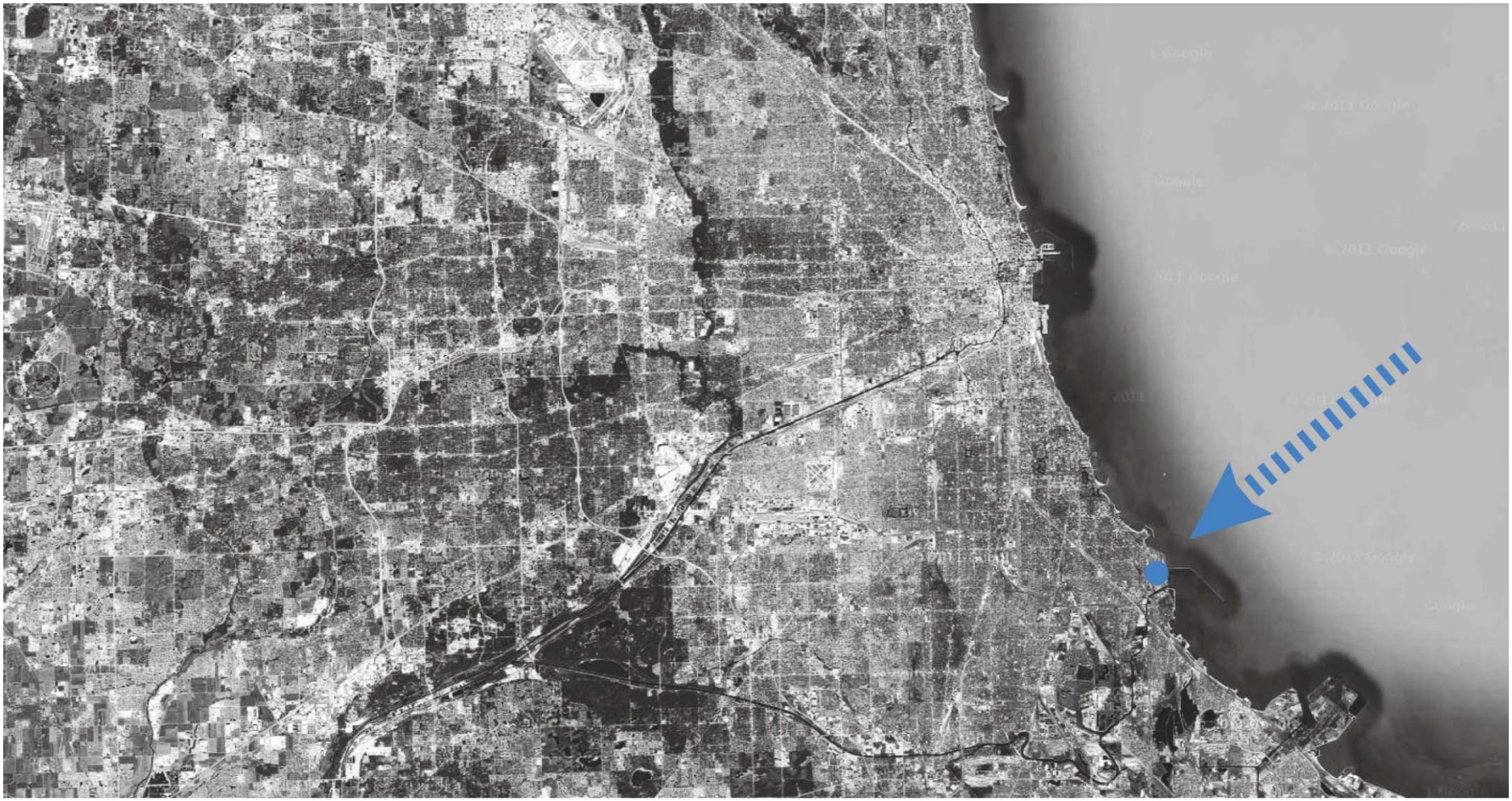
CHICAGO

Travis Bost + Elliot Glassman + Jean Yu

Site: calumet river/south chicago, IL



Site: calumet river/south chicago, IL

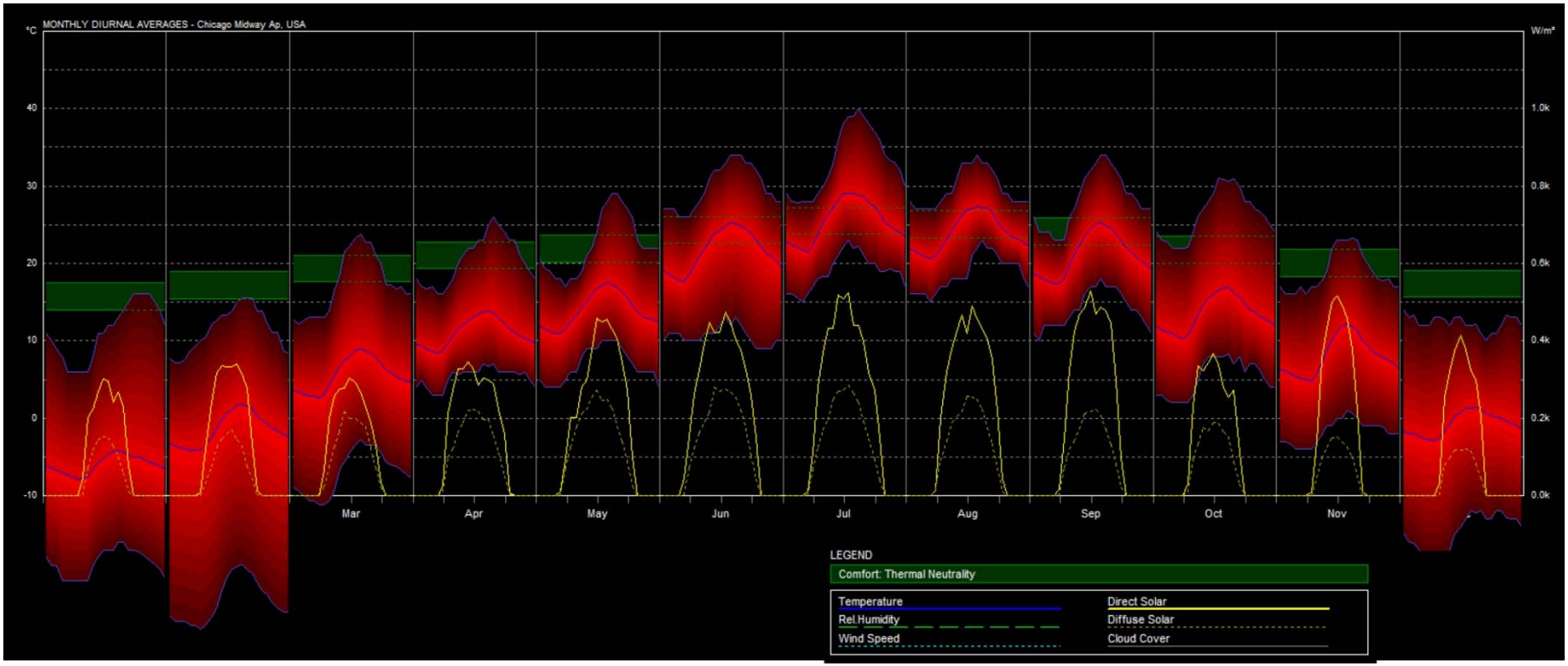
Site: calumet river/south chicago, IL

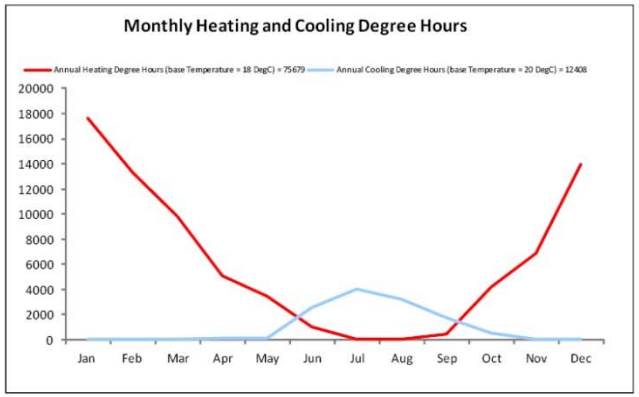
_ former US Steel Factory
_ built on fill
_ barge slip remains
_ concrete pad foundations remain
_ brick slag containment walls remain
_ subject to lakefront micro-climate
_ isolated neighborhood
_ extreme climate [summer/winter]

Goals for Sustainability

_ mixture of uses to create walk-able neighborhood for work and living
_ energy balance between program elements
_ on-site energy generation
_ use site attributes to benefit sustainability
_ create local industry to replace former role of site
_ address outdoor comfort

Climate Analysis : temperature analysis





Heating Degree Hours for 18 C — Annual 75679

Cooling Degree Hours for 20 Deg C — Annual 12408

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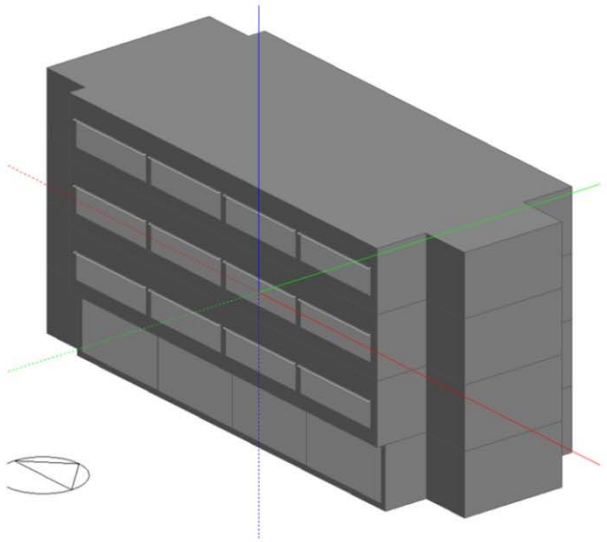
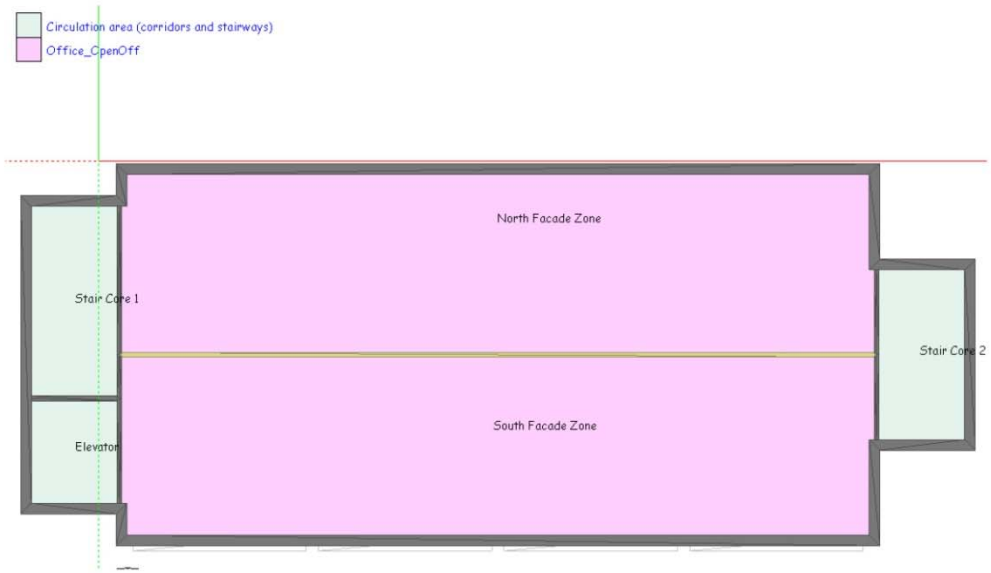
Simulation Model: Office Prototype





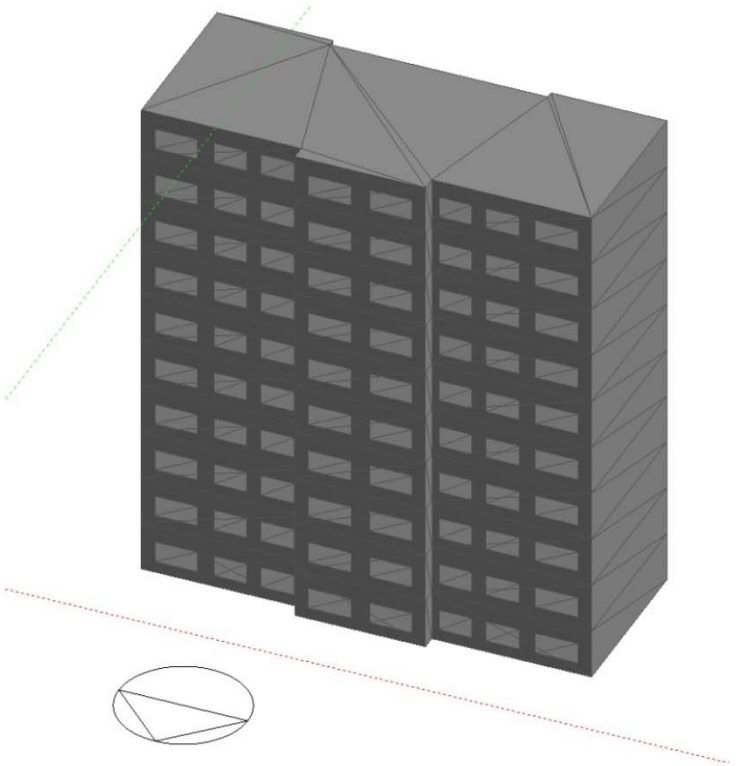
The office prototype is a mid-rise building with three stories of open office space. The building is a narrow floor plate oriented from east to west to maximize the opportunities for daylight and ventilation. The core elements are on the west and east facades.

Construction
- A well insulated envelope. U value: 0.250 W/m2-K

Openings
- 40% WWR. Double glazed, low e glass

HVAC
- Hot water radiator heating, mixed mode with nat vent, local comfort cooling

Simulation Model: Residential Prototype



The residential prototype is a ten story tower. Each building holds forty units, four units per floor. Ten of these buildings will be necessary to provide the 400 units required.

While ideal solar orientation is east to west, the views to the lake are to the north (lake and Chicago skyline) and the value of that could not be ignored. Therefore the building has been oriented so that each unit will provide a view to the lake.

