

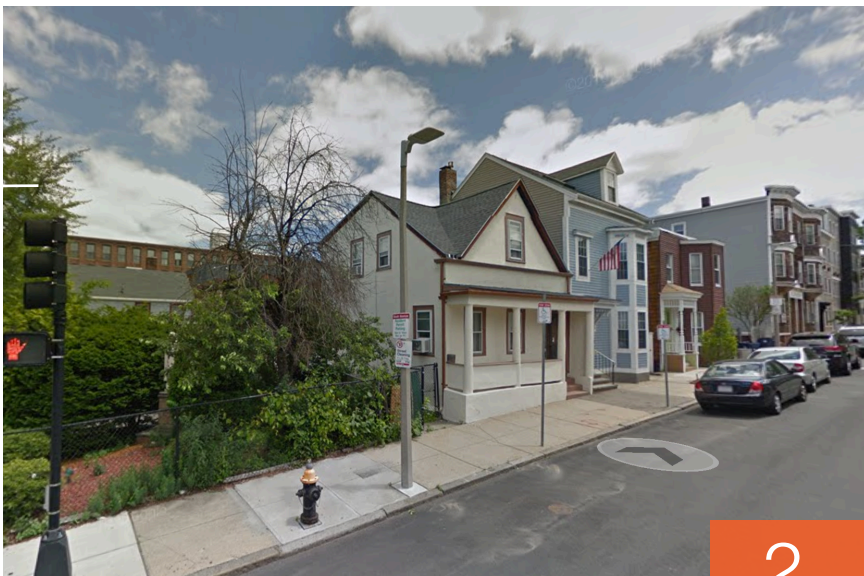
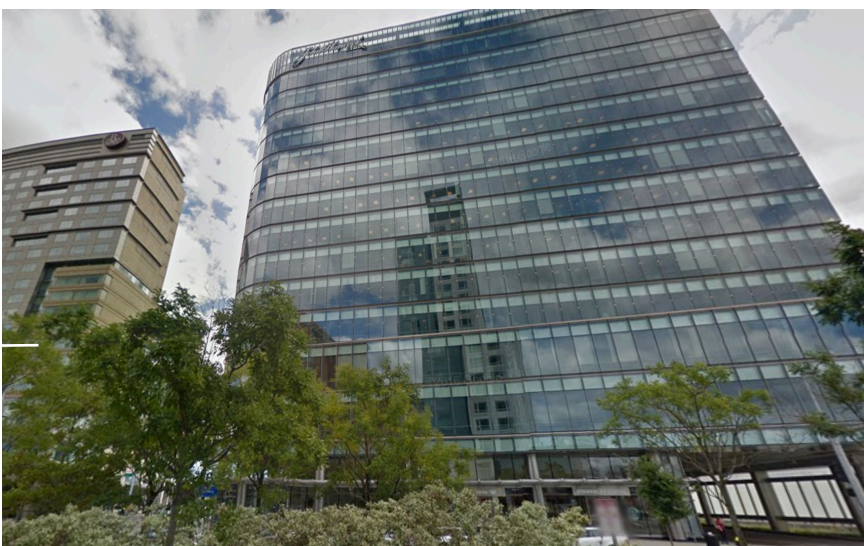
BOSTON ZERO: SUNNY SEAPORT CROSSING

4.432/4.433 Modeling Urban Energy Flows 2017

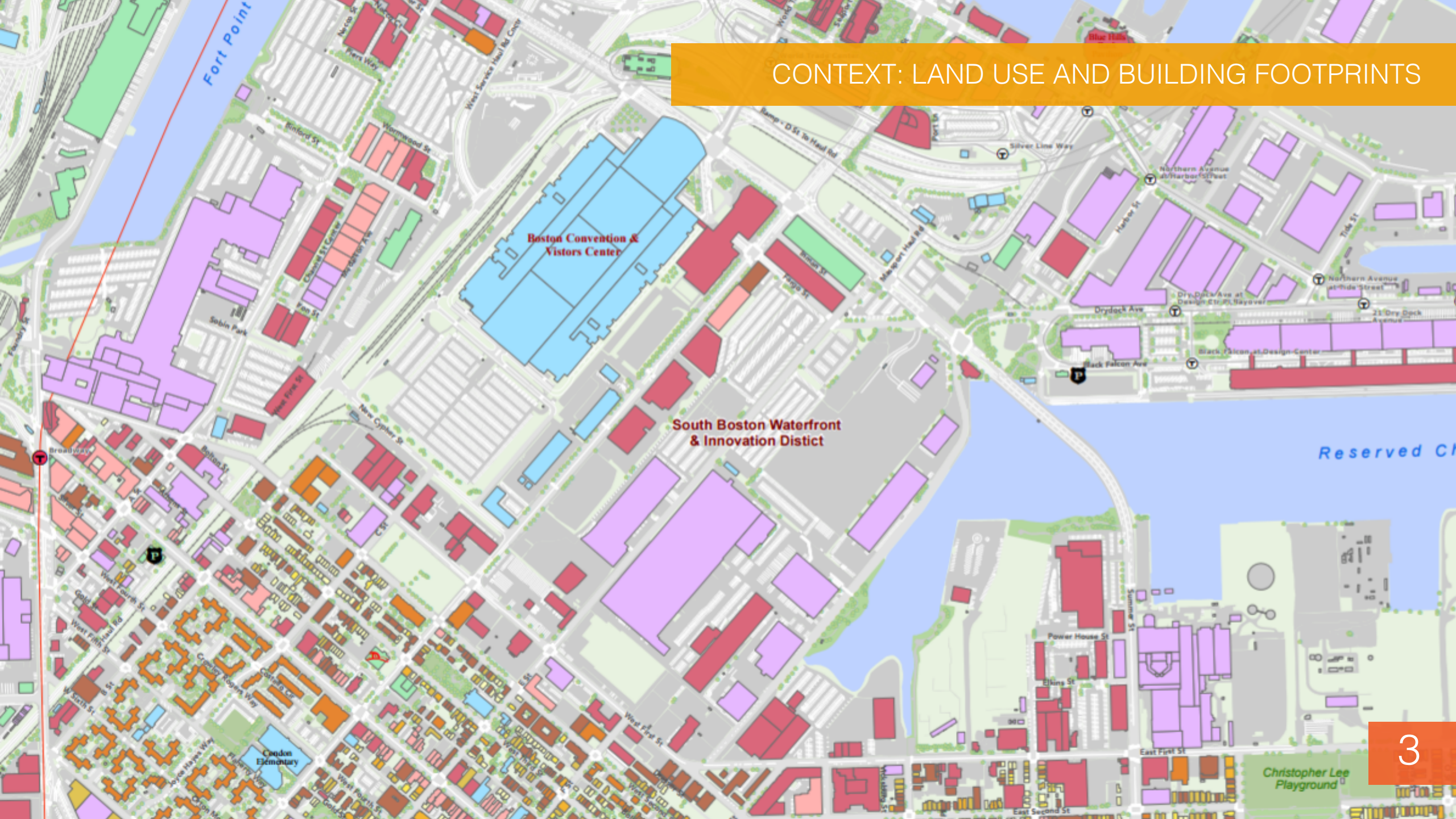
Greg Hopkins
Ed Barbour
Jiamin Sun
Danya Littlefield



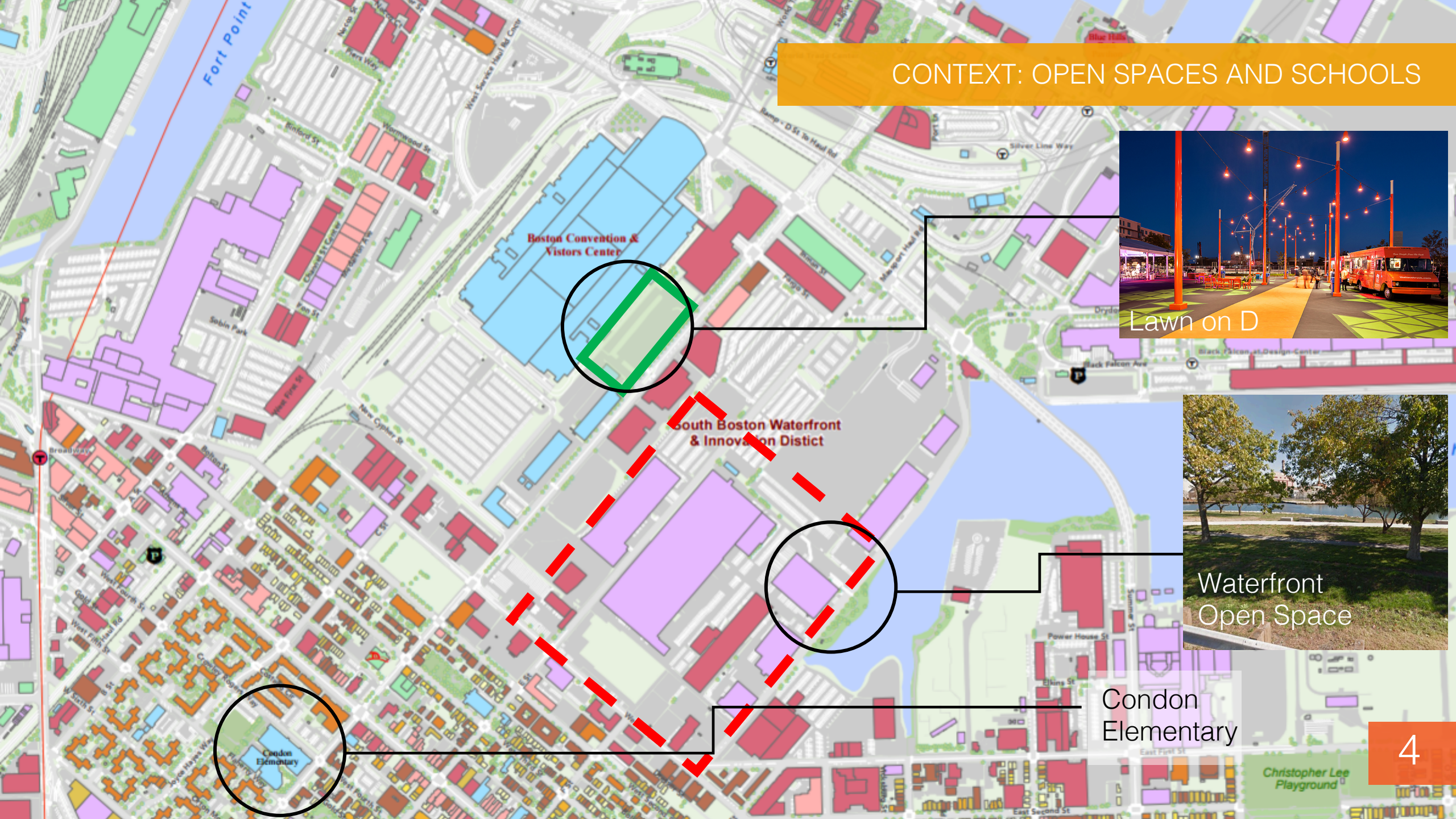
CONTEXT: BOSTON SEAPORT & SOUTH END



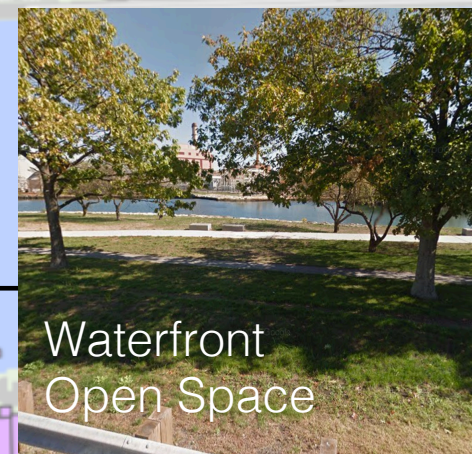
CONTEXT: LAND USE AND BUILDING FOOTPRINTS



CONTEXT: OPEN SPACES AND SCHOOLS



Lawn on D

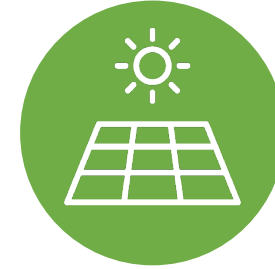


Waterfront
Open Space

Condon
Elementary

DESIGN GOALS

Minimize site-wide EUI and greenhouse gas emissions, and **pursue net zero operational energy**

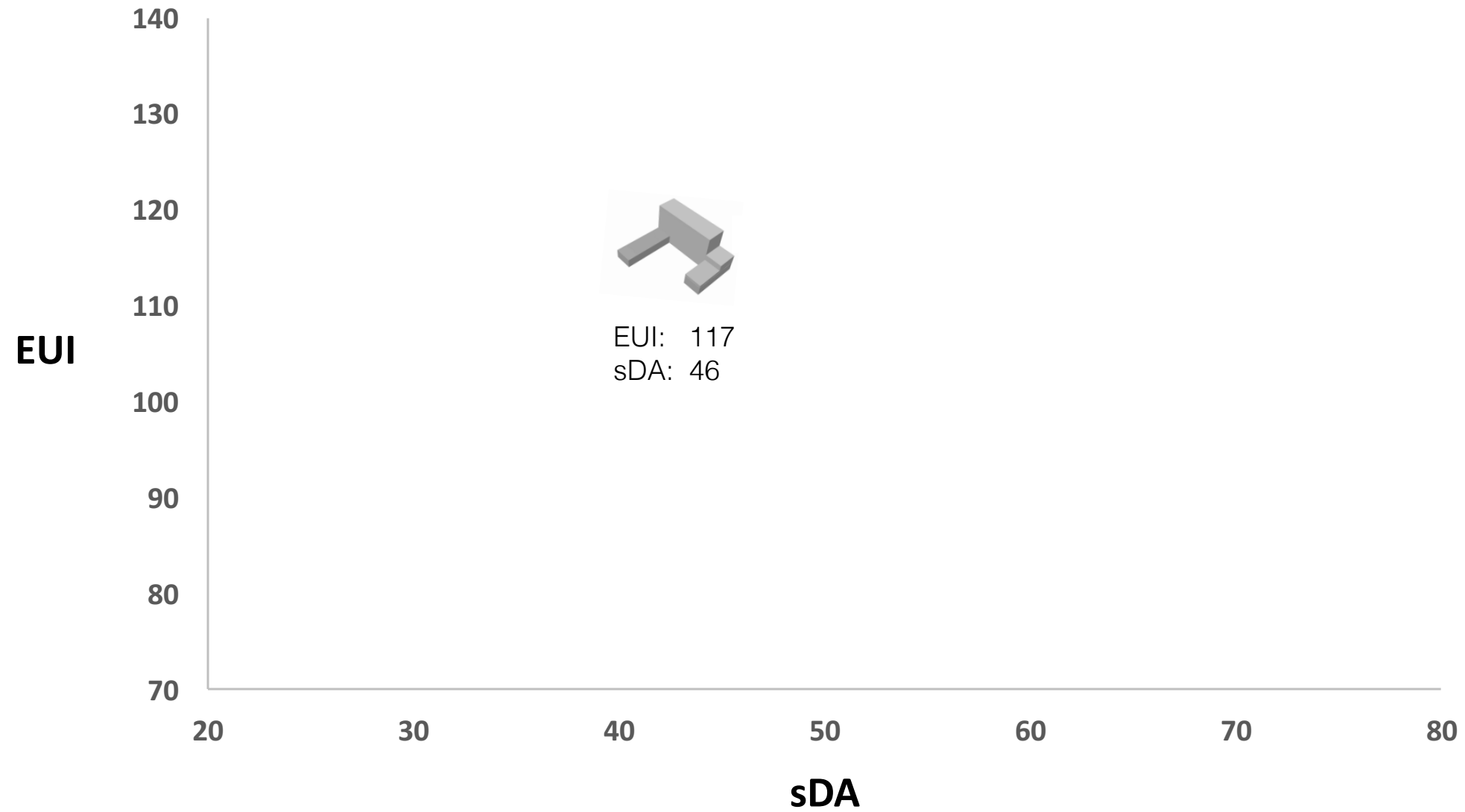


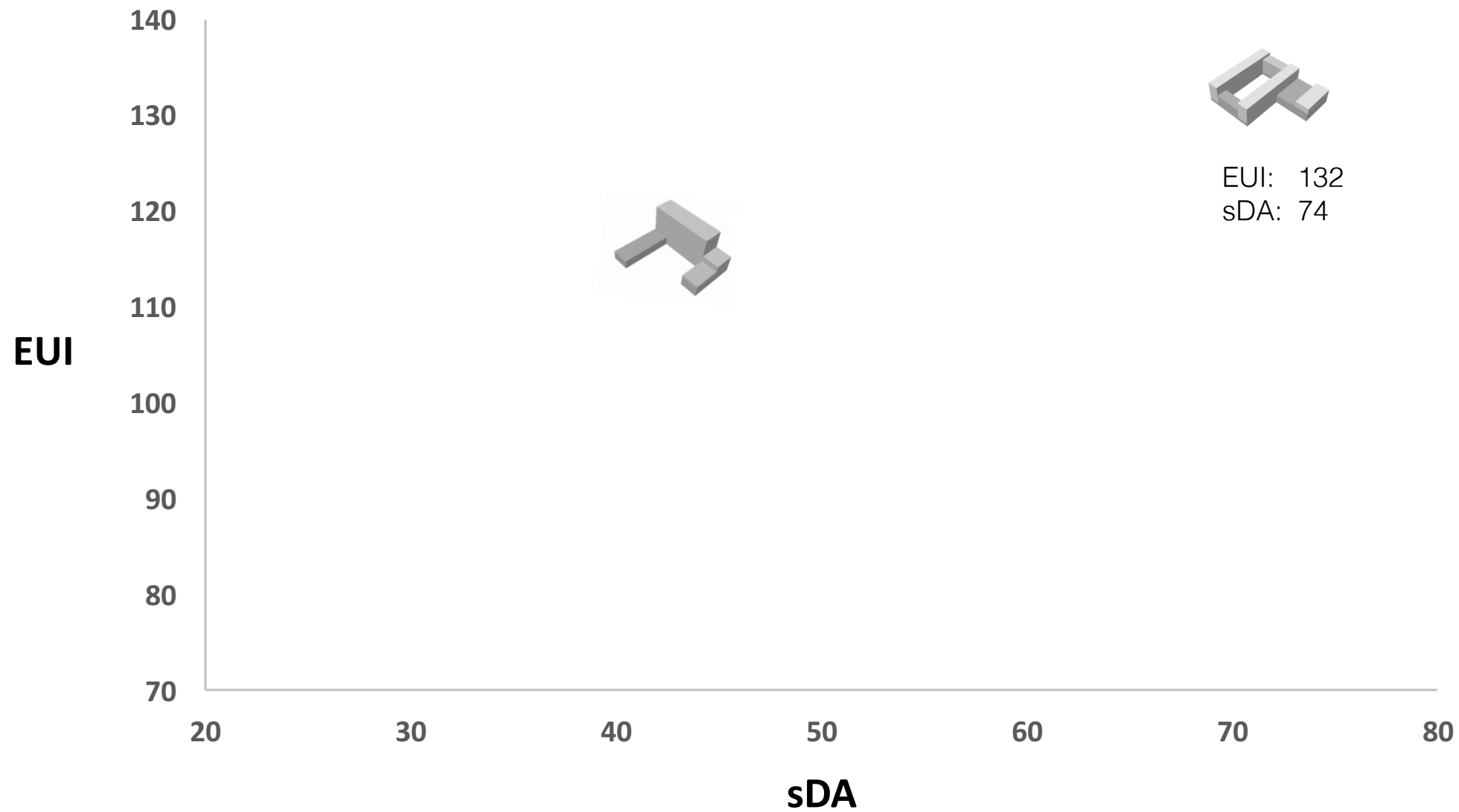
Create a **walkable, mixed-use** district with abundant **public spaces** sensitive to the impacts of climate change

