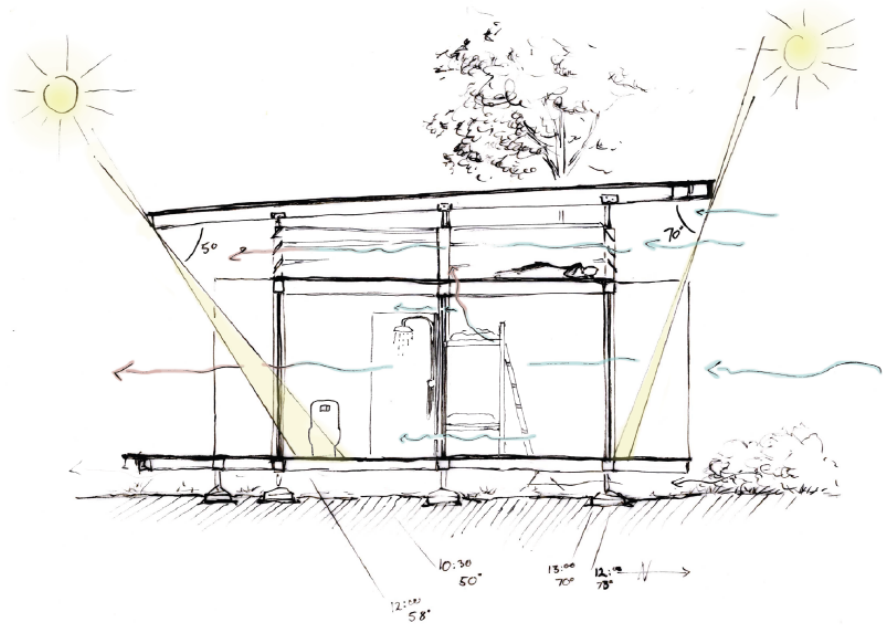
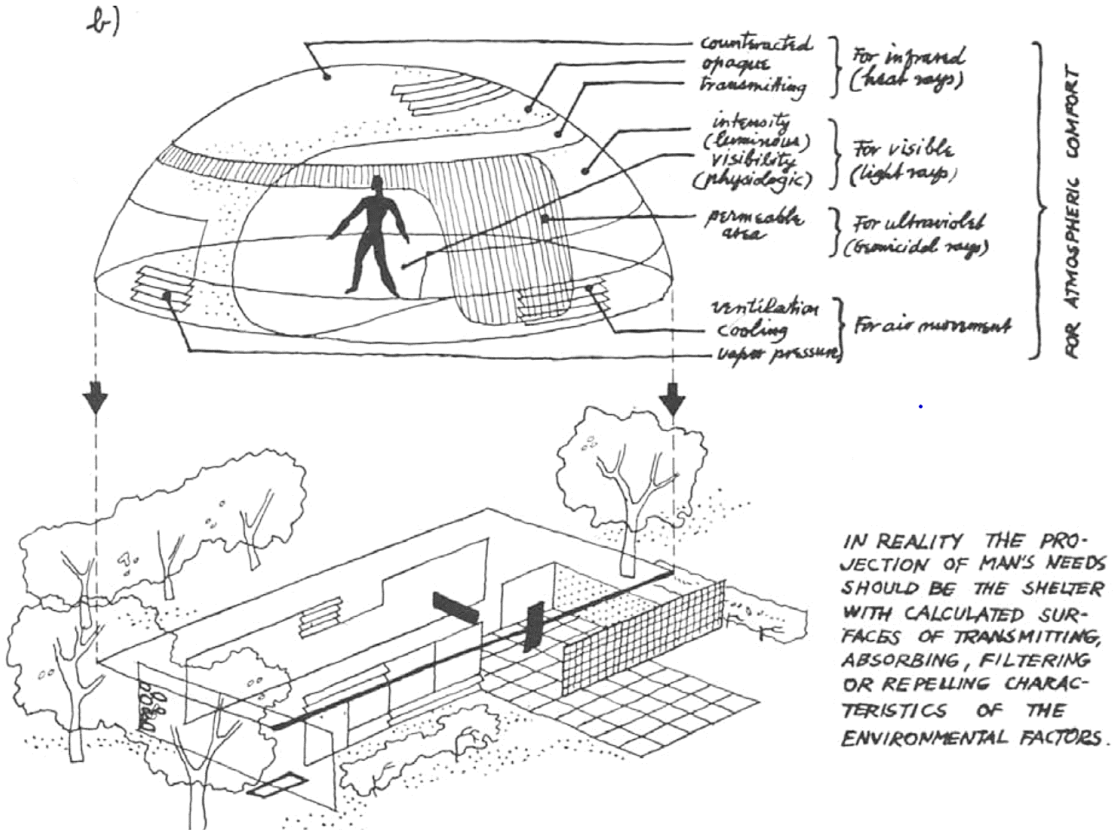
CLIMATE AND BUILT FORMS

AAR4532+AAR4832 _ aug/dec 2024



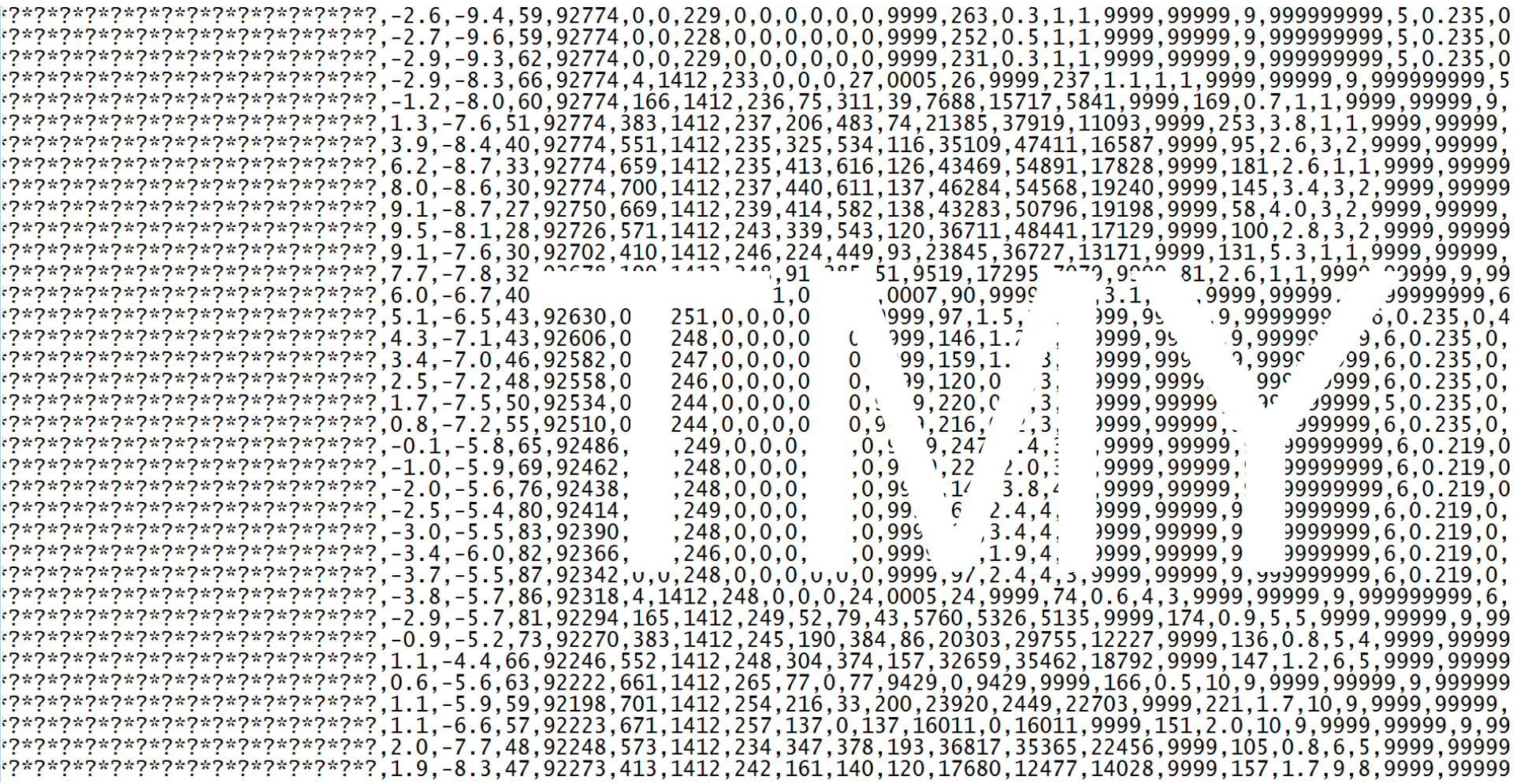
Luca Finocchiaro NTNU
Det skapende universitet

