GENÈVE
CONSTELLATION MÉTROPOLITAINE

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GENÈVE

CONSTELLATION MÉTROPOLITAINE

Genève, 27th January 2020

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A kaleidoscopic Metropolis: a Constellation of Biodiversity

Stefano Boeri

On a planet that is heading towards the great challenge of a new and necessary alliance between cities - the highest expression of human civilization - and the world of forests, woods, mountains, oceans.
In one continent, Europe, where the urban condition in recent decades has exploded to occupy most of the coasts and surrounding plains, reducing the Alps and other mountain ranges to theme parks,
In a region such as Geneva, used to hosting what geologist Peter K. Haff calls the Tech-nosphere, or an intense system of transnational flows of goods, information, ideas and people.

On this planet, in this Europe, in this transnational region, we have designed the future of the Geneva metropolis in the form of an urban constellation.

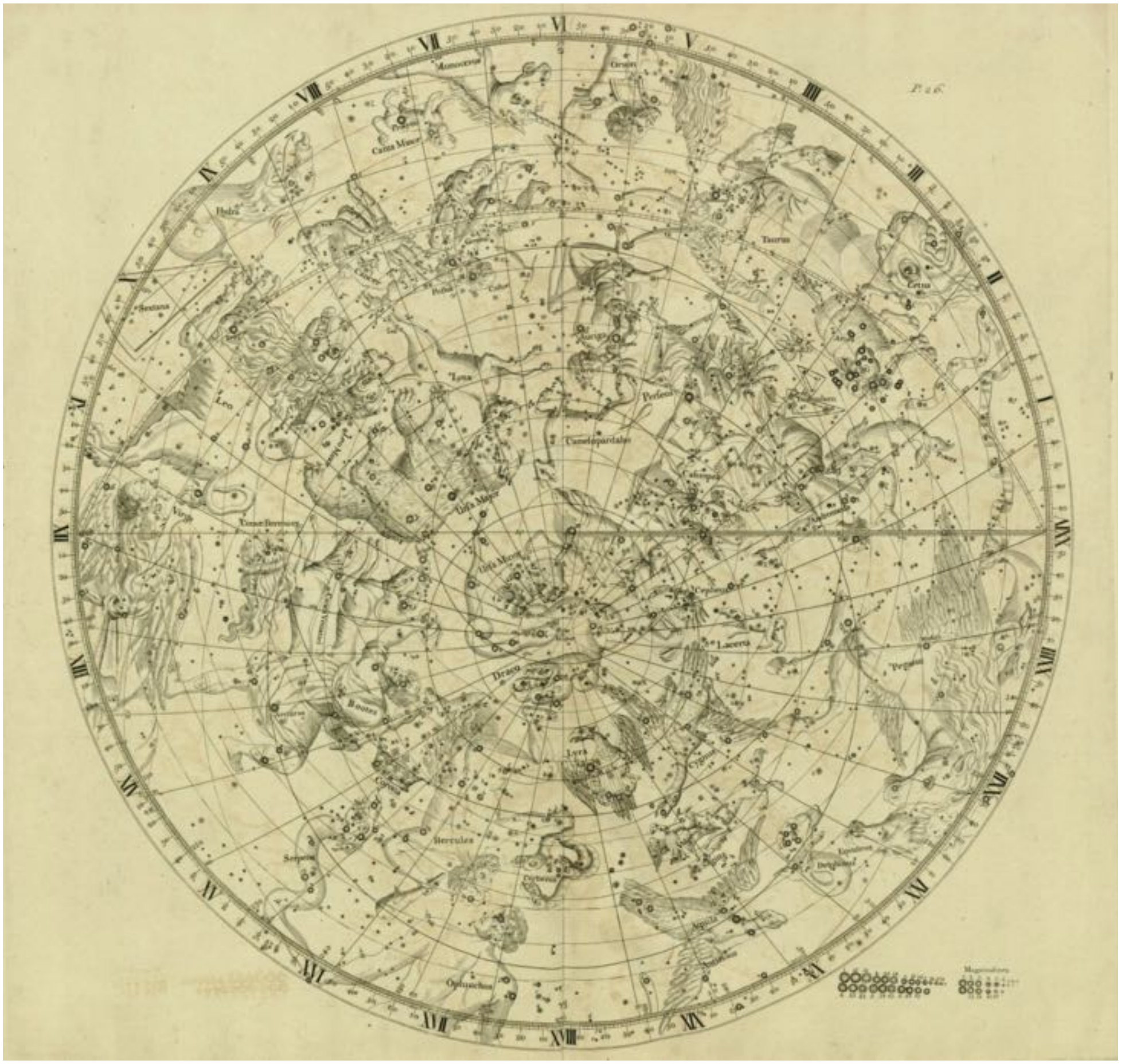
A constellation of eleven small, medium and large urban nuclei that will encompass the two cities of Geneva and Annecy and will host the great mass of Salève at its centre, with the aim of establishing itself as the first planetary Biodiversity metropolis.
Around the Salève massif, the Geneva kaleidoscopic metropolis will extend alternating urban areas, portions of agriculture and wooded areas, pursuing a final balance between energy consumption for urbanization and environmental compensation through foresta-tion.

The new metropolitan Constellation will therefore have at its heart not a city but a moun-tain, the place par excellence of the life of other non-domestic living species (chamois, fawns, deer, wolves, rodents, birds ...) and domestic (mammals and sheep) and will thus become the first planetary manifestation of a coexistence no longer based on an authori-tarian and muscular anthropocentrism.
The Metropolitan Constellation - outside of which an orbital forest will develop - will grow following the surface circumference of the CERN's new particle accelerator (FCC) pro-ject, to exploit its energy potential - and make its ambition to become even more visible during coming decades as an extraordinary catalyst of multidisciplinary knowledge and cosmopolitan skills.

The new transnational metropolis will grow within a defined perimeter and according to a principle of energy self-sufficiency (inspired by Kate Raworth's "Doughnut Economics"), using wood produced from natural forestry in the Salève area as a building material and - in the initial phase- in the largest area of the Swiss, French and Italian Alps.
The new Geneva conurbation will make its transnational nature the primary resource with which to accentuate its openness to the world, integrating the broadest cultural and eth-nic differences in its territory and embodying - the world's first metropolis - that concept of Mondialite' 'that Eduard Glissant proposed as the future of urban coexistence.
The kaleidoscopic metropolis of Geneva and Annecy will host a system of new public schools, open all hours of the day, every day of the year, for all ages; schools that will form the nodes of a ring of epicentres of collective life, transforming the concept of collec-tive space proposed by Richard Sennet into reality.

The transnational metropolis will see new jobs and skills emerge, thanks to the meeting between the presence of the most advanced technologies, international training centres, the headquarters of the leading multinational companies and a local network of research and development centres.
A complex and sustainable system of networks for public and private zero-emission mo-bility will be intertwined with a series of intermodal hubs for teleworking in order to guar-antee a decrease in commuting throughout the metropolitan area.
Following the promotion of a transnational district promoted by the cities of Geneva and Annecy, the elaboration of a Vast Area Plan will start which will be the first political and administrative outcome of the new transnational metropolis.

The geographical constellation of the new Geneva will become the model of a new form of metropolis, ready to face the great challenges of the near future on Planet Earth.
An ambitious project that could only be created in an ancient and cultured city, lapped by the waters of a lake and surrounded by large mountain massifs and which has hosted some of the giants of Western thought over the centuries - from Calvin to De Saussure, from Starobinsky to Corboz.
Mountain regions and deep regions of thought from which to start again today to chal-lenge the future.
We are here to provide all possible help so that this project - together so ambitious and so necessary - is immediately created.



Atlas Coelestis, John Flamsteed. London, 1729

In Mondialité (which is there, even if we have yet to find it), we don't belong to exclusive fatherlands or to nations, least of all to territories, but to "Places", linguistic storms, free gods who don't ask to be loved, native lands that we have chosen, languages that we have wanted to speak, geographies woven from lands and visions that we have forged. And these "Places" will become permanent, entering into relationships with all the other "Places" of the world.

Patrick Chamoiseau and Édouard Glissant, Le Mura, Abitare 486, October 2007

Intensifying landscapes
Michel Desvigne

We want to give even more quality to the existing landscape framework, to intensify it along small streams, green continuums, etc. Switzerland already has policies and habits relative to their protection. We offer to add a layer of demands, to make it more operational. Our project's identity relies on two points:

- The Greater Geneva's area has such a scale that our aim cannot be to design a specific figure but rather to suggest a process, to implement a constellation of specific actions and policies, in order to increase the landscape's intensity, notably using green and blue continuums ;
- A linear park crossing the LHC ring could be a prototype for how to accompany new urban settlements.

We do not want to develop a vast rigid garden. Since almost all the land correspond to private property, we should consider consolidating a constellation of small places and paths in order to open views on the park entity, to give readability, access and uses to the people. The Swiss landscape is already very protected. The project uses this given fact and suggest that in the park, it is possible to go further into detail, to give a general gardened aspect but only thanks to the juxtaposition of individual practices, to helping for more horticulture and less intensive farming and to small interventions along the paths. We already experiment this process elsewhere. It needs time but it lasts into time and is truly perceivable.

We would rather avoid giving the ring project a materiality that would even may not be visible from the sky. Landscape is about amplifying existing practices through a series of actions that generates a physical reality in time. Thus, defining actions is the basis for a credible strategy. The linear park does have a reality at the territorial scale. Moreover, it is a support for exchange and experimentation of what could actually be implemented in different locations of the Greater Geneva's area, around every new urban settlement, in order to organize the interface between those new cores and their environment.

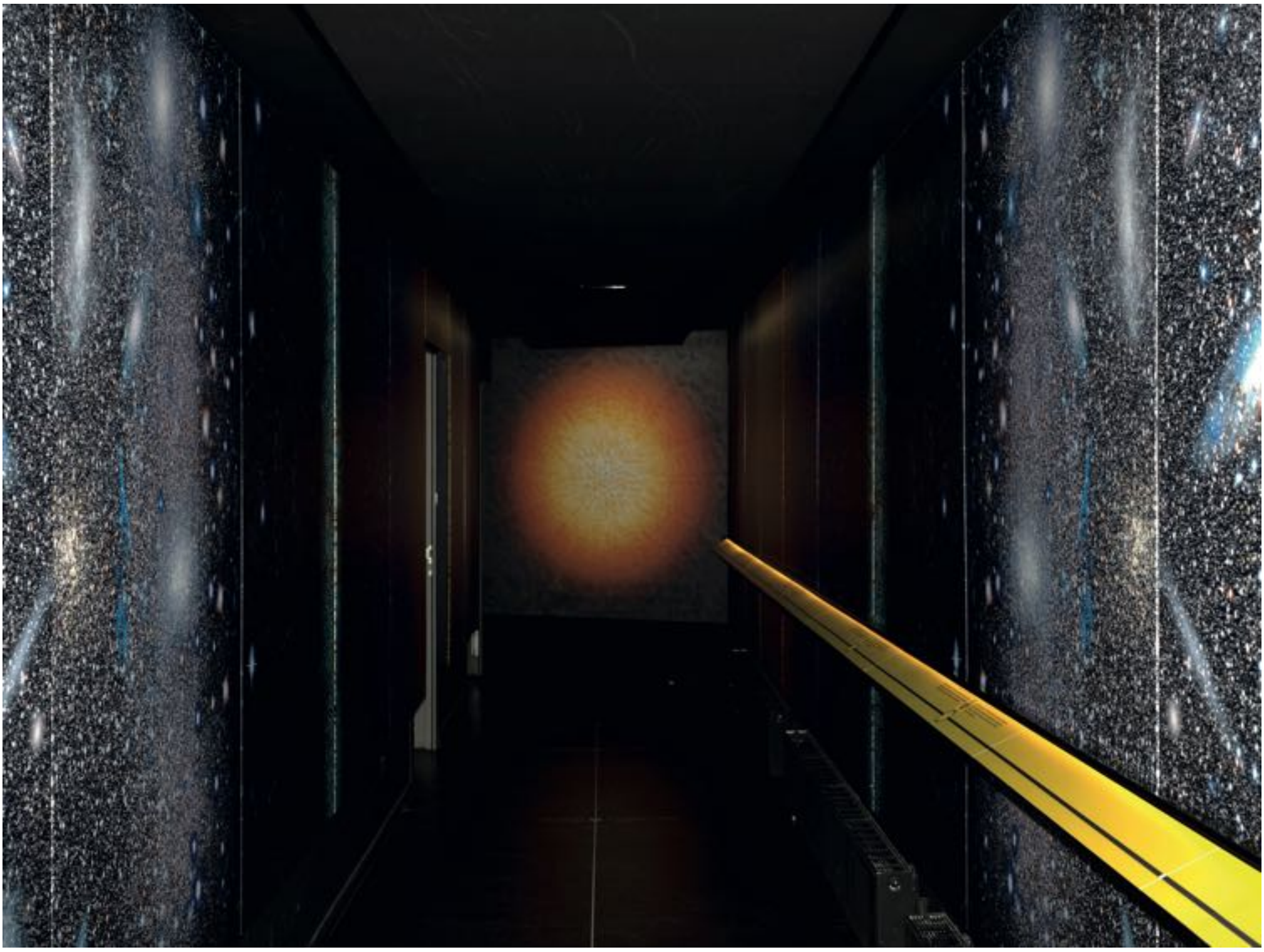
The proposed strategy for the Greater Geneva is somehow similar to Michel Desvigne Paysagiste's work in Euralens. It consists in enhancing landscape continuities and main points, which appears to develop as a very complex and irregular grid at the territorial map scale but is actually very structuring and legible from within this territory.

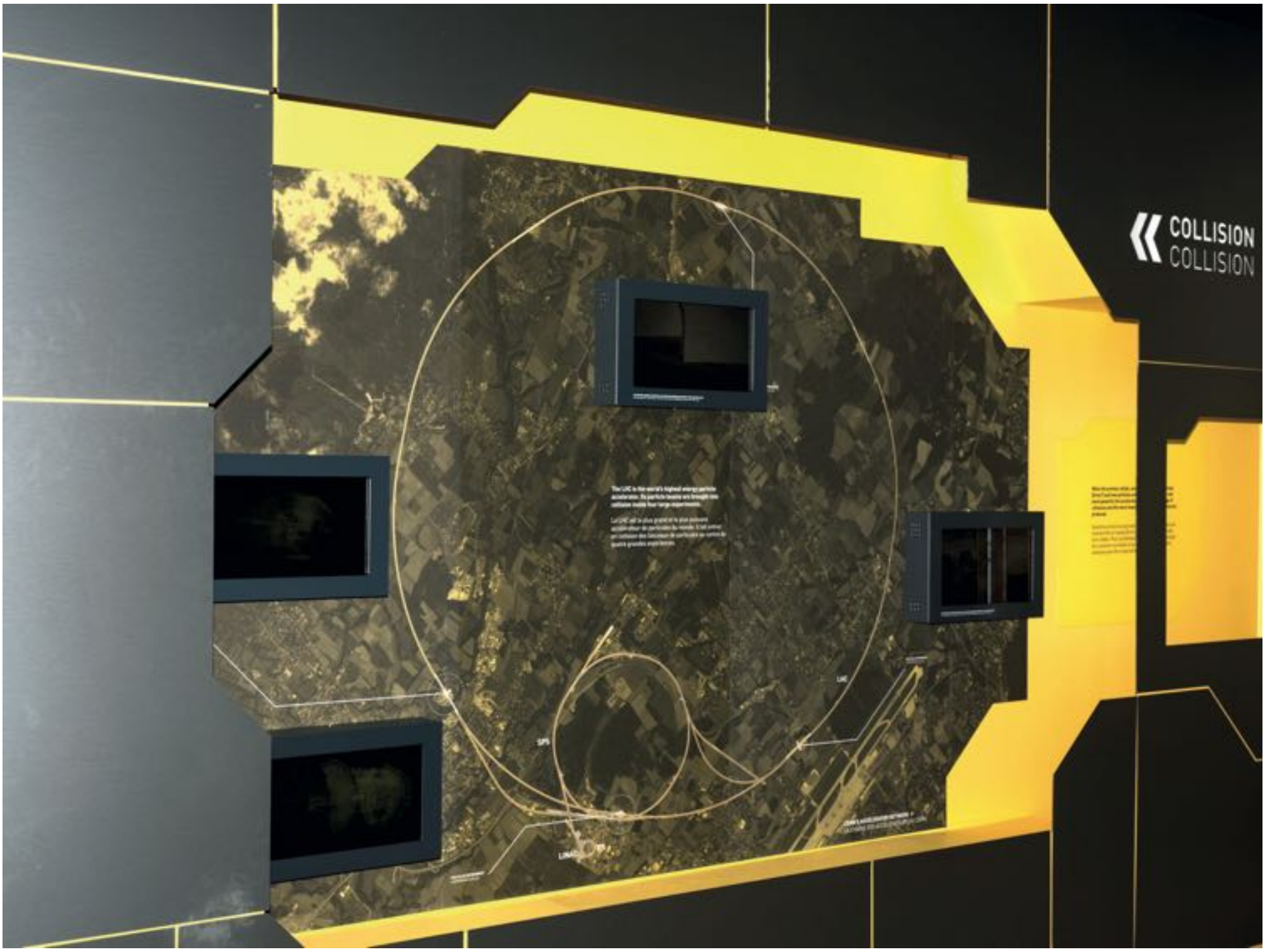
Perfection, sometimes

An excursion to CERN and Salève, 12 November 2019

Pier Paolo Tamburelli and Armin Linke

The sky is blue, cars move in the suburban green. Nothing special to see. On the crust, a city like many, then villages, farms, below the incredible machine, maybe the biggest machine in the planet. The entrance to the machine is uninspiring: didactic materials for schoolkids all over the walls. And yet it does not really look like schools would get to this place; the posters are for us, anyhow we do not really understand – and yet it is not comfortable to be treated as kids. More surprisingly, the scientists themselves keep on referring to these images. Didactic images are everywhere, everywhere reproductions of the machine, to document, survey, map, scan, describe, explain. Models of particles, models of colliders, models of components, posters, 3D models; the CERN is maybe just the machine to represent the CERN. In the end, CERN is a machine of representation: its overall scope is to show collisions of particles that we cannot otherwise see. Moving in between the posters, we finally go down into a gigantic hole in the ground, a pit with walls of concrete. We enter into the pit, quickly move down, and reach the machine. People are repairing, fine-tuning, upgrading the machine. It seems that the mechanical-technical-sculptural works never stops. The machine is gigantic, somehow impossible to be seen, only its interior organs sometimes appear, veins, bellies, monumental and invisible at the same time. What is more surprising is that the technology seems incredibly banal, but endless: cables and cables, metal pieces, leftover cables, plastic bags to collect more cables. People work everywhere, rather affable craftsmen, friendly, sort of umpa lumpas of particle collisions – you recognize they are engineers only from their proud rebuttal of any aesthetic. Things are ugly at CERN, but it is a friendly ugliness: puppets, coffee-mugs with supposedly funny jokes, infinite amount of group pictures. And all of this survives hidden, connected with the infrastructure that keeps scientists going back and forth from the machine to the rest of the world, but unseen, lost to the city, immersed in geological depth. After the visit we re-emerge to the industrial storages that hide the machine, exit, move back in the suburban Geneva and drive to a Moroccan coffee bar at the border. The city is quiet, at times ugly. It seems impossible that CERN is here, you are immediately convinced it is not. We drive to the Salève, go all the way along the slow path leading to the top. All of a sudden everything disappears: city is lost, scientific machinery does not exist anymore. Only a few farms, some paragliders, some lovers in young and old ages, and the landscape with the Alps and the Jura. Geography slowly reappears with all its necessity: the lakes, the mountain ranges, the convergence of the rivers, the valleys and then, in the middle of this, finally understandable, the city. And in front of this landscape, in the suspension produced by the snow, also the hidden monumentality of CERN re-surfaces, and somehow finds a place, a rhythm that coincides with the rhythm of the city. For a while everything seems to match: perfection, sometimes.

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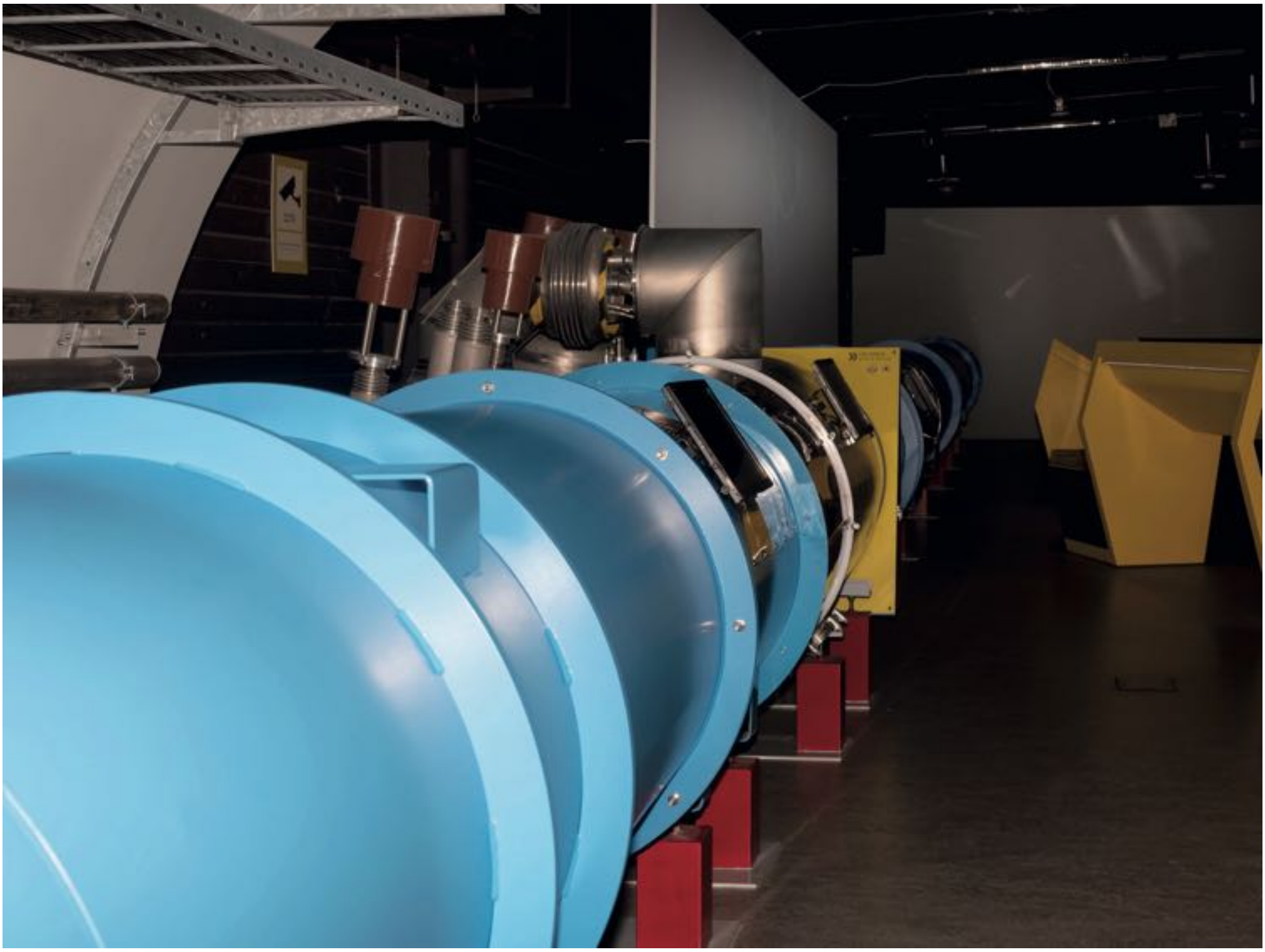

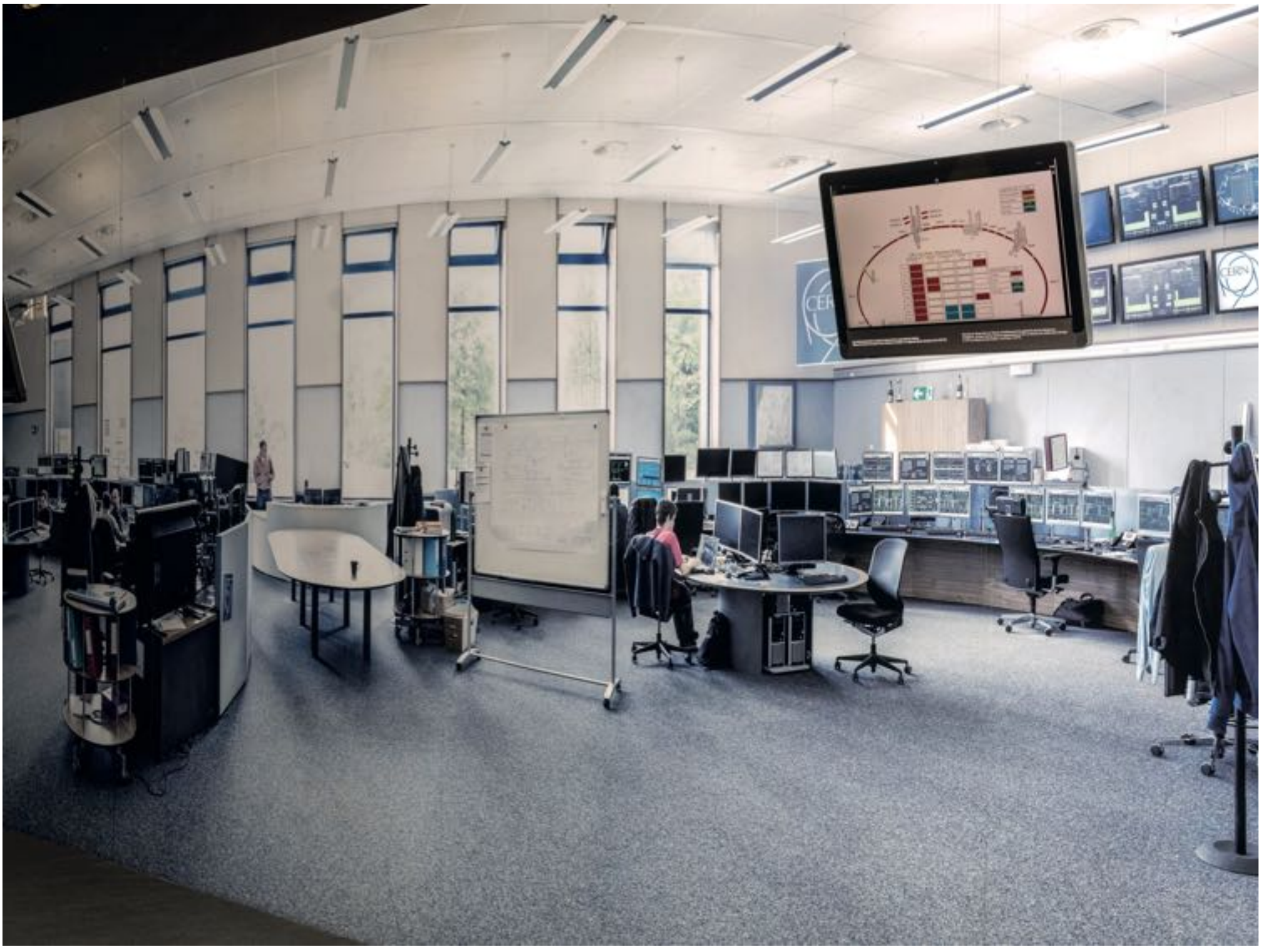

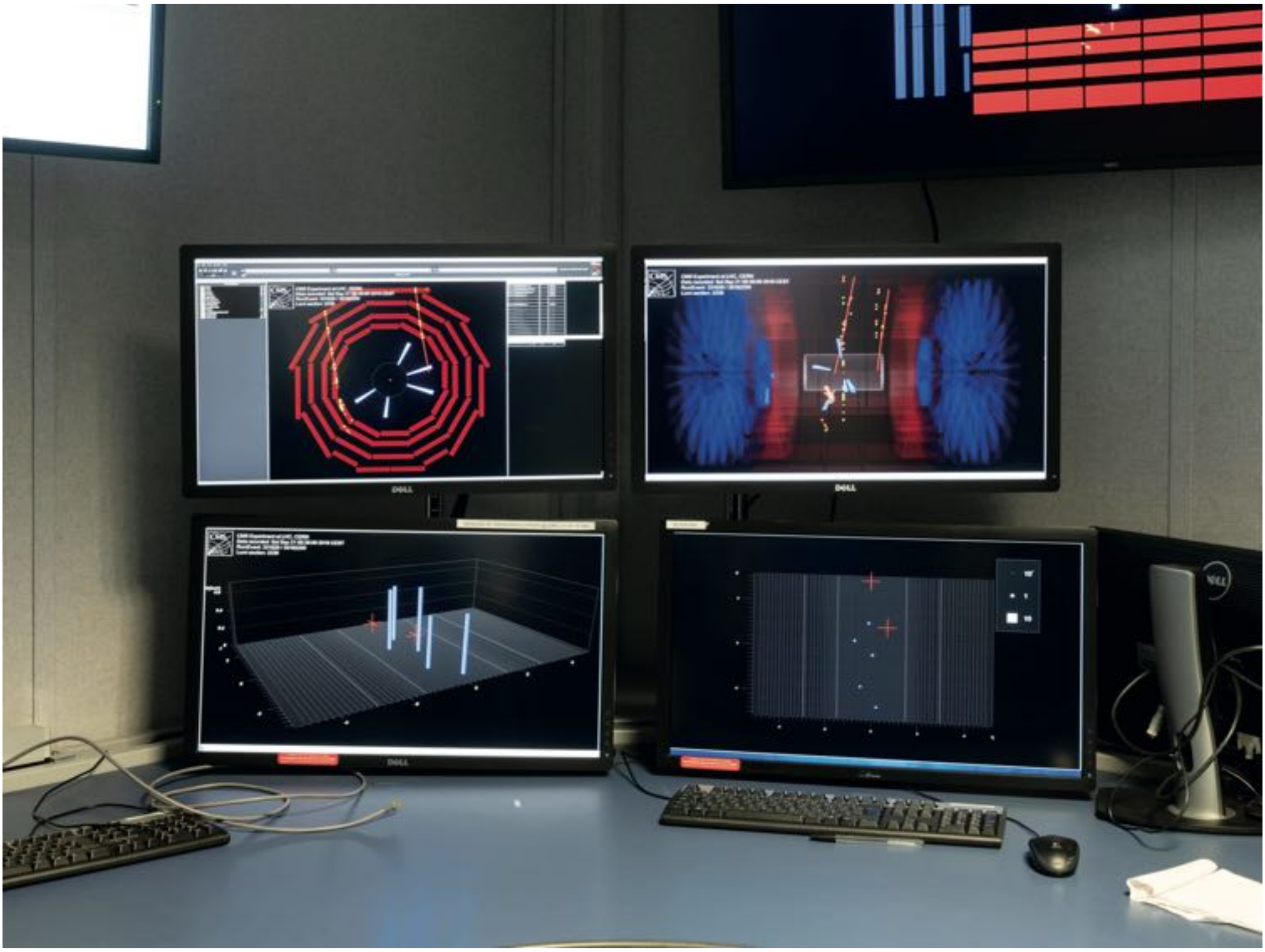
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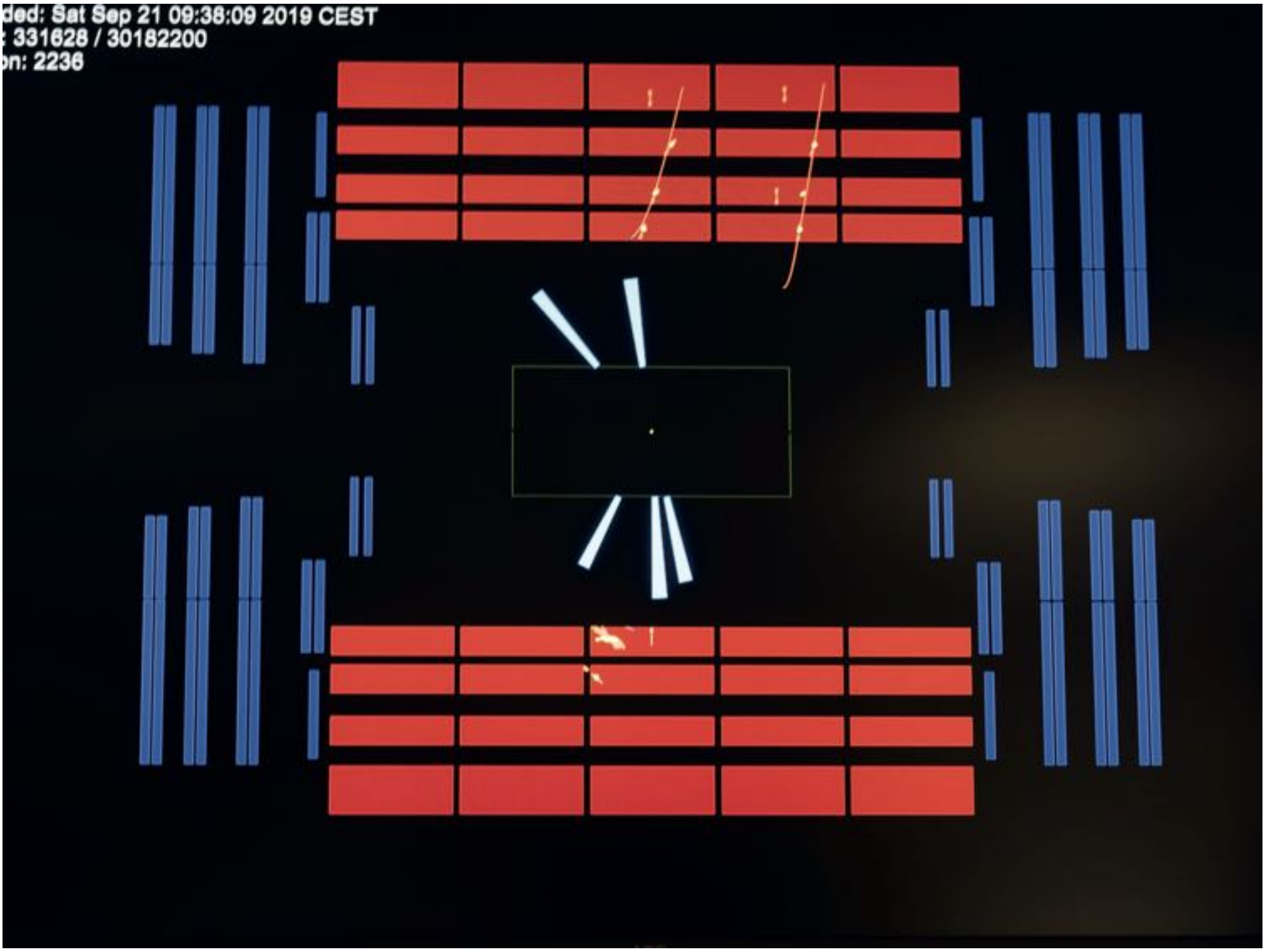
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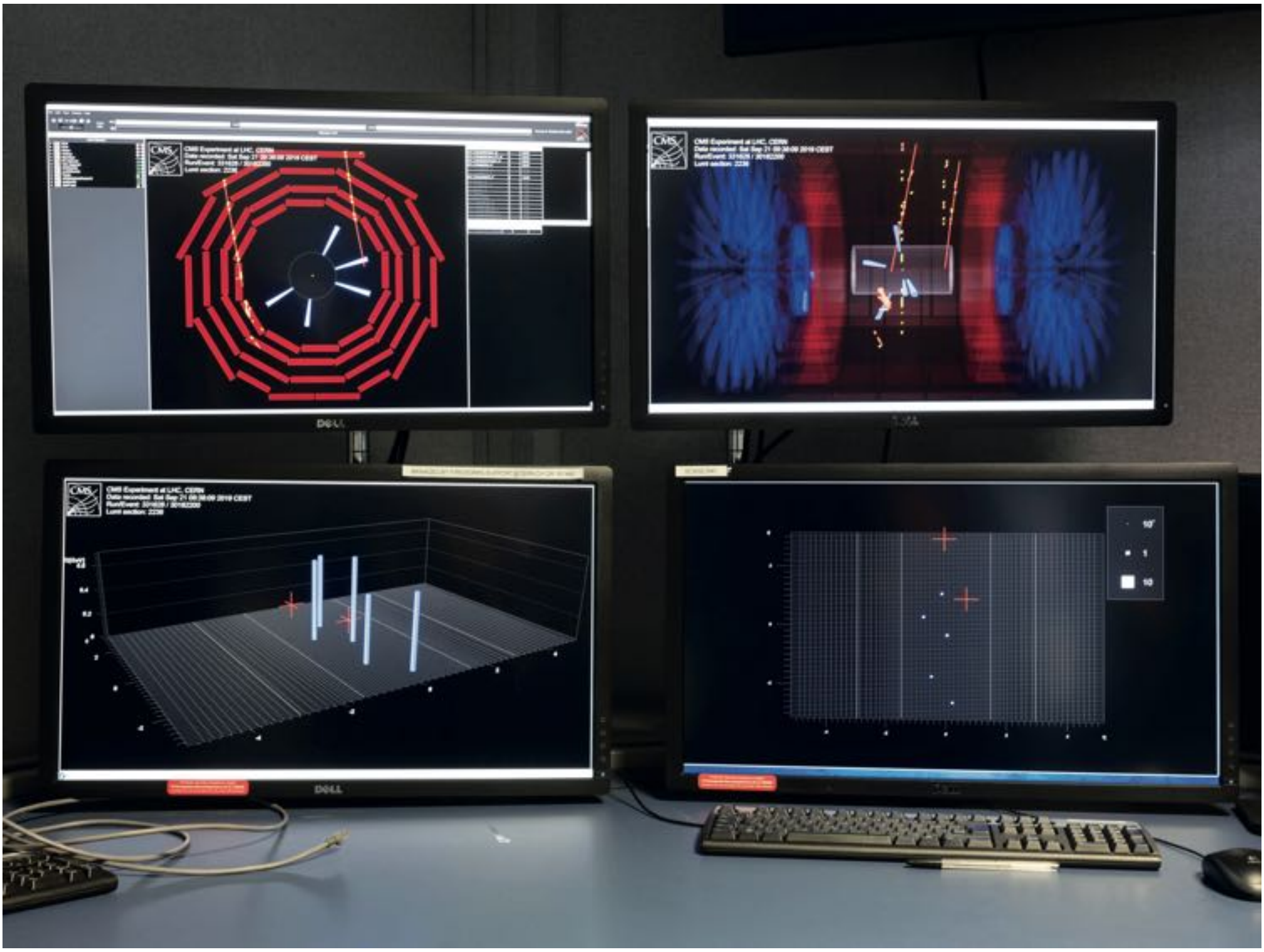
CMS Experiment at LHC, CERN
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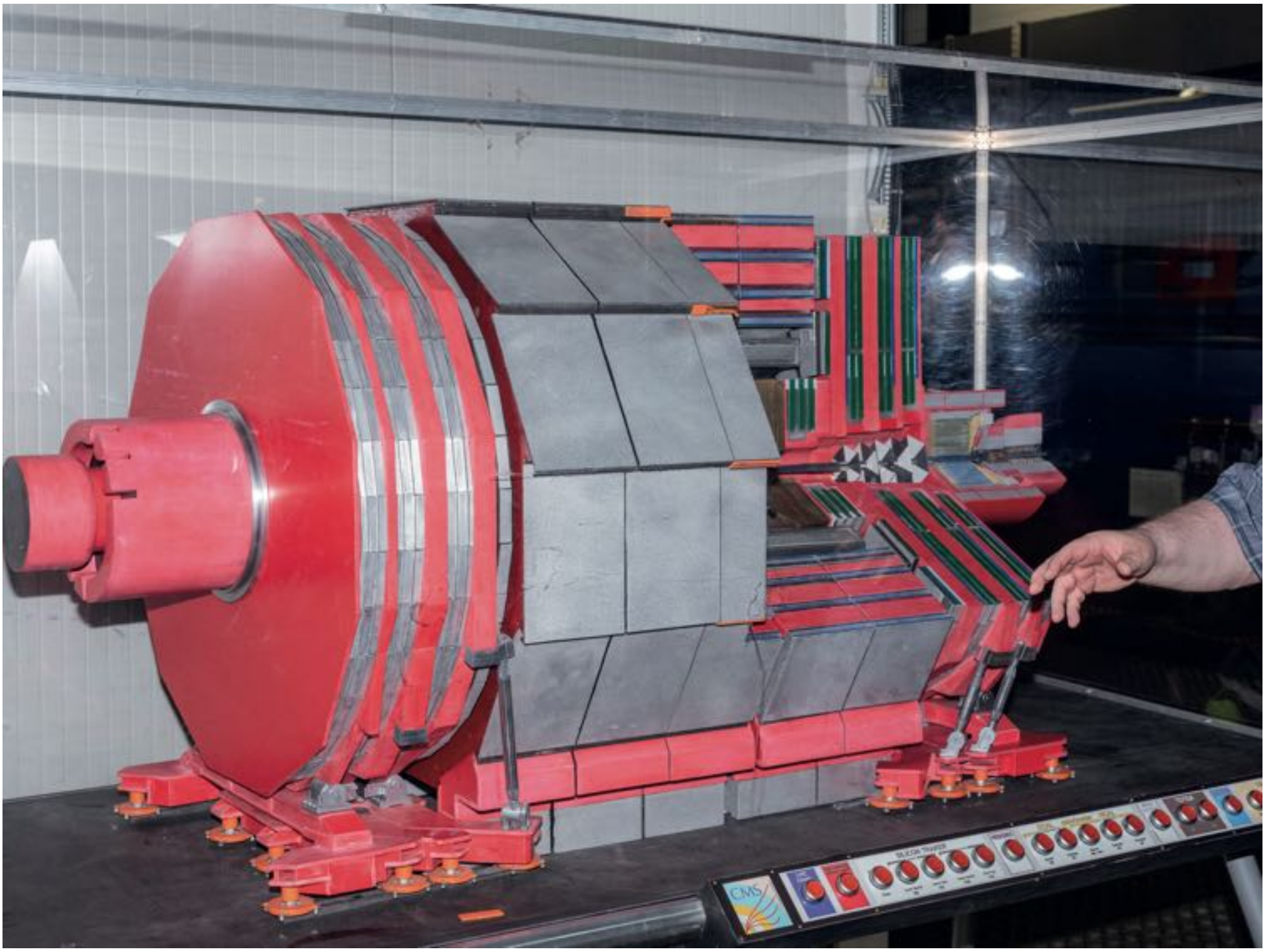
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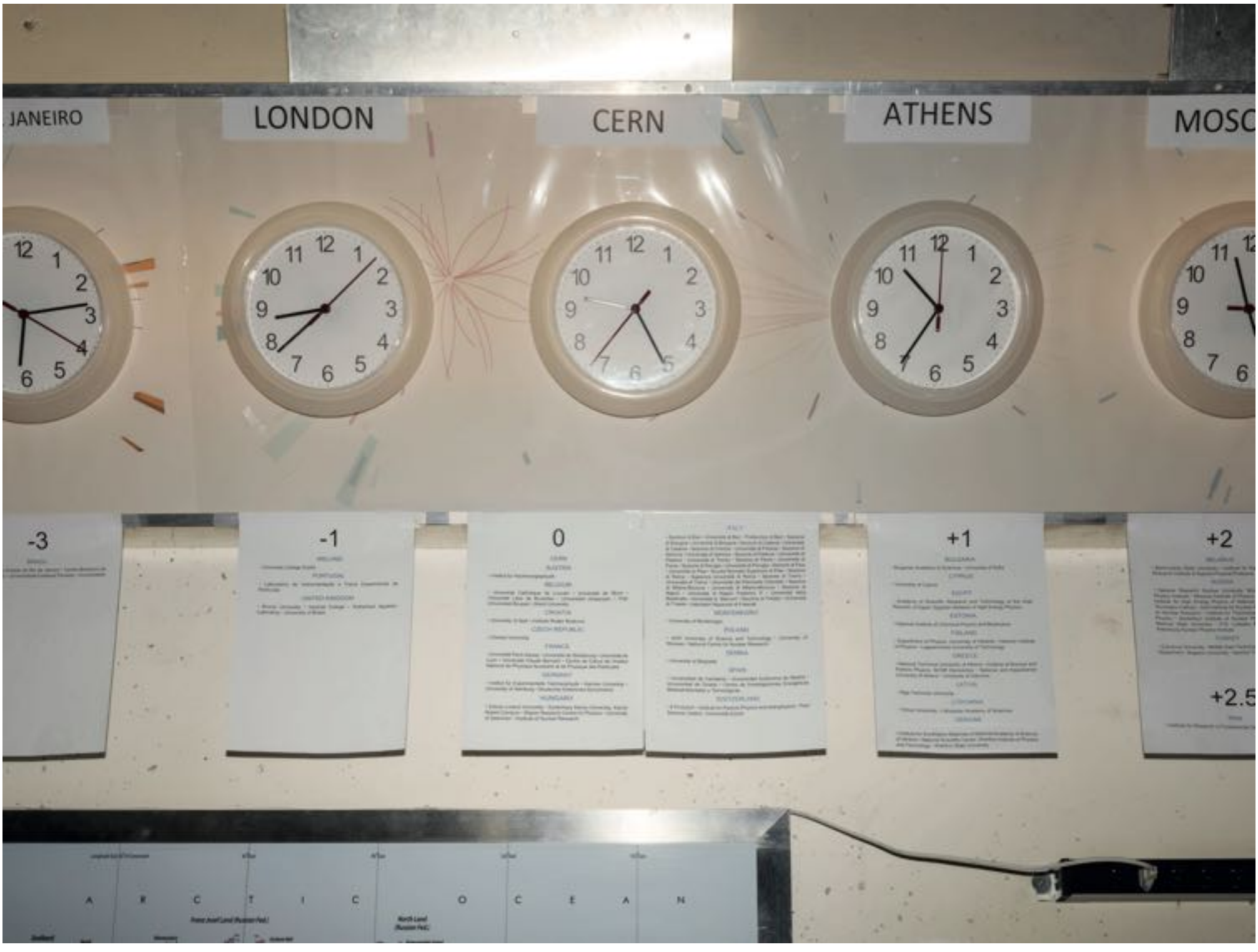
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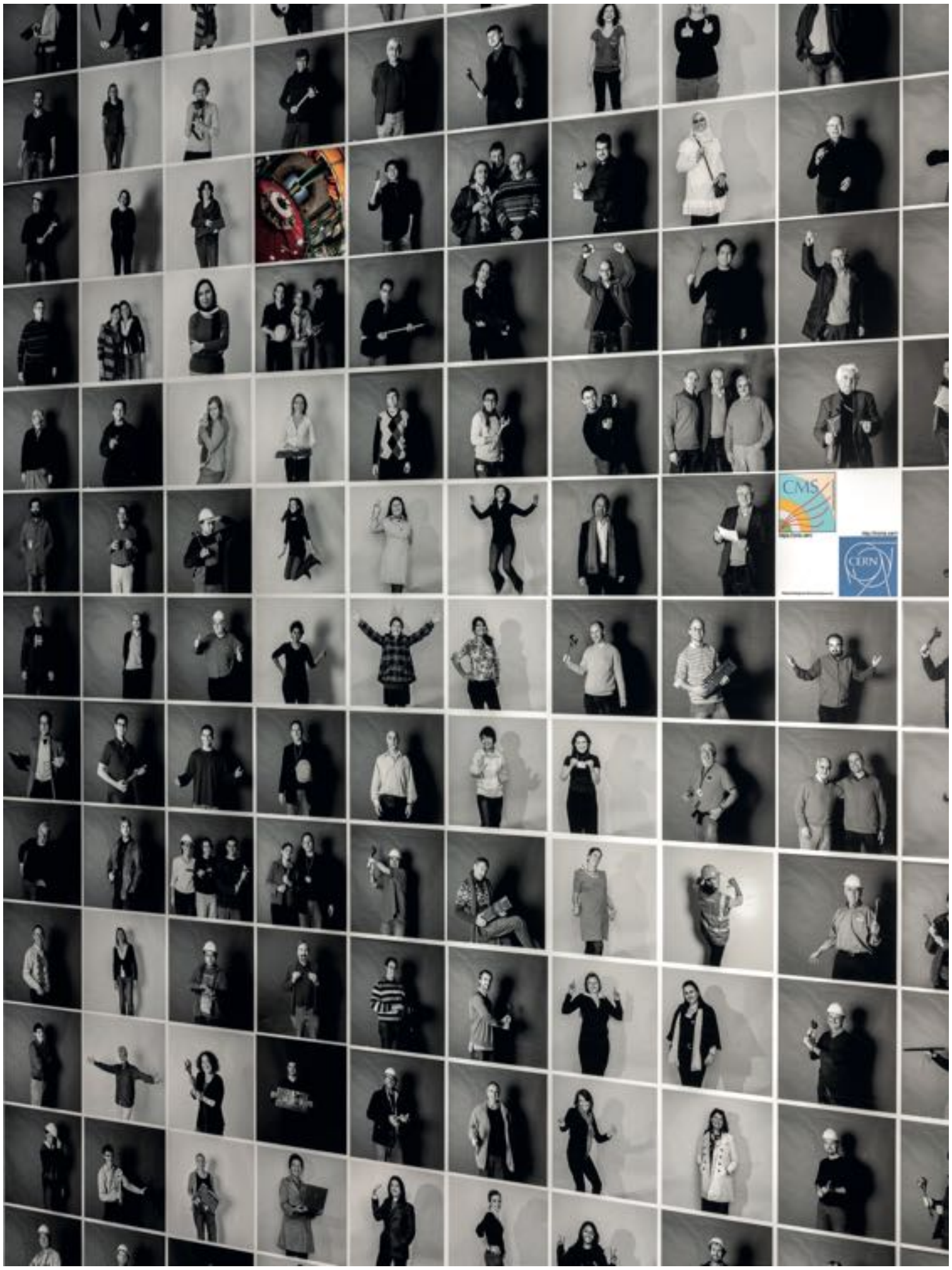
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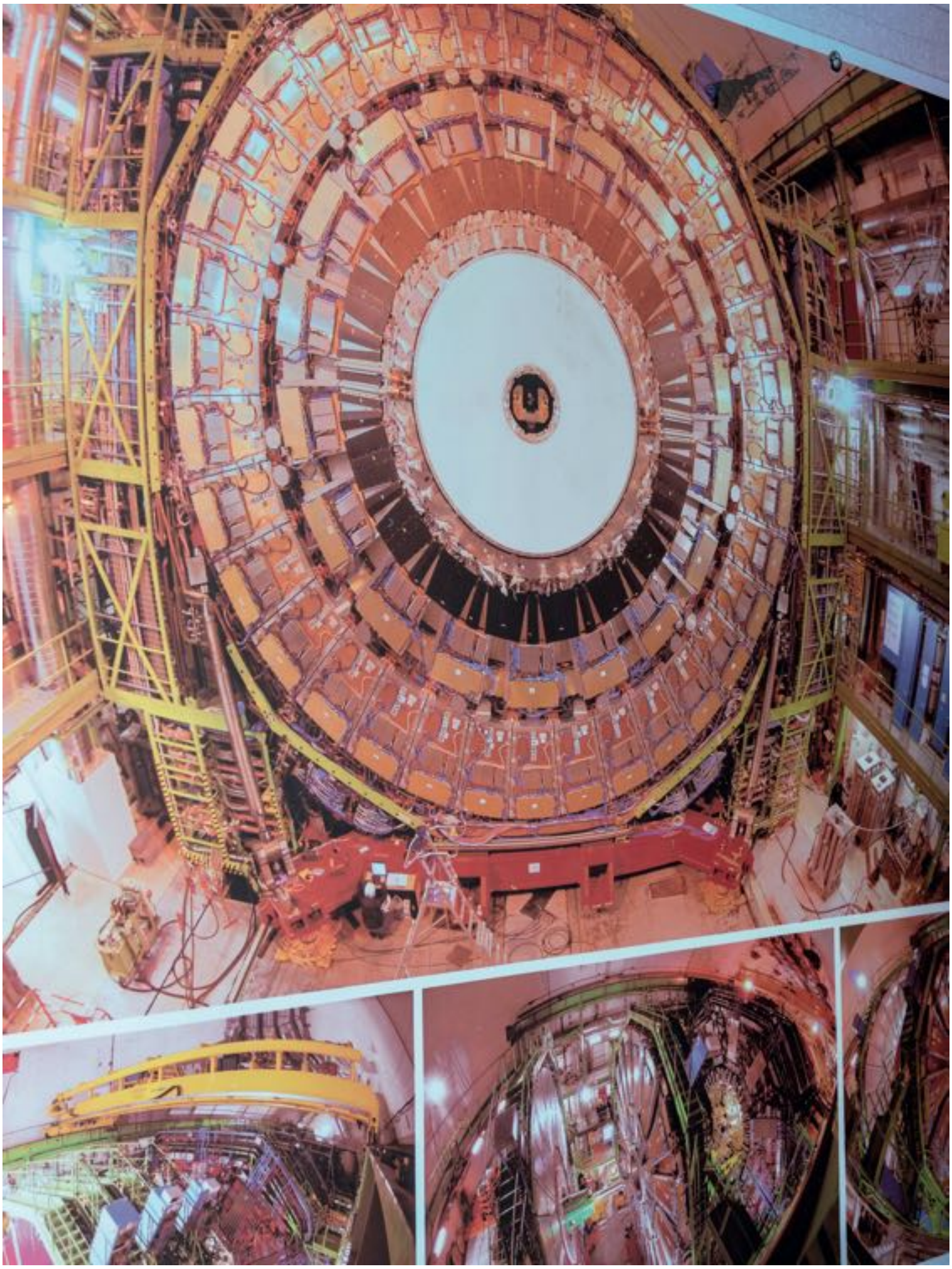
The Compact Muon Solenoid Collaboration
The Compact Muon Solenoid Collaboration
The Compact Muon Solenoid Collaboration