Construction
- A well insulated envelope. U value: 0.161 W/m2-K

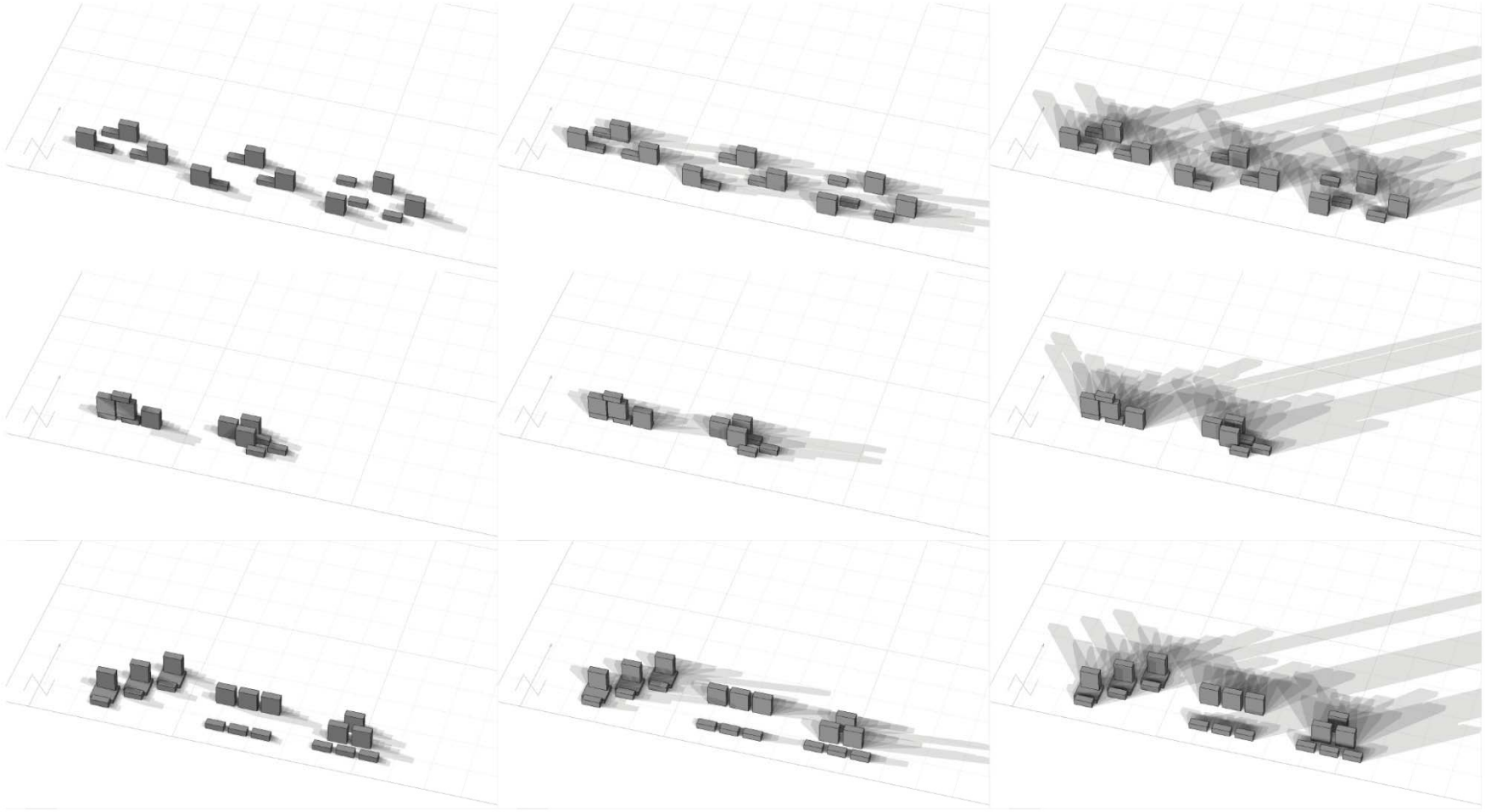
Openings
- 30% WWR. Double glazed, low e glass

HVAC
- Packaged terminal usage with heat recovery

Protoblocks: Strategies for Configuration

_ maintain view to lake/chicago
_ create open spaces between buildings for recreation
_ maintain outdoor comfort in those spaces, solar access
_ maximize on-site energy generation
_ reduce travel distance to work
_ address outdoor comfort

Protoblocks: Shadow Range Studies (1 Hr Time Step)



Summer Solstice

Equinox

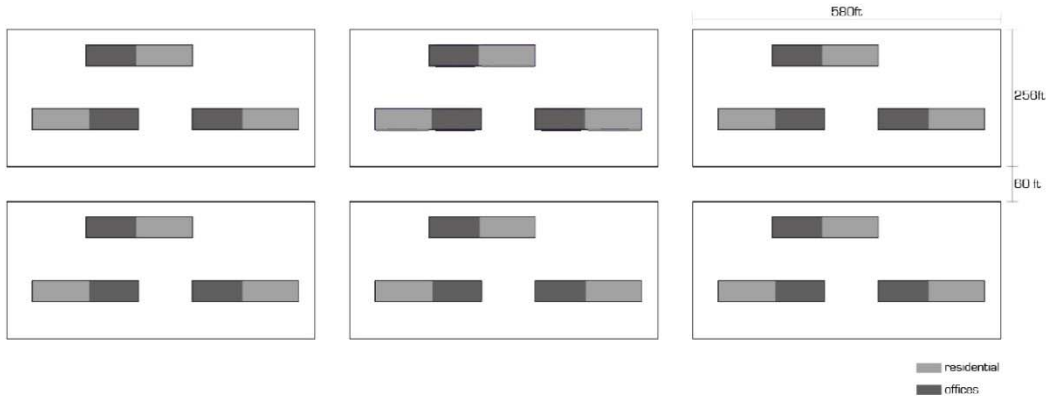
Winter Solstice

Protoblocks: Site Plans

Option 1

Density:

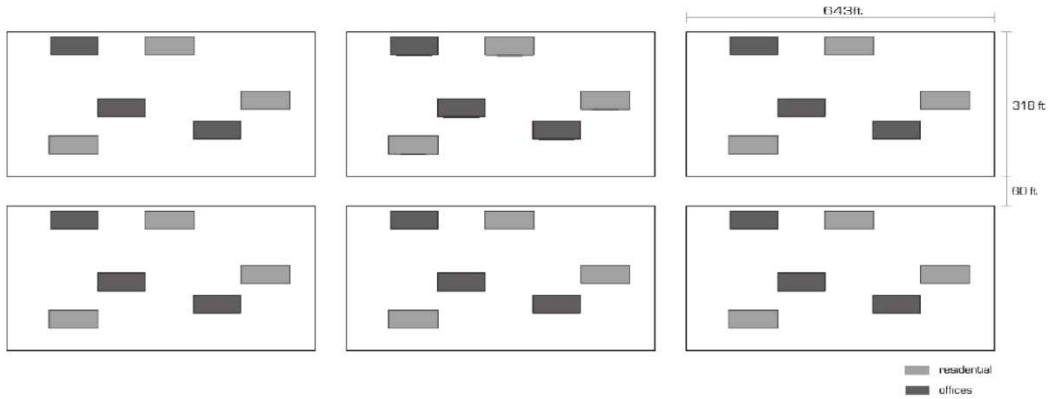
1.0 FAR
19.3 m2/person



Option 2

Density:

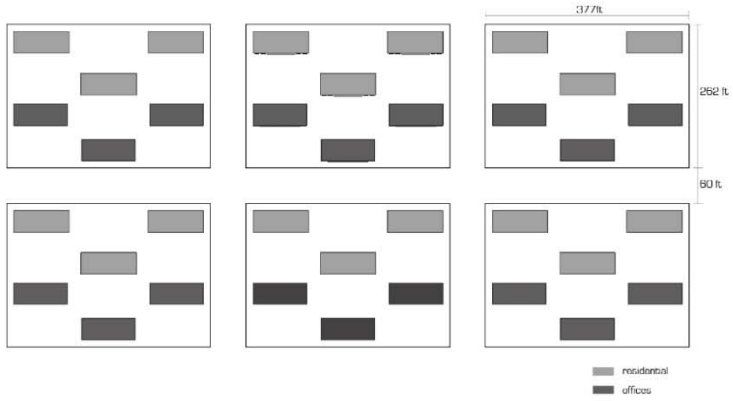
0.75 FAR
26.39 m2/person



Option 3

Density:

1.5 FAR
12.69 m2/person



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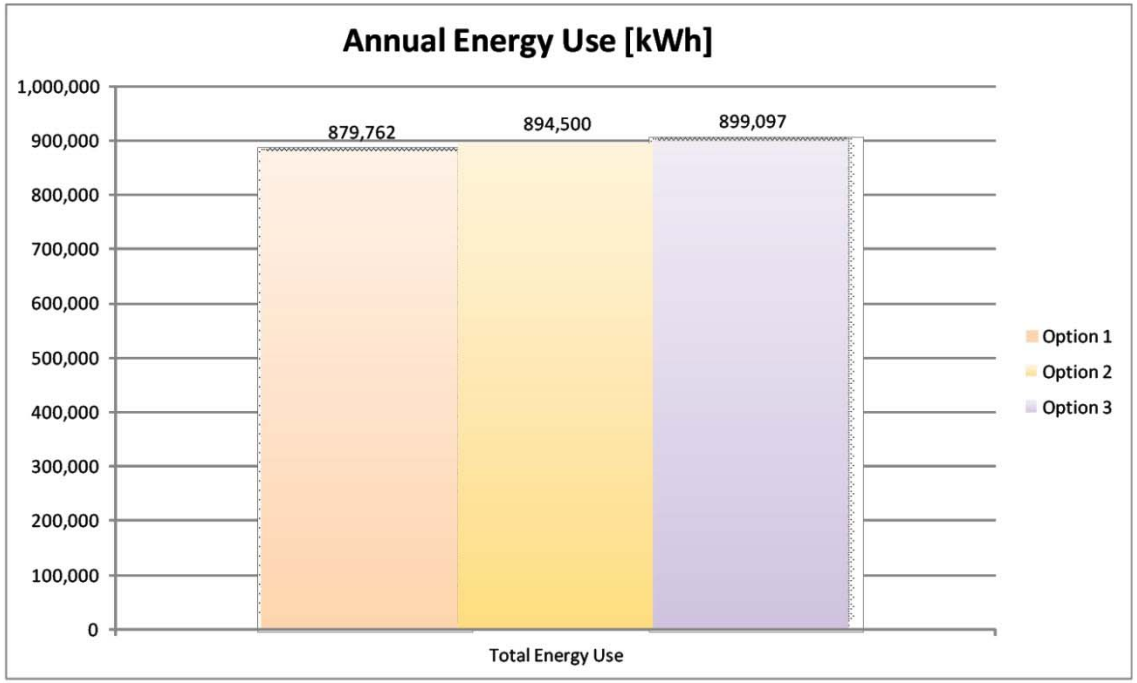
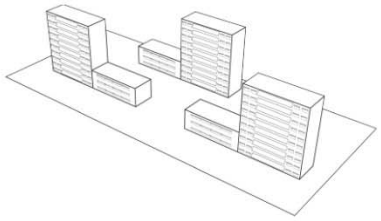
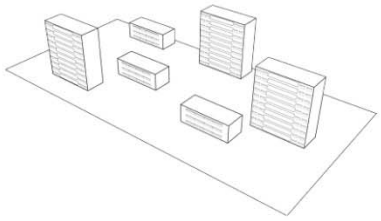
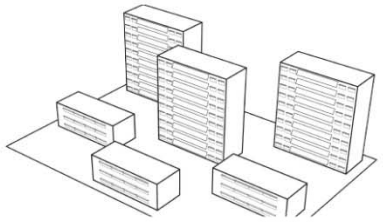
Protoblocks: Annual Simulation Results



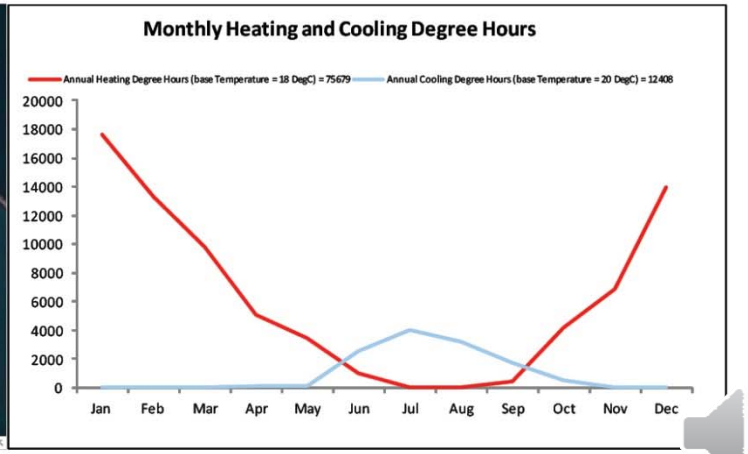




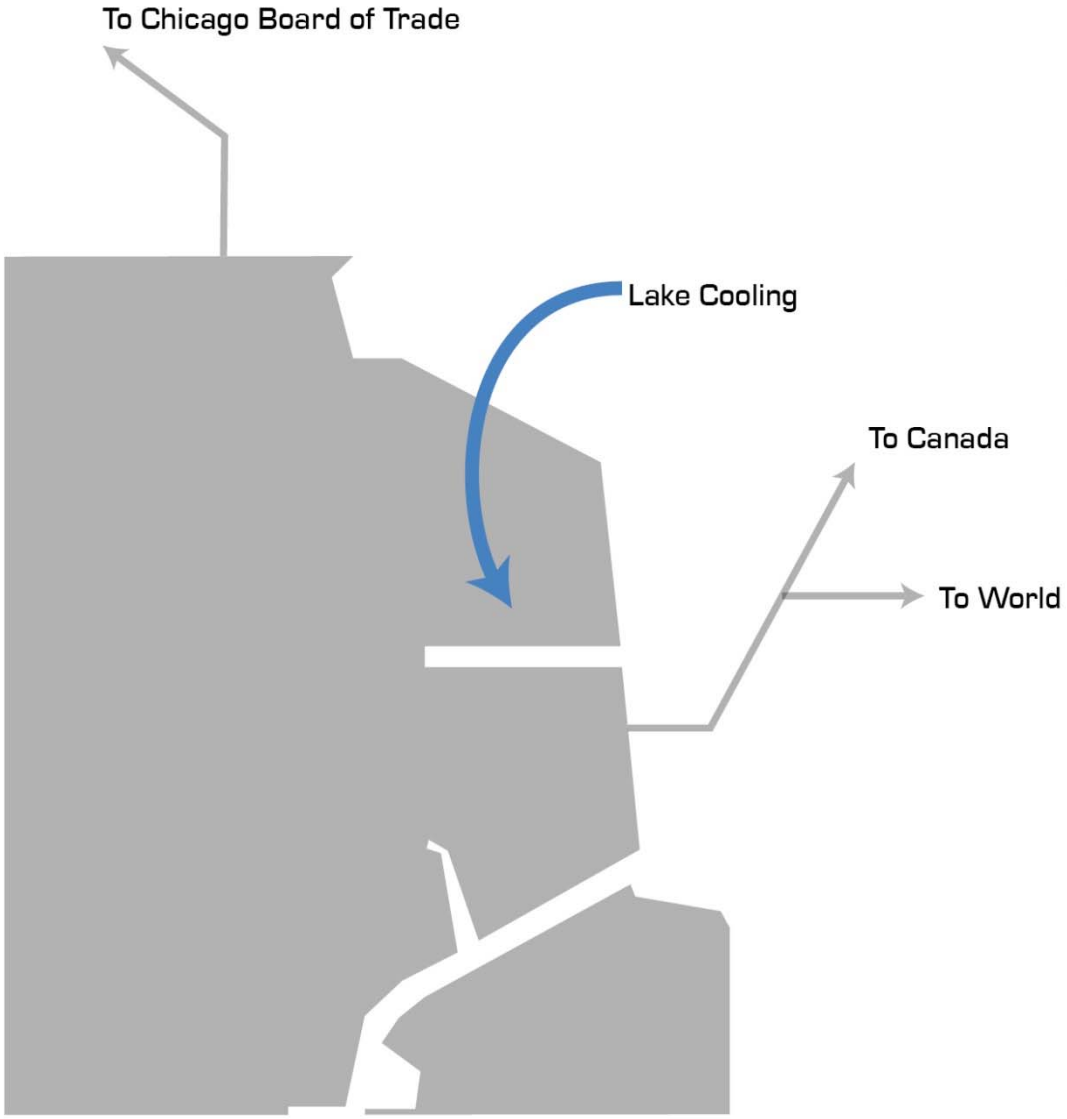


Adapting to Site and Program : goals in context

_ mixture of uses to create walk-able neighborhood for work and living
_ energy balance between program elements
_ on-site energy generation
_ use site attributes to benefit sustainability
_ create local industry to replace former role of site
_ address outdoor comfort

