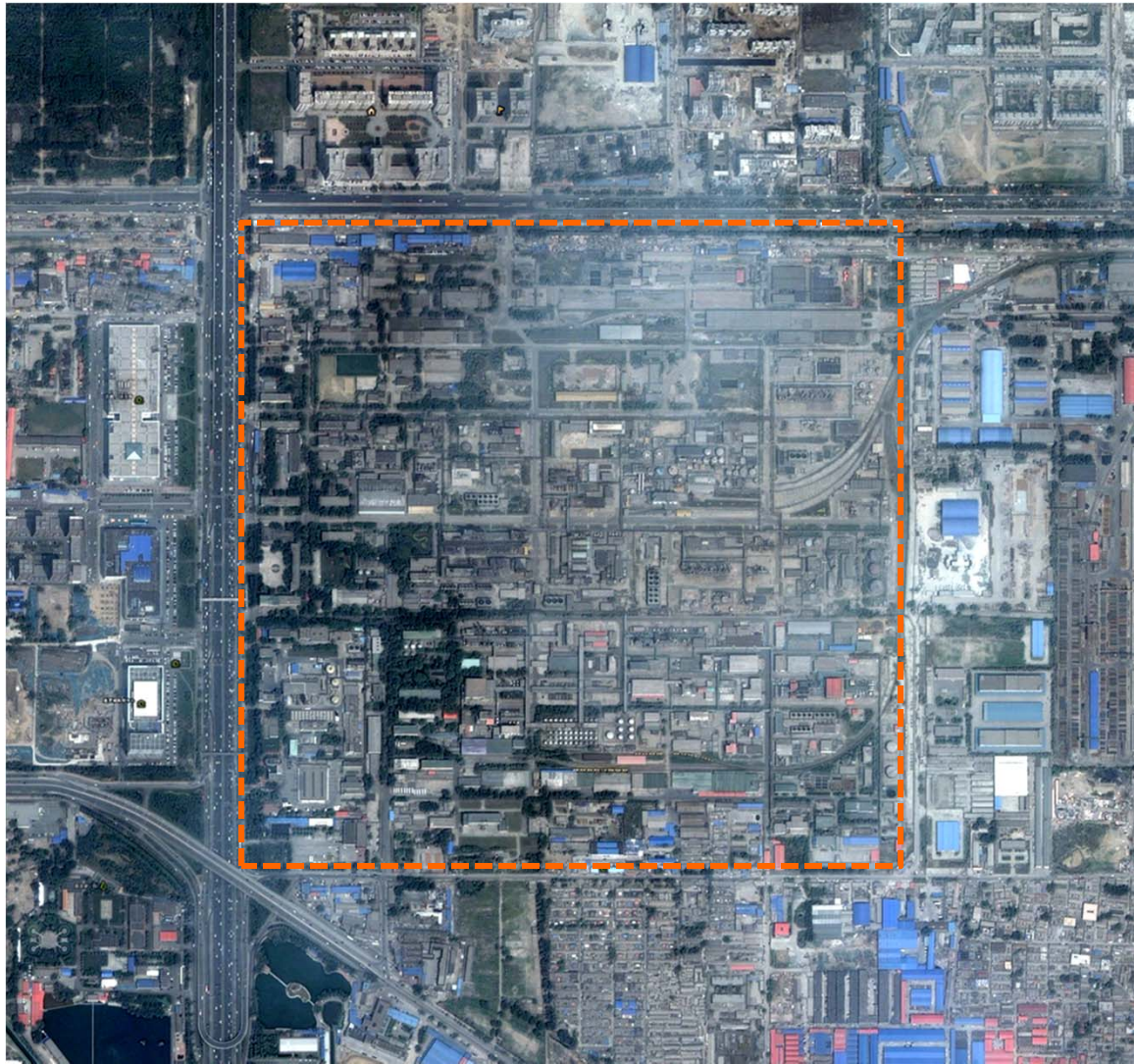


Compact Residential Development

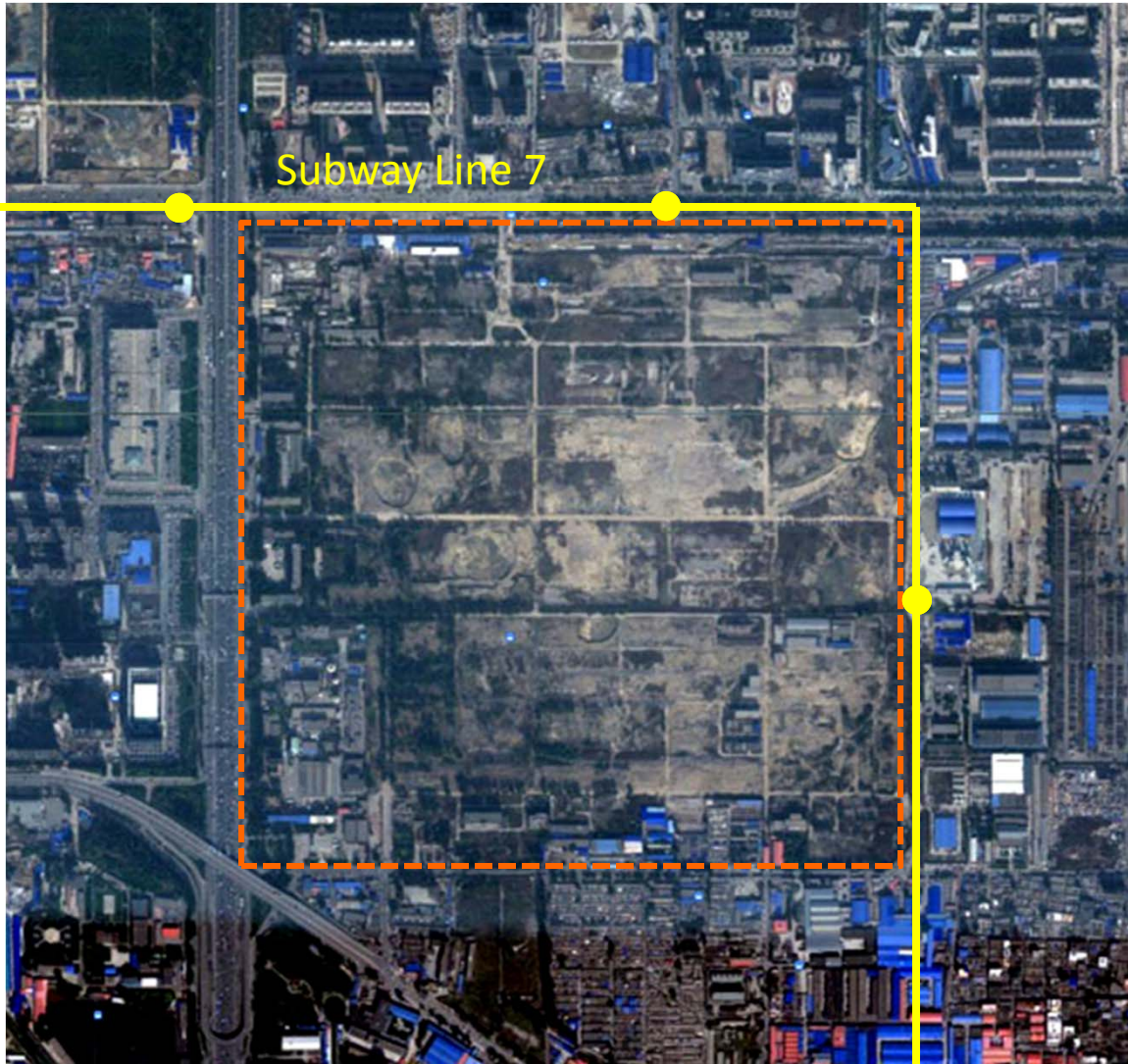
Beijing

Debashree | Juho | Memo | Yingying



SITE 2009





Subway Line 7

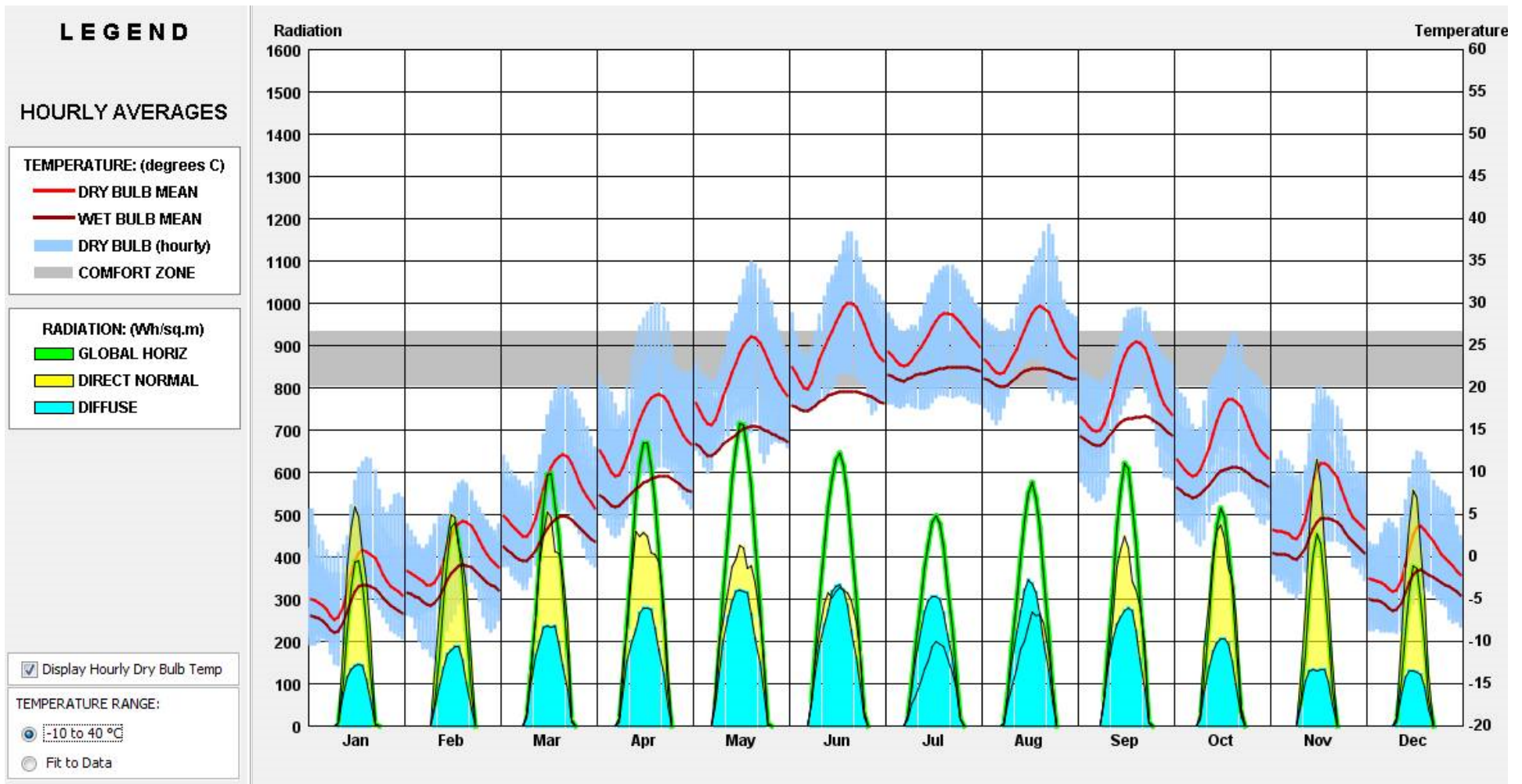
Site Area: 100 Ha

Land Use: Residential

Density : 50,000person/sq km

Transit: Subway Line7 (2013)