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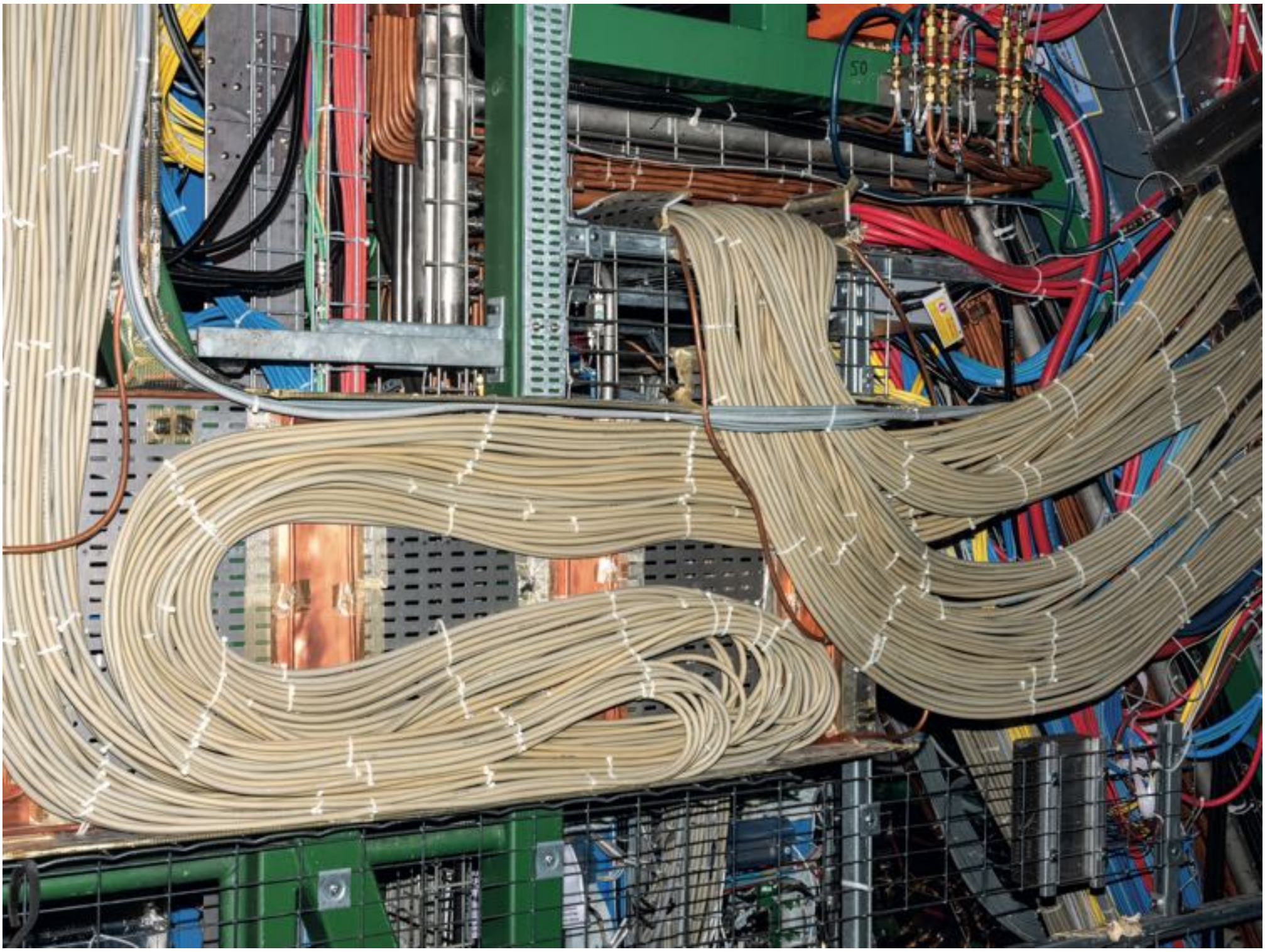

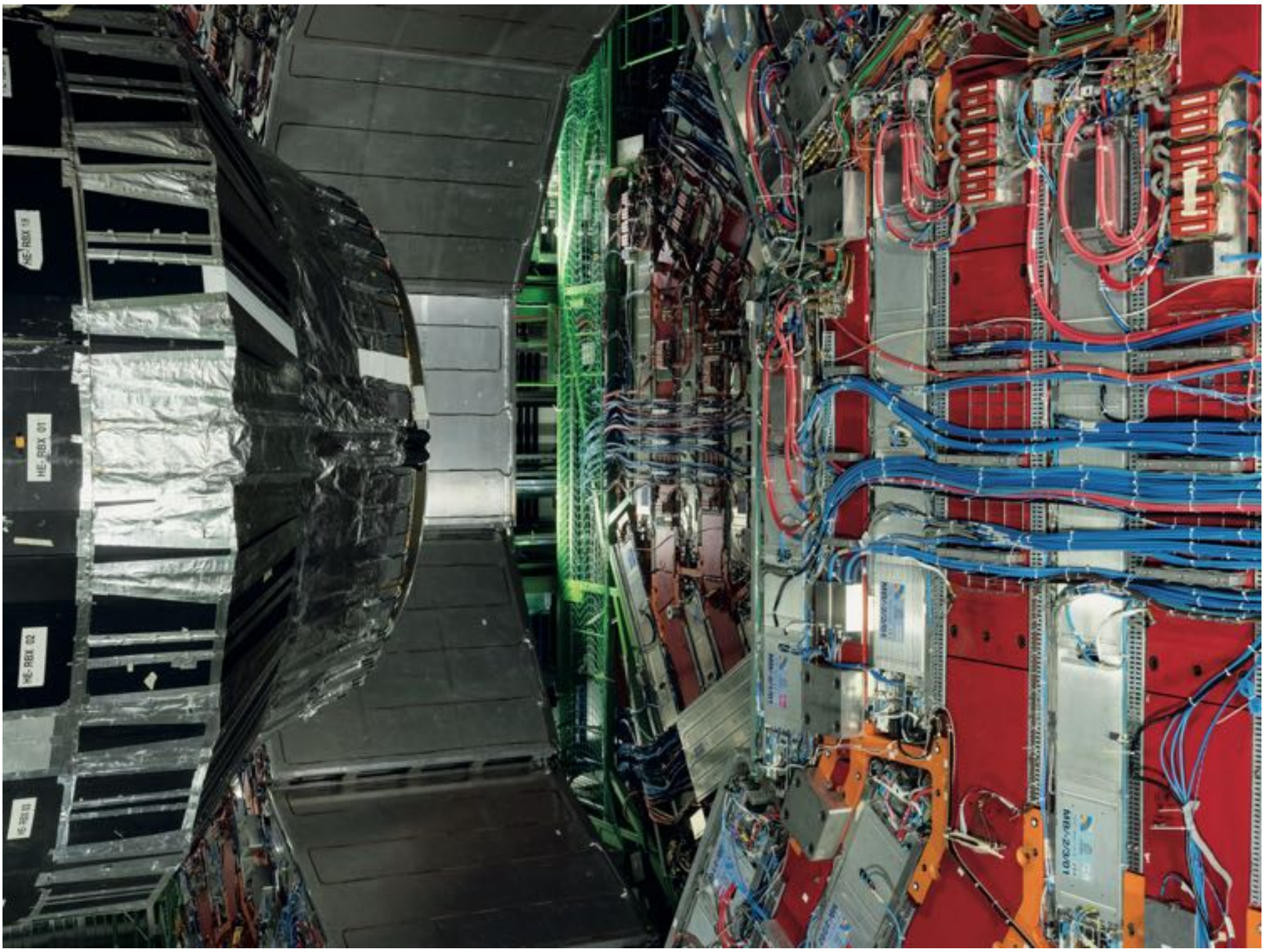
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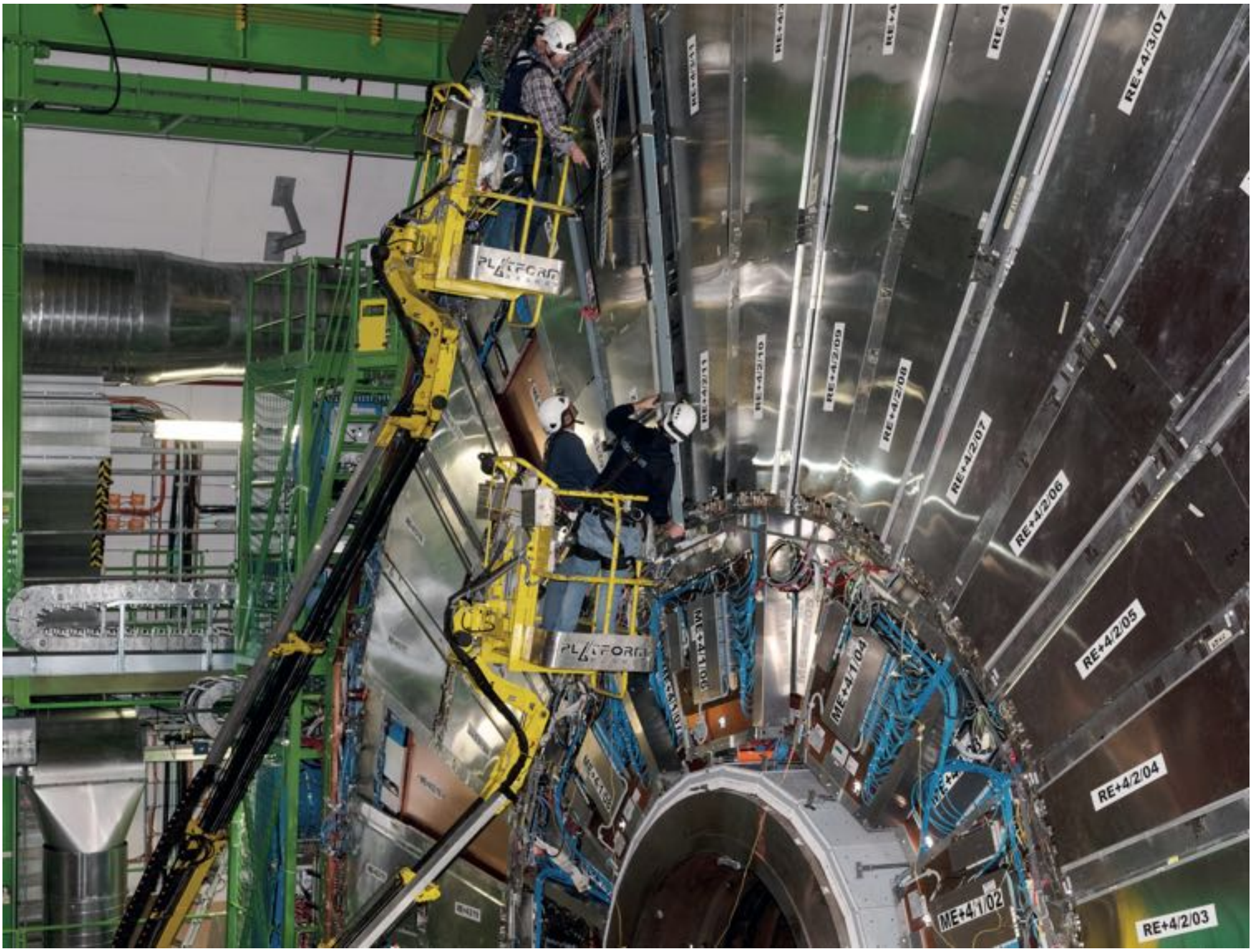
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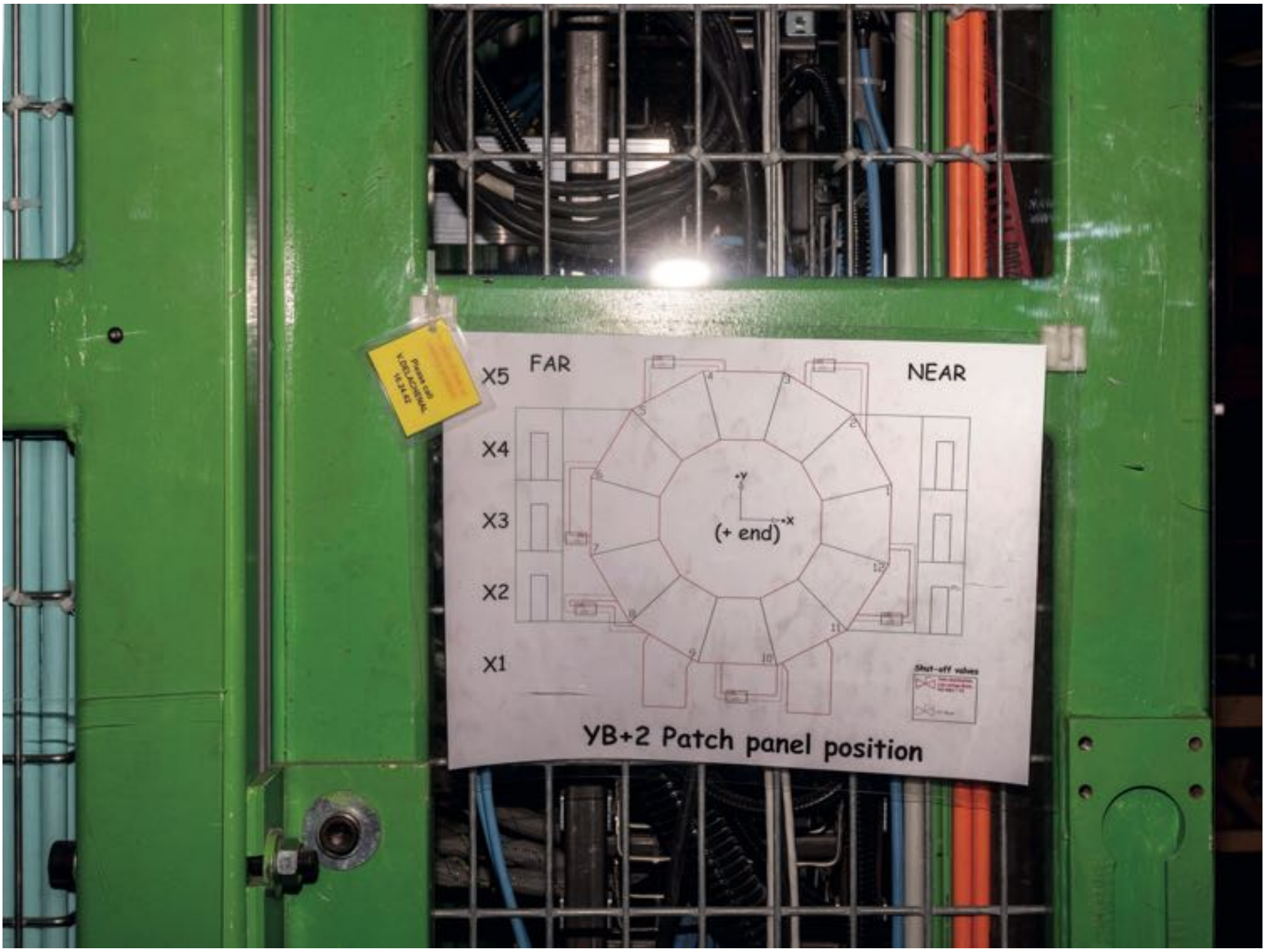
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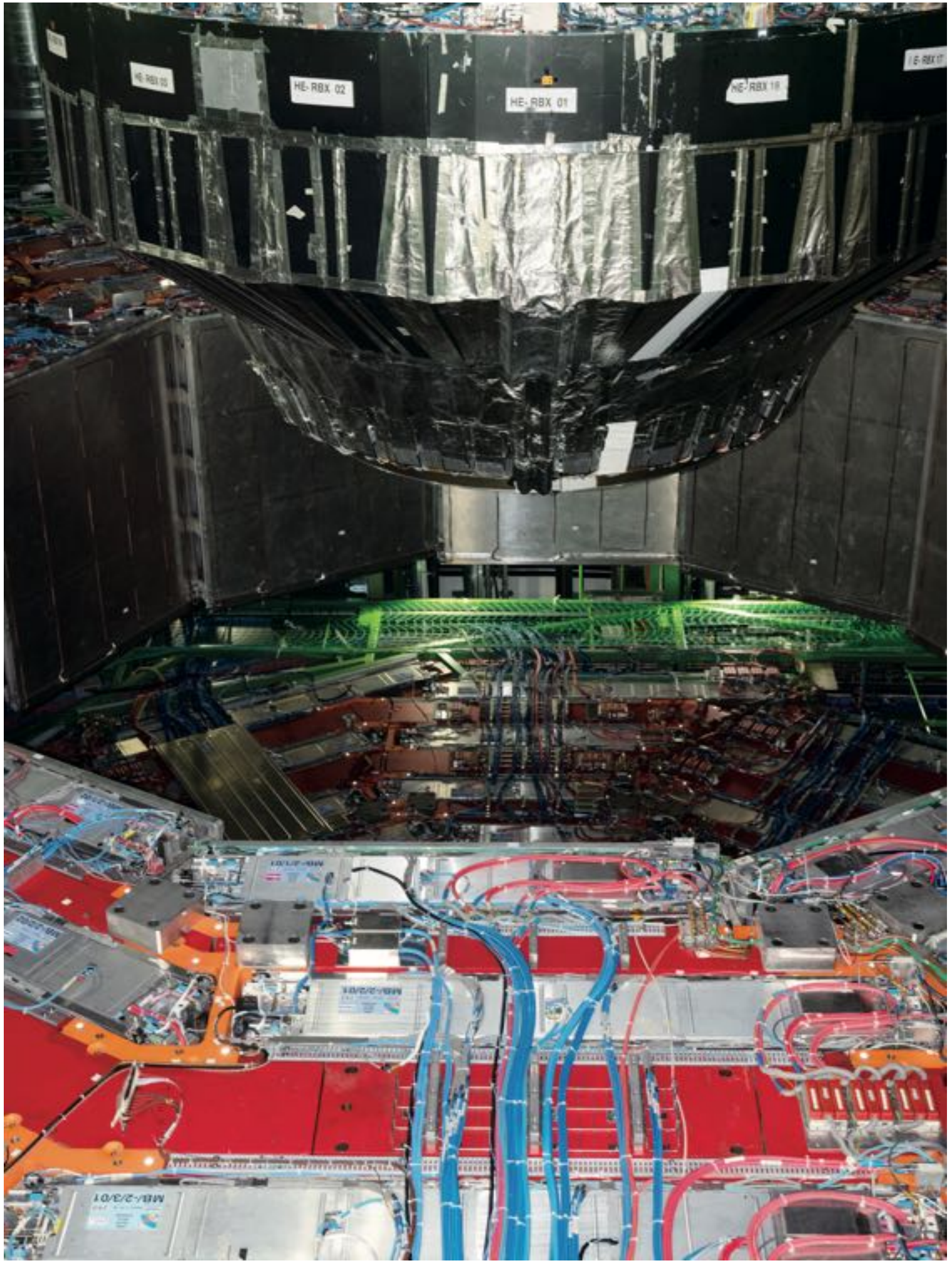
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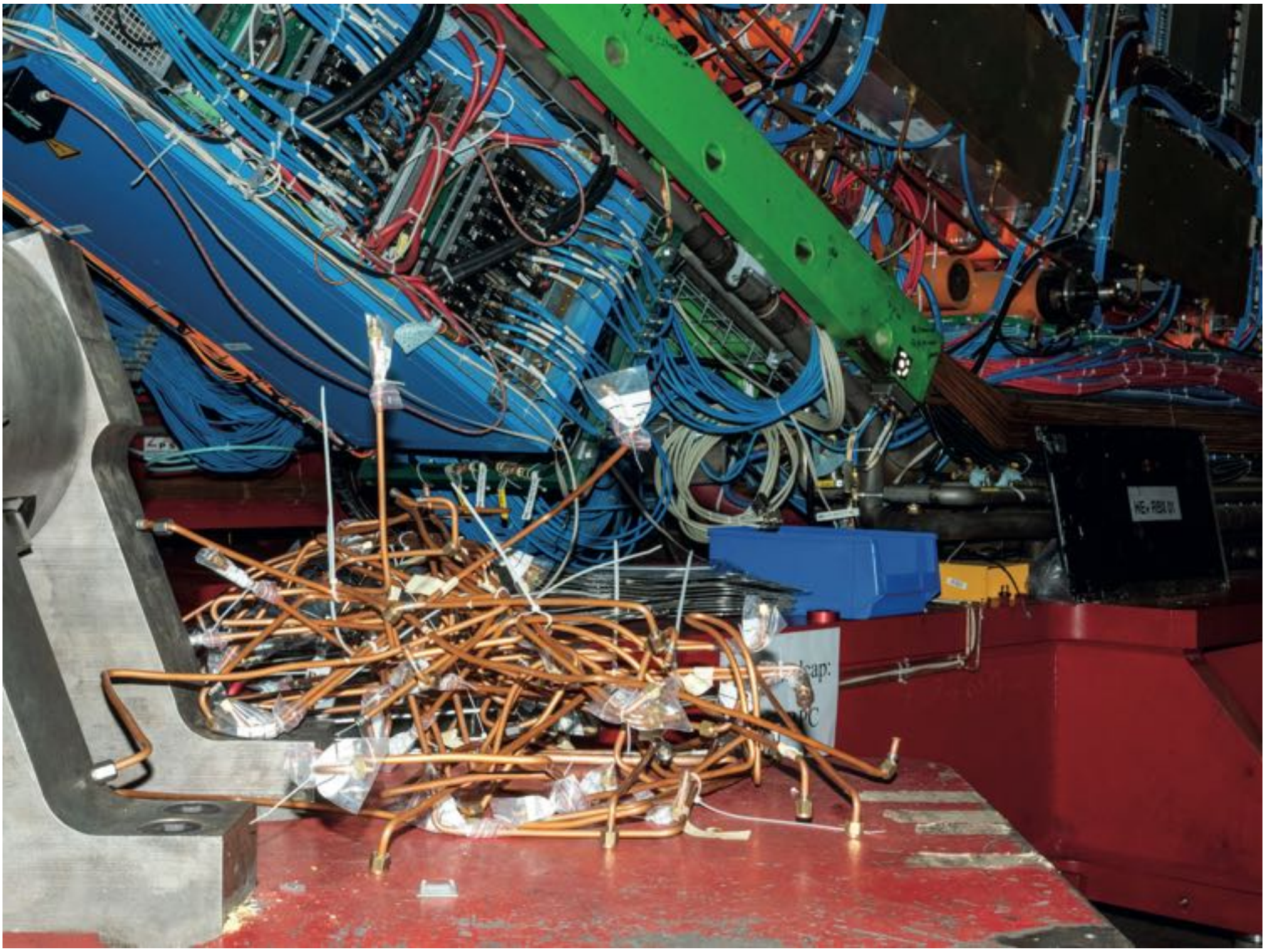

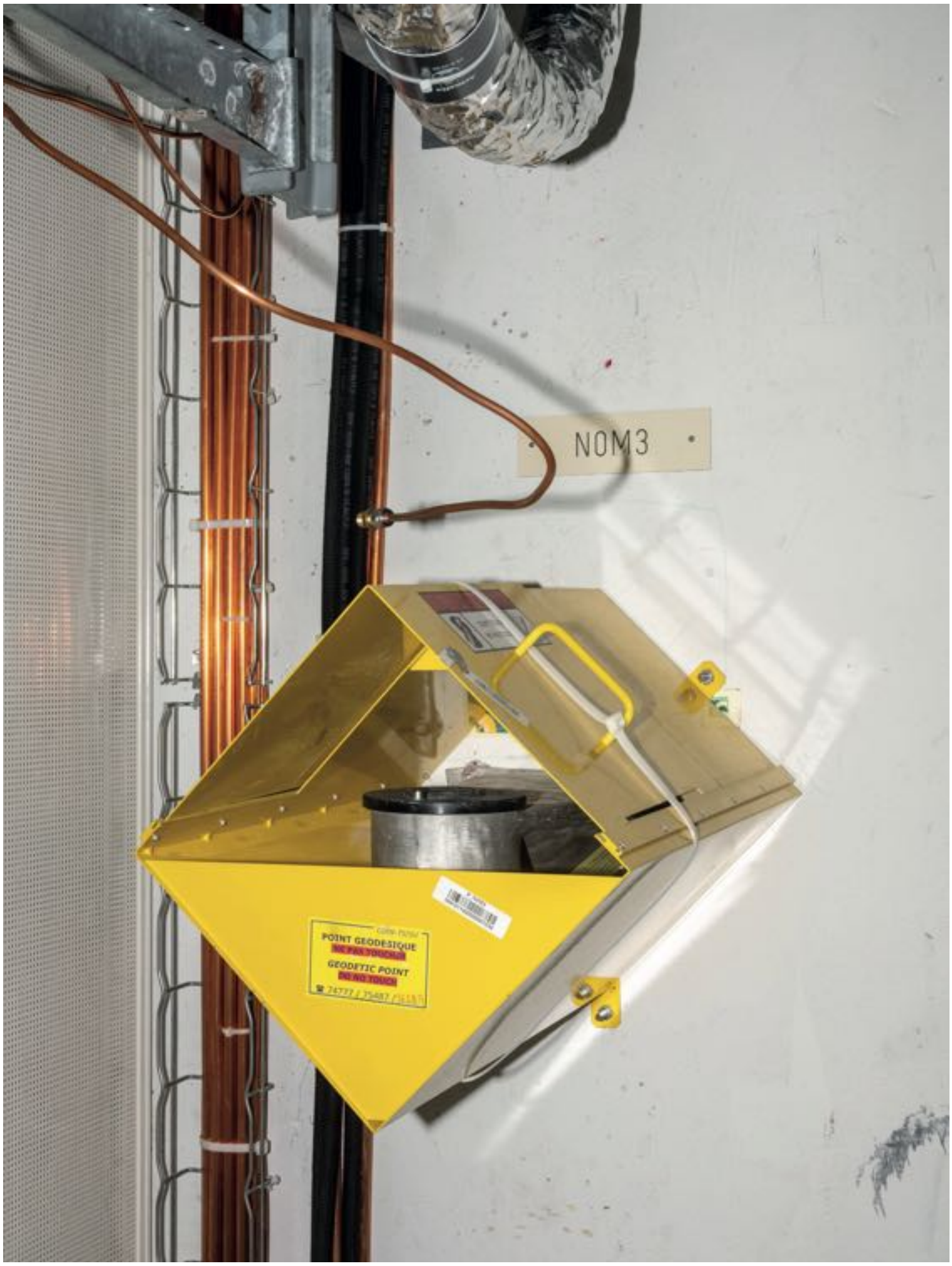
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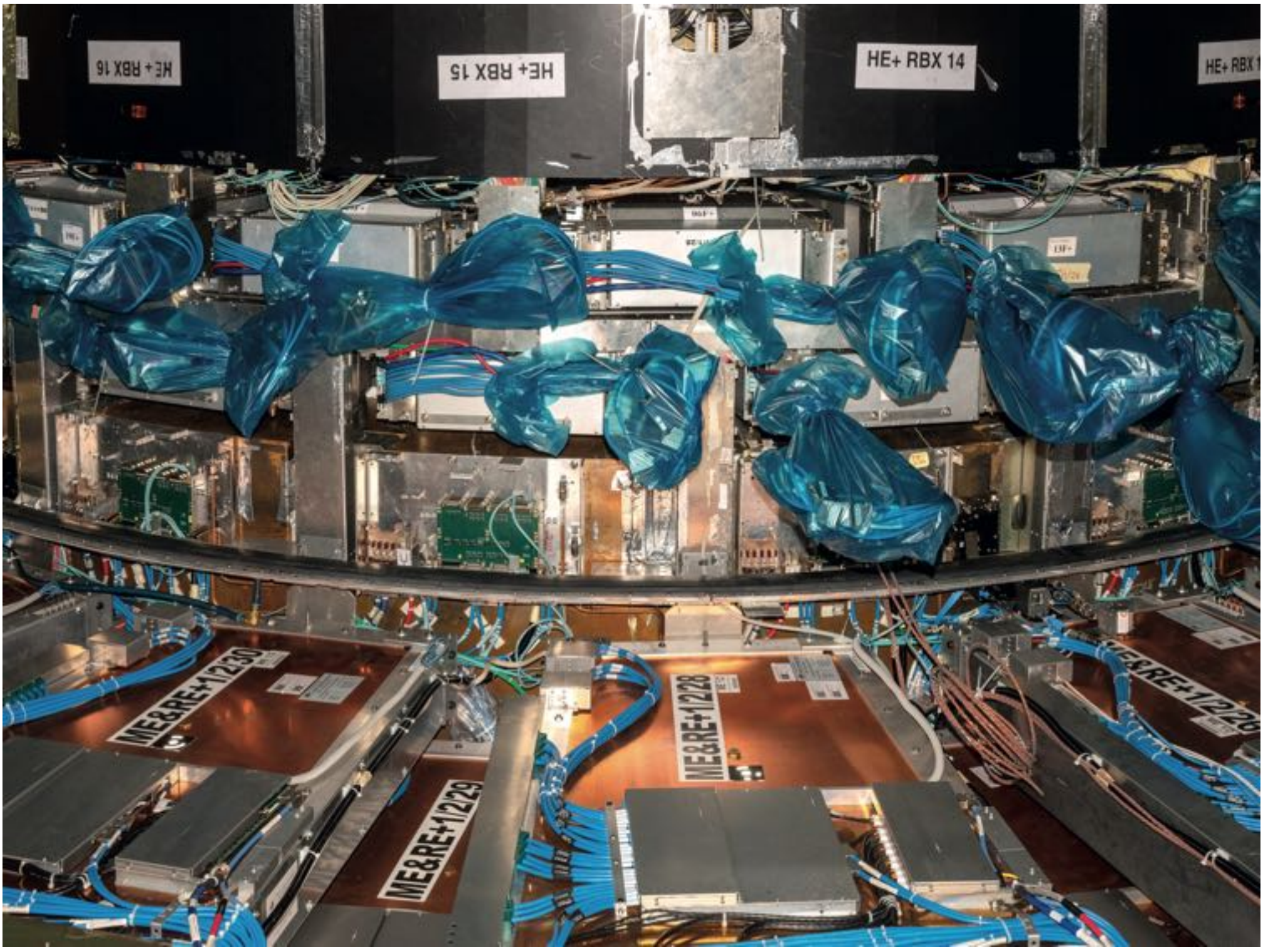
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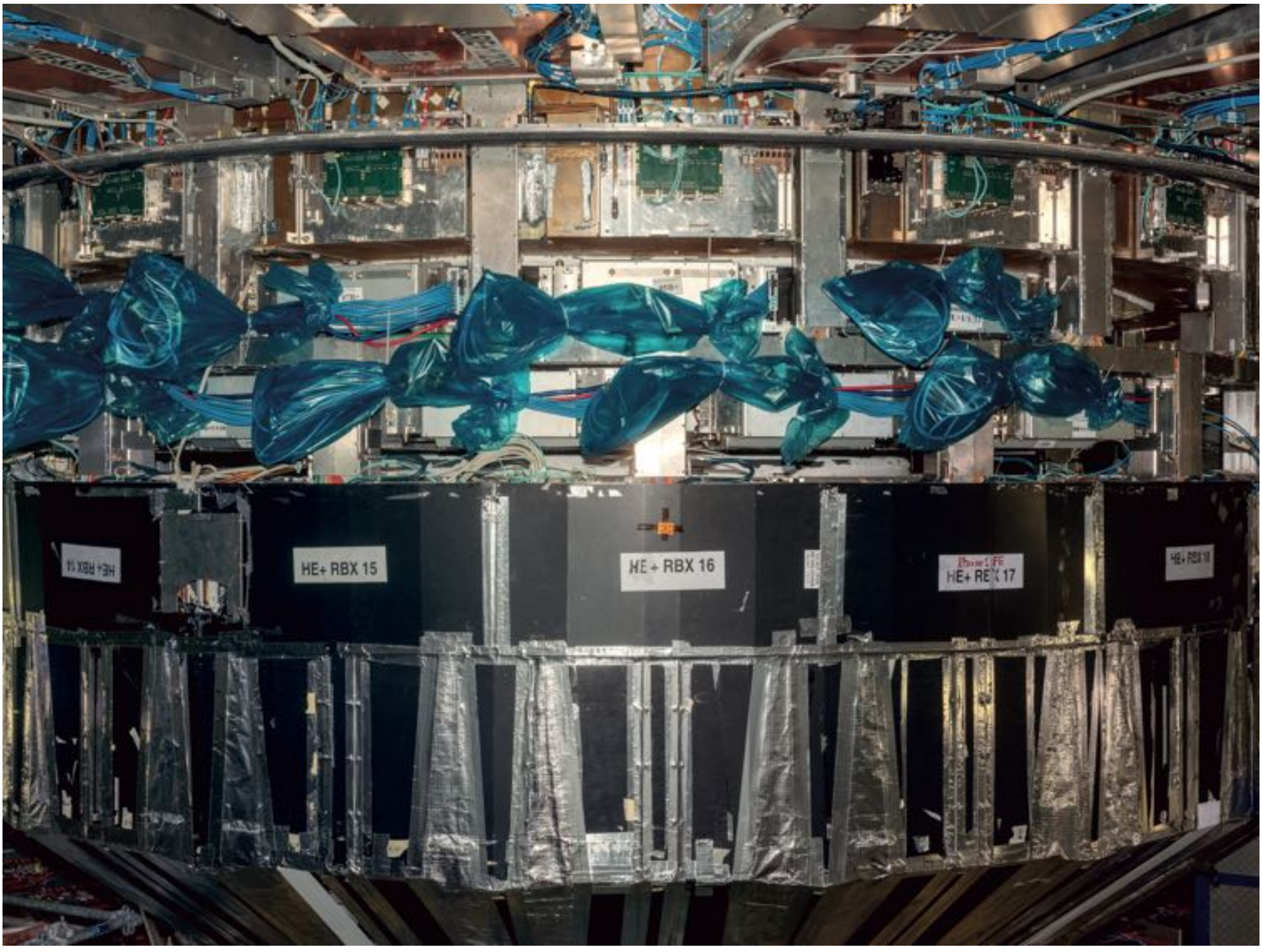
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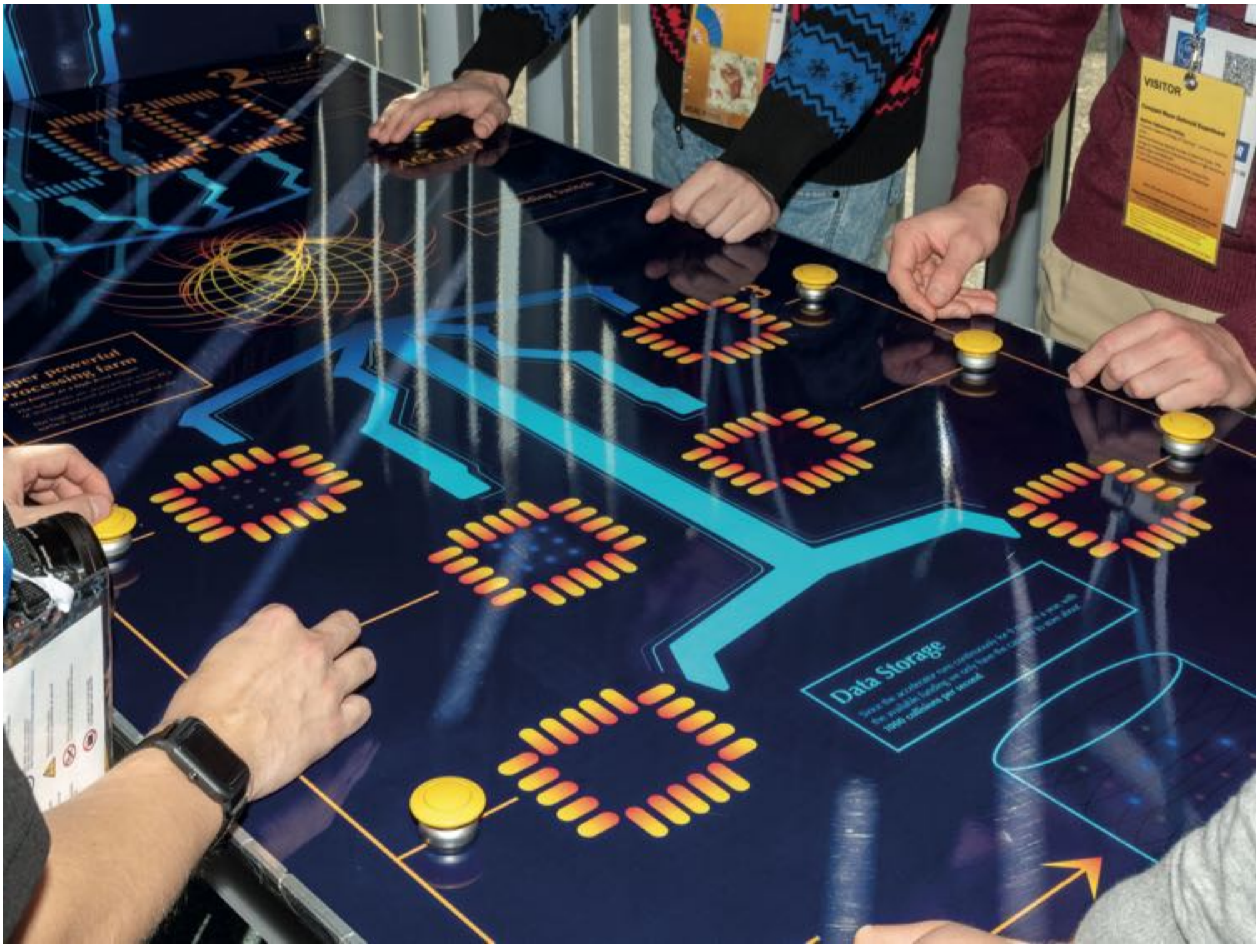
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Genève Constellation Métropolitaine.
Manifesto

