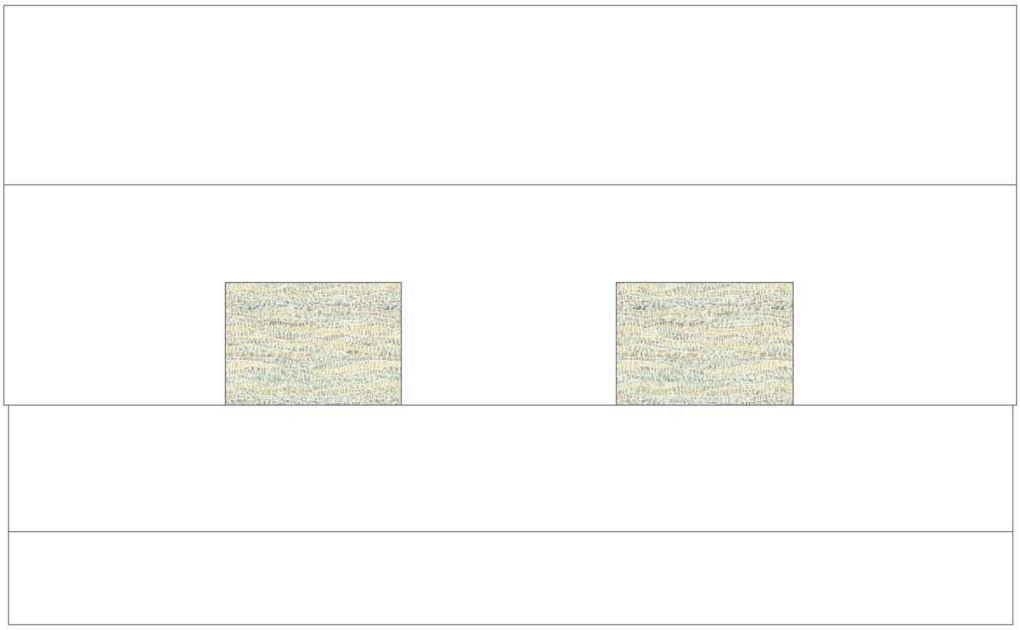
Urban Community Garden and Educational Center



DIPLOMA DESIGN

Sustainable Architecture Specialization

GJ79IB . İlaydanur KARATAŞ . Consultant: Dr. Arpad Szabo

LOCATION ANALYSIS

The IV district of Újpest in Budapest, Hungary, is a historically significant area that was once a separate town before being incorporated into Budapest in 1950.

It features a mix of industrial heritage and modern revitalization, with former factories being repurposed into trendy apartments and creative spaces.

The district also boasts green spaces, parks, and the scenic Rákos Creek, offering residents opportunities for outdoor activities. Culturally diverse, the IV district is home to a variety of culinary options and reflects both traditional Hungarian influences and immigrant communities.

Overall, it's a dynamic and evolving part of Budapest, blending history, culture, and modern amenities.

The development goals for the IV district of Újpest in Budapest focus on enhancing infrastructure, promoting economic diversification, revitalizing urban areas, preserving historical sites, engaging the community, fostering sustainability, and promoting tourism and cultural exchange. These goals aim to balance preservation of the district's heritage with modernization and growth, ensuring a prosperous and inclusive future for residents and visitors alike.

LOCATION ANALYSIS

The project site is located on the south portion of the IV district and its area totals around 9000m².

This location is accessible mainly from the main road Tél utca wich is tangential to the plot, and from the south direction through Anonymus utca.

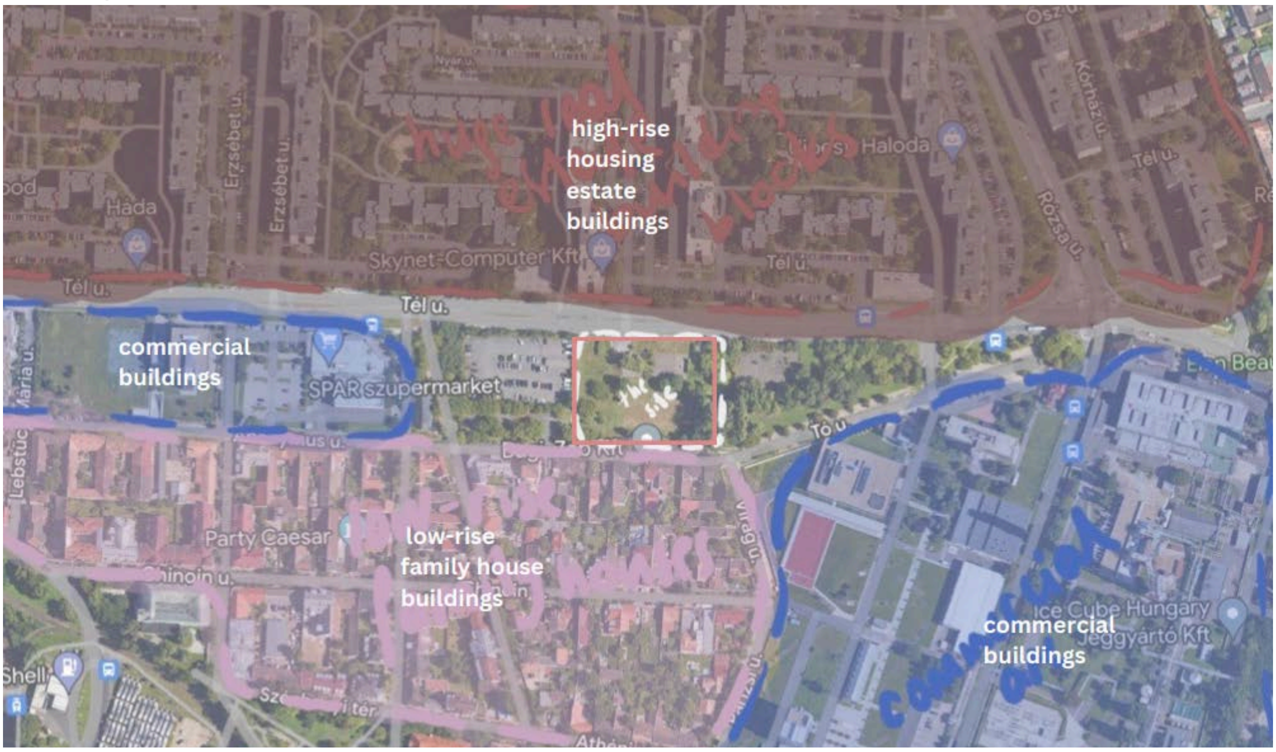
The plot is filled by a couple of trees, an already paved area and easily accessible from the residential buildings which are found on the surroundings.

Giving the site's characteristics and the district's developing goals, this site is the perfect spot for the development of a project with the goal of boosting the community's life by introducing a communal graden and learning environment.

SITE ANALYSIS

As previously mentioned the plot is souroundеd by many different types od estates including high rise housing, low rise housing, commercial and parking.

AIn the map below you can see the highlited areas and their orientation in relation to the plot.



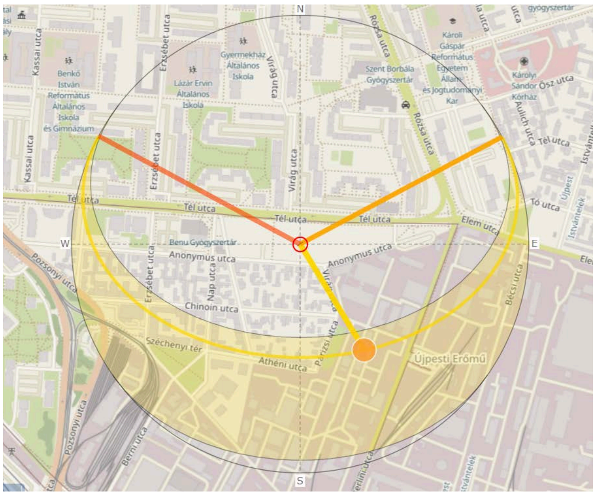
SITE ANALYSIS

Budapest experiences a continental climate with four distinct seasons. Spring starts cool, gradually warming up with blossoming flowers. Summer brings warmth and sunshine, perfect for outdoor activities. Autumn sees mild temperatures and vibrant foliage, transitioning into cooler, damp weather in November. Winter arrives with cold temperatures and occasional snowfall, offering opportunities for winter sports. Throughout the year, Budapest offers a diverse range of weather experiences, from blooming springs to snowy winters, catering to a variety of preferences and activities.

