

Snøhetta 



Harvard House Zero  
Cambridge MA  
400m<sup>2</sup> BRA





## HOUSE ZERO PROJECT TEAM

Name	Title	House Zero Role	Contact
<b>HCGBC - Harvard Center for Green Buildings and Cities</b>			
Ali Malkawi	Director, Administration	Center Director	amalkawi@gsd.harvard.edu
Gosia Sklodowska	Associate Director, Administration	Project Coordinator; External relations liaison	gsklodowska@gsd.harvard.edu
Jeff Fitton	Outreach and Events Manager	Workshop facilitator	jfitton@gsd.harvard.edu
Matan Mayer	Postdoc Materials, LCA		mmayer@gsd.harvard.edu
Bin Yan	Postdoc	Modeling	byan@gsd.harvard.edu
Yujiao Chen	Research Associate	Modeling	chenyujiao1960@gmail.com
Jeremy Tong	Postdoc	Modeling, CFD	ztong@gsd.harvard.edu
Bin Cao	Visiting Postdoc	Modeling, thermal comfort	caobin@mail.tsinghua.edu.cn
Stephen Ervin	Research Adviser	Landscaping	servin@gsd.harvard.edu
<b>Harvard Planning and Project Management Team</b>			
Matthew Ali	Sr Project Manager	Project Manager	matthew_ali@harvard.edu
Tanya Iatridis	Senior Director	University Planning	tanya_iatridis@harvard.edu
Alexandra Offiong	Director of Planning Services		alexandra_offiong@harvard.edu
<b>Snøhetta Oslo</b>			
Tonje Værdal Frydenlund	CEO	Contracts	tonje@snohetta.com
Tine Hegli	Senior architect / Project manager	Design team leader / Project manager	tine@snohetta.com
Kristian Edwards	Senior architect/Interior architect	Architect / Interior architect	kristian@snohetta.com
Pål Hasselberg	Architect	Architect	paalh@snohetta.com
Julia Dorothea Schlegel	Architect	Architect	julia@snohetta.com
<b>Snøhetta NY</b>			
Aaron Dorf	Senior architect	Architect	aaron@snohetta.com
Claire Fellman	Landscape architect	Landscaping	claire@snohetta.com
<b>Skanska Norway</b>			
Tor Helge Dokka	Project developer / Energy division	Project team coordinator energy concept	Tor.helge.dokka@skanska.no
Niels Lassen	Division leader / Energy adviser	Energy consultant	niels.lassen@skanska.no
Maria Myrup	Advisor green construction	Advisor green construction	maria.myrup@skanska.no
Henning Fjellheim	Civil engineer	Advisor on climate change and materials	henning.fjeldheim@skanska.no

Name	Title	House Zero Role	Contact
<b>Skanska USA Building</b>			
Al Gogolin	Senior Vice President	Cost analysis	Al.Gogolin@skanska.com
Bethany King	Project Manager	Constructability review, cost analysis, subcontractor coordination	bethany.king@skanska.com
Matt Impastato	Electrical Director	Electrical estimating, subcontractor coordination	matt.impastato@skanska.com
Steve Lappin	Mechanical Director	Mechanical estimating, subcontractor coordination	steve.lappin@skanska.com
<b>WindowMaster</b>			
Peter Nygaard	Nordic sales manager	Sales coordinator	pny.dk@windowmaster.com
Jannick Roth	Ventilation institute	Modeling, CFD	jkr.dk@windowmaster.com
<b>Silman</b>			
Robert Silman	President Emeritus	Structural engineer	silman@silman.com
Nat Oppenheimer	Executive Vice President	Structural engineer	oppenheimer@silman.com
<b>R.W. Sullivan Engineering</b>			
Kevin Hastings	Principal	Code Consultant	ksh@rwsullivan.com
<b>Brekke&amp;Strand Akustikk</b>			
Jarle Ellefsen	Acoustic consultat	Acoustic consultat	jel@brekkestrand.no
<b>Kessler McGuinness &amp; Associates, LLC</b>			
Josh Safdie	Principal	Accessibility Consultant	jsafdie@kmaccess.com
<b>HOUSE ZERO - stakeholders</b>			
<b>GSD Harvard Graduate School of Design</b>			
Mohsen Mostafavi	Dean		
Kevin Cahill	Facilities Manager		
<b>HOUSE ZERO - workshop contributors</b>			
<b>Stoss Landscape Urbanism</b>			
Chris Reed	Principal / Design Director	Landscape design - adviser	cr@stoss.net
Scott Bishop	Principal	Landscape design - adviser	sb@stoss.net

## **Triple zero ambition**

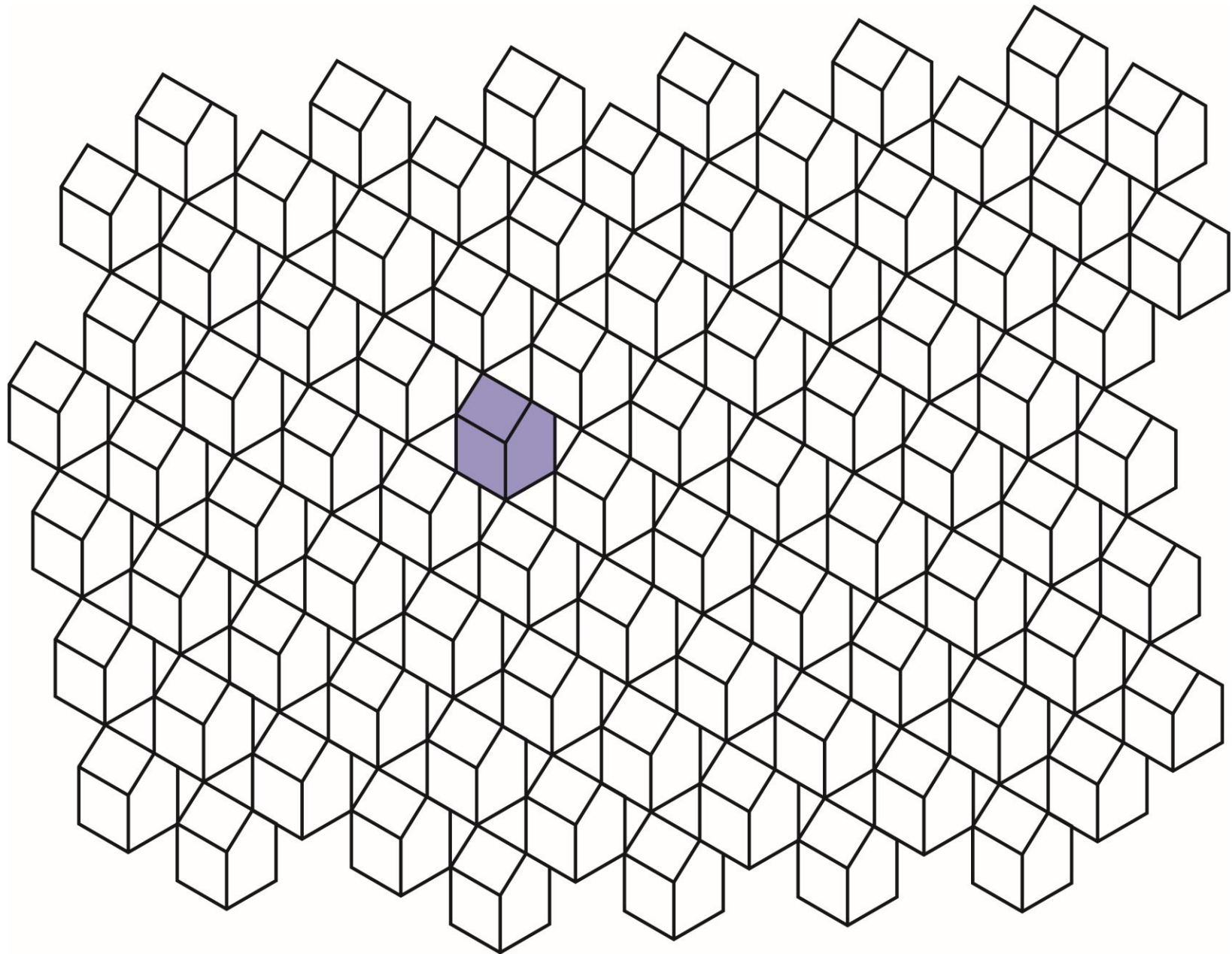
Null levert energi til oppvarming og kjøling