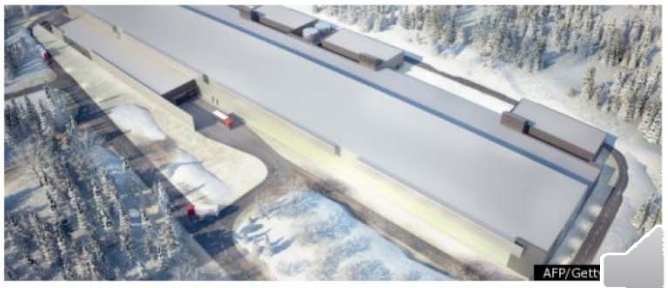


Data Center : suitability and precedents



US Steel - Southworks Chicago

Facebook - Prineville, OR



Google - Hamina, FI

CHICAGO

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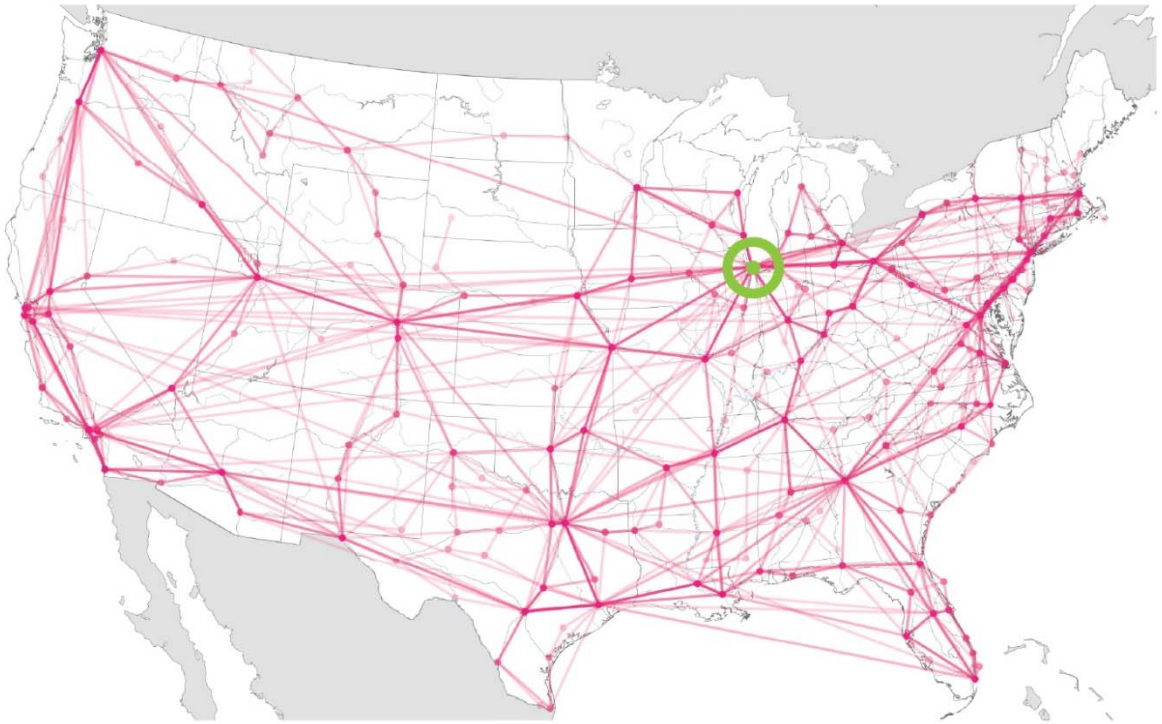
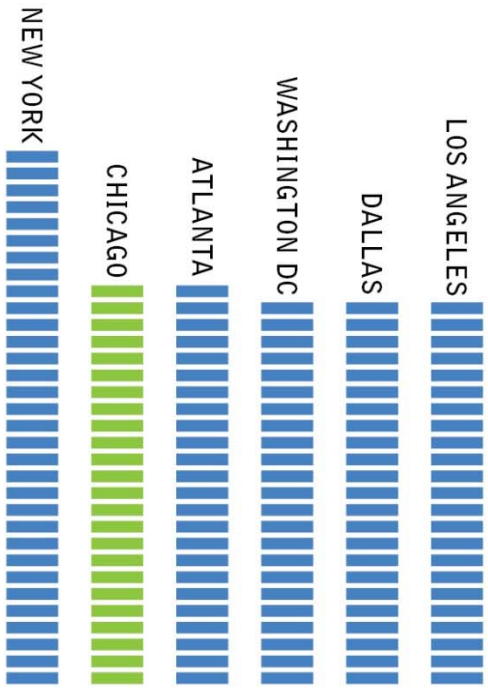
Data Center : suitability



NATIONAL FIBER OPTIC NETWORK



TOP US INTERCHANGES

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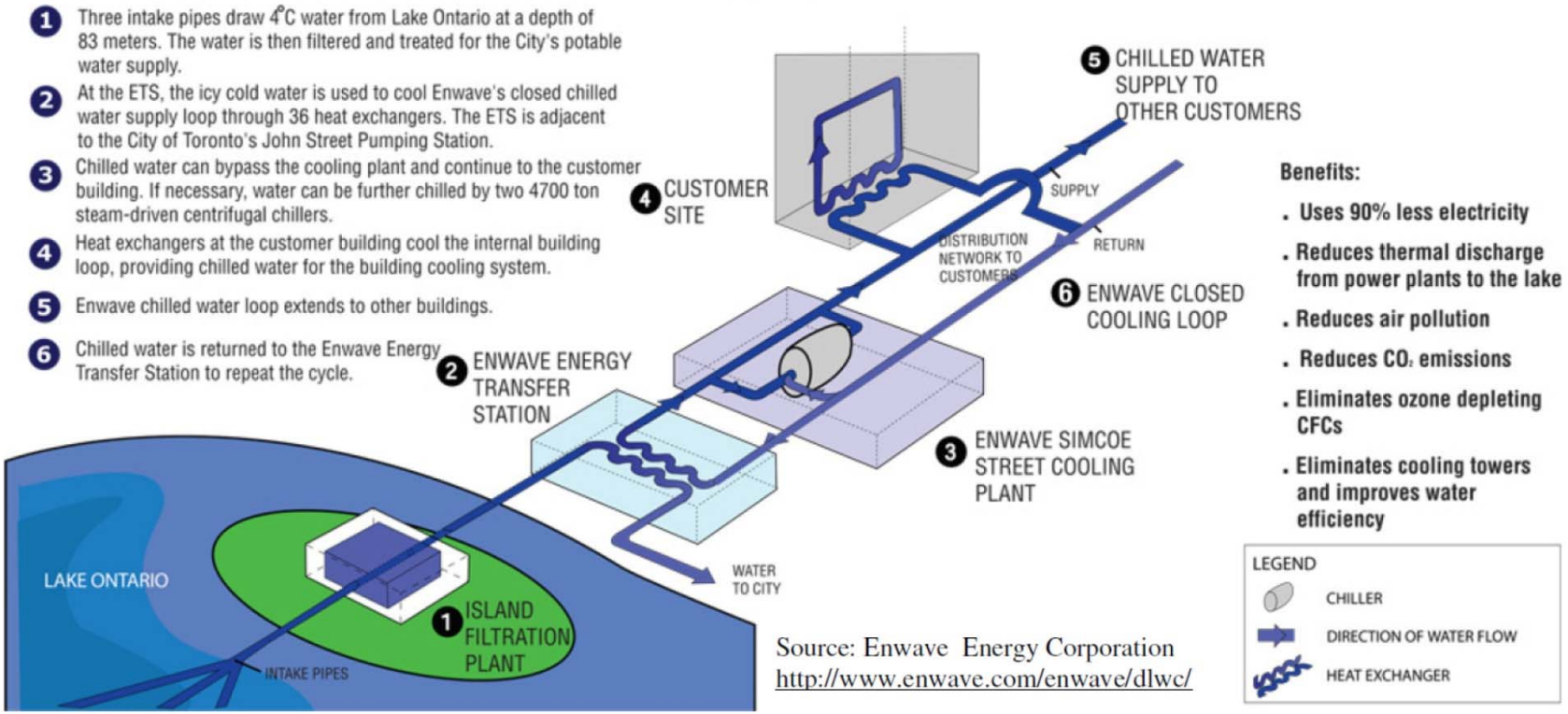
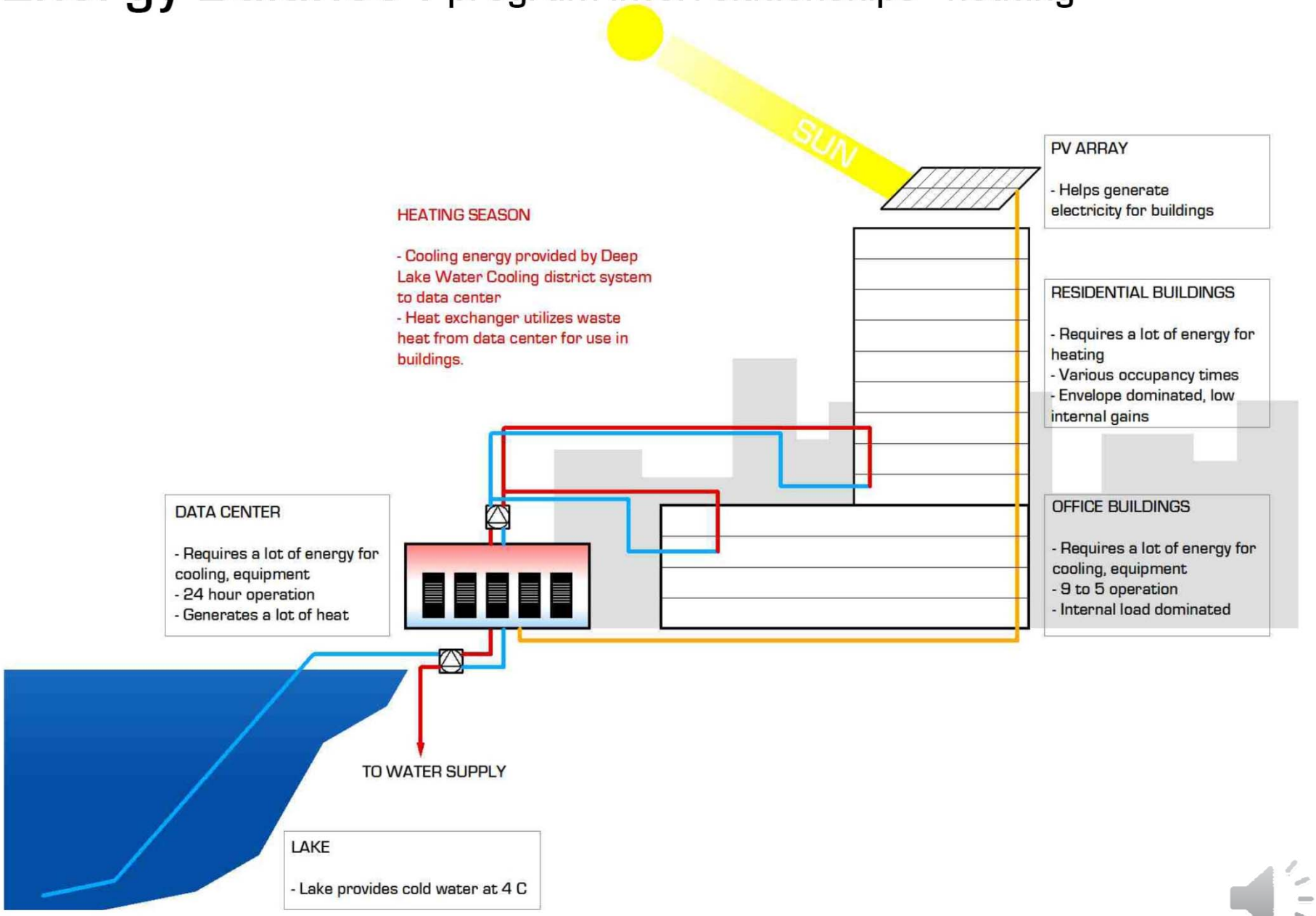
Deep Lake Water Cooling : process explained