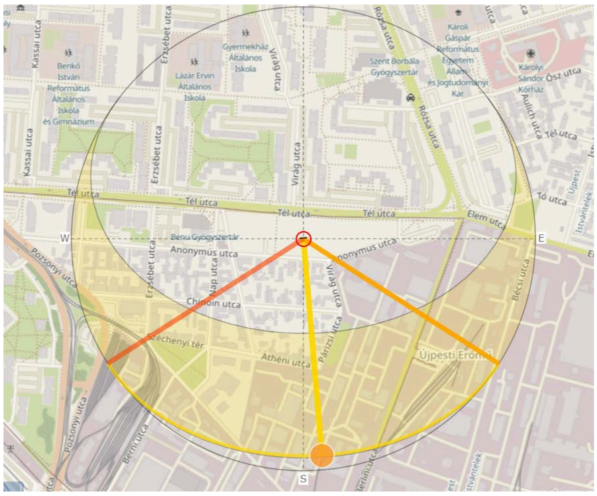
Mar Equinox:	20.03.2024 04:06 CET
Jun Solstice:	20.06.2024 22:51 CEST
Sep Equinox:	22.09.2024 14:43 CEST
Dec Solstice:	21.12.2024 10:20 CET
--- Photovoltaic ---	
Solar constant:	1359.6 W/m²
Air mass:	1.329
Irradiance:	978 W/m²

Height:	**107m**	Set Lat/Lon
Lat:	N 47°33'16.9"	**47.55470°**
Lng:	E 19°5'51.8"	**19.09772°**
UTM:	34T 356884 5268562	
TZ:	**Europe/Budapest DST CEST**	

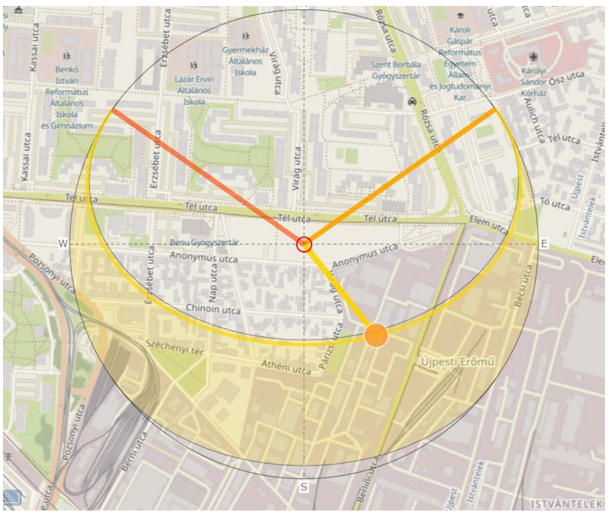
SPRING



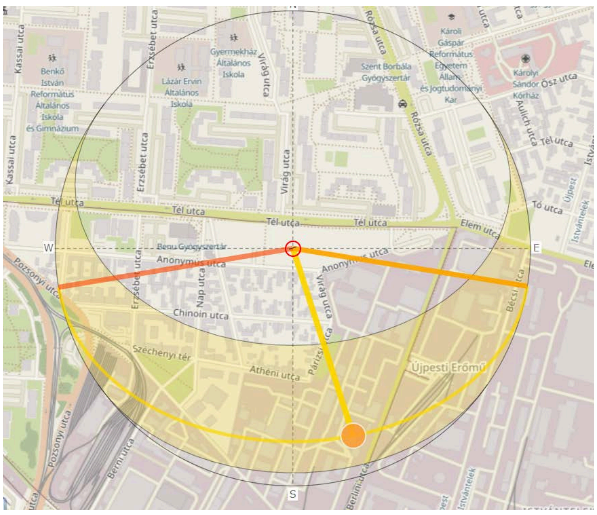
WINTER



SUMMER



FALL



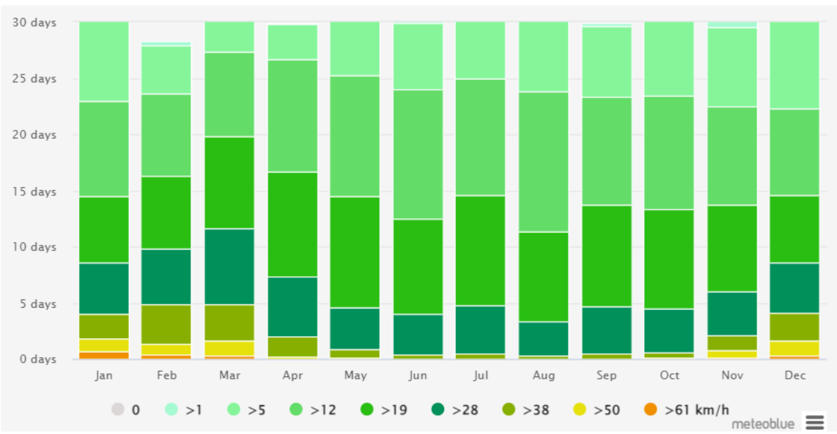
SITE ANALYSIS

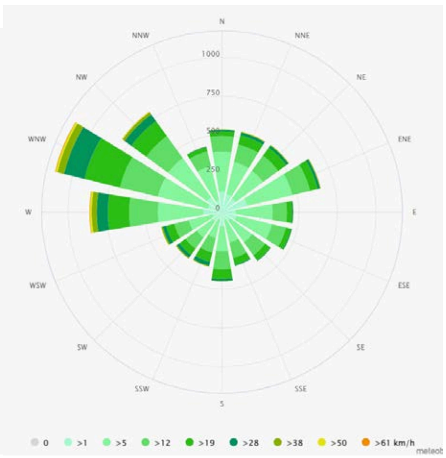
Budapest experiences a range of temperatures throughout the year, with average highs and lows in Celsius. Spring begins with cool temperatures in March, averaging around 5°C to 10°C, gradually warming up to 15°C to 20°C by May. Summer brings warmth, with average highs ranging from 25°C to 30°C in June, July, and August.

Autumn sees mild temperatures, starting around 15°C in September and cooling to 0°C to 10°C in November. Winter brings cold temperatures, with average highs between -1°C and 4°C in January and February. Overall, Budapest's climate offers a variety of temperatures suitable for different activities and preferences throughout the year.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	-0.5 °C (31.1) °F	1 °C (33.9) °F	5.7 °C (42.2) °F	11.7 °C (53.1) °F	16.4 °C (61.6) °F	20.2 °C (68.4) °F	22.1 °C (71.8) °F	21.7 °C (71.1) °F	16.7 °C (62.1) °F	11.3 °C (52.4) °F	6 °C (42.8) °F	0.6 °C (33.1) °F
Min. Temperature °C (°F)	-3.4 °C (25.8) °F	-2.8 °C (27) °F	0.9 °C (33.6) °F	6.3 °C (43.3) °F	11.1 °C (52) °F	15 °C (59.1) °F	17 °C (62.6) °F	16.6 °C (61.9) °F	12.3 °C (54.1) °F	7.4 °C (45.3) °F	3 °C (37.3) °F	-2.1 °C (28.2) °F
Max. Temperature °C (°F)	2.6 °C (36.7) °F	4.9 °C (40.9) °F	10.4 °C (50.7) °F	16.7 °C (62.1) °F	21.1 °C (70) °F	24.8 °C (76.6) °F	26.7 °C (80.1) °F	26.4 °C (79.6) °F	21.2 °C (70.1) °F	15.6 °C (60) °F	9.4 °C (48.8) °F	3.5 °C (38.3) °F
Precipitation / Rainfall mm (in)	40 (1)	38 (1)	44 (1)	50 (1)	70 (2)	72 (2)	71 (2)	59 (2)	60 (2)	54 (2)	55 (2)	48 (1)
Humidity(%)	81%	78%	70%	62%	64%	62%	61%	62%	67%	75%	82%	83%
Rainy days (d)	6	6	6	7	9	8	8	6	6	6	7	7
avg. Sun hours (hours)	4.1	5.2	7.5	10.0	11.1	12.1	12.3	11.4	8.9	6.4	4.6	3.8

WIND AND ROSE





SITE ANALYSIS - soil type

The soil type found in District IV of Budapest is primarily composed of loess. Loess is a fertile, wind-blown sedimentary deposit consisting of fine-grained particles such as silt and clay, often found in river valleys and on the plains of central Europe, including Hungary.