Null mekanisk ventilasjon

Null utslipp av CO2 gjennom byggets livsløp inkludert materialer

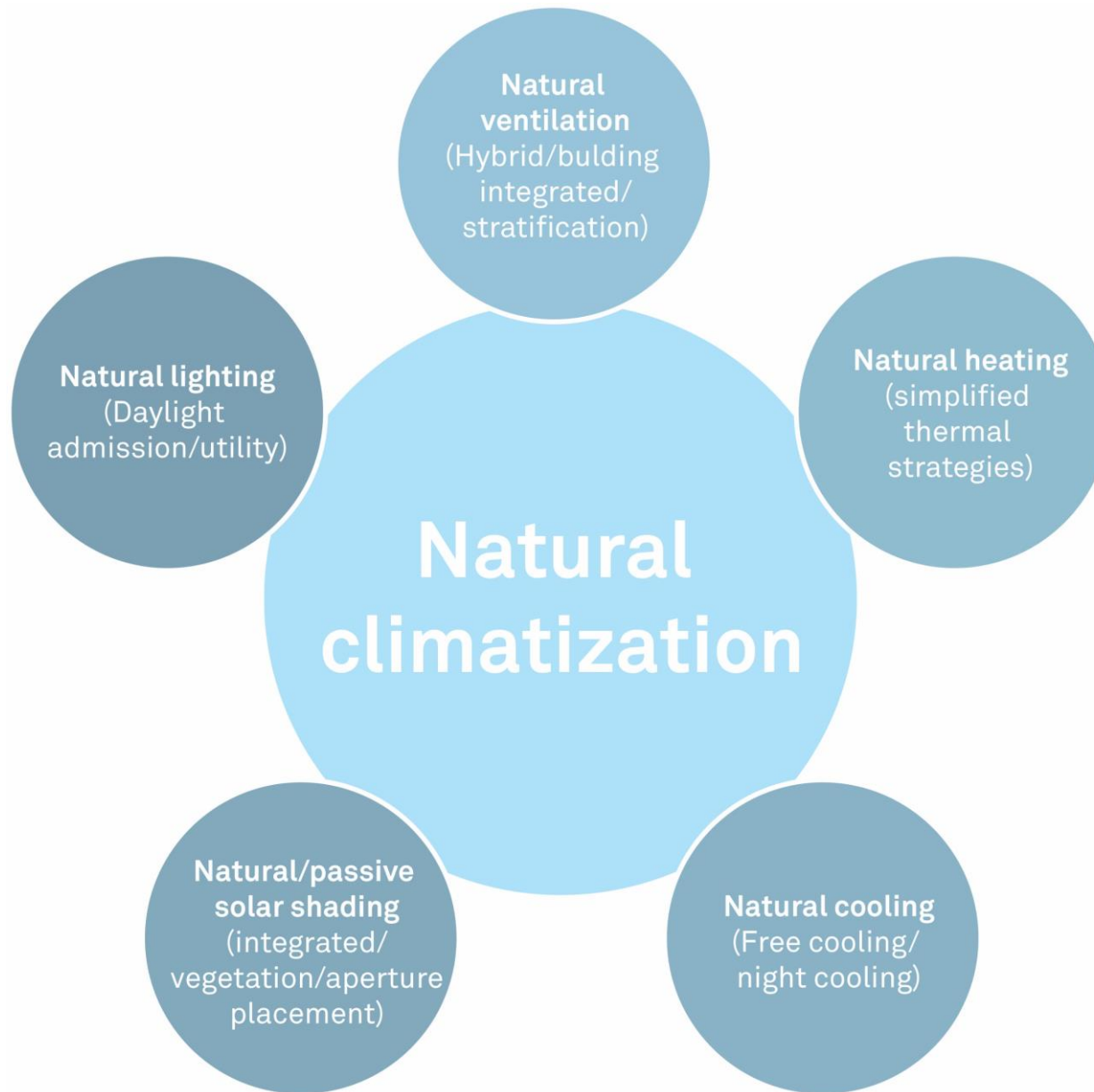
100% dagslys



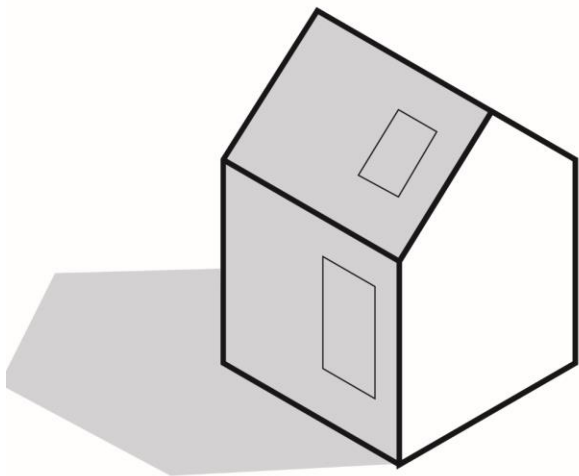




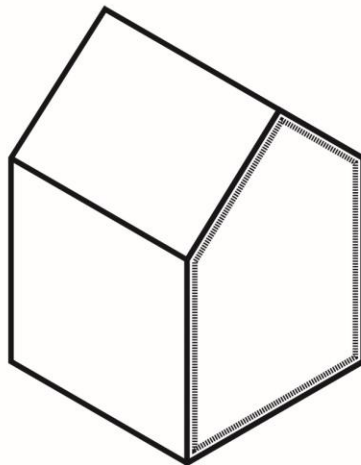




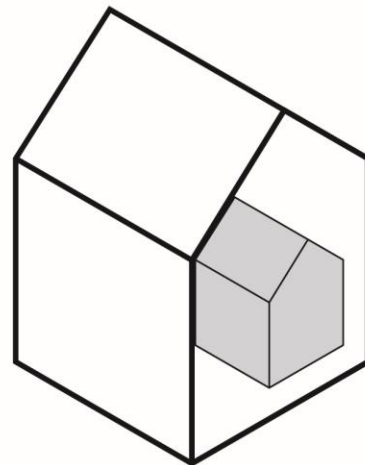
Orientering



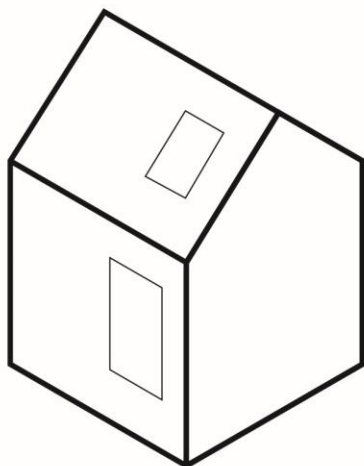
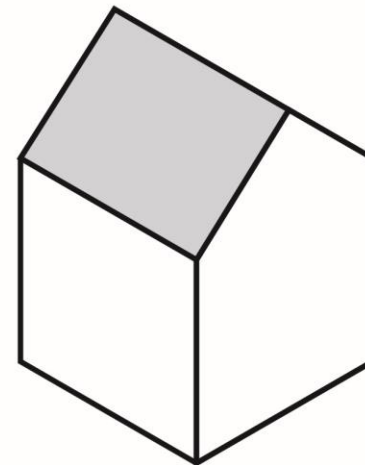
Fasade