1 A NEW GEOGRAPHY

Grand Genève's future growth and ecological transition must be imagined within a larger geographical context. The simple geometry defined by the 100 km circle of the future circular collider (FCC) provides an excellent starting point to observe, comprehend and grasp the overall image of the entire region. The enormous circle leaves the Salève, hence nature, at its centre. This unintended coincidence of technology and geography has a liberating power and allows us to abandon an outdated model with the old city at the core and everything else gravitating around it and to imagine a New Metropolitan Constellation, where Genève enters a new dimension in which the larger eco-system plays a new role.

2 A METROPOLIS AS AN ORBITAL SYSTEM WITH TWO LAKES

Grand Genève's future growth and ecological transition must be imagined within a larger geographical context. The simple geometry defined by the 100 km circle of the future circular collider (FCC) provides an excellent starting point to observe, comprehend and grasp the overall image of the entire region. The enormous circle leaves the Salève, hence nature, at its centre. This unintended coincidence of technology and geography has a liberating power and allows us to abandon an outdated model with the old city at the core and everything else gravitating around it and to imagine a New Metropolitan Constellation, where Genève enters a new dimension in which the larger eco-system plays a new role.

3 NATURE IN/AT THE HEART

The very heart of the metropolis is a protected reservoir and enhanced natural eco-system. Wildlife and the carbon sink of the forest generate a Metropolitan Biosphere, a breathing bubble, to ensure quality of life and a series of fundamental eco-system services: air purification, climate and water cycles regulation, a bank of renewable resources. Only through this hearth of nature can the metropolis achieve a complete and sustainable ecological balance.
The Saléve is at the centre of this new Kaleidoscopic Metropolis: a central protected and contemplative mountain that will offer the inhabitants of the polycentric city the possibility of escape and suspension of the hectic urban life. The quiet mountain at the centre of the metropolis becomes a wildlife reservoir, a climate-regulating carbon sink, and an observation platform: the new circular metropolis is best understood from the mountain at its centre, the metropolitan constellation becomes visible only from inside nature.

4 MAKE THE INVISIBLE VISIBLE

The circular tunnel of the FCC will be created underground. As with all other international institutions in Geneva, it will be invisible. Yet the hidden figures of the CERN colliders (LHC and FCC) and the walled fortress of the United Nations can contribute to the production of a metropolitan landscape; they can be used as intelligible urban figures. On one side, the FCC will guide the growth of the new settlements distributed around the Saléve, on the other side, the LHC will emerge to the surface generating a new park along its diameter and the United Nations will be part of a new green sequence meandering through the city.

5 A METROPOLIS MADE OF FORESTS

The new metropolis is entirely built of wood. All the new expansion, densification and substitution projects along the metropolitan ring will be realized of wood, using certified Swiss, French and Italian timber.
In order to ensure the immediate creation of the wooden-built settlements, available timber coming from Switzerland, France and Italian forests will be used. This material will be harvested in Switzerland and France but processed locally in the Great Geneva, where a chain of sawmills and a woodworking infrastructure plant will be immediately established. The new metropolis will grow together with a new large-scale territorial forestry project aimed at establishing a new Circular Wood Economy in planted forests and related bio-based industries, thereby creating new jobs and skills in the territory. New forests will be planted inside the ring (around the Saléve) and in the neighbouring regions. They will contribute to compensate for the land consumption resulting from the new settlements. Part of the trees will be ready for selective cutting in 60 years -and will guarantee a complete autonomous timber economy for the region. This new system of planted forests will follow naturalistic forestry criteria suitable for the ecological processes of the woods. This strategy will ensure continuity in the current selective cutting policy used for the natural regeneration of the wood. Planted forests will be mainly composed of oaks and conifers with a single age range and a regular spacing system between trees.

6 AN EXPERIMENTAL FIELD FOR THE ANTHROPOCENE

Grand Genève will become the first and largest carbon-positive and zero-emission-zone in the world, where fossil combustion and CO_2 emissions will be completely eliminated by 2050. Human life inside the inner ring of the metropolis will be agile, acting in a light way on land: mobility is intended as a service possibly relying on light means of transport and always powered by renewable resources. The new zero-emission-zone will rely on the development of an innovative high-speed digital network system, supporting remote working within a maximum 5 km radius traffic distance and reducing commuting matrices by 50%. The construction industry will minimize material and the embodied energy in the building stock.

The development of such a complex mix of innovative strategies involving urban, infrastructural, transportation, agricultural, and energy policies makes Grand Genève the ideal place for a new UN agency related to the challenges of the Anthropocene. Grand Geneva will become an experiment on sustainability with worldwide implications.

7 AGRICULTURAL RENOVATION

The polycentric and Polymorphic new Metropolis will have at its external edge a continuous sequence of woodlands and garden forests. The urban poles will be interspersed by a series of public use agricultural fields that will replicate the format of the Agricultural Public Park designed for the area between the Geneve Airport and the UN headquarters. This series of new agricultural settlements will combine new typologies of sustainable cultivation (with high biodiversity), farms for the transformation of agricultural products into food with a systems of public paths and collective places from where it will be possible to experience the environmental conditions of a renovated agricultural sphere.

8 AN ECLECTIC STRATEGY FOR ENERGY

The excavation of the FCC tunnel will offer an opportunity to integrate the particle collider with a new high-voltage underground energy transmission infrastructure. This new circular network of energy distribution will emerge at strategic points (access points), serving settlements in a 5 km radius. Renewable thermal energy produced by centralized power stations as well as renewable electric energy generated through central photovoltaic or wind turbine plants will give energy to the 11 poles on the orbit. A regional energy plan will allow for new zero-emissions developments, encouraging decentralized renewable energy production, or de-localized carbon neutral energy plants. A series of energy storage systems will be installed along the ring to synchronize demand and production within the region. Low density developments will be able to produce more energy than they need and will trade energy for land with the denser developments. The large-scale circular energy distribution network will be integrated with smaller scale, local strategies. A culture of re-use will be adopted. New and existing commercial buildings or logistic facilities will adopt a zero-waste policy.

9 TRANSPORTATION

At the entrance of the zero-emission-zone, a series of interchange nodes will act as new territorial landmarks, sorting external mobility fluxes into a new carbon-free ecosystem, where electric smart roads, collective transport and last mile/micro mobility solutions will serve the orbital polycentric metropolis. The new polycentric model will reduce commuting demands by 50% and will animate the rural and urban territory. The fast-global business will be optimized through smart equipped work facilities distributed along the ring and well-connected to the airport.

A network of open schools, active all day long and all year long, will serve as civic epicenters within urban developments -and will trigger an infinite combination of public facilities and cultural services.

10 GOVERNANCE

Grand Genève will need a new model of governance: a binational euro district will be established. The binational euro Grand Genève district will be the platform for cross border cooperation between Switzerland and France, Vaud, Genève and Haute-Savoie. This new administrative body will collaborate with local authorities and will contribute to the experiments of the zero-emissions zone and of the ring of forests in collaboration with the UN agency for the Anthropocene. For these new planted forests, it will be necessary to think about a legislative status other than the current one, defining a multifunctional forest program (recreational, productive and with environmental benefits).

The goal of this juridical implemental process is to create a variegated new transnational metropolis that will become a reference for many other urban transnational conurbations all other the world. To do that, the new Grand Geneve Kaleidoscopic Metropolis will develop a strong integration of different cultural and national population groups. The idea of a Metropolis that will embody the Eduard Glissant concept of Mondilité -through a large mixture of national and international communities cohabiting in the same circular sphere- will be one of the main characters of the Grand Geneve project.

Genève Constellation Métropolitaine.
The numbers

0 CO_2 emissions from the mobility sector

1 Central Biodiversity Core

1 UNHACC - UN Headquarter for Anthropocene and Climate Change

1 UN Research Center for Ecological Transitions

2 Major cities

2 Lakes

4 Metropolitan areas

4 Regional primary polarities

6 Primary intermodal multifunctional nodes

8 Regional secondary polarities

9 km of Linear Agricultural Park

10 km max of smart working distance

10 km diameter for each Centrality

11 New self-sufficient centralities

11 New Open Schools

11 FCC Accelerator Access Points

11 New timber processing sites

11 New smart working polarities

11 Agricultural parks

13 Secondary intermodal multifunctional nodes

15 kWh/m2y
Energy reduction for new buildings

35 km of Railway corridors

100 km
of CERN FCC accelerator circumference

100 km
of high-voltage underground energy distribution

120 km of E-vehicle Ring Road

132 Municipalities involved in the Transnational Intervention Area

Genève Constellation Métropolitaine.
The numbers

155 km of Tree Planted Infrastructure

350 inh/sqkm Minimum housing density within the new Centralities

450 kWh/pers y
of Space heating Energy Budget

800 kWh/pers y
of Domestic hot water Energy Budget

2.500 inh/sqkm Maximum housing density within the New Centralities

4.725 ha
of Biodiversity protection Area on the Salève

5.400 ha of Urban Development Areas

7.853 ha of Slow Mobility Area

37.443 ha of Central biodiversity Core

45.000 ha of Agroforestry

55.000 ha of Buffer Forest System

60.000 ha of Protected Natural Land

86.383 ha of Smart Grid Energy areas

100.000 ha of Transnational Constellation Metropolitaine de Genève

100.000 ha of ZEZ Zero Emission Zone

120.000 Residential units in Constellation Metropolitaine de Genève

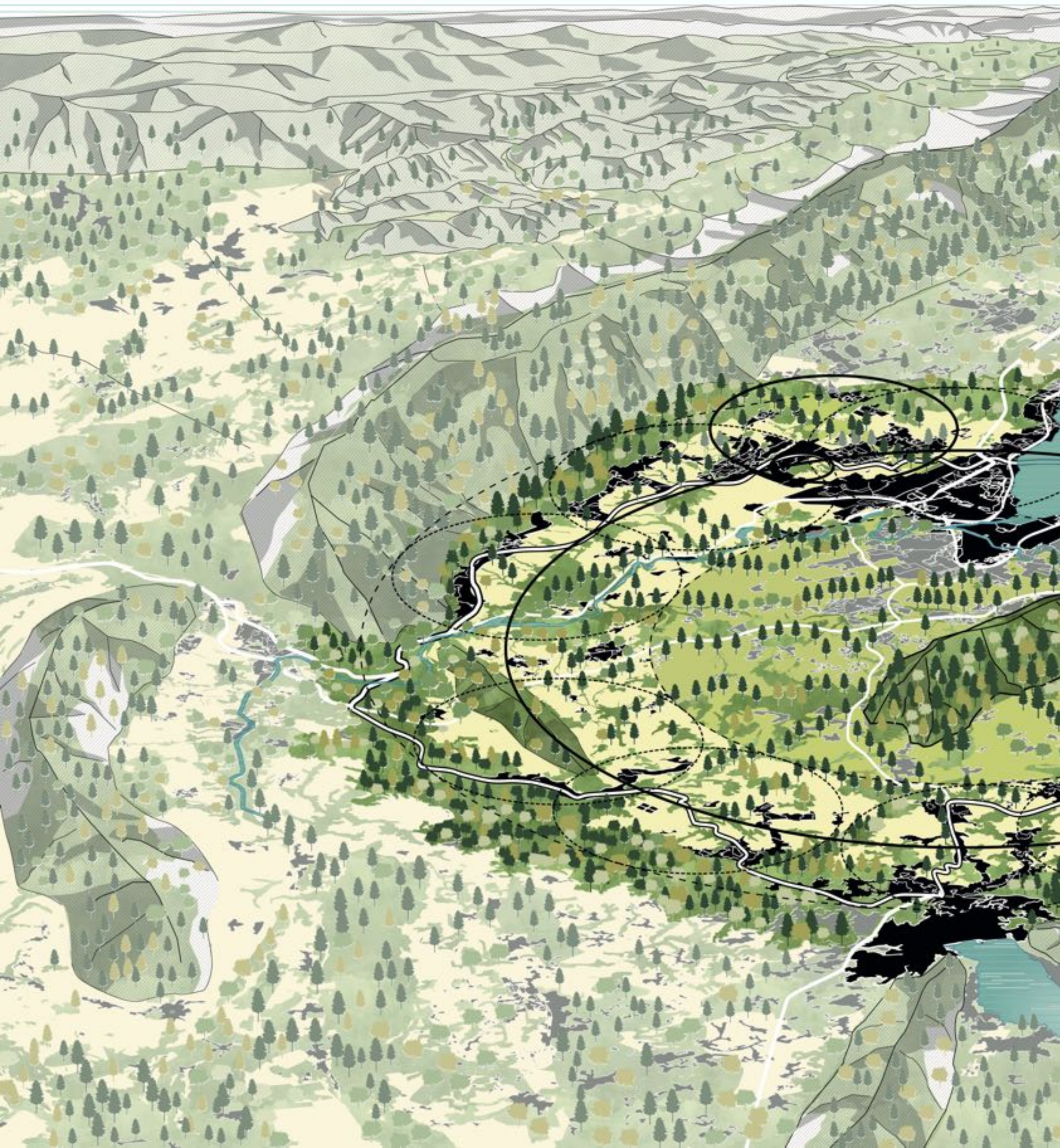
500.000 New inhabitants in Constellation Metropolitaine de Genève in 2050

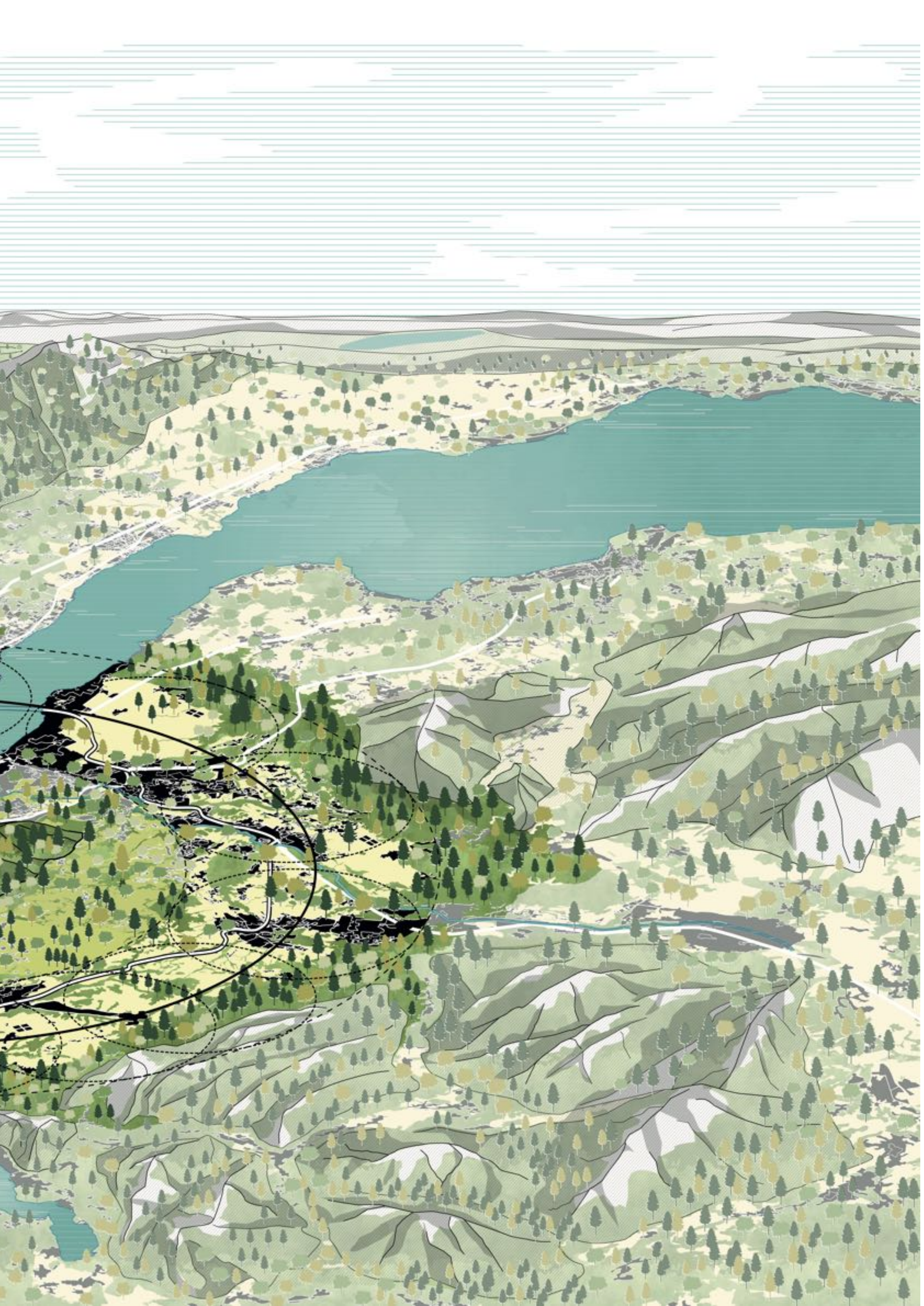
of which: +350.000 New inhabitants in Grand Genève and +150.000 New inhabitants in France outside of Grand Genève

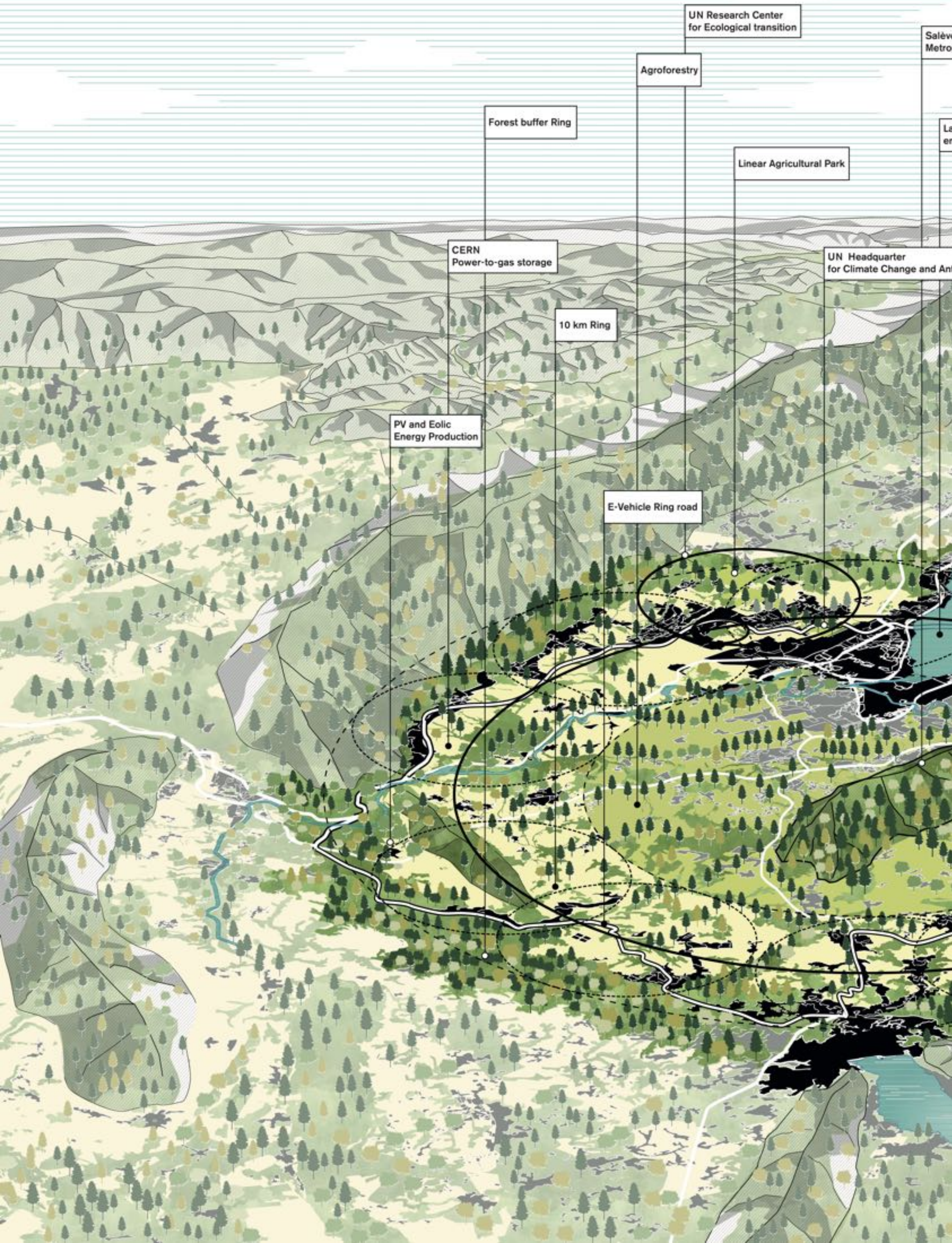
5.400.000 m3 of Timber Demand

5.400.000 t CO2

stored by new Timber Constructions






UN Research Center
for Ecological transition
Agroforestry
Forest buffer Ring
Linear Agricultural Park
CERN
Power-to-gas storage
UN Headquarter
for Climate Change and An
10 km Ring
PV and Eolic
Energy Production
E-Vehicle Ring road

e: the Green Heart of the
politan Constellation

ZEZ Zero Emission Zone

ake underwater
nergy storage system

La Roche-sur-Foron
New centrality

thropocene

International Hub and P+R solutions
Teleworking

Open School

Timber Production chain

FCC High-Voltage Energy
distribution Infrastructure

New Planted Forests

Géographie du pensée

A parallelism between the most iconic mountains' peaks
and the greatest thinkers and intellectuals

Ferdinand de Saussure

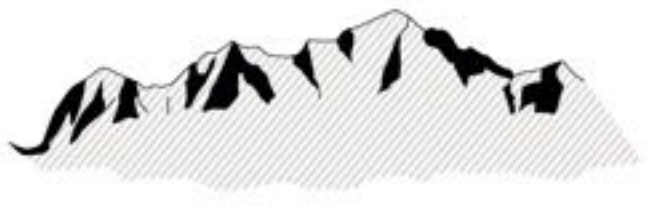
Third Course of Lectures on General Linguistics, 1911

Monts Jura

I propose to retain the word "sign" [signe] to designate the whole and to replace "concept" and "sound-image" respectively by "signified" [signifie] and "signifier" [signifiant]; the last two terms have the advantage of indicating the opposition that separates them from each other and from the whole of which they are parts.
(…) To sum up, the word does not exist without a signified as well as a signifying element. But the signified element is only a summary of the linguistic value, presupposing the mutual interaction of terms, in each language system.

André Corboz

Il territorio come palinsesto in Casabella n. 516, settembre 1985



Mont Blanc

Le territoire, suchargé comme il l'est de traces et de lectures passées, s'apparente à un palimpseste. Pour y installer de nouvelles structures, pour tirer parti de façon plus rationnelle de certaines terres, il est indispensable d'en modifier la substance de manière irréversible. Mais le territoire n'est pas un emballage à jeter, ni un produit de consommation qu'il serait possible de remplacer. Chaque territoire est unique. C'est pour cette raison qu'il est nécessaire de « recycler », de gratter une fois de plus – mais ceci avec la plus grande attention possible – le texte ancien que les hommes ont gravés sur ce sol irremplaçable, pour y déposer de nouvelles inscriptions répondant aux exigences d'aujourd'hui, avant qu'elles ne soient à leur tour effacées.

Jean Starobinsky

François Azouvi et al., Jean Starobinski, Paris, Pandora Éditions, Centre Georges Pompidou, Cahiers pour un temps, 1985, p. 11-12

Mont Salève

…Je ne me suis pas consacré à perfectionner les méthodes descriptives ; j'ai préféré, à mes risques et périls, les entreprises d'interprétation, où l'on n'est assisté par des balises méthodologiques que sur une partie du parcours. […]
Ma conviction, c'est que les techniques d'interprétation doivent s'inventer en fonction de la question qu'on a d'abord posée en toute liberté…

Édouard Glissant

Édouard Glissant and Patrick Chamoiseau, Le Mura, Abitare 486, October 2007

Chaîne des Aravis

In Mondialité (which is there, even if we have yet to find it), we don't belong to exclusive fatherlands or to nations, least of all to territories, but to "Places", linguistic storms, free gods who don't ask to be loved, native lands that we have chosen, languages that we have wanted to speak, geographies woven from lands and visions that we have forged. And these "Places" will become permanent, entering into relationships with all the other "Places" of the world.

Daniele Del Giudice

Atlante Occidentale, 2009

Mont Saxonnex

For him, the future was exactly what he saw at that moment: a rarefaction of smaller and smaller machines, almost invisible in nature. A coexistence of nature and technology, so perfected that it is no longer bulky but discreet and essential: trees, meadows, woods, greenery, a farm in the background, and here and there a protrusion of concrete, clear and clean, like a periscope.

Jura

Gex

UNHACC Research Center

Crozet

Divonne-les-Bains

Versoix

Ferney-Voltaire

UNHACC

Linear Park

Jardin Botanique

LHC

Meyrin

Open school

Airport

Intermodal hub

Etoile

Eaux-Vives

Cimitiere de St-George

Champel

Lancy

PAV

Carouge

an-les-Ouates

Sawmill

Sawmill

Croix-de-Rozon

Moint Tendre

Lausanne

Gland

Nyon

Coppet

Collonges
Bellerive

Open school

Annemasse

Cologny

Open school

Intermodal hub

La Gradelle

Thonex

Vetraz-Monthoux

Ambilly

Veyrier

Les-Terrasse
de-Geneve

Collonges
sous-Saleve

Massif du Chablais

Dents du Midi

Tour Saillere

Le Cheval

Cranves-Sales

Bonne

Reigner-Esery

E-vehicle road

Blanc

Mole

Matterhorn

Mont Blanc

Cluses

Bonneville

Saint-Pierre
en Faucigny

Open school

Arenthon

Intermodal hub

La-Roche
sur-Foron

Saint-Sixt

Pers-Jussy

Sawmill

Sawmill

Chaine d'Aravis

La Point Percee

Groisy

Menthonnex
en-Bornes

Sawmill

La Tournette

Semnoz

Annecy

Intermodal hub

Open school

Villaz

Open school

Les Ollierès

Allonzier
la-Caille

Sawmill


Mont Granier
Aix-les-Bains
Le-Balme-de-Sillingy
Cruseilles

Vuache

Contamine-Sarzin

Open school

Vers

Sawmill

Sawmill

Chevrier

Vulbens

Open school

Collonges

Farges

Intermodal hub

Péron

Sawmill

Viry

Feigeres

Jura

Gex

UNHACC
Research
Center

Crozet

Open school

Thoiry

E-vehicle road

Linear Park

Saint-Genis
Pouilly

LHC

Meyrin

Open school

Cimitiere de
St-George

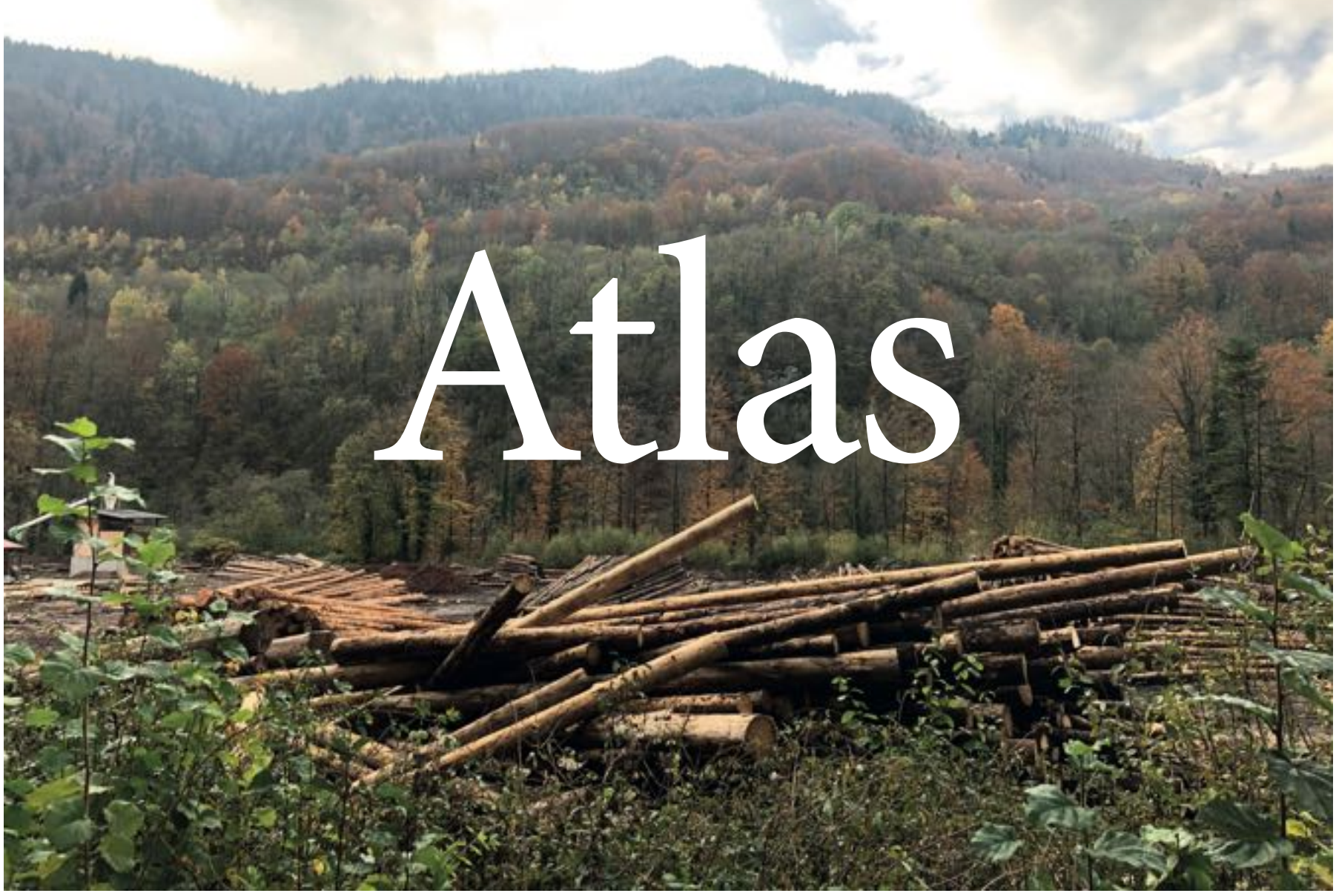
wmill

Cressy

Lancy

Plan-les-Ouates

Saint-Julien
en-Genevois


Atlas

Climate Planning:
Towards a Nature-Based Metropolis

Eugenio Morello

Climate change observations and hazards

Official meteorological measurements from MeteoSwiss and climatology scientific studies report significant climate change observations [1]. The metropolitan area is going to face increasing climate hazards and significant variations in water and air temperature regimes. Among others, an increase of mean air temperatures (and the consequent change of snow cover and regional water cycles) and the variation of precipitation phenomena represent the main challenges for this region. Air-surface temperature air temperature has increased by +1.75°C between 1864 and 2012, which corresponds to a linear trend of about +0.12°C per decade, with an acceleration of increase between 0.28 and 0.55°C per decade for the last 30 years (1983-2012). Since 1961, the zero-degree level has increased by 60m per decade in winter to 75m per decade in summer.
If the annual mean precipitation trends did not significantly change in the last 100 years, seasonal variations are emerging: During the last 30 years (1983-2012), mean precipitation is predominantly decreasing in winter and spring [2]. Moreover, statistically significant increases in heavy precipitation measures in winter and autumn have been found [3].
Concerning snow cover, a decrement in snowfall days and decrease in extreme snow depth have been observed [4]. Glaciers have been receding since the '80ies with a loss of mass of 2-3% per year. Negative trends for extreme snowfalls at low and high altitudes have been recorded [5].

Nature-Based Metropolis as a solution

Climate is already changing cities, but cities as well can change climate through design and the employment of all the raw materials that constitute the built environment, namely grey, green and blue materials. If it is true that cities cannot invert global trends of climate change, they can anyway contrast and mitigate micro-climate conditions at the local level.
Putting nature at the centre of the planning system – both metaphorically and geographically – is the key of this project and the only strategy to address the gradual increase of climate change pressure over this territory. Intensification of nature, and in particular the proposed ambitious regional forestation program, will act as a regulating eco-system service[6] helping cooling down temperature and managing water cycles at the regional scale.

Vegetation to reduce urban temperatures and cool down air

The Salève mountain at the centre of the metropolitan system together with the two lakes already

[1] Brocard E, Philipona R, Jeannet P, Begert M, Romanens G, Levrat G, Scherrer SC (2013) Upper-air temperature trends above Switzerland 1959-2011. *Journal of Geophysical Research*, 118:4303-4317.
[2] Brönnimann S et al (2014) *Climate change in Switzerland: A review of physical, institutional, and political aspects, Wires Climate Change.*
[3] Schmidli J, Frei C (2005) Trends of heavy precipitation and wet and dry spells in Switzerland during the 20th century. *International Journal of Climatology*, 25:753-771.
[4] Marty C, Blanchet J (2011) Long-term changes in annual maximum snow depth and snowfall in Switzerland based on extreme value statistics. *Climatic Change*, 111:705-721.
[5] Perroud M, Bader S (2013) Klimaänderung in der Schweiz. Indikatoren zu Ursachen, Auswirkungen, Massnahmen. Umwelt-Zustand Nr. 1308. *Bundesamt für Umwelt, Bern, und Bundesamt für Meteorologie und Klimatologie,* Zürich.
[6] Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well Being: Synthesis*. Island Press, Washington DC.

constitute a natural air-purifying system. Air movements are naturally induced by the difference in height and temperature between the heat stored in the two water bodies and the top of the mountain.
This peculiar geographical conditions have a direct and visible impact on the micro-climates and hence on animal and plant life on the different mountain slopes. In addition, if we increment the consistence of forests crossing the above mentioned regional and local air movements, air entering the urban system and reaching out to the FCC will also get naturally purified and humidified, while penetrating the dense biomass of the metropolitan trees.
Trees also play a double role during day and night: during the day, shadowing effects due to tree canopy will cool down urban materials on the ground; during the night, the beneficial properties of evapotranspiration can locally decrease temperatures by almost 2 degrees compared to areas built-up of impervious surfaces.
Hence, our vision materializes in diffusing vegetation to infill the built environment, both trees and nature-based solutions (NBS), from the large regional scale up to the single building components: A Nature-Based Metropolis, indeed. Green densification is the only way to achieve effective benefits on human comfort in outdoor spaces: beside the provision of big green lungs and the satellite green belt, achieving a capillary distribution of vegetation right there where people are, live and work, is the answer to urban climate change mitigation.
In fact, improving the urban micro-climate will positively impact on people in two ways. Firstly, in terms of human comfort and well-being: people will make more use of open spaces and enjoy the psycho-physiological benefits of vegetation, due to the multi-sensory experience (mainly involving the sense of vision and the sense of touch, due to the thermal feelings of humidity and shadowing generated by plants). Secondly, the energy demand will be reduced, due to the reduced heat pressure on the building envelopes.

Vegetation to regulate the water cycle
Tree roots regulate the water cycle, absorbing and releasing the water content of the ground, managing irregular frequency and intensity of precipitation phenomena. In addition, guaranteeing the conservation of permeable soil and promoting depaving strategies enables sustainable urban drainages systems (SUDS) in urban environments to be easily implemented. By reducing the pressure on urban water run-off it will be possible to gradually detach buildings and urban open spaces from centralized water collection systems. A variety of blue and green NBS can greatly slow down urban water run-off in a scenario of increasing intensification of heavy precipitation phenomena (both in terms of frequency of events and of quantity of rain falling in a short time).

In short, green-blue-grey solutions together, if properly balanced in each of the established density schemes for the building typologies, can give a robust boost to achieve effective regulating eco-system services at all scales of design.

Forests

with Eugenio Morello and Fabio Salbitano

The surface of the Swiss forests is equal to the 32% of the surface of the country (1.31 million ha) and is composed of 71% of public forests and 29% of private ones. [1] Of these, 49% (585,000 ha) is defined as a protection forest: forest that prevents the release of avalanches, stabilizes the slopes, slows down the fall of the stones, regulates the water balance (21% of the protective forests have an avalanche protection function , 8% protect against falling rocks, 27% from landslides and 80% from torrential phenomena). [2]
The area of the forests of Grand Genève is 41% of the total area, or 90,200 ha.

The exploitable potential of Swiss forests is 8.2 million m^3/year. Compared to other European countries, the Swiss forest has a higher growing stock, equal to 350 m^3/ha., total 422 million m^3, of which 33% deciduous, 67% conifers.

In the Swiss forest, the annual prescribed wood yield is lower than the periodic annual increment of forests, particularly in private and mountain areas. Therefore, Switzerland has one of the highest wood growing stock in Europe.