It is known for its high fertility, making it suitable for agriculture and supporting vegetation growth. In Budapest's District IV, loess soil plays a significant role in shaping the landscape and supporting various plant life.

Particle Size:

The particle size of loess soil typically ranges from about 0.002 to 0.05 millimeters in diameter.

Porosity:

Loess soil typically has a porosity ranging from 40% to 50%, meaning that 40% to 50% of its volume is comprised of pore spaces filled with air and water.

Strength:

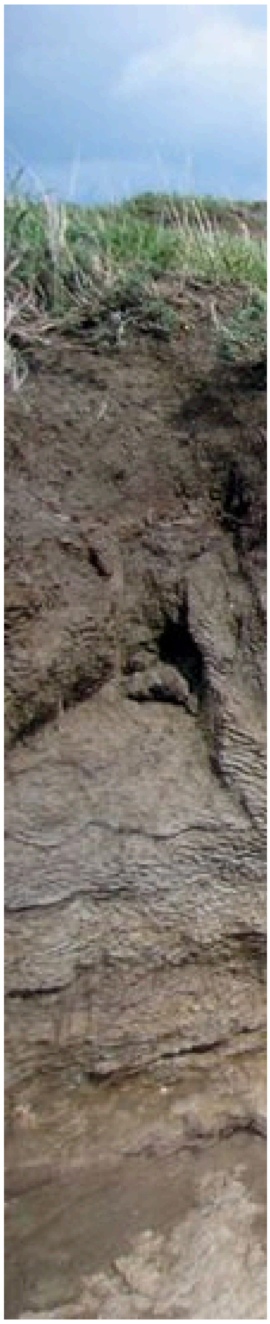
The shear strength of dry loess soil can vary widely depending on factors such as compaction, moisture content, and mineral composition. However, it's generally in the range of 50 to 200 kPa (kilopascals).

Compaction:

Loess soil can experience significant compaction under heavy loads or pressure. Its maximum dry density typically ranges from 1.3 to 1.7 g/cm^3.

Erosion Resistance:

Dry loess soil is generally resistant to wind erosion due to its cohesive nature, but it can be highly susceptible to erosion by water when wet.



BUILDING PROGRAM

The Ujpest Urban Farming and Community Center aims to unite residents through accessible gardening education and communal activities. Situated near Housing Estate buildings, the center comprises a community hub, greenhouse, and extensive vegetable beds.

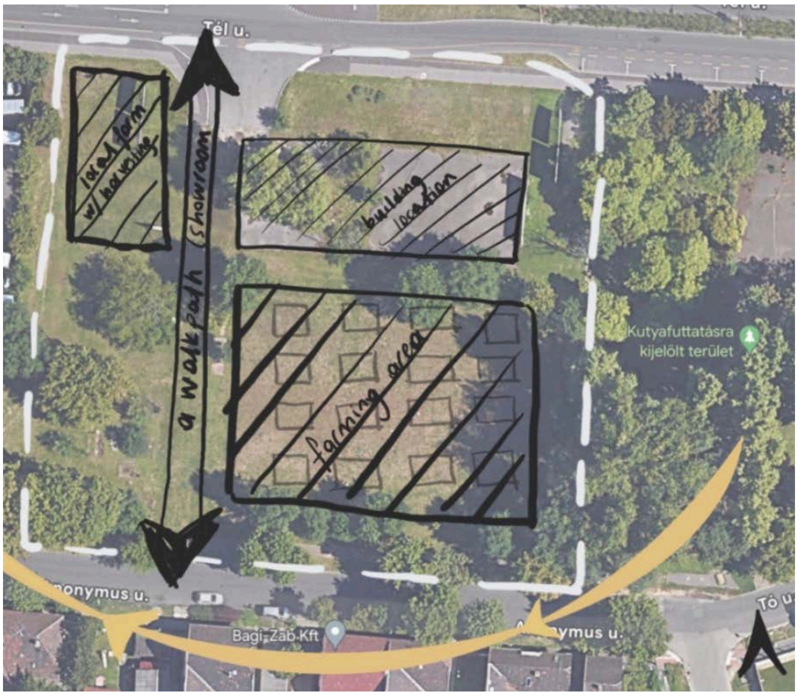
It focuses on teaching sustainable gardening, hosting workshops, and providing cooking classes to foster community bonds. Residents can engage in shared experiences, cultivating both fresh produce and a sense of connection. This comprehensive initiative strives to enhance the lives of Ujpest locals through education, socialization, and a deeper appreciation for nature.

Community Garden

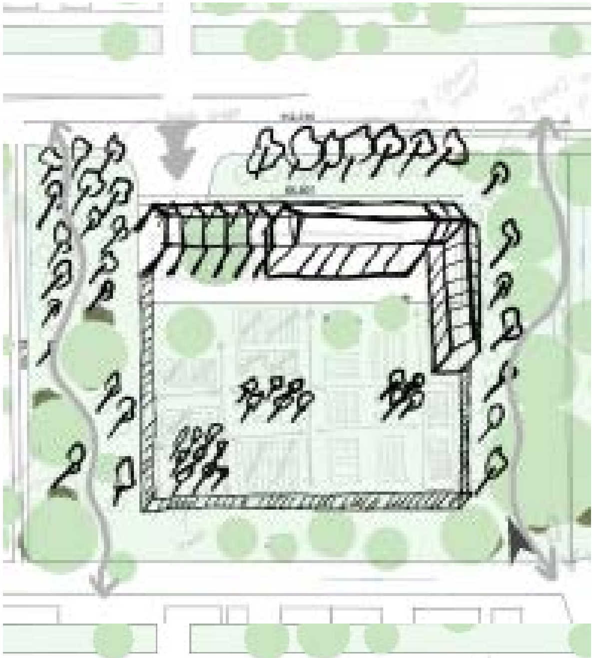
Vegetable Beds
Greenhouse

Community Center

Enterance / Lobby
Multipurpose room
Clasroom (Workshops)
Kitchen
Administrative Rooms
Office
Bathroom and Toilets