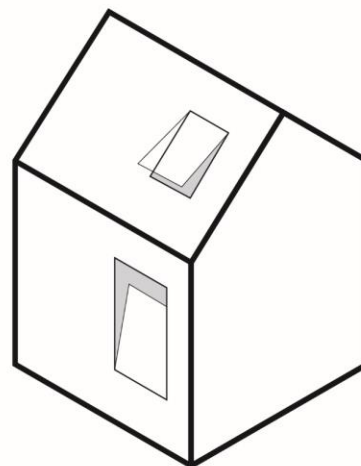
Termisk masse



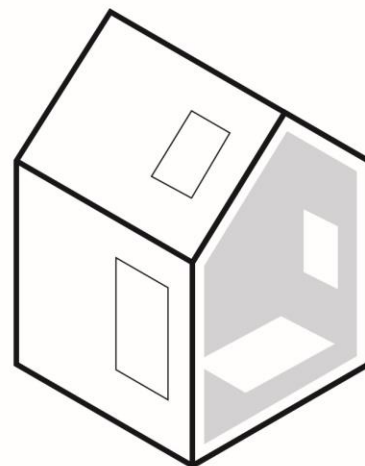
Energi høsting



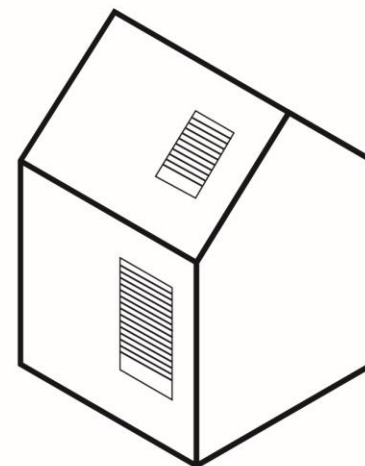
Dagslys



Ventilasjon



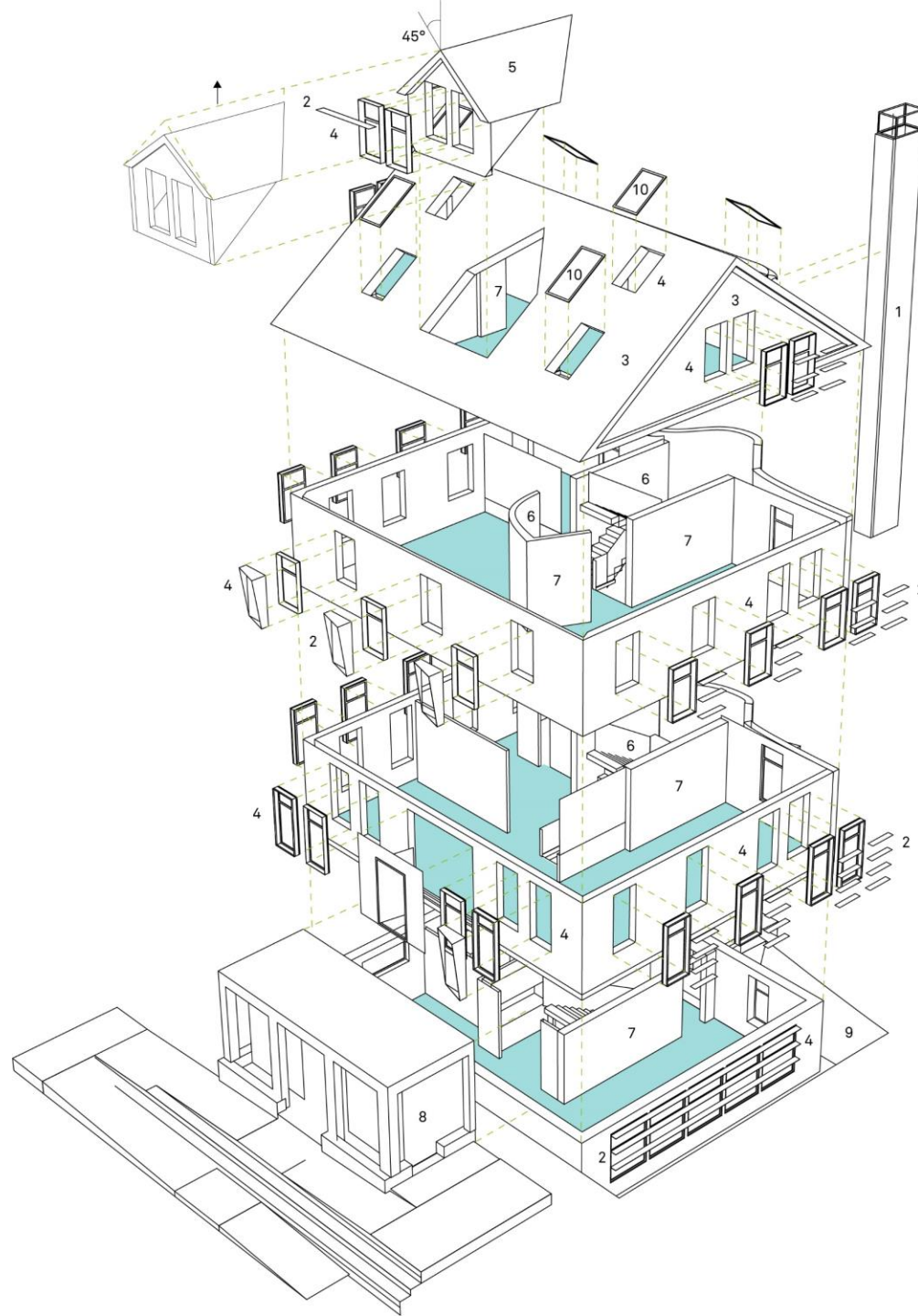
Passiv sol



Solavskjerming



- 1 Sol skorstein
- 2 Solavskjerming
- 3 Solceller
- 4 Automatiske vinduer
- 5 Solfangere
- 6 Akustisk kammer
- 7 Varmeaktive overflater
- 8 Vinter hage
- 9 Lysbrønn
- 10 Overlys



