Sustainable Switzerland 2050:

A CITY OF FUTURE AND ITS DISSEMINATION TO CHILDREN AND THE GENERAL PUBLIC THROUGH INTERACTIVE EDUCATIONAL SIMULATIONS AND GAMIFICATION

Politecnico di Torino
Department of Architecture and Design M.Sc.
Architecture for Sustainability

Sustainable Switzerland 2050:
A city of future and its dissemination to children and the general public through interactive educational simulations and gamification.

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A.A. 2021/2022

People make cities, and it is to them,
not buildings (and cars), that we must fit our plans
- Jane Jacobs

The best way to predict the future is to design it
– Buckminster Fuller

To everybody that helped me get here today.

Acknowledgment

I would like to take this opportunity to thank my professor and mentor Ianira Vasallo for her time and guidance throughout the process as well as the professors at Politecnico di Torino (POLITO) .

The entire team of the Innovative envelope team at the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) especially my supervisor and co-tutor Researcher Isa Zanetti for her guidance, kindness and unwavering support

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On a personal level, I am grateful to my parents for being the wind beneath my wings to make my dreams turn into reality and my friends for their unconditional support and love to keep me strong on this journey.

ABSTRACT

Figure 1: View of Lago di Lugano as seen from the Monte San Salvatore, exhibiting the true nature of Switzerland with it's natural terrain and human settlements. Source: author.

Over the last few years, there has been an ongoing discussion about the future of our planet and our existence on it. Efforts are continuously being made to improve the quality of life in every aspect of human survival with regard to the concept of urbanization which has since evolved drastically. With the last two years of surviving the COVID-19 pandemic, the efforts and the consciousness have increased for better living conditions as we move ahead. Switzerland lies in a beautiful location characterized by mountains, valleys, rivers, lakes, forests, animals and so much more, a place that many call heaven on earth. The constant increase in population and their needs raises a very crucial issue for Switzerland, its sustainable urbanization w.r.t the topography of the nation. Fast forward to 2050, will it be a continuous sprawl of macro cities connected with minor ones? Will it be a mega city called the 'City of Switzerland' spread along the major and minor axes? Or will it preserve its character as it is right now and still address the issue of sustainable urbanization and cater to its inhabitants? The question isn't what we do, it's how we do it! Ideal Switzerland is the one where the rural and natural landscapes play a major role alongside its cities. My thesis aims at exploring the current state of the country, it outlines the capabilities of government policies and highlights real-life as well as conceptual projects that are currently in process, all w.r.t to sustainability and efforts required to reach the targets of 2050. The contributions of the government, as well as the AEC industry, are worthy of mention, but what about the general public, the children of today i.e the citizens of future cities who must survive the fast-changing climate scenarios and its impacts? In light of this, it was important to address the issue of increasing the communication and reachability of the topic to a larger audience outside of the design and administrative industries, for a successful transition towards a sustainable future. After all, innovation will not be able to come close to tackling the problems if the common man and newer generations are not aware of their significant role in shaping a better tomorrow. Hence, it was important to establish a pilot educational project that literates the children of today on the topic of sustainability through interactive educational simulations. This project will educate to bring about a radical change in the mindset of the people as well as imbibe the values of conscious efforts, responsibility, and initiative to make the necessary changes for a better future. The thesis has been developed under the able guidance of professor Ianira Vassallo and researcher Isa Zanetti at the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) within the Institute for Applied Sustainability to the Built Environment (ISAAC).

Keywords: sustainable, city of the future, Switzerland, 2050, education, children

INTRODUCTION

Figure 2. View of Lago di Lugano as seen from Curegnia, Monte Boglia, exhibiting the true nature of Switzerland with it's natural terrain and human settlements. Source: author

How do we design to adapt to the climate change?

Could Darwin's theory of 'survival of the fittest'[1] *(Evolution by Natural selection, 1859)* apply to cities as well? Considering the dramatic effects of climate change[2] the environment, cities will need to adapt by being 'sustainable'[3], enabling a healthy ecosystem and thus thriving cities. Such cities together will have a cumulative counter effect on the current crisis bringing about a state of 'climate neutrality'[4] to the environment.

To address this very topic concerning the cities of the future, ISAAC had the idea of introducing the concept of 'the city of the future'[5] to a larger audience. It was this drive that led to the birth of the project Futurminiatur with important stakeholders such as SUPSI, Swissminiatur, canton of Ticino, and many more that will come together that talks on the topic of sustainability. Fortunately, around the same time, I was searching for institutes and companies to collaborate with me on my thesis that combined my education in Architecture and Sustainability, climate crisis, and the future. I stumbled upon the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) and more specifically, the team at the Institute for Applied Sustainability to the Built Environment (ISAAC) and their project of an ideal Swiss city of 2050 which got me interested in the topic and made its way to my thesis theme. The project in its very initial bureaucratic state is currently progressing amidst authorizations, grants and schemes. My role as a master thesis student was established to form strong foundations upon which the project could ideate in the second phase. This first stage also became my base point for the thesis and went hand in hand with the research development for the city of the future.

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1. 'Survival of the fittest' is a phrase that was originated by Herbert Spencer (Principles of Biology, 1864) from the Darwinian evolutionary theory as a way of describing the mechanism of natural selection not just in terms of biological references, but in general.

2. 'Climate change' threatens people with food and water scarcity, increased flooding, extreme heat, more disease, and economic loss. Human migration and conflict can be a result. It is the greatest threat to global health in the 21st century (WHO, 2015)

3. Sustainability is a societal goal that broadly aims for humans to safely co-exist on planet Earth over a long time. It is commonly described along the lines of three dimensions (also called pillars): environmental, economic and social. (Purvis, Ben; Mao, Yong; Robinson, Darren (2019)).

4. 'Climate neutrality' refers to the idea of achieving net zero greenhouse gas emissions by balancing those emissions so they are equal (or less than) the emissions that get removed through the planet's natural absorption; in basic terms it means we reduce our emissions through climate action (UNFCCC, 2021).

5. 'City of the future' an educational design project proposal for Swissminiatur, Switzerland developed in collaboration with ISAAC-SUPSI,Mendrisio and Steiner Architekten AG, Sarnen.

As a result, at a first glance it became crucial to understand the country and the context in its current stage as of today based on: mapping based on the topography & terrain, its geographical division into cantons, zoning w.r.t urban, semi & peri urban and rural areas, population densities, urban agglomerations w.r.t 'binational nature at border crossings'[6] due to its strategic interlocked position amongst neighboring countries. This together, gave a very strong base point in understanding the country and its features.

After establishing the context of the current state it was important to understand and analyzes the future perspectives moving forward towards the target of 2050. How does an entire country bring about a 'paradigm shift'[7] to achieve targets by the year 2050 such that it accomplishes a state of climate neutrality? The idea was to sift through varied policies, strategies, goals, targets and guidelines and choose the most appropriate that will fit the criteria for designing the city of the future. A detailed study for each chosen document has been carried out to underline the important features to be taken ahead for the design phase. This technical part of the thesis was significant in giving direction to the design proposal.

The third part analyses and documents case studies, pilot & demonstration projects where researchers, architects, designers, and urbanists have their ideologies pertaining to sustainability and the future. More importantly, it focuses on the context of the country, its location, climate, geographical strengths and weakness as well as its capabilities to survive the transition. This gave a deep insight into the thought process of the visionaries with their expertise in the field such that it answers the question of 'In 2050 what do the cities of Switzerland need, to be sustainable?'

The final part of my thesis emerges by recognizing the gap between the common people and the government, public, private stakeholders that are helping to shape a better tomorrow. It understands the importance to educate the younger generations as well as the common people on the themes of sustainability and their role in envisaging a livable future.

6. 'Binational nature of border crossing cities', Switzerland with it's interlocked nature is surrounded by 5 neighboring countries of Italy, France, Germany, Austria and Liechtenstein. The cities on the borders and the migration within it for employment or livelihood can be seen.

7. 'Paradigm shift' is a fundamental change in the basic concepts and experimental practices of a scientific discipline.

It outlines in detail the factors taken into consideration to decide on 6 important themes to be showcased in the project considering also their "communicability", to arrive at a concept that gives the gist of the project through an analogical comparison to a Rubik's cube and it's nature of interlocked moves for a perfectly solved output, here in our case a sustainable 'city of the future' in the year 2050. The project culminates into a conceptual design for bridging the gap between design and the common man through gamification: an informative education and simulation with the help of 3 elements in focus: motion graphic experience as the future of tomorrow's education, learn by doing through informative gaming, traditional output of the mind palace through drawings and discussions.

Switzerland as a country thrives because major cities here are in sync with the smaller towns and municipalities, the rural areas in the vicinity, and there is still a symbiotic relationship. For 6 months I have experienced living in the rural village of Cureggia on Monte Boglia, getting the urban infrastructure of the city of Lugano just 15 minutes away via public transport connectivity while enjoying mesmerizing views. My home amidst the Swiss topography played a huge part in understanding & formulating the thesis specific to the context.

Figure 3: View of Lago di Lugano and citta di Lugano as seen from Cureggia, Monte Boglia, exhibiting the rural neighborhood with easy access to urban city infrastructure. Source: author.

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1 SWITZERLAND TODAY

1.1 Context
SWITZERLAND TODAY

Figure 4: View captured on the journey from Rosenlaui to Grindelwald of the country's natural environment. Source: author

Geographical Zoning:

Switzerland is a country at the intersection of Western, Central, and Southern Europe. It's bordered by Italy to the south, France to the west, Germany to the north, and Austria and Liechtenstein to the east. Geographically it is divided into 3 main components:

60% the Alps, 30% Swiss Plateau and 10% the Jura.

This image shows the geographical zoning of the country w.r.t its terrain with high mountain ranges to low lying plains and the valleys and how it navigates the path for its spatial development (highly urbanized in the plateau region).

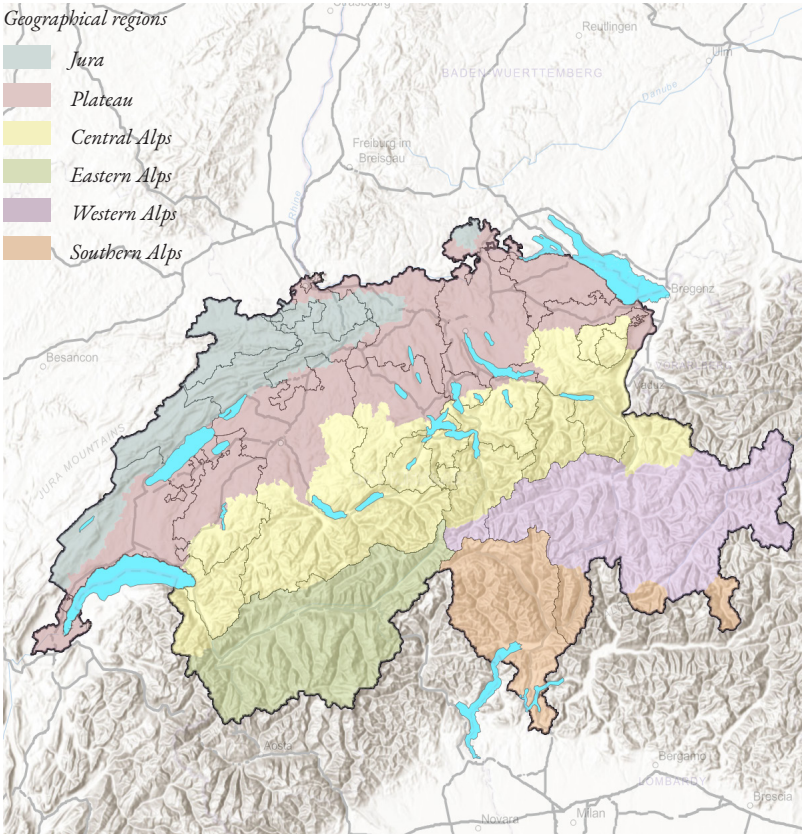


Figure 5: Image of Switzerland with it's geographical zoning created by the author using GIS tools.

Cantons:

The country has 26 cantons with the federal headquarters at Bern. Each canton has particular attributes that determine the "image of the city" *(Kevin Lunch, 1960)* and the topography of the region affects the spatial development of the city from being highly dense in Zurich to being highly sparse in the Alpine cantons of Valais and Graubünden.

To design a sustainable future for Switzerland, it is crucial to have, not one strategy that fits all, but a variety of customized policies depending on the location, history, heritage, natural resources & existing spatial planning of the areas.

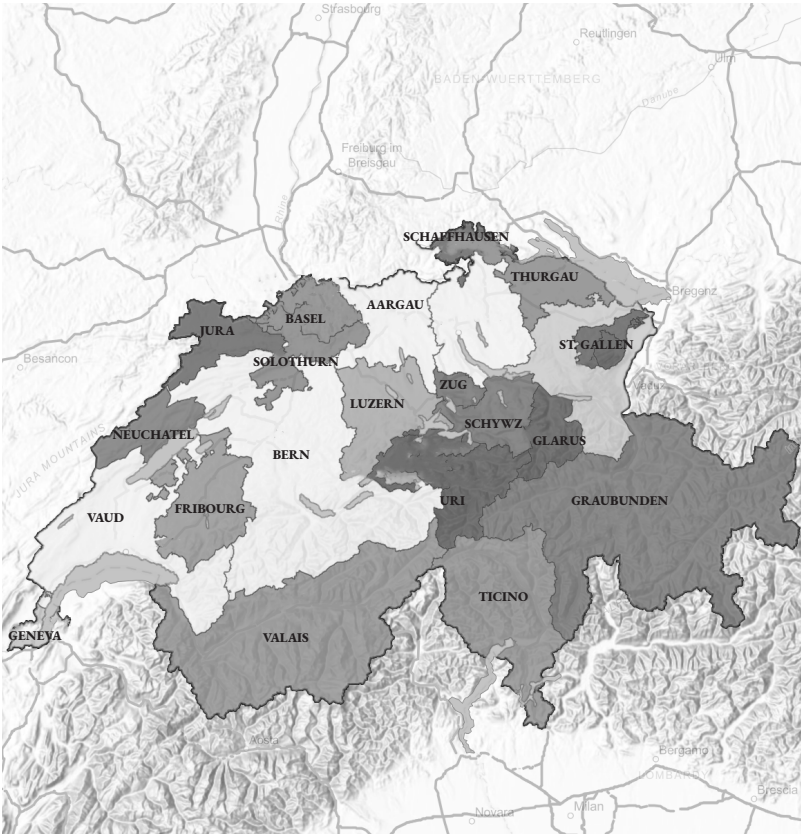


Figure 6: Image of Switzerland with it's 26 cantons created by the author using GIS tools.

Population Density:

"The average population density in 2019 was 215.2 inhabitants/km^2. In the Alps, population density falls to 28.0 inhabitants/km^2 and in the highly-dense plateau areas, the density is high as 926.8 inhabitants/km^2" (Wikipedia).

As seen from this image, it is very evident that the major urban sprawl has taken place in the plateau region and around the water bodies like lakes and rivers, thereby protecting the rural part in the Alpine region of the country.

The question remains, as we move forward with increasing needs for shelter, how do we protect the rural areas and design the future urban growth.

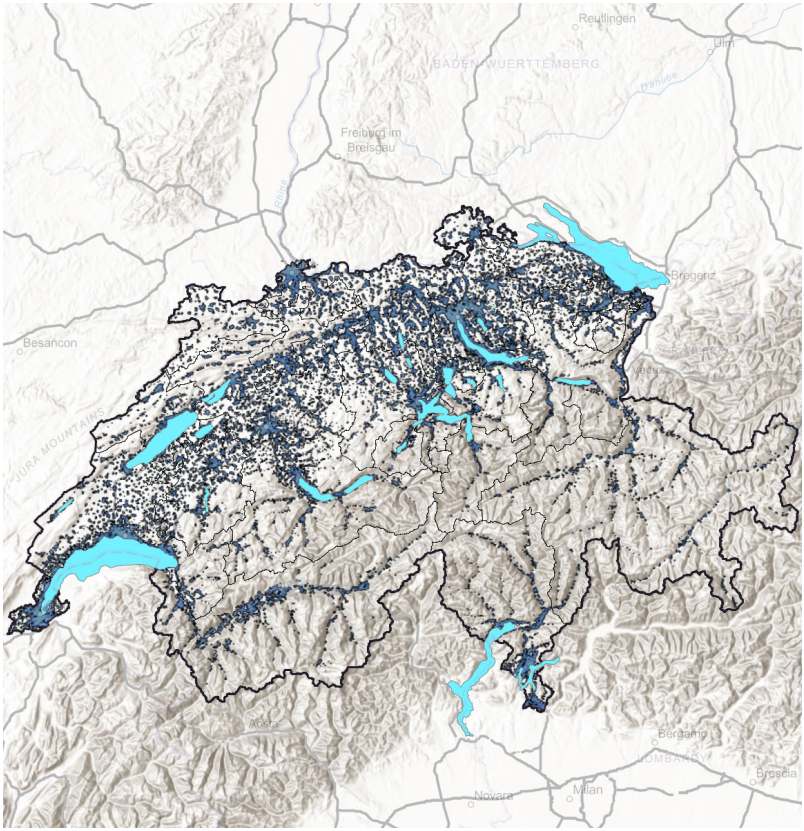


Figure 7: Image of Switzerland with it's population density created by the author using GIS tools.

Land use zoning:

The Swiss Plateau is highly populated. Its landscape is characterized by hills, partly with forests, partly with open pastures, usually with grazing herds or vegetables and fruit fields, but it is still hilly. The image portrays the ratio of urban sprawls against the still intact natural areas of the environment. As seen, the proportions of regions with urban (pink) to that of the rural (green) as of now are quite balanced and it is to this that we owe designing a future. The flat lands have been highly encroached and moving towards the future, the sustainable design for a gradual, camouflaging and less invasive urbanization has to be well thought of in order to protect the environment, human race & the image of Switzerland in the eyes of the World.

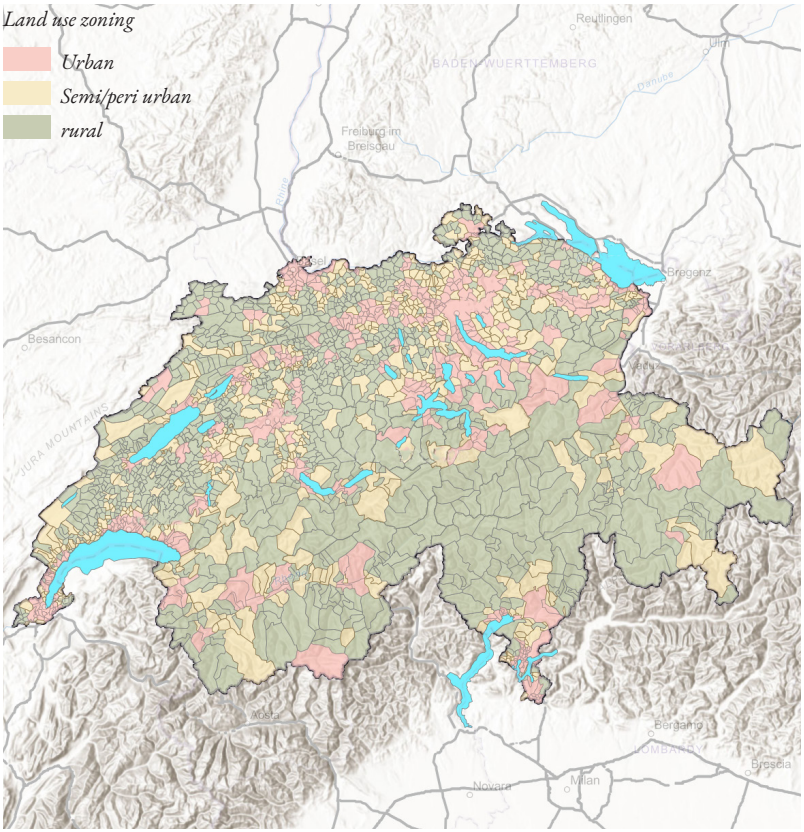


Figure 8: Image of Switzerland with it's landuse zoning created by the author using GIS tools.

Urban agglomerations:

The very nature of human civilization to settle around water bodies for flourishing in terms of food, water, and shelter is very evidently seen in this mapping which demonstrates the urban agglomerations in the Swiss context.

Interestingly, this also depicts the relationship of the country with its bordering regions i.e.,of bi-political governance nature. The bordering regions have seemingly encroached into their respective closest borders. This calls to action for a very fragile custom approach that safeguards the interests of the countries affected by this, and more importantly protecting the environment that is now burdened by 2 countries instead of just one.

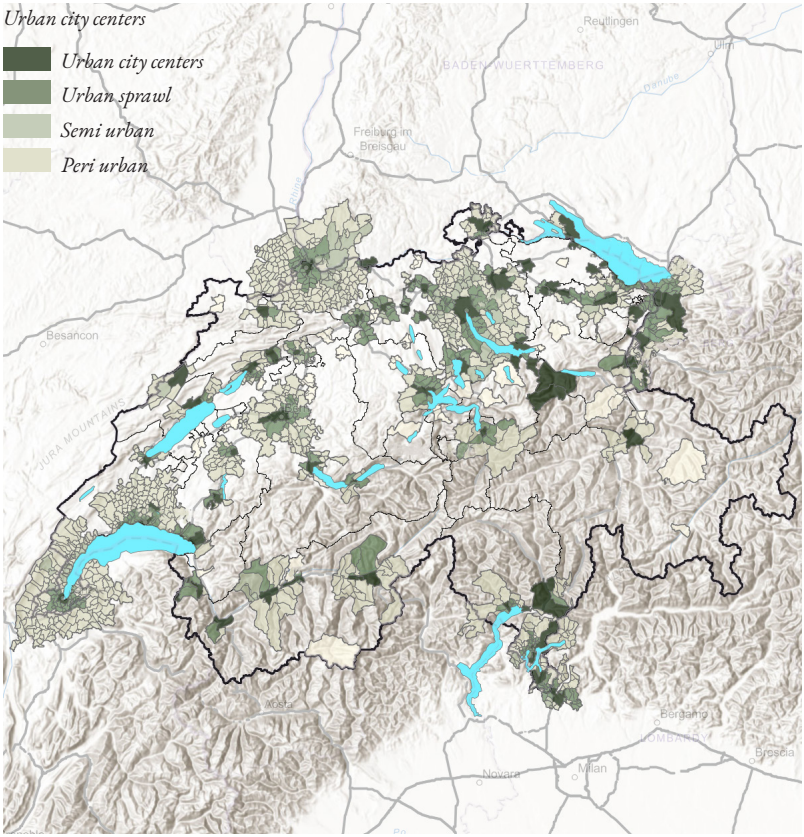


Figure 9: Image of Switzerland with it's urban agglomerations created by the author using GIS tools.

Switzerland: Europe's water tower-

Among the Swiss Alps, there are glaciers totaling an area of 1,063 square kilometers that give birth to several major rivers, such as the Rhine, Inn, Ticino, and the Rhone, which flow in all 4 cardinal directions into the whole of Europe.

"6 % of Europe's freshwater stock lies in Switzerland with more than 1500 lakes. 48 of Switzerland's mountains are 4,000 meters above the sea in altitude or higher" (Wikipedia)

Water is an important feature in Switzerland.

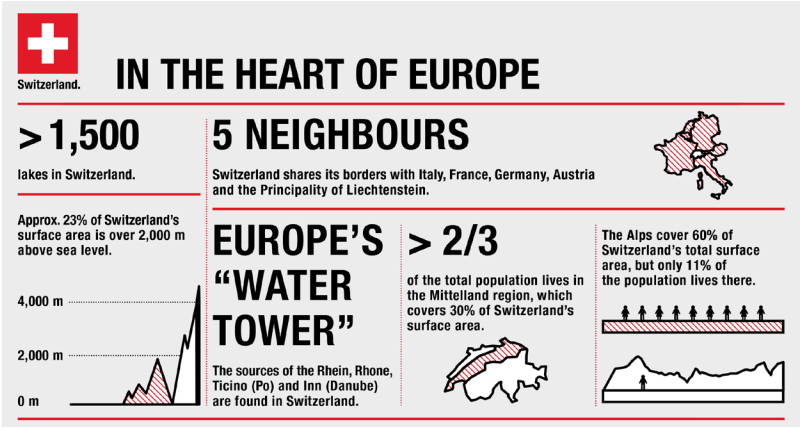


Figure 10: Info graphic of water as an important feature for Switzerland, source: Swisstopo, FOEN

1.2 Environment & Urbanization
SWITZERLAND TODAY

Figura 11: View of Paradiso and Lugano as seen from the Monte San Salvatore funicular. Source: author

Figure 12. Lago Ritom 2022,. Source; author

"Almost three planets like Earth would be needed if everyone lived like the Swiss population" (Federal Statistical Office, Switzerland)

The alpine region's climatic, geological, and topographical conditions result in it having a very delicate ecology that is extremely susceptible to climate change. Switzerland ranks #1 out of 132 nations in protecting the environment *(Environmental Performance Index EPI, 2014)* due to its environmental public health records and a significant reliance on renewable energy sources (hydro-power and geothermal energy). The country's efforts in management of greenhouse gas emissions placed it #3 out of 180 countries in 2020 (EPI, 2014).

Despite it's high rankings, in 2019 the 'forest Landscape Integrity Index score'[8] was 3.53/10, placing it #150 out of 172 countries *(Swissinfo).* Switzerland also has a 'bio-capacity deficit'[9] *(Wikipedia),* meaning they are using more than their capacity, almost 4 times more than what they have thereby highly risking depletion & depending on imports.

My stay in Switzerland has been crucial in understanding the current situation as well as knowing the local side of the effects of climate change. Traveling around the country gave me an insight into the views of the Swiss nationals and their perception of the effects of climate change especially in this year. On my walk at Lago Ritom, I met several Swiss citizens who are frequent visitors at the location saying the same thing – "Never in our lives have we seen this lake with such a low water level"(Swiss Nationals on hike o f Lago Ritom). This year on the Lake Lugano boat parking at several destinations has been a problem because the water level has not risen to it's standard level. Snowfall and resulting snow accumulation in 2022 has been low compared to the past few years, (Swissmeteo) resulting in a dry summer with low-intensity waterfalls, low lake levels, and dry lands in many parts of the country.

This is climate change and its naked impacts.

8. The Forest Landscape Integrity Index (FLII) is an annual global index of forest condition measured by degree of anthropogenic modification.

9. A bio-capacity deficit occurs when the Footprint of a population exceeds the bio-capacity of the area available to that population.

Figure 13: Average density 77.8 inhabitants / km²

Source: The Open Urban Studies Journal, 2010, Volume 3

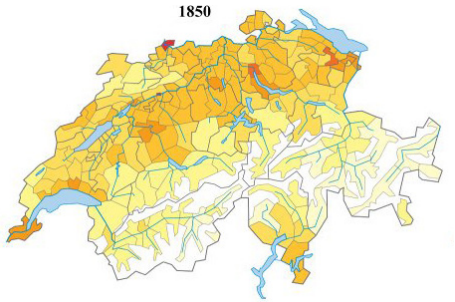


Figure 14: Average density 107.8 inhabitants / km²

Source: The Open Urban Studies Journal, 2010, Volume 3

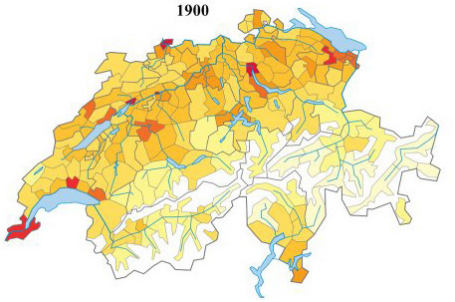


Figure 15: Average density 153.3 inhabitants / km²

Source: The Open Urban Studies Journal, 2010, Volume 3

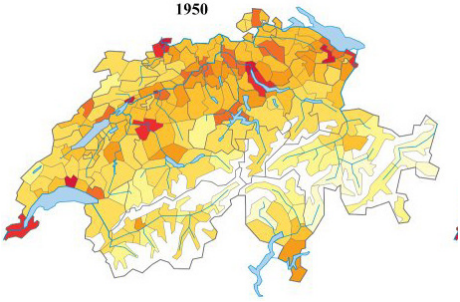
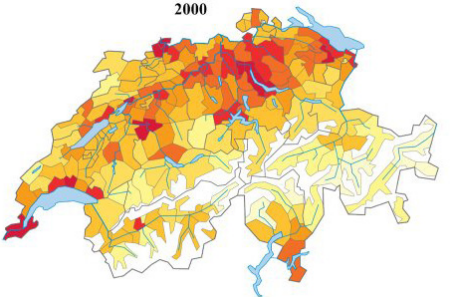


Figure 16: Average density 237.0 inhabitants / km²

Source: The Open Urban Studies Journal, 2010, Volume 3



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500-999
300-499
200-299
100-199
50-99
25-49
>25

Spatial Development:

Once a rural country, in just 70 years Switzerland has transformed more and more into an urban one *(Swissinfo, 2008)*. This growth has been drastic as compared to the previous historic years majorly due to the opportunities and the high quality of lifestyle that cities of today's Switzerland offer. As seen from the historic mapping to today, the encroachment towards foothills of mountains has considerably grown due to the increasing population giving rise to a quickly increasing urban sprawl. Comprised of a variety of landscapes, from flat plateau lands to the highest of the high peaks, from densely populated urban areas to the most remote areas untouched by mankind, from big lakes to small ponds and rivers to streams, from highly tamed agricultural lands to unreachable forests depths, Switzerland resembles a jumble of jigsaw pieces neatly put together. Therefore, to preserve this special and unique country's character, it is important to devise strategies and plans for its safeguarding. One of the policies at the top priority is the densification of the built spaces to ensure the protection of the natural unbuilt areas. The Federal Office for Spatial Development ensures the appropriate and economical use of land as follows: one-third is given over to agricultural use, approximately one sixth is comprised of urban areas, a further one sixth is for 'unproductive' land like glaciers and rocks and the remaining one-third is covered by forests *(Federal Statistical office, 2015)*

Urban areas:

Due to industrialization, urbanization, and globalization, the need for living, working & recreational activities impose a huge demand on the settlement areas for a high standard of quality life. Due to these very demands, almost 80% of the economic share of the country is concentrated in those areas. Almost half of Switzerland's population lives in the country's top five biggest cities like – Zurich, Geneva, Basel, Bern & Lausanne. The high demands on these areas from the ever-increasing population pose a continuous threat to the natural lands surrounding them due to encroachment for urban sprawl.

