

# URBAN HYBRID HOUSE

*and its application in a block context*

BEATRIZ MACHADO

# URBAN HYBRID HOUSE

- Design a single family house able to produce energy, reduce energy consumption, water consumption, waste generation and greenhouse gases emissions in comparison to a typical single family house.
- Study its repetition in a block configuration comparing the solution to a typical block in the site surroundings.

# BACKGROUND

Rural Areas



Urban Areas

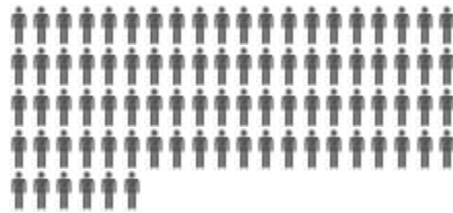


1800



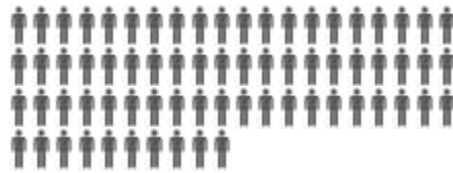
3%

1900



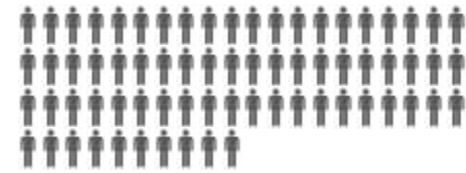
14%

1950



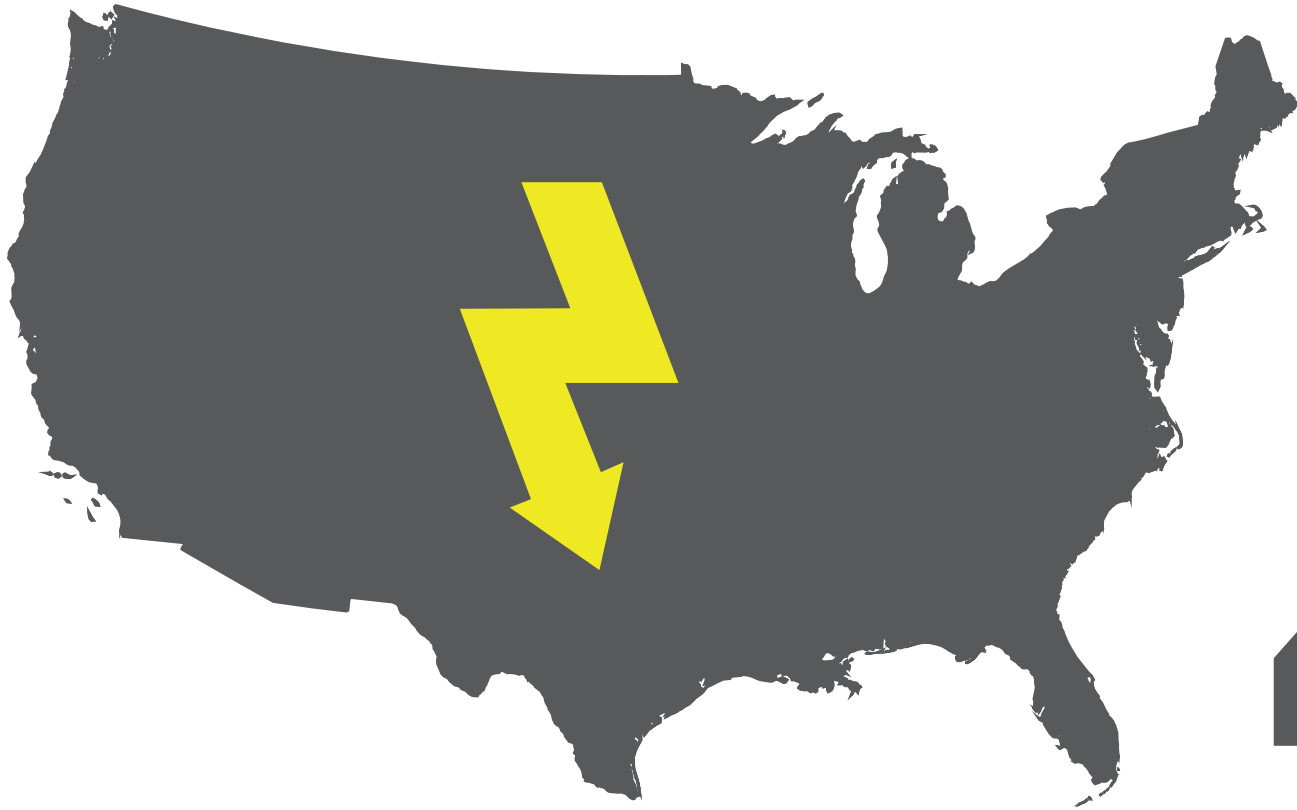
30%

2050



70%

# BACKGROUND



20%



-20 to 25%



# GOALS

- Demonstrate performance improvement.
- Develop an example of block configuration that maximizes sun exposure in living areas and enhance interaction between them and the landscape
- Awareness that it is possible to live in a more environmental friendly unit without hardship and comfort compromising.

# SPECIAL FEATURES

- Water Conservation



Rain water  
collection



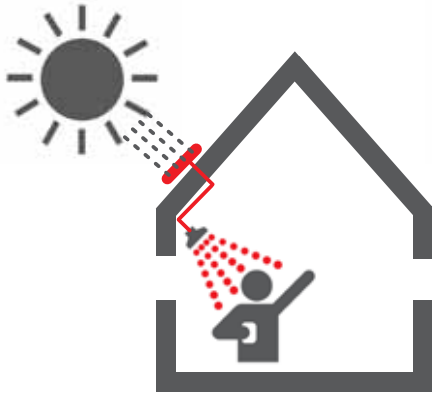
Low flow  
plumbing fixtures



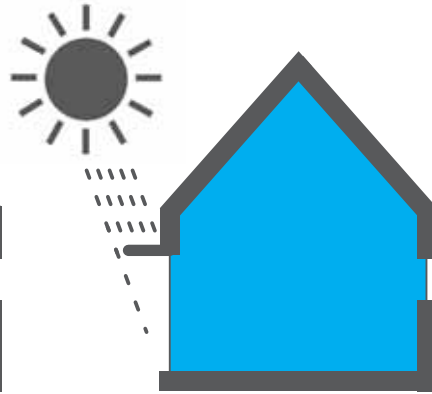
Water  
Recycling

# SPECIAL FEATURES

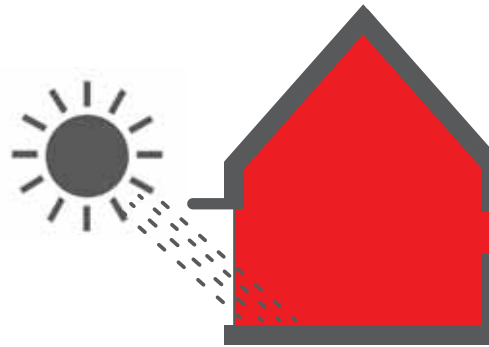
- Energy Conservation



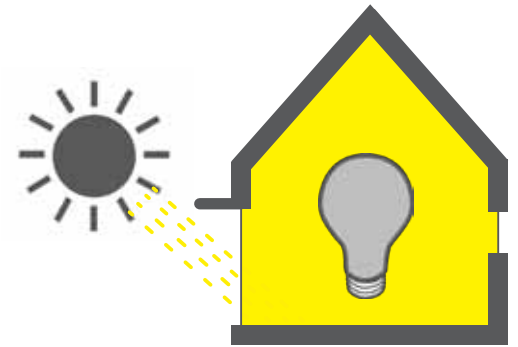
Solar panels



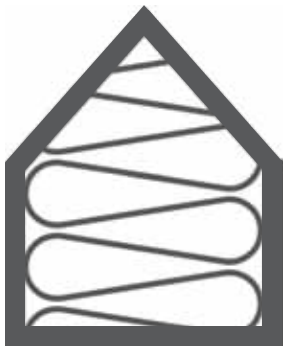
Shading devices



Maximize heat gain in winter



Daylight Maximization



Super insulation  
Tight building



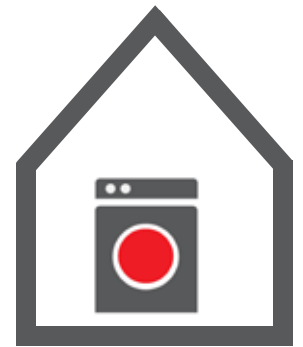
Cross  
Ventilation



Geo exchange



Energy  
efficient  
appliances

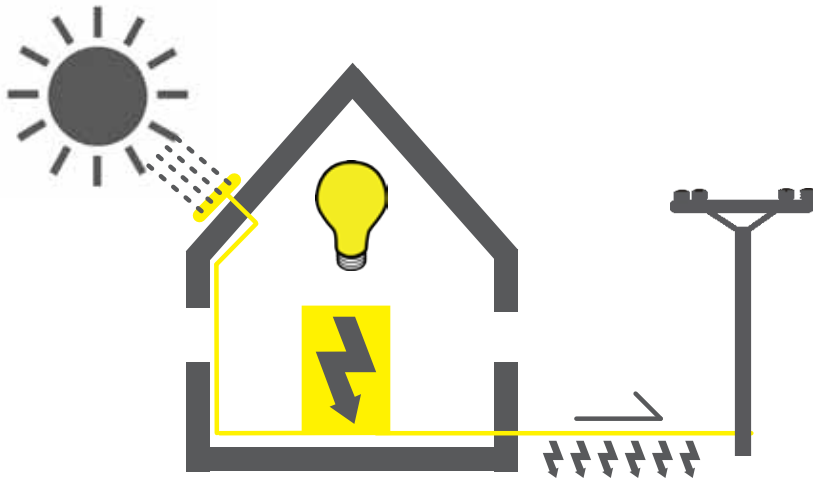


Heat  
recovery

# SPECIAL FEATURES

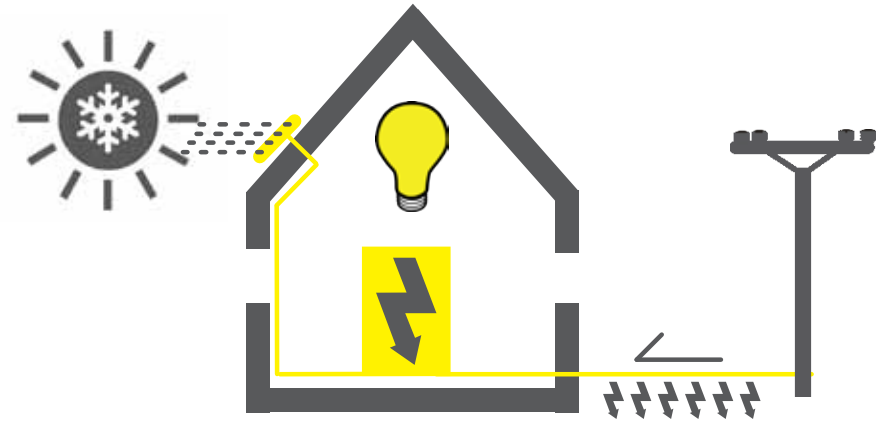
- Energy Production

Summer



Surplus energy  
delivered to grid

Winter

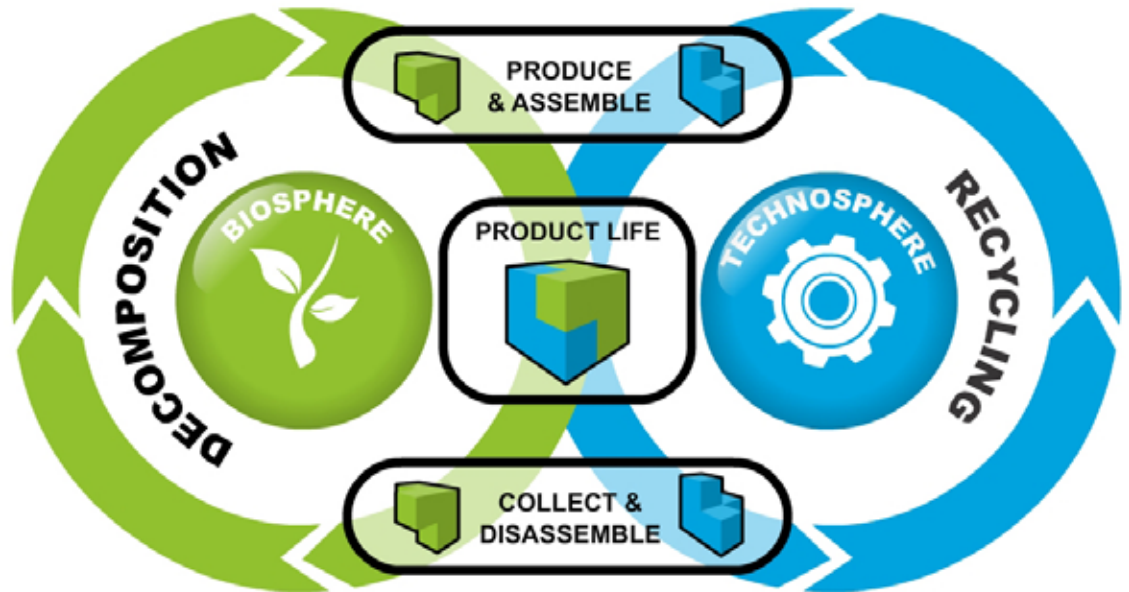


Recover the energy  
delivered in summer

NET ZERO

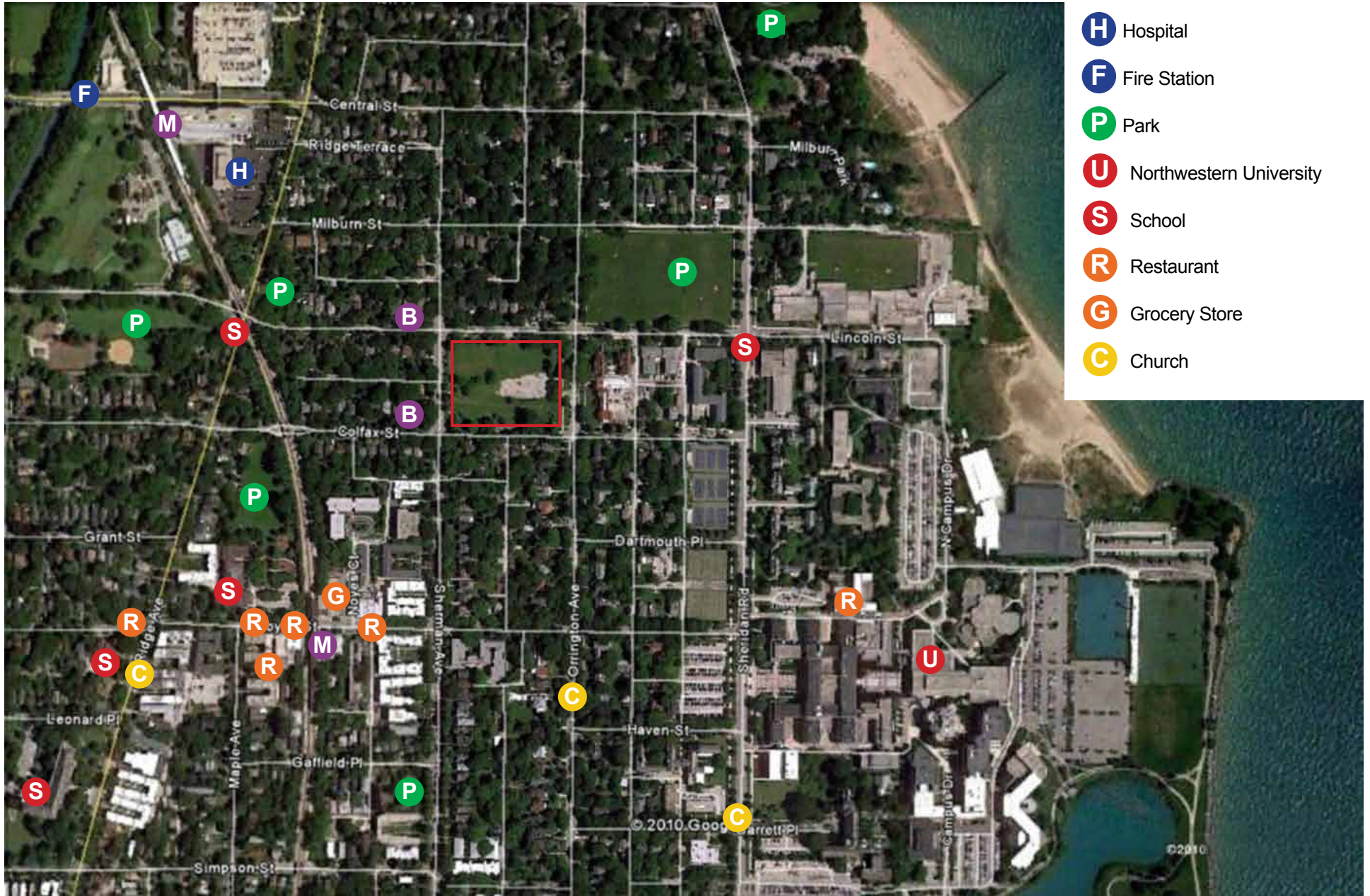
# SPECIAL FEATURES

- Waste Management
- Material Selection - Low embodied energy
- Design for Deconstruction
- Budget Allocation





# SITE





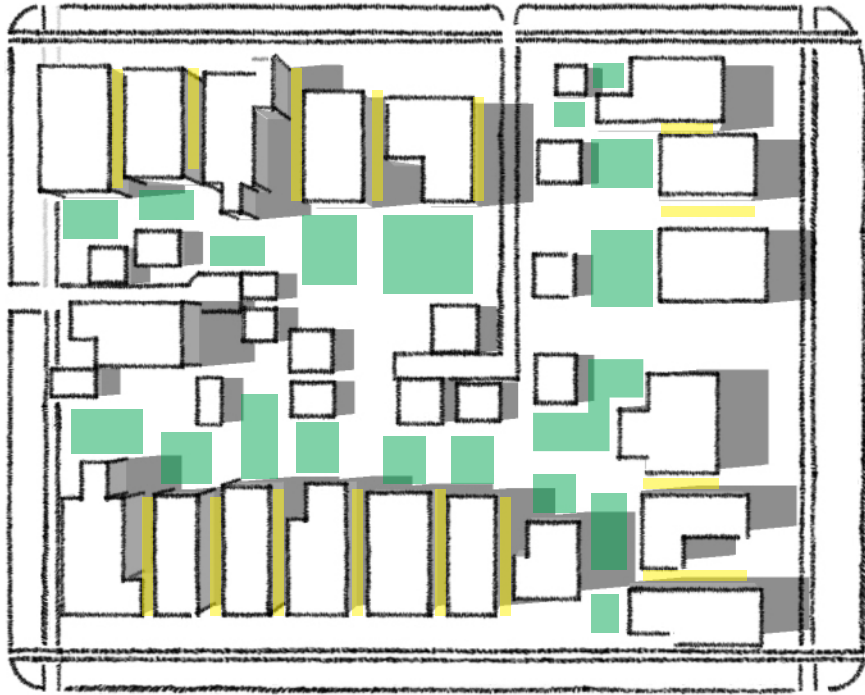
# SITE

## SITE SELECTION:

- Appropriate size, 3.5 acres,
- Prime location in the city  
Northwestern + Lake.
- Surrounded by single  
family houses
- Easy access to public  
transportation nodes and  
commercial areas.



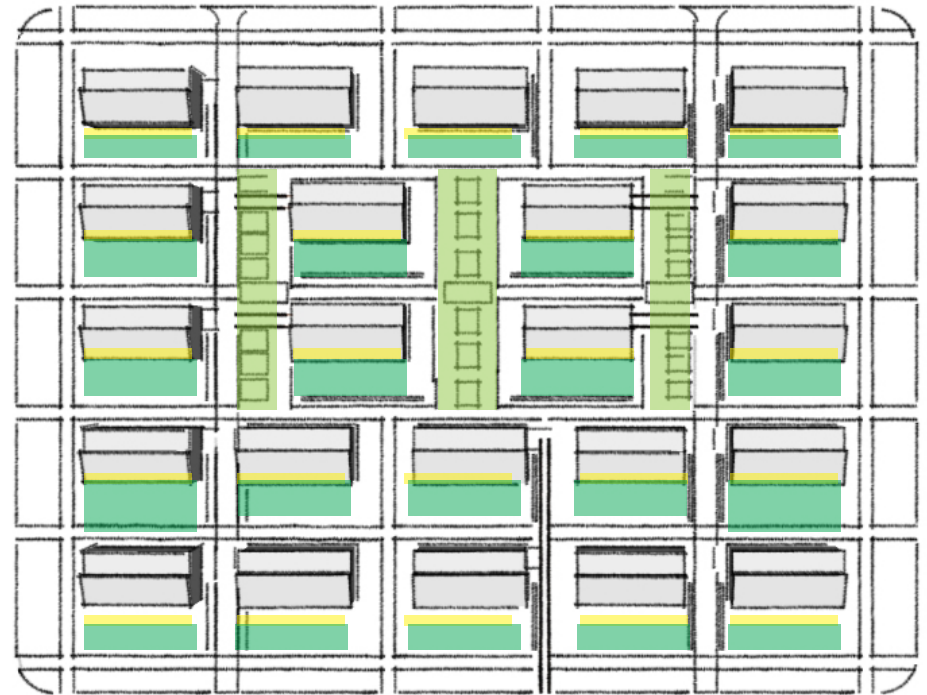
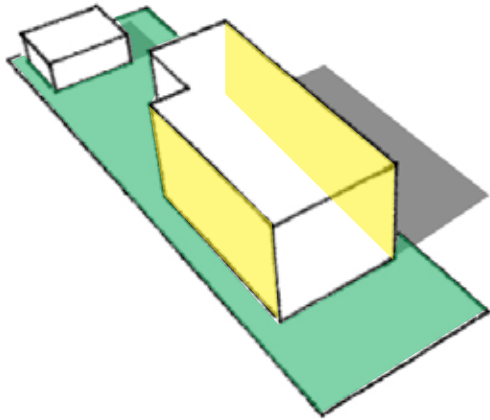
# NEIGHBOR BLOCK VS BLOCK PROPOSAL