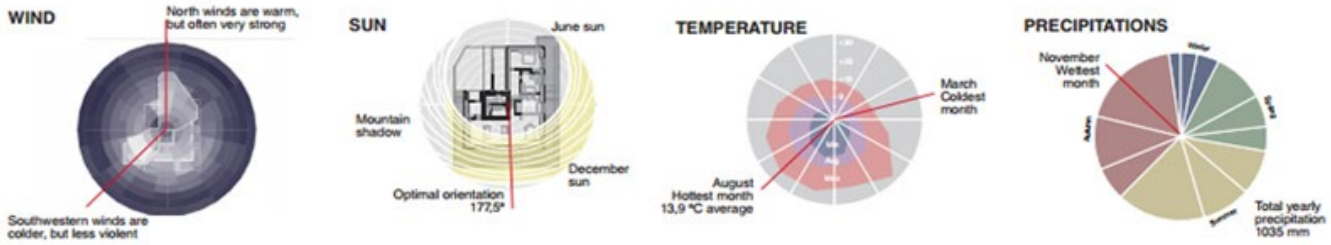
FOCUS >> climate as a source for architectural design



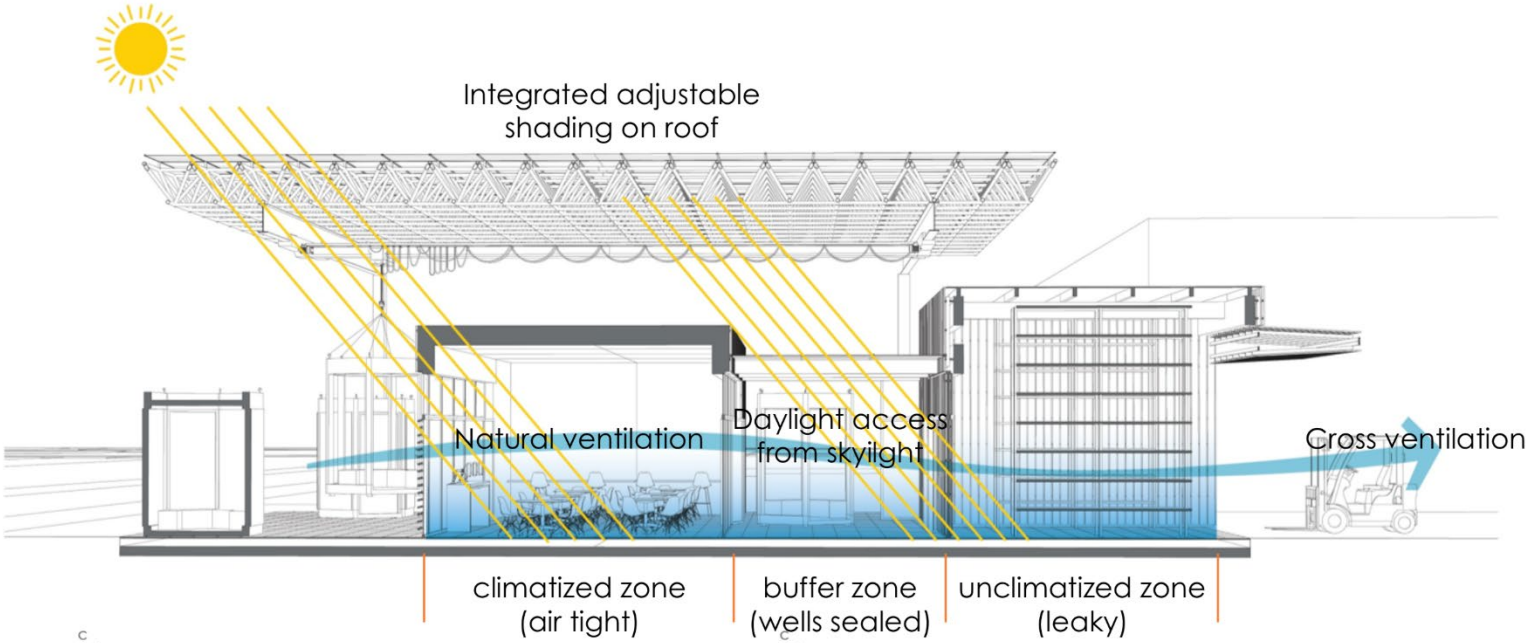
Source: Victor Olgyay _ Design with Climate

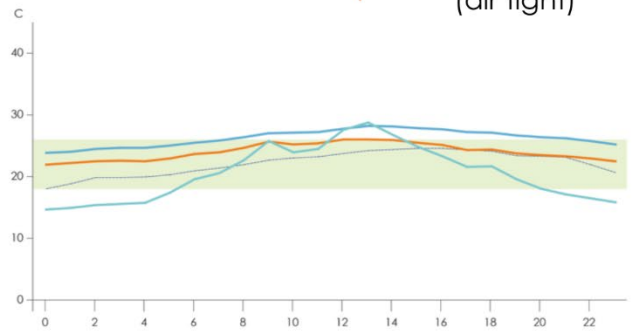
environmental control vs environmental imagination





Translating data into diagrams informing the design process


Integrated adjustable
shading on roof
Natural ventilation
Daylight access
from skyilght
Cross ventilation
climatized zone
(air tight)
buffer zone
(wells sealed)
unclimatized zone
(leaky)


C
40
30
20
10
0
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2
4
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8
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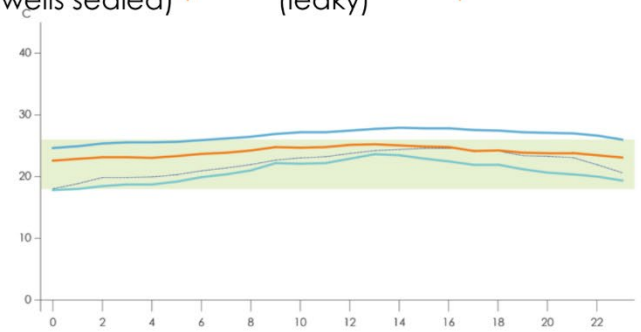
C
40
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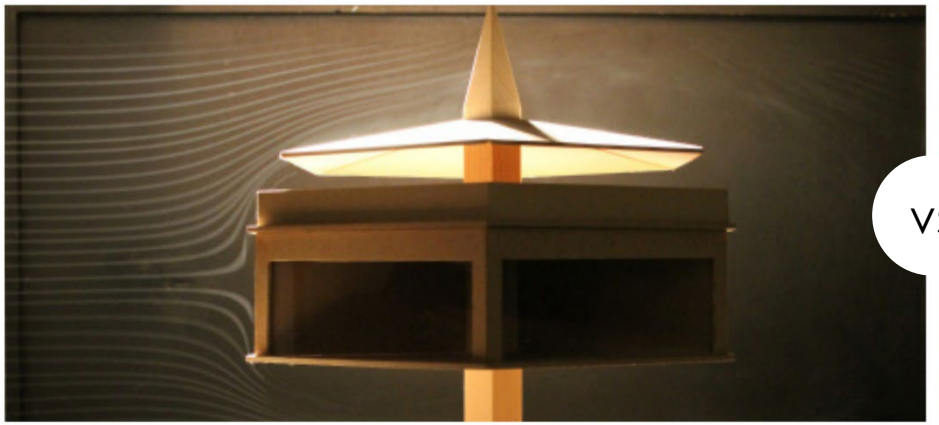
22

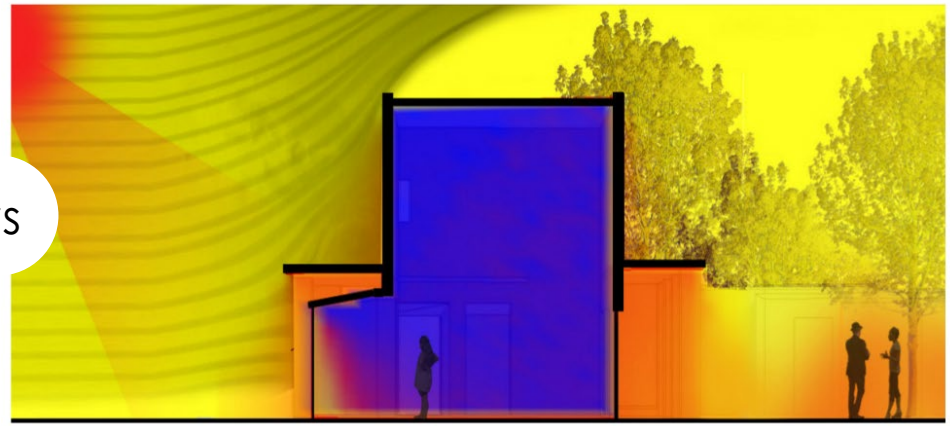
Learning outcome

Main focus of the course is the **environmental performance** of climate adaptive buildings and their ability to passively create comfortable internal conditions. Thus energy.

