

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.

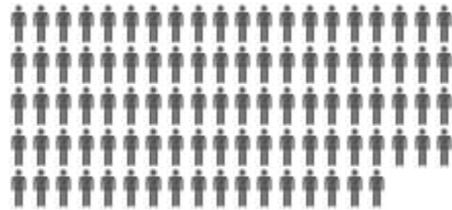
BACKGROUND

Rural Areas

Urban Areas

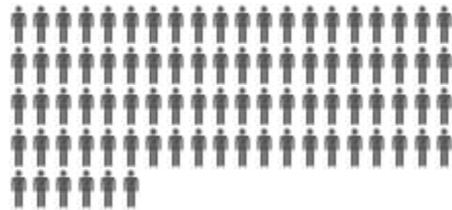


1800



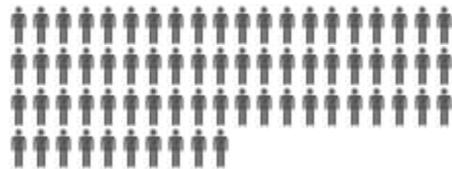
3%

1900



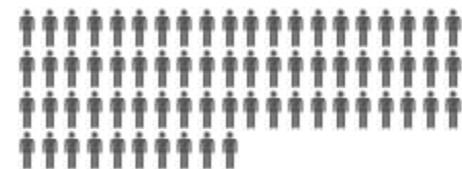
14%

1950



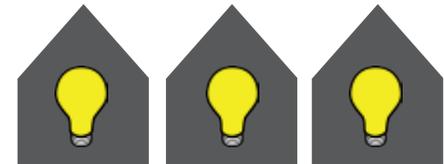
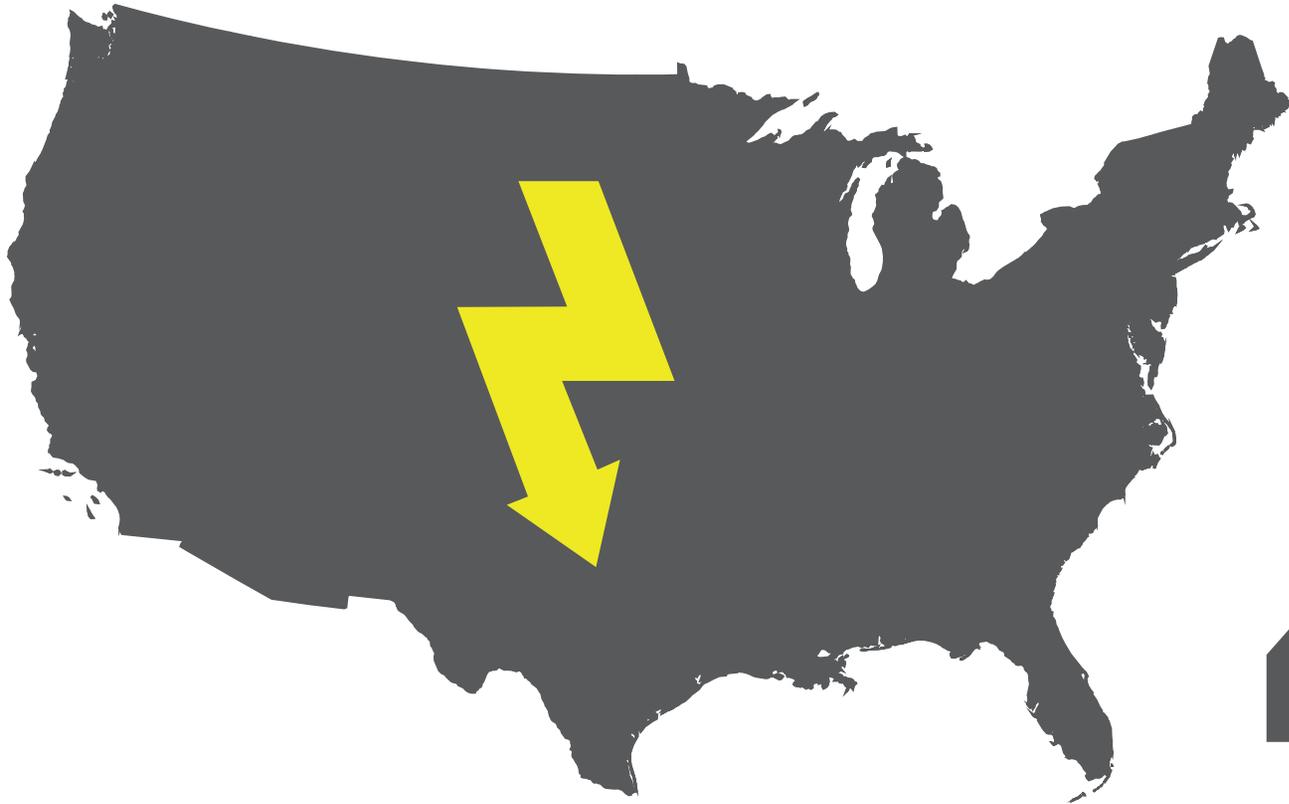
30%

2050

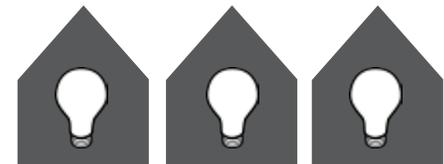


70%

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



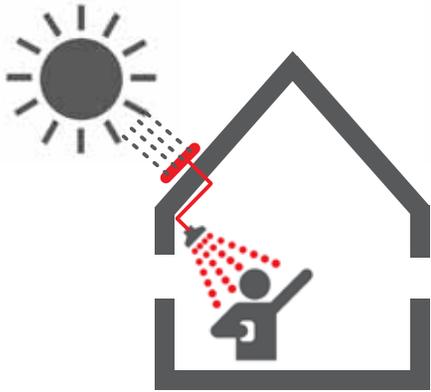
Low flow
plumbing fixtures



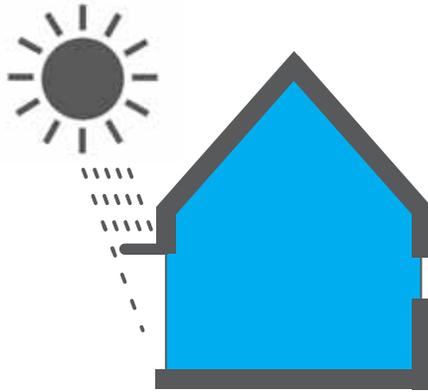
Water
Recycling

SPECIAL FEATURES

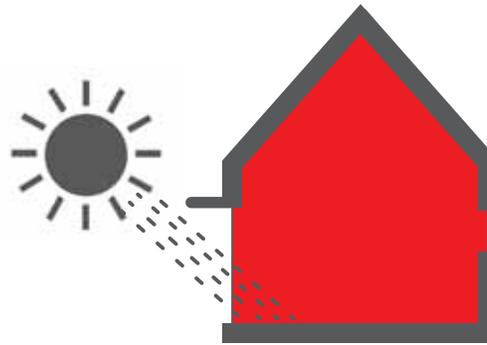
- Energy Conservation



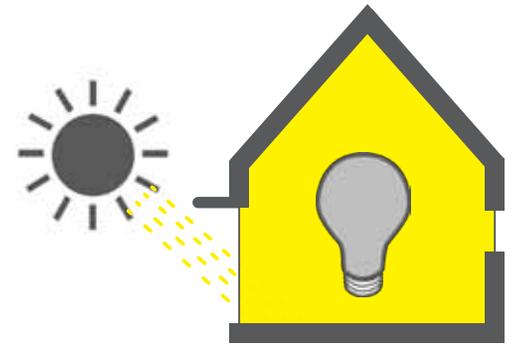
Solar panels



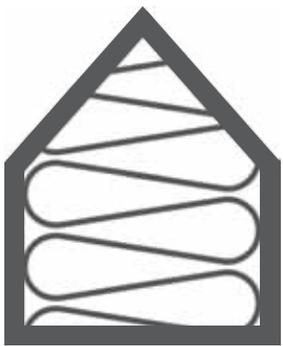
Shading devices



Maximize heat gain in winter



Daylight Maximization



Super insulation
Tight building



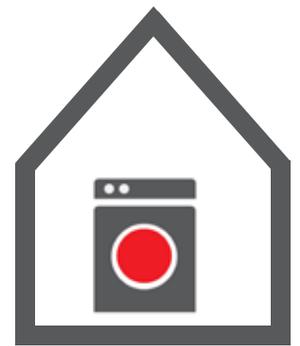
Cross
Ventilation



Geo exchange



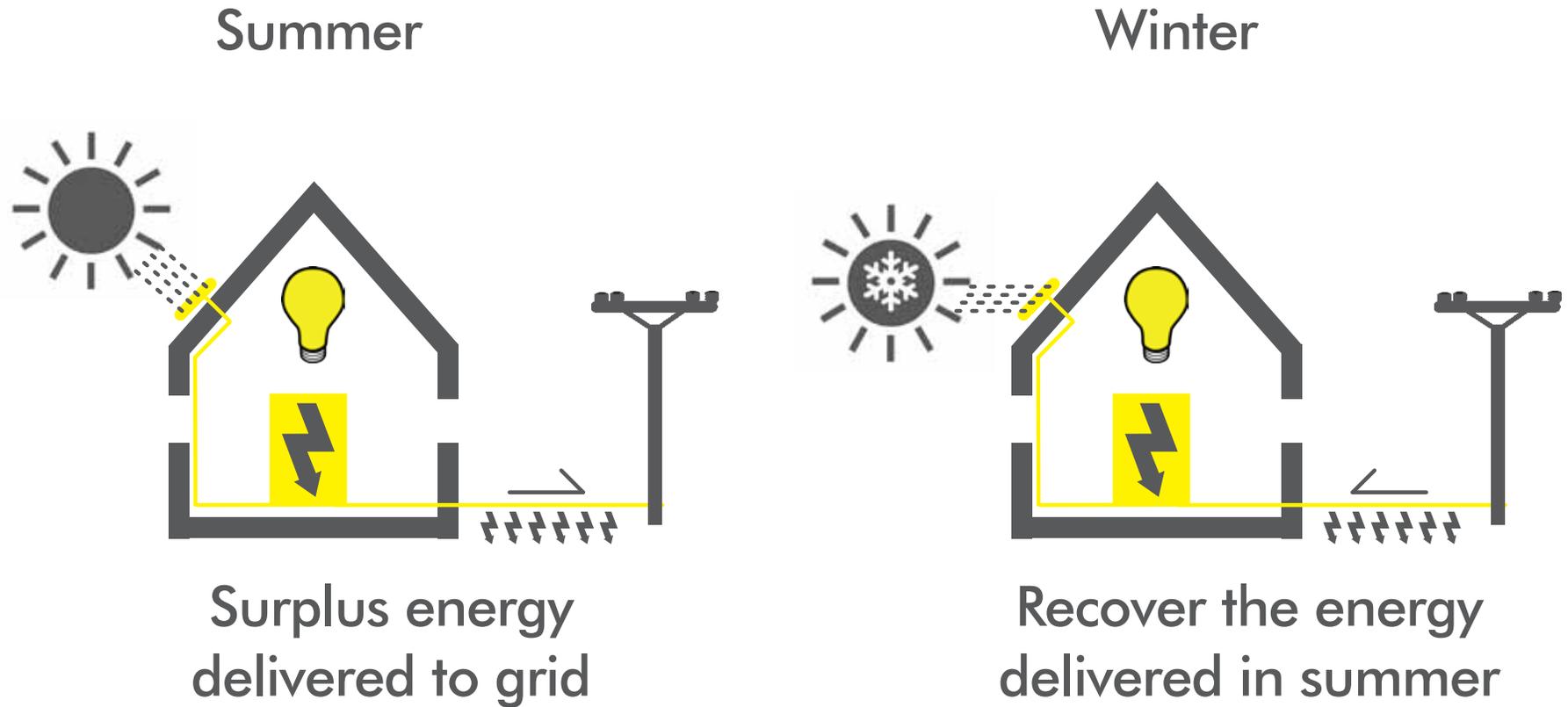
Energy
efficient
appliances



Heat
recovery

SPECIAL FEATURES

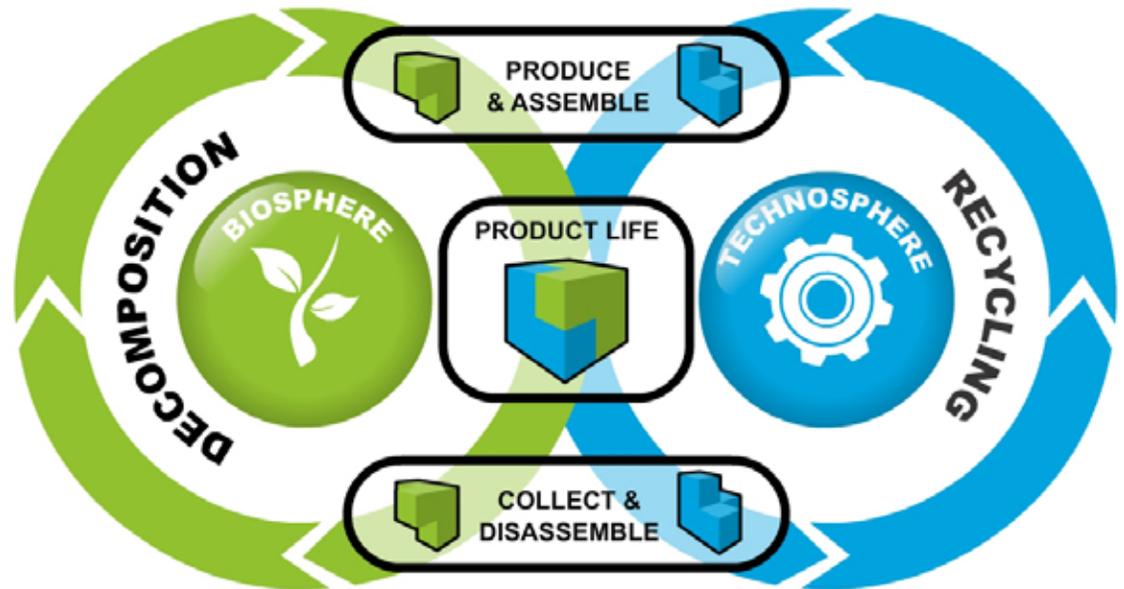
- Energy Production



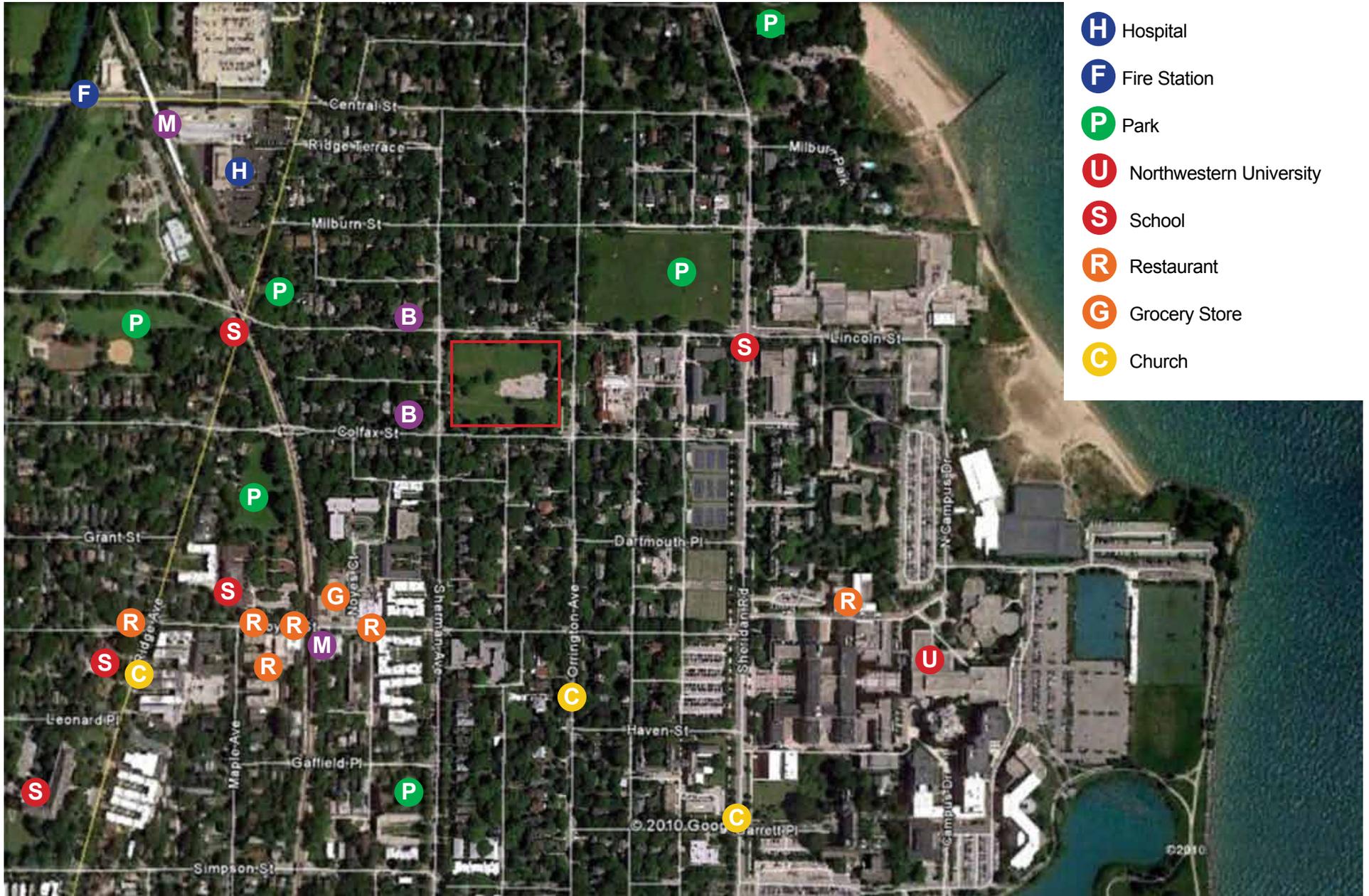
NET ZERO

SPECIAL FEATURES

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



SITE



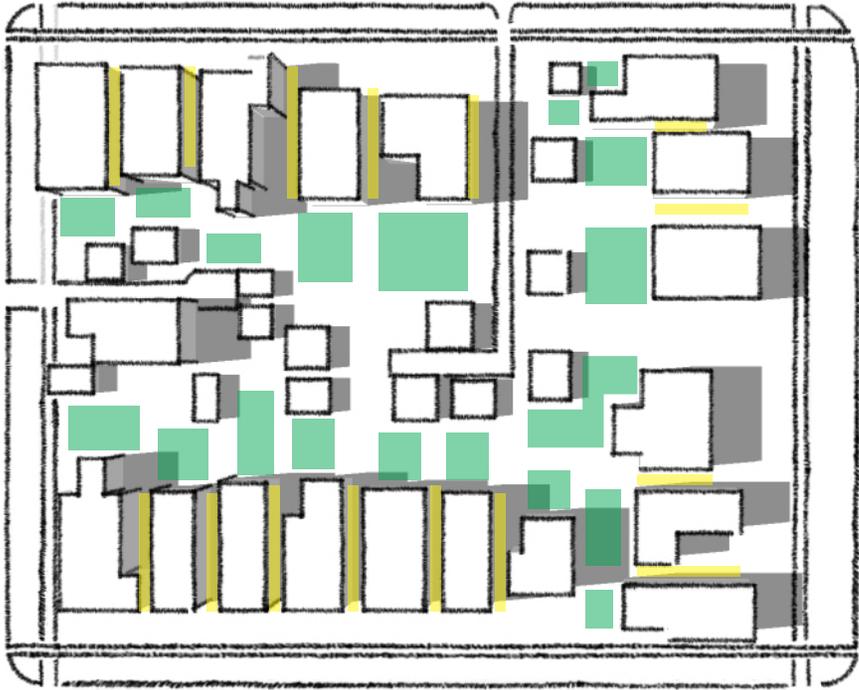
SITE

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.



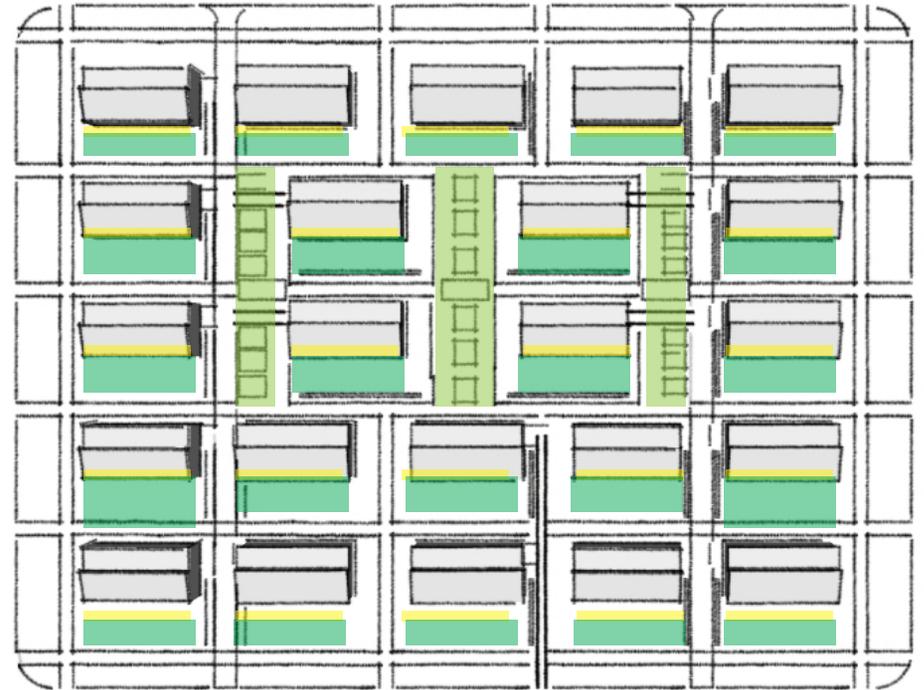
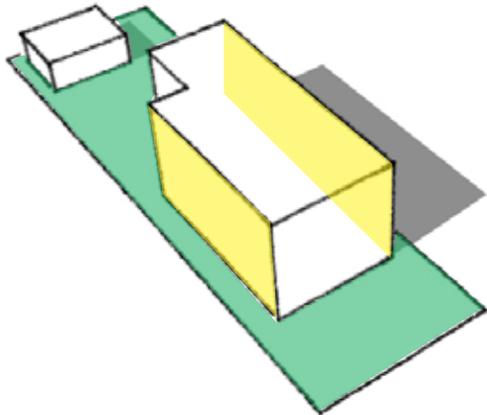
NEIGHBOR BLOCK VS BLOCK PROPOSAL



19 houses

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

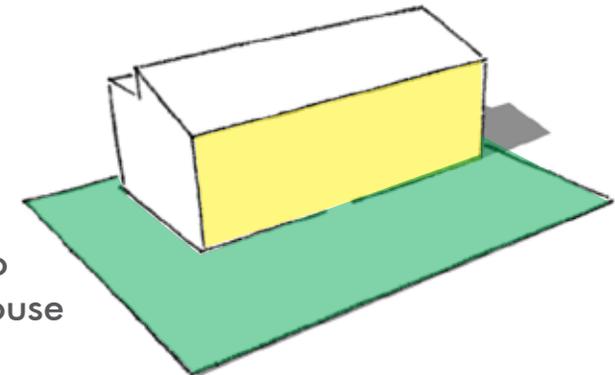
16% South facing



23 houses

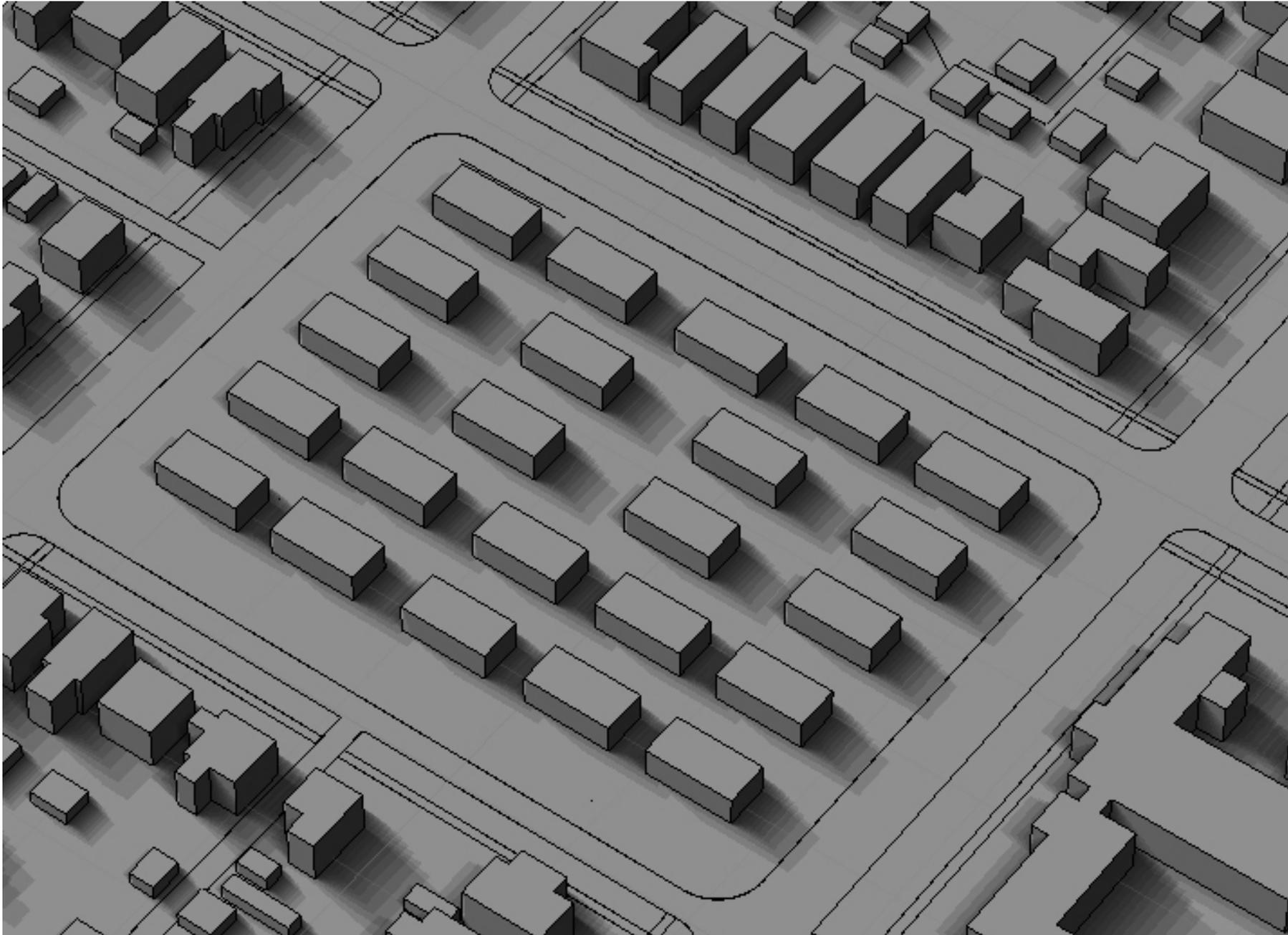
- Prime areas facing the garden
- Garden integrated to the body of the house
- Common green area