19 houses

- Prime areas facing the neighbor
- Excess of residual spaces in the garden

16% South facing

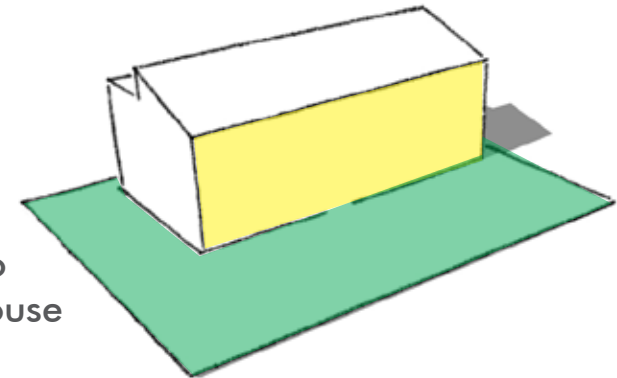


23 houses

- Prime areas facing the garden
- Garden integrated to the body of the house

33% South facing

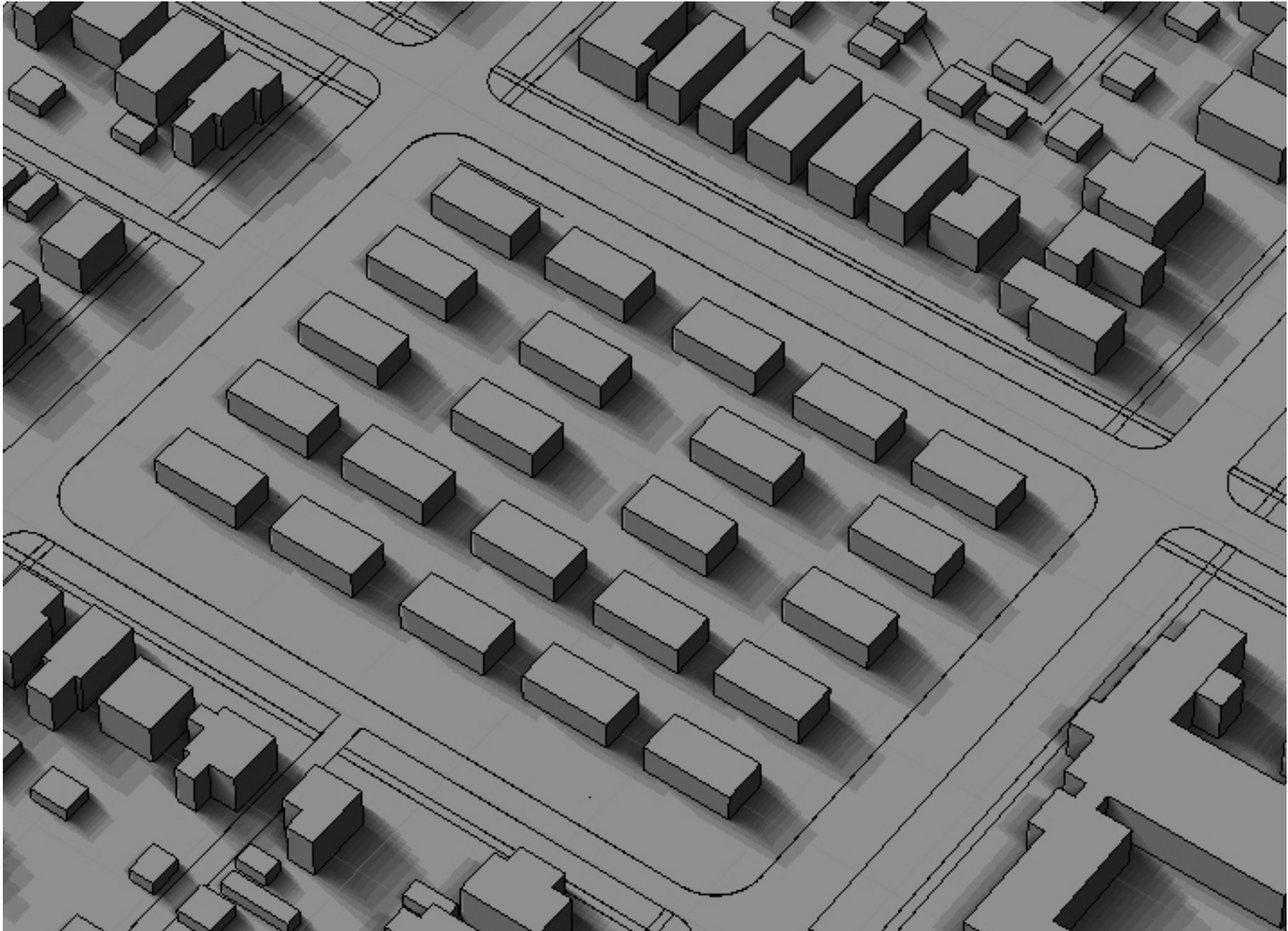
■ Common green area





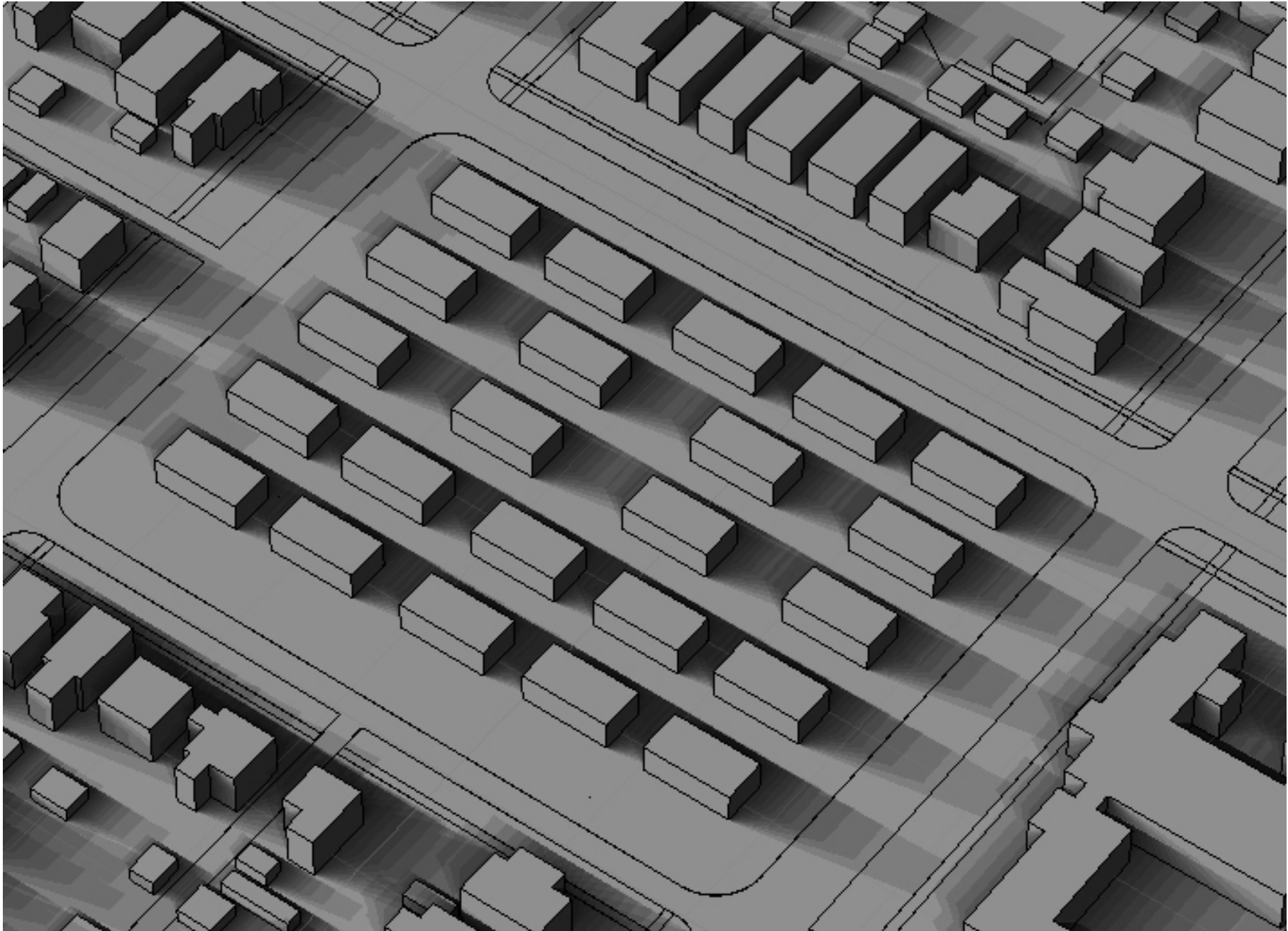
# BUILDINGS DISTRIBUTION/ SHADOW RANGE

Summer Solstice



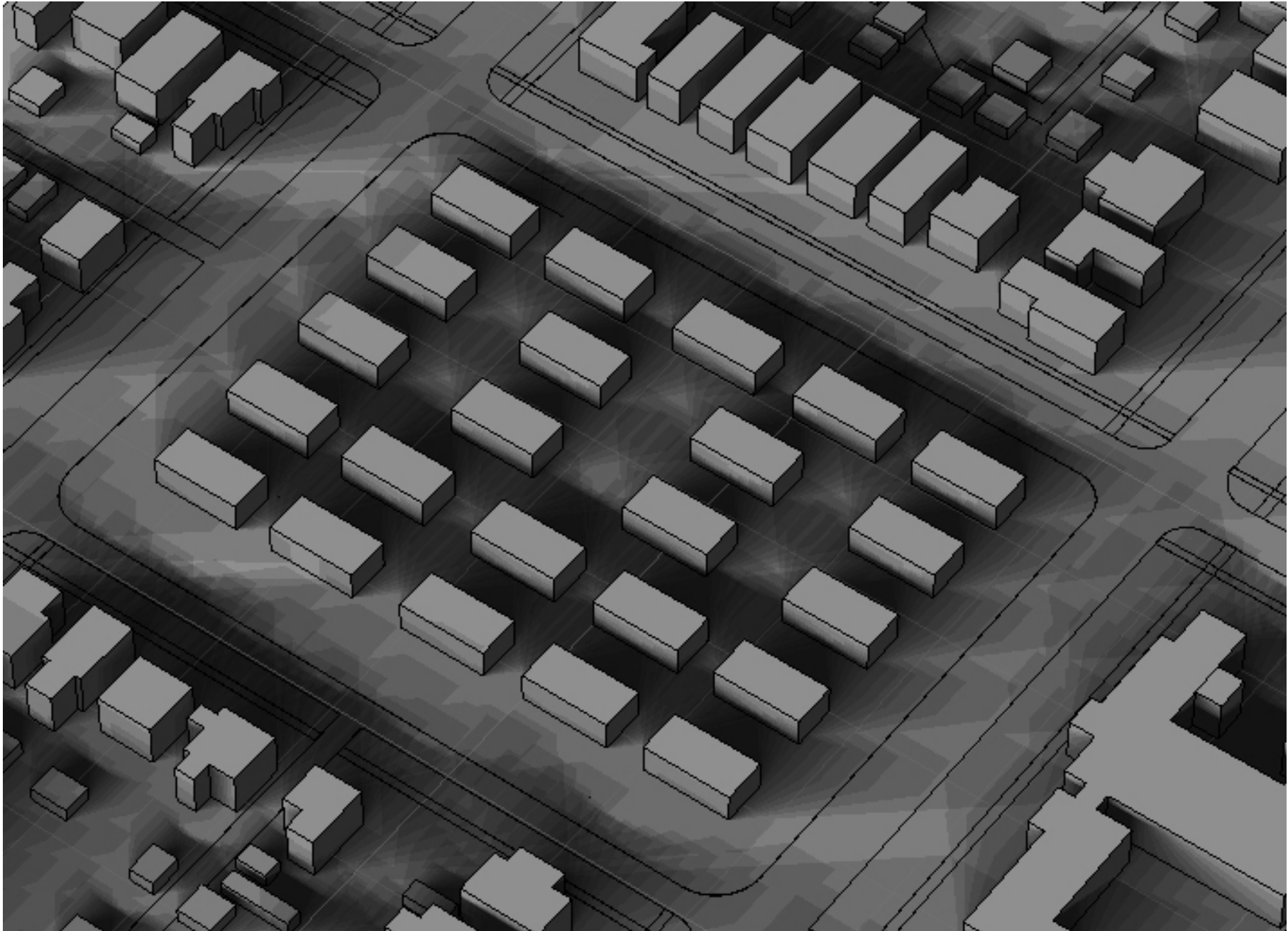
# BUILDINGS DISTRIBUTION/ SHADOW RANGE

Spring/ Fall Equinox



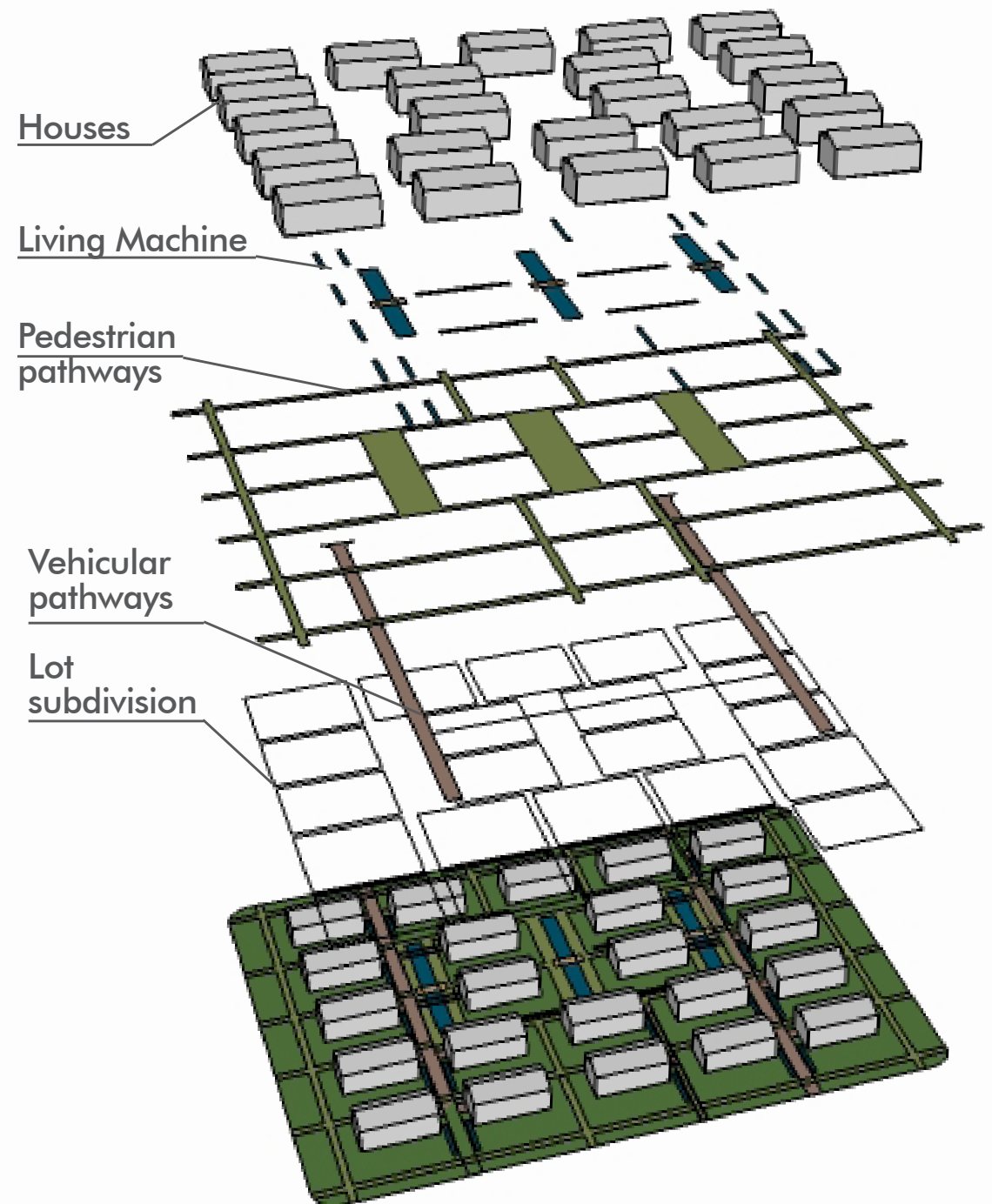
# BUILDINGS DISTRIBUTION/ SHADOW RANGE

Winter Solstice





# SITE ORGANIZATION



# SITE PLAN



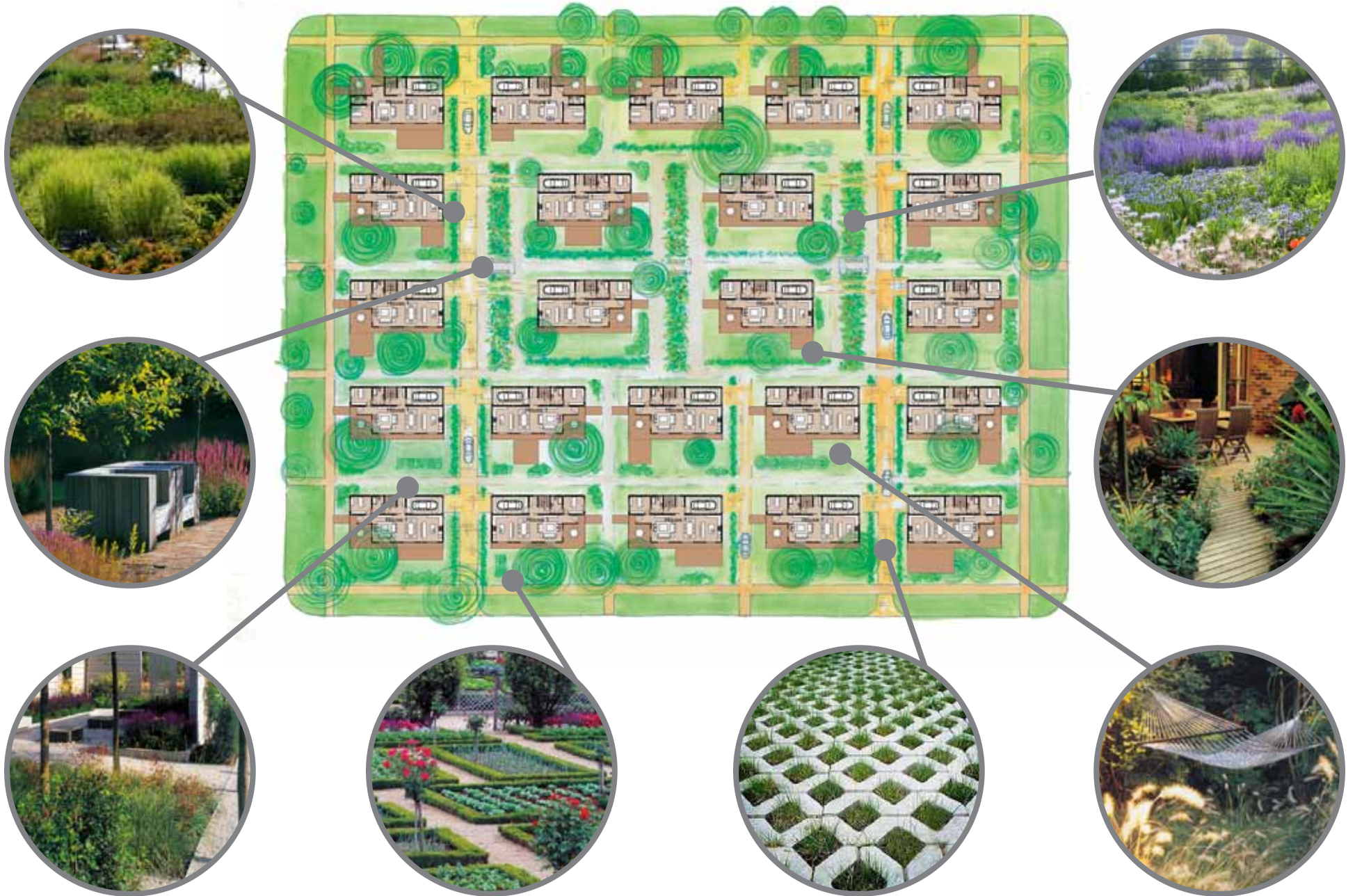


# LANDSCAPE

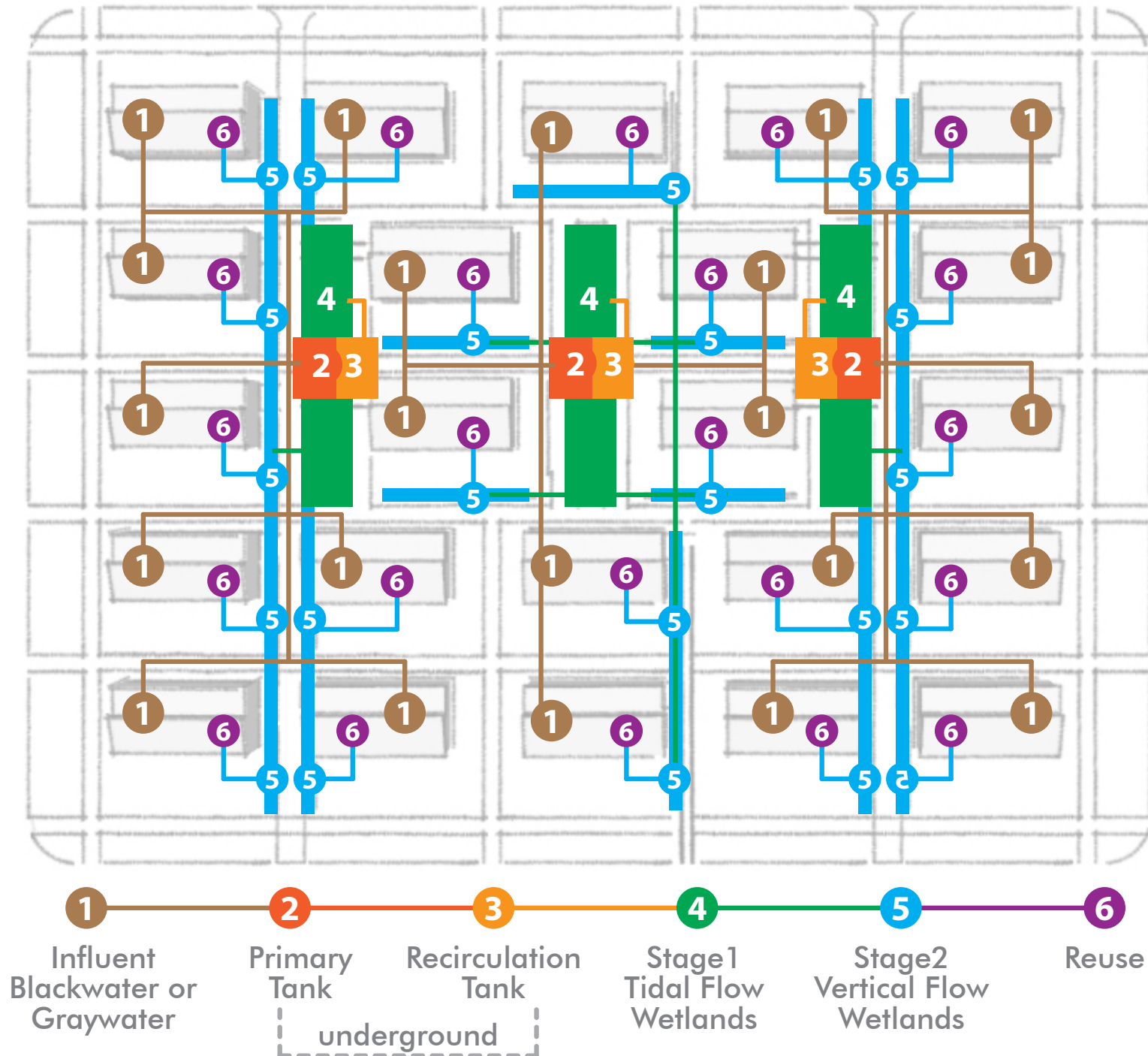




# LANDSCAPE - INSPIRATIONAL IMAGERY

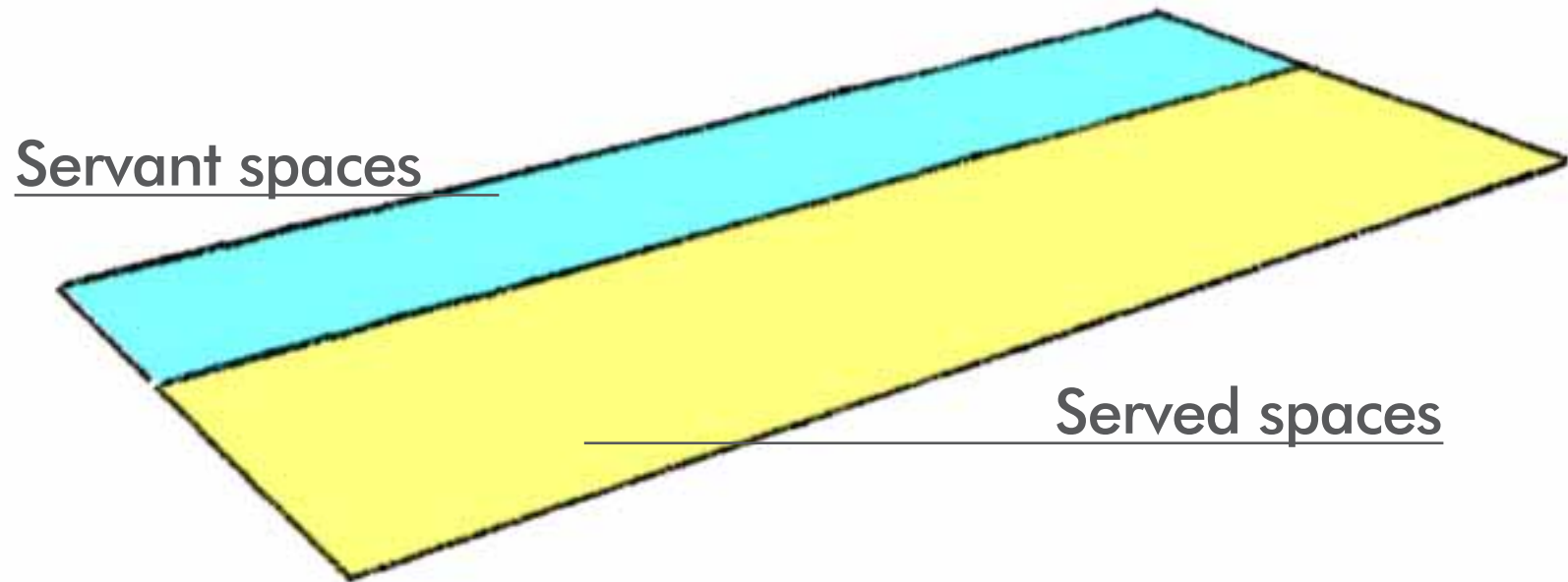