SITE 2011



Latitude: 39⁰55N

Summers: hot and humid

Average High: 30⁰C

Highest: 40⁰C

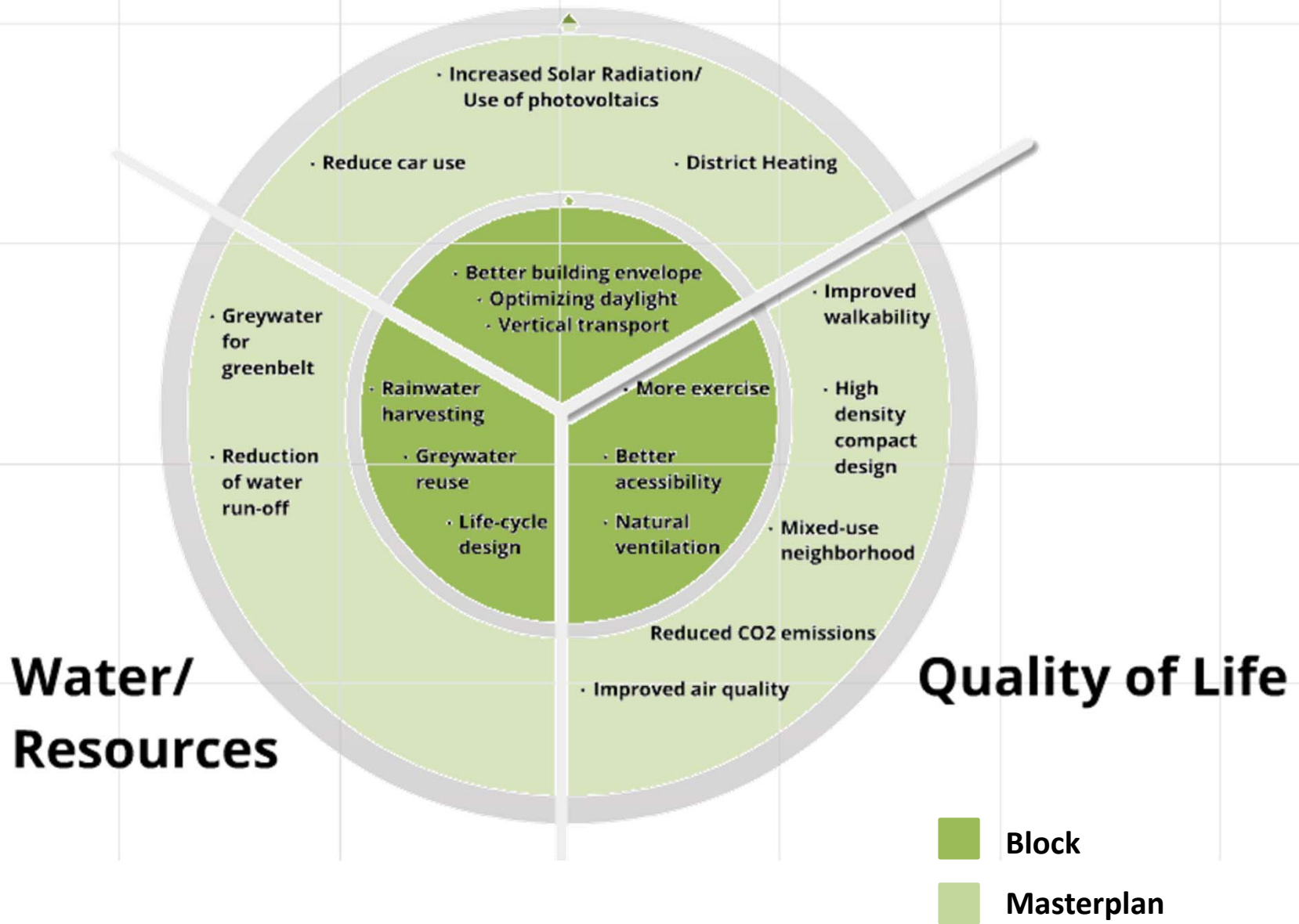
Longitude: 116⁰25E

Winter: cold and dry

Average Low: -4⁰C

Lowest: -20⁰C

Energy





Residential



Designers: THCA Architectural
Design & Consulting Institute

Masterplan

- Mixed landuse
- Walkability
- Water ecology

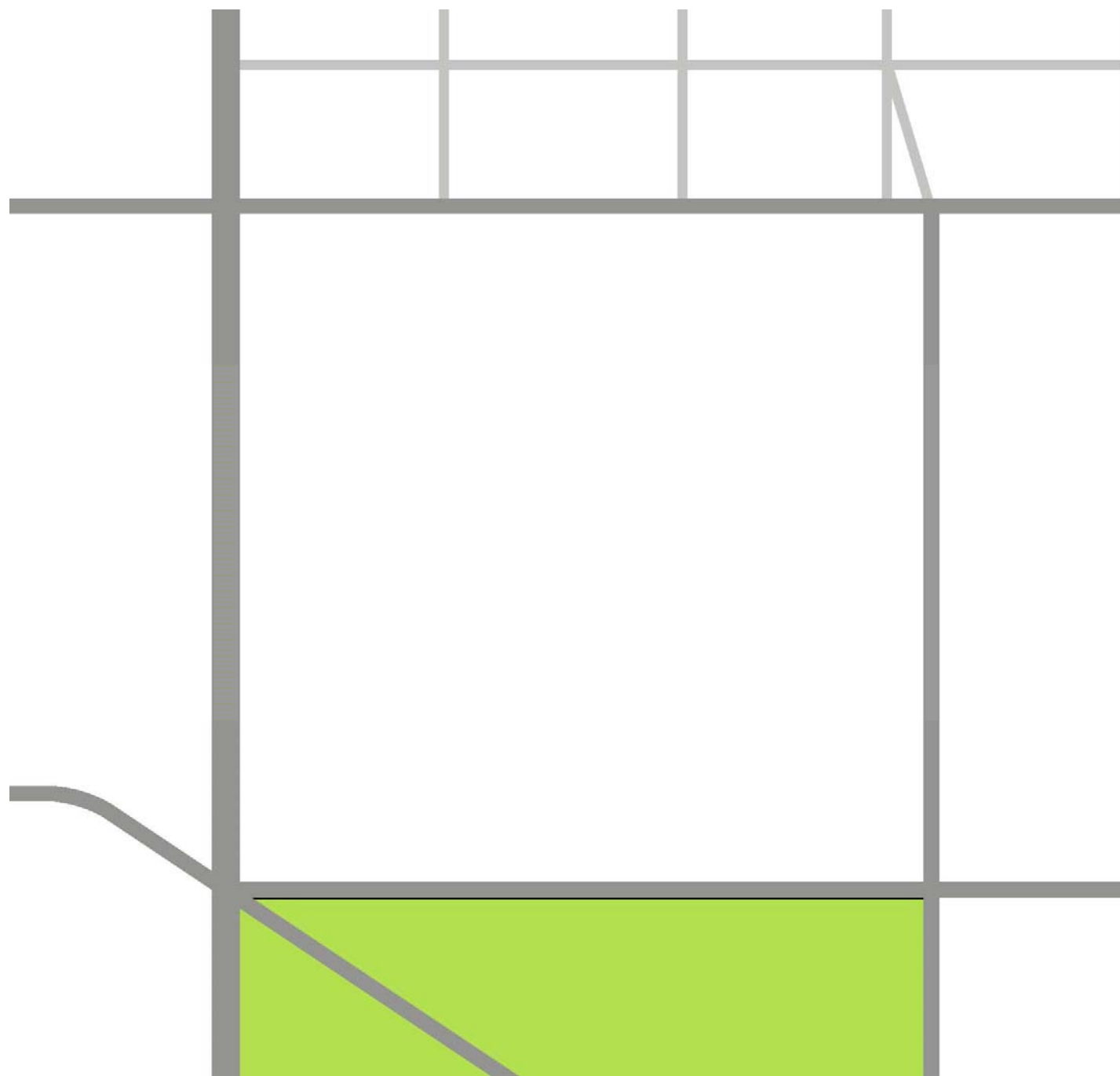
Block

- human scale
- operative energy
- thermal comfort

Lifecycle

- PV
- lifecycle
- CO2 emission
- rainwater harvesting

- **Mixed landuse**
- **Walkability**
- **Water ecology**



BEIJING

our proposal



 Subway station

 Boulevard

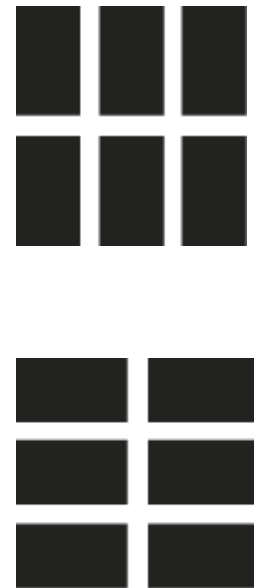
BEIJING

our proposal



 Subway station

 Boulevard



Average block size 120 x 200m






BEIJING

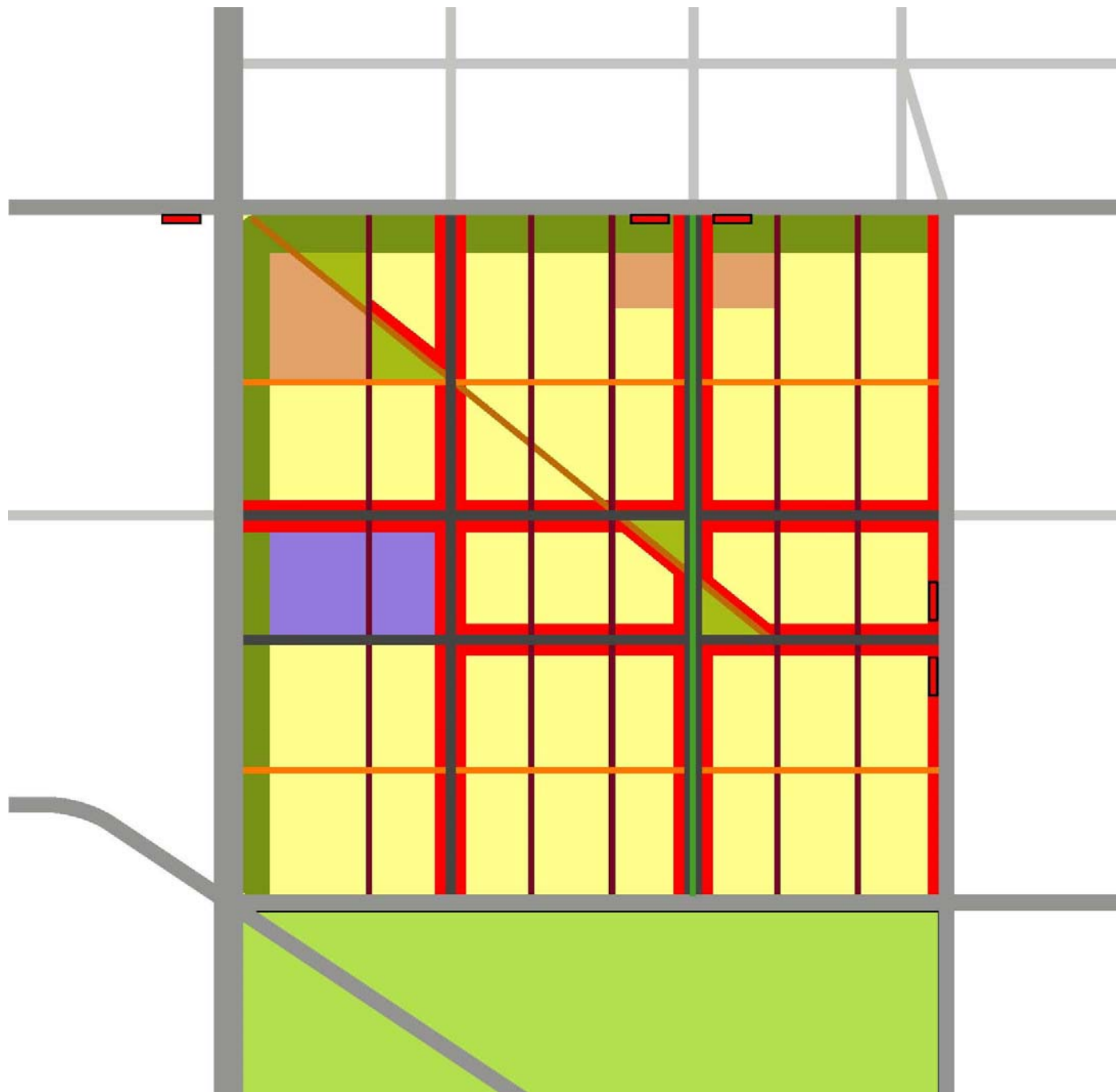
our proposal



-  Subway station
-  Boulevard
-  A street
-  B street



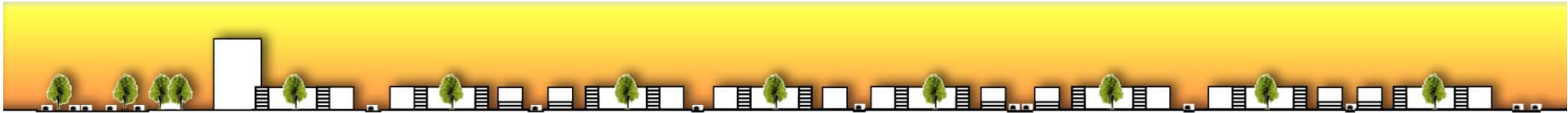
-  Subway station
-  Boulevard
-  A street
-  B street
-  Pedestrian Path



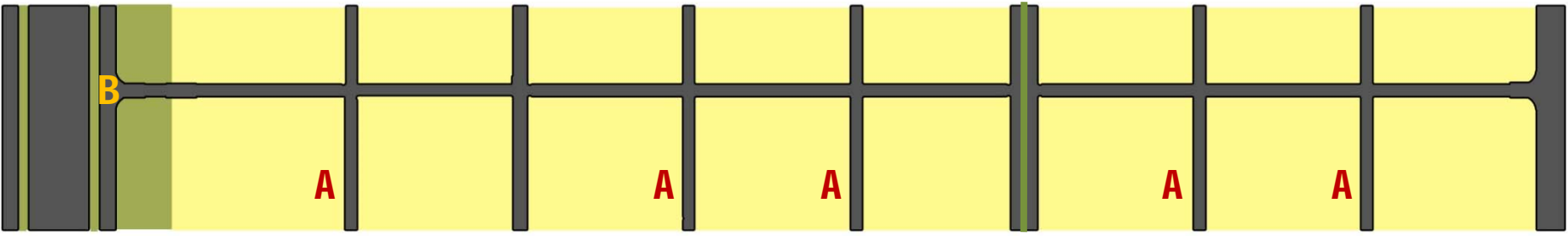
- Subway station
- Boulevard
- A street
- B street
- Pedestrian Path
- Green Buffer
- Public Square
- Residential
- Retail
- Offices
- School