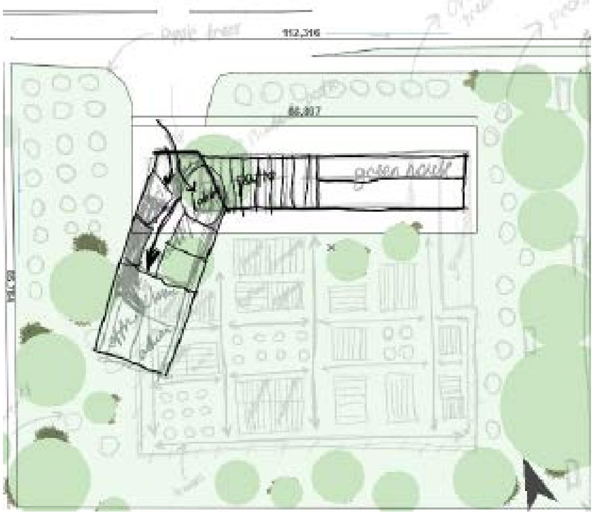


CONCEPT



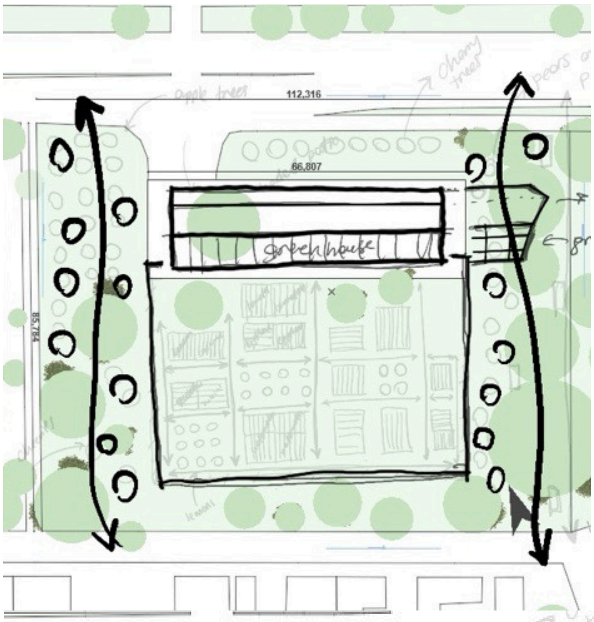
The intervention approach has the goal to maintain as much of the original site in the original state with which it was found. And that is achieved by placing the building on the already existing paved area in the site, and allowing for the remaining already green zones to correspond to the farming area.

New walk paths are supposed to go around the farming area, allowing the visitors to explore the site and access the main building through Anonymus utca on the south portion of the site.



Greenhouse placement is placed next to the main building in order to increase the sun driven on the greenhouse. And the main building will be able to use the gained heat. And it will act like a buffer zone.

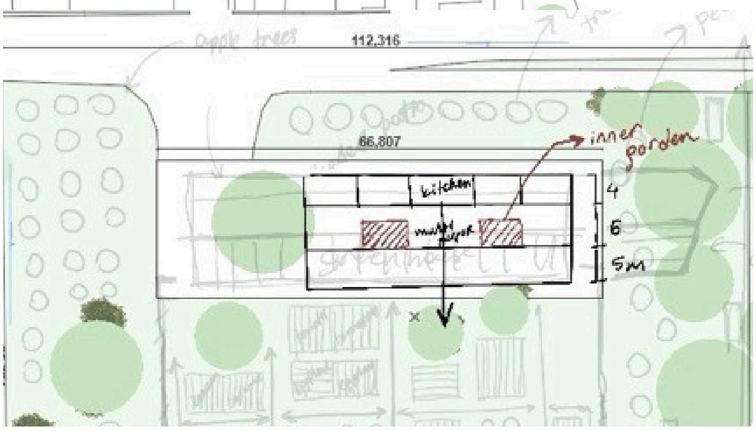
The main material used for its construction will be wood. As an attempt to comunicate the closer contact with the nature and successfully provide this feeling in such an urban environment.



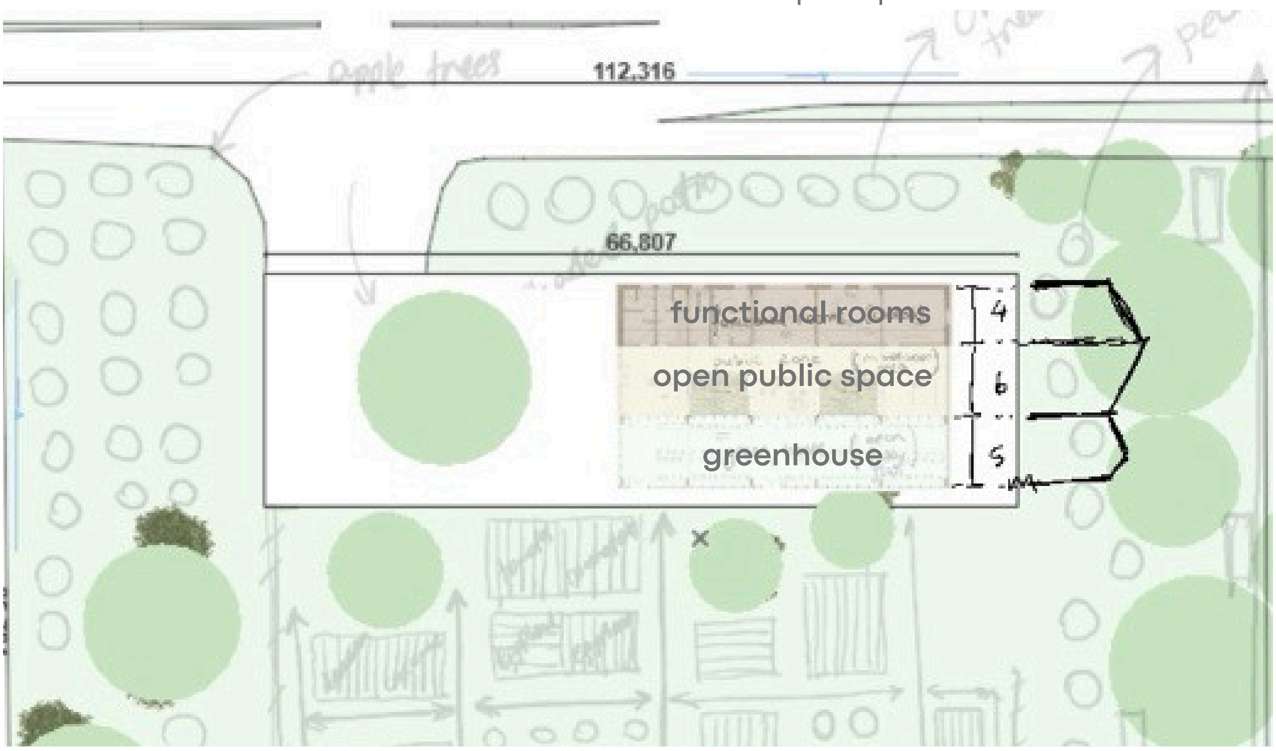
After trying different placement of greenhouse, The Greenhouse is placed next to the main building in order to use the heat gain on the greenhouse on the main building too.

And by placing the greenhouse facing fully south, it has been allowed the greenhouse to take sun all day long.

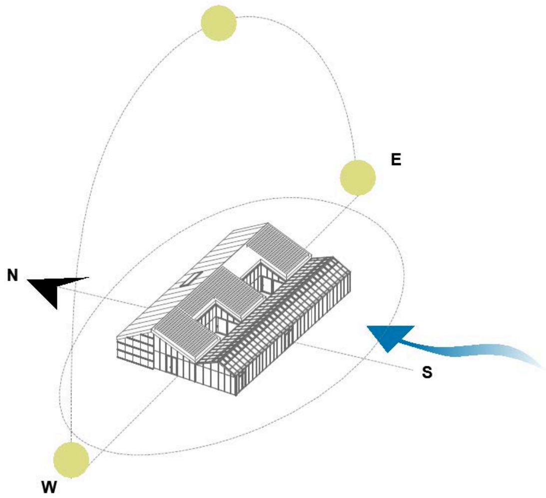
Two path was placed on the sides of the building in order to invite people walk by the garden and take interest by them.



The main building has 3 strong aisle, first is the functional; is fully close with timber wall and placed on the north side. The one in the middle is open public zone which has glazed facade and 2 gardens inside separeting the spaces.Third one is the greenhouse which is fully glazed open space.



SUSTAINABLE BUILDING DESIGN



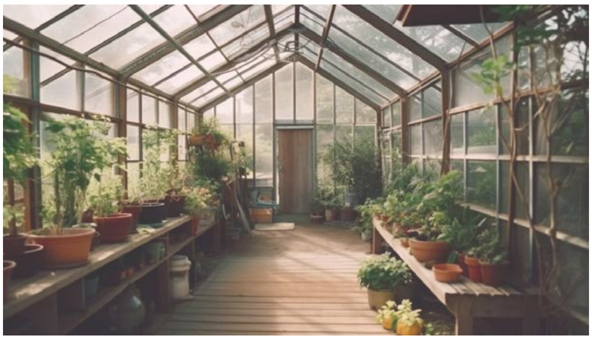
A communal garden greenhouse in Újpest, Budapest exemplifies sustainable design through its multiple environmental, social, and economic benefits. Firstly, the greenhouse promotes local food production, reducing the carbon footprint associated with transporting produce from distant locations. This aligns with the principles of sustainability by lowering greenhouse gas emissions and fostering food security within the community.

