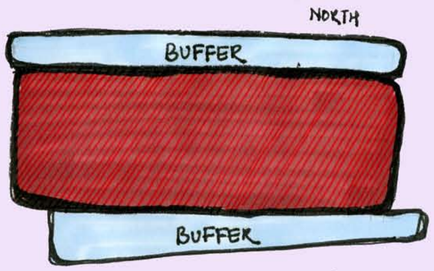
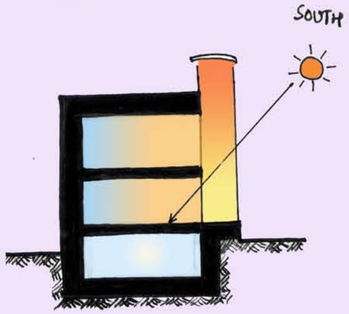
BRØSET KLIMA CENTER

Arjun Basnet, Mila Shrestha, Nigar Zeynalova, Sarah Flausse

CONCEPT





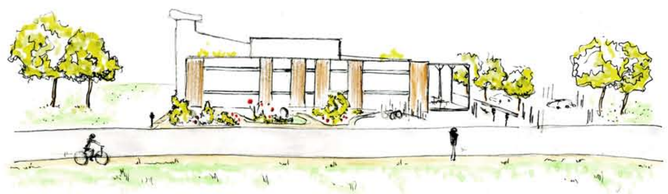
"The new suburb of Trondheim, Brøset, will be carbon neutral. Built from healthy materials and using little energy, Brøset will make an integrated and future-oriented suburb. The work in Brøset will be given full priority in Cities of the Future and should become a model for future urban development." *-'Brøset. Trondheim Kommune'*

We have a simple approach - The main space of the building is sandwitched by buffer spaces in the north and south acting as protectors form the harsh outdoor climate. The buffer space in the north being service space to the 'served' space, while that to the south is the special kind of double facade which have dual function - as a sun space and circulation/exhibiton space. We don't intend for closed insulated box, rather we want the building to communicate with the surrounding environment and breath. **Selective Design** is what we have opt for.
Basically we tired to be as simple as possible both in plan and form; plans being more open and flexible to adust to changing time and demand. Architectural vocabulary is used to adapt the building to local climate and condition. Zoning is implemented to minimise heating and renewable energy source is used to fulfill the demand. For materials, we've chosen certified recyclable natural materials as far as possible.

APPROACH: Selective Design
Selective design is a system of interrelated and interacting elements in a building where the form, fabric, materials, mechanical systems of a building and the controls that operate upon them are located within a naturally occurring climate with all of its seasonal and diurnal variations of solar radiation, temper ature, humidity, wind speed and direction, variations of ambient light and so forth. This is then inhabited by human activity that creates a complex set of demands for space and environment that the building has to satisfy. The occupants of the building and their behaviour play a vital role in the operation of the environmental system to adjust the fabric; by opening windows, drawing blinds and the like by their operation of plant, setting heating controls, switching lights, and so forth. *-'Hawkes, D., McDonald, J. & Steemers, K. 2002. The Selective Environment'*

SITE

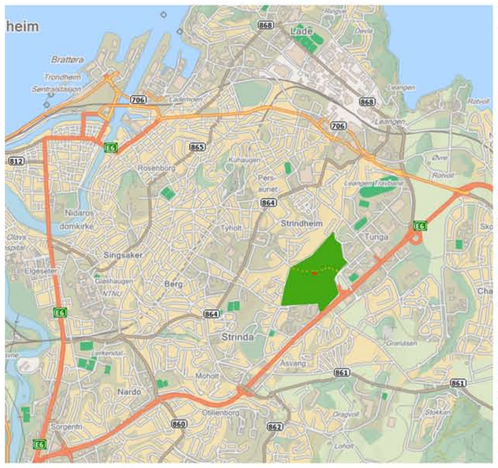
Site Plan
Sale- 1:500



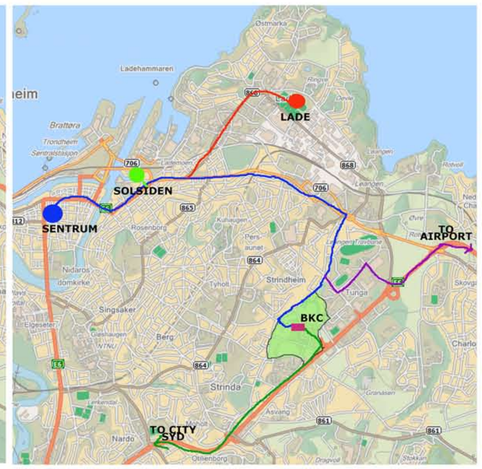
The building is placed in the center of the Brøset site, and along the Spine, which is supposed to be the main axis passing through Brøset. The idea was to create a core on the center of the Brøset project. The site is more or less flat. The entrance of the building is situated on the Western façade. A large 'forume' with stone paving, brings us to the inside. The stones are laid such that rain water pass in order not to disturb the natural infiltration.

We tried as much as possible to create outdoor facilities like the parking for electric cars and for bicycles to encourage people to change their habits to greener transport. The transport supply is really important for the quality of the site. The concrete used in the car parking is of porous type.
On the site, a lot of existing trees will be conserved. The trees at South will be deciduous and will loose their leaves in winter to get more sun in the building during this period. And in winter, the trees at the East will be of ever green types and keep their leaves to protect the building from the wind. The pool and the organic timber deck in the South will serve as an extension of the building during the good summer days, people will be able to have lunch, or play in the grass, or just seat and discuss. This pool will collect the rain water, so it won't affect the water consumption.

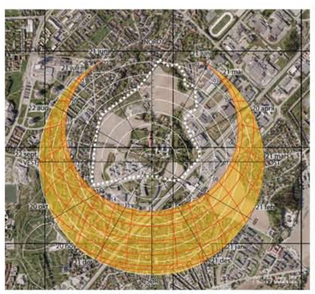
In all the surrounding native plants will be chosen in order to fit with the local climate. In the north, there is organic garden where all sorts of plants and vegetables will be grown with only natural and organic way of farming.