BEIJING

our proposal

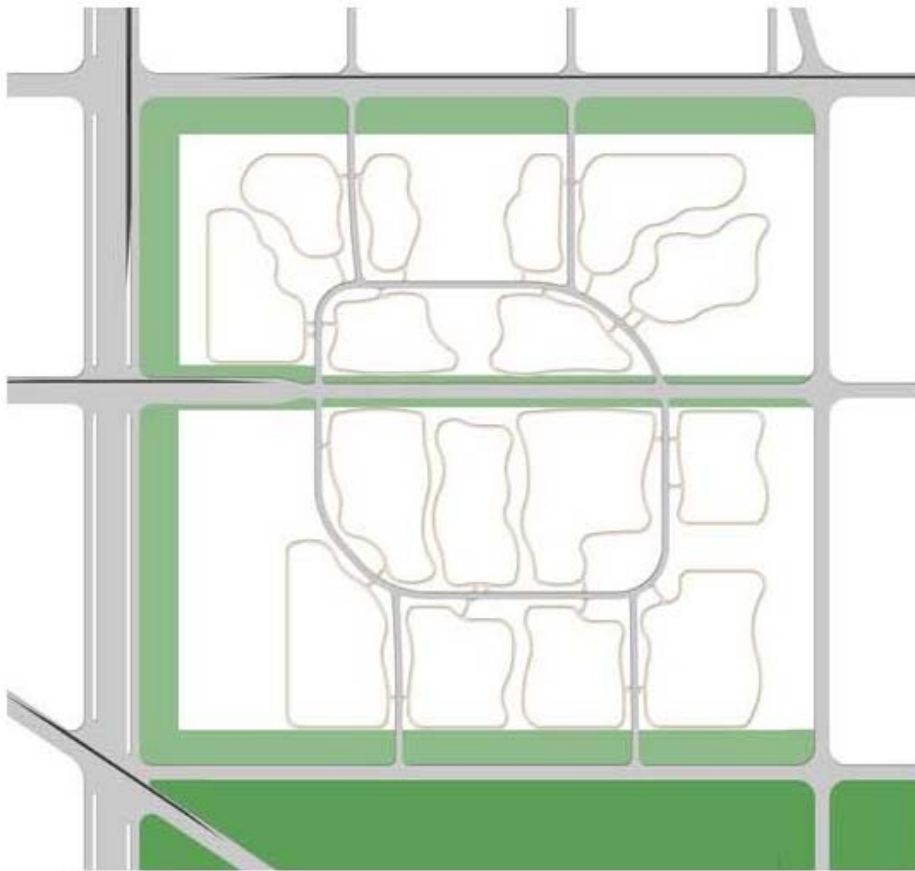


Site Section



Conceptual Sketch of Boulevard

Source: Adapted from Ian Lockwood

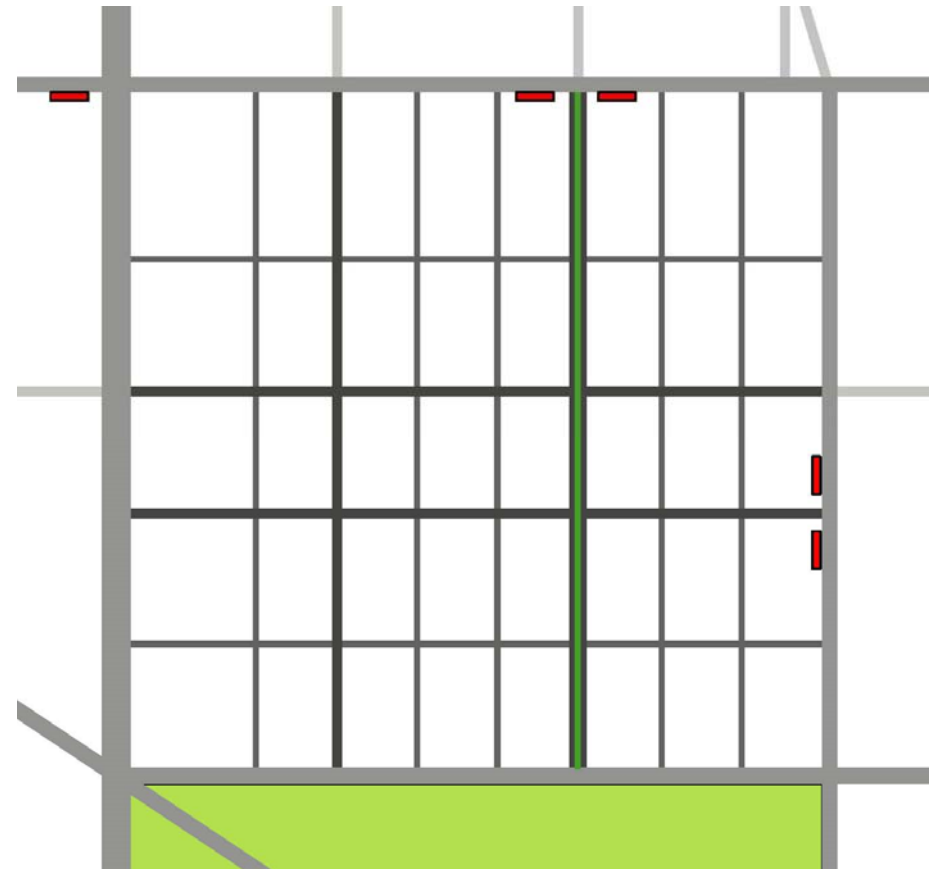


Base Case

Central Road: 45m

Secondary Streets: 12m

Block Streets: 6.5m



New Proposal

Boulevard: 45m

Primary Streets: 25m

Secondary Streets: 12m



Highest Walkscore: 90

Lowest Walkscore: 50

Average Walkscore: 71

- Housing
- Restaurant
- Grocery
- Shopping



Highest Walkscore: 100

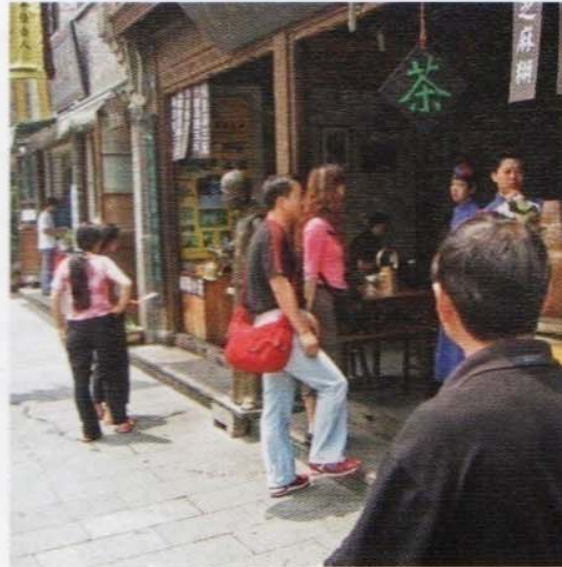
Lowest Walkscore: 88

Average Walkscore: 96

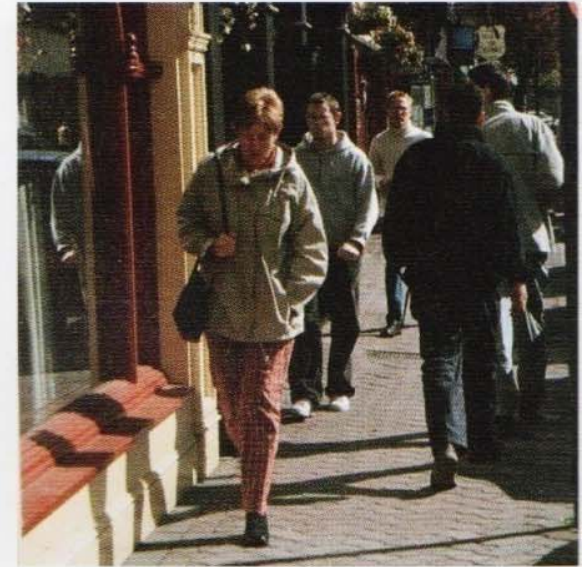
- Schools
- Entertainment
- Books
- Coffee