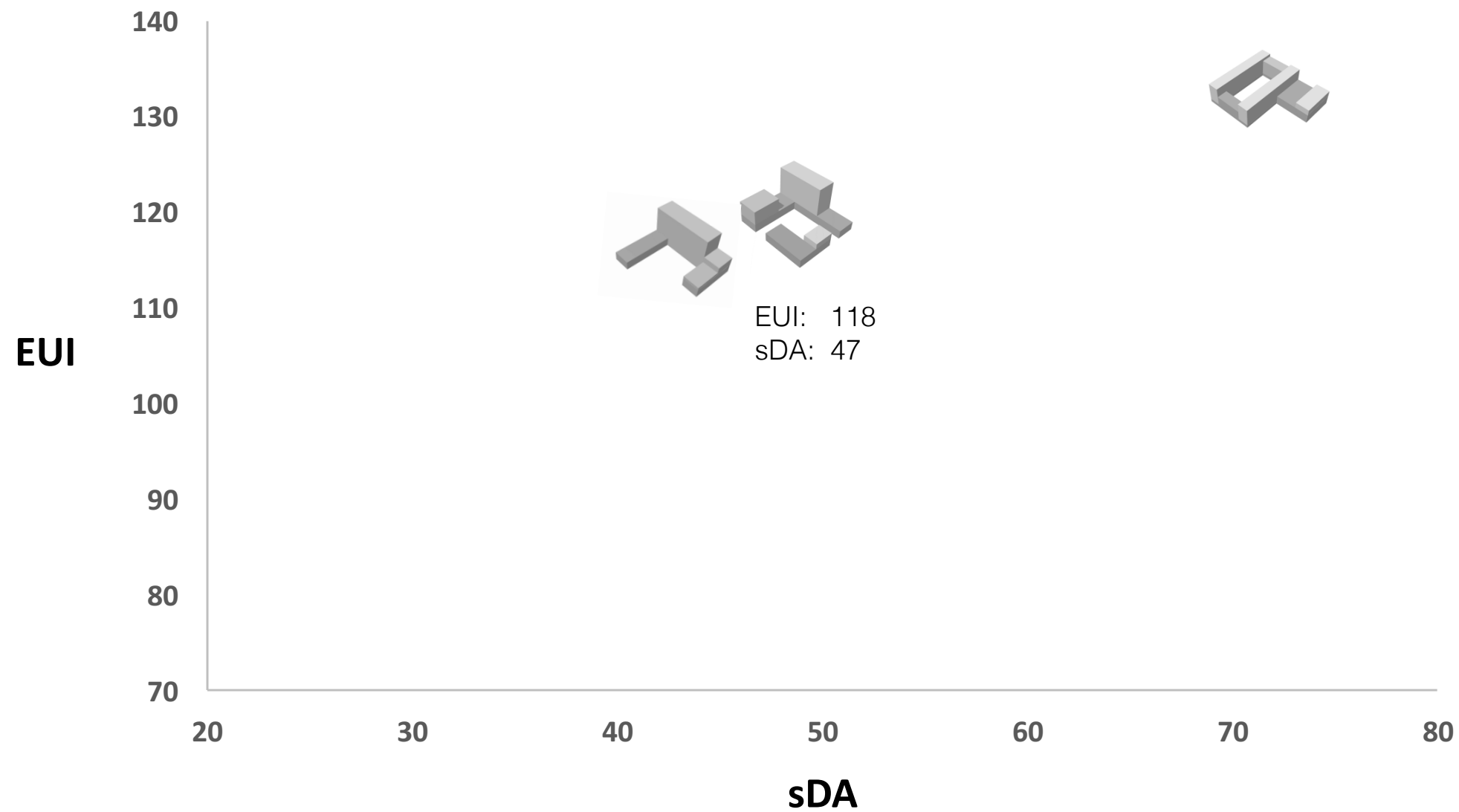


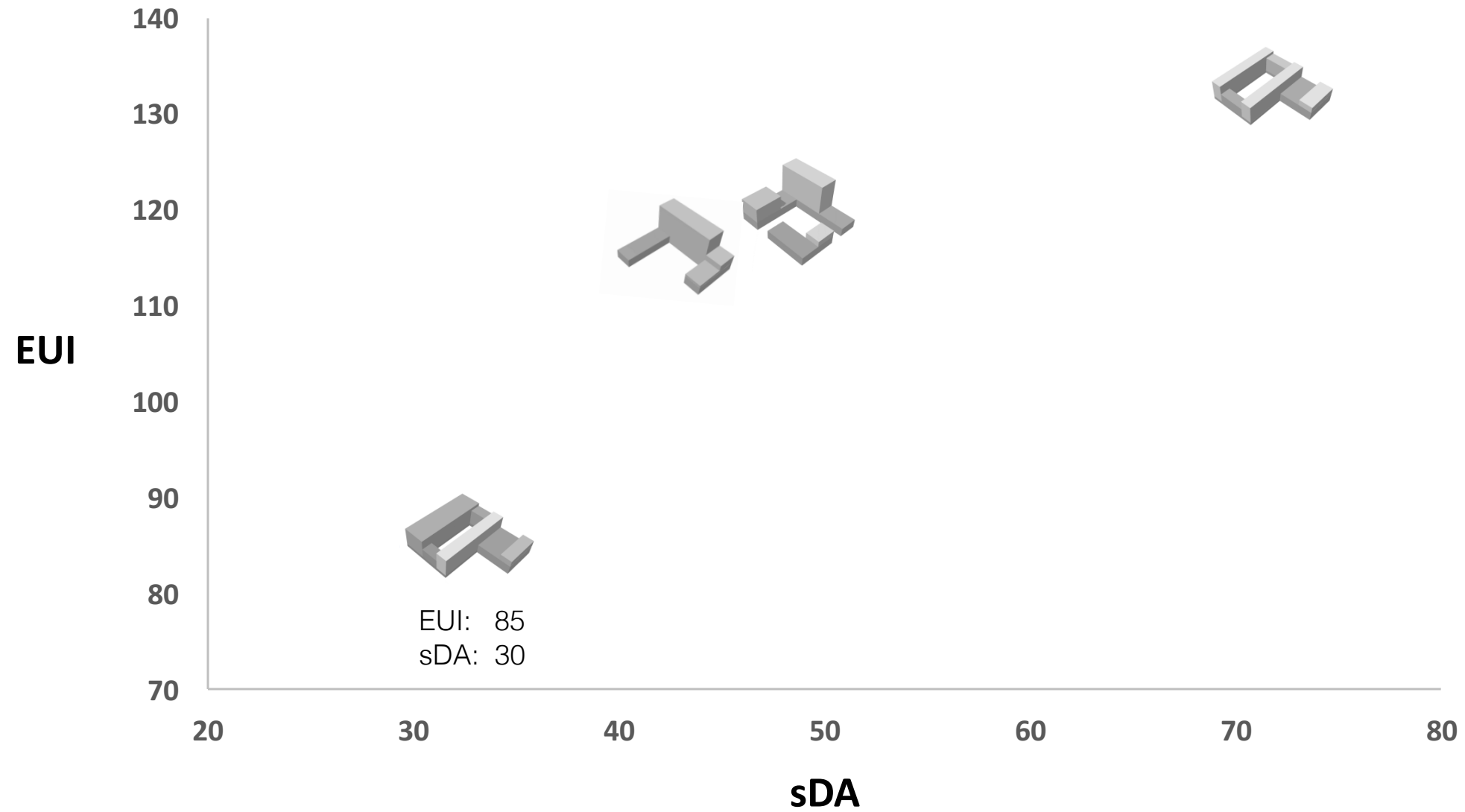
Ensure accessibility to mixed income housing and consider **affordability** relative to other project goals

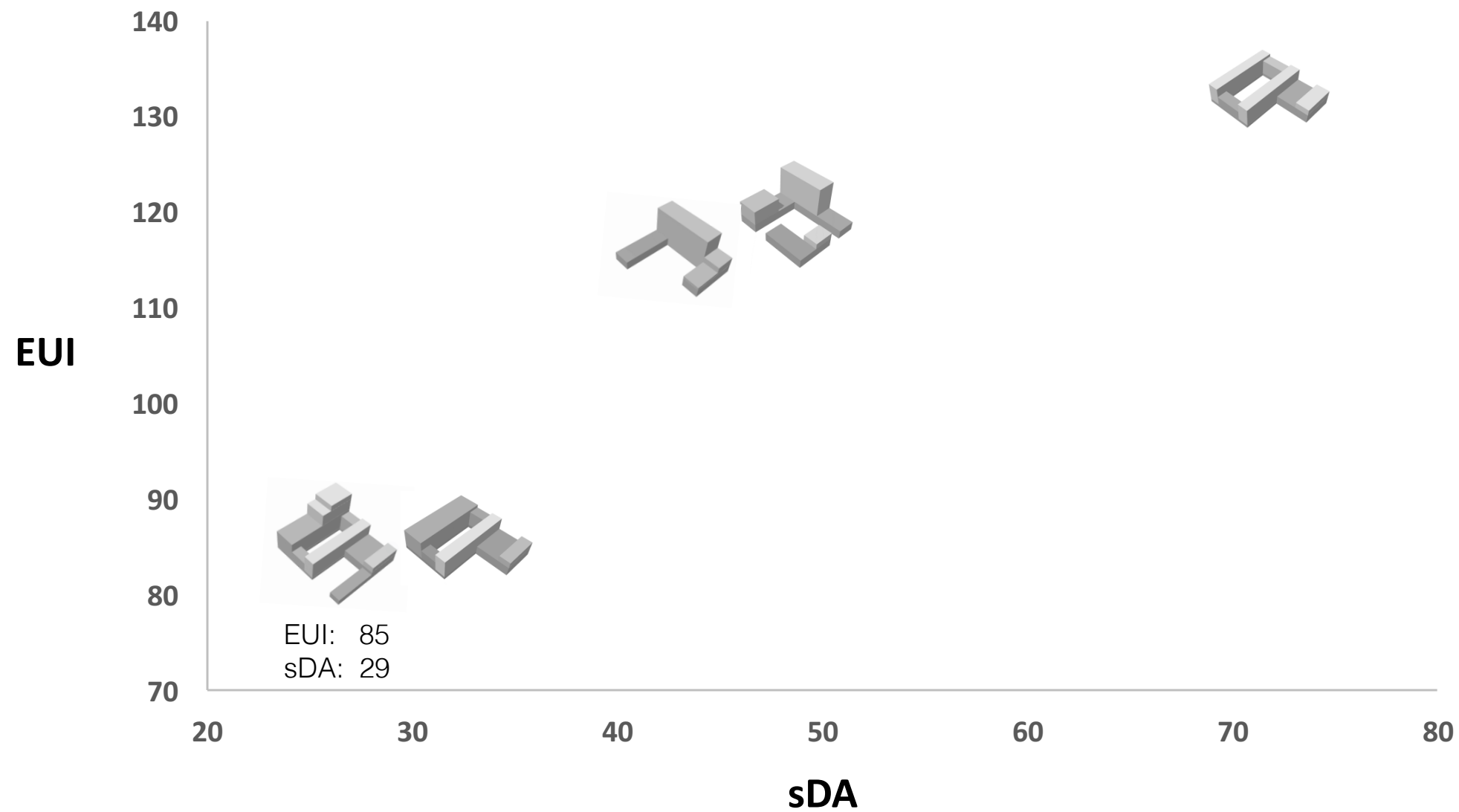


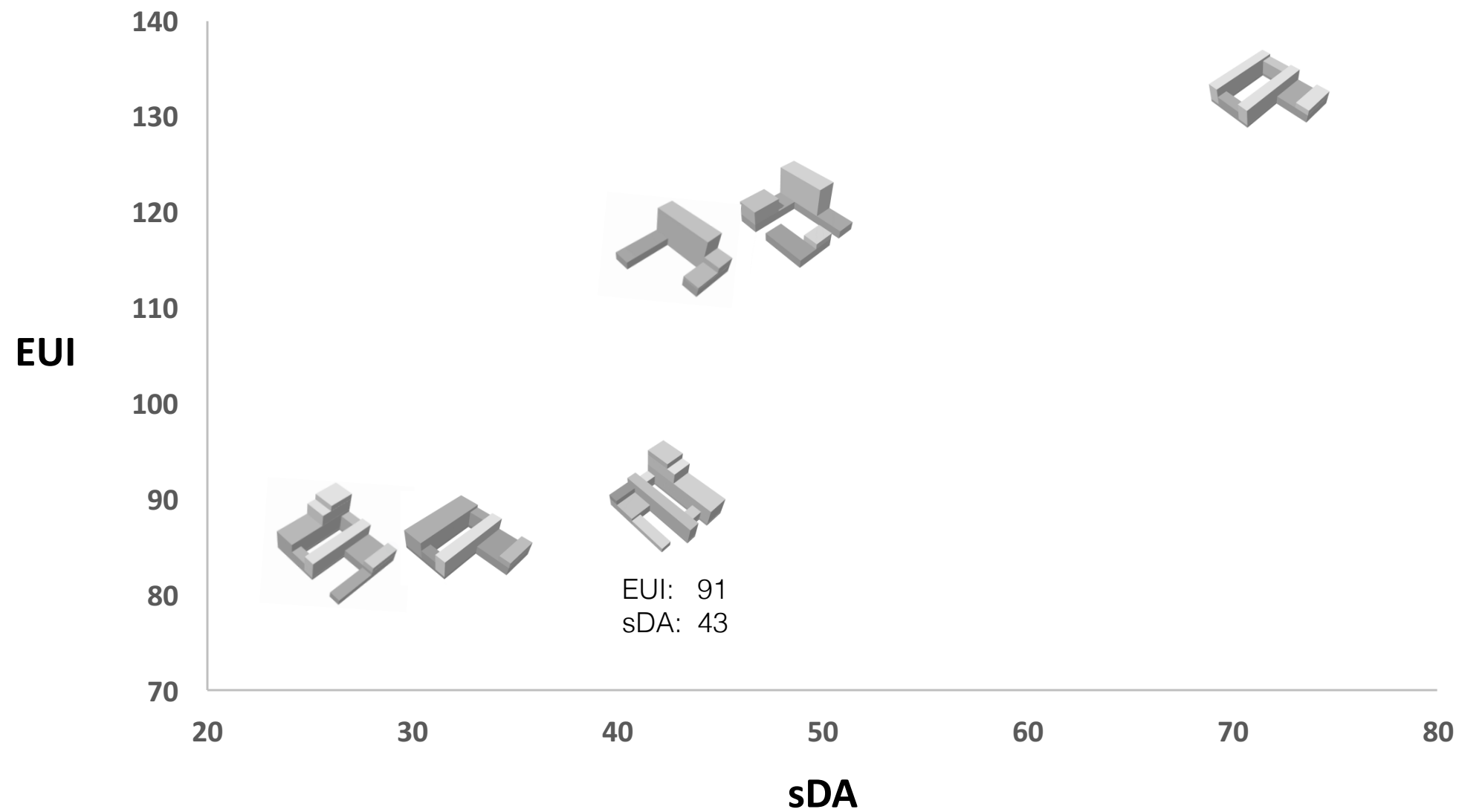


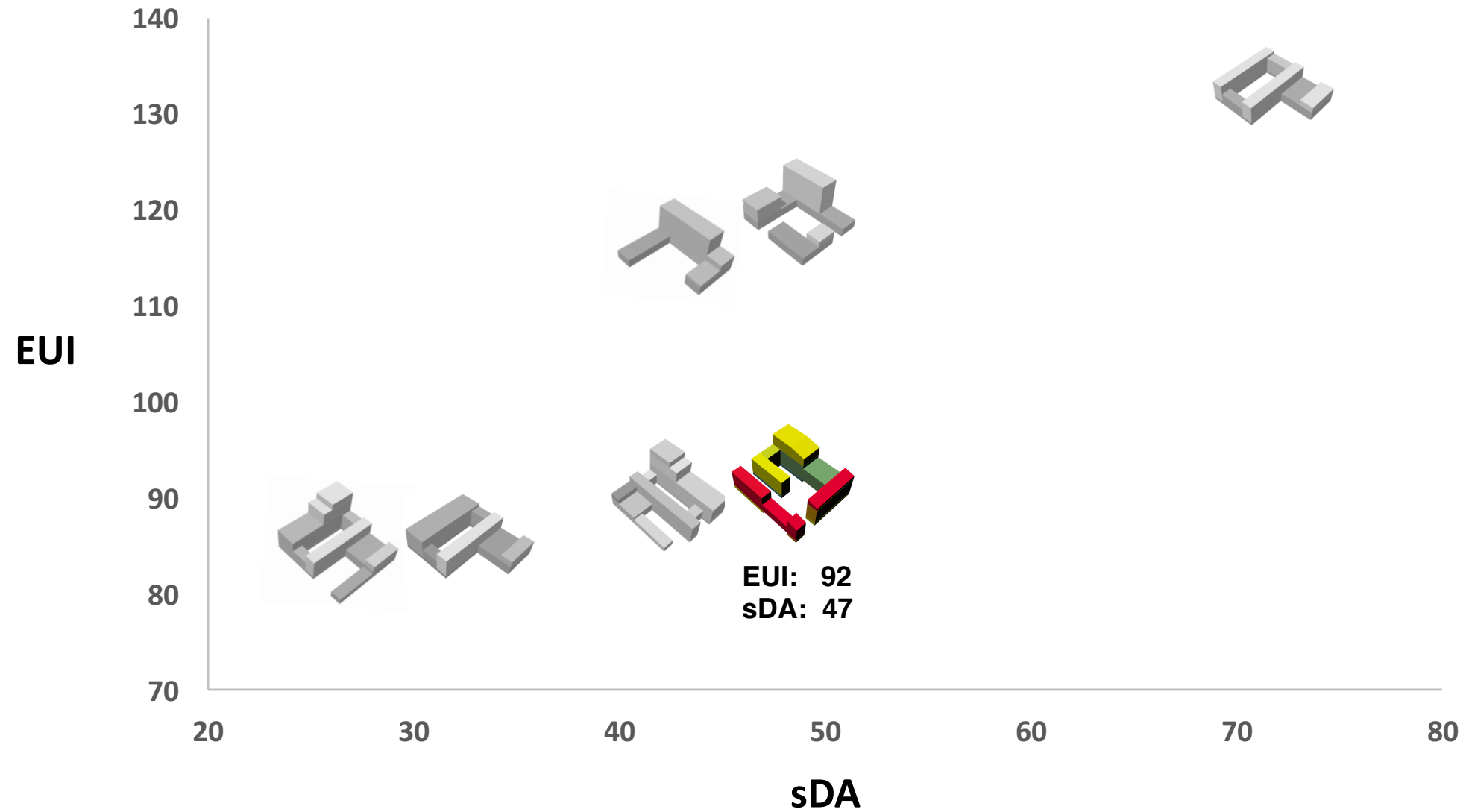










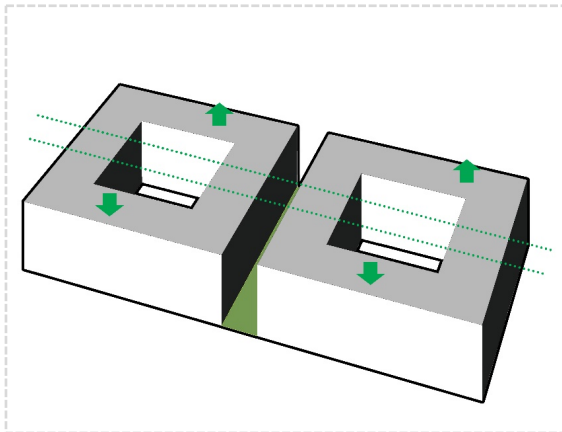
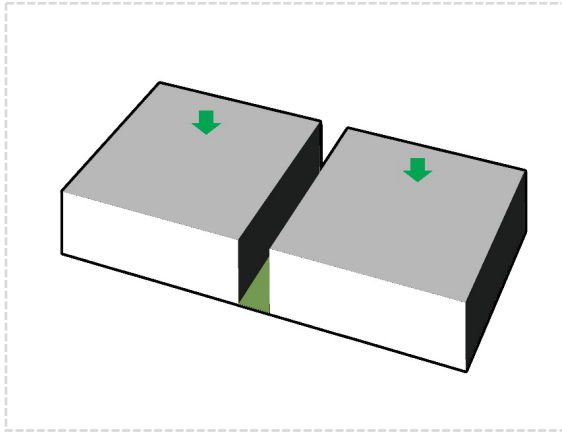