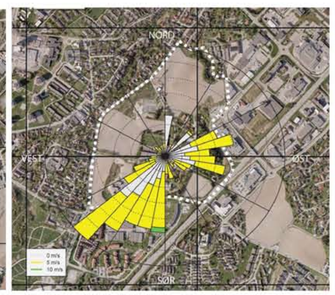
Location

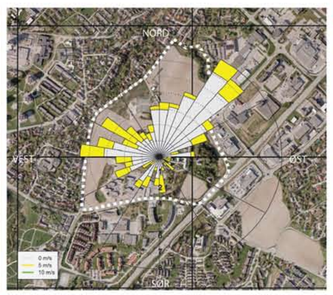


Access



Sun Path





Prevailing wind

Surroundings

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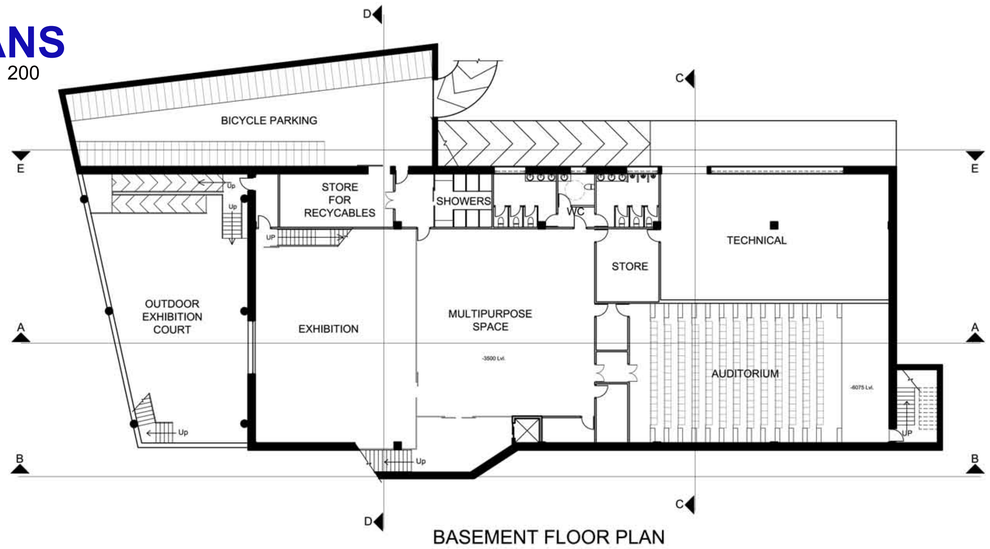
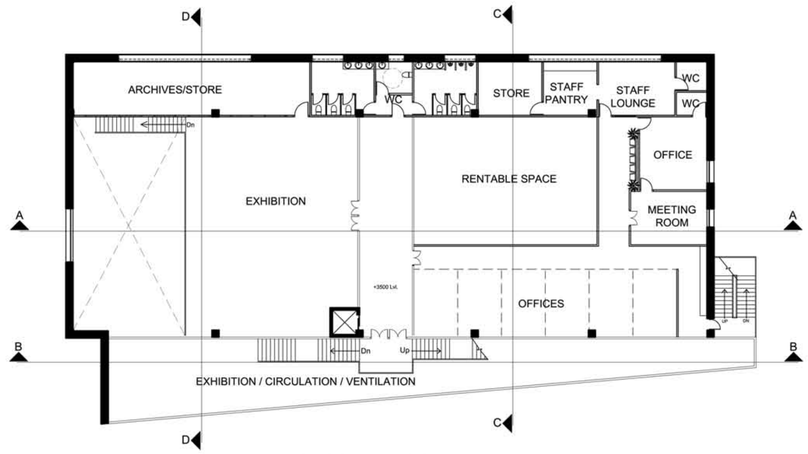
PLANS