# LIVING MACHINE

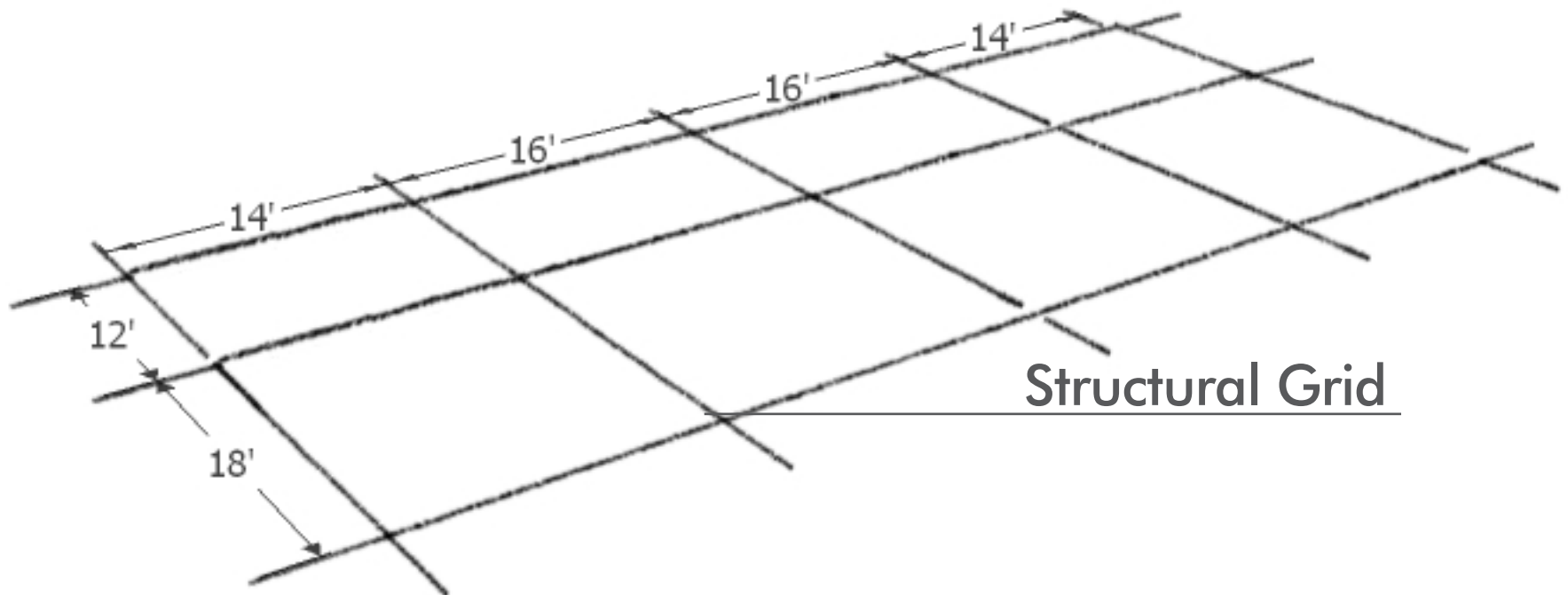




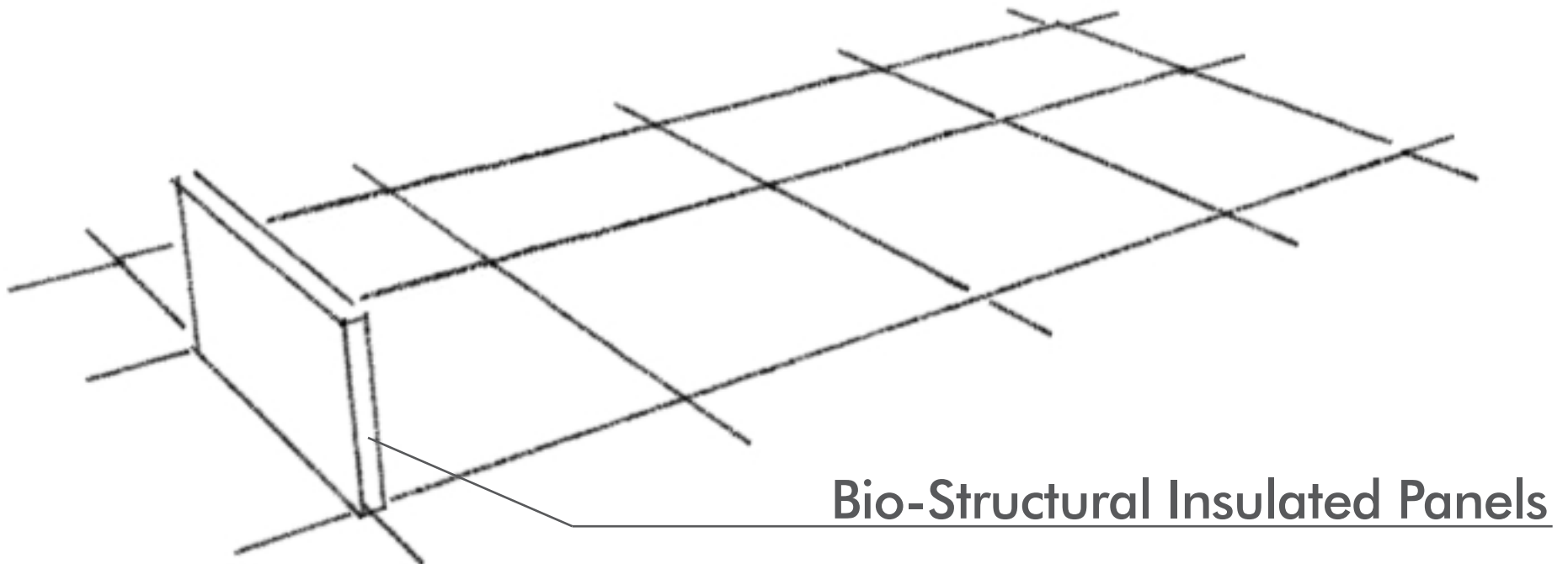
# PROTOTYPE HOUSE



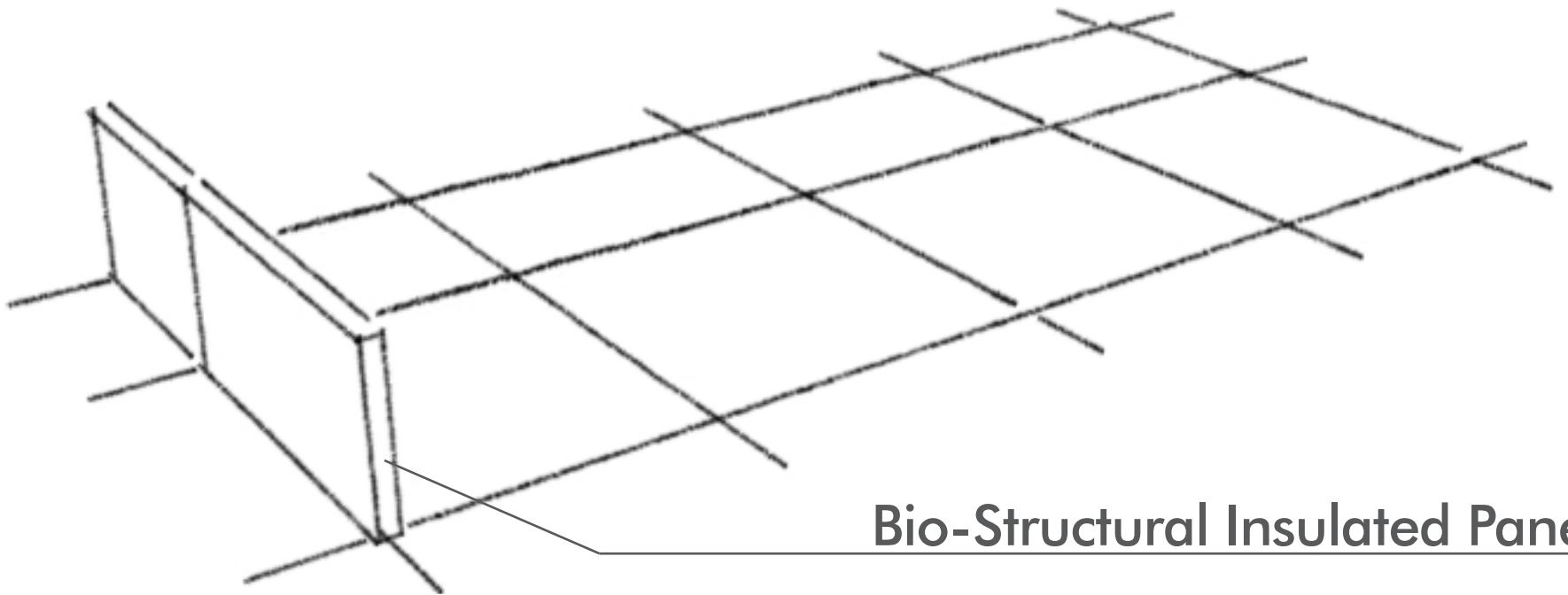
# PROTOTYPE HOUSE



# PROTOTYPE HOUSE

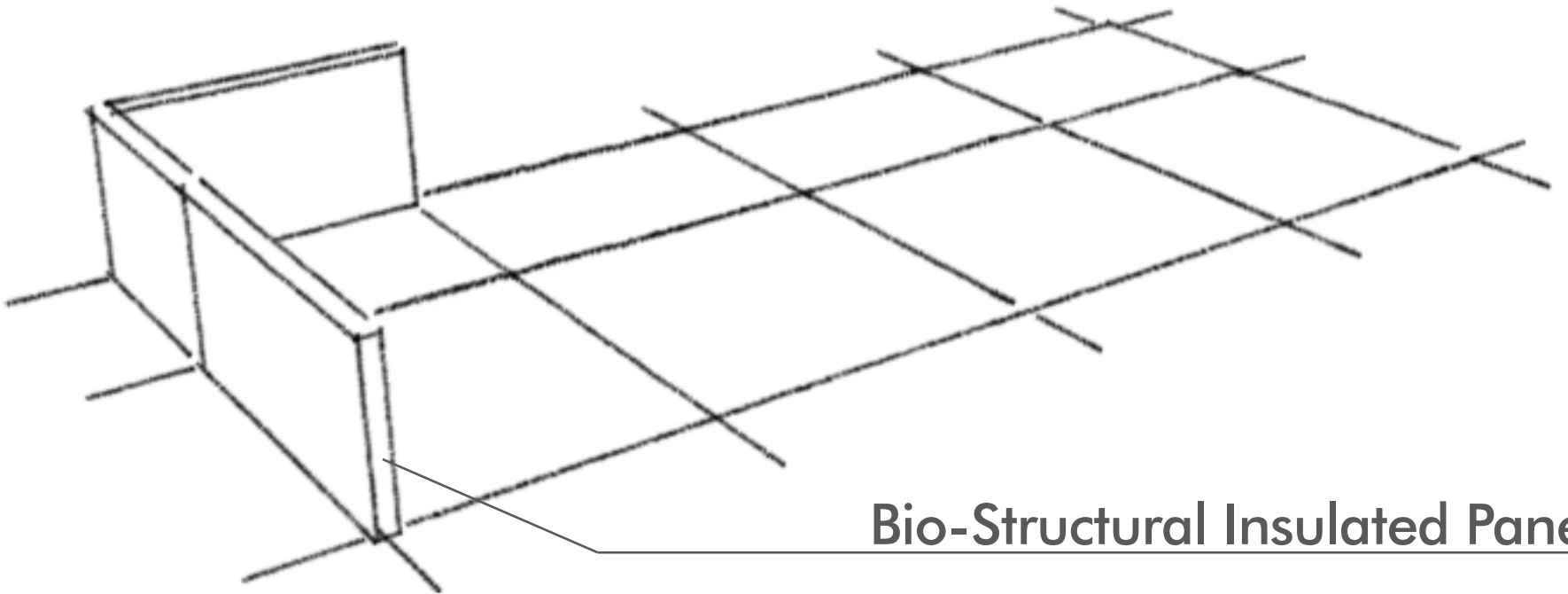


# PROTOTYPE HOUSE



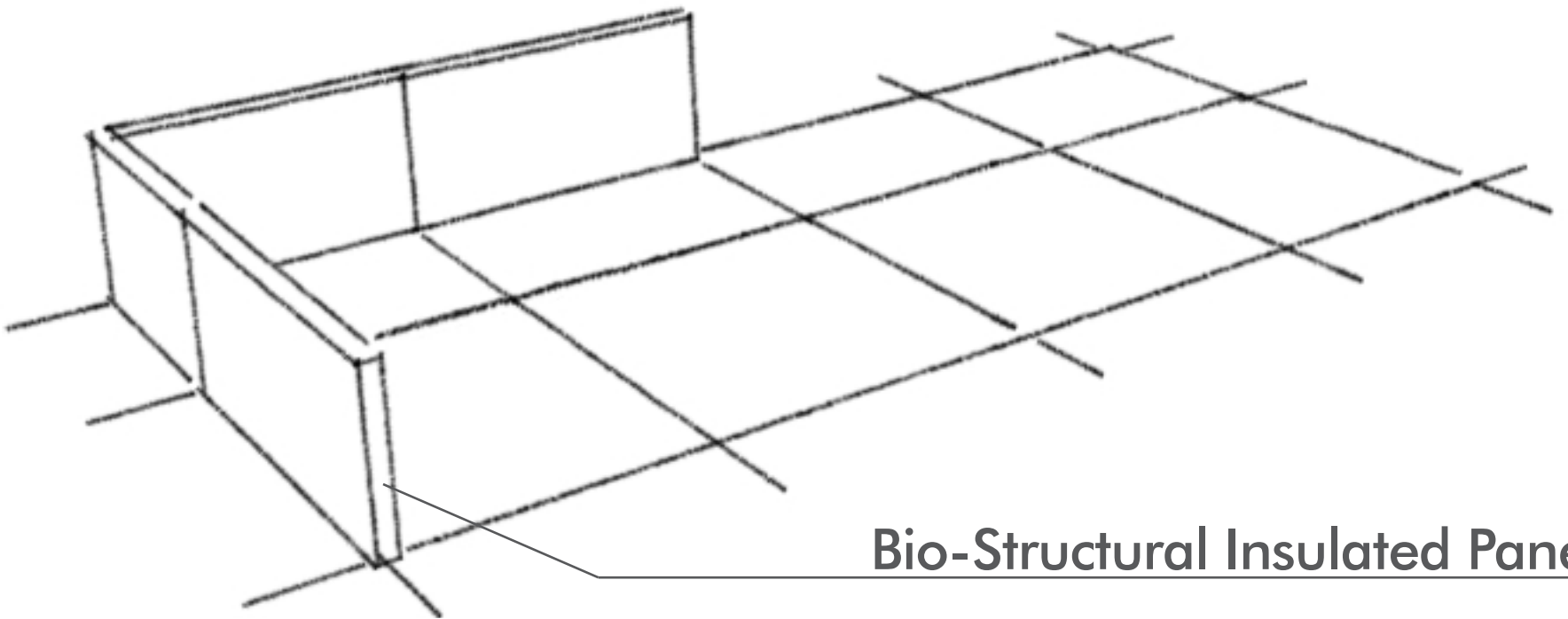
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



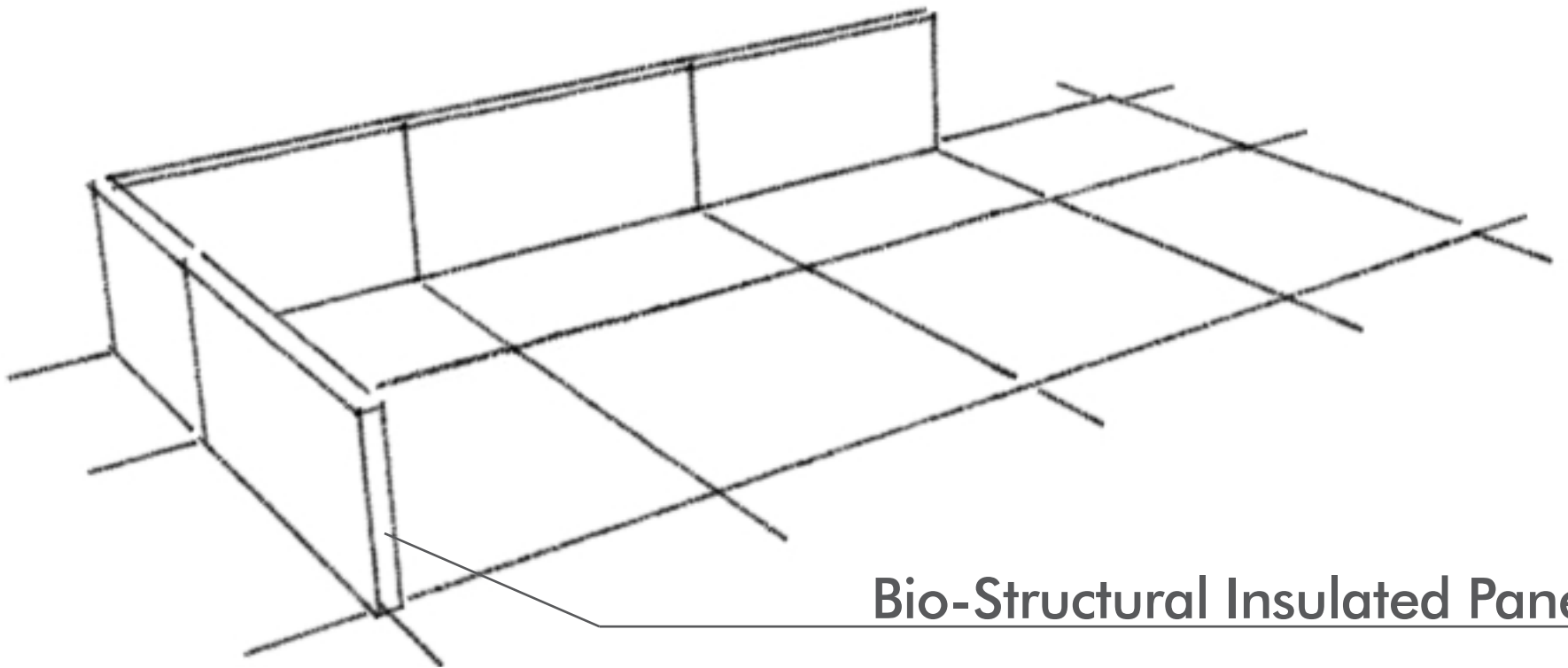
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



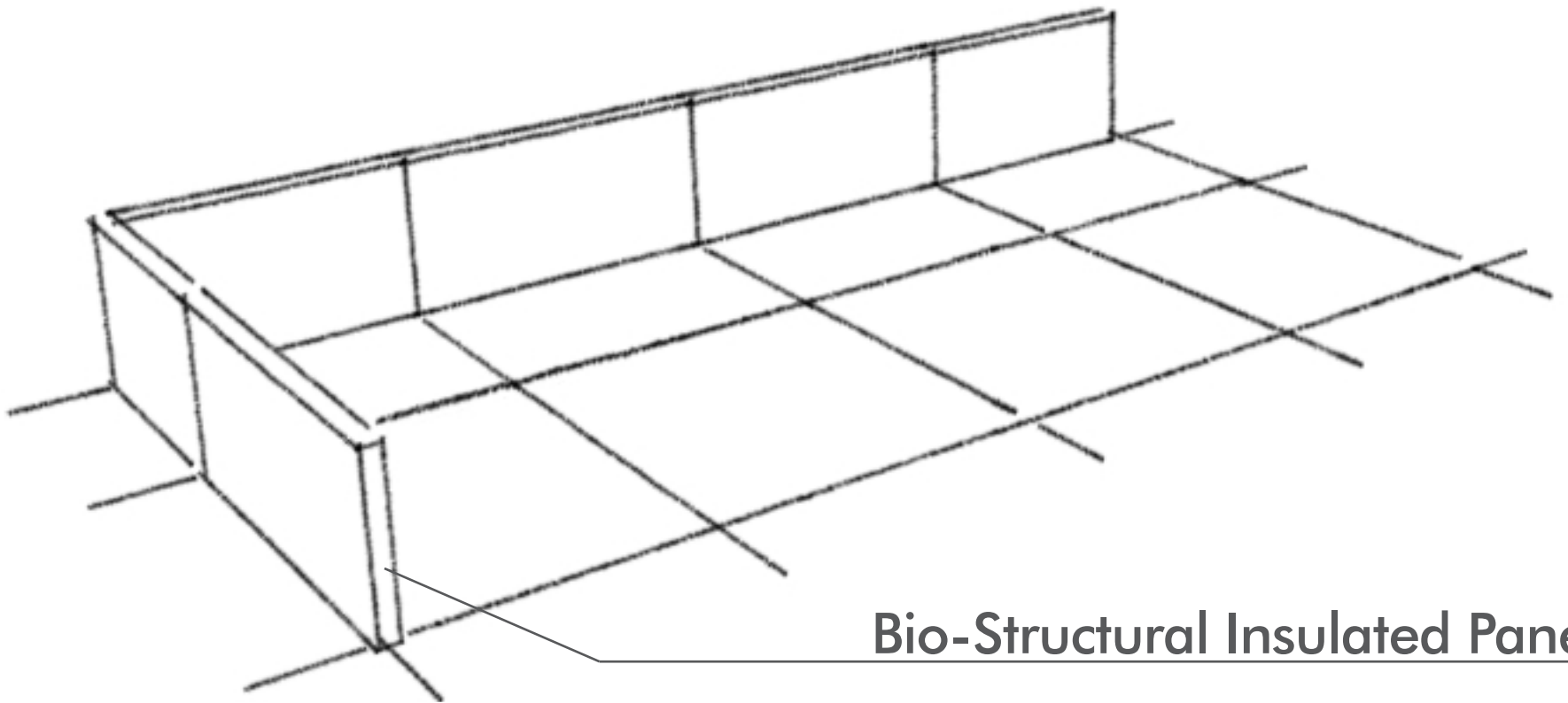
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



Bio-Structural Insulated Panels

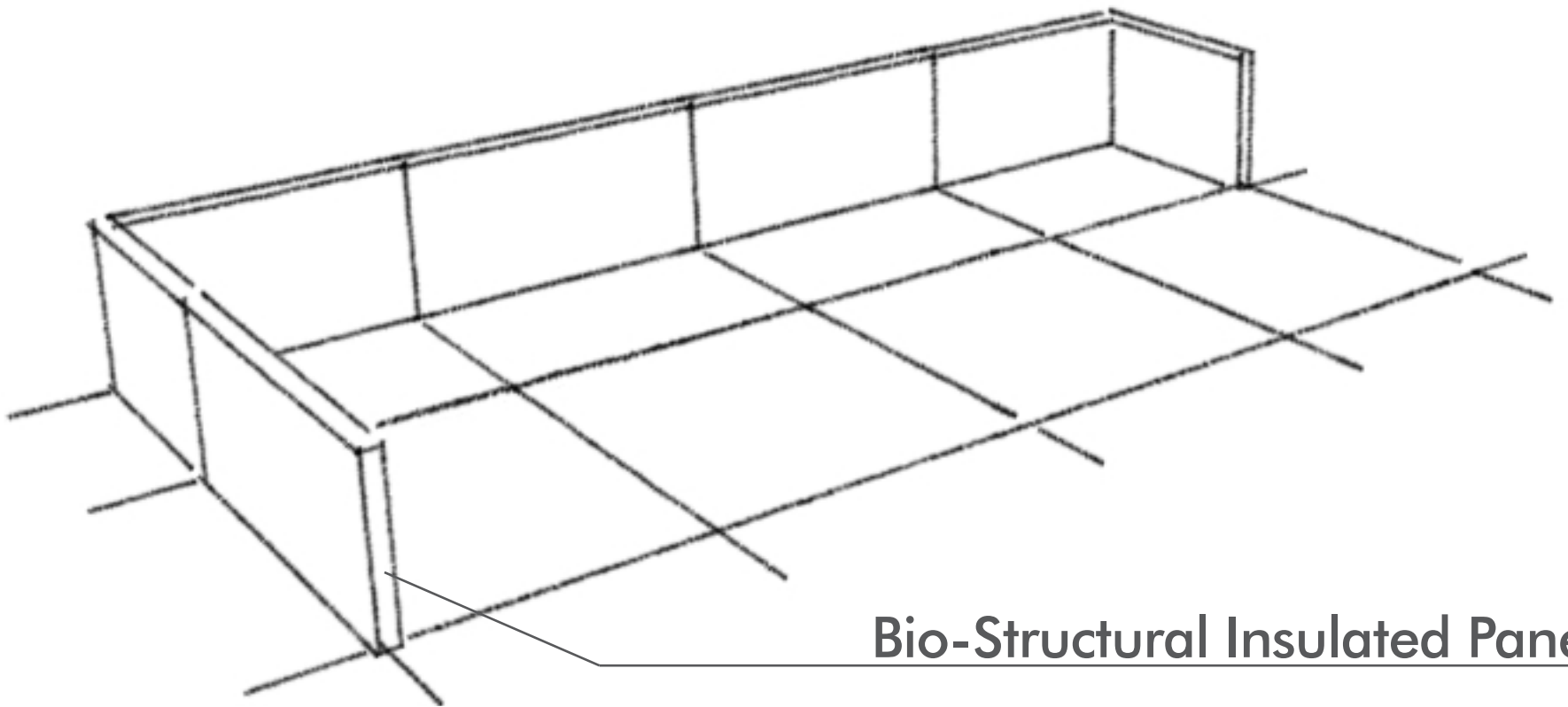
# PROTOTYPE HOUSE



Bio-Structural Insulated Panels

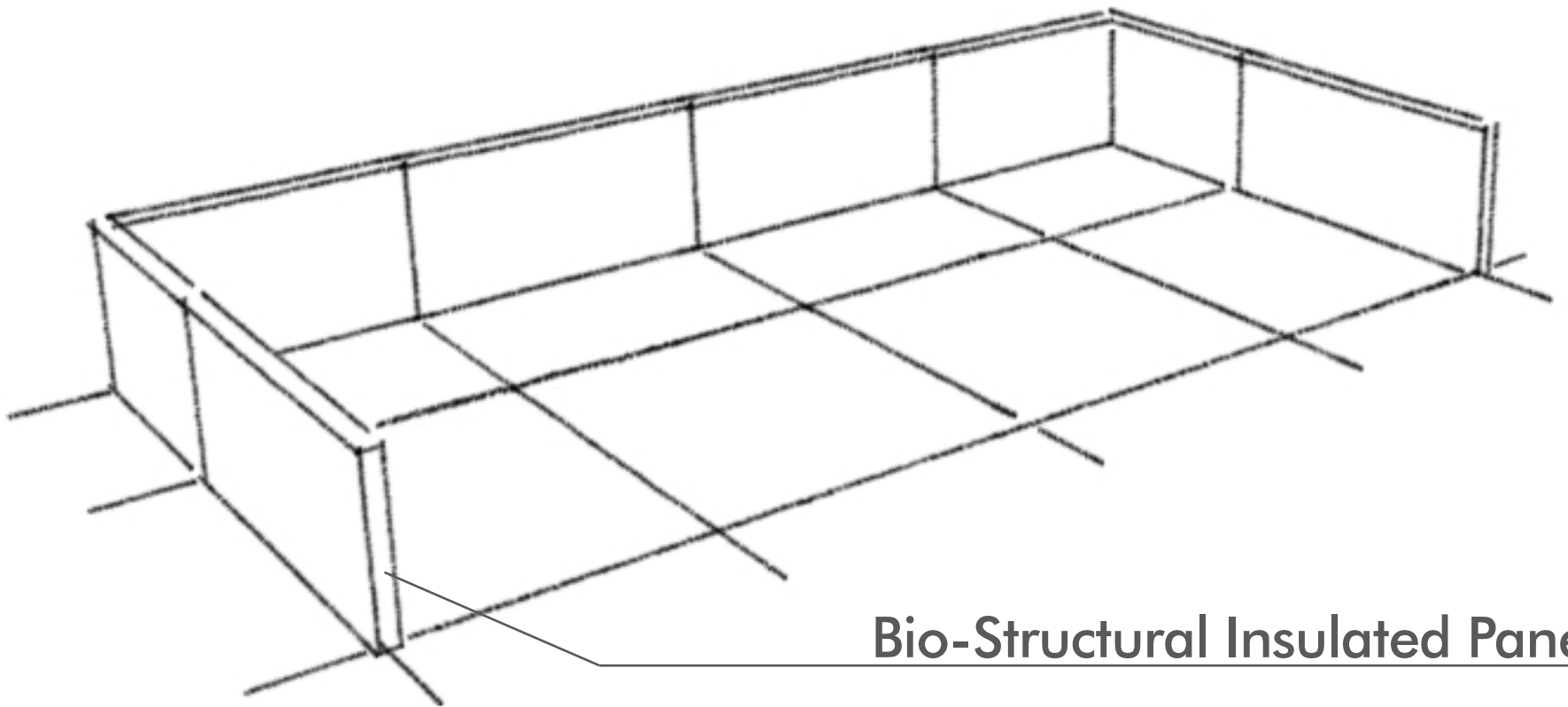


# PROTOTYPE HOUSE



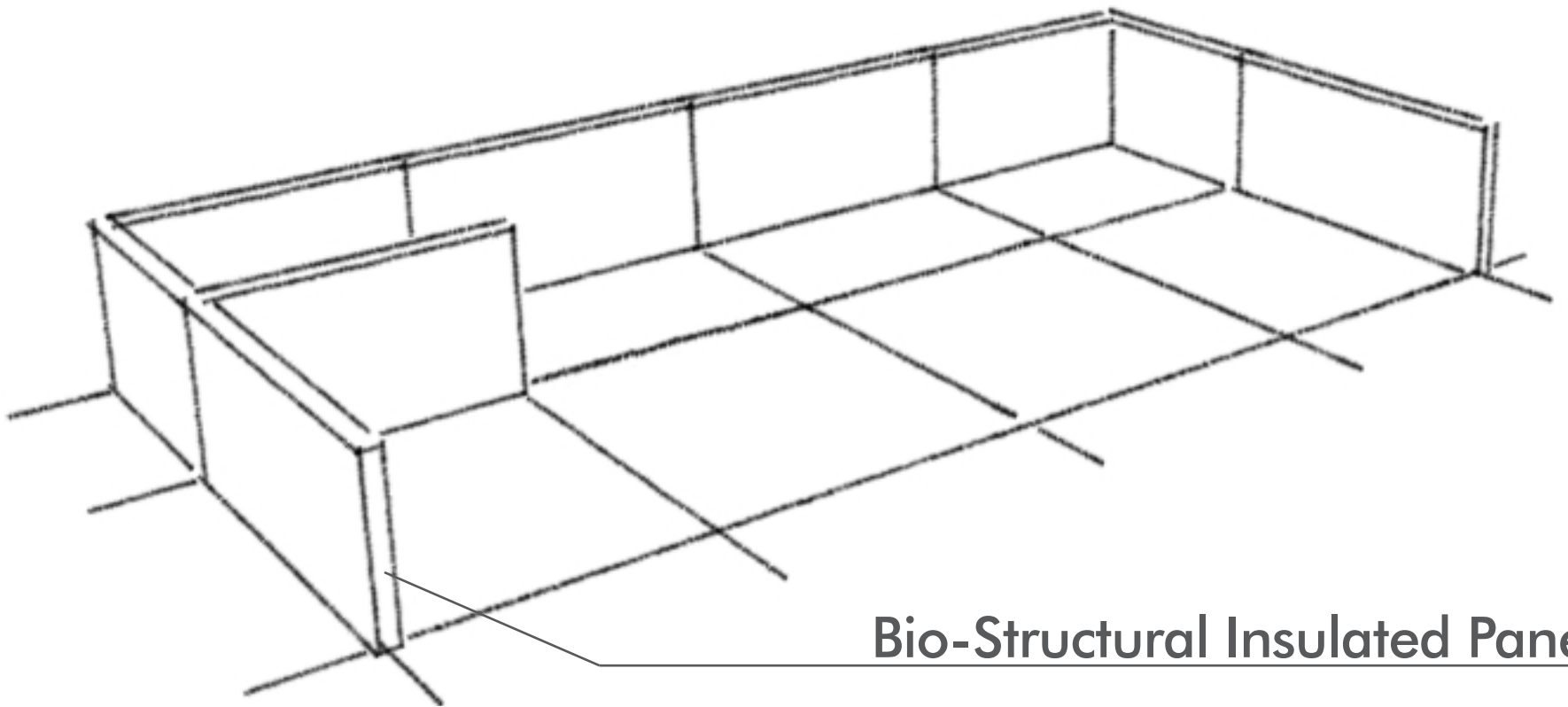
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