Tools



vs



analogue

digital

U.1 _ The architectural potential of climate
U.2 _ The bioclimatic approach
U.3 _ **FORM** and thermal balance
U.4 _ **HEAT** - Passive solar heating systems
U.6 _ **AIR** - Natural ventilation strategies
U.7 _ **LIGHT** - The luminous environment

Task 1 > Task 2

CASE STUDY ANALYSES >> ARCHITECTURAL DESIGN

scope _ **learning principles and tools** for sustainable architecture while developing competences

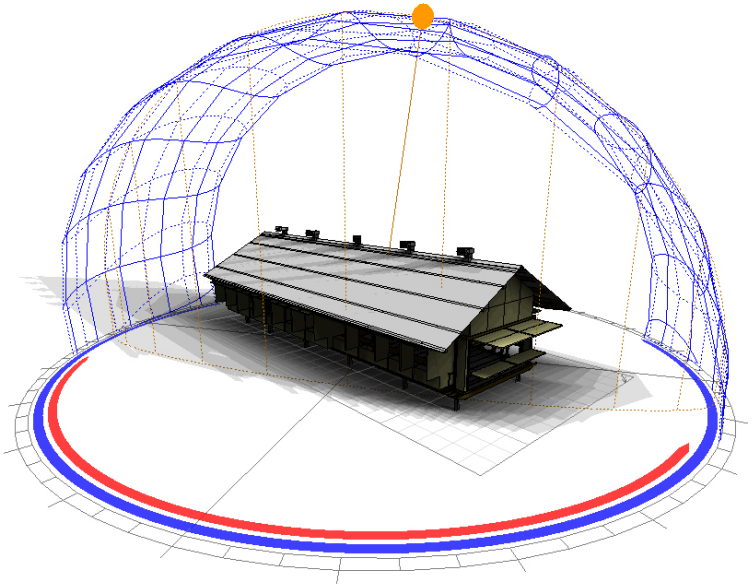
scope _ defining a meaningfull **design process** based on the understanding of the external environment

Task 1_ case study analysis >> learning principles and tools

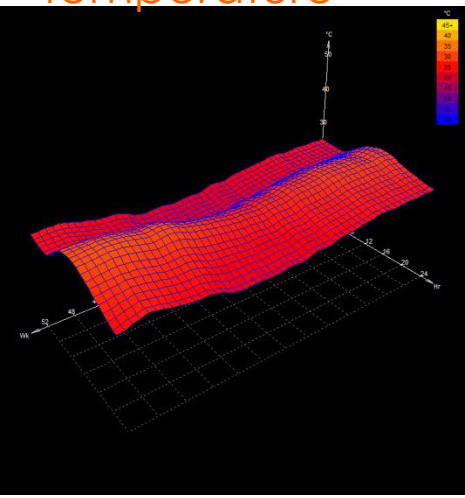
Task 1 | relevant case studies

Task 1 | modeling

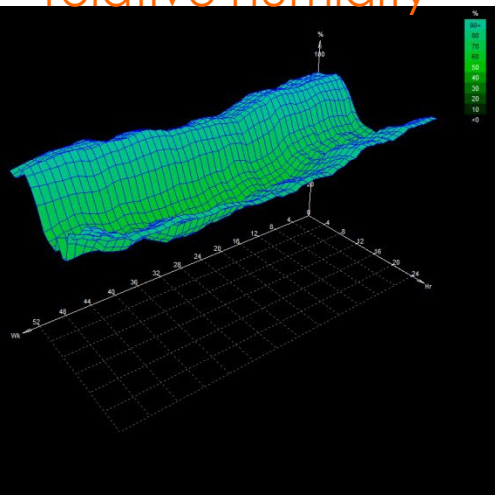
Task 1 | climate analysis and adaptation



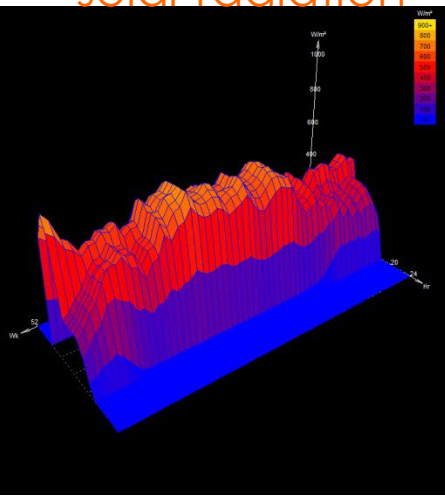
temperature



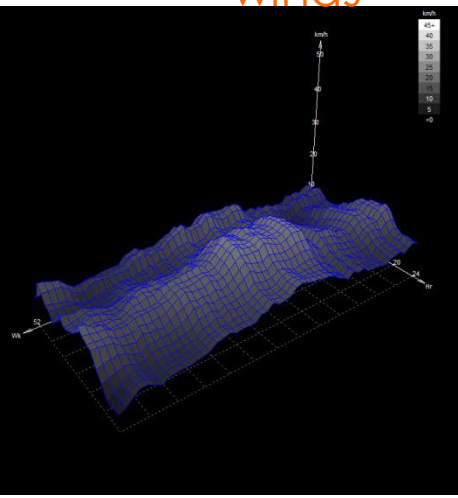
relative humidity

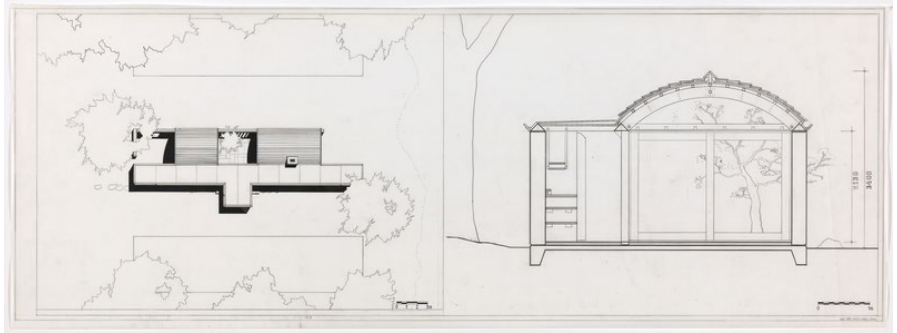


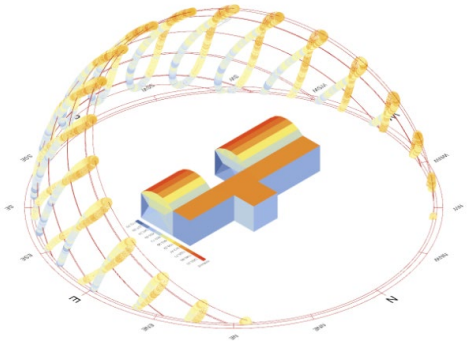
solar radiation

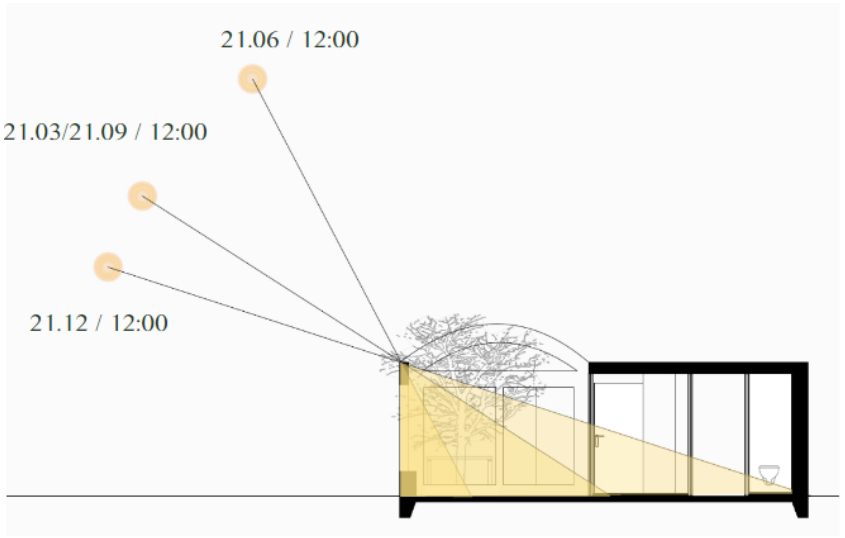


winds





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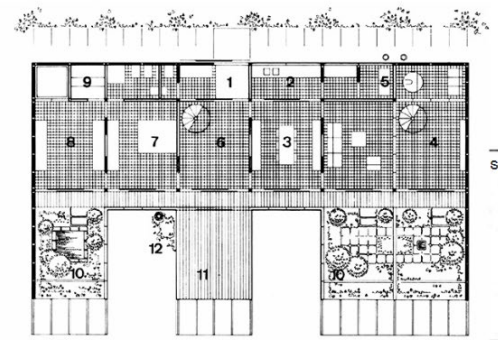
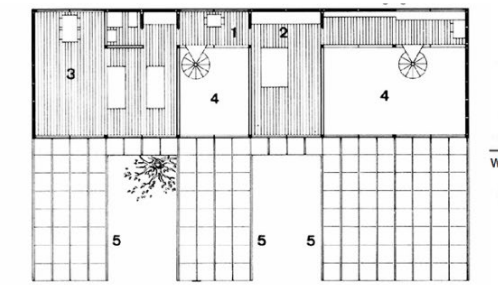
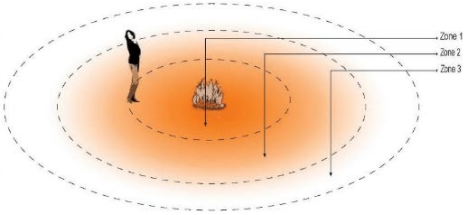
21.12 / 12:00