FINAL PROTOBLOCK DESIGN

FAR: 3.6 | SDA: 47 | EUI: 92

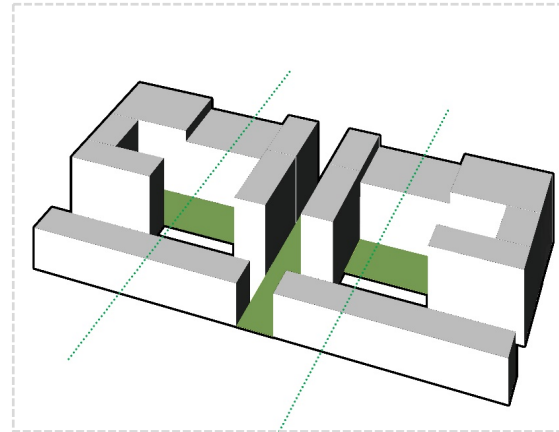
SOLAR ON EVERY SURFACE

EASY PEDESTRIAN MOVEMENT THRU SITE



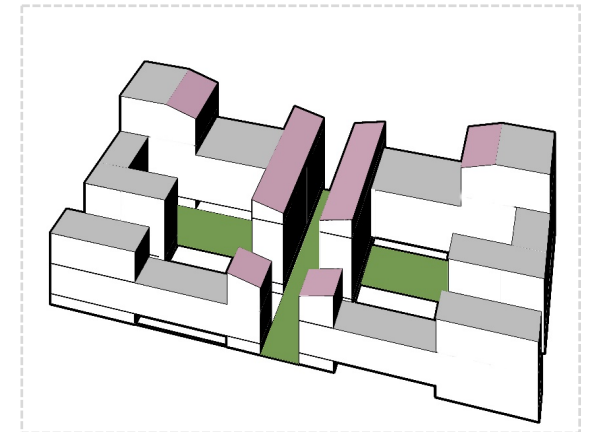
Basic Idea

Multiple
Simulations



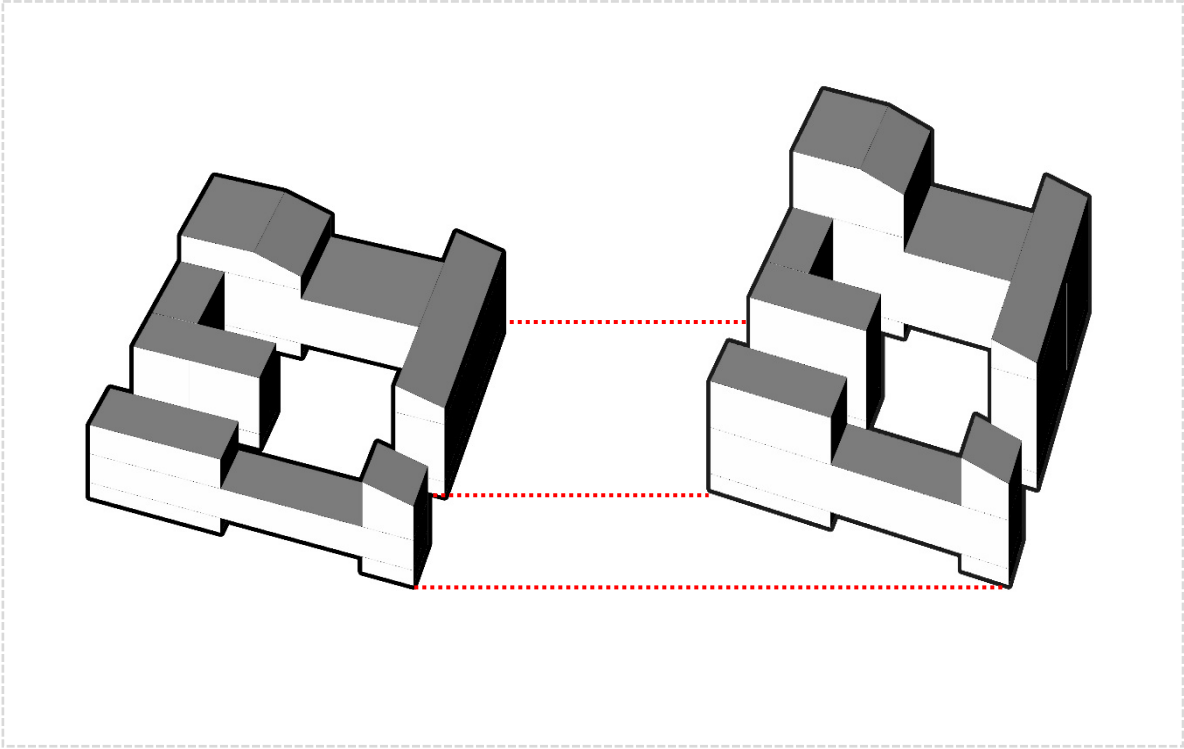
Optimized Protoblock

Details



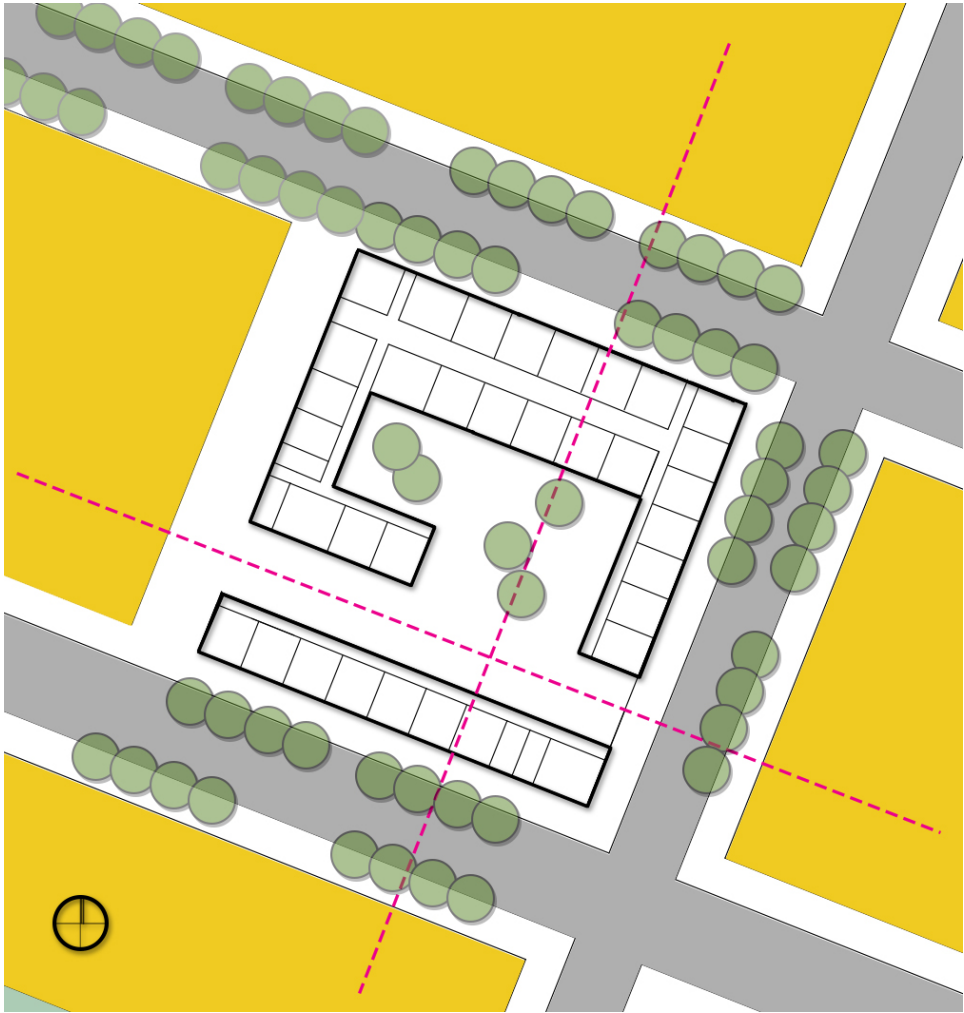
Final Protoblock

FINAL PROTOBLOCK DESIGN



Lower version

Higher Version



An aerial photograph of a site with a proposed street grid and green spaces. The grid is shown as a series of dashed lines with arrows at the ends, indicating the direction of flow. The green spaces are shown as solid black areas. The grid connects to existing roads and open space networks.

SITE DESIGN CONCEPT: STREET GRID / OPEN SPACE

STREET GRID CONNECTS
TO EXISTING ROADS

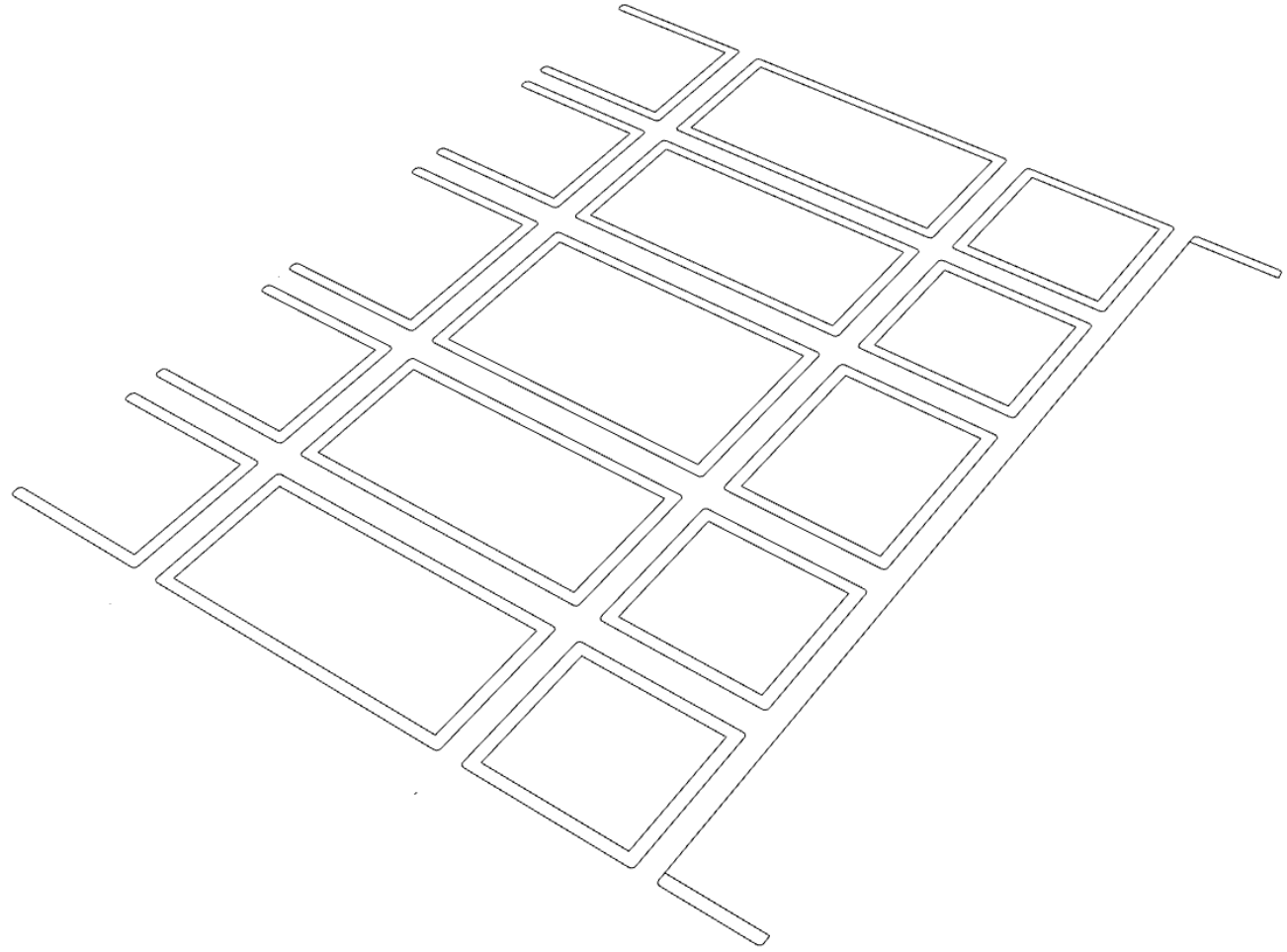
GREEN SPACES PROVIDE
STORM SURGE
PROTECTION AND
CONNECT TO EXISTING
OPEN SPACE NETWORK



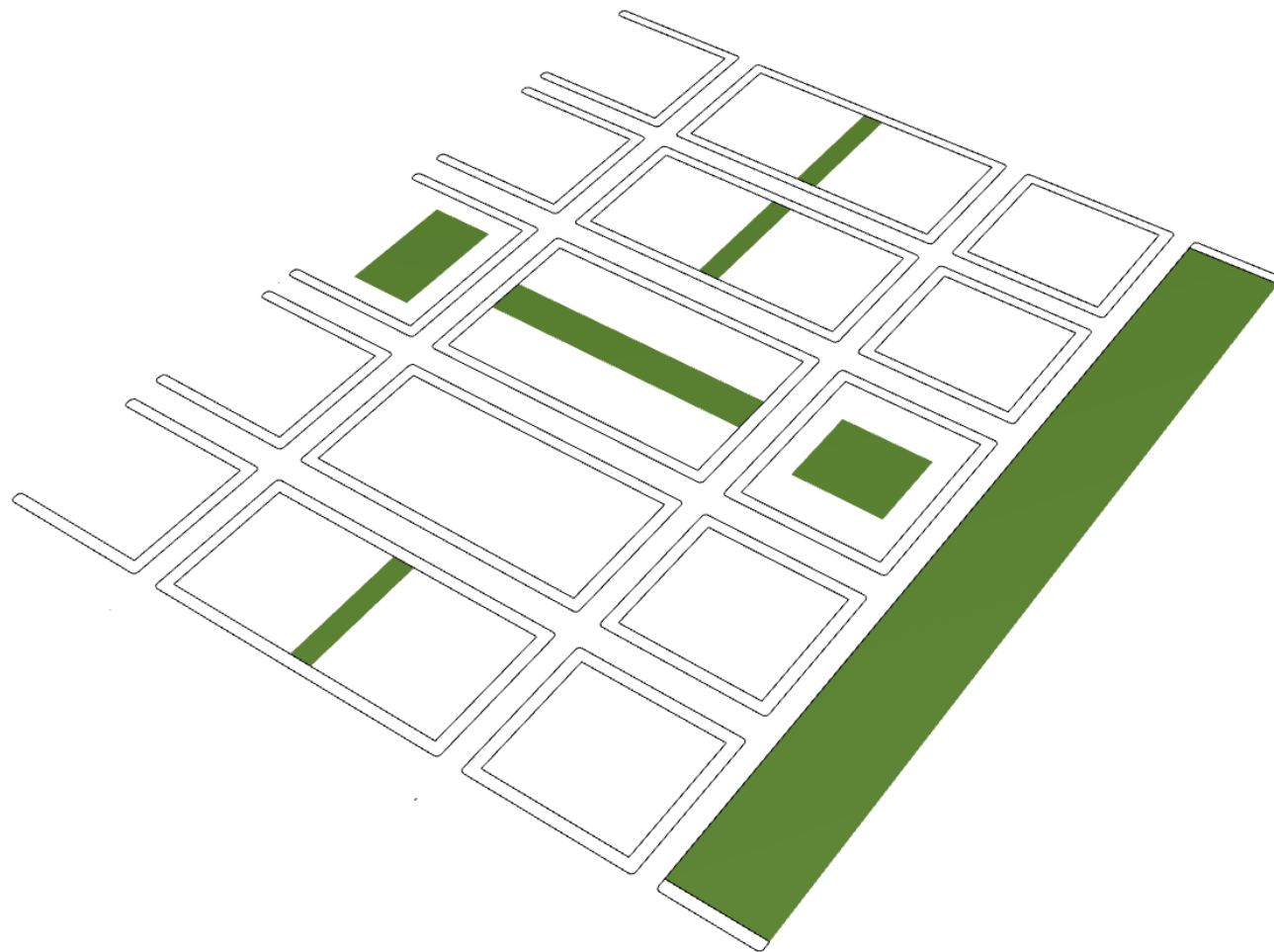
SITE DESIGN CONCEPT: STREET GRID / OPEN SPACE

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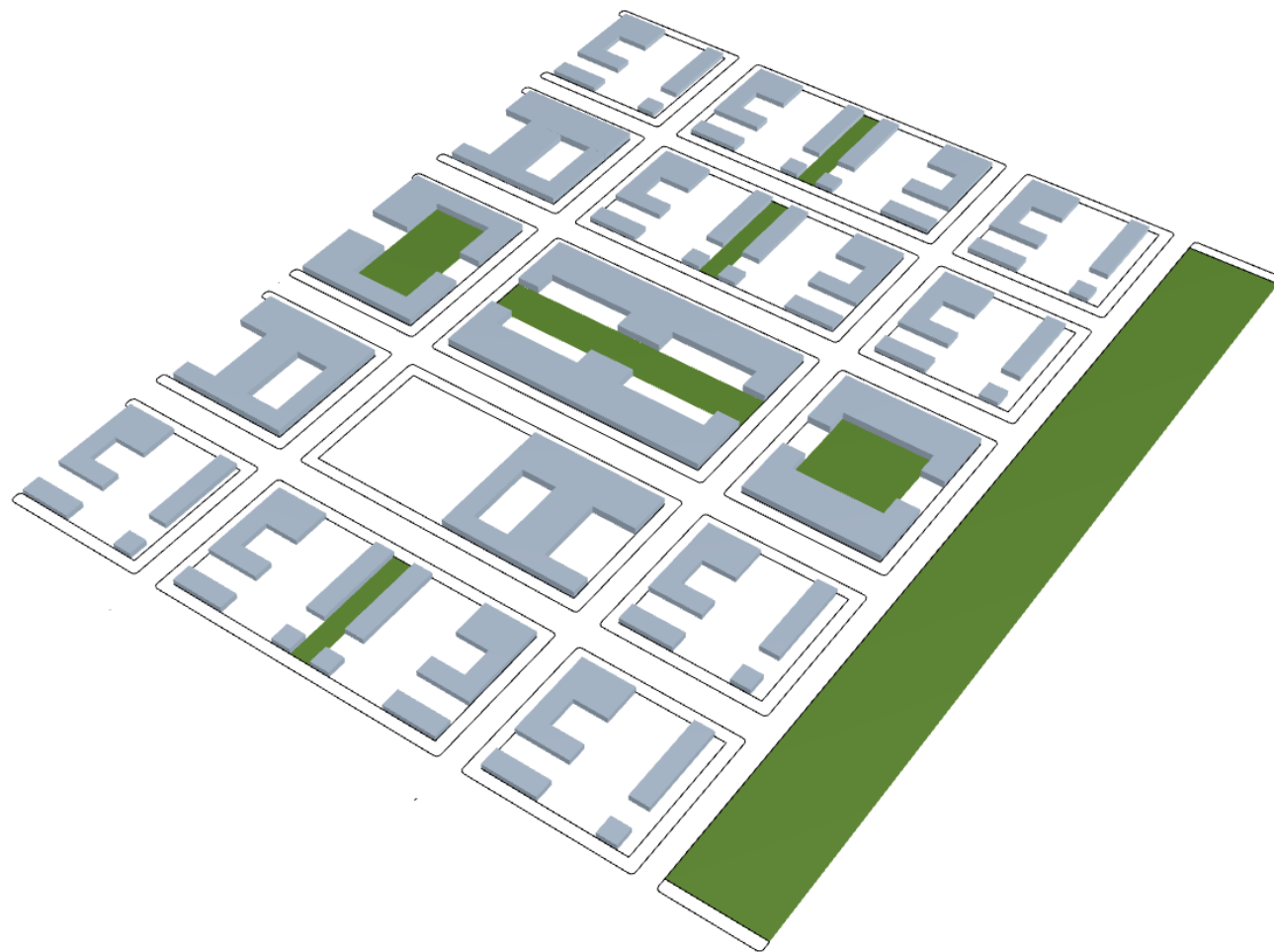
SITE DESIGN: OPEN SPACE