# Fasade

Flere løsninger ble evaluert

Original bæring beholdt

Lufttetthet ACH 0.5/hr

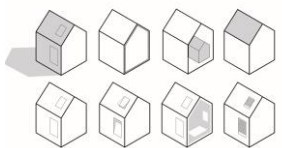
U-verdi yttervegg 0.14 w/m<sup>2</sup>K

U-verdi tak 0.11 w/m<sup>2</sup>K

U-verdi vinduer og dører 0.7 w/m<sup>2</sup>K

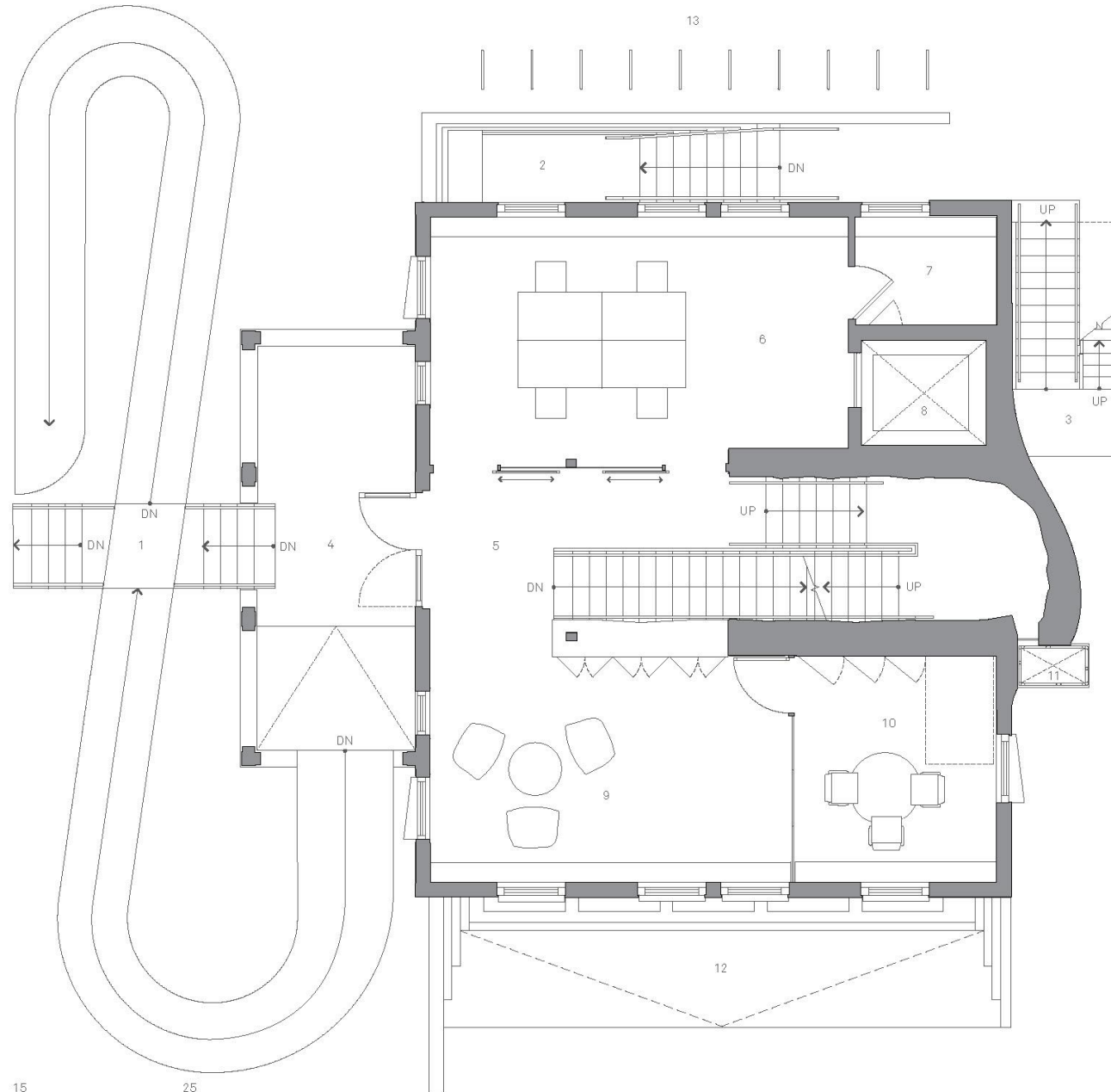
Sponfasade i ubehandlet sedertre

All materialbruk beregnet i forhold til  
GWP/LCA for samlet livsløp



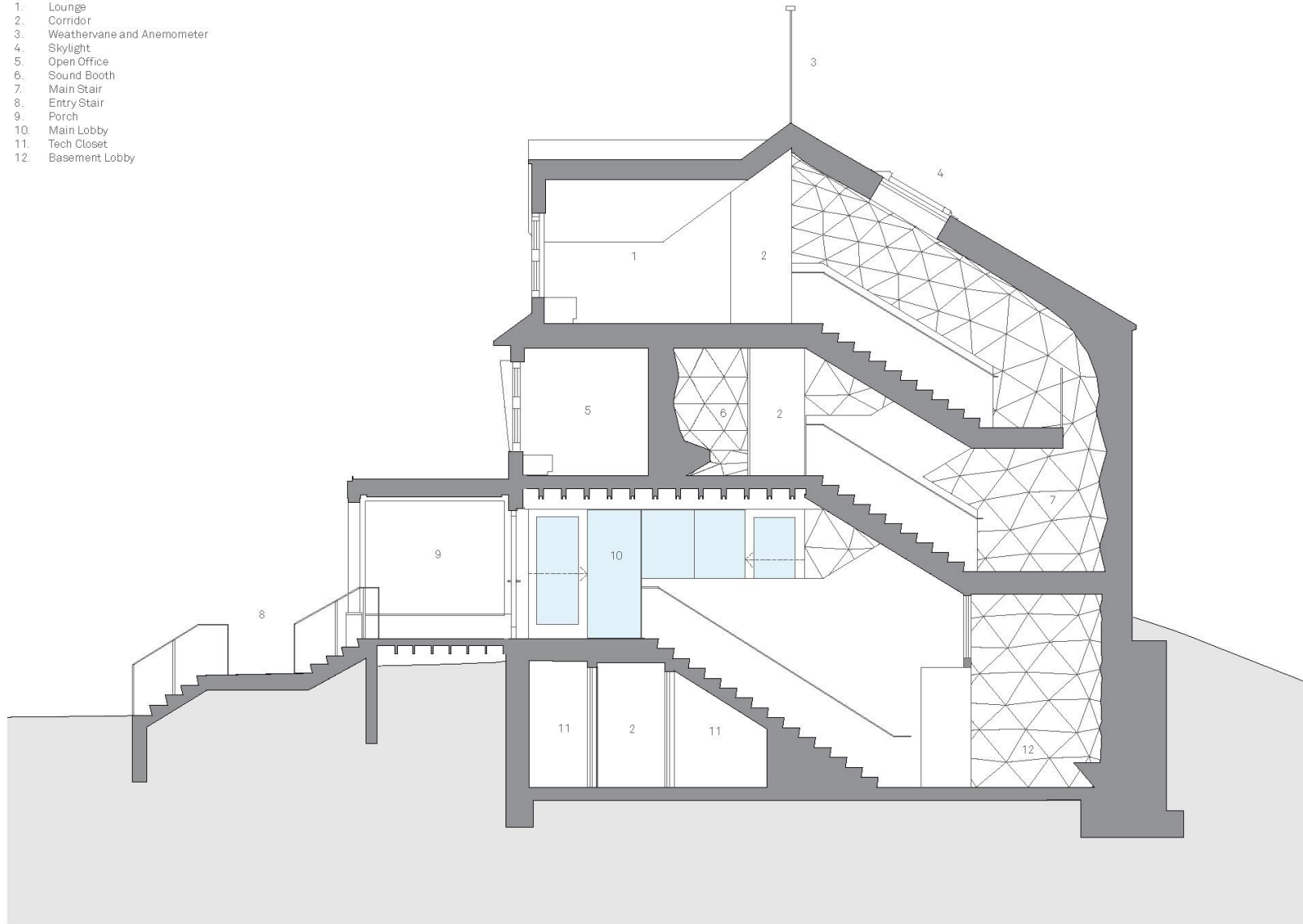
Level 1

- 1. Entry Stair & Ramp
- 2. Basement Entry
- 3. Fire Escape
- 4. Porch
- 5. Main Lobby
- 6. Administration
- 7. Copy Room
- 8. Elevator
- 9. Waiting / Demonstration Area
- 10. Director's Office
- 11. Solar Chimney
- 12. Light Well Below
- 13. Bike Parking



East-West Section through Main Entrance

- 1. Lounge
- 2. Corridor
- 3. Weathervane and Anemometer
- 4. Skylight
- 5. Open Office
- 6. Sound Booth
- 7. Main Stair
- 8. Entry Stair
- 9. Porch
- 10. Main Lobby
- 11. Tech Closet
- 12. Basement Lobby



# Dagslys

Målsatt dagslys autonomi 100%

Flere soner

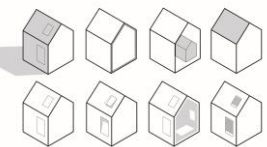
85 – 98% DA simulert

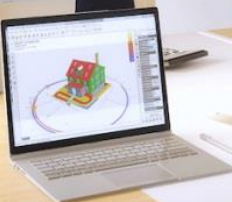
Materialvalg ble simulert i iterasjoner og verifisert senere av 3dje part.

Vinduer forstørret med 10% og delvis repositionert

Materialvalg og farger for refleksjon av lys.

Bepantning på nordsiden har seinblomstrende hvite blomster.





$$\begin{cases} \text{Ratio}(1) = \frac{1}{2} \\ \text{Ratio}(2) = \frac{1}{3} \\ \text{Ratio}(3) = \frac{1}{4} \end{cases}$$

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EXIT



# Naturlig Ventilasjon

Kryss ventilasjon

Puls ventilasjon og natt-kjøling

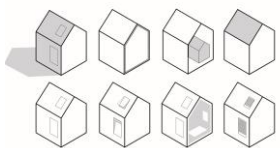
Windowmaster aktuatorer som til slutt ble styrt av HCGBC's egne algoritmer

Input fra egne værstasjoner, historisk data og værmeldinger

Energate EN1202 vinduer med trerammer

Glass: Superisolert 3-lags glass,  $U_g=0.5 \text{ W/m}^2\text{K}$

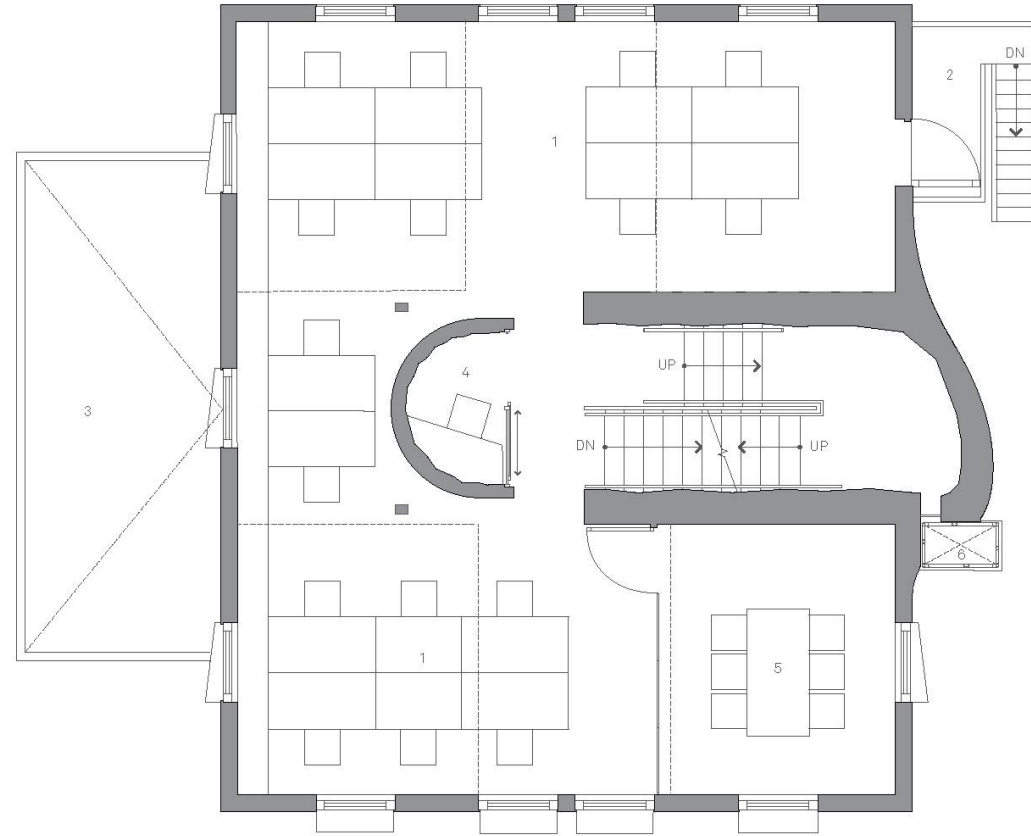
Insektskjermer!