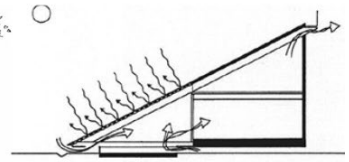


Ground floor

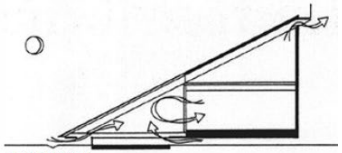


1th floor

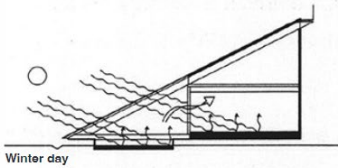




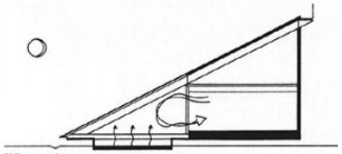
Summer day



Summer night

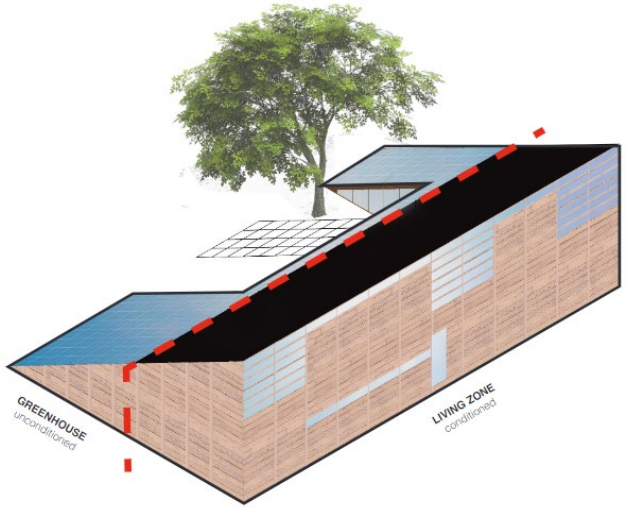


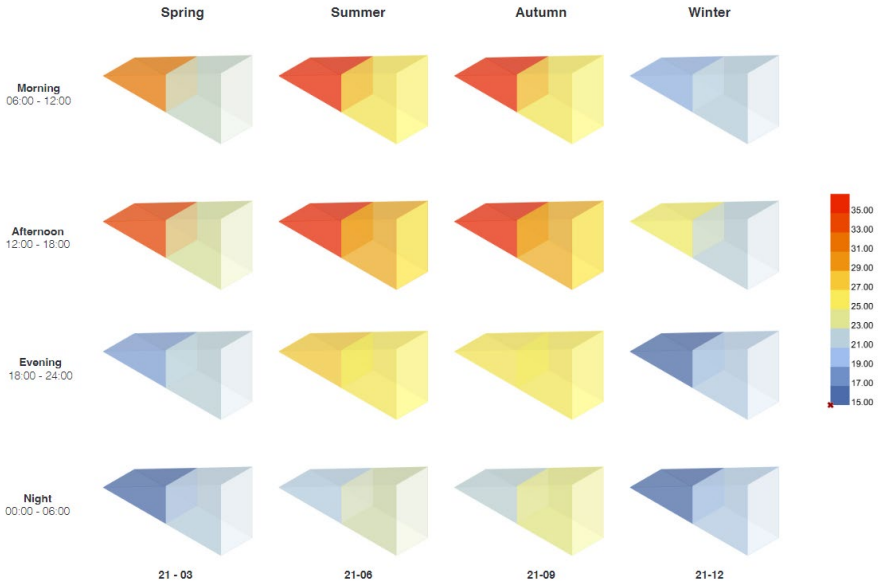
Winter day

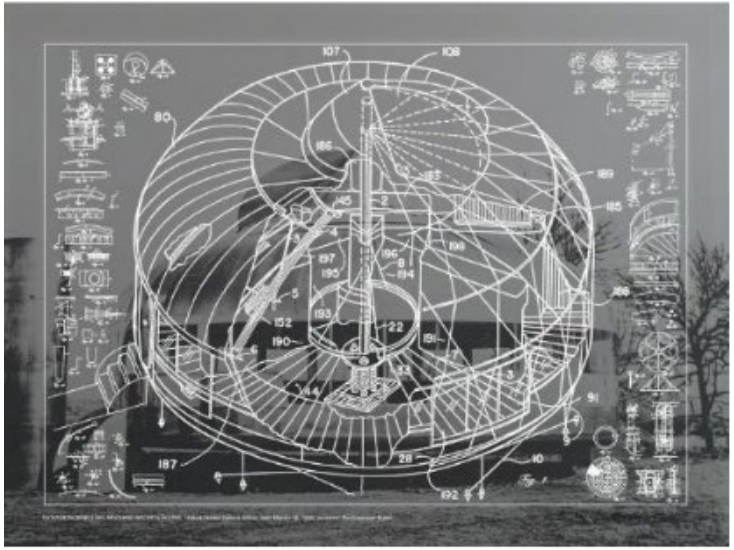


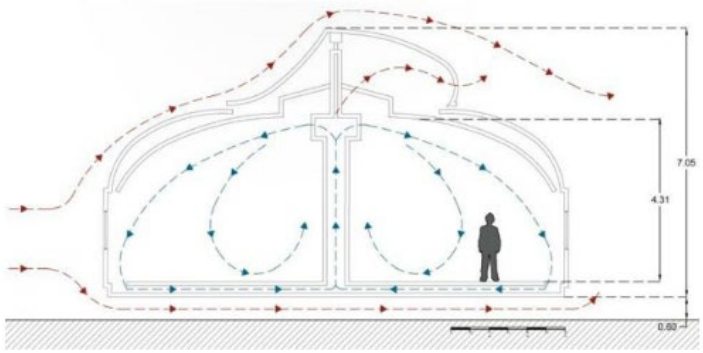
Winter night

1	Entrance	**7**	Bedroom
2	Kitchen	**8**	Dressing room
3	Dining area	**9**	Sauna
4	Living room	**10**	Greenhouse
5	Heating	**11**	Balcony
6	Lobby	**12**	Beech





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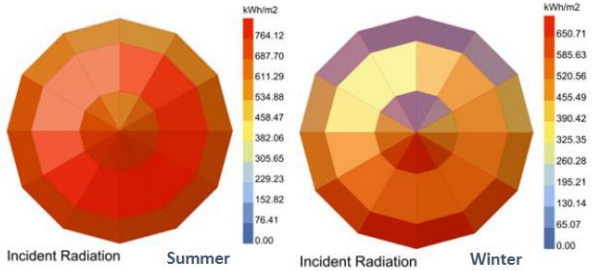
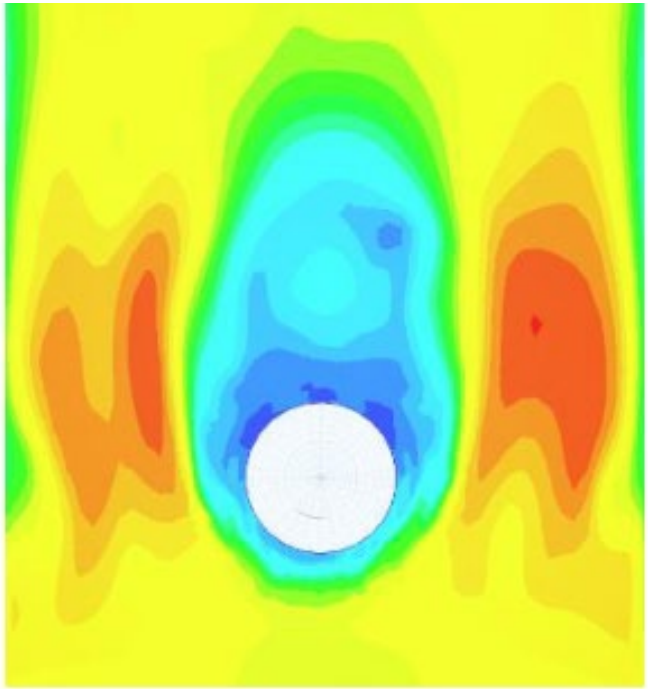
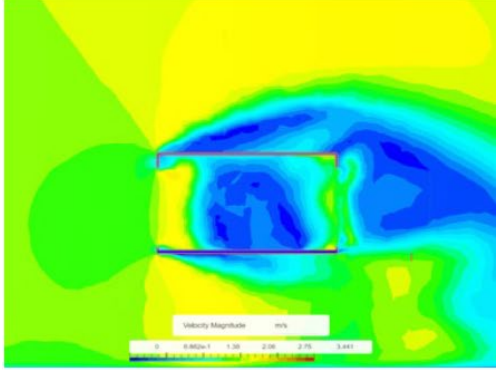
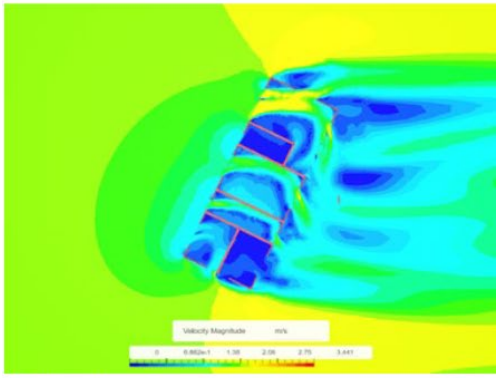
0.60


kWh/m2
764.12
687.70
611.29
534.88
458.47
382.06
305.65
229.23
152.82
76.41
0.00
Incident Radiation
Summer
kWh/m2
650.71
585.63
520.56
455.49
390.42
325.35
260.28
195.21
130.14
65.07
0.00
Incident Radiation
Winter