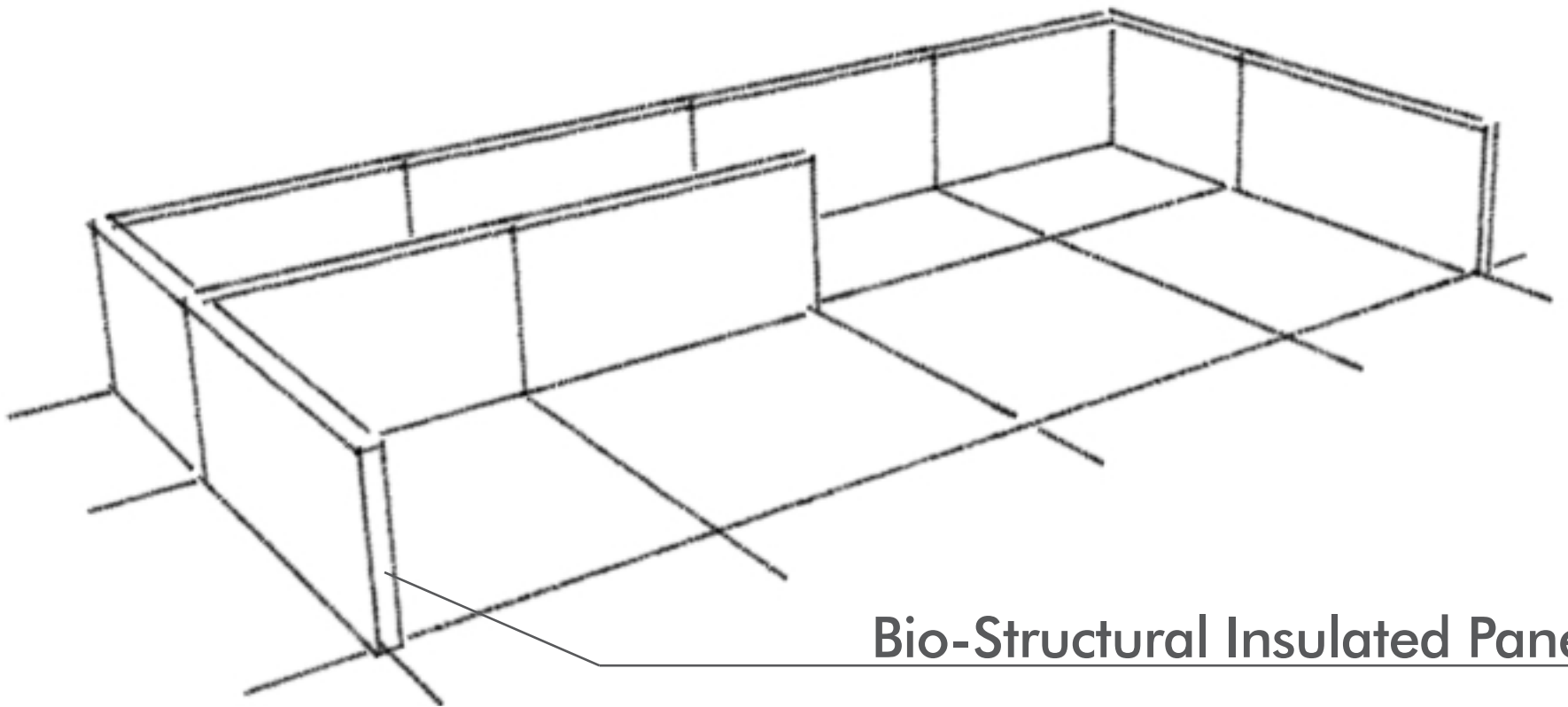
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



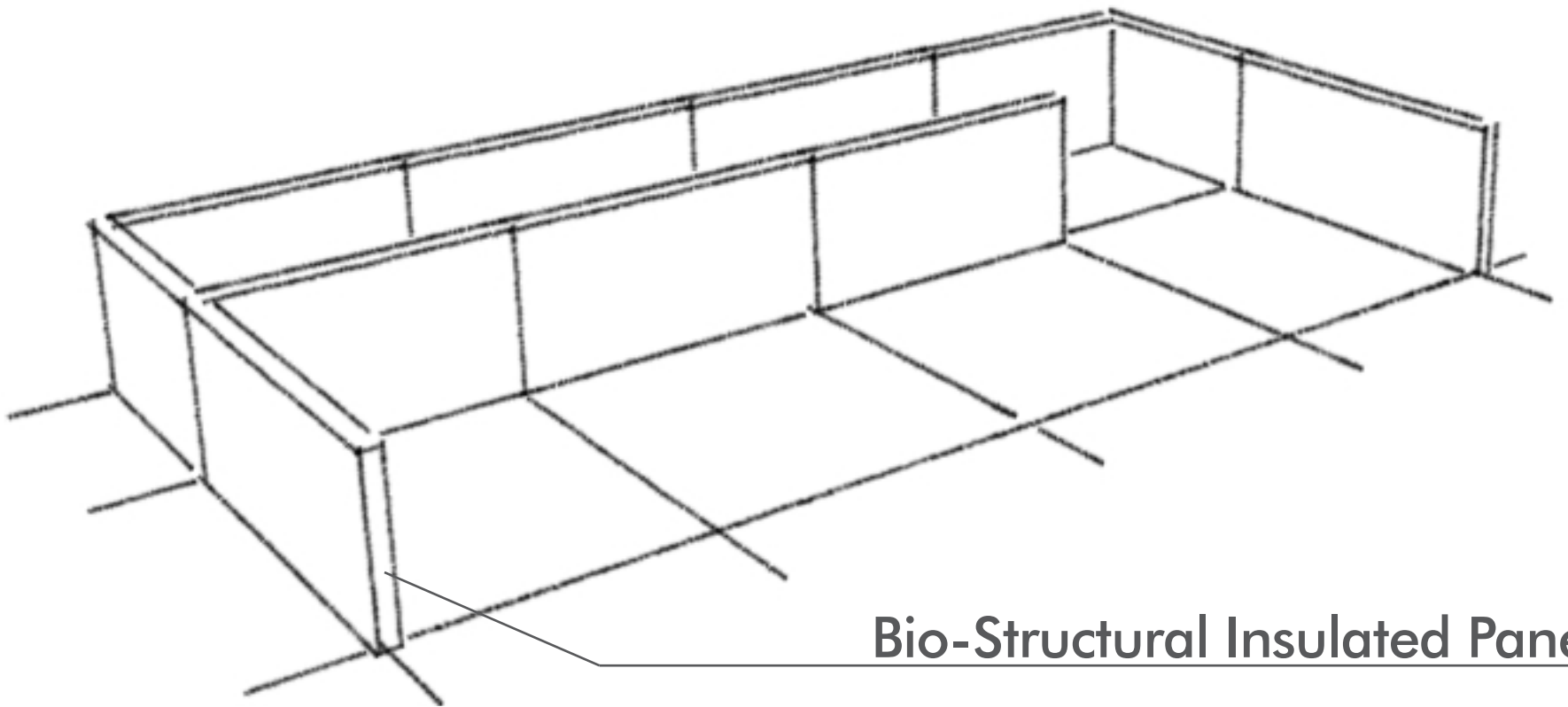
Bio-Structural Insulated Panels

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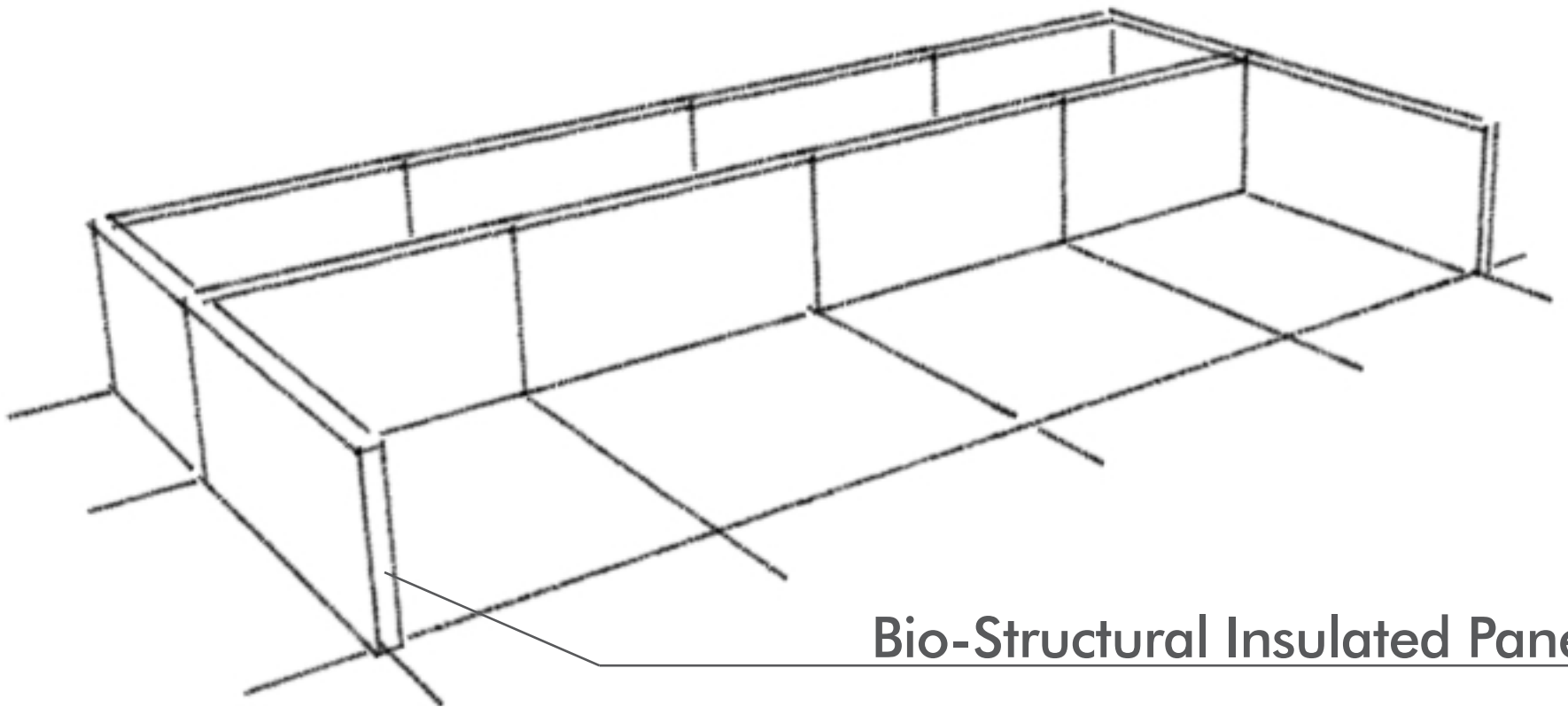
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



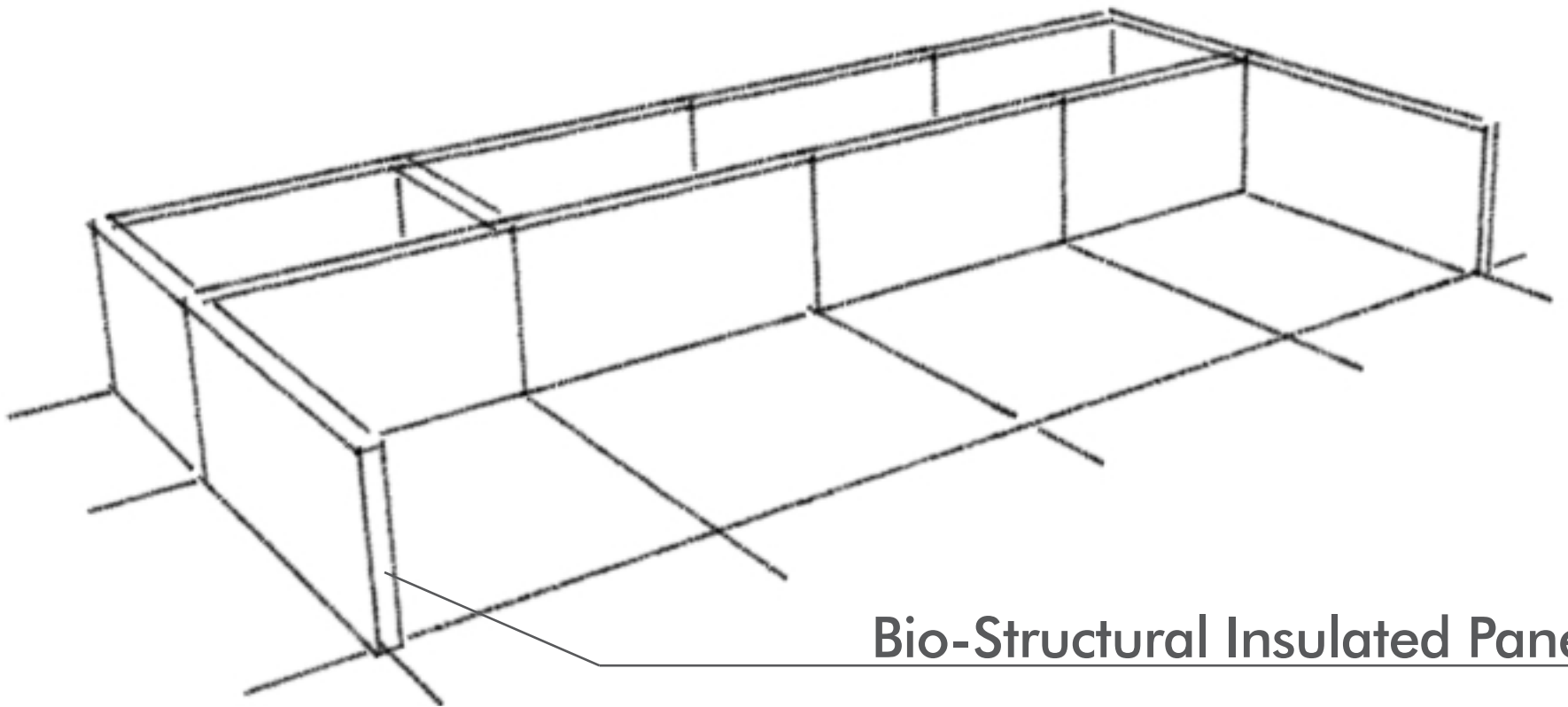
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



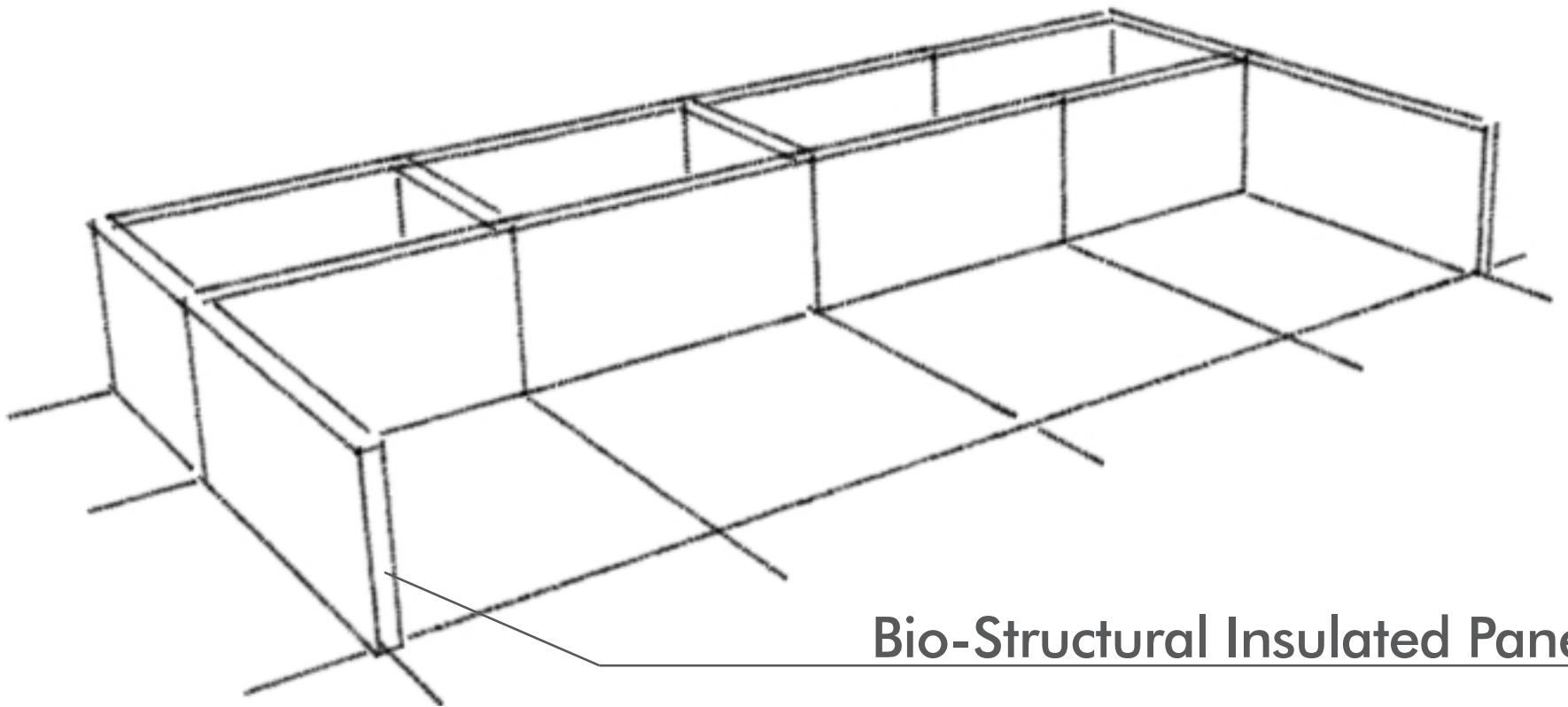
Bio-Structural Insulated Panels

# PROTOTYPE HOUSE



Bio-Structural Insulated Panels

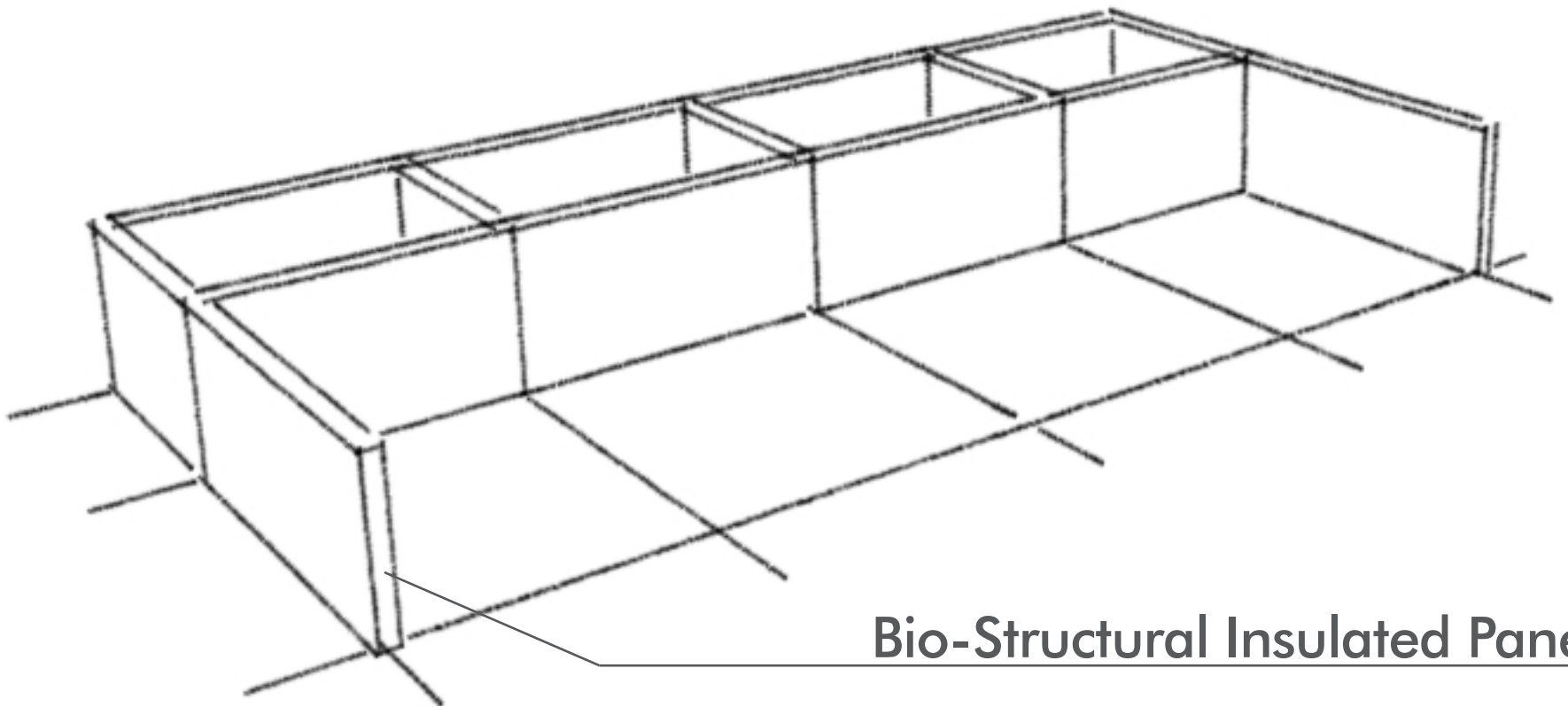
# PROTOTYPE HOUSE



Bio-Structural Insulated Panels

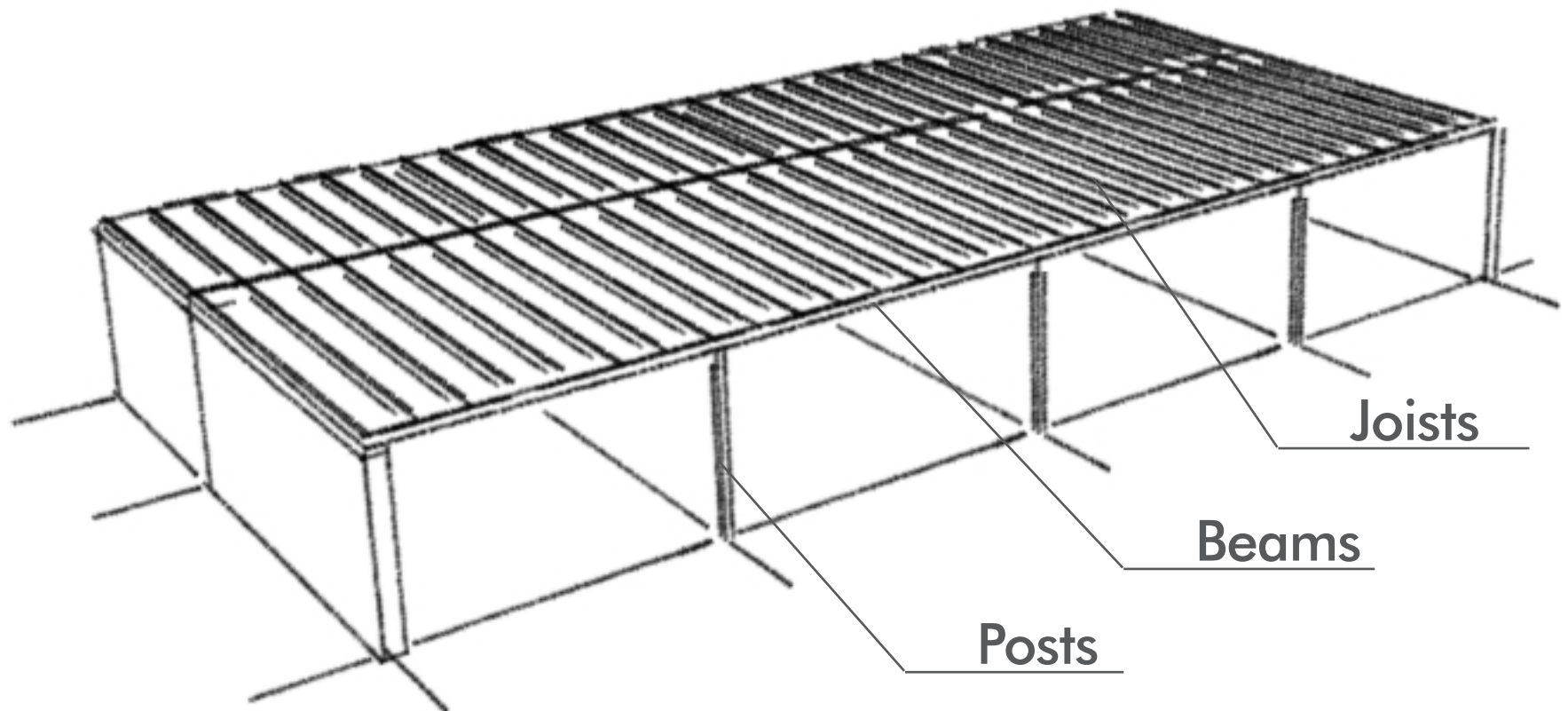


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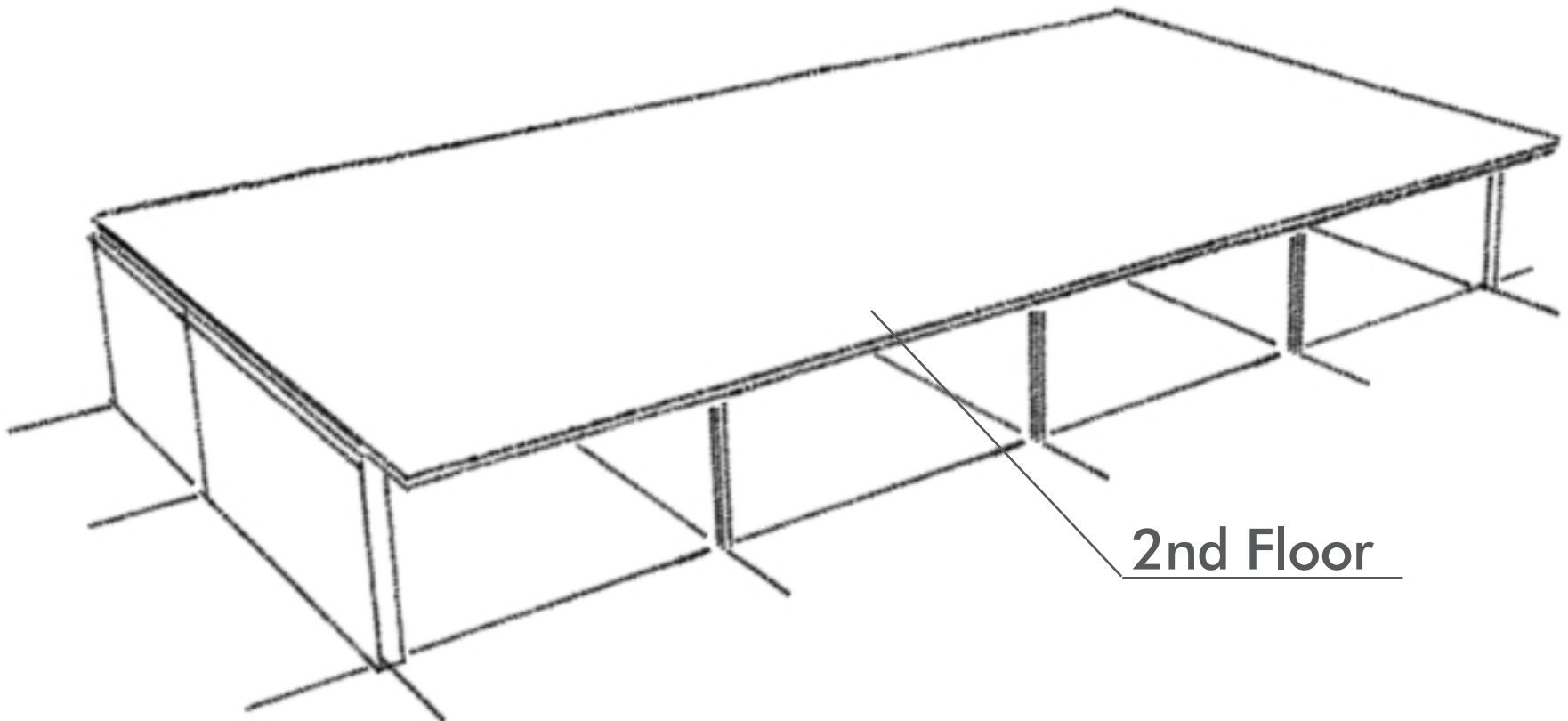