OPEN SPACE

STREET GRID

SITE DESIGN: RETAIL USE



RETAIL

OPEN SPACE

STREET GRID

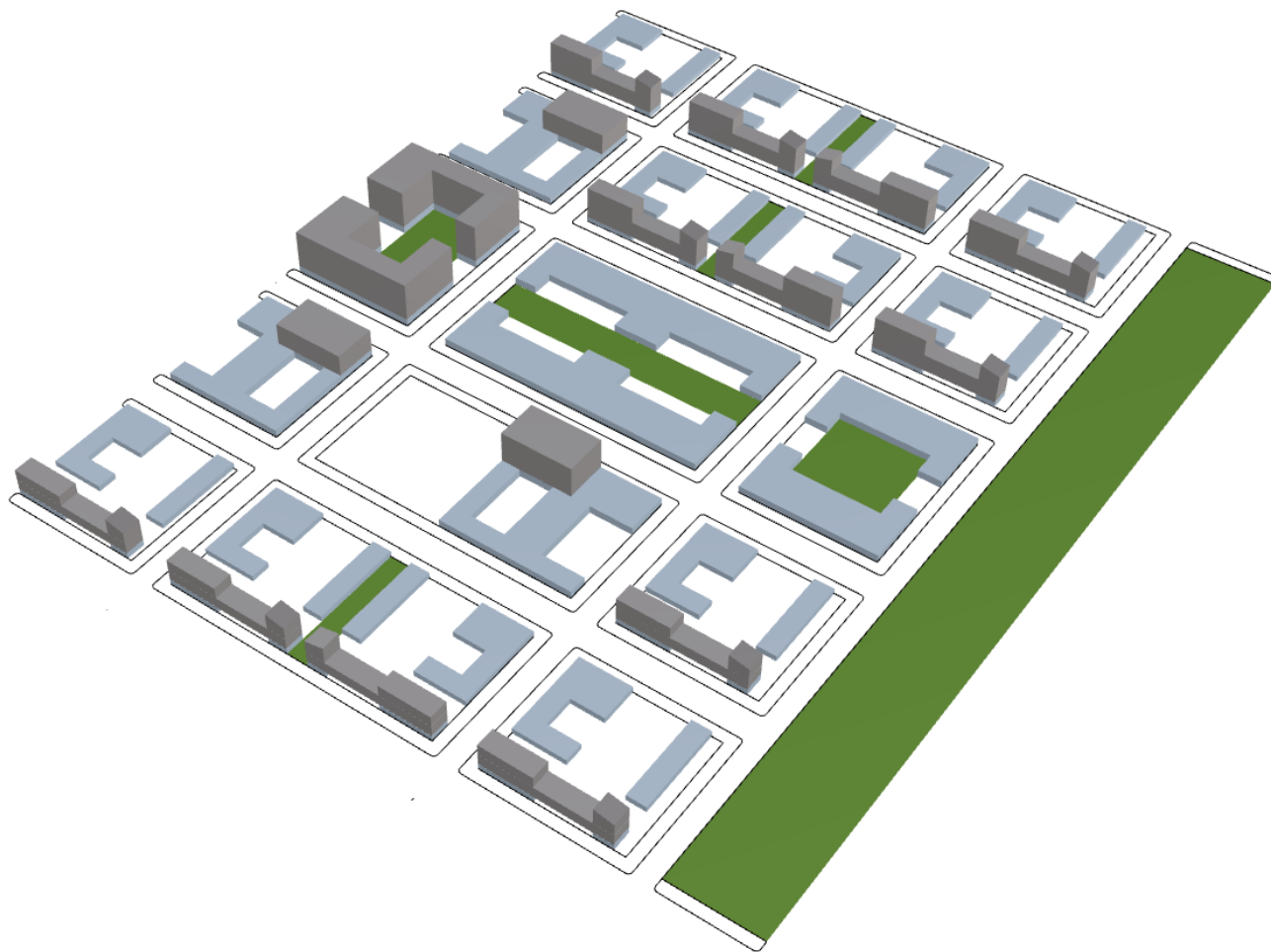
SITE DESIGN: OFFICE USE

OFFICE

RETAIL

OPEN SPACE

STREET GRID



SITE DESIGN: RESIDENTIAL USE

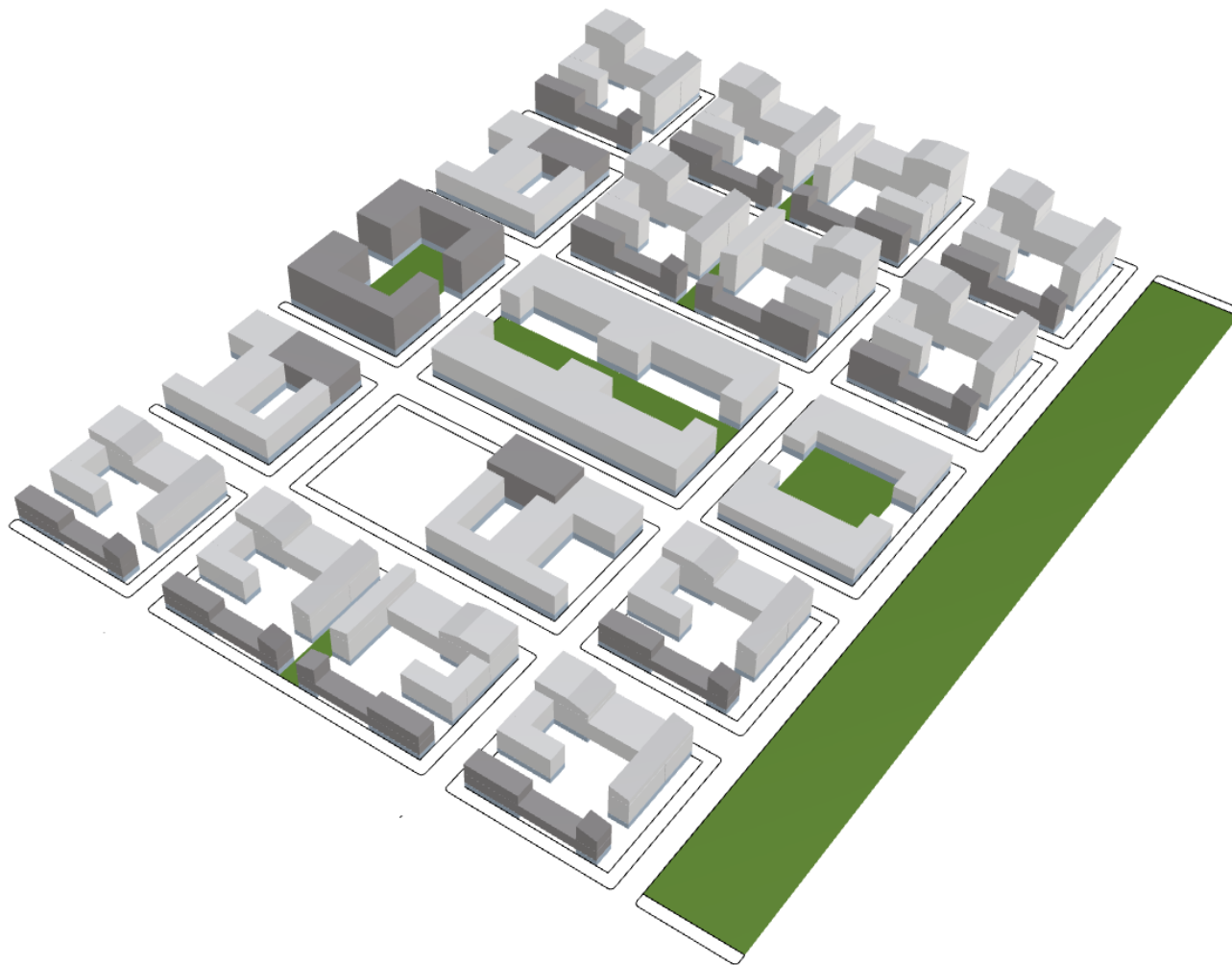
RESIDENTIAL

OFFICE

RETAIL

OPEN SPACE

STREET GRID



SITE DESIGN: PARKING GARAGE

PARKING

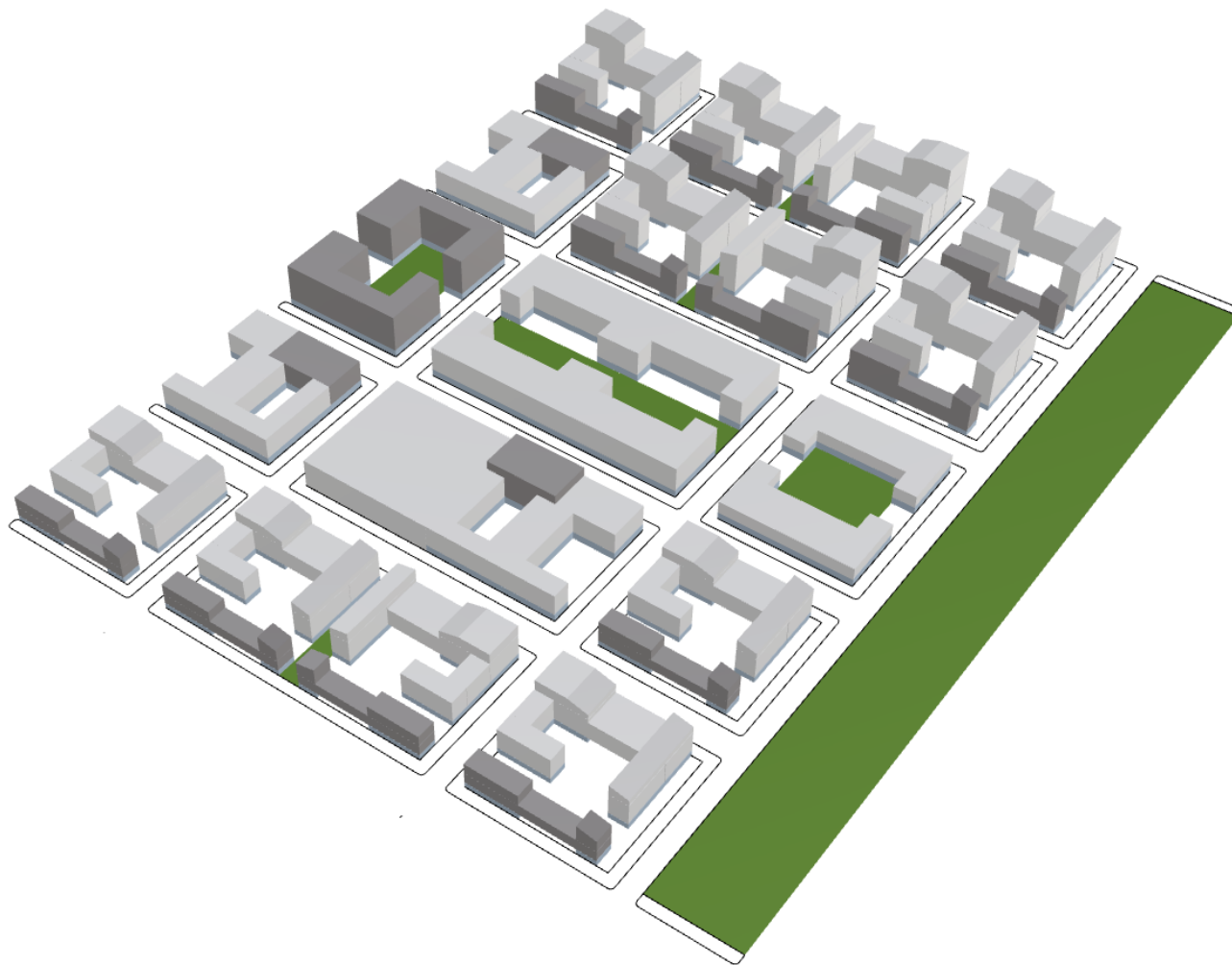
RESIDENTIAL

OFFICE

RETAIL

OPEN SPACE

STREET GRID



SITE DESIGN

SOLAR

PARKING

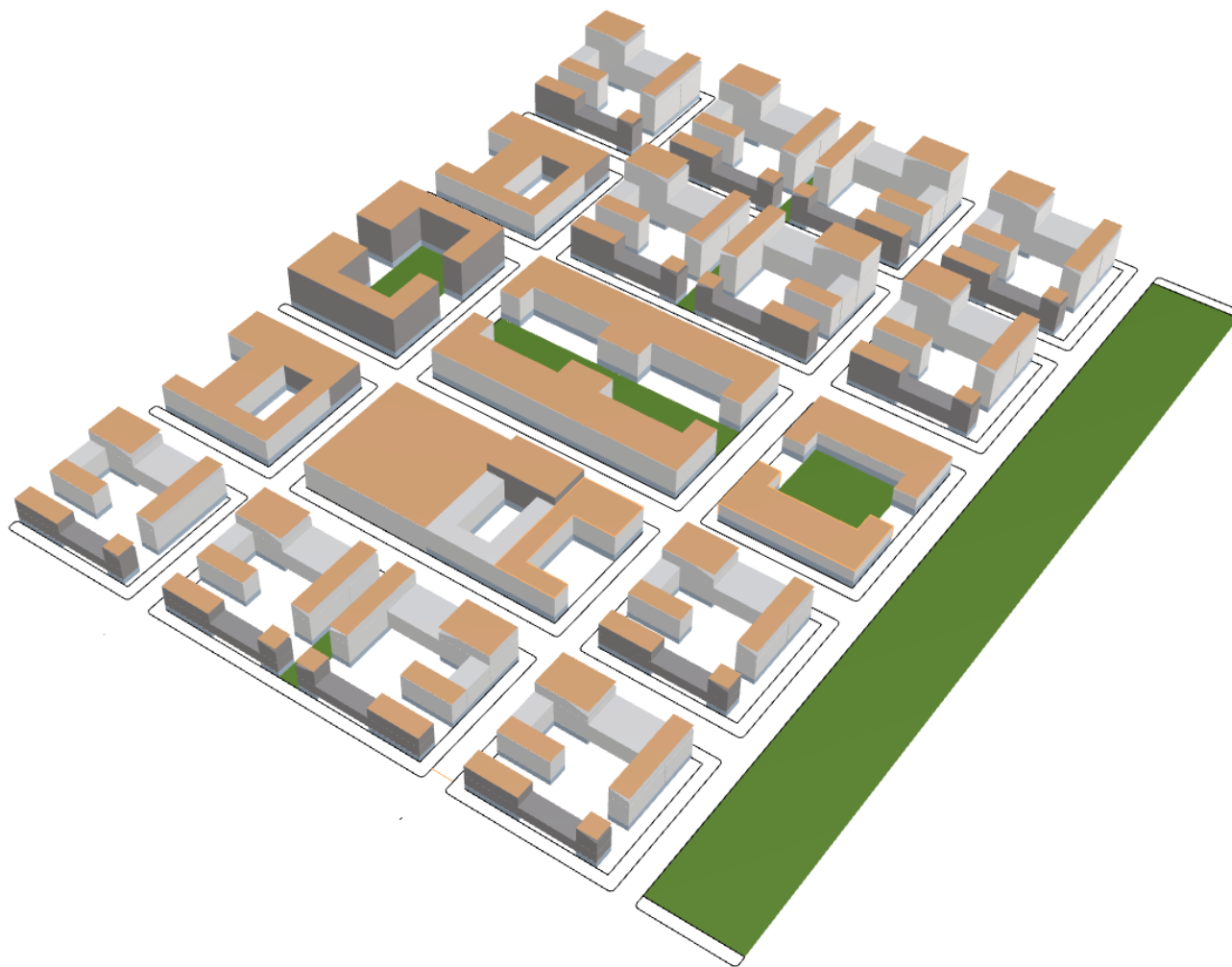
RESIDENTIAL

OFFICE

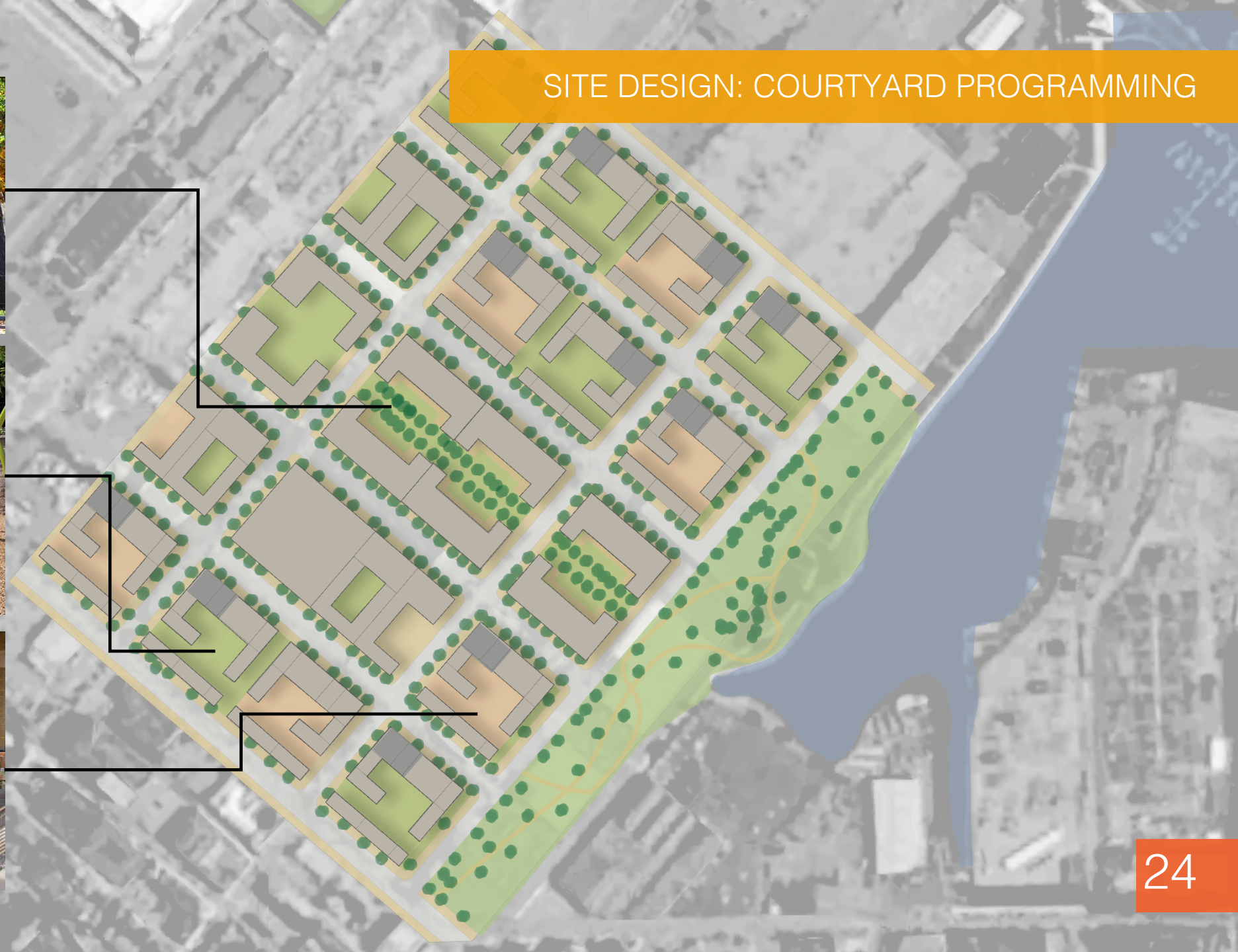
RETAIL