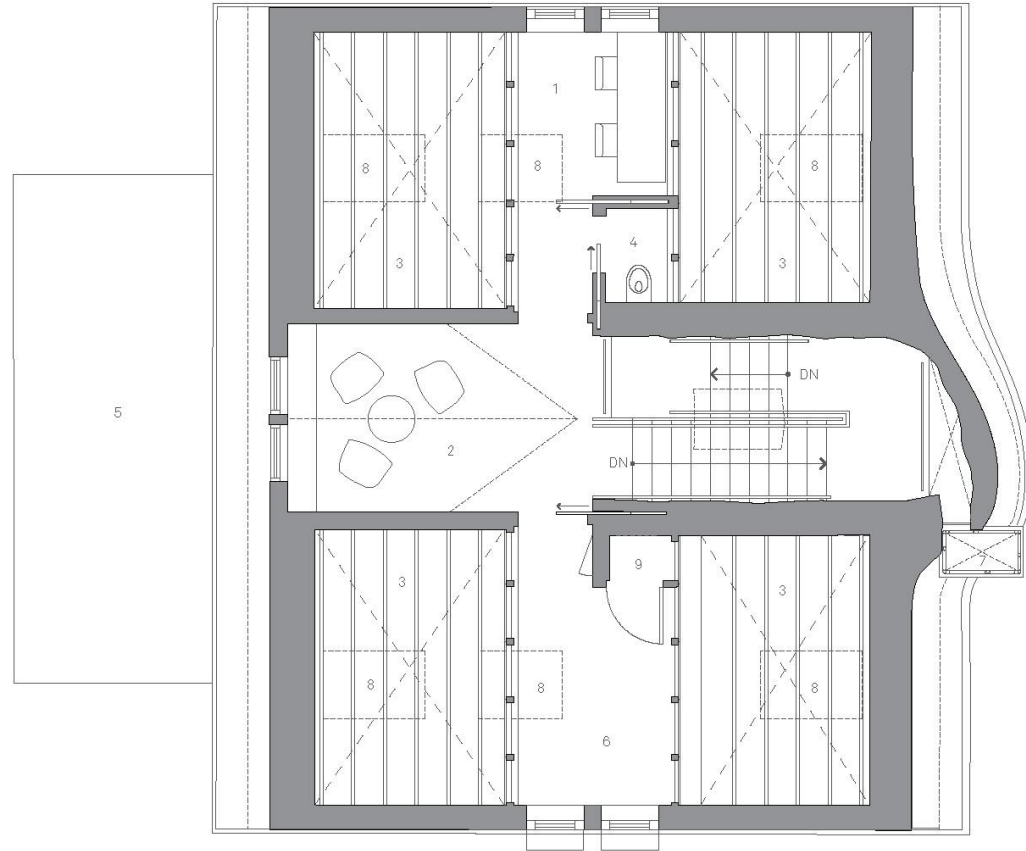
Level 2

- 1. Open Office
- 2. Fire Escape
- 3. Roof Below
- 4. Sound Booth
- 5. Meeting Room
- 6. Solar Chimney



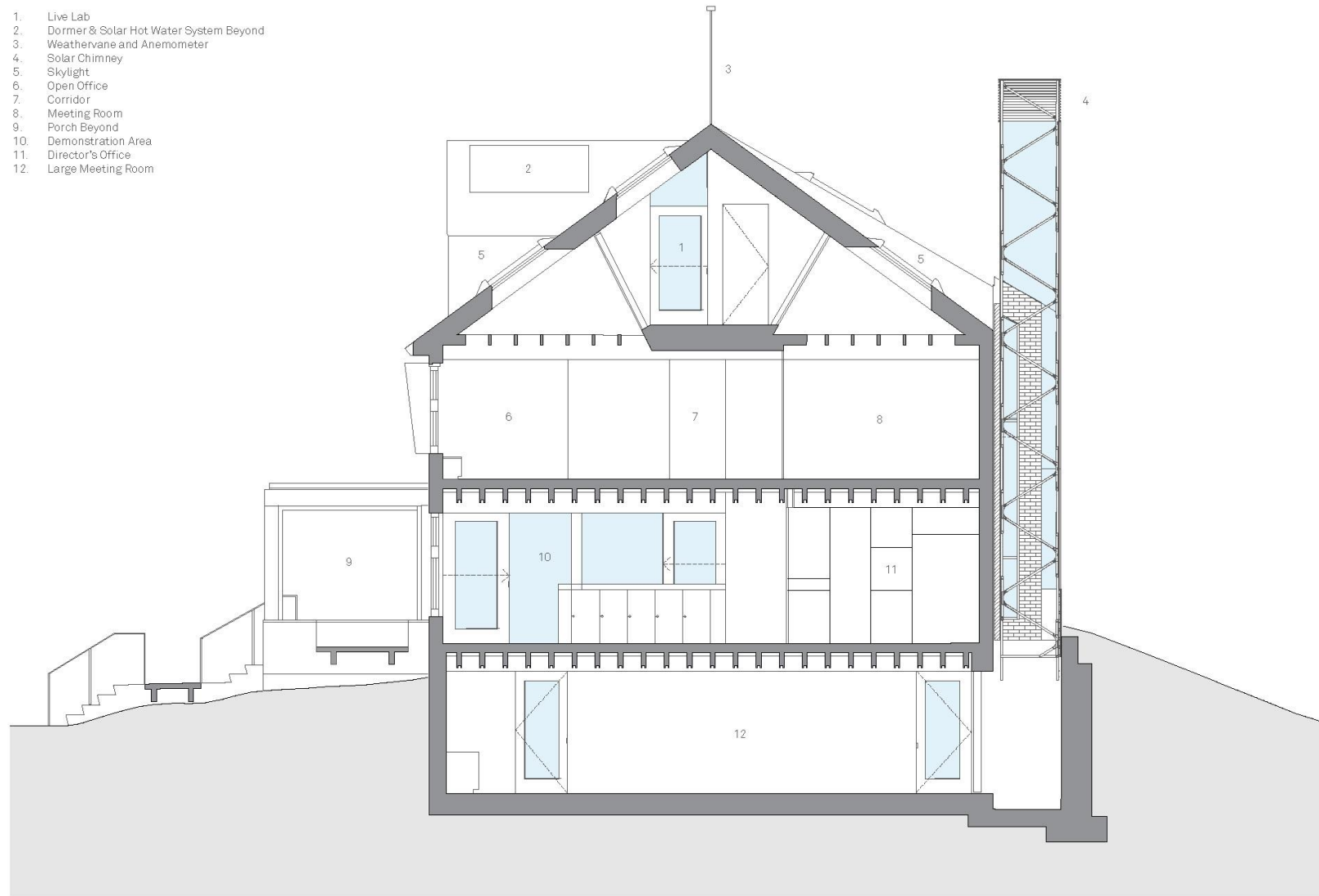
# Level 2 Mezzanine

- 1. Workspace
- 2. Lounge
- 3. Open to Below
- 4. W/C
- 5. Roof Below
- 6. Live Lab
- 7. Solar Chimney
- 8. Skylight Above
- 9. Tech Closet



East-West Section through Solar Chimney

1. Live Lab
2. Dormer & Solar Hot Water System Beyond
3. Weathervane and Anemometer
4. Solar Chimney
5. Skylight
6. Open Office
7. Corridor
8. Meeting Room
9. Porch Beyond
10. Demonstration Area
11. Director's Office
12. Large Meeting Room

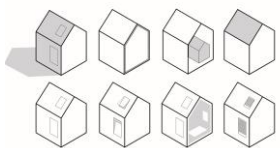




# Termisk masse

Aktive/passive betongdekker med 80% slagg  
Håndlagt leir-puss  
Gipsplate substrat

Samlet designet termisk masse = 66W





# Termisk masse og solavskjerming i balanse

Tilpassede vindusrammer i aluminium fungerer både som solavskjerming og reflektorer