5 million m^3/year are collected, in relation to 10 million m3 wood growth/year [3] , and the wood consumed is approximately 10.5 million m^3/year (reuse included).
The overall demand of wood affects rather differently coniferous and broadleaves forests: the wood of conifers is three times highly requested than the wood of broadleaves.
Eg. Wood harvested in 2017: 4.69 million m^3
- 65% is transformed by sawmills in various assortments (boards, beads, wood peeling etc.)
- 10% is intended to pulp wood to be transformed into cellulose and paper
- 25% is used for energy production

An adult forest has an average periodic annual increment for timber intended to construction uses ranging from 4m^3 to 7$m^3yr^{-1}ha^{-1}$ depending on the latitude and type of forest management applied. In the case of close-to-nature silviculture treatments (like the ones legally accepted in Swiss natural forests) the P.A.I. can be reasonably estimated around 4-5 $^m3yr^{-1}ha^{-1}$, while the values rise to 6-7 $m^3yr^{-1}ha^{-1}$ and more in intensively managed and shorter rotation planted forests.
To have a forest ready for use, average rotation time ranges from 80 to 120 years (or more, depending on the forest species and the ecological parameters of the forests) in the mountains, 50 to 80 years in hills and plains.
Around 142 million tons of CO_2 are stored in Swiss forests. An adult forest store around 5.13 T/ha/year of CO_2.[4]

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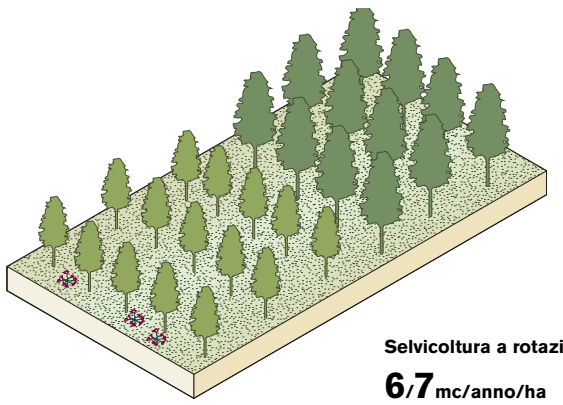
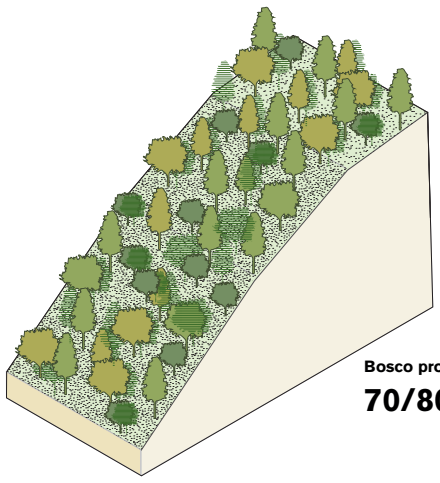
[1] https://www.bafu.admin.ch/bafu/it/home/temi/bosco/info-specialisti/stato-e-funzioni-del-bosco/il-bosco-svizzero-in-breve.html
[2] Losey, S.; Wehrli, A. (2013): Schutzwald in der Schweiz. *Vom Projekt SilvaProtect-CH zum harmonisierten Schutzwald.* p. 29 und Anhänge. Bundesamt für Umwelt, Bern.
[3] OFEV (éd.) 2018 : *Annuaire La forêt et le bois*.
[4] Marino de Santa, presidente Legnolandia.

SILVICULTURE TREATMENTS



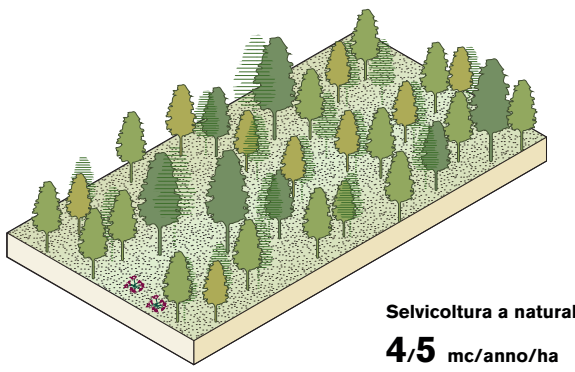
Selvicoltura a rotazione

6/7 mc/anno/ha



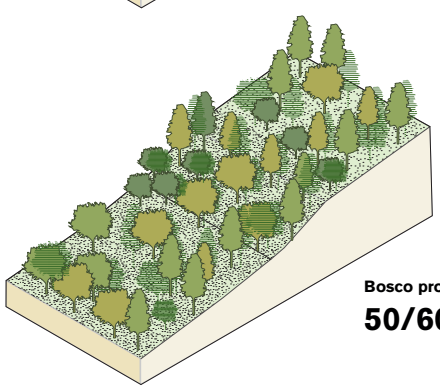
Bosco pronto in montagna

70/80 anni



Selvicoltura a naturalistica

4/5 mc/anno/ha

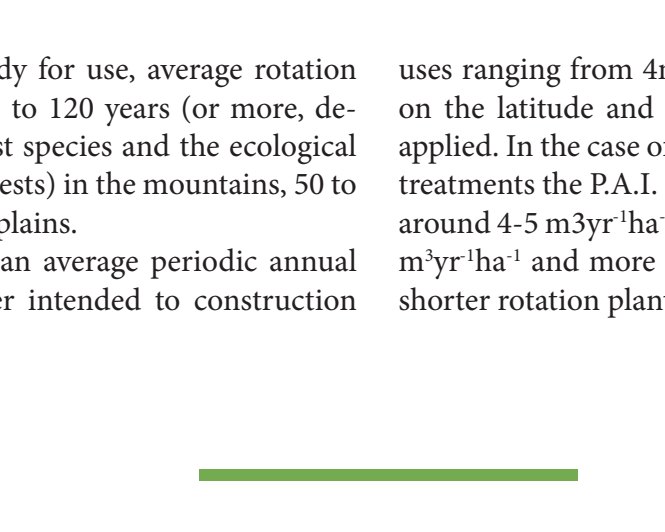


Bosco pronto in collina/pianura

50/60 anni

To have a forest ready for use, average rotation time ranges from 80 to 120 years (or more, depending on the forest species and the ecological parameters of the forests) in the mountains, 50 to 80 years in hills and plains.
An adult forest has an average periodic annual increment for timber intended to construction uses ranging from 4m^3 to 7$m^3yr^{-1}ha^{-1}$ depending on the latitude and type of forest management applied. In the case of close-to-nature silviculture treatments the P.A.I. can be reasonably estimated around 4-5 m3$yr^{-1}ha^{-1}$, while the values rise to 6-7 $m^3yr^{-1}ha^{-1}$ and more in intensively managed and shorter rotation planted forests.

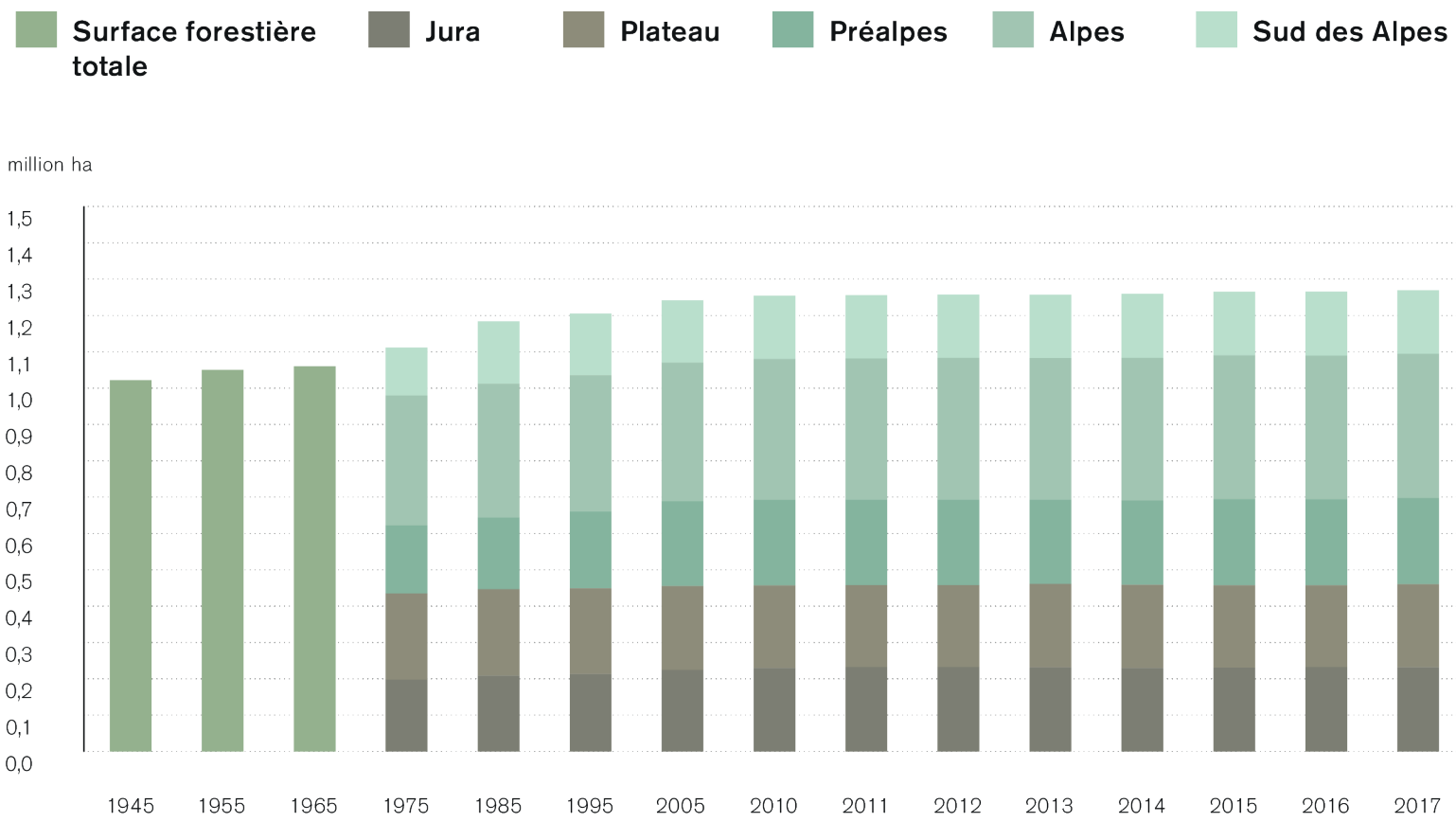
$C0_2$ STORED IN FORESTS



The new Swiss emissions law makes it possible to actively take into consideration the ability of construction wood to store CO2: every cubic meter of wood stores 1t of Co2.

Around 142 million tons of CO2 are stored in Swiss forests. An adult forest store around 5.13 T/ha/year of CO2

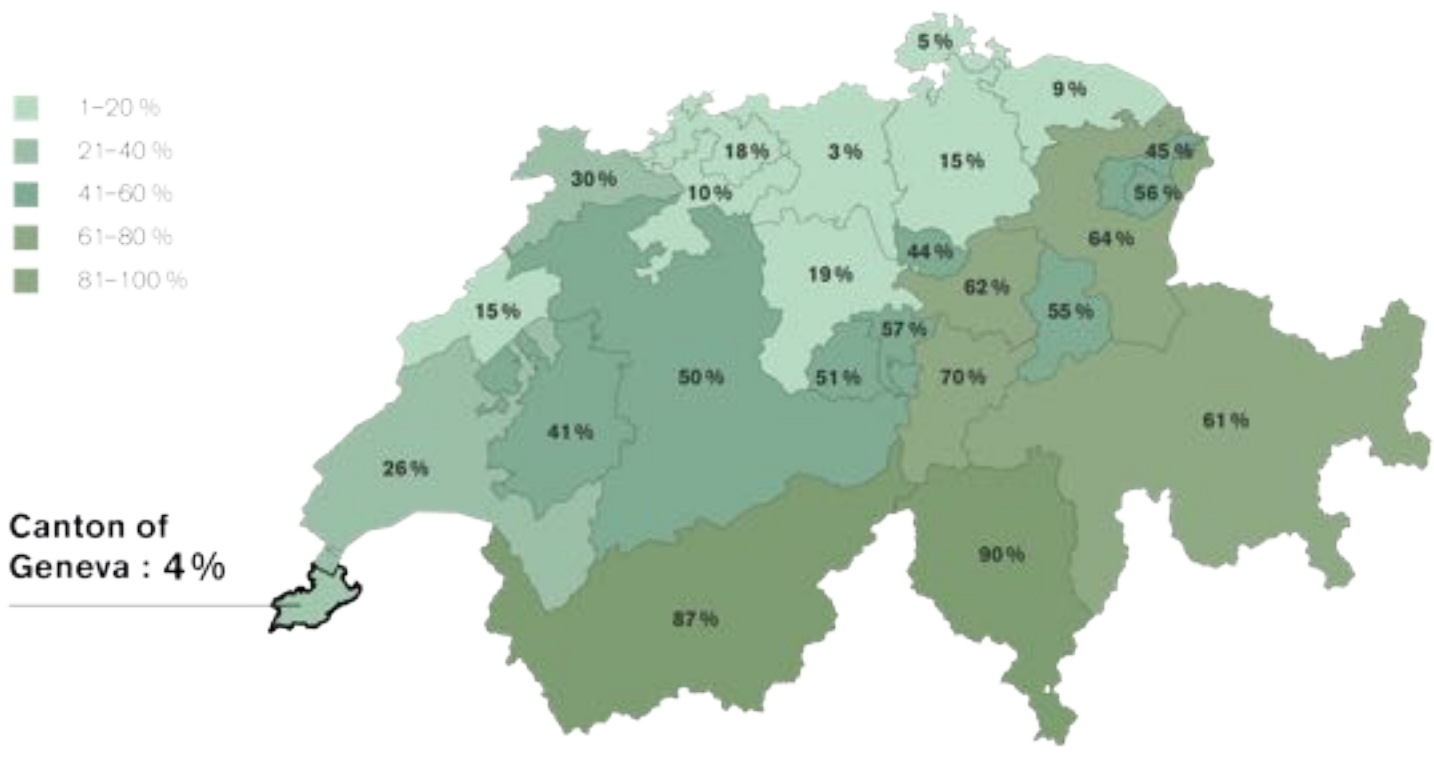
EVOLUTION OF THE FOREST AREA IN SWITZERLAND, 1945-2017



Since 2006, the surface of Swiss forests has grown by 4000 ha/year, equal to + 0.3%/year (n.b: by proportion the forests of Greater Geneva are growing by 270 ha/year.).
The growth is observed on all mountain areas where mountain farmers have given up on managing alpine pastures and areas covered with unproductive vegetation.

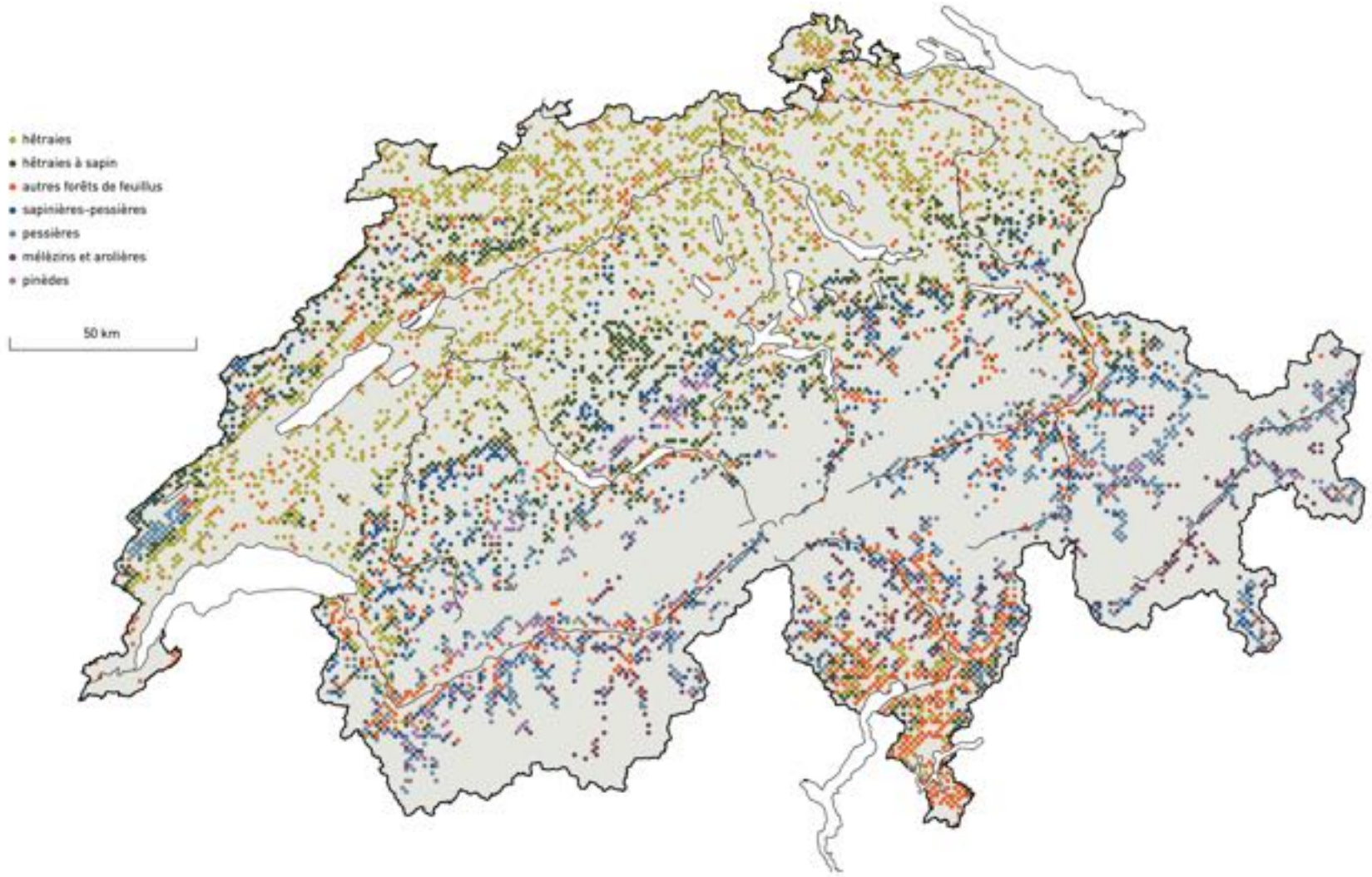
According to forestry statistics, the afforestation rate in 2017 was 49% in the Jura, 23% on the Plateau, 37% in the Pre-Alps, 24% in the Alps and 50% in the south of the Alps.
According to forestry statistics, the wooded area in Switzerland reached 1,270,590 ha in 2017. It has increased by 3,583 ha compared to 2016.
Source: Statistique forestière suisse

PROTECTION FOREST PERCENTAGES



Protection forest: forest that prevents the release of avalanches, stabilizes the slopes, slows down the fall of the stones, regulates the water balance (21% of the protective forests have an avalanche protection function , 8% protect against falling rocks, 27% from landslides and 80% from torrential phenomena).

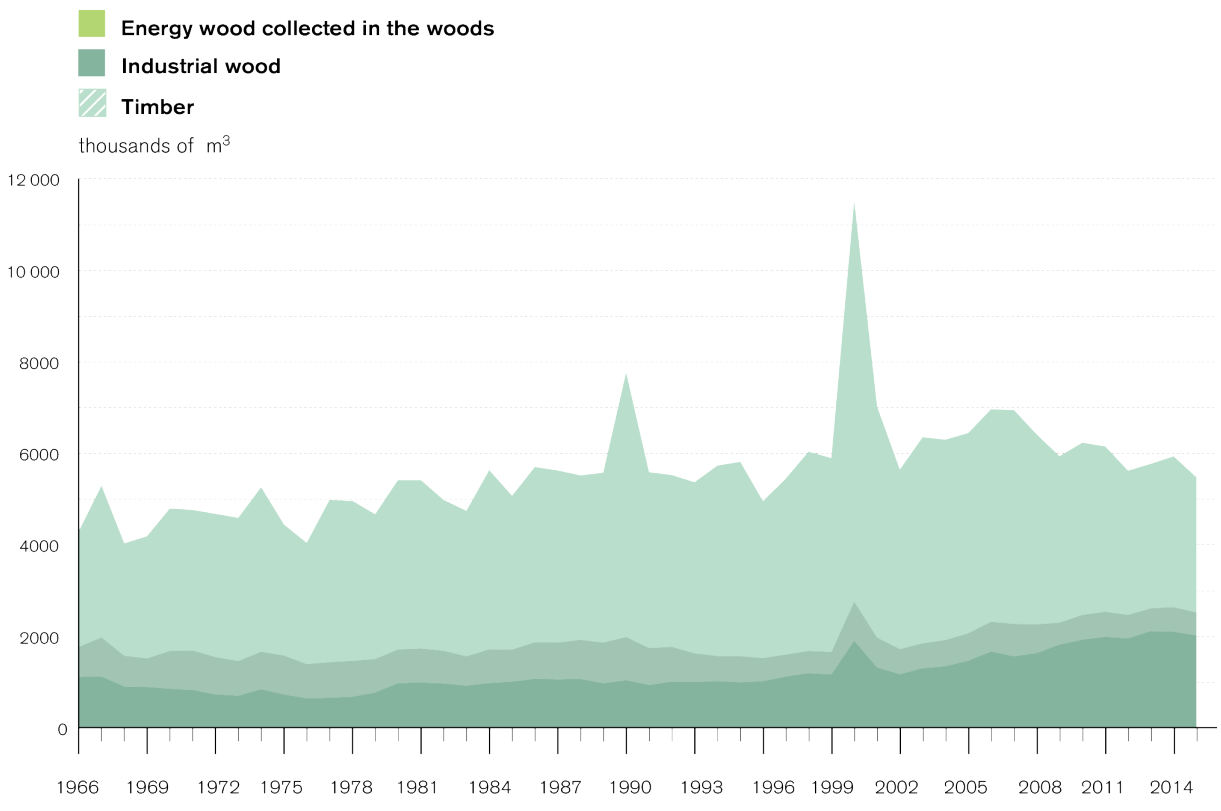
FOREST TYPOLOGIES IN SWITZERLAND



The forest changes depending on the climate, geographic location and soil. The map shows which are the dominant typologies of forest in Switzeland.
The forest is a very complex ecosystem: more than 20,000 species of plants and animals as well as various microorganisms live in Swiss forests.

Source: Inventaire forestier national suisse, Résultat du troisième inventaire 2004–2006

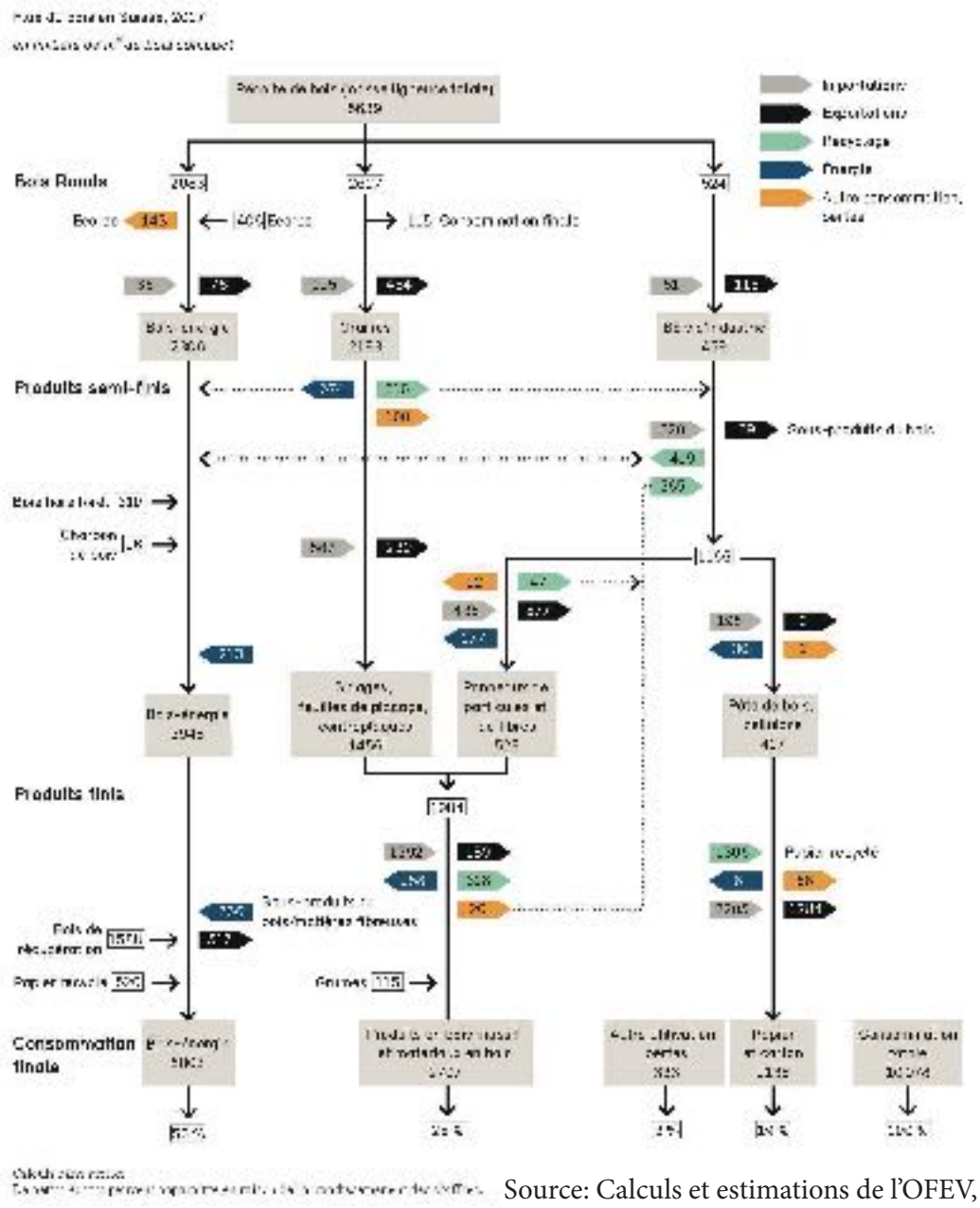
EXPLOITATION OF SWISS WOOD 1966-2015



Exploitation of wood and wood for energy collected in the forest, referred to timber harvesting 1966–2015 in thousands of m3.

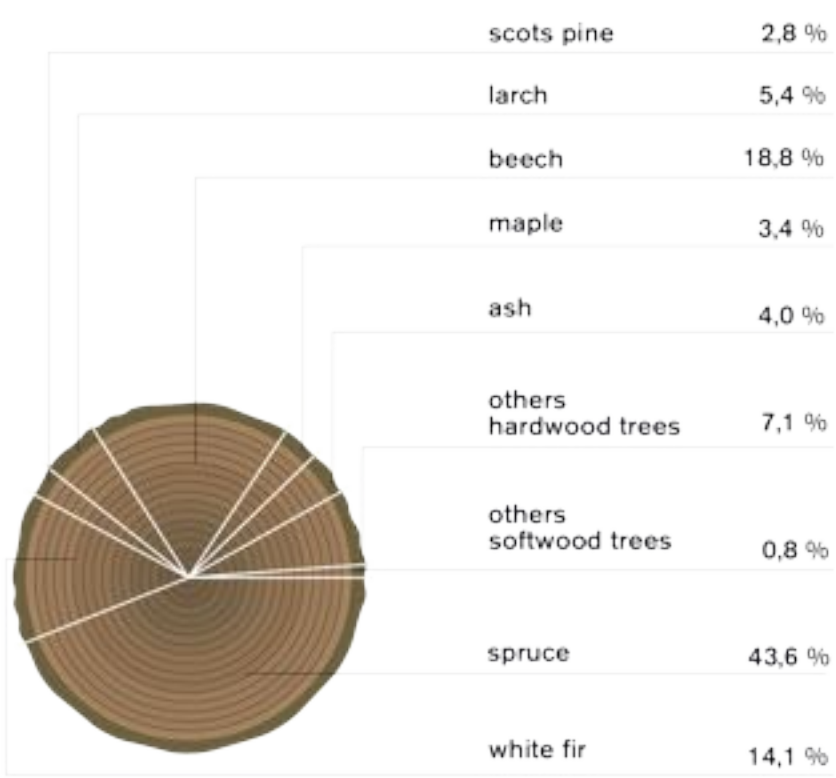
Source: Statistica Forestale UST

SWISS WOOD IN 2017



Source: Calculs et estimations de l'OFEV, division Forêts

MOST COMMON TREE SPECIES IN SWITZERLAND



Climate change, higher temperatures and more frequent rainy periods increase the percentage of larches and oaks on the plateau, as well as that of spruces and firs in the mountains. Climate change is changing the forest in the long term. Spruce, the most used species in the wood industry, will be in short supply on the plateau.

Source: OFEV, indicateurs relatifs aux forets et au bois

WOOD SPECIES IN THE SWISS FOREST

Swiss forests are two-thirds composed about softwood. Hardwoods represent the remaining third, but their proportion is increasing because they grow back naturally and are favored by lobal warming.

Beech

Station: Up to 1300 m above sea level; in eastern Jura and through places in Ticino.
Share: 19.2%
Number: 97,466,000
Features: Hardwood and flexible.
Jobs: Furniture, parquet, stairs, plywood, wood to paper, energy wood.

Ash

Station: From 400 to 800 m above sea level; on the Plateau, west of Jura and the Alps.
Share: 3.6%
Number: 18,238,000
Features: Hardwood and resistant, easy to work and flexible.
Jobs: Floors, walls, roofs, furniture, plastic gym equipment, broom handles, chipboard

Birch

Station: Mainly above 1800 m altitude; in Engadine and in the valleys side of southern Valais
Share: 0.8%
Number: 4,078,000
Characteristics: Very tender, fibrous and light, easy to work.
Jobs: Woodwork, furniture, window frames, veneers, pruning and polishing wood.

Fir (white fir)

Station: From 600 to 1220 m altitude; in the west of the Jura, in the center of the Plateau and in the Pre-Alps.
Share: 11.8%
Number: 60,081,000
Characteristics: Very essence tender and very light, easy to to work.
Jobs: Interior construction and outdoor, furniture, beams carriers, wood for paper.

Sycamore maple

Station: From 300 to 1700 m above sea level; in the Jura, in eastern Plateau and in the Pre-Alps.
Share: 3.4%
Number: 17,112,000
Features: Relatively tender, easy to work and imbue. Uniform clear color.
Jobs: Furniture, utensils kitchen, wood of size and polish wise, construction of models, chipboard.

Stone pine

Station: Mainly above 1800 m altitude; in Engadine and in the valleys side of southern Valais
Share: 0.8%
Number: 4,078,000
Characteristics: Very tender, fibrous and light, easy to work.
Jobs: Woodwork, furniture, window frames, veneers, pruning and polishing wood.

Larch

Station: At all altitudes in Valais, in the alpine valleys of Ticino and Graubunden.
Share: 4.2%
Number: 21,105,000
Characteristics: Softwood the heaviest and hardest of Swiss. Resistant.
Jobs: Construction and exterior and interior cladding, furniture, window frames, veneer, shingles.

Chestnut

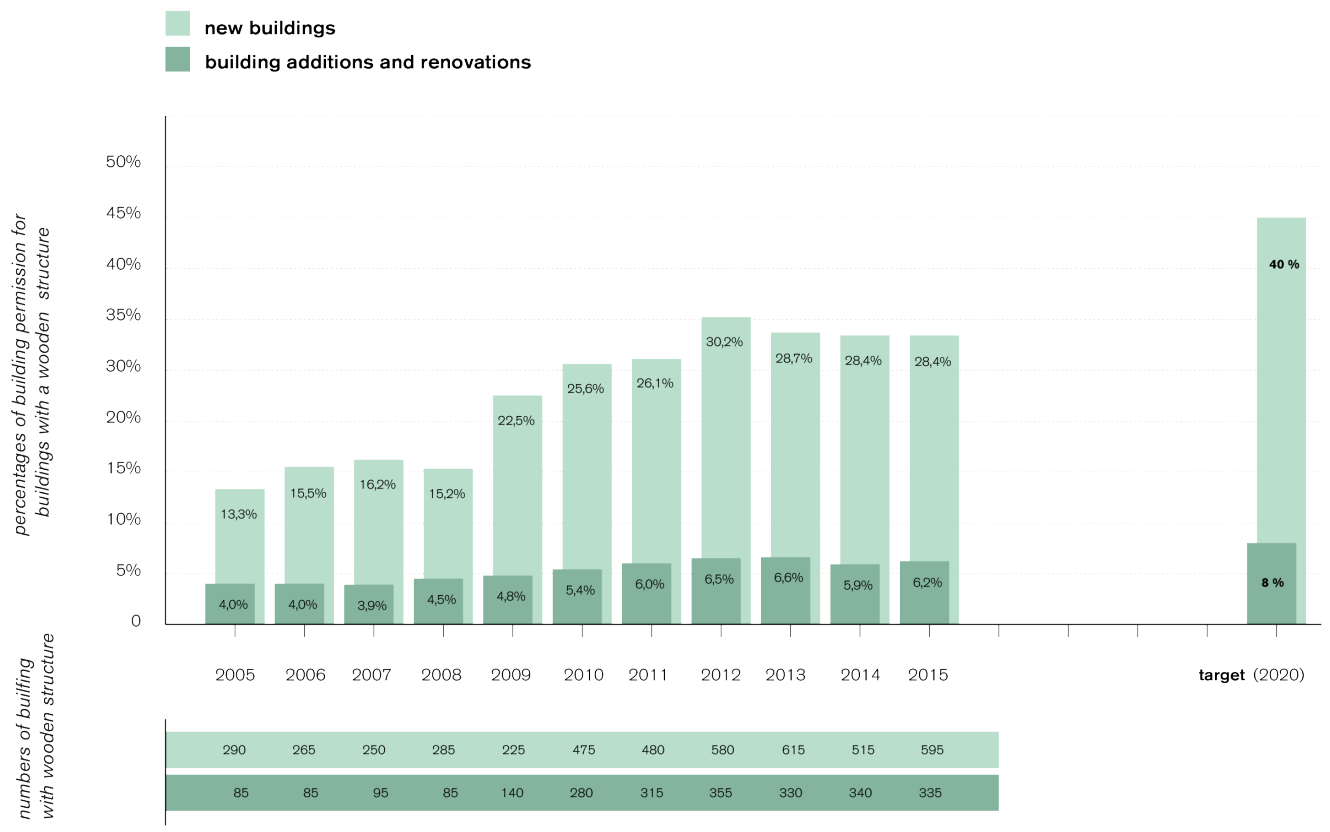
Station: From 300 to 1700 m above sea level; in the Jura, in eastern Plateau and in the Pre-Alps.
Share: 3.4%
Number: 17,112,000
Features: Relatively tender, easy to work and imbue. Uniform clear color.
Jobs: Furniture, utensils kitchen, wood of size and polish wise, construction of models, chipboard.

Pedunculate oak

Station: Below 800 m altitude; on the Plateau and in west of Ticino
Share: 0.7%
Number: 3,594,000
Features: Hardwood and resistant, easy to work.
Jobs: Timber for indoor and outdoor, furniture, veneers, parquet floors, support uprights.

Source: Inventaire forestier national

WOODEN BUILDINGS IN SWITZERLAND



Source: Neubauer-Letsch etat.2015

SALÈVE FAUNA SIGHTINGS

wolf
Canis lupus

dog
Canis lupus familiaris

marten
Martes martes

fox
Vulpes vulpes

cat
Felis catus

roe
Capreolus capreolus

badger
Meles meles

man
Homo sapiens

boar
Sus scrofa

weasel
Mustela nivalis

hare
Martes Pinel

deer
Cervus elaphus

peregrine falcon
Falco peregrinus

bat
Chiroptera Blumenbach

Source:
Suivi du Lynx et de la Faune du Salève
CAMPAGNE DE PIEGEAGE
PHOTOGRAPHIQUE AU SALEVE

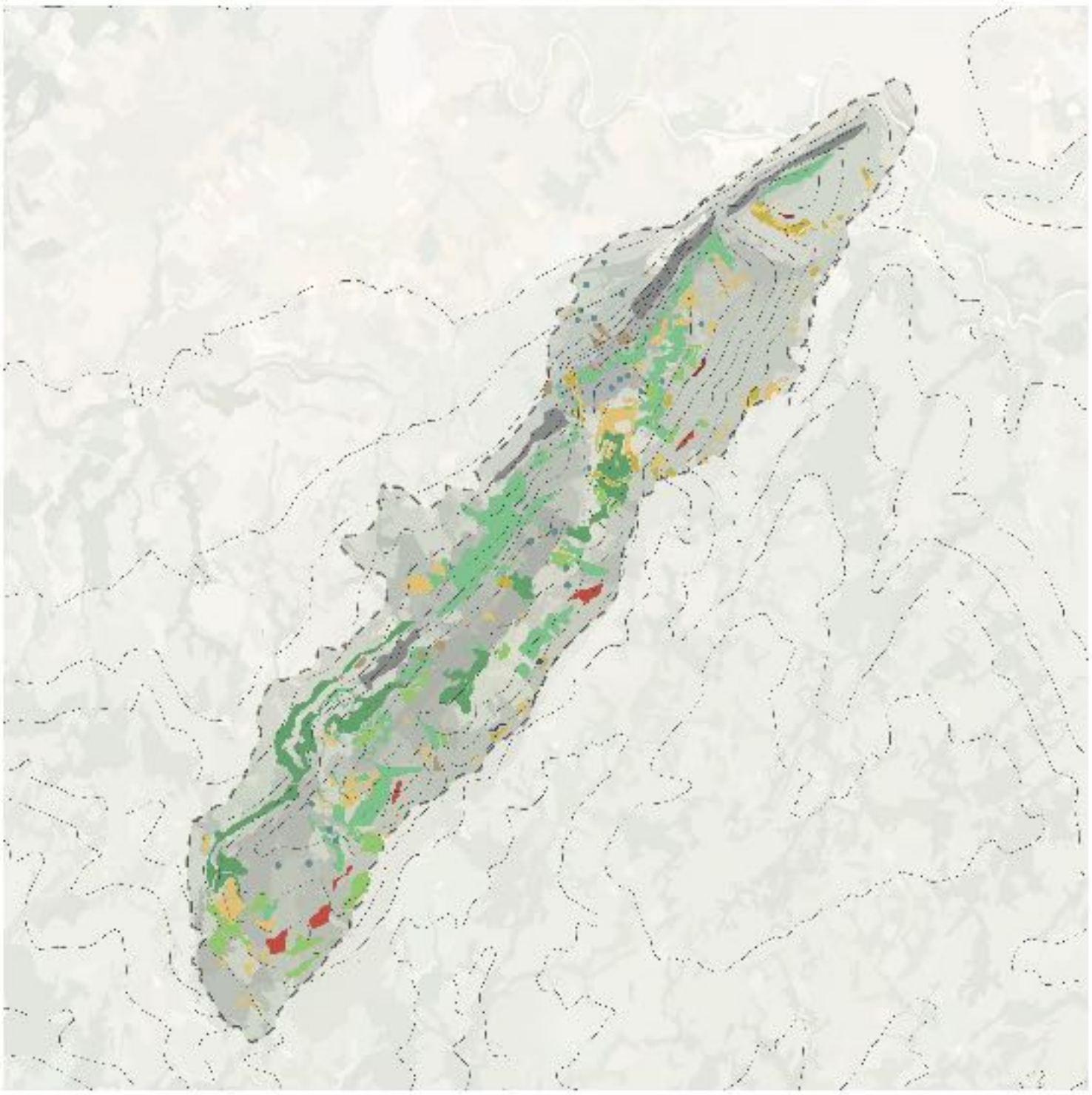









FLORA OF THE SALÈVE



- acid-loving beech forest
- fresh beech forest
- dry beech forest
- heath of juniper
- pond
- limestone cliff
- dry meadow
- semi dry meadow
- meadow on rocky debris
- chesnut forest
- swiss pine alone
- swiss pine forest

Source:
Document d'Objectifs du site Natura 2000 « Salève »










Source:
Document d'Objectifs du site Natura 2000 « Salève »

Landscape

Michel Desvigne Paysagiste

Tucked in between the lake and the mountains, this large territory encompasses forest and agricultural land of a great landscape interest. Mainly concentrated on the banks of Lac Leman, the Genevan metropolis spreads itself to the West on the slightly hilly Swiss plateau.

Geology and topography are responsible for the outstanding landscapes: the crests of the Jura and Alps crests set remarkable landscapes. From the foothills to the lake, natural and built zones arrange a fragile balance, though it is nowadays threatened by a strong urban pressure.

Landscape units are closely fitting together. They spread themselves concentrically around the lake.
1. Lac Leman. Originally dug by the Rhône glacier, it offers a large view opening onto the mountain chains.
2.Geneva's urban area. Set on the lake banks, it is widening with low-density individual housing and industrial zones. Borders with the contiguous agricultural lands may be either porous or abrupt.
Between city and mountains are two different agricultural rings. They lie on a soft topography created by the encounter between streams and the mountainous terrain. They offer diverse landscapes: vineyards, meadows, cereal fields. Agricultural practices and associated vegetal structures adjust to land constraints.
3.Thus, on the fringes of Geneva, a first agricultural ring is set on the slight slopes of the hilly plateau. Its qualities and vocations are submitted to the urban sprawl pressure. Grain farming tends to homogenize landscapes: consolidated parcels and large open fields take over a residual bocage structure. It alternates with vineyards set on the south-facing edge of soft hills. Deciduous woodlots punctuate the plains.
4.By contrast, the second agricultural ring, set on the Jura and Alps foothills, has a relatively preserved forest structure: the preserved bocage unties thin strips of shrubby hedges and broader tree hedges. The dense vegetation emphasizes the topography and frames fragmented plots of meadows, farmlands and orchards. Though it sometimes conceals views, it creates ecological continuity and essential biodiversity reserves. Limited urbanization consists in small concentrated centers, regularly distributed on the limit between the agricultural plateau and the Jura and Alps foothills.
5.On the foothills, forestry replaces agriculture. Mono-specific conifer plantations close the landscape. Vegetation adapts to more arid environments and to the constraints relative to slopes and altitude.