Chatting by



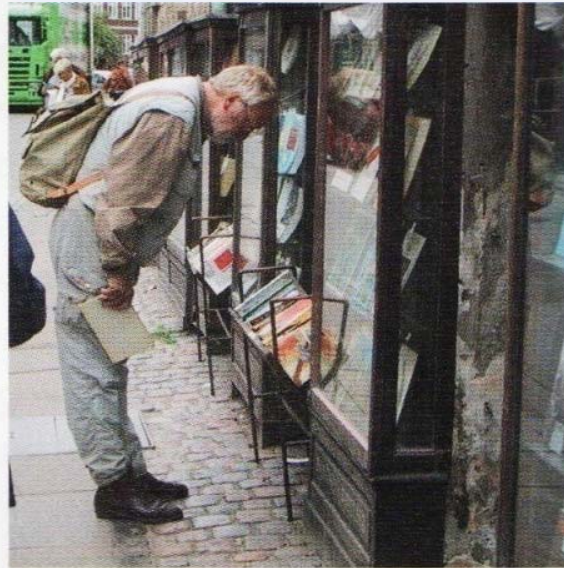
Entering and leaving



Walking alongside



Grocery on the way home



Looking at displays with



Looking in and out of

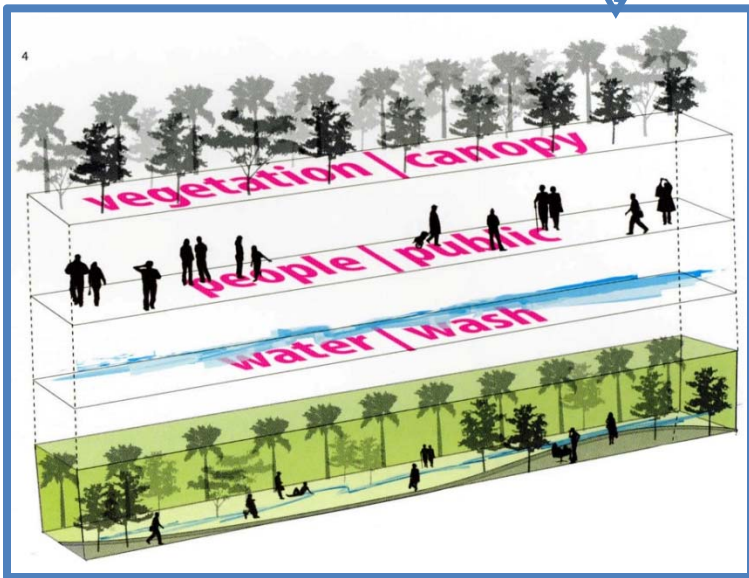
Source: Adapted from Jan Gehl

Rainwater: harvested

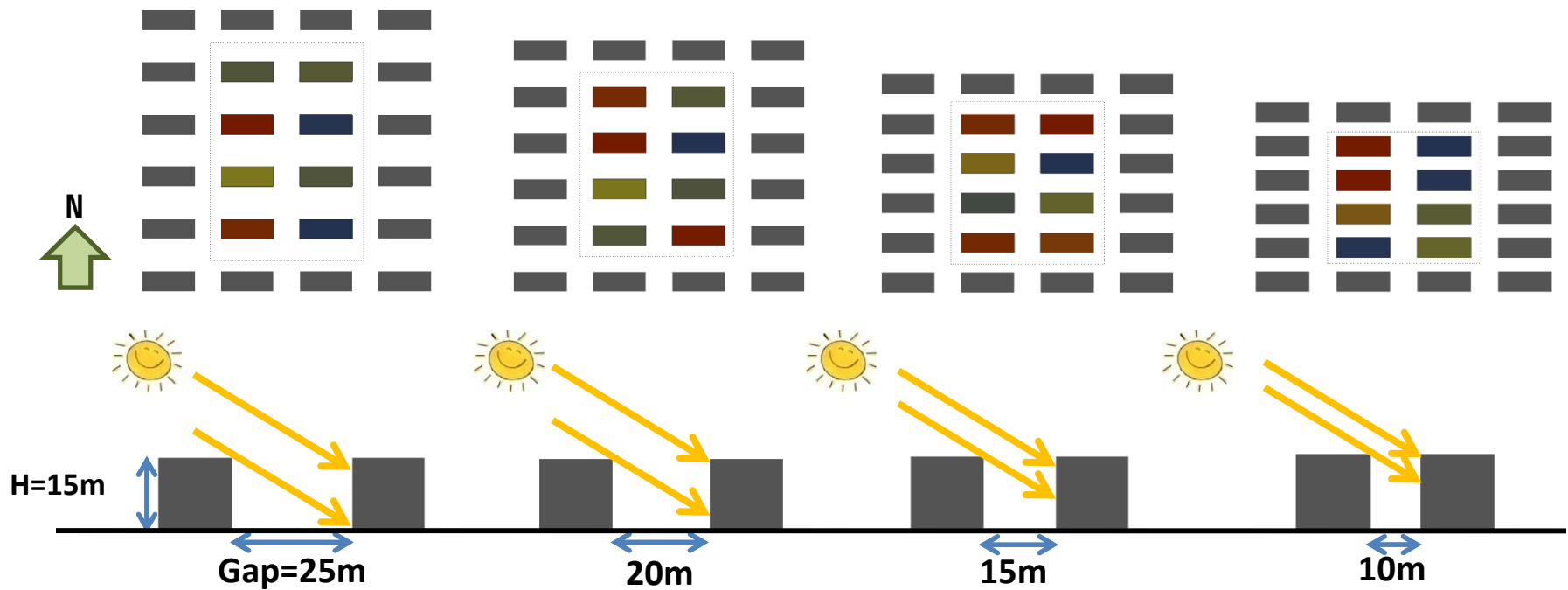
Stormwater: infiltration

Grey Water: infiltration then landscaping

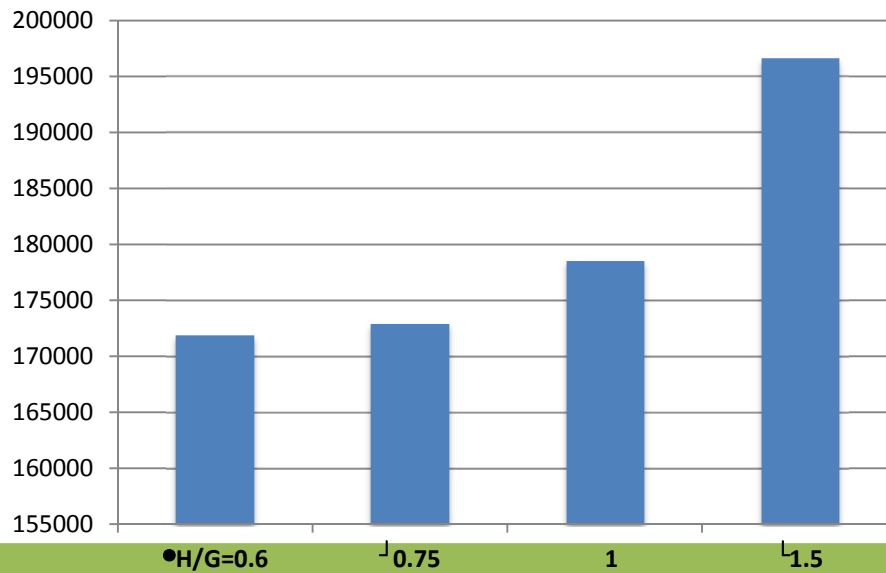
Blackwater: treatment



- human scale
- operative energy
- thermal comfort

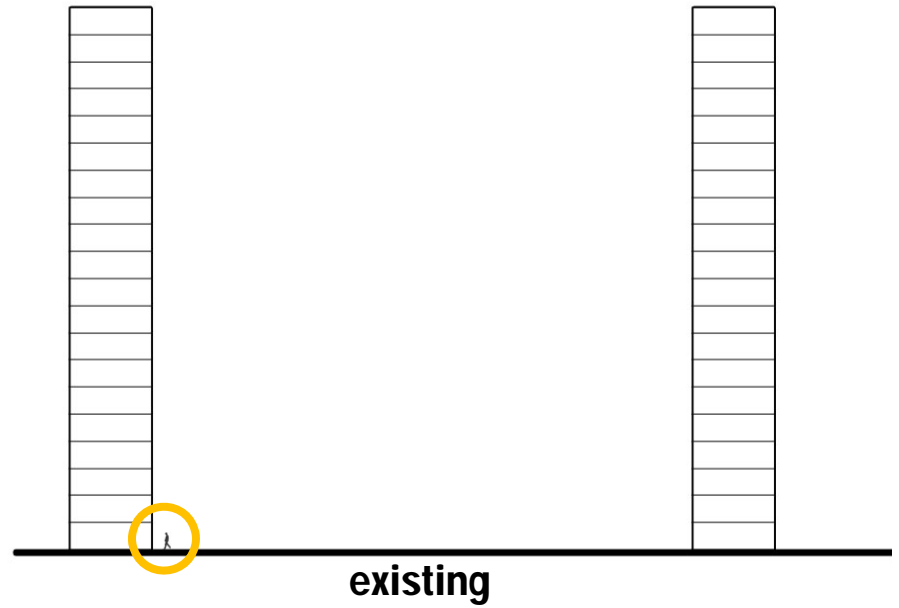
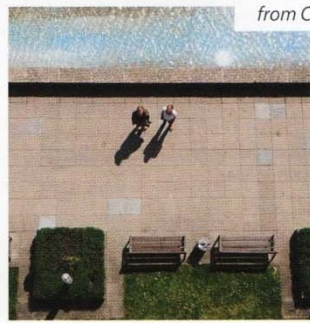
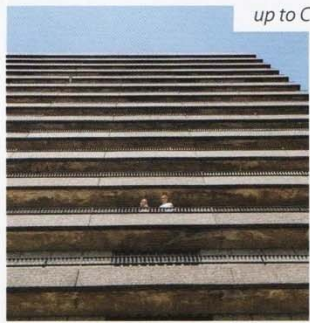
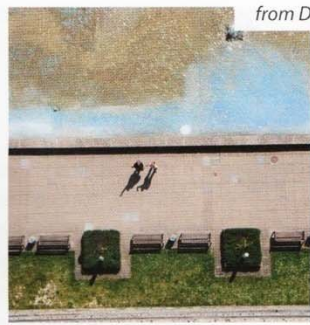
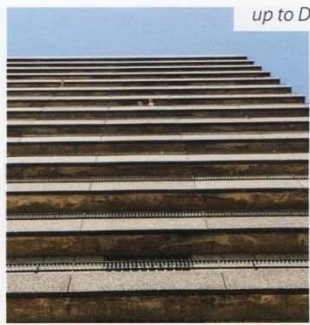
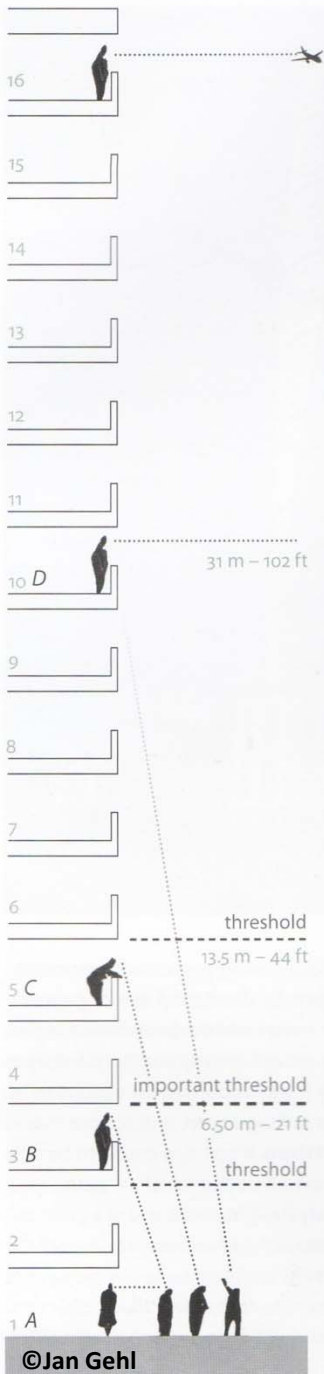


Heating(kWh)

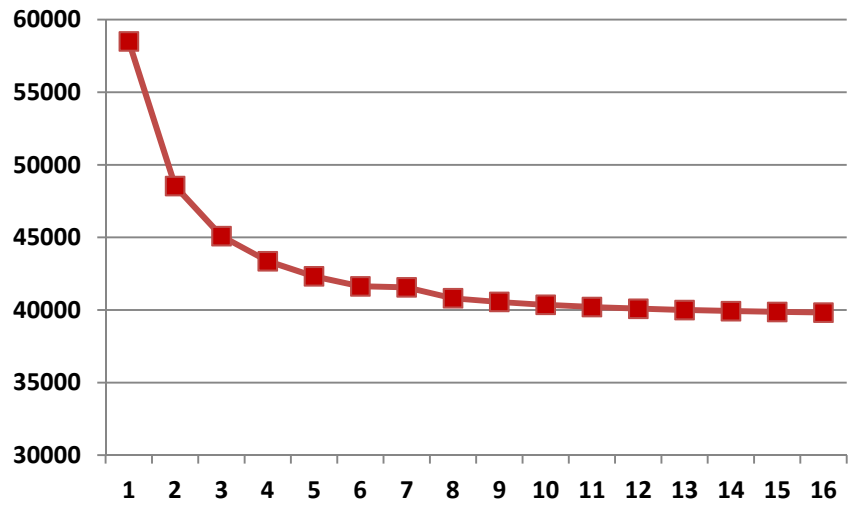
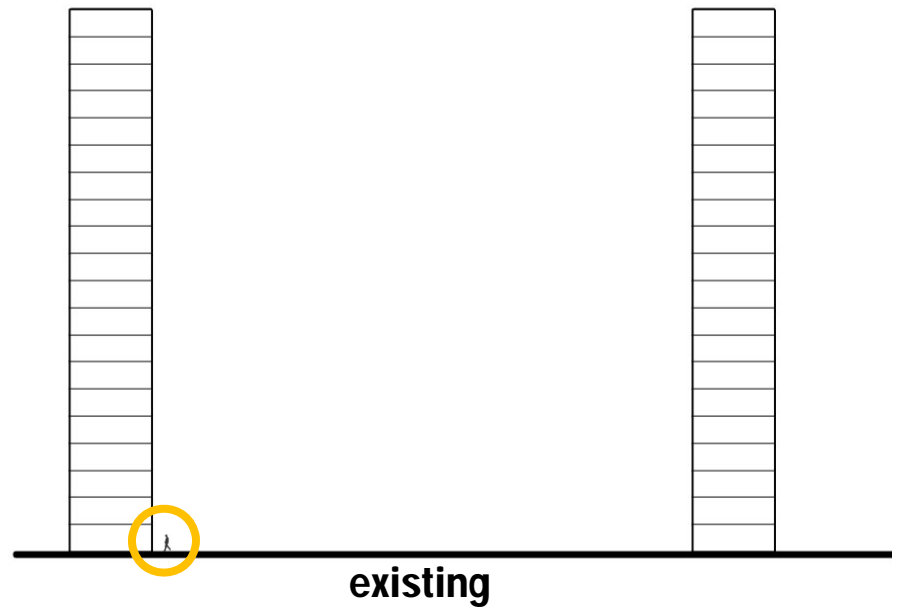
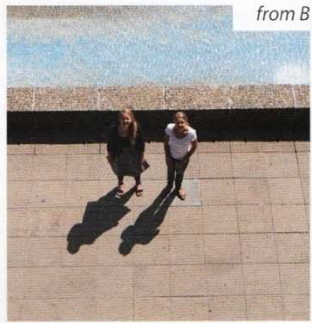
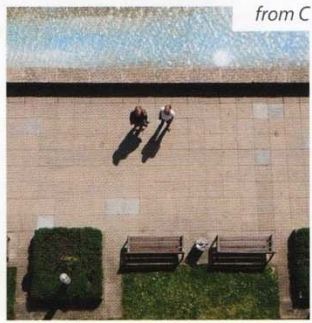
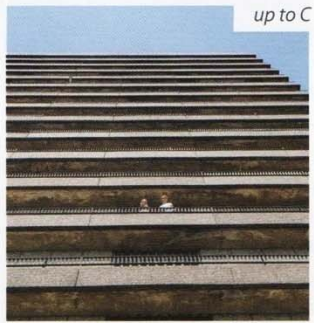
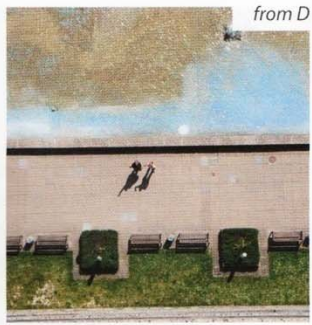
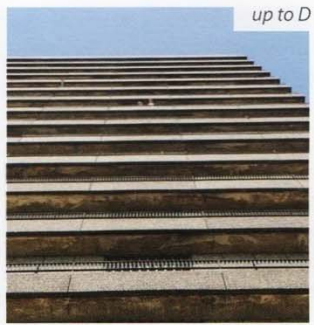
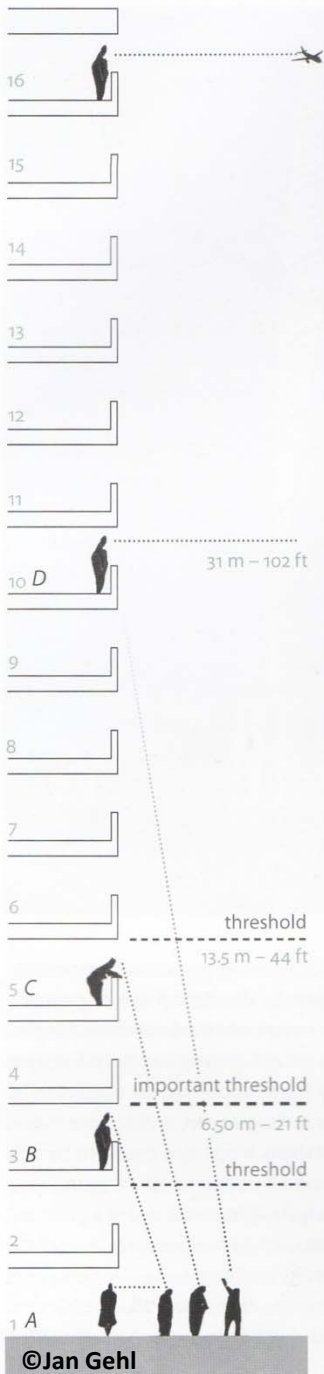


