving me the opportunity to write this thesis and for giving me important feedback.

Thanks to everyone else who supported me during this thesis.

SOURCES

BIBLIOGRAPHY
BOOKS

Aksamija Ajla/Perkins+Will: Sustainable facades. Design methods for high-performance building envelopes, New Jersey-Canada 2013

Brown, G. Z./DeKay, Mark: Sun, Wind & Light. Architectural Design Strategies, Canada 2000

Geisendorf, C.-E. u. a.: Dichte individuelle Wohnbauformen. Eine systematische Beispielsammlung, Schweiz 1983

Glücklich,Detlef: Ökologisches Bauen. Von Grundlagen zu Gesamtkonzepten, München 2005

Hausladen Gerhard/Liedl Petra/Saldanha, Mike: Klimagerecht Bauen. Ein Handbuch, Basel 2012

Hegger Manfred a. o.: Energie Atlas. Nachhaltige Architektur, München 2008

Yeang, Ken: Ecodesign. A Manual for Ecological Design, Great Britain 2006

ARTICLES/JOURNALS

Rosenzweig, Cynthia a.o.: Mitigating New York City's Heat Island. Integrating Stakeholder Perspectives and Scientific Evaluation, in: Bulletin of the American Meteorological Society 90 (2009), 1297- 1312

WEB

Alvi, Kiran: Mott Haven neighbors gather around a campfire for all the kids in jail in The Bronx Ink (2011), available: http://bronxink.org/2011/10/07/17188-mott-haven-neighbors-gather-around-a-campfire-for-all-the-kids-in-jail/ (Accessed oct 28 2013)

American Institute of Architecture Students: Transformation 2030 Competition Info. Available: http://www.aias.org/website/article.asp?id=3041 (Accessed oct 2013)

Autodesk: Sustainability Workshop, available: http://sustainabilityworkshop.autodesk.com/buildings/measuring-light-levels (Accessed sept 28 2014)

Belmaker, Gidon: Bronx Juvenile Detention Center Closes Doors in The Epoch Times (2011), available: http://www.theepochtimes.com/n2/united-states/bronx-juvenile-detention-center-closes-doors-53892.html (Accessed oct 28 2013)

Canady, Keith: The Neighborhood And History Of Hunts Point in the Bronx. Available: http://www.thebx.net/info/_neighborhoods_bronx_huntspoint.php (Accessed july 20 2014)

Census 2010, City Council 2008, http://home2.nyc.gov/html/dcp/html/hunts_point/index.shtml (Accessed nov 9 2013)

Cornell University, New York State Climate Office: The Climate Of New York, available: http://nysc.eas.cornell.edu/climate_of_ny.html (Accessed oct 29 2013)

Corpus Christi Monastery, Dominican Nuns of Bronx: HISTORY OF THE MONASTERY, available: http://www.opbronx.org/about/ (Accessed nov 2 2013)

Daily News (2011): Art that heals: South Bronx murals bring hope and inspiration to one of city's poorest neighborhoods available: http://www.nydailynews.com/new-york/art-heals-south-bronx-murals-bring-hope-inspiration-city-poorest-neighborhoods-article-1.156604 (Accessed oct 28 2013)

DeRienzo, Paul (2009): The Fabulous, Fantastic Timeline Of Hunts Point, Bronx. Available: http://de.slideshare.net/pderienzo/history-of-hunts-point-crucial (Accessed oct 28 2013)

Esser, Felix: Chris Arnade-Capturing the Faces of Drug Addicts in Hunts Point, in: The Phoblographer (2013). Available: http://www.thephoblographer.com/2013/05/19/chris-arnade-capturing-the-faces-of-drug-addicts-in-hunts-point/#.U_xdOmOf_c8 (Accessed dec 11 2013)

Food Service Technology Center: Kitchen Ventilation Designguide http://www.fishnick.com/ventilation/designguides/ (Accessed dez 2013)

Garcia, Sandra: The Rich History of Hunts Point, in: The Bronx Journal (2011), available: http://www.thebronxjournal.com/the-rich-history-of-hunts-point/ (Ac-

cessed oct 20 2013)
Harper, Douglas (2003): Emancipation in New York. Available: http://slavenorth.com/nyemancip.htm (Accessed oct 29 2013)

Manzria, Edward a. o.:http://2030palette.org/ (Accessed oct 2013)

Michler, Andrew: Interview: Ed Mazria, Founder of Architecture 2030 Introduces the 2030 Palette page 1, 31.3.2014 in Inhabitat http://inhabitat.com/interview-ed-mazria-founder-of-architecture-2030-introduces-the-2030-palette/2/

NYC Department of City Planning, http://www.nyc.gov/html/dcp/pdf/lucds/bx2profile.pdf (Accessed oct 22 2013)

NYC Police: http://maps.nyc.gov/crime/NYC (Accessed oct 22 2013)

Perkins+Will: Analysis for Application of LEED-ND to Existing Communities, in: Transformation 2030 Design Competition. Site Information Packet, p.23 (2013-2014). Available: http://www.aias.org/website/article.asp?id=3041 (Accessed oct 14 2013)

Singer, Roberta / Martínez, Elena: A South Bronx Latin Music Tale. Available: http://www.herencialatina.com/South_Bronx_Latin/Latin_Music_Bronx.htm (Accessed july 20 2013)

United States Environmental Protection Agency (EPA) (2012): http://www2.epa.gov/toxics-release-inventory-tri-program (Accessed nov 15 2013)
Walsh, Kevin: Hunt’s Point, Bronx (2009), available: http://forgotten-ny.com/2009/03/hunts-point-bronx/ (Accessed nov 2 2013)