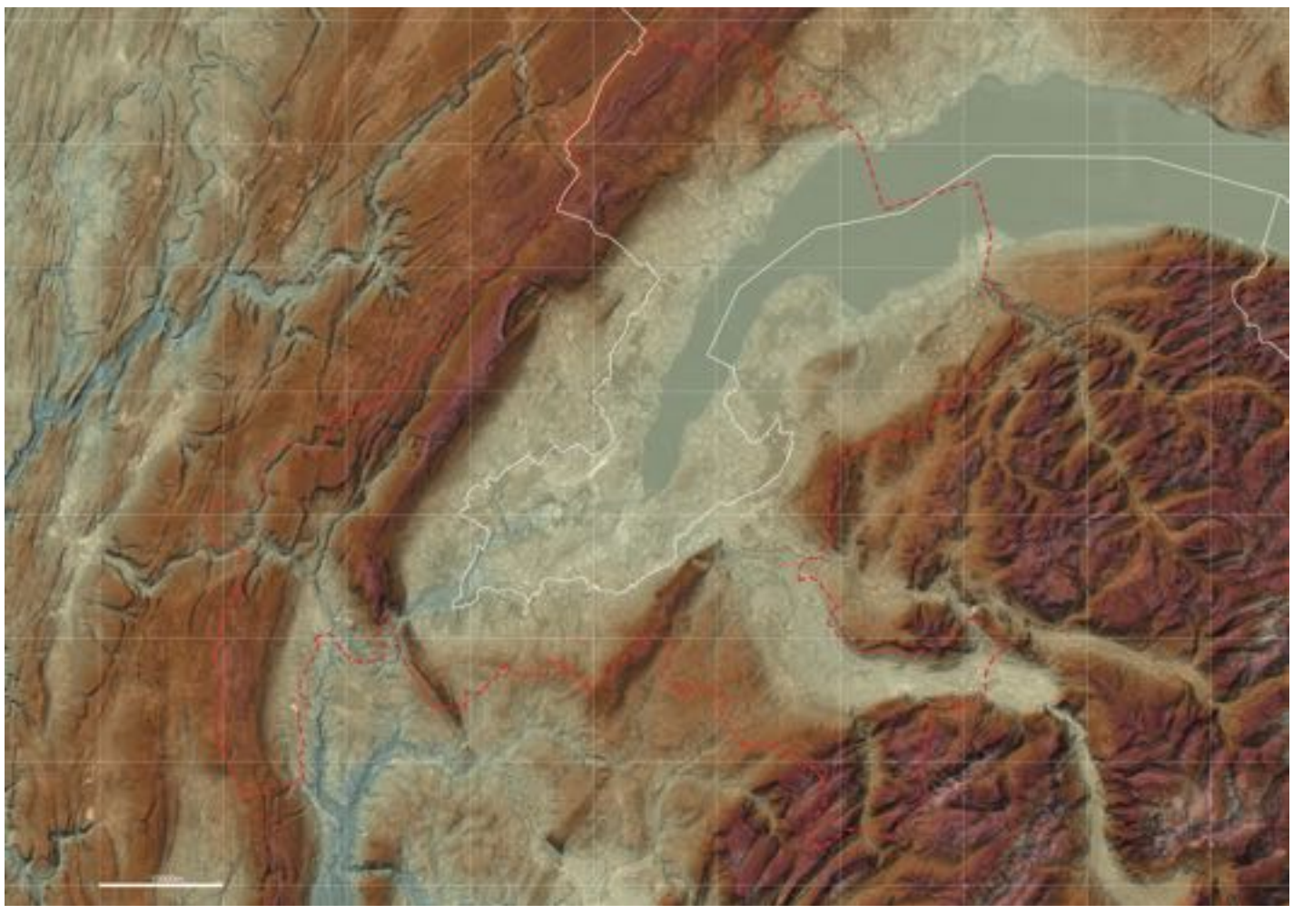
These 5 large units are crossed by major natural events, rivers and streams, and by a dense network of road and rail infrastructures, on geographical scales.
The streams, rivers and torrents come from the mountains surrounding the lake. They draw a series of transverse sections punctuating the agricultural plateau. In the plain, the Rhône and the Arve have their beds widened with multiple meanders. The hydrographic network structures the metropolitan area. River banks are generally diked and built. Nevertheless, some keep their naturalistic (alluvial vegetation) character and create significant vegetation corridors into the city.
The network of road and rail infrastructures follows a similar scheme: it is both concentric and converging towards the center of Geneva. Contrary to the natural structure, its surroundings are generally sparsely wooded and not very well integrated into the landscape.

Key landscaped areas to develop
1.Rivers. When not artificialized, they are bordered by large strips of vegetation. They constitute landscape links to be amplified: between the different metropolitan area entities and between the latter and its territory.
2.Road structures, potential support for vegetation.
3.The "edges", interfaces between urban and agricultural spaces.
4.Intermediate voids in the city.

GREATER GENEVA

A large territory spreading from the Leman lake to Jura and Alps mountains
At its core, the urban spot extends around the lake. At the frontier between urbanized banks and foothills, a large agricultural ring structured by wooded continuums sets on the plateau.

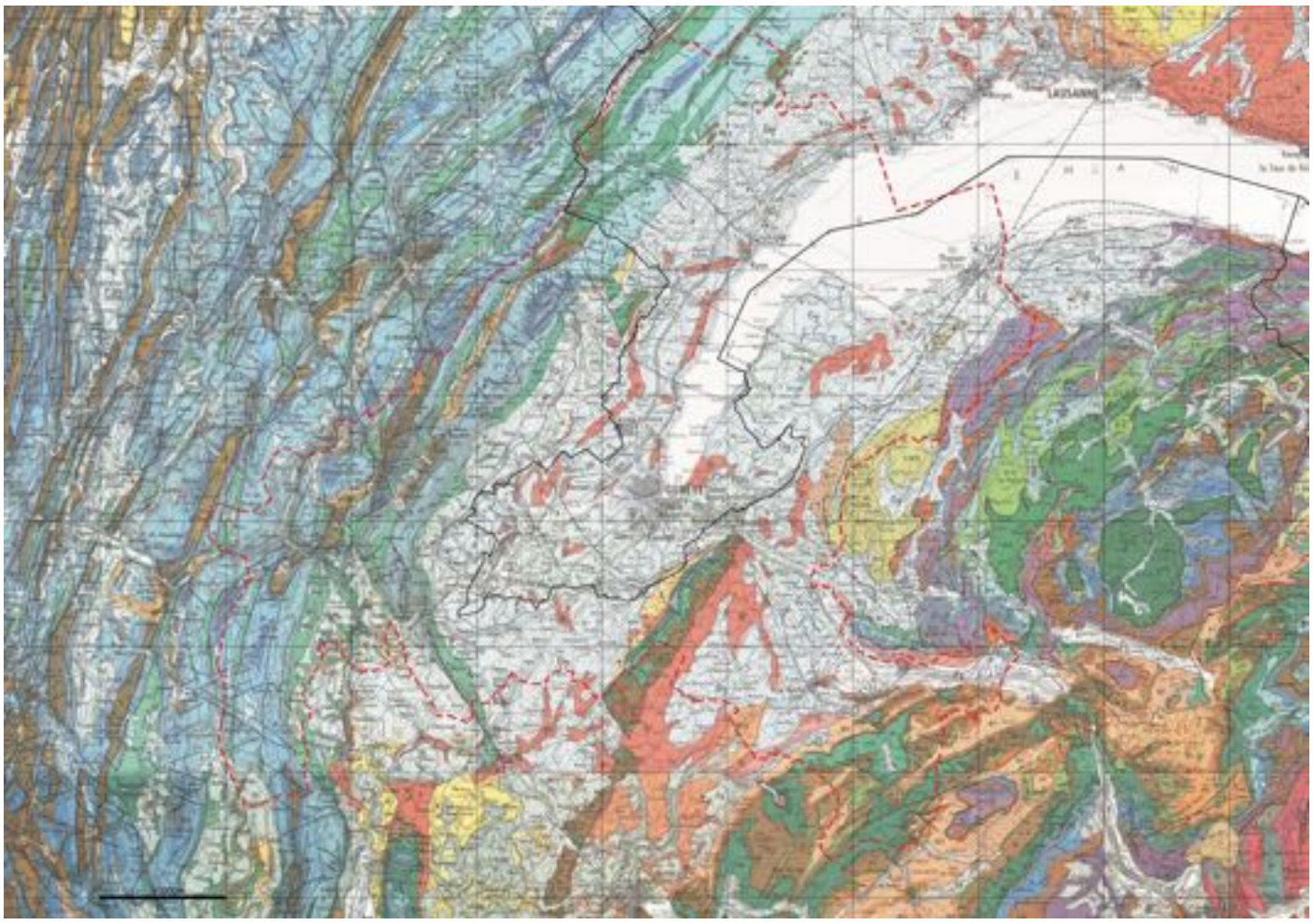
TOPOGRAPHY



A contrasting topography between the undulating plateau and the rugged mountainous terrain. This topography is inherited from major geological phenomenons :

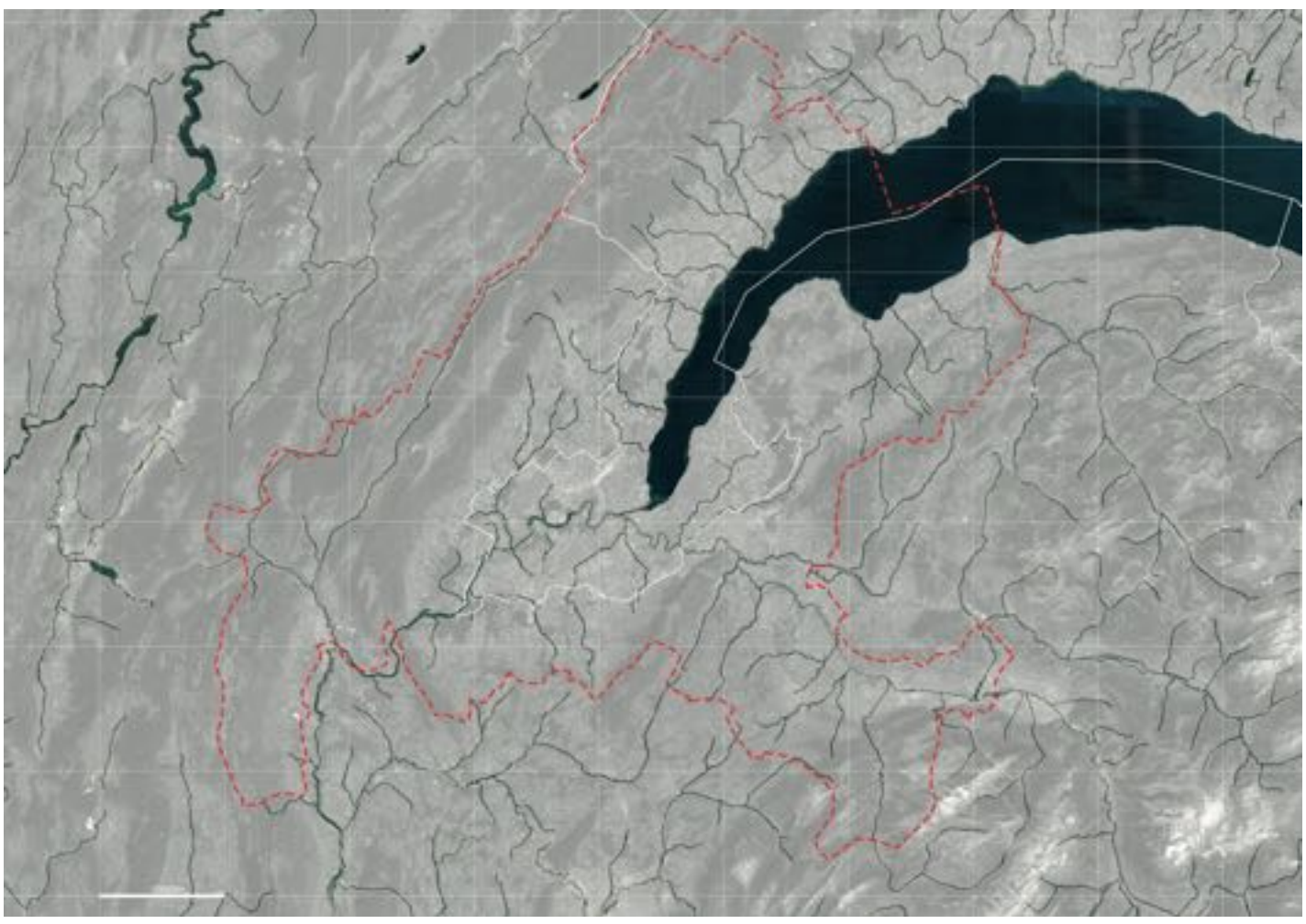
- High and rough landforms created by the Alpine orogeny: compression and folding of the old Jurassic sedimentary plateaus by the Alpine massif.
- An intermediate molassic plateau, resulting from the Alps erosion and from alluvial deposits between the two massifs.

GEOLOGY



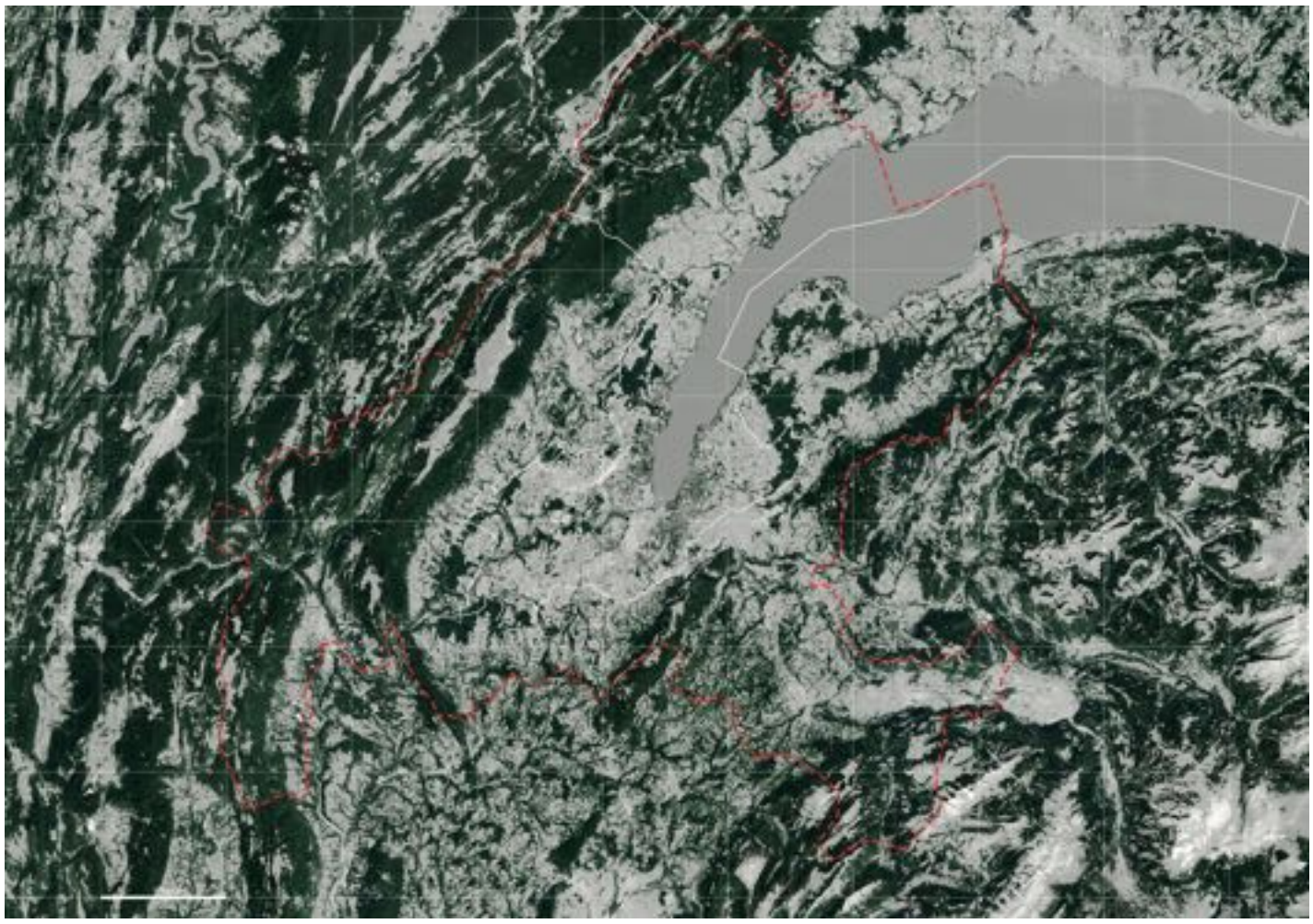
A complex geology responsible for soils, landforms and lanscape diversity

HYDROGRAPHY



The Swiss plateau is structured by a dense hydrographic network
The Rhône and the Arve constitute its landmark. Multiple streams converge from the mountains on the Leman lake. They create transverse sections structuring agricultural and urban spaces.

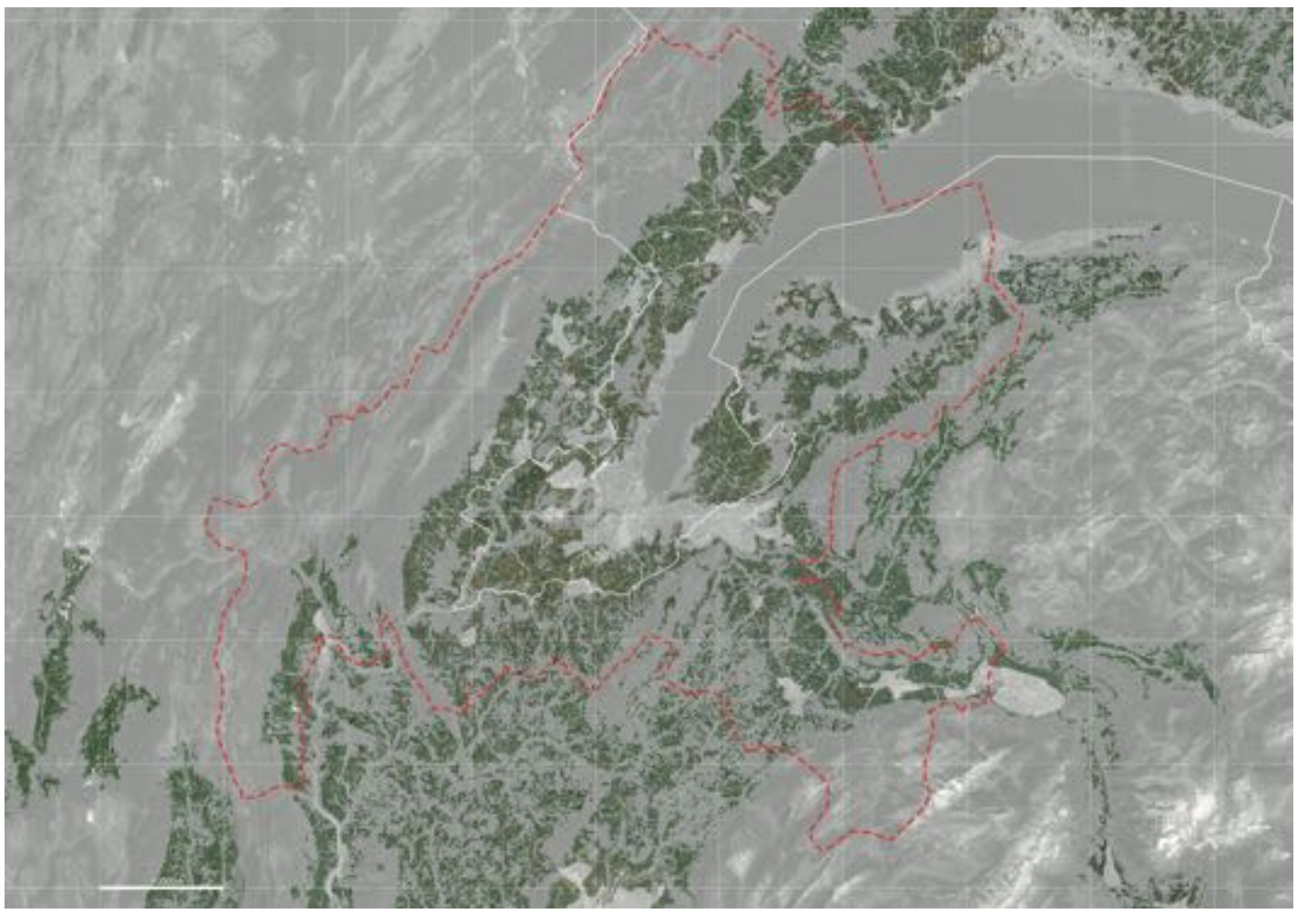
VEGETAL STRUCTURES



Very planted spaces
There are 5 main patterns :

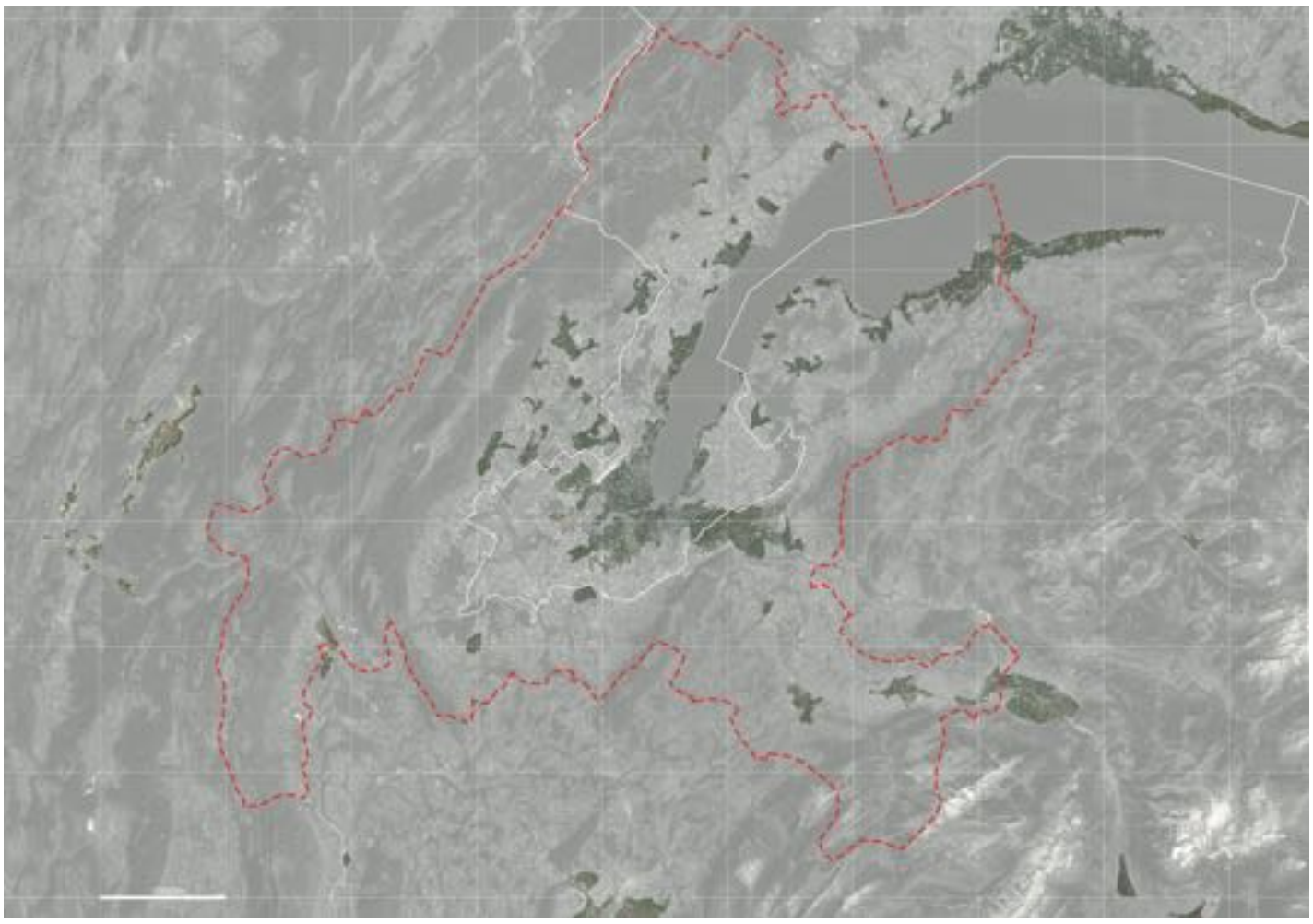
- Crests and foothills forests
- Tree hedges organizing part of the agricultural plateau
- Isolated woodlots in the plain
- Riparian vegetation in linear strips along the hydrographic network.

AGRICULTURAL LANDS



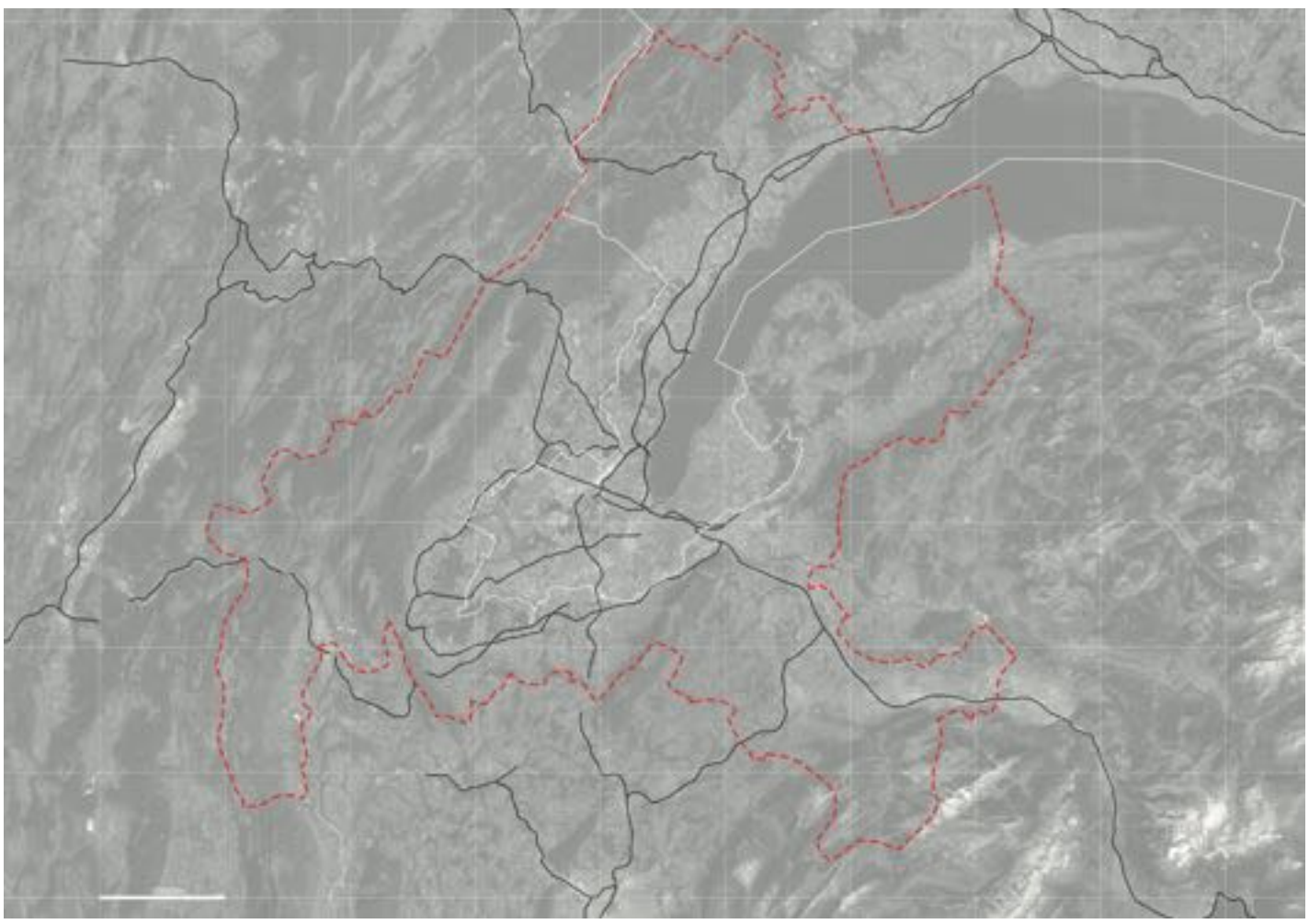
A contrasting agricultural plateau with both bocage and openfields

URBANIZATION

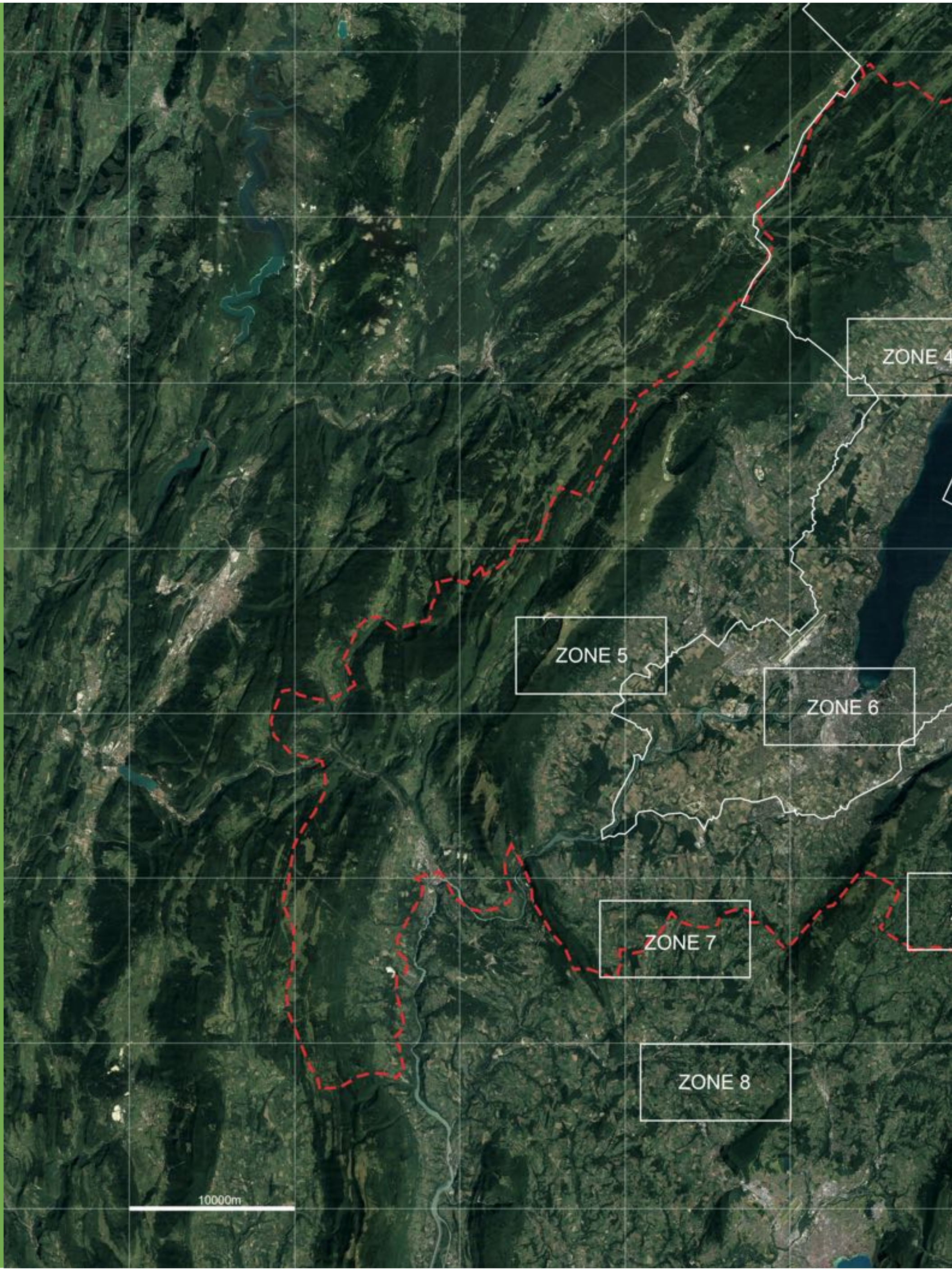


The urban system is dominated by Geneva metropolitan area
The agglomeration is concentrated on the lake edges. It sprawls homogenously and takes over agricultural lands to the South and to the East. Urban satellites, denser, punctuate the agricultural plateau.

INFRASTRUCTURES



A concentric network converging on Geneva
It highlights the topography. Just as the hydrographic network, it is made of transverse sections structuring the territory.


ZONE 4
ZONE 5
ZONE 6
ZONE 7
ZONE 8
10000m

VEGETAL STRUCTURE UNITS:

- Bocage (see zones 1 and 2 for example)

- Riparian vegetation (see zones 3, 4 and 5 for example)

- Crest forests (see zone 6 for example)

- Bocage and forests on hillsides (see zone 7 for example)

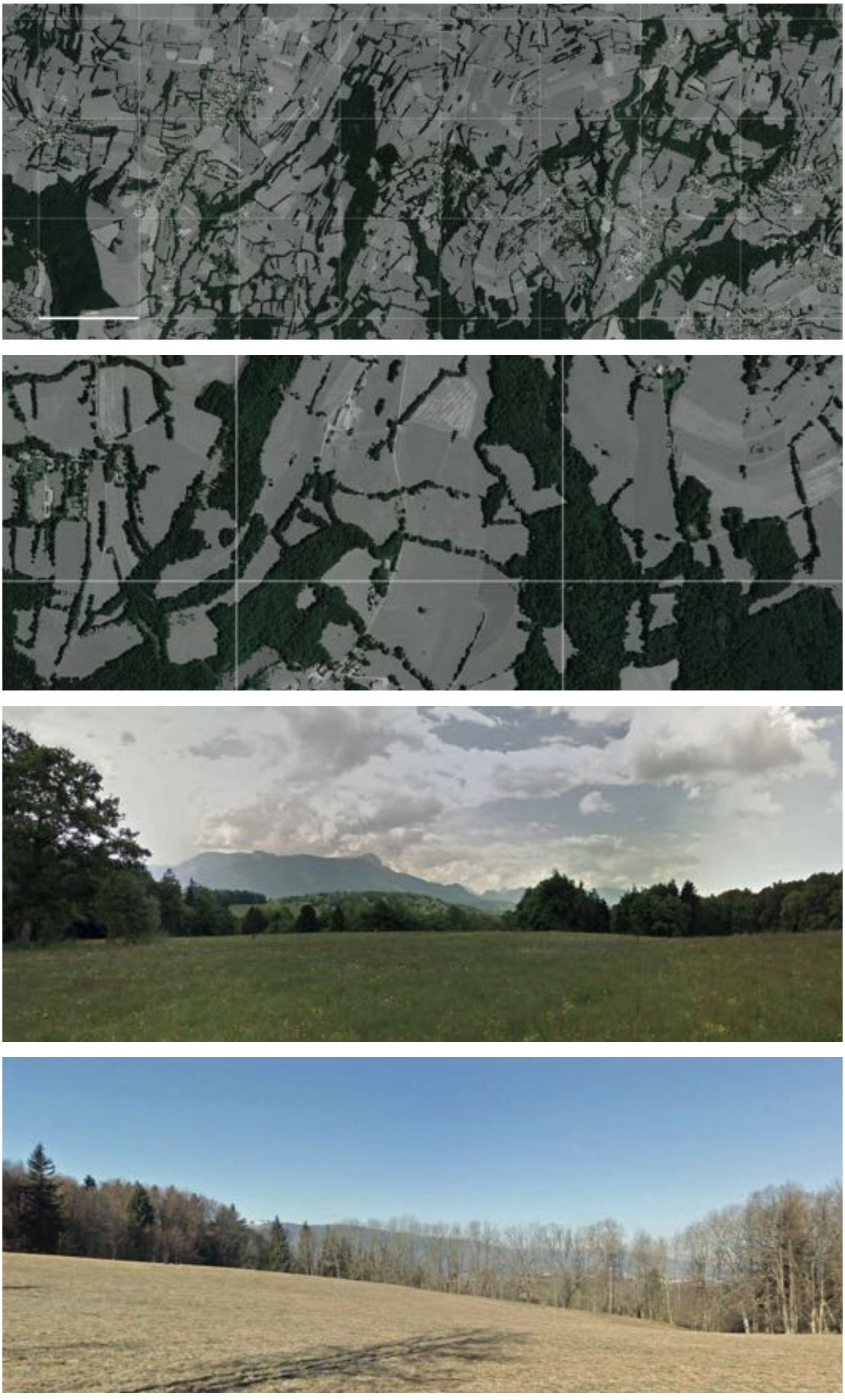
- Plain woods (see zone 8 for example)

BOCAGE: wood lace

Zone 1

Agricultural land is structured by major planted continuums thanks to hedgerows and wooded strips which underline land divisions. This order is only shaken up by the riparian vegetation framing the streams.

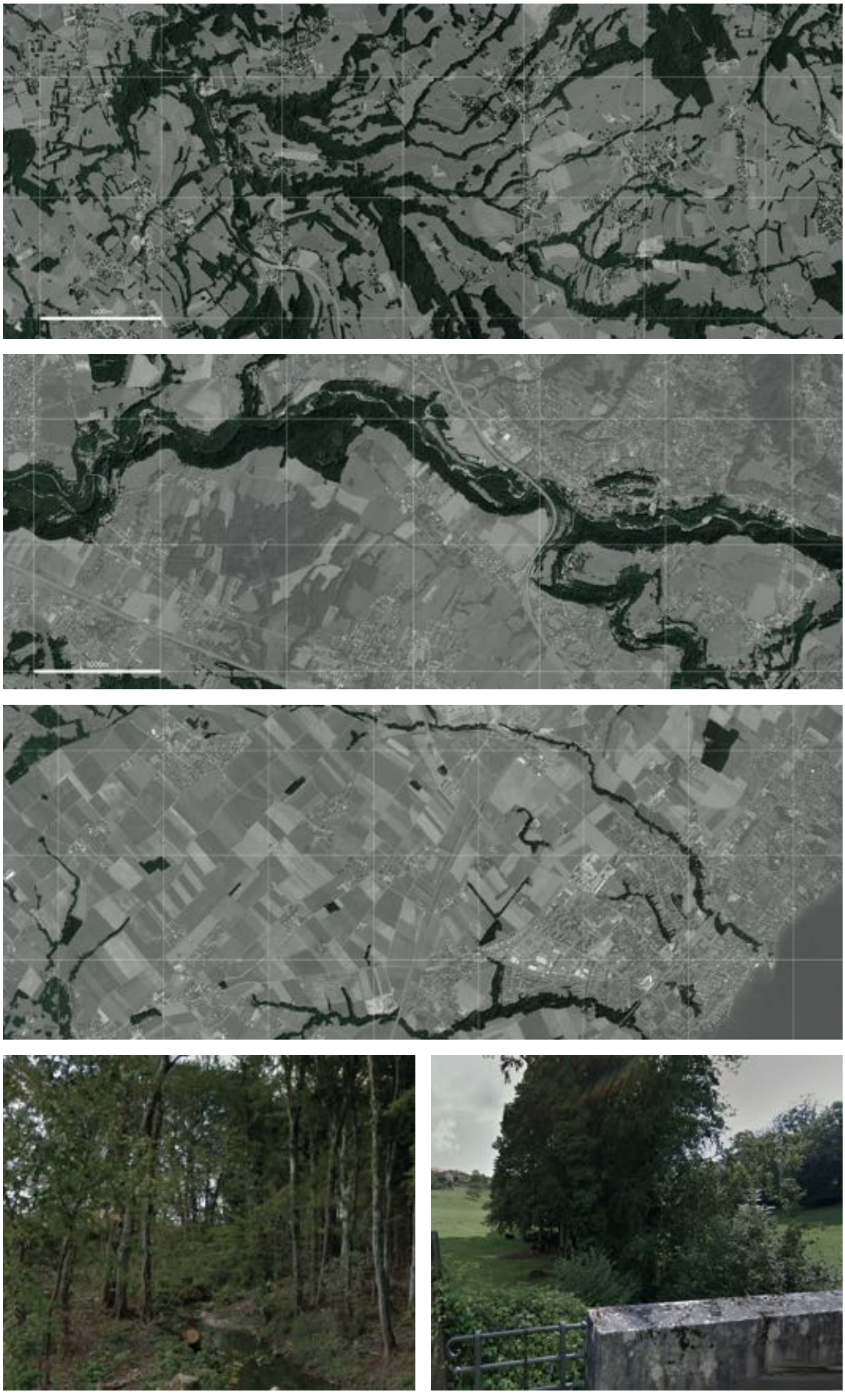
BOCAGE: groves network



Zone 2

This thin lace made of hedgerows and wooded strips also link woodlots, thereby creating a groves network.

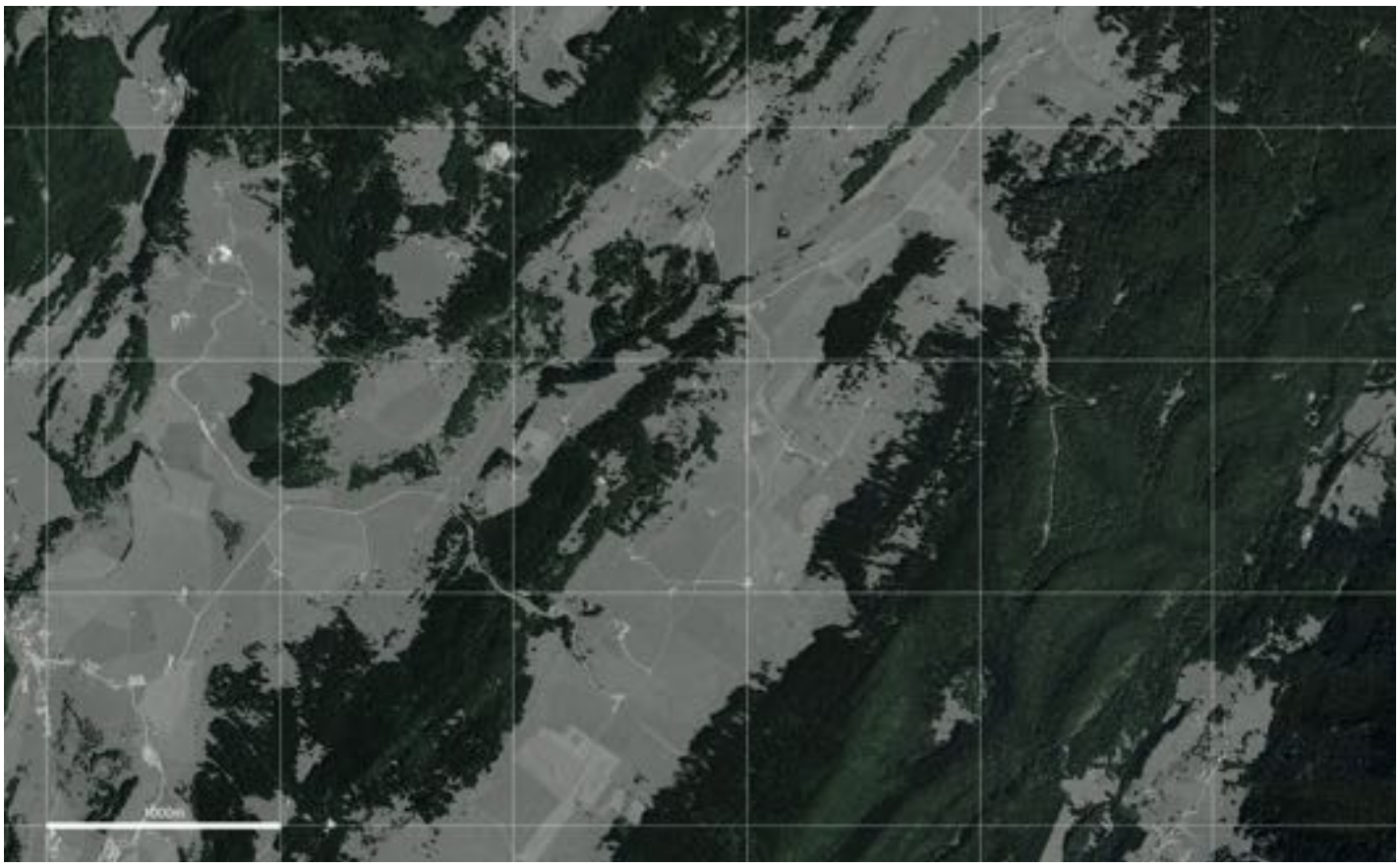
RIPARIAN VEGETATION



Zones 3,4 and 5

The hydrographic network is decisive for the vegetation distribution at the territorial scale. Bordered with riparian vegetation, streams display a large ecological corridors network.