Natural areas:

A part of Swiss territory, due to its characteristic topography, is considered unproductive lands which are neither used for farming, nor settlements and cannot even grow vegetation. These include glaciers, high-altitudes, and lakes.

Figure 17: Leventina 2022. Source: author

Agricultural land:

Farming accounts for one third share of Switzerland *(Federal Office of Statistics)* and it is highly important for the tourism sector and the country's food security *(Swissinfo)*. The agricultural lands by their very own nature and favorable conditions lie in the flat lands of the country - over half of the land in the Central Plateau, the southern side of the Jura, and the Pre-Alps in the east of the country are put towards farming. In the cantons hugely located in the mountains, most of the farmlands are used for the animal industry to cater to their needs of grazing and being in a natural environment. Hence, these areas are not considered for food production or use by humans. Nonetheless, the agricultural lands are shrinking day by day to urbanization & forests.

Forests:

Recently, lot of tree cover has increased in the country adding to its natural environment, but at the same time due to urbanization as well as unproductive land, a lot of this surface cannot be technically claimed as forest lands. For a country with modest size & beautiful landscapes, it is highly essential to have all the different types of ecosystems where varied flora and fauna thrive. The country is running on a 'bio-capacity deficit'[10] *(Federal Office of Environment)*, To overcome this, the native natural ecosystems and context specific wildlife have to be preserved and the encroachment of foreign flora-fauna has to be regularly scrutinized leading to a total prohibition in the future.

Areas of national importance:

To preserve biodiversity and the landscape, Switzerland has given several natural areas, almost 23%, the special status of national importance. Out of this, 4% are strictly protected and their complete preservation is mandatory by law. Since 1977, there has been a slight increase in these areas as a result of the phased introduction by the Federal Inventory of Landscapes and Natural Monuments of National Importance, as well as protecting moors and wetlands under the 1987 constitutional provision *(Federal Commission for the Natural and Cultural Heritage BLN, 2020).*

10. The imbalance between Switzerland's ecological footprint and it's self bio-capacity is huge. This lifestyle is not sustainable, because the country consumes 2.8 times the amount of natural resources that are available per capita worldwide (1.6 global hectares, gha).

1.3 Energy & infrastructure
SWITZERLAND TODAY

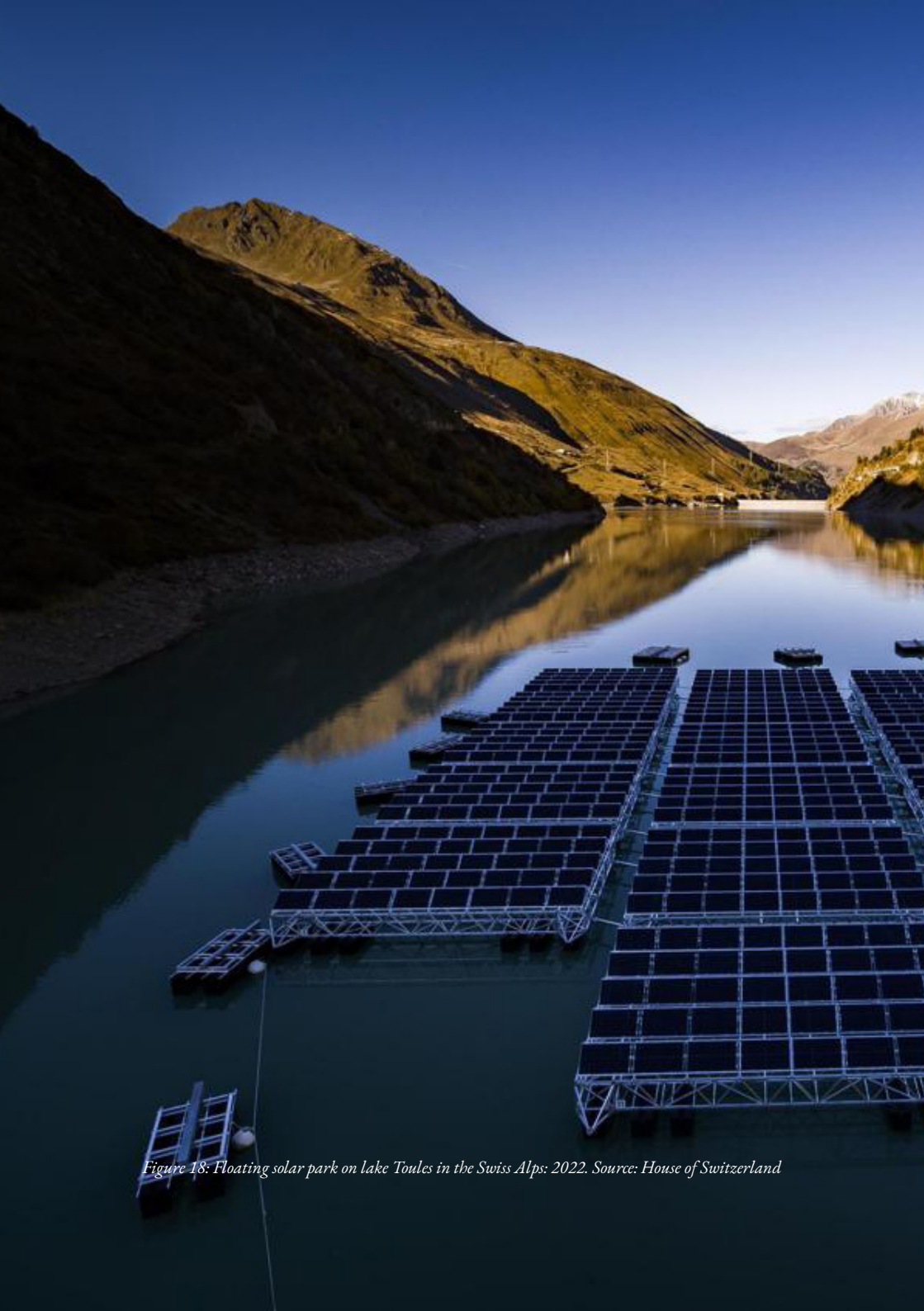


Figure 18: Floating solar park on lake Toules in the Swiss Alps: 2022. Source: House of Switzerland

Hydro energy:

Having such a strong ecosystem of water resources and water networks, Switzerland makes a high potential generation of hydroelectricity and it is the most important domestic source of energy in the country *(SFOE, 2017)*. Known as Europe's water tower (SFOE), it has the highest number of lakes, ponds, rivers & streams for the available spatial area. However, due to the use of water for energy generation and with increasing drastic effects of climate change on snow & glacier levels, the water reserves are facing a challenge .

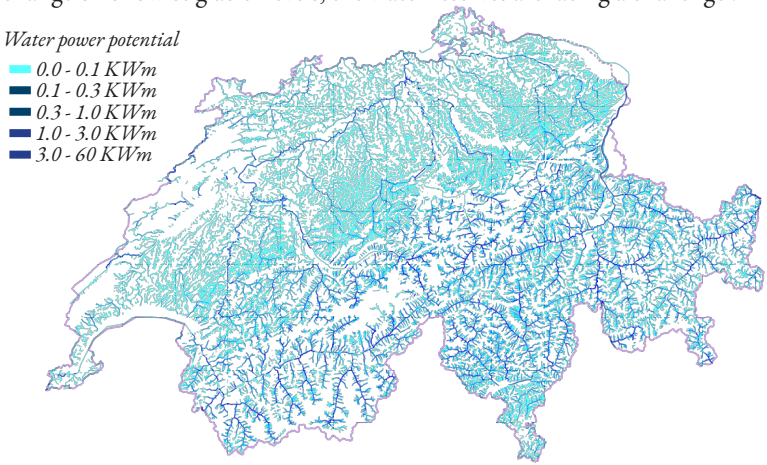


Figure 19: Hydrology mapping of Switzerland, created by the author using GIS tools.

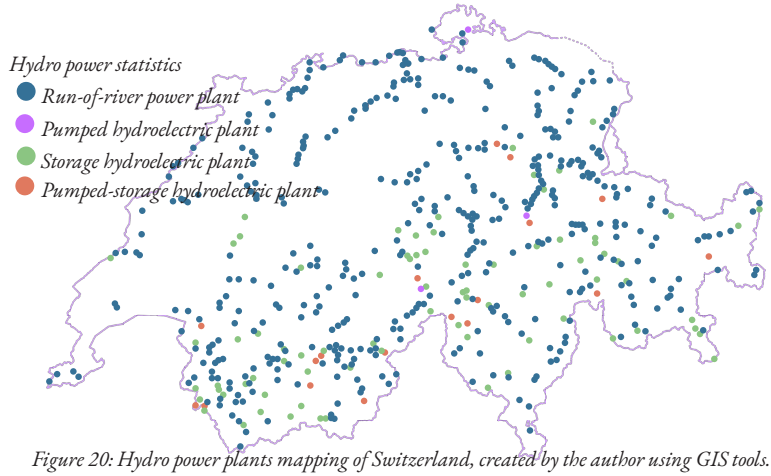


Figure 20: Hydro power plants mapping of Switzerland, created by the author using GIS tools.

Electricity generation:

56% of electricity generated in Switzerland is from hydro power stations *(SFOE, 2017)* whereas the other 39% is generated from nuclear power, thereby making it a nearly CO2-free electricity-generating network. With more and more energy efficiency in the life cycle of electricity generation, a significant decrease in harmful environmental impacts is observed. Efforts through projects like 2000 Watt society that focus on energy efficiency are being made to decrease the electricity generation and consumption.

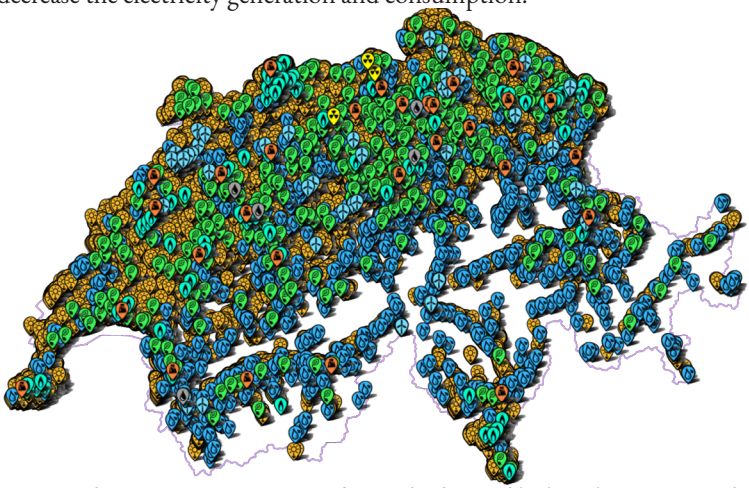


Figure 21: Electricity generation mapping of Switzerland, created by the author using GIS tools.

Ban on nuclear power generation:

After the Fukushima nuclear disaster *(Wikipedia)*, as a preventive method, the Swiss government passed a bill in 2011 to end the use of nuclear energy in the coming decades. Although nuclear energy generation is considered to be CO2 free due to no pollution via greenhouse gases thereby not contributing to global warming, on the other hand its high levels of dangerousness, the vulnerability in case of accidents which can cause catastrophic events as experienced in the past, huge costs in building up the reactors, time consumption in setting up the whole plant and the generation of radioactive waste make it a choice less preferred.

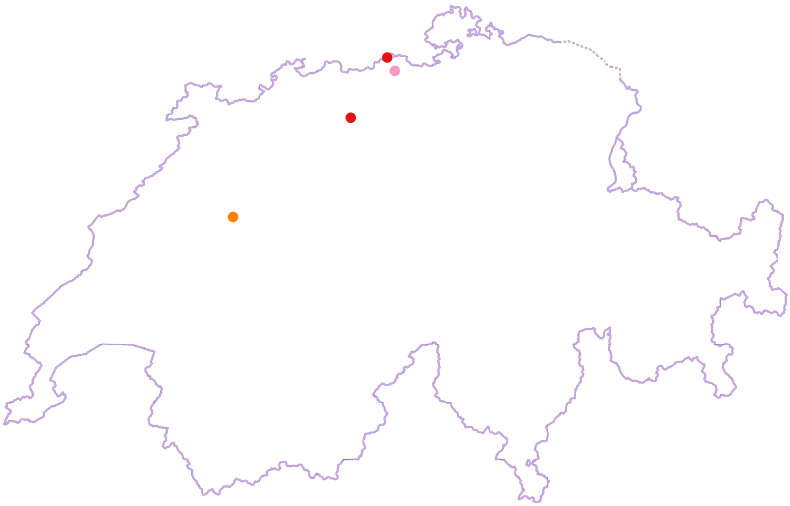


Figure 22: Nuclear power plant mapping of Switzerland, created by the author using GIS tools.

Nuclear power plants

- *In operation 2 reactors*
- *In operation 1 reactor*
- *Decommissioning 1 reactor*

Waste & recycling:

"Although consumption rates are above the global average, Switzerland is often cited as a recycling role model because of its waste collection, separation and recovery system. In addition to a state-of-the-art waste management infrastructure, the authorities actively encourage the population to recycle as much as they can" (FDFA, Switzerland). The current plan promotes recycling with many collection points of accessibility in neighborhoods, supermarkets, etc. This, added to the comparatively expensive garbage disposal tax imposed through expensive garbage disposal bags creates awareness in the amount of trash generated and disposed and be more alert.

Figure 23: Waste incineration plant mapping of Switzerland, created by the author using GIS tools.

Waste incineration plants

- *Waste incineration plants*

Road network:

Switzerland has a public managed road network without tolls that is financed by highway permits as well as vehicle and gasoline taxes. *"With a total length of 1,638 km as of 2000 and an area of 41,290 km2, it is classified as one of the highest motorway densities in the world" (Wikipedia).* The highly advanced, well-developed, and maintained road network encourages users to adopt private transport use. Making sure the cars are more and more energy-efficient and the network conditions favorable, the effects on the environment are considerably reduced. As seen evidently from the mapping, the majority of the flat lands and the major cities are highly accessible but also the rural areas in between these cities.

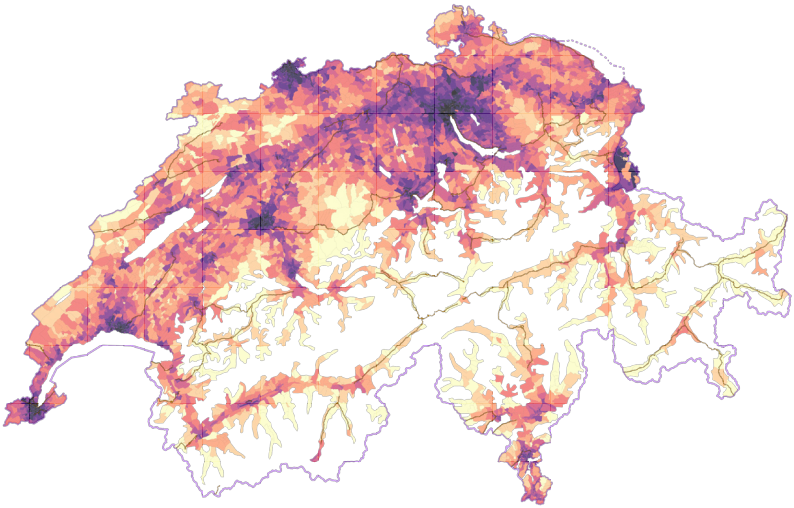


Figure 24: Road network accessibility mapping of Switzerland, created by the author using GIS tools.

Accessibility by road network

0 -250 points
250 -1000 points
1000 - 2500 points
2500-5000 points
5000-7500 points
7500-10000 points
10000-15000 points
15000-25000 points
25000-50000 points
more than 50000 points

Public transport network:

Switzerland has one of the densest 100% virtual electrified rail networks in Europe covering approximately 5,250 kilometers and carrying over 596 million passengers annually as of 2015, (*Federal Office of Transport FOT).* According to the 2015 statistics (FOT), each Swiss resident traveled an average of 2,550 kilometers by rail. Highly efficient networks have been realized over time, St. Gotthard being one of the recent achievements in the infrastructure sector. Highly efficiently planned networks, high reach of accessibility and different modes of transport for flat lands and high altitudes are a highlight of the Swiss public transport system. The conditions are highly sanitized, frequent and punctual which makes it more luring and highly used.

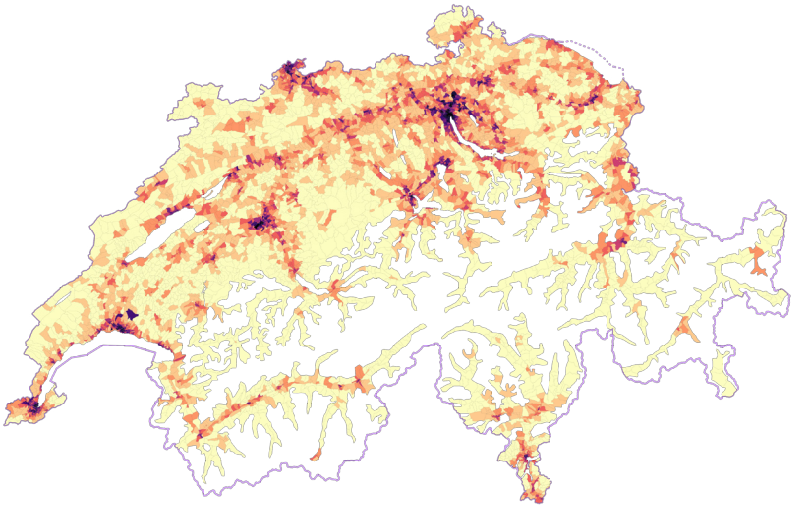


Figure 25: Public transport network mapping of Switzerland, created by the author using GIS tools.

Accessibility by road network

0 -250 points
250 -1000 points
1000 - 2500 points
2500-5000 points
5000-7500 points
7500-10000 points
10000-15000 points
15000-25000 points
25000-50000 points
more than 50000 points

2. TOWARDS A SUSTAINABLE FUTURE

For achieving the targets of the Paris agreement to attain climate neutrality by 2050, it was important to analyze Switzerland's efforts and the vast available research tackling the very issues of urban planning, design & sustainability, and understanding the questions of Where? How? What? When? and most importantly Why?

Therefore, current policies underlining the goals, standards, agendas, legislations & measures aimed towards the year 2050 have been studied in detail such that the design proposal has a proper line of track and direction.

Policies:

1. Energy

A. Energy Policy
   - » Why
   - » The 2030 Agenda

B. Energy perspectives 2035

C. Energy perspectives 2050+

D. Energy Strategy 2050

   - » What is it
   - » Measures
     - Energy efficiency
     - Renewable energy
     - Nuclear energy
     - Electricity grids
     - Additional measures
   - » Targets

E. Towns, cities, municipalities and cantons

F. International energy policy

2. Transport

A. Swiss Transport Policy
   - » What
   - » Objectives
   - » Approach

B. Transport Outlook 2050
   - » The basis scenario
   - » The business-as-usual scenario (BAU)
   - » The Sustainable Society scenario (SuS)
   - » The Individualized Society scenario (InS)

C. Transport landscape 2050: Speculations

D. Developments in passenger transport

3. Landscape & Environment

A. Swiss landscape policy (CPS)

B. General landscape quality objectives

C. Specific objectives

2.1 Energy Policy: TOWARDS A SUSTAINABLE FUTURE

The contemporary sustainable Swiss energy policy depends on 5 main legislative tools as follows *(Swiss Federal Office of Energy)*:

The Federal Energy Act
The Federal CO2 Act
The Federal Nuclear Energy Act
The Federal Electricity Supply Act
The Federal Water Use Act.

The Energy Act only came into force on 1 January 1999, before that, according to Article 89 *(Section 6 Energy and Communications, Art. 89 Energy policy: Federal Constitution of the Swiss Confederation)*, the cantons had their energy legislation and regulations which established necessary prerequisites for securing an adequate, comprehensive, safe, economical, and ecological & efficient energy supply as well as use.

Why the need of a Energy Policy?

Moving towards a sustainable future has a lot to do with energy, especially since it contributes to the impacts caused by climate change due to its production, use, import and export. Especially considering the current on-going scenarios around the world, the war, the pandemic and climate change.

Since the war between Ukraine and Russia started, Switzerland along with many other countries in Europe recognized its high reliability on Russian resources. When energy resources become a political statement the uncertainty in supply greatly increases, costs rise and competitiveness between consumers also increases (industry vs. households) thereby causing problems for the general public at large.

COVID-19 has caused problems and difficulties due to the dependency on neighboring countries and the restrictions in ease of import/export, air travel, shutting down of production plants, etc. that came with such relations. Also, the impacts of climate change are already evident where lakes in Switzerland have not filled to their maximum potential levels as a result of the shortage of snow and constant changes in the climate. All these factors point out the crucial need for Switzerland, but it is a matter that can be extended to most other nations, to first become self-sufficient in its energy resources to achieve the final target of being sustainable.

B. The 2030 Agenda:

In 2015 all the 193 UN member parties adopted 'The 2030 Agenda' for sustainable development and pledged their willingness for a common target of achieving the 17 sustainable development goals (SDGs) by 2030 and this applied to Switzerland as well on a national level. More specifically, Switzerland's energy policy helps achieve these goals and in particularly the following 5:

Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all.

Figure 26: Goal 7 of SDG source: United Nations.

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Figure 27: Goal 9 of SDG source: United Nations.

Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.

Figure 28: Goal 11 of SDG source: United Nations.

Goal 12: Ensure sustainable consumption and production patterns.

Figure 29: Goal 12 of SDG source: United Nations.

Goal 13: Take urgent action to combat climate change and its impacts.

Figure 30: Goal 13 of SDG source: United Nations.

C. Energy Perspectives 2050+:

This particular system helps in developing energy systems analyzed in net-zero emission scenarios in sync with the long-term climate goal of reducing greenhouse gas emissions by 2050 as well as keeps track of secure energy supply. It came into the picture as a result of the 1973 oil crisis *(first oil crisis due to proclaimed oil embargo by Organization of Arab Petroleum Exporting Countries (OPEC), led by Saudi Arabia)* which made it clear that Switzerland needed a national energy policy and then following the Fukushima reactor accident *(2011 nuclear accident at the Fukushima Daiichi Nuclear Power Plant in Ōkuma, Fukushima, Japan)*, it was clear that the energy policy had to be revised which then would be the basis of Energy perspectives 2050+ (EP 2050+).

The figure below gives a brief idea about the planned objectives of a climate-neutral Switzerland by 2050:

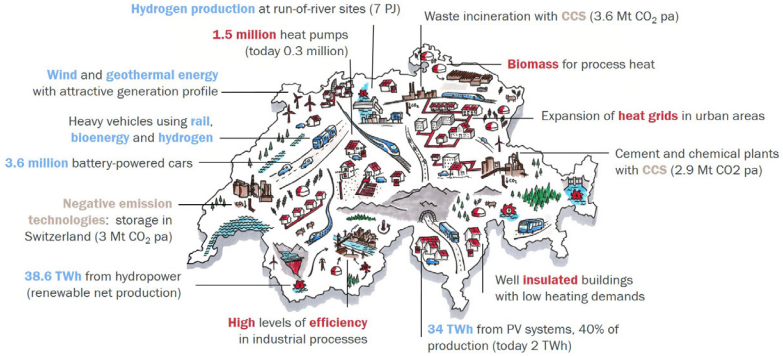


Figure 31: Objectives for a climate-neutral Switzerland by 2050, source: Dina Tschumi, Prognos AG

Why?

Before developing the Energy policy for 2050, it was important to have a vision (perspectives) of what 2050 must look like for Switzerland as a country that is slowly moving towards climate neutrality and sustainability. The 2030 agenda and 2050 perspectives, were strong foundations upon which the Energy policy 2050 was built. It was a peek into the future, a transition space that bolstered the values, ethics, and morals towards which the country wanted to move.

D. Energy Strategy 2050 :

What is it?
Initially, in 2007, the Swiss Federal Council believed that the energy strategy of the country should rest on the foundation of 4 main notions – energy efficiency, renewable energy, replacement/construction of large-scale energy production facilities (including nuclear power plants), and foreign energy policy *(Federal Office of Energy)*. This changed after the 2011 disaster at Fukushima *(2011 nuclear accident at the Fukushima Daiichi Nuclear Power Plant in Ōkuma, Fukushima, Japan)*. Switzerland pledged to stop using and building new production plants of nuclear energy by 2050. This major decision with other changes in the international energy sector led the Federal council to adopt a new policy – 'Energy strategy 2050'. The submission of the revised Federal energy act *(Energy Act EnA)* took place on 4th September 2013, and the Parliament adopted it later on 30th September 2016. Later, with a clear Swiss electorate majority, the act was approved on 21st May 2017 and has been active since 1st January 2018. Because of the revised energy act, amendments are being made to the federal electricity act & federal electricity supply act both aiming towards full liberalization of the electricity market & also to provide incentives for making the shift towards renewable energy. Lastly, Climate policy: Paris agreement *(The Paris Agreement often referred to as the Paris Accords or the Paris Climate Accords, 2015)*, which pledged to halve the greenhouse gas emissions by 2030 as against the 1990 levels and to reduce the net greenhouse emissions to zero by the year 2050.

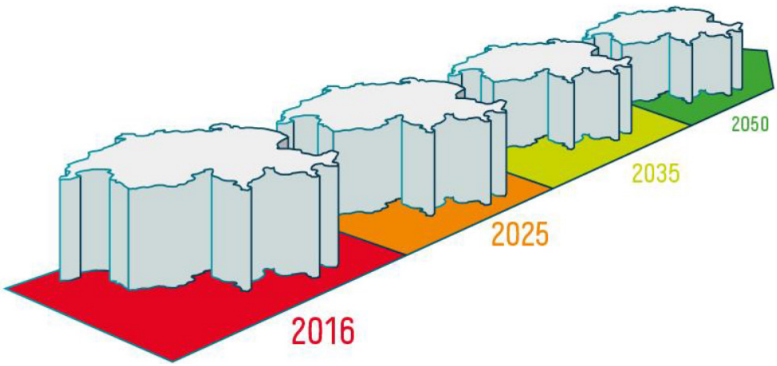


Figure 32: Green transition towards 2050, source: Federal Office of Energy

Why?

To achieve the targets by 2050, it was necessary to have a strong foundation that could be supported by the public at large. Also, it was important to create milestones *(2030 agenda, energy perspectives 2050+)* to finally reach the desired target of 2050. After the Fukushima disaster, the Paris Agreement, and the increasingly tangible warnings of climate change, it was important to have one policy *(Energy strategy 2050)* for the entire country that specifically regulates the production, usage, and maintenance of energy at large.

Described in detail on the next pages, the three main strategies on which the Energy strategy 2050 is based on are as follows:

1. Increasing energy efficiency in buildings, mobility, industries & appliances
2. Increase the use of renewable energy through promotions, tax & financial incentives and simplifications of the legal framework.
3. Withdrawal from nuclear energy step-by-step, all the while keeping safety as the main criteria and by avoiding any new general licenses.

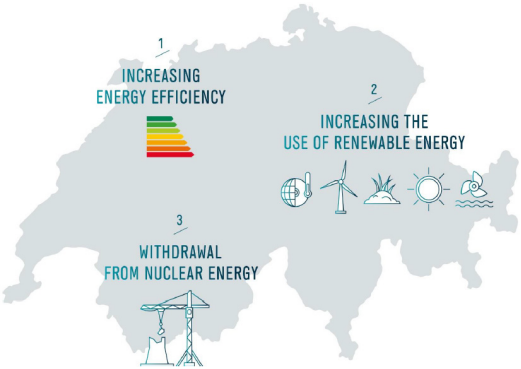


Figure 33: Three main pillars of Energy Strategy 2050, source: Federal Office of Energy

Measures:

A few measures have been underlined to ensure the smooth functioning and proper understanding of the Energy Strategy 2050 by all and also highlight the perks if followed by individuals and businesses in their projects.

1. Energy efficiency:

- Buildings: The AEC industry in Switzerland contributes to almost 40% of energy consumption and one-third of CO2 emissions *(Federal Office of Energy)*. Through this program, the cost of energy-saving renovations is subsidized. It is partially financed by revenues from the CO2 levy on fuels since the energy policy came into the picture.

- Tax incentives for building renovations: Since there is a lot of heritage architecture in the country, it means maintaining is also a very important factor. Building renovations, partial or full have been made tax-deductible with the Energy Strategy 2050 which in fiscal terms has been beneficial and helps in achieving the aim to move towards total energy efficiency.

- Emission specifications for motorized vehicles: More than a third of the total CO2 emissions and energy consumption is due to motorized traffic (*Federal Office of Transport)* and hence in the light of EU law, the limits were further tightened in 2020 to 95g CO2/km for passenger vehicles and 147g CO2/km for light articulated trucks and delivery vehicles *(Federal Office of Energy)*. In the light of this, the Federal Office of Transport is making efforts like expanding the public, private and freight transport network with the aim of getting fewer people to use private transport.

- Competitive tenders: Promotional subsidies for programs and projects contributing to economical energy consumption in the industrial, service, and household sectors are awarded by auction so that the ones with the best cost-benefit ratio can participate. The financing for the same comes from the grid surcharge payments of energy consumers for promoting renewable energy and energy efficiency.

2. Renewable Energy:

- Feed-in remuneration scheme: Facility operators producing electricity from solar, biomass, wind & geothermal energy can apply for feed-in remuneration since 2009. Also, the system is in transition to become market-oriented to be able to sell this directly rather than through a long line of mediators.

- Contributions towards investment costs: Operators of both small and big solar systems may apply for a one-time payment toward the facility's investment expenditures, which typically account for about 30% of the overall cost. Up until 2030, contributions for massive hydro power projects as well as for the remodeling and extension of current facilities are also available.

- Support for existing large hydro power plants: Due to the sharp decrease in electricity prices in the first half of 2010 in Switzerland *("because of the expansion of renewable energy; the near-collapse of the European emissions trading scheme; over-optimistic power plant investments; a decline in final electricity consumption; and cheap coal and natural gas". Sourcce: Wikipedia),* so much that they were too low to even cover the production costs of hydro power plants. To overcome this situation the National Council and the Council of States decided to offer a market premium for electricity sold at a lower cost than that of the production *(this scenario might have changed w.r.t the current scenarios and ongoing war crisis).*

- National interest: By legislation, the preservation of nature has always been in the national interest, compared with humankind's use of it and energy generation. This makes sure that nature comes first above everything else.