Residential

- Roof R=3.52
- Exterior Wall R=1.96
- WWR=20%
- Window Glass U=1.78
- SHGC=0.6

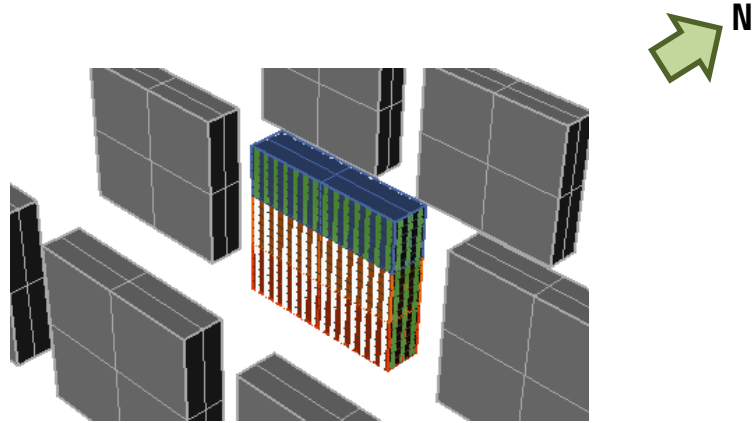


©Jan Gehl



Residential Block Prototypes

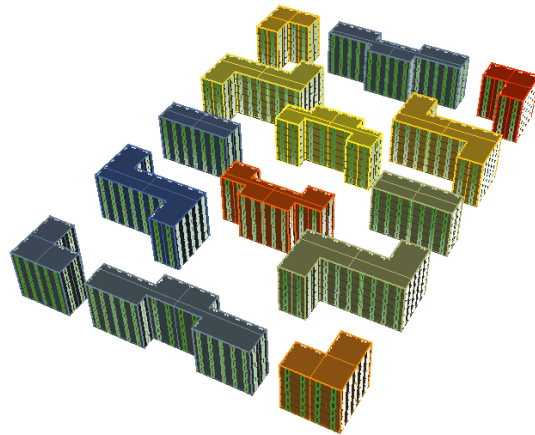
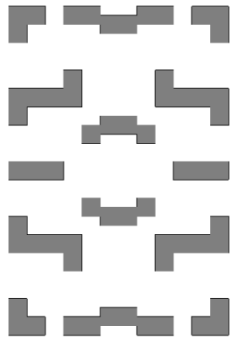
Base Case



Energy: 47.3kWh/m²

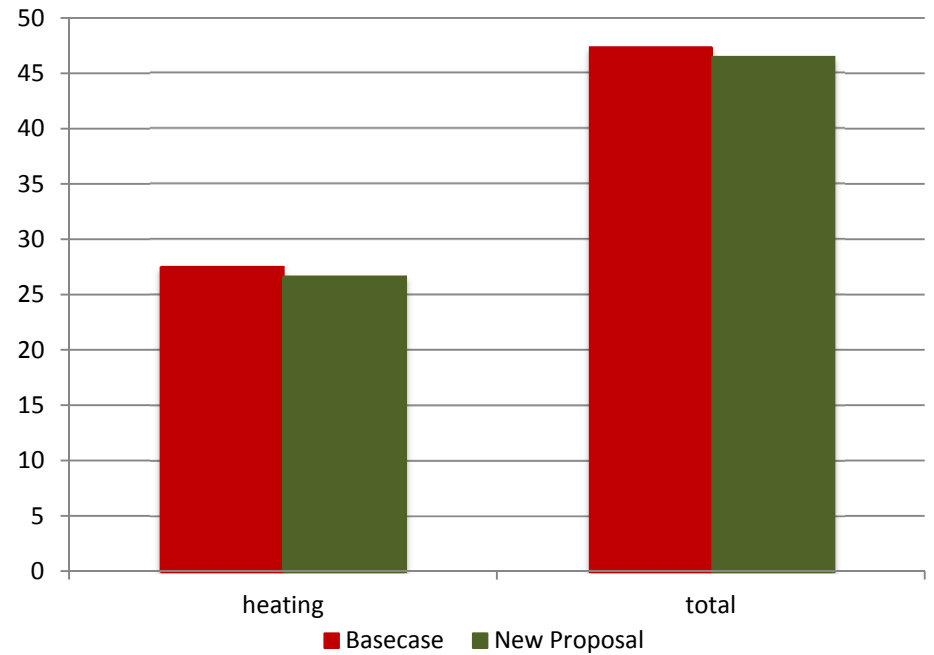
20F

Our Proposal



Energy: 46.4kWh/m²

6F



Parameters: Roof R=3.52; Exterior Wall R=1.96; WWR=20%; Window Glass U=1.78; SHGC=0.6; Natural Ventilation; Lighting control Off