Bio-Structural Insulated Panels

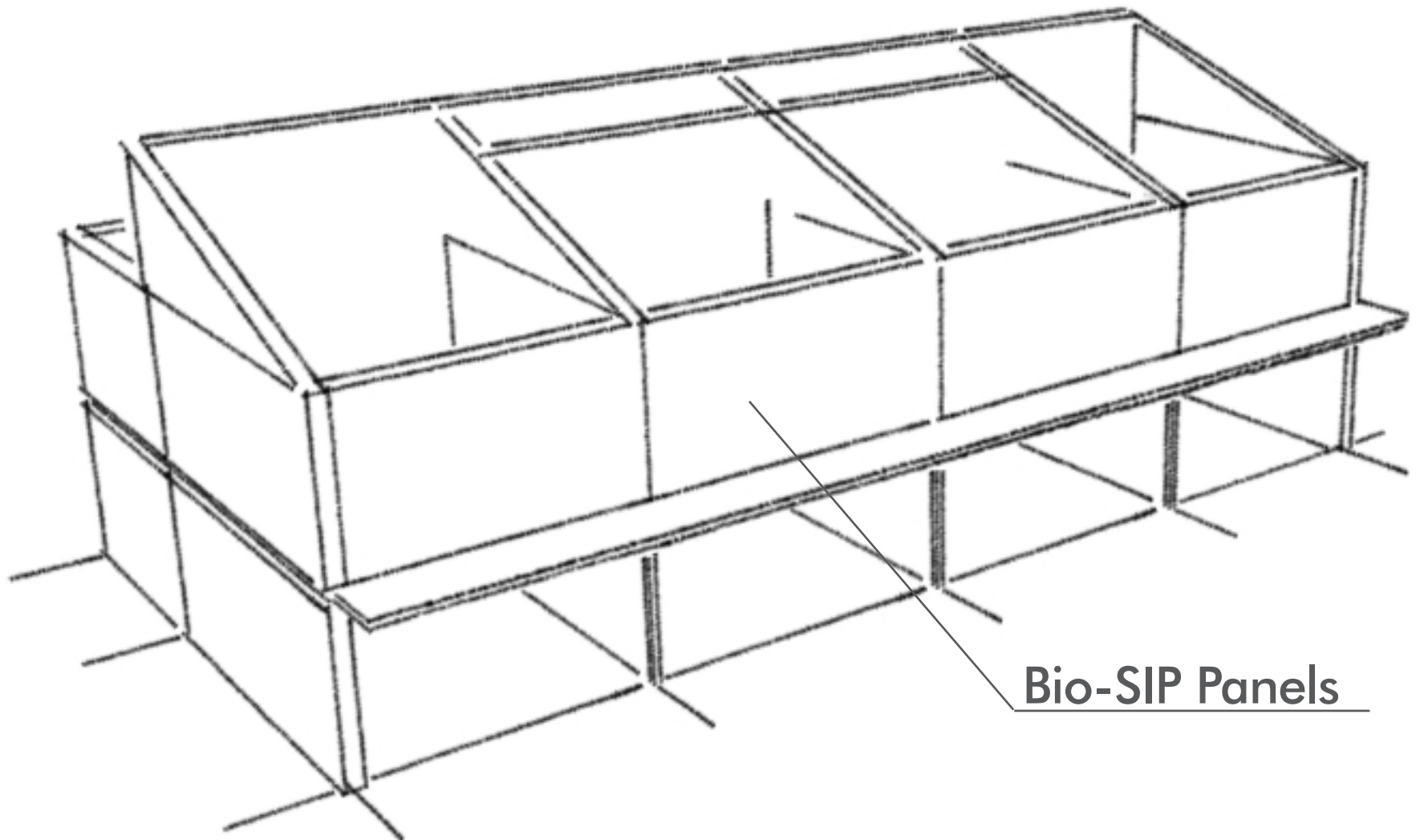
# PROTOTYPE HOUSE



# PROTOTYPE HOUSE

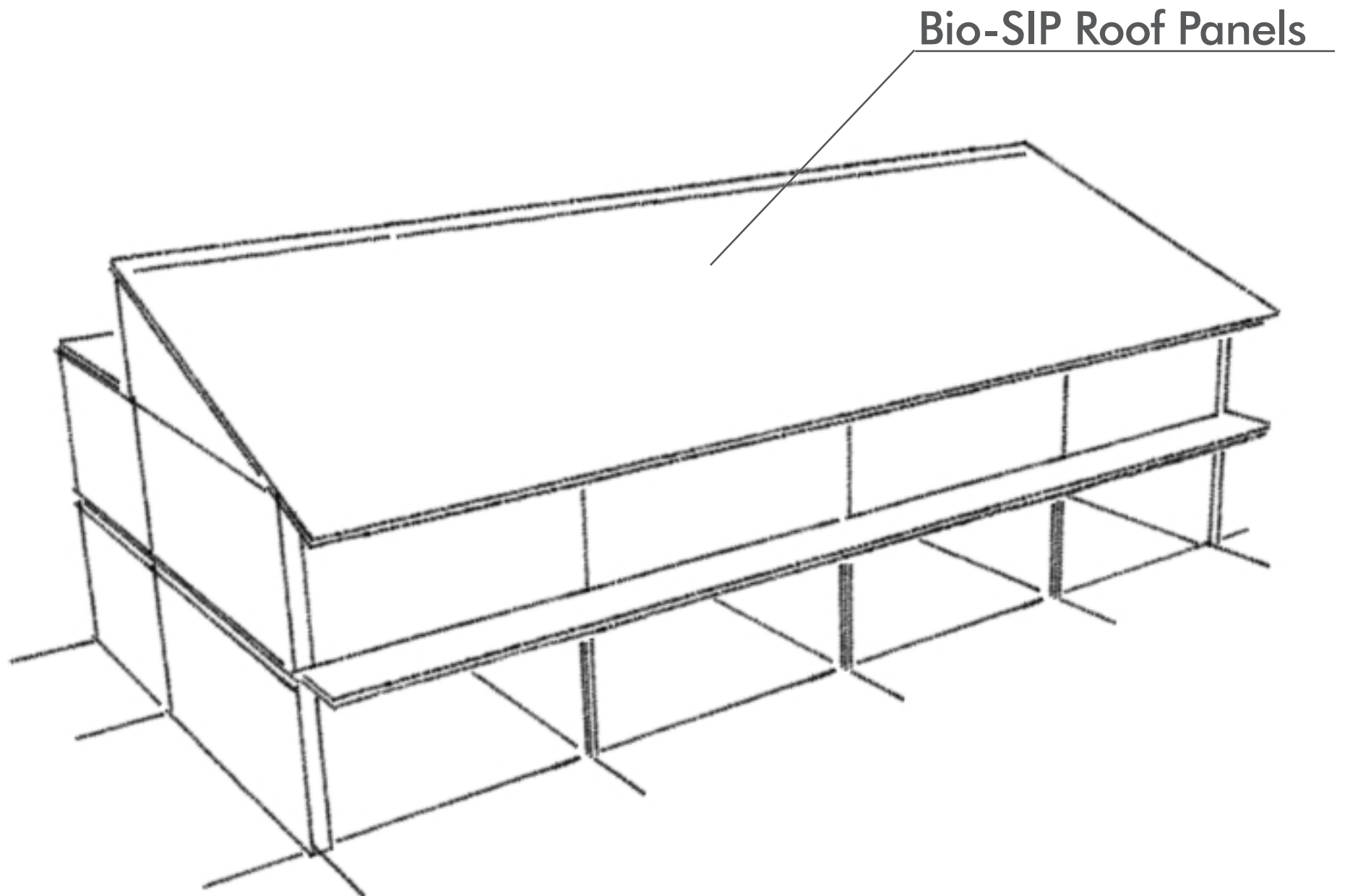


# PROTOTYPE HOUSE



Bio-SIP Panels

# PROTOTYPE HOUSE













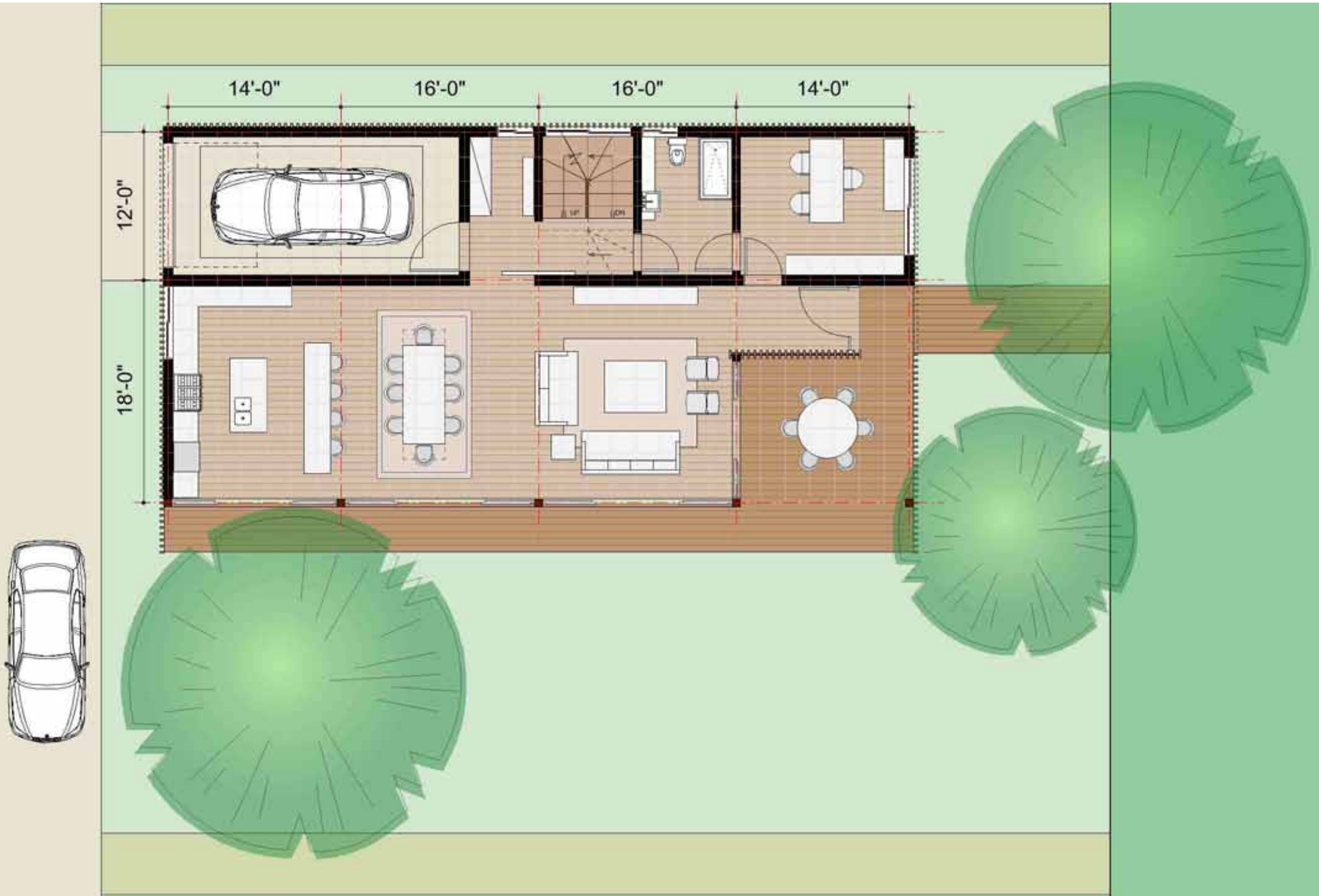






# PROTOTYPE HOUSE

First Floor - 1668sqf



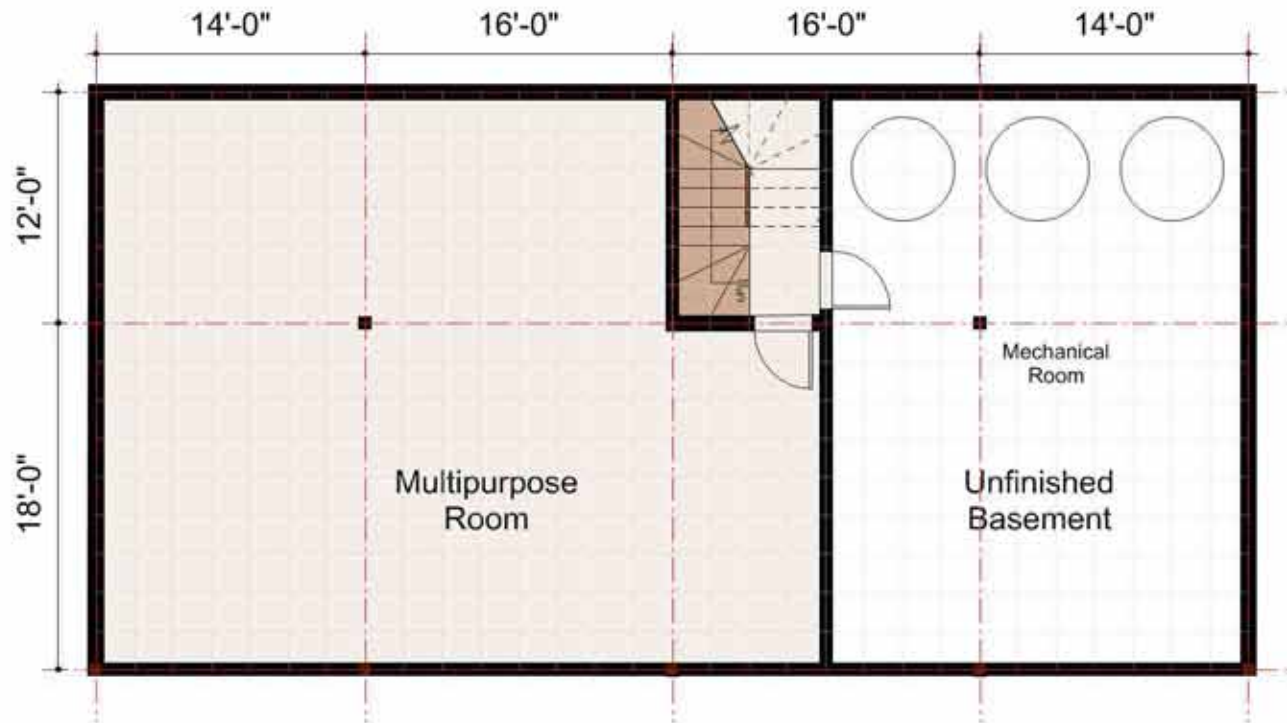
# PROTOTYPE HOUSE

Second Floor - 1875sqf



# PROTOTYPE HOUSE

Basement - 1875sqf



# PROTOTYPE HOUSE

South Façade



# PROTOTYPE HOUSE

North Façade





# PROTOTYPE HOUSE

East Façade





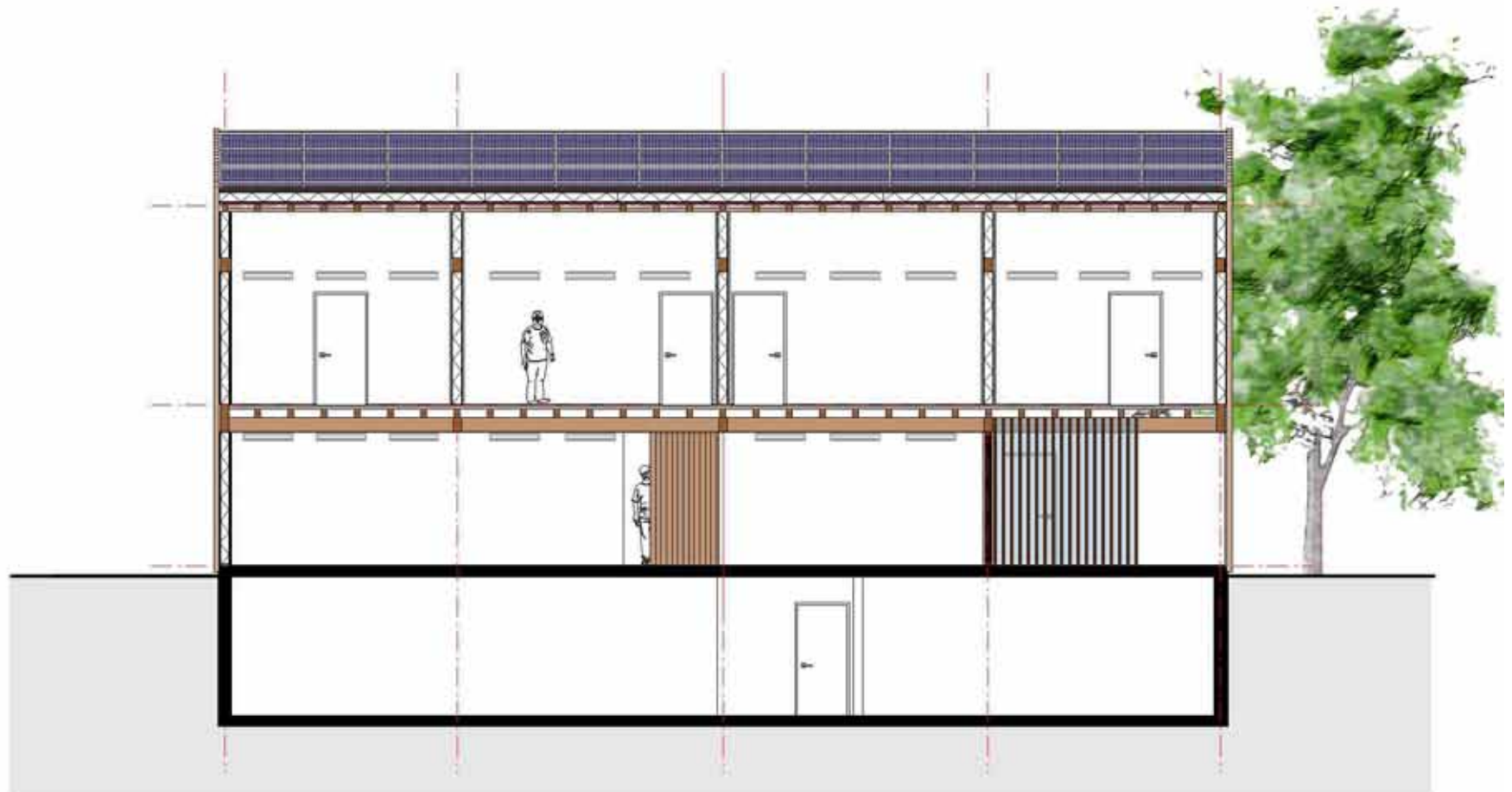
# PROTOTYPE HOUSE

West Façade



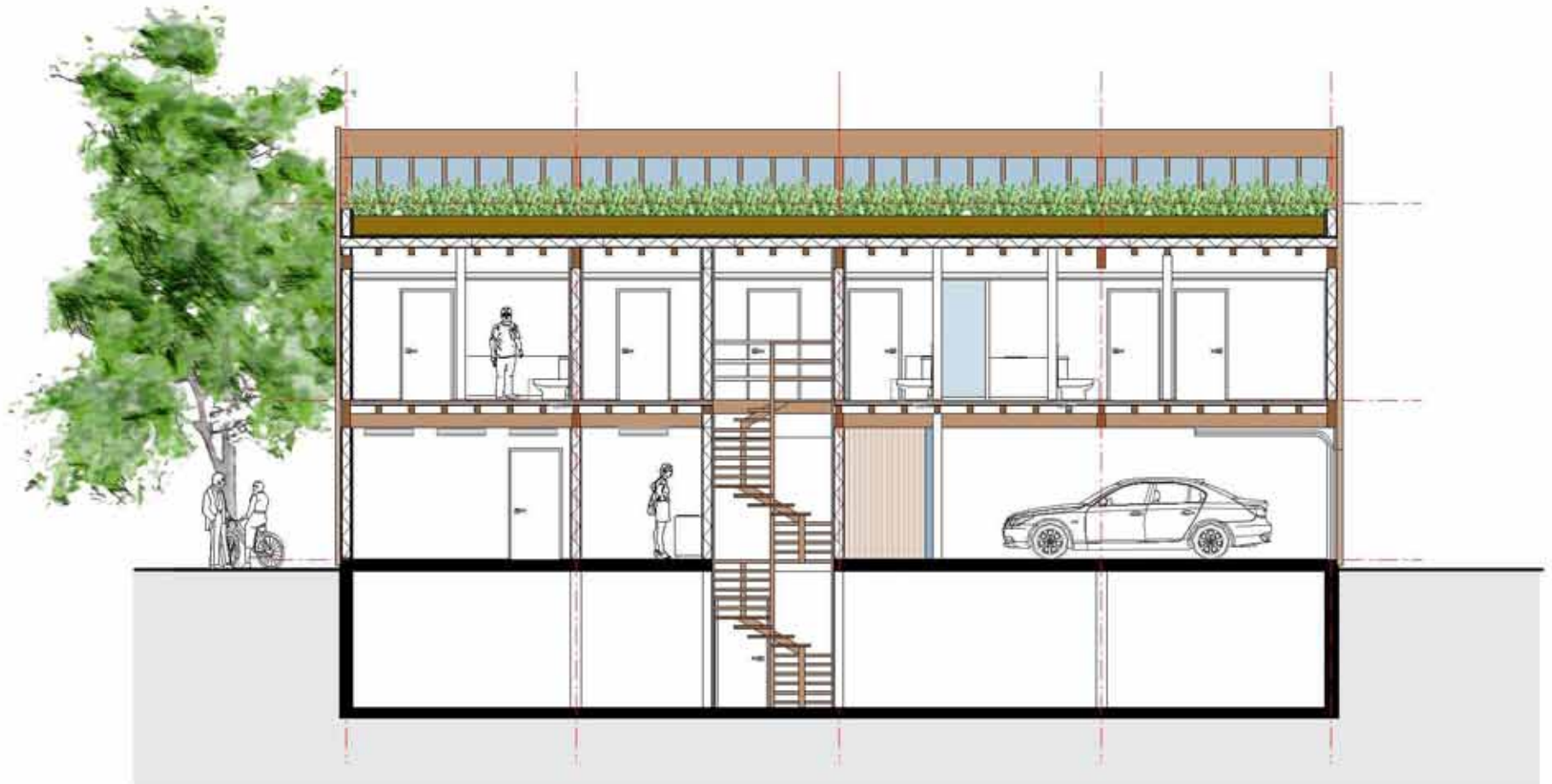
# PROTOTYPE HOUSE

## Section A-A'



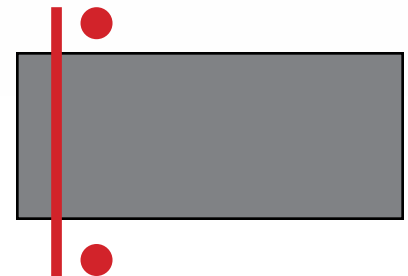
# PROTOTYPE HOUSE

## Section B-B'



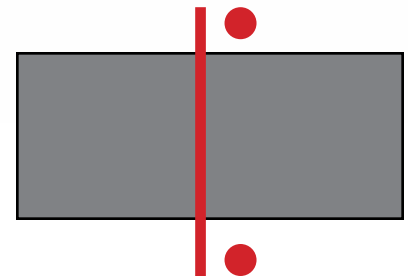
# PROTOTYPE HOUSE

## Section C-C'



# PROTOTYPE HOUSE

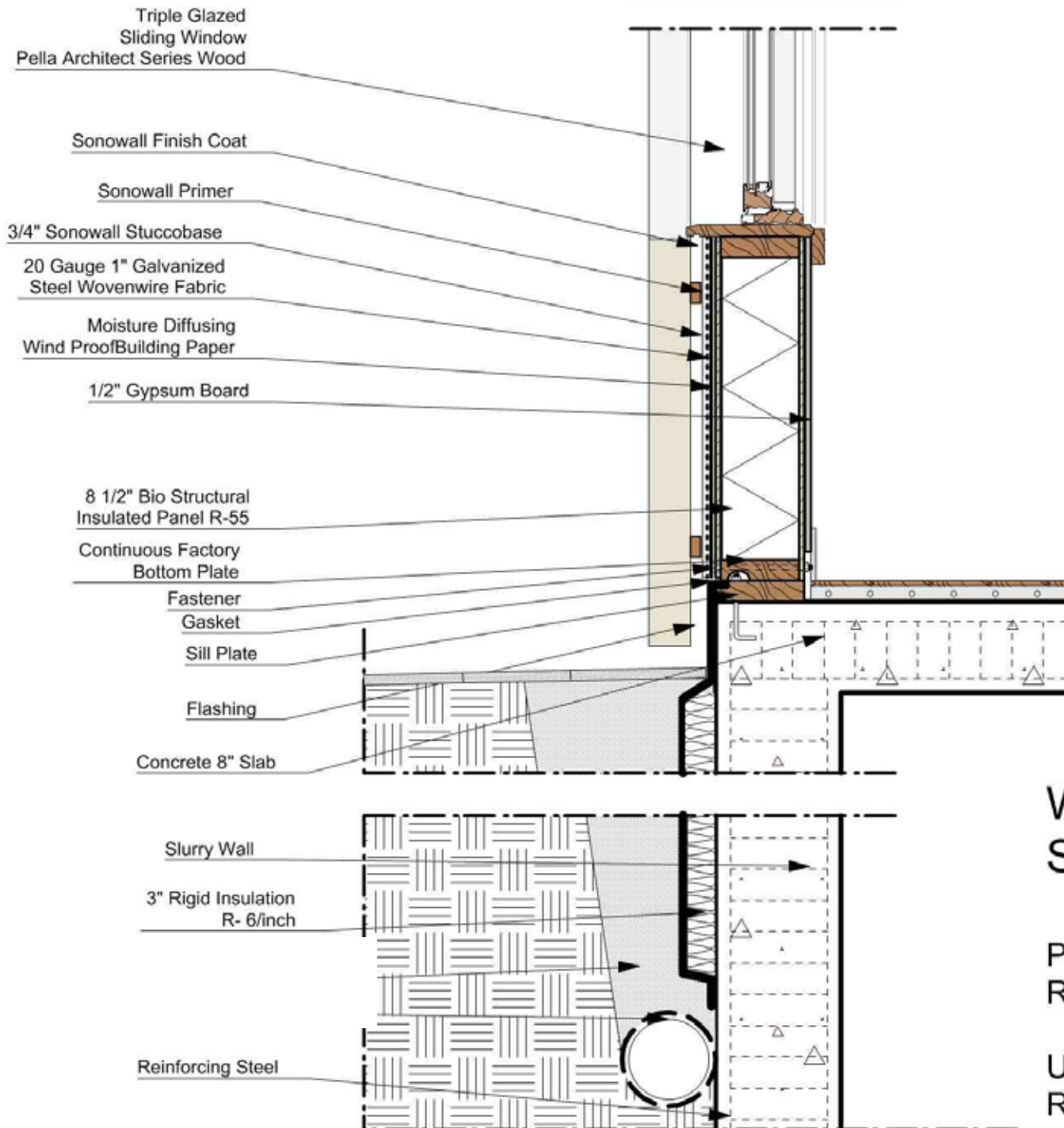
## Section D-D'