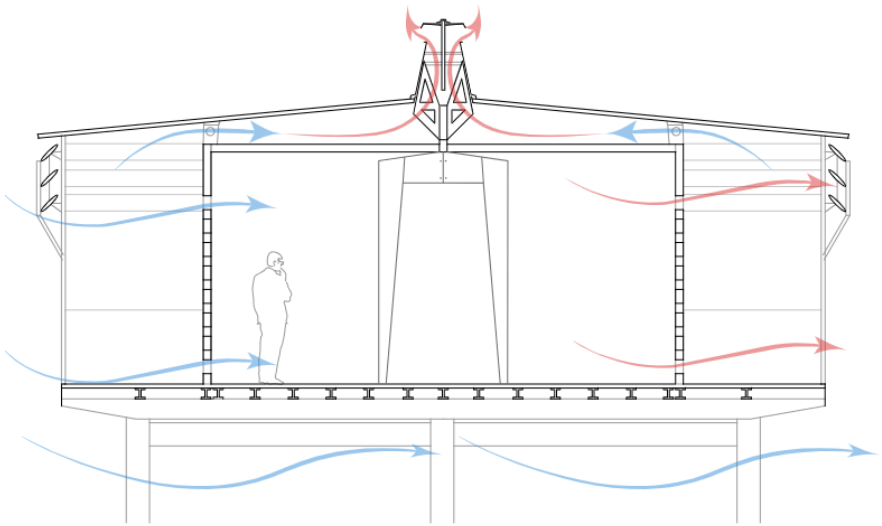

South
South

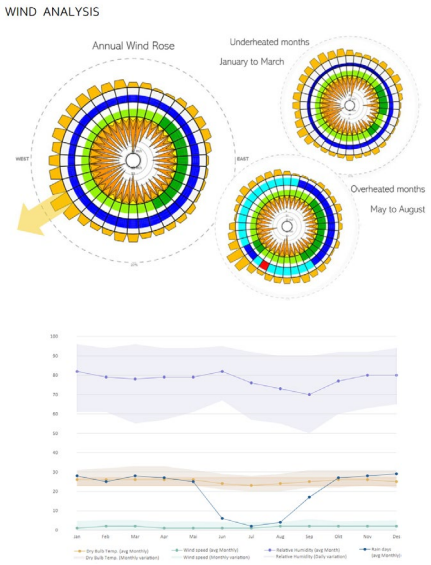






Wind simulations in wind tunnel:
Figure 7. Crossection and plan showing the wind pattern and velocity at a base speed of 2 m/s when all the sliding doors are open. Wind coming from west south-west.





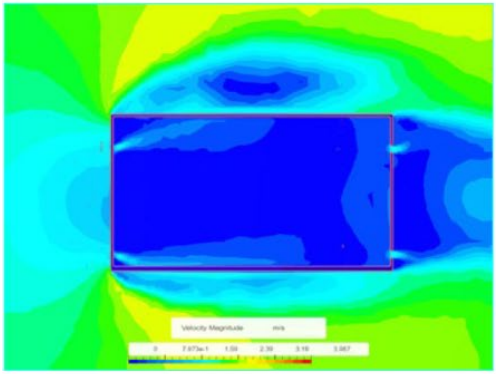
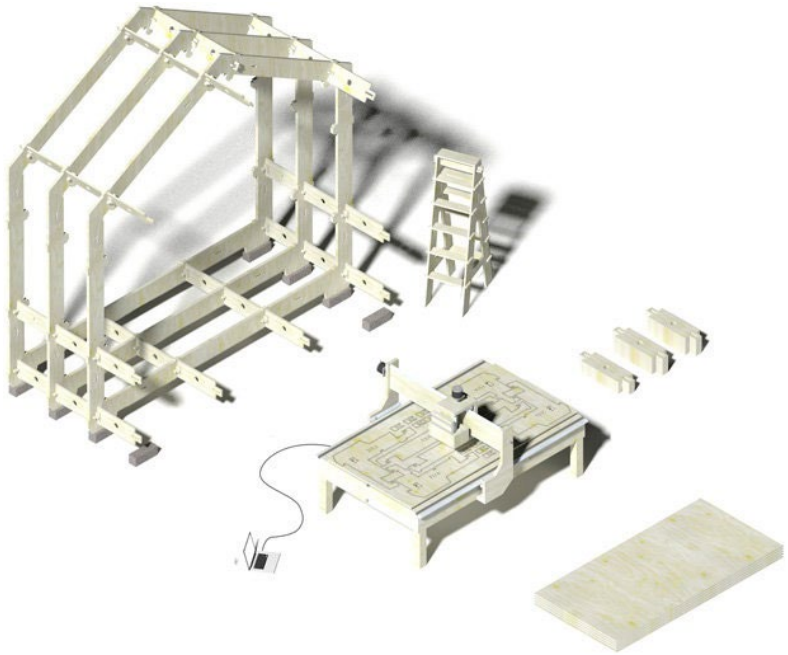


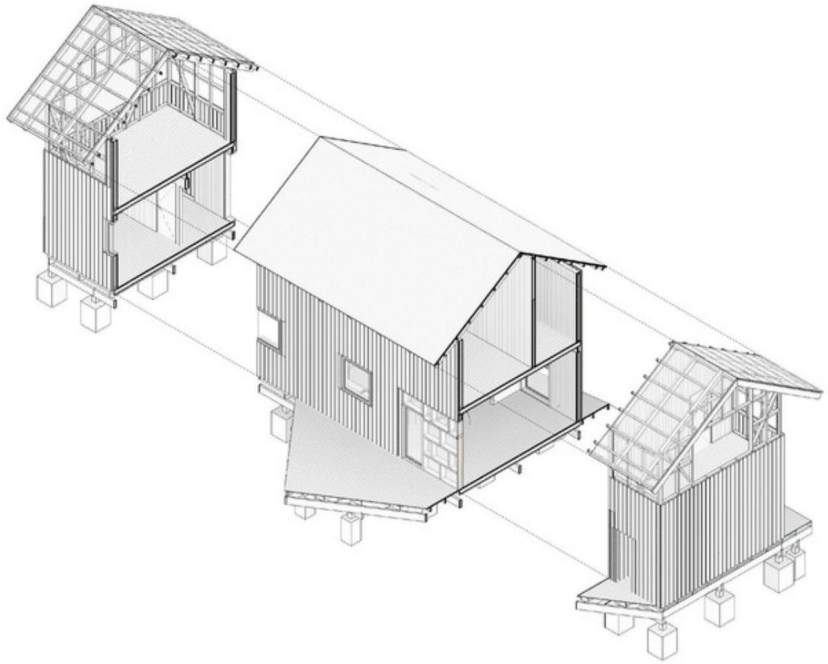
Figure 9. Crossection and plan showing the wind pattern and velocity at a base speed of 2 m/s with the ventilation grills of 1 times 0,02 m² . Wind coming from west south-west.