OPEN SPACE

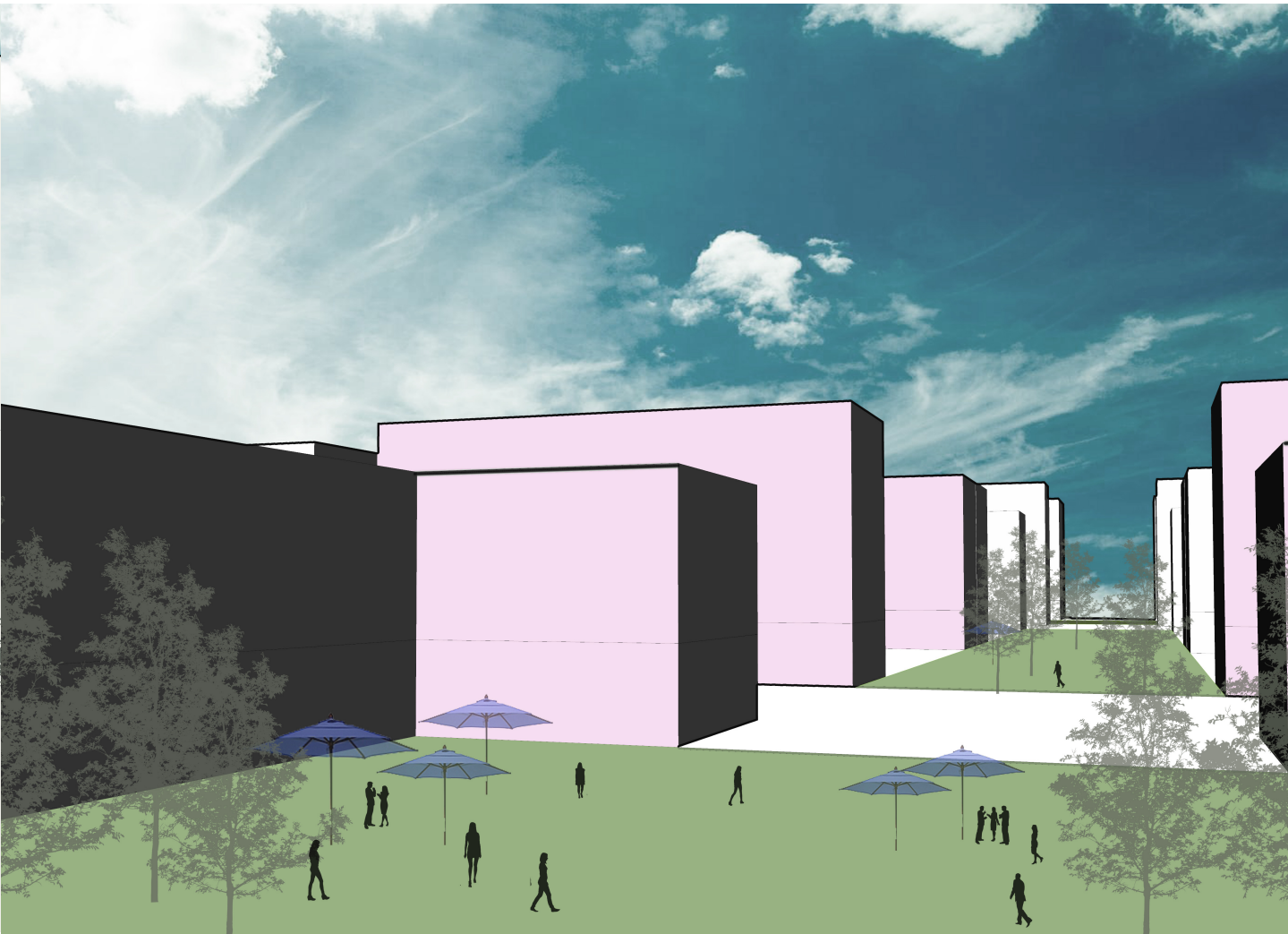
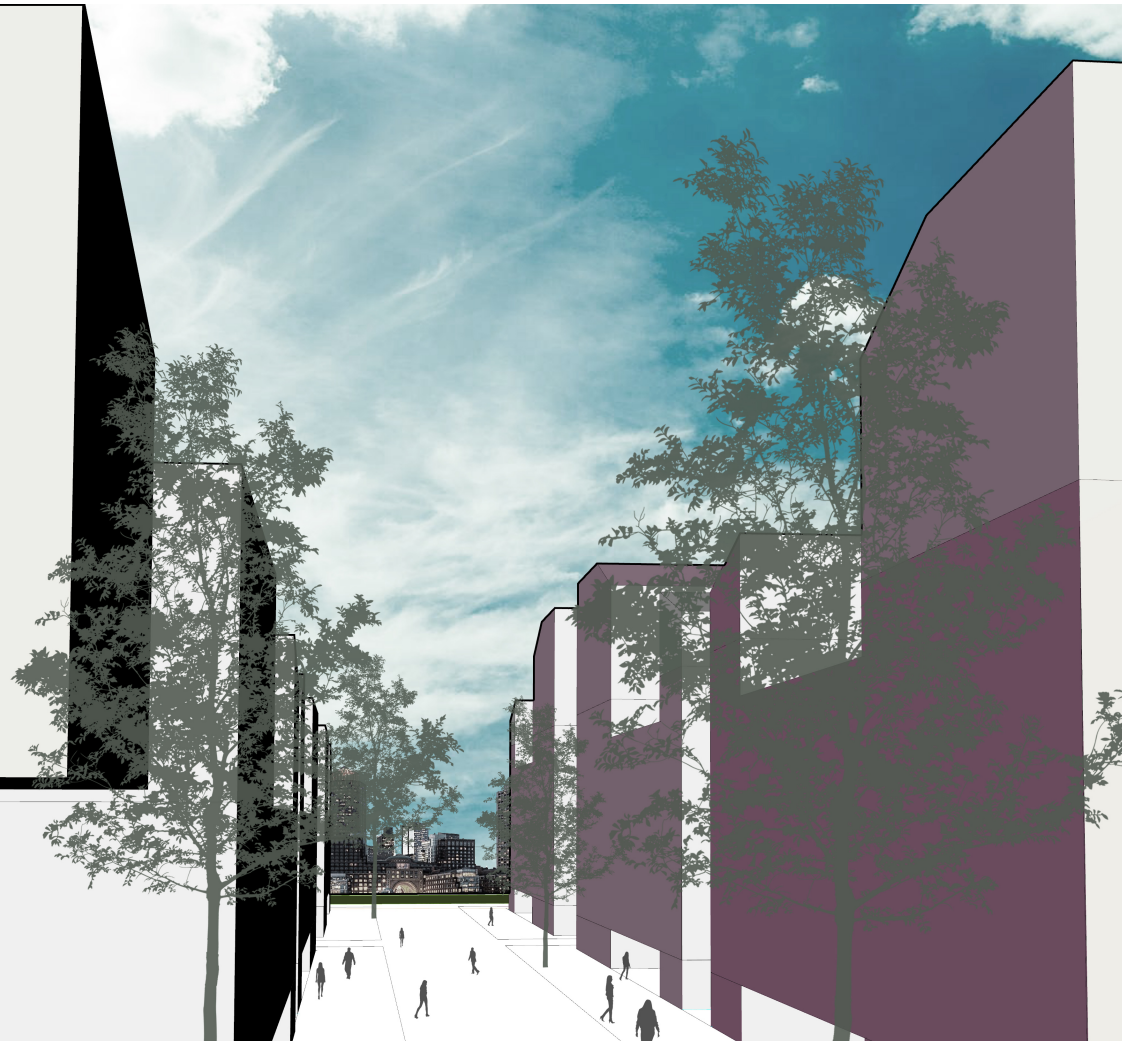
STREET GRID



SITE DESIGN: COURTYARD PROGRAMMING



SITE DESIGN: WALKABLE PUBLIC SPACE



981 SPACES | 0.5 SPACES/UNIT

645 GARAGE | 336 STREET

FUTURE PARKING RATIO BASED ON
INCREASED SHARED/AV

PARKING STRATEGY



981 SPACES | 1.5 SPACES/UNIT

645 GARAGE | 336 STREET

FUTURE PARKING RATIO BASED ON
INCREASED SHARED/AV



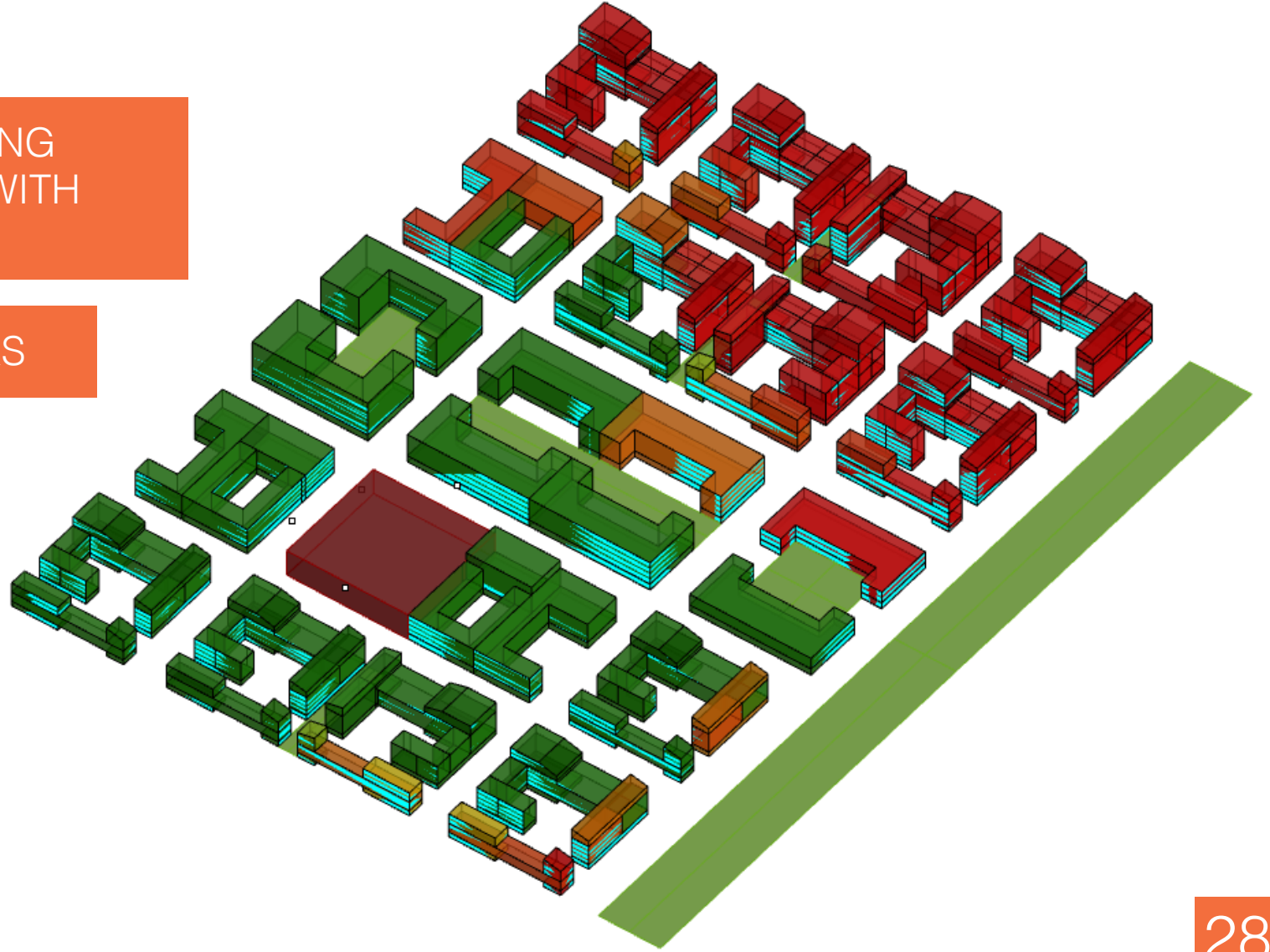
PARKING STRATEGY



PARKING STRATEGY : GROCERY STORES

WHAT AREAS ARE WITHIN EASY WALKING
DISTANCE OF THE PARKING GARAGE WITH
GROCERIES??

