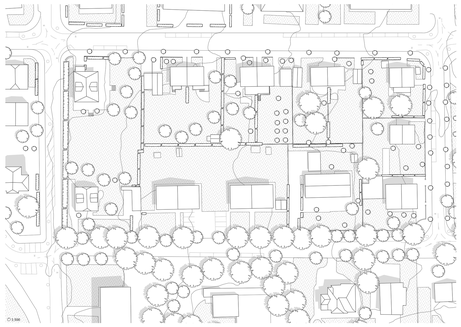

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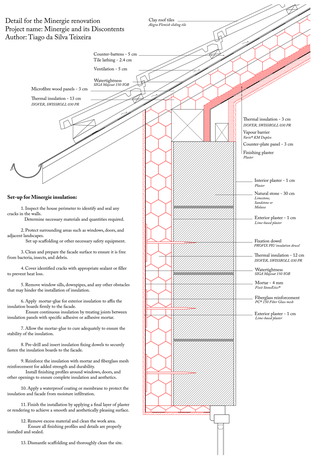
Detail for the Minergie renovation
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira



Set-up for Minergie insulation:

1. Inspect the house perimeter to identify and seal any cracks in the walls.
Determine necessary materials and quantities required.

2. Protect surrounding areas such as windows, doors, and adjacent landscapes.
Set up scaffolding or other necessary safety equipment.

3. Clean and prepare the facade surface to ensure it is free from bacteria, insects, and debris.

4. Cover identified cracks with appropriate sealant or filler to prevent heat loss.

5. Remove window sills, downspipes, and any other obstacles that may hinder the installation of insulation.

6. Apply mortar-glue for exterior insulation to affix the insulation boards firmly to the facade.
Ensure continuous insulation by treating joints between insulation panels with specific adhesive or adhesive mortar.

7. Allow the mortar-glue to cure adequately to ensure the stability of the insulation.

8. Pre-drill and insert insulation fixing dowels to securely fasten the insulation boards to the facade.

9. Reinforce the insulation with mortar and fiberglass mesh reinforcement for added strength and durability.
Install finishing profiles around windows, doors, and other openings to ensure complete insulation and aesthetics.

10. Apply a waterproof coating or sunshroom to protect the insulation and facade from moisture infiltration.

11. Finish the installation by applying a final layer of plaster or rendering to achieve a smooth and aesthetically pleasing surface.

12. Remove excess material and clean the work area.
Install all finishing profiles and details on properly installed and sealed.

13. Dismantle scaffolding and thoroughly clean the site.

Summary
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira

Minergie, is a label for low-energy buildings, emphasizing comfort and energy efficiency. Yet, its certification overlooks environmental impacts of materials, raising sustainability questions.

Phase one aims for Minergie certification while evaluating material harm. Phase two proposes innovative approaches like enclosing houses in greenhouses and prioritizing local materials and green spaces.

This dual strategy sparks discussions on eco-label sustainability and offers a model for sustainable architectural renovation.

Title: Minergie and its Discontents

Subtitle: Innovative Strategies for Sustainable Building Renovation Beyond Labels

Author: Tiago da Silva Teixeira

Why should we renovate?
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira

1. The Paris Agreements:

The Paris Agreement aims to reduce worldwide greenhouse gas emissions, with the primary goal of keeping global warming well below 2 degrees Celsius above pre-industrial levels, and preferably limiting it to 1.5 degrees Celsius. Countries are expected to regularly review and update their commitments every five years.

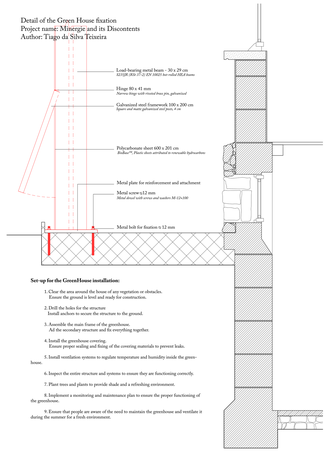
2. Energy efficiency:

Buildings from the 1950s are often poorly insulated, resulting in heat loss in winter and heat gain in summer. Therefore, improving energy efficiency reduces heating and cooling costs, offering long-term financial savings for homeowners.

3. Comfort and quality of life:

Better « insulation » and modern heating and systems enhance occupant comfort.

Detail of the Green House fixation
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira



Set-up for the GreenHouse installation:

1. Clear the area around the house of any vegetation or obstacles.
Ensure the ground is level and ready for construction.