Task 2: studio >> climate adaptation

TASK 2 _ The bioclimatic shelter – the Wikihouse

Digitally-manufactured building systems for bioclimatic shelters





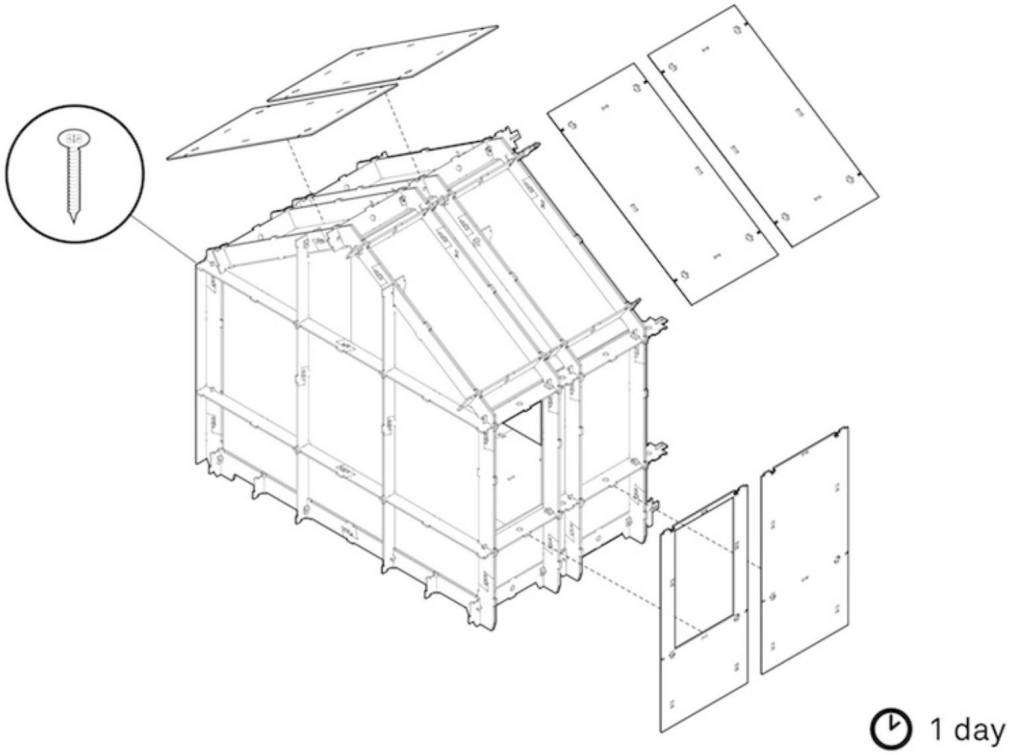
Program

- Prefabricated
- Fast-built
- Climate adapted shelters

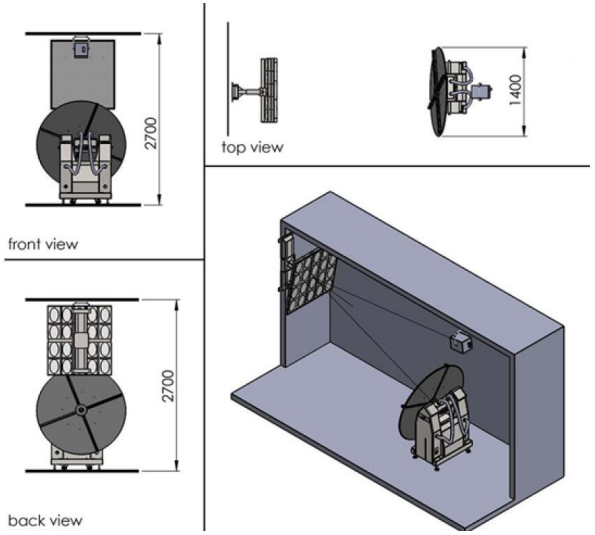
Source: https://www.archdaily.com/965657/architecture-with-sip-panels-fast-build-high-performance-prefabricated-homes

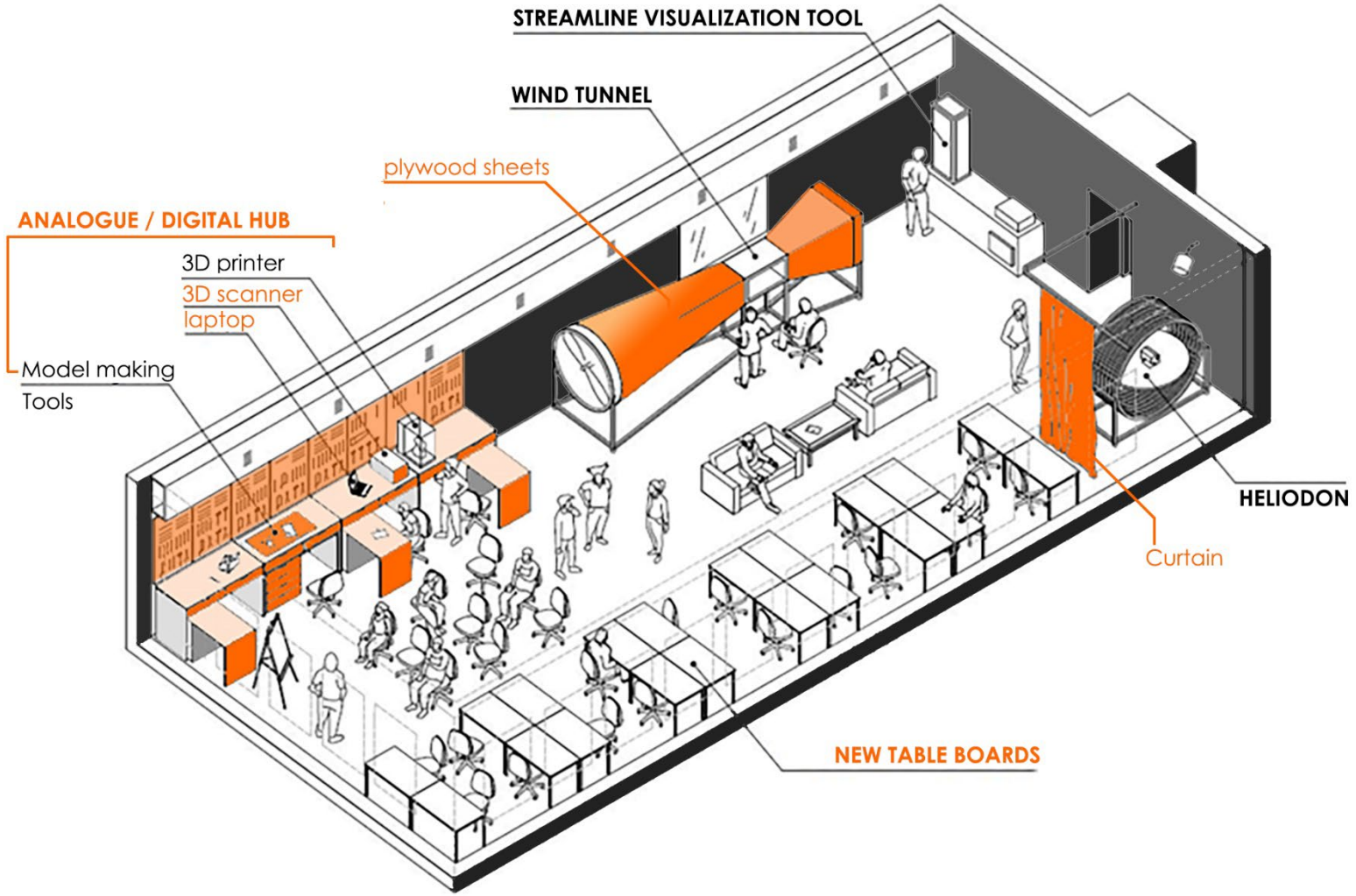
TASK 2 _ challenges

- Detailing for production (open source construction drawing)
- Quantitative + qualitative dimension of environmental design
- Design in four climatic contexts



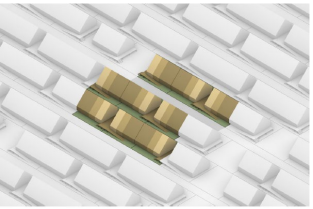
Source: Wikihouse's Alastair Parvin on how to build your own house


2700
front view
top view
1400
2700
back view

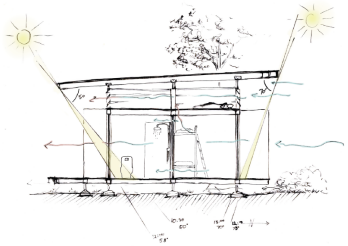


AAA _ Existing material purchased through the AVIT 2016 program **AAA** _ Missing components to buy through AD Strategisk midler