- Licensing procedures: Shortening the licensing processes for plants that generate power from renewable resources is the goal. This makes it possible for more and more people to choose renewable energy sources over non-renewable and greenhouse gas-emitting ones.

3. Nuclear Energy:

- Ban on new nuclear power plants: Permits for new nuclear power plants or any changes in the existing ones have been strictly prohibited and the existing plants remain in operation only until the authorities deem them fit and safe (*regular checks are performed for the keeping a track by the Federal Office of Energy).* Following the Fukushima disaster, this ban was a major decision taken for the safety of not just the public but also of the environment in case of a catastrophe.

- Ban on re-processing of spent fuel: Until 2016 it was possible to export spent fuel rods for re-processing, after which it has been banned indefinitely considering the harmful impacts of this on the environment.

4. Electricity Grids: The Federal authorities are aiming to expand the electricity networks to meet the demand in the required time frame. This development is a very crucial factor in achieving sustainability in the electricity sector. Therefore, the four key aspects of the electricity network strategy are as follows:

- Guidelines on the optimization and development of the Swiss electricity networks.
- Optimization of the approval procedure for electricity supply line projects.
- Criteria and guidelines for deciding whether to install underground cables or overhead lines.
- Raising the level of acceptance and transparency of supply line projects.

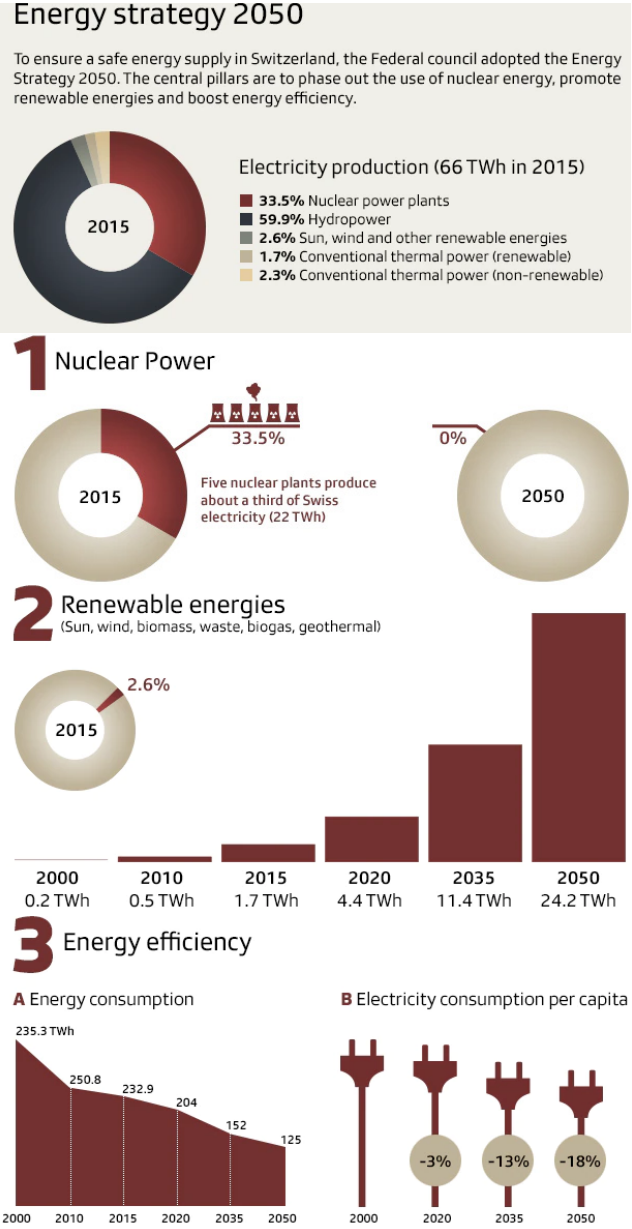


Figure 34: Energy Strategy 2050 at a glance. Source: Federal Office of Energy

5. Other measures -

- SwissEnergy program *(Federal Office of Energy)*: It is the binding factor amongst all the stakeholders involved, to keep everybody informed about moving towards a sustainable future. It has an educational role that helps informing and staying up to date while encouraging people to opt for green energy.

- Pilot, demonstration, and flagship projects: Such projects help in testing and publicizing the research focused towards sustainability and also helps everyone to gain insight into Switzerland's sustainable future and its benefits. It also helps in humanizing the content available on sustainability to make it more reachable and approachable to the public in a way that they understand and learn about it *(like green-city Zurich, 2000 Watt site, green-city Lausanne, Smart buildings Fribourg)*.

- Climate package: The climate package incorporates the federal administration's 'Resource and Environment Management System' (RUMBA), the 'Spatial Planning and Environment Management System of the Federal Department of Defense, Civil Protection and Sport' (RUMS DDPS), and the 'Exemplary Energy and Climate' initiative aimed towards reducing greenhouse gas emissions by specifying the requirements for air travel, vehicle fleet and government premises, making the Federal authorities more alert about their role in the Energy Strategy 2050.

- Energy research: The formulation of Energy Strategy 2050 gave rise to the Parliament setting up 8 Swiss Competence Centers for Energy Research (SCCERs). These centers created a huge impact giving rise to establishment of more such applied energy research centers in Swiss universities of technology. Moreover, The Swiss Federal Office of Energy receives additional funding to promote pilot and demonstration projects and are given out by considering the merits of the project proposals.

- 2050 Climate strategy (net zero emissions): In August 2019, the Federal Council pledged that Switzerland will no longer emit greenhouse gases that cannot be absorbed either by natural, technical, or artificial means. This gave rise to the net-zero emissions target which helps reducing the global climate warming by 1.5 degree Celsius as compared to now *(Paris agreement, 2015)*

6. Targets:

To achieve the goals defined in the 2050 energy strategy, the following tangible and quantifiable targets must be met:

- Average per capita energy consumption is to be reduced by 43% until 2035 compared to that of 2000.
- Average per capita electricity consumption is to be reduced by 13% until 2035 compared to 2000.
- The average domestic production of renewable energy excluding hydro power will reach 11400 GWh by 2035.
- By 2035 there will be a production of 37400 GWh of hydro power.
- The network surcharge of 2.3 cents/KWh will be used for the promotion of electricity from renewable energy, energy-efficiency & improvement of the quality of water bodies.
- Companies with high electricity consumption can receive a refund with fewer prerequisites as long as 20% of it is spent on energy efficiency measures.
- A direct marketing strategy of supply to the necessary demand.
- Faster and easier process for licensing and paperwork of renewable energy.
- Proposing levy to improve the energy efficiency in buildings.
- Increasing the tax incentives for improving energy efficiency in the buildings.
- Reducing the CO2 levels in vehicles for inducing low-impact mobility.
- A planned renovation of the energy network and decentralization of the supply chain.

E. Towns, cities, & municipalities & cantons:

While cantons and municipalities are in charge of carrying out and overseeing policies at the local level, the Federal government is responsible for overseeing policies at the national level. Additionally, cantons are in control of regionally specific policies. In order to make sure that the suggested projects are successful, the federal government and the cantons work closely together.

Despite its modest size, Switzerland has managed to maintain a strong holistic functioning system. The main reason for this is that administrative, legislative, and political powers are divided not just among 26 cantons, but also further among cities, municipalities and tows. People may easily make decisions in such small places, and they are considerably more significant than when spread out over greater areas. This fine-grained management structure enables seamless operation and optimum collaboration.

The major goal of the cantons is to guarantee that energy-related laws and legislation are consistent across all 26 cantons and are in line with national energy policies. Each canton is in charge of developing its policies and promotions in terms of monetary assistance for long-term sustainability. Furthermore, the federal government recognizes such campaigns and plans and may grant additional financial aid from the CO2 tax if funds are available, as long as everything falls under national energy regulations and standards.

Defining and enforcing regulations, governing energy efficiency in businesses, defining the use of renewable energy in their structure plans, advising private individuals and businesses on energy issues, licensing power plant facilities, and assisting with energy planning are all tasks that the cantons are responsible for. They also play a significant role in the energy sector as sole or joint owners of energy companies, serving as role models for the federal government and local governments.

These stakeholders are important role models for the general population in educating and implementing measures to reach the 2050 energy goals. They can help steer their energy development using spatial energy planning, support the public with energy promotions, boost energy production facilities, to regulate and make legal provisions. Through the SwissEnergy program financial support is provided for activities aimed at boosting renewable energy use, energy efficiency, and ecological mobility.

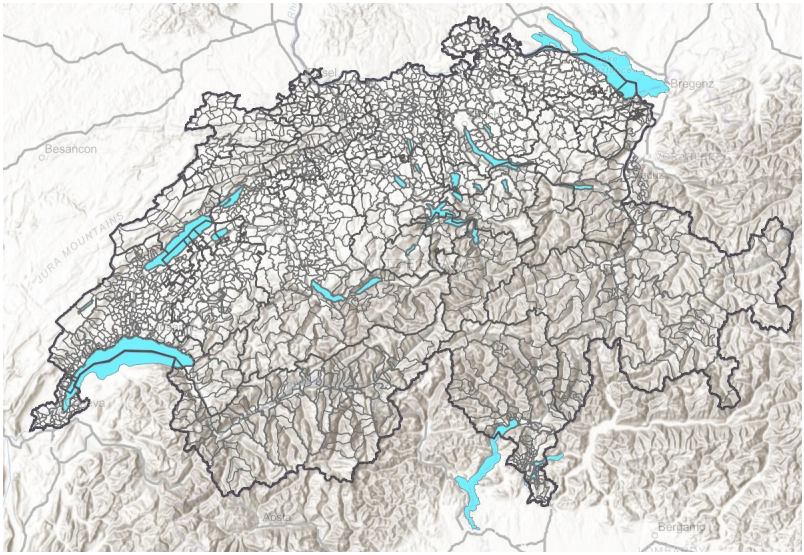


Figure 35: Mapping of municipalities in Switzerland, created by the author using the tools of GIS

F. International Energy Policy :

"Around 80% of Switzerland's energy supply depends on imports of fossil fuels, nuclear fuels, combustibles as well as electricity, especially in winter" (Swiss Federal Office of Energy). The country could be more independent with hydro power, but most of it is sold for exports.

This means close co-operation with international organizations and authorities within and outside EU is very crucial as this directly reflects on the high import dependency, guarantee for supply security & more importantly the declared sustainability objectives. Currently, negotiations are in progress with the EU for an electricity agreement and Switzerland is also campaigning for a global energy policy considering that it is for a collective cause.

With the ongoing war between Ukraine and Russia, the coming months could pose a threat to the country in terms of a shortage of supply of gas from Russia as well as other resources hugely required in AEC industry. It means that the country has to prepare itself in acquiring other stakeholders and also try to move towards self-sufficiency for the future. Such unannounced scenarios are always a reminder to rely less on external factors and avoiding the need for major imports.

2.2 Transport Policy: TOWARDS A SUSTAINABLE FUTURE

"Switzerland values the extension of an ecological, social and efficiently organized transport and traffic system. The shift of transalpine goods traffic from road to rail plays a key role. To implement the transport policy, Switzerland depends on good and close cooperation with neighboring countries and the EU" (Federal Office of Transport).

"The Swiss government plans to make drivers ditch their cars and take public transport, doubling the market share of trains and buses by 2050" (NZZ am Samstag). This would mean that 40% of all public transport distances will be covered by train or bus, compared with 21% today. The same doubling target applies to freight transport, based on the new documents & reports *(such as Transport Outlook 2050 and other supporting documents)* from the Federal Office of Transport. The driving force behind these efforts is the government's climate target of ceasing to emit greenhouse gases by 2050. *"However, even the government's experts admit that this target is 'very ambitious'. A look back shows why: despite all the expansion, the share of public transport has been stagnating for years, and the Swiss still make almost 80% of their journeys by private car or motorbike" (NZZ am Sonntag).*

Energy strategy for Public Transport 2050 (ESPT 2050):

Approximately a third of all energy is used for transportation *(Federal Office of Transport)*. The Federal Council considers transportation to be a significant part of the Energy Strategy 2050 in minimizing energy consumption, increasing energy efficiency, and promoting the use of renewable energy sources. Public transportation will prove to be valuable tool in attaining the objectives outlined in the Energy Strategy due to its potential for high energy efficiency.

The FOT set in motion the 'Energy Strategy for Public Transport 2050 (ESPT 2050)' initiative based on the strong foundation of the Energy Strategy 2050.

"Public transportation uses three times less energy than motorized private transportation for the same capacities. Rail freight transportation is up to ten times more efficient than road freight transportation" (FOT, 2018). Public transport will play a huge role in improving the energy efficiency of the entire transportation industry due to its capacity to carry larger shares of the passenger traffic. Not only that, by increasing the use of renewable energy resources in the transportation sector it will prove to beneficial for the environment as well.

The objectives of ESPT 2050 are:

- Boost energy efficiency
- Avoid use & generation of nuclear power
- Reduce CO2 emissions
- Promote and generate renewable energy
- Intelligent management of networks

Approach:

The ESPT 2050's goals are challenging as well as demanding. They call for effective and coordinated action on cars, infrastructure, and operations from the transportation sector, industry, and authorities.

The program uses three primary strategies:

- Establishing the fundamentals: Create reward schemes and encourage the application of measures
- Operating an information network: Establish a strong evidence base, encourage information sharing, and improve cooperation
- Promoting practice: Finding, funding, and promoting innovative ventures

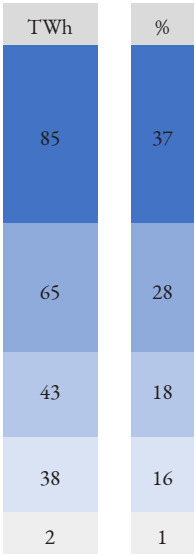


Figure 36: Percentages of energy consumption from various sectors in Switzerland. Source: Federal Office for Spatial Energy ARE

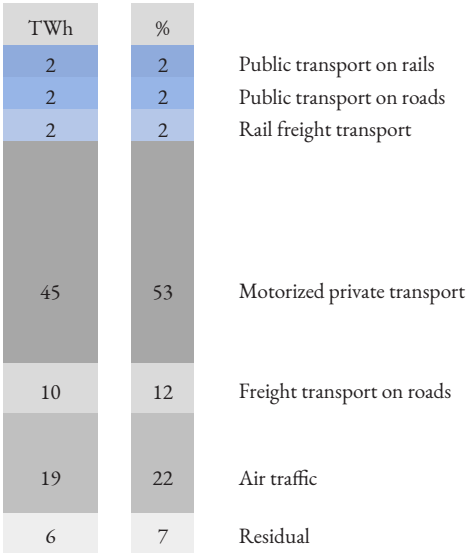


Figure 37: Percentages of energy consumption from various modes of transport Switzerland. Source: Federal Office for Spatial Energy ARE

Transport Outlook 2050:

"Transport use will continue to grow in the future. However, it will grow more slowly than the population due to social and economic trends such as the increase in working from home, continuing urbanization and population aging." (Transport Outlook 2050, a report by the Federal Department of the Environment, Transport, Energy and Communications (DETEC) 2022).

Findings at a glance from the report mentioned above:

+11% Passenger transport (passenger-kilometers) :

+ 2% Share of public transport (from 21% to 24%)
+ 2% Share of bicycles (from 2% to 4%)
- 5% Share of cars (from 73% to 68%)

- 13% in commuter trips:

+31% freight transport (tonne-kilometer):

+ 2% Share of rail (from 37% to 39%)
- 2% share of road (from 63% to 61%)

+53% light commercial vehicles (vehicle-kilometer):

The report *(Transport Outlook 2050)* envisions 4 scenarios of mobility in terms of future development, out of which 1 is the basis scenario and the remaining 3 are alternative scenarios based on changing conditions like (change in government structure, population, advancements in green technology, intentions of politicians, etc.). The common assumptions between these 4 scenarios are as follows: prosperity, work from home and on-line shopping will all increase.

The scenarios are as follows:

1. The basis scenario
2. The business-as-usual scenario (BAU)
3. The Sustainable Society scenario (SuS)
4. The Individualized Society scenario (InS)

1. The basis scenario:

- It reflects a development towards resource-efficient mobility of people and goods.
- It depends on development of mobility w.r.t the plans of the FOT.
- This scenario includes a series of transportation policy initiatives that support resource conservation and sustainable mobility.
- The Basis scenario typically assumes that society will accept these policies.
- As e-bikes gain popularity and cycling infrastructure is improved, there is an increase in bicycle utilization.
- Using a private vehicle is more expensive than taking the bus or train.
- As working from home grows more common, business and commuter travel will be drastically reduced.
- In contrast, leisure travel has significantly increased.

2. The business-as-usual scenario (BAU):

- Considers that things will progress in terms of the current case with little changes.
- It is a continuance of the current state of affairs.
- Technological advancements do occur, but only slowly do they impact mobility.
- The primary concern is not sustainability.
- The rate of urban sprawl is steadily increasing.
- The types of settlement and housing are unchanging, and car ownership is reasonably inexpensive.
- As more individuals work from home and shop on-line, the average number of visits per person declines slightly, but since more trips are taken for leisure, the amount of traffic stays about the same as it is now.

The two scenarios Individualized Society (InS) and Sustainable Society (SuS), when compared to the Basis scenario, demand a more advanced level of technological development and acceptability. In all scenarios, several automated cars are assumed. More than 60% of passenger vehicles will be automated by 2050. As part of on-demand transportation services, buses that can be ordered flexibly as needed are established. Electro-mobility develops at a different rate in each scenario; in the Sustainable Society, almost 85% of all cars will be electric by 2050, whereas in the Individualized Society, the figure would be closer to 44%. These many suppositions for the two situations consider

account whether technological advancements are exploited for environmental or economic purposes (Sustainable Society) or of the benefits of individuals (Individualized Society).

3. Sustainable society scenario (SuS):

- This scenario assumes that mobility is strongly dependent on the technical advancements in the industry, here in this case for sustainability and conservation of resources.
- The sense of obligation to the natural world and the broader social context is strong in this situation.
- There is a strong readiness to contribute and people care more about sustainable services than material things.
- The focus of spatial planning is on internal urban growth, which improves the quality of life in urban areas.
- Instruments that increase the cost of owning an automobile are introduced by policymakers.
- Prices for public transportation are also being reduced.
- These presumptions have the effect of making the overall amount of traffic lower than in the other scenarios.
- Long term, automated passenger and freight vehicles are developed, such as automated public transportation systems in cities and on-demand shuttle buses in rural areas.
- The majority of passenger vehicles run on electricity.
- Almost all passenger cars run on electricity.
- Political tools like the heavy goods truck tax aid in the substantial movement of freight traffic onto the railroads.

4. Individualized society scenario (InS):

- This scenario assumes that mobility is strongly dependent on the technical advancements in the industry, here in this case for individual comfort.
- Individual transport users utilize technical advancements largely for their own personal gain in the Individualized Society scenario.
- While the trend toward larger automobiles continues, owning a car is a given.
- Sustainability comes second; people care about the environment as long as it doesn't limit their freedom of action or cost too much.
- There is a trend in spatial planning toward more urban sprawl.

- Instead of urban settings, new neighborhoods develop in rural and intermediate areas.
- Since public transportation receives fewer subsidies than passenger automobile use, which continues to be inexpensive, its cost has increased.
- Combining several forms of transportation or sharing possibilities are virtually ever desired.
- Rail and road freight transportation are inexpensive to run.
- Online commerce grows faster than it does in the other cases.

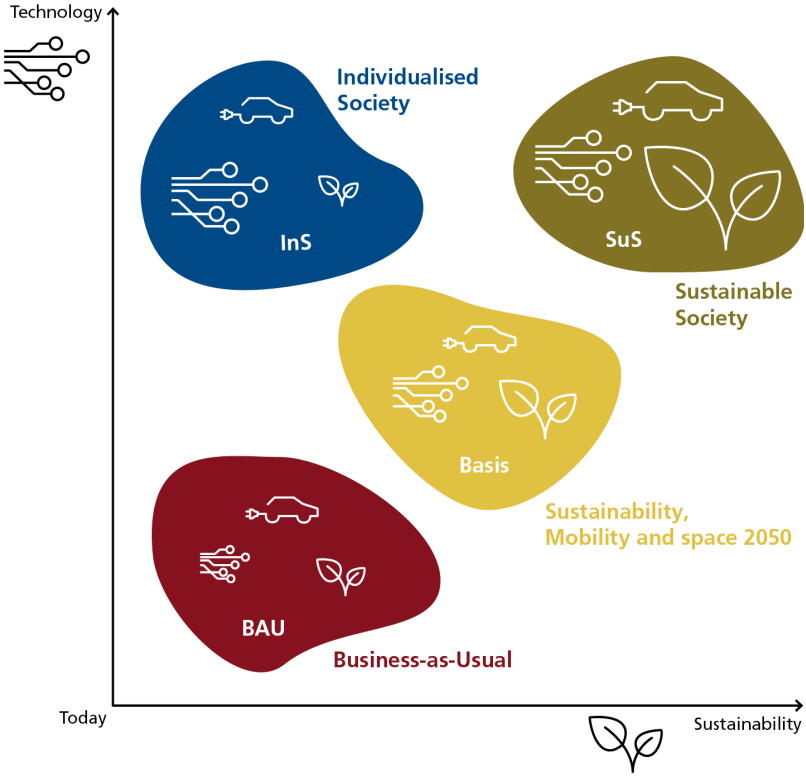


Figure 38: Graph of scenarios based on their inclination towards sustainability and/or technology. Source: Federal Office for Spatial Energy ARE

Transport landscape 2050: Speculations

These are predictions of how transport could be in the next 30 years based on the basis scenario which follow the contemporary social and economic trends.

1. Economy and population:
   All scenarios are predicated on the premise that by 2050, the population will have increased by 1.8 million to 10.44 million and that GDP will have grown by more than 50%.

2. Work from home:
   The prevalence of working from home has considerably grown due to the corona virus epidemic. Even if later there is a fall in the number of people working from home, many people will continue to do so on a regular basis. Therefore, it is assumed in all scenarios that fewer people will commute each day.

3. Deliveries:
   Online shopping is already very common. All scenarios presume that there will be more home deliveries and fewer shopping visits because Internet shopping will only continue to grow.

4. New modes of transportation:
   In the future, automated vehicles are expected to be a common sight on the roads, according to the Transport Outlook. According to the Basis scenario, the percentage of automated passenger vehicles is predicted to rise quickly starting in 2040 and might reach 32% by 2050.

5. Electro-mobility:
   According to the Transport Outlook 2050's Basis, Individualized Society (InS), and Business as Usual (BAU) scenarios, over half of all automobiles will be electrically powered. According to the Sustainable Society scenario, this number might reach 80% of all passenger cars.

6. Road infrastructure development:
   The Transport Outlook is predicated on the premise that existing access roads and national highways would be expanded and new ones built as planned until 2040.

7. Public transportation:
   The scheduled rail network expansions through 2035 will proceed according to schedule. Increased mobility options, such as bus and tram links, etc., would be strongly related to urban agglomeration initiatives.

8. Seasonal tickets and vehicles:
   Season passes for local, regional, and national transportation networks, such as the GA and Half-Fare Travel-card, will become more popular under the basic scenario. Therefore, using public transportation will result in lower mobility costs for users. As more people are anticipated to live in urban areas with great public transit, another supposition is that households will possess slightly fewer cars in 2050 than they do now. The availability of automobiles, accessibility, and incentives on public transportation all have a direct impact on people's choices.

9. Transport expenses for both people and goods:
   The Transport Outlook determines the cost per kilometer of using either public transportation or a private vehicle in the base case, presuming that the latter is more expensive than the former. Due to an increase in the heavy goods vehicle levy, freight transportation by road will become slightly more expensive than by rail (HGVC).

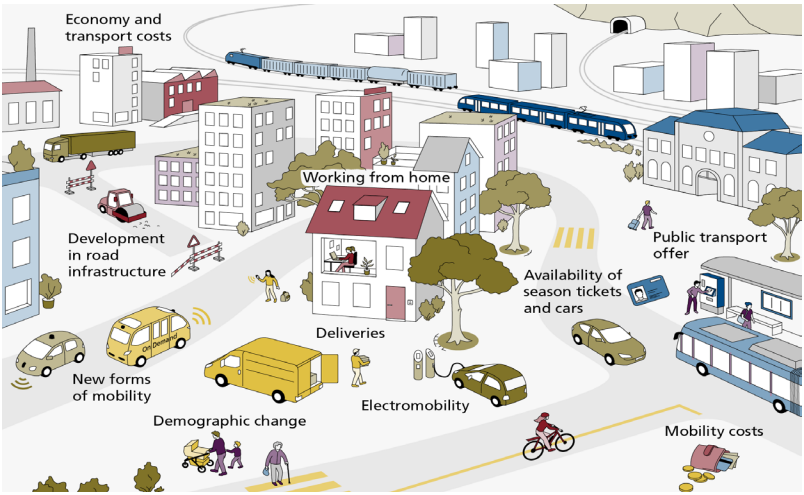


Figure 39: Transport landscape 2050 speculations and assumptions.
Source: Federal Office for Spatial Development ARE

Developments in passenger transport:

In the Basis scenario, traffic volume grows over the ensuing 30 years more gradually than would be implied by the anticipated population rise. On the one hand, demographic aging reduces the workforce's share of the most mobile population. Contrarily, the socioeconomic development will lead to quicker shopping trips and shorter commutes. Instead, people spend more of their free time traveling.

1. Use of transport grows at a considerable low rate compared to the population:

A crucial finding in passenger transportation is the use of transportation. This is measured in person-kilometers (pkm) each year. A 10 km trip taken by one person in one car has a value of 10 pkm, while a trip taken by two people in the same car over the same distance has a value of 20 pkm. The description of the results emphasizes the Basis situation.

In the period from 2017 to 2050, the population will grow by roughly 21%. In contrast, the Basis scenario sees an increase in transportation use of 11%, expanding at a rate that is disproportionately slower than that of the population. To put this into perspective, while the population increased by 9% between 2010 and 2019, transportation consumption increased by 13% during that same time. Fewer people are working, which can be attributed in part to the rising average age of the population.

When considering the usage of passenger automobiles alone rather than all means of transportation, which increases by only 3% in the Basis scenario, the abnormally low growth in traffic is made further obvious. This means that even though there will be more people living in Switzerland in 2050 than there are today, car traffic will only modestly increase. Vehicle-kilometers are essentially at the same level as they are now. The fact that more people share car use overall is one factor in the stagnating vehicle-kilometers.

By contrast, use of public transportation has increased significantly (29%), as has cycling (97 per cent). These modes of transportation are used for greater distances more frequently, which results in lengthier individual trips. The typical distances for pedestrian traffic remain the same in any scenario.
In the Business-as-Usual (BAU) scenario, the number of cars being transported

increases in proportion to population growth. The Individualized Society (InS) scenario experiences the highest rise in vehicle-kilometers, at 22%.

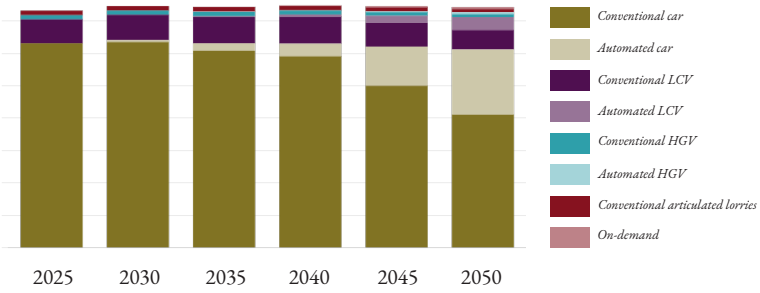


Figure 40: Transport services and use vkm vehicle type, basis scenario.
Source: Federal Office for Spatial Energy ARE

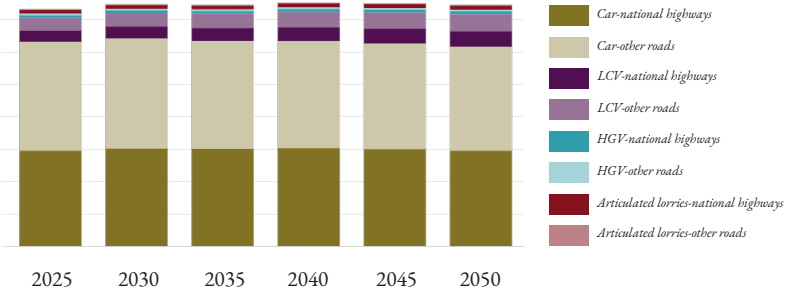


Figure 41: Transport services and use vkm journey type, basis scenario.
Source: Federal Office for Spatial Energy ARE

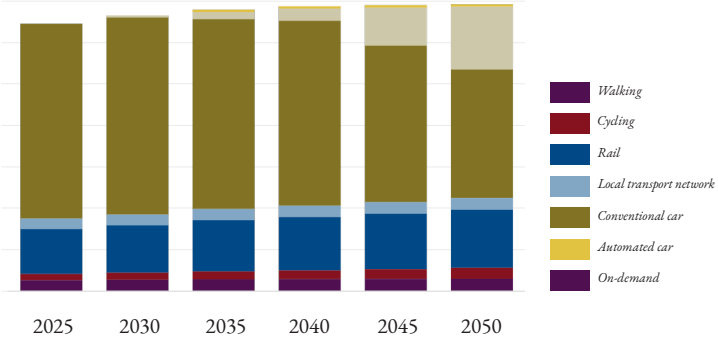


Figure 42: Transport services and use person-kilometers, basis scenario.
Source: Federal Office for Spatial Energy ARE

2. Shift in the share of public transport, walking and cycling in transport use:

The modal split is calculated using the share of each mode of transportation in overall transport usage. In the Basis scenario, public transit use increases by 3.4 percentage points, cycling increases by 1.7 percentage points while passenger car use declines by 5.4 points. In this case, despite the decline in passenger automobile use, two out of every three kilometers are still traveled by car in 2050. The Individualized Society (InS) scenario is the only scenario where passenger automobile use as a share of overall transportation increases from the present.