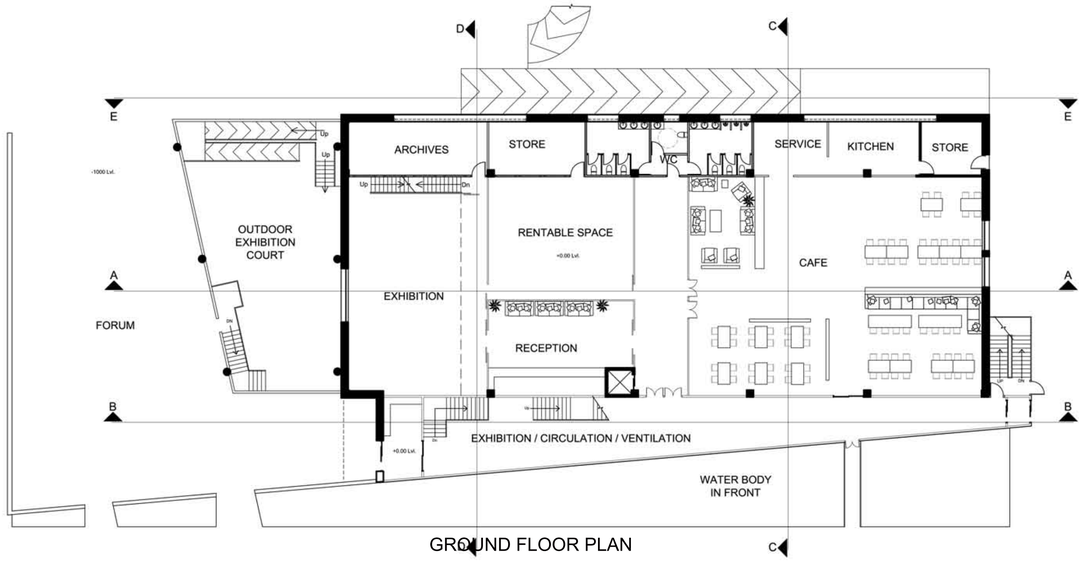
Scale- 1: 200



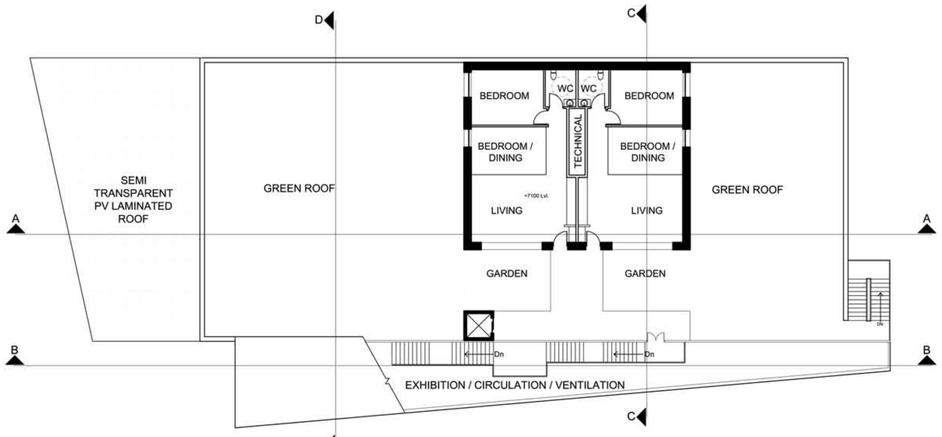
BASEMENT FLOOR PLAN



SECOND FLOOR PLAN



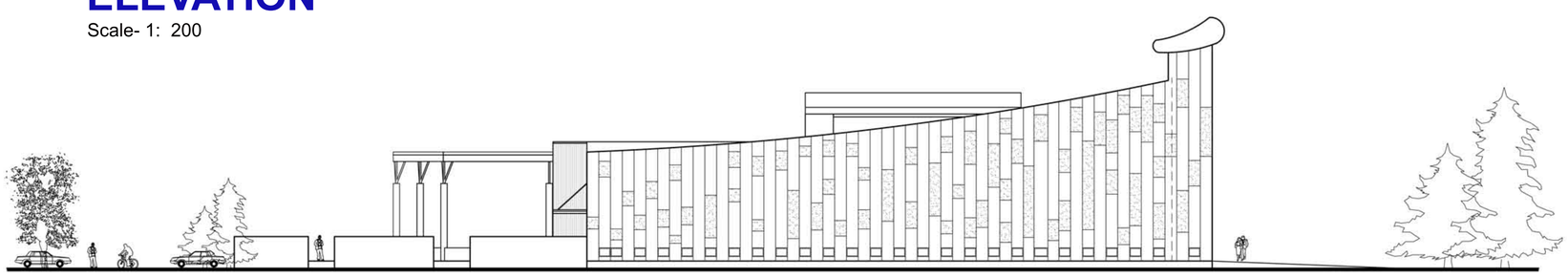
GROUND FLOOR PLAN



PROTOTYPE APARTMENTS

ELEVATION

Scale- 1: 200



SOUTH ELEVATION

BRØSET KLIMAX CENTER

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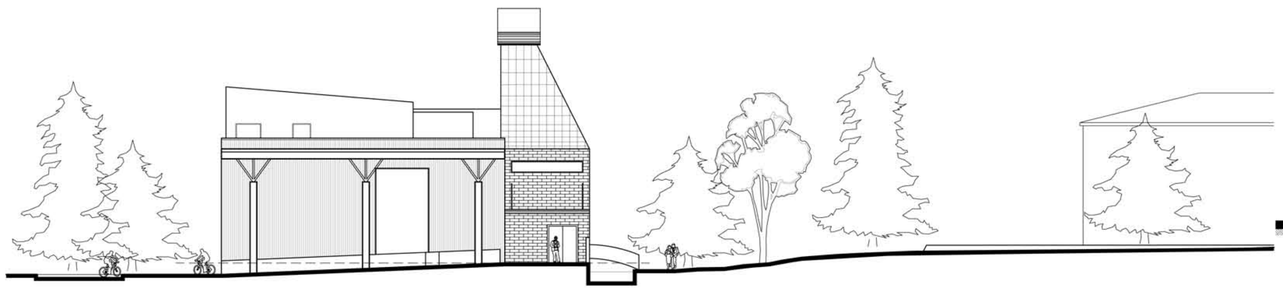
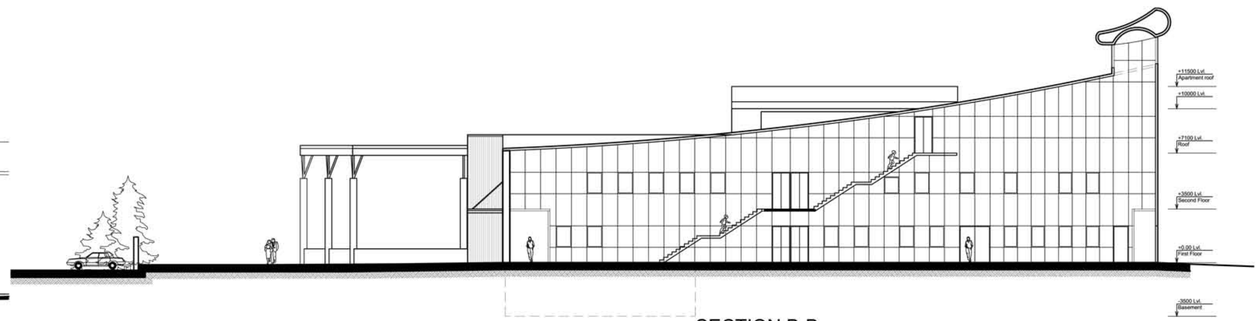
ELEVATIONS / SECTIONS