33% South facing



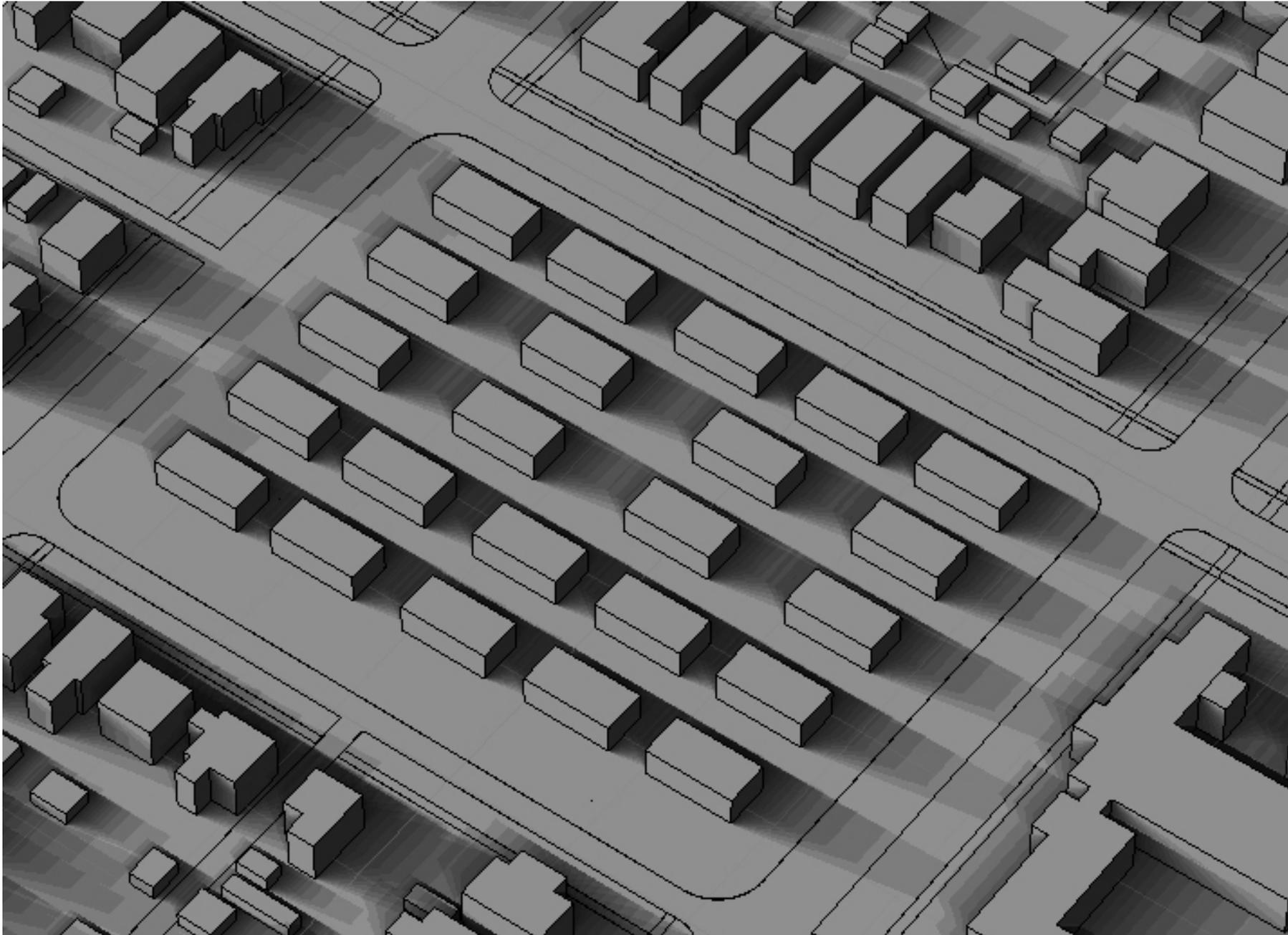
BUILDINGS DISTRIBUTION/ SHADOW RANGE

Summer Solstice



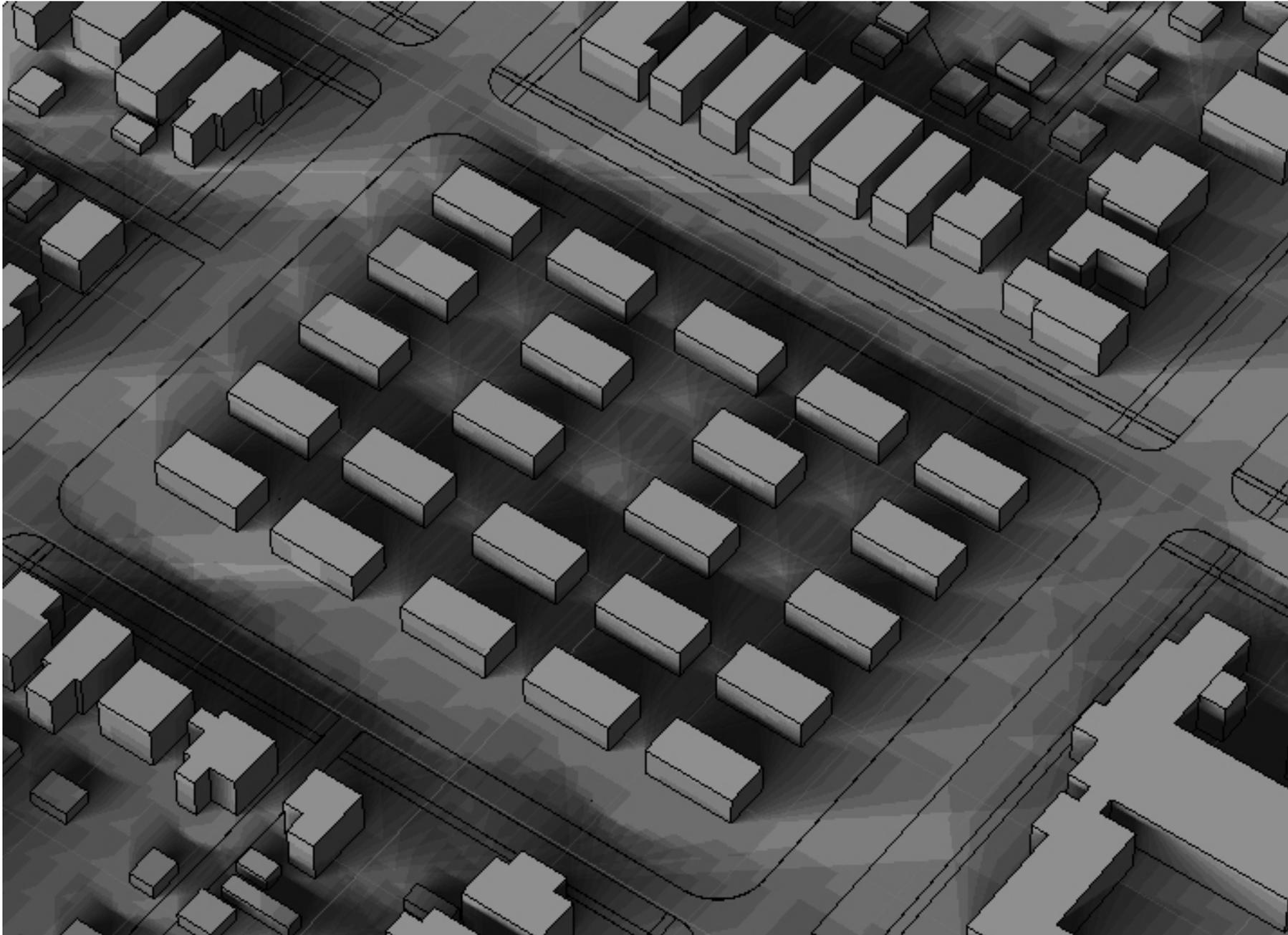
BUILDINGS DISTRIBUTION/ SHADOW RANGE

Spring/ Fall Equinox

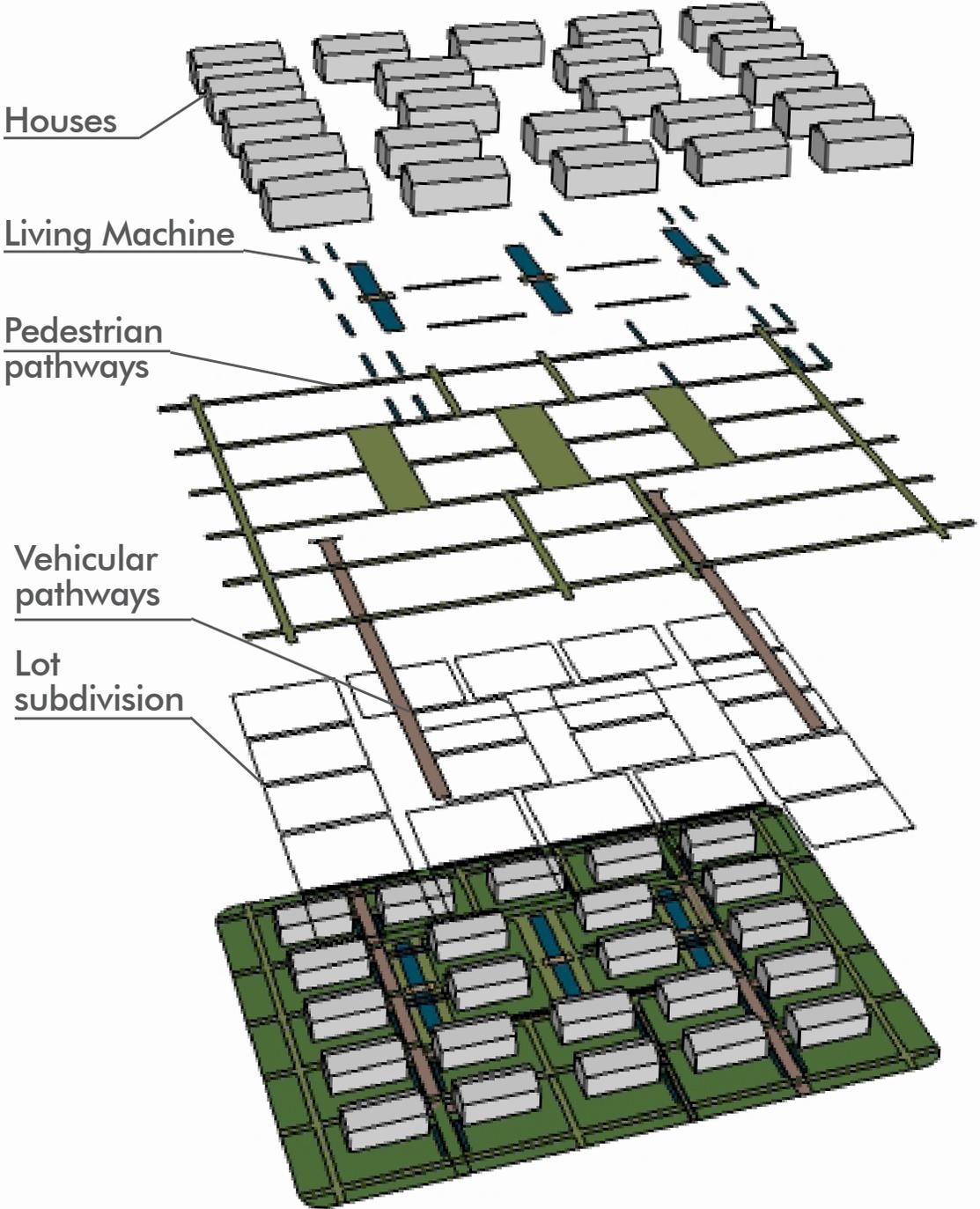


BUILDINGS DISTRIBUTION/ SHADOW RANGE

Winter Solstice



SITE ORGANIZATION



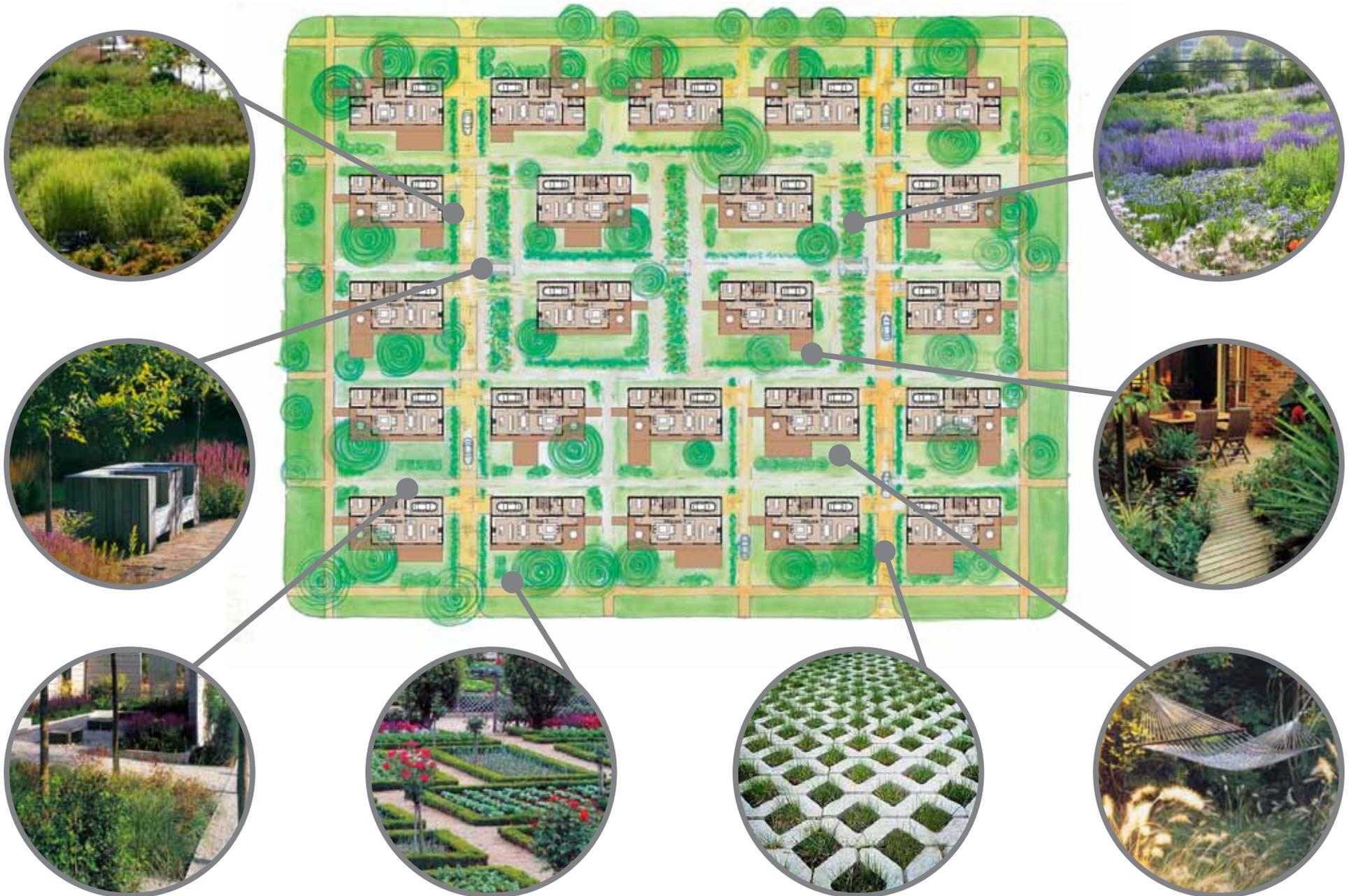
SITE PLAN



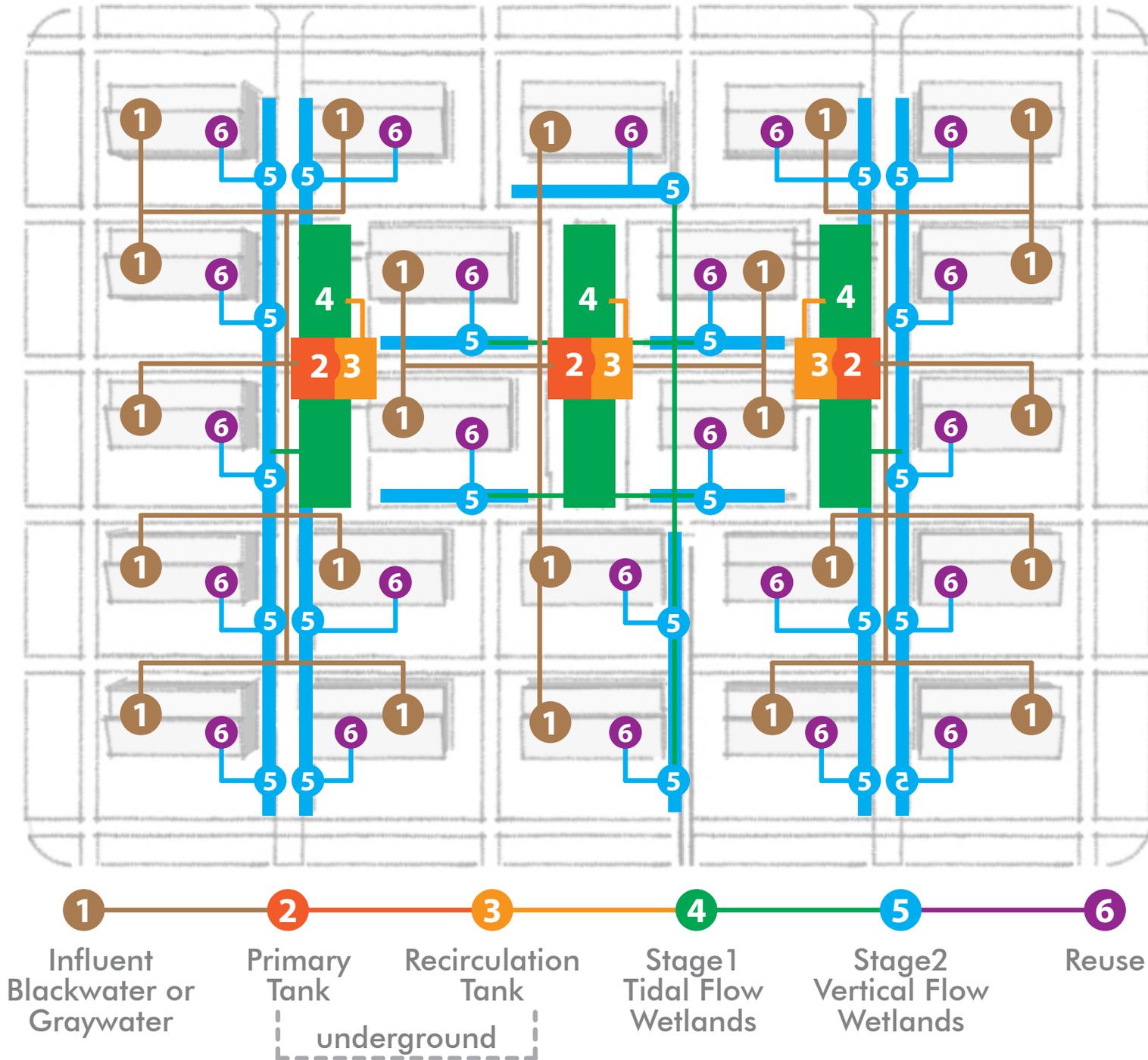
LANDSCAPE



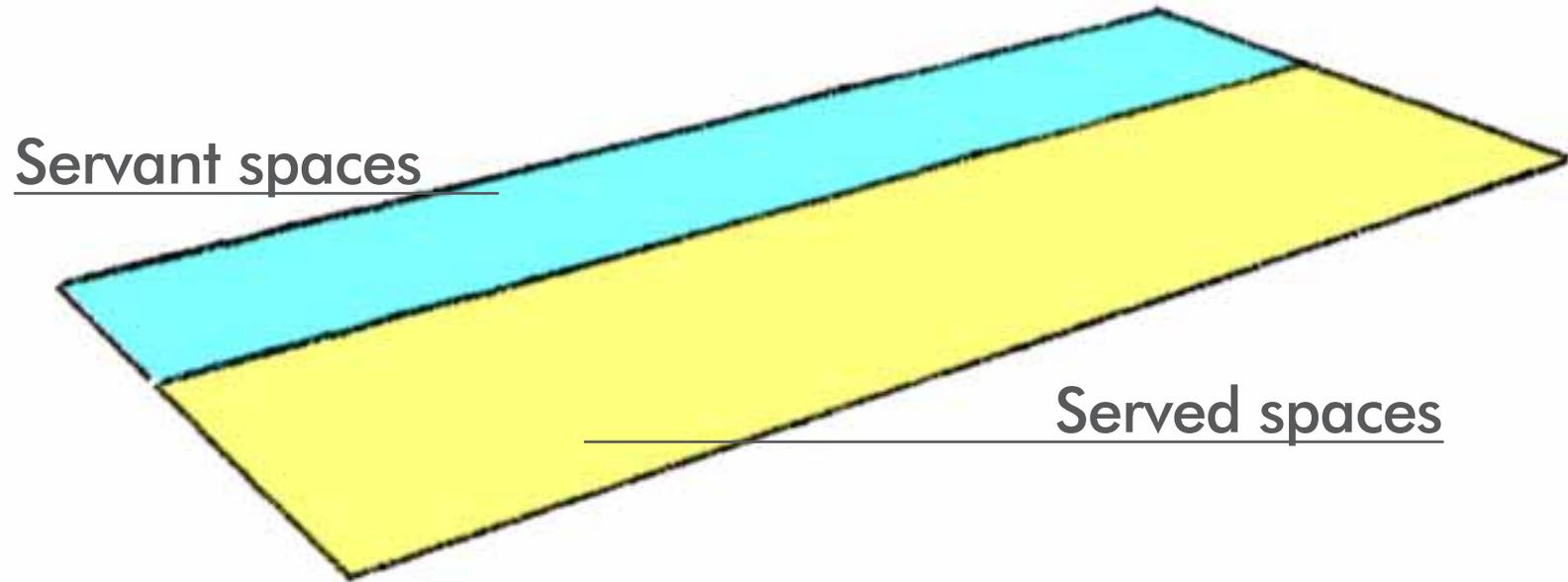
LANDSCAPE - INSPIRATIONAL IMAGERY



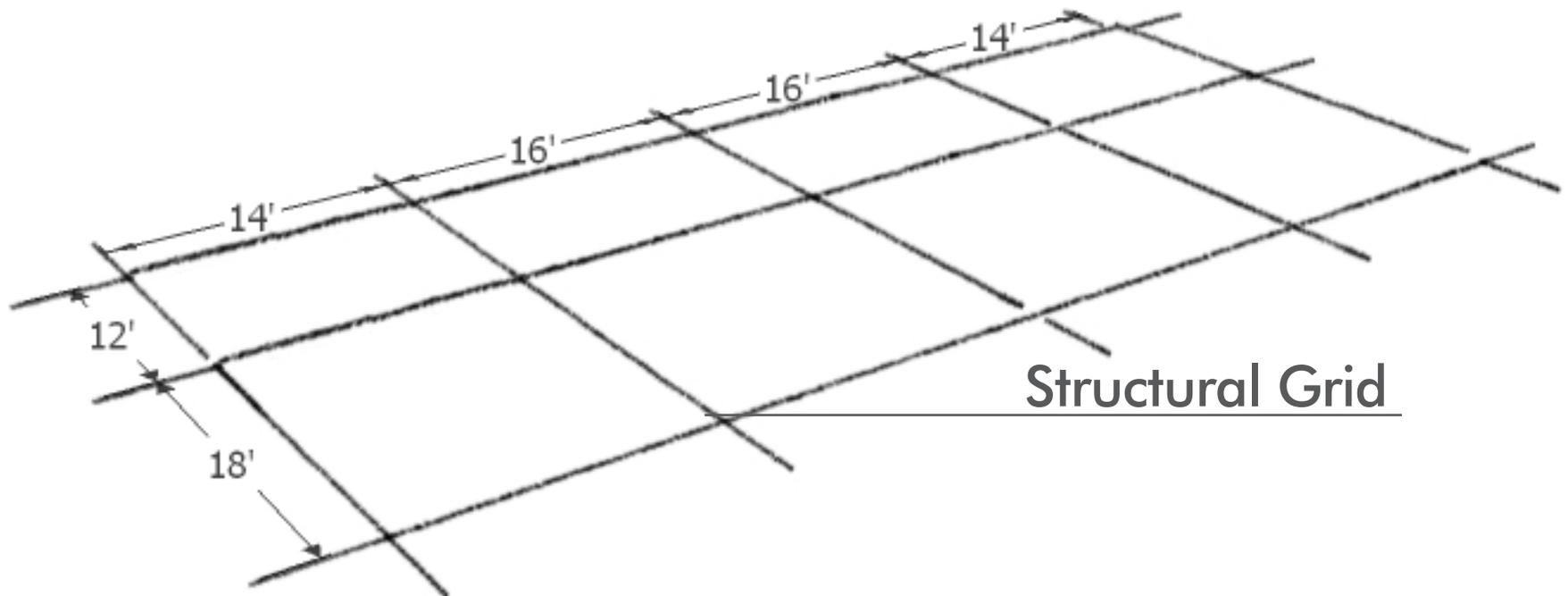
LIVING MACHINE



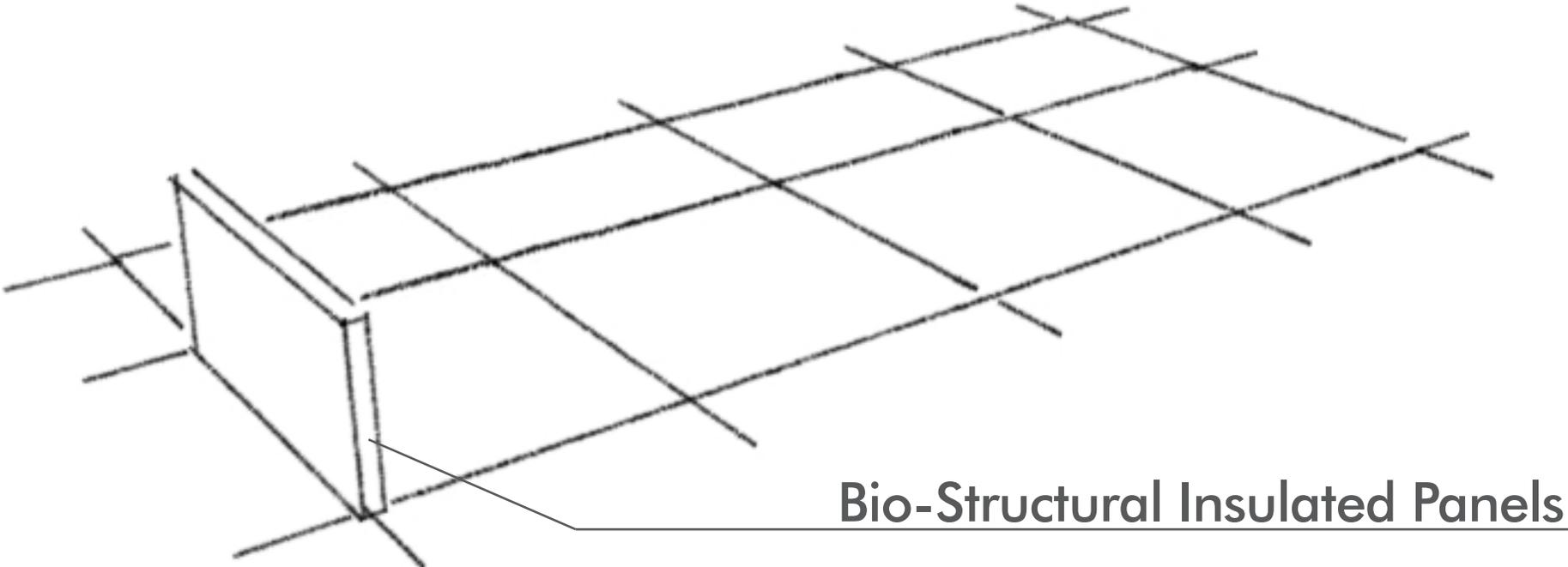
PROTOTYPE HOUSE



PROTOTYPE HOUSE

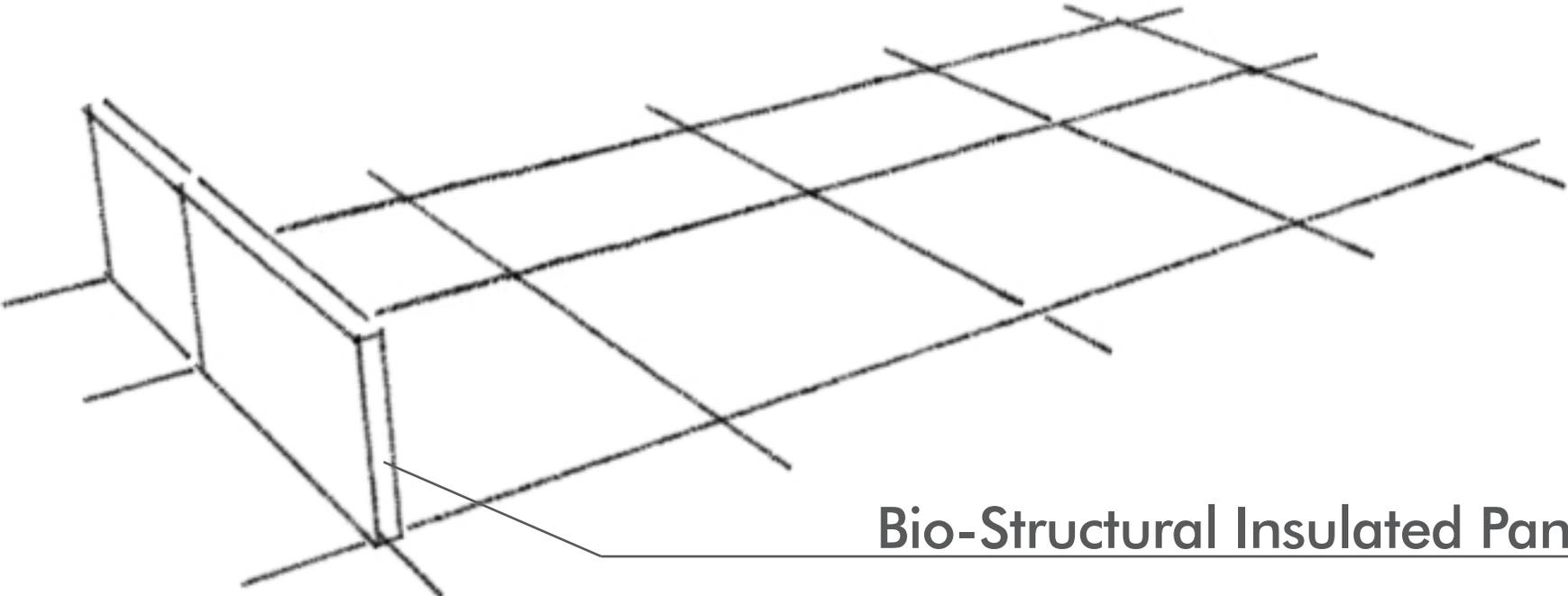