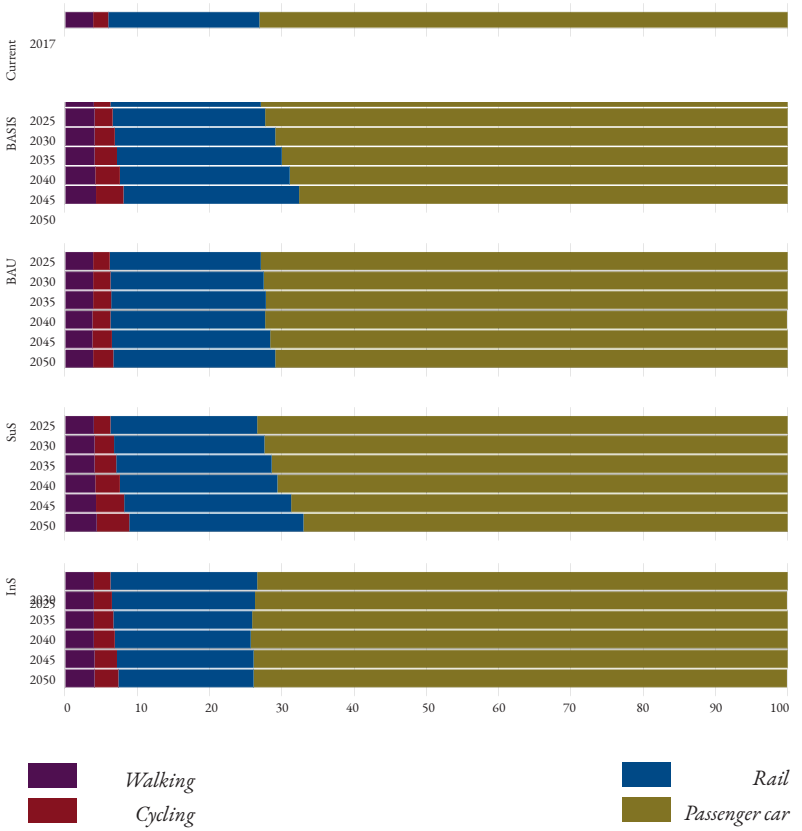


Figure 43: Shift in the share of public transport, walking and cycling in transport use.
Source: Federal Office for Spatial Energy ARE

3. Major changes in mobility behavior from the 2030s onwards:

Starting about 2035, it is expected under the Basis and Sustainable Society (SuS) scenarios that driving a private vehicle will be more expensive than taking public transit. This is because public transit is more likely to receive larger subsidies and because laws are in place that take into account the external expenses of using a private vehicle.

Due to increased passenger car usage costs, more compact cars are purchased under the Basis and Sustainable Society scenarios. The market share of large and medium-sized passenger cars is declining. In the scenario of an Individualized Society, there is a trend toward large and medium-sized autos.

The Transport Outlook projects an aggressive development in vehicle engines based on Energy Perspectives 2050+. In particular, the Sustainable Society scenario's high percentage of electrically powered vehicles represents a set of policy changes intended to achieve 2050 net zero greenhouse gas emissions.

4. Automated vehicles and on-demand transport become established:

From roughly 2035 onward, a rise in highly autonomous vehicles is anticipated. These are cars that help drivers brake, stay inside the speed limit, and stay in their lane; in certain situations, they are fully autonomous. In the Business-as-Usual and Basis scenarios, the percentage of autonomous passenger automobiles will rise to about 6% in 2040 and to 32% in 2050.

Delivery vans and commercial vehicles make up a larger percentage of autonomous vehicles than other types of vehicles; estimates place this proportion at 7% in 2040 and 39% in 2050. The options for a sustainable society and an individualized society both imply much higher penetration.

On-demand call buses, which run only when necessary, may be used more frequently in the future. After 2035, it's also likely that some of the fleet may be autonomous. Their contribution is still modest in the 2050 Basis scenario, but it is rising.

5. Road network and public transport capacity remain stretched:

In the Basis scenario, the distance traveled increases when both passenger and freight transportation are taken into account. The reason for this is, instead of more individuals using their own automobiles to get about, more freight transportation is using the roads. As a result, vans and big freight trucks are more prevalent. The van travel distance, for instance, increases by a significant 58 percent. After 2035, the increase in the cost of using a passenger car somewhat causes the decrease in distance traveled.

Only in the Sustainable Society scenario driving is reduced. Any other circumstance leads to an improvement. The road infrastructure is still incredibly clogged with traffic.

In the Individualized Society scenario, with the exception of a few routes, the number of passengers using public transit progressively increases until 2050. For this, the necessary capacity is provided by the expansion of public transportation, as described in the Transport Outlook. Compared to rail transit, which is often used for longer trips, local public transportation develops more slowly.

6. Less commuting, more recreational traffic:

Less people travel for work and for shopping, but more people travel for pleasure. Society's societal digitization is a significant contributor to this. Video conferencing, for instance, has made it unnecessary to go 100 kilometers to a business meeting, giving you more time for a nighttime stroll. The Transport Outlook predicts that doing business remotely will become commonplace. In 2050, employees who have the choice to work from home would do so for half of their working hours, according to the Basis scenario. Even if there are more jobs, there are 13 percent fewer commutes as a result.

Every scenario where going shopping is being replaced by on-line shopping results in an increase in delivery van trips. Less people are traveling for business and shopping, but this is offset by more individuals traveling for leisure. Since they are often shorter, people are more inclined to travel by foot or a bicycle. In each case, the average daily number of trips is not significantly different.

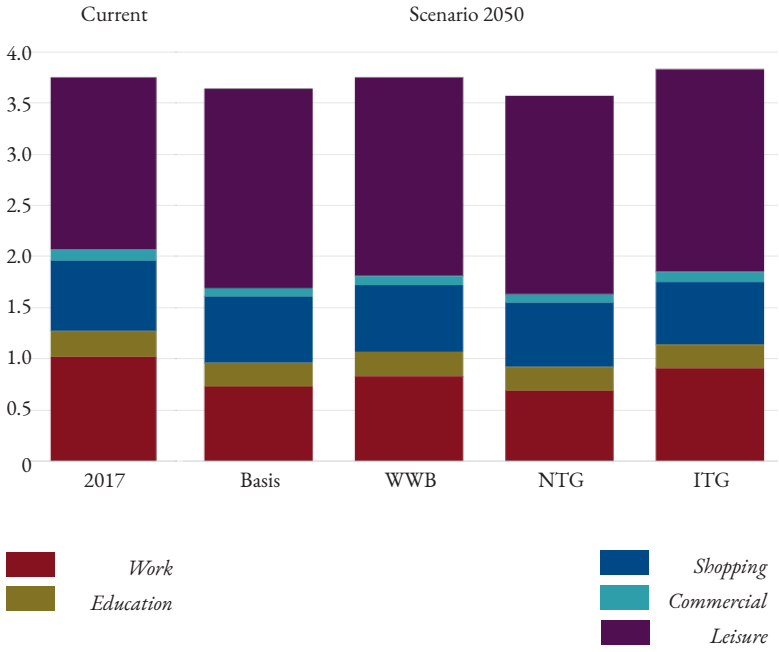


Figure 44: Number of trips by purpose, No of trips per person/working day.
Source: Federal Office for Spatial Energy ARE

7. Trip length variations:

Every scenario involves assumptions and events that have an impact on future travel lengths. For instance, commute times between residences and places of employment, shopping, and pleasure are influenced by spatial layout. The distances change based on the circumstances.

Bicycles, especially electric bikes, are used to travel farther in the Basis scenario. For lengthy trips, passengers prefer the railroad. This is because using the train offers people time to do tasks that are impracticable when driving, and because trains are not slowed down by traffic.

The only scenario that depicts a different picture is the Individualized Society one; in this scenario, workplaces are predicted to experience extensive urbanization, making the distance between residences and jobs occasionally shorter. Furthermore, long-distance public transit is far more expensive in this scenario due to the lack of subsidies. As a result, people usually search for locations closer to their homes.

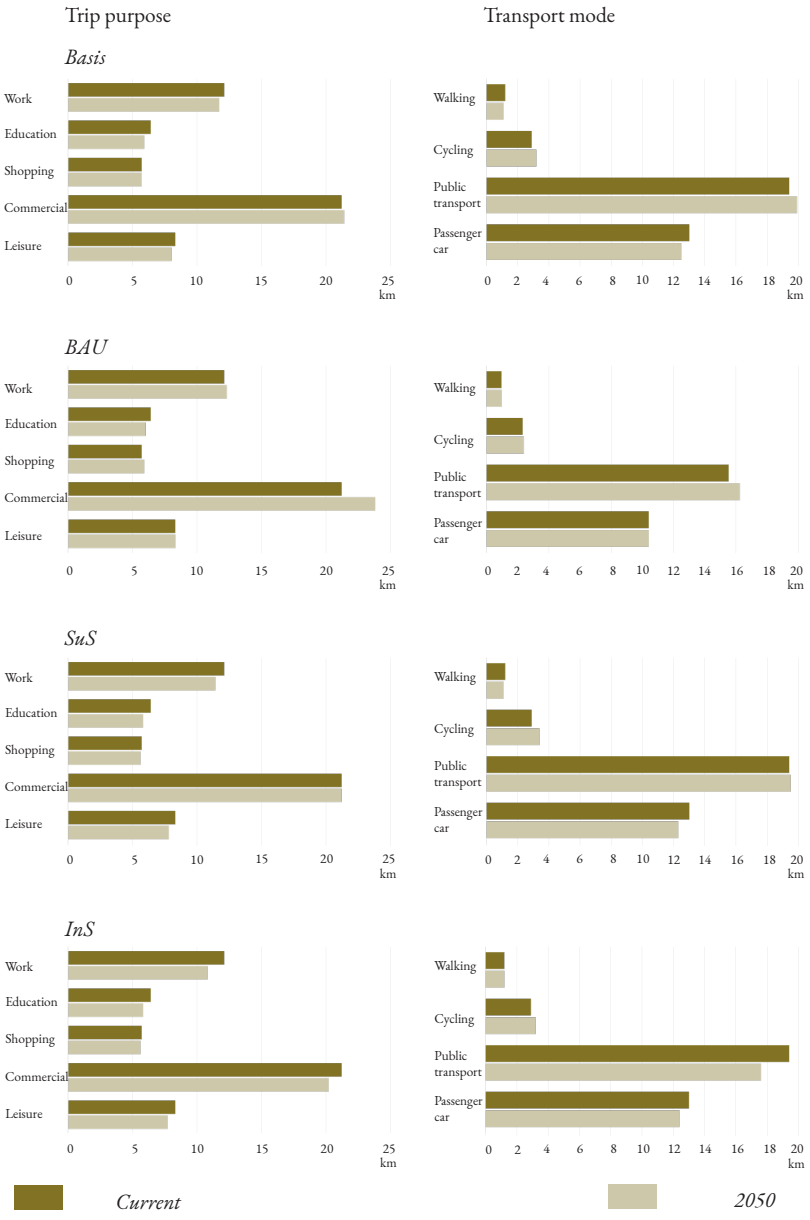


Figure 45: Change in trip length. Source: Federal Office for Spatial Energy ARE

2.3 Landscape Policy: TOWARDS A SUSTAINABLE FUTURE

The Swiss Landscape Concept (CPS)[1] is based on Article 13[2] of the Spatial Planning Act. The Federal Council uses this planning tool, to create the framework for the consistent and qualitative development of Swiss landscape environments.

The main objectives, aims, and principles of the CPS are oriented towards a rational policy for the landscapes to be followed through by the authorities in charge. The primary foundation of this policy is based on 14 goals described in later chapters for utmost quality and depends on relevant stakeholders at all levels of governance and are strictly advised or follow it through. To further assure that each of the smallest detail is looked after, the policy has 13 sectors described in later chapters (including building confederations, energy and transport) with a plan of measures that provide a detailed outlook from small landscapes to big.

The variety of Swiss landscapes is what makes them unique. This enormous natural and cultural wealth is a special resource that is one of the pillars of the country's economic allure, particularly in the tourism industry. In order to ensure that the diverse landscaping services continue to benefit the Swiss population and economy in the future, it is imperative to promote quality-focused development for the benefit of both present and future generations. With landscape quality objectives specific issues concentrating on unique challenges in terms of territory, general landscape quality targets are valid for the entire national territory. The landscape typology strengthens the connection between CPS and the territory planning tools by drawing on the geographical differentiation of the Swiss Territory Project as well as current cantonal spatial planning principles.

The CPS is based on the three principles of:

- Principle 1: Implement the objectives of the CPS with spatial planning tools.
- Principle 2: Use the territory in a sustainable way.
- Principle 3: Consider the objectives of the CPS in the context of weighing the interests.

1. Concezione Paesaggio Svizzero (CPS) - Italian, Conception Paysage Suisse (CPS) - French, Landschaftskonzept Schweiz (LKS)

2. Chapter 2 Special Measures by the Confederation Art. 13 Policies and sectoral plans

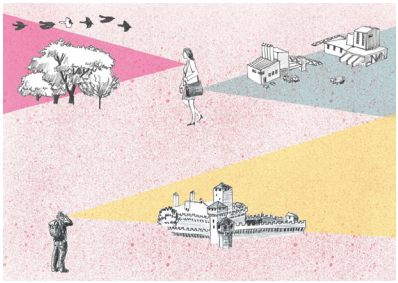
Figure 46: Swiss Landscape Policy. Source: BAFU, Federal Office for the Environment FOEN.

"The Swiss landscapes are diverse. As a place to live and do business, Switzerland benefits from these unique and diverse landscapes. Their high natural and cultural values are a guarantee for a good quality of life and an indispensable basis for Swiss tourism, for example. So that these diverse services available to the Swiss economy and population in the future stand, the landscape is to be further developed in a qualitative manner in the interest of present and future generations. The landscape concept Switzerland LKS lays down as a planning instrument of Confederation defines the framework for a coherent and quality-based development of the Swiss landscapes. The landscape quality goals specify the LKS vision for the year 2040. They support the landscape-relevant actors at federal, cantonal and communal level to achieve high landscape qualities. the general landscape quality objectives apply to the entire area of the Switzerland. The specific landscape quality goals address spatial issues specific challenges. The designation of the landscape types is based on the spatial differentiation of the room concept Switzerland and current cantonal spatial development concepts. Thereby the LKS is better linked to the instruments of spatial planning". (Federal Office of Environment, 2020)

Objective #01

Promote the diversity and beauty of Swiss landscapes.

Figure 47: Objectives of the CPS, source BAFU, FOEN



Objective #02

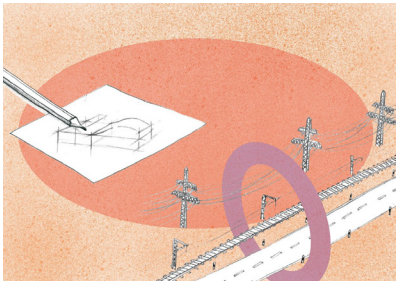
Strengthening the landscape as a location factor.

Figure 48: Objectives of the CPS, source BAFU, FOEN

Objective #03

Develop the land-use in a way that is appropriate to the site.

Figure 49: Objectives of the CPS, source BAFU, FOEN



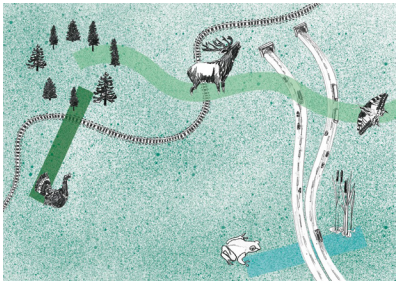
Objective #04

Carry out interventions with care aiming at quality.

Figure 50: Objectives of the CPS, source BAFU, FOEN

Objective #05

Recognize the landscape as cultural and national heritage
A
Figure 51: Objectives of the CPS, source BAFU, FOEN



Objective #06

Conserve and enhance natural environments of great ecological value.

Figure 52: Objectives of the CPS, source BAFU, FOEN

Objective #07

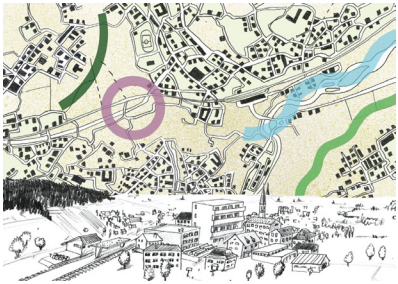
Give free reign to natural dynamics.

Figure 53: Objectives of the CPS, source BAFU, FOEN

Objective #08

Urban landscapes- densify by aiming for quality and guaranteeing green spaces.

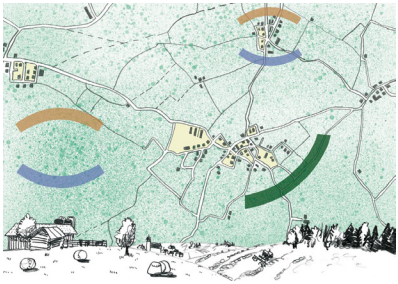
Figure 54: Objectives of the CPS, source BAFU, FOEN



Objective #09

Peri-urban landscapes- stop the spread of urban sprawl and develop urban fringes.

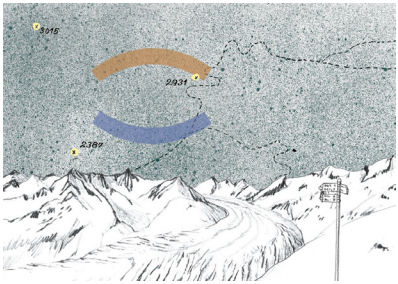
Figure 55: Objectives of the CPS, source BAFU, FOEN



Objective #10

Dominantly rural landscapes- grant priority to land use specifically adapted to the site.

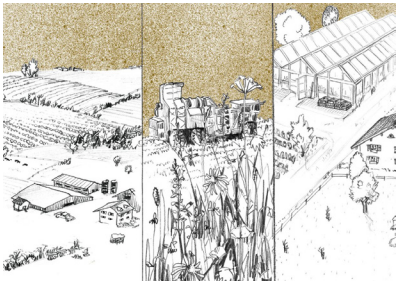
Figure 56: Objectives of the CPS, source BAFU, FOEN



Objective #11

High mountain landscapes- retaining the natural character.

Figure 57: Objectives of the CPS, source BAFU, FOEN



Objective #12

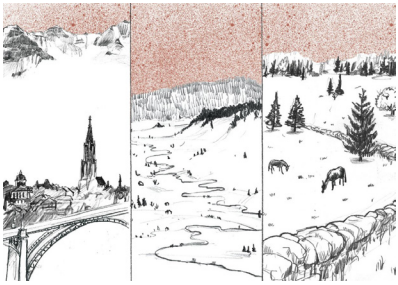
Landscapes used primarily for agriculture- conserving agricultural land and increasing its ecological quality.

Figure 58: Objectives of the CPS, source BAFU, FOEN

Objective #13

Landscapes marked for tourism- conserving and enhancing the landscape, architectural and cultural qualities.

Figure 59: Objectives of the CPS, source BAFU, FOEN



Objective #14

Remarkable landscapes- enhancing the identity of regional landscapes.

Figure 60: Objectives of the CPS, source BAFU, FOEN

Sectors that focus on specific objectives:

1. Confederation Buildings:
2. Health, exercise & sport
3. Energy:
4. National defense:
5. Landscape policy, nature and landscape protection:
6. Agriculture
7. General spatial planning:
8. Regional development:
9. Transportation:
10. Tourism:
11. Forests:
12. Hydraulic works and protection against the dangers of nature:
13. Civil aviation:

3. PILOT, FLAGSHIP AND DEMONSTRATION PROJECTS

The Swiss government encourages the people within the country to boost the development of pilot projects, especially with a high level of transparency to induce insights about technologies and innovations currently ongoing in Switzerland. The aim is to support such projects with funding and promotions to execute it as well as create an awareness within the people with real projects. Many such projects have taken place in the past and many are currently ongoing as presented in the next pages :

Pilot, flagship & demonstration projects:

1. House of Switzerland: Swiss Stories

A. Greens
   - » Making room for nature
   - » Trees of southern Europe
   - » Planting on higher ground

B. Water and Energy
   - » Bacteria to combat climate change
   - » Swiss lakes to heat and cool
   - » Floating solar farms in the Alps

C. Waste
   - » PET recycling leads the way
   - » Introduction of worm composting
   - » Upcycling in the AEC industry

D. Waste
   - » Softcar
   - » Light footprint for heavy vehicles
   - » Riding the waters on electricity

2. 2000 Watt Society
    - » Introduction
    - » What, how & why
    - » Targets
    - » Takeaways
    - » Participant of this vision: The city of Zurich
    - » Project under the umbrella: Smart living lab building, Fribourg

3. Sustainable neighborhoods
    - » Greencity Zurich South
    - » Plaines-du-Loup ecodistrict
    - » Pres-de-Vidy ecodistrict

4. 15 minute city

5. Consultation Greater Geneva:
    - » Greater Geneva and its soil- property, ecology, identity
    - » The great crossing- in search of unique ecologies
    - » Metabolizing the invisible
    - » Energy Landscape
    - » Territory of resources- reconfiguring the existing & revealing the commons
    - » Soil and labor- transition, a new bio-political project
    - » Geneva- metropolitan constellation

3.1 House of Switzerland: PILOT PROJECTS

Purpose: Publishing Swiss achievements across all sectors

Managed by: Presence Switzerland, a unit of the Federal Department of Foreign Affairs (in charge of promoting Switzerland's image abroad)

Leadership: Ambassador Nicolas Bideau, Head of Presence Switzerland.

The purpose of the website is to showcase the achievements of Switzerland as a country across all sectors of science, technology, art, architecture, sports, etc. This ensures a boost of the country's image in the public image locally as well as internationally. Some of the stories covered in the next pages are carefully chosen for the research to have an idea about the measures , projects implementations carried out in the AEC sector in terms of sustainability to adapt to climate change.

Greens:
Adaptation to climate change program by Federal Office for the Environment (FOEN)

Making room for nature:

Figure 61: Park pockets in Geneva. Source: House of Switzerland, Swiss Stories.

In July 2019, the administrative authorities of Geneva took an initiative to introduce through a scattered approach pocket parks, small green squares, plants and trees to move away from as much concrete as possible. To make a more coherent and continuous network, unclaimed and brown field lands are being acquired by the authorities to turn them into green parks with the concept of making room for nature in the city.

Trees of Southern Europe:

Figure 62: Hackberry tree alongside roads. Source: House of Switzerland, Swiss Stories.

With increase in temperature due to climate change, the authorities of Geneva are planning ahead for warmer futures. Considering that the temperatures will keep on rising, they predict that it will get harder for native trees to survive hotter temperatures. Hence, they are planning to plant Souther European trees (Hackberry) alongside roads that will help in shading and will thrive much more in warmer temperatures .

Planting on higher ground:

Figure 63: Green rooftops to avoid concrete. Source: House of Switzerland, Swiss Stories.

Inspite of being located in a natural setting of Lake Leman on one side and Jorat forest on the other, the city of Lausanne faces effects of micro-heat islands as a result of global warming and urbanization. To combat this, in 2015 the city of Lausanne launched a program to create living (green) roofs to reduce concrete surfaces. The authorities envision the city to act like a sponge absorbing water and heat to cool down.

Water & Energy:
Combating climate change with Swiss lakes as well as using them as a medium for energy production.

Bacteria, to combat climate change:

Figure 64: Useful bacteria in Swiss lakes.
Source: House of Switzerland, Swiss Stories.

In June 2017, scientists from Swiss Federal Institute of Aquatic Science and Technology (Eawag) accidentally discovered the Crenothrix bacteria in lakes of Rotsee and Zug to be absorbing methane before it reaches the atmosphere. The bacteria, otherwise considered a nuisance for its role in blocking iron pipes, has emerged as a hero, with a possibility to introduce in another lakes for methane consumption.

Using the lakes to heat & cool:

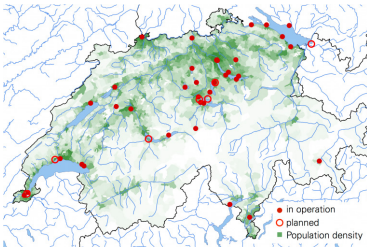


Figure 65: Heating-cooling plants on lakes.
Source: House of Switzerland, Swiss Stories.

Lake surface waters contain a huge amount of thermal energy that is collected from the sun and stored as heat, which is extracted and put to use. With 35 lake water heating-cooling facilities in the country, some help in heating homes, while others help in cooling Europe's largest super computer and producing clean electricity simultaneously. The country is making most of it's water potential in a green way.

Floating solar farms in the Alps:

Figure 66: Floating solarpark in Swiss Alps.
Source: House of Switzerland, Swiss Stories.

In Dec 2019, Bourg-Saint-Pierre in Swiss Alps installed the world's first high altitude floating solar power plant at 1,810 meters above sea level on lake Toules by Romande Energie. High-altitudes produce up to 50% more energy than one on low-lying land due to: the cold temperatures where photo-voltaic cells are more efficient, stronger UV rays, and reflected light from the surrounding snow.

Waste:
Recycling, up-cycling and composting to combat the problem of landfills

PET recycling leads the way:

Figure 67: Muller PET recycling industry. Source: House of Switzerland, Swiss Stories.

Switzerland is leading in its waste management systems. The Muller recycling attempts to increase the lifecycle of plastic bottles by use of innovative technologies. PET is 95% recyclable as it is made from petroleum/ natural gas, which makes it possible to recycle one bottle almost 6 times. Although the consumption has increased leading to more waste, the recycling industry is playing its role in waste management.

Introduction of worm composting:

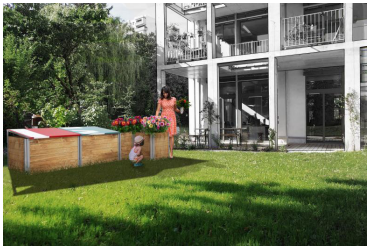


Figure 68: Vermicompost in Swiss homes. Source: House of Switzerland, Swiss Stories.

With already at a head start in PET, glass, aluminum, etc. The country wants to do more with bio-waste, especially at the source itself. A number of startups are creating systems for worm composting that could be installed in homes, commercial complexes, etc. to directly cut-off bio-waste accumulation at the regional level and also producing fertilizers that could be used on-site, generating a circular management.

Up-cycling in the AEC industry:

Figure 69: Alpine home the recycled PET. Source: House of Switzerland, Swiss Stories.

In order to build affordable housing, the Ustinov Hoffmann Construction System (UHCS) uses upcylced plastic waste in the form of PET and other materials. The technique generates Lego-like components for wall connections as well as load-bearing beam and post structures. This system has received high praise for being a extremely innovative design as the housing has a longer shelf life and PET is upcycled.

Mobility:
The transition towards a cleaner mobility system to reduce the CO2 emissions through zero carbon mobility

Softcar:

Figure 70: 4-wheel drive designed by softcar. Source: House of Switzerland, Swiss Stories.

To assure reducing a car's carbon impact at all levels from cradle-to-cradle, Softcar has launched an electric 4-wheel drive that is completely recyclable at its enf of life cycle. It is marketed as the first vehicle that is entirely powered by electric mechanisms and is thus 100% environmentally friendly. The car is now being mass produced and is simplified to require only 4% part numbers to that required by conventional cars.

Light footprint for heavy vehicles:

Figure 71: Heavyweight drive by Futuricum. Source: House of Switzerland, Swiss Stories.

Futuricum, under the umbrella of designwerk manufactures completely electrical mechanism systems to run heavy weight vehicles. They have a reduced rate of noise and air pollution which is generally a huge problem with the conventional heavy vehicles. Switzerland, Netherlands and Germany are trying to move towards this sustainable approach by eliminating CO2 emissions.

Riding the waters on electricity:

Figure 72: Electric ferry by Leclanche. Source: House of Switzerland, Swiss Stories.

With other forms of automobile shifting towards electric mode, Swiss boats are also moving in the direction, with the Swiss company - Leclanche and its electric ferry 'Ellen' running 100% on electric mode. It roughly takes 30 minutes to charge and travels a distance of 41 kms, stronger than any other existing electric ferries and has a capacity to carry 200 passengers and 40 vehicles. This is a great step towards CO2 free water transport.

3.2

2000 Watt Society: PILOT PROJECTS

Date: 1998

Stakeholder: The Swiss Federal Institute of Technology in Zürich (ETHZ)

Aim: 2000 Watt of energy use for every inhabitant by 2050

Partcipants under this concept:
2001, Pilot Region Basel
2005, The city of Zurich
2008, The canton of Geneva

Projects under this concept:
2022, Fribourg Smart living building

Figure 73: Logo for the 2000 Watt campaign. Source: website of 2000 watt swiss.

Figure 74: Logo for the 2050 goals. Source: website of 2000 watt swiss.

The concept of 2000 Watt Society, believes in equality in terms of fixed energy consumption targets for each individual , a vision for a livable future respecting the resources that are available for human consumption, and aiming toward a high quality of life through sustainability.

The main aim is that each person gets 2000 Watts of energy for primary consumption as against 4700 Watts (2000 Watt Areal, 2018) that is being used by each Swiss person. This ensures a just and orderly distribution of energy for every individual as well as bringing down CO2 emissions. To achieve the aim of the 2000 Watt society concept, 3 main strategies are being implemented :

- Efficiency – less use of the same energy for the same task.
- Consistency – use of renewable energy resources, environmentally friendly technologies, re-use & recycle.
- Sufficiency – use less for a better-quality life.

Why is there a need for such a concept of the 2000 Watt Society?

- Limited resources: With the growing population (8,787,522 in 2022 as against 4,957,066 in 1955, Switzerland. Source: worldometer) and the limited availability of resources that the planet has to offer, sensible use of such raw materials must be considered a top priority.
- Climate: As agreed internationally in the Paris agreement to restrict the global increase in temperature under 2 degrees Celsius, it is mandatory that the energy consumption levels of each person must be regulated to reduce the CO2 emissions to 1 tonne per person per year.
- Justice: Everybody has an equal right to the resources that this planet has to offer and with this in mind, the distribution of these resources must be made equally so that everybody enjoys the same rights.

Considerations of this vision:

In the 2000 Watt vision, the calculations are based on all the phases of the life cycle of a project such as development, planning, implementation & operation of new and old sites to achieve the target of the 2000 Watts. Moreover, for existing sites, the transformation over a long duration can be monitored. This allows checking the greenhouse gas emissions, mobility, gray energy & primary energy keeping in mind the goals of 2000 Watt society.
The project is aimed at not just focusing on a single building but also across a larger urban area as a whole. This ensures low resource consumption achieved by individual energy-optimized buildings in a well-functioning urban development context based on the targets and aims of the 2000 Watt society.

For the successful achievement of goals, the implementation of the following guidelines for action by all actors is of crucial importance.