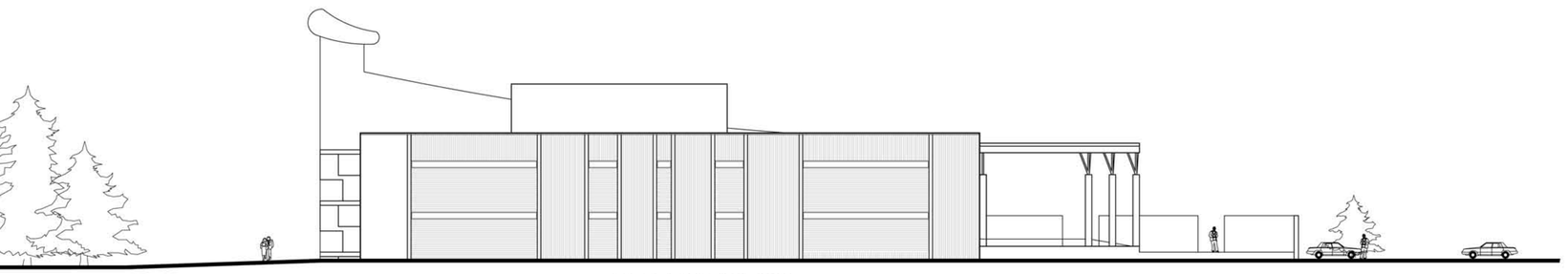
Scale- 1: 200



WEST ELEVATION



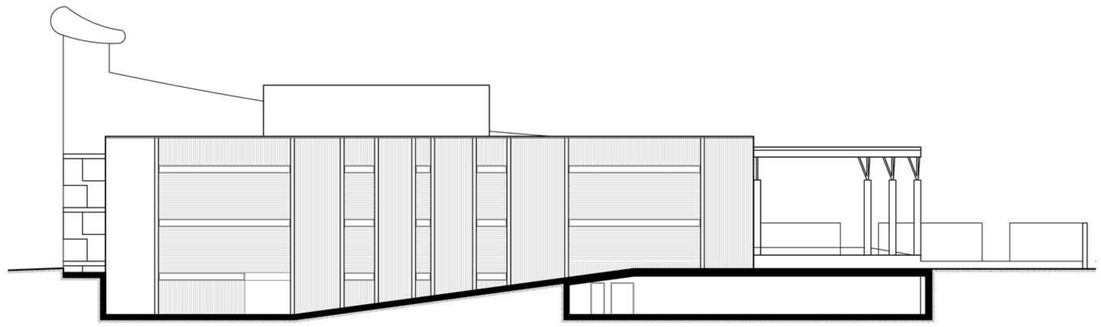
SECTION B-B



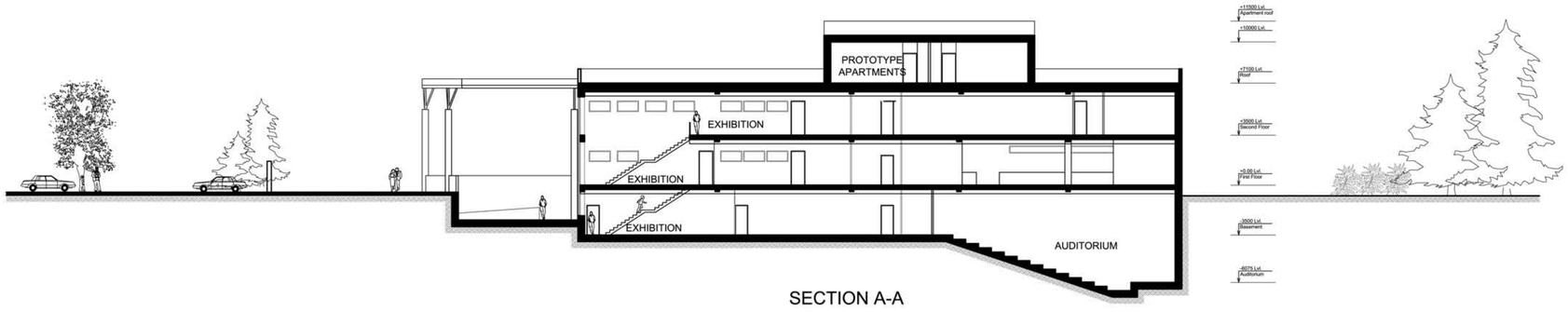
NORTH ELEVATION

SECTION C-C

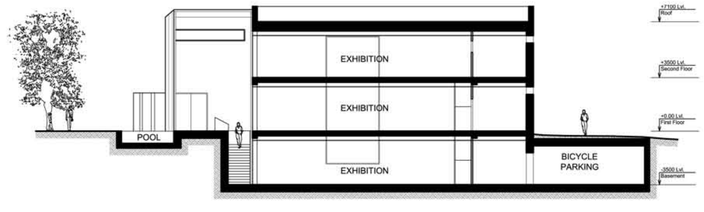
EAST ELEVATION



SECTION E-E



SECTION A-A



SECTION D-D

BRØSET KLIMA CENTER

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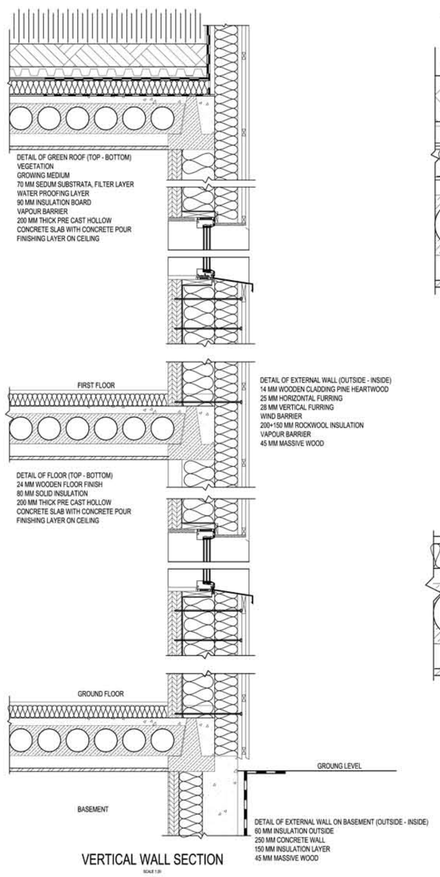
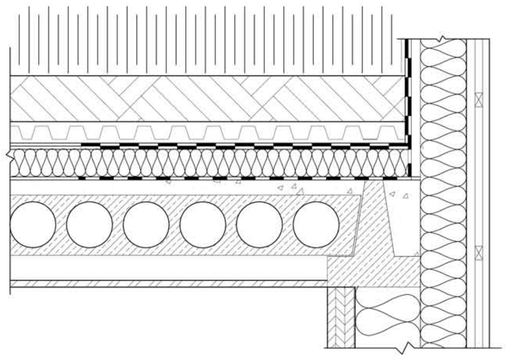
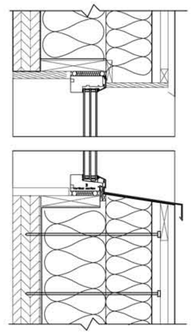
DETAILS