The choice of materials for the construction, particularly the use of wood, aligns with sustainable design principles. Wood is a renewable resource that, when sourced responsibly from certified forests, has a lower environmental impact compared to conventional building materials like concrete and steel. Its use in construction reduces the carbon footprint of the project, as wood acts as a carbon sink, storing carbon dioxide throughout its lifespan.

Additionally, wood provides excellent thermal insulation, enhancing the energy efficiency of the greenhouse by maintaining optimal temperatures with minimal energy consumption. The natural aesthetic of wood also blends harmoniously with the garden setting, creating a warm and inviting space for community members. By prioritizing sustainable materials like wood, the greenhouse not only minimizes environmental impact but also fosters a connection to nature, promoting a holistic approach to sustainability.

The design of the greenhouse incorporates energy-efficient technologies, such as passive solar heating and natural ventilation, which minimize the need for artificial heating and cooling. This reduces energy consumption and operational costs, contributing to the greenhouse's sustainability.

Additionally, the greenhouse utilizes rainwater harvesting systems to irrigate the plants, thereby conserving water and reducing reliance on municipal water supplies. The use of organic growing practices within the greenhouse further enhances its environmental sustainability by eliminating the need for chemical fertilizers and pesticides, which can harm local ecosystems.



MATERIAL CHOICES

Hemp fiber is a sustainable choice for facade cladding due to its low environmental impact during cultivation, including minimal pesticide use and low water requirements. It sequesters carbon, improves soil health, and is durable and strong, offering excellent thermal insulation and breathability. Economically, hemp is cost-effective, supports local agriculture, and reduces transportation emissions. Its natural aesthetic, versatility in design, biodegradability, and recyclability further contribute to its sustainability, making it an eco-friendly and efficient option for building facades.

The high cellulose content (60 - 70%) of the plant makes it a very strong and durable material.

The sheet is bound with a sugar based resin made entirely from agricultural waste.
Our hemp sheets are a natural alternative to corrugated steel, PVC, bitumen and cement.

The sheets can be used externally to form a rain screen or internally as ceiling or wall linings or other acoustic treatments. The product is natural and like timber exposed to UV the colour will lighten over time.

Building with Cross-Laminated Timber (CLT) is a sustainable choice due to its use of renewable wood, which sequesters carbon and reduces greenhouse gas levels. CLT panels offer excellent thermal insulation, enhancing energy efficiency by lowering heating and cooling needs.

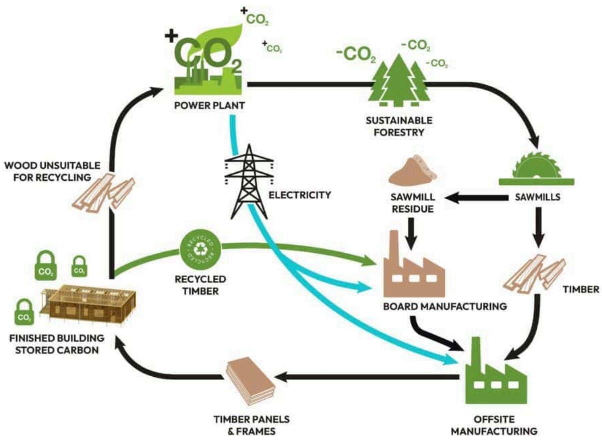
CLT construction is efficient, reducing building time and material waste, while supporting sustainable forestry practices. These factors collectively contribute to a lower environmental impact and promote eco-friendly building solutions.

talk about co2 emission

Compare it with brick and concrete

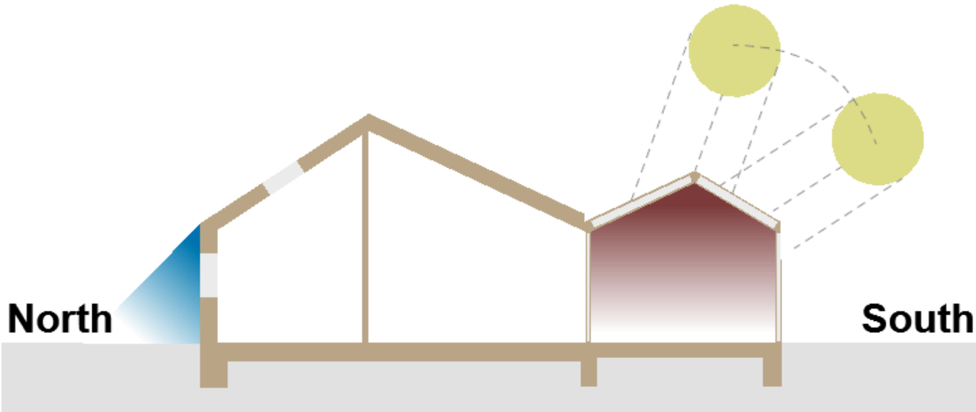
talk about co2 emission

Compare it with brick and concrete



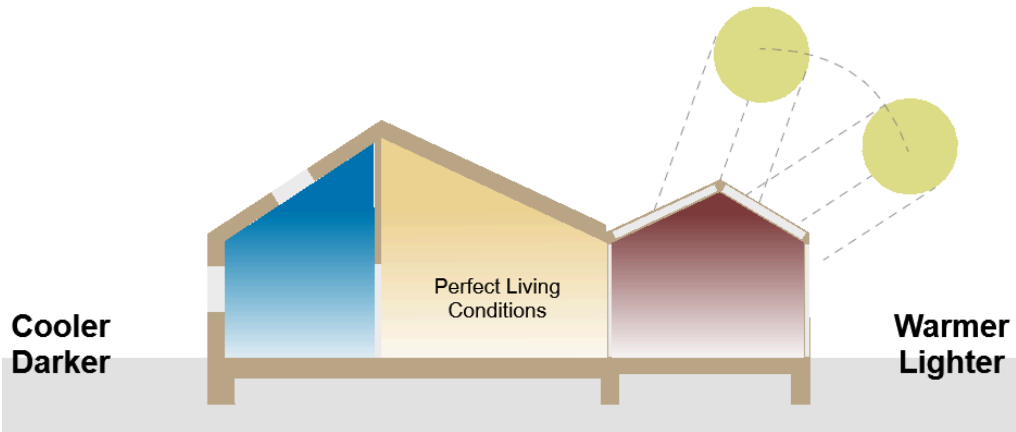
PASSIVE HOUSE EFFECT

The design of the greenhouse incorporates energy-efficient technologies, such as passive solar heating and natural ventilation, which minimize the need for artificial heating and cooling. This reduces energy consumption and operational costs, contributing to the greenhouse's sustainability.



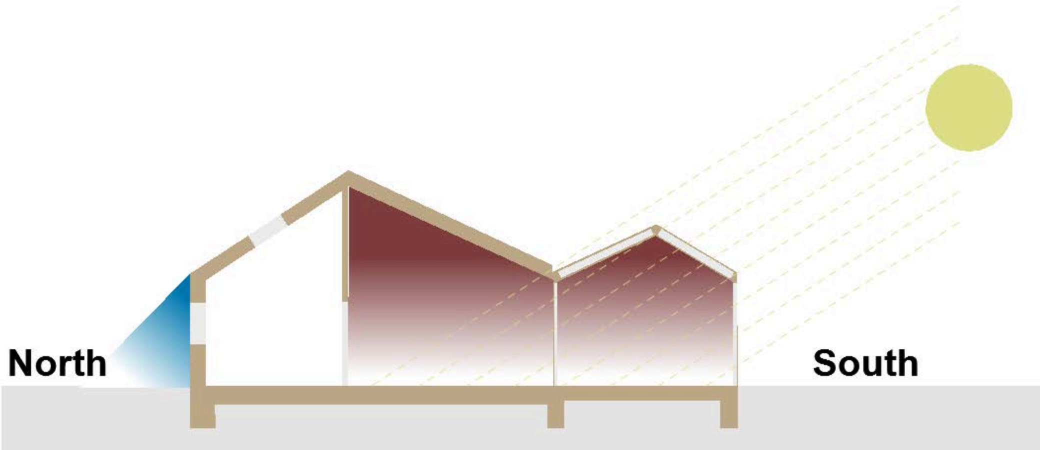
MICROCLIMATES

Core living and daytime spaces are buffered from unwanted heat gain or heat loss. Functions needing more daylight and warmth (living, dining, cooking, study) are grouped and zoned towards the natural daylight and warmer southern side. Functions needing less light and warmth (changingrooms, storages, toilets) are grouped and zoned toward the darker and cooler northern side.