1. Use energy resources sustainably, efficiently and frugally. There is a limited availability of such resources.
2. Provide for renewable energy production on and around all buildings as much as possible.
3. Align energy planning with renewable heating systems, decentralize gas infrastructure for fossil heat supply & retirement of residual networks.
4. No more installing fossil heaters and no longer replacing old fossil heaters with new ones.
5. Utilize the local potential of renewable heat. Coordinate energy infrastructure regionally and nationally.
6. In the long term, alternative, renewable combustibles and fuels should only be used for specific purposes.
7. Only electricity from 100% renewable use energy sources. This also includes electricity from nuclear energy no option.
8. Pay attention to the CO2 footprint of technologies & products used. Reduce the (grey) emissions.
9. Keep distances short to cover them on foot, by bike or public transport. Use renewable energy for remaining motorized transport.
10. Skip flights as far as possible by trying reduce long distance travel and shift to using alternative forms of transportation.
11. Minimize emissions from consumption & from the life cycle of goods and services & climate-neutral financial investments.
12. Procure food primarily from regional, seasonal and plant-based sources. prevent food waste.
13. In construction projects, take into account and minimize greenhouse gas emissions from the manufacture of building materials.
14. Monitoring: Monitor the achievement of goals. Define consequences if targets are missed.

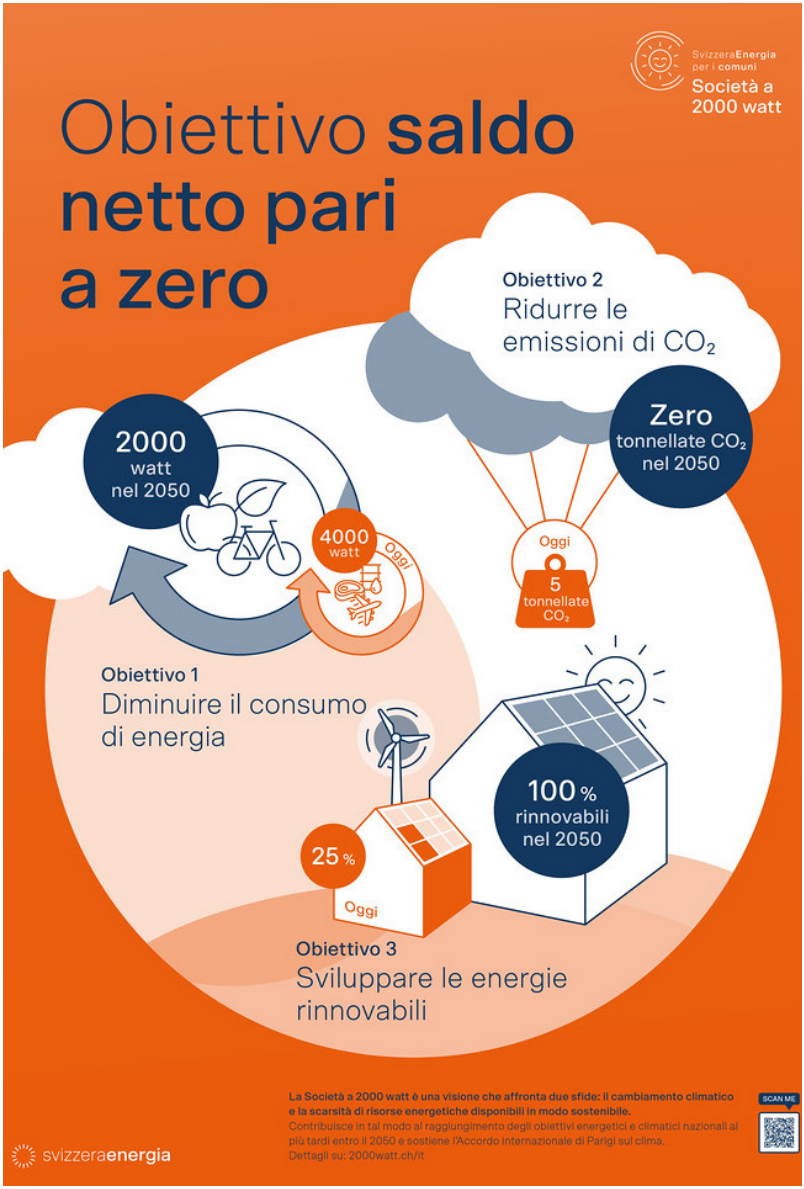


Figure 75: Poster design for the 2050 scenario of the 2000 Watt Society vision. Source: website of 2000 watt swiss.

Important takeaways from the 2000 Watt vision:

Energy efficiency & equality: 2000 watts of primary energy continuous output per person. Equality in terms of resources, services & benefits.

Climate neutrality for climate change: Zero energy-related greenhouse gas emissions. Appreciate the resources & use them sensibly.

Sustainability: 100% renewable energy supply. High quality of life meeting the goals of sustainability.

"Why 2000 Watts?

Today's Swiss standard of living could be maintained with effective energy use of 2000 watts per person.
With consumption of 2000 watts per person, a reduction of the annual CO2 emissions to one tonne or less per person caused by energy use is realistic.
2000 watts is approximately the average energy consumption worldwide.

Why one tonne of CO2?

Based on the targets outlined in the Paris agreement, worldwide annual greenhouse gas emissions must drop to one tonne per person by 2050, so that climate warming can be limited to two degrees.

How much is 2000 Watt in reality?

The work performed by twenty workers, or three horses, working around the clock. Burning one litre of petrol every six hours consumes 2000 watts.

How much is a tonne of CO2?

One tonne of CO2 = 300 litres of combusted petrol, enough to drive (8 l/100 km) 4000 kilometres, e.g. from Zurich to Stockholm and back."

(Report - On the way to the 2000-watt society: Zurich's path to sustainable energy use, City of Zurich)

The city of Zurich: 2000 Watt society vision

The city of Zurich has been actively incorporating the vision of 2000 Watt site society since 2005. The diagram below demonstrates the road-map the City of Zurich envisions for its progress in achieving the targets starting from 2015 until 2050.

Figure 76: Roadmap designed by the city of Zurich along the lines of the 2000 Watt Society vision. Source: website of city of Zurich.

Consumption

Areas of action

1 Goods and products: Reviewing requirements and consuming in an environmentally conscious manner
2 Producing food in an ecological manner and using with consideration
3 Closing materials cycles: promoting reuse, recycling and utilisation
4 Developing and promoting new forms of consumption and production

	Measures of the City	Status	Level of effect	Effect
K1	Implementation guidelines on ecological procurement in procurement processes in municipal administration	●	□	▶
K2	Sustainable diet in public facilities (local, seasonal, preferably plant-based, reduction in food waste)	●	□	▶
K3	Expansion of recycling (e.g. slag processing)	●	■	▶
K4	Reinforcing communication on the 2000-Watt Society	○	■	◀
K5	Strengthening of the green industry (e.g. resource-friendly products, repair, sharing, plastics recycling)	◌	■	◀
	Measures of the canton and of the federal government			
K6	New steering fees for other resources (e.g. areas, raw materials)	◌	■	▶

Settlement

Areas of action

5 Reducing area consumed for living, working and infrastructure
6 Implementing attractive, mixed and compact forms of housing
7 Reducing need for motorised mobility

	Measures of the City	Status	Level of effect	Effect
S1	Identification of concentration potential and area planning for areas with special usages	●	■	▶
S2	City of short distances (e.g. social and functional mix, usage of ground floor)	●	■	◀
S3	Ensuring development of free space in areas of concentration and in the portfolio	●	■	◀
S4	Realisation of special recreational areas on the edge of the city	●	■	▶
S5	Contribution of the 2000-Watt requirements in the planning procedures	●	■	▶
S6	Development of municipal structure plan settlement, landscape and public buildings in close coordination with energy planning	●	■	◀
S7	Compensation of planning-related benefits in planning projects	○	■	◀
	Measures of the canton and of the federal government			
S8	Entrenchment of the compensation of planning-related added value in cantonal law	○	■	◀

Mobility

Areas of action

16 Increasing attractiveness of public transport/bicycle/walking
17 Reducing cross-border motorised private traffic
18 Using efficient, climate-friendly drive concepts
19 Reducing CO_2 emissions of aviation

	Measures of the City	Status	Level of effect	Effect
M1	Expansion of tram and bus network pursuant to VBZ network development and trolley-bus strategy	●	■	▶
M2	Implementation of parking space planning and management	●	■	▶
M3	Optimisation of traffic management (volume control e.g. via traffic lights, access restrictions)	●	■	▶
M4	Implementation Master Plan Bicycle	●	■	▶
M5	Expansion of mobility consultations (e. g. mobility in companies)	●	■	▶
M6	Optimisation of logistics for industrial and freight traffic	●	■	▶
M7	Promotion of alternative drives for municipal vehicles pursuant to vehicle policy	○	□	▶
M8	Further development Strategy Urban Traffic (e.g. expansion of public transport, adaptation of traffic volume motorised private traffic, alternative drives, home office)	◌	■	▶
	Measures of the canton and of the federal government			
M9	Tightening of CO_2 threshold values for passenger vehicles and commercial vehicles	●	■	▶
M10	Introduction of CO_2 tax on motor fuels or increase in petroleum tax	◌	■	▶
M11	Entrenchment of mobility pricing in federal law	◌	■	◀
M12	Reduction in CO_2 burdens caused by aviation, e.g. through CO_2-dependent fuel taxation or take-off and landing fees	◌	■	▶

Buildings

Areas of action

8 Reducing requirements of buildings and services (e.g. area)
9 Optimising existing properties from an energy perspective
10 Designing new buildings for minimum energy consumption
11 Using energy-efficient materials and devices
12 Supplying properties with renewable energy

	Measures of the City	Status	Level of effect	Effect
G1	Further development of energy coaching and energy consulting	●	■	▶
G2	Strengthening of energy-related optimisations in building operations	●	■	▶
G3	Implementation and further development 7-Milestones as municipal building standard	●	□	▶
G4	Area reduction per functional unit in City's own properties	●	□	▶
G5	Enforcement of occupancy regulations in City's own properties	●	□	▶
G6	Implementation of 2000-Watt specifications in portfolio strategies of the City's own buildings	●	□	◀
G7	Cost-benefit consideration of the 2kW specifications in construction projects	●	□	◀
G8	Reduction in requirements of buildings (e.g. mechanisation, equipment, area per functional unit)	○	□	▶
	Measures of the canton and of the federal government			
G9	Continuation «The buildings programme»	●	■	▶
G10	Ongoing tightening of minimum standards and energy label for electricity applications	●	■	▶
G11	Entrenchment of the model regulations of the cantons in the energy sector (MuKEn 2014) in cantonal legislation	○	■	▶
G12	Introduction of electricity steering fee	○	■	▶
G13	Obligation to renewal fund when purchasing property to finance future redevelopments with regard to energy	◌	■	▶
G14	Extension of fiscal deduction period for overall redevelopments	◌	■	▶
G15	Introduction of redevelopment obligation for buildings with a very poor energy record	◌	■	▶
G16	Introduction of target agreements on energy saving for SMEs	◌	■	▶

Energy supply

Areas of action

13 Expanding production of electricity from renewable sources
14 Ensuring purchase of renewable electricity in the liberalised electricity market
15 Heat generation and usage from local renewable sources and waste heat

	Measures of the City	Status	Level of effect	Effect
E1	Continuation efficiency bonus for large-scale consumers	●	■	▶
E2	Expansion of production of renewable electricity pursuant to ewz electricity future	●	■	▶
E3	Development of district heating grids to use waste heat from waste combustion	●	■	▶
E4	Development and adoption of Municipal Energy Planning	●	■	◀
E5	Promotion of own production and consumption of electricity	●	■	▶
E6	Expansion of municipal funds (former electricity saving fund)	○	■	▶
E7	Development and expansion of networks for the usage of waste heat from cleaned waste water and heat/refrigeration from lake water	○	■	▶
E8	Increasing production and usage of biogas	○	■	▶
E9	Development of strategy photovoltaic systems for City's own buildings	○	□	◀
E10	Area-overarching heat supply emanating from municipal properties	○	□	▶
E11	New funding and financing models and/or accompanying measures for comprehensive heat and refrigeration networks	◌	■	◀
E12	Adjustment gas grid (target grid planning Energie 360° AG)	◌	■	▶
	Measures of the canton and of the federal government			
E13	Increasing CO_2 tax on fuels	○	■	▶
E14	Prohibition of fossil heating systems in new builds and when replacing systems	◌	■	▶
E15	Risk capital for new renewable energies (e.g. geothermal energy, storage technologies)	◌	■	▶

Effect: ▶ direct; ◀ indirect; — **very high**; — high

Status: ● ongoing measures; ○ planned measures; ◌ further measures

Level of effect: ■ Municipal territory; □ City Administration

Figure 77: Legend of the roadmap designed by the city of Zurich along the lines of the 2000 Watt Society vision. Source: website of city of Zurich.

Smart living lab building: 2000 Watt society vision

"The Smart Living Lab will play a key role at the heart of the new low carbon district" (Behnisch Architekten)

Location: 1700 Fribourg, Switzerland

Client: BlueFACTORY (BFF)

Architect: Behnisch Architekten, Stuttgart

General contractor: JPF Entreprise Générale SA, Bulle

Floorspace: 5,000 m2

Design: 2019-2023

Completion: 2023

What is Smart living lab?

It is a research center for the future of built environment founded in the year 2014 as an extended campus of EPFL in Fribourg. It is located in the blueFACTORY innovation district whose mission is to mission is to develop, build, promote, and foster community life. The site is affiliated to the Switzerland innovation network West EPFL. It is formed at the intersection of multidisciplinary people from EPFL, the school of Engineering and Architecture of Fribourg & the University of Fribourg that offers research, experimentation & testing facilities in the field of sustainable built environment.

"The facility has been designed with the targets of Switzerland's Energy Strategy 2050. The design also reflects a wider environmental approach that is informed by the values set for 2050 by the 2000-watt society vision and applied during the whole life cycle of its component parts, and meets the requirements of the Minergie-A-ECO energy label and Swiss Sustainable Building Standard (SNBS) certification" (website: Smartlivinglab)

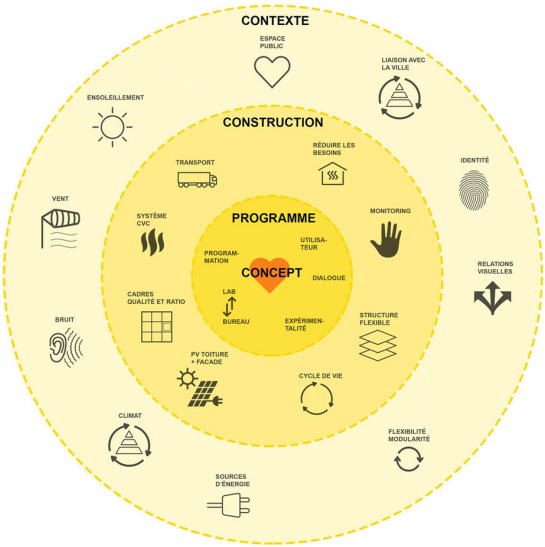


Figure 78: Concept design based on the vision of 2000 Watt society for the Smart Living Lab building in Fribourg. Source: Behnisch Architekten.

Concept:

A structure that uses the least amount of energy possible, with materials and construction techniques carefully chosen to maximize life-cycle effects and decrease grey energy. A sustainable strategy that grounds the new structure as the symbolic core of the site includes intelligent, custom-built facades, winter gardens as "green lungs," and an open plan that encourages interaction. The central plaza, which doubles as an event space and an invitation to grab attention of outsiders, is essential to the contextual approach.

It plans to conduct large-scale trials in four areas: well-being and behavior, building technologies, energy systems and interactions, as well as design processes. The experimental parts of the building face outward, allowing viewers to observe the research in progress. Therefore, in addition to being an educational institute, it also functions as an experimental object on its own. Hence, even after construction is finished, the structure will continue to evolve in order to serve research needs, enhance its functionality, maintain its longevity, and keep its position at the forefront of innovation.

The design concept:

The planning includes the existing structures, including a chimney and silo, both of which have historical significance, presenting the past as a source of regional identity. The sustainable climate concept heavily relies on the facade.

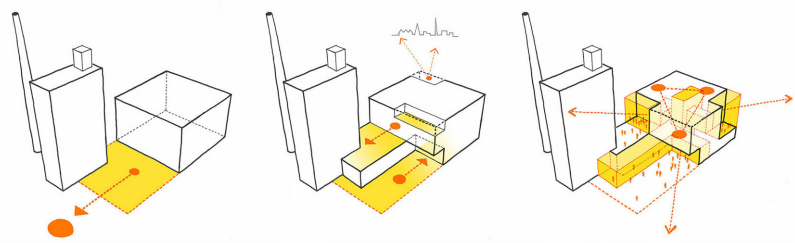


Figure 79: Concept design for the Smart Living Lab building in Fribourg. Source: Behnisch Architekten.

The facade can also adapt intelligently to changing weather conditions: In the spring and fall, the winter gardens serve as a source of air that has been heated by the sun. This lowers energy use. With clay panels acting as thermal mass, the heating, cooling, and ventilation systems are all integrated into a cleverly constructed timber ceiling.

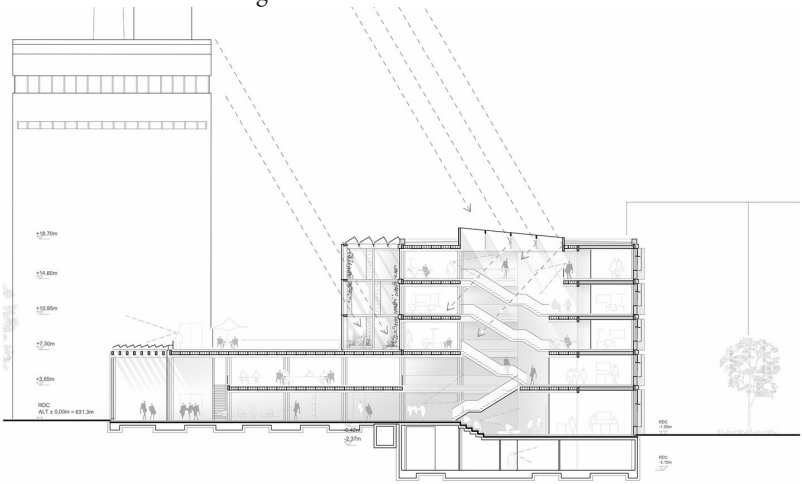


Figure 80: Section detailing climate considerations of the Smart Living Lab building in Fribourg. Source: Behnisch Architekten.

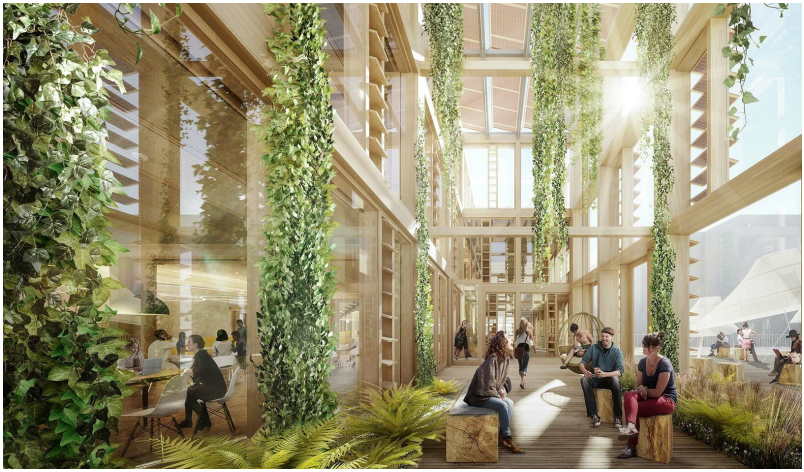


Figure 81: Perspective view of the sustainable features for the Smart Living Lab building in Fribourg. Source: Behnisch Architekten.

The grid of the structural timber frame is filled with prefabricated timber pieces. Lamellas that are positioned vertically and horizontally provide shading; their geometry is uniquely designed for each orientation, allowing for both customized utilization of natural light and sun protection. The lamellas also incorporate photovoltaic components to generate energy.

Figure 82: Perspective view of the Smart Living Lab building in Fribourg. Source: Behnisch Architekten.

3.3 Sustainable neighborhoods: PILOT PROJECTS

"Energy, mobility, architecture and business: thanks to technological innovations, the city of the future will be less polluted and more pleasant. In Switzerland, as in other parts of the world, the urban ecosystem is reinventing itself to improve the quality of life in the cities.

Switzerland is pursuing an innovative policy in this field. In 2012, the Swiss Federal Office of Energy launched a pilot project called Smart City Switzerland, which has brought together Swiss universities of applied sciences, universities, public administrations and companies to rethink our urban environment. Over 60 projects are currently under way under the umbrella of Smart City Switzerland. Responding to an urgent challenge, the project is facilitating new scientific partnerships and boosting innovation in this area" (House of Switzerland, Swiss Stories: Switzerland's smart cities, a valuable export, 2017)

Projects discussed under the umbrella of 'Smart City Switzerland' are as follows:

- Green-city Zurich South
- The Plaines-du-Loup ecodistrict
- Prés-de-Vidy eco-district

Green-city Zurich South

A sustainable city district called as Green-city located in the South-west edge of Zurich city, at exit of the slopes of Sihl Valley, which opens to the North. It is housed on the former industrial wasteland Sihl-Manegg site of the Sihl paper factory. With the Manegg station, Greencity has its own S-Bahn station and is close to the Zurich main station as well.

A city in a city, it has been designed for maximum sustainability. Green-city is characterized by a high density and a carefully coordinated mix of uses between living and working. On the ground floors around the public squares, public-oriented uses ensure life and atmosphere.

"Greencity is urban and sustainable. This combination attracts exciting people and companies, which have a positive impact on the productivity of the new district" (Hannes Spanring, CEO of Meininger Hotels)

Energy Contractor & Consultant: EWZ Energiedienstleistungen

Sustainability:

- 2000 watt area: First certified "2000 watt area" in Switzerland.
- Energy costs: Reduce energy costs to a minimum.
- Care: 100% supply from renewable energy sources
- Green-city grid: Highly efficient networking of power generation and consumption.
- Environmentally friendly mobility concept: Two car sharing locations; 10% of the parking spaces are for electric vehicles.
- MINERGIE: MINERGIE and MINERGIE-(P)-ECO standard for all new residential buildings.
- Certification: LEED Platinum Core & Shell certification for high quality ecological office buildings.

Planning: 2002-2012

Execution: 2013-2020

General Contractor: Losinger Marazzi AG

Architects & Planners:
- Adrian Streich
- AS.Architecture-Studio (Paris)
- Diener & Diener Architekten
- EM2N
- Gigon & Guyer
- JSWD
- Peter Märkli
- Steib & Gscwentner
- Zach + Zünd
- Zita Cotti
- Vogt Landschaftsarchitekten

Land area: 8 hectares

Total built area: 163,000 m2
- Residential: 85,400 m2
- Office: 55,000 m2
- Hotels: 10,000 m2
- Retail: 6,600 m2
- School: 6,000 m2
- Number. of buildings: 13
- Number of Apartments: 731
- Number of inhabitants: 2000
- Number of jobs: 3000

Figure 83: Aerial view of the site of Greencity Zurich. Source: Google maps.

Figure 84: Masterplan of Greencity Zurich. Source: website of Greencity.

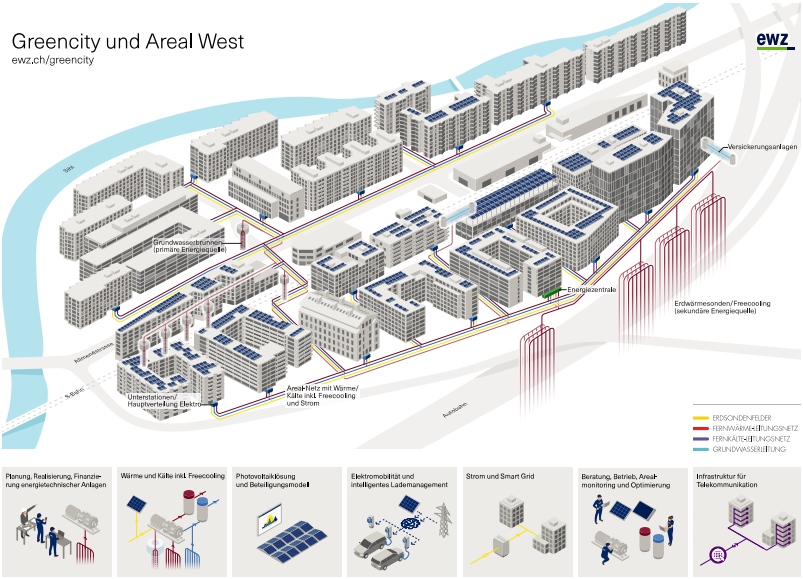


Figure 85: Energy concept diagramto achieve targets of the 2000 Watt Society vision. Source: website of Greencity.

Figure 86: Construction of the Greencity in progress. Source: website of Losinger Marazzi AG.

Figure 87: Areal perspective view of the Greencity Zurich, South in its landscape setting. Source: website of Greencity.

The Plaines-du-Loup eco-district

The Plaines-du-Loup eco-district aims to offer quality sports infrastructure north of Lausanne, while responding to current environmental, social and economic concerns. In addition, the project aims to respond to the concept of a 2,000 watt society, by integrating a series of measures aimed at energy efficiency.

The Plaines-du-Loup site located between the neighborhoods of Bossons, Bois-Gentil, Bois-Mermet, Ancien-Stand and the Blécherette aerodrome. The project is also closely linked to the development of public transport, in particular that of the future m3 metro line, which should be completed by 2030.

Allocations and types of housing are mixed across the entire site to ensure social ,cultural and functional diversity, open to all generations. The distribution of housing is approximately 30% subsidized housing, 40% rent-capped housing, and 30% open-market housing.

Owner: City of Lausanne

Masterplan: Tribu Architecture

Duration: 2010 - 2022

Site area: 30 hectares

Inhabitants: 11000, Jobs: 3500

Functions: community center, schools, ice rink, skate park, greens, residential units.

Architects: 12 firms

The current sports wasteland is surrounded by a heterogeneous built fabric. The urban structure of the master-plan aims to homogenize the new district with the existing buildings, while giving an identity specific to each place by a detailed treatment of the public space. For eg. while in one of the streets there are ramps of the skate park, in another there is a wide ditch allowing the infiltration of water and the development of fauna and flora capable of enriching the biodiversity of the region. From this network, the adjoining buildings form clear street fronts and define a large tree-lined courtyard. The buildings are oriented such that large balconies to the south are provided to protect from the sun in summer, while to the north, the facades are smooth in order to limit heat loss as much as possible.

The concept is that of a zip which aims to join two parts. In Plaines-du-Loup, this term expresses the desire to link the new eco-district to its surrounding context through a network of public spaces.

Figure 88: Masterplan of Plaines-du-Loop co-distrcit. Source: website of Tribu Architecture.

The Prés-de-Vidy eco-district

In the Lausanne region, where diversity is crucial, the Prés-de-Vidy sector (containing of two sites) represents a key location between the major transit networks. A true entrance to the city, it serves as a transition point between the districts of the varied urban areas and the Hautes Ecoles while also being in the center of the conurbation. The master plan's main function is to specify the parameters for the project's development and act as a foundation for the creation of the allocation plans. It specifically responds to the site-specific environmental, social, and economic challenges.

The following strong elements have been retained:

- Maintaining the horticultural establishment and part of the workshops on the current site while optimizing it.
- The desire to offer a local neighborhood and public spaces on a human scale.
- The opening up of the site by strong connections in soft mobility.

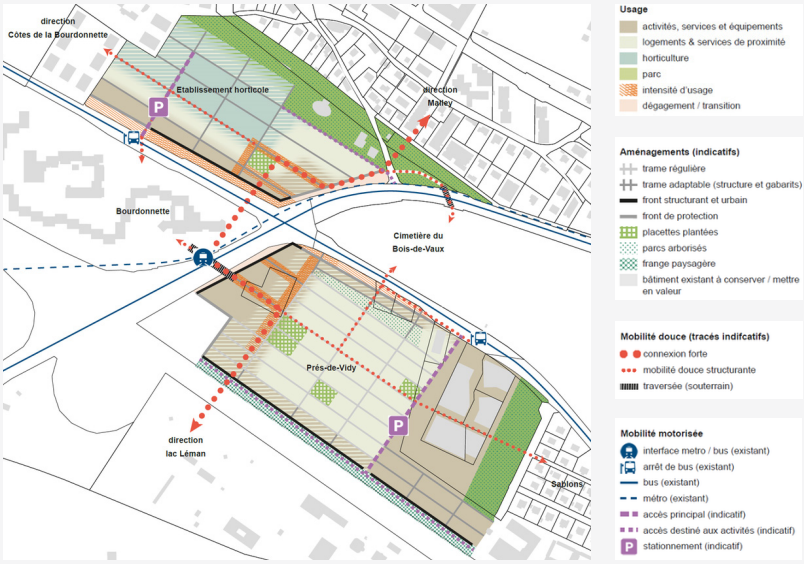


Figure 89: Masterplan of Pres-de-Vidy eco-distrcit. Source: website of city of Lausanne.

Owner: City of Lausanne

Site elevation: 379m maximum

Area: 180,000 m 2

Jobs: 1'000

Delivery: from 2029-2033

Inhabitants: 2500, from 2029

Total perimeter: 14.5 hectares

Archaeological: 8,000 year old remains

The municipality of Lausanne made it possible to stabilize this guiding image focused on thematic approaches (environment, mobility, energy, archaeology) that will serve as a basis for the continuation of detailing of the master-plan.