PROTOTYPE HOUSE



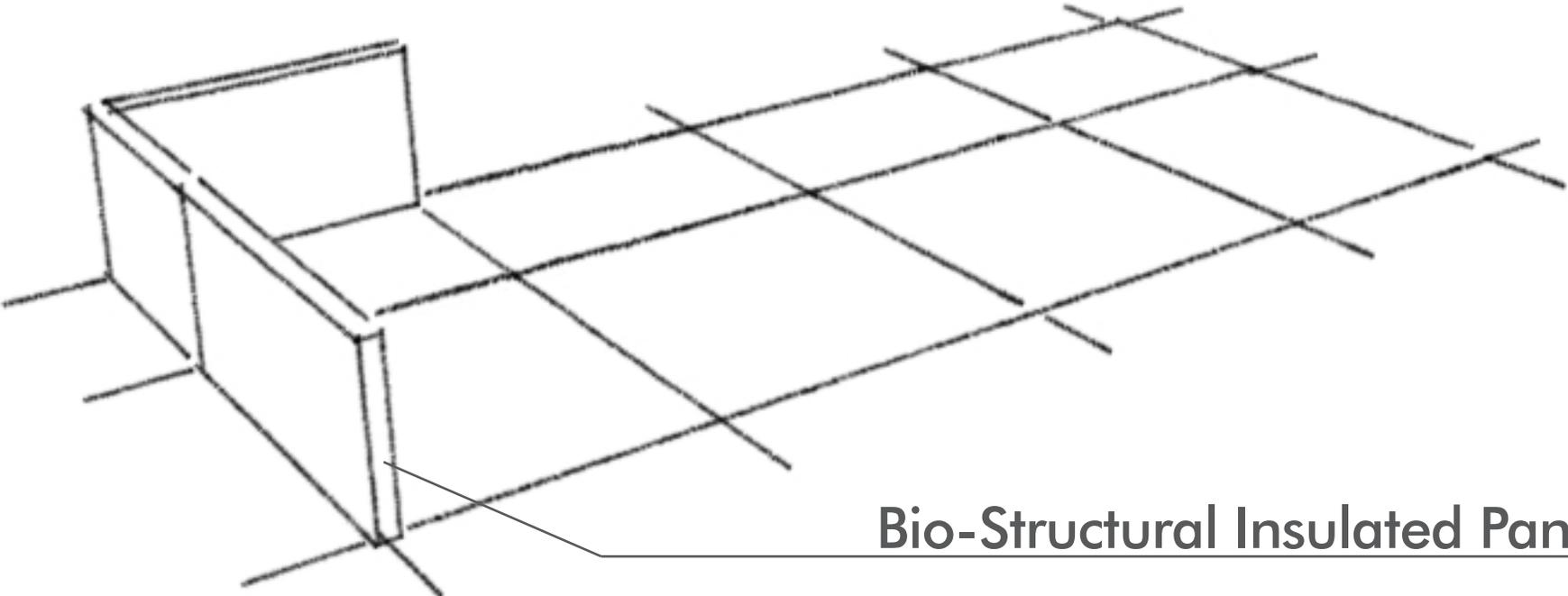
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



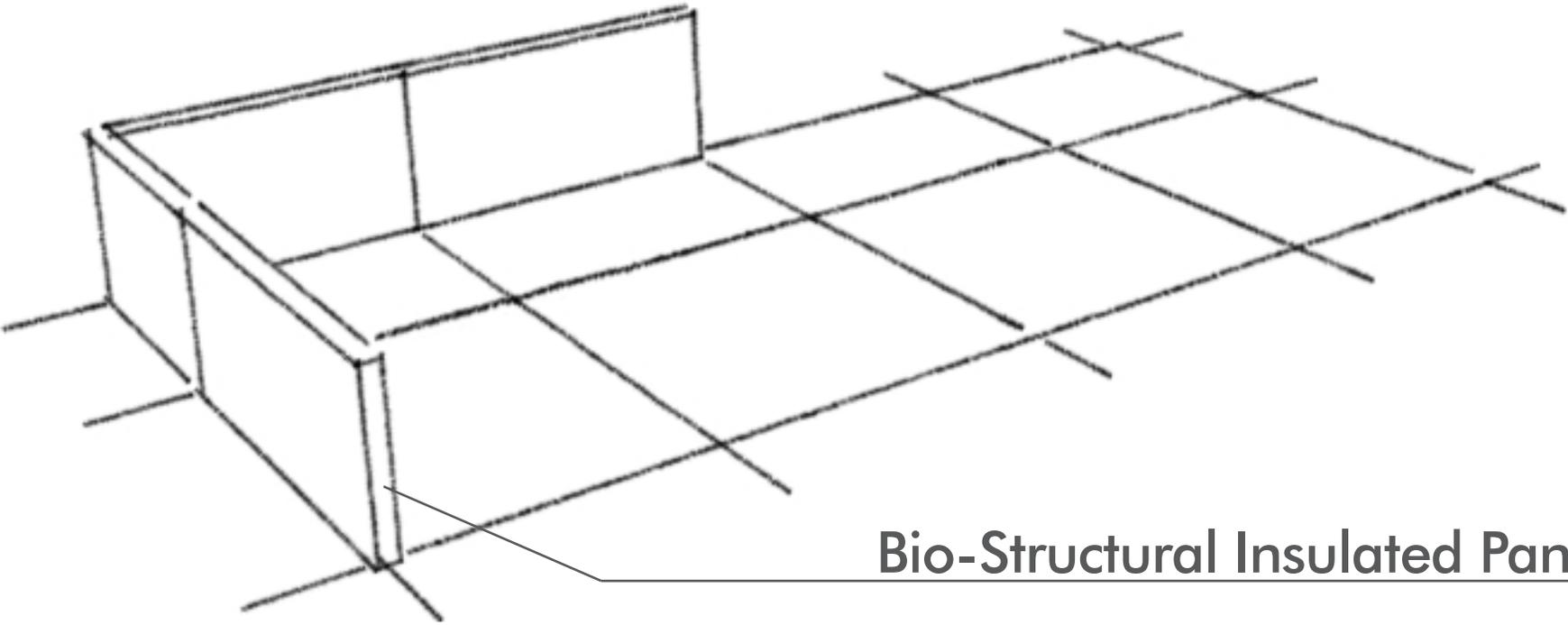
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



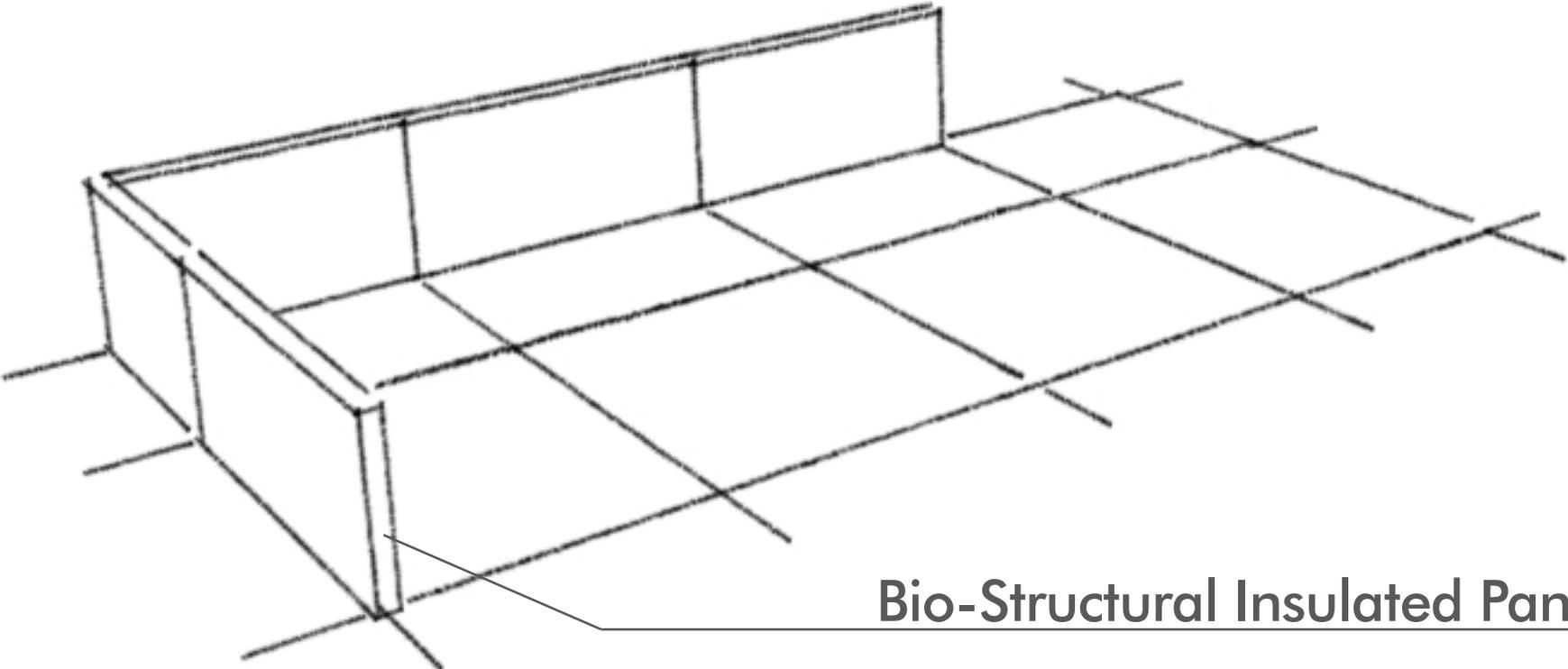
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



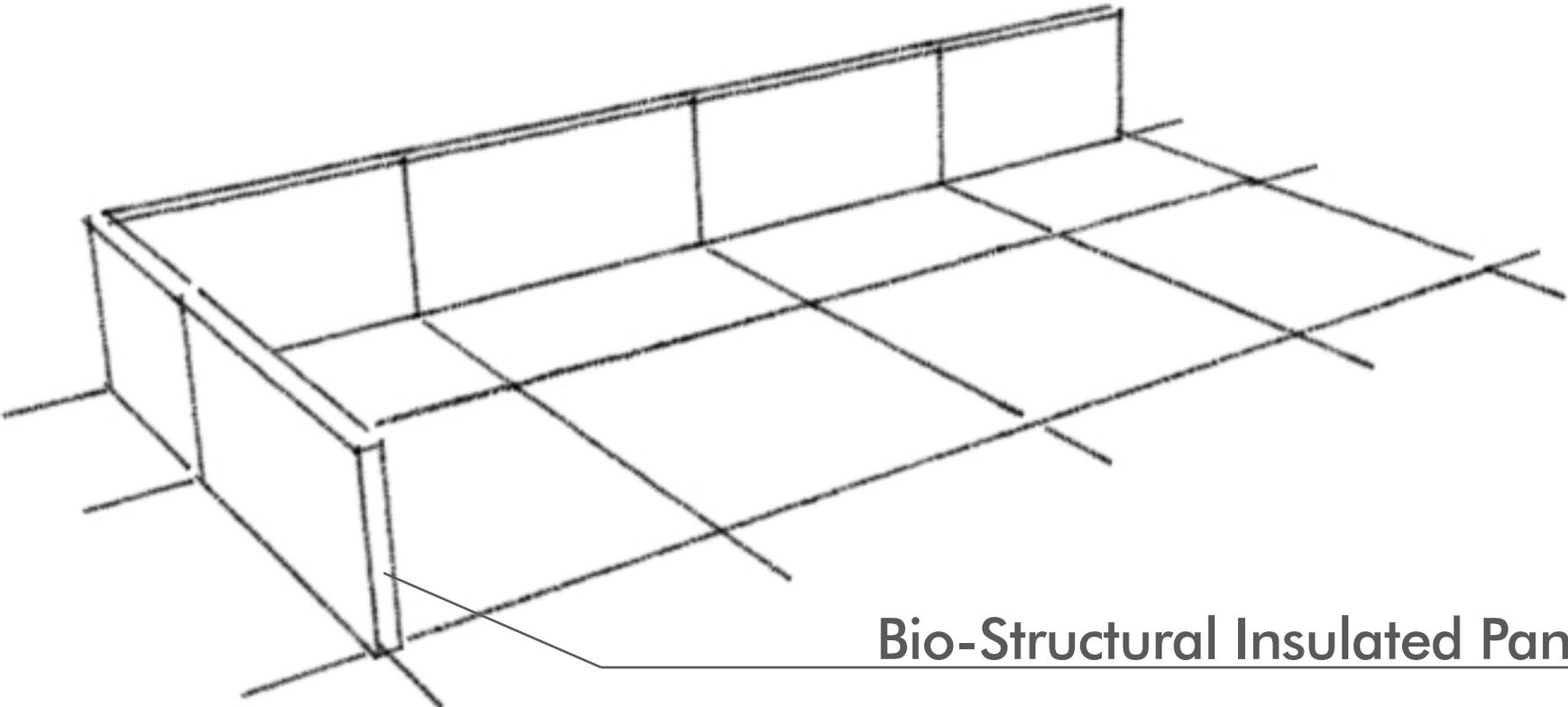
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



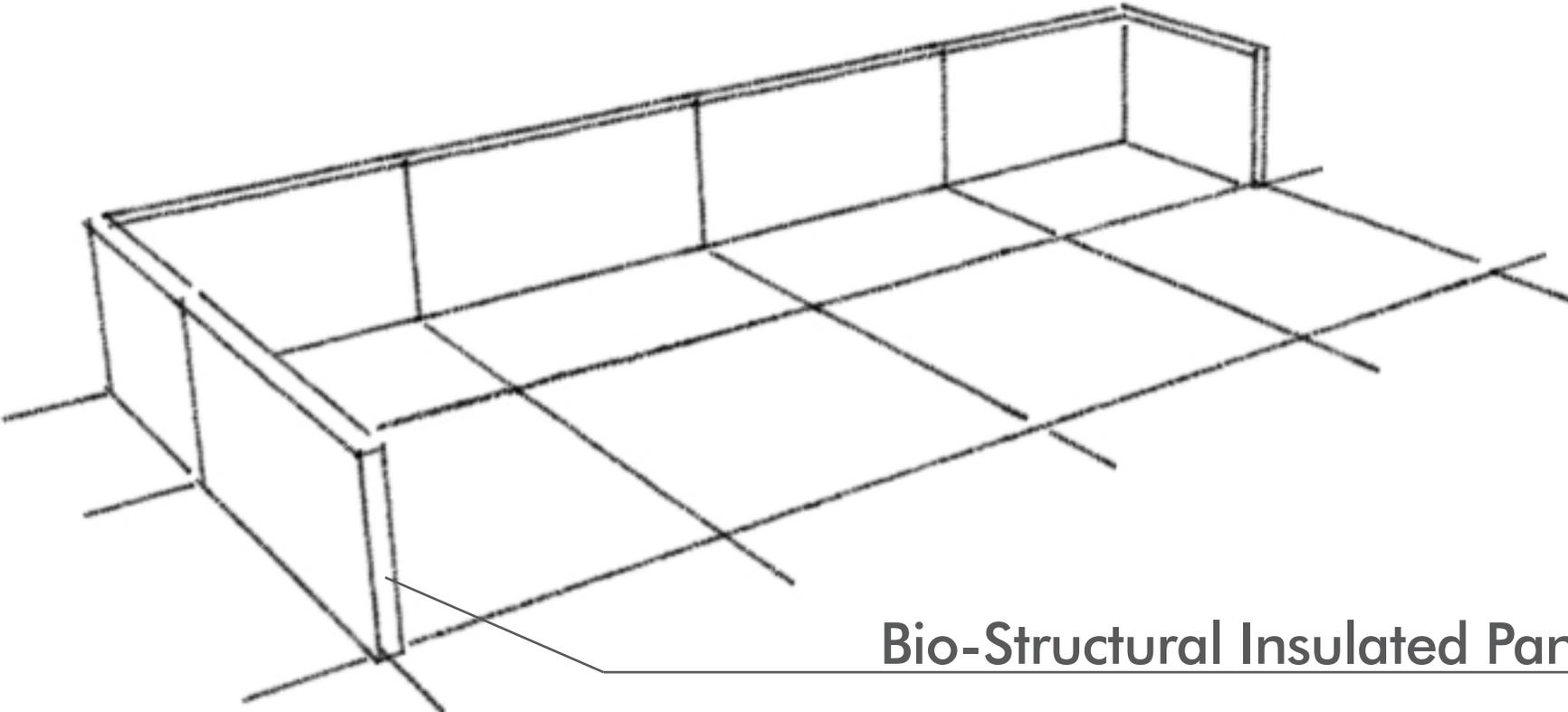
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



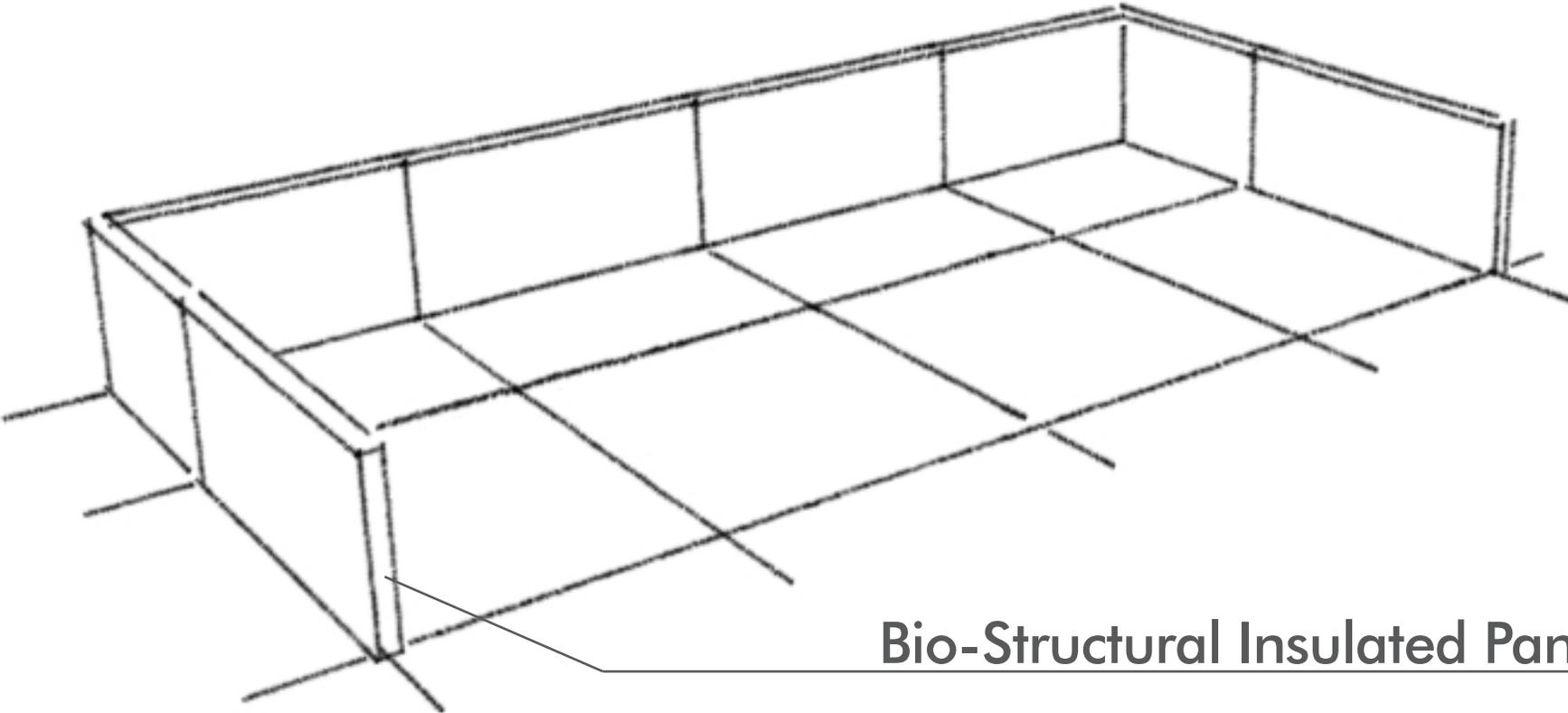
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



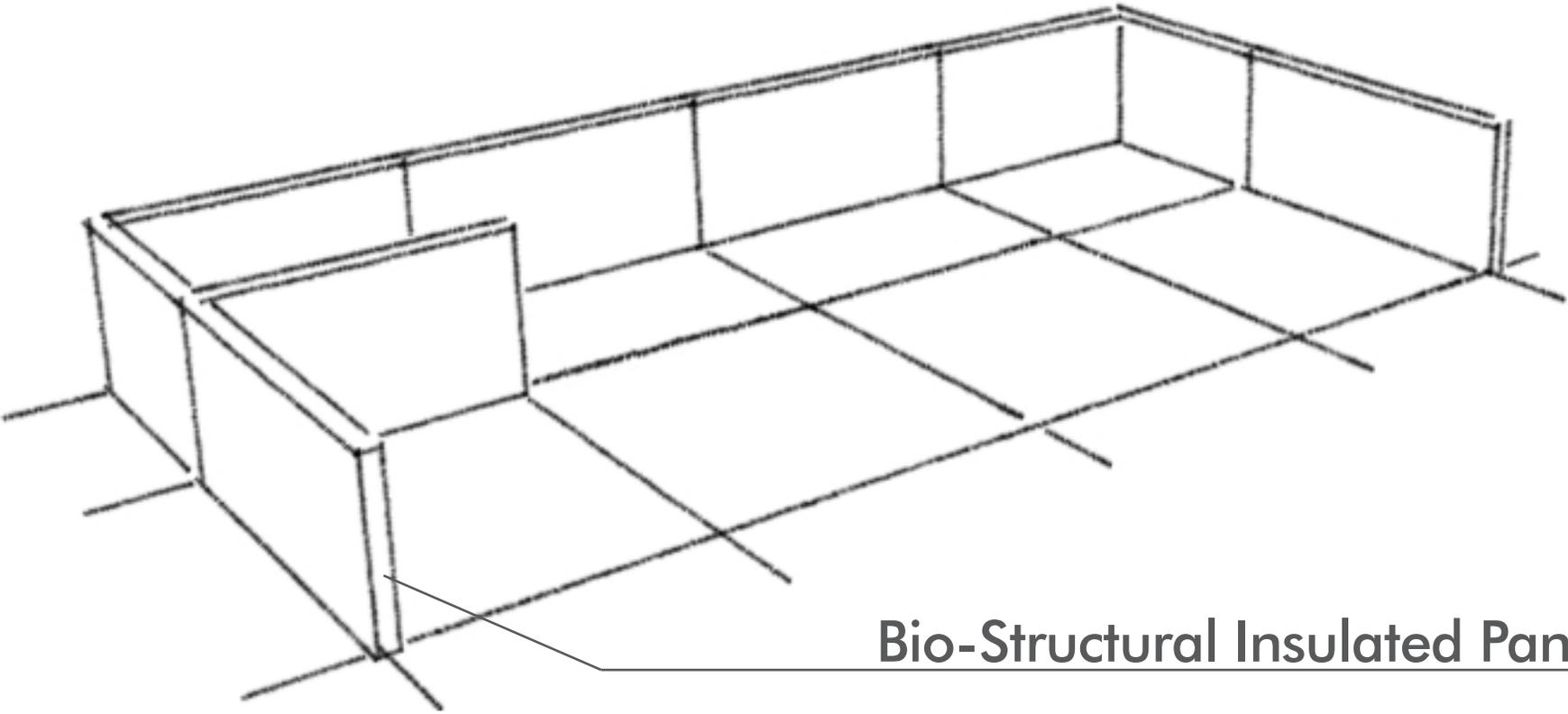
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