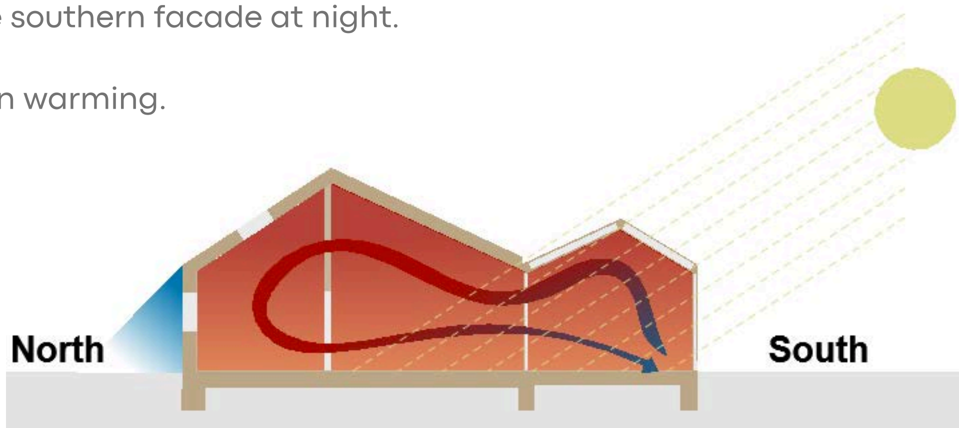
PASSIVE HOUSE EFFECT

The glasshouse acts as a climate machine for sun-driven ventilation, warming and cooling

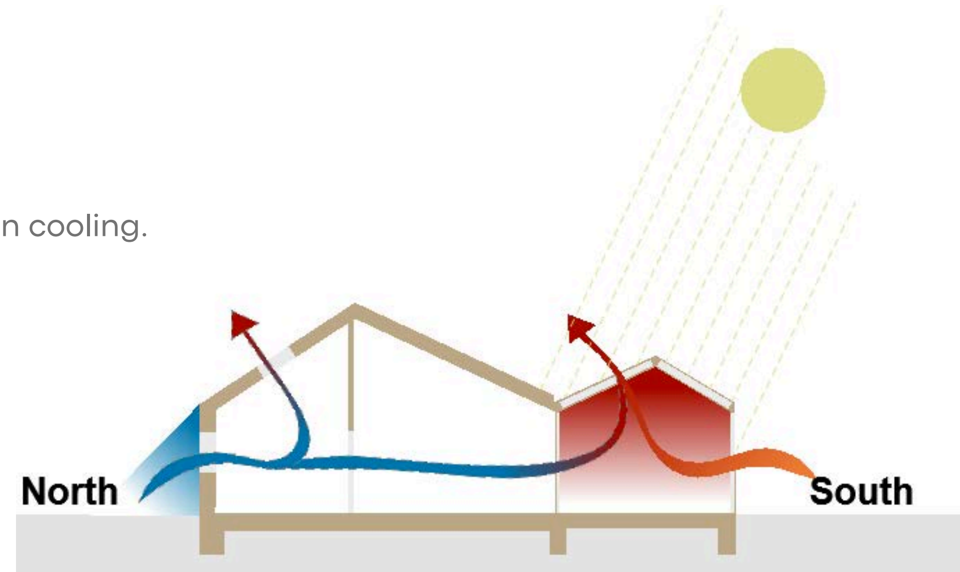


The glasshouse reduces heat loss from the main house as windows are protected from cooling wind and rain. This increases the insulation value of the southern facade by an additional ratio of 0.2. Combined with individually managed internal thermal curtains, the two layers add an additional ratio of 2, giving a total ratio of 4.2 for the southern facade at night.

Sun-driven warming.



Sun-driven cooling.



RENEWABE ENERGY INTEGRATION

As previously mentioned the communal garden design integrates renewable energy technologies as well. The buildings roof is going to count with 64 PV panels which will be installed in 77 square meters of roof space facing south.

E renewable= 0.25*91.800= 22.950 Wh/m²a
Amount of panels required= 22.950/360= 63,75 PV Panels
Panel size: 80*150 cm (1,2m²)

Roof space required: 64*1,2= 77m²

The building will also feature solar tube heating system showcasing an innovative and environmentally conscious approach to fulfilling the hot water needs of its visitors and occupants.

Solar tubes, crafted with rows of glass tubes containing a substance adept at absorbing solar energy, form the backbone of this system. These tubes efficiently capture sunlight and convert it into heat, which is then conveyed to a heat exchanger or storage tank holding water.

This heated water is subsequently circulated throughout the community center's plumbing network, providing a reliable supply of hot water for various purposes. The use of solar tube heating ensures high efficiency and dependable performance, even during periods of low sunlight or cooler weather conditions, aligning seamlessly with the community center's dedication to sustainability and overall well-being.

Using PV panels and solar heating makes the communal garden building super energy efficient by harnessing renewable energy from the sun to meet its electricity and heating needs. PV panels convert sunlight into electricity, reducing reliance on non-renewable energy sources and lowering utility costs. Solar heating systems capture and utilize solar energy to heat the greenhouse, maintaining optimal growing conditions with minimal energy input.

This integration of solar technologies significantly cuts down on fossil fuel consumption, decreases greenhouse gas emissions, and supports a sustainable, self-sufficient energy model for the building.

Classification classes	Ratio [%]	Classifications
A+	< 55	Very energy efficient
A	56 - 75	Energy efficient
B	76 - 95	Better than requirement
C	**96 - 100**	**According to requirement**
D	101 - 120	Close to requirement
E	121 - 150	Better than average
F	151 - 190	Average
G	191 - 250	Close to average
H	251 - 340	Weak
I	341 >	Bad

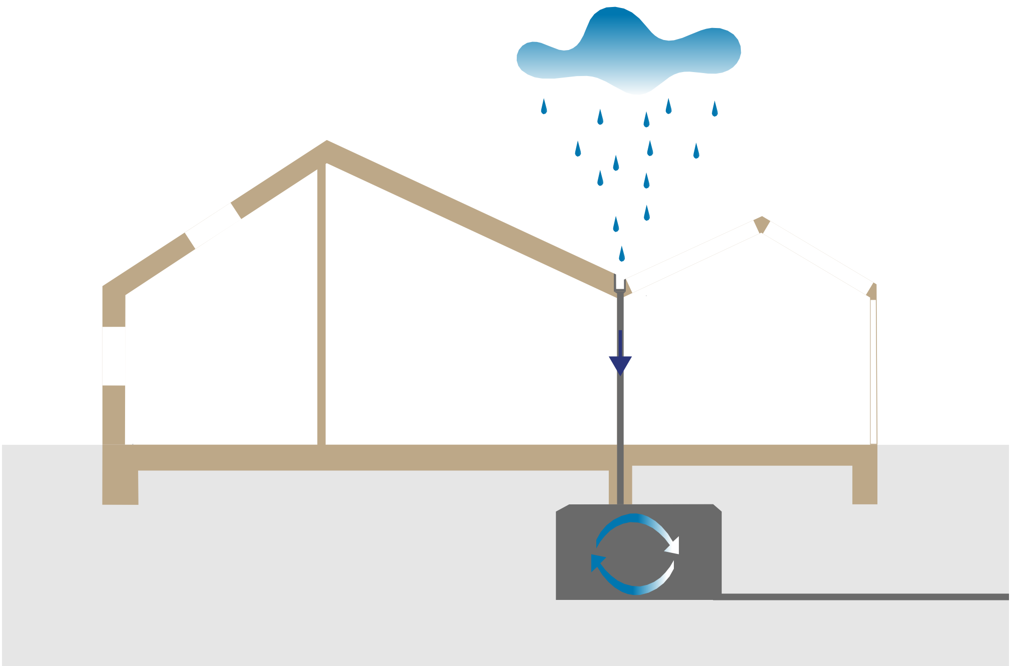
Building Energy Performance classification