200-300 METERS | 2.5 – 3.7 CITY BLOCKS



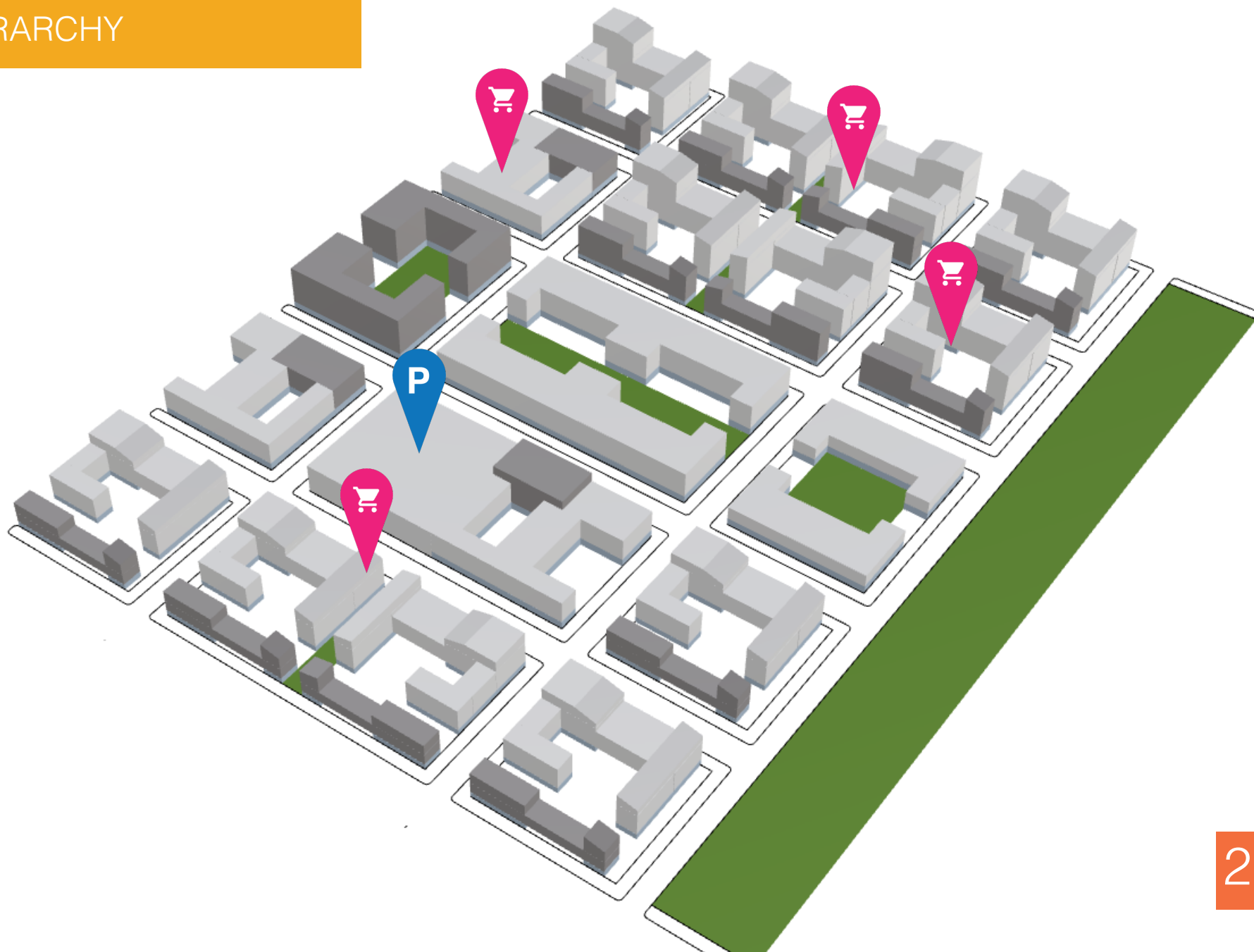
AMENITIES & STREET HIERARCHY



Parking



Grocery Store



AMENITIES & STREET HIERARCHY



Shopping




AMENITIES & STREET HIERARCHY



Entertainment



AMENITIES & STREET HIERARCHY

 Restaurant




AMENITIES & STREET HIERARCHY

 Coffee




AMENITIES & STREET HIERARCHY

 Bank/ATM

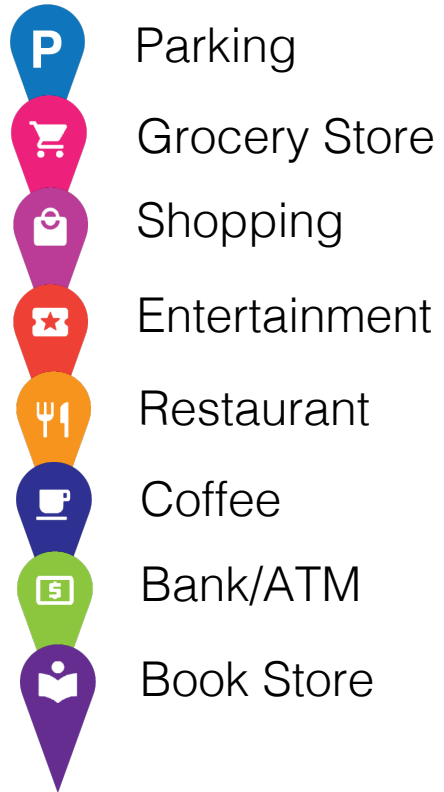


AMENITIES & STREET HIERARCHY

 Book Store

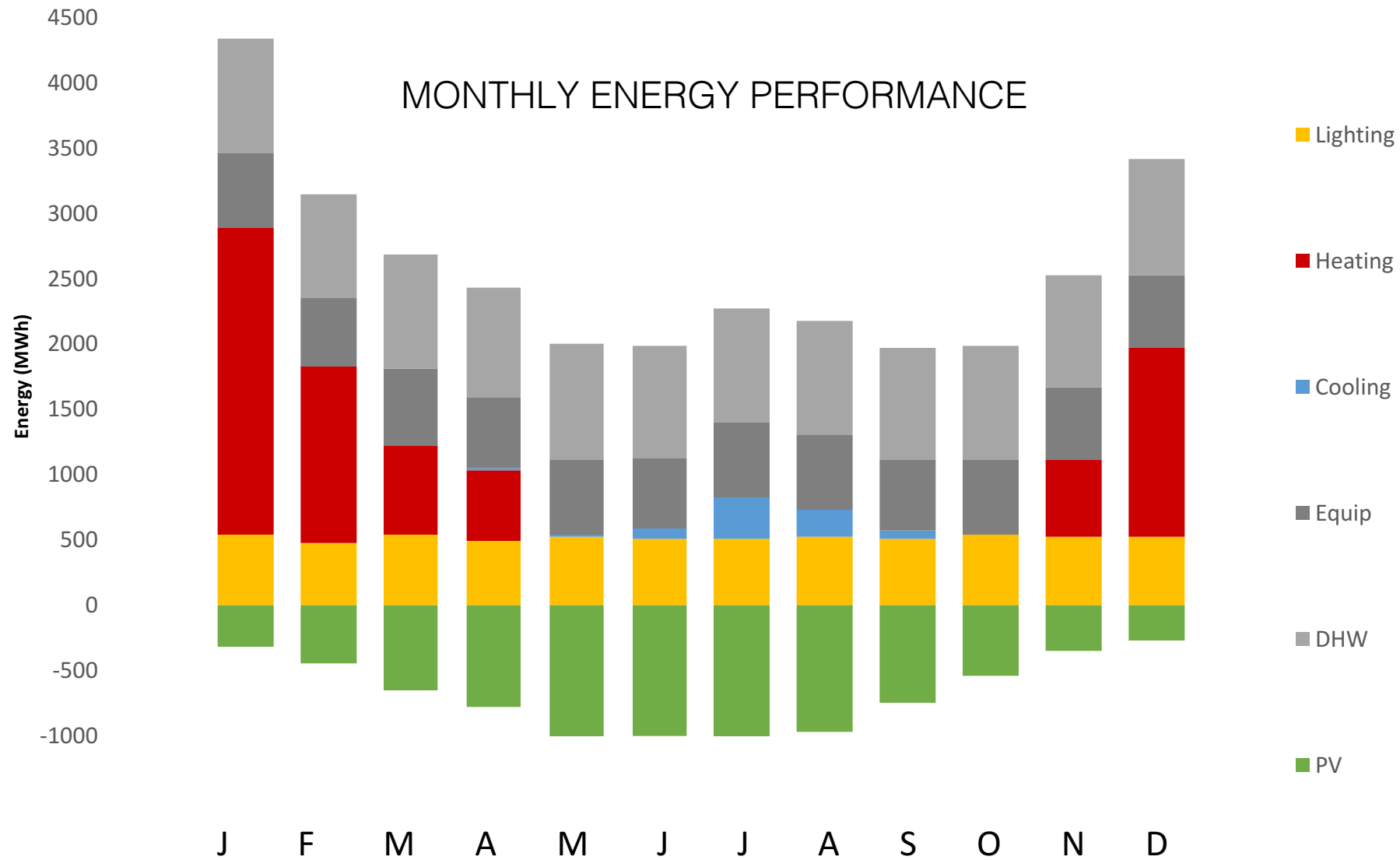


AMENITIES & STREET HIERARCHY



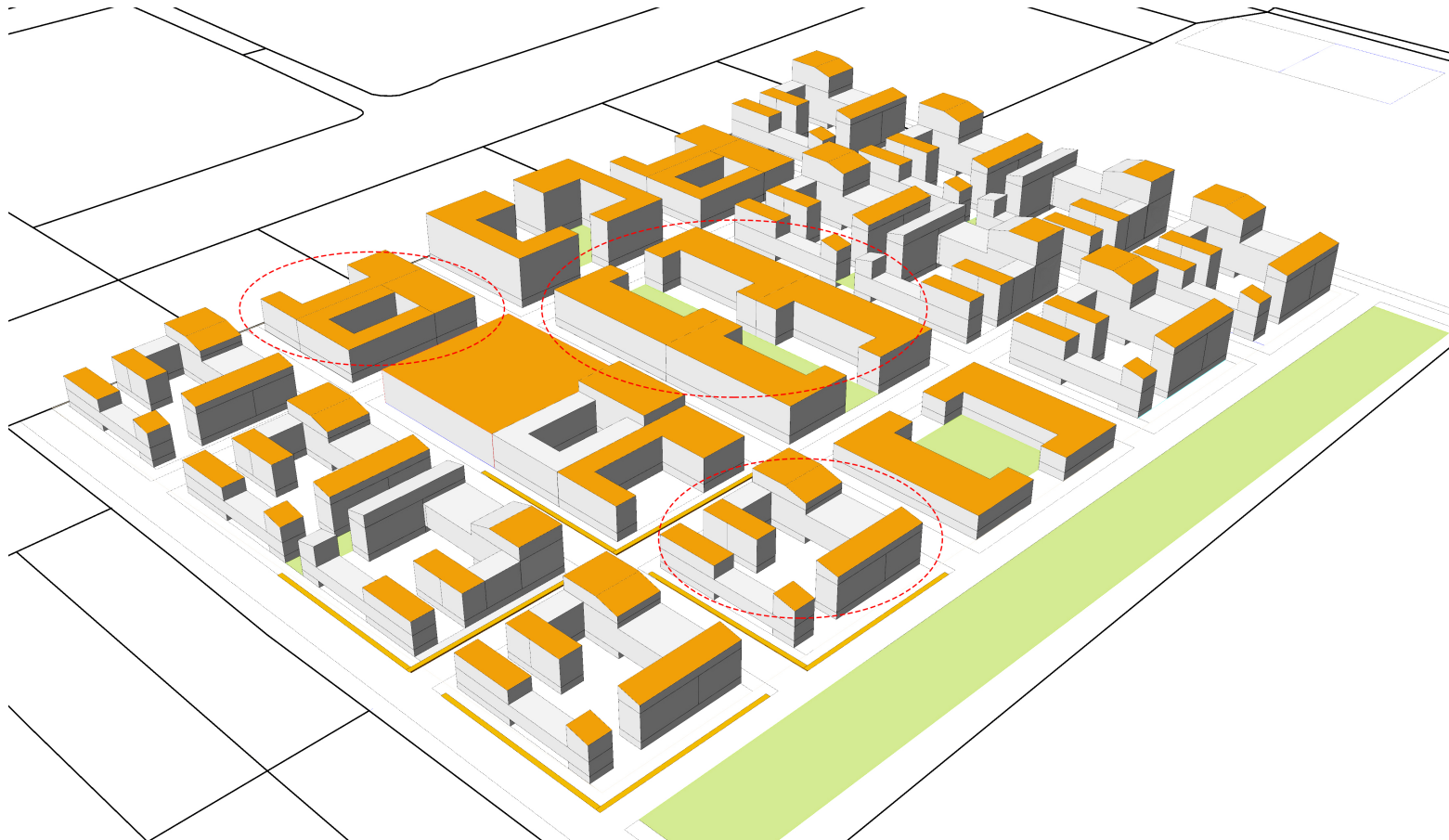
OVERALL WALKABILITY:

92

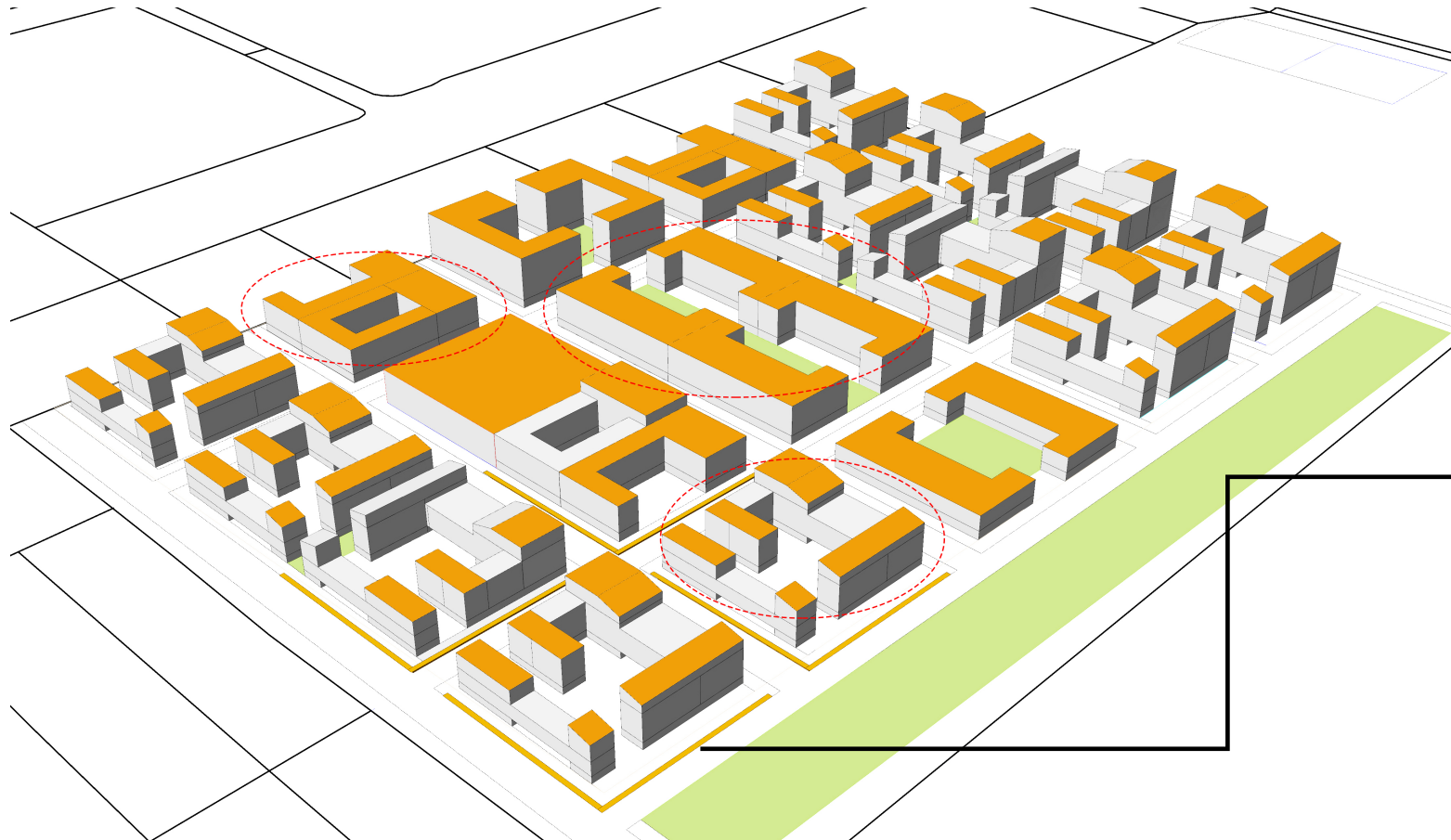


... AND CAN WE GET TO NET ZERO?!

... AND CAN WE GET TO NET ZERO?!



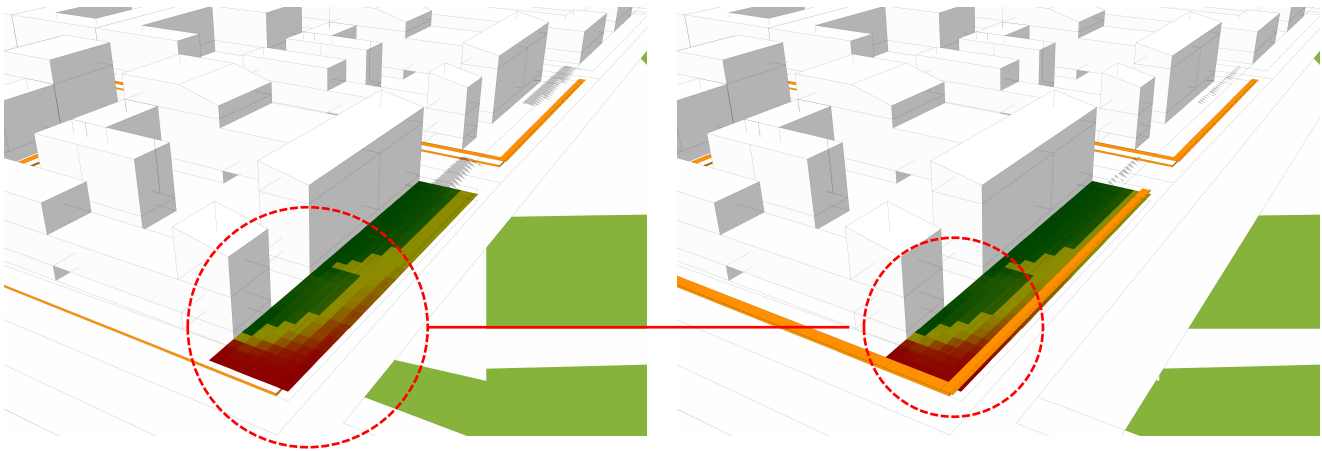
... AND CAN WE GET TO NET ZERO?!



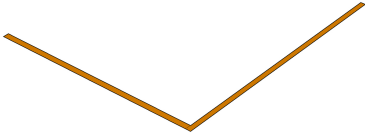
SOLAR COVERED
ON-STREET
PARKING!

SOLAR ON-STREET PARKING – WORTH IT?

Outdoor Thermal Comfort

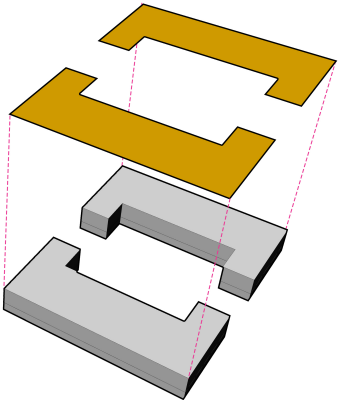


Area of on-
street PV

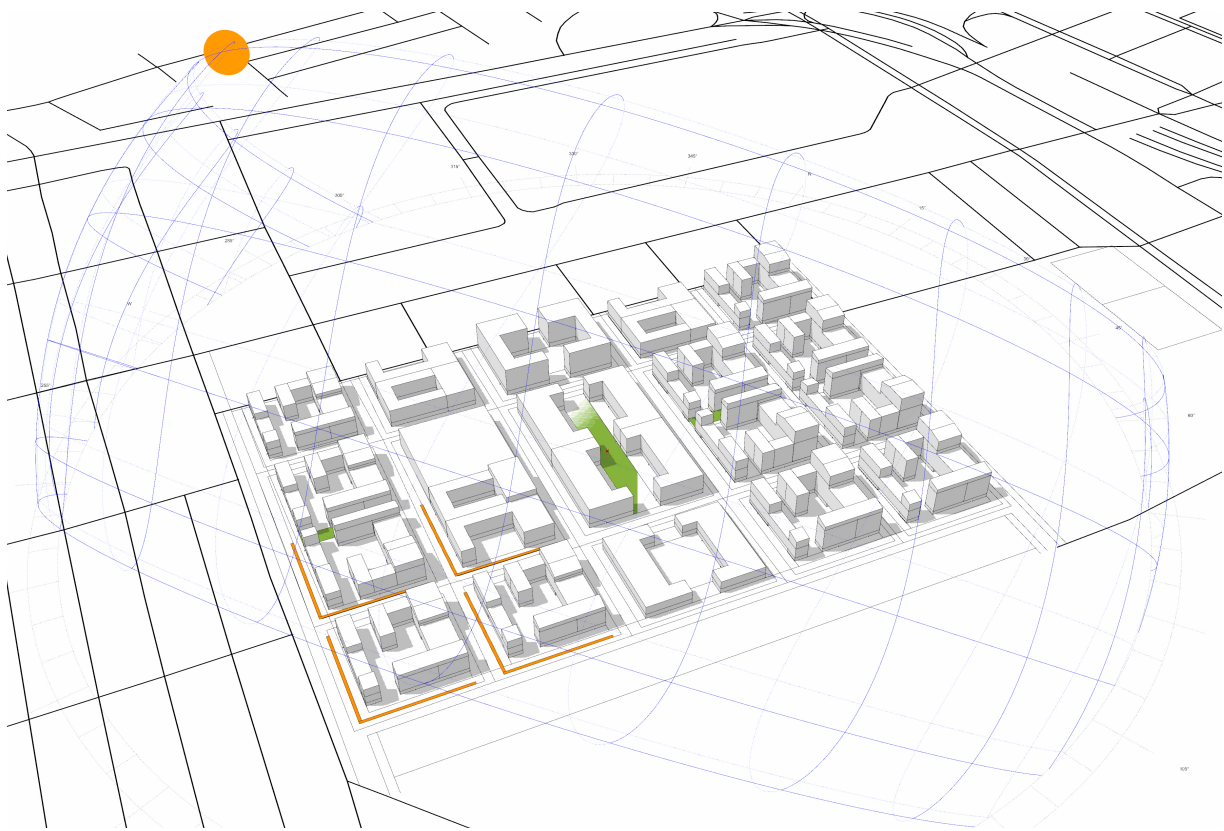


x 14

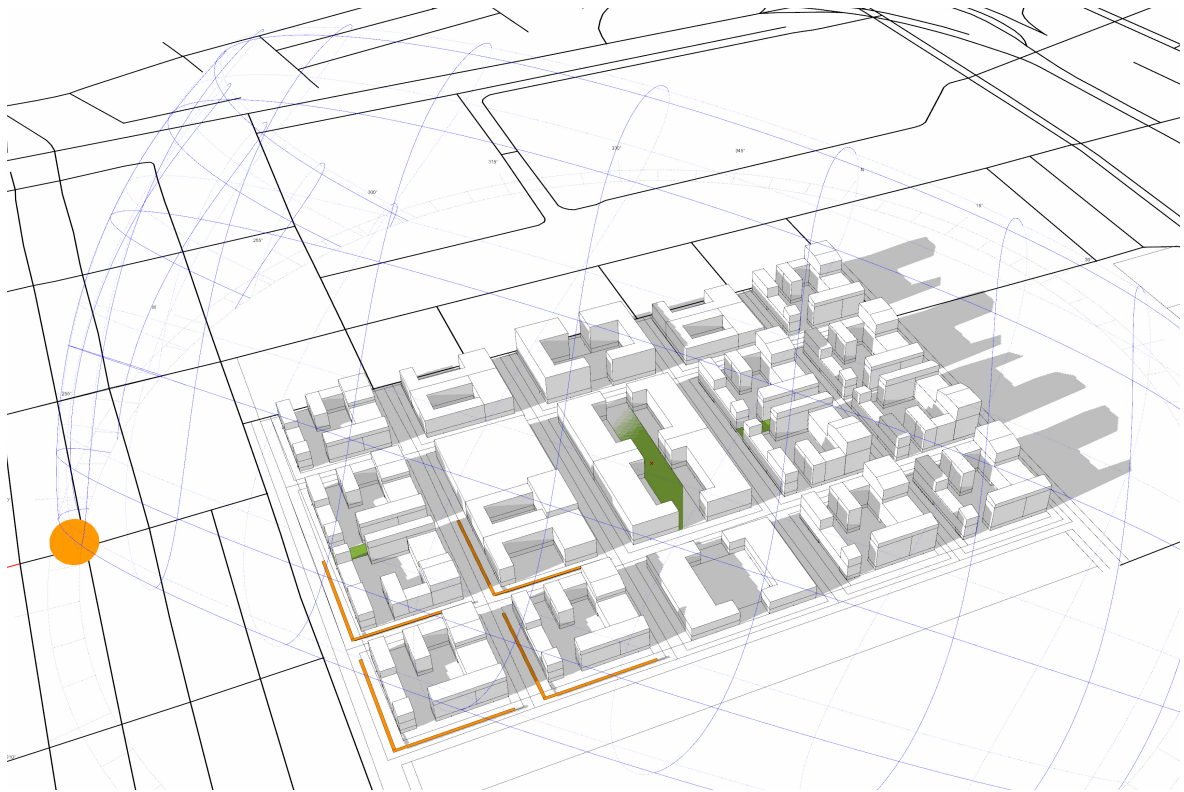
=



SOLAR ON-STREET PARKING – WORTH IT?