Source: Enwave Energy Corporation
http://www.enwave.com/enwave/dlwc/

Energy Balance : program interrelationships - heating



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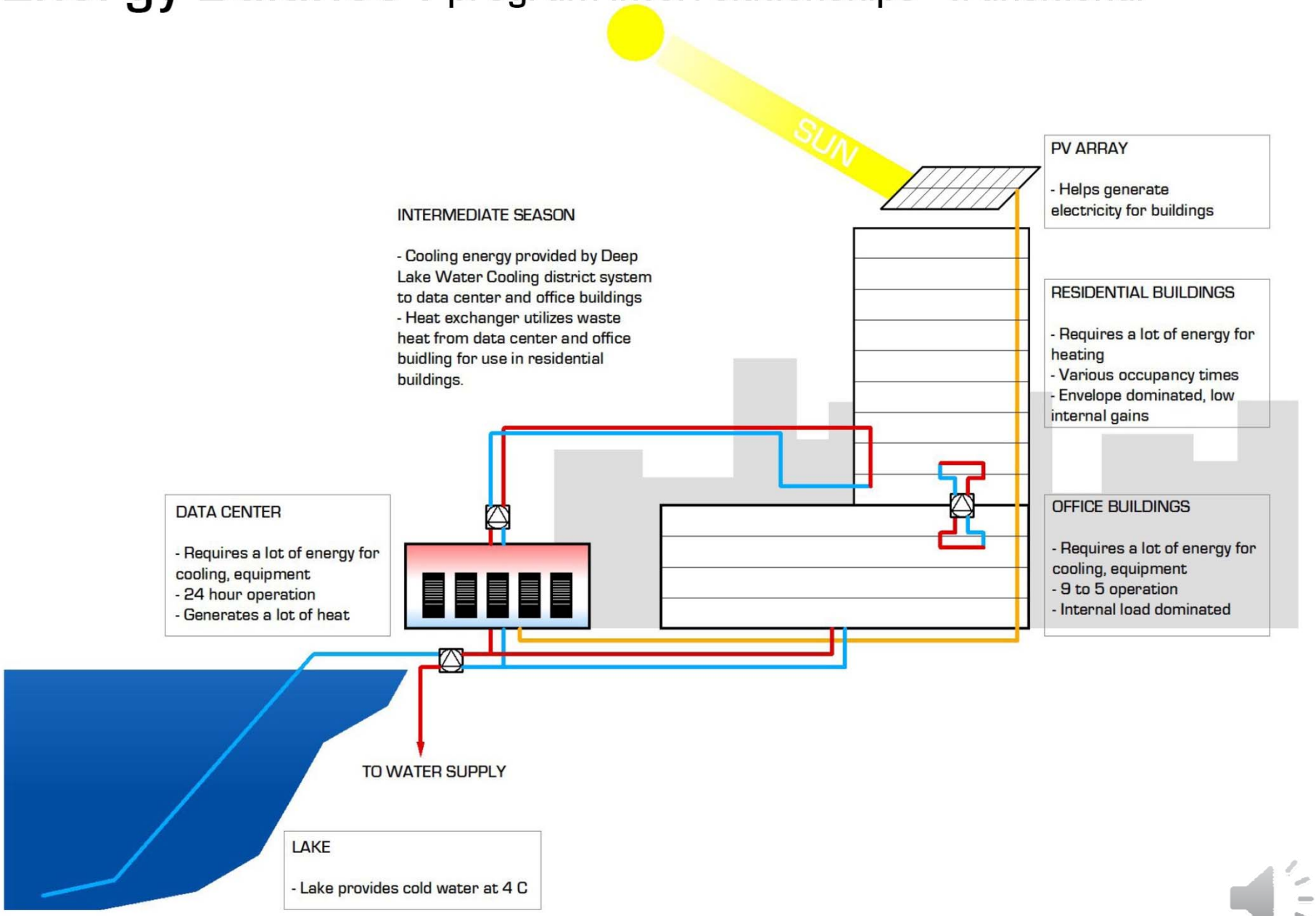
Energy Balance : program interrelationships - transitional



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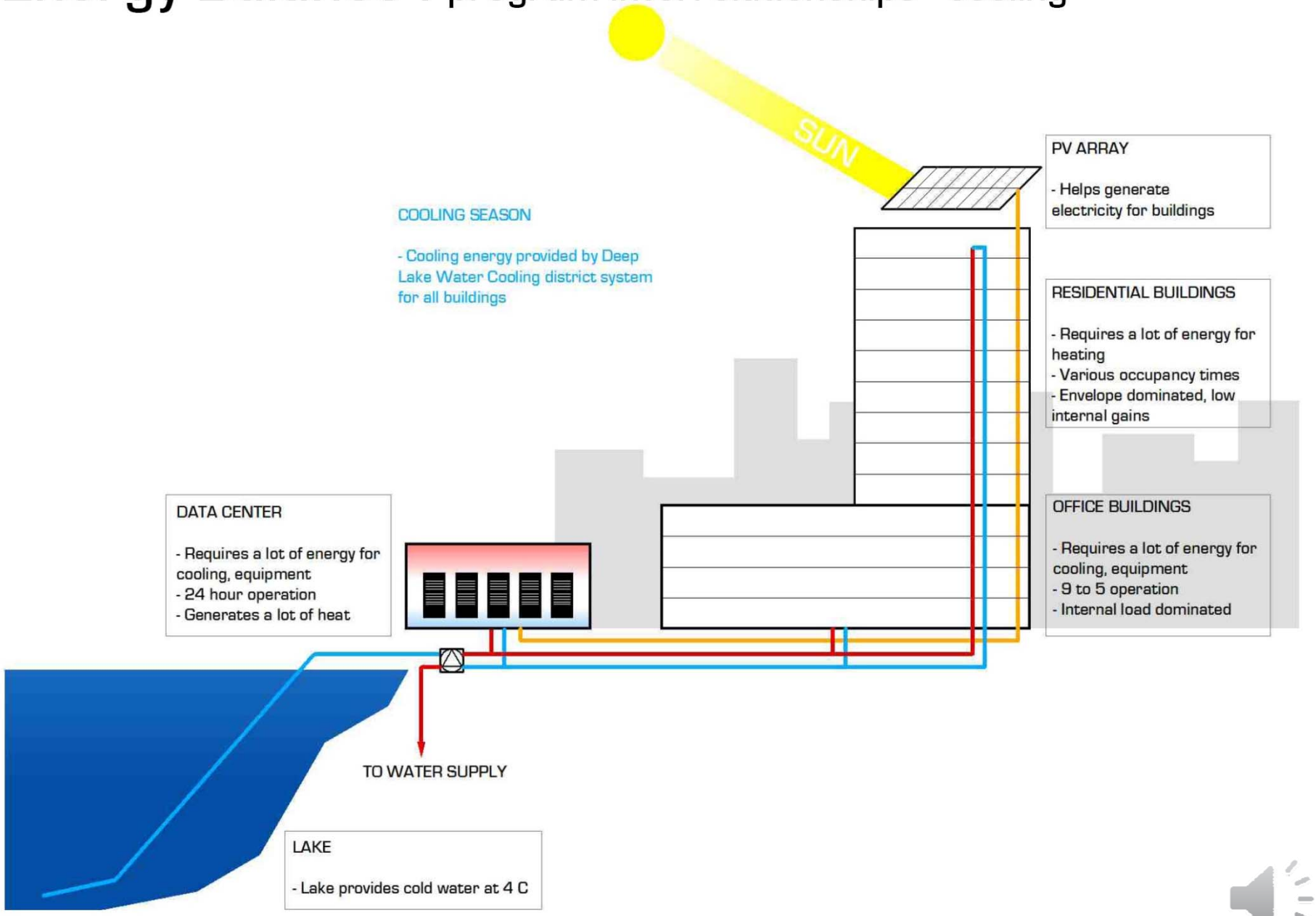
Energy Balance : program interrelationships - cooling



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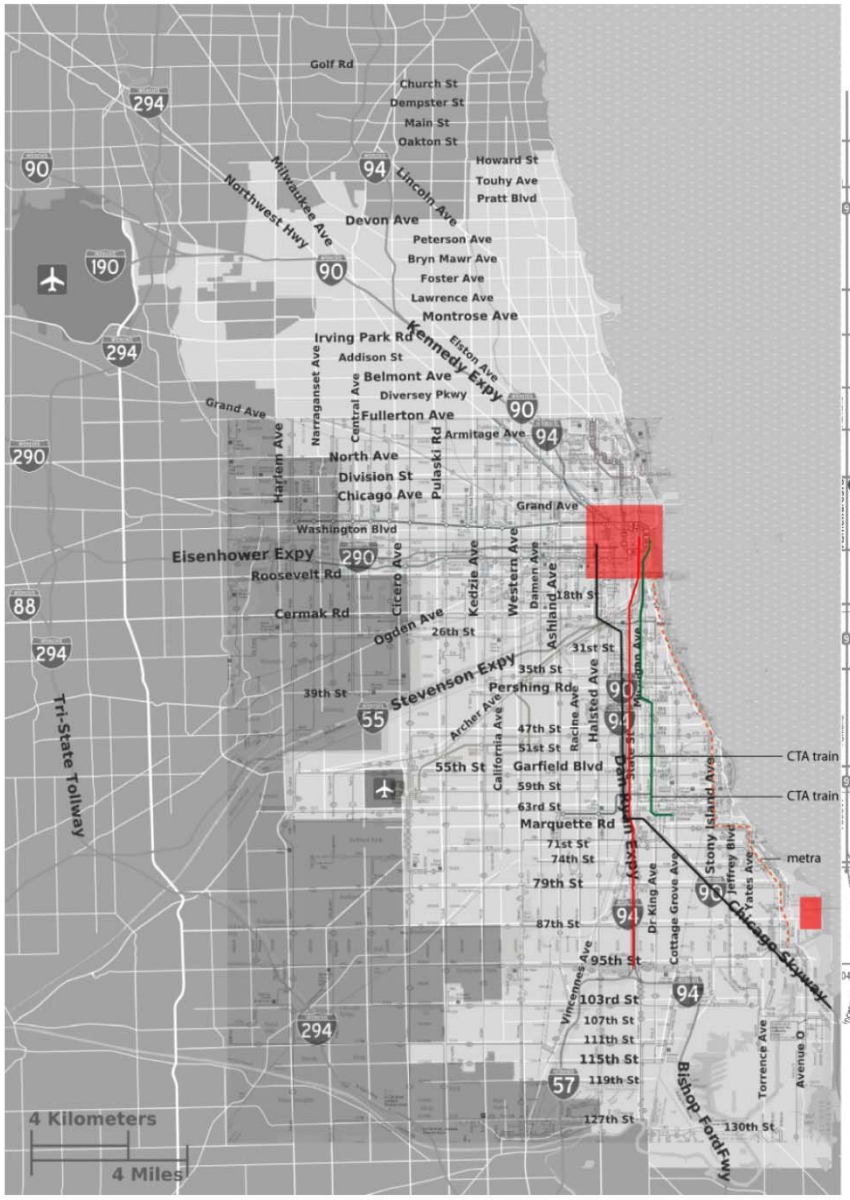
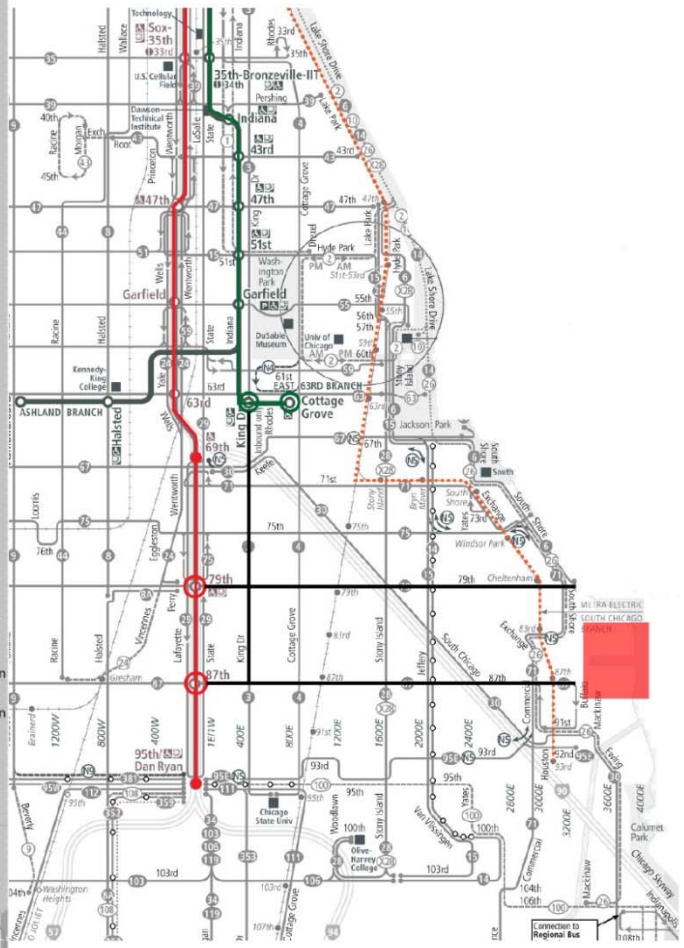
Metro Region : transportation