# PROTOTYPE HOUSE

## Details



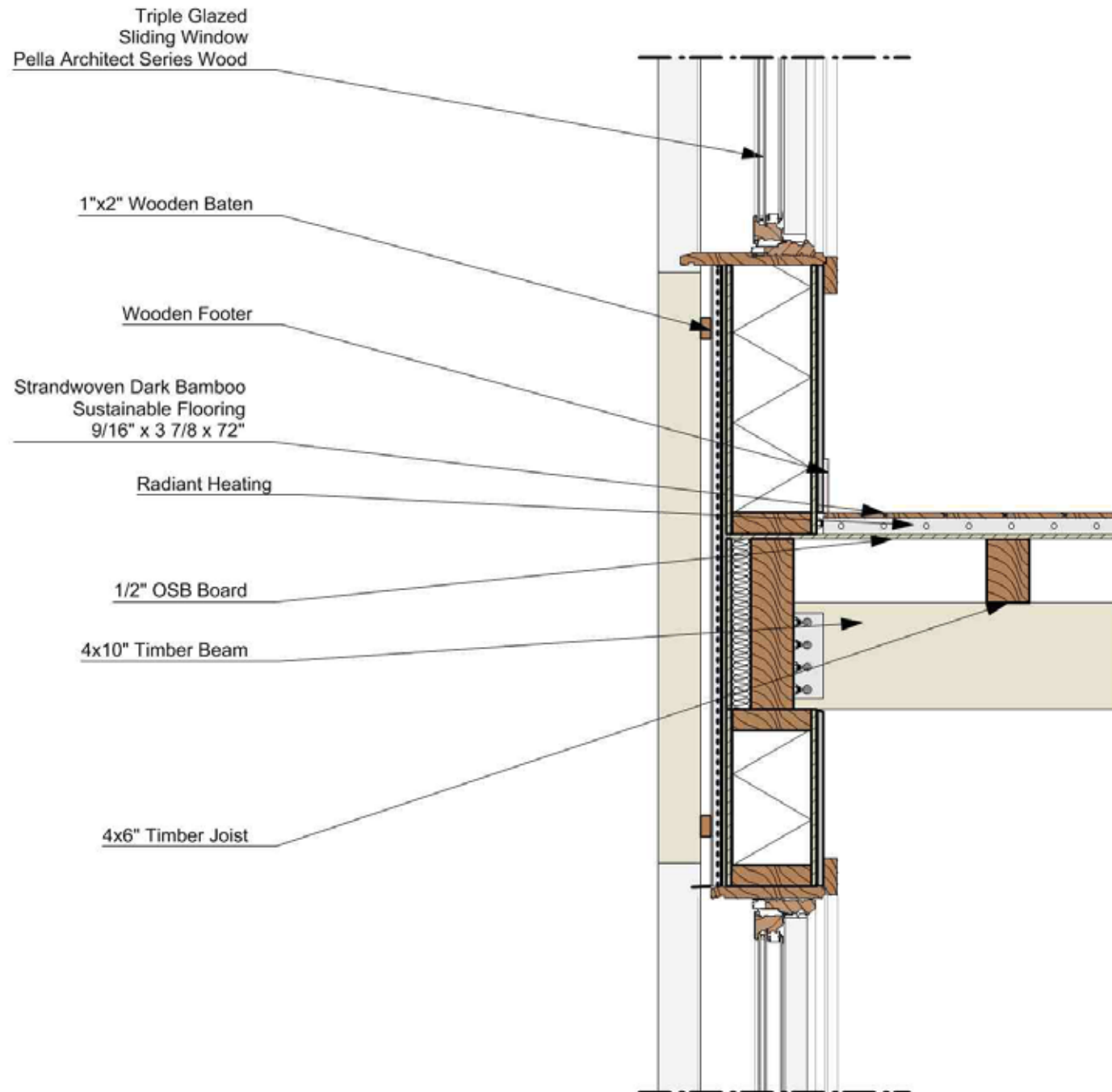
Wall Section  
Scale 3/4" = 1'