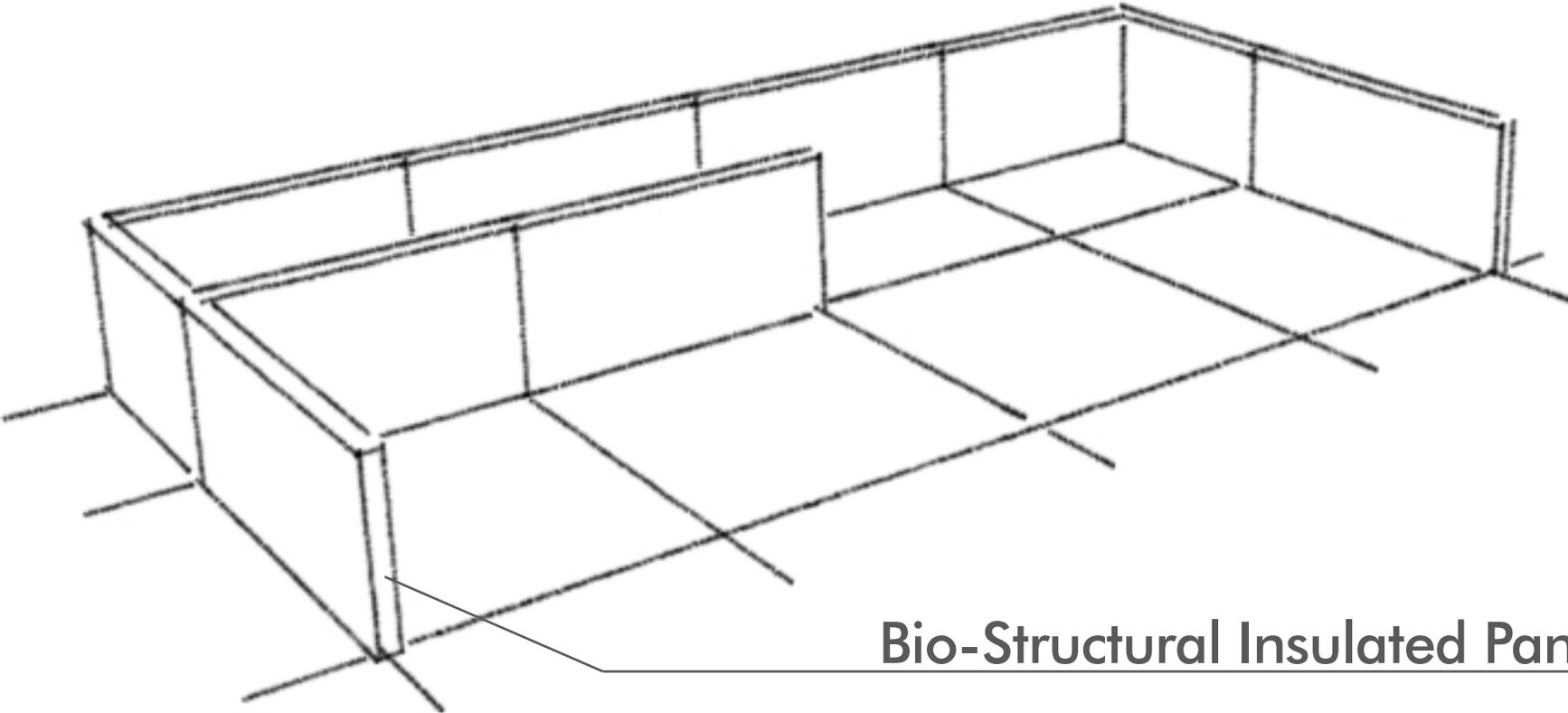
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



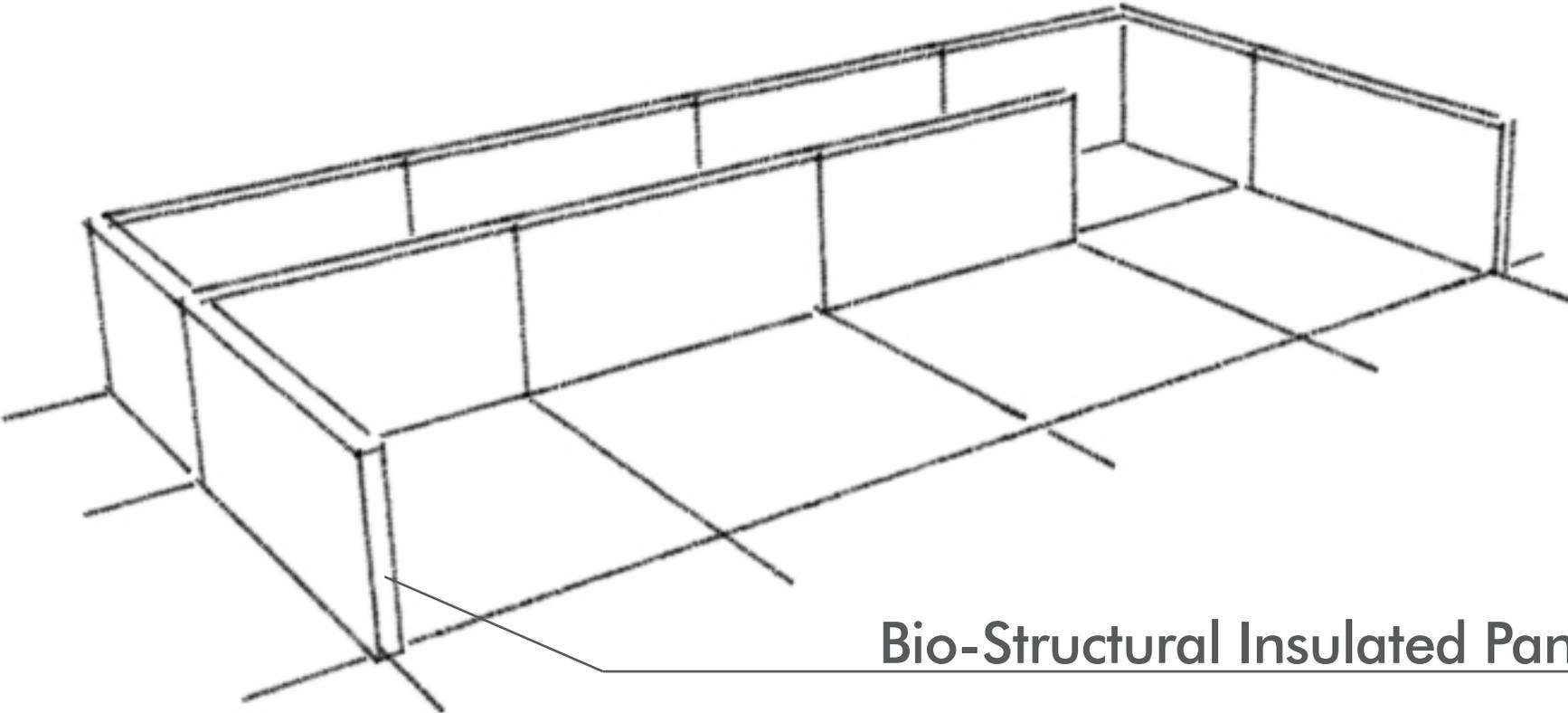
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



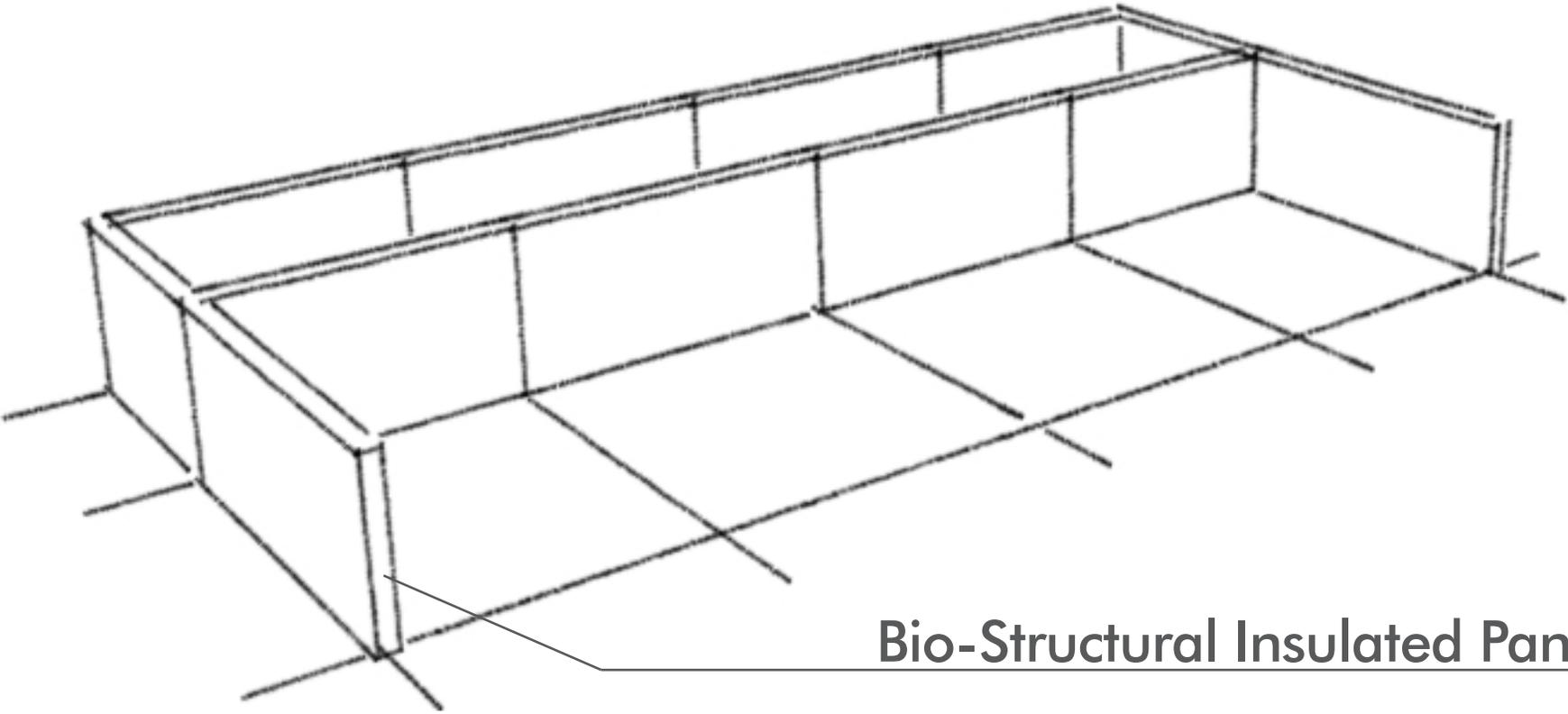
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



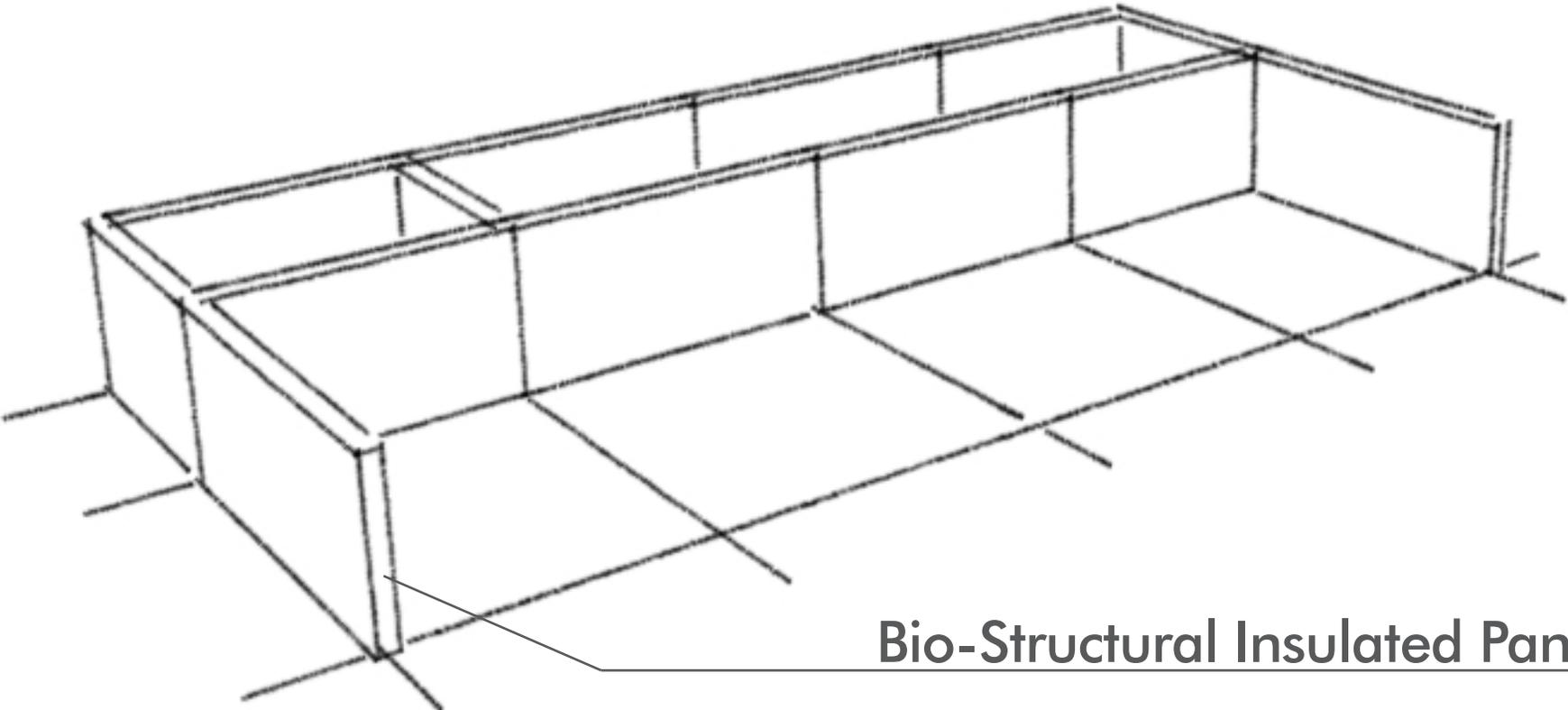
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



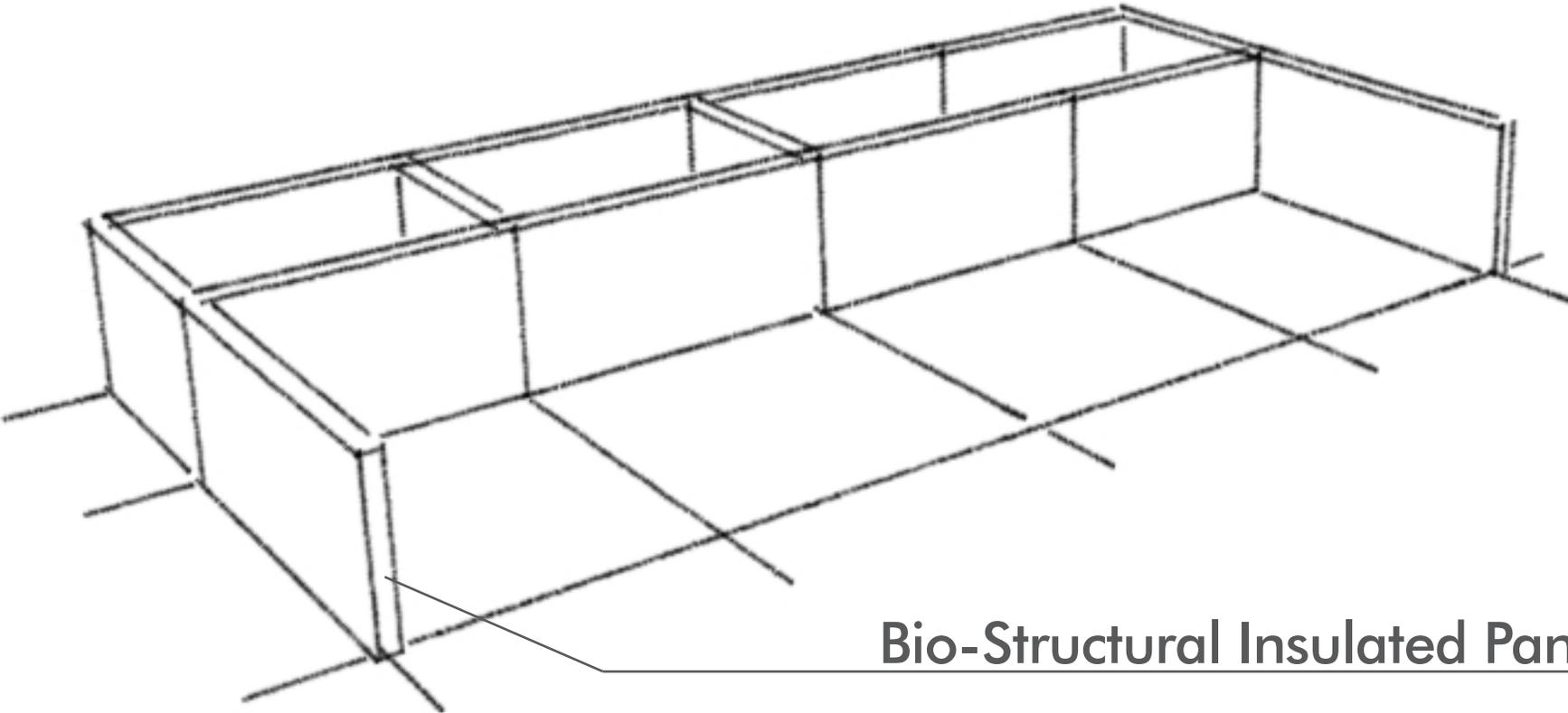
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