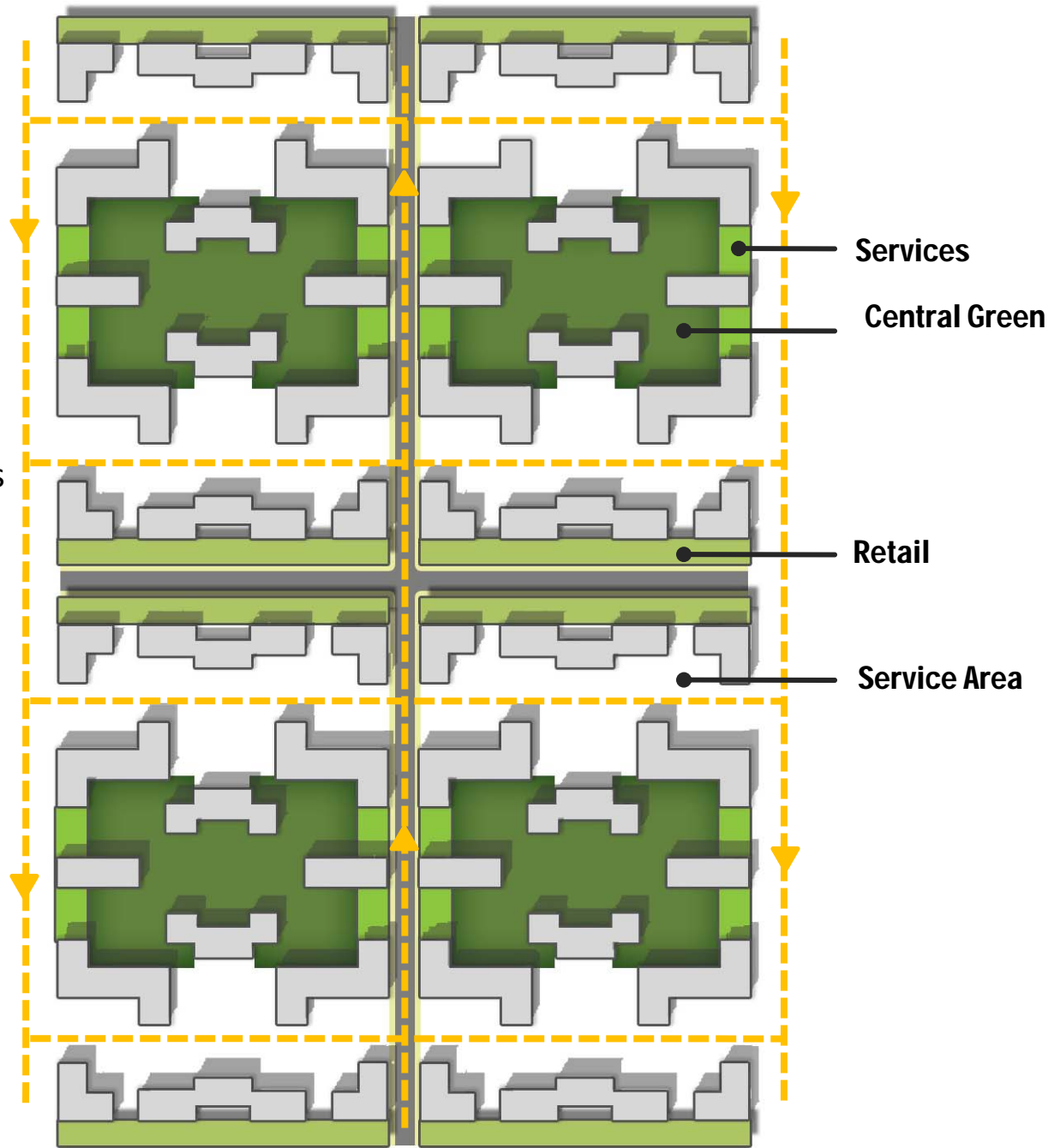
Open area: 13600sq m

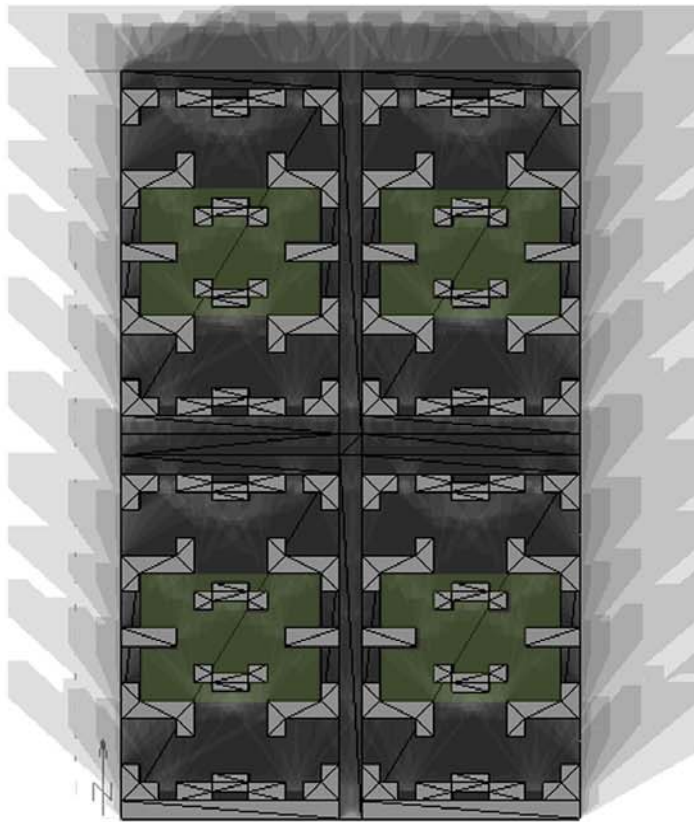
Central Green: 7000sq m

Roof Area: 10400sq m

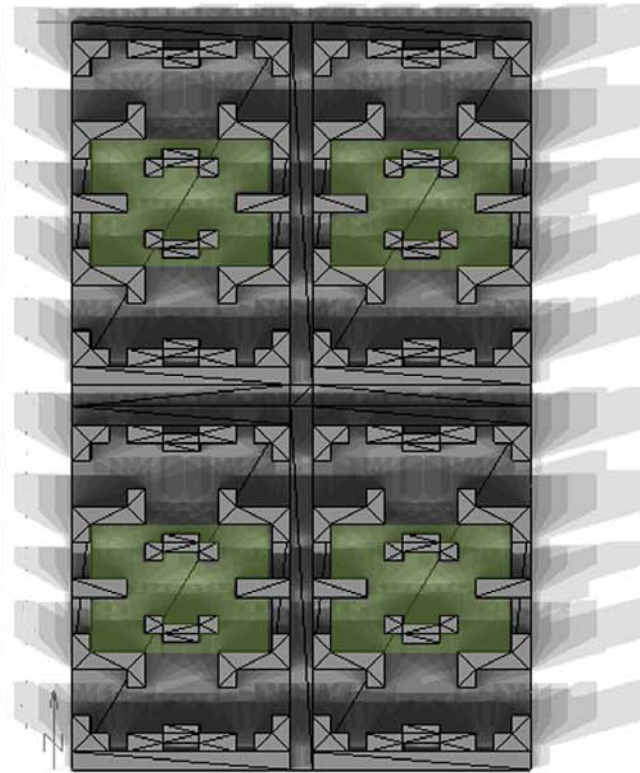
Built Area: 43%

Covered Parking: ~300 cars

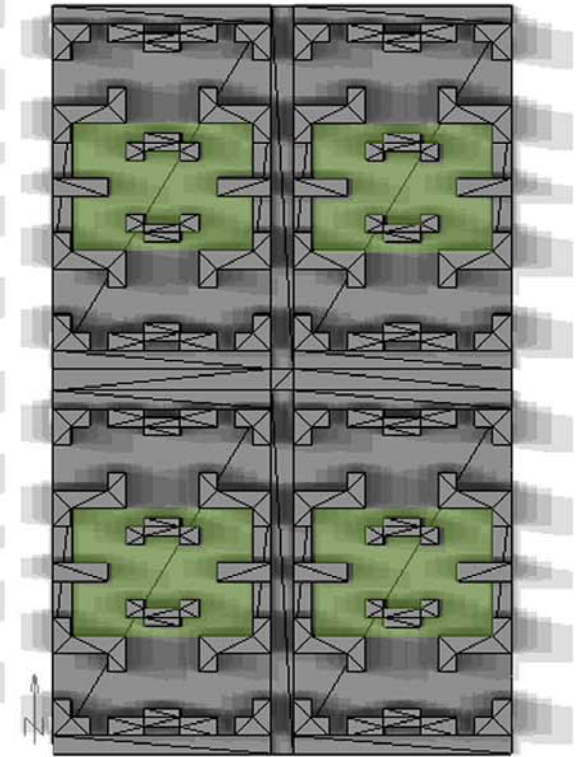




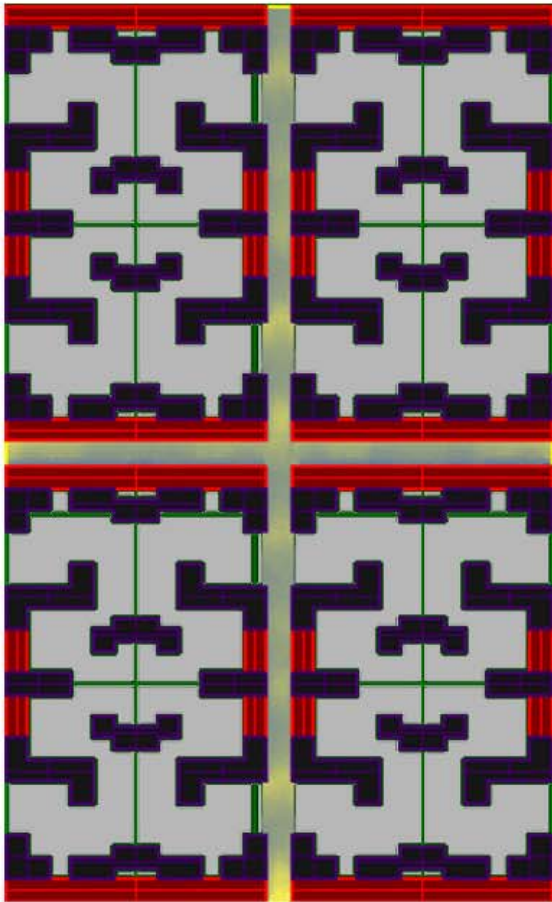
January



March

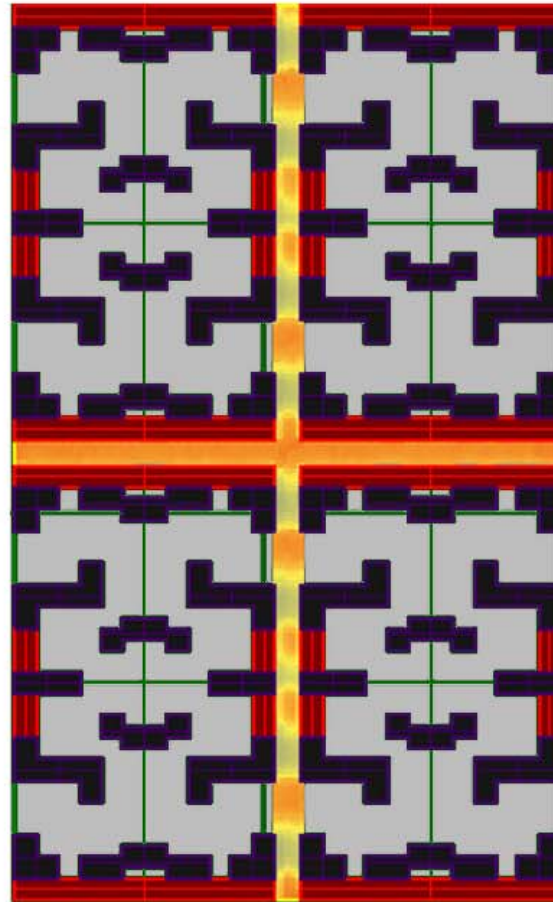


June



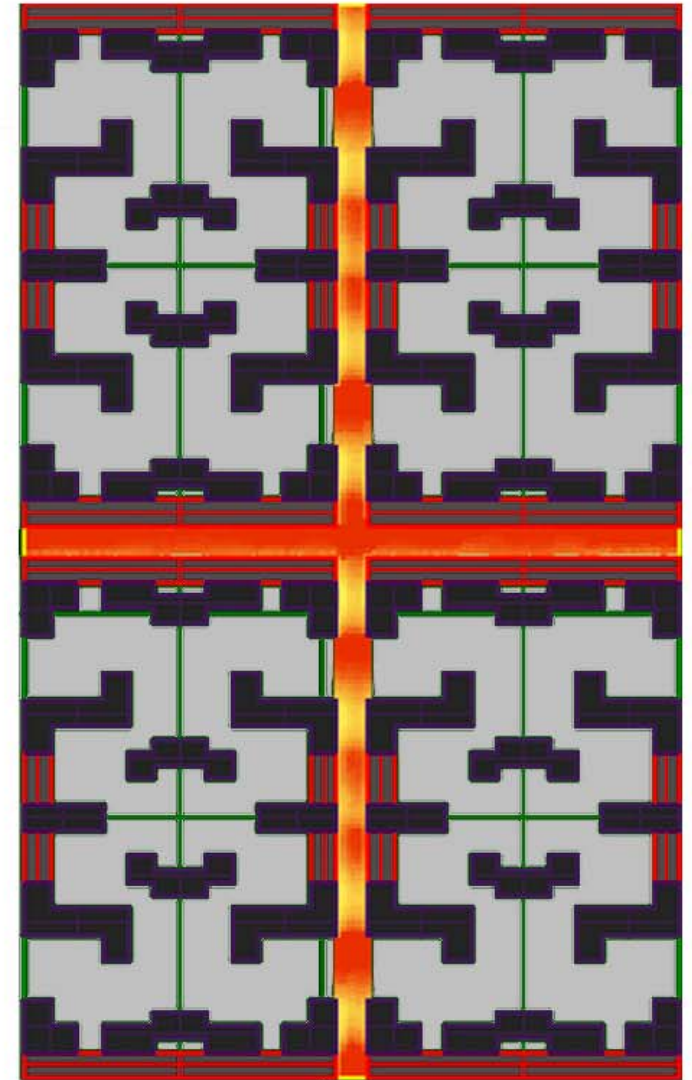
Mean Radiation= 241.7kWh/m²

October-March



Mean Radiation= 563.6kWh/m²

April-September



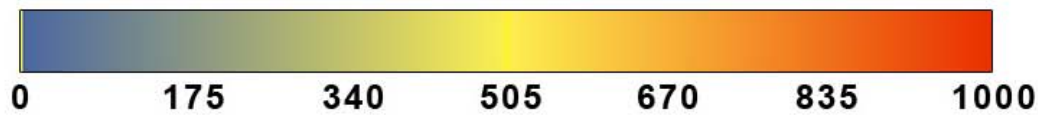
Mean Radiation= 807kWh/m²

75.6% area between 0-1000

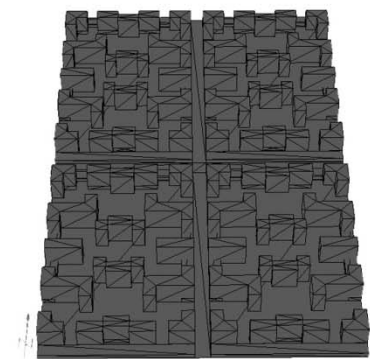
24.6% area >1250

Annual

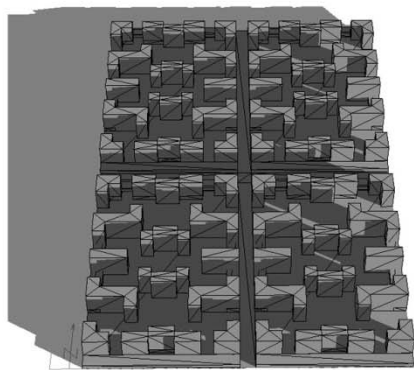
solar radiation



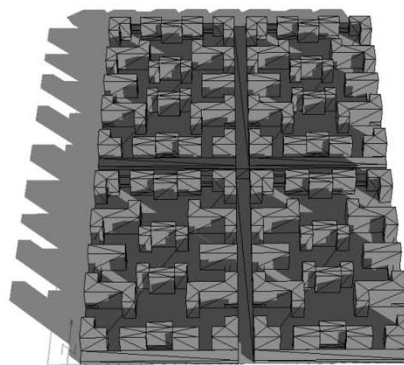
Radiation(kWh/m²)