CREST FORESTS



Zone 6

A uniform landscape made of coniferous forests.

PLAIN WOODS

Zone 8

Woods are restructured by grain farming
Because of land consolidation, bocage is nothing but residual. Vegetation remains through woodplots, most of the time used for forestry and whose geographic limits correspond to land division.

BOCAGE AND FOREST ON HILLSIDES

Zone 7

On the hillsides can be found a partly abandoned bocage being progressively replaced by woodland. This progressive abandonment of farmland on those less accessible lands is thus responsible for views to slowly shutting themselves. At the same time, it creates a very soft transition between the crests forest and the agricultural foothills whose shapes could be an example of how to. This wide limit where different environments meet is also hosting a large biodiversity.

PLANTS SELECTION

TREES

Acer campestris
érable champêtre

Acer platanoides
érable plane

Acer pseudoplatanus
érable sycomore

Carpinus betulus
charme commun

Castanea
chataigner

Eurnymus europaeus
fusain d'europe

Populus tremula
peuplier tremble

Prunus avium plena
merisier

Prunus Domestica
prunier commun

Pyrus sylvestris
poirier sauvage

Quercus robur
chêne pédonculé

Quercus petraea
chêne sessile

Tilia cordata
tilleul à petites feuilles

Ulmus glabra
orme des montagnes

Fagus sylvatica
hêtre

Malus sylvestris
pommier sauvage

Populus alba
peuplier blanc

Populus nigra
peuplier noir

Taxus baccata
if

Juniperus communis
genevrier

Buxus sempervirens
buis

Ribes uvacrispa
groseiller à maquereau

Abies alba
sapin

Pinus sylvestris
pin sylvestre

BUSHES

Corylus Avellana
noisetier

Frangula alnus
bourdaine

Hippocrepis emerus
coronille

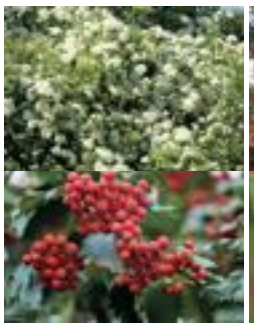
Ilex Aquifolium
houx

Ligustrum vulgare
troène vulgaire

Rhamnus cathartica
neprun purgatif

sambucus Racemosa
sureau rouge / sureau à grappe

Viburnum Opulus
viorne obier



Cratageus sp.
aubépine

Berberis vulgaris
épine vinette

Rosa arvensis
rose des champs

Rosa Canina
eglantier

Territory and population

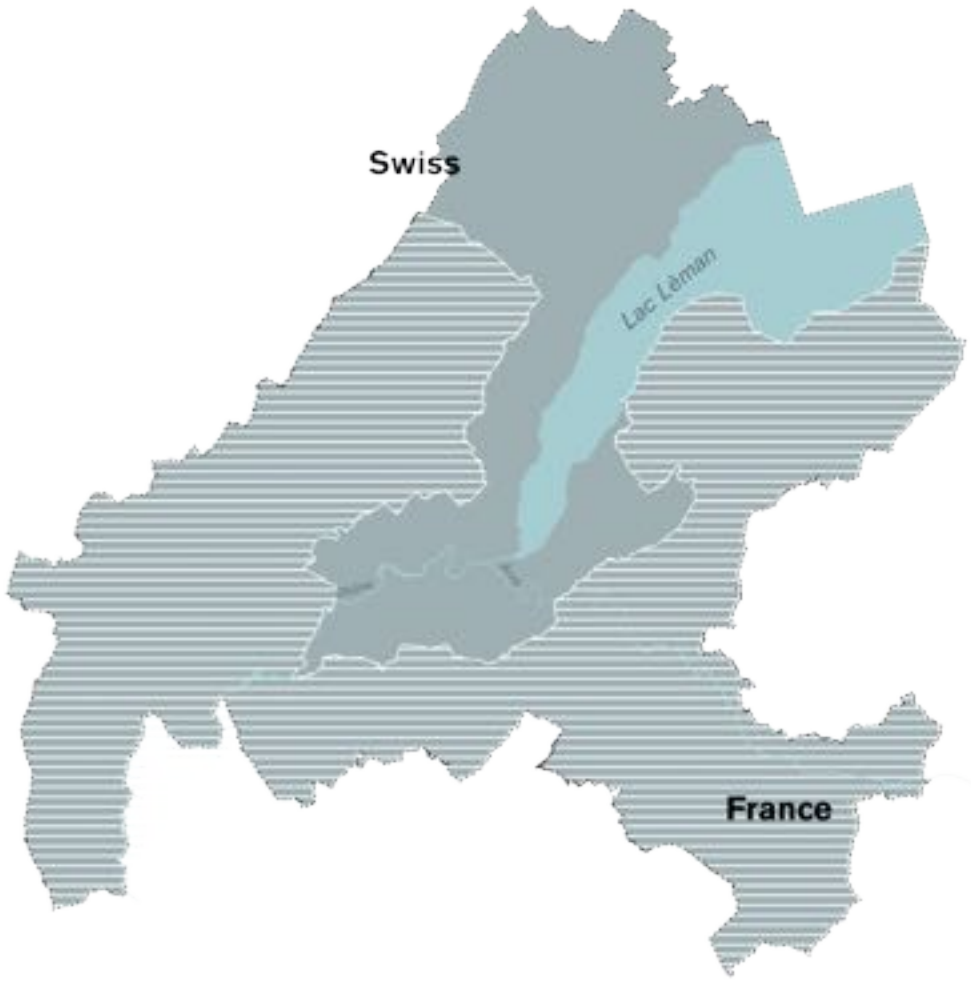
The population of Greater Geneva is now estimated at around one million inhabitants, with a general growth rate that fluctuates from 2000 to around 1.5% per year. The number of jobs follow an even faster evolution curve, starting from an already very favorable situation with 500,000 jobs. The prevision is of +357,000 inhabitants in 2040: +208,000 in the central agglomeration (+43,000 in the Municipality of Geneva), +79,000 in the municipalities scattered throughout the region, +70,000 in villages and small towns.

Centreville is the core of Geneva, its cultural and historical center.
The Centreville is located at the southwestern end of Lake Geneva at its junction with the Rhone River. The city lies at an elevation of 375 m in the center of a natural basin encircled by mountains. The Centreville border, most of the time, is defined by its infrastructure, where the "perception" of the border is given by a road more than a proper border.
The distinction between the consolidated city and the rest of the metropolitan region is established by the specificity of the different poles, which have distinct identities.

Crossing ground brings into question the administrative borders and the limits of the metropolis of Geneva. It is composed by systems of relations at various scales, connecting the different episodes of metropolitan Geneva, the population spends a great amount of time driving from one side to the other of the border. The number of people in neighboring countries but commuting to jobs in Switzerland has been increasing steadily in recent years, the number of people with a G - permit in April 2019 is 112,814. There are currently more than 630,000 incoming and outgoing commuters in the Canton of Geneva on a weekday.
Greater Geneva is the result of the process of suburbanization. This process is characterized by the territorial expansion of agglomerates and by functional and social differentiation. 112,814 people living in neighboring countries but commuting to jobs in Geneva. Mobility related to cross border is problematic. The road infrastructure is overstrained. The cross-border rail infrastructure is currently inadequate. No cross-border commuter rail (S-Bahn) network comparably to other metropolitan regions exists in this region.
The environmental pressure of mobility is multifaced with the intense activity of the airport, cross-border commuting and commuting in general as half of the Home-Work trips are internal of the Genevois français. This whole transport system is in fact responsible of 38 % of the carbon footprint of the region; in comparison the Grand Paris the emission of road transport represent 25% of the greenhouse gas.

Suburbia is the sum of the villages around Genève city center. It comprises traditional sub-urban areas and villages immersed in the metropolitan region. While both territories fundamentally operate in the same way, villages tend to keep an appearance of traditional life, desperately defending their rural atmosphere (so crucial for their real estate value). Suburbia and villages are entirely dependent on car circulation. The agglomerations are groups of municipalities of at least 20,000 inhabitants.
Currently the agricultural spaces in the Great Geneva area represents the 33% of Grand Genève area (660 sqkm), while 41% are Forests, 13% Built Spaces, 13% Hydrography. In the agricultural sector in the Great Geneva, there are 1300 agricultural enterprises, with over 6000 employees.

TERRITORY



220.000 Ha
Grand Genève territory with Lac Léman

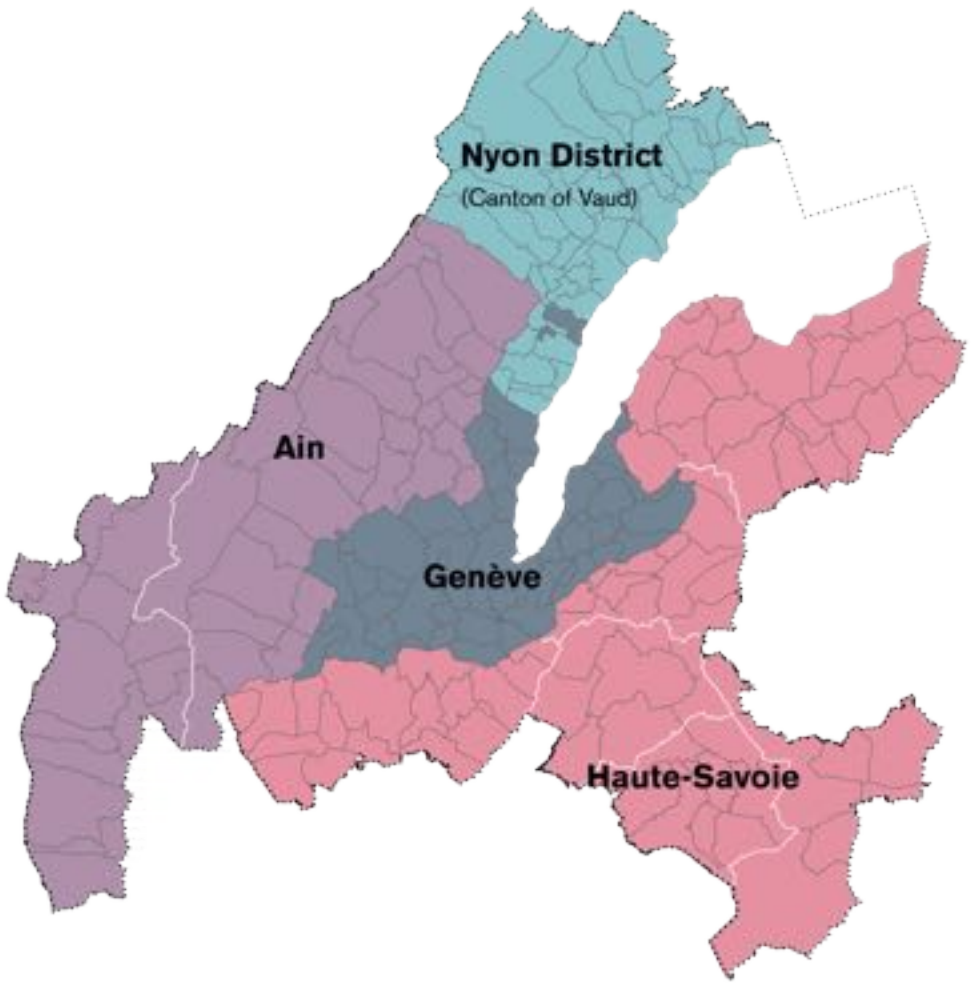
143.000 Ha

France
77.000 Ha
Swiss (with Lac Leman)

1.000.000
inhabitants of the Grand Genève

The Grand Genève territory extends over 220.000 hectares and represents a transnational territory between Switzerland and France. Grand Genève has a population comparable to that of an average European Metropolitan area and is territorially unbalanced towards France, with an extension twice Switzerland.

ADMINISTRATIVE DIVISION



212
numbers of municipalities in Grand Genève

42
municipalities in Ain

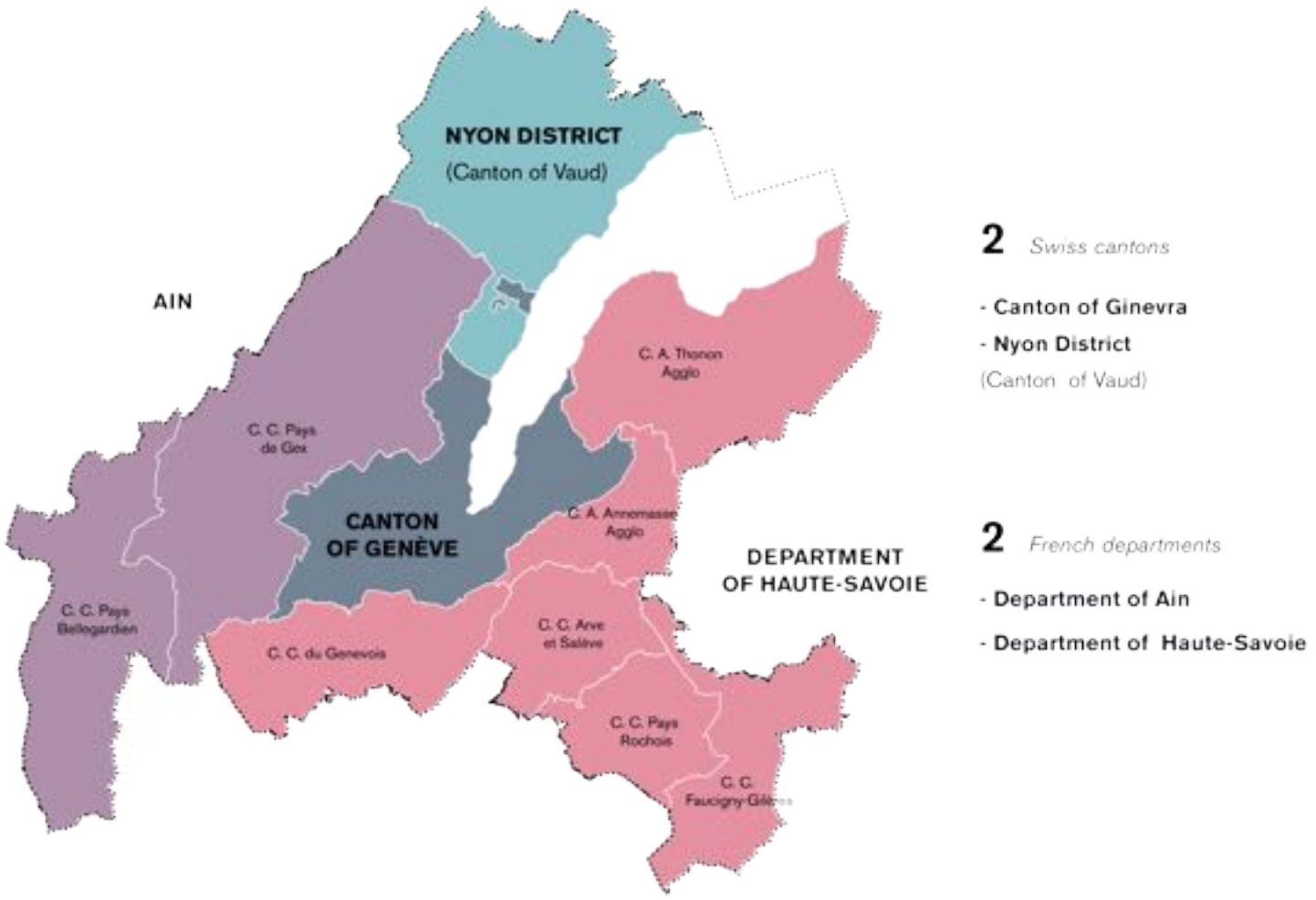
45
municipalities in Genève

78
municipalities in Haute-Savoie

78
municipalities in Nyon District

The Grand Genève region is divided into four sub-regions, 2 for each state, within which are located 212 Municipalities.

MUNICIPALITIES



2 *Swiss cantons*

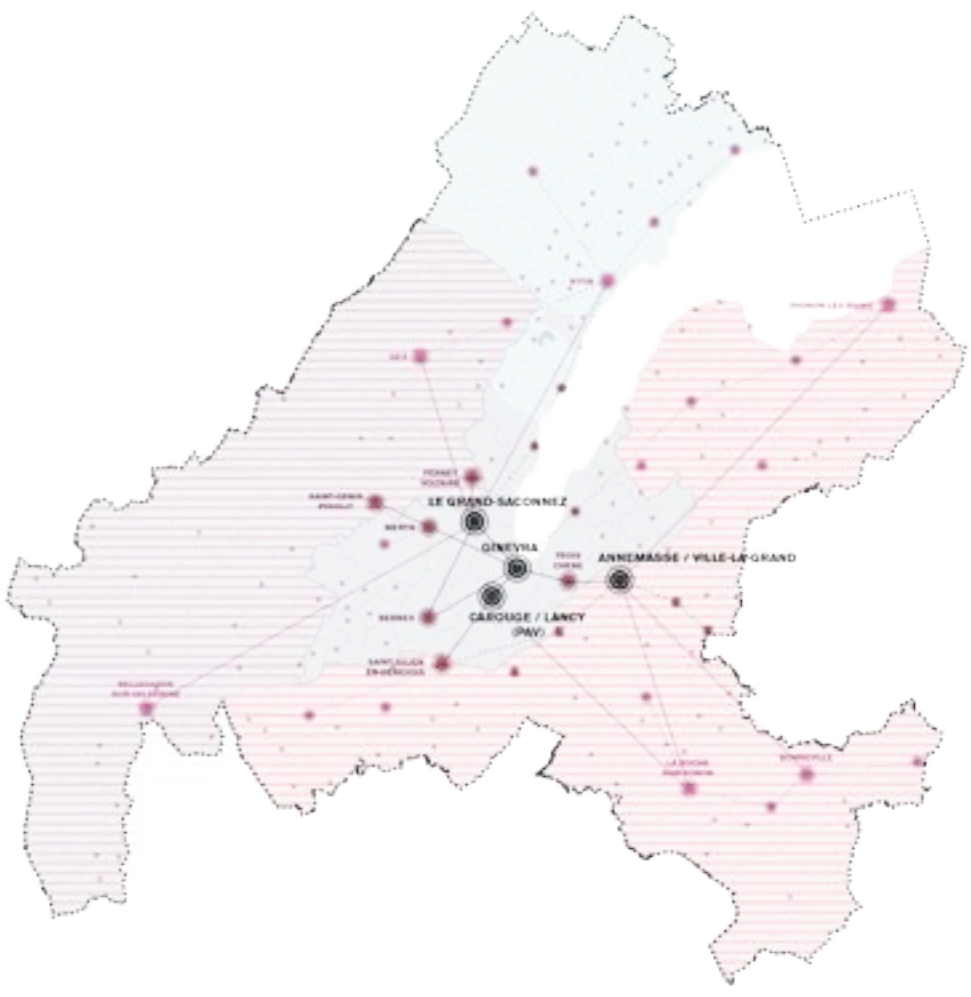
- **Canton of Ginevra**
- **Nyon District**

(Canton of Vaud)

2 *French departments*

- **Department of Ain**
- **Department of Haute-Savoie**

CONGLOMERATE



Central urban area

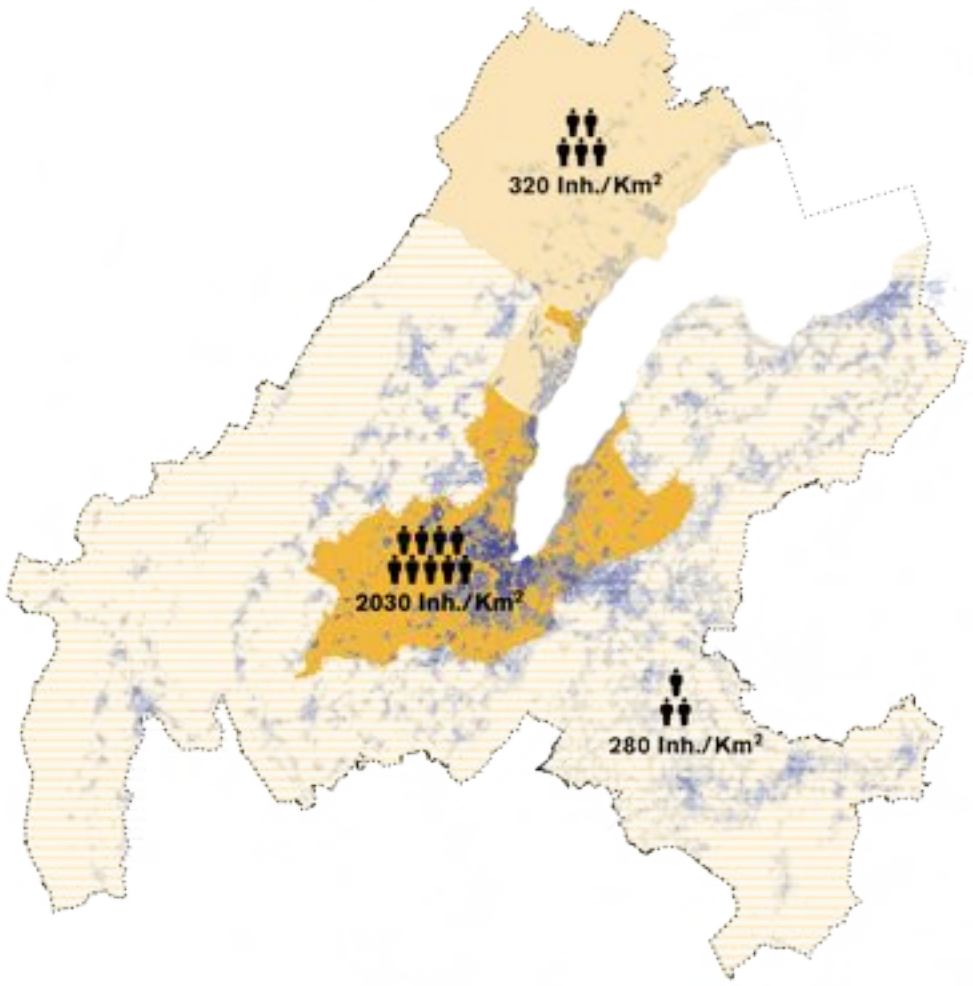
4 *Metropolitan centers*
7 *Regional centers*
8 *Local centers*

Regional urban area

7 *Regional centers*
15 *Local centers*
140 *Villages*

The Grand Genève territory project proposes, within the Horizon 2030 programme, a new urban poles' hierarchy, divided into central and regional epicentres.

INHABITANTS



1.000.000
inhabitants in
Grand Genève

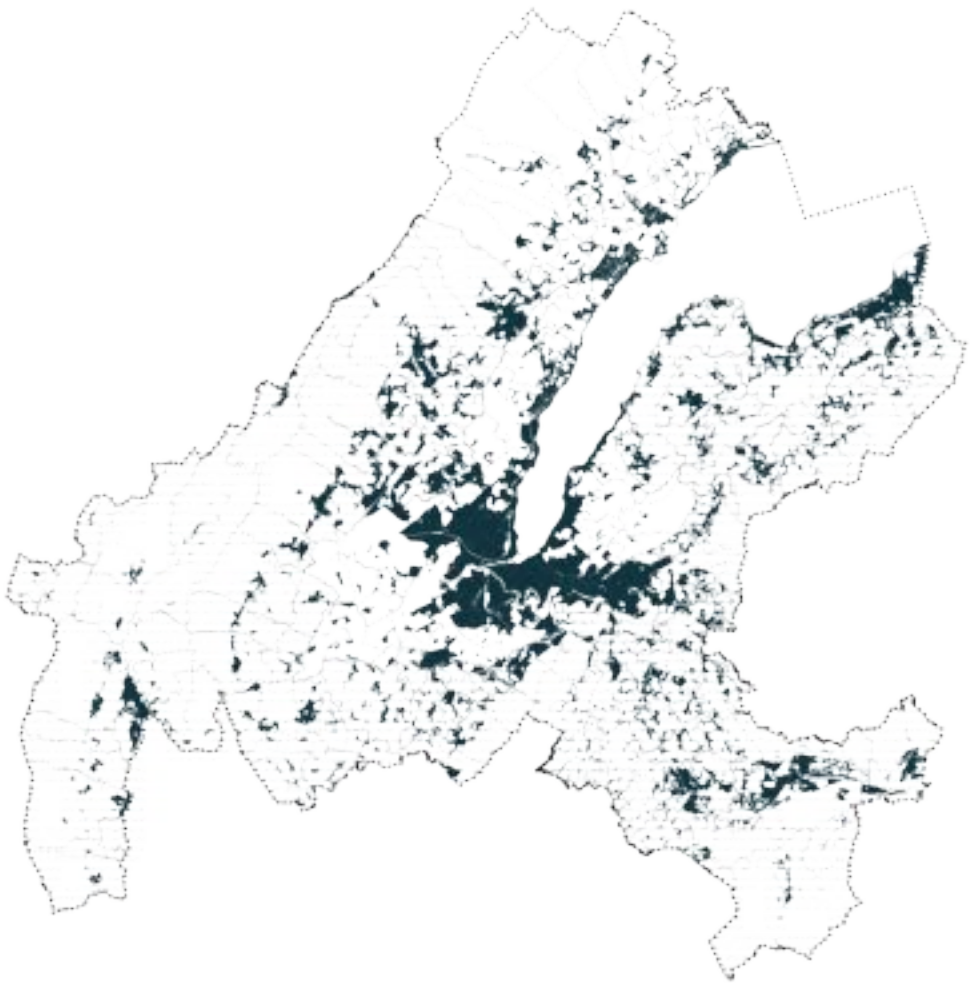
50%
Canton of Genève
500.000 abitanti

40%
French Grand Genève
400.000 abitanti

10%
Nyon Dystrict
100.000 abitanti

The population density of the Grand Genève area frames a greater concentration of population in the Canton of Genève (2030 inhab./sqkm.)
In external territories the population density is reduced by about 7 times in the lower density fabrics.
The graph illustrates the inhabitants' breakdown within Grand Genève, highlighting a substantial coincidence between Switzerland and France.

URBANIZED TERRITORY



30.600 Ha
Grand Genève territory with Lac Léman

13%
of Grand Genève

The cartographic estimates made by the work team highlight the presence of urbanised territories which are estimated to be around 13% of the Metropolitan area.

NATURALISTIC AREAS

220.000 Ha
Grand Genève territory with Lac Léman

42%
natural and wooded areas

About 42% of Grand Genève is made up of natural areas and forests, an important natural wealth that becomes one of the core elements of the ecological transition.

FORESTS TYPOLOGIES

28% *Conifer woods*

25% *Mixed woods with mainly conifers*

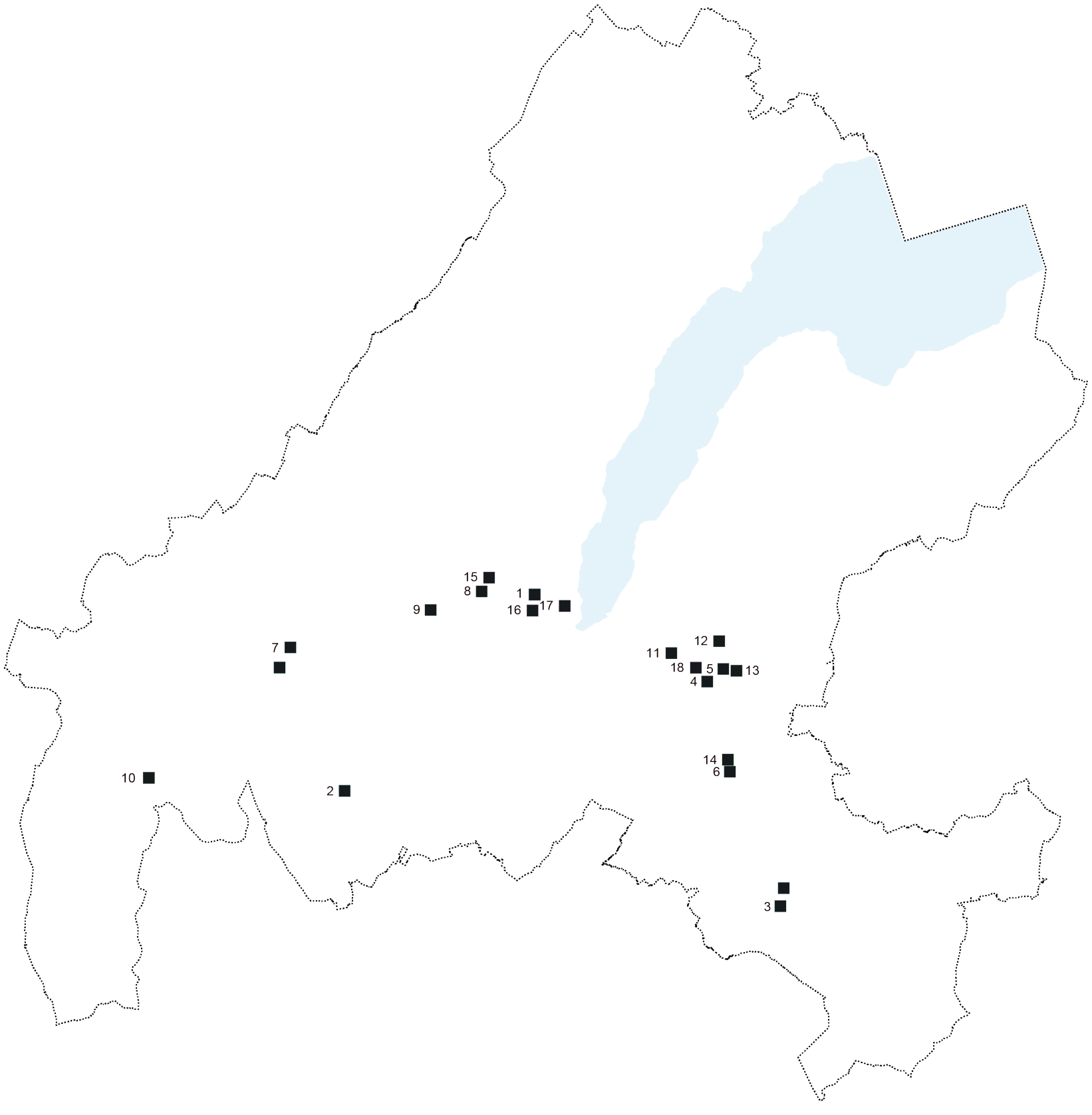
32% *Mixed woods with mainly broad-leaved*

15% *Broad-leaved woods*

About 42% of Grand Genève is made up of natural areas and forests, an important natural wealth that becomes one of the core elements of the ecological transition.

It is estimated that coniferous forests are prevalent in the wooded areas of Genève; a significant figure within the ecological transition process.

URBAN FABRIC



samples for urban fabric analysis (area ha)

1. **Geneve**
2. **Valleiry**
3. **La Roche-sur-Foron**
4. **Annemasse**
5. **Annemasse**
6. **Reigner-Esery**
7. **Péron**
8. **Meyrin**
9. **Satigny**
10. **Bellegarde**
11. **Annemasse**
12. **Annemasse**
13. **Annemasse**
14. **Reigner-Esery**
15. **Meyrin**
16. **Geneve (Vernier)**
17. **Geneve**
18. **Annemasse**

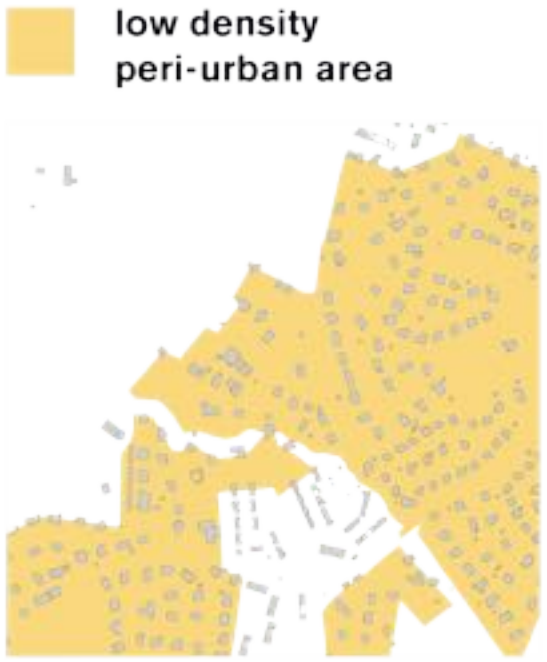
URBAN FABRIC SAMPLES

n. 1: Geneve (Aèreport)

1 : 10000

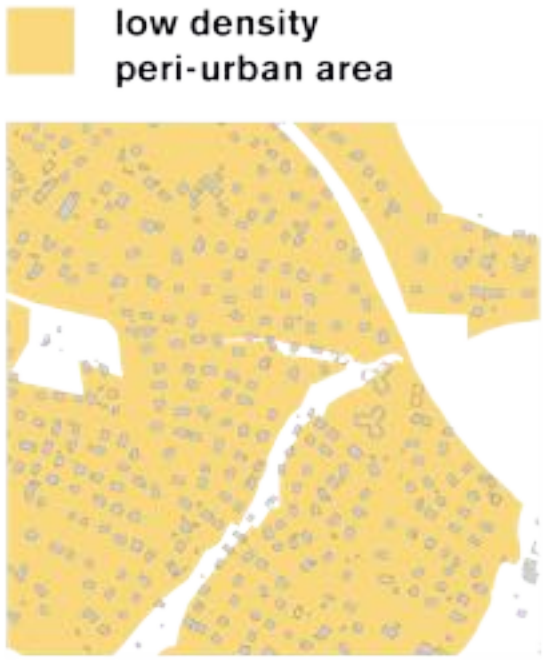
n. 2: Valleiry

1 : 10000



n. 3: La Roche-sur-Foron

1 : 10000



URBAN FABRIC SAMPLES

n. 4: Annemasse

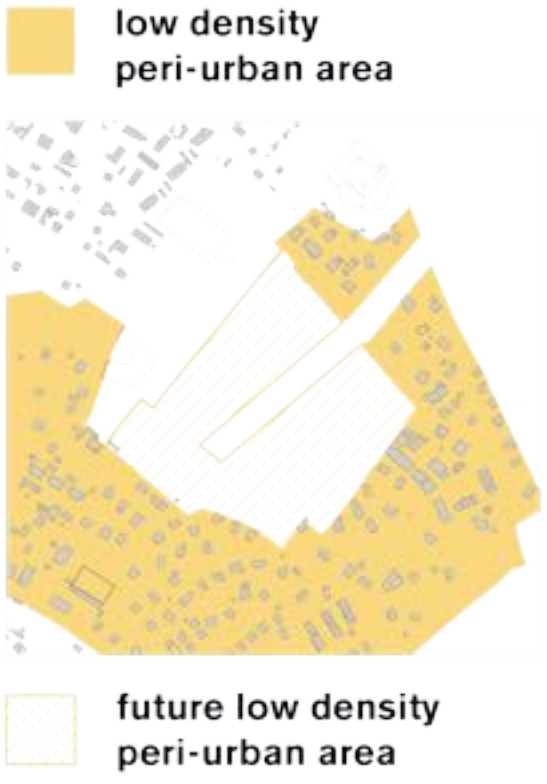
1 : 10000

n. 5: Annemasse

1 : 10000

n. 6: Reigner-Esery

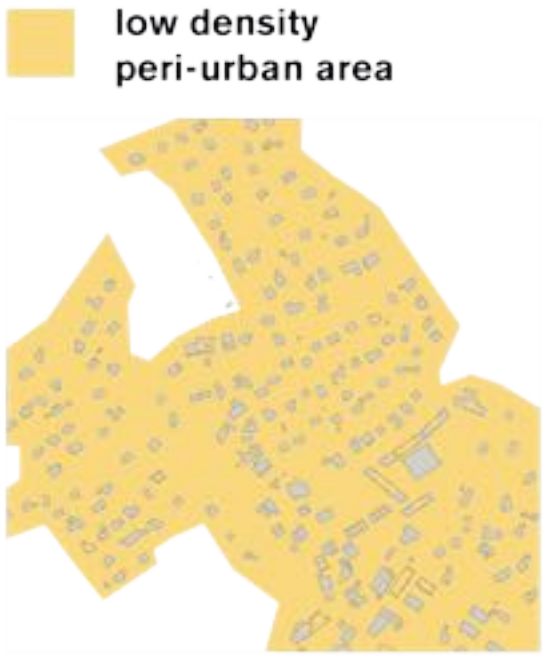
1 : 10000



URBAN FABRIC SAMPLES

n. 7: Péron

1 : 10000

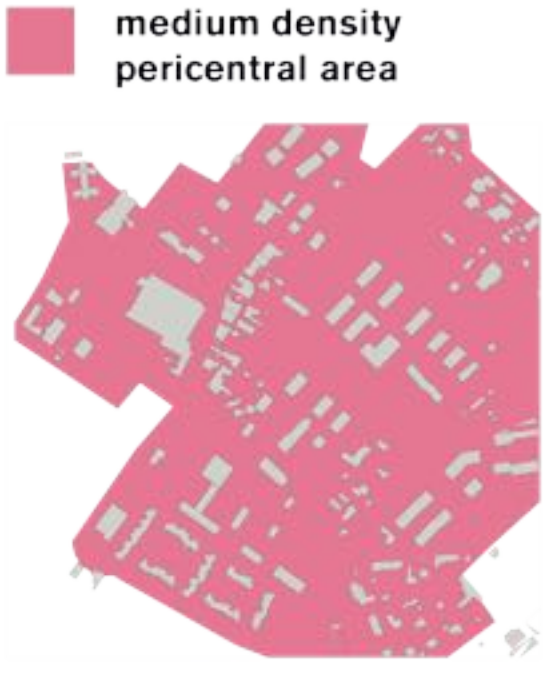


n. 8: Meyrin

1 : 10000

n. 9: Satigny

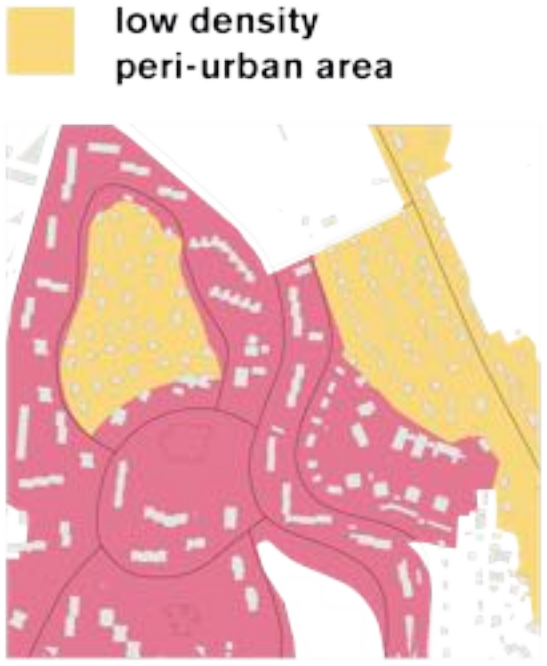
1 : 10000



URBAN FABRIC SAMPLES

n.10: Bellegarde

1 : 10000



n. 11: Annemasse

1 : 10000

n. 12: Annemasse

1 : 10000

URBAN FABRIC SAMPLES

n. 13: Annemasse

1 : 10000

n. 14: Reigner-Esery

1 : 10000

n. 15: Meyrin

1 : 10000

URBAN FABRIC SAMPLES

n. 16: Geneve (Vernier)

1 : 10000

n. 17: Geneve

1 : 10000

n. 18: Annemasse

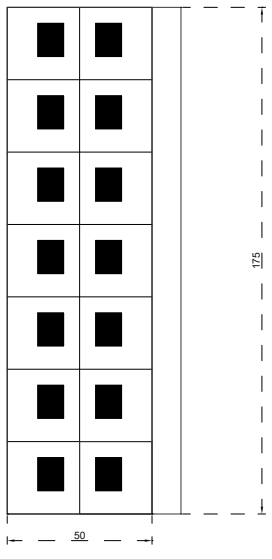
1 : 10000

Floor area ratio 0.2-0.3

residential standard : 50-150 m^2/inh.

tipology : **single house**

Genève, low density
tipology: urban fabric with single houses,1 o 2 floors, private green



sigle unit footprint: 125 m^2
footprint: 1750 m^2
land area: 8750 m^2
total floors area: (1750*1.5)= 2625 m^2

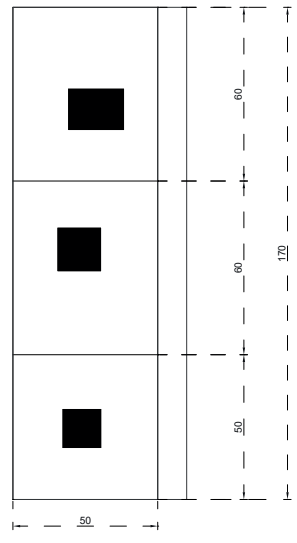
F.A.R.: 0.3

inhabitants for residential units: 3/4 inh.
residential units: 14

inhabitants: 49 (3.5 inhabitants for each residential units)
resulting index: (30 m^2/inh)

tipology: **villa**

Annemasse, hilly area, low density
tipology: urban fabric of isolated villas, 2 o 3 floors, private green



sigle unit footprint: 250 m^2
footprint: 750 m^2
land area: 8500 m^2
total floors area: (750*2,5)= 1875 m^2

F.A.R.: 0.2

inhabitants for residential units: 3/4 inh
residential units: 3

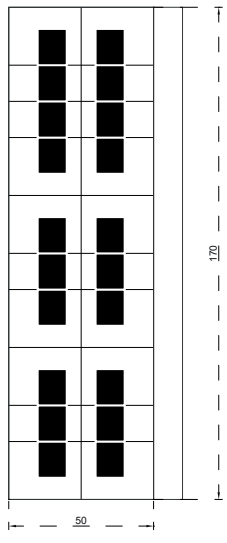
inhabitants: 12 (4 inhabitants for each residential units)
indice risultante: (30 m^2/inh)

Floor area ratio 0.5-0.6

residential standard : 30-70 m^2/inh.

tipology: **row house**

Geneve, medium density
tipology: urban fabric with row houses, 2 floors, private green



sigle unit footprint: 125 m^2
footprint: 2500 m^2
land area: 8500 m^2
total floors area: (2500*2)= 5000 m^2

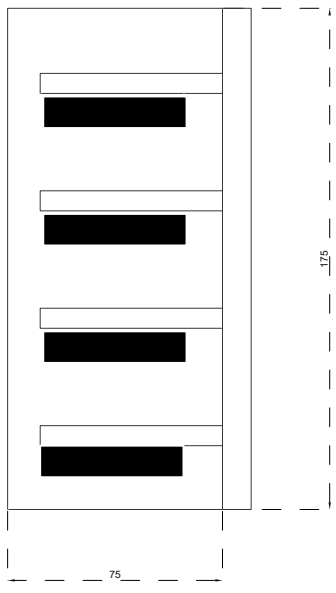
F.A.R.: 0.6

abitanti insediabili: (30 m^2/inh): 167
inhabitants for residential units: 3/4 inh.
residential units: 20

inhabitants: 70 (3.5 for each residential units)
resulting index: (70 m^2/inh)

tipology: **townhouse**

Satigny, small urbanization outside Geneve, very high density
tipology: townhouse, 4 floors,



sigle unit footprint: 550 m^2
footprint: 2200 m^2
land area: 13125 m^2
total floors area: (2500*2)= 6600 m^2

F.A.R.: 0.5

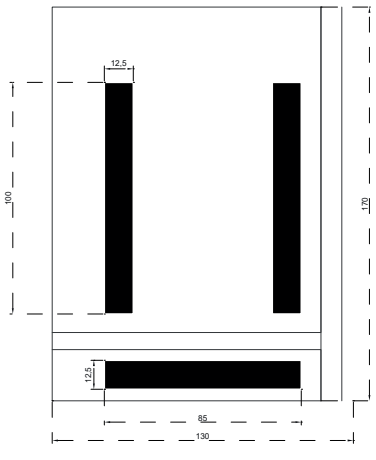
settleable inhabitants: (30 m^2/inh): 220

Floor area ratio 1

residential standard : 30 m²/inh.

tipology: **linear block**

Meyrin, Geneve periferia, alta densità
tipologia: isolato con edifici in linea, 6 piani, verde di pertinenza permeabile



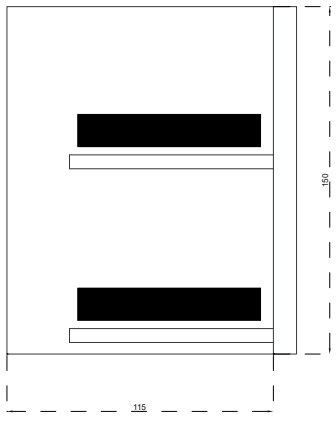
area unit 1: 1250 m²
area unit 2: 1050 m²
footprint: (900*3+675*2)= 3550 m²
land area: 22100 m²
total floors area: (4050*4)= (3500*6)=21300 m²

F.A.R.: 0.9

settleable inhabitants: (30 m²/inh): 710

tipology: **linear block**

Geneve, high density
tipology: urban block with long houses, 8 floors, permeable private green



sigle unit footprint: 1200 m²
footprint: 2400 m²
land area: 17250 m²
total floors area: (2400*8)= 19200 m²

F.A.R.: 1.1

settleable inhabitants: (30 m²/inh): 640

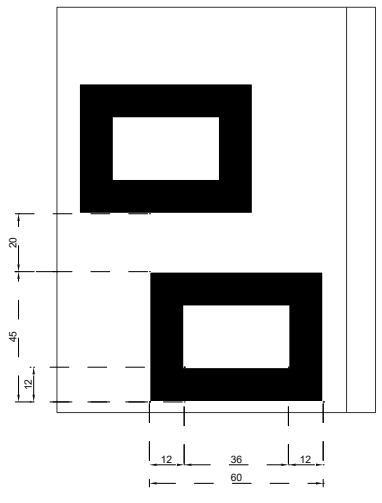
Floor area ratio 1.2-2.0

residential standard : 30 m²/inh.

tipology: **courtyard**

Vernier, Du Lignon, urbanization outside Genève, very high density, permeable private green and walkable path between the buildings

tipology: court, 4 - 6 floors



sigle unit footprint: 1950 m²
footprint: 3900 m²
land area: 14000 m²
total floors area: 3900*5= 19500 m²

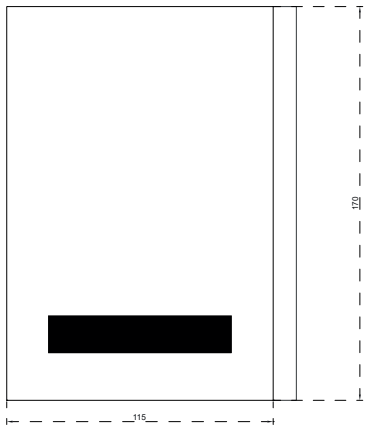
F.A.R.: 1.5

settleable inhabitants: (30 m2/inh): 650

tipology: **tower**

Vernier, Du Lignon, urbanization outside Genève, very hugh density

tipology: tower
(first tower: 32 floors 112 m, second tower: 26 floors, 91 m)



sigle unit footprint: 1360 m²
footprint: 1360 m²
land area: 19500 m²
total floors area: (1360*29) 39440 m²

F.A.R.: 2,0

settleable inhabitants: (30 m2/inh): 1314

Mobility and infrastructure

Systematica srl

The Grand Genève (Greater Geneva) is a vast territory of 2,000 sq Km including the Swiss cantons of Geneva and Vaud, and the French departments of Ain and Haute-Savoie. Composed of the Canton of Geneva, the District of Nyon and the Pôle métropolitain du Genevois français (French part of Greater Geneva), the territory includes 212 municipalities in total, with Geneva being the main city and the heart of the agglomeration.