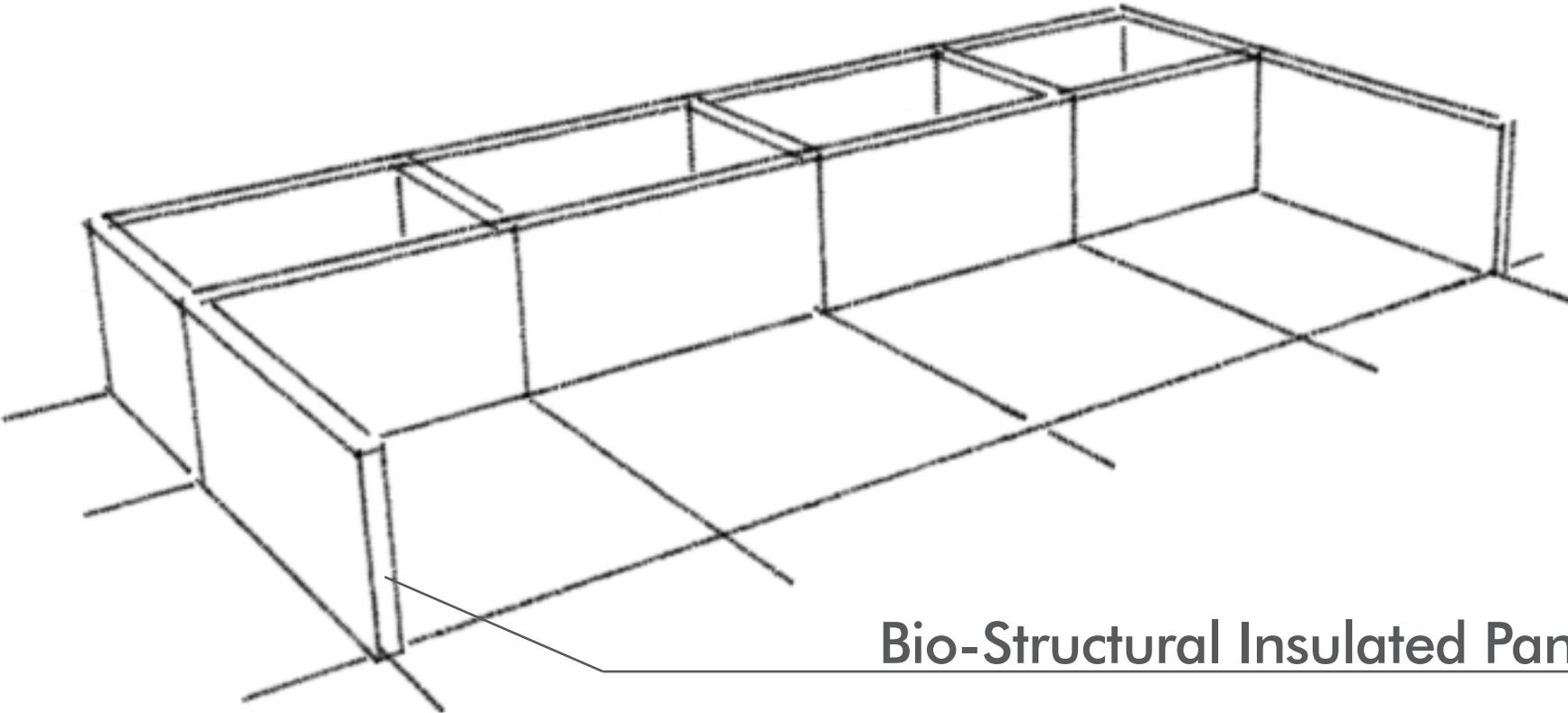
Bio-Structural Insulated Panels

PROTOTYPE HOUSE



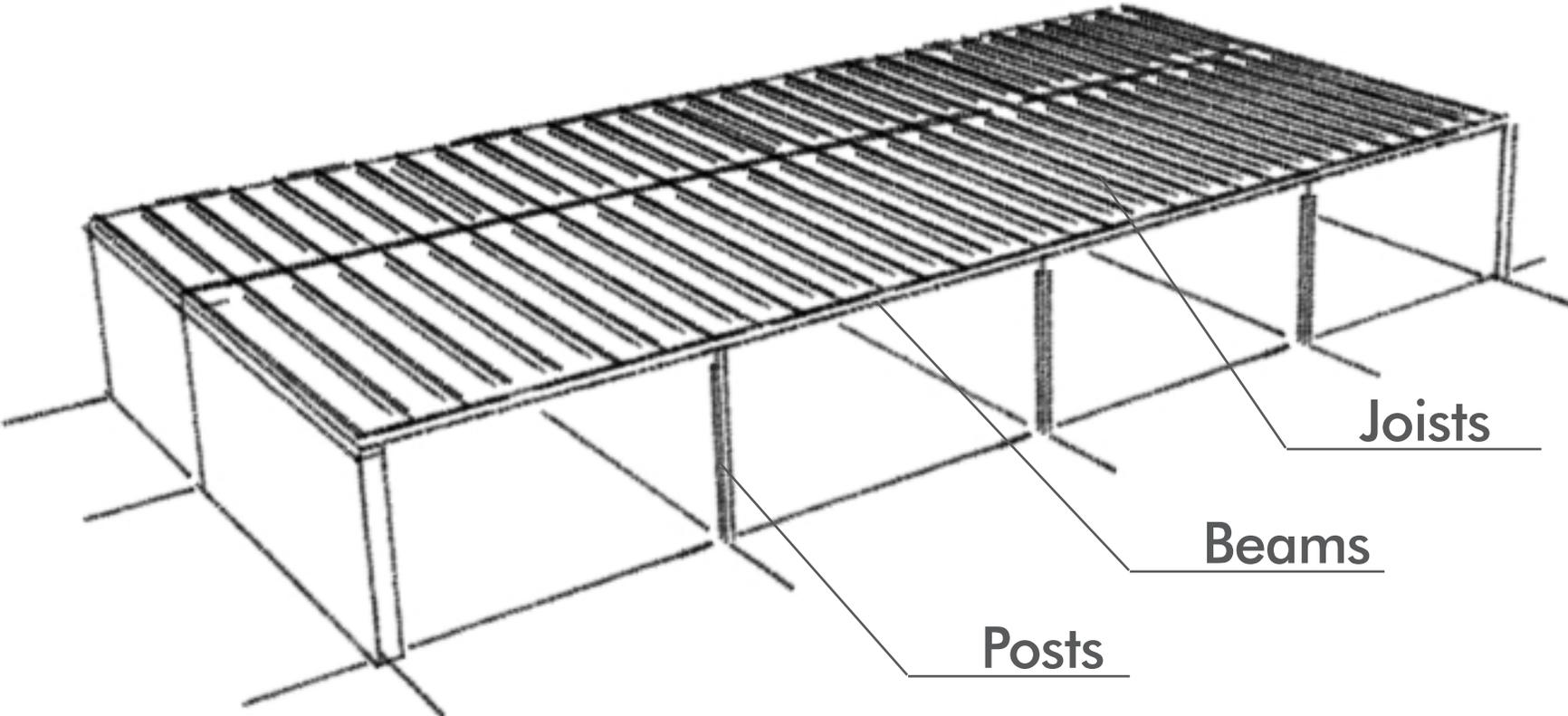
Bio-Structural Insulated Panels

PROTOTYPE HOUSE

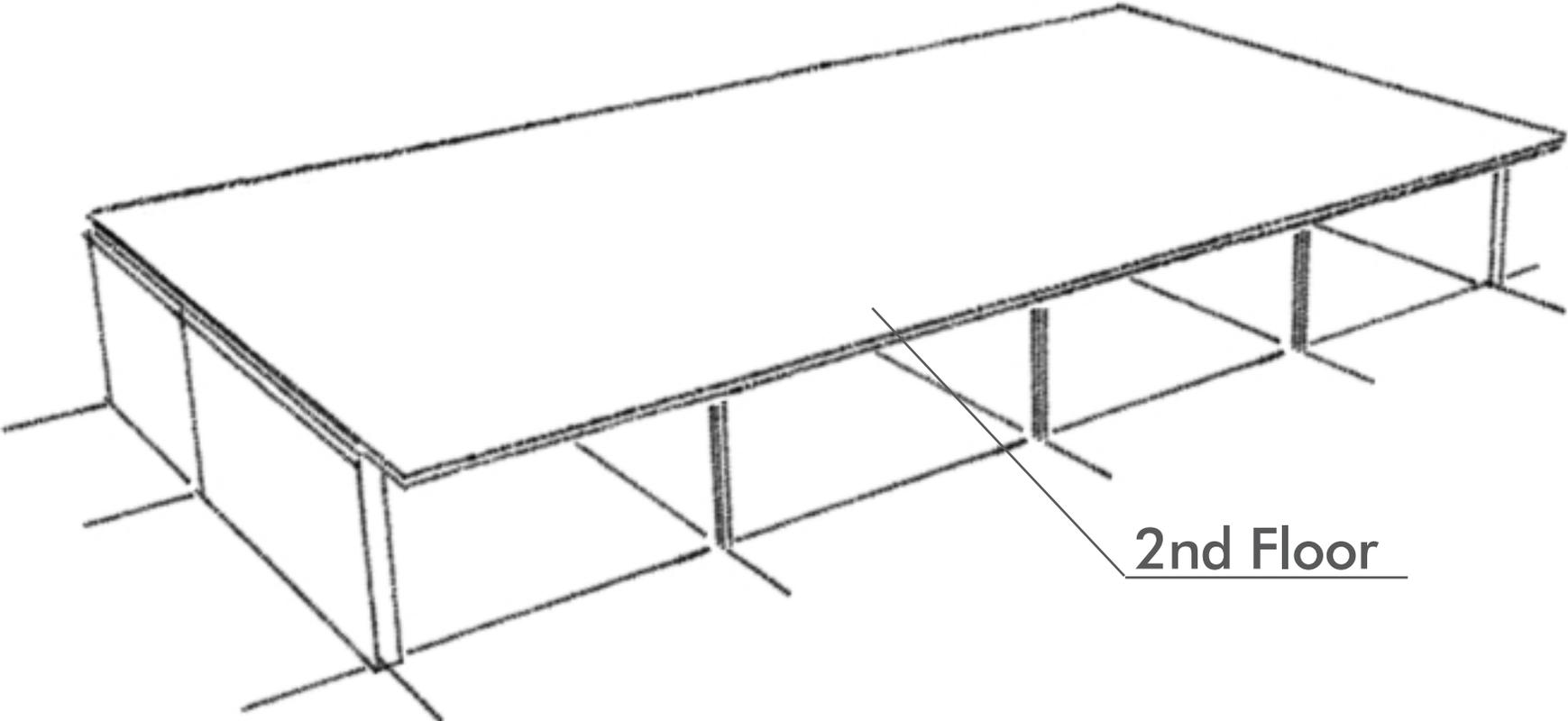


Bio-Structural Insulated Panels

PROTOTYPE HOUSE

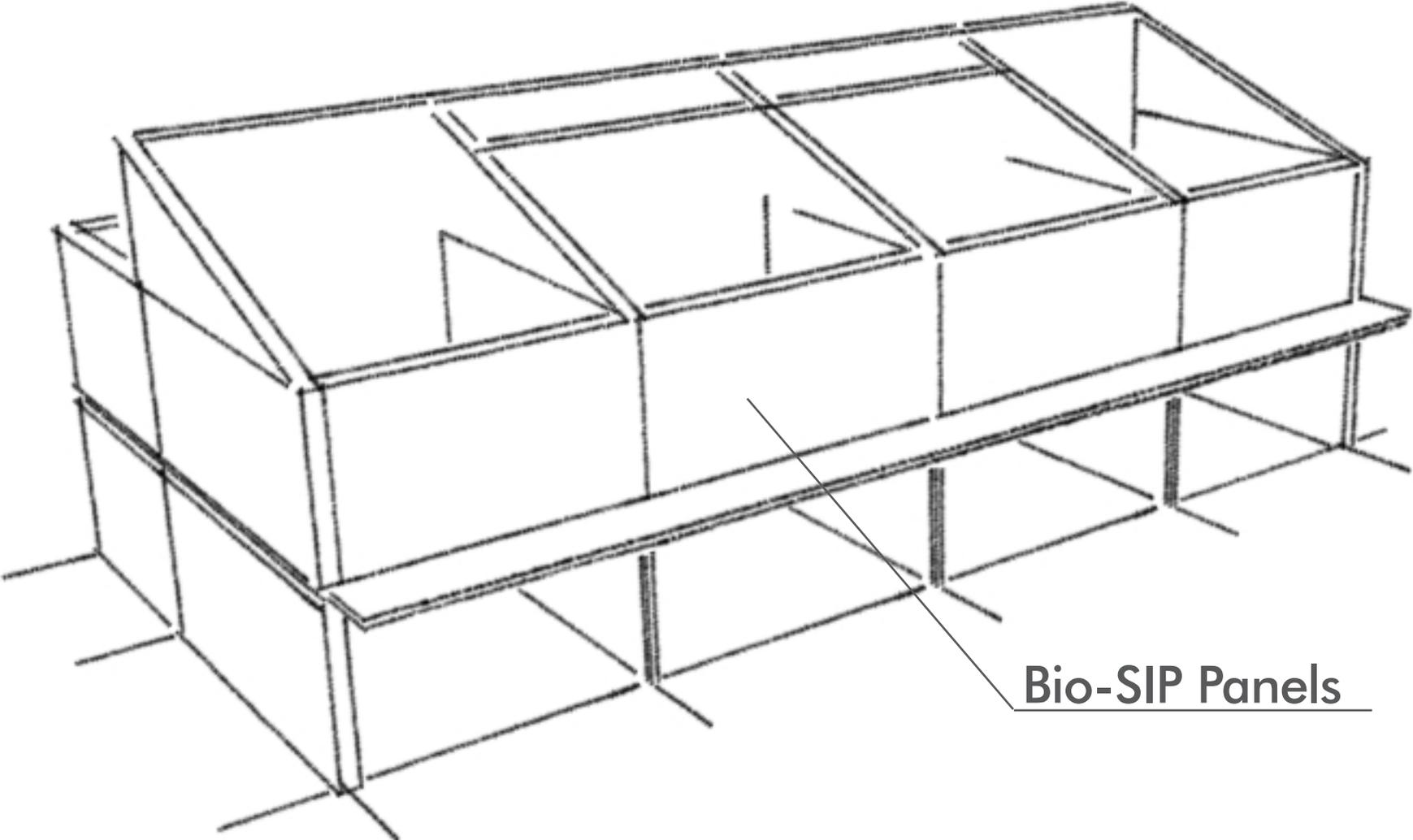


PROTOTYPE HOUSE



2nd Floor

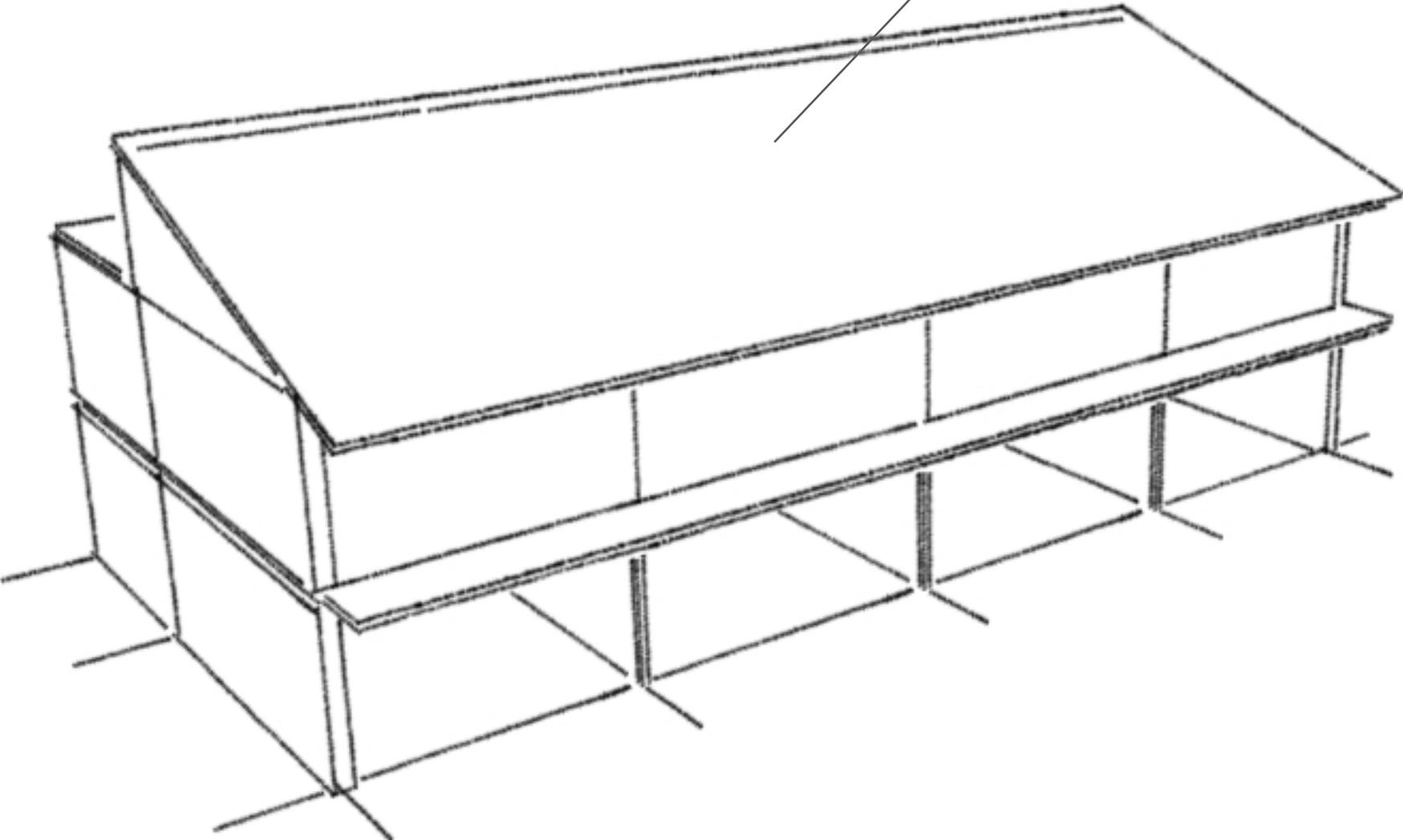
PROTOTYPE HOUSE



Bio-SIP Panels

PROTOTYPE HOUSE

Bio-SIP Roof Panels







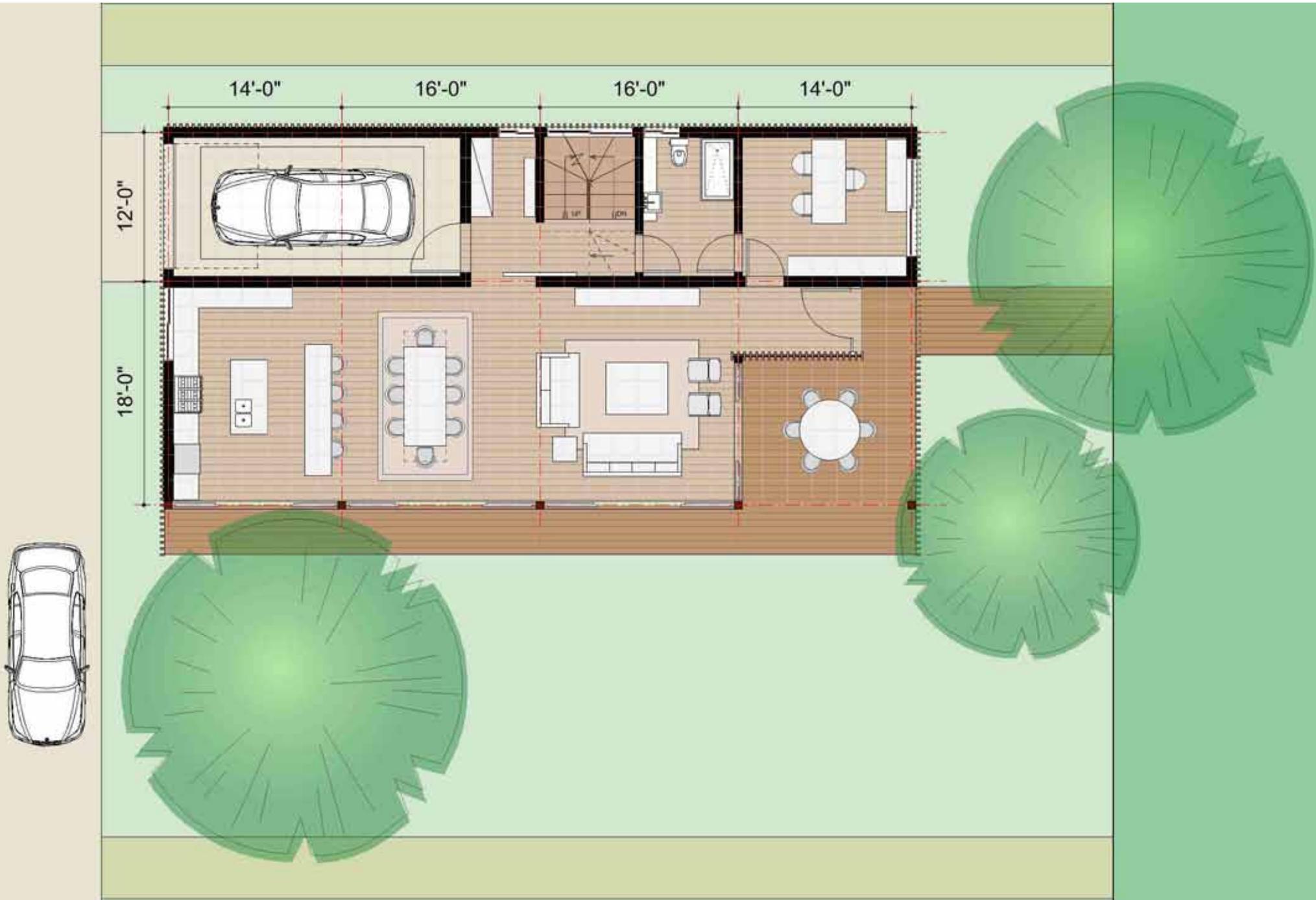






PROTOTYPE HOUSE

First Floor - 1668sqf



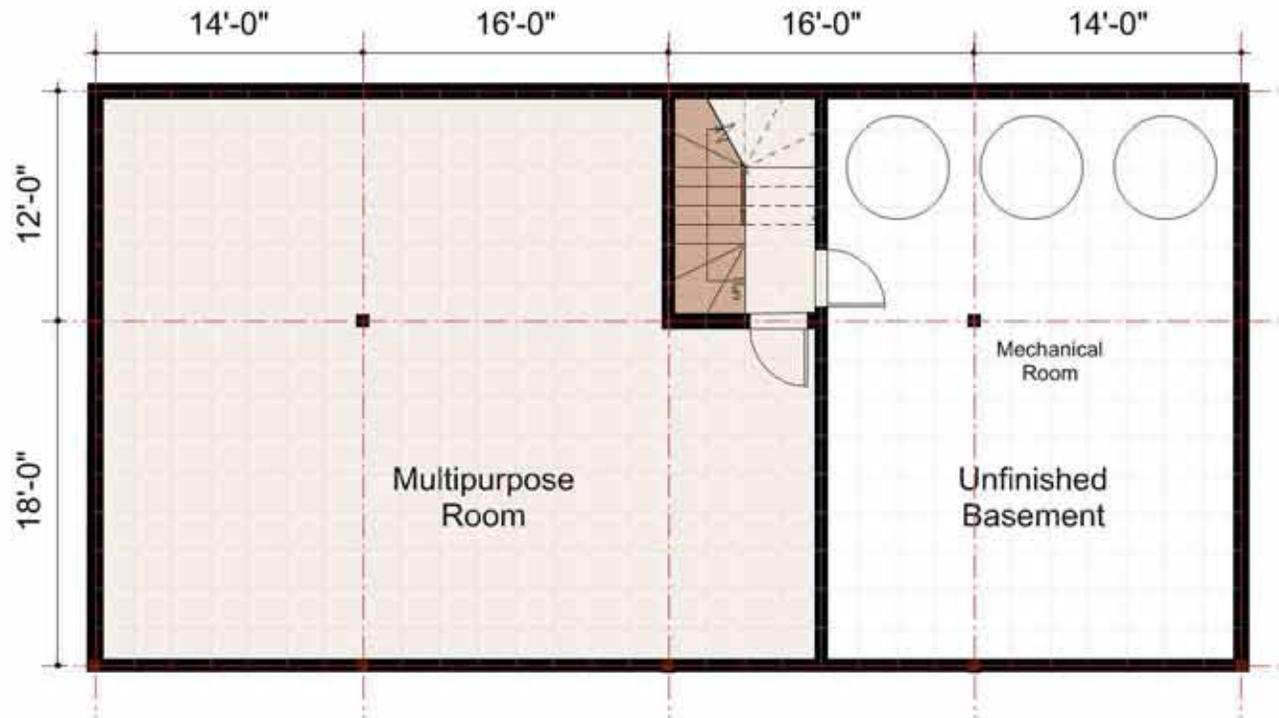
PROTOTYPE HOUSE

Second Floor - 1875sqf



PROTOTYPE HOUSE

Basement - 1875sqf



PROTOTYPE HOUSE

South Façade



PROTOTYPE HOUSE

North Façade



PROTOTYPE HOUSE

East Façade



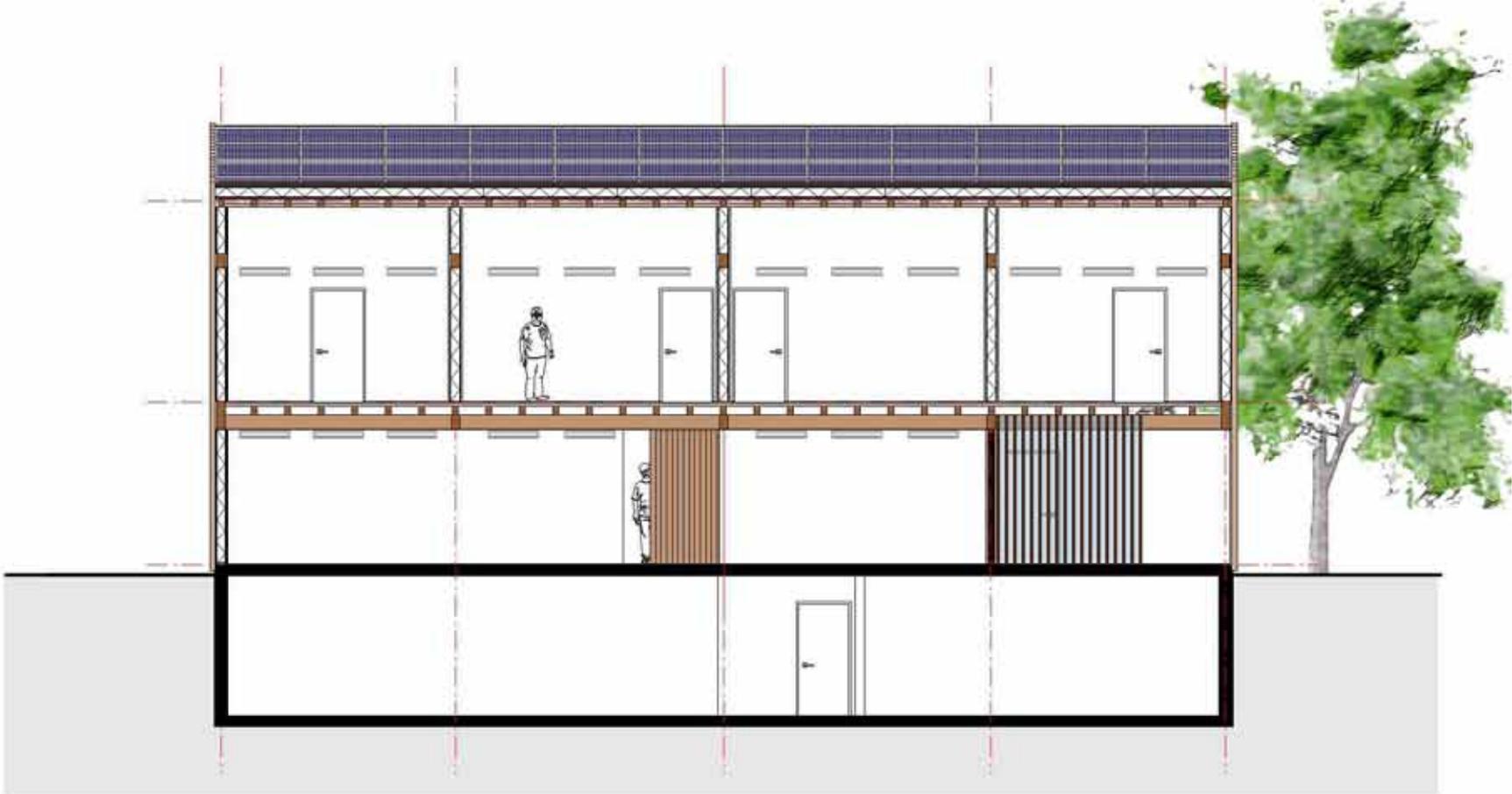
PROTOTYPE HOUSE

West Façade



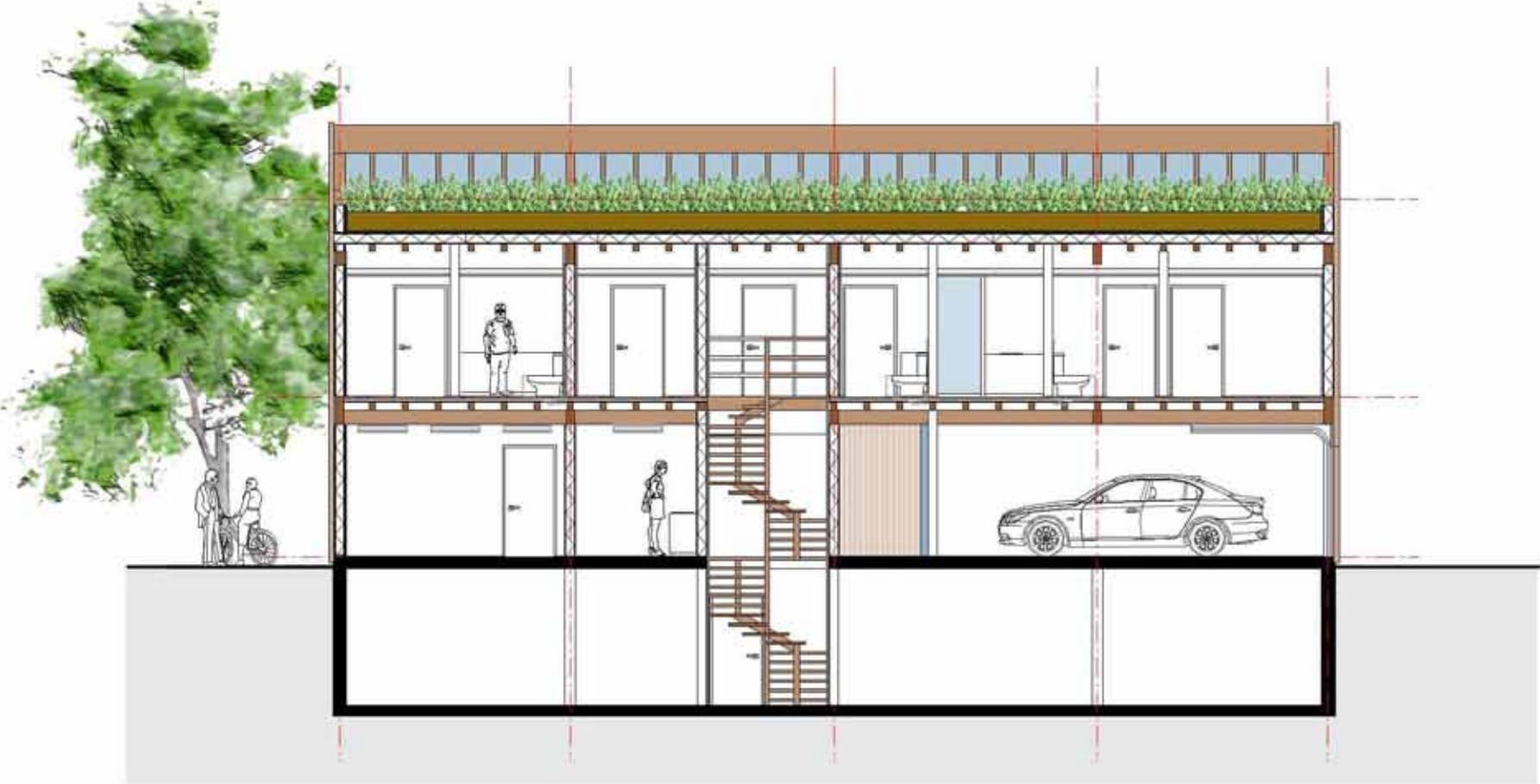
PROTOTYPE HOUSE

Section A-A'