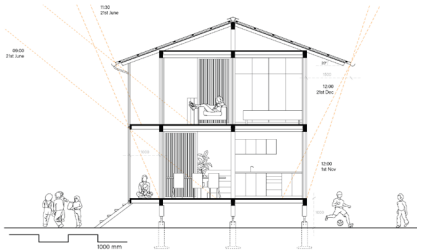
Task 2 _ students projects



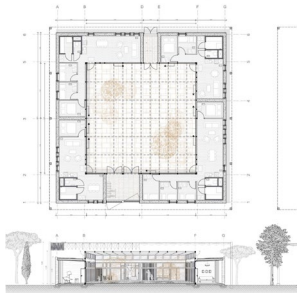
Cold



warm humid

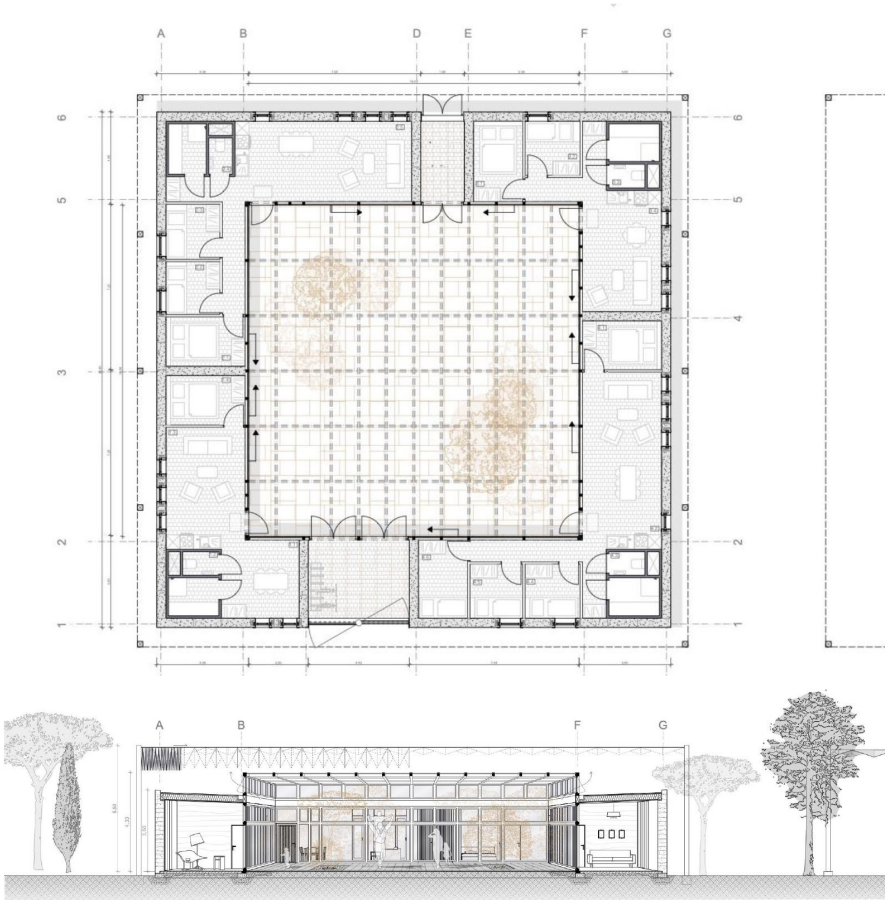


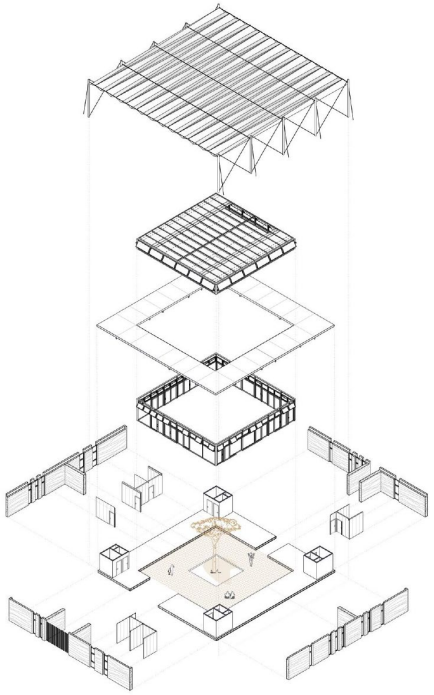
Hot arid

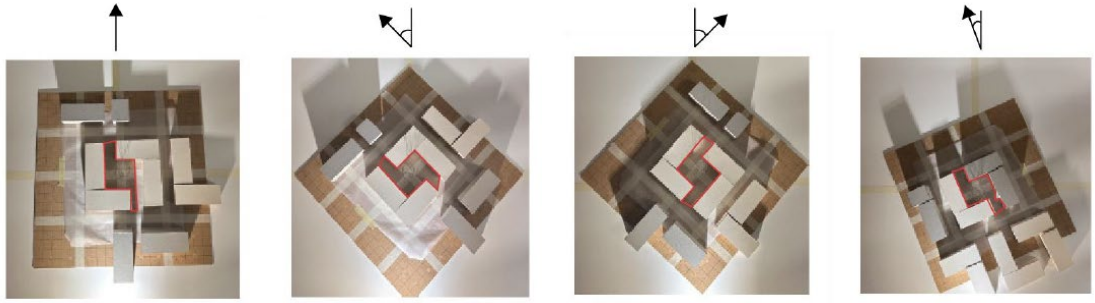


Mediterranean

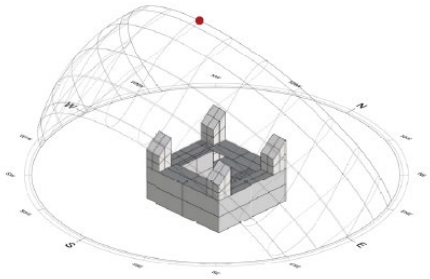
Mediterranean

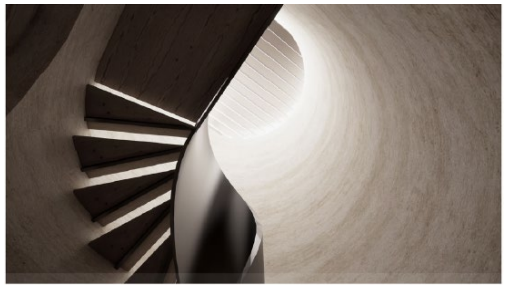




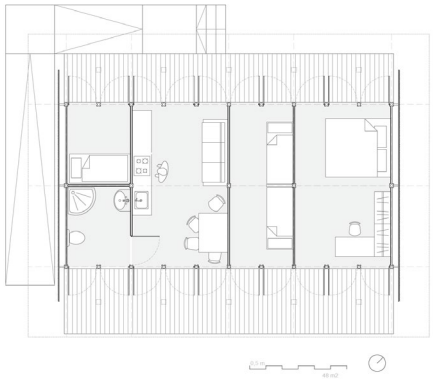


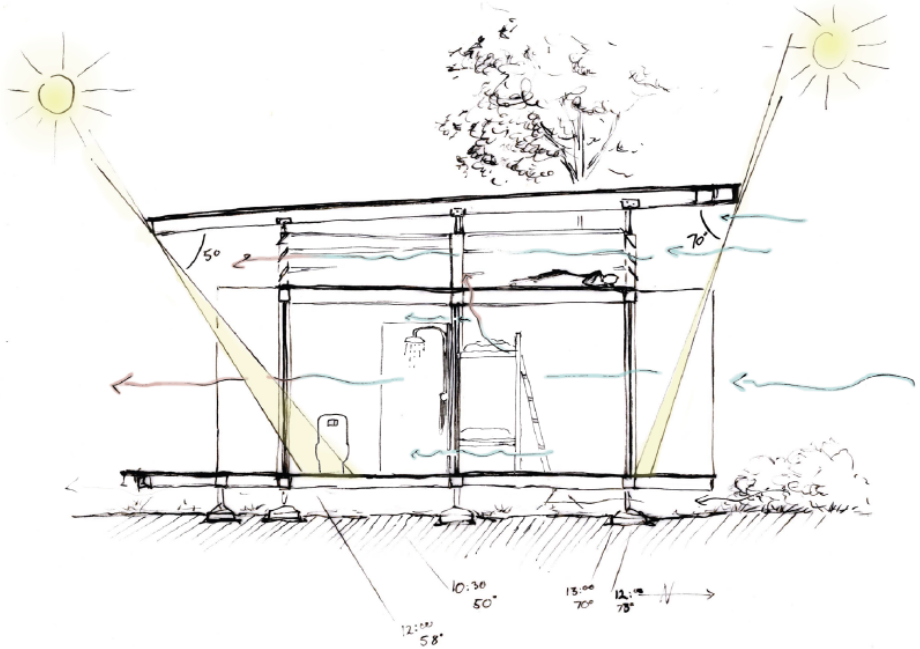
Hot-Arid climate



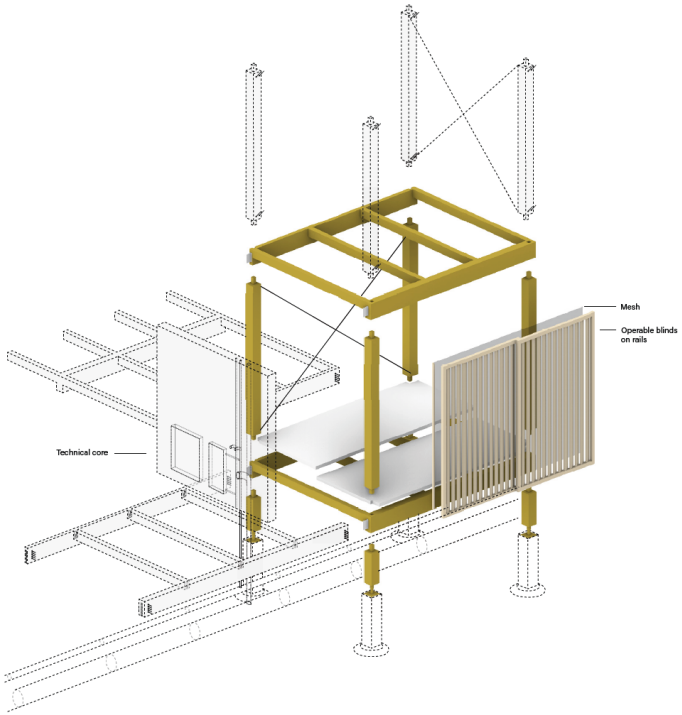


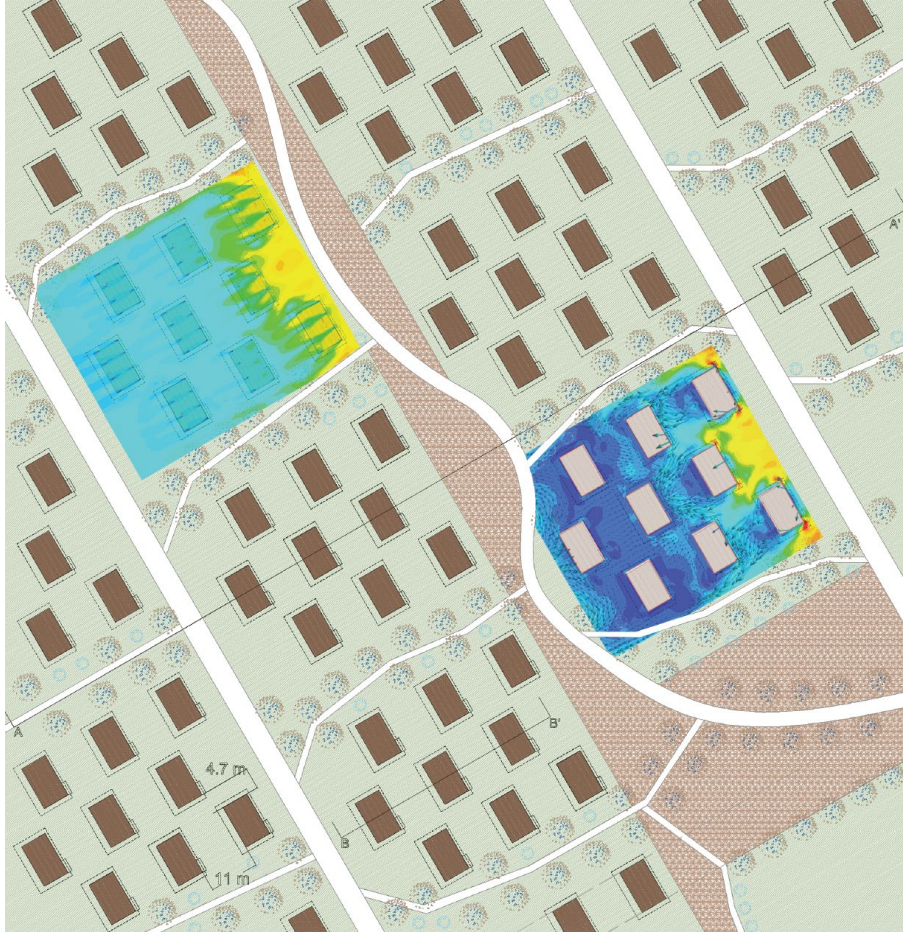
Warm humid climate

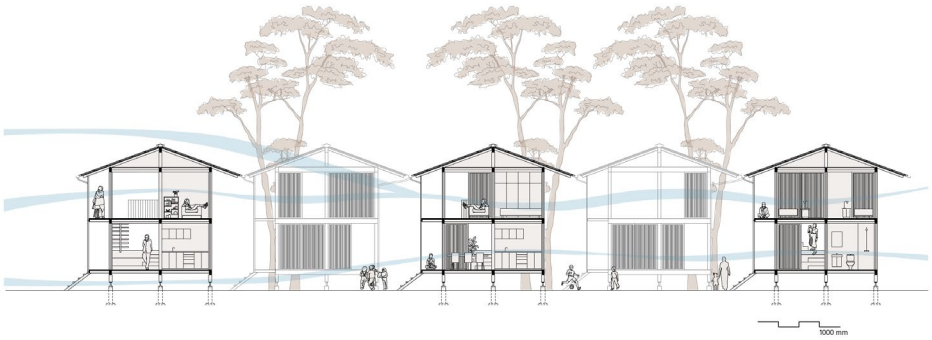




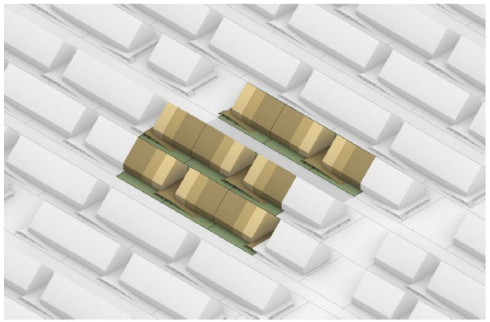
Warm humid climate