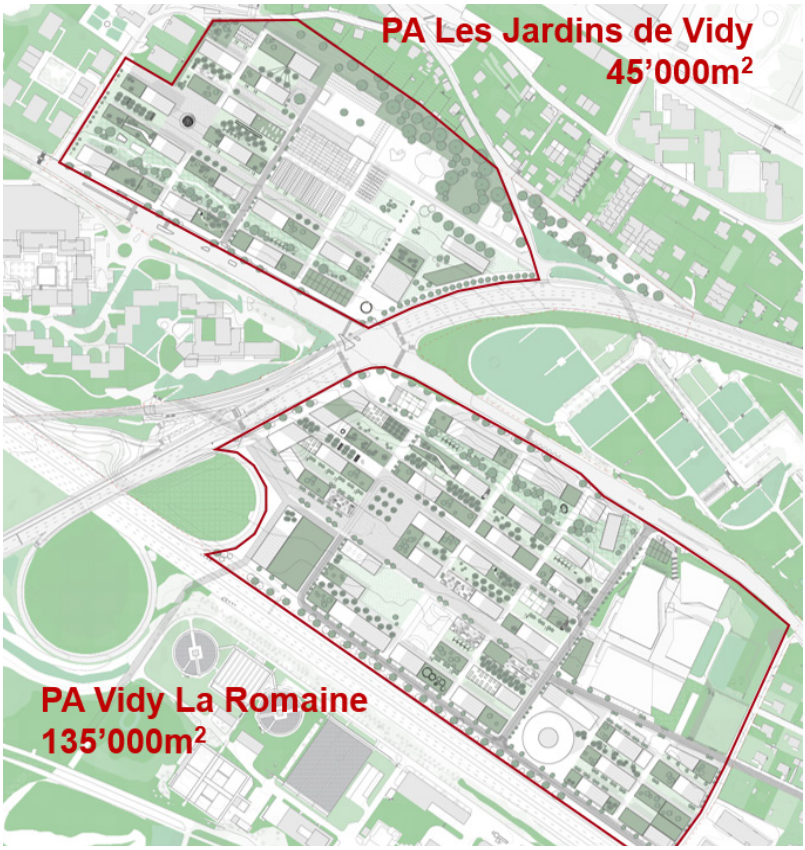


Figure 90: Siteplan of Pres-de-Vidy eco-distrcit. Source: website of city of Lausanne.

3.4

15 minute city:
PILOT PROJECTS

Date: 2016. Republished in 2021.

Author: Carlos Moreno, French-Colombian

Popularized by: Mayor Anne Hidalgo, Paris for re-election campaign 2020

Type: Research - vision & concept

Based on:
Jane Jacob's - The death and life of great American cities, 1961
Clarence Perry's - controversial neighborhood unit, 2006
Nikos Salingaros - Compact city replaces sprawl, early 1900's.

Precursors & successors:
Kent Larson's - 20 minute city, 2012
Weng's - 15 minute walkable neighborhood, 2019
Da Silva's - 20 minute city, 2019

Recognition: Obel Award 2021 celebrating "outstanding architectural contributions to human development"

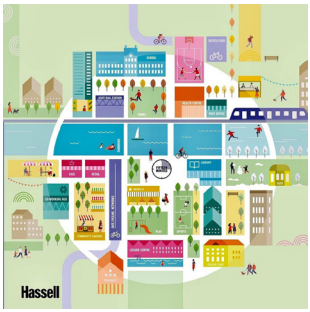


Figure 91: 15-minute city illustration.
Source: Hassell.

The concept of the 15-minute city became popular in the COVID-19 pandemic times, when the entire world was at a standstill, movements were restricted and the reach of the World for the people suddenly shrunk to only the reach of the neighborhood. Hence, major cities like Paris, started to work towards this idea of a 15-minute neighborhood to design for any future catastrophe.

The aim is to device a strategic plan to help improve the quality of life of the inhabitants of dense metropolitan regions.
The concept revolves around the strong foundation of decentralizing the cities such that each inhabitant has easy access to home, work place and all necessary facilities within a distance of 15 minutes. This time frame of the distance ensures that all places are accessible by soft and/or green mobility thereby reducing fuel consumptions, harmful effects on environment, climate change impacts and carbon emissions.

Cities are concentrations of creativity , diversity and innovation. But, with the increase in population and its effect on the increasing urban sprawl, the connectivity, relativity and proximity between people, places and their activities is lost. This loss of proximity has given rise to an individualistic behavior of car ownership and its use which cause harmful effects to the environment by CO2 emissions and other greenhouse gas emissions.

This calls to action for redesigning the cities to save the planet and its people and hence the rise of the concept - 15 minute city. It is an urban redesign model that forces us to think of the city in new ways that are beneficial to the humans and the environment that they live in. The model is based on the following criteria:

- Neighborhood redesign: each inhabitant has easy access to all essential basic facilities, their home & work place within a reach of 15 minutes either by walk, bike or alternative green mobility transport. This will ensure that the community as a whole thrives without the need of long commutes.

- Rhythm: Cities should be designed around humans as the central point. Until now, cities have been planned and designed around cars and as a result, the experience is not human centric. The same space used for wide infrastructures for cars, parking spaces and relevant activities can be repurposed for bike lanes, outdoor dining, meeting junctions, public transport points, local markets, parks & playgrounds and many such functions.

- Multipurpose space use: Activity mapping, time frame of activities, user age group, etc should be mapped such that coherent activities can run in the same space at different times.

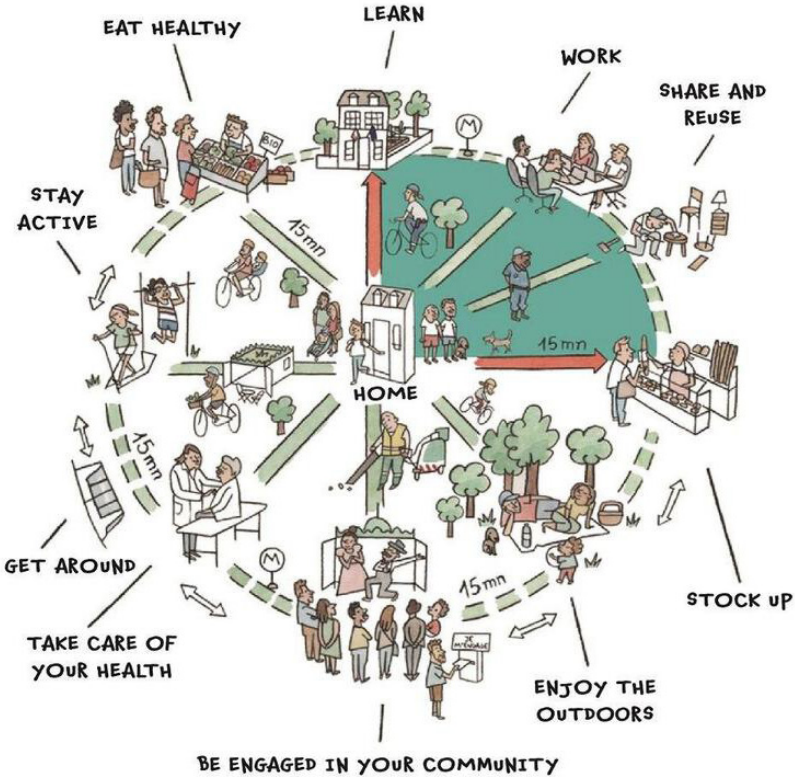


Figure 92: 15-minute city illustration. Source: Artists Micael.

The 15 minute model will work efficiently if more and more cities apply it within their framework such that global resonance effect helps combat the climate change. This will give rise to the desired effect of livable and sustainable cities.

3.5 Consultation Greater Geneva: PILOT PROJECTS

In the face of environmental emergency, the ecological transition is proving to be a priority collective project, based on an increasingly broad citizen consensus. The cornerstone of this project is the city and more generally the urbanized Earth, whose drastic reduction of CO2 emissions and its ecological footprint must be considered with rigor and imagination. This Consultation is interdisciplinary and is aimed at the expertise of space transformation (urban planning, architecture, landscape) and related disciplines (human and social sciences, environmental engineering, mobility, etc.). , in order to renew the tools, methods and devices that can influence the shape and functioning of the urban.

Partners: Fondation Braillard Architectes

Title: Consultation Greater Geneva. Prospective Visions for Greater Geneva: To inhabit the landscape city of the 21st century.

Duration: 2018 - 2020

Selected entries: 7 (detailed out in next pages)

"Urban-Architectural and landscape consultation for the ecological transition of urban areas. On the initiative of the Braillard Architects Foundation, a consortium of partners launched the Urban-Architectural and Landscape Consultation. International and interdisciplinary, its ambition is to gather elements of knowledge and to develop scenarios of evolution by the project for the Franco-Valdo-Geneva agglomeration by 2050. Its character is based on the three pillars of sustainable development, namely the environment, the social and the economy. The Consultation is under the aegis of the United Nations for the Environment and under the high patronage of the Federal Office for Territorial Development. The project perimeter proposed by the Consultation is that of the Greater Geneva Territory Project. This territory has a cross-border character as it includes the Canton of Geneva, the district of Nyon and the French municipalities grouped in the Metropolitan Pole of the French Geneva" (Fondation Braillard Architectes, 2020)

1. Greater Geneva and its soil: property, ecology, identity:

Team:

ETHZ DARCH-
Prof. Milica Topalovic, Karoline Kostka, Ferdinand Pappenheim, Charlotte Schaeben, Jan Westerheide

University of Luxembourg-
Prof. Florian Hertweck, Prof. Dr Markus Hesse, Prof. Dr Nikolas Katsikis, Ivonne Weichold

Raumbureau-
Rolf Jenni, Tom Weiss

The central framework of the project is based on the fact that currently Geneva is in an asymmetrical place w.r.t distribution of resources, facilities and socio-economic-environmental needs. Thus, there is an urgent need for an socio-ecological transition of the region, for it to be more socio-economically equitable, ecologically balanced and poly-centric in nature such that the built and the unbuilt are interwoven for a productive coherence. Geneva needs to have a unified cross-border governance because of its geographic proximity to the French border and the fact that the city's unplanned sprawl and growing urbanization already have a bi-national character and will only continue to expand in response to the city's growing population and its needs. As a result of these ideologies, this project is organized along 2 components as follows: 5 urban strategies which can be applied at all scales: architectural to urban & 7 territories of potential within the Geneva region that serves as a conceptual framework for the future land-use planning.

One of the targets for Geneva in moving towards the net-zero target of 2050 is to reduce the CO2 emissions from 10 tonnes to 1 tonne per inhabitant per year. And to achieve this, ,there is an urgent need to drastically change the economy, lifestyle & governance. Hence, the following 5 strategies have been proposed:

"To combat CO2 emissions and reduce them from 10 to 1 tonne, we would need to afforest half of Switzerland completely" (Prof. Florian Hertweck: Greater Geneva Consultation,2020)

City of nature – Geneva has a rich ecological setting which ensures biological continuity between higher (the Jura) and lower (the plateau) altitudes. Hence, protection of soil, water, unbuilt land, resources, forests and everything natural is extremely important.

City of Agriculture - Regionalising food system through agro-ecology (diversity in planting practices, agro forestry, responsible governance via direct regional selling & distribution). Also, enhancing dietary changes with a vegetarian and organic approach.

City of proximity – It aims at interlinking working, living, commerce, and leisure by placing them in a relationship with social and cultural infrastructures, agriculture, and nature areas such that a decentralized or poly-centric urban fabric is achieved.

City of sharing- awareness of a thriving community spirit through th use of shared common goods (air, soil, water, land, infrastructures, knowledge, and even housing). It aims in strengthening the communal and collective practices.

City of cyclic character: it is based on the principles of circular economy, taking into account the cycles of built forms, environment and the biorhythm of humans, such that the city functions as a cradle-to-cradle entity.

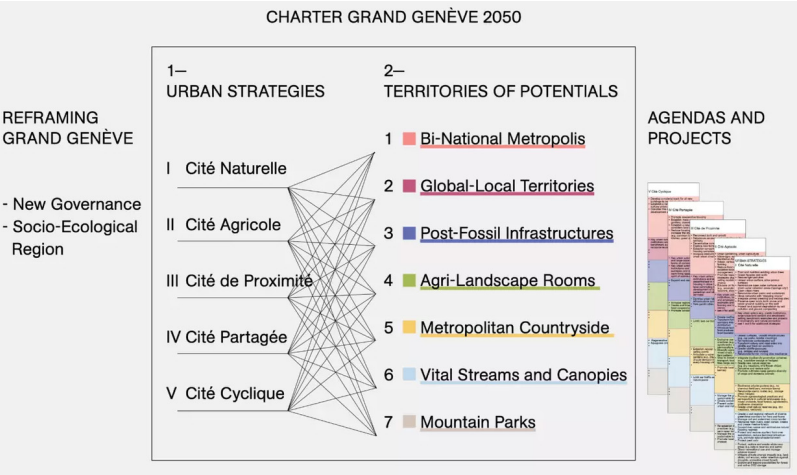


Figure 93: Charter for Greater Geneva by the team. Source: NSL, ETHZ.

The second component: territories of potential, envisions the land-use scenario for Geneva, that interweaves the built and the unbuilt thereby setting in motion the ecological transition by bringing back the land (nature)to the city. The 7 territories of potential are based on current problems of urbanization in Geneva city as well as its strengths w.r.t the rich ecology in the region of Geneva.

Bi-national metropolis: as urban sprawl continues, the regions lying on the borders of Switzerland and France need to have a bi-national governance for a harmonized planning & use of resources.

Global-local territories: lying on the cross-border front of either Switzerland or France, are of very fragile nature and the development of such areas needs to be regularized such that it does not harm the ecology of the neighboring country.

Post fossil infrastructures: identifying networks of former fossil infrastructure sites which are currently abandoned/brownfield such that in the future they can be reclaimed as new corridors for fresh air, passage for nature and wildlife, urban life, public spaces, etc.

Agri-landscape rooms: urban agriculture and farming to introduce recreational leisure within the city that also prevents densification of built forms, enhances surface water permeability and supports biodiversity.

Metropolitan countryside: areas that are currently in the status of exclusive and frozen landscapes solely for elite uses, need to be developed as inclusive and diverse cultural landscapes available for use to all in the metropolitan region.

Vital streams and canopies: there is a need to move from fragmented natural areas to a more refined, integrated and connected ecological network that link higher and lower altitudes thereby also enriching the water permeability along such networks.

Mountain parks: are important for the identity of Geneva and regional ecological governance. There is an urgent need to move from singular nature areas to a continuous network of natural reserves through a strategic and conscious development.

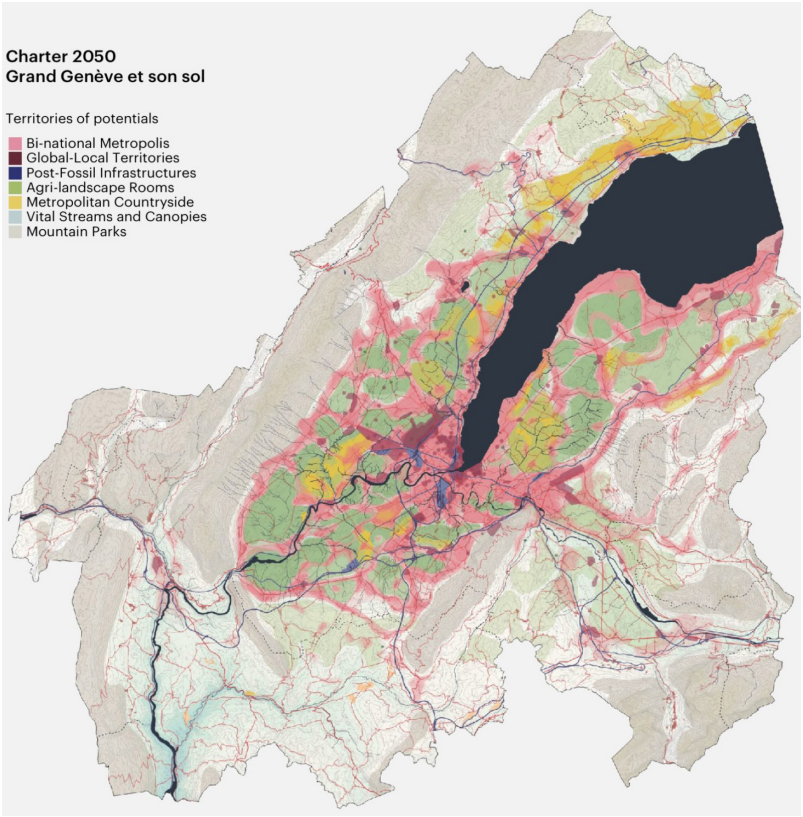


Figure 94: Master plan for Greater Geneva based on the concept of 7 territories of potential. Source: NSL, ETHZ

Figure 95: Perspective of the designed masterplan with the 7 territories of potential as seen from the surrounding mountains. Source: NSL, ETHZ

2. The great crossing: in search of unique ecologies:

Team:

Interland-
Franck Hulliard, Alizee Moreux

Bazar Urbain-
Nicolas Tixier, Charles Ambrosino

Contrepoint, projets urbains-
Pascal Amphoux

Coloco-
Miguel Georgieff

Coopératives Équilibres-
Benoît Molineaux

Ecole urbaine de Lyon
Michel Lussault, Adrian Torres-Astaburuaga, Valerie Disdier

The idea started out by seeking 'singular ecologies' in the cross-border (France-Vaud-Geneva) metropolitan region. To realise this idea, the team underwent a major crossing, both physical by walking in the metropolitan region mentioned earlier as well as metaphorical - through a research for ecological transitions.

All of this helped in finalizing a systematic approach to identify three conditions of the singular ecologies: the experimentation cluster, the cross-border passage and the catchment area.

Figure 96: (L-R) The experimentation cluster, the cross-border passage and the catchment area. Source: Interland

4 fields of research supporting the hypothesis of singular ecologies, guided to arrive to a final proposal:

- Re-wilding natural and anthropogenic resources: the symbiotic relationship between man, his surroundings and other living forms needs to be strengthened by regeneration of abandoned lands.

- Territories of inhabitation: the entire system to generate built forms and their socio-economic-environmental impacts must be thoroughly considered before planning of such built forms.

- Establishing a contractual basis for exchange: increase in the reciprocity of agreements between stakeholders regarding policies, strategies , decisions, exchanges of common goods, etc. pertaining to the ecology, to maintain a common framework of knowledge for any future project proposals regarding the metropolitan region.

- The invention of a third scale: there is no fixed design for any new visions. All developments need to be contextual and site specific.

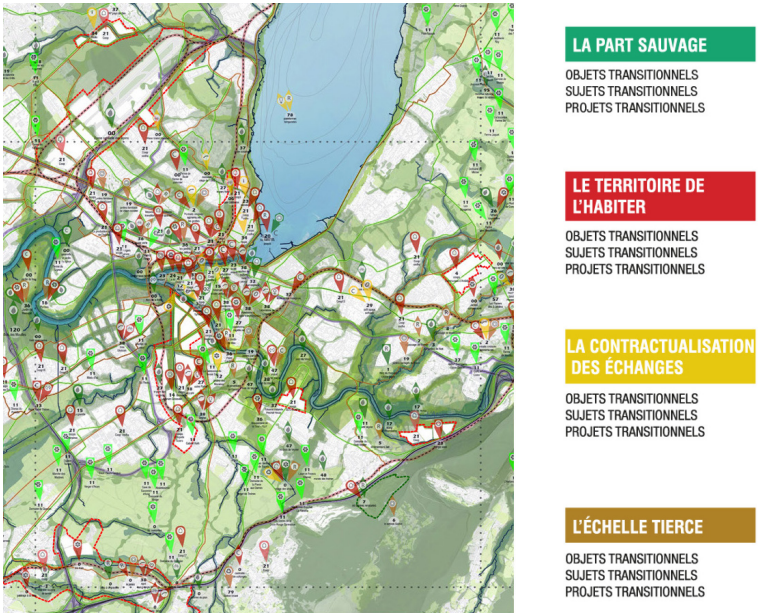


Figure 97: The 4 research fields explained before, mapped on the Greater Geneva region to identify potential sites for project proposal. Source: Interland

This background of the vision of singular ecologies and 4 fields of research defined, 3 demonstration projects: the Archamps-Bardonnex agro-hub, the Geneva-Europe airport and railway station, and the Thonnex Vallard free zone.

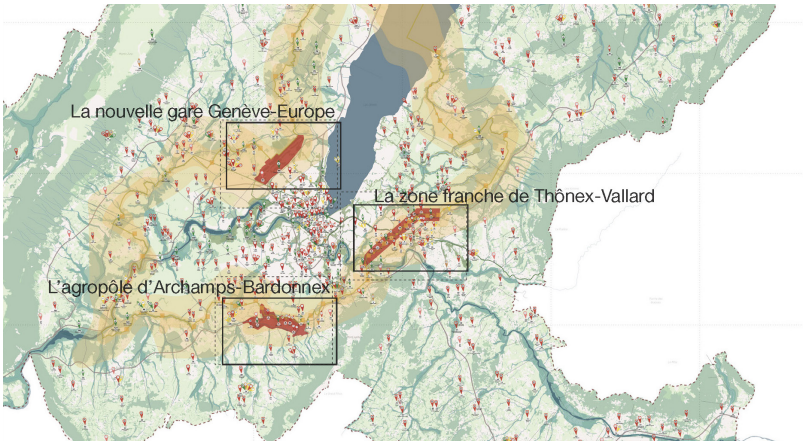
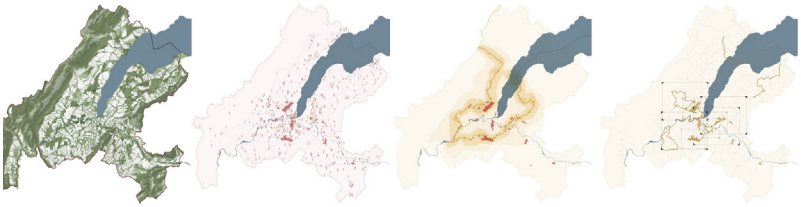


Figure 98: 3 sites identified for the project proposal . Source: Interland

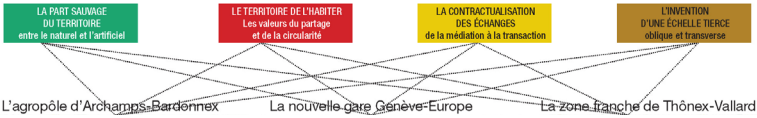


Re-wilding natural and anthropogenic resources

Territories of inhabitants

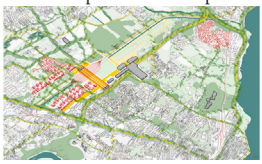
Establishing a contractual basis for exchange

The invention of a third scale



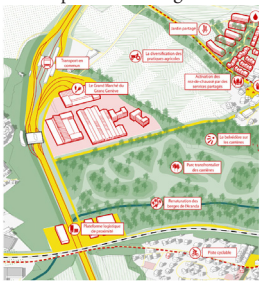
Master plan for the Agrohub

Master plan for the airport

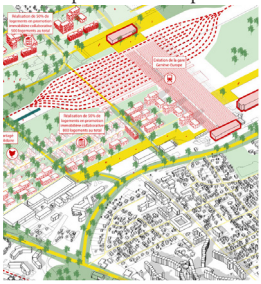


Master plan for the free zone

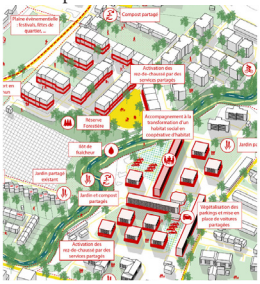
Site plan for the Agrohub



Site plan for the airport



Site plan for the free zone



Agrohub

The airport

Free zone

Figure 99: Step wise development of the project proposal. Source: Interland

3. Metabolizing the invisible:

Team:

AWP Agency, entire team.

TOPOTEK1, entire team.

Alice EPFL Laboratory, entire team.

The interdisciplinary team addresses the ecological transition of Geneva through the under-rated themes of water, waste, energy, transport, logistics & digital which are the natural and technical systems for the basis of land-use. These themes have high investment and climate crisis impacts, yet go unnoticed by majority of the people. By rethinking these themes they can become the strong foundational network for the desired ecological transition with the concept of 'Living Network'.

Upon a detailed study by the team, they realized that Geneva has turned its back on the natural strengths w.r.t its geographical location and landscapes, therefore the network based concept imagines a systemic grid harmonious with the natural landscapes. The networks have to run in synergy and re-established into the systems of nature such that they are adaptable and resilient. Through this approach, the team envisions a rebalanced ecology of the region. To achieve the transition from current to the desired network, pilot projects are to be designed that have a strong impact on the 6 themes mentioned before. Upon closer look, a number of sites were identified which fall under the categories of water, waste, energy, transport, logistics & digital which account to almost 10% of the Geneva region, are public and largely adaptable. This offers a good scope for intervention.

"The aim is not to fill these gaps, but to metabolize them through a series of pioneering projects in order to bring about an overall rebalancing of Greater Geneva's metabolism".(The team at the presentation of Greater Geneva Consultation, 2020)

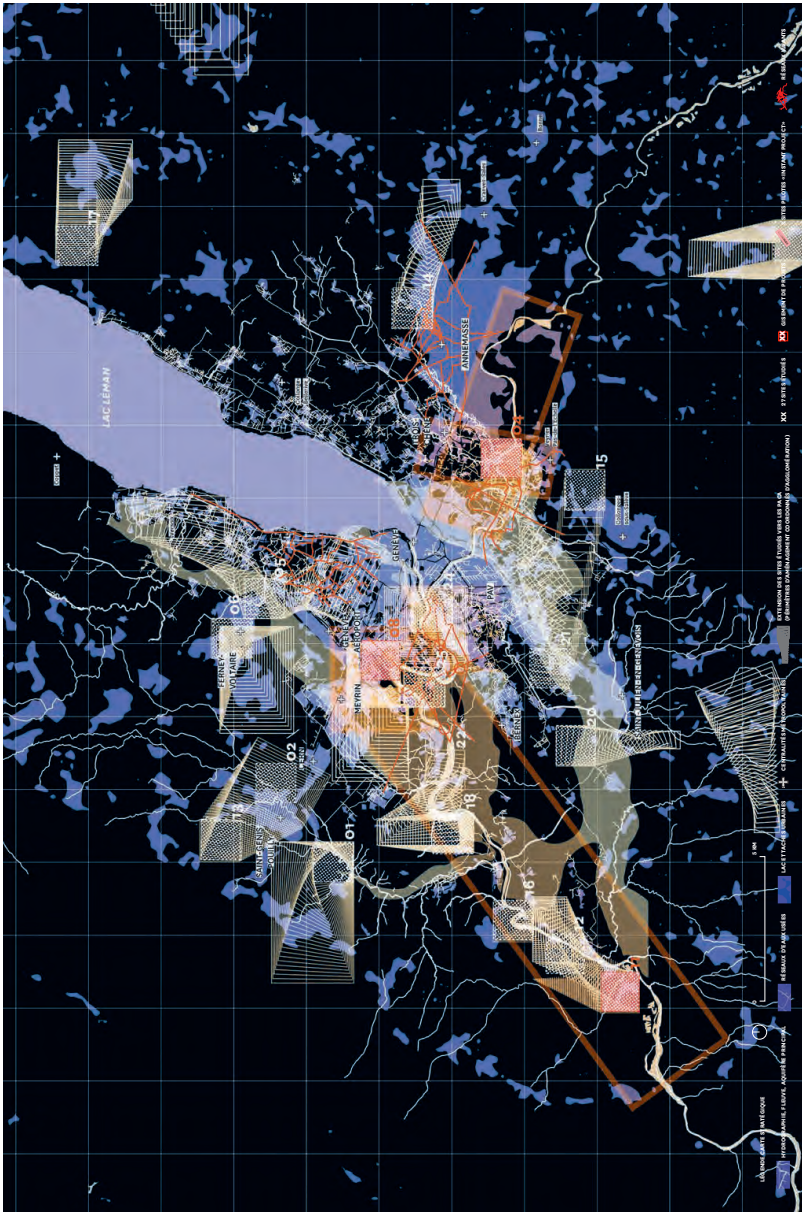


Figure 100: Mapping of the 27 potential sites for Greater Geneva based on the 6 of water, waste, energy, transport , logistics supply demand and digital communication. Source: AWP

4. Energy Landscape:

Raum404 -
Oscar Buson

Lorenz Eugster architecture du landscape et urbanisme -
Lorenz Eugster

Università della Svizzera Italiana -
Sascha Roesler

Emch+Berger -
Guido Rindfüser

Drees & Sommer -
Thiébaut Parent

Urban Studies, University of Basel -
Giulia Scotto

The team proposes a concept that focuses on the relationship between the energy and landscape in the territory, in particular its dependence on oil.

The advancements in technology and with the power of humankind has made it possible to extract fossil fuels from the earth, which makes it extremely fascinating yet poses a threat to the resources, their degradation and bio-diversity. This has been addressed by the team also for the social and spatial impacts of energy on the landscapes of Greater Geneva, where 67% of energy comes from fossils. The goal is to change people's perspectives about the production, distribution, and use of energy from an individualistic perspective to one of commonality and networking. In order to envision this, a number of tactics are used, including the pedestrian as a powerful mobility indicator, synergies between various networks, and a more aware and environmentally conscientious architectural typology.

Along this research journey, the Cointrin airport was identified as the most potential site for an oil-free radical change with reduction in passenger numbers by 2030 and closure in 2050 with development of new mobility alternatives.

The area around the airport in Cointrin has been planned to become a future eco-neighborhood that generates clean, green energy. In order to make room for new 30000 inhabitants and workers, the 17 million air travelers who were responsible for the majority of the fossil fuel usage had to be canceled. The goal is to create an environment with a high level of biodiversity that is livable and has effective energy and climatic systems. Due to this radical change, the nearby agricultural area will also be protected, resulting in the creation of Geneva's harmonious energy-landscape.