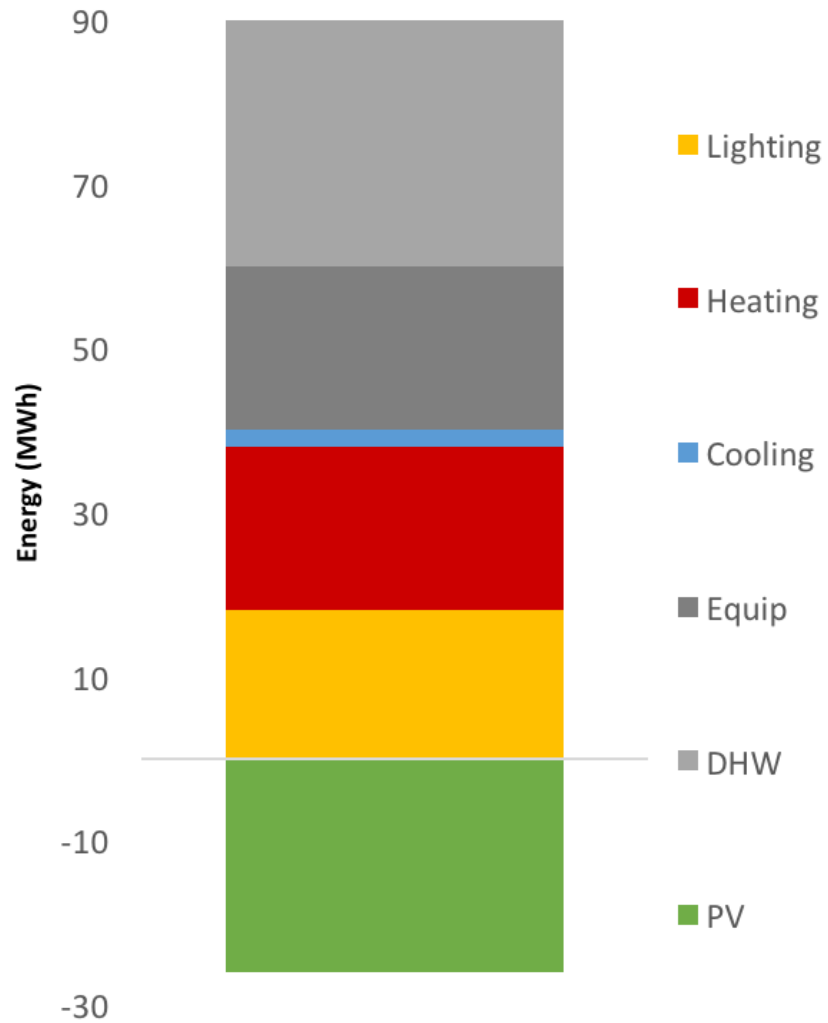


JULY 3:30 PM



DECEMBER 3:30 PM

SITE-WIDE EUI

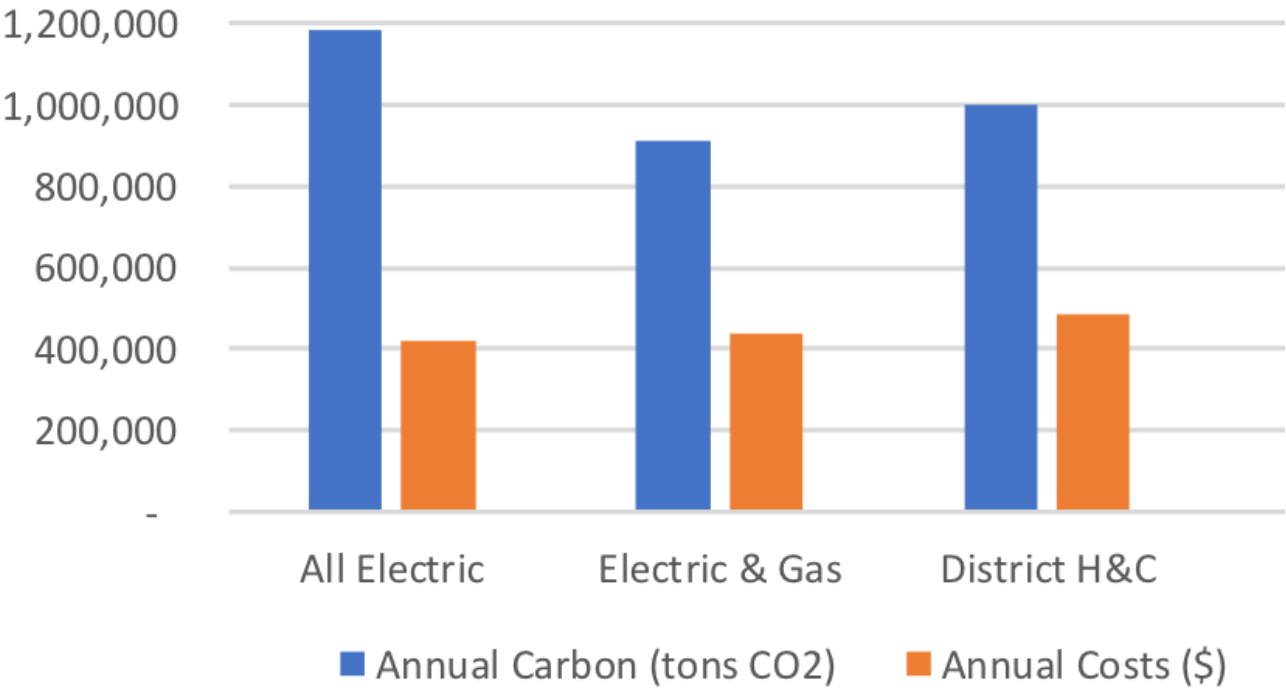


Final EUI: **63**

NOT QUITE TO NET ZERO,
BUT PRETTY GOOD!

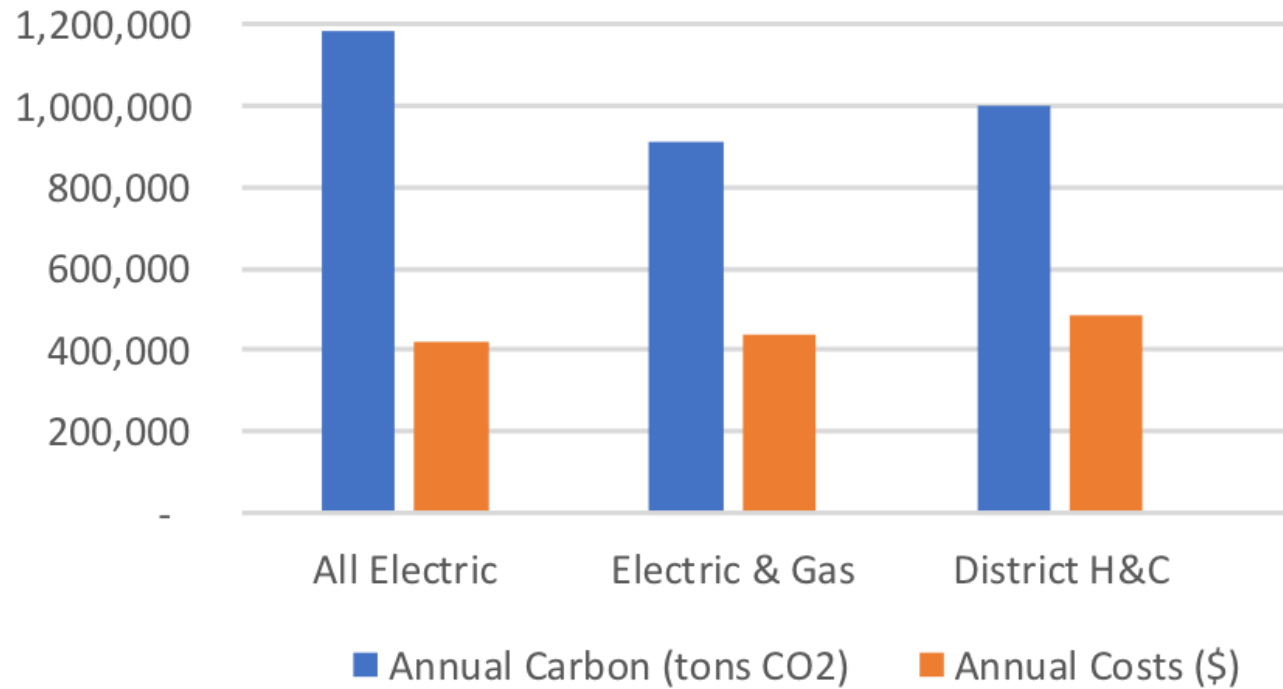
WHAT ENERGY SYSTEM MAKES SENSE?

SUPPLY SCENARIOS



WHAT ENERGY SYSTEM MAKES SENSE?

SUPPLY SCENARIOS



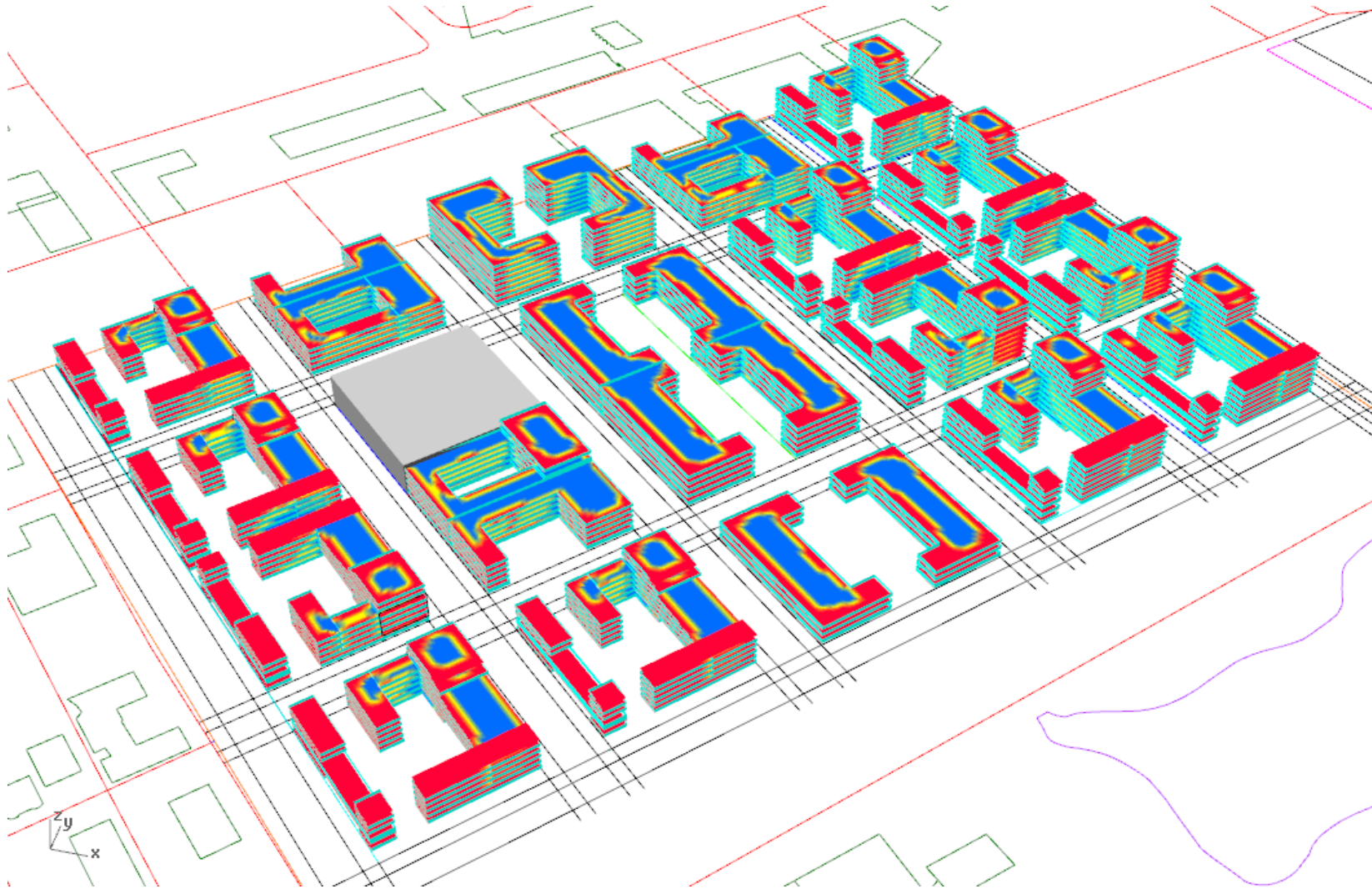
All Electric, Baby!



sDA 49

CREATING VALUE THROUGH
DAYLIT BUILDINGS

WWR VARIES THROUGHOUT
SITE BY ORIENTATION



... BUT IS IT AFFORDABLE?

... BUT IS IT AFFORDABLE?

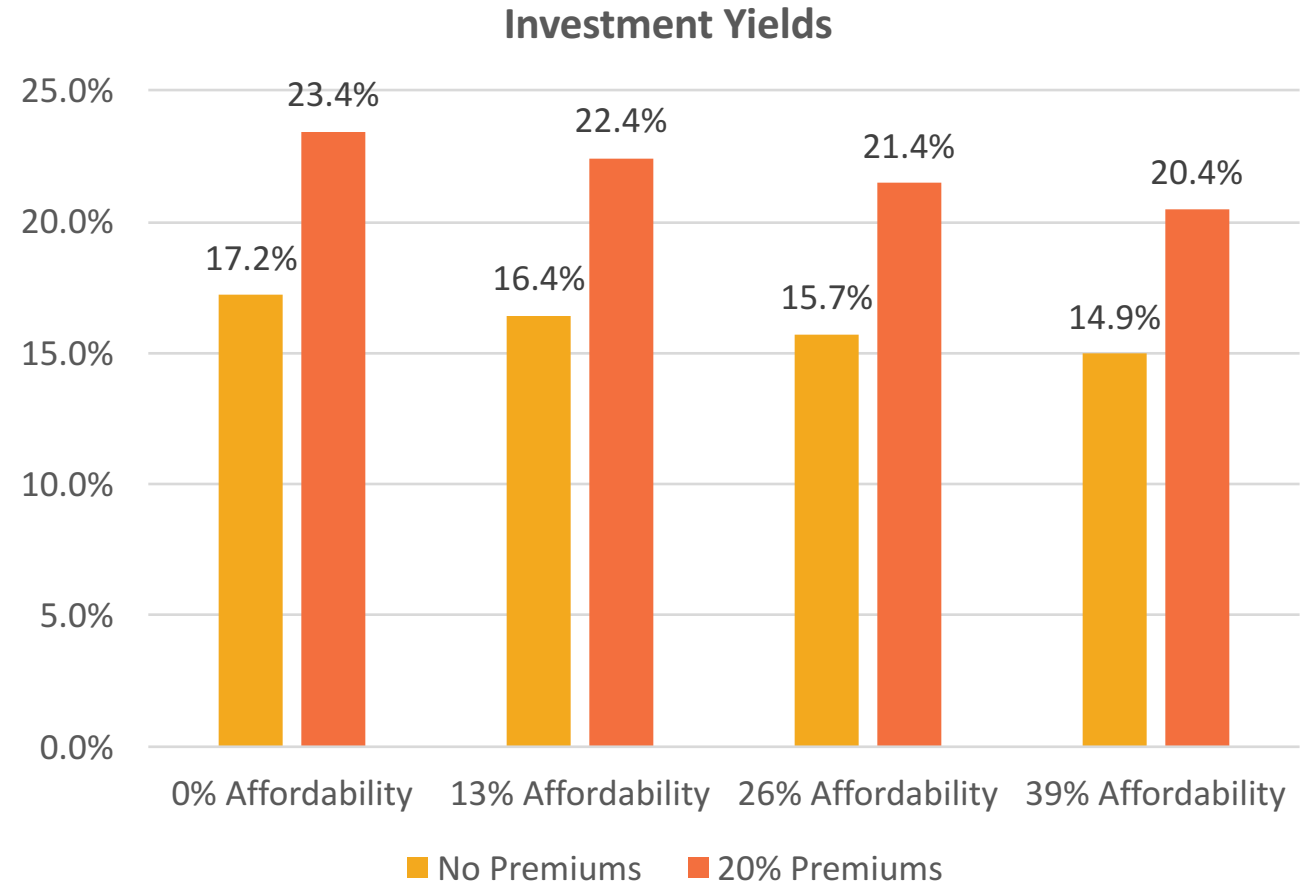
South Boston Waterfront: Zone A

Required to designate 13% of units as Inclusionary Development Policy (IDP) units

IDP units are for households earning < 70% Area Median Income (AMI)

Prorated \$414/m² residential market rent with \$163/m² affordable rent at 50% AMI

Investment yields still attractive with 3x affordability requirement and no premiums



FINANCIAL ANALYSIS: OTHER FINDINGS

5% daylighting premium corresponds with ~0.5% increase in investment yield

5% walkability premium corresponds with ~1.0% increase in investment yield

5% daylighting premium corresponds with ~0.5% increase in investment yield

5% walkability premium corresponds with ~1.0% increase in investment yield

→ More total space within site considered highly walkable versus well daylit

FINANCIAL ANALYSIS: OTHER FINDINGS

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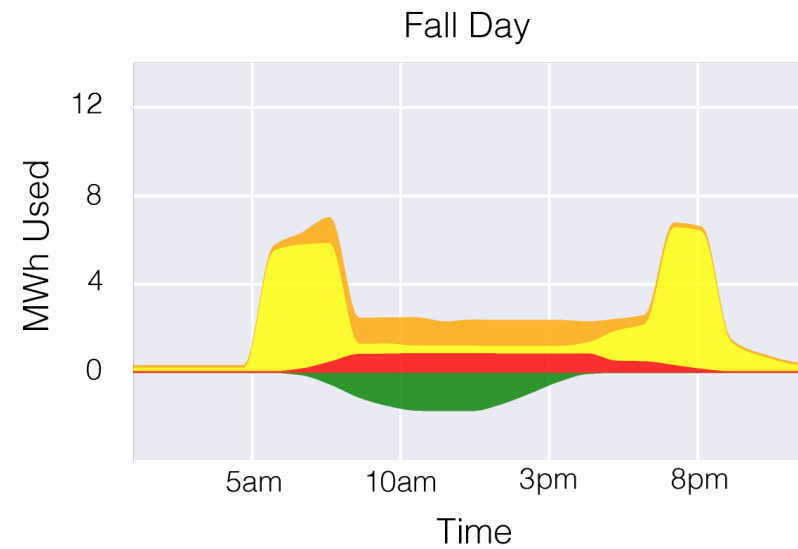
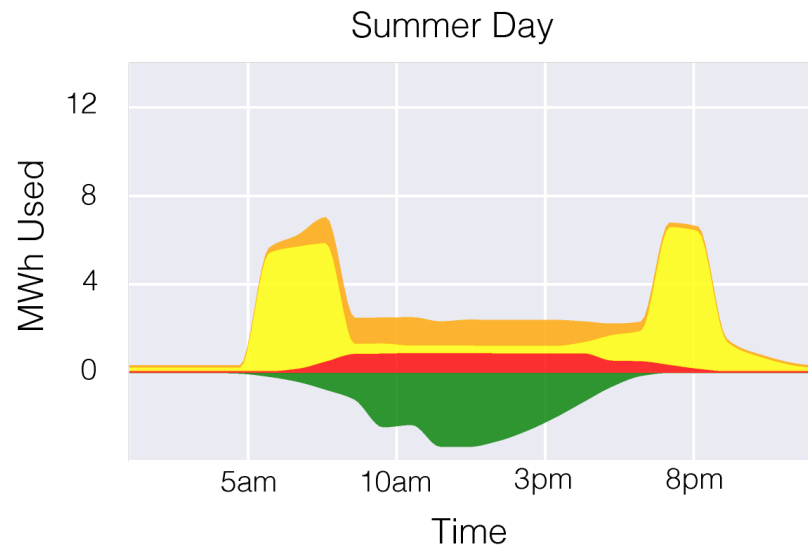
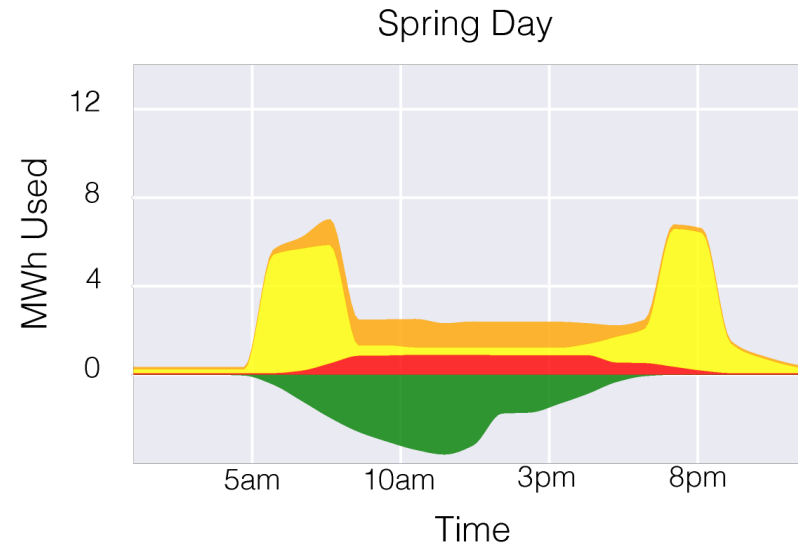
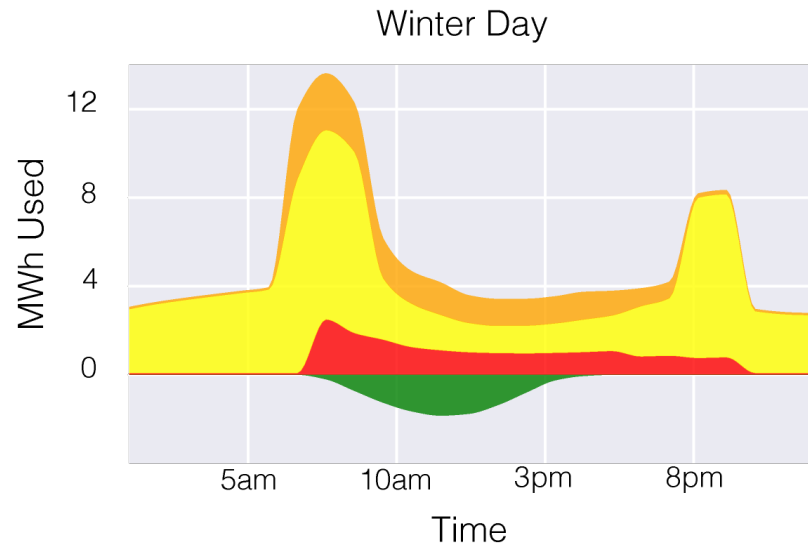
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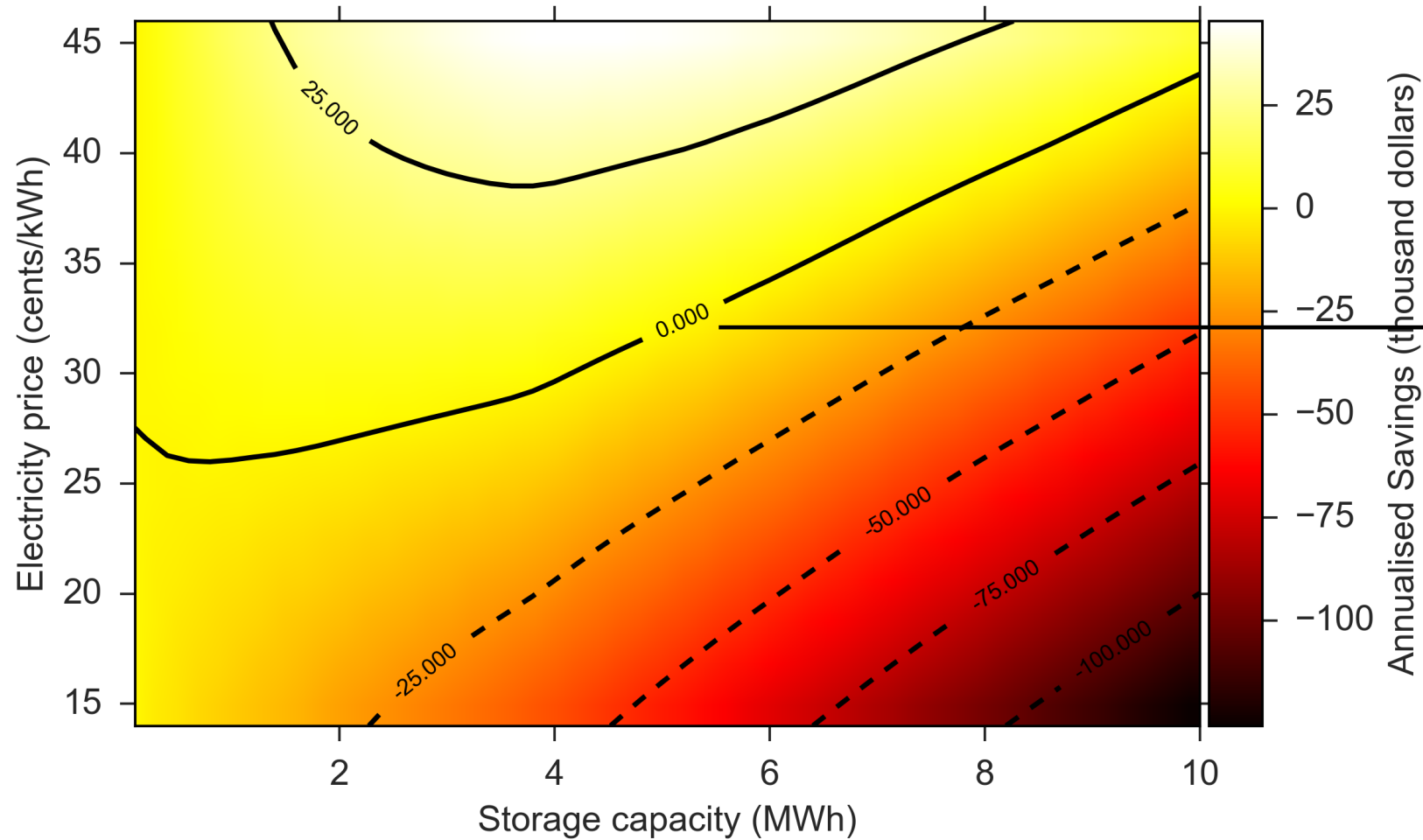
→ More total space within site considered highly walkable versus well daylit