Passive Haus Standard  
R-56 aprox 27" Thickness

UHH Wall Assembly  
R-56 10" Thickness

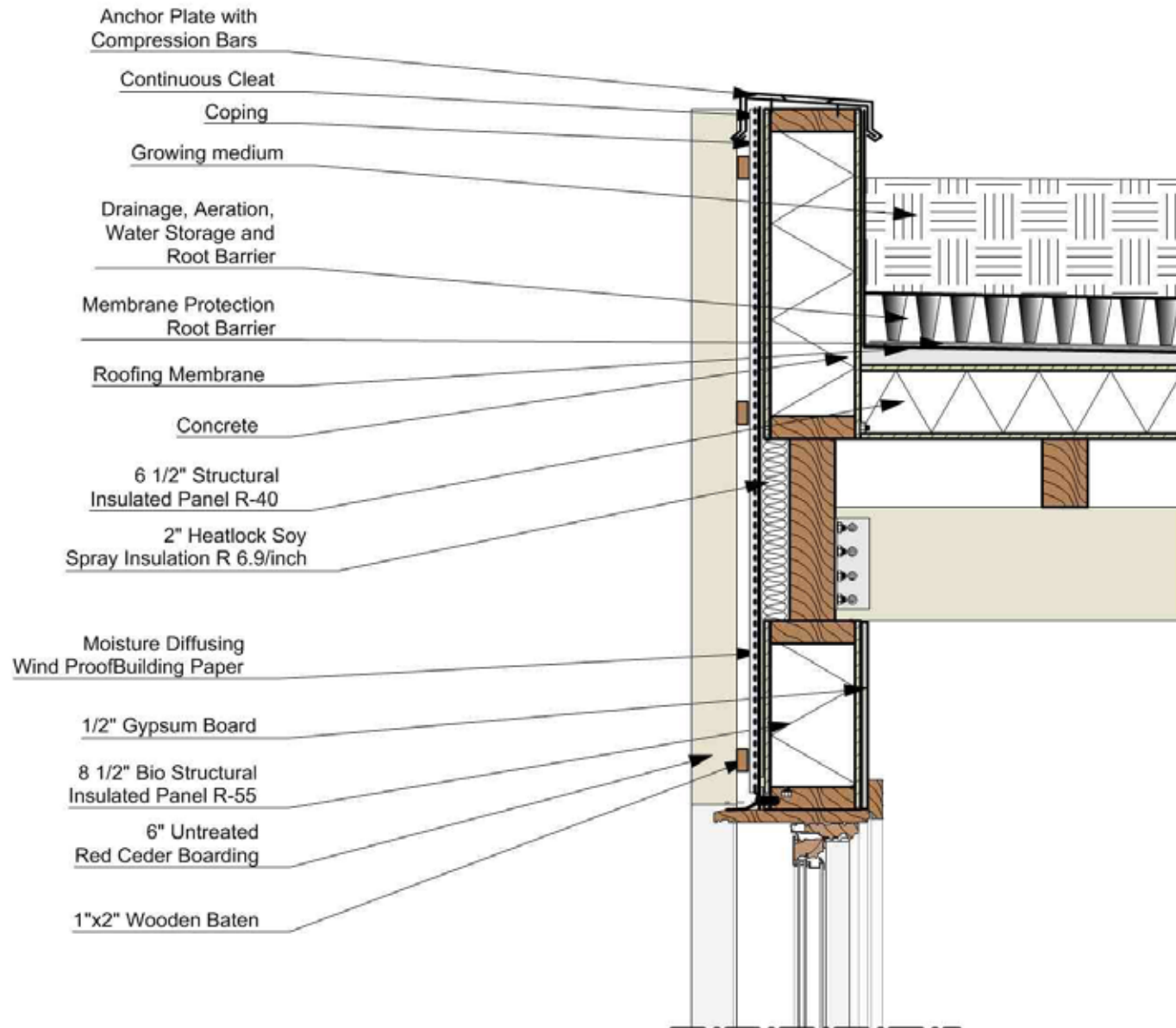
# PROTOTYPE HOUSE

## Details



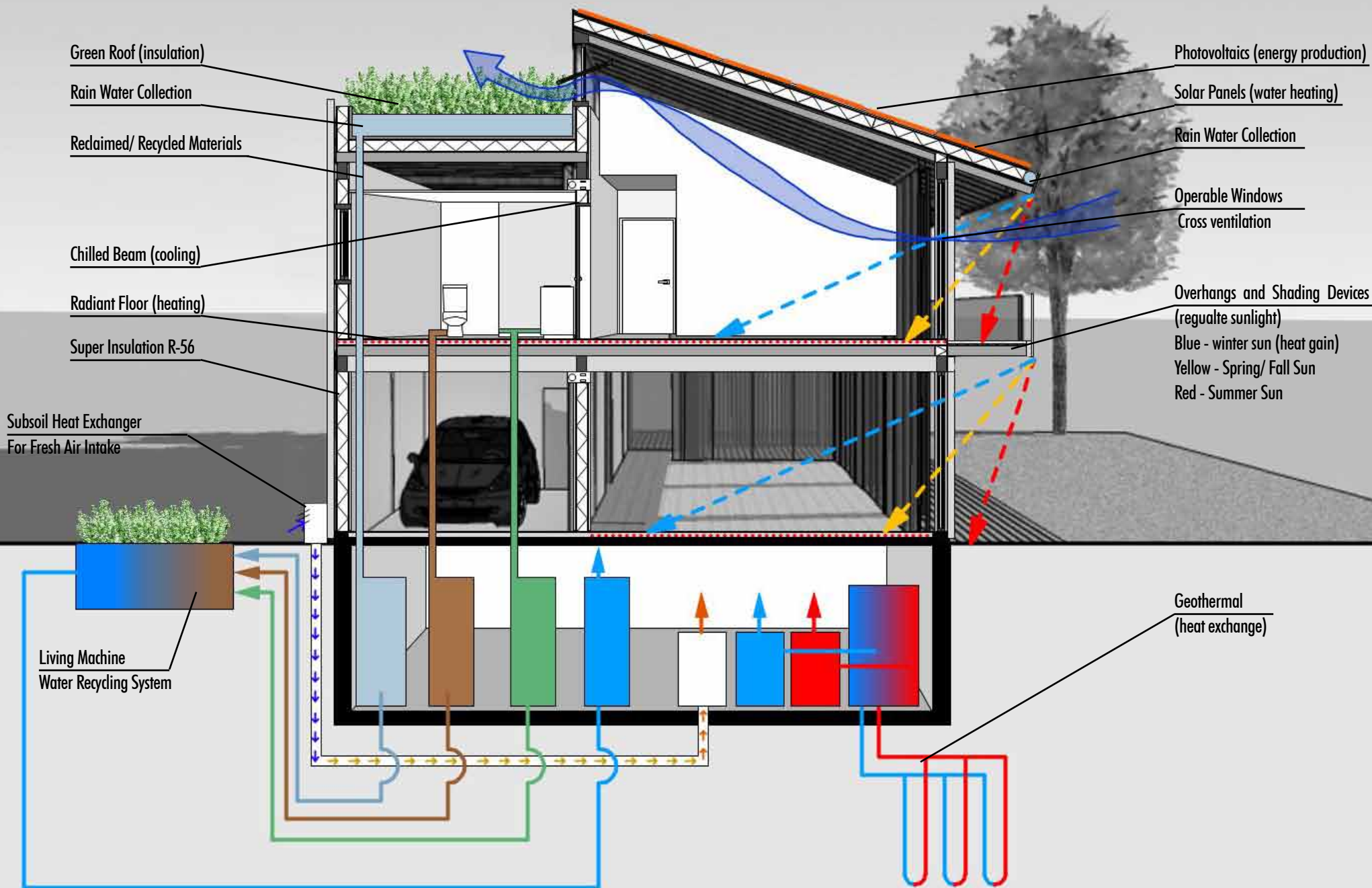
# PROTOTYPE HOUSE

## Details



# PROTOTYPE HOUSE

## Systems

















# HOUSE VARIATION

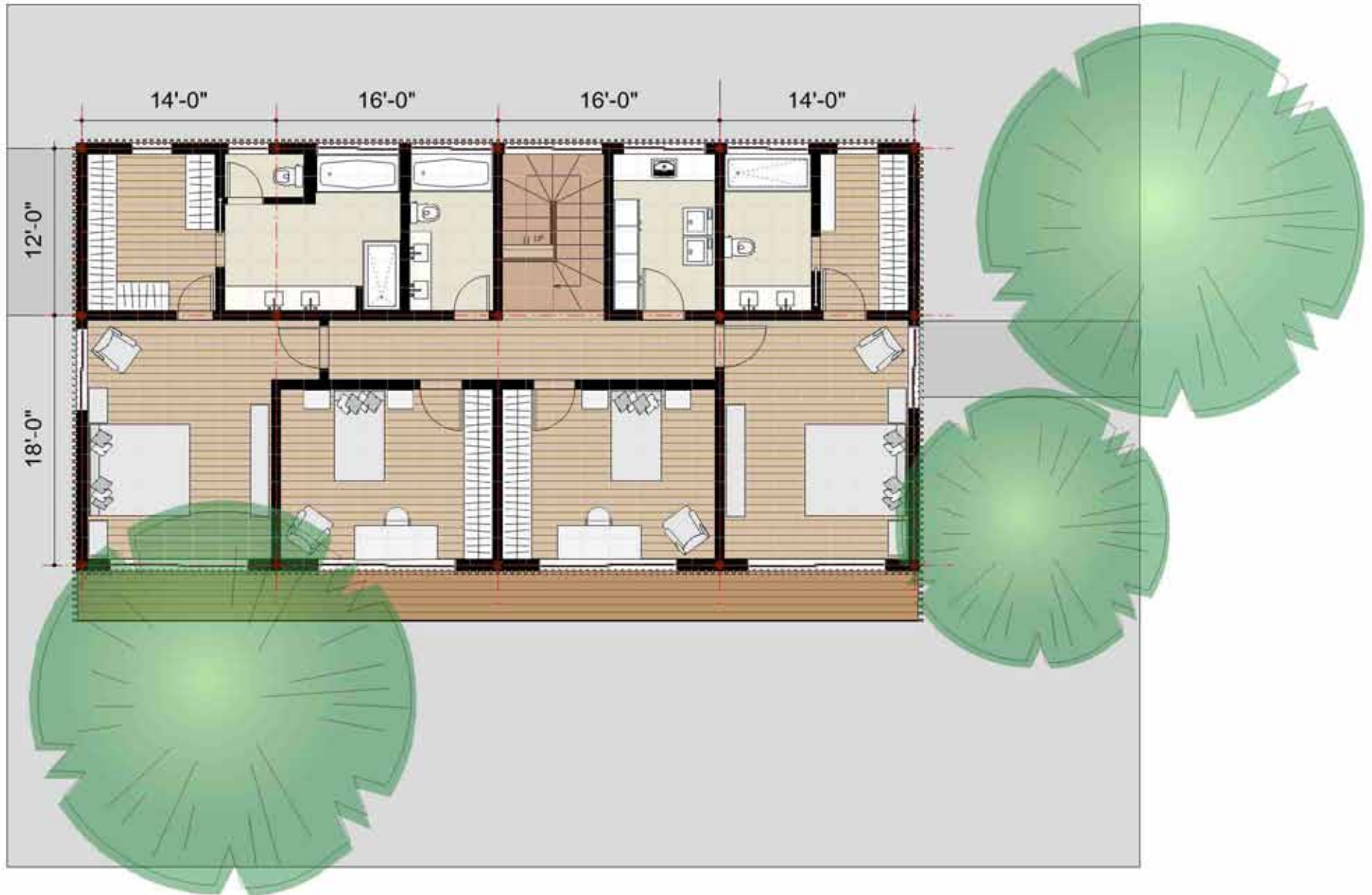
First Floor 1636 sqf





# HOUSE VARIATION

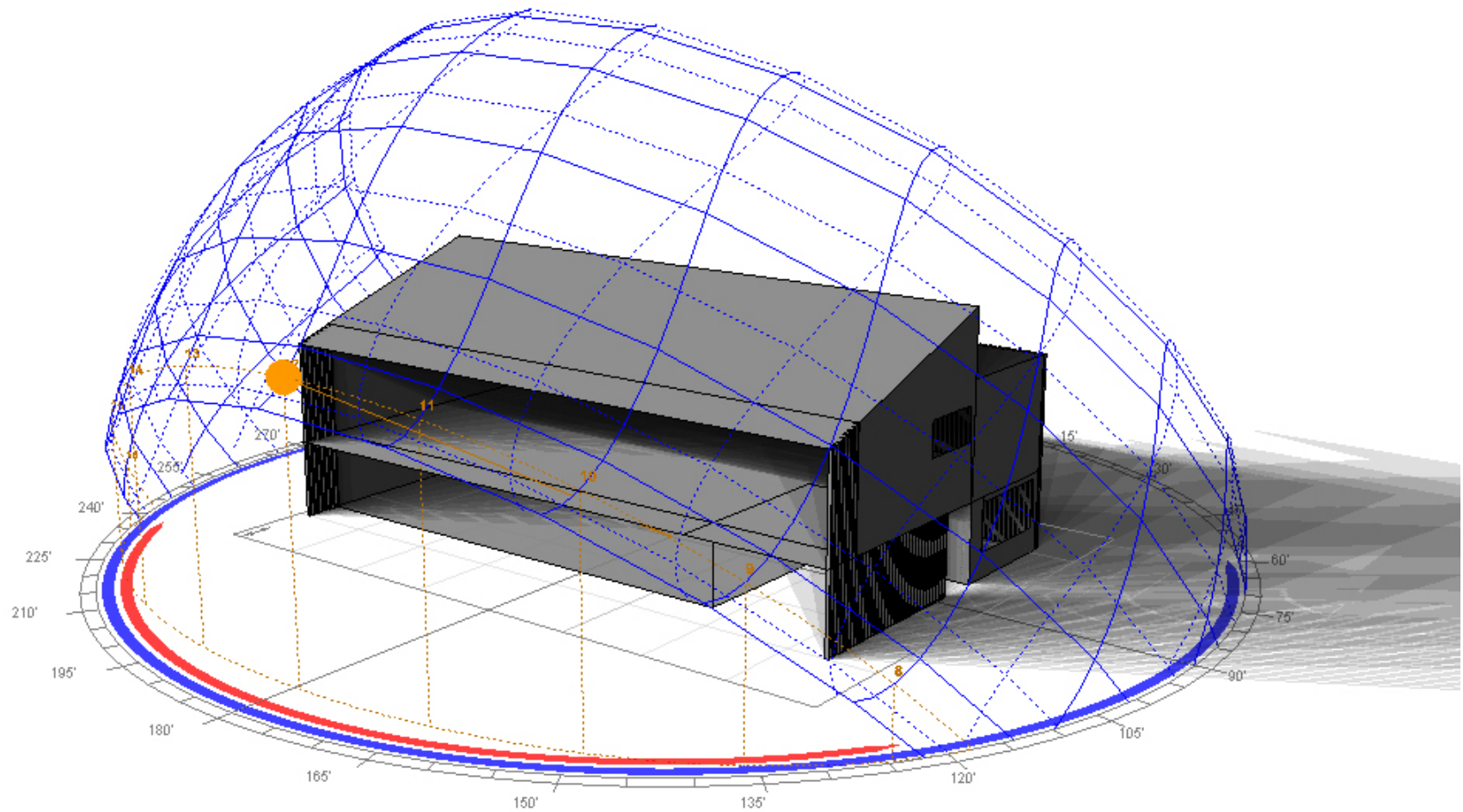
Second Floor 1875 sqf





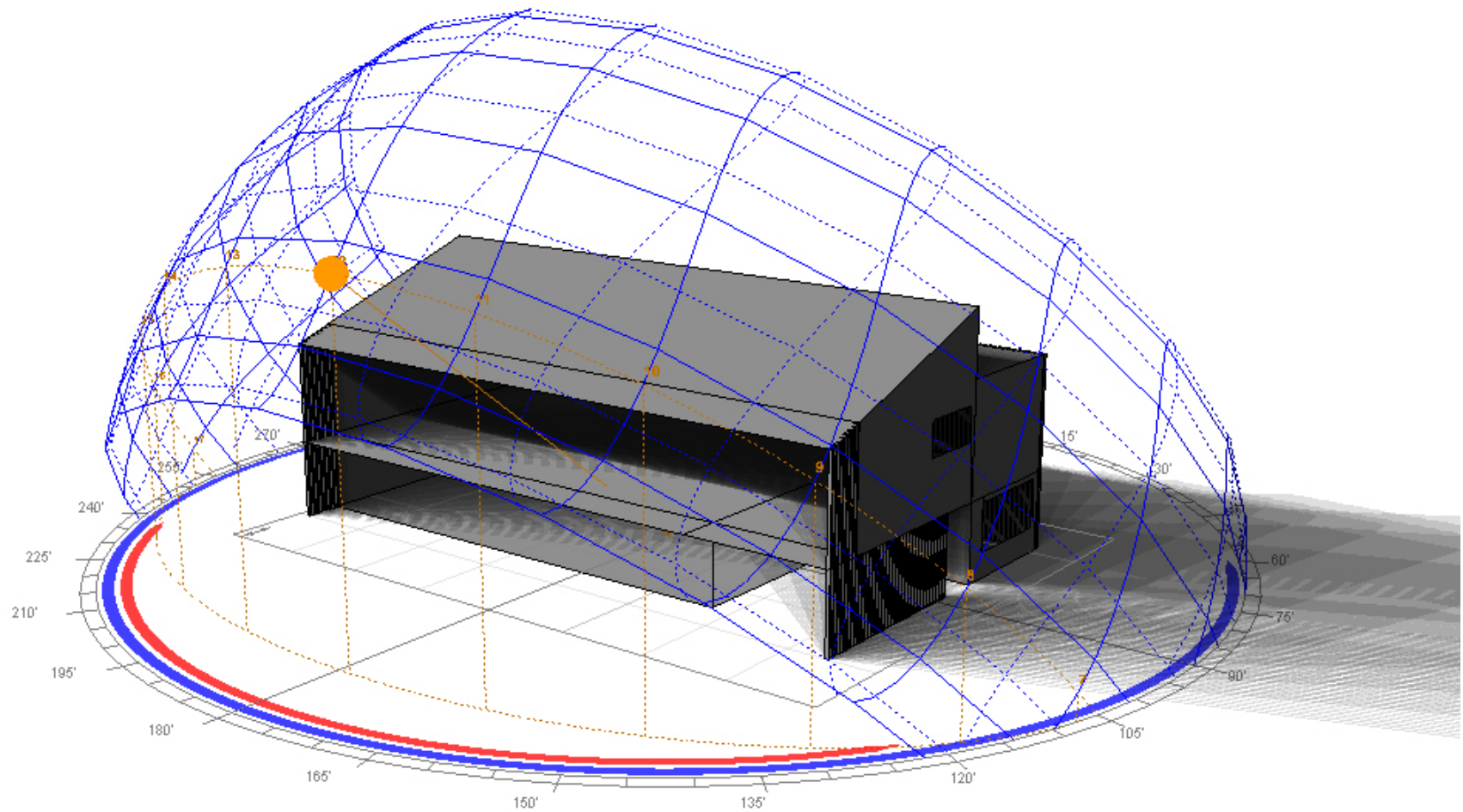
# PROTOTYPE HOUSE

Shadow Range - January



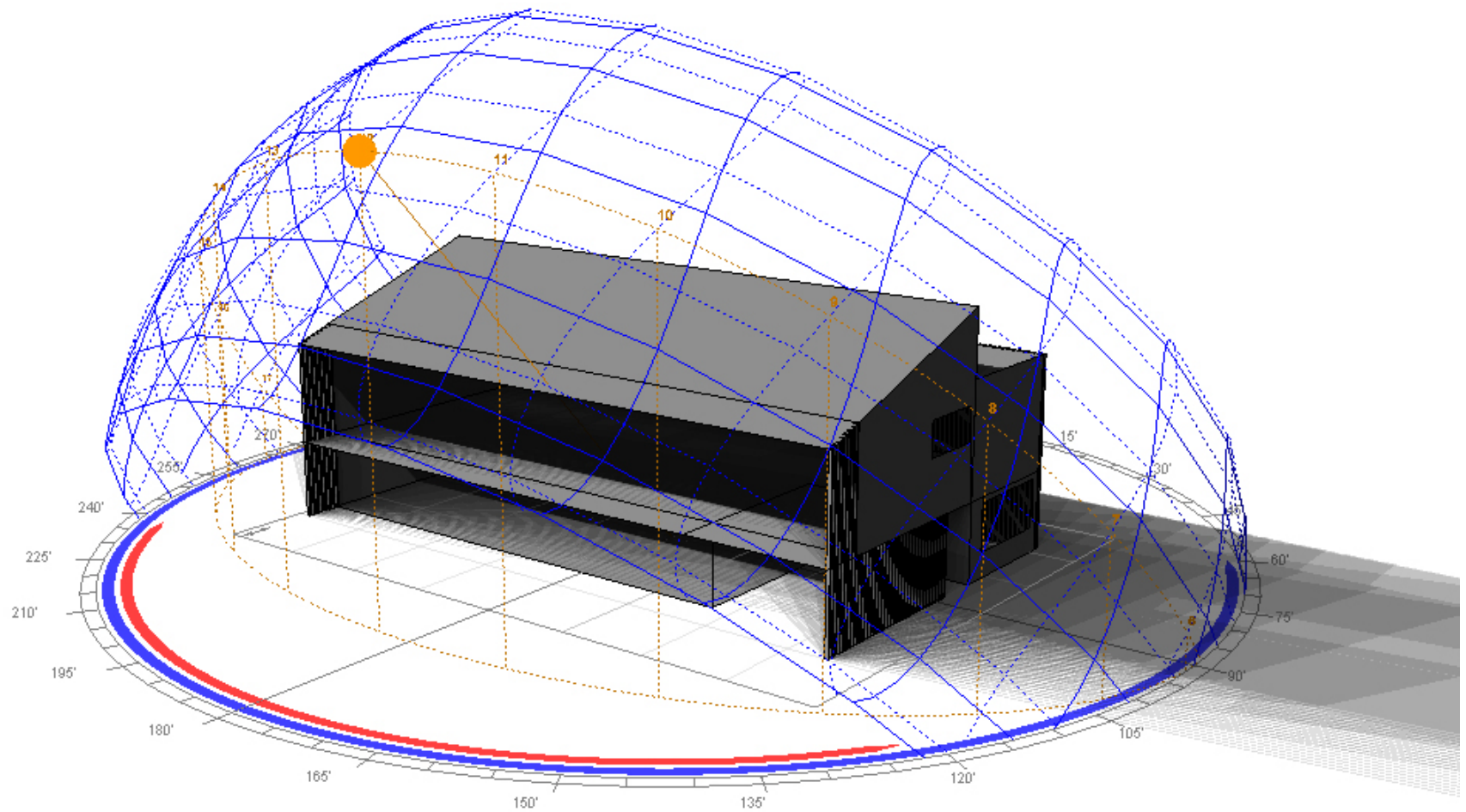
# PROTOTYPE HOUSE

Shadow Range - February



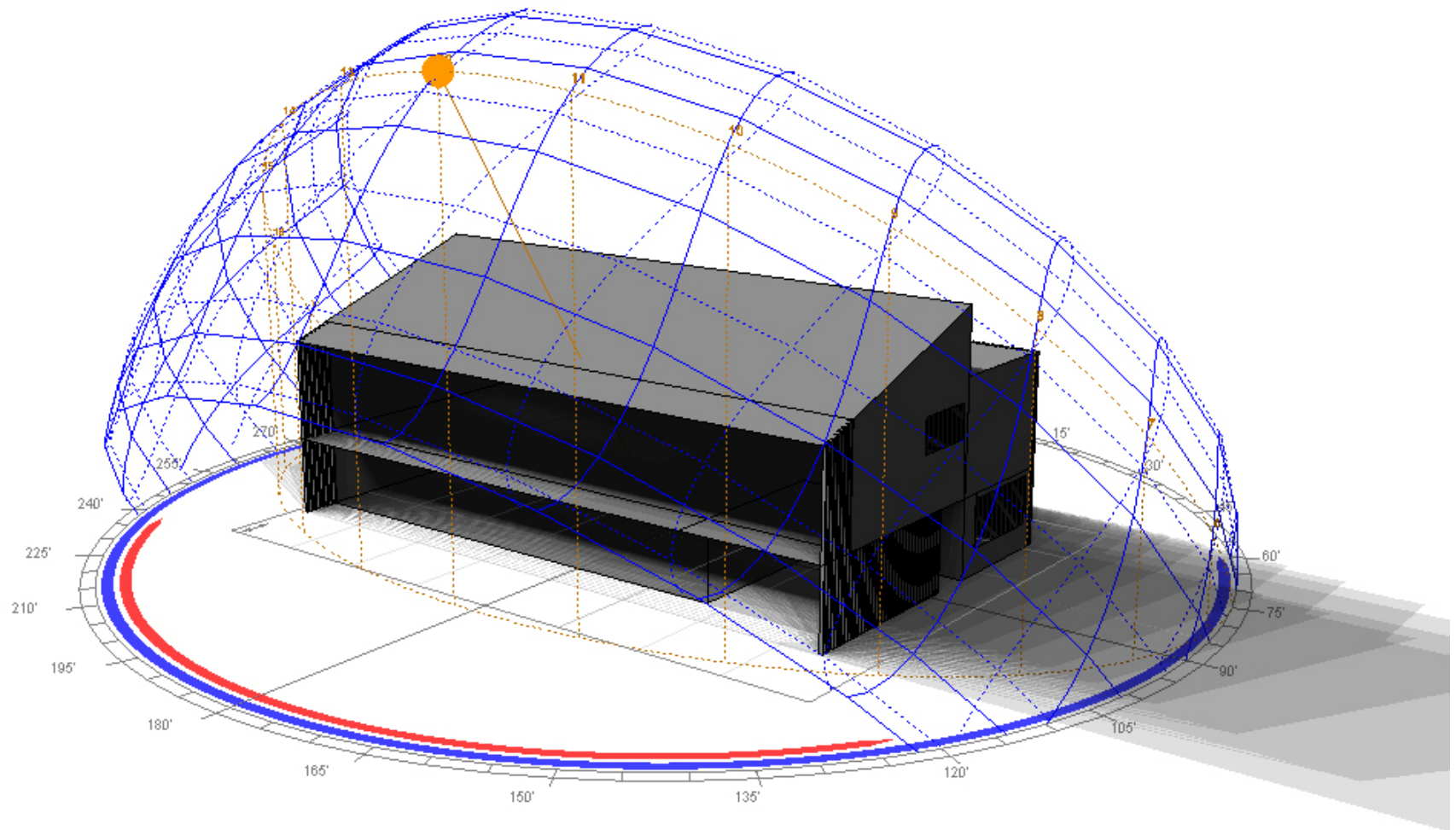
# PROTOTYPE HOUSE

Shadow Range - March



# PROTOTYPE HOUSE

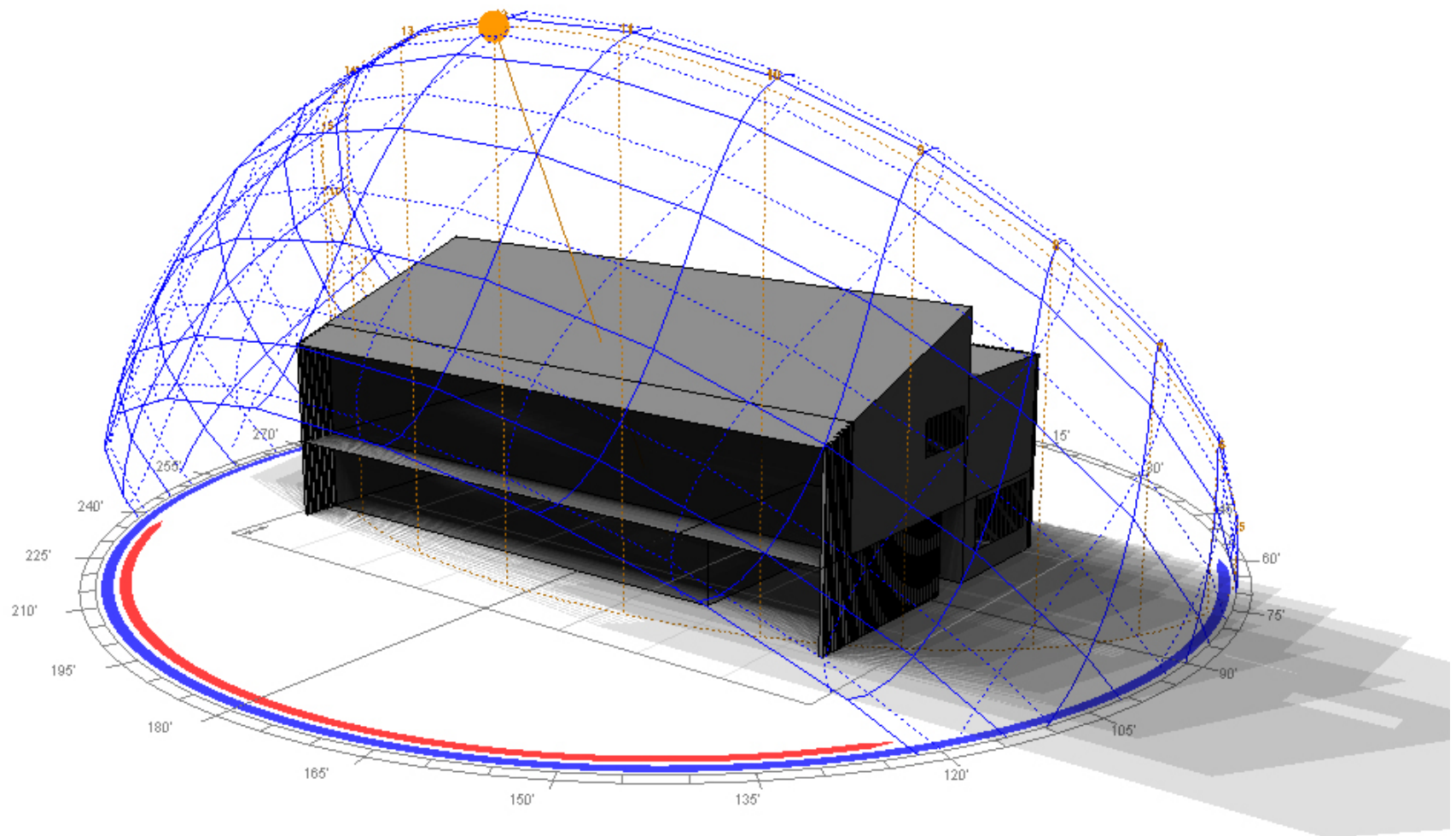
Shadow Range - April





# PROTOTYPE HOUSE

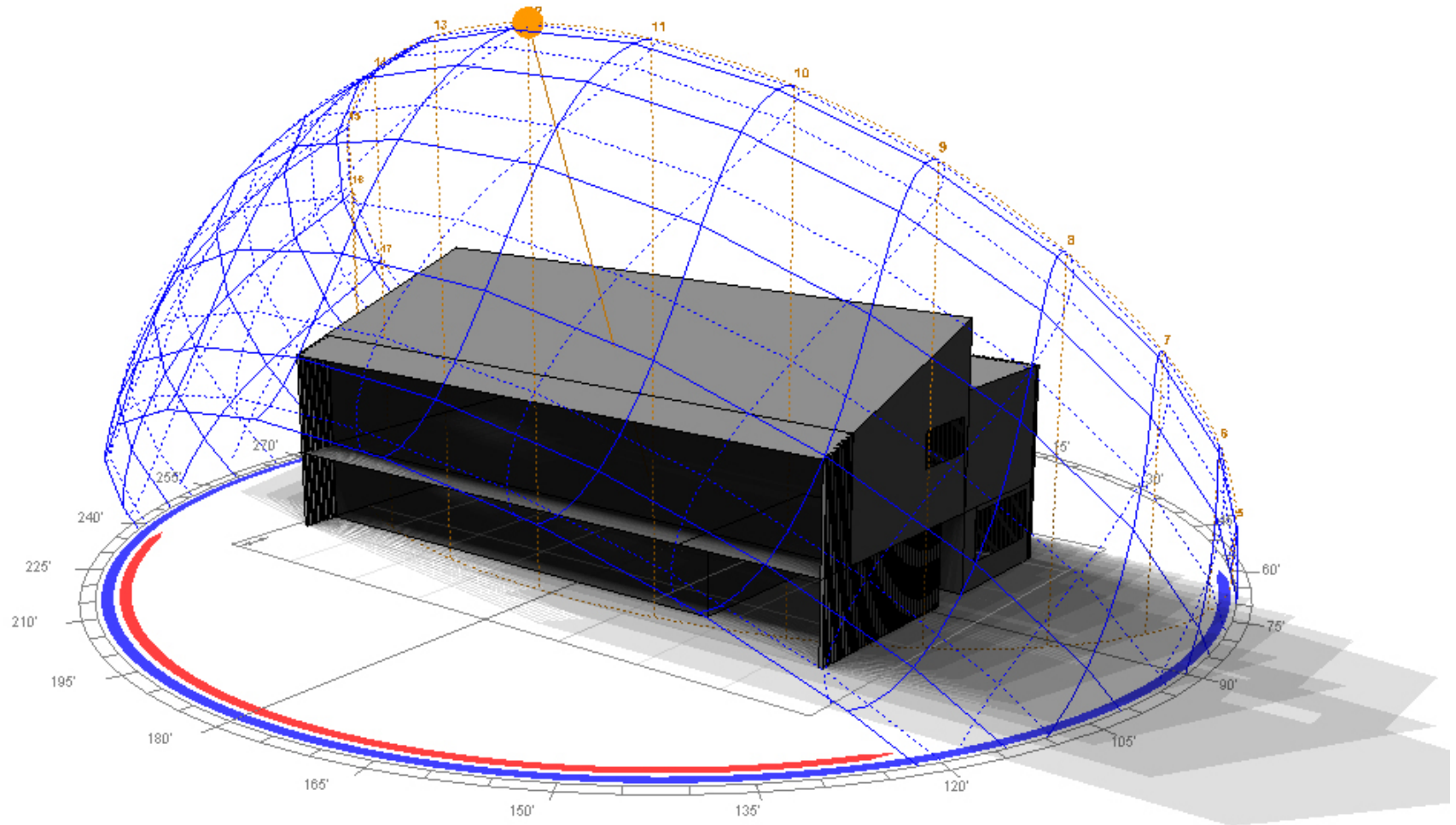
Shadow Range - May





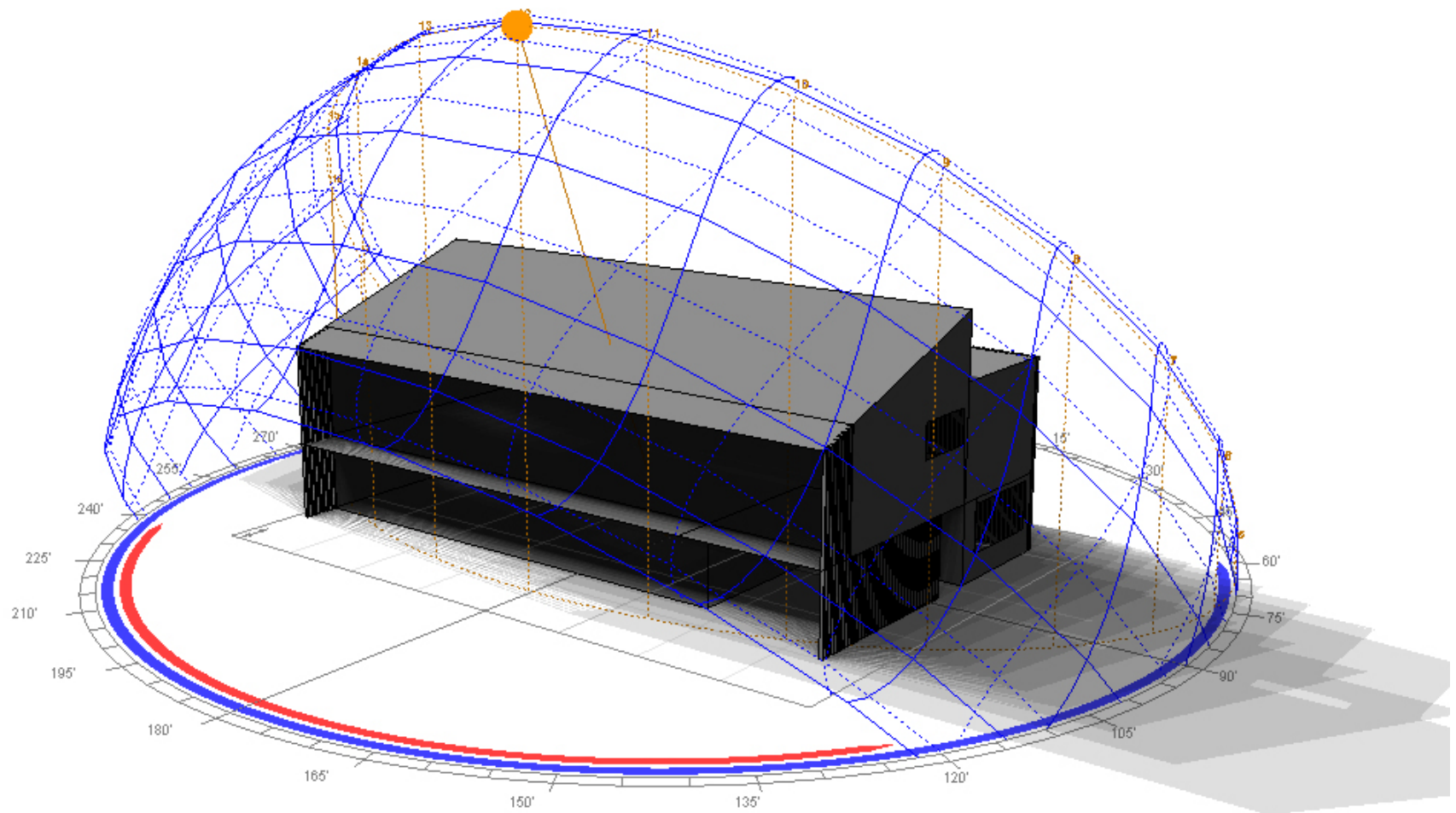
# PROTOTYPE HOUSE

Shadow Range - June



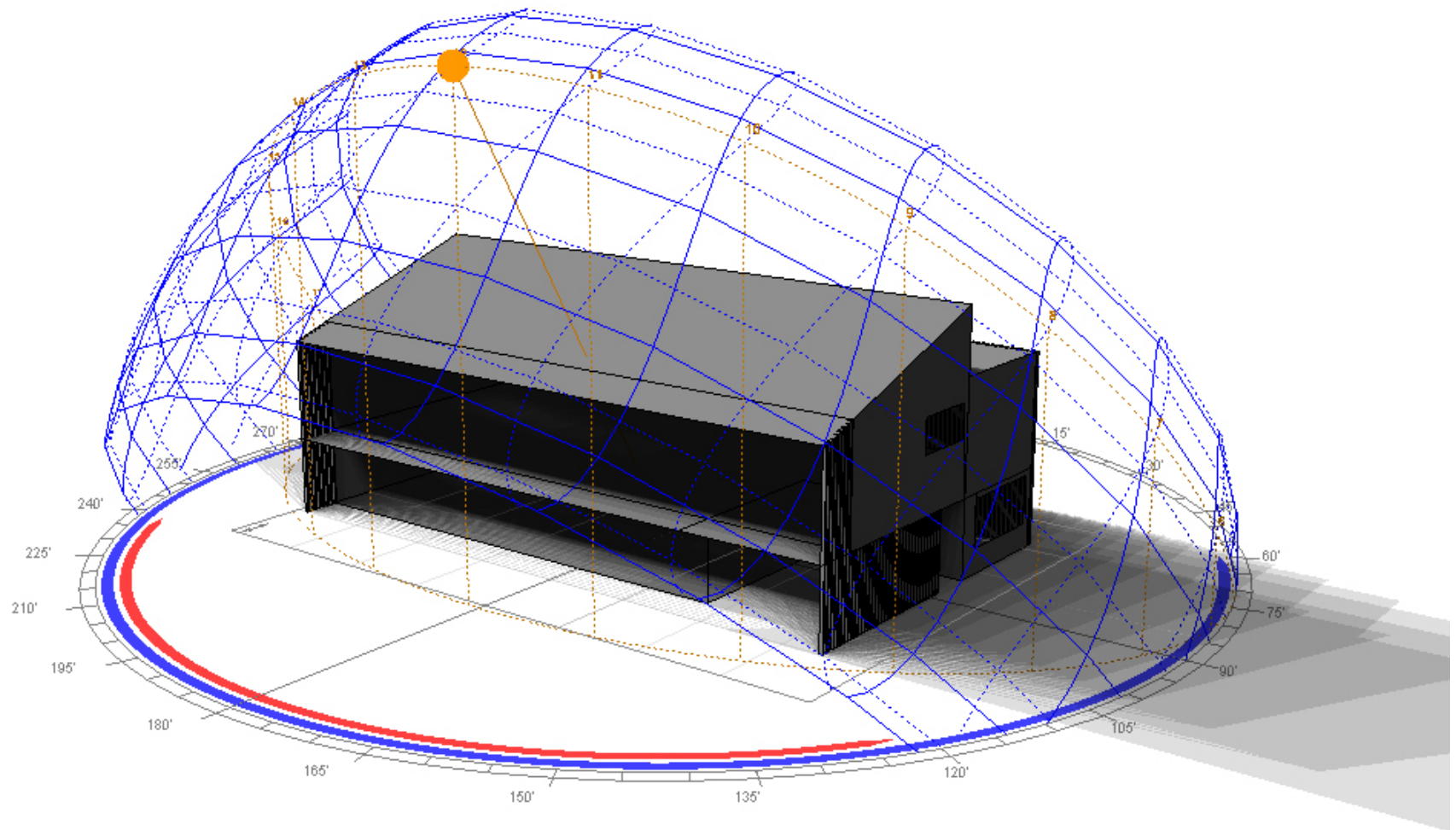
# PROTOTYPE HOUSE

Shadow Range - July



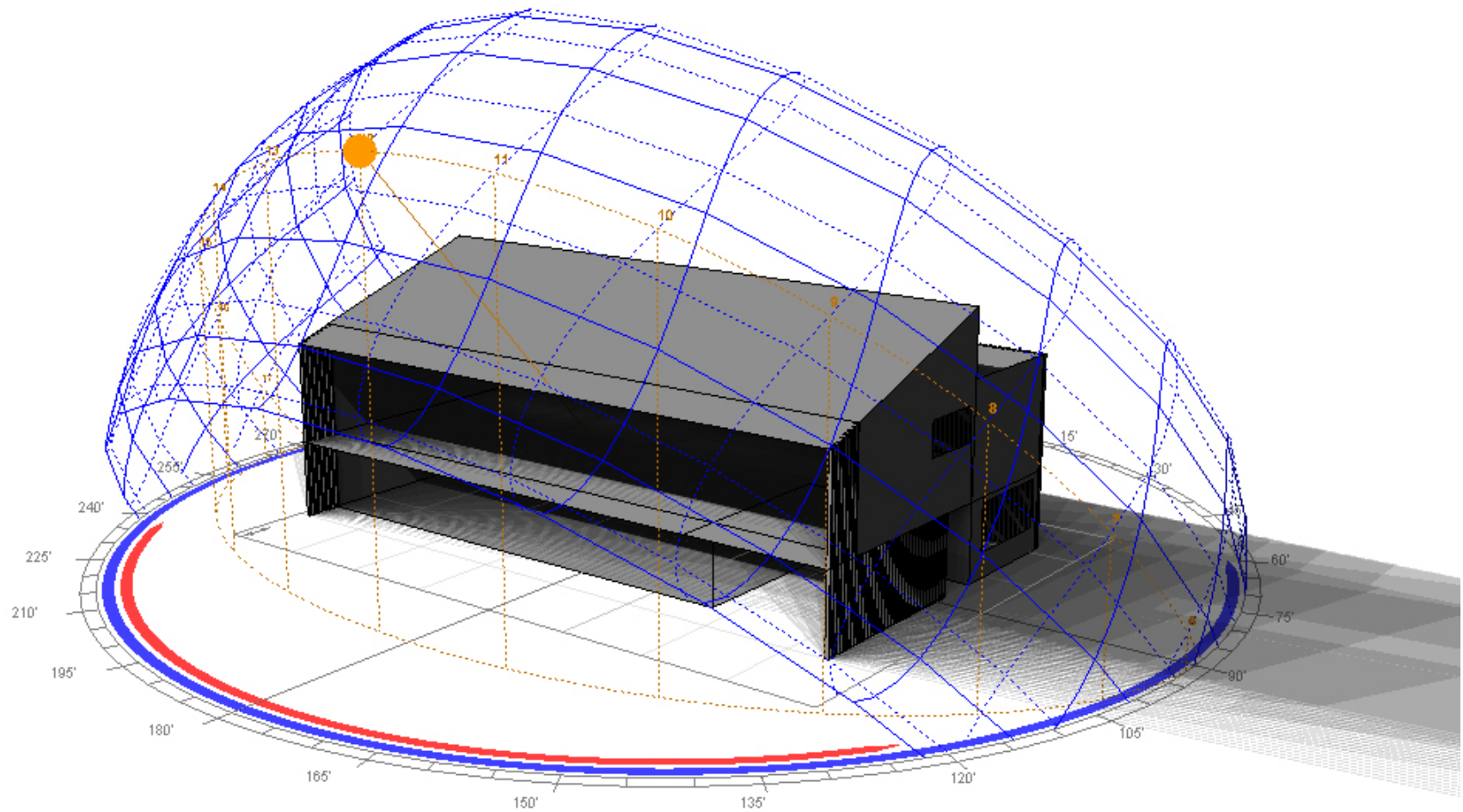
# PROTOTYPE HOUSE

Shadow Range - August



# PROTOTYPE HOUSE

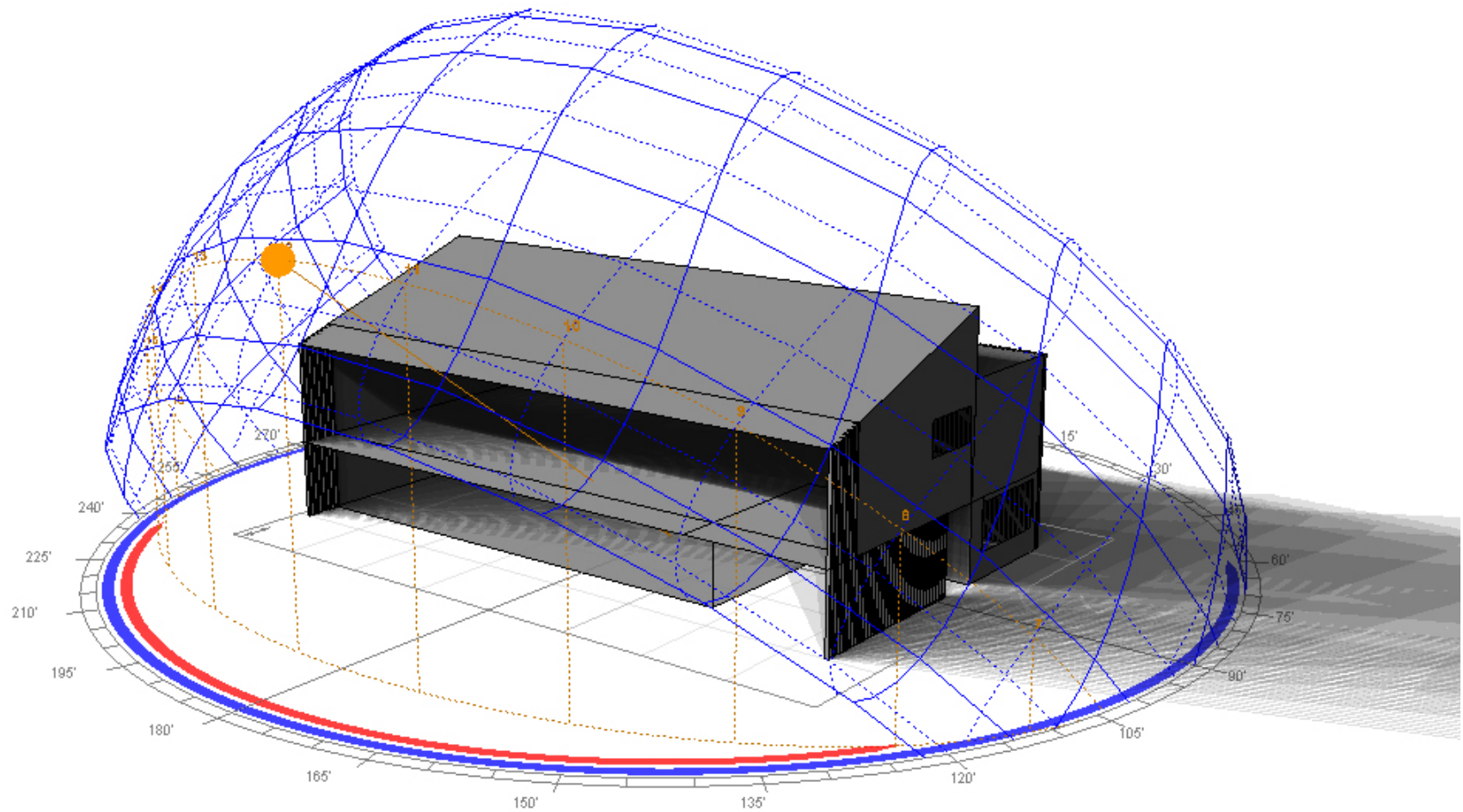
Shadow Range - September





# PROTOTYPE HOUSE

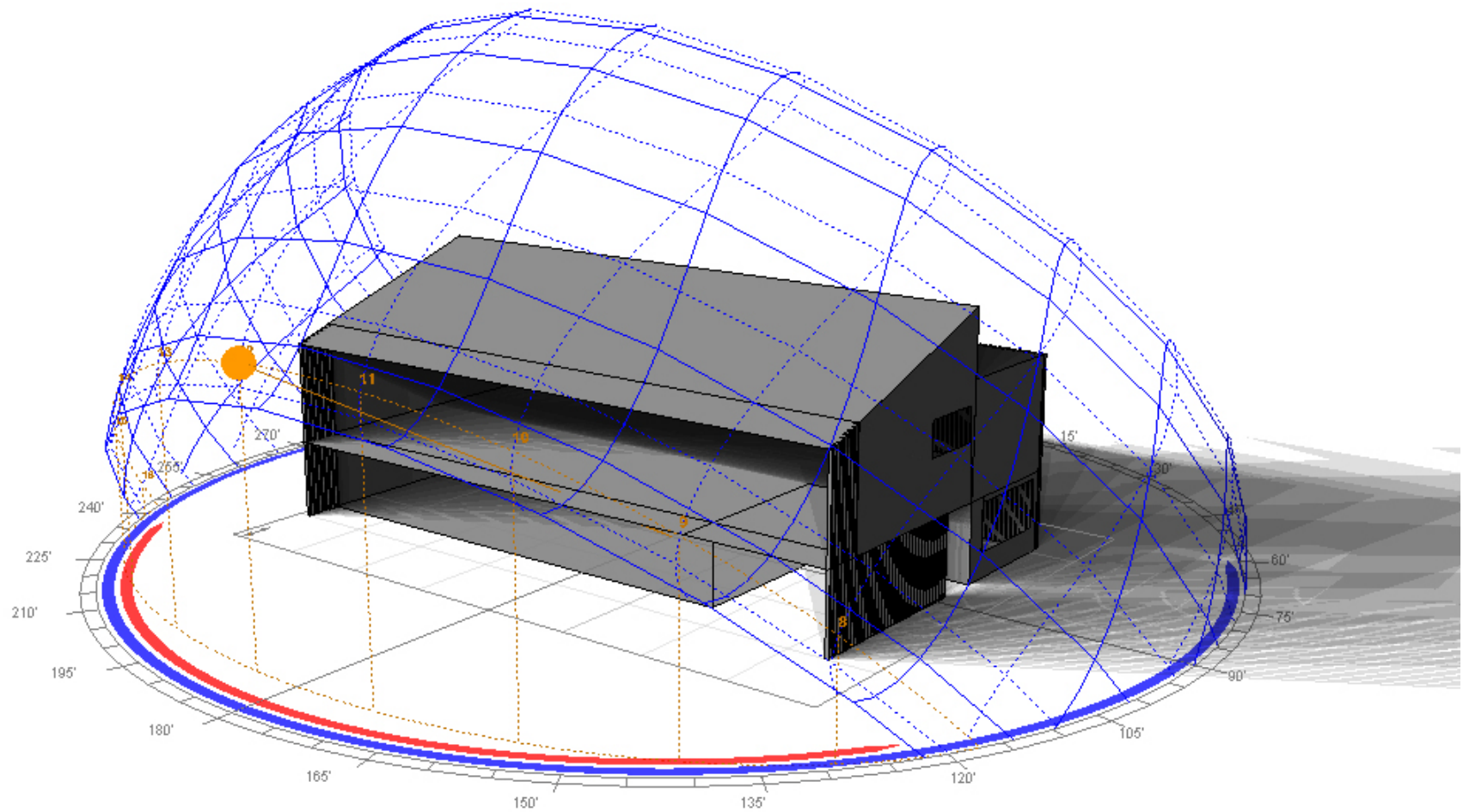
Shadow Range - October





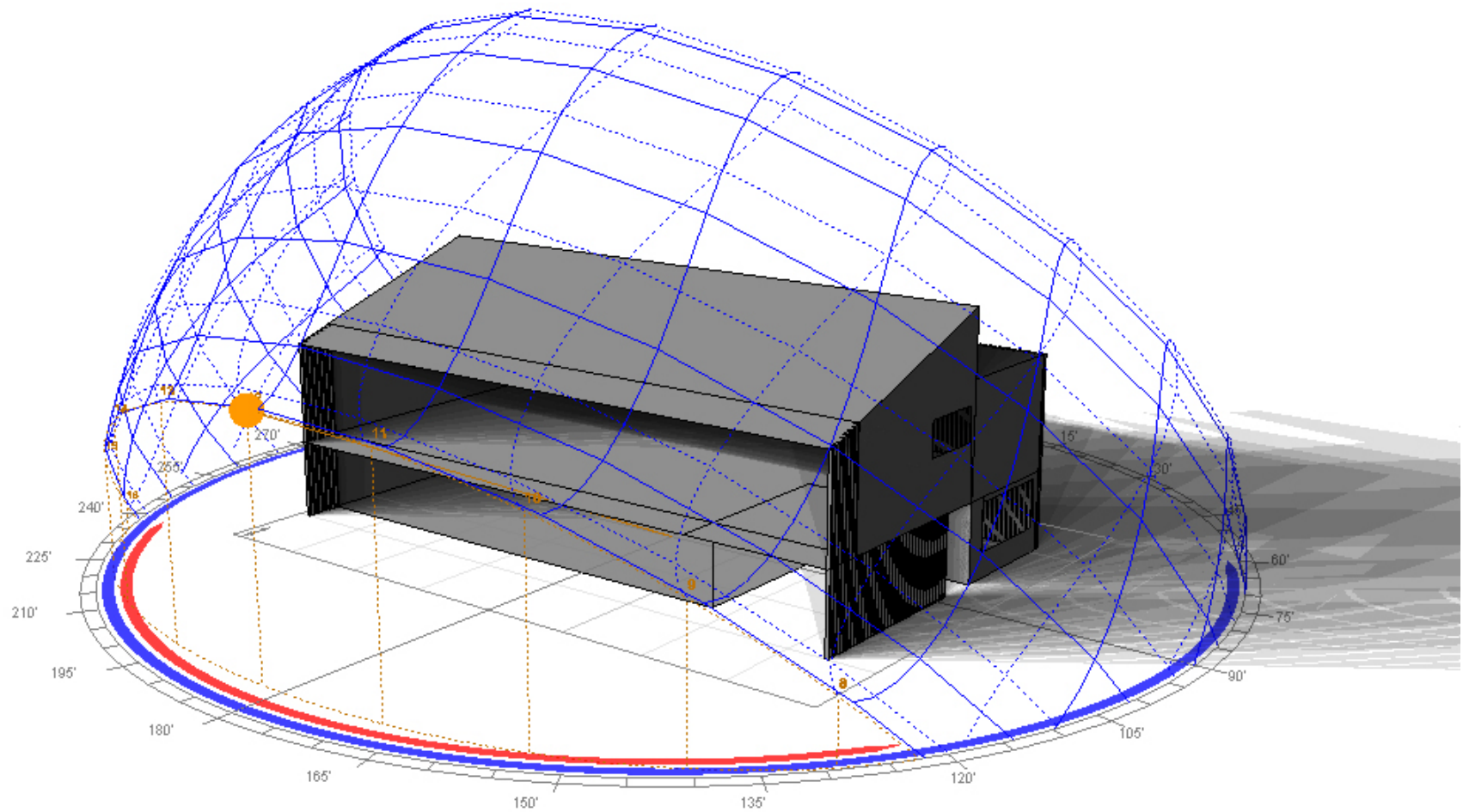