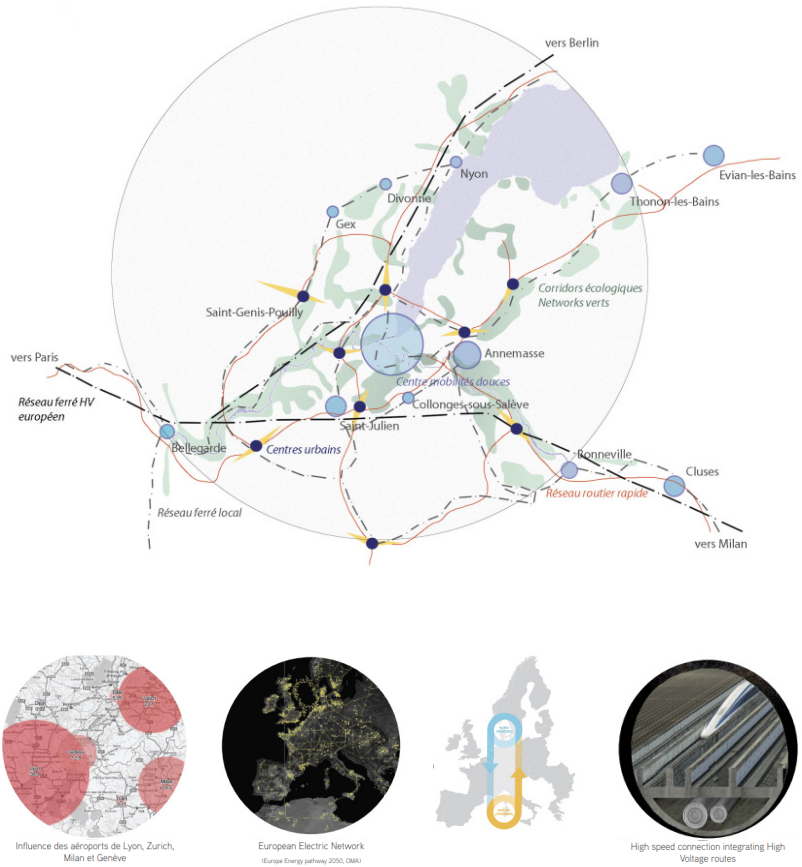


Figure 101: Mapping of crucial indicators like nearby airports, electricity networks grid, alternative mobility options to arrive at a strong backing for choosing the site. Source: Emch+Berger

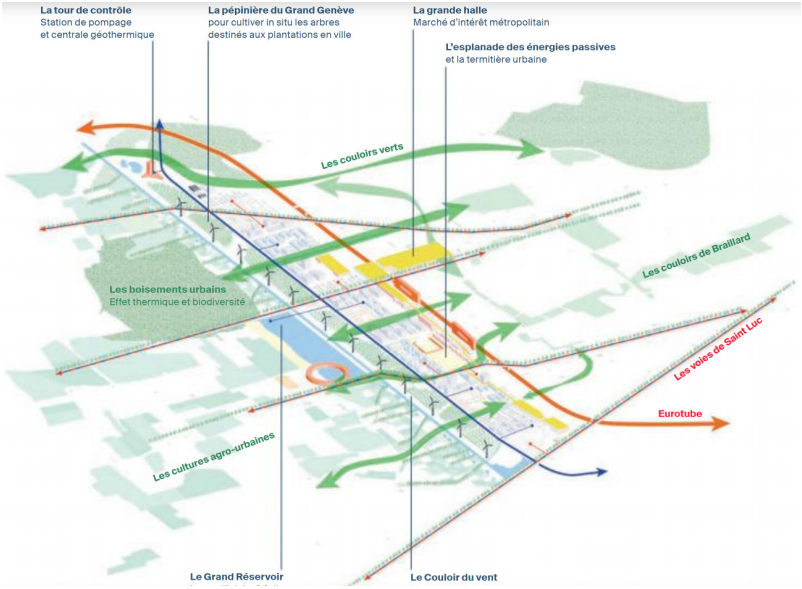


Figure 102: Conceptual site plan for the transition of the Cointrin Airport site. Source: Emch+Berger

Figure 103: Zoomed aerial perspective of the Cointrin Airport project. Source: Emch+Berger

Figure 104: Scenario before of the Cointrin Airport site. Source: Emch+Berger

Figure 105: Scenario after of the Cointrin Airport site. Source: Emch+Berger

5. A territory of resources: reconfiguring the existing and revealing the commons:

Team:

Atelier Apaar-
Nathalie Mongé, Raphaël Niogret, Séraphin Hirtz and Thomas Bollinger

Illustrations-
Irene Gil

Sofies-
David Martin

6t-mobilité-
Sébastien Munafò

Team Academy HES-SO

The concept is based on the resources of the territory that generate new forms of production and habitat and the proximities in the region. A collective image was envisaged at the intersection of 3 laboratories- neighborhood, new village and alpine pastures. A further development of 4 goals was set up to reinvent the image of the region and enhance the ecological transition of Greater Geneva:

Towards more commons
Towards a bio-region
Towards an alter-functionalism
Towards an archipelago of territories

"Each component must perform several functions and each function is performed by several components"(Team at the Greater Geneva Consultation, 2020)

Towards more commons: It facilitates sharing of common goods, resources amenities, etc . for the collective benefit of the community as a whole.

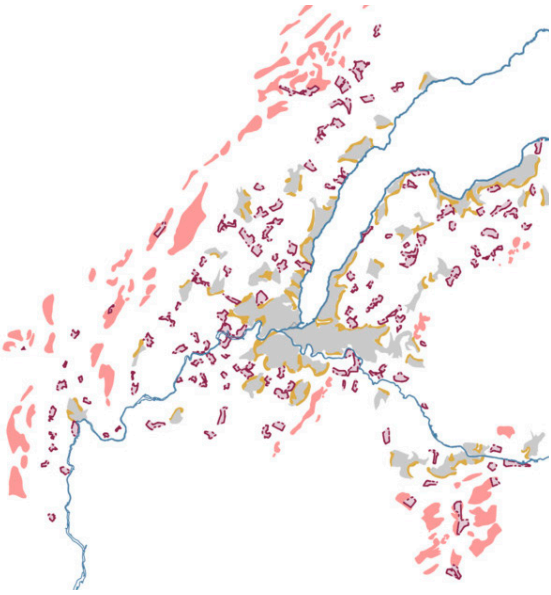


Figure 106: Illustration of the common facilities mapping. Source: Irene Gil.

Towards a bio-region: the city is embedded in a natural setting of biodiversity, landscapes and other natural forms. Thus, green networks and their connectivity from the city to the countryside is considered as a resource.

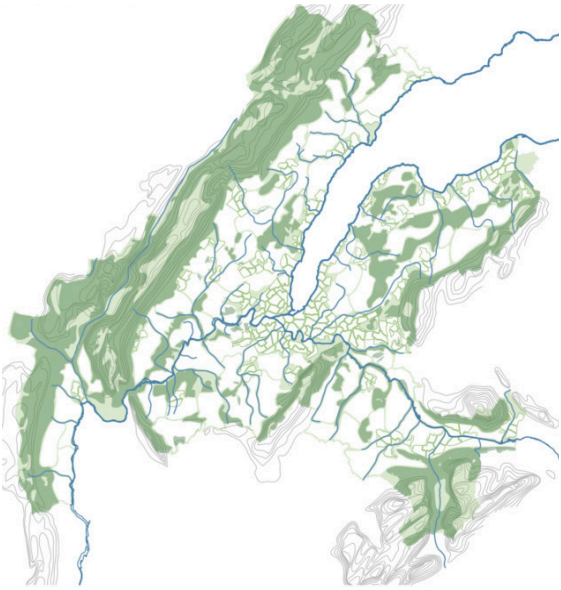


Figure 107: Illustration of the natural landscapes. Source: Irene Gil.

Towards an alter-functionalism: Ecological transition is based majorly on the existing & ordinary scenarios. Hence it cannot be exclusively planned entirely new. The ideas of multi-functionality & reversibility play a very important role in the concept developed by the team.

Figure 108: Illustration of the alter-functionalism. Source: Irene Gil.

Towards an archipelago of local territories: To have micro-territories for better governance, responsibility, decision-making, progress, balanced densities, and in general a proximity for the inhabitants.

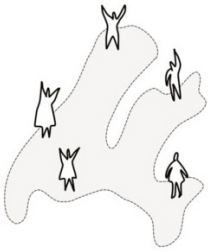


Figure 109: Illustration of the concept of archipelago territories. Source: Irene Gil.

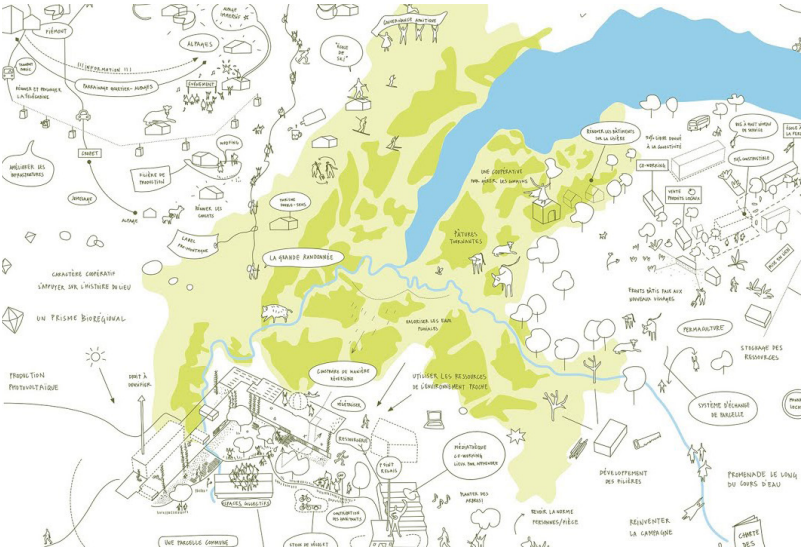


Figure 110: Illustration of the 4 concepts described before in harmony. Source: Irene Gil.

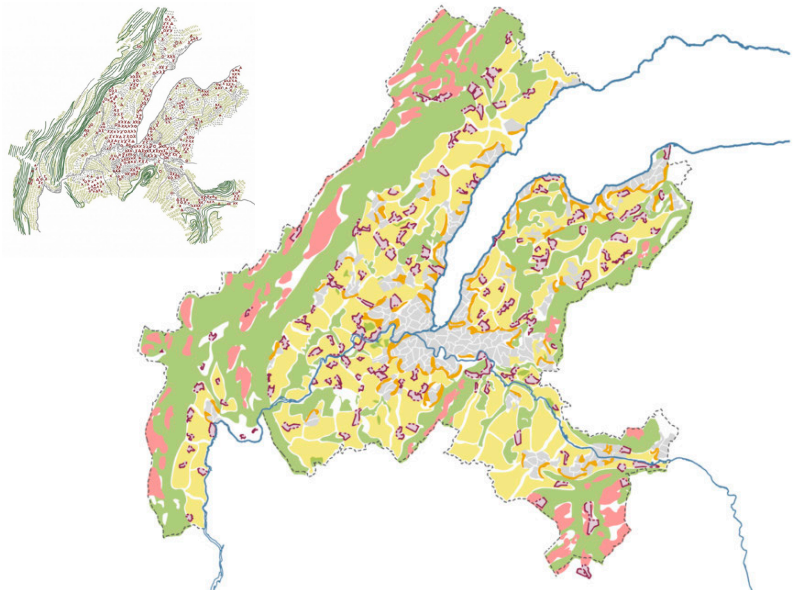


Figure 111: Image guide of the project proposal based on its concepts. Source: Atelier Apaar

6. Soil and labor: transition, a new bio-political project:

Team:

Habitat Research Center, EPFL-
Paola Viganò, Roberto Sega, Vincent Kaufmann

HEPIA-
Pascal Boivin

University of Neuchâtel-
Olivier Crevoisier

"Bernardo Secchi, a critic of this denial, argued that town planning should be based on archaeology, architecture, geography, history, landscape, paedology, and philosophy, as well as a true "soil project." This raises awareness of the soil as a material and metaphorical representation of our relationship with the environment." (Paola Vigano, Greater Geneva Consultation, 2020)

The concept of this proposal focuses on 2 key parameters of soil & labor, that the team deems fit for Greater Geneva's transition not just in ecological terms but also in socio-demographic and economic terms. The concept brings into focus the cross-border territory of Switzerland and France determining it as the 'weak structure' that has to be developed as continuous and merged network such that the contrasts of Geneva in Switzerland and its urban spill in the French part work in harmony. These weak structures assist the strong structures (city centers) by decentralizing, bringing a territorial balance and establishing a horizontal relationship between the centers and their peripheries.

Over time, the key factors identified in the weak structure such as water, soil regeneration, bio-diversity and the decentralization of social and economical systems have become insignificant due to urbanization. Hence, the vision for need to develop this weak structure as a significant network comes into focus. To bring this vision into force, team proposes a stronger and continuous soft mobility network for the cross border region in connection with their centers in the respective Swiss and French parts such that the territory as a whole (as seen in the figure) is a heterogeneous network of inhabitable spaces that are healthy, livable, green, productive and continuous in connection with the functions of living and work.

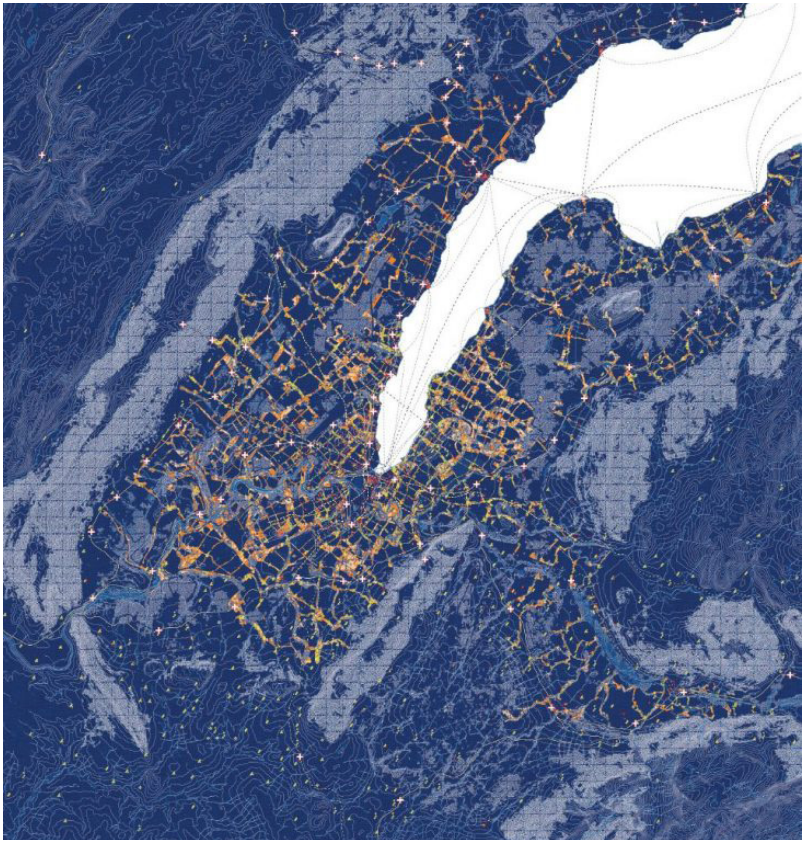


Figure 112: Mapping of the weak territory network. Source: HRC and Lab U, EPFL.

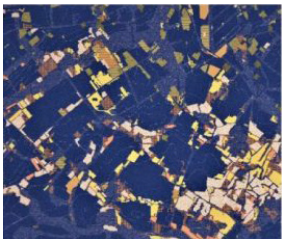


Figure 113: Weak territories as a continuous network. Source: HRC and Lab U, EPFL.

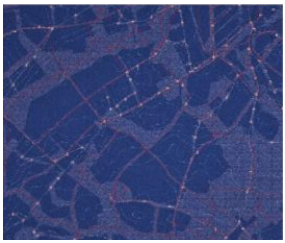


Figure 114: Mobility for accessibility as a continuous network. Source: HRC and Lab U, EPFL.

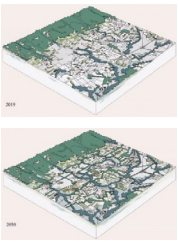


Figure 115: Continuous green network. Source: HRC, Lab U, EPFL.

7. Geneva: metropolitan constellation:

Team:

Stefano Boeri Architects -
Stefano Boeri & team

Michel Desvigne Landscape Architect-
Michel Desvigne & team

Baukuh-
Pier Paolo Tamburelli and team

Bollinger+Grohmann-
Klaas De Rycke & team

Systematica-
Filippo Bazzoni

With the visible impacts of climate change, the team envisions a drastic change in interpreting the future of cities as self sufficient neighborhoods. The need to connect the conventional cities and their neighboring centers in a functional way, is now more than ever.

"To avoid the tragedy of the sprawl that has ruined European territories by turning them into out-of-control suburbs, we must imagine, more than ever before, urban life resettling in peripheral centers, re-inhabiting the small nuclei that had been towns in the past, thus guaranteeing a strong relationship with nature" (Stefano Boeri, Greater Geneva Consultation, 2020)

The concept is therefore of an archipelago metropolis constellation having its center as the Saleve mountain, which integrates city characters, humans, domestic & wild flora-fauna and natural ecosystems. The archipelago character addresses the small neighborhoods as self-sufficient units in a symbiotic union with the others. They will generate new forms of living and work thereby providing a livelihood to the inhabitants in the cradle of nature. The sea in this archipelago scenario is the network of bio-diversity corridors that connect these neighborhoods with nearby urban agglomerations ensuring a perpetual establishment of nourishing ecosystems and a systematic development that protects from extreme land encroachment.

Thus, the nature becomes the strongest resource of the new Greater Geneva in its journey towards an ecological transition.

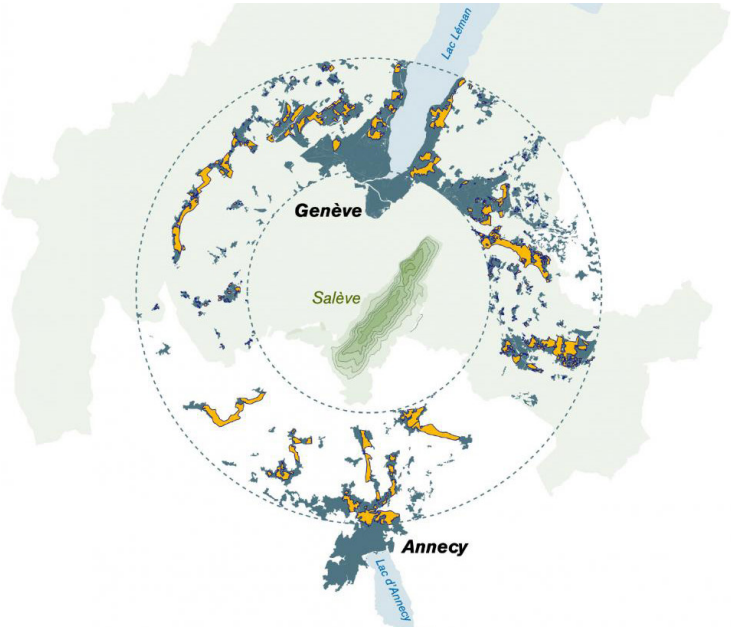


Figure 116: Conceptual diagram for Geneva as a metropolitan constellation. Source: Systematica

Figure 117: Masterplan for Geneva as a metropolitan constellation. Source: Stefano Boeri Architects

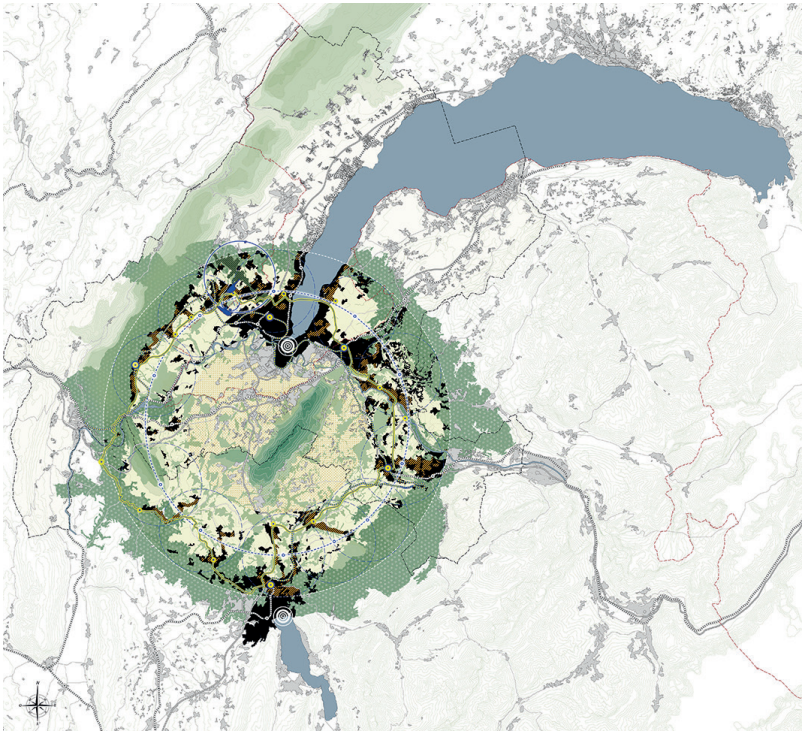


Figure 118: Siteplan for Geneva as a metropolitan constellation. Source: Stefano Boeri Architects

Figure 119: Aerial illustration. Source: Stefano Boeri Architects

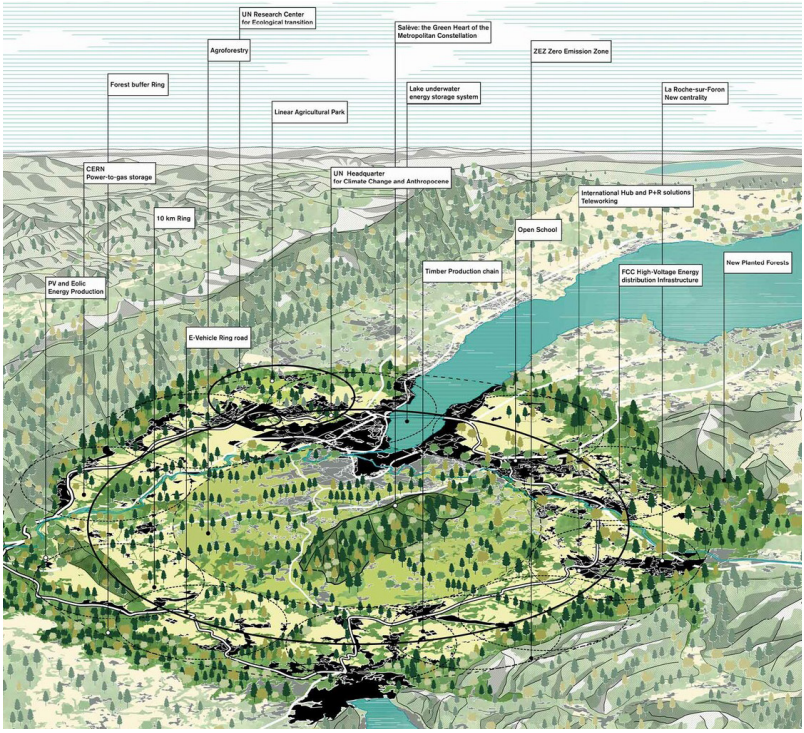


Figure 120: Activity mapping. Source: Stefano Boeri Architects

4. LEARNINGS AND OUTCOMES

Switzerland today

Towards a Sustainable Future

Context

Energy & Infrastructure

Environment & Urbanization

Energy Strategy 2050

Energy Strategy Public Transport 2050

Swiss Landscape Concept

Understanding the existing scenarios and the basis of the context

Analyzing the available literature to better the existing by 2050

Pilot, flagship & demonstration projects

Futurminiatur

House of Switzerland: Swiss Stories

2000 Watt Society

Sustainable neighborhoods

15 minute city

Consultation Greeater Geneva

City of the Future

Studying the real life examples related to the literature

Application of the analysis and studies obtained from 1 2 & 3

	2000 Watt Society & 15 minute city	Sustainable neighborhoods
FOUNDATIONS	Energy Strategy 2050	Energy Strategy 2050 Sustainable development goals SDGs
FEATURES FOR 2050	Energy efficiency	2000 Watt vision
	Sustainability	High density
	Equality	Self-sufficiency
	Renewable resources	Horticulture
	Net-zero emissions	Soft-mobility
	Shared energy	Building Integrated PV
	Proximity	Proximity
	Soft mobility	Bio-diversity
	Public transport	Net-zero emissions
	Human-centric	Composting
	Multi-functional spaces	Permeability

House of Switzerland: Swiss Stories	Consultation Greater Geneva
Energy Strategy 2050	Energy Strategy 2050
Energy Strategy Public Transport 2050	Energy Strategy Public Transport 2050
Swiss Landscape Concept	Swiss Landscape Concept
Green urban network	Urban farming
Roof gardens	Bio-diversity
Adaptable vegetation	Proximity
Alpine/urban solar farms	Energy network
Lakes to heat & cool	Circular network
Useful lake bacterias	Renewable
PET in AEC industry	Water network
Vermicompost	Waste network
Electric transportation	Self-sufficient
Net-zero emissions	E-public transportation
	Green urban network
	Net-zero emissions

5. PUBLIC EDUCATION: THE MISSING PUZZLE PIECE

The research up until now, summarizes in detail the concept of sustainability, its role in tackling climate change crisis, the policies and projects by the Swiss government as well as public & private stakeholders. So, it would be safe to say that it identifies with a specific group of people. While all this is a step forward in the right direction, it fails to address the majority general population. It lacks educating people and young generations to understand the meaning of sustainability, its application and importance in the real world and their role in contributing to save the planet. This is where gamification comes in.

Figure 121: Gamification and its advantages. Source: google images.

"Gamification is the strategic attempt to enhance systems, services, organizations, and activities by creating similar experiences to those experienced when playing games in order to motivate and engage users. This is generally accomplished through the application of game-design elements and game principles (dynamics and mechanics) in non-game contexts. It is part of persuasive system design to improve user engagement, learning, knowledge retention, ease of use, physical exercise, voter apathy, public attitudes about alternative energy, and more. A majority of studies on gamification find it has positive effects on individuals". (Gamification, Wikipedia)

Hence, identifying this issue, two case studies have been studied that integrate play, fun and learning through an interactive approach to address the common man.

1. Moscow urban forum:

"City for All will share the main changes that are taking place in the city and draw attention to major projects aimed at creating comfortable living environments. The exhibition presents Moscow through various thematic zones. From residential and office buildings, to transportation system improvements, new playgrounds, sports clusters, science centers, hospitals and museums".(Moscow Urban Forum website)

Figure 122: Interactive 3D model with infographics. Source: Moscow urban forum website.

Figure 123: Green pockets installation for bringing nature in. Source: Moscow urban forum website.

2. Museum of the City of New York:

"Come design the future of New York: The Future City Lab is the innovative, interactive culmination of New York at Its Core, the Museum of the City of New York's three-gallery signature exhibition. The Lab invites you to consider the big challenges facing New York City today and to imagine approaches and solutions for a better future. The exhibition captures the pulse of the city through creative design games, immersive data-driven animated maps, dynamic data visualizations, and artistic interpretations of New York's diverse subcultures, street life, and the sometimes invisible but prevalent patterns of city living. Together they bring contemporary history to life and invite visitors to help imagine the city's future. The gallery is dedicated to the memory of curator Hilary Ballon (1956-2017)". (Musuem of the City of New York website)

Figure 124: Future city laboratory gamification room Source: Museum of city of NY website.

Figure 125: Interactive screen for urban planning and design. Source: Museum of city of NY website.

Figure 126: Interactive information via gaming. Source: Museum of city of NY website.

Figure 127: Interactive information via display screens. Source: Museum of city of NY website.

6. PILOT PROJECT DESIGN PROPOSAL

With the drastic naked impacts of climate change, SUPSI-ISAAC with their expertise in the built environment focused towards sustainability, had the idea of developing the educational project of 'the city of the future'. It was just this very crude idea that was there all along since a few years, until recently when they came in contact with Swissminiatur, a touristic park located in Melide, Ticino.

The starting point to any change is keeping up with the pace of time & technology. And so, Swissminiatur pledged to adapt and give itself a new identity in the form of Futurminiatur which addresses the issue of climate change through sustainable initiatives, such that it not only acts as a tourism park but also shifts its agendas towards educating the children of today.

This exchange of information between SUPSI-ISAAC and Swissminiatur led to developing the project together. Now that the idea was in place, it was just a matter of fact before it started being an actual project proposal. This is where my part comes in.

Initially, my role was to draft out a literature review which would come in handy as the foundational backdrop of the project and also while applying for authorizations as well as grants. Mid-way along this research for the city of the future, I came across government's keen interest to boost the development of pilot projects that are aimed towards improving the environment. As discussed in the third chapter - the Swiss government encourages the people within the country to boost the development of pilot projects, especially with a high level of transparency to induce insights about technologies and innovations currently ongoing in Switzerland. The aim is to support such projects with funding and promotions to execute it as well as create an awareness within the people with real projects.

And thus the birth of the project:

'The city of the future', an educational pilot project to upgrade the existing popular tourist attraction - Swissminiatur with the aim to entertain & interact with the general public through education.

Since its based in Swissminiatur, this project (Futurminiatur) which will be a part of the touristic park is titled 'City of future (CoF)'

Swissminiatur as identified by its current owners and management crew, is static. Hence, with the current trends, they wanted to move towards the future and adapt accordingly. ***Thus, the three key points responsible for the birth of the project of Futurminiatur are:***

Sustainability towards future.
Public education through interaction.
Dynamic experience for visitors & viewers.

From the research above as well as discussions and meetings, the question of 'What could be the future Swiss city of 2050?', had few answers as follows:

Futuristic in terms of sustainable technologies as the first priority.
Circular cities through circular economies.
Green-over-smart, smart-over-green or Smartly-green?
Productive cities & productive buildings leading to productive ecosystems aiming towards self sufficiency.