Unik tilpasset geometri for hver himmelretning

Gir en sammensatt skyggevirkning som reduserer peak verdiene i varmeoppbygging

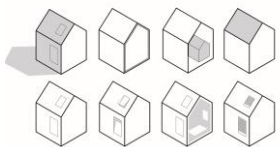
Designet for å minimere hindring av sikt

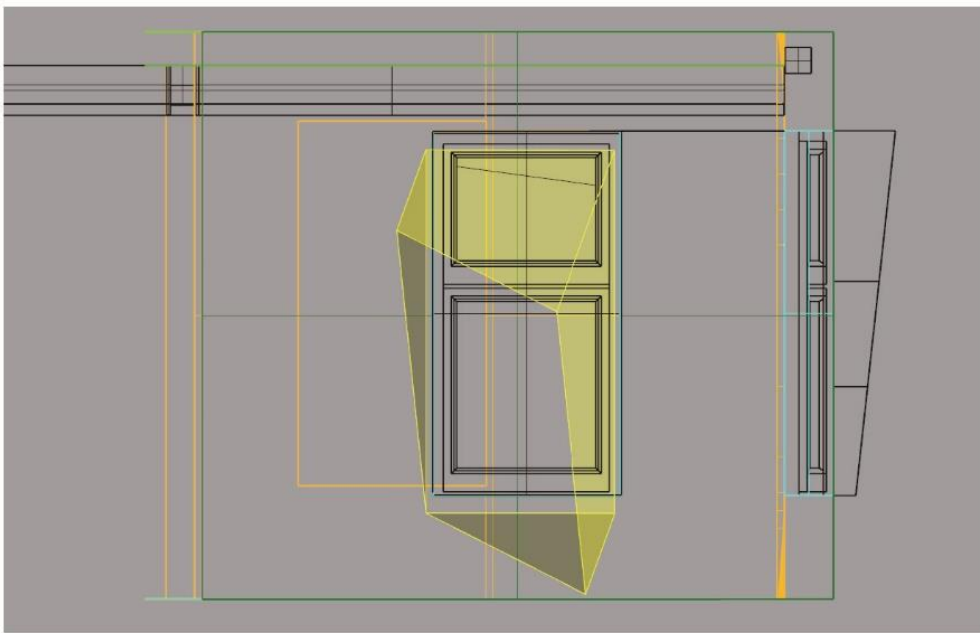
Energate vinduer med 0.4 W/mK U-verdi

Laboppbygging i glass tilpasset retning

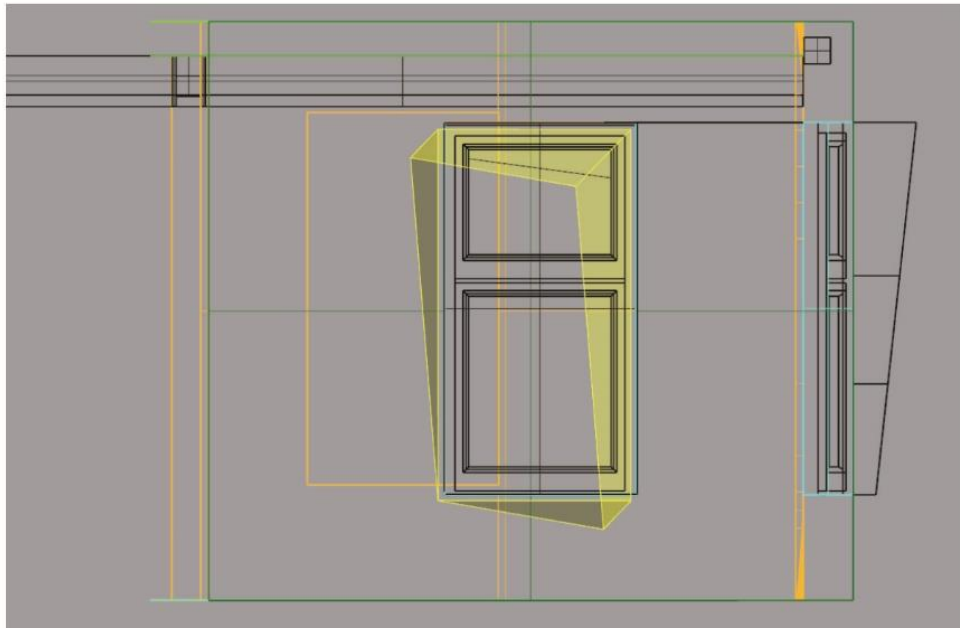
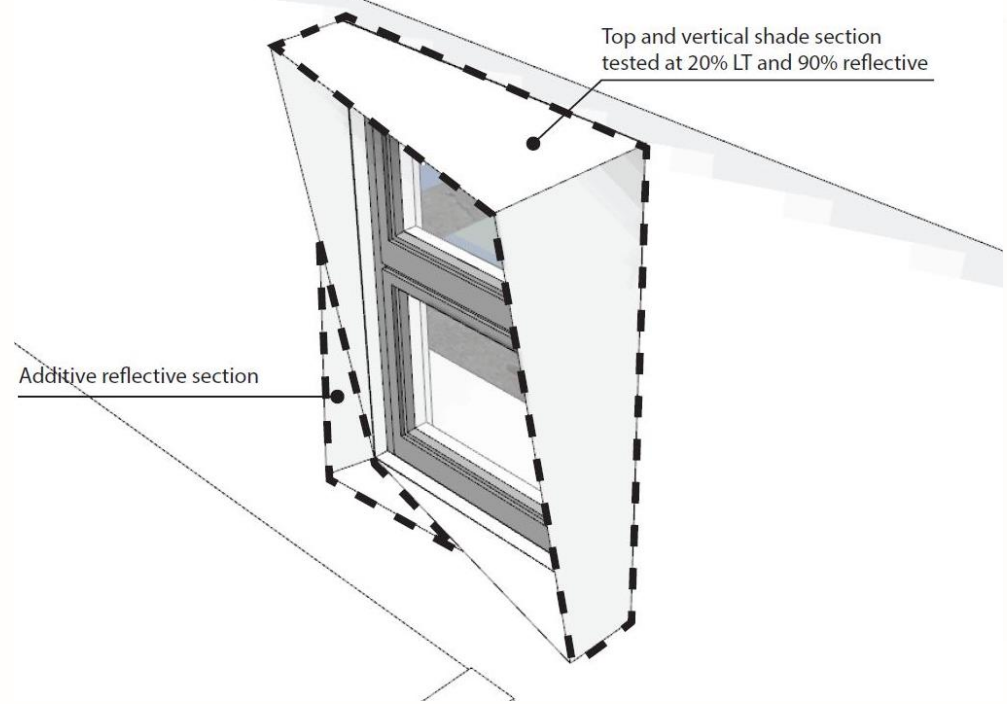
74% LT for alle hovedretninger

55% LT i karnapp

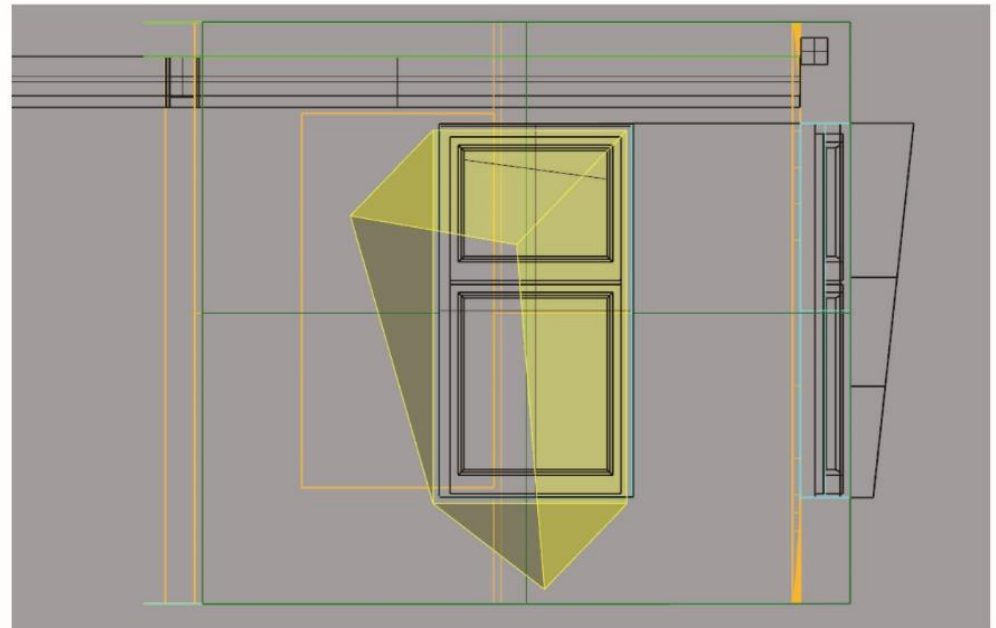




450mm shade 21.06.13.30 (utc -4)