The Canton of Geneva is a global city, the second most populous in Switzerland and one of the most important financial centers in the world (ranked 15th in the world and 5th in Europe in 2017) with offices and headquarters of international organizations such as UN and Red Cross. There are 34 international organisations, 250 NGOs, headquarters of 130 multinationals, not to mention many highly export-oriented companies located in canton of Geneva. With more than a million inhabitants and over 450,000 jobs, Greater Geneva is one of the most dynamic regions in Europe.

Cross-border commute is notable, with high demand in Greater Geneva, mainly from France, predominantly for work purposes . The dynamic labour market of the city/region of Geneva attracts French employees, and, in addition to French commuters, a lot of international officials which are not considered in statistics. Moreover, a considerable amount of Swiss citizens who work in Geneva choose to live in France. Hence, the number of cross border commuters using the existing infrastructure is higher than statistics and expected to increase in the future.

The Geneva International Airport (Aéroport international de Genève), is the second largest in Switzerland with 17.7 million passengers and 95,270 tons of cargo in 2018, is connected to 148 destinations and operated by 57 airlines. The catchment area of Genève Aéroport includes six million people within a radius of 150 km, including one million inhabitants for Greater Geneva.

The airport is 4 Km from the Geneva city centre and is accessible by both train and bus. The Geneva Airport railway station (Gare de Genève-Aéroport) is 250 meters away from the airport terminal and is operated by Swiss Federal Railways. In average three trains an hour, take passenger to and from Geneva-Cornavin station in 6 minutes and from there to other Swiss cities such as Basel, Zurich, St. Gallen or the Valais Alps (Brig). Connections to Italy and France are available at the Geneva main station.

Apart from local buses connecting the airport to the city, there are also buses to and from Annecy, France, and seasonal buses to ski resort Chamonix in France and ski resorts in Switzerland.

Geneva is accessible by motorway networks of Switzerland and France.

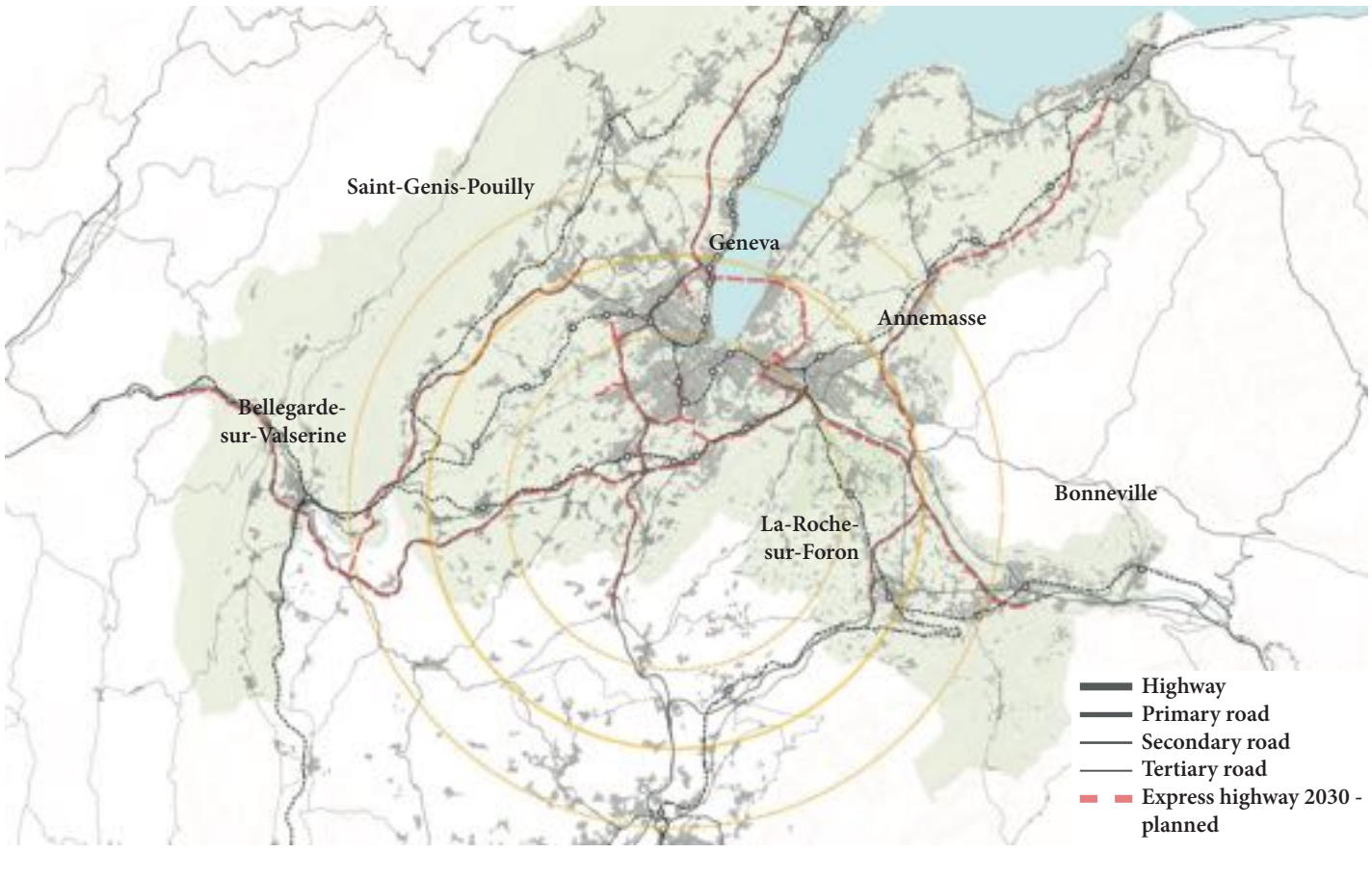
The A1 motorway of Switzerland (called Autobahnen in German, autoroutes in French, autostrade in Italian), which is one of the main two and spans 383 km, is the main east-west axis connection from St. Margrethen in north-eastern Switzerland's canton of St. Gallen through to Geneva in the southwestern part of the country.

Linking the main hubs of Greater Geneva, the LEMAN Express (Franco-Valdo-Geneva regional express network), inaugurated in December 2019, is an efficient and environmental friendly rail alternative to the private car. It includes 230 km of track linking France and Switzerland with 45 stops in Grand Geneva and beyond, six lines to and from Coppet, Bellegarde, Evian-les-Bains, Annecy and St-Gervais-les-Bains-Le Fayet, and 40 trains running under the Léman Express brand.

The LEMAN Express has interchanges with soft mobility networks and public transport. Previous to the implementation of LEMAN, the crossborder rail infrastructure was problematic with two missing links, and two offering connections with more than one change.

The modal share of Greater Geneva in 2014 is 48.9% Private Transport, 38.6% Soft Mobility and 12.6% Public Transport.

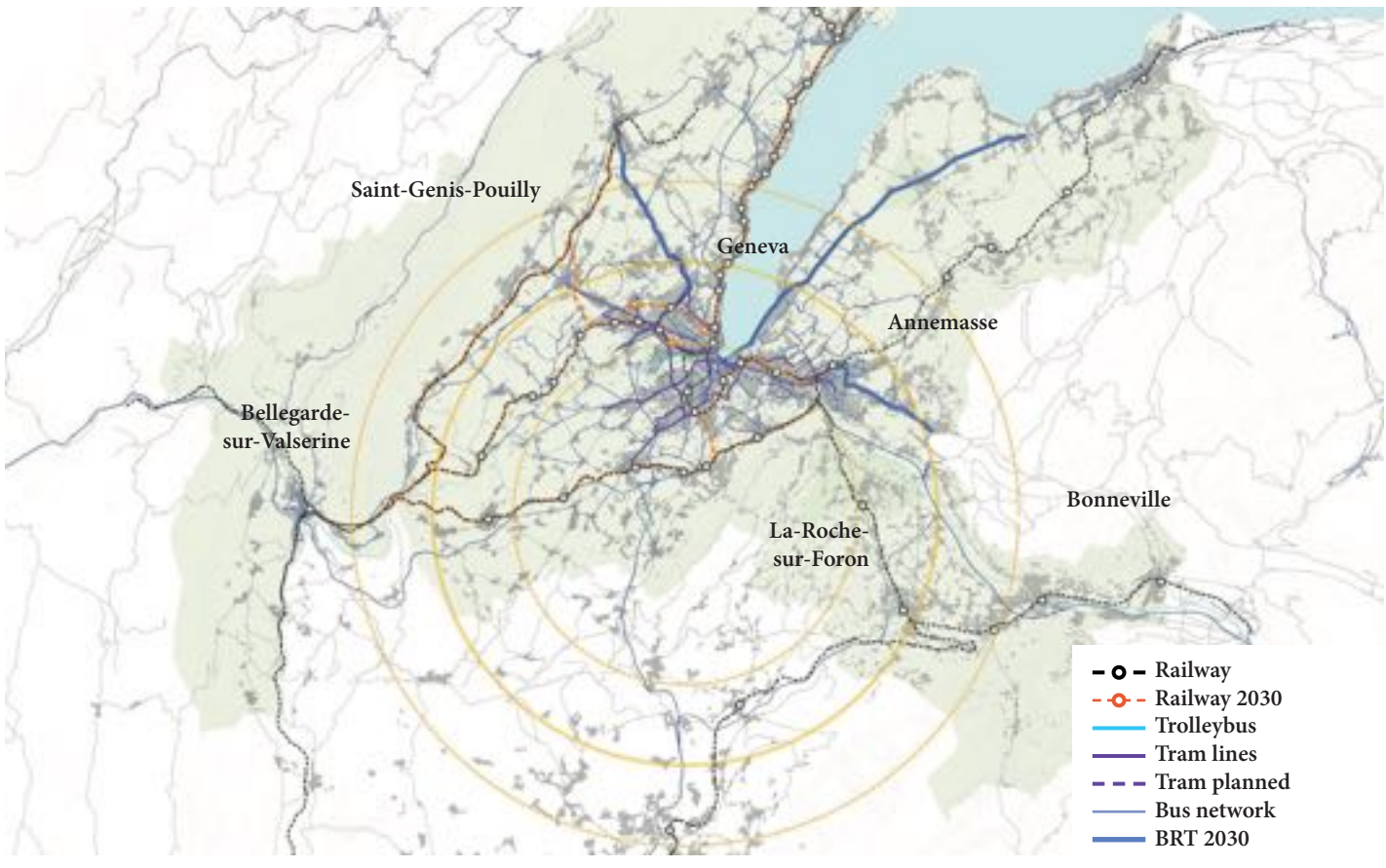
CURRENT ROAD NETWORK



Currently there are strong north-south road connections, although the cross border network is slow speed and congested during the rush hour.
The near distance connections are generally slower than longer distances.
If effective green mobility strategies are not implemented, there is the risk of further increase in congestion and reduction in air quality.

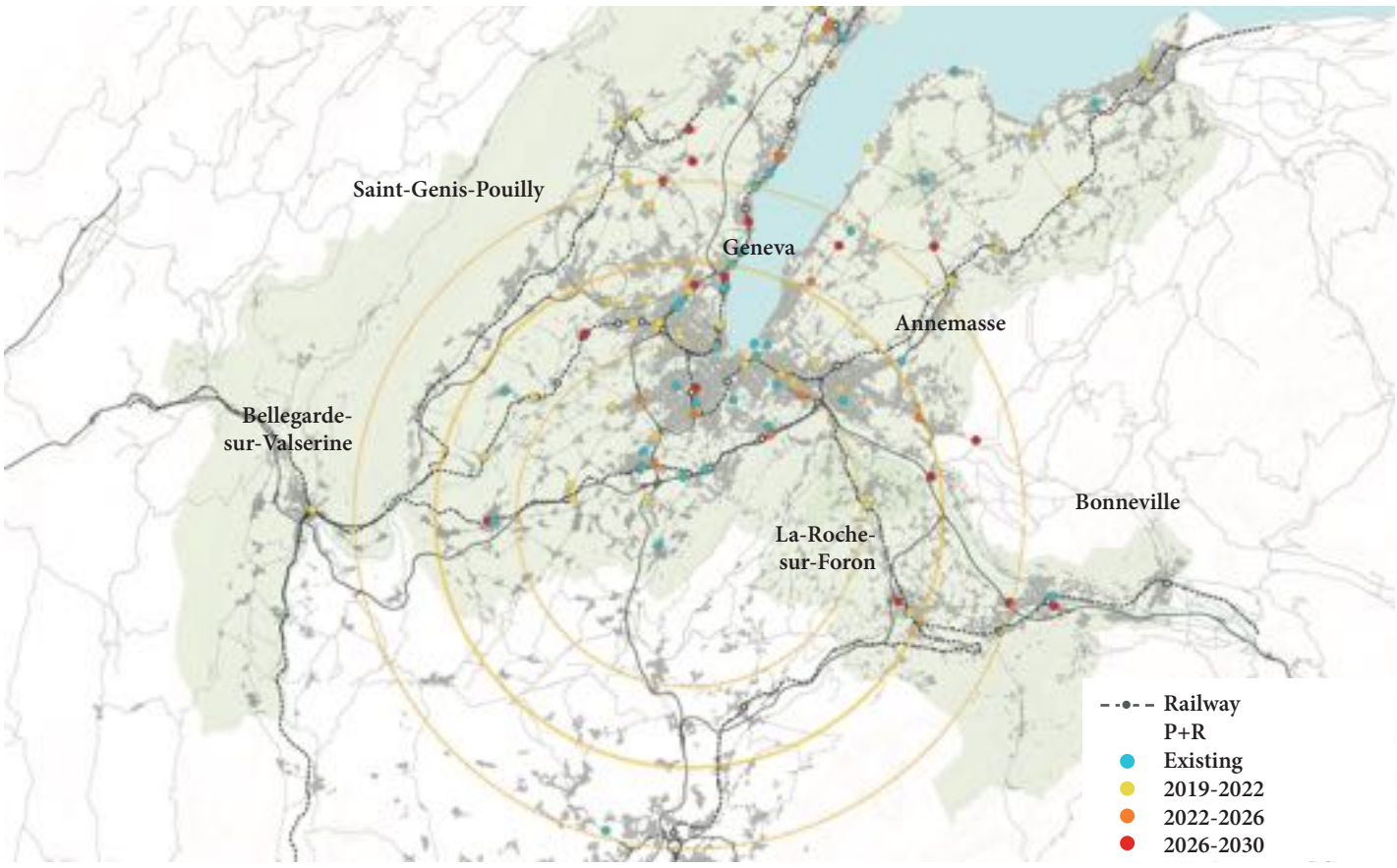
The planned lake bridge offers an improved West-East connection. There is also the possibility of repurposing the Express Highway proposal to reduce car use (e.g. bus lanes, green vehicles lanes, etc.).

PUBLIC TRANSPORT



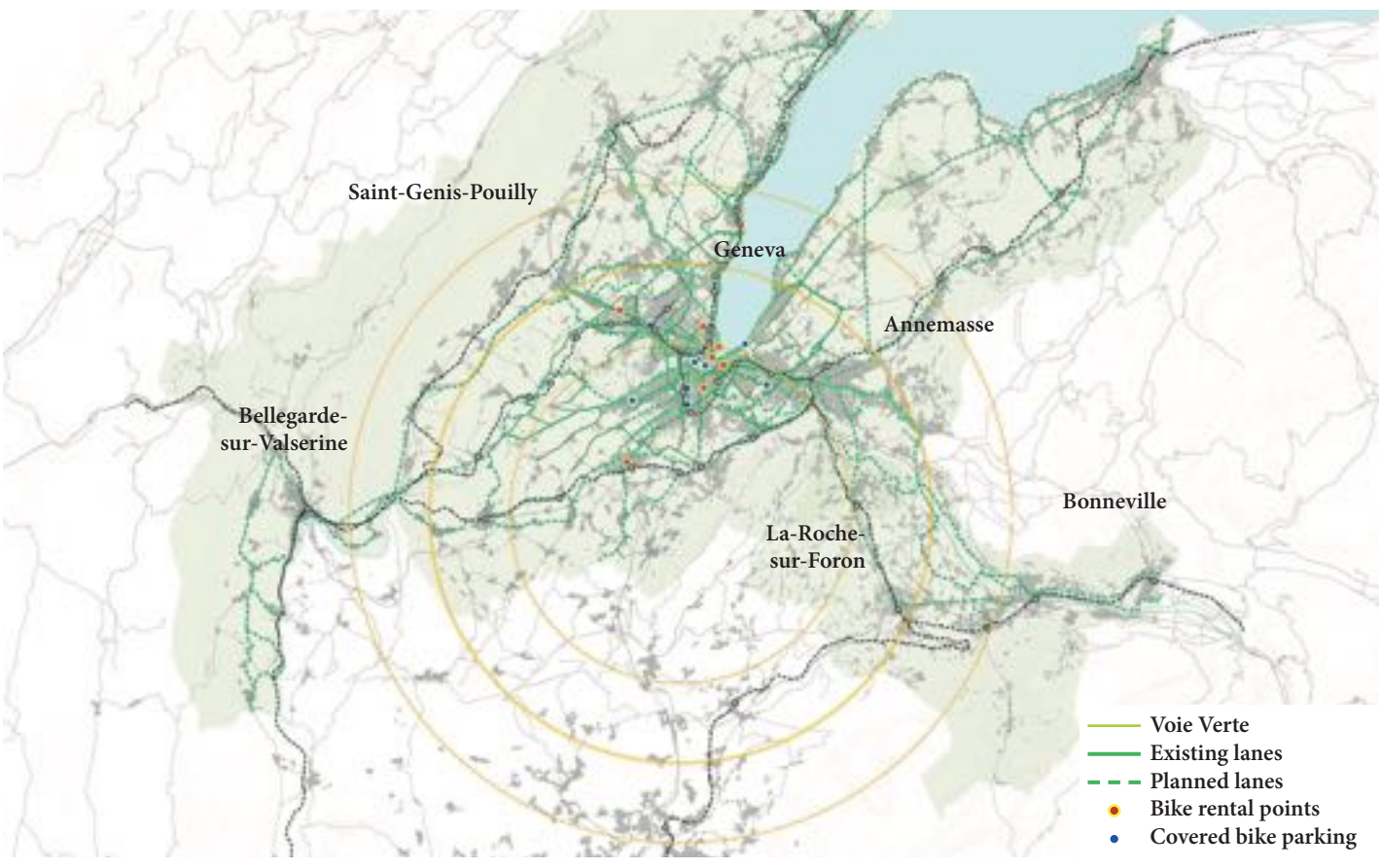
The current public transport network is dense but not homogeneous as the density is much less in the southern part of agglomeration. It includes railway (LEMAN Express), trams, buses, trolleybus and planned BRT for the 2030.
The main challenge for Greater Geneva is to encourage and speed up the shift towards the use of public transport by increasing frequency of the service, locating the stops at interchanges with other modes, and expanding and strengthening current and planned connections, as well as implementing complementary transport modes.
Another important issue is electrifying the fleet to minimize the environmental impacts.

P+R FACILITIES AND MAIN INTERCHANGE NODES



The current P+R facilities correspond with railway stations, future BRT stops, and the tram network.
Planned P+R car parks play a major role in linking Greater Geneva and limiting vehicular flows within the agglomeration.
Increasing the number of P+R should also correspond with the road network to encourage the shift towards the public, active and sustainable modes of transport, and shared mobility solutions within the Greater Geneva.

SOFT MOBILITY

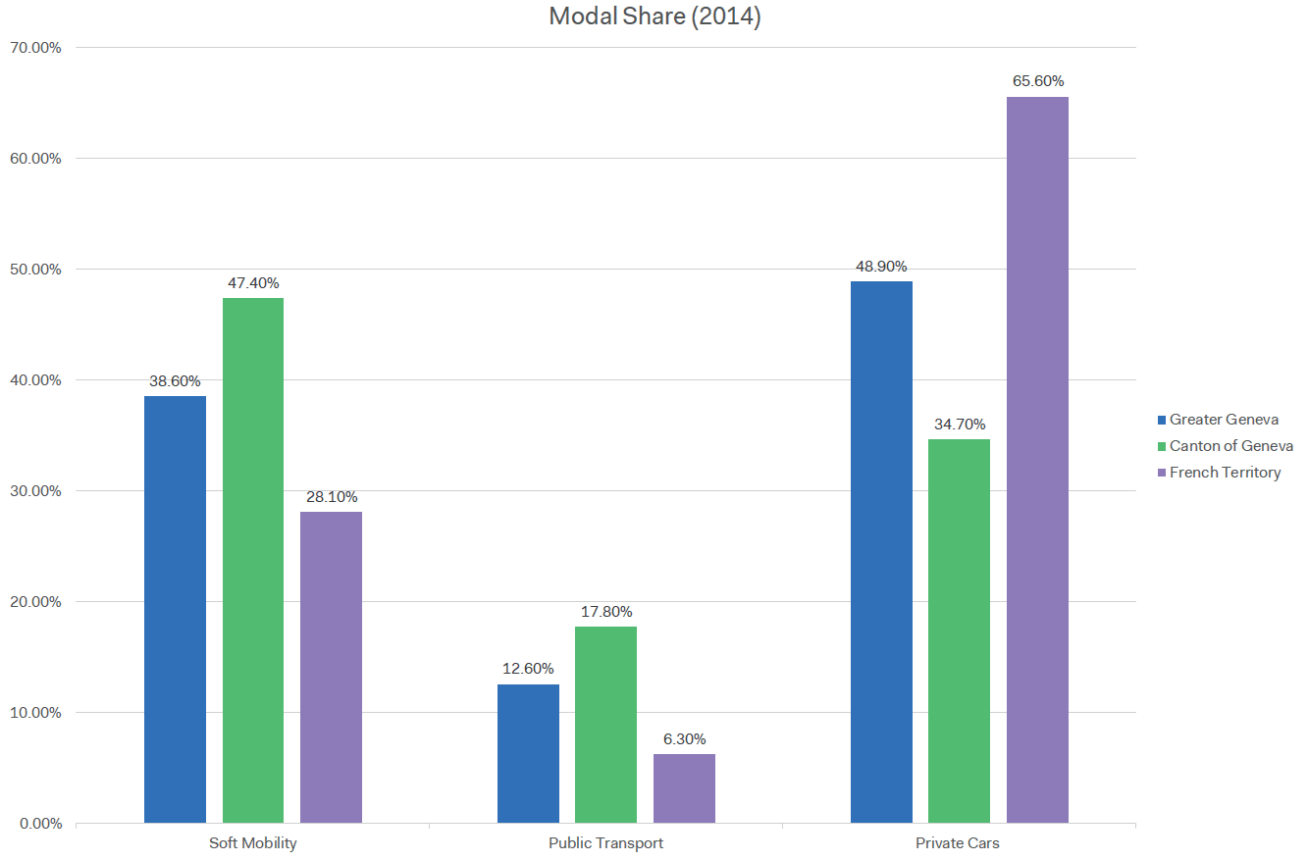


The cycling network is planned to be expanded beyond Geneva city borders. The bike sharing service Vélospot has recently retracted from the Geneva market and other bike sharing services should be identified to ensure an efficient service.
The Voie Verte (Greenway) of Geneva that crosses 6 municipalities of Annemasse Agglo : Gaillard, Ambilly, Annemasse, Vétraz-Monthoux, Cranves-Sales and Bonne is a pilot project for a dedicated and secure lane reserved for the circulation of soft and active modes of transport including walking, biking, wheelchair use, skateboard, rollerblade, scooter and stroller.

MOBILITY AS A SERVICE

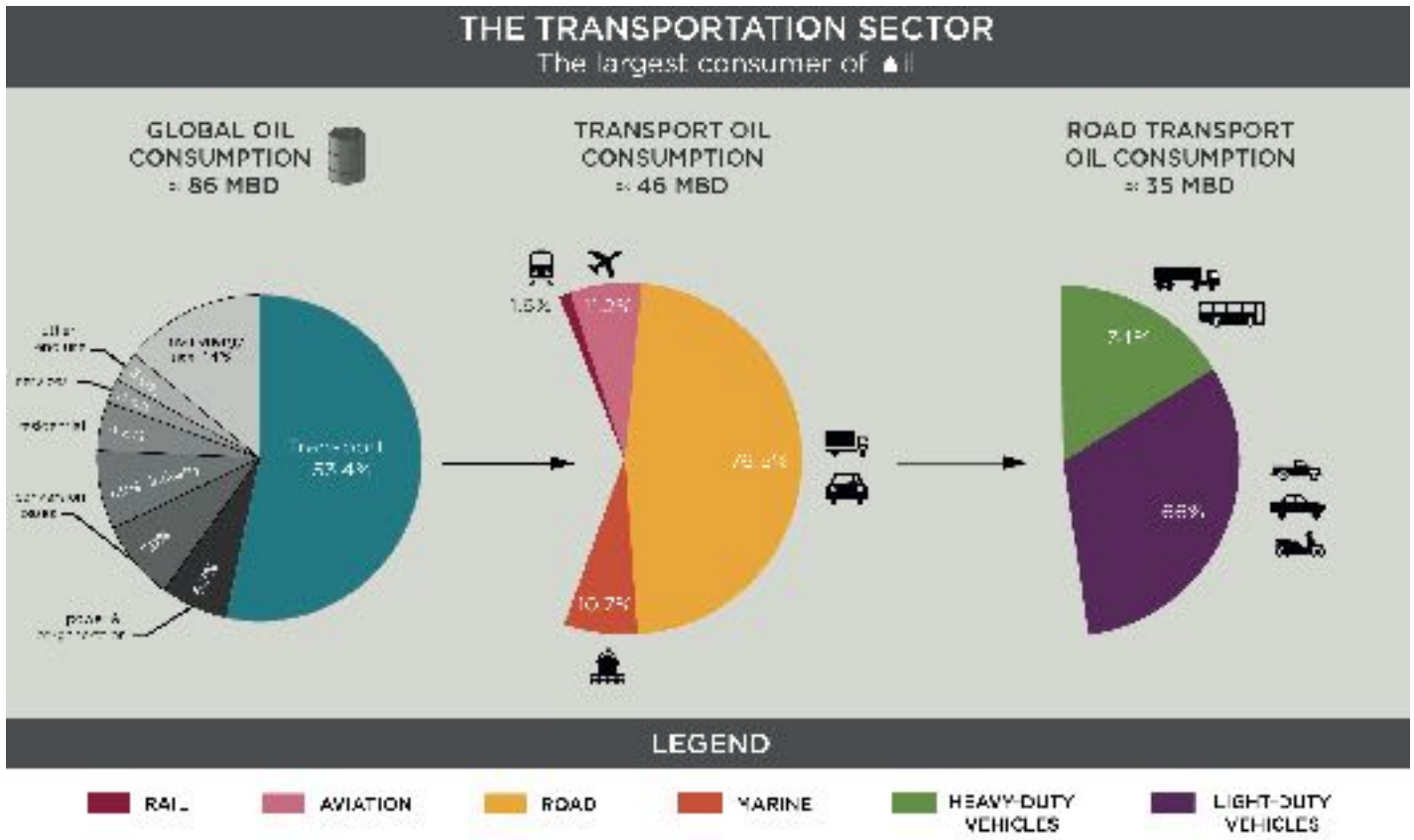
Mobility as a Service (MaaS) encourages the shift away from private and personally owned vehicles towards mobility provided as a service. Car sharing, bike sharing and scooter sharing services are considered MaaS. In short term, MaaS could result in the decrease in car ownership. The most effective strategy for offering MaaS is ensuring its integration with public transport and electric and sustainable vehicles that will contribute to emission reduction. Currently the MaaS offer in Geneva includes Hé!Léman, the first spontaneous carpooling service in Greater Geneva, with 4 meeting points - 3 in France and 1 in Switzerland, and 6 destinations within Greater Geneva, with the service provided through SMS. The Mobility Go is the free-floating car sharing service in Geneva, with a fleet of 100 cars that are allowed to park in all Geneva public parking areas, with 4 permanent parking spaces at the airport and 2 parking spaces available at the P+R du Globe at CERN. The GenèveRoule! is the free-floating bike rental and loan service with 11 rental points in Geneva. Bikes can be rented through app or at bike point for short and long terms.

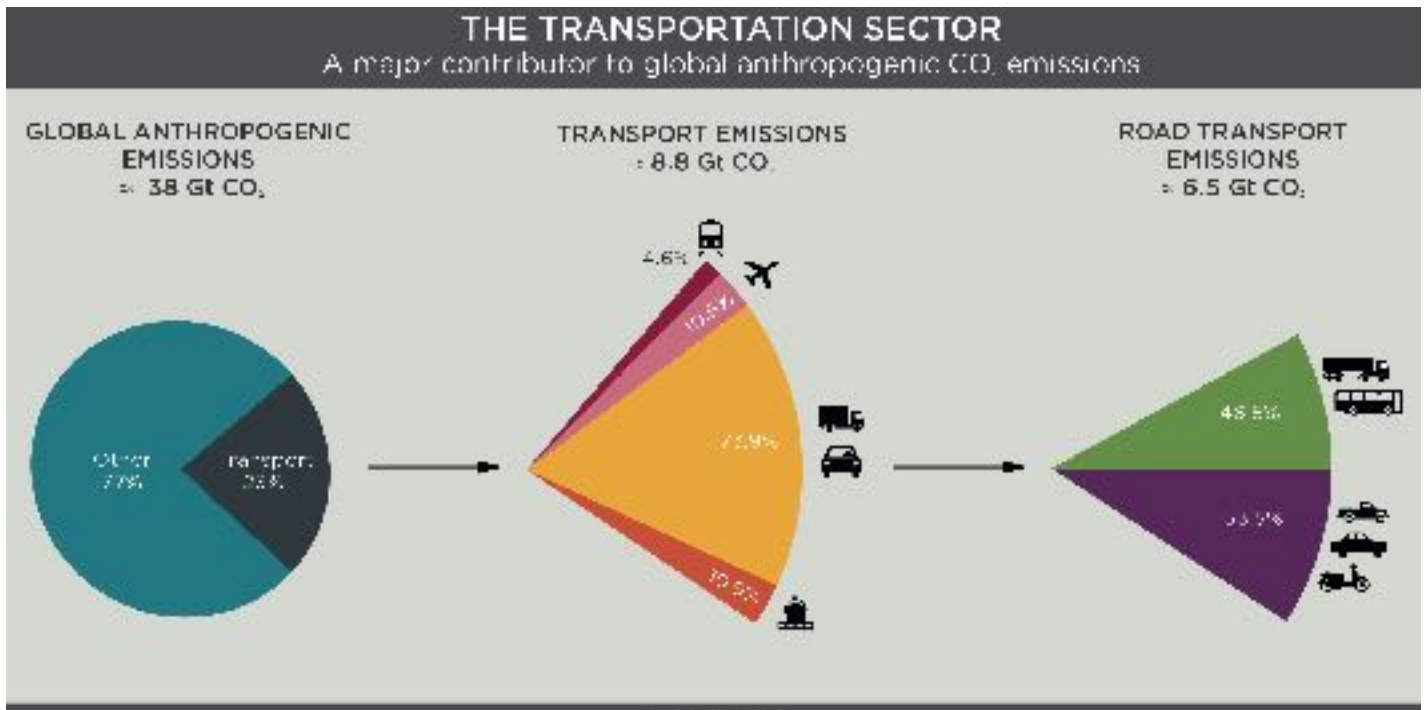
MODAL SHARE



The current modal share of Greater Geneva, Canton of Geneva and the French Territories shows that the share of public transport is low while the use of private car is high. Although the current inauguration of LEMAN network will increase the use of public transport across the Greater Geneva, the integration of soft mobility and Maas with public transport and unifying the payments system is an efficient and effective strategy to decrease the use of private cars.

WORLDWIDE TRANSPORT SECTOR IMPACT





The EU is fighting climate change through ambitious policies across its territory and in close cooperation with international partners. The transition to a climate-neutral society is both an urgent challenge and an opportunity to build a better future. The 2030 climate and energy framework includes EU-wide targets and policy objectives for the period from 2021 to 2030. The European Council adopted the framework in October 2014. The key targets for 2030 are; at least 40% cuts in greenhouse gas emissions (from 1990 levels), at least 32% share for renewable energy and at least 32.5% improvement in energy efficiency.

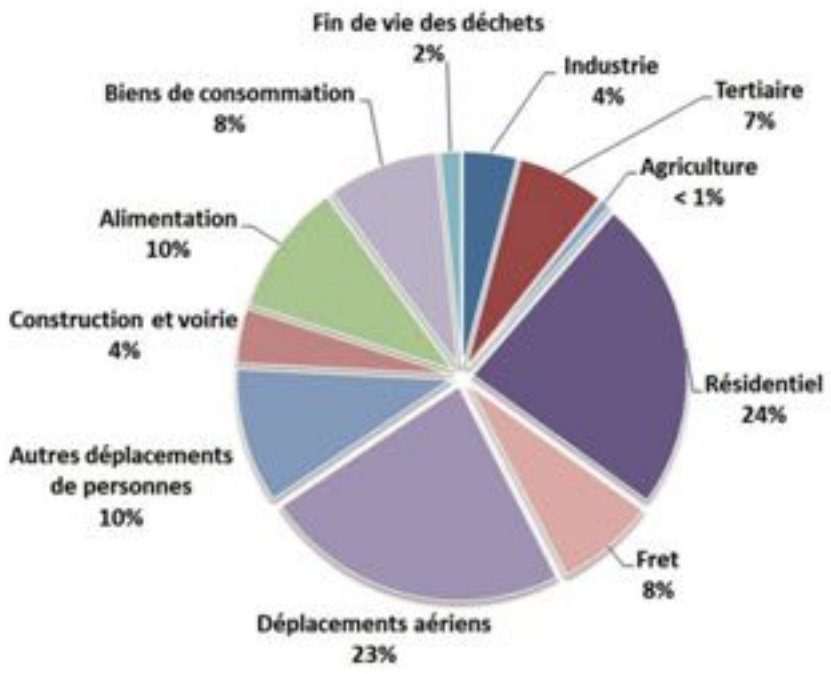
The targets for renewables and energy efficiency were revised upwards in 2018.

Transport sector accounts for 53% of global oil consumption and 23% of global carbon dioxide emissions.

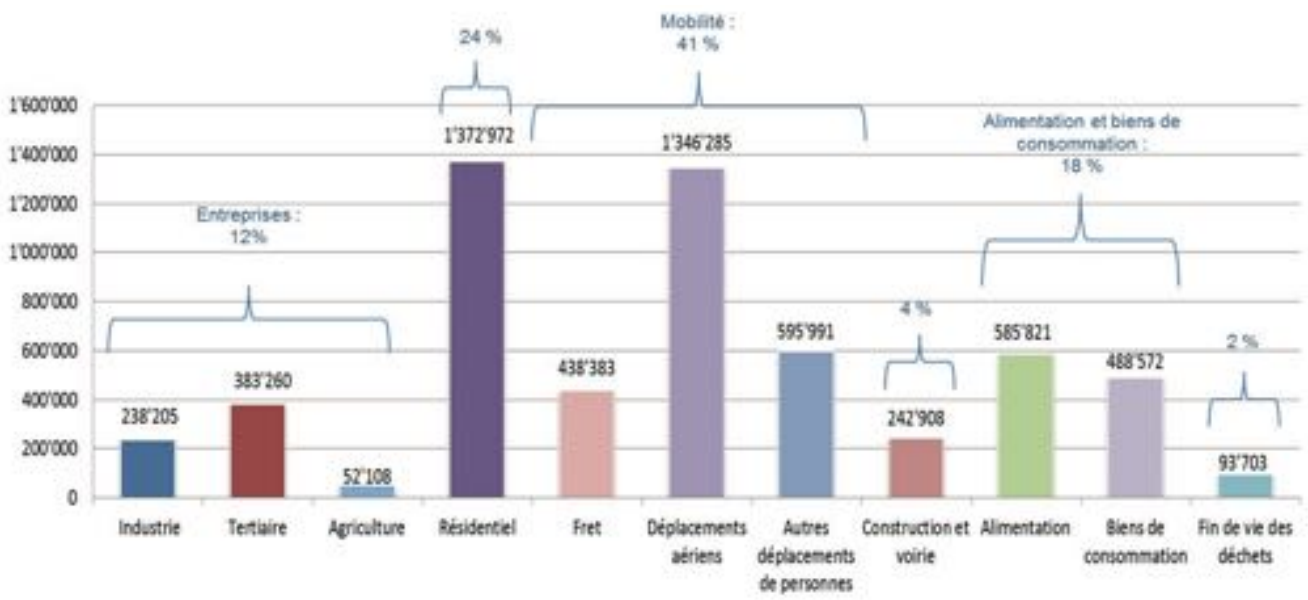
By 2050, the EU is targeting a 60% cut in transport-related greenhouse gas emissions versus 1990 levels, and more specifically: no more conventionally-fuelled cars in cities, 40% use of sustainable low carbon fuels in aviation, 40% cut in CO2 emissions from maritime bunker fuels, 50% shift of freight journeys greater than or equal to 300 km from road to rail and to waterborne transport, majority of medium distance travel completed by rail, complete European high-speed rail network, complete trans-European transport network and progress towards zero road transport fatalities.

Shifting towards sustainable modes of transport and investing on electrifying the fleet provides governments with possibilities to reach the key climate change targets by reducing emissions and increasing the use of renewable sources of energy.