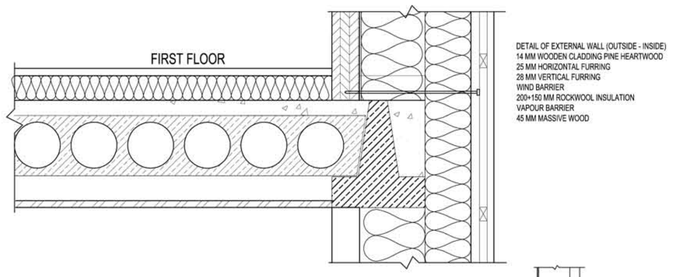
VERTICAL WALL SECTION



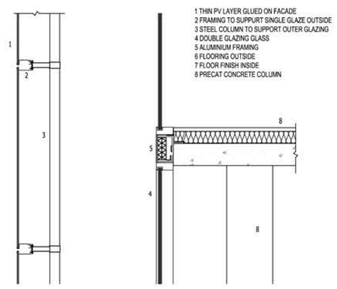
DETAIL- GREEN ROOF
SCALE- 1:5



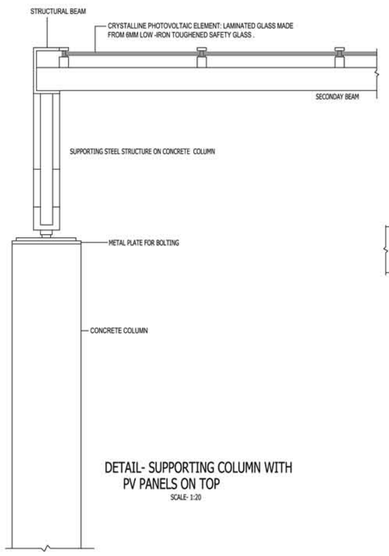
DETAIL- OPENING
SCALE- 1:5



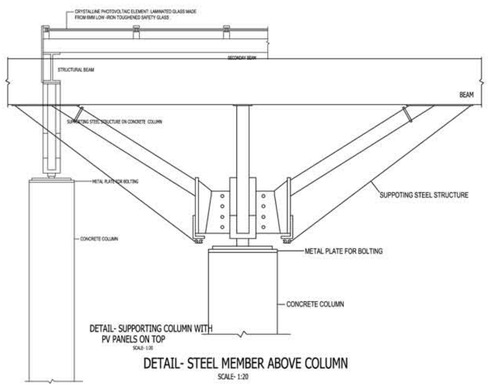
DETAIL- CONNECTION BETWEEN FLOOR AND WALL
SCALE- 1:5



DETAIL- DOUBLE SKIN FACADE



DETAIL- SUPPORTING COLUMN WITH
PV PANELS ON TOP
SCALE- 1:20



DETAIL- SUPPORTING COLUMN WITH
PV PANELS ON TOP
SCALE- 1:20

DETAIL- STEEL MEMBER ABOVE COLUMN
SCALE- 1:20

PERSPECTIVE

BRØSET KLIMA CENTER

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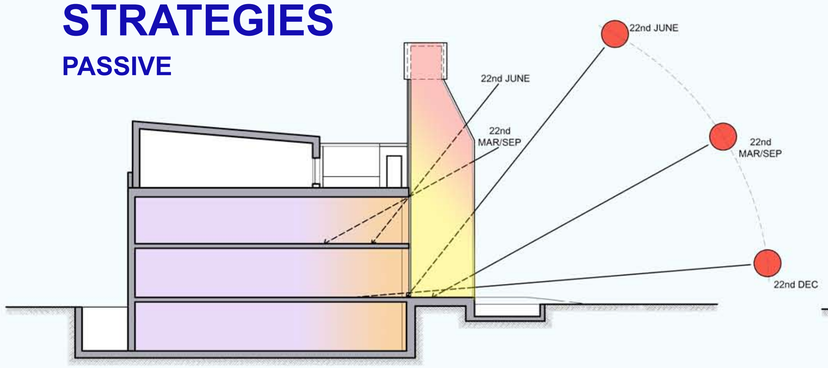
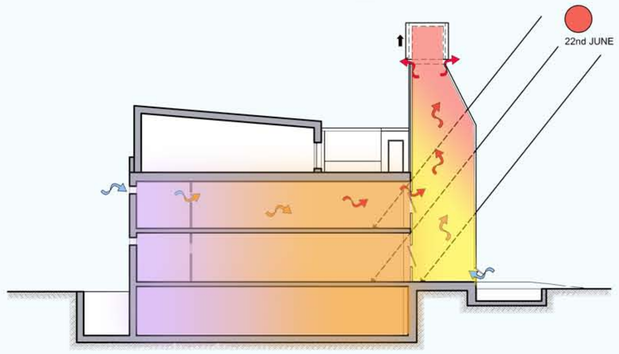
STRATEGIES