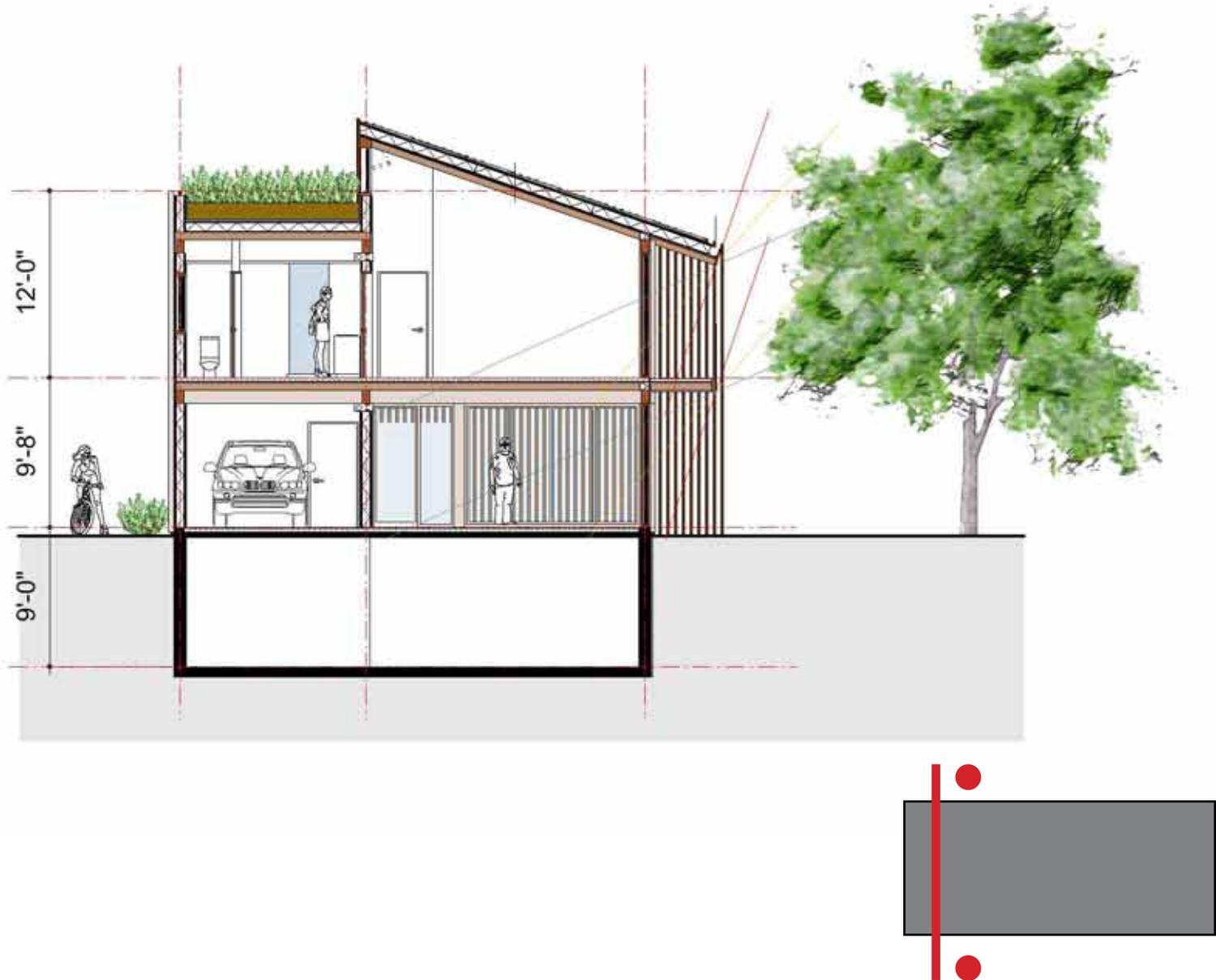
PROTOTYPE HOUSE

Section B-B'



PROTOTYPE HOUSE

Section C-C'



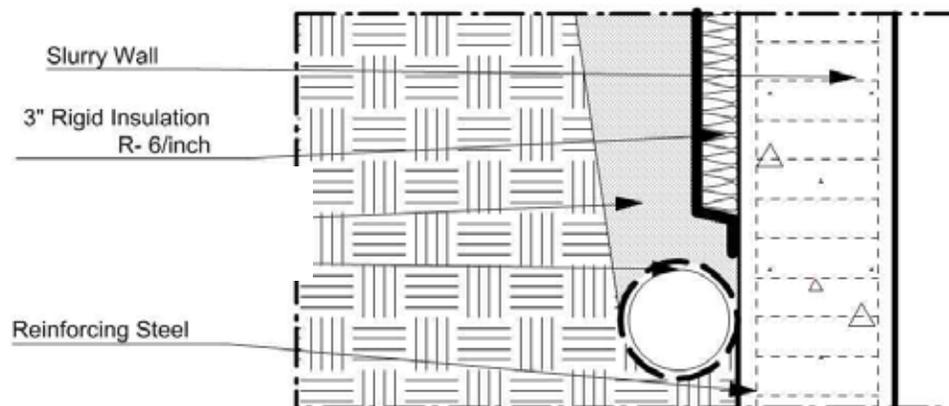
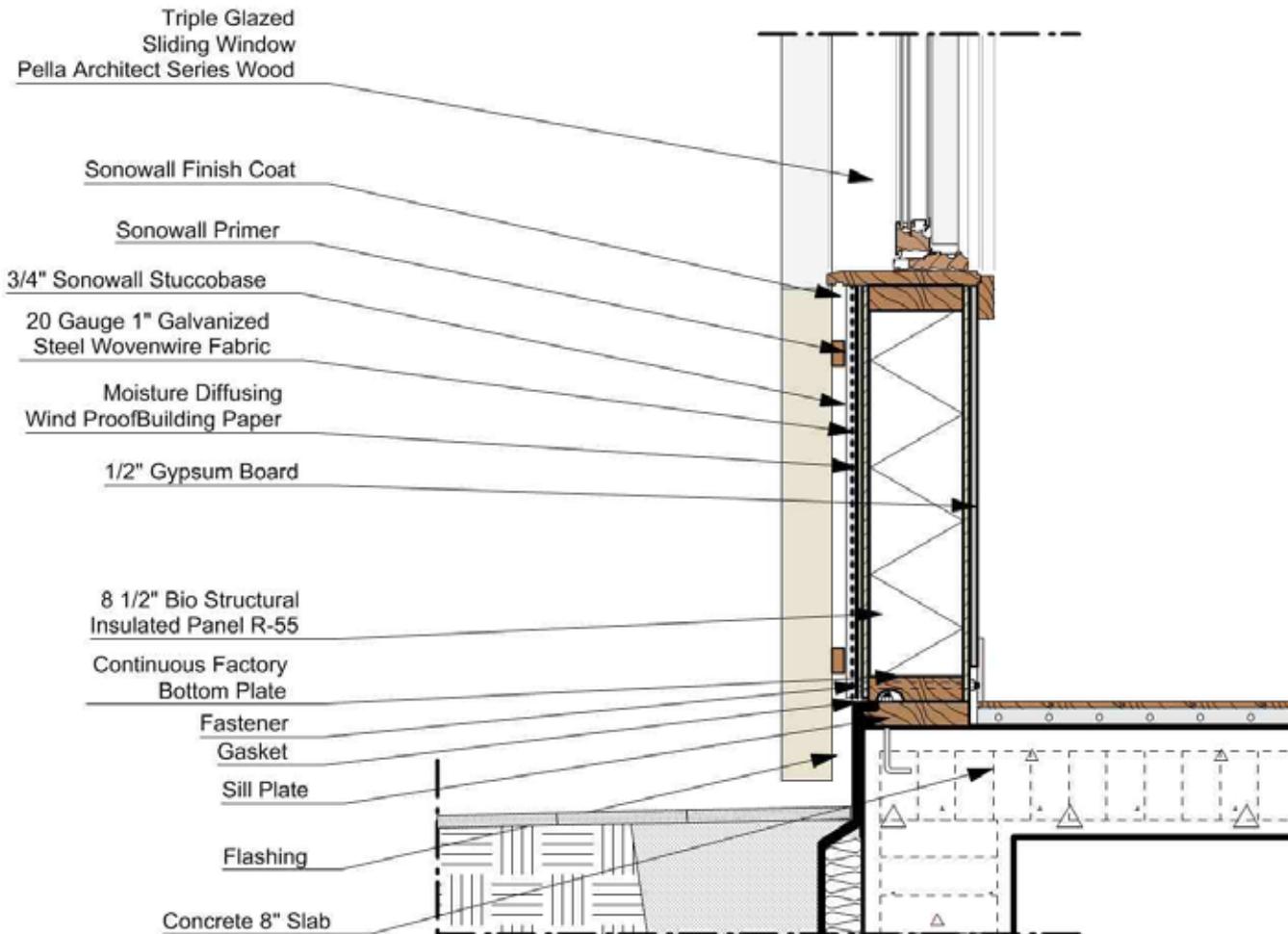
PROTOTYPE HOUSE

Section D-D'



PROTOTYPE HOUSE

Details



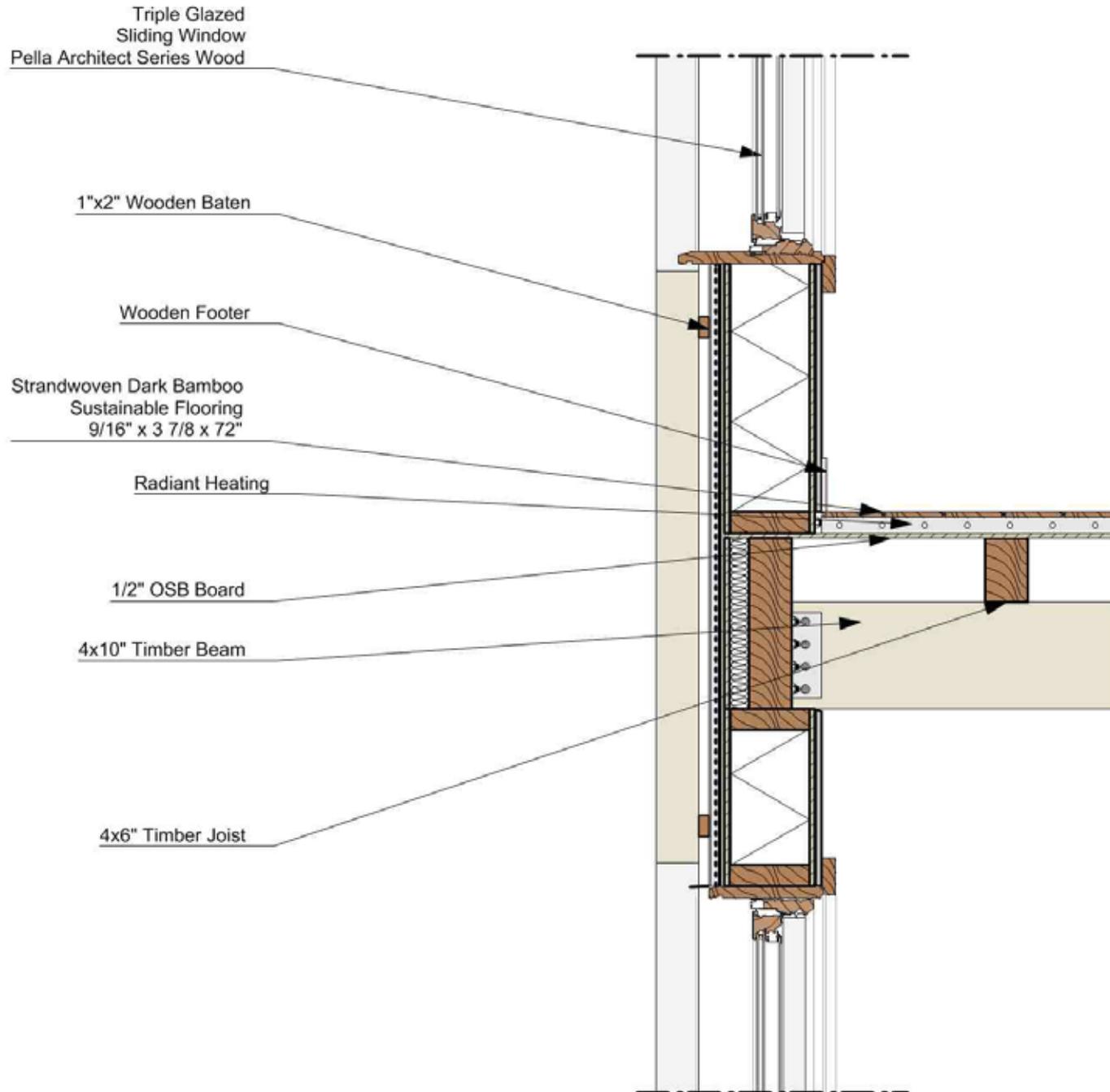
Wall Section
Scale 3/4" = 1'