EMISSIONS IN CANTON OF GENEVA

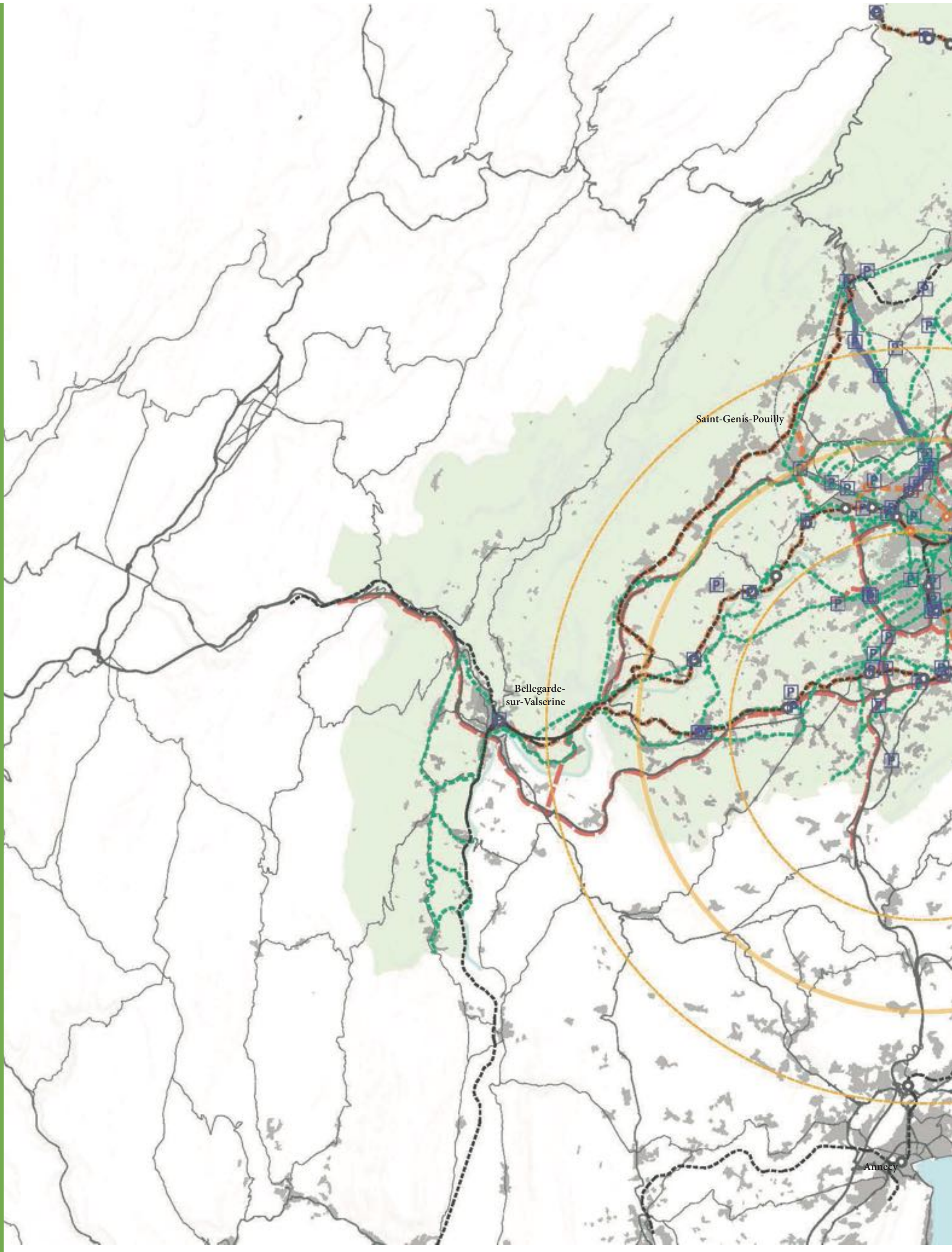


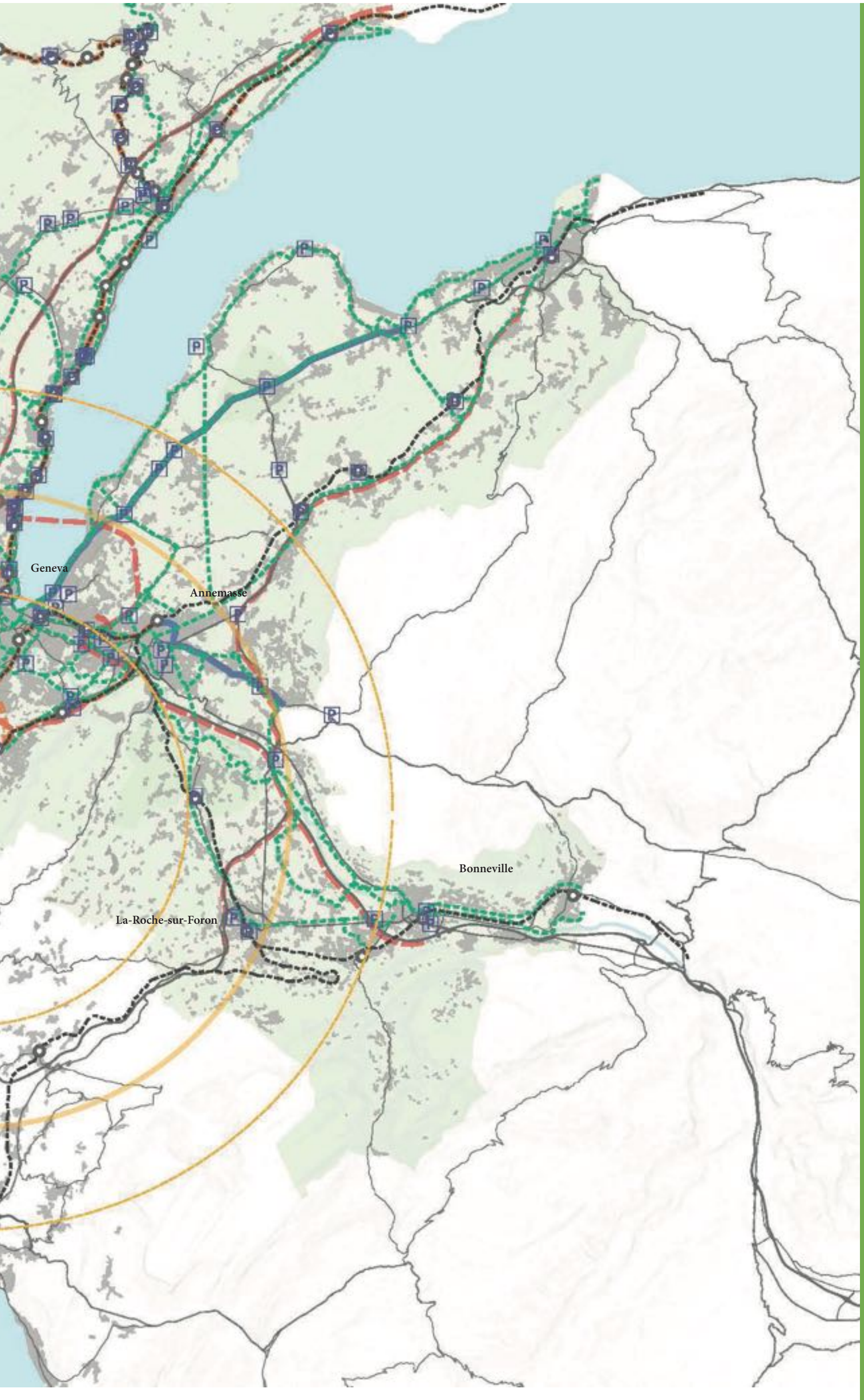
Source: https://www.ge.ch/document/plan-climat-cantonal-volet-1/telecharger



Source: https://www.ge.ch/document/plan-climat-cantonal-volet-1/telecharger

In 2012, the GHG emissions emitted by the Geneva canton amounted to 5,838,207 tCO2e.
This result is however based on a global approach to accounting for emissions linked to air traffic. In order not to attribute all of the emissions to residents of the canton, a ratio of 12 residents / travelers has been set. By applying this ratio, each inhabitant of the canton of Geneva (470,000 inhabitants in 2012) emitted an average of 10.2 tCO2e. The mobility sector represents 41% of the canton's GHG emissions. Due to the regional use of Geneva International Airport, travel by residents and visitors by air accounts for almost 70% of emissions from the mobility sector and 23% of the carbon footprint. Similarly, air freight is characterized by 60% of emissions from the freight item. The rest of the emissions linked to the mobility sector are mainly attributable to road transport of people or goods. Transport sector is accountable for 41% of total GHG emissions in Canton of Geneva, which 23% is for air travels, 8% is for freight and 10% for other movements of peoplemainly attributable to road transport.
The Greater Geneva is currently investing on electrifying parts of its public transport fleet to reduce the negative impact of transport sector on environment, the TOSA e-bus, is "the first 100% electric large-capacity bus system". The fleet of 20 emissions-free vehicles, each with 130 passengers' capability are running between the airport and municipality of Carouge. The fleet contributes to saving 1,000 tonnes of carbon dioxide emissions per year.


Saint-Genis-Pouilly
Bellegarde-
sur-Valserine
Annecy



LEGEND:

- Express highway 2030
- Railway
- Railway 2030
- BRT 2030
- Planned bike lanes
- P Park & ride

The map illustrates the entire planned mobility and transport network of Greater Geneva, and its proximate surroundings.

Energy

Transsolar KlimaEngineering

In 2015, with the Paris Accord, the international community set itself the objective of limiting average global warming well below 2 degrees from pre-industrial era, pursuing a maximum temperature increase of 1.5 degrees. Unequivocally, it shows that to reach the target by the middle of the century, global CO2 emissions must be reduced to a net balance of zero.

In 2014, the Gran Genève area produced around 4000 T of CO2 and now its plan is to reduce it to 3300 T by 2030 and to reach the net balance of zero in 2050. How? Increasing the air quality (reducing the pollution emissions connected to buildings, mobility and industry), following the climate changes (biodiversity integration in urban areas, limiting the water consumption per person, reducing the impermeable soil, ..), increasing waste management and reducing the energy consumption for building, mobility and industry and raising renewable energy use.

The renewable energy industry is currently at its own infancy time; even though a lot of studies and improvements have been done in the last decades only 24.5% of electricty was produced by renewable resources in 2016 (68% with hydroelectricity).

Solar and wind resources can produce the most significant amount of energy but currently only 5.5% of worldwide production comes from them. The main reason is that their highest production happens during the lowest demand time (solar energy is maximum during the day, when the demand is low, and wind is normally stronger during night, when again the demand is low). To be truly effective, energy produced needs to be stored. In 2017, the worldwide electrical energy stored was around 176 GW, that represents less than 2% of the world's electric power production capacity. Particularly, in the same year, USA was able to store only 2,2% of its production capacity, Europe 10% and Japan 15%. In any case, the European commission is aiming for 27% of renewable energy storage by 2030.

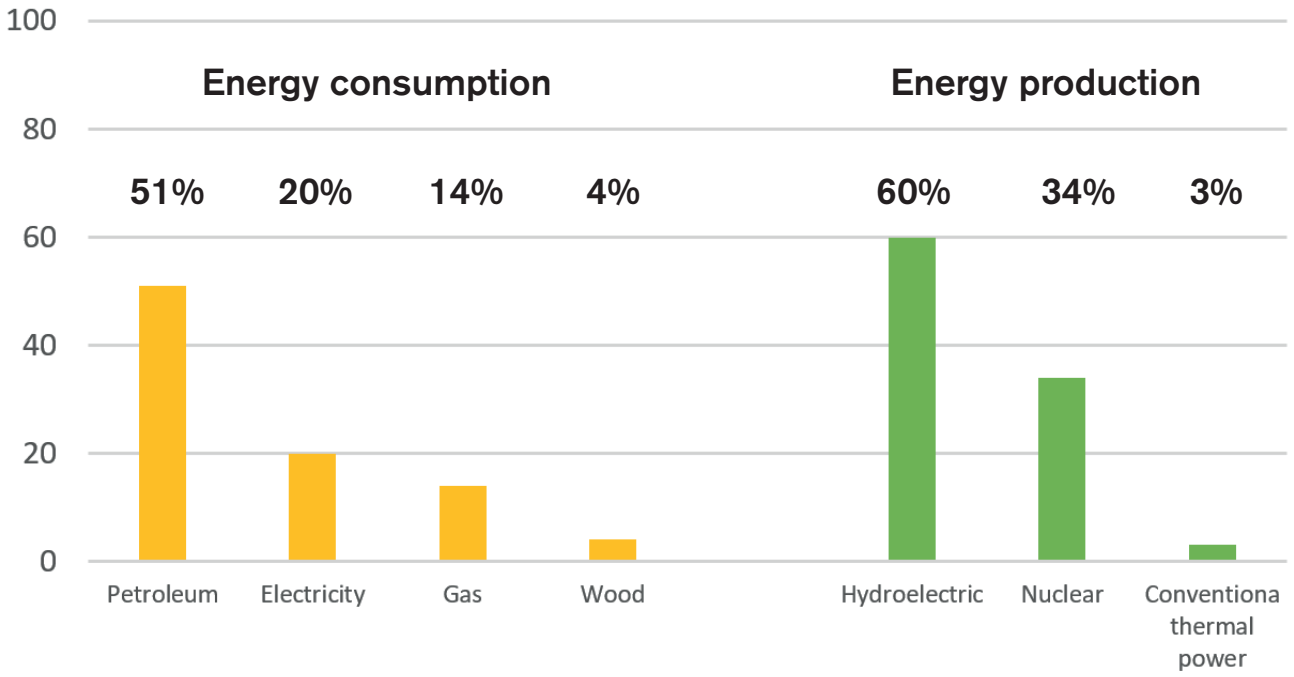
Energy production in Switzerland comes mainly from hydroelectric power plants, around 60%, while a smaller percentage comes from imported nuclear energy and conventional thermal plants. This production manages to balance the consumption of energy in all the Swiss land, which consists mainly of oil (51%), electricity (20%), gas (14%) and wood (4%).

Although average per capita consumption has decreased by about 14.5% since 1990, if we take into account the population increase (23.4% during the same years), total energy consumption in Switzerland has increased by 5.5%, defining a consumption of 7.033 kWh/pers of electricity in 2015.

Due to the significant climate changes, it is rational to think that the hydrological system may be affected by a changing in its functionality, with the immediate consequence that the resulting electricity production may decrease. Assuming an A1B scenario (rapid economic growth, rapid diffusion of new technologies, population growth up to 9 billion by the middle of the century and subsequent gradual decline) the flow of water related to hydropower production will decrease by 1/3, leading to a 27% reduction in terms of electricity produced, by 2050. The reduction of ice melt will not be compensated by the potential increase of precipitations.

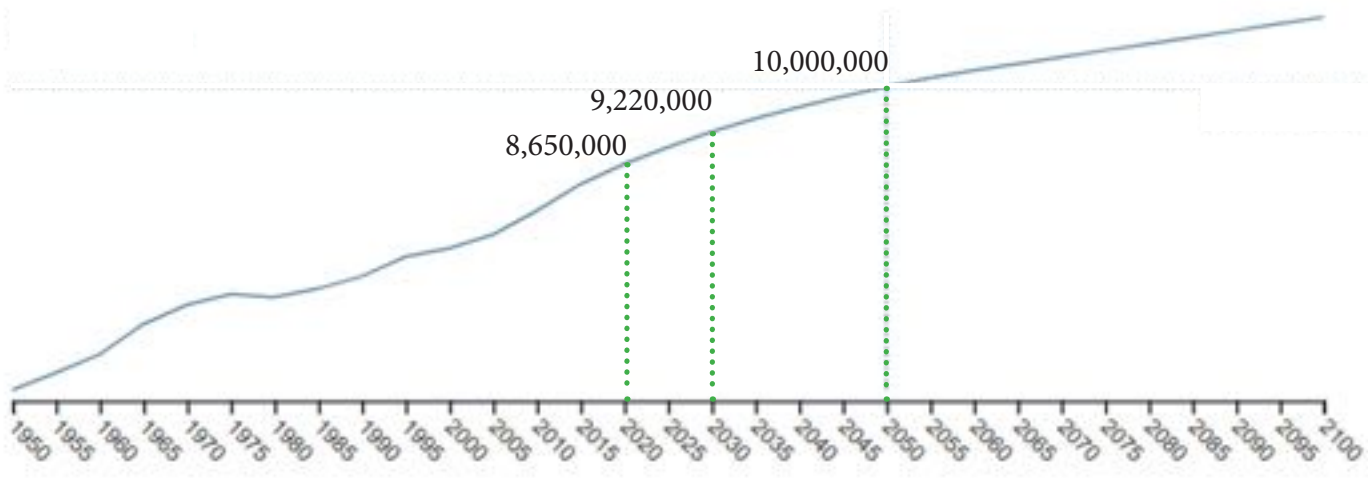
All these reasons point to the idea that it is time to push forward to an energy system based entirely on renewable resources, combined with a solid on-site storage system, which provides a high energy autonomy level.

ENERGY BALANCE



Switzerland energy balance, referred to 2018.

POPULATION GROWTH TREND



Swiss population growth trend.
(2020-2030-2050).

Waste

Transsolar KlimaEngineering

Waste management in Switzerland is based on the polluter pays principle, that, in environmental law, aims to make people responsible for producing pollution and for paying for the damage they do to the natural environment.

Although the recycling rate of 54% is above the European average of 28% (data referred to 2015), Switzerland is among the largest waste producers in Europe (730 kg of waste per capita in 2014).

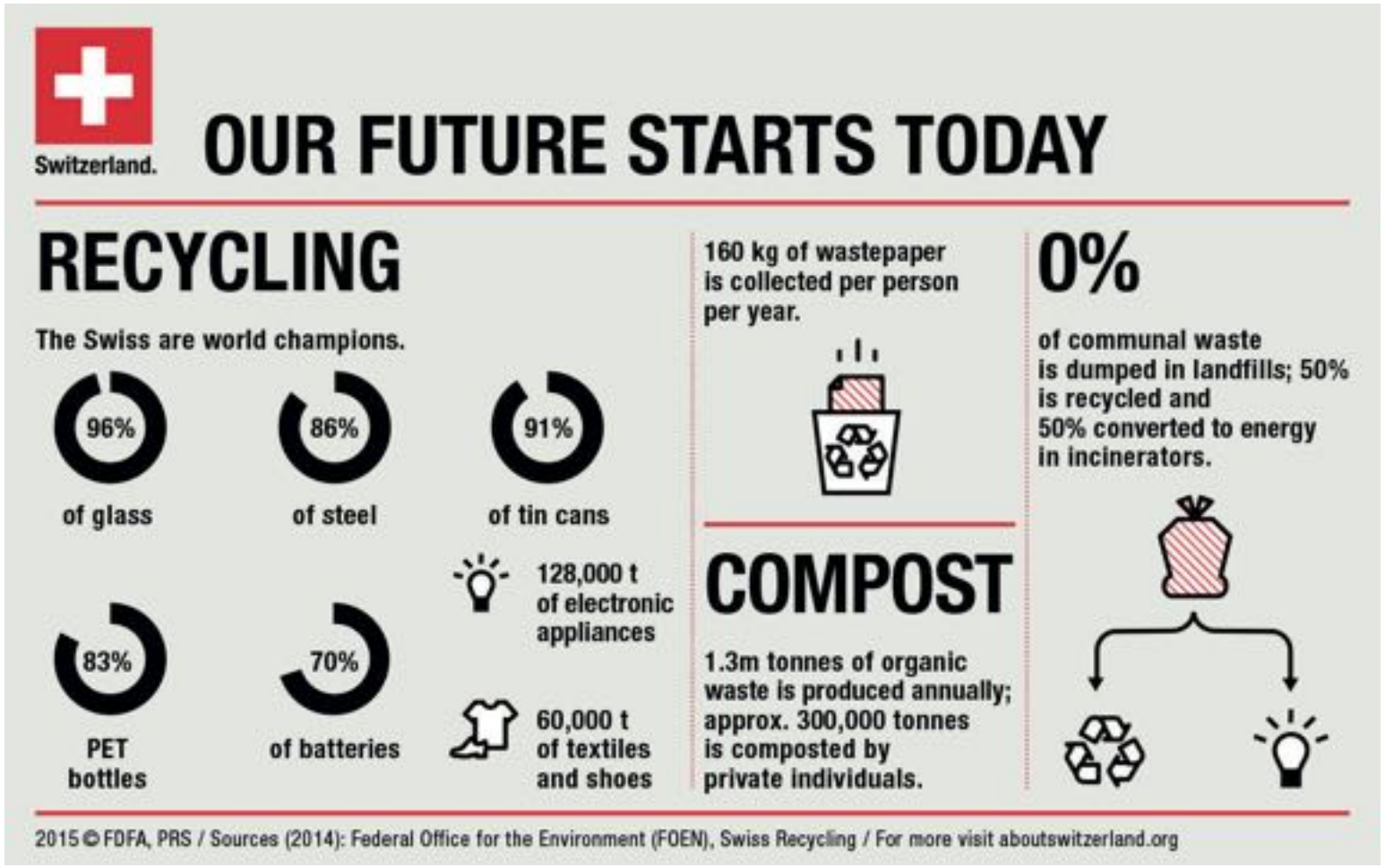
Waste management, as well as energy system, is strictly connected to the urban development density.

In low density areas, the energy balance is normally positive (production higher than consumption), due to the fact that there are many available surfaces for production (like rooftop), for a limited energy demand. At the contrary, in high density area, the energy balance is normally negative and the waste management needs more and more attention, according to the greater amount of waste, the bigger infrastructures, transportations, treatments stations and to the hygienical problems.

World's population reached 7 billion people in 2011 and is expected to grow to 9 billion by 2050. Nowadays Swiss population is around 8.6 million but it will probably reach 9.2 million people in 2030 and 10 million in 2050.

We need to think about alternative ways of living, combining the user and the environmental comfort, looking for good energy balance solutions with zero carbon emissions and a proper waste management system.

SWISS RECYCLING



ZERO WASTE

International Machines

Genève hosts two incredibly important international institutions: the United Nations and the Conseil Européen pour la Recherche Nucléaire. As of today these two institutions are almost perfectly inaccessible and do not offer much to the territory in which they are located. They are inaccessible in one case (UN), and inaccessible and unrecognizable in the other (CERN). They do not contribute to the city neither offering activities to perform nor providing figures to recognize. Their huge metropolitan potential is deliberately wasted for the sake of not endangering the (supposed) Swiss idyll.
CERN and UN are responsible for a large percentage of the Genève economy.
In 2017 the expenditure related to international organizations amounted to 6.189 billion CHF. Overall, the contribution of international organizations, NGOs and permanent missions to the Geneva canton's GDP is estimated at 9%.
CERN has a total budget from member states and additional contributors of 1130 million CHF (as per December 2016). About 50% of CERN's budget (about 500 MCHF) is invested into contracts with industries in its 21 member-state countries.
CERN consumes immense amount of energy, using 1.3 terawatt hours of electricity annually - that's enough power to fuel 300,000 homes for a year. At peak consumption, usually from May to mid-December, CERN uses about 200 megawatts of power, which is about a third of the amount of energy used for the entire Genève.
UN, on the contrary, has relatively limited energy needs and, between 2000 and 2017, it has reduced by 66% its water consumption and by 33% its electricity consumption.
Both UN and CERN heavily contribute to the traffic congestion of Geneva.
And yet UN and CERN do not produce urban figures, do not provide metropolitan energy, do not appear as elements of a landscape. They have consequences at metropolitan scale without having a precise image.
We assume that it is possible to reduce consumption and integrate energy production into the operations of such machines, and we assume that it is possible to expose – at least partially – the spectacles of the discussions of the delegates of the United Nations and of the most complex scientific instrument on the Earth, and to turn these events and technologies into a multiple, unique and sophisticated urban experience.
UN and CERN, no matter their current obscurity and humbleness, can produce an incredible city.

United Nations
Housed at the Palais des Nations, the United Nations Office at Genève serves as the representative office of the Secretary-General at Genève. A focal point for multilateral diplomacy, UNOG services more than 12,000 meetings every year, making it one of the busiest conference centres in the world. With more than 1,600 staff, it is the biggest duty station outside of United Nations headquarters in New York.
The Palais des Nations is made of several buildings that were built in several stages. The overall usable surface area is 153,500 square meters. There are some 2,800 offices and 34 conference rooms serviced by 5 km of corridors.
UNOG has been an architectural disaster since the refusal of Le Corbusier's projects (or Hannes Meyer's) in 1927.
As of today, the United Nations and the neighboring international institutions do not coordinate their territorial strategies. As a result, the "international quartier" in Genève evolves through a series of unrelated decisions, without an overall strategy and without profiting from the

UN AND THE INTERNATIONAL INSTITUTIONS

CERN LHC SURFACES COMPARAISONS

CERN

Genève

Milan

Rome

Paris

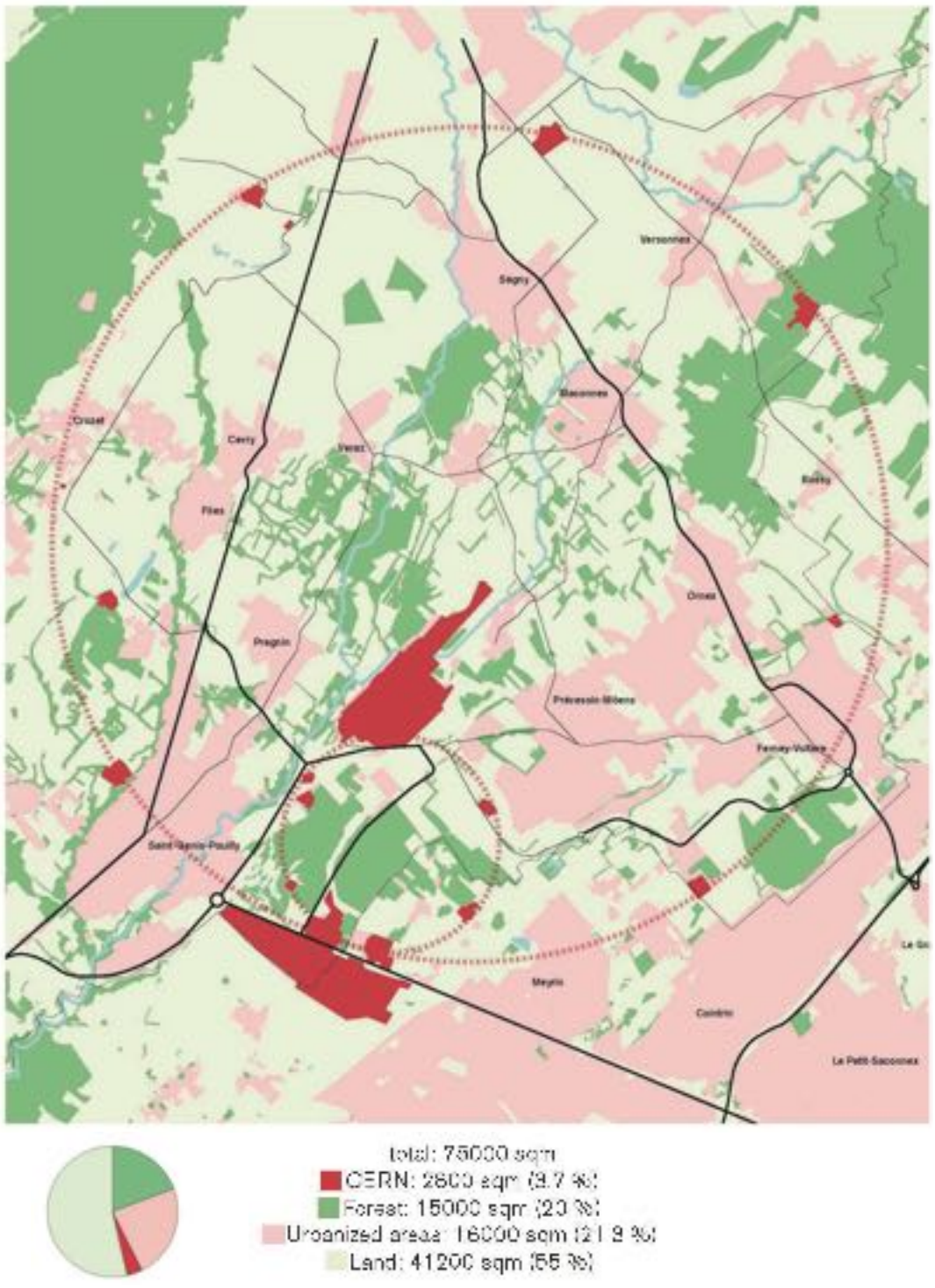
Manhattan

many possible synergies. This situation is mainly the consequence of the complex system of international governance of such institutions, that are based on the consensus of an extended international set of stakeholders. This sort of governance tends to ignore space-related and locally-related problems and specificities.

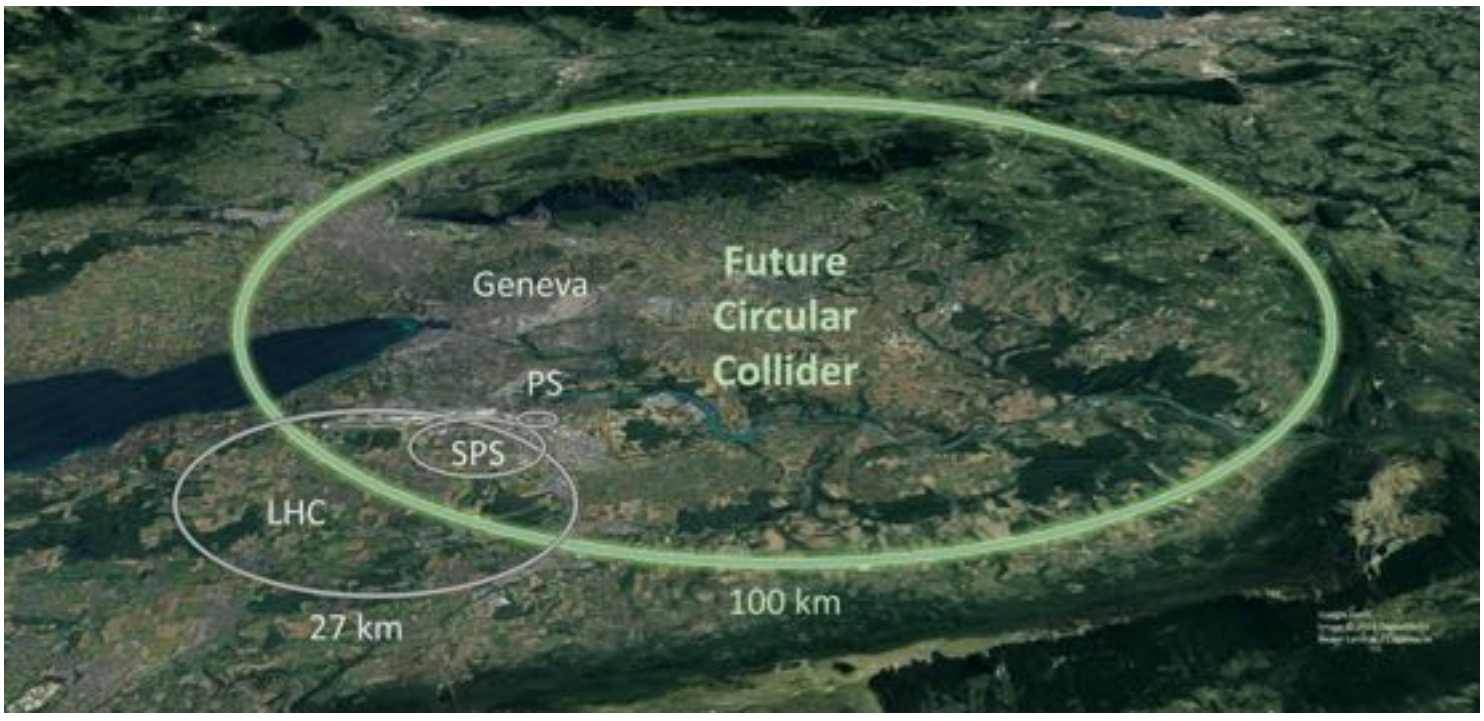
CERN

According to CERN's own website, CERN is the most complex scientific instrument on the Earth. Yet the most sophisticated technological jewel on the planet – from outside – looks like the shabbiest combination of run-down industrial sheds that can possibly be imagined.
CERN's workforce is stable at around 2 400 full-time-equivalent members of personnel, of which 16,000 scientists of more than 110 nationalities: about 70% of the world's particles physicists do research at CERN.
CERN LHC has 325 underground structures including 50 shafts,160 service galleries of a total length of 17 km and about 59 km of tunnel. While the machines hidden inside the tunnels and the sheds are impressively beautiful objects (and strangely baroque), the architecture of CERN is the definition of the visually unimpressive. CERN holds about 700 buildings of all sizes, covering a total footprint of 435 000 m2 and about 318 barracks (huts, modular buildings and maritime containers). No industry of a similar size shows as much disrespect for the territory in which it ended up being placed (possibly it is the moral status of such a scientific institution, per se good, that justifies its aesthetic misery).
The Large Hadron Collider (LHC) is a 27 Km long ring made of superconducting magnets. LHC is 75% on French territory and 25% on Swiss territory, and runs 100 m below ground. On the surface, LHC is invisible. The only visible objects belonging to this enormous underground infrastructure are the four particle detectors and the access points; Atlas, CMS, ALICE and LHCb. CERN's fenced sites (those in use) have a total surface area of 200 hectares – 80 in Switzerland and 120 in France – and a further 400 hectares have been made available by the Organization's two Host States.
The LHC runs inside the tunnel that was built to house CERN's previous large accelerator, the LEP, dismantled in 2000. Digging an underground tunnel proved to be the best option for a 27-km machine, since it was cheaper than acquiring land to build on at the surface and the impact on the landscape was minimised. In addition, the Earth's crust provides good shielding against radiations.
CERN is currently planning a new particle collider (Future Circular Collider, or FFC), to be realized by 2050. This new machine is – once again – an underground collider, this time with a circumference of around 100 Km. The southernmost tip of this circle will almost reach Annecy. The new FCC will be for 75% on French soil and 25% on Swiss soil (70% of its trajectory belongs to the Grand Genève area).
While the LHC collider was designed and realized not only as an underground installation, but as an entirely hidden infrastructure, completely indifferent to what happens in the landscape above it, it is possible to consider the impact of the new FCC on the Genève region from the beginning and to coordinate the evolution of the machine with that of the territory. At last, the only institution on earth exploring the origins of the universe, could develop a relationship with its surrounding territory.

LHC RING SURFACE



FCC FUTURE CIRCULAR COLLIDER




Vision

Grand Genève - Strategy of intervention

ECOLOGIC URBAN TRANSITION
350.000 new inhabitants are expected to live in Grand Genève by 2050. They will need new houses, new schools, new public spaces, new infrastructure. And yet this growth should not waste agricultural soils, should not compromise the environment, should not increase emissions. All these territorial challenges are linked to a main question, namely: how to guarantee a sustainable development for a territory that wants to increase its position and leadership at a global level, how to combine growth and preservation of the environment?

Grand Genève needs to be seen as an experimental field that could generate knowledge at an international scale. The metropolitan region should address the ecological transition by imagining, developing and testing new solutions, and so becoming the model of a new form of metropolis, ready to face the great challenges of the near future of Planet Earth.

The project proposes a set of tools, operating both at the infrastructural and the architectural scale. They correspond to a set of policies that can be implemented together or separately. All these tools target the carbon positive environment goal and at the same time provide space for social and economic growth.
The transition will be inspired by a few main policies:

Densification of living and working spaces will be concentrated in a few strategic locations, defining eleven new poles distributed along the perimeter of the FCC.

Promoting new housing and working models and giving up low-density lifestyles is a long-term process which requires a deep lifestyle change. High-quality housing construction integrated with nature is the answer.

Multifunctional concentration of services, energy and mobility interchange on the major nodes along the FCC orbit. The demand for energy and the demand of local mobility will be reduced.

New mobility and new working modalities (places and services) both for local inhabitants and for global city users is a trend already started; agile work based on smart services and ICT tele-conferencing will bring together increase of performance and quality of life improvement.

Rethinking the capillarity and sustainability for the logistics of goods in cities: new forms of distribution and facilities at the metropolitan and local scale (from big hubs, to last mile infrastructure).

Zero soil sealing - urban settlement will be organized around the new poles, promoting urban densification and re-naturalization strategies.

Enhancing the ecological corridors and the biodiversity – New policies of urban forestry policies and new strategies for the timber production chain as well as on a different approach to landscape and mobility.

Circular wood economy and productive forest landscape will redirect the construction industry to wood technologies, and the availability of raw material will regulate the growth of new settlement in the long-term.

Zero waste - All goods and materials will be managed locally without generating combustion. The use of biodegradable materials and recycling of non-renewable matter will be the strategy.

SALÈVE - GREEN BIODIVERSE PROTECTED CORE
The Salève is a fragment of Jura extending form the valley of the Arve to the Annecy region. The mountain consists essentially of limestones which were deposited in shallow and tropical seas during the Jurassic and Cretaceous periods (between 150 and 120 million years). Emerging from the soft lands of the Etrembières region, a first bastion, the Petit-Salève, rises up to 898 m. Then, separated by the Monnetier valley, the chain picks up altitude and reaches its highest point in Les Pitons at 1375 m.

Inside the landscape of Grand Genève, the Salève plays a special role. Although it does not belong to Swiss territory, it has long been part of the imagination and practices of the Genèvois: its rocks, its forests, its pastures and villages, crystallize their Alpine dreams. The Salève is a "urban" mountain: following ethnologist B. Crettaz, it is possible to place this mountain in the category of "city mountains" which, from the 18th century onwards, were the object of a real craze on the part of a new romantic society in search of nature (the creature of Mary Shelley's Frankenstein shows his skills in climbing the Salève). The metropolitan dimension of the mountain strangely coincides with its wealth of fauna and flora. In the middle of the riparian forest is a stream and on its banks live the riparian forest fauna, in particular insects but also many others species such as the fly, mosquito, dragonfly, magpie and crow. The riparian forest also serves as crossing point for animals like foxes, roes, bats, wolves, chamois, martens, badgers, boars, weasels, hares, deers and peregrin falcons.

A LANDSCAPE FOR A METROPOLIS WITH A MOUNTAIN AT ITS CENTRE
The scale of Grand Genève is such that our aim cannot be to design a specific figure but rather to suggest a process, to implement a series of actions and policies in order to increase the intensity of the landscape, notably using green and blue continuums.
We do not propose to develop a vast rigid garden. Since almost all the land correspond to private property, we should consider consolidating a constellation of small places and paths in order to open views on the park entity, to give readability, access and uses to the citizens.

The Swiss landscape is already very protected. The project starts form this condition and suggest that in the park, it is possible to go further into detail, to give a general gardened aspect, but only thanks to the juxtaposition of individual practices, helping horticulture and less intensive farming with small interventions along the paths.

The ring forest at the borders of the FCC perimeter will not have a strong, recognizable form. It will not be visible from the sky. Landscape is about amplifying existing practices through a series of actions that generates a physical reality in time. Thus, defining actions is the basis for a credible strategy.

The linear park along the diameter of the LHC does have a reality at the territorial scale. Moreover, it is a support for exchange and experimentation of what could actually be implemented in different locations of the Grand Genève area, around every new urban settlement, in order to organize the interface between those new cores and their environment.

A CONSTELLATION OF NEW METROPOLITAN CENTRES
The constellation of settlements of the new Grand Genève will be made of medium and small-size urban nuclei, gravitating around the two gravitational anchors of Genève and Annecy. The constellation has the Salève as its centre. The new city defines a Zero Emission Zone; at the borders of this zone, intermodal hubs allow transport interchange. A new high speed grid will allow tele-working and contribute to the reduction of transportation needs inside the Zero Emission Zone.

The new settlements will grow within defined perimeters according to a principle of energy self-sufficiency and will use wood produced by close-to-nature selvicolture in the French, Swiss and Italian Alps as a building material. Each settlement is positioned inside of a 10 Km-wide zone spanning across the perimeter of the new FCC. As such, each settlement can use the energy distributed along the FCC tunnel and can profit form the updated infrastructure of public transport that is pragmatically developed along this figure.

As activators of the new centres, a series of open schools are implanted. The new public schools, open all hours of the day, every day of the year, for all ages, will form the nodes of a single system of epicenters of collective life. As such, the new schools will embody – at the very basic level of primary education and of neighborhood social life – an idea of a transnational metropolis, whose primary resource is the openness to the world of cultural and ethnic differences, and so providing a concrete example - as the first metropolis in the world - that concept of *Mondialitè*, which Eduard Glissant proposed as the future of urban coexistence.

STRATEGIES FOR FORESTS AND CIRCULAR WOOD ECONOMY

Vegetation, and forestation in particular, is the strongest regulatory machine in place. It can be expanded over the region in order to produce a the green-blue-grey nexus, and so improving:

Water management, through water retention, sustainable urban drainage systems and depaving strategies;

Climate mitigation, through evapotranspiration and shadowing temperatures can be controlled in open spaces and minor effects on indoor energy demand can be achieved;

Air purification, through CO2 absorption and release. Forests are a MegaStore of carbon, as trees absorb CO2 from the atmosphere through photosynthesis, fixing it as carbon in their organic matter and releasing the remaining oxygen back into the atmosphere.

The quantity of timber that is necessary in order to satisfy the whole housing demand can be calculated assuming that a 100 m^2 home host an average of 3 inhabitants. The prevision of growth is of +350.000 inhabitants in 2040, therefore there will be a need for +120.000 new housing units. In order to meet the housing demand of +350.000 new inhabitants, and considering an average of 45 m^3 of timber per housing unit, we need a total of ca. 5.400.000 m^3 of construction timber.

At a transnational level Gran Genève will define agreements with the Swiss and French forestry companies in order to secure the possibility of acquiring all the timber necessary for the realization of the interventions for the first years of the project. The woodworking will be centralized at a regional level; the new sawmills will be placed at the borders of the Zero Emission Zone, in order to establish a short chain between harvesting activities, places of manufacturing and places of utilization. Therefore, also the time and energy needed for transportation will be reduced.

The products of this process are used for the construction of buildings within the region or for the energy retrofitting and volumetric expansion of the existing construction stock. In fact, thanks to its insulating, mechanical, and manufacturability properties, wood is useful for multiple purposes: structural applications (Mass/Laminated-timber construction); finishings (flooring, window frames and facade panels) and insulation (in the form of panels or insulating pulp).

At the end of the life-span of the timber buildings, the deconstructed wooden components will find new reuse and recycling possibilities within Great Genève. Effective recycling or reuse will be allowed

by the implementation of digital and physical solutions. A virtuous cycle is established that enhances the natural assets of Grand Genève, dramatically reducing carbon emissions while increasing the forestry within the region and generating new economies. By letting the wood go through this closed-loop, new job and business opportunities are created: carpenters, manufacturers, recyclers, and