# PROTOTYPE HOUSE

Shadow Range - November



# PROTOTYPE HOUSE

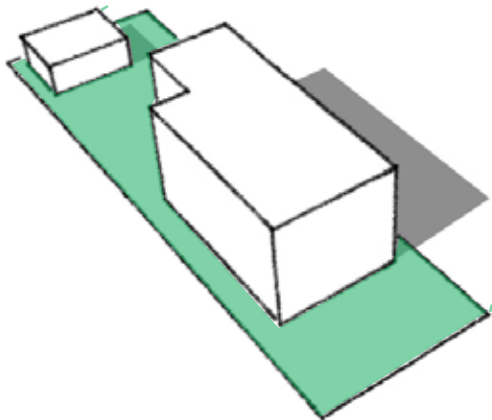
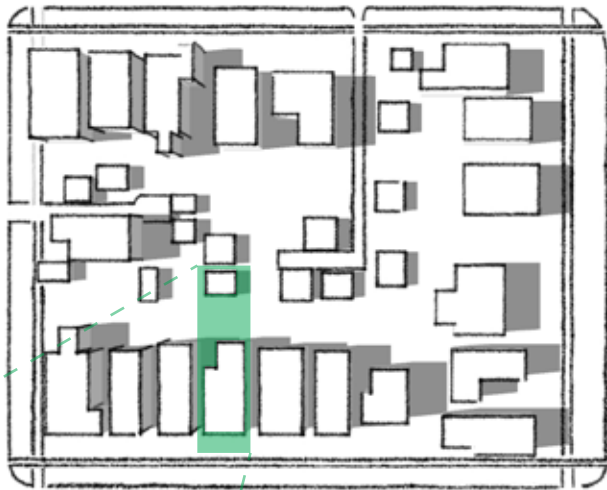
Shadow Range - December



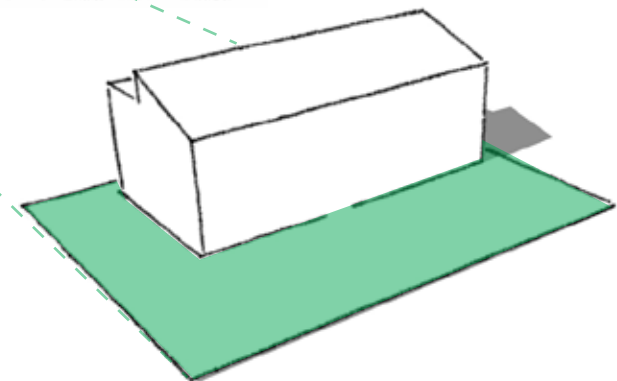
# CRITERIA

## Typical House vs Prototype House

- Same square footage
- Analyzed in the same softwares (ecotect, equest and Integrated Environment Solution)
- Same climate conditions
- Similar position in the block



Wall assembly: R-19  
brick  
cavity  
insulation  
wood frame  
dry wal



Wall assembly: R-56  
wood  
bio sip panel  
dry wall

# ENERGY AND WATER CONSUMPTION REDUCTION

In Comparison to a Typical House with the same square footage



40%

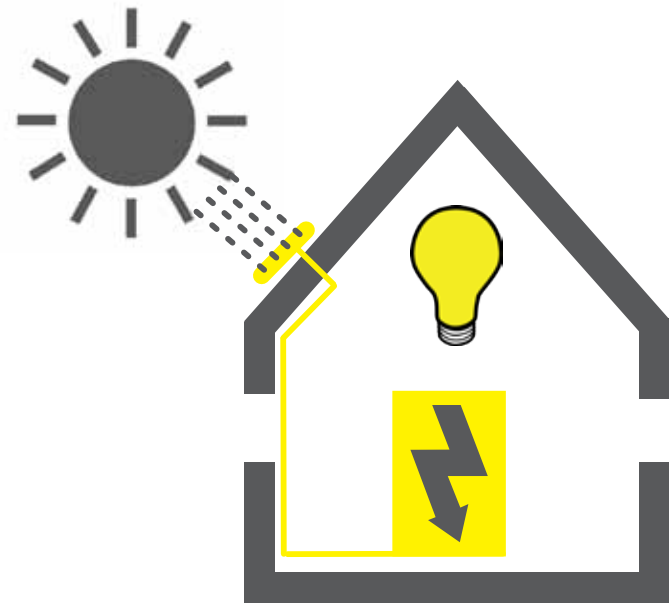


35%

# ENERGY PRODUCTION AND WATER COLLECTION



65,700 gal/year

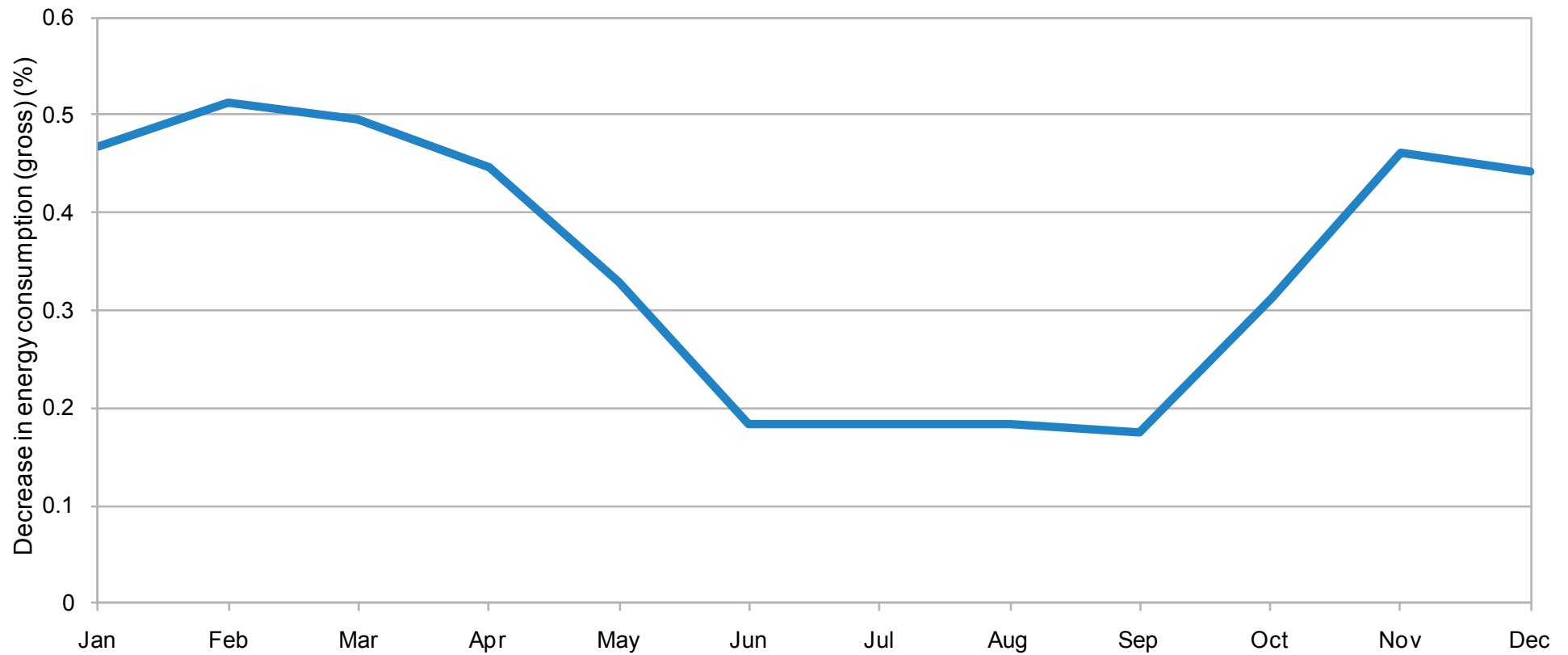


28,807 kwh/year



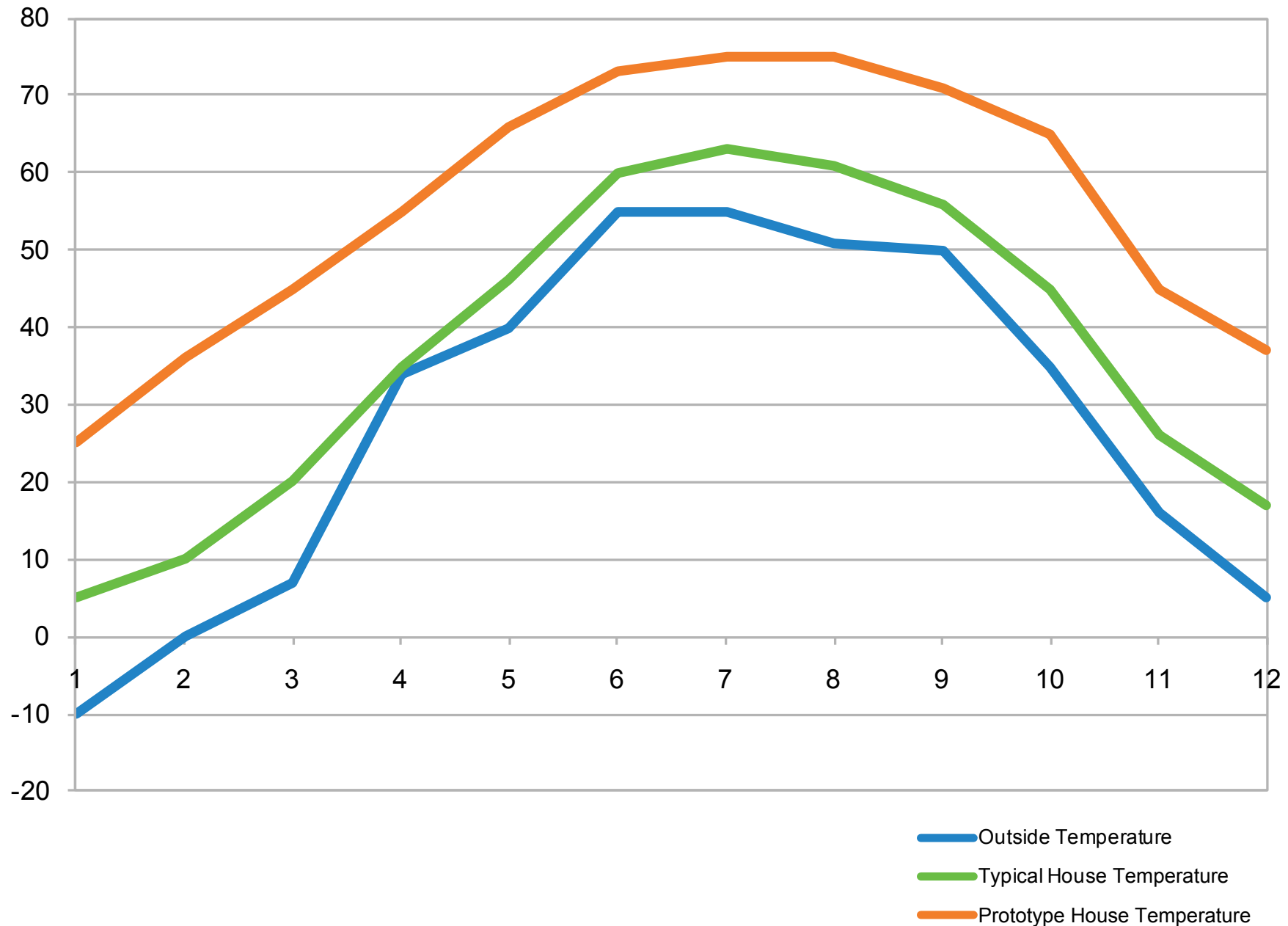
# EFFICIENCY GAINS THROUGH THE YEAR

In Comparison to a Typical House with the same square footage



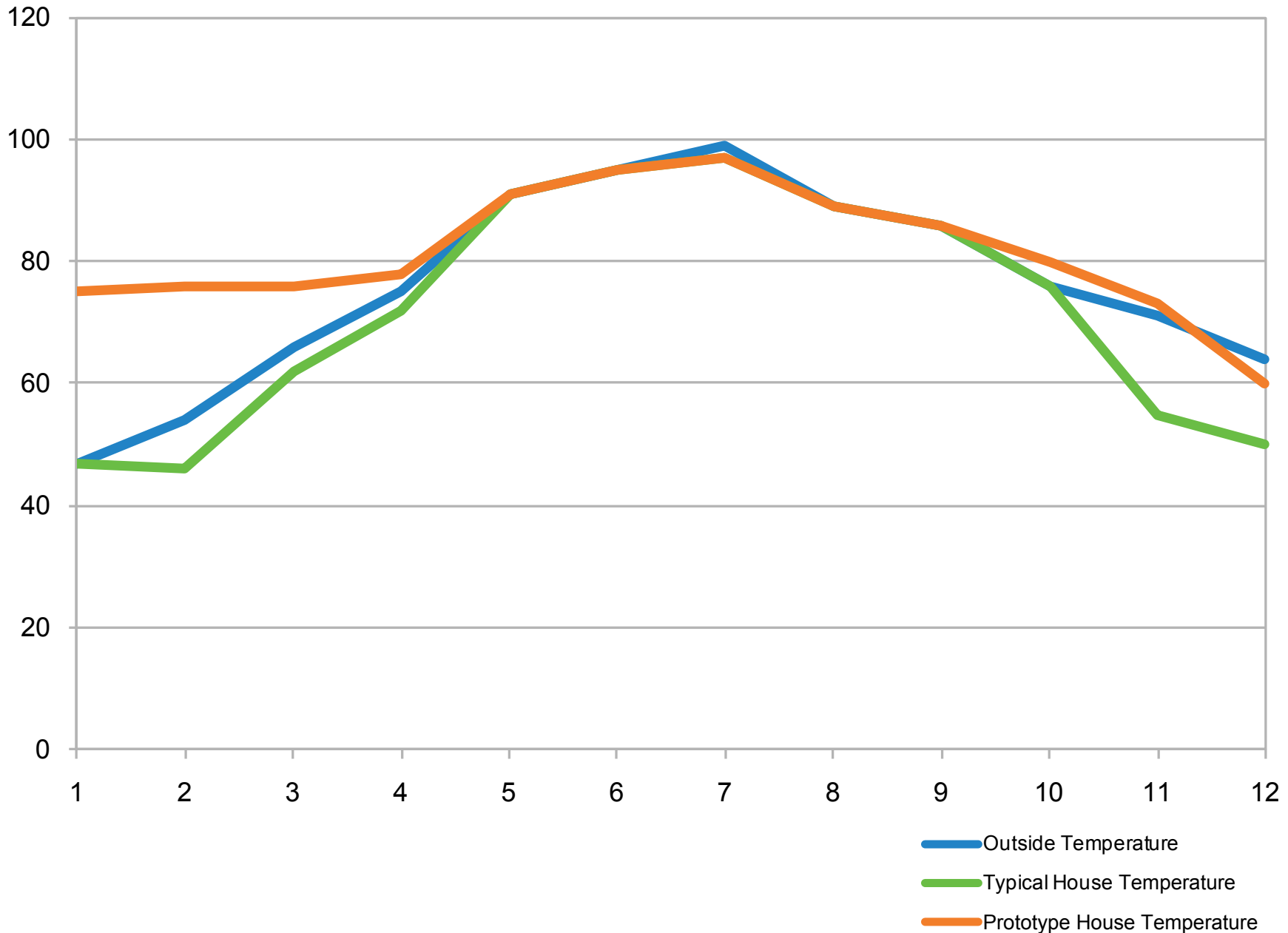
# TEMPERATURE VARIATION THROUGH THE YEAR

Considering the lowest temperatures in each month

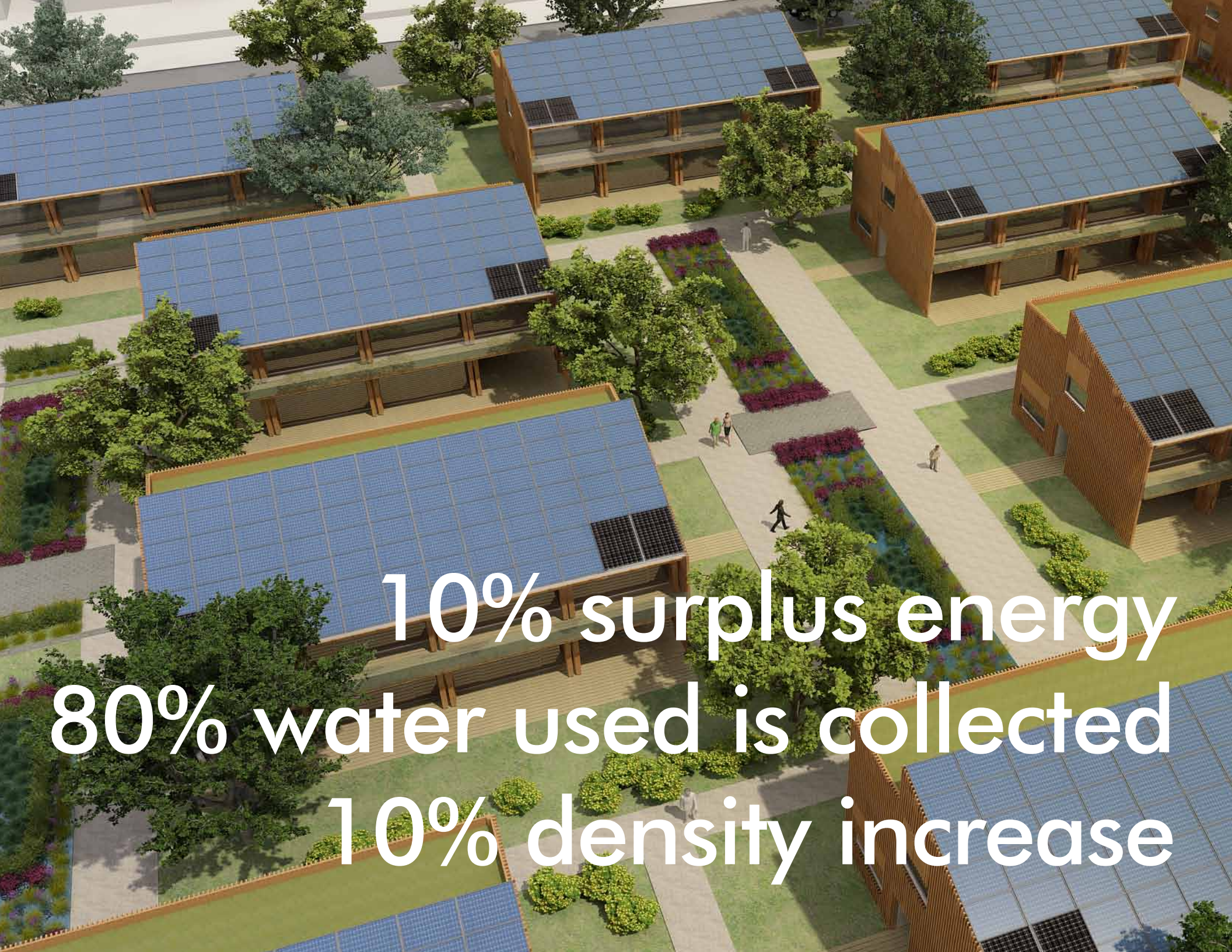


# TEMPERATURE VARIATION THROUGH THE YEAR

Considering the highest temperatures in each month







10% surplus energy  
80% water used is collected  
10% density increase