2. Drill the holes for the structure.
Install anchors to secure the structure to the ground.

3. Assemble the main frame of the greenhouse.
Ad the secondary structure and fix everything together.

4. Install the greenhouse covering.
Ensure proper sealing and fixing of the covering materials to prevent leaks.

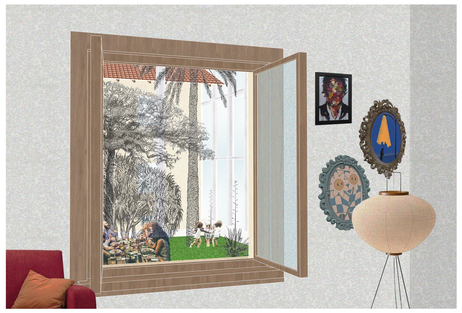
5. Install ventilation systems to regulate temperature and humidity inside the greenhouse.

6. Inspect the entire structure and systems to ensure they are functioning correctly.

7. Plant trees and plants to provide shade and a refreshing environment.

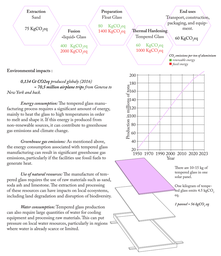
8. Implement a monitoring and maintenance plan to ensure the proper functioning of the greenhouse.

9. Ensure that people are aware of the need to maintain the greenhouse and ventilate it during the summer for a fresh environment.



Tempered Glass

Density : 2500 kg/m³
Compressive strength : until 1000 MPa
Tensile strength : 45 - 90 MPa
Thermal conductivity : 0.8 w/mK



Environmental impacts :

0,134 Gt CO2eq produced globaly (2016)
= 58,5 million airplane trips from Geneva to New York and back

Energy consumption The tempered glass manufacturing process requires a significant amount of energy, mainly to heat the glass to high temperatures in order to melt and shape it. The energy consumption produced from non-renewable sources, it can contribute to greenhouse gas emissions and climate change.

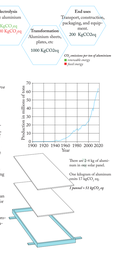
Greenhouse gas emissions As mentioned above, the energy consumption in the tempered glass manufacturing can result in significant greenhouse gas emissions, particularly if the facilities use fossil fuels to generate heat.

Use of natural resources The manufacture of tempered glass requires the use of raw materials such as sand, soda ash and limestone. The extraction and processing of these natural resources can have environmental impacts, including land degradation and disruption of biodiversity.

Water consumption Tempered glass production can also require large quantities of water for cooling purposes and other processes. The extraction of water can put pressure on local water resources, particularly in regions where water is already scarce or limited.

Aluminium (Al)

Density : 2700 kg/m³
Compressive strength : 200 - 250 MPa
Tensile strength : 70 - 700 MPa
Thermal conductivity : 273 w/mK



Environmental impacts :

1,3 Gt of CO2eq produced globaly
= 378,5 million airplane trips from Geneva to New York and back

Deforestation The areas where aluminum is mined can be subject to deforestation, as forests often have to be cleared to gain access to extraction sites.

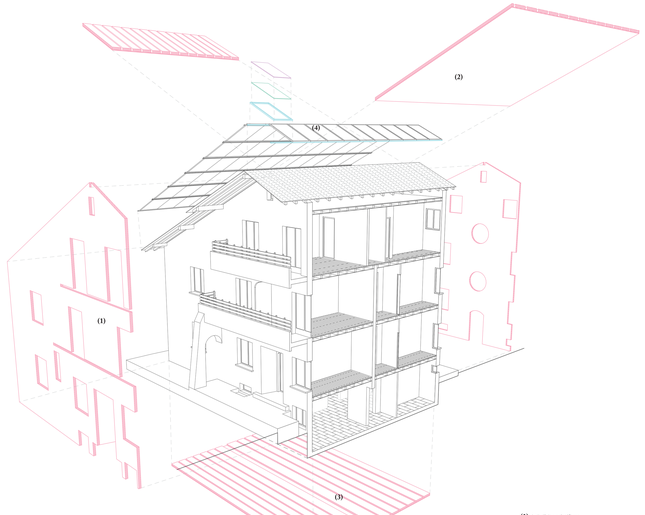
Greenhouse gas emissions The process of extracting aluminum, in particular by electrolysis of alumina, consumes a great deal of energy, mainly in the form of electricity. If this electricity is generated from non-renewable sources, this can result in significant greenhouse gas emissions, contributing to climate change.