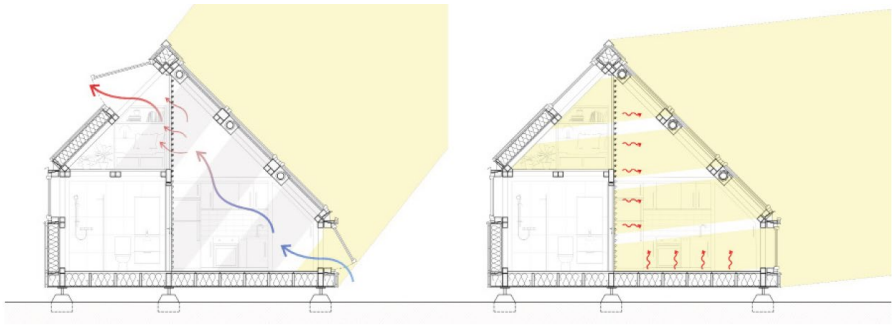






Cold climate





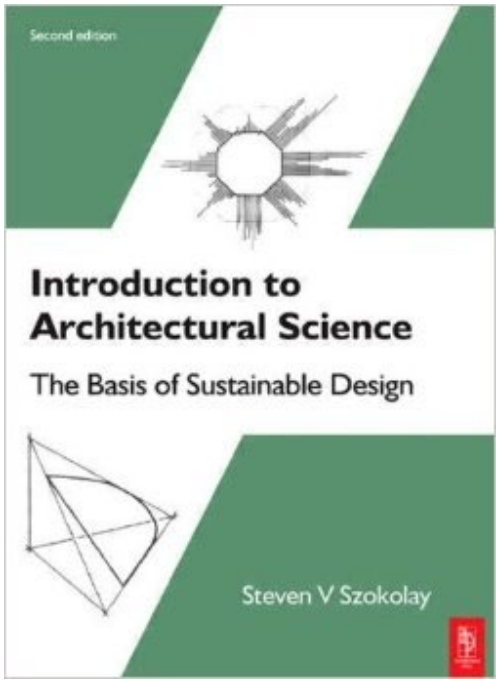
Teaching team in 2023:
Luca Finocchiaro
Anshuman Mishra
Ole Jørgen Bryn
Bunji Izumi

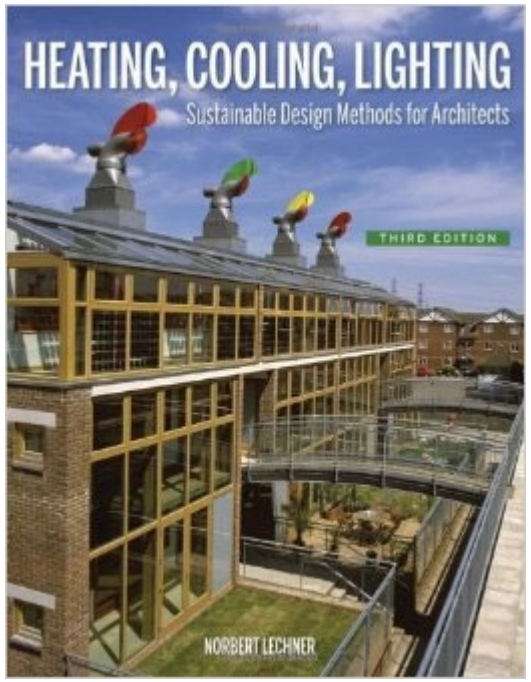
+ 2 Student assistants

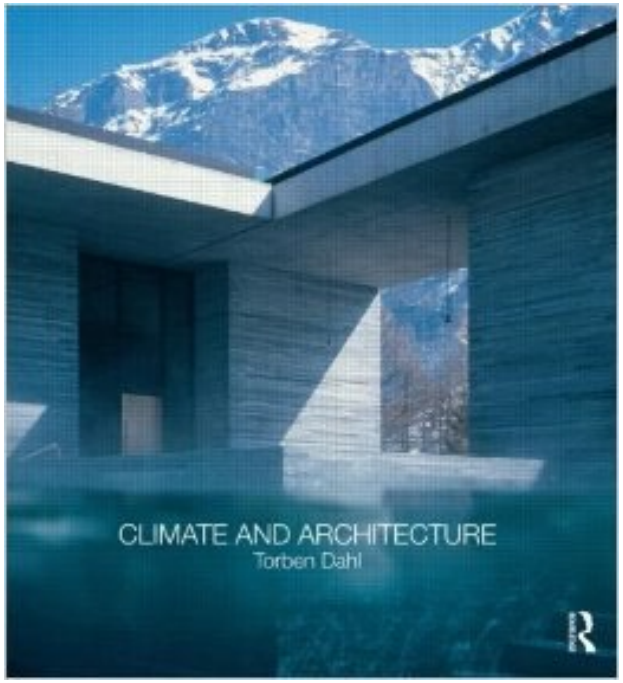
Language: English

Course Start: 26. August

AAR4832+AAR4532 | Pensum







- Steven Szokolay, The basis of sustainable design, Architectural press, USA 2008
- Norbert Lechner, Heating Cooling and Lighting, John Wiley and Sons Inc. , USA 2008
- Torben Dahl, Climate and Architecture, Routledge ED.

- Victor Olgyay, Design with Climate, Princeton University Press, New Jersey 1963

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