10% construction cost premium would decrease above returns by ~1.5%

20% construction cost premium would decrease above returns by ~3.0%

EXPLORING BATTERIES: THE LOAD-DOWN



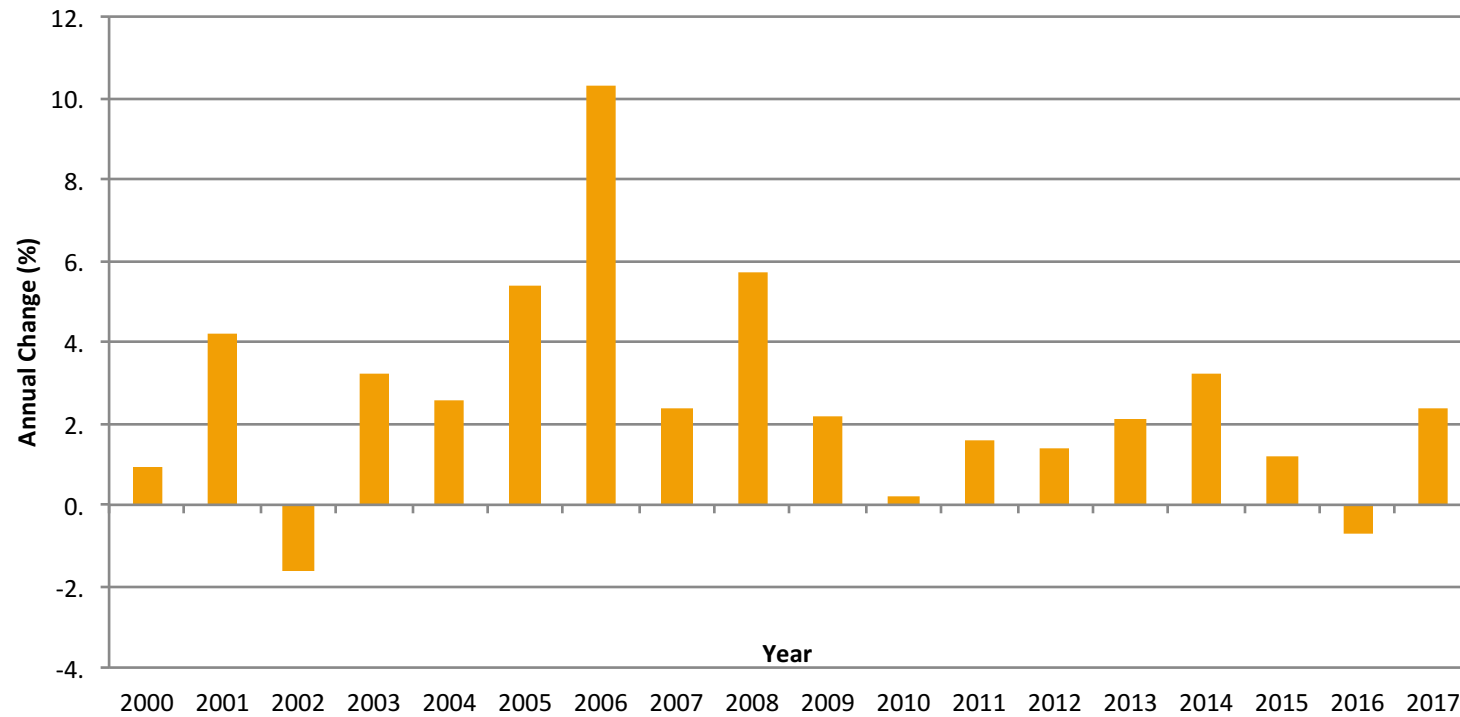


We find that there is no net benefit until electricity prices reach \$0.26/kWh

Currently, electricity prices in Massachusetts \$0.19/kWh...

MORE BATTERY EXPLORATION

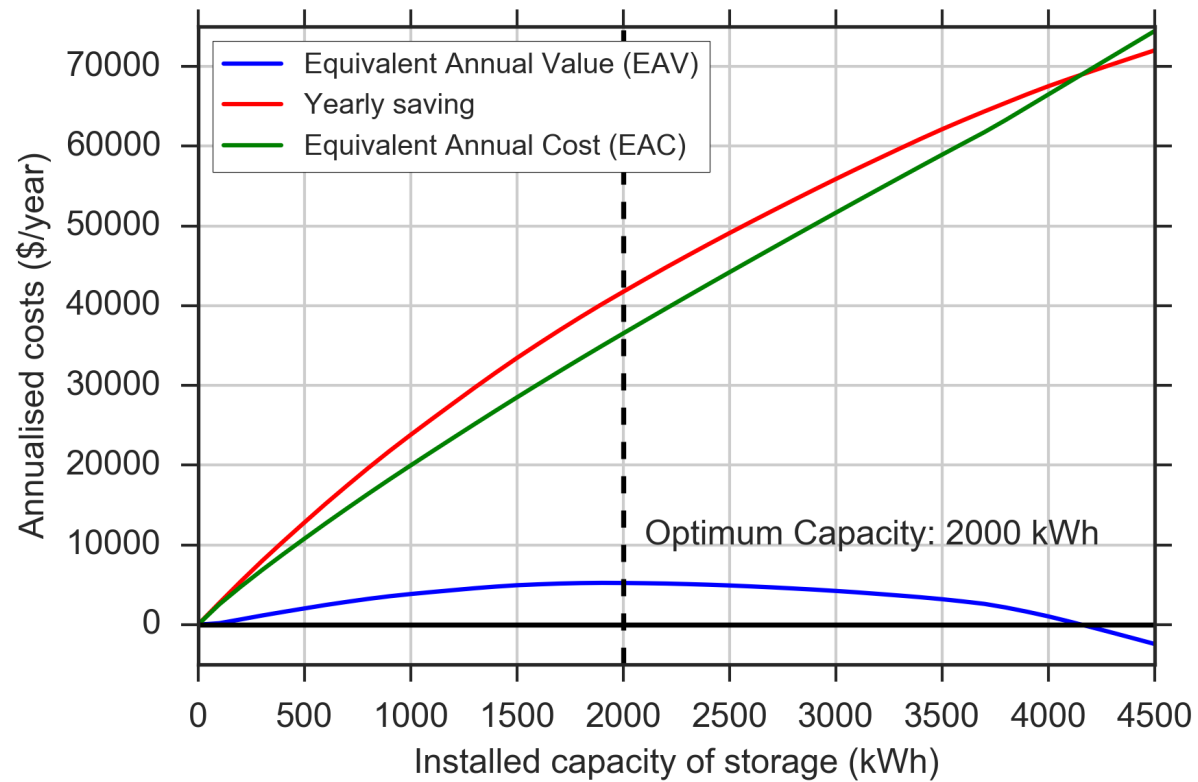
Retail electricity price increases in the USA



Average price increase per year: 2.6% → 12 years to reach battery profitability

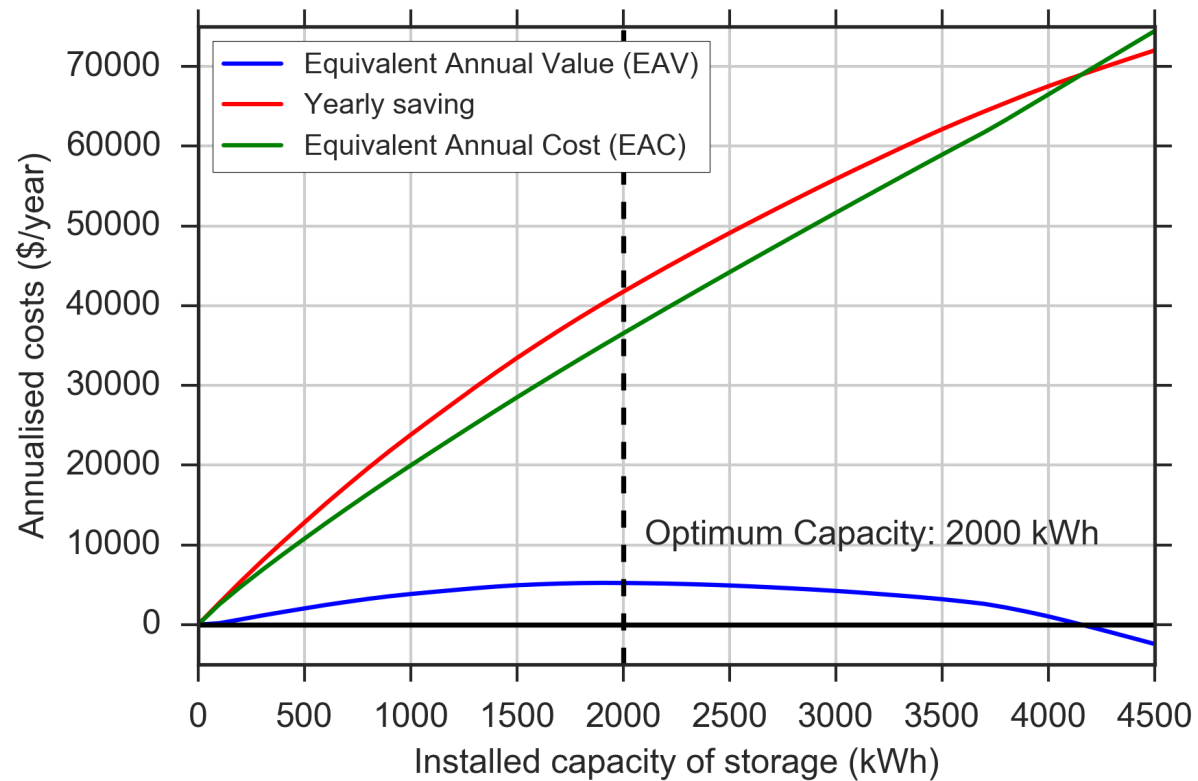
MORE BATTERY EXPLORATION

Consider a future electricity price of \$0.30/kWh...

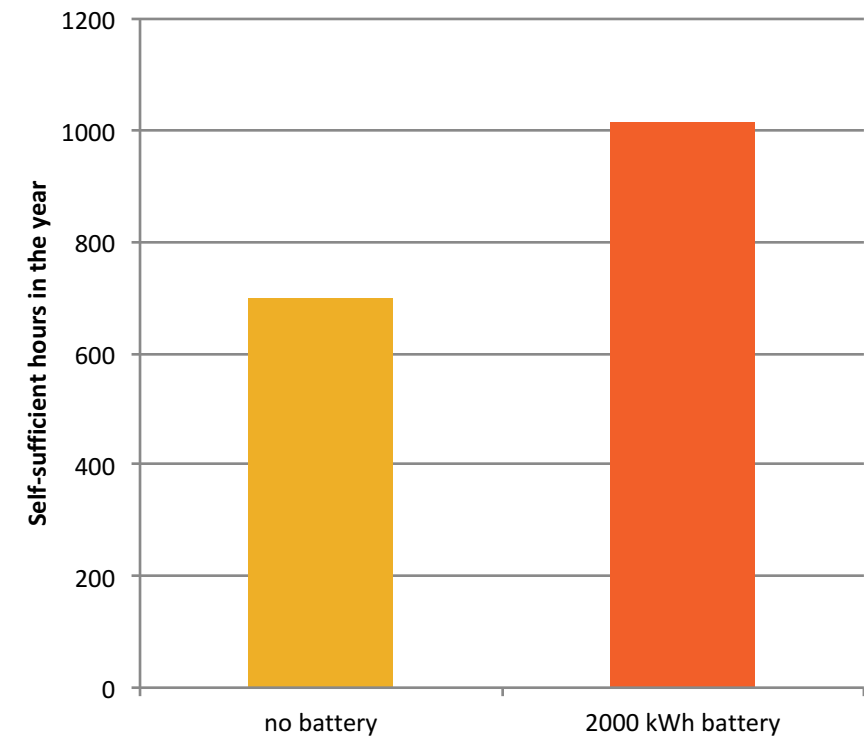


MORE BATTERY EXPLORATION

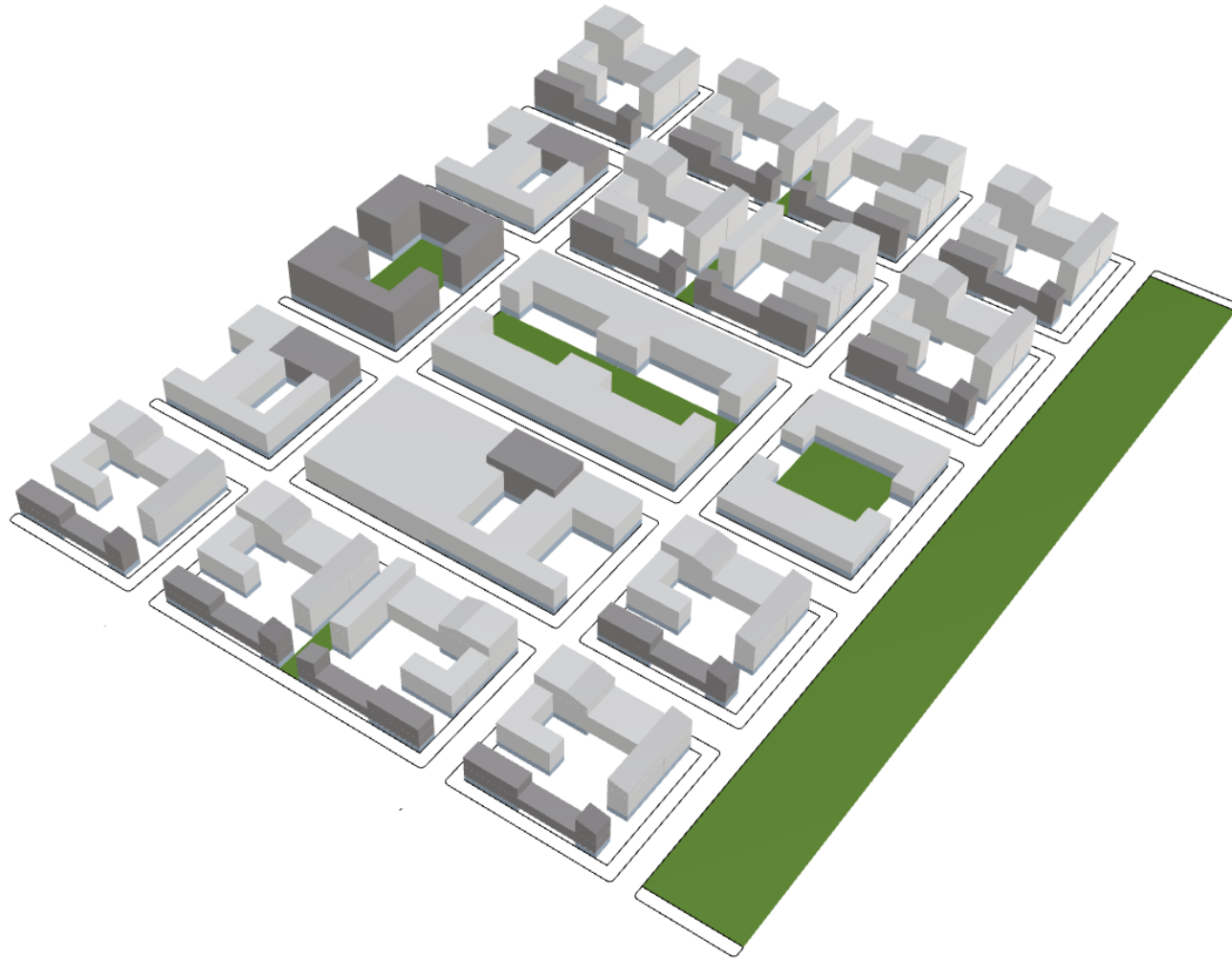
Consider a future electricity price of \$0.30/kWh...



>1,000 hours of self- sufficiency/ year



IN SUMMARY...



sDA **49**

Final EUI: **63**

Walk Score: **92**

BOSTON ZERO: OUT

Greg Hopkins
Ed Barbour
Jiamin Sun
Danya Littlefield