Water and soil pollution Mining and extraction activities can contaminate groundwater and surrounding soils with chemicals used in the extraction process or released naturally from excavated minerals.

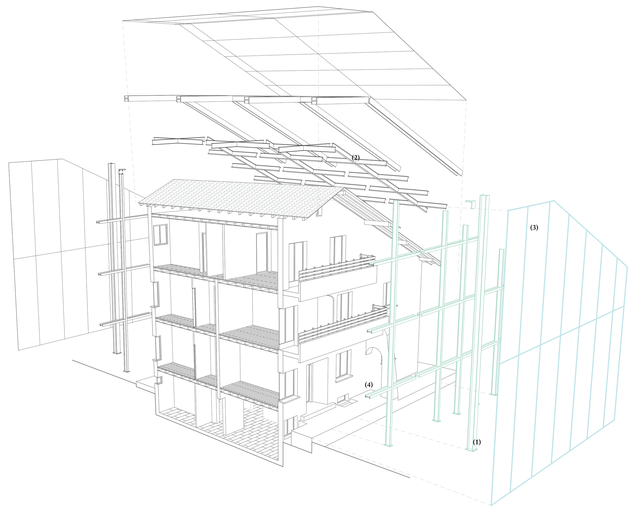
Destruction of ecosystems Aluminium mining can disrupt local ecosystems and destroy natural habitats for plants and animals.

Water consumption The aluminum extraction process requires large quantities of water for various operations, such as cooling equipment or transporting ores.

Exploded AXO of the Minergie renovation
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira

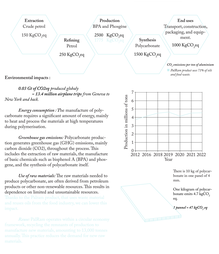


Exploded AXO of the Green House renovation
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira



Bio-Base cellular polycarbonate sheets

Density : 1300 kg/m³
Compressive strength : 65 - 80 MPa
Tensile strength : 55 - 75 MPa
Thermal conductivity : 0,20 w/mK



Bio-Base Sheets are made of 100% recyclable thermoplastic, ensuring sustainability and adaptability for various applications. Its lightweight nature and high durability make it ideal for construction, automotive, and manufacturing industries, while its recyclability supports environmental sustainability initiatives.

Galvanised Steel

Density : 7900 kg/m³
Compressive strength : 370 - 700 MPa
Tensile strength : 400 - 850 MPa
Thermal conductivity : 45 - 58 w/mK

Environmental impacts :

0,32 Gt of CO2eq produced globaly
= 160 million airplane trips from Geneva to New York and back

Iron ore mining The creation of iron ore mines often involves deforestation and disturbance of natural habitat. Extraction and transportation of iron generates dust that can affect air quality and the health of local communities.

Coal mining (for coke production) Coal contains methane, a powerful greenhouse gas, which is released during mining. Mining can cause landslides and degradation of surrounding land.

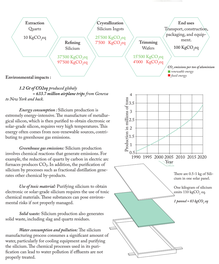
Greenhouse gas emissions The process of extracting iron ore and producing steel can emit greenhouse gases, in the form of electricity. If this electricity is generated from non-renewable sources, this can result in significant greenhouse gas emissions, contributing to climate change.

Water and soil pollution Mining and extraction activities can contaminate groundwater and surrounding soils with chemicals used in the extraction process or released naturally from excavated minerals.

By repurposing steel sourced from demolition sites, still in good condition for building the greenhouse, we can significantly reduce CO2 and other greenhouse gas emissions, while minimizing the environmental impact typically associated with extraction.

Silicium (Si)

Density : 2330 kg/m³
Compressive strength : 115 MPa
Tensile strength : 170 MPa
Thermal conductivity : 149 w/mK



Environmental impacts :

1,2 Gt of CO2eq produced globaly
= 633,7 million airplane trips from Geneva to New York and back

Energy consumption Silicium production is extremely energy-intensive. The manufacture of metallurgical silicon, which is then purified to obtain electronic or solar-grade silicon, requires very high temperatures. This energy consumption can come from non-renewable sources, contributing to greenhouse gas emissions.

Greenhouse gas emissions Silicium production involves chemical reactions that generate emissions. For example, the reduction of quartz by carbon in electric arc furnaces produces CO_2. In addition, the purification of silicium by processes such as fractional distillation generates other chemical by-products.