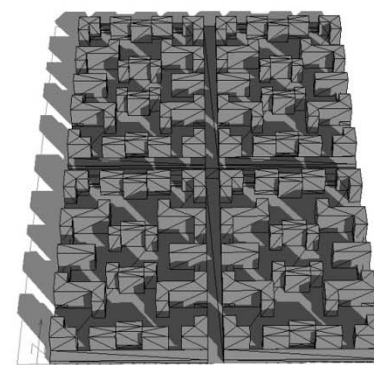
7:00 am



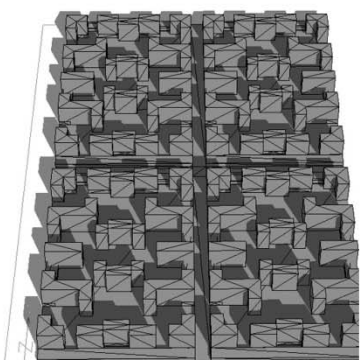
8:00 am



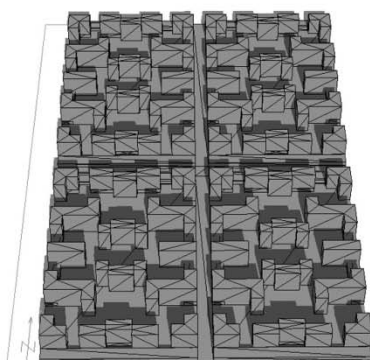
9:00 am



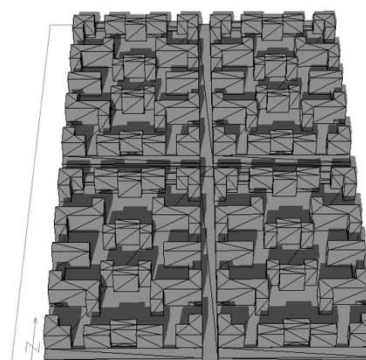
10:00 am



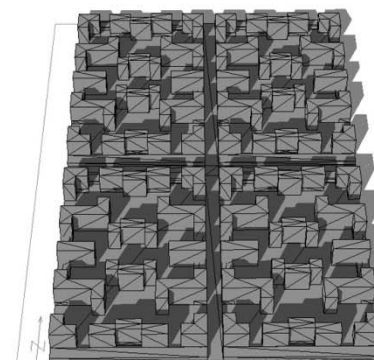
11:00 am



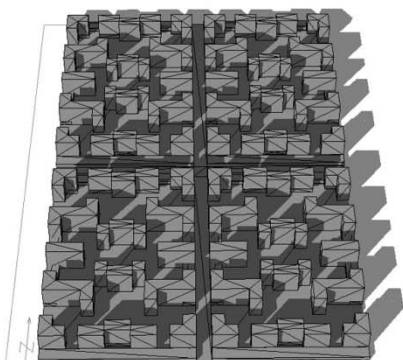
12:00 am



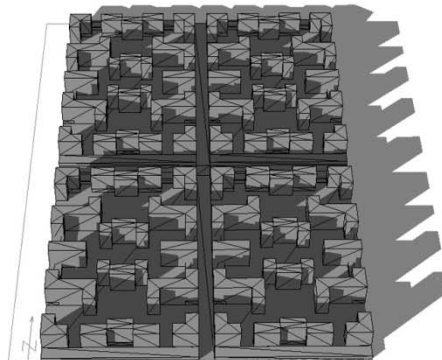
1:00 pm



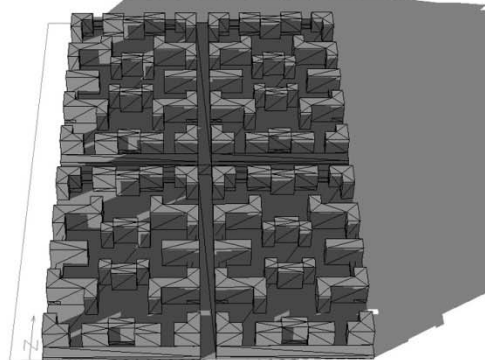
2:00 pm



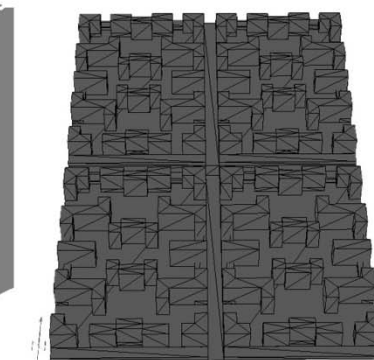
3:00 pm



4:00 pm

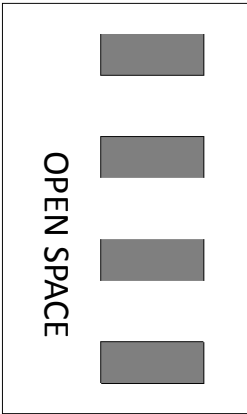


5:00 pm



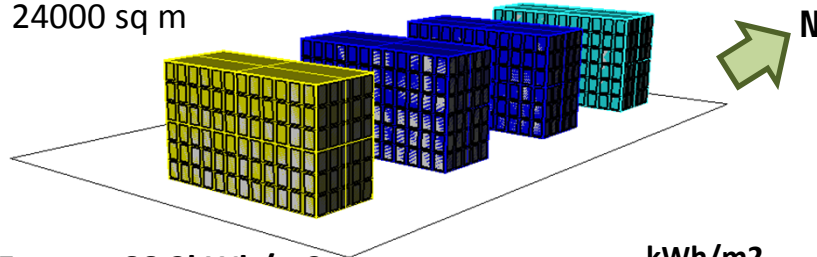
6:00 pm

Option 1



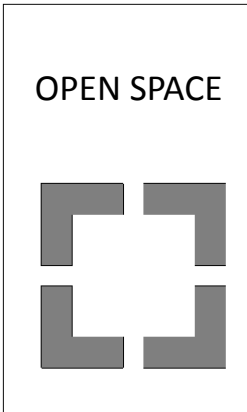
Office Block Prototypes

Area
24000 sq m

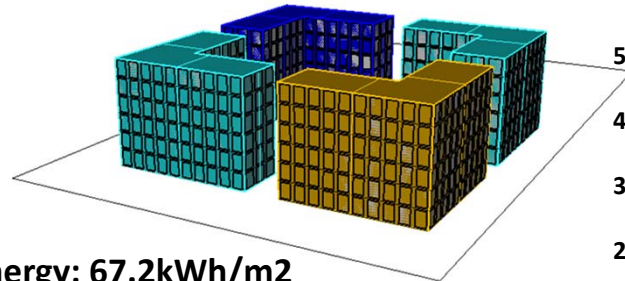


Energy: 66.2kWh/m2

Option 2

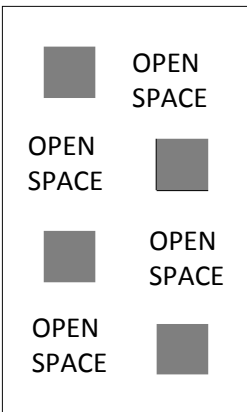


Area:
23400 sq m

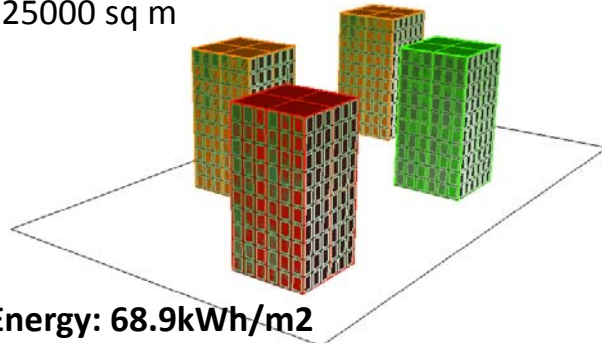


Energy: 67.2kWh/m2

Option 3

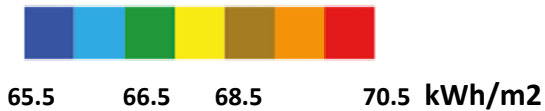
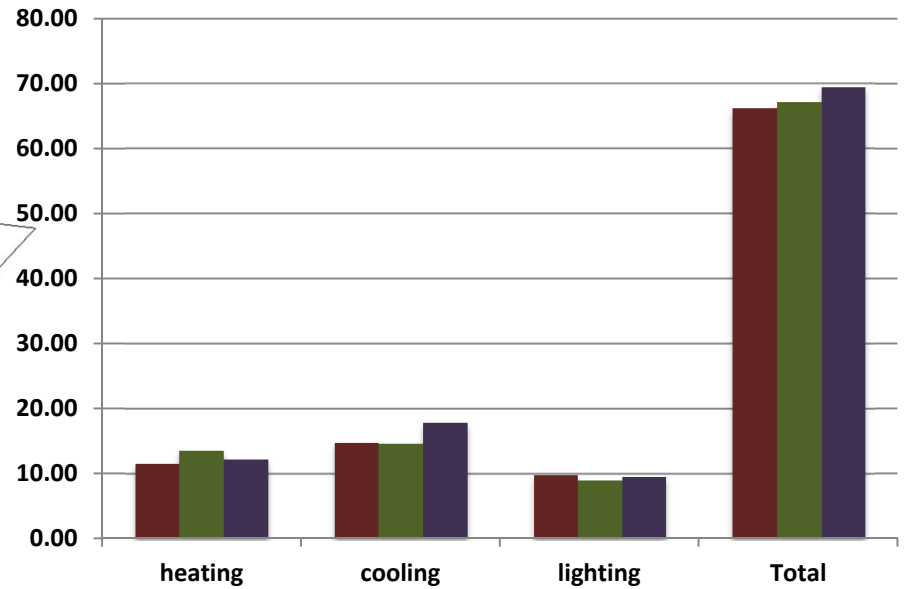


Area:
25000 sq m



Energy: 68.9kWh/m2

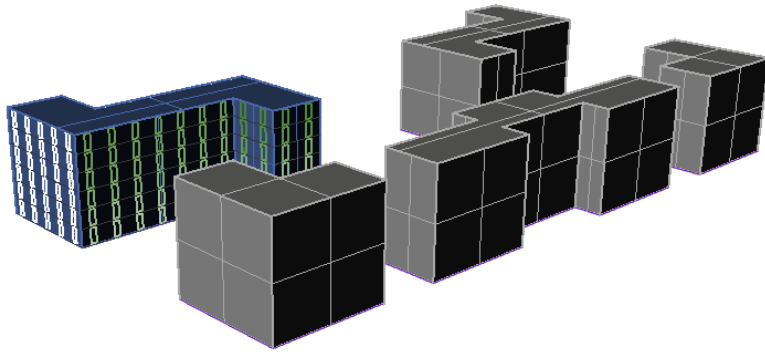
kWh/m2



Parameters: Roof R=3.52 Exterior Wall R=1.96 WWR=60% Window Glass U=1.78 SHGC=0.6 Lighting power density=9 Lighting control=On

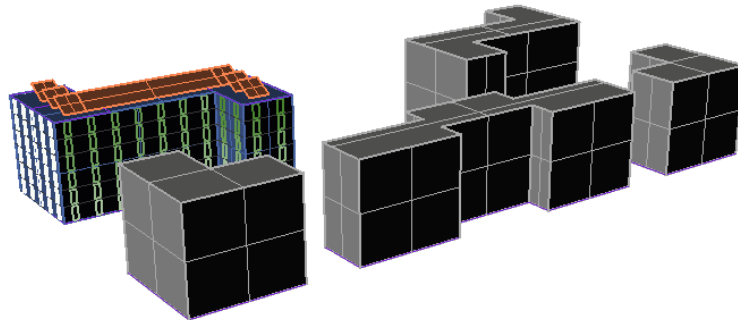
- PV
- lifecycle
- CO2 emission
- rainwater harvesting

No Photovoltaic Panels



Total energy used: 46.14kWh/m²

With Photovoltaic Panels



Total energy used: 39.29kWh/m²

Energy Reduced: 6.85kWh/m²

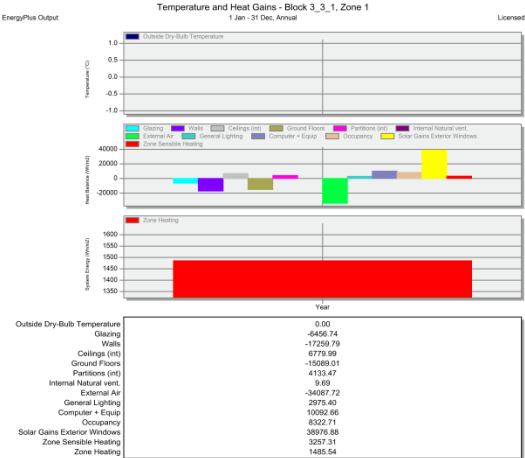
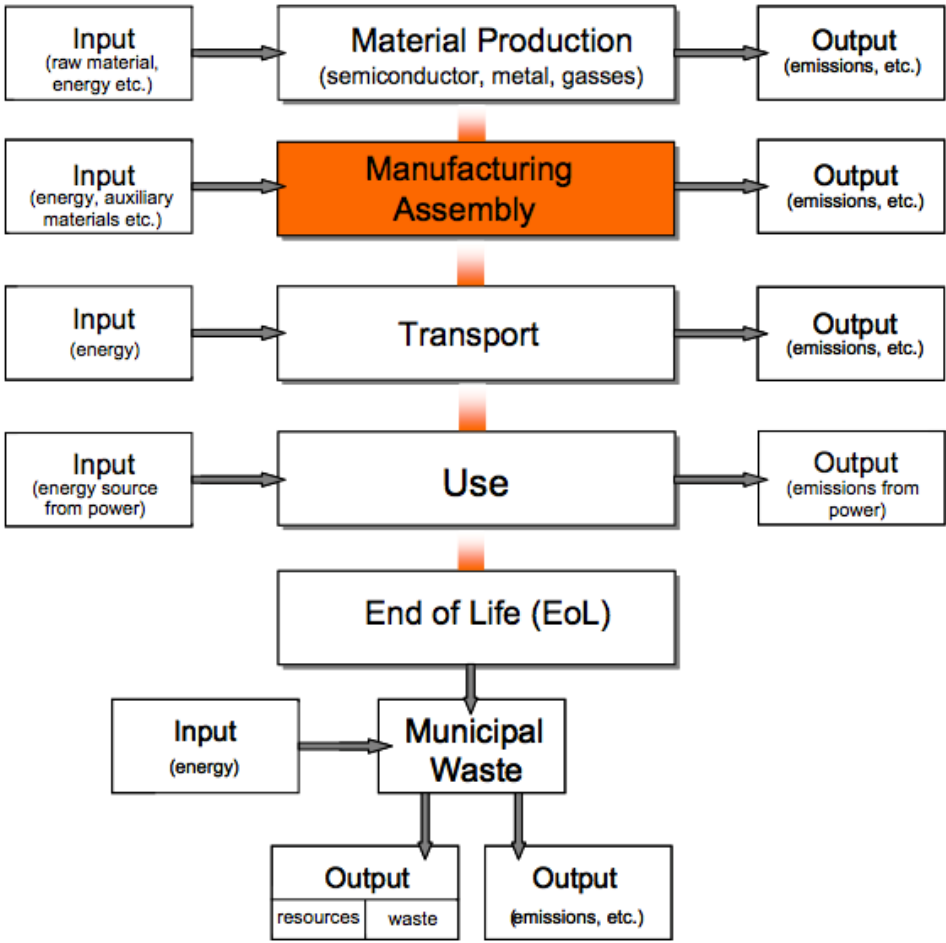
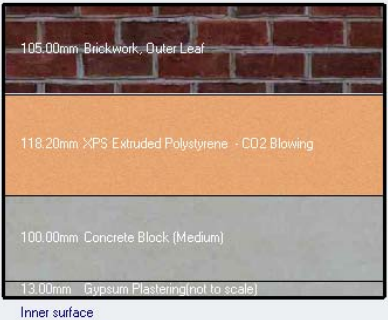
Energy Produced/sq m: ~420 kWh/m²

Total PV Production for a block: ~260,040 kWh

Total PV Production for residential: ~9,101,400 kWh

Cell Efficiency: 0.12 Inverter Efficiency: 1.0

What is life-cycle assessment?