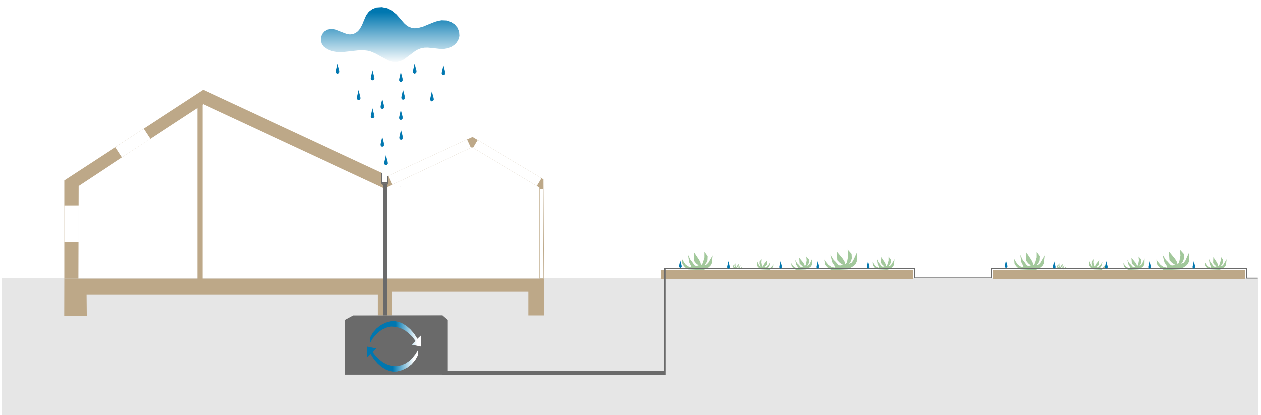
RAINWATER HARVESTING

A water harvesting system is highly relevant in a communal garden greenhouse building because it promotes sustainable water use by capturing and storing rainwater for irrigation and other needs. This system reduces dependence on municipal water supplies, conserving valuable freshwater resources and lowering water costs.

By utilizing harvested rainwater, the greenhouse can maintain consistent watering schedules for plants, ensuring optimal growth and productivity even during dry periods. Water harvesting helps manage stormwater runoff, reducing the risk of flooding and soil erosion on the site. Overall, it enhances the building's sustainability by efficiently managing water resources and supporting eco-friendly gardening practices.

The water will be harvested throught the building's main gutter and directed downwards through the pipe systems into a submerged water collecting tank.





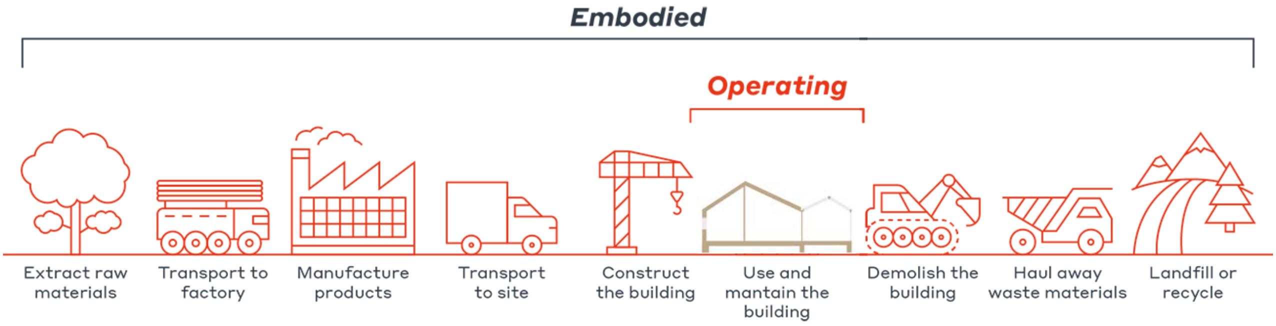
Furthemore a water-efficient irrigation system will be integrated into the communal garden greenhouse, for it is essential for sustainable water management and optimal plant growth. Such systems, like drip irrigation or automated sprinkler systems with moisture sensors, deliver water directly to the plant roots with minimal waste. This precision reduces water consumption by ensuring that plants receive the exact amount of water they need, avoiding overwatering and evaporation losses.

By using drip irrigation, water is slowly released directly to the soil, promoting deep root growth and reducing surface runoff. Automated systems with moisture sensors can adjust watering schedules based on real-time soil moisture levels and weather conditions, further enhancing efficiency. This not only conserves water but also improves plant health and yields.

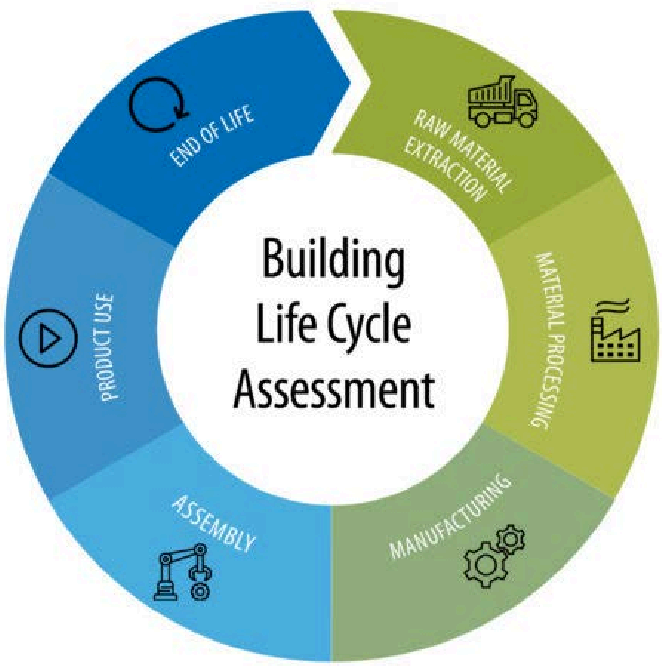
Incorporating these advanced irrigation techniques supports the greenhouse's sustainability goals by maximizing water use efficiency, lowering operational costs, and contributing to a more resilient and productive gardening environment.