Use of toxic materials Purifying silicium to obtain electronic or solar-grade silicium requires the use of toxic chemical materials. These substances can pose environmental risks if not properly managed.

Solid waste Silicium production also generates solid waste, including slag and quartz residues.

Water consumption and pollution The silicium manufacturing process consumes a significant amount of water, particularly for cooling equipment and purifying the silicium. The chemical processes used in its purification can lead to water pollution if effluents are not properly treated.

Fiber Glass Wool Insulation

Density : 2000 kg/m³
Compressive strength : 100 - 300 MPa
Tensile strength : 200 - 400 MPa
Thermal conductivity : 0,035 w/mK

Environmental impacts :

0,011 Gt of CO2eq produced globaly
= 4,4 million airplane trips from Geneva to New York and back

Energy consumption Melting sand and other components to produce glass requires very high temperatures, typically achieved by burning fossil fuels, which contributes to significant CO_2 emissions and therefore to climate change.

Greenhouse gas emissions In addition to CO_2, glass production can also emit other greenhouse gas pollutants, including nitrogen oxides (NO_x), sulfur oxides (SO_x) and fine particles, which can contribute to air pollution and have adverse effects on human health and the environment.

Use of chemicals Binders and treatment agents are often used in the production of glass wool to improve its mechanical and fire resistance properties. Some of these chemicals can be toxic and pose risks to the environment and human health if not handled properly.

Life cycle and recyclability Although glass wool has a long lifespan, its recycling can be complex. Glass wool recycling rate can be low. Recycling challenges include separation of composite materials and contamination by impurities.

Extraction of raw materials The main raw material for glass wool is sand, a natural resource which, when extracted in large quantities, can cause ecological disruption, including habitat destruction and soil erosion.

+++ 12.07.2024 +++
CO^2 accountability
Minergie and its Discontents
Tiago da Silva Teixeira

	$KgCO^2eq$
Solar pannels	**47600**
Aluminium frame (40 panels) x 51	*12240*
Tempered glass cover (40 panels) x 16	*12640*
Photovoltaic silicium units (40 panels) x 61	*19720*
Insulation mats	**31928**
Wall insulation (100 mats) x 11	*17472*
Ceiling insulation (12 mats) x 12	*4401,42*
Basement insulation (60 mats) x 12	*5962,58*
Sealing membrane	**2820,93**
Roof sealing 402,12 kg x 5,86	
Facade plaster	**4213,44**
Facade plaster 1040 m² x 4,14	
TOTAL	**84'562,37**

Thank you for your sustainable design choices

+++ MINERGIE except +++

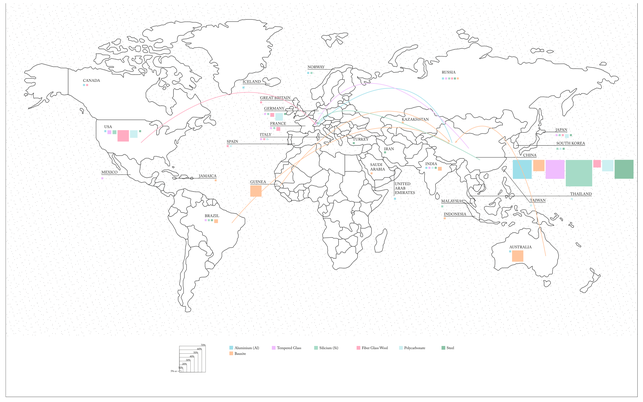
Supplement for Minergie axonometry
Minergie and its Discontents
Tiago da Silva Teixeira

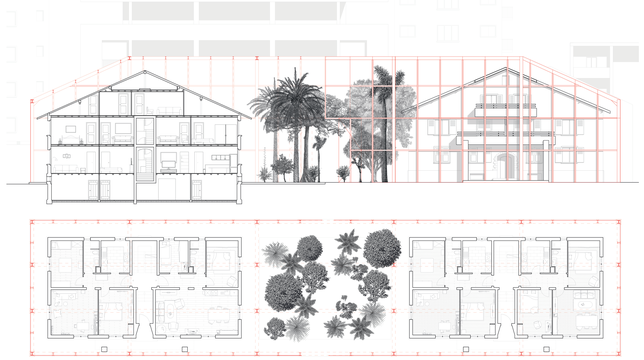
During my initial visits to these houses to speak with the tenants, I realized that these buildings, dating back to 1945, were very energy-intensive.
With winter temperatures in Bulle ranging from -5 to 5°C, and considering the house is not insulated, a lot of energy is required to heat it.
Therefore, a renovation was essential. The Minergie label, recognized for its rigorous sustainability and ecological criteria, seemed to be the best reference to follow for proposing an appropriate renovation.