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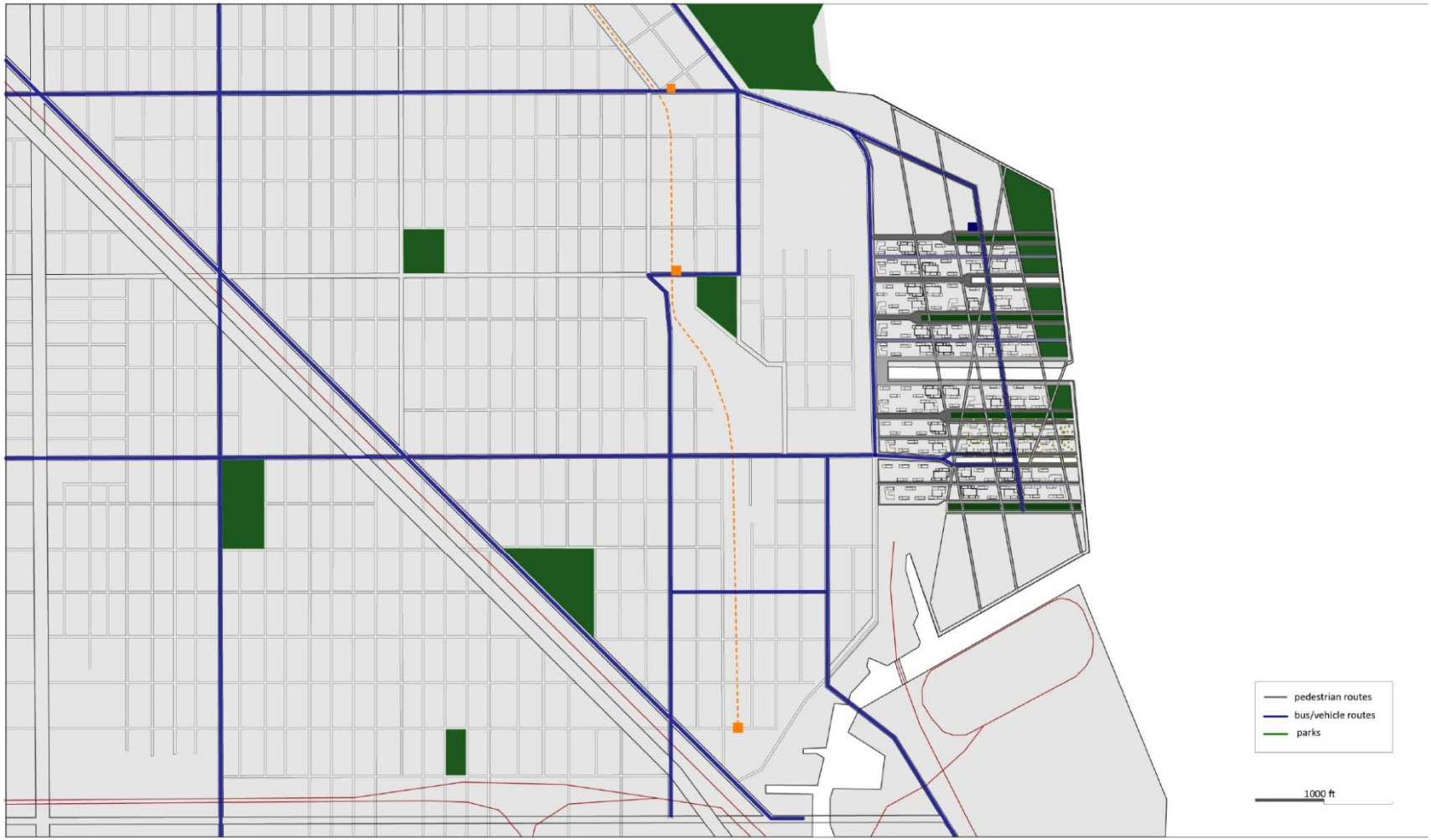
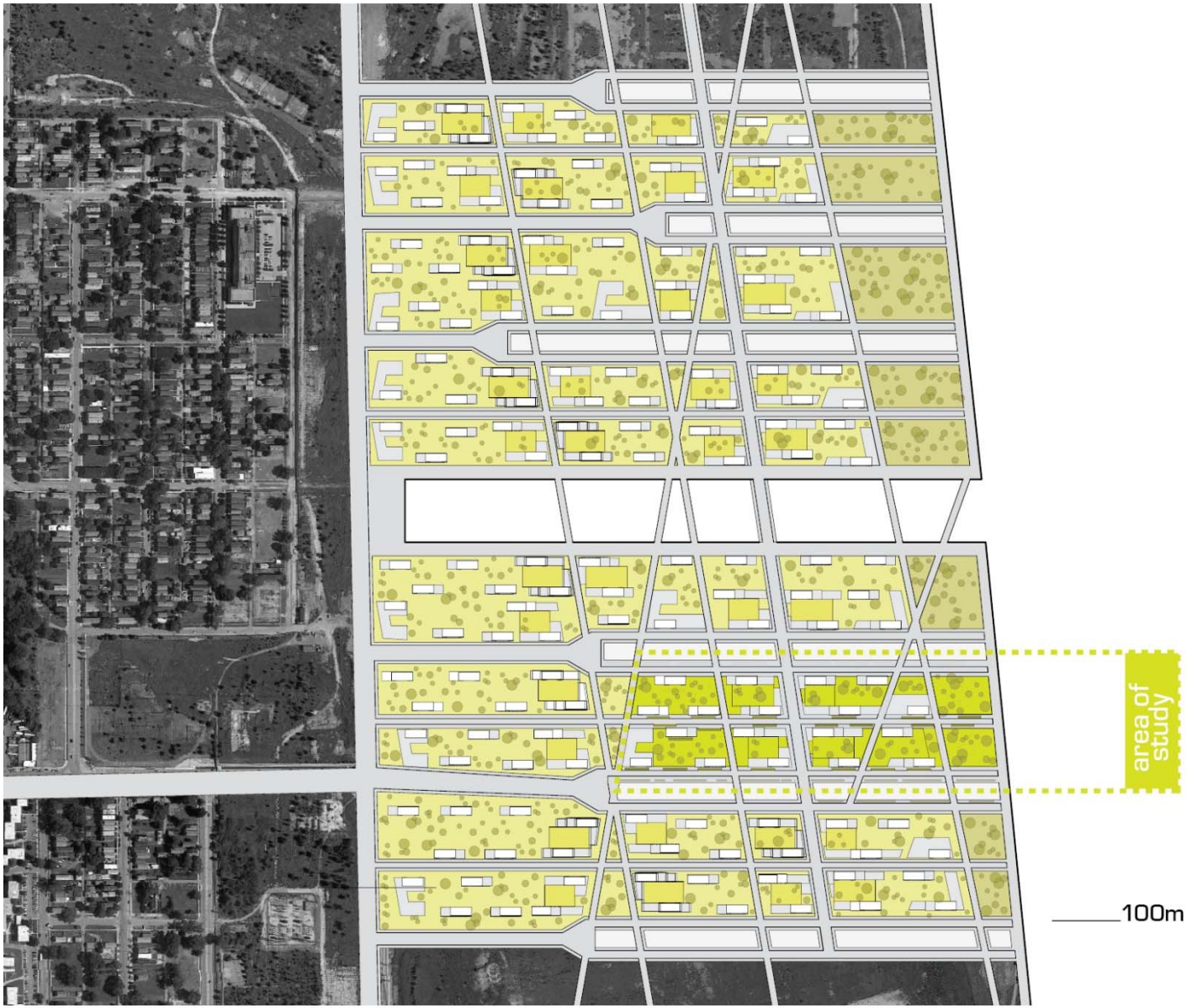
Metro Region : existing infrastructure

Metro Region : proposed connections



Site Plan : overview



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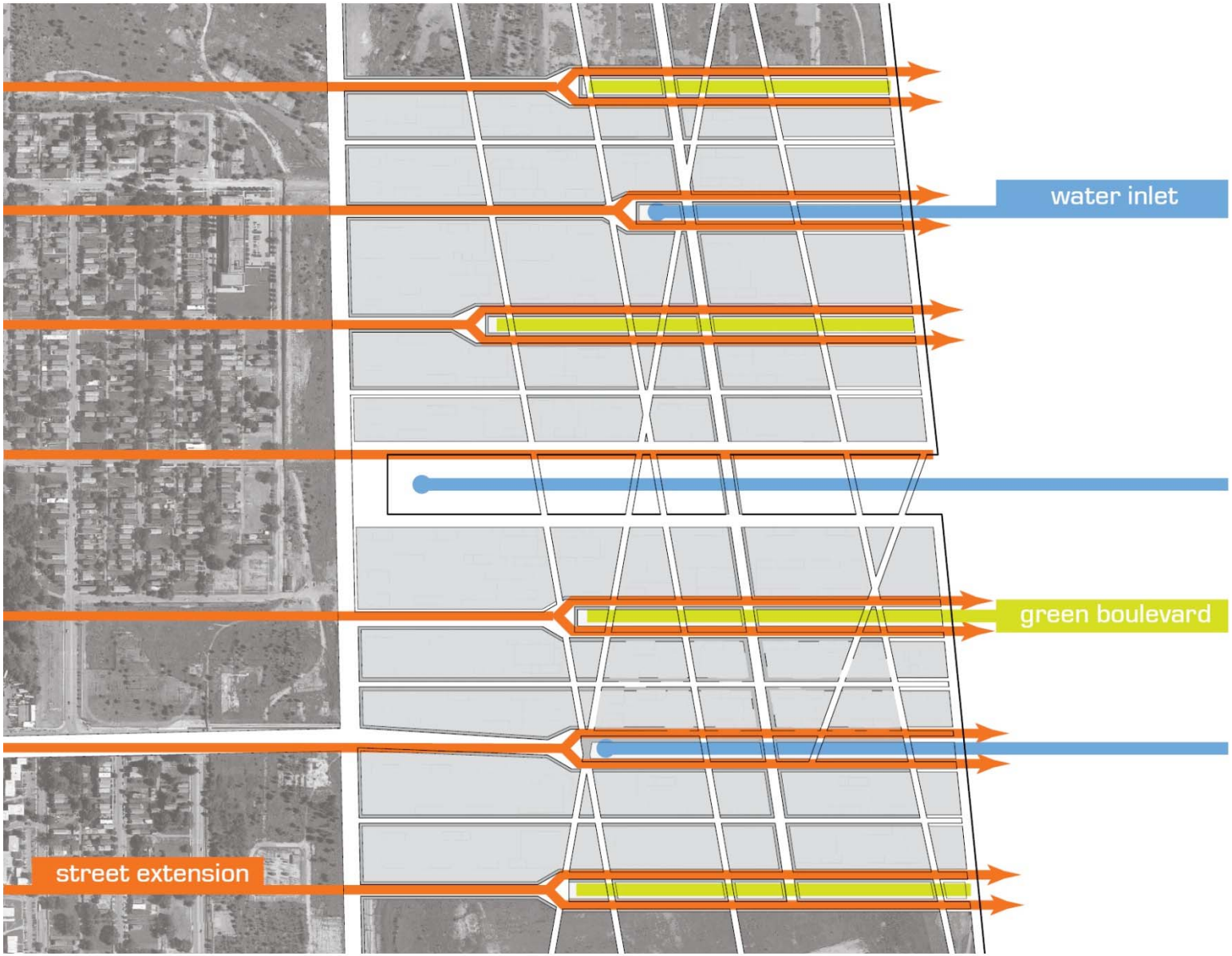
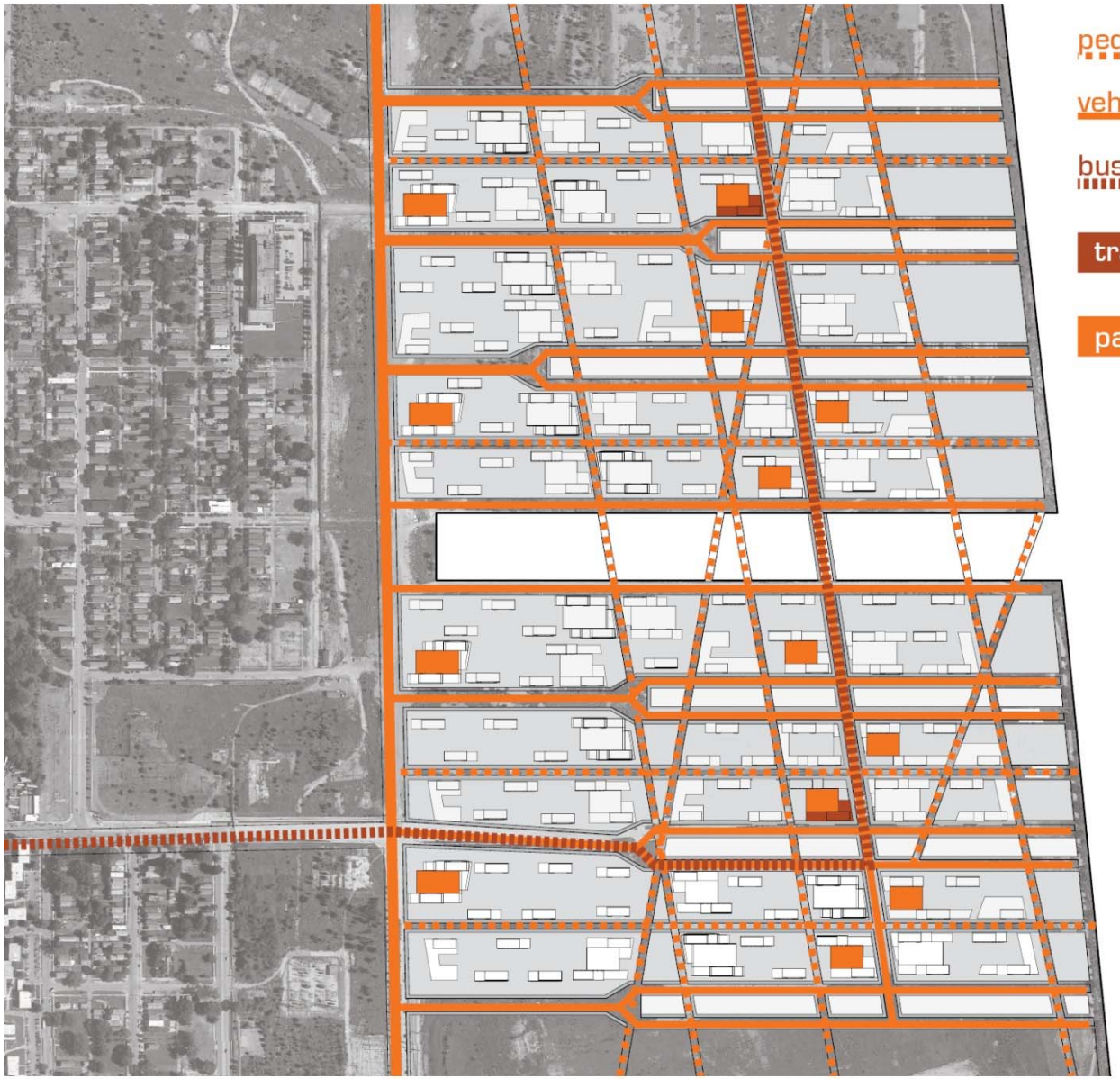
Site Plan : grid diagram



Site Plan : transportation diagram



pedestrian path

vehicle street

bus line

transit station

parking structure

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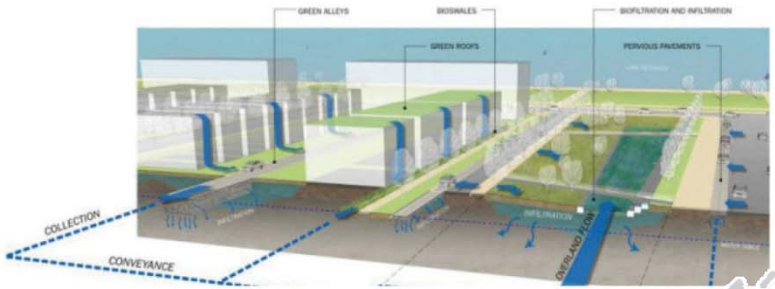
Site Plan: data center locations

Travis Bost + Elliot Glassman + Jean Yu

SOM masterplan : comparison

TEAM CHICAGO	SOM
Our energy-based design interfaces with SOM water-oriented scheme	
transit corridor onto site, avoid neighborhood	transit corridor separates development
heirarchy of roads favoring pedestrians	limited road typologies scope
replace industry	leisure + retail
Both guard waterfront as public green space, connecting to larger park system	