BUILDING LIFE CYCLE ASSESSMENT

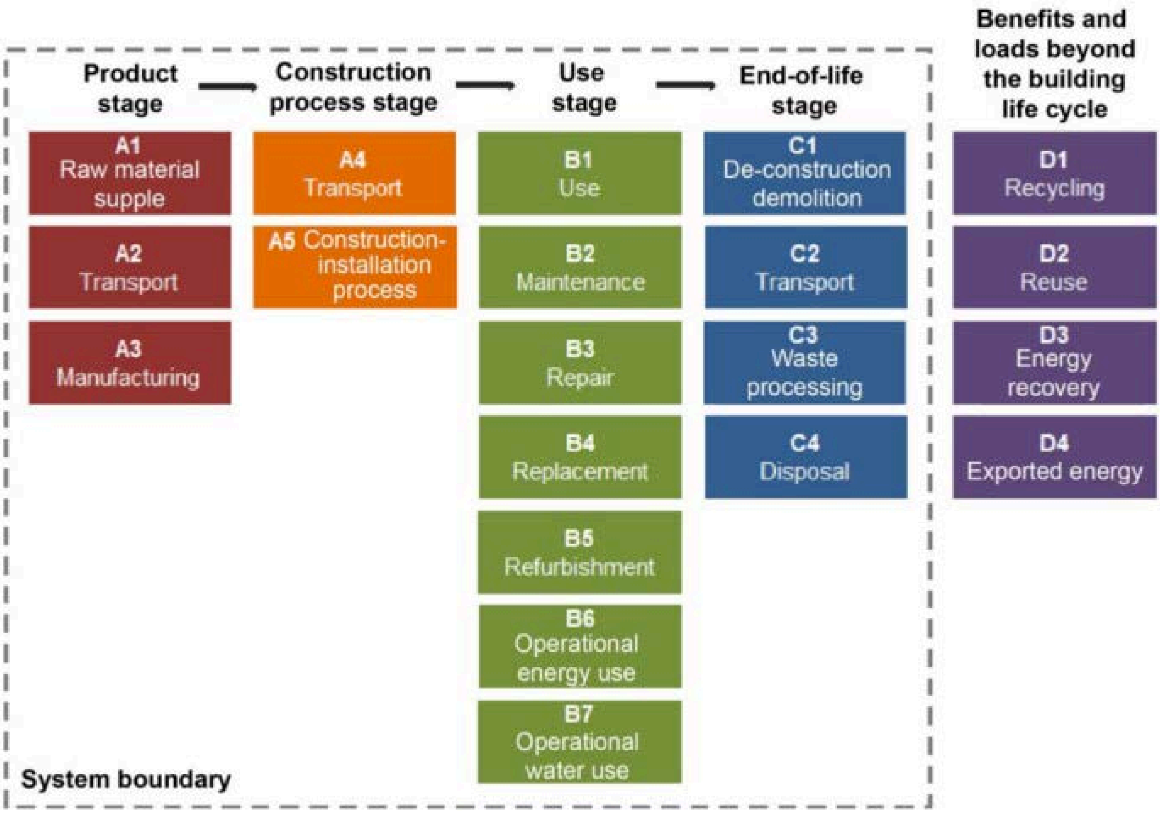
Life cycle assessment (LCA) is a systematic way of compiling and analyzing all the inputs, outputs, and potential environmental impacts of a product or system over its lifetime, from initial extraction of raw materials through manufacture, distribution, use, and final disposal. In the context of buildings, LCA can be used to evaluate a single product—like a 2×4, an engineered wood beam, or a mass timber floor panel. It can also be used to analyze an entire building system by compiling data from all the individual building components. This is referred to as Whole Building Life Cycle Assessment (WBLCA) to differentiate it from assessments focused on individual products or building components. WBLCA has emerged as an effective way to measure embodied carbon and other environmental impact measures associated with buildings at a holistic level.



Building phases can be classified into several stages (Fig. 2) based on the process involved, including the product and construction (P&C) stage, operational stage, End of life (EoL) stage and supplementary information beyond building life cycle (Benefits) stages.



- Production Stage: Modules A1-A3
- A1 starts with raw material extraction or harvest; A2 is the transportation of those raw materials to the factory or mill; and A3 is manufacturing of the product itself. Together, these modules are often referred to as "cradle-to-gate."
- Construction Stage: Modules A4-A5
- A4 is transportation of the product to the construction site; A5 is installation and/or the construction process.
- Use Stage: Modules B1-B7
- These modules include maintenance, repair, replacement, and refurbishment, as well as operational water and energy use for the duration of the building's life.
- End-of-Life Stage: Modules C1-C4
- C1 includes deconstruction and/or demolition; C2 is transportation of waste to the disposal or processing site; C3 is waste processing; and C4 is the final disposal of that waste.

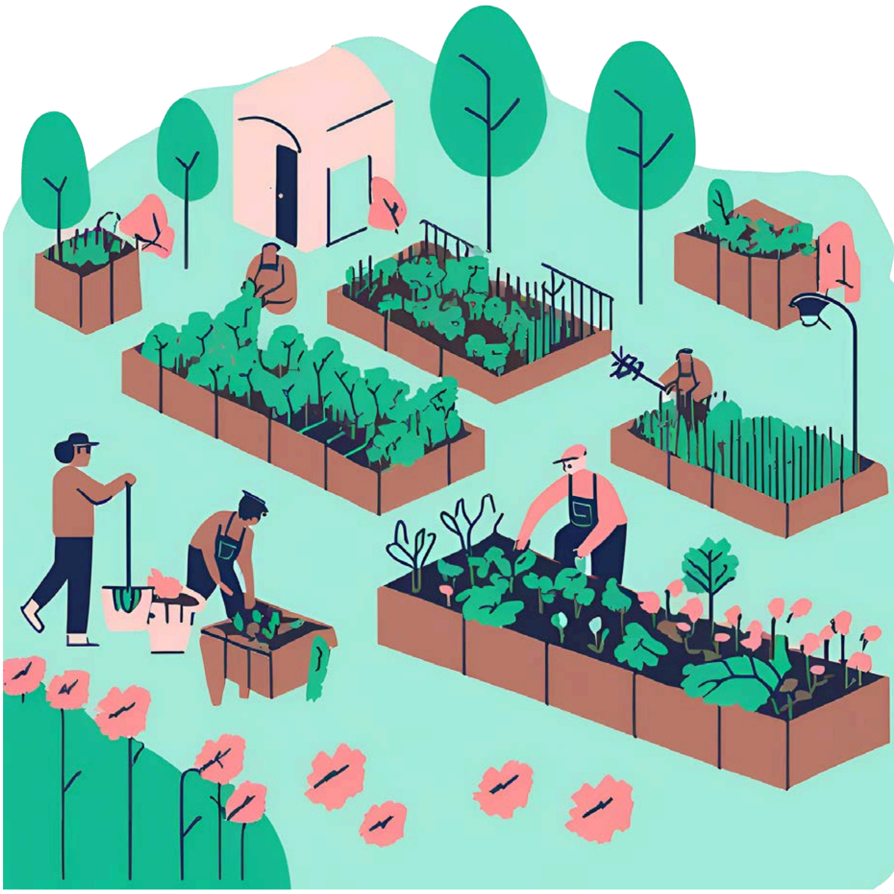


SOCIAL AND ECONOMICAL ASPECTS

Socially, the communal garden greenhouse fosters community engagement and education. It serves as a gathering place for residents, encouraging social interaction and collaboration. Educational programs and workshops on sustainable gardening practices can be held in the greenhouse, raising awareness and promoting environmental stewardship among the local population.

Economically, the greenhouse supports local economies by providing fresh produce that can be sold at local markets or directly to residents, keeping money within the community and supporting local farmers and gardeners.

In summary, the communal garden greenhouse in Újpest, Budapest, aligns with sustainable design by promoting local food production, utilizing energy-efficient and water-conserving technologies, fostering community engagement, and supporting the local economy.



URBAN AGRICULTURE

Community engagement and education will be central to the success and sustainability of the communal garden greenhouse in Újpest, Budapest. This facility acts as a vibrant community hub, fostering social interaction, collaboration, and a shared sense of purpose among residents. By providing a communal space where people can come together to grow food, share knowledge, and work on common projects, the greenhouse strengthens community bonds and encourages collective stewardship of local resources.

Educational programs and workshops are a vital part of this project. These activities can cover a wide range of topics, including sustainable gardening practices, composting, rainwater harvesting, and energy efficiency. By offering hands-on learning experiences, the greenhouse empowers community members with the skills and knowledge needed to adopt more sustainable lifestyles. Workshops can be tailored for different age groups and skill levels, ensuring accessibility and inclusivity.

School groups can visit the greenhouse to learn about biology, ecology, and the importance of sustainability in a practical setting, enhancing their environmental education. Additionally, adult education programs can focus on advanced gardening techniques, sustainable living practices, and even small-scale entrepreneurship for those interested in selling their produce.

Community events such as harvest festivals, plant swaps, and volunteer days further enhance engagement by providing opportunities for socializing and celebrating collective achievements. These events can also help raise awareness about the benefits of sustainable living and inspire more people to get involved.

Overall, the communal garden greenhouse serves as a dynamic platform for community engagement and education, promoting environmental awareness, enhancing social cohesion, and building a resilient, knowledgeable, and connected community.