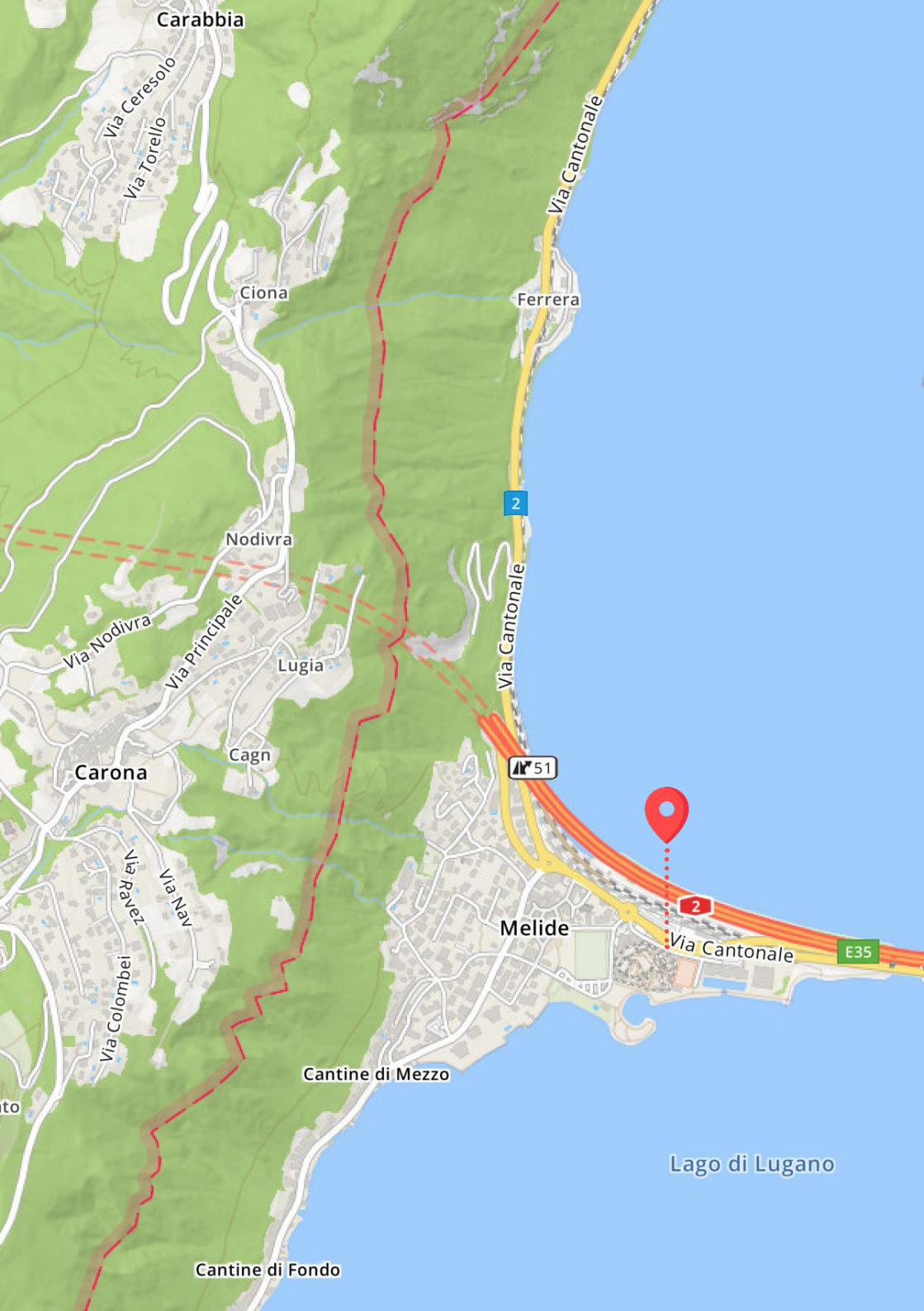
Foundations from the research above, for the Futurminiatur project :

Urban : 2000 Watt society and 15-minute city visions, sustainable neighborhoods, sustainable mobility, renewable energy use, urban farming,

Architecture : Building Integrated technologies, smart, passive technologies, productive instead of static

Targets : Energy Strategy 2050, Energy Strategy Public Transportation 2050 (ESPT 2050), Swiss landscape concept (CPS)

Stakeholders : Swissminiatur, SUPSI-ISAAC, Steiner Sarnen Schweiz AG, EnergieSchweiz, Canton of Ticino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Lago di Lugano
Cantine di Fondo

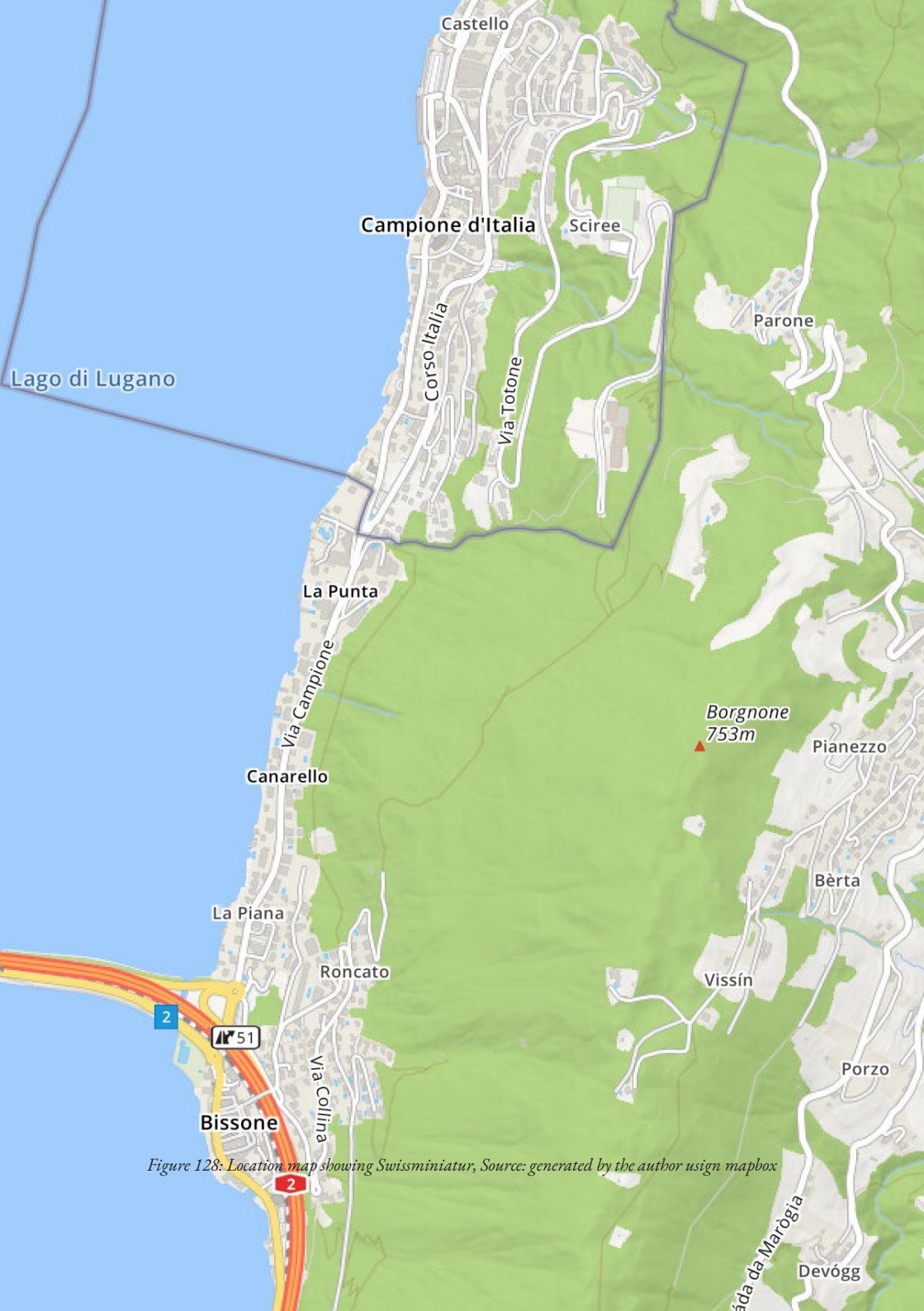

Figure 128: Location map showing Swissminiatur, Sourcc: generated by the author usign mapbox

Figure 129: Masterplan of Swissminiatur. Source: Swissminiatur website


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6.1

Kick-off & start point
PROJECT PROPOSAL

A kick-off workshop was held at Swissminiatur, Melide, to get a common base line of the project in the minds of all the 3 stakeholders:

Swissminiatur, SUPSI-ISAAC & Steiner Sarnen Schweiz AG

The workshop addressed 4 important questions that would give a start-point for the design proposal.

Why at Swissminiatur and not in a museum or at SUPSI?

- Opportunity for sustainability through education
- Need to reach out with the topic with maximum coverage and age groups.
- Learning by doing
- The children of today will in reality be the ones that live in the CoF.
- Image transition of Swissminiatur towards sustainability
- Static park to dynamic interactive education through games as a marketing strategy for Swissminiatur to engage the visitors.

What are the Personas, Target groups, Flow?

- The average family that is visiting Swissminiatur at the present: parents and school children under the age of 12.
- The focus for the exhibition/content should be specifically on the children as a starting point and can be later modified or updated as per demand.

What is the vision?

- The CoF has to be very dynamic and interactive.
- The exhibition should aim to integrate with the park with historic models, the app and the general master planning.

What are the key takeaways for audience?

- Considering the area of the project intervention, the target audience-children, their attention span and the aim to have key takeaways while exiting, prompts a condensed version with just 6 themes to be exhibited in the CoF.
- This decision was taken unanimously and the finalization of the topics will be done through a survey with the expertise in the field. Sustainability is a highly complex topic and in the best case we can deliver a key takeout for every aspect.

6.2 Themes
PROJECT PROPOSAL

At the end of the workshop, the aim was to finalize the themes that could be the design features of Futurminiatur. Hence, we carried out a survey at SUPSI with the ISAAC team and collected roughly 20 results which would help us finalize the broad topics along with the research carried out.

(The SUPSI-ISAAC team includes professionals working on different themes oriented towards a single mission of sustainability such as: Building integarted photovoltaics, smart-city, urban planning and design, architecture, etc. Hence, I could ask them without simplifying too much and expecting coherent answers w.r.t their expertise)

The team was briefed about the topic and its journey from start until the workshop, after which they were asked to answer the survey question in a very concise manner.

More than the scientific side, we also wanted to know the human side of the survey and what people would want in the city of the future. This was an important aspect, because while currently there are many design projects for ideal cities and cities of the future, we tend to lack the human perspective and head on strong mostly on the design perspective. In the end, the city of the future is viable only if its people think its viable.

The question posed was a s follows:

According to you and your expertise, what are the 6 main broad topics to design a city of the future that cover the concepts + ideas + goals + aims + targets + guidelines + features?

1) Why only 6? Because of space restrictions at Swissminiatur.
2) To be concise and try to cover the major topics and their sub-topics
3) Easier for the kids to remember a limited number of pointers.

- Electric public transport
- Energy efficiency
- Reuse of resources
- Housing density
- Renewable energy
- Waste management

- Zero carbon energy
- Smart interconnections
- Zero-waste
- Safe & accessible
- Human-centric multicultural
- Solar sufficiency

- Green cities
- Clean energy
- Livable society
- Smart with AI
- Human-centered mobility
- Innovative governance

- Smart city
- Livable city
- Blue-green city
- Energy producer
- Human centered city
- 15 minutes city

- Urban farming
- 15 minute city
- Peri-urban parks
- Pedestrian city
- Soft mobility city
- Co-working & co-living

- Smart infrastructures
- Technology
- Quality of life
- Low environment impact
- De-carbonization
- Energy self sufficient

- Urban farming
- Energy saving
- Quality of life
- Circular economy
- Ecological re-wilding
- Animal citizenship

- Smart
- Sustainable
- Livable
- Green spaces
- Public transport
- Affordable housing

- Smart building
- Social transport
- Green mobility
- Quality of air
- Green roofs
- Clean energy

- Data science
- Transport
- Climate
- Food
- Remote work
- Nature

- Circular economy
- Green-soft mobility
- Biodiversity
- Urban farming
- Climate control
- District heating & cooling

- Car free
- Pollution free
- More culture & art
- More sustainability
- More public parks
- More safety

- Public transport
- Walkable city
- Bike lanes
- Trees & plants
- Rainwater reuse
- Safety

- Soft mobility infrastructure
- Energy & food self-sufficient
- Green-blue spaces & facades
- Car free
- Renewable energy
- Human friendly

- Solar city + renewable energy
- 15 minute city
- Intelligent city AR + AI
- Co-spaces: living, working.
- Sufficiency
- Green infrastructure

- Local circular economy
- Renewable energy production
- Social inclusion
- 15-minute city
- Green infrastructure
- Resource management

- Work-life balance
- Food producing city
- Energy producing city
- Waste management
- Water
- Green infrastructure

- Governance
- Urban heat island effect
- Mobility
- Intelligent buildings
- Nature
- Safety

- Sustainable mobility
- Urban+Arch photovoltaics
- Small cities
- Sustainable food
- Recycle
- Reduce waste

- Energy production
- Energy network
- Mobility
- Efficiency
- Climate change
- Natural resources

After sifting through the entire research carried out earlier as a literature review, the survey carried out at SUPSI-ISAAC and the discsussions within the stakeholders, the concept of identifying and justifying the themes to be included in the Futurminiatur, I came across the concept of Baukultur.

What is BAUKULTUR?
People operate within space and shape the space in its full diversity. And it is to this, that we owe our efforts to practice sustainability.

And hence with this definition as the background, let's say we compare a rubik's cube to the baukultur of future cities. Each side & each piece is equally important and so is every move. These interlocked moves give result to a solved cube, in our case livable futures as an expression of a balanced baukultur. Based on the project development from research, policies, case-studies and informative discussions, we believe the following six factors to be most relevant, each with its own major and minor details.

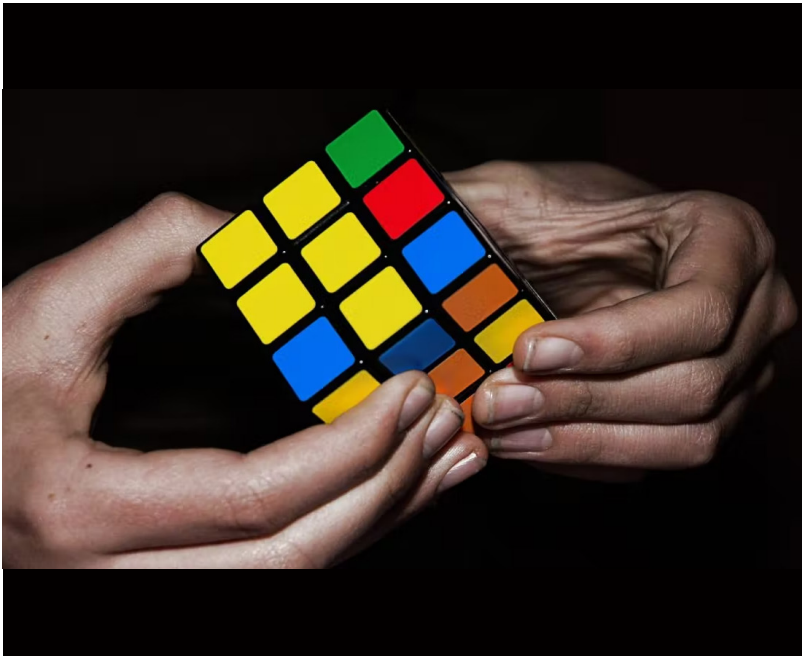

Figure 130: unsolved rubik's cube. Source: google images.

Logical reasoning	Themes	Research foundations
Any civilization since ancient history and any life on earth is always based around water.	**Water:** Resource + protection + availability	Switzerland as Europe' water tower & FDFA's guidelines 2022-25 on World water day of 2022
It is essential to have a shelter in the environment for wellbeing.	**Environment:** Built + unbuilt + everything beyond and in between	Spatial planning act of FOE
To advance and run the daily life, energy is needed in different forms.	**Energy:** Use + production + renewability.	Energy Strategy 2050
Interconnecting housing, employment and the environment requires mobility.	**Mobility:** Infrastructure + transport	Transport outlook 2050
Achieving the previous four stages resulted in the exploitation of resources.	**Consumption:** Over + under + sensible + resource depletion + Three R's	Planetary boundaries BAFU
The whole cycle leads to an impact on climate & neutrality is in making each phase sustainable.	**Climate:** change + neutrality	Paris agreement

Water

resource	protection	seasonality
efficiency	hydropower	agriculture
heat island	ecosystem	life

Environment

protection	biodiversity	farming
resources	15 minute city	smartly green
pollution	density	human centric

Energy

building integrated	network	production
efficiency	renewable	safety
equality	technology	self sufficiency

Mobility

infrastructure	public	soft + green
15 minute city	smart	electric
adaptable	accessible	affordable

Consumption

equality	refuse	reduce
recycle	footprint	consumerism
disposal	biodegradable	resource depletion

Climate

decarbonization	pollution	circular design
renewable sources	adaptable	extreme
survival	natural disasters	extinction

Figure 131: Solved rubik's cube. Source: google images.

6.3 Concept & schematic design
PROJECT PROPOSAL

To design the project of the city of future, the concept of 'citizens of future' proposed by Steiner Sarnen Schweiz AG was chosen after a few iterations.

Why Citizens of future?

Background: The children of today are the inhabitants of tomorrow's city and can help shape it and hence need to understand the importance of it.

Objectives: learn by doing, experience the story line through interaction, adaptable with changing times and scenarios and focused in the main room.

Context: visitors, especially children, become citizens of the city of the future and help learn, build and develop the concepts of sustainability in the city of the future.

Implementation: At the entrance there is a welcome by the 'mayor' of the city of the future: "We are building the city of the future and right now starts your journey to become a citizen of this city". Each resident/occupant receives a mini 3D building block. This serves as a key to get to know the topics, play games and access the city. At the end of the experience, every participant gets an ID as being a valuable citizen of the future. This way, everyone can leave their contribution and actively learn, develop and build the city of the future.

As conceptualized earlier, The focus of the project is based on the 6 themes identified in the previous chapters and hence the proposal envisions that in the City of future:
1.The Climate will be hot and harsh, ***and to avoid it, we need to make sure,***
2.The Water will be protected and properly used
3.The Environment will be more natural and diverse
4.The Energy will be renewable and valuable
5.The Mobility will be public & electric
6.The Consumption will be conscious and circular

It is important to communicate the ideas strongly and in an effective way. Hence, taking inspiration from case-studies, the project proposal has 3 components: ***motion graphics experience room, educational gaming and drawing the city of your dreams.***

1. MOTION GRAPHICS EXPERIENCE ROOM:

After completing the current Swissminiatur tool in the park, the children with their parents/teachers will enter the City of Future with the miniature building block handed to them at the entrance. For this transition to work and get the children interested in the educational area, the motion graphics experience show should be effective, captivating and memorable.

Figure 132: A kid in awe. Source: google images.

A motion graphic of historic & current Switzerland in all its glory and beauty will be showcased. This will be important in establishing context and set a goal of why the citizens of the future should care and take action.

A glitch in the transition from now to 2050, then showcases the worst scenario due to global warming, climate change and their impacts which becomes crucial to give the audience an idea of the bad picture which covers the first theme 'CLIMATE'.

This is the point where the educational experience sets in, where in the next 5 themes cover the topics and send out a message of what is the responsibility of the audience and what should the key takeaways be.

WATER:
All life exists around water and hence it is important to bring forward the importance of water as a resource, its protection and conservation, and its vitality to survive on earth.

ENVIRONMENT:
Going forward, environment is an important aspect that in current cities is getting more and more built. Cities should be integrated with nature and run as an ecosystem in itself giving equal importance to all life-forms as well as non-life forms. Cities should be greener with public parks and trees, they should be accessible to undisturbed nature, the environment should be bio-diverse, the buildings should be productive in terms of energy production and food production. Cities should be self-sufficient and easily accessible within short distances.

ENERGY:
This theme focuses on renewable energy resources and showcases the different sources which are considered to be environmental friendly. It takes the users through an immersive experience of solar energy, hydroelectric, wind power, geothermic, etc. with its sources and uses,

MOBILITY:
This theme strongly gives out the message of using more and more soft-mobility like bicycles and walking, as well as to maximize public transportation use in day to day life that is powered by electricity, carries a huge capacity of passengers in one go and is powered through electricity causing less environmental impacts.

CONSUMPTION:
After going through the 5 themes as described above, it is evident that consumption has occurred. Although Switzerland is very efficient in the aspect of collection, segregation and recycling, this themes highlights the importance of it and to ask the audience to limit their consumption and reduce to the basic necessities, and to recycle and up-cycle everything possible.

The show ends again with a beautiful Swiss scenario asking the audience to follow the themes and their messages to preserve the image of Switzerland.

The images in the next pages are created by the author using the midjourney AI software as it produces eye catching images based on the inputs by the user and hence each image is specific to its context rather than having generalized images via google or other sites.

SIMULATION EXPERIENCE

Story-telling through a comparative showcase of the past, present and the future

CLIMATE: CHANGE / NEUTRAL

To protect our planet and save it from the harmful effects of global warming and climate change, we need to act together.

WATER AS A LIFE RESOURCE


Water is a very important resource, life depends on it. Use water carefully for daily use & to produce energy.

SUSTAINABLE ENVIRONMENT

Cities should be green with parks, nature, wild life. Buildings will produce food and energy.

RENEWABLE ENERGY SOURCES

Be efficient and use renewable resources to produce energy, like solar, wind & hydroelectric.

SUSTAINABLE MOBILITY

Use public transport and/or slow-soft mobility that does not produce harmful emissions.

CONSUMPTION MANAGEMENT


Refuse to buy. Reduce consumption. Reuse
waste. Recycle waste. Upycle waste.

2. INTERACTIVE 3-D ABSTRACT MODEL:

In continuation with the theme behind the existing Swissminiatur, it was important to have a 3D model. But how and for what?

It was decided to have an interactive model which kids could interact with it, a feature that is currently lacking in the other models in Swissminiatur as the kids cannot touch them. Moreover, it has to be something modern and a little futuristic to stick with the theme of City of Future. Hence, we propose an abstract 3D model of Switzerland made up of pexi-glass blocks and back lighted with LED, such that only a few blocks will be detailed where in its important to showcase them.

This is where the research part of the thesis comes into picture:

SWITZERLAND TODAY:
With a few actions children will be able to know more about the 6 identified themes. Hence, the mapping presented in the research chapter 1 will be helpful in translating it onto the 3D model as required with a general urban scenario with public transport network, green parks, natural environment features such as rivers, lakes, forests, nature reserves, etc. energy production plants.

TOWARDS A SUSTAINABLE SWITZERLAND, PILOT PROJECTS:
The specific projects will be the detailed blocks in the model and with the help of a few actions children will be able to know more about them through pictures and very basic information that they could relate to. The idea is for them to want to visit these projects in vicinity when they go back home.

2050 SIMULATIONS:

The model will demonstrate real-life best-case scenarios of 2050 if citizens take responsibility: like protected nature, flowing rivers, snow-capped mountains, etc.

And it will also showcase the worst case scenarios of 2050: like black-outs due to low energy in the future, very less green lands due to ever growing urbanization, water scarcity, etc.

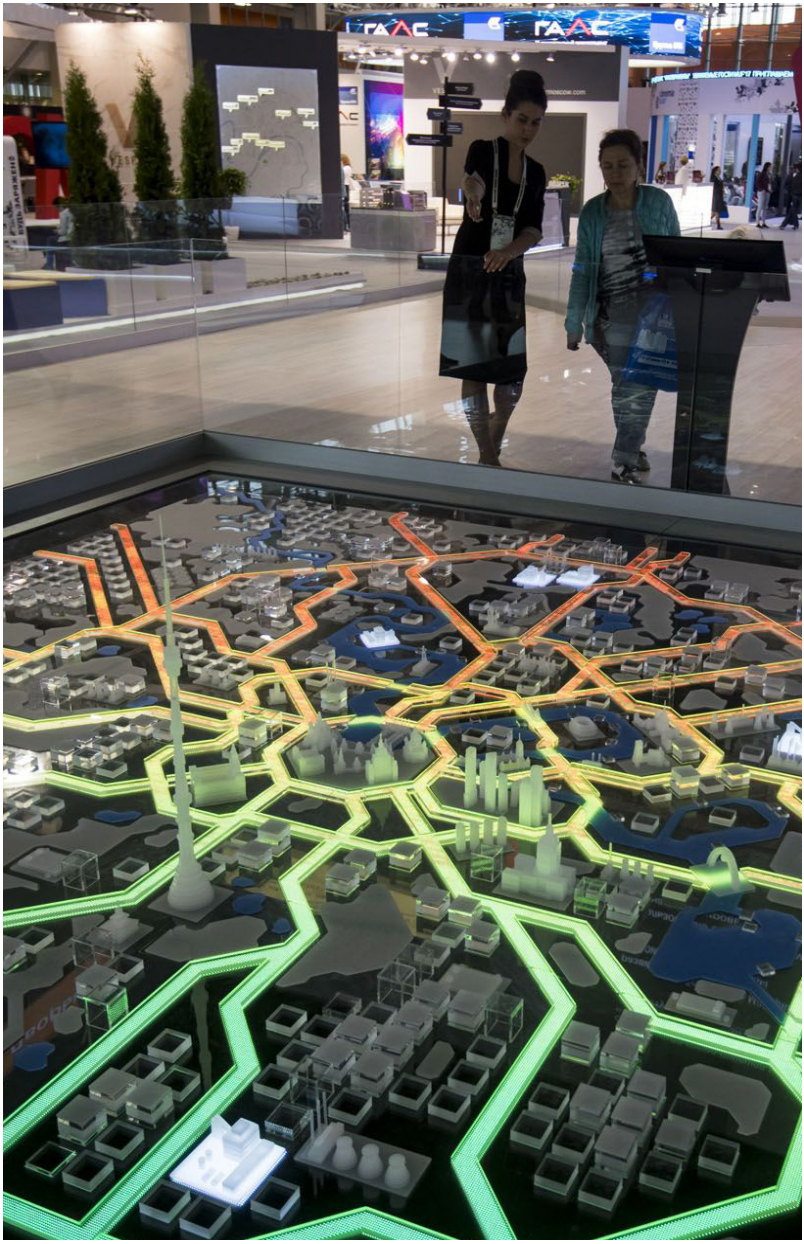

Figure 133: Interactive 3D map. Source: Urban forum Moscow 2017

INTERACTIVE CITY MODEL

Abstract 3D model of Switzerland with back-lit LED displaying information related to the 6 themes.

INTERACTIVE CITY MODEL

Detailed blocks of case-studies identified in chapter 3 with general information of the projects.

3. EDUCATIONAL GAMING:

It's necessary to involve the "educational system" as it's very important to communicate in the right way and to go hand in hand with the scholastic system. It is evident that children are always more interested in playing games, and hence its important to teach the ideas of the themes through interactive gaming so that children enjoy the education experience. The ludic experience surrounding the city of the future could be divided into three strategies:

1. DRAW AND DISCUSS YOUR MIND PALACE:
The children will be able to draw, paint or write their ideas of dream city or on the topics of the themes. And all of this artwork will be on display on a dedicated wall inside Futurminiatur to showcase the ideas of children and inspire new visitors to paint their ideas as well.

2. PLAY GAMES:
Video games or active games focusing on the 6 themes (one or all at once) will be developed and placed in one part of the room . Some possible ideas are: segregate the waste video game, reach the Christmas tree star by cycling to produce energy, plant and adopt a tree, drink water by activating the hand pump, etc. Many more such games can be devised to activate and stimulate the children's minds.

3. BUILD YOUR DREAM CITY:
LEGO/Minecraft/Secondlife have proved to be important games and hence will also be useful in the City of Future so that they can build their own concepts of dream home or dream cities after having an immersive experience in the motion graphic room, the interactive model and educational games.

4. CoF IDENTITY CARD PHOTOBOOTH:

The last step before exiting Swissminiatur is to print an identity card with their photo certifying them as citizens of the future. These cards will play a huge role in the social media campaign to bring in more and more chidlren to Swissminiatur and educate them through the City of Future.

Figure 134: Children in their element when painting. Source: google images.

DRAW YOUR MIND PALACE

Figure 135: Children in a table discussion. Source: Future city lab NYC.

Figure 136: Children building LEGO city. Source: google images.

Interactive table discussions with lego blocks, drawing board, stationery, creative wealth from waste

LEARN BY DOING: GAMES

Figure 137: Waste segregation game. Source: google images

Figure 138: Energy generation game. Source: google images

Figure 139: Hand operated water pump. Source: google images

Figure 140: Urban farming, plant and adopt a tree. Source: google images

Interactive games based on waste segregation, energy Generation by cycling, food farm and hand pump

7. DISCUSSIONS AND CONCLUSIONS

In conclusion, the thesis outlines a thorough research analysis to the problem statement of 'how do we design to adapt to the climate change' as well as addresses a crucial issue of increasing the reachability of the topic to a larger audience highlighting the importance of everyone's contribution in this transition towards a sustainable future by 2050.

Primarily, it explores the current state of the country in regards to sustainability to know the amount of efforts to reach the targets of 2050, it brings into picture the government policies that provide a base for any future developments, and highlights real life as well as conceptual projects that are currently in process based entirely on the foundation of sustainability. While all this is a step forward in the right direction to achieve climate neutrality by combating global warming, at a secondary level, my thesis underlines and delivers the importance of educating the common people and newer generations via interactive educational gaming and simulations by translating the research into application based concepts. As a result, a holistic approach is achieved: first by the front-liners that actively bring about change through formulating policies, designing and building sustainably, and many others such stakeholders. But more than that, it stimulates the rest of the population to be aware of all such information pertaining to the future.

The project 'City of the Future' with its vision of taking children by the hand and educating them by understanding their important role as 'citizens of the future' on the issues of sustainability, climate change, its impacts. I believe that the project will bring about a radical change in the children of today who must forcefully coexist with the fast changing climate scenarios and its impacts. It will imbibe the values of conscious efforts, responsibility and initiative to bring the required change and envision a better tomorrow. And so to achieve this, the project aims to:

Maximize reach and arouse curiosity.
Ensure variety, fun, play, and movement.
Focus on limited number of messages.
Educate with simple language.

The concept relies on educating via six different themes identified through case-studies, policies, research as well as an on-site survey. The themes of Climate, Water, Environment, Energy, Mobility and Consumption have been chosen to encompass a holistic approach on sustainability.

The thesis recognizes the gap between the general public and the Architecture/ Engineering/Construction industries and tries to bridge this gap through informative education and simulation via 3 important aspects:

Motion graphic experience as the future of tomorrow's education:
To grasp the children's focus, limited number of informative messages related to the 6 themes need to be simulated through a 'WOW FACTOR' such that it inscribes the life lessons in a graphic memorable way. These will be the key takeaways when they exit City of Future and enter the real life. Not just that it will showcase the transition of Switzerland from what it was in the past, to how it is now at present and with the efforts of everybody what it will be in the future.

Learn by doing through informative gaming:
Numbers without a clear context are never useful nor clear. People, and more so children need to relate to the content and understand it well in order to be more responsible in their day to day life. Hence, games that educate on the topics of water, environment, mobility, energy, consumption and climate should be introduced so that the numbers are translated into real life experiences at a very young and formative age.

Traditional output of the mind palace through drawings and discussions:
Often, children have much more to say when given a platform, and hence a discussion table with LEGO blocks, drawing books and stationary, even digital media such as video games focused on sustainable city building are sometimes much more effective. The CoF would like to adapt to children's dream cities and hence will pose a periodic competition while imposing the question of 'what does your dream city have. Please write/draw or discuss your ideas' . This will help to adapt the CoF according to the understanding levels of the children as well as their expectations from the future.

In the end, design will not be able to come so close to solving this crucial problem if the general public and more over the citizens of future i.e. children of today are not aware of their significant role. This is an important aspect, because while currently there are many design projects for ideal cities and cities of the future, we tend to lack the human perspective and head on strong mostly on the design perspective. At last, the city of the future is viable only if its people think its viable. So, as designers let's take the children by the hand and make them the change-makers to envision the best version for 2050.

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Thank you