Project Image : bird's eye view

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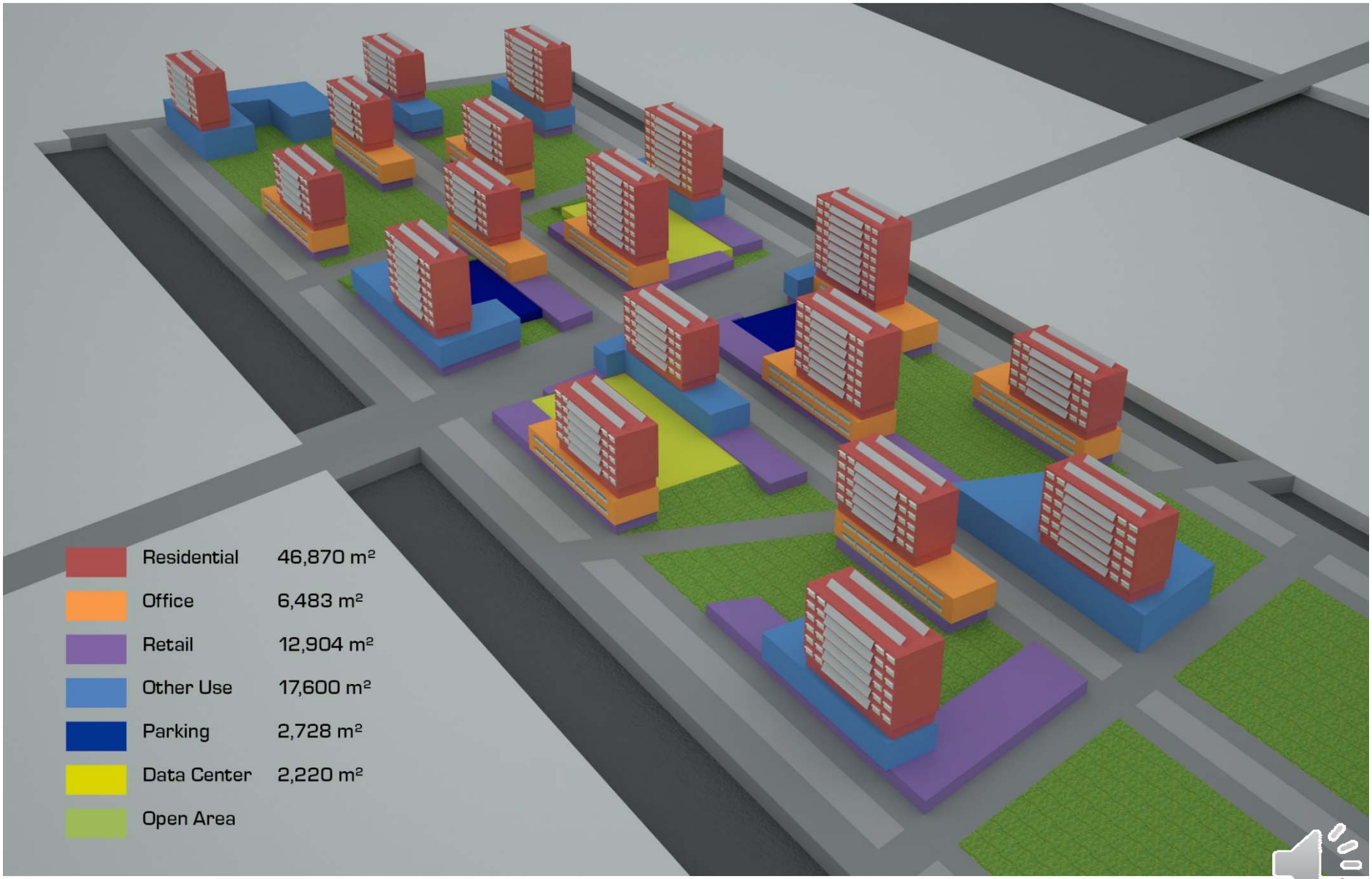
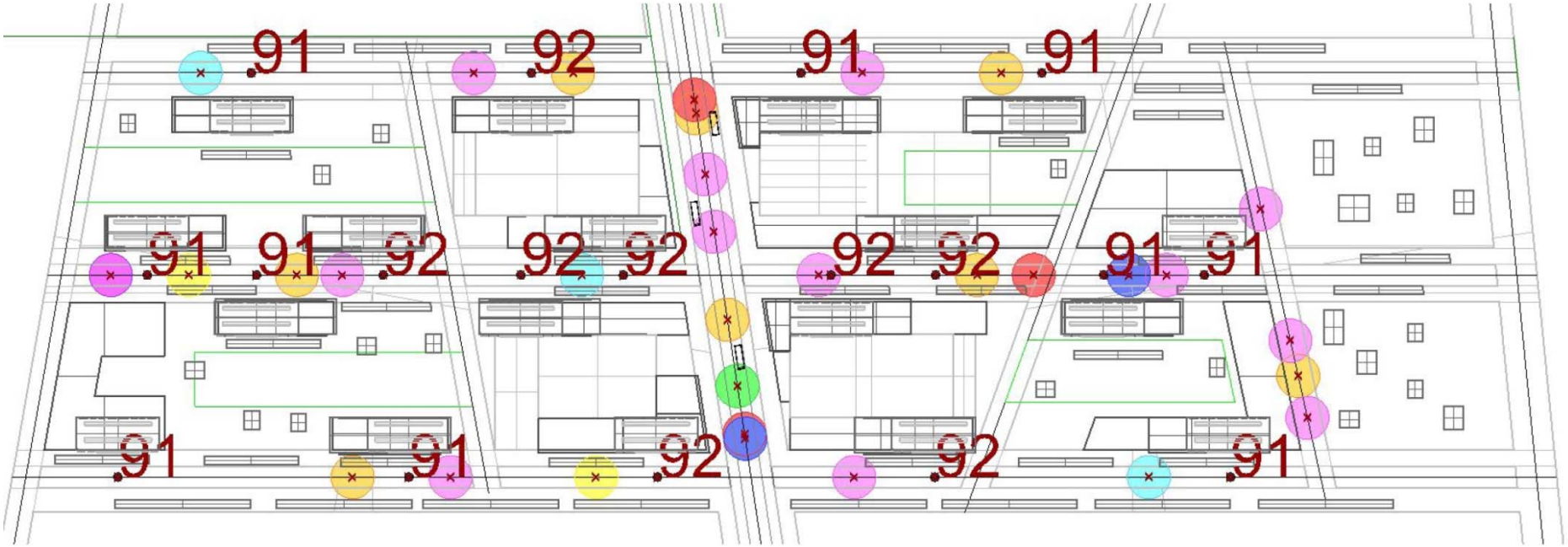
Project Program : floor area breakdown



Design Analysis : walk score



- Residential Entry
- Grocery
- Restaurants
- Shopping
- Banks
- Schools
- Book Store
- Entertainment
- Coffee Shop

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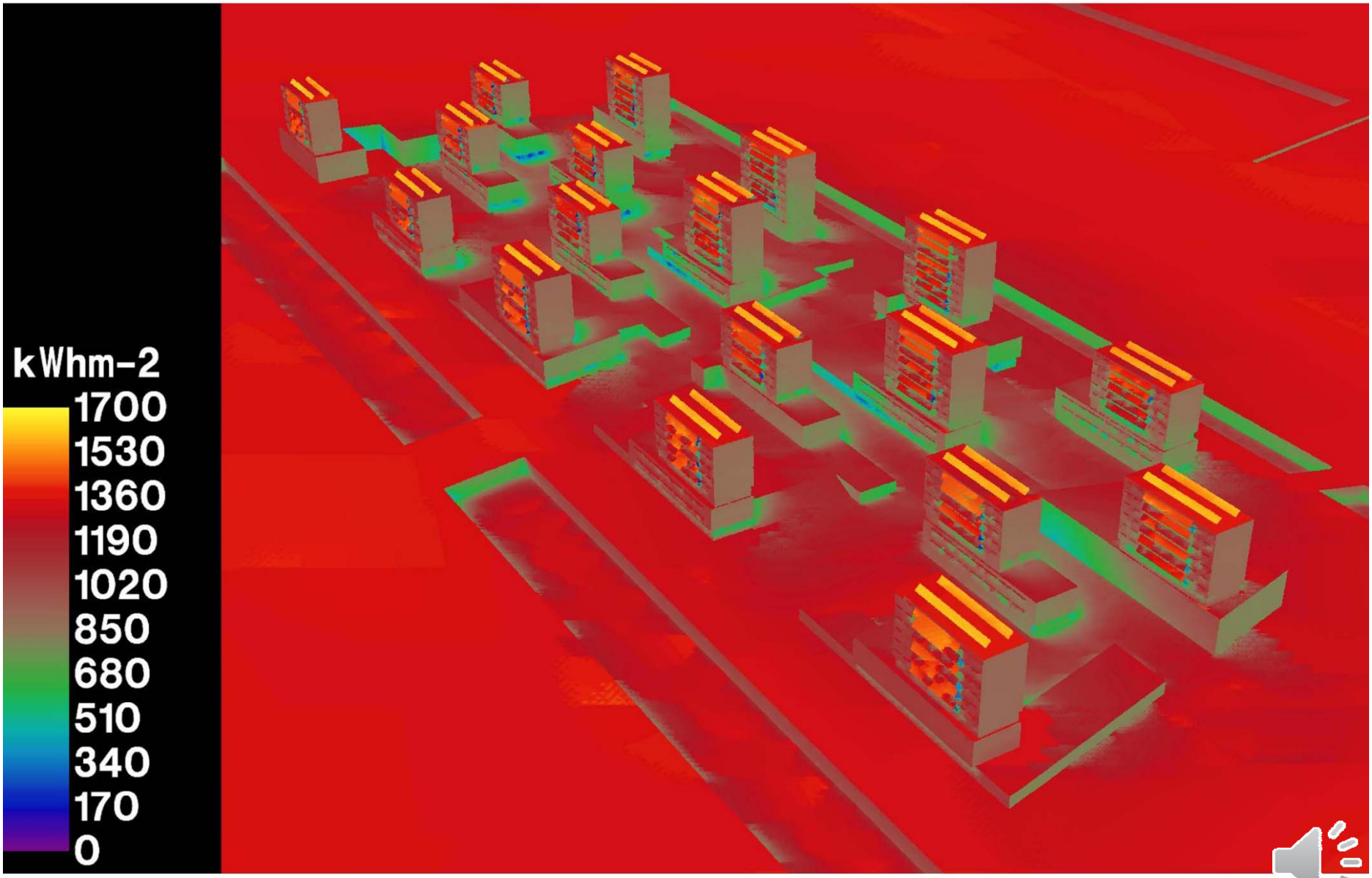
Design Analysis : radiation map



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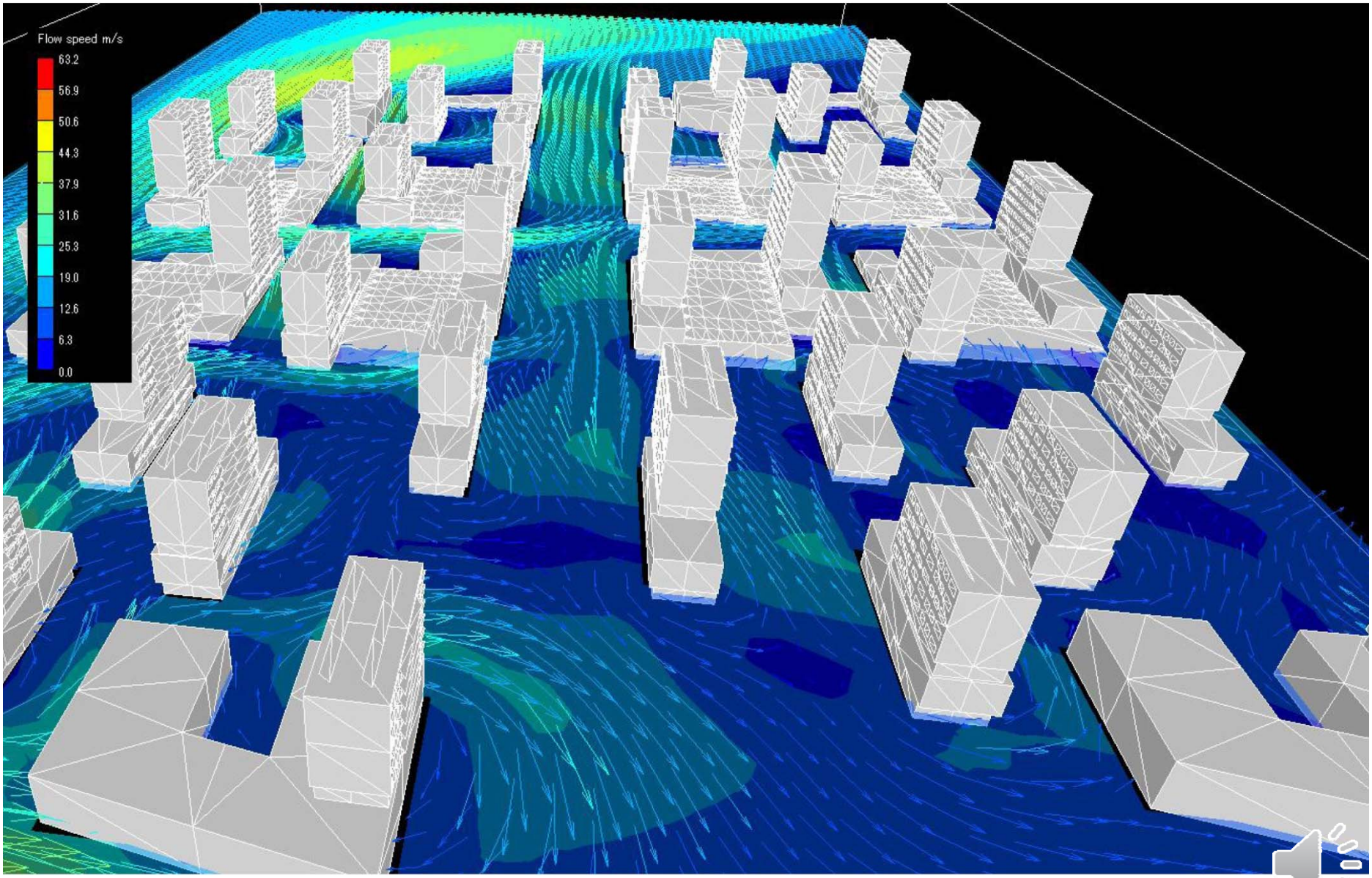
Design Analysis : wind comfort