Passive Haus Standard
R-56 aprox 27" Thickness

UHH Wall Assembly
R-56 10" Thickness

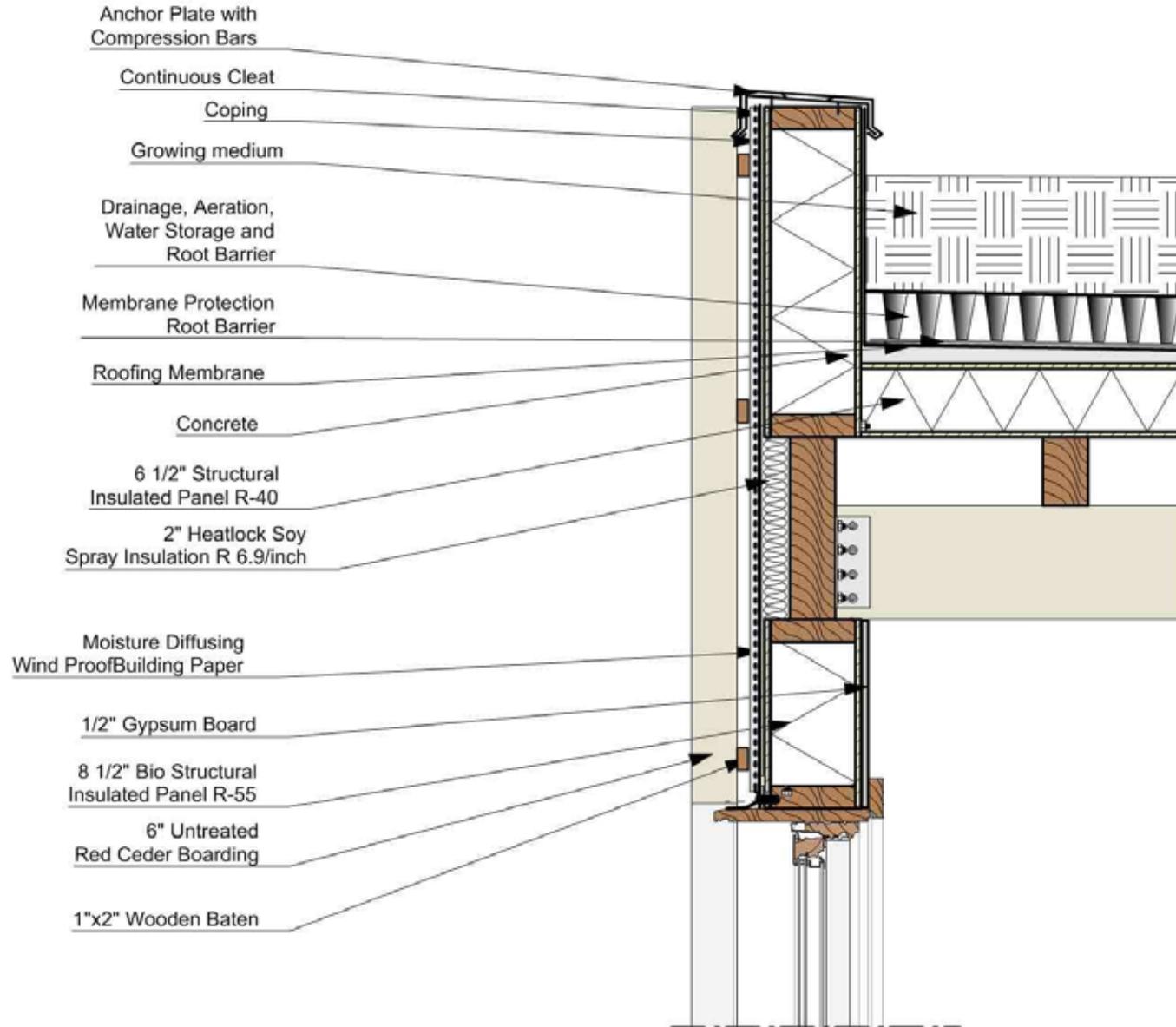
PROTOTYPE HOUSE

Details



PROTOTYPE HOUSE

Details











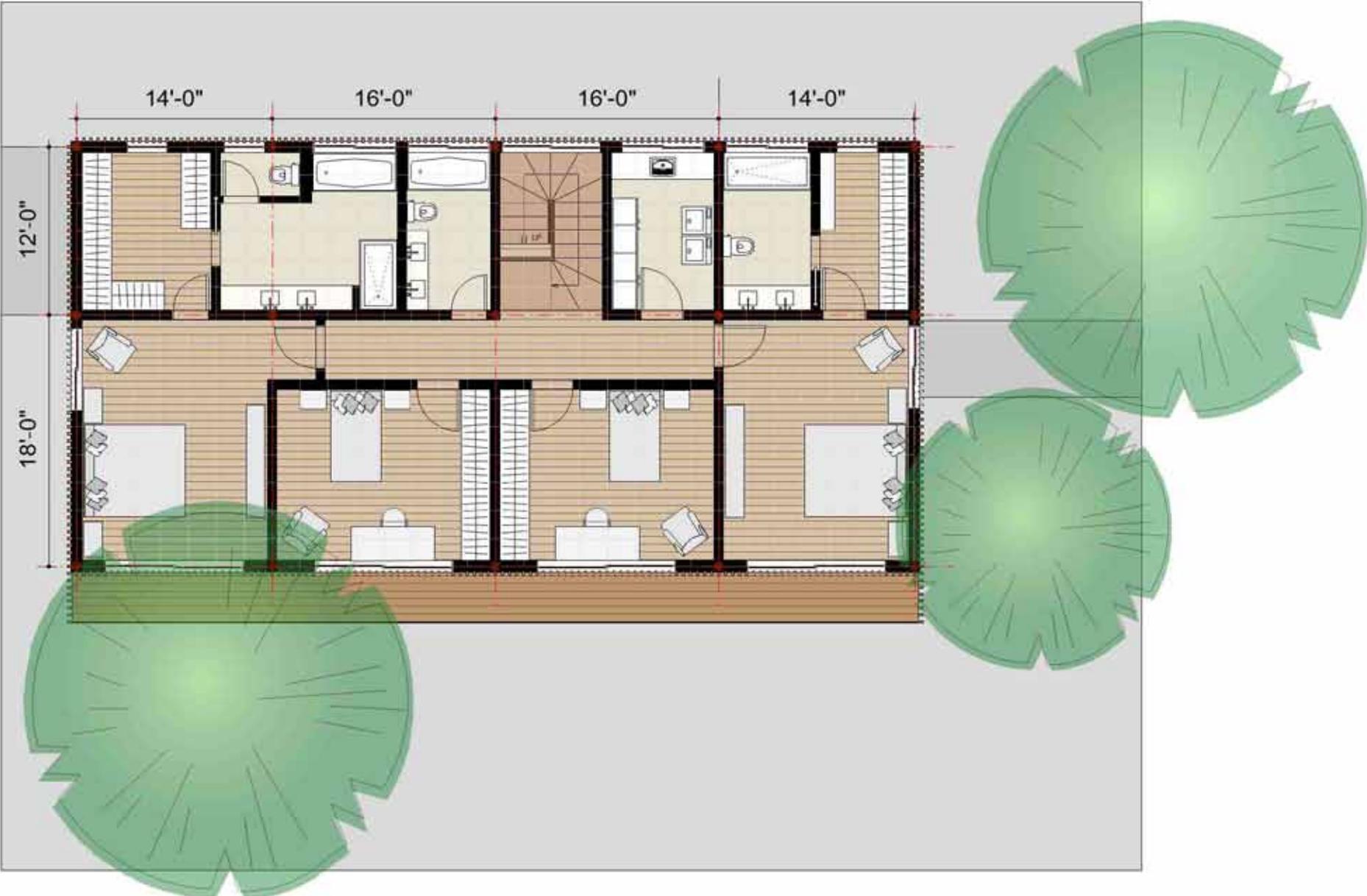
HOUSE VARIATION

First Floor 1636 sqf



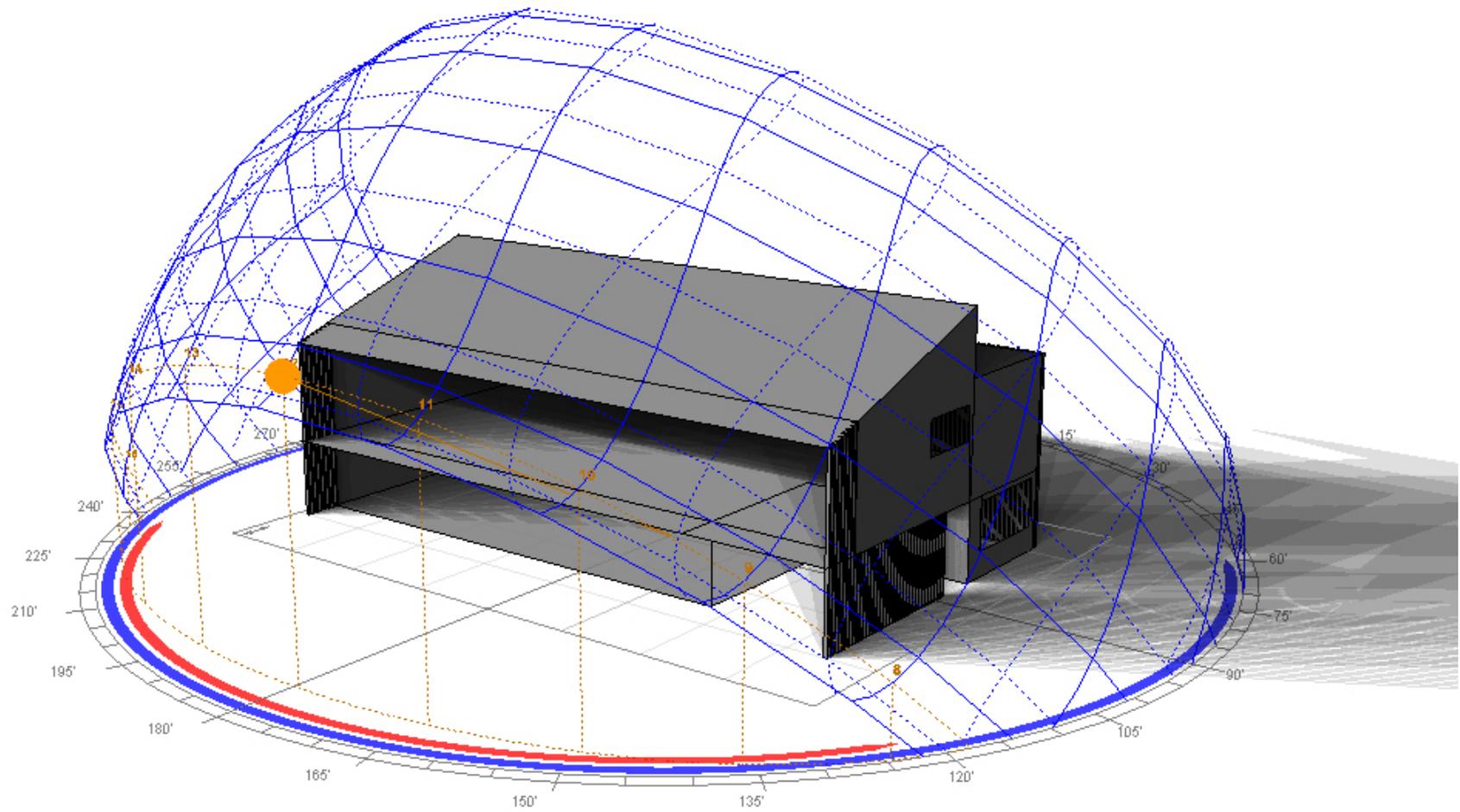
HOUSE VARIATION

Second Floor 1875 sqf



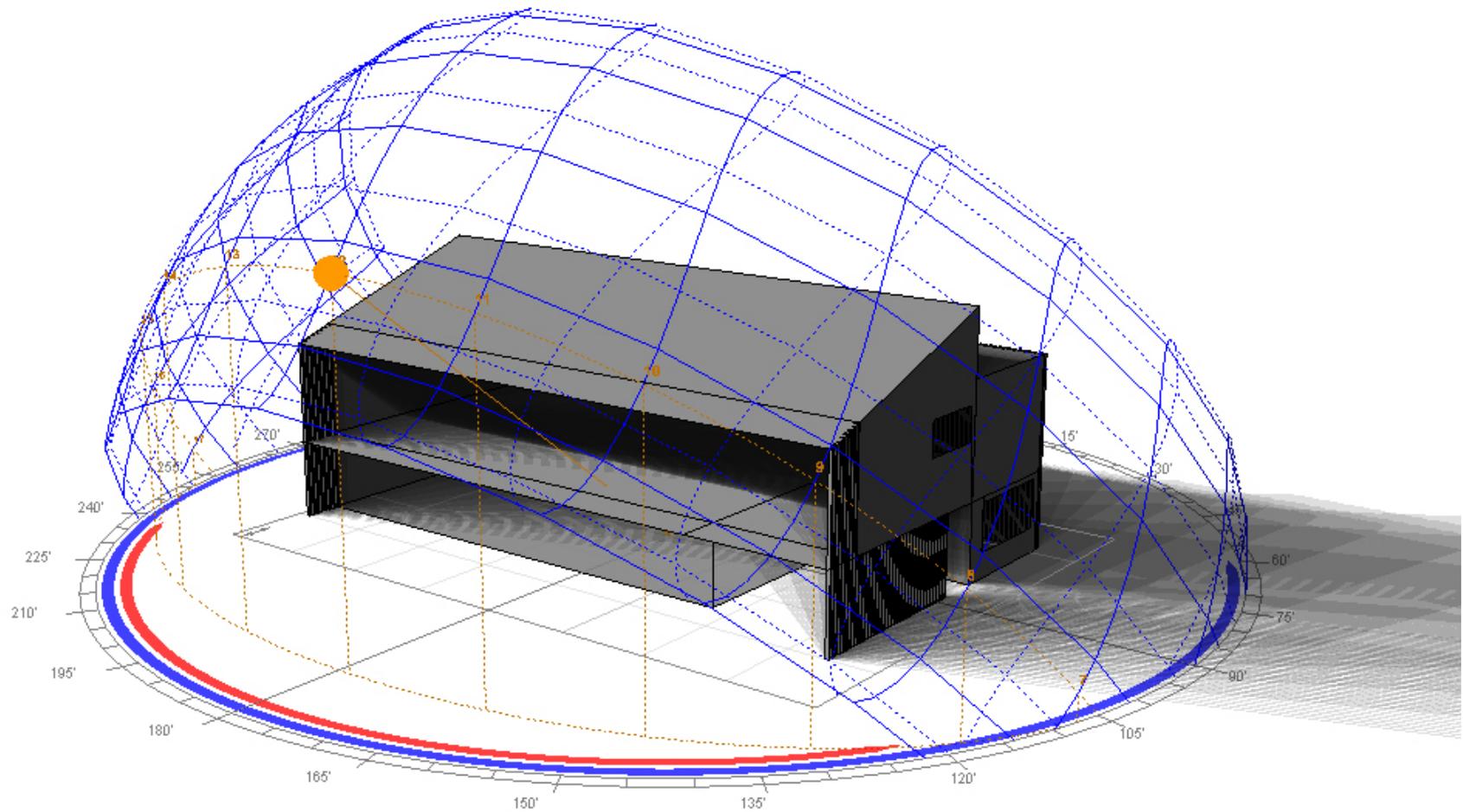
PROTOTYPE HOUSE

Shadow Range - January



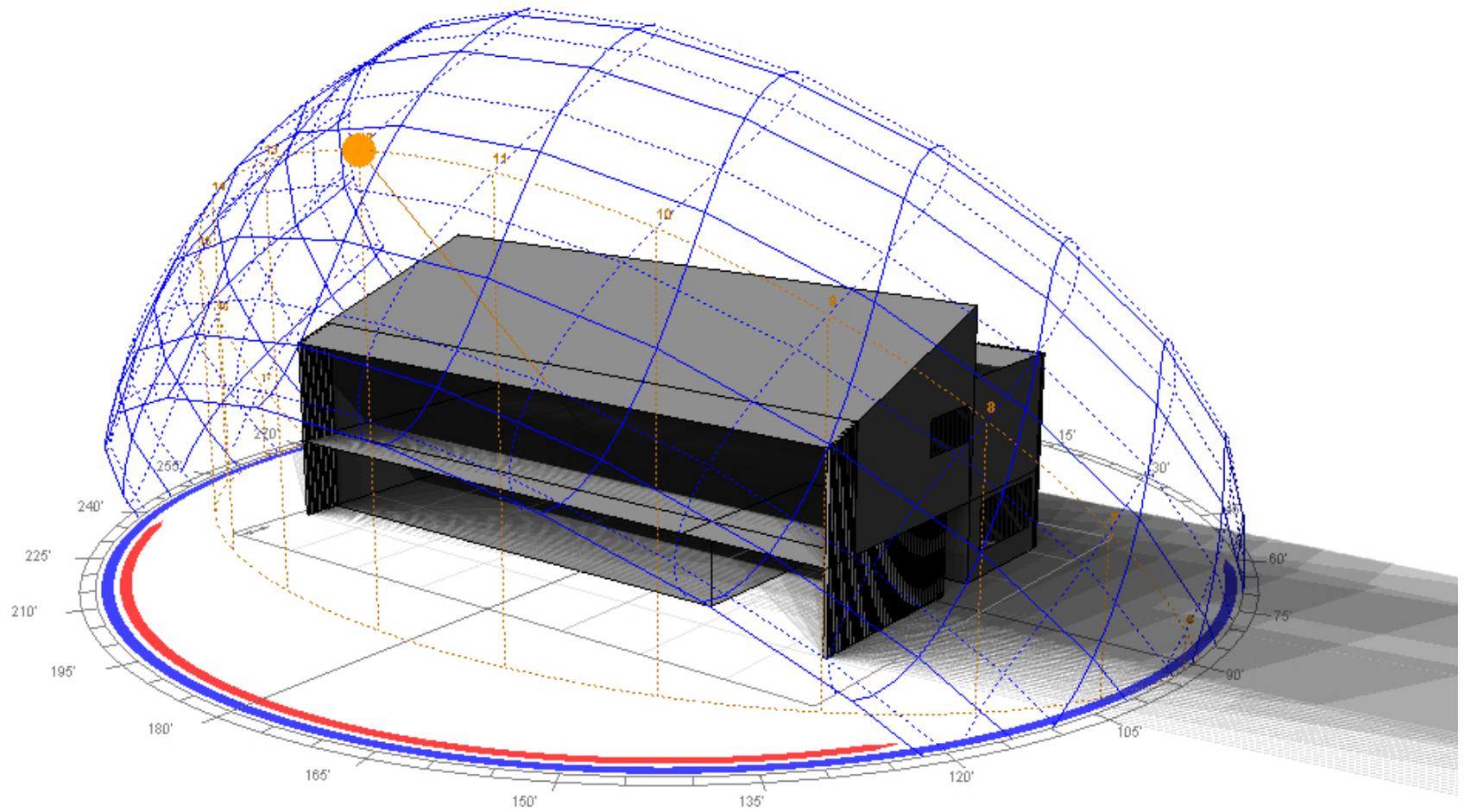
PROTOTYPE HOUSE

Shadow Range - February



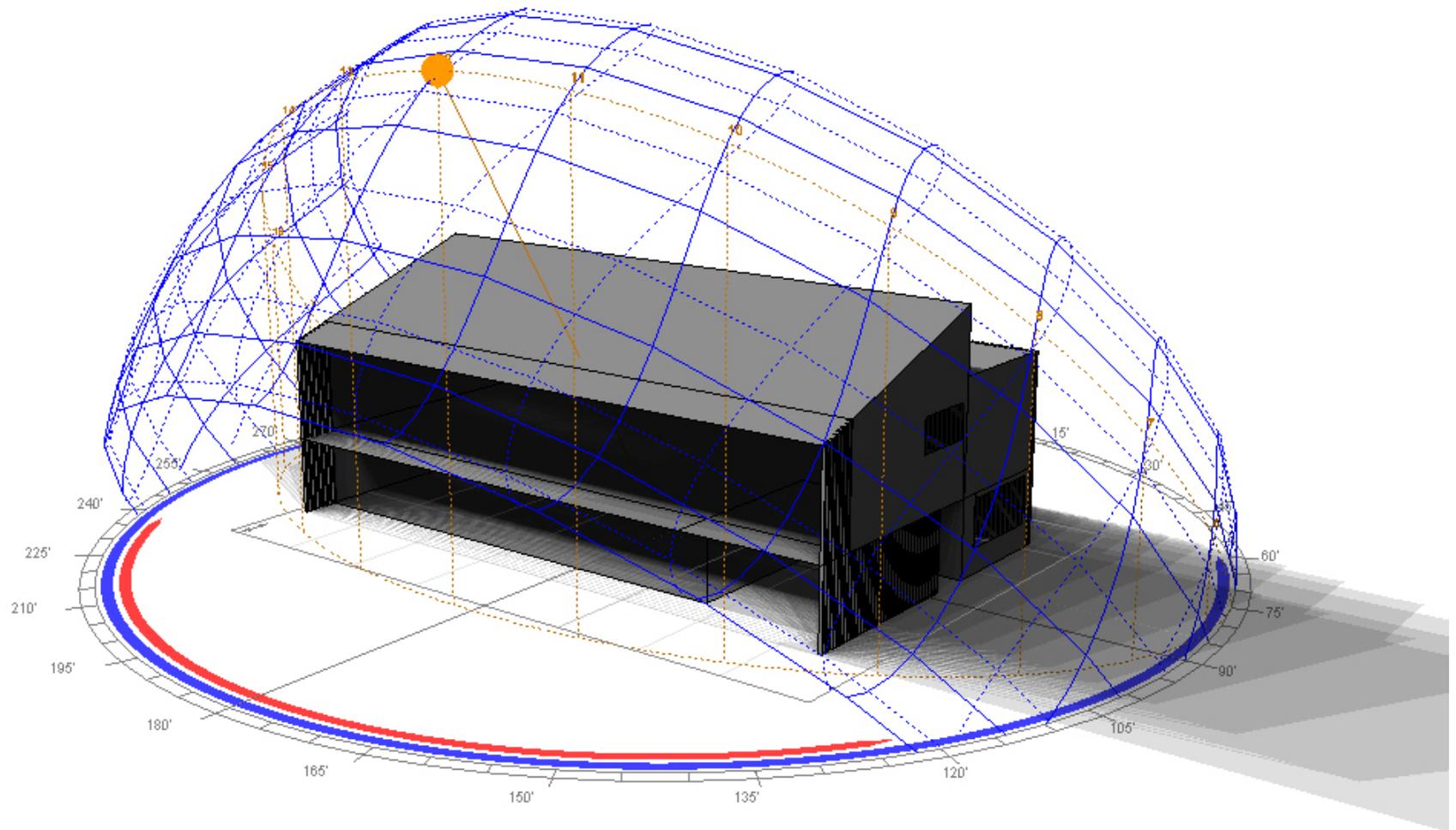
PROTOTYPE HOUSE

Shadow Range - March



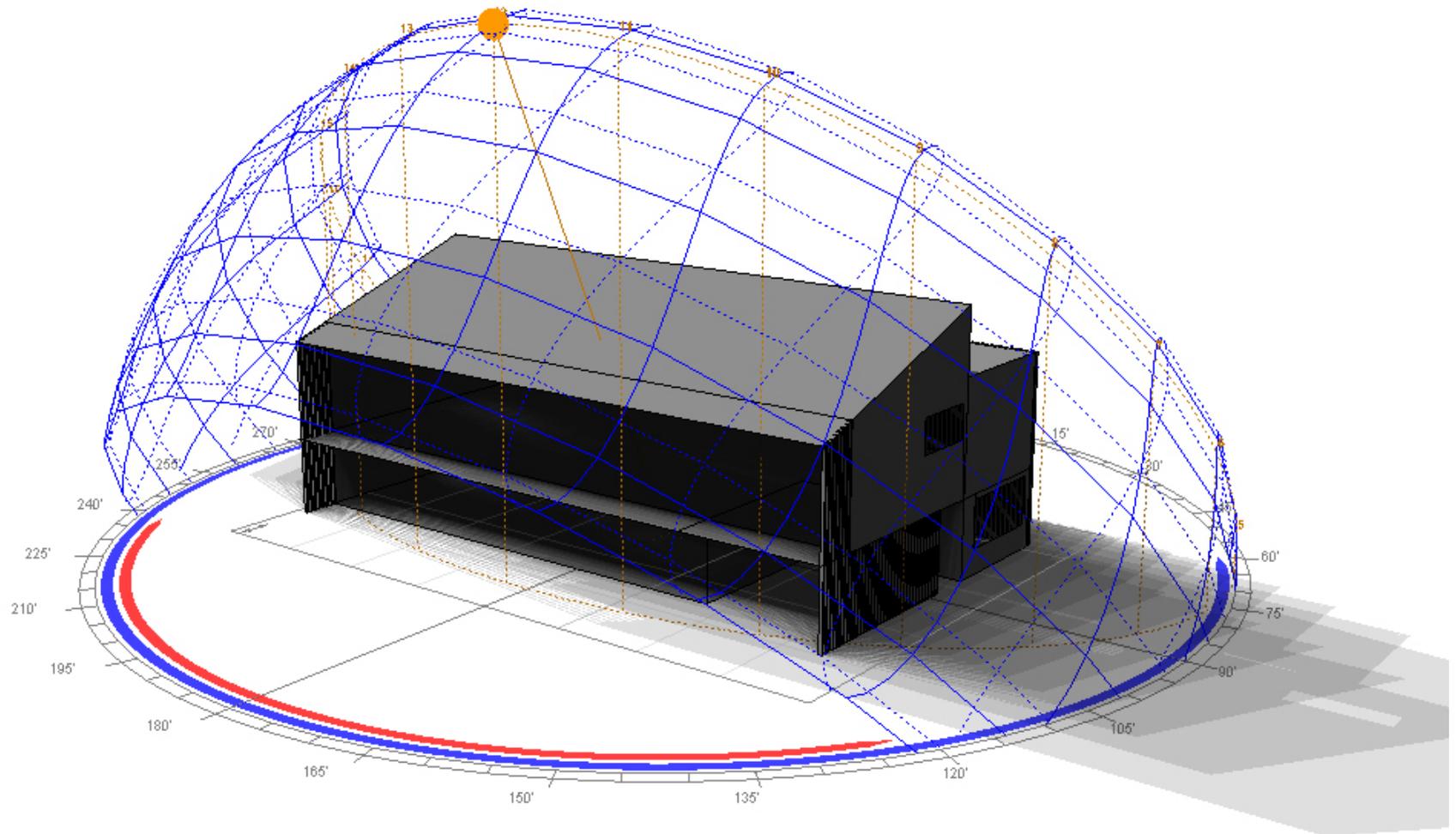
PROTOTYPE HOUSE

Shadow Range - April



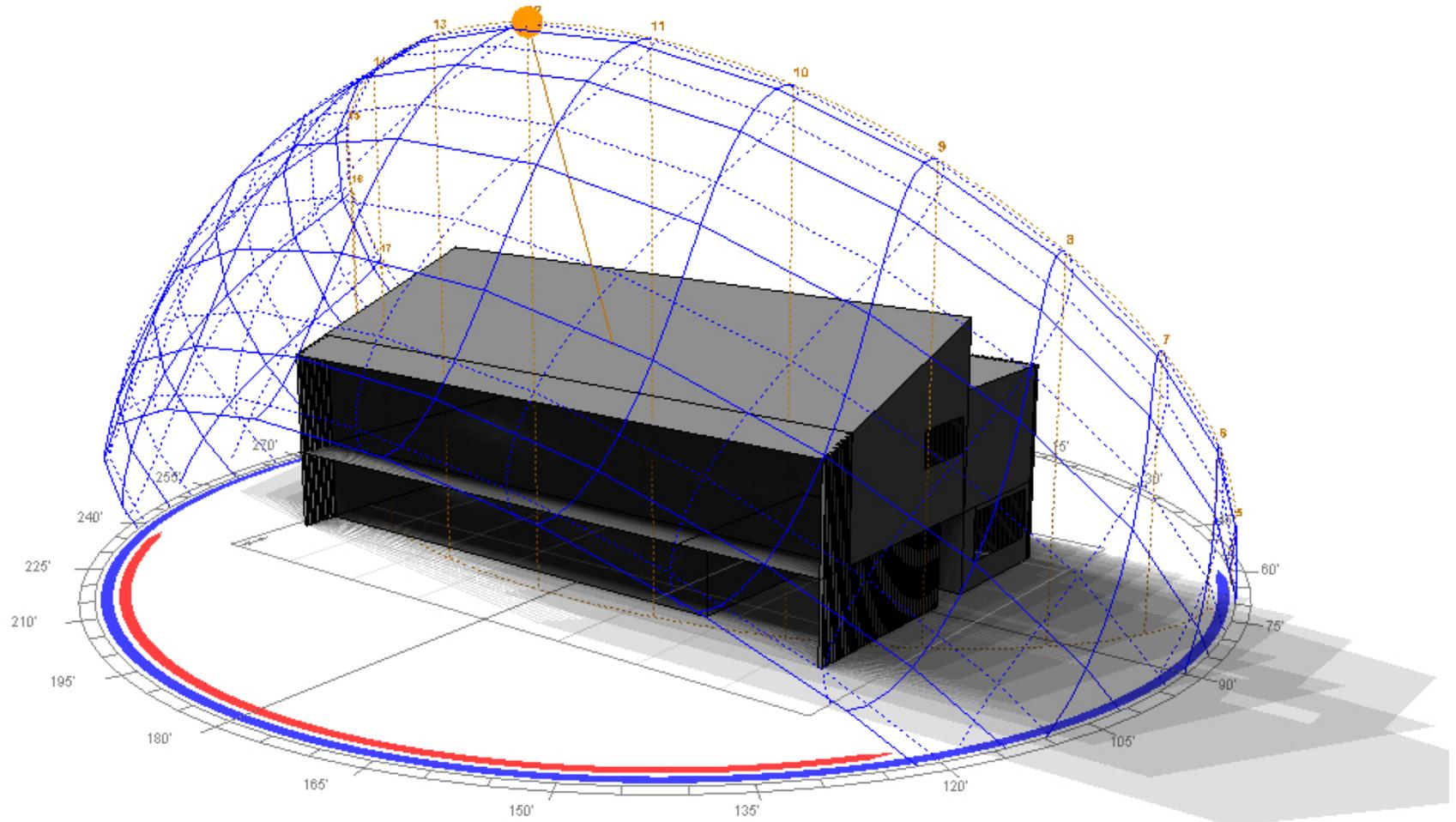
PROTOTYPE HOUSE

Shadow Range - May



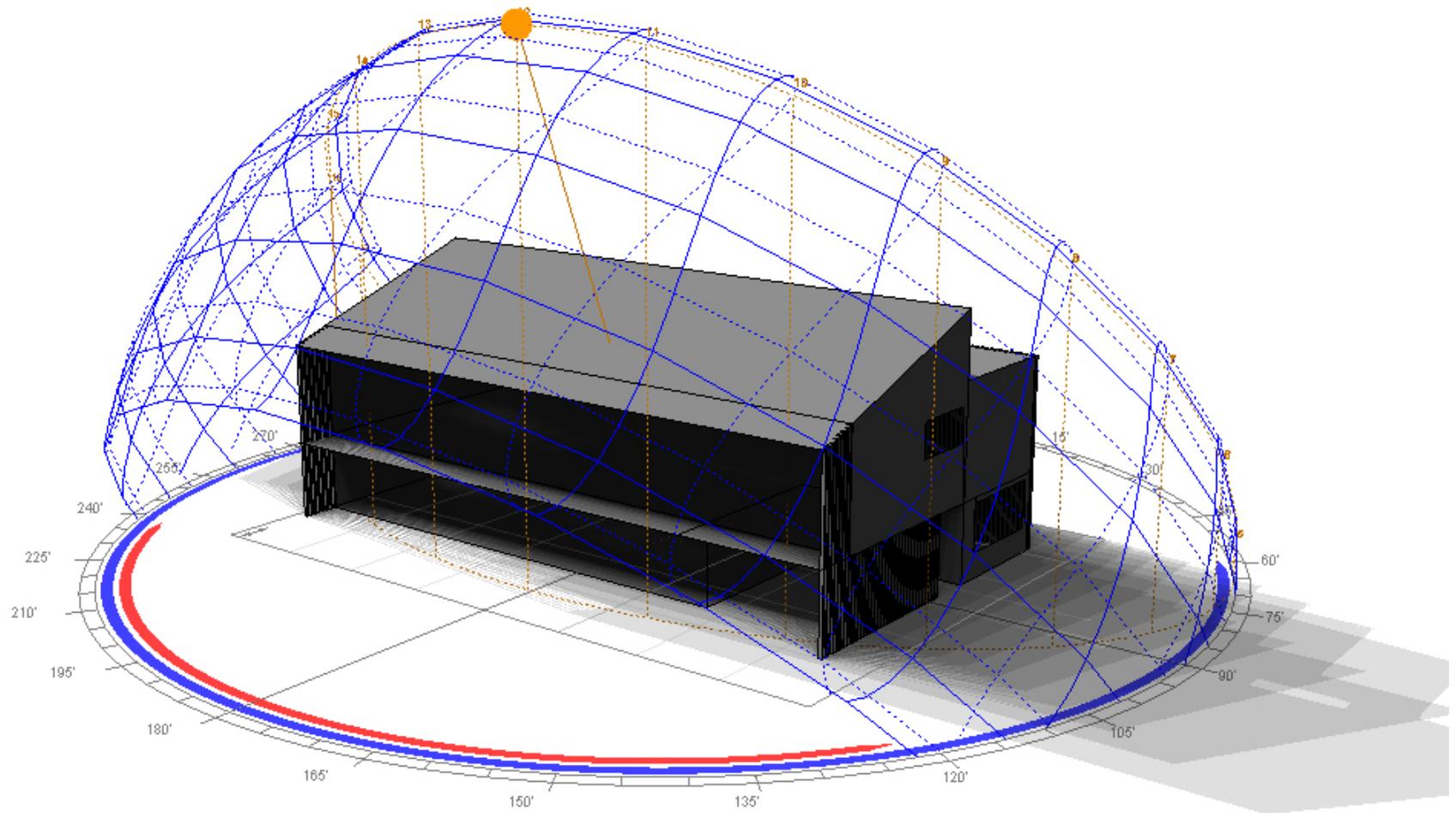
PROTOTYPE HOUSE

Shadow Range - June



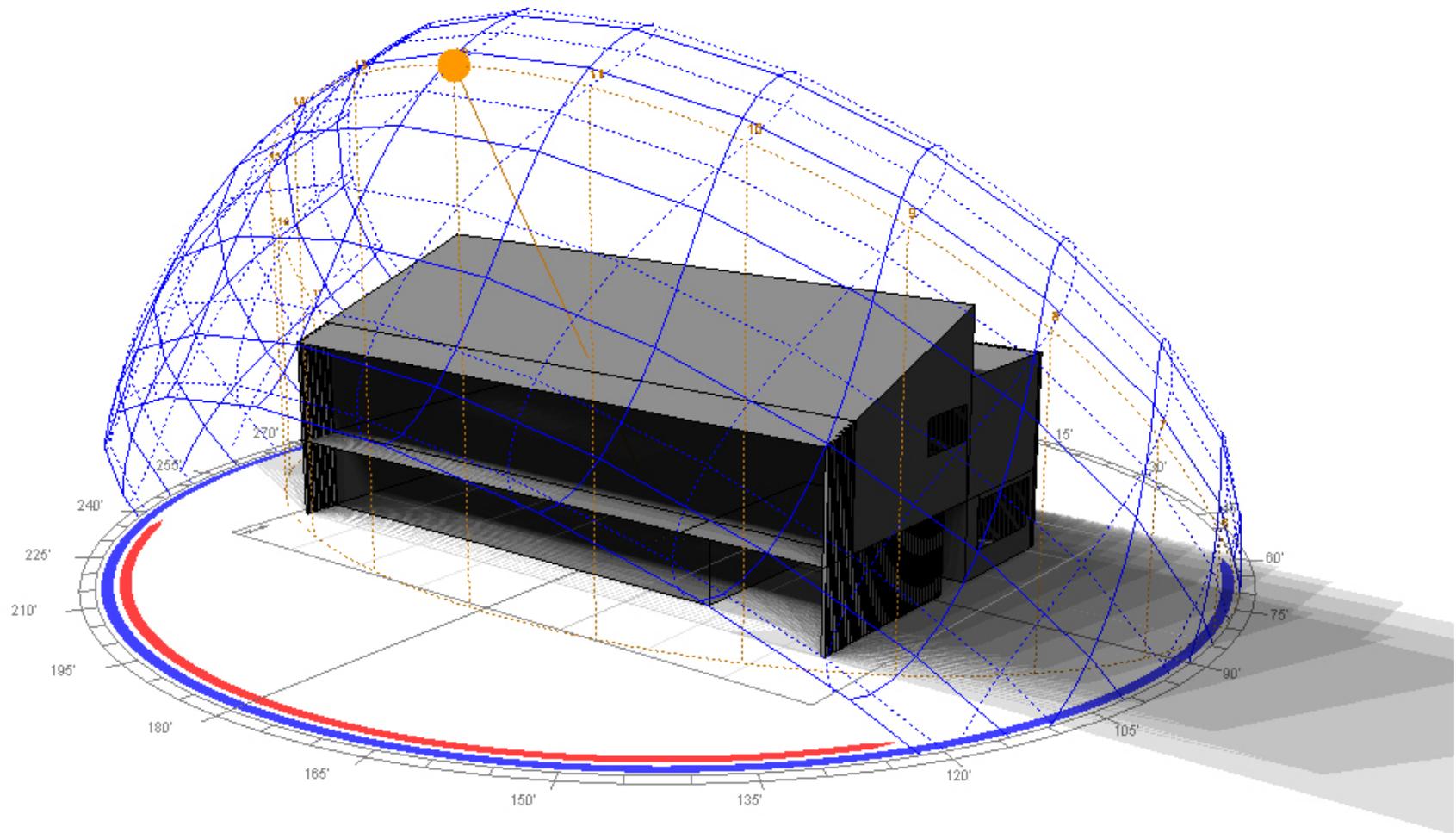
PROTOTYPE HOUSE

Shadow Range - July



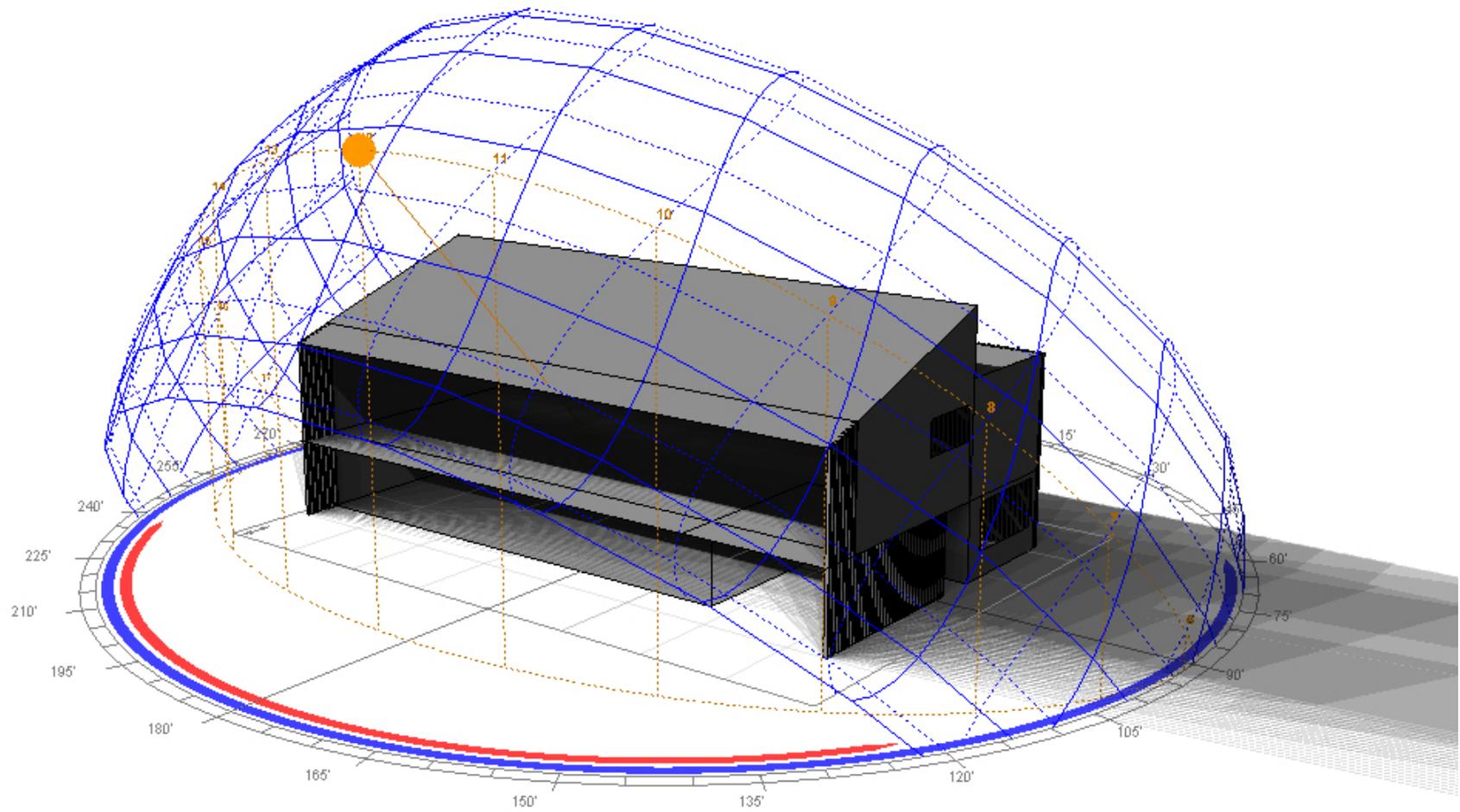
PROTOTYPE HOUSE

Shadow Range - August



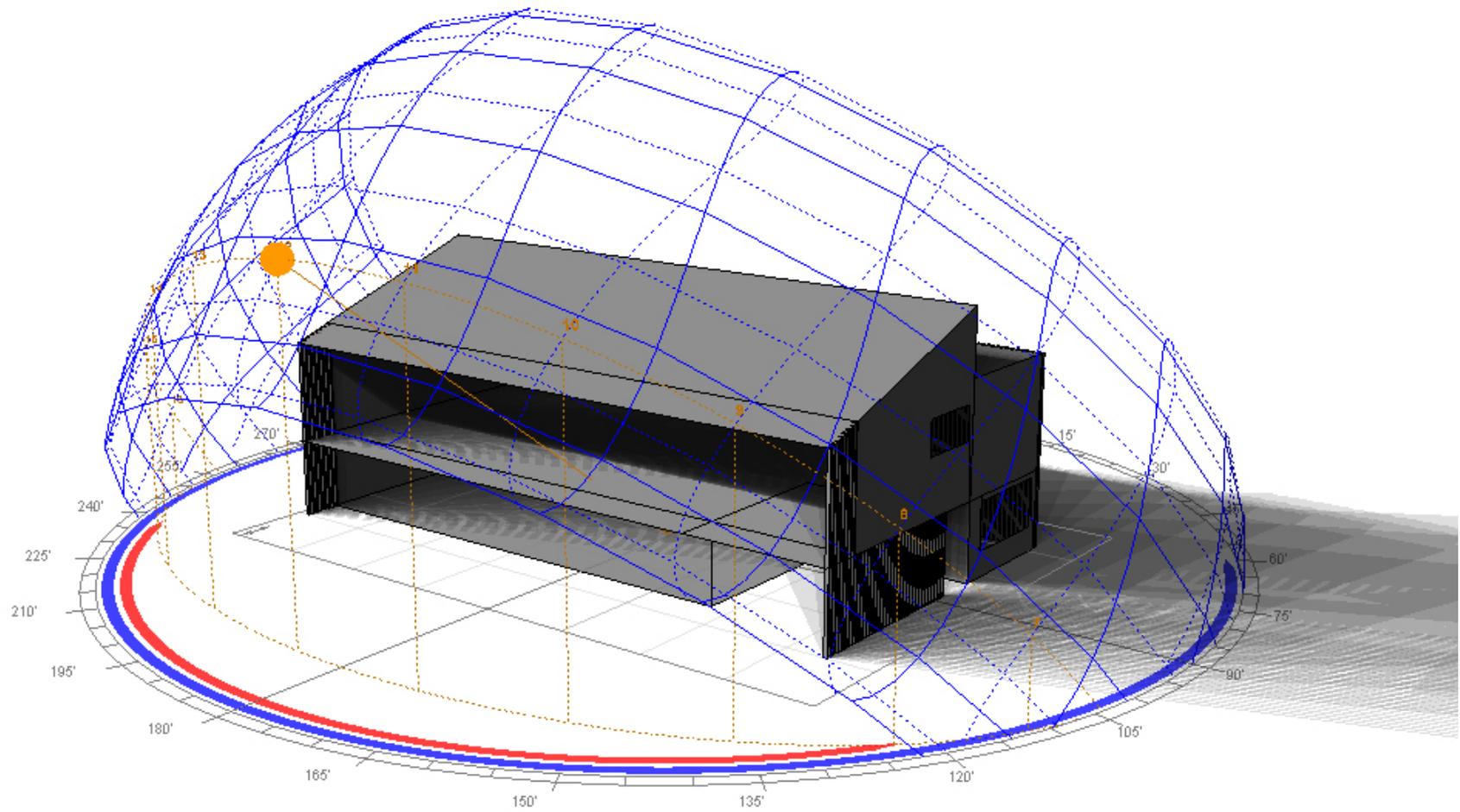
PROTOTYPE HOUSE

Shadow Range - September



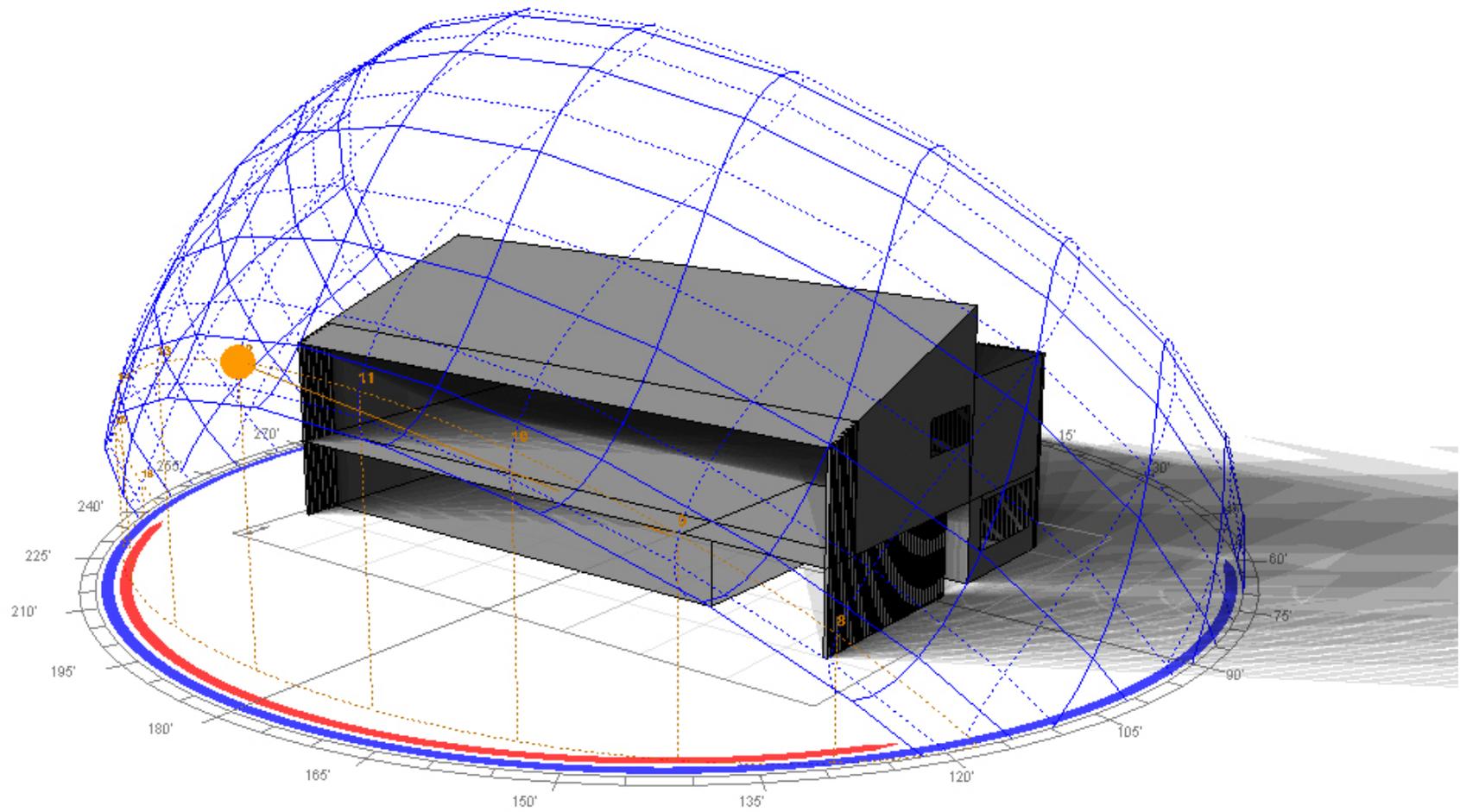
PROTOTYPE HOUSE