SOURCES

GRAPHICS & IMAGES*

[1] World map: NYC
Image source: http://english.freemap.jp (accessed oct 2013), edited by H.K.
Data Source: http://quickfacts.census.gov/qfd/states/36/3651000.html (accessed oct 2013)

[2] Bronx District 2: Borders of Hunts Point and Longwood
Image source: NYC Government, NYC Department of City Planning: Bronx Community District 2. Available: http://www.nyc.gov/html/dcp/pdf/lucds/bx2profile.pdf (accessed oct 2013)

[3] Map of New York City; Hunts Point
Image source: http://english.freemap.jp, edited by H.K. (accessed oct 2013)

[4] Faces of Addiction; Hunts Point
Image source: http://www.dailymail.co.uk/news/article-2252602/Hunts-Point-Bronx-Chris-Arnade-photographs-New-York-Citys-Red-Light-District.html (accessed dec 2013)

[5] Percentage Unemployed: New York City, Bronx and Hunts Point
Graphic by H.K.
Data Source: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_DP03 (accessed july 2014)

[6] Median Family Income: New York City, Bronx and Hunts Point
Graphic by H.K.
Data Source: http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml (accessed july 2014)

[7] Percentage of Family, Single & Nonfamily Households in BCD2
Graphic by H.K.
Data Source: http://www.nyc.gov/html/dcp/pdf/lucds/bx2profile.pdf page 5 (accessed july 2014)

[8] Population Origin, BCD2
Graphic by H.K.
Data Source: http://www.nyc.gov/html/dcp/pdf/lucds/bx2profile.pdf page 5 (accessed july 2014)

[11] Home to the city‘s elite: Casanova Mansion
Image source: http://de.slideshare.net/pderienzo/history-of-hunts-point-crucial (accessed oct 2013)

[12] Bruckner Expressway in the 50ies
Image source: http://de.slideshare.net/pderienzo/history-of-hunts-point-crucial (accessed oct 2013)

[13] Corpus Christi Monastery
Source: http://www.opbronx.org/wp-content/uploads/2012/12/Histor1.jpg (accessed july 2014)

[14] Population growth of Hunts Point and the Bronx 1900 - 2010
Graphic by H.K.
Data source: http://www.census.gov/# (accessed oct 2013)

[15] Hunts Point View
Image source: bing maps (accessed july 2014)
edited by H.K.

[16-19] Street view images
Image source: google maps (accessed july 2014)

[20] Asthma Hospitalizations per 1.000 Children map
Image source: http://www.cccnewyork.org/blog/concentrations-of-risk-asthma-and-poor-housing-conditions/ (accessed oct 2013)

[21] Citizens protest for better air conditions
Image source: http://de.slideshare.net/pderienzo/history-of-hunts-point-crucial (accessed oct 2013)

[22] A typical cell of the Juvenile Center
Image source: http://www.juvenile-in-justice.com/wp-content/uploads/2011/11/MG_5995_750.jpg (accessed dec 2013)

[23]] Locals protest against the prison
Image source: http://brie.hunter.cuny.edu/hpe/2011/03/24/spofford-rally-planned/
(accessed dec 2013)

[24] In 2011, the prison was closed
Image source: http://bronxink.org/wp-content/blogs.dir/3/files/2011/10/SpoffordPhotoLR2.jpg (accessed dec 2013)

[25] Street art on walls in the Bronx
Image source: http://www.nydailynews.com/new-york/art-heals-south-bronx-murals-bring-hope-inspiration-city-poorest-neighborhoods-article-1.156604 (accessed dec 2013)

[26-29] Neighbouring buildings
Image source: Google Street

View (accessed nov 2013)

[30] Koppen-Geiger Climate Classification Map
Image source: Sustainable facades : design methods for high-performance building envelopes / Ajla Aksamija, Ph.D., Perkins+Will. P.3

[31] IECC/ASHRAE Climate Classification System: United States
Image source: Sustainable facades : design methods for high-performance building envelopes / Ajla Aksamija, Ph.D., Perkins+Will. P. 7

[32] Weather stations in NYC
Image source: Project Vasari (Program)

[33] City climate: Urban Heat Island Effect
Information source: Hausladen Gerhard/Liedl Petra/ Saldanha, Mike: Klimagerecht Bauen. Ein Handbuch, Basel 2012. P. 163

[34]Temperature Difference: New York City and surrounding
Image source: Rosenzweig, Cynthia a.o.: Mitigating New York City's Heat Island. Integrating Stakeholder Perspectives and Scientific Evaluation, in: Bulletin of the American Meteorological Society 90 (2009), p. 1297- 1312

[36] Global radiation map
Image source: Energieatlas, p. 51

[42] Solar Radiation Intensity: Summer & Winter
Information source: Hausladen Gerhard/Liedl Petra/ Saldanha, Mike: Klimagerecht Bauen. Ein Handbuch, Basel 2012. P. 57

[47-52] Design Guidelines, Climate Consultant
Image source: Climate Consultant Version 5.3

[53] Heat Island Mitigation
City of Ann Arbor Urban Tree Canopy Analysis
Image source: http://2030palette.org/ (accessed april 2014)

[54-60] Palette 2030 strategies
Image source: http://2030palette.org/ (accessed april 2014)

[61-68] Palette 2030 strategies
Image source: http://2030palette.org/ (accessed april 2014)

*All the graphics and images not included in this list are made by the author.