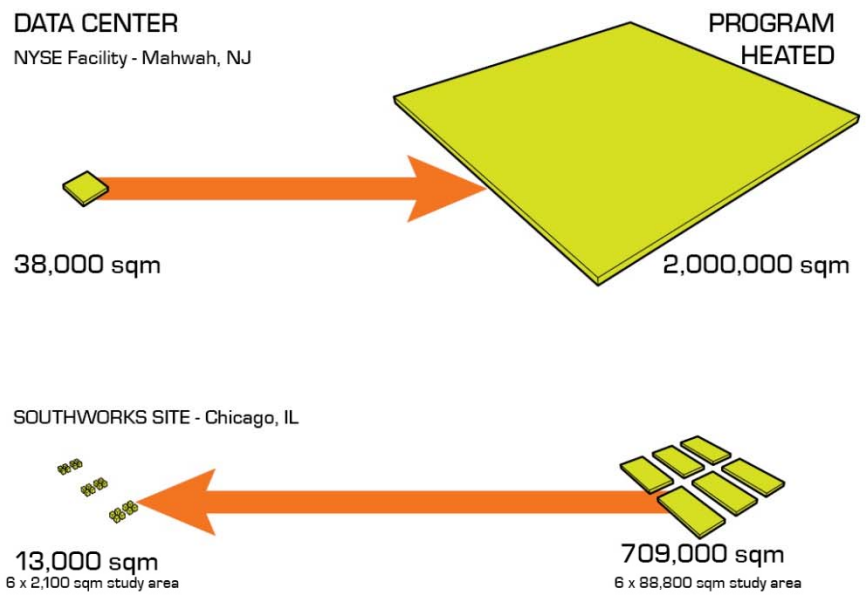


Site Energy Use : methodology

_ Simulated energy usage of urban design using UMI

_ Sized data center based on hourly heating needs

_ Simulated energy usage of data center using Design Builder



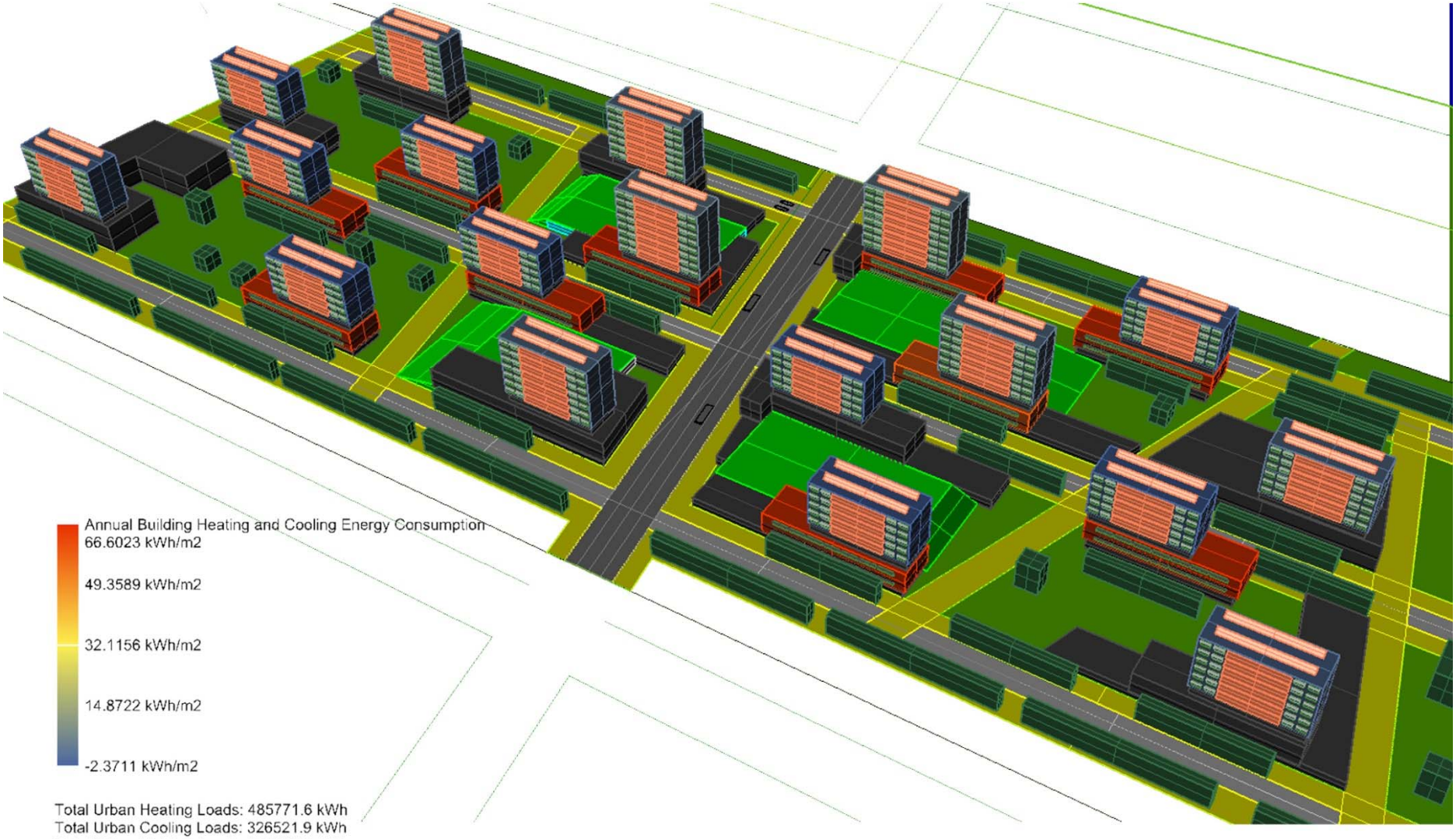
_ Used internal loads of data center simulation to offset heating energy use in buildings

Assumptions: 70% efficiency of heat recovery
10% additional loss in district transmission

_ Calculated effects of Deep Lake Water Cooling district cooling system

Assumption: Eliminate chiller energy
Double pump energy

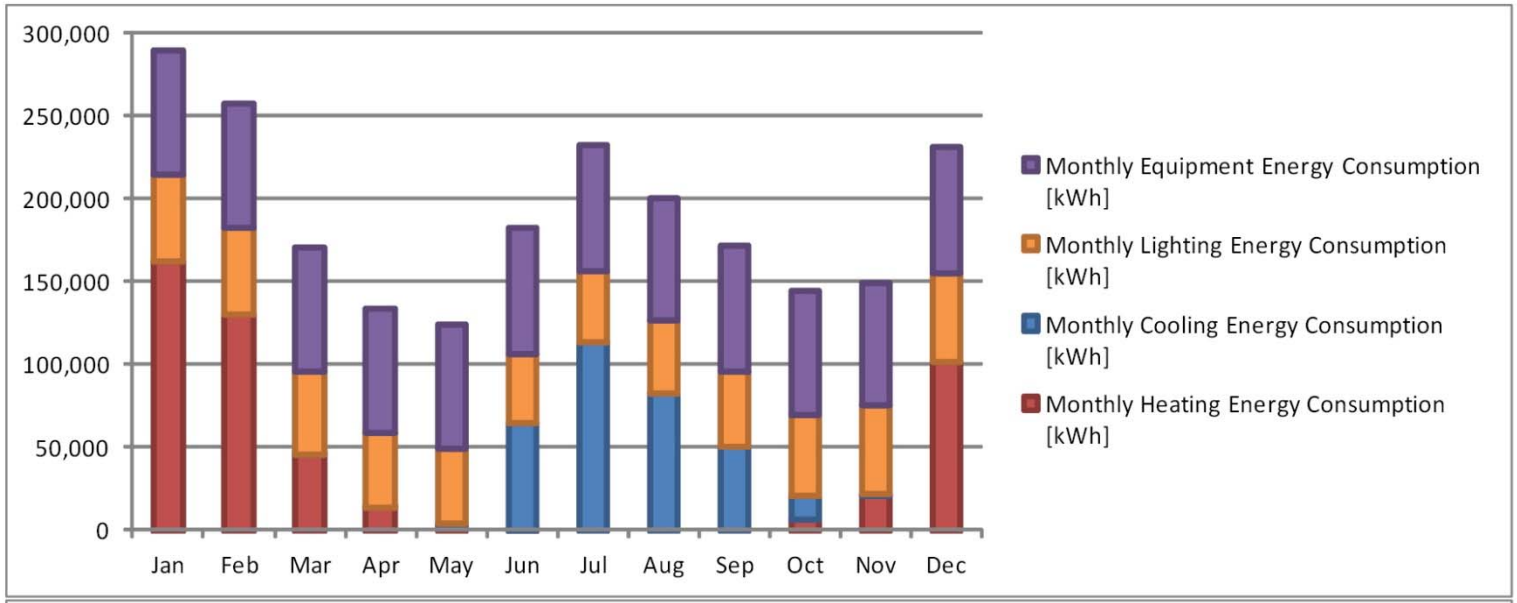
Site Energy Use : UMI results



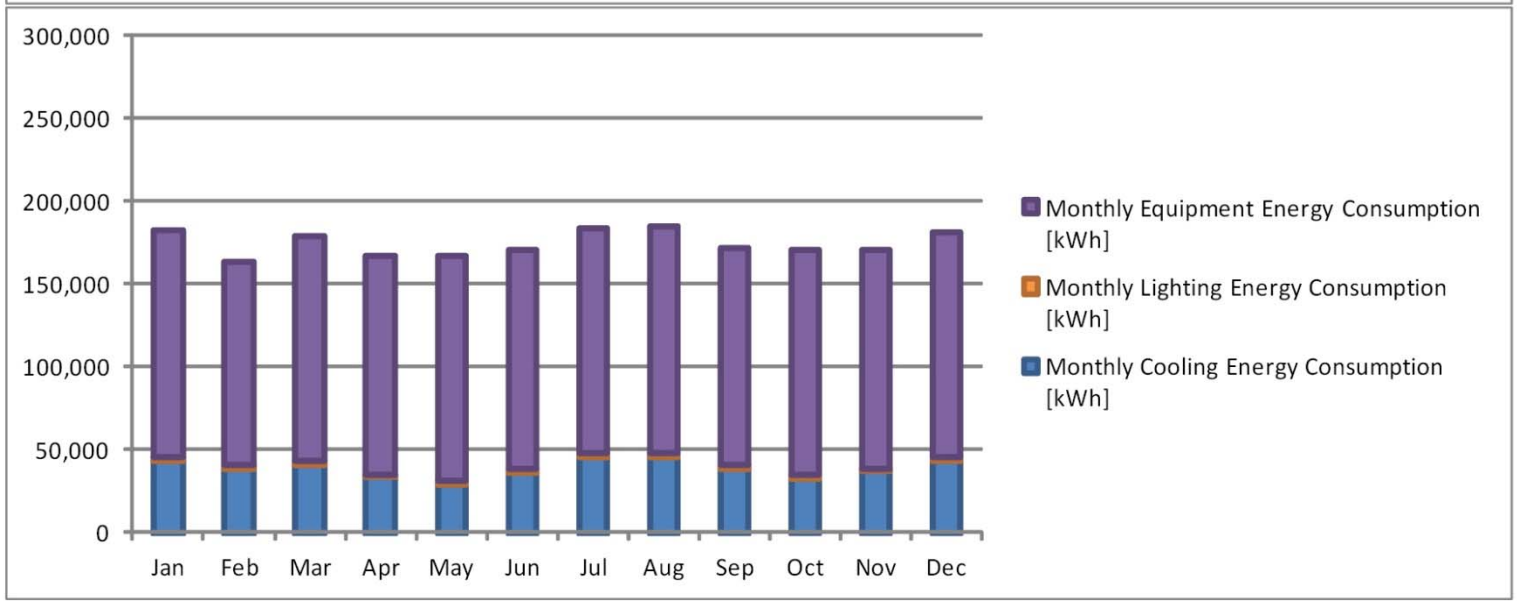
Total Urban Heating Loads: 485771.6 kWh
Total Urban Cooling Loads: 326521.9 kWh
Total Urban Lighting Loads: 574535.5 kWh
Total Urban Equipment Loads: 904769.1 kWh
Total Urban PV Production: 1437802.0 kWh