Minergie's requirements are clear:
- Comfort in summer and winter
- Minimum energy use
- Sustainability and low environmental impact

To limit heat loss, I decided to insulate the entire building envelope, including the walls (1), attic (2), and basement (3), in accordance with Minergie recommendations. Thanks to a tight, well-insulated envelope, energy consumption can be considerably reduced, lowering both heating costs and CO_2 emissions.
Continuing with this renovation, the Minergie label requires class B energy efficiency for the building, meaning energy consumption of less than 50 kWh per m^2 per year, or at least 50% of appliances must be energy-efficient.
To achieve these objectives, I decided to install photovoltaic panels (4) on the roof. Given their optimal location, the roofs of these houses are ideal for solar energy production. They will be entirely covered with solar panels, increasing the production of renewable electricity, generating substantial savings on energy bills, and helping to make the building even more eco-responsible.
The Minergie certification is based not only on energy efficiency but also on indoor air quality and thermal comfort. Therefore, in addition to insulation and solar panels, it is crucial to ensure controlled ventilation and optimal energy management. Since this is a renovation and the Minergie label accepts the current ventilation method, the tenants need to take responsibility and ensure proper ventilation of their buildings.
By adhering to Minergie standards, this renovation will transform the building into a model of sustainability and energy performance by Swiss standards and in Switzerland, improving comfort for residents while reducing its carbon footprint.

World Map with the 10 first producers of each material and their travel
Project name: Minergie and its Discontents
Author: Tiago da Silva Teixeira





Supplement for alternative axonometry
Minergie and its Discontents
Tiago da Silva Teixeira

During my initial visits to these houses to speak with the tenants, I realized that these buildings, dating back to 1945, were very energy-intensive.
With winter temperatures in Bulle ranging from -5 to 5°C, and considering the houses are not insulated, a substantial amount of energy is required for heating.
Therefore, renovation was essential. Upon discovering that the Minergie label isn't as sustainable and ecological as claimed, I sought an alternative.

Inspired by the works of renowned architects such as Lacaton & Vassal, as well as practices in Sweden, I decided to construct a greenhouse around the houses.
To minimise ecological impact, I investigated nearby demolition projects and fortuitously found a 1000-square-meter warehouse slated for dismantling by year's end, making room for three new apartment buildings. Consequently, both the primary (1) and secondary (2) structures were sourced entirely from this demolition site.
For the envelope, PalRam Enterprises incorporates recycled oils, food industry waste, and remnants from previous sheet production into their polycarbonate sheets (3). This eco-friendly approach not only cuts CO_2 emissions compared to traditional methods but also repurposes materials that would otherwise be discarded, achieving performance equivalent to standard polycarbonate sheets. I selected their material specifically for the greenhouse project.
The 1.3-meter gap (4) between the house walls and the greenhouse allows us to create a winter insulation effect by reducing ventilation. By enclosing the air, which acts as an excellent insulator, we achieve comparable results to the Minergie label while enhancing sustainability.
During summer, tenants can ventilate the greenhouse to maintain a comfortable temperature. Additionally, to further improve air quality, trees will be planted at the center of the greenhouse.

(1) Wall insulation
ISOVER, SWISSWOOL 036 PB 12cm

(2) Attic Insulation
ISOVER, SWISSWOOL 036 PB 16cm

(3) Basement Insulation
ISOVER, SWISSWOOL 036 PB 16cm

(4) Solar pannels

(1) Primary steel structure
HEA 300, B: ø 29 cm

(2) Secondary steel structure
PE 240, 24 x 72 cm

(3) Polycarbonate sheet
PalRam Bioblase polycarbonate, 210 x 600 cm

(4) Air gap for insulation

+++ 12.07.2024 +++
CO^2 accountability
Minergie and its Discontents
Tiago da Silva Teixeira

	$KgCO^2eq$
Polycarbonate sheets	**7990**
Bio-Base polycarbonate (70 sheets) x 47	*3290*
Steel	**192'982**
Primary structure (HEA 300 - 88 m) x 176	*15'488*
Secondary structure (IPE 240 - 68 m) x 68	*129'536*
TOTAL	**200'972**
Sale	*- 192'842*
Steel sale	*192'982*
Transport (200 x 0 km) x 1,5	*140*
New TOTAL	**8'130**

Thank you for your sustainable design choices

+++ Alternative except +++