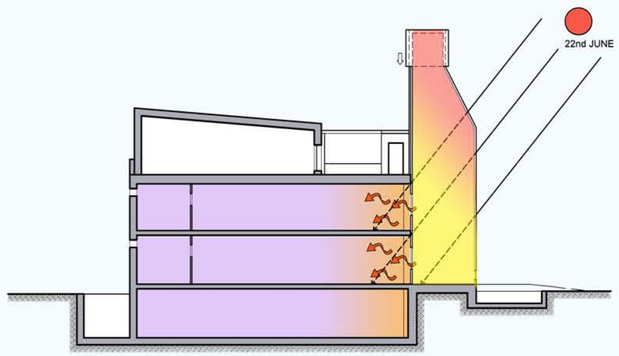
PASSIVE



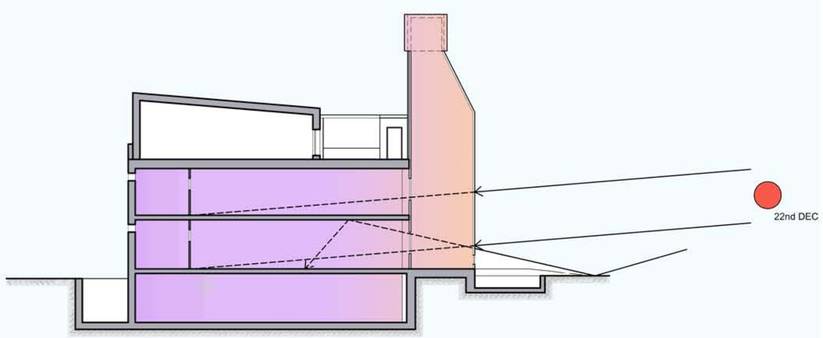
SUN'S ANGLE



SUMMER AFTERNOON

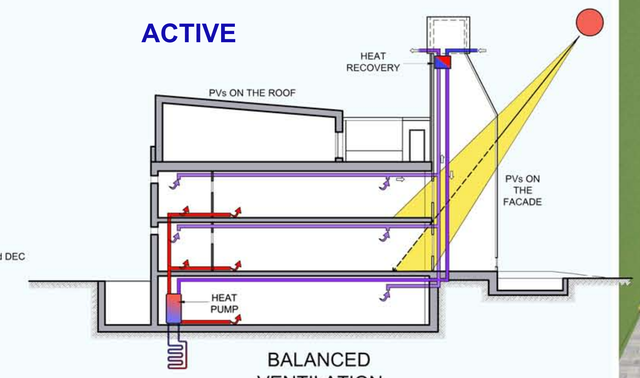


SUMMER MORNING

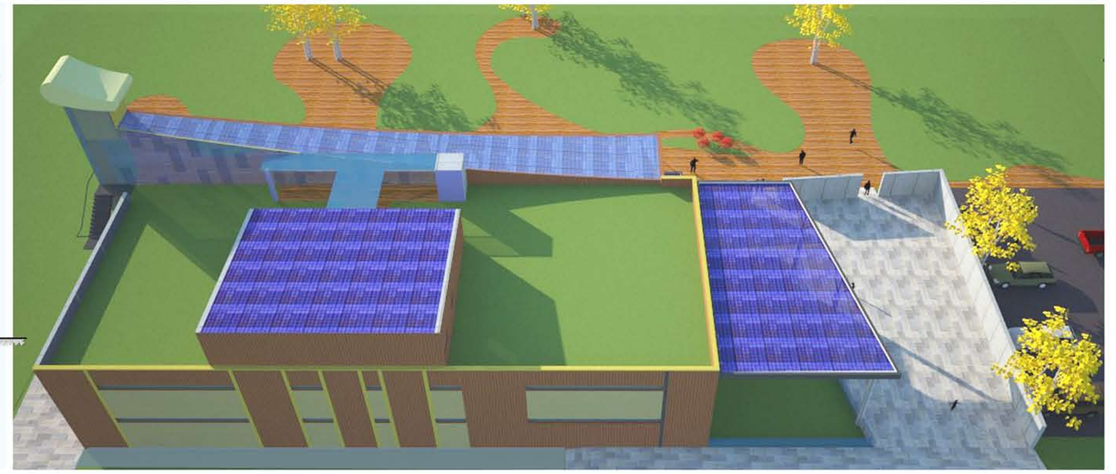


WINTER

ACTIVE

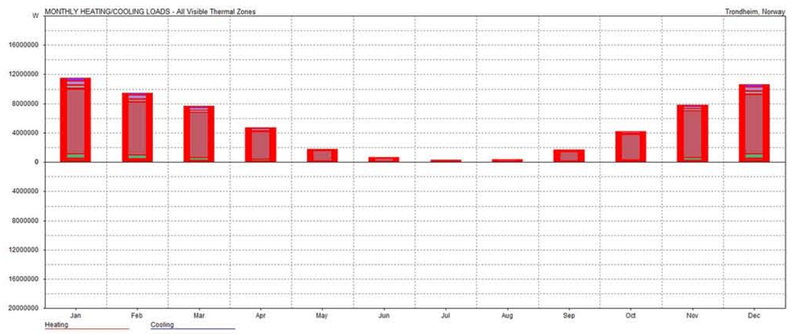


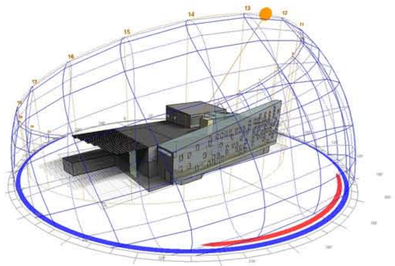
BALANCED VENTILATION



ENERGY RESULTS

MONTH	HEATING (Wh)	COOLING (Wh)	TOTAL (Wh)
Jan	11493708	0	11499707
Feb	9455178	0	9460056
Mar	7706400	0	7710240
Apr	4709860	0	4711894
May	1806744	3824	1807168
Jun	673927	3841	673942
Jul	330210	5999	330211
Aug	393367	4878	393376
Sep	1734187	2034	1734454
Oct	4249592		4251068
Nov	7863191	0	7867014
Dec	10648384	0	10653563
TOTAL	**61064748**	**20576**	**61092696**
PER M2	**25041**	**9,4**	**25052**