Site Energy Use : simulation results

URBAN ENERGY BREAKDOWN

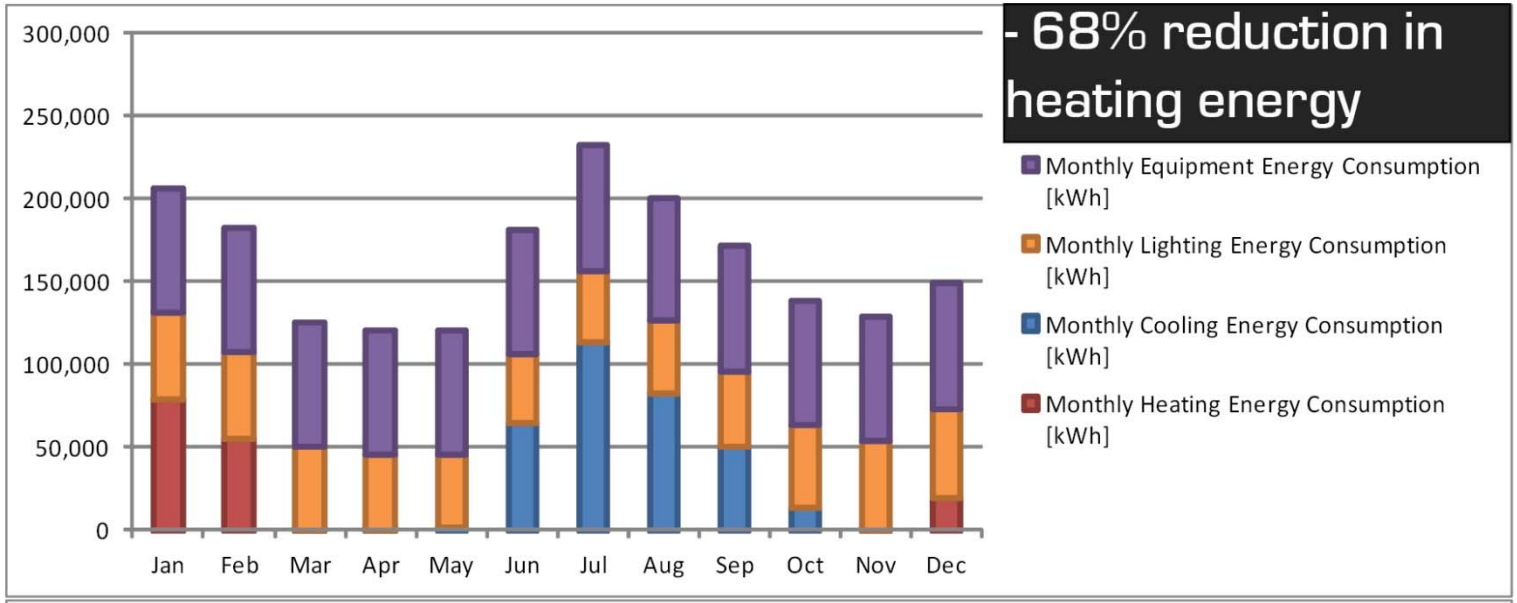


DATA CENTER ENERGY BREAKDOWN



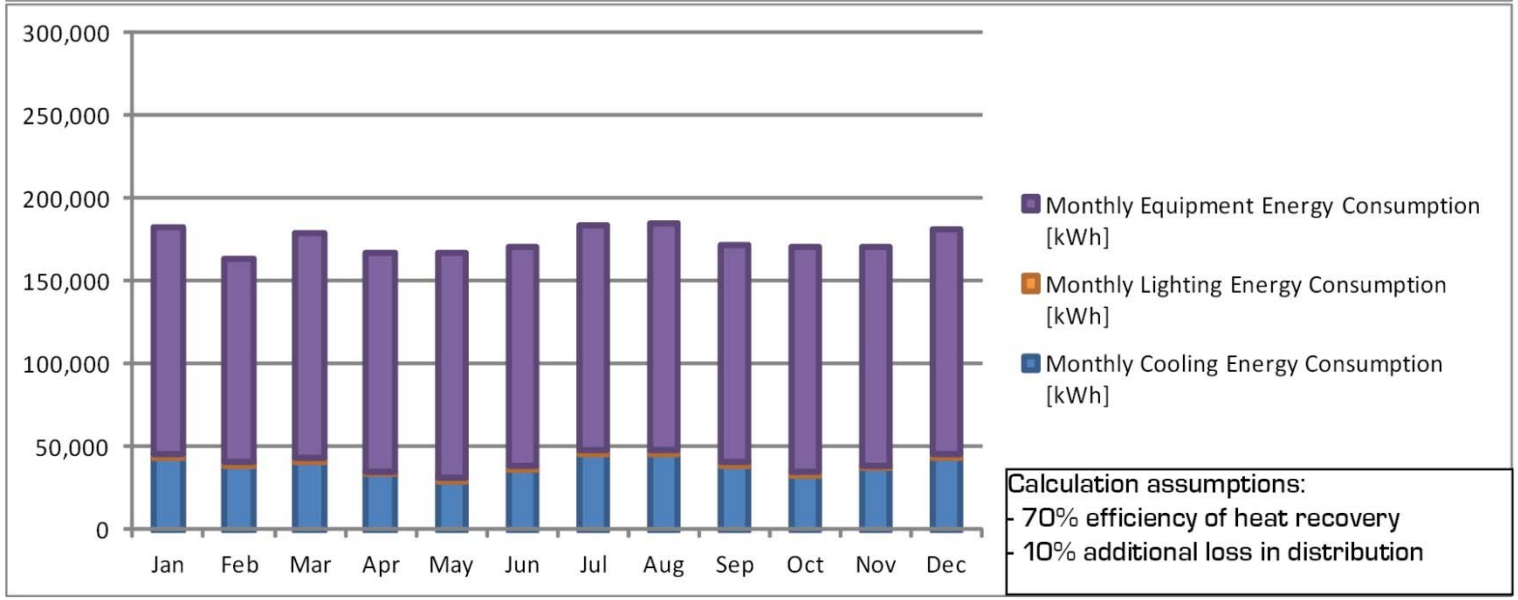
Site Energy Use : heat energy recovery from data center

URBAN ENERGY BREAKDOWN



- 68% reduction in heating energy

DATA CENTER ENERGY BREAKDOWN



Calculation assumptions:
- 70% efficiency of heat recovery
- 10% additional loss in distribution

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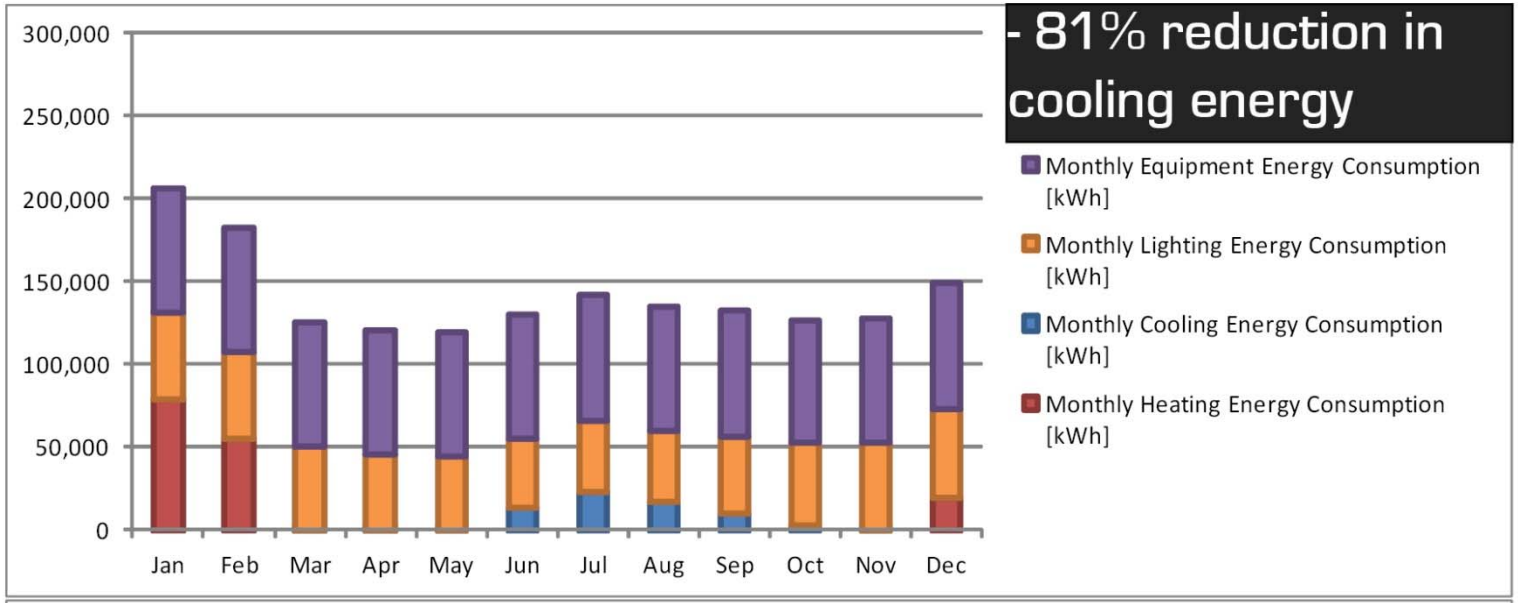
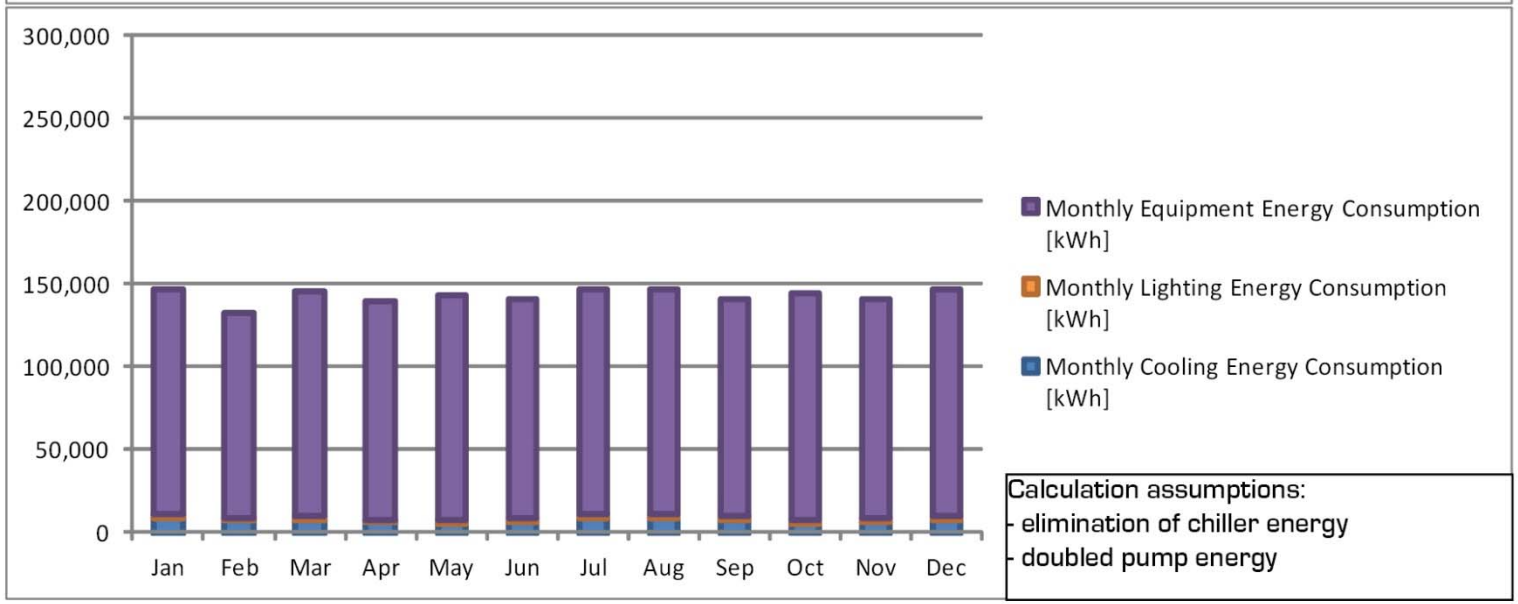
Site Energy Use : impact of deep water lake cooling

URBAN ENERGY BREAKDOWN



DATA CENTER ENERGY BREAKDOWN



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Site Energy Use : comparisons

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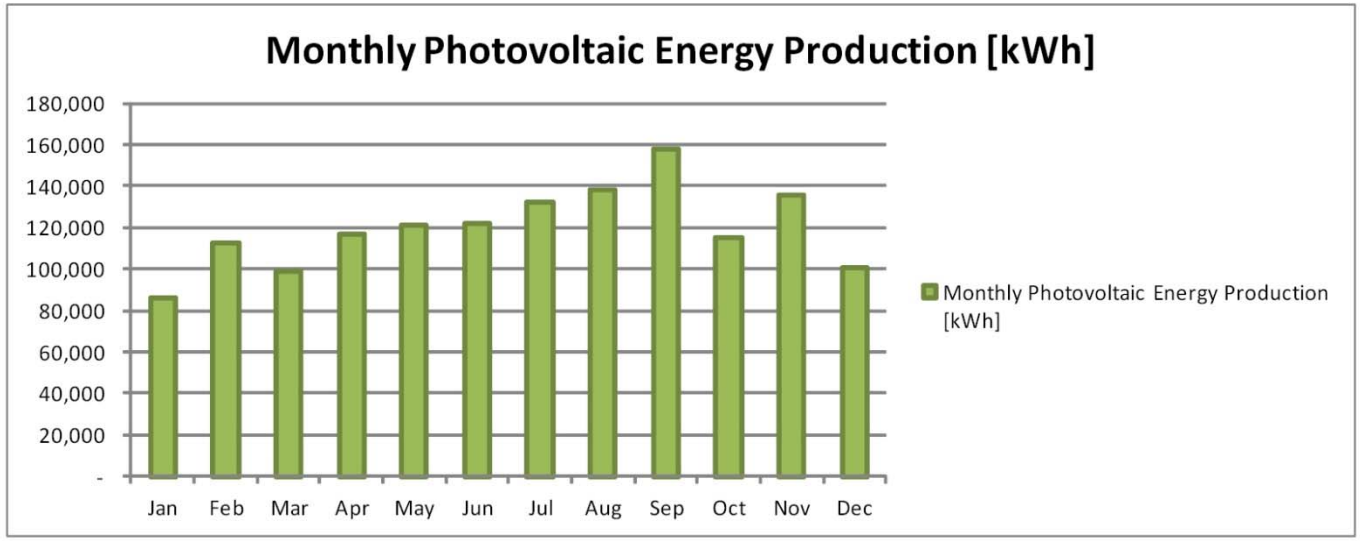
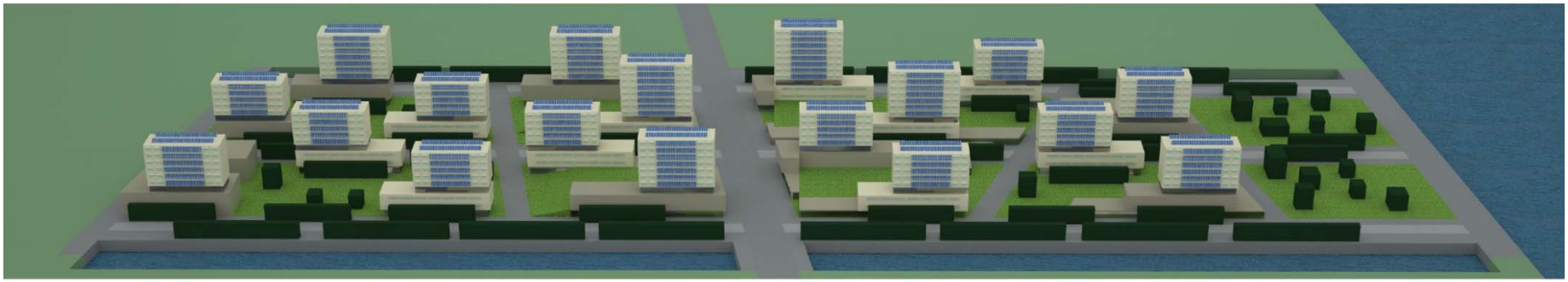
Site Energy Use : carbon emission reductions

Carbon Emissions in RFC West eGRID Subregion	1,551.52	ib/mWh		
	Energy Saved/ Generated [kwh]	Source Energy Multiplier	Carbon Emissions [ibs per kWh]	Total Tons of Carbon Saved
Onsite Photovoltaics	1,437,801.95	3.1	1.55152	3457.706646
Reusing Data Center Waste Heat	331,616.23	3.1	1.55152	797.4892804
Using Deep Lake Water Cooling	261,217.50	3.1	1.55152	628.1904626



Conclusions : sustainability and process lessons



sustainability

_ quantitative and qualitative aspects of sustainability must be balanced
_ realized the broader range of issues possible to define sustainability
_ greater breadth of programs would have enabled a more accurate model of neighborhood

process:

_ working between scales necessary
_ starting with site specific concerns rather than in abstraction
_ limitation in accuracy
_ small scale typology and large scale environmental design studies more effecive over mid-scale urban block configurations