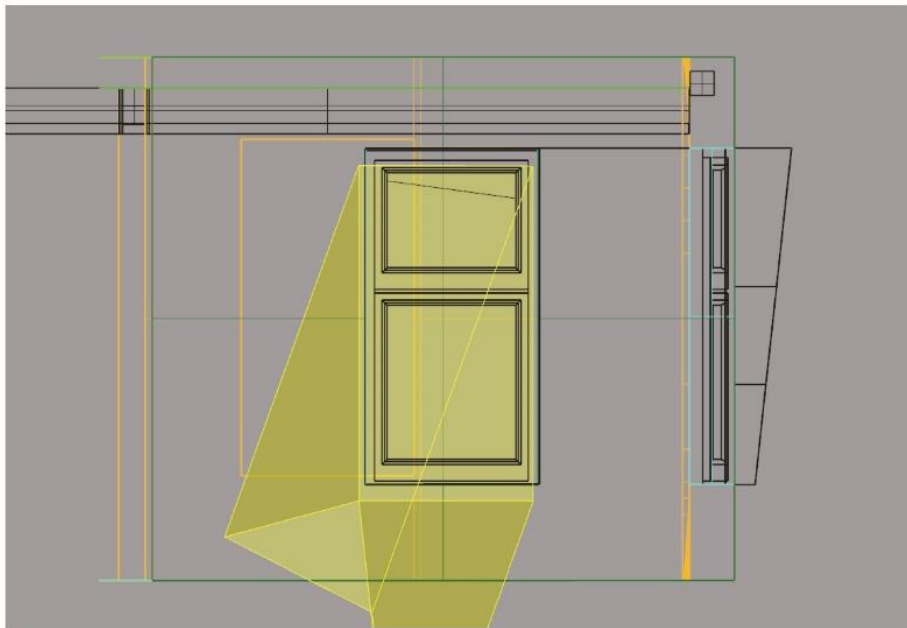


450mm shade 31.03.15.00 (utc -4)

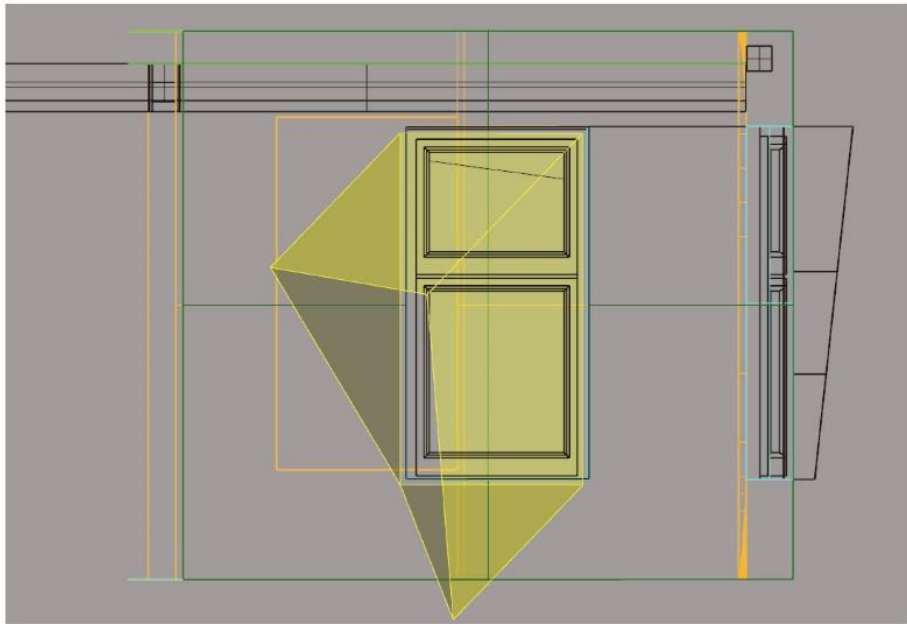


900mm shade 31.03.15.00 (utc -4)

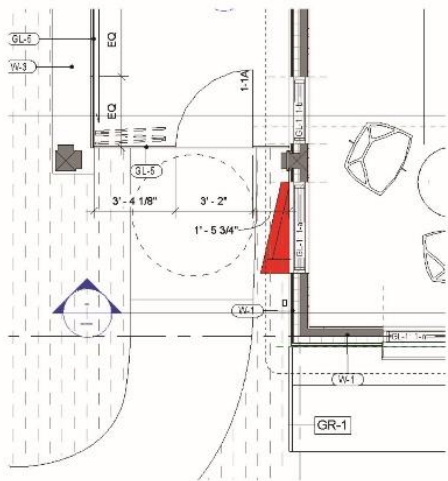




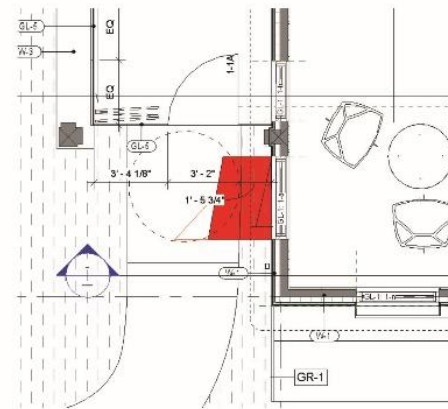
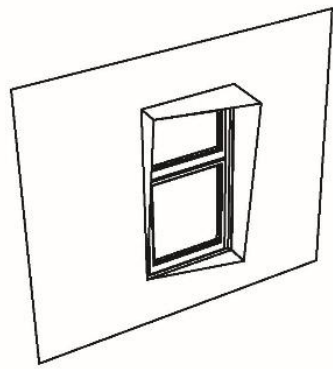
1350mm shade 21.06. 13.30 (utc -4)



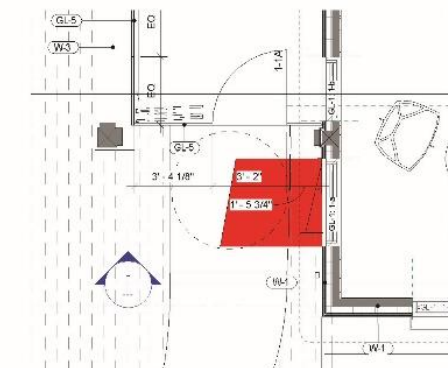
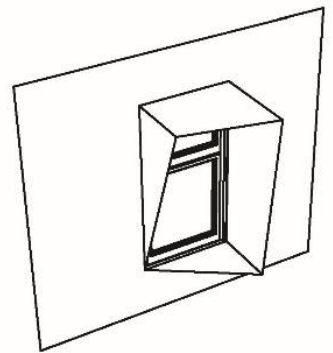
1350mm shade 31.03. 15.00 (utc -4)



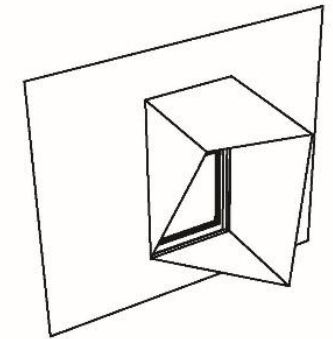
450mm shade



900mm shade

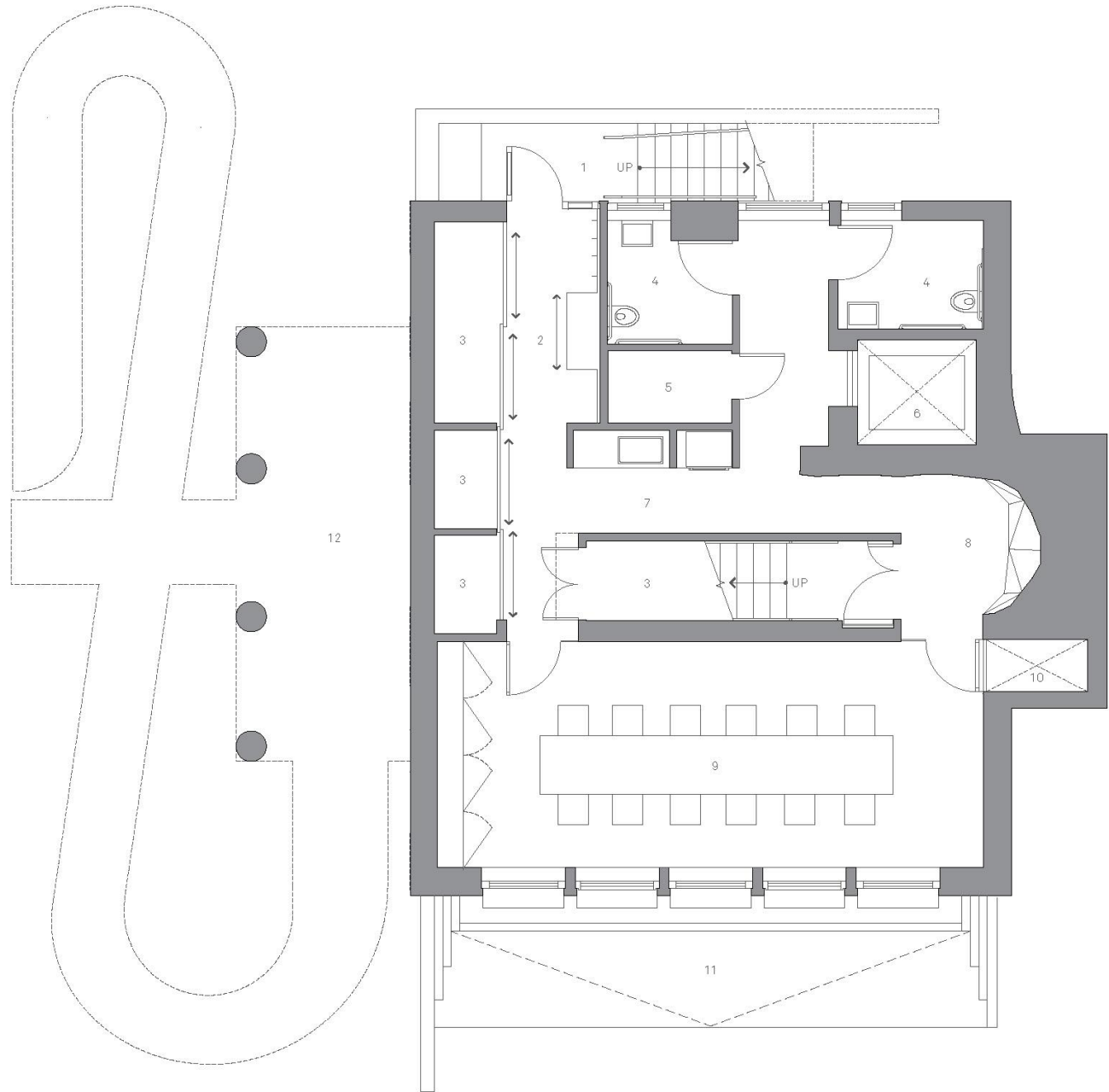


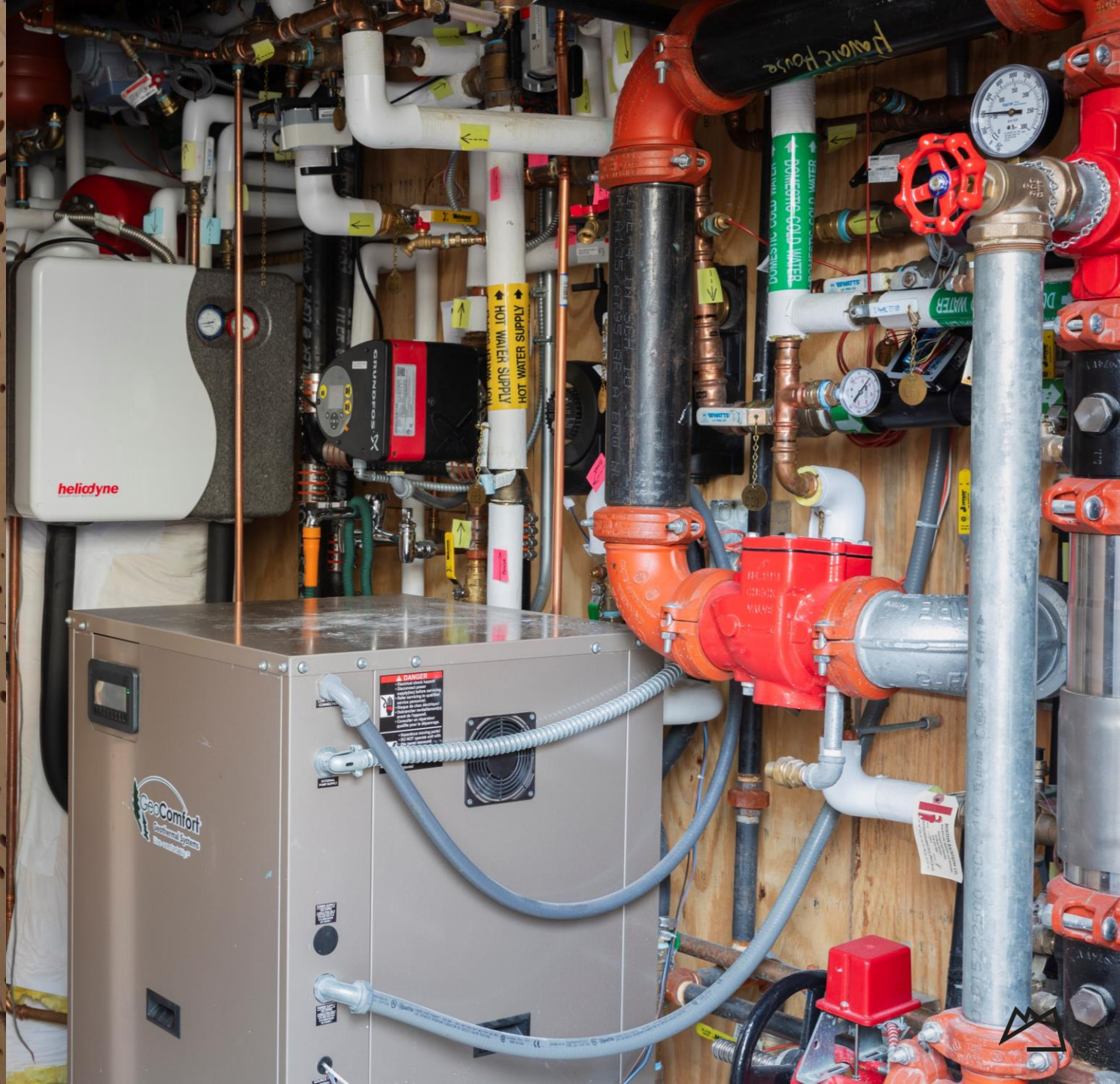
1350mm shade



# Basement

- 1. Basement Entrance
- 2. PV Battery Storage
- 3. Tech Closet
- 4. W/C
- 5. Elevator Machine Room
- 6. Elevator
- 7. Kitchenette
- 8. Basement Lobby
- 9. Large Meeting Room
- 10. Solar Chimney
- 11. Light Well
- 12. Porch and Ramp Above



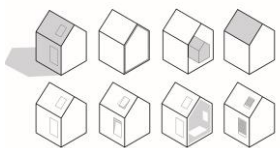


## Materialbruk overflater

Betong i dekker med 80 % slagg  
Eksisterende eike konstruksjon  
Forsterking av samlinger i finer  
Bjørkefiner i trapperom  
Hvit amerikansk eik i trappetrinn  
Ull filt i himling trapp  
Spray applisert akustisk overflate under mesanin  
Mineralull som akustisk demper mellom bjelkene

Bøkefiner kontorppulter med innslag av  
HiMacs

Tekstiler fra Kvadrat





HARVARD  
CENTER  
FOR GREEN  
BUILDINGS  
AND CITIES



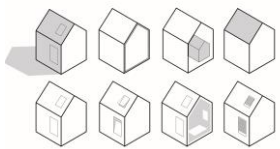
# Sol skorstein

Stålramme  
Forsterket tolagsglass  
Integrert termisk masse:  
Murstein fra nærliggende Aldridge Hall

Spesialventil i toppen

Temperaturen på innsiden kan nå 100°C

Dobler opp som dagslysinntak i trapperommet.







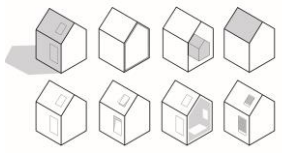




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CENTER  
FOR GREEN  
BUILDINGS  
AND CITIES



Takk



Snøhetta 