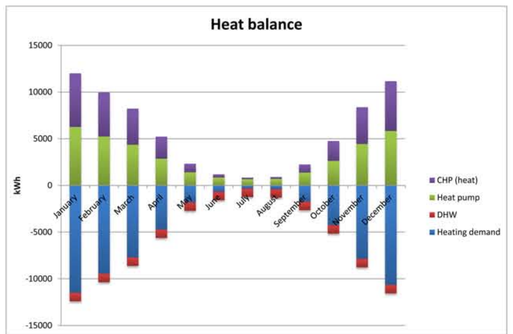


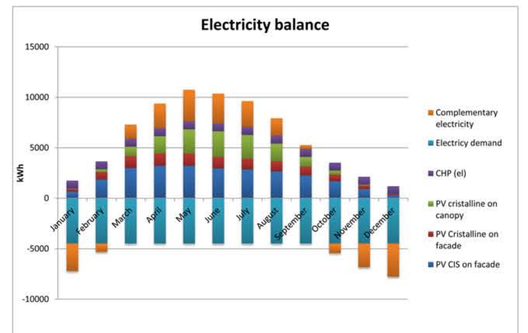


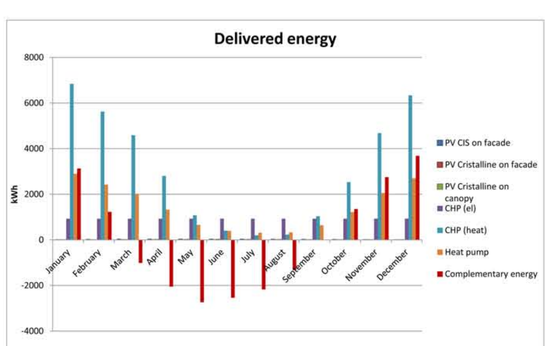
Annual energy budget

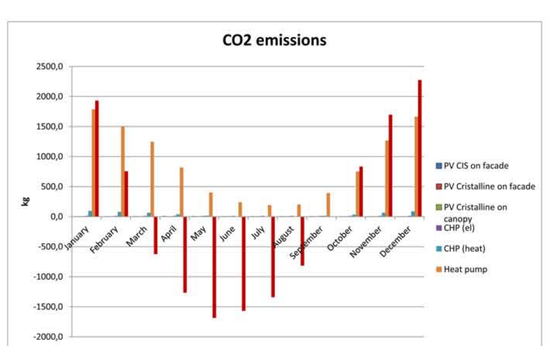
	Heat (kWh/a)	Electricity (kWh/a)	Total net energy demand (kWh/a)
Space heating			
Ventilation heating	54600		
Domestic hot water	10920		
Fans and pumps		6115	
Lighting		34070	
Equipment		13540	
Cooling		0	
Sum	65520	53725	122521
kWh/m²a (2184m²)	30	24,5	54,5

	Delivered energy (kWh/a)	Specific delivered energy (kWh/m²a)	CO2 emissions (kg)	CO2 emissions (kg/m²)
Electricity	10155,4	4,7	-547,8	-0,23
Heating	53031,6	24,3	10323	4,6
Total	**63187**	**29**	**9775,2**	4,37









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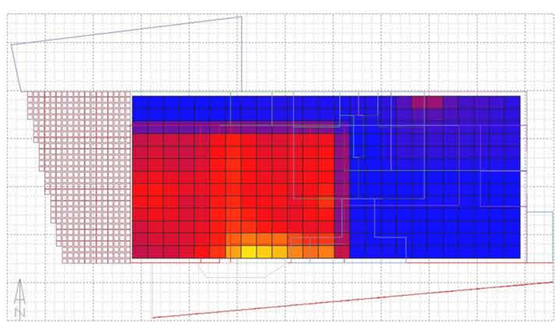
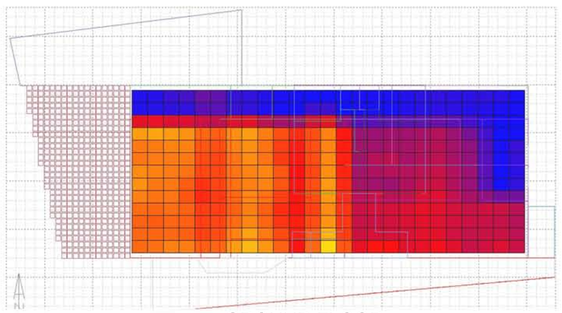
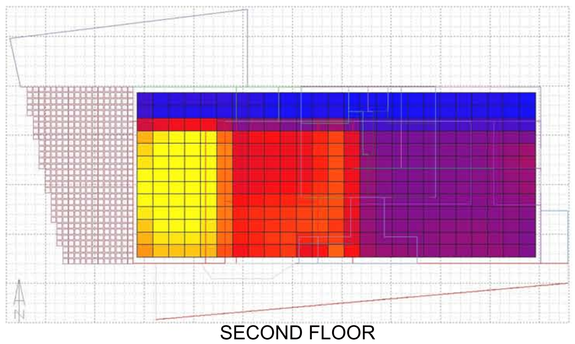
LIGHTING ANALYSIS