Shadow Range - October



PROTOTYPE HOUSE

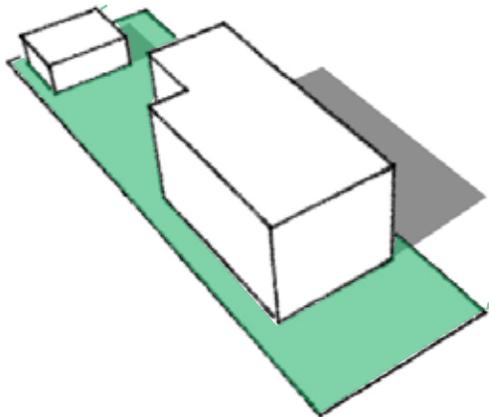
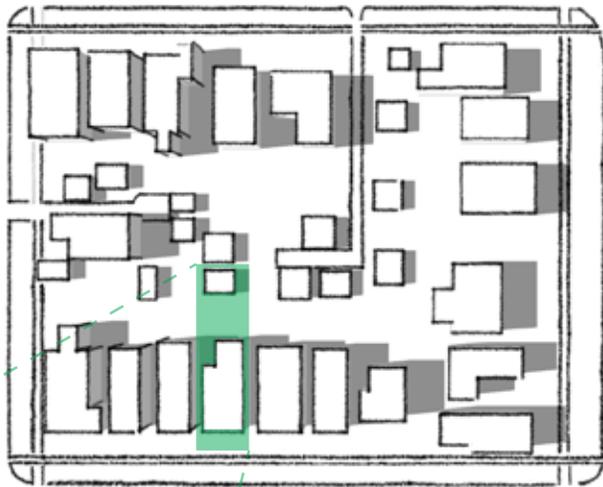
Shadow Range - November



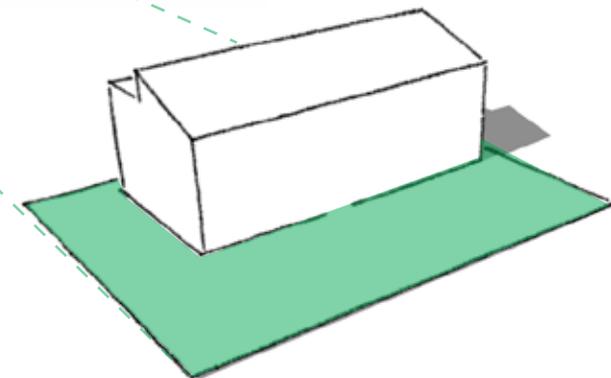
CRITERIA

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



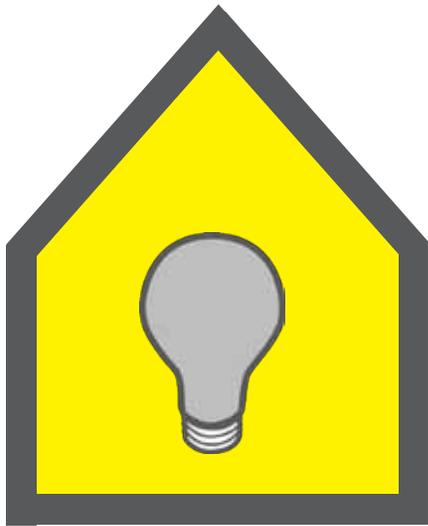
Wall assembly: R-19
brick
cavity
insulation
wood frame
dry wal



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%

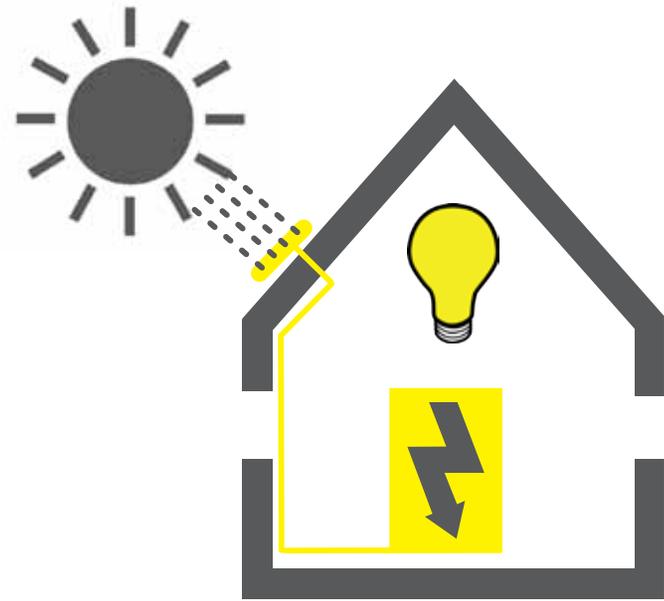


35%

ENERGY PRODUCTION AND WATER COLLECTION



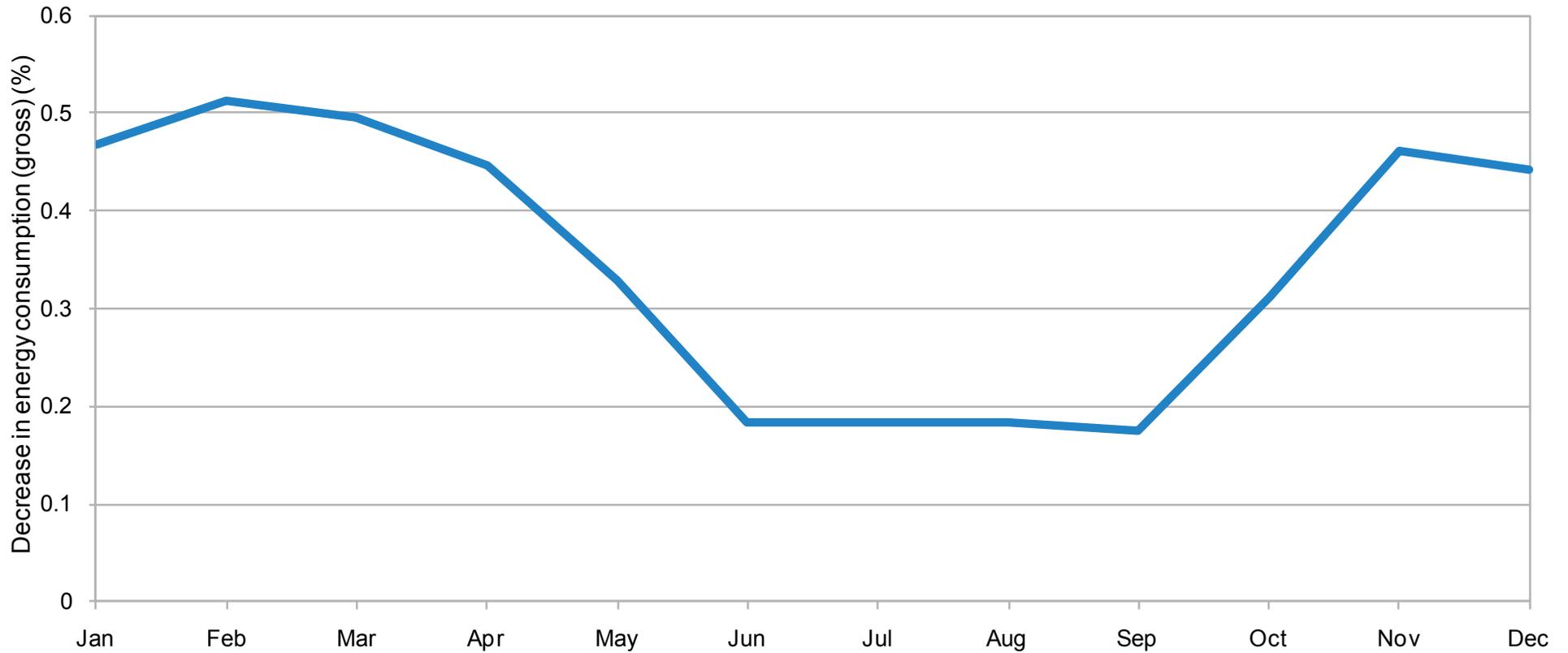
65,700 gal/year



28,807 kwh/year

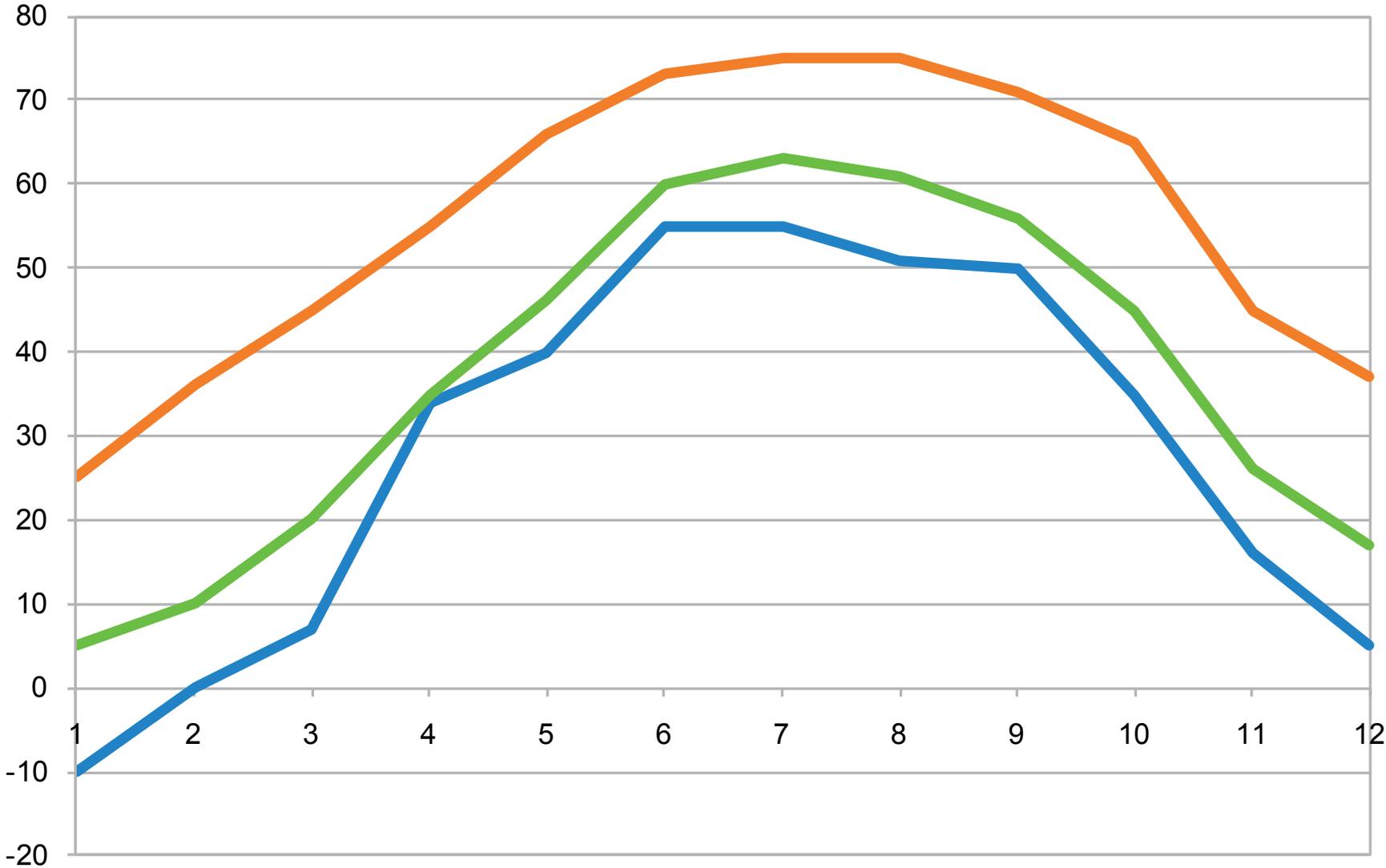
EFFICIENCY GAINS THROUGH THE YEAR

In Comparison to a Typical House with the same square footage



TEMPERATURE VARIATION THROUGH THE YEAR

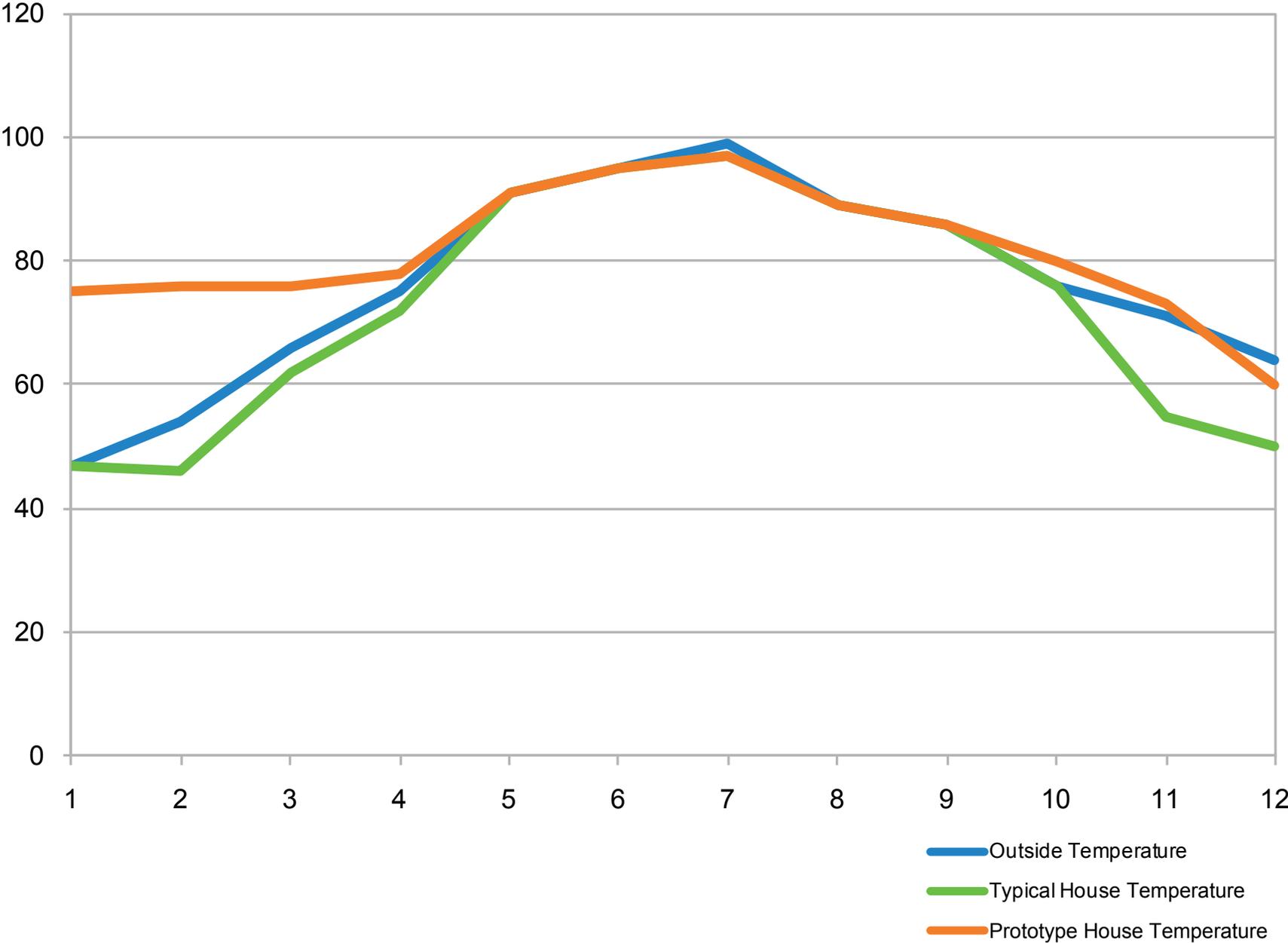
Considering the lowest temperatures in each month

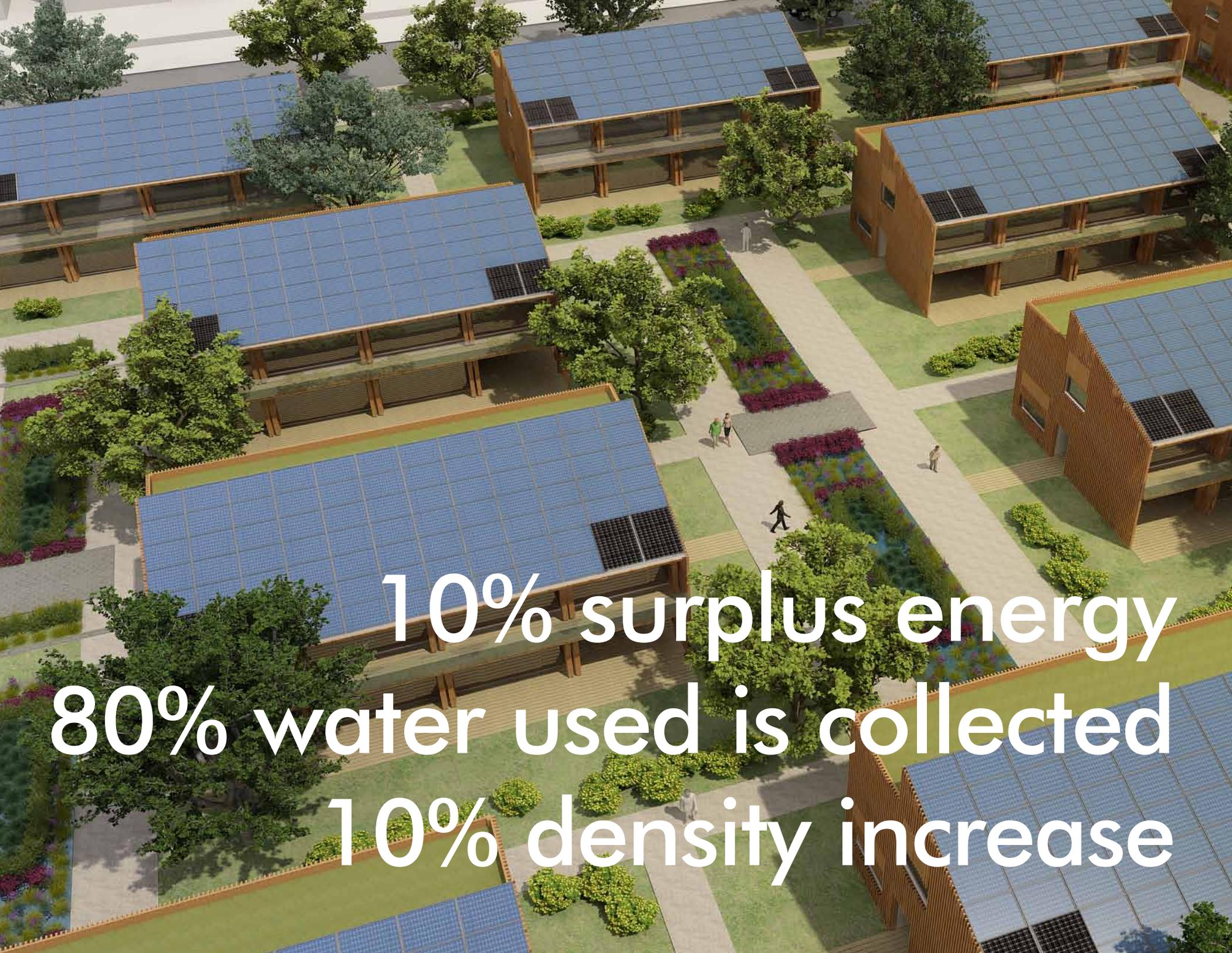


- Outside Temperature
- Typical House Temperature
- Prototype House Temperature

TEMPERATURE VARIATION THROUGH THE YEAR

Considering the highest temperatures in each month





10% surplus energy

80% water used is collected

10% density increase