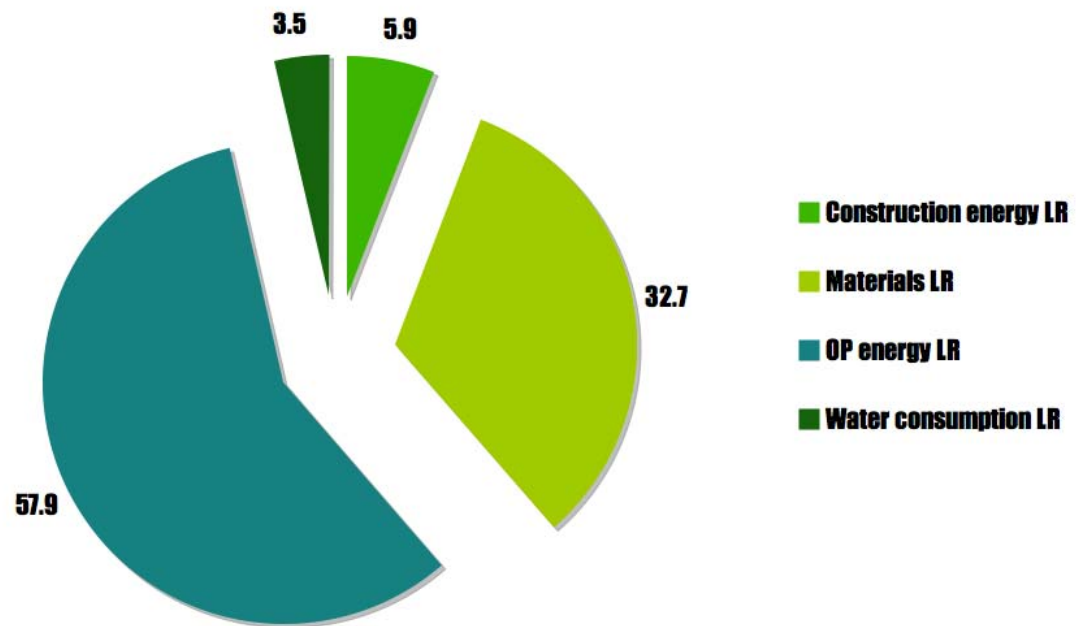
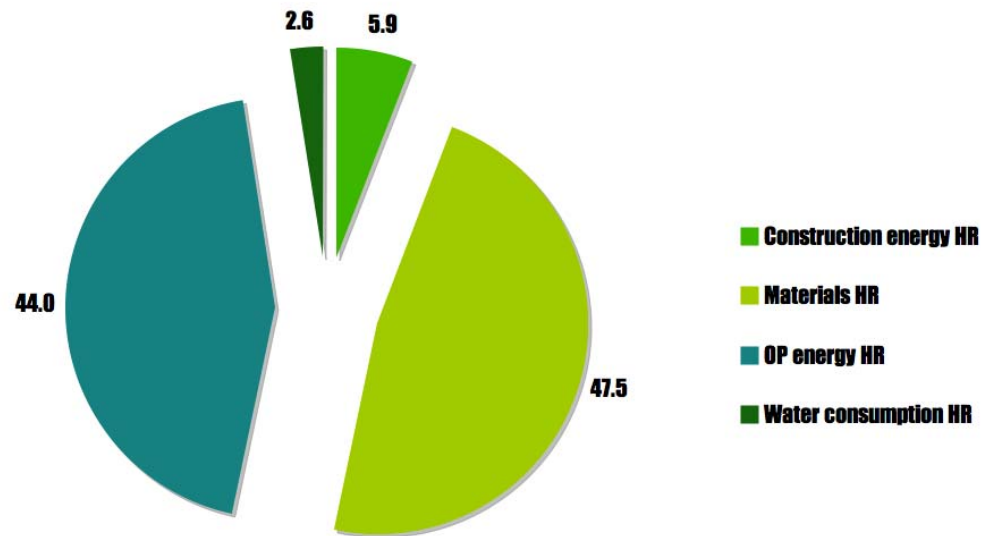
Source: What is the LCA of illuminants? Osram.com

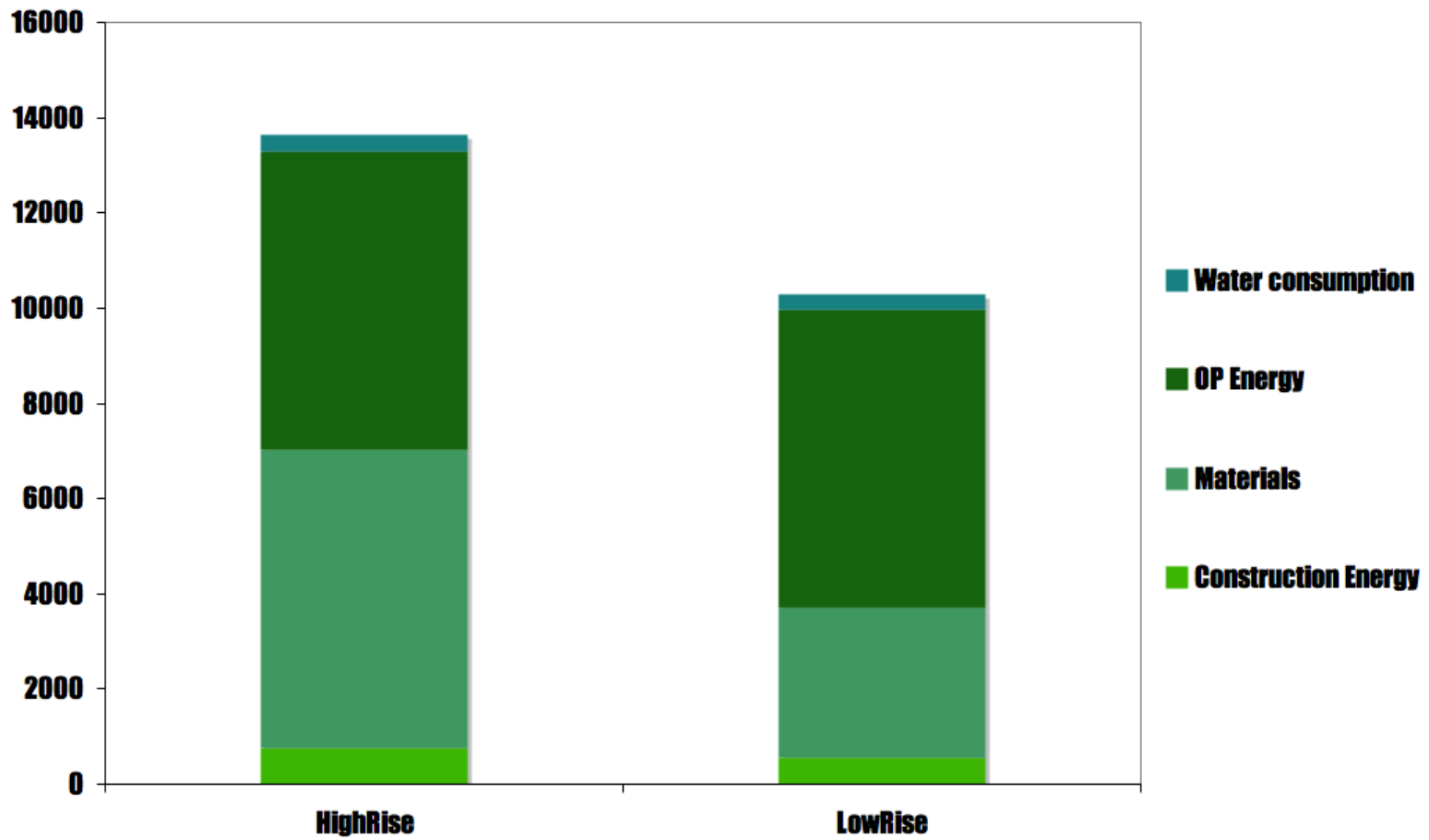
From DesignBuilder we know

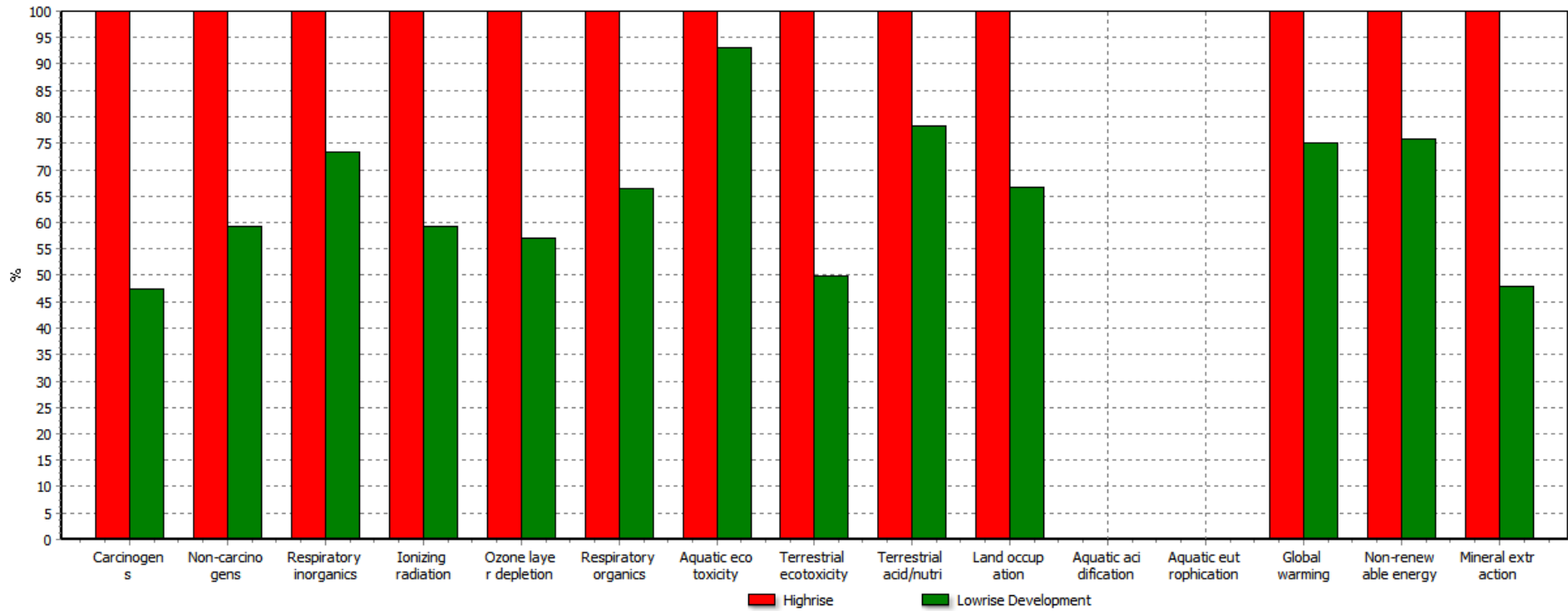
- High rise building consumes 2.5% more electricity
- Low rise requires 47% more heating energy

Assumptions for the material input and energy calculation

- Ratio of concrete to steel in HR: 40/60
- Ratio of concrete to steel in LR: 60/40
- Energy requirements in HR construction: 987 MJ/m²
- Energy requirements in LR construction: 650 MJ/m²
- Elevator energy consumption 8% HR, 5% LR

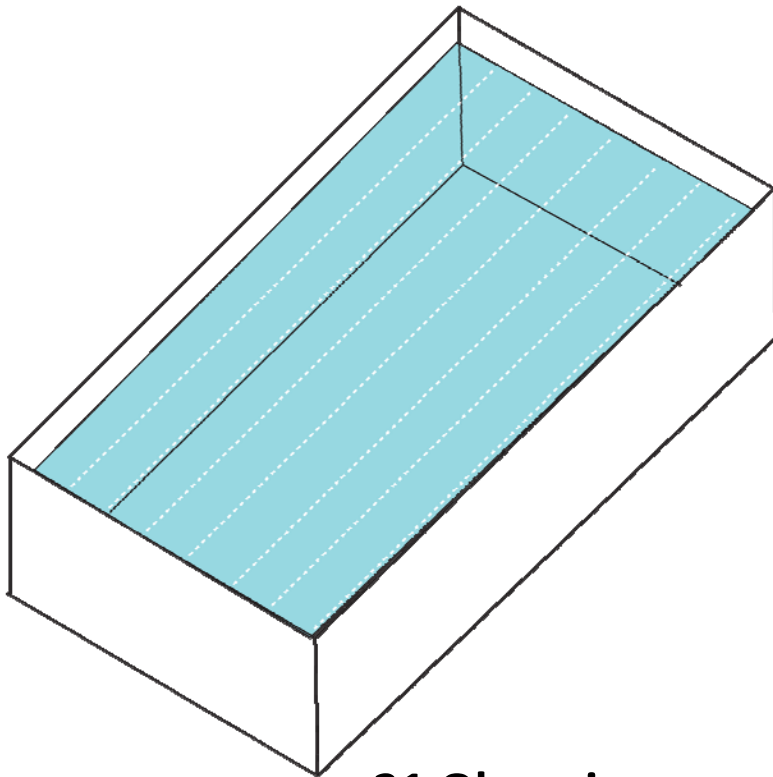






Comparing 1 p 'Highrise' with 1 p 'Lowrise Development';
 Method: IMPACT 2002+ V2.10 / IMPACT 2002+ / Damage assessment

52 million litres of Water per can be harvested per year



**~21 Olympic
Swimming Pools
per Year**



**Enough water to flush
8 million times**

Acknowledgement:

Christoph

Ian

Alstan

Diego