BASEMENT



GROUND FLOOR



SECOND FLOOR

BREEAM ASSESSMENT

BREEAM sections	BREEAM issues	Credits	Minimum credits for Outstanding	Influence on Design	Easy credits	Credits achieved	Comments on strategies used in the project to achieve the points
ENERGY	Energy efficiency	15	10	+	-	12	Current energy requirement for label A building: 70 kWh/m² per year and our annual delivered energy: 29 kWh/m² and Percentage improvement over the requirement: 59 %
	Low zero carbon technologies	3	1	+	-	1	Renewable energy supplies: PV panels, and Biofuel micro CHP, heat pump
	Energy efficient lifts	2	-	-	+	2	Compactness of the building
	Sub-metering of substantial energy uses	1	1	-	+	1	
	Sub-metering of high energy load areas and tenancy	1	-	-	+	1	
	External lighting	1	-	-	+	1	
	Innovation	3	-	+	-	0	
						14,87%	
HEALTH AND WELLBEING	Daylight: at least 80% of floor well daylit	1	-	+	-	1	Daylight simulation shows that the daylight factor is above the minimum requirement of 3,3 %; offices, exhibition rooms and café well-lit
	View out	1	-	+	-	1	except for the auditorium
	Glare control: occupant controled shading system	1	-	+	-	1	installation of movable shading devices
	High frequency lighting	1	1	-	+	1	
	Potential for natural ventilation	1	-	+	-	1	Use of a chimney to ventilate the building with stack effect
	Internal and external lighting levels	1	-	-	+	1	
	Lighting zones and controls	1	-	-	+	1	
	Indoor air quality	1	-	-	+	1	
	Volatile organic compounds	1	-	+	-	1	Choice of materials: low emiting materials approved by Norwegian environmental declaration,which pass the indoor climate label
	Thermal comfort	1	-	+	-	1	Exploitation of the effect of trees on the solar heat gain and shading and as daylight is maximized, no need for artificial light during the daytime (less cooling loads from the use of artificial light)
	Thermal zoning: occupant control of temperature	1	-	-	+	1	
	Microbial contamination	1	1	-	+	1	
	Acoustic performance	1	-	-	+	1	
	Innovation	1	-	+	-	0	
						15%	
MATERIALS	Materials specification (green guide to specification ratings)	4	-	+	-	3	Each building element follows the green guide: our elements are rated A and B
	Responsible sourcing of materials	3	-	-	+	3	Use of responsibly sourced materials for key building elements: materials approved by Norwegian Environmental Declaration
	Insulation : low embodied energy and responsibly sourced	2	-	+	-	2	Insulation: Rockwool Product rated A by Green Guide to Specification; embodied energy of 17,3 MJ/kg according to LCA
	Hard landscaping and boundery protection	1	-	-	-	1	
	Designing for robustness : durable materials	1	-	-	+	1	
	Innovation	2	-	+	-	0	
						9,62%	
MANAGEMENT	construction site impact	4	-	-	+	4	
	Commisioning	2	2	-	+	2	
	considerate constructors	2	2	-	+	2	
	Building user guide	1	1	-	+	1	
	security	1	-	-	+	1	
	Innovation	1	-	-	-	0	
						12%	
LANDUSE AND ECOLOGY	Enhancing site ecology	3	-	-	-	3	No change of the topography and greenery
	Mitigating ecological impact	2	1	-	+	2	
	long term impact on biodiversity	2	-	-	+	2	
						7%	
POLLUTION	Nox emission from heating source	3	-	-	+	3	
	Flood risk	3	-	-	+	3	
	Preventing refigerant leaks	2	-	-	+	2	
	Refrigerant GWP- Building services	1	-	-	+	1	
	Reduction of night time light pollution	1	-	-	+	1	
	Noise attenuation	1	-	-	+	1	
						10%	
TRANSPORT	provision of public transport	3	-	-	+	3	Public transport available in close proximity
	cyclist facility	2	-	+	-	2	Covered cyclist parking, changing rooms and showers
	Maximum car parking capacity	2	-	+	-	2	A limited number: 20 parking places
	proximity to amenities	1	-	-	+	1	
	Pedestrian and cycle safety	1	-	-	+	1	
	Travel plan	1	-	-	+	1	
						8%	
WASTE	Construction site waste management	4	-	-	+	3	
	Recyclable waste Storage	1	1	+	-	1	20 m² storage close to the road
	Recycled Aggregates	1	-	-	+	1	
	Floor finish	1	-	-	+	1	
						6,43%	
WATER	Water consumption	3	2	-	-	3	Rainwater collection thanks to the green roof and the pool
	Water meter	1	1	-	+	1	
	Measure leak detection	1	-	-	+	1	
	Sanitary supply shut off	1	-	-	+	1	
						6%	
						89,91%	

PV

THIN FILM TRANSPARENT GLASS

For double south façade, we propose the use of PV panels technologies: a-Si panels made with micro amorphous photovoltaic glass and CIS/CIGS panels that combines various components of copper (Cu), indium (In), selenium (Se) or sulphur (S) and in some cases gallium (Ga).

a-Si: micro amorphous photovoltaic glass
- most common thin-film technology.
- film is transparent and can transmit the light into the building.
- Efficiency: 50 to 90 W/m2
- exists a lot of dimensions, and it's possible to ask for a special size of film for the all building: in the project each panel will be 80 cm per 120 cm.
- thermally stable. With a thermal coefficient of 0,13 %/°C, it's more resistant at extreme conditions.

CIS / CISG: photovoltaic glass
- better than the above technology
- Efficiency: 90 to 130 W/m2
- Thermal coefficient: 0,36 %/°C
- Through laser cutting technology, the active area of the glass can be modified in order to get different patterns and 100% customized

MATERIALS

Miljøindikatorer	Deklarert enhet: Fra råvareutvinning til fabrikkport	Funksjonell enhet: Fra råvareutvinning til avhending av bygget:
Global oppvarming:	141 kg CO_2/FE	144 kg CO_2/FE
Energiforbruk:	1 533 MJ/FE	1 542 MJ/FE
Andel fornybar energi:	19 %	17 %
Kjemikalier	Inneholder ikke stoffer fra OBS-listen	

PRECAST HOLLOW CORE CONCRETE

Global warming	5,6 kg CO_2-eq.
Energy consumption	166 MJ
Amount of renewable materials	87 %
Indoor classification (according to EN 15251:2007)	not relevant

NORWEGIAN EXTERIOR CLADDING

Amount of renewable materials	98	%
Indoor classification (according to EN 15251:2007)	NA	

NORWEGIAN EXTERIOR CLADDING

Global warming	0,4 kg CO_2-eq.
Energy consumption	32 MJ
Amount of renewable materials	100 %
Indoor classification (according to EN 15251:2007)	not measured

NORWEGIAN INTERIOR WOOD PANEL

ROCKWOOL INSULATION

External wall

1	Cladding	0,147					14	
2	Vertical furring	0,147					28	
3	Rockwool batt	0,037					350	
4	Massive wood	0,147					45	
5								
6								
7								
8								
			Percentage of Sec 2		Percentage of Sec 3		Total	cm
							43,7	

U-Value: 0,098 W/(m²K)

Floor to the ground

1	Wooden floor finish	0,147					32	
2	Rockwool batt	0,037					80	
3	Precast hollow concret	0,300					200	
4	Rockwoll batt	0,037					120	
5								
6								
7								
8								
			Percentage of Sec 2		Percentage of Sec 3		Total	cm
							43,2	

U-Value: 0,151 W/(m²K)

Roof

1	Growing medium	0,150					150	
2	Oldroyd membrane	0,150					52	
3	Waterproof membrane	0,150					20	
4	Rockwool batt	0,037					180	
5	Precast hollow concret	0,300					200	
6								
7								
8								
			Percentage of Sec 2		Percentage of Sec 3		Total	cm
			2,09				60,2	

U-Value: 0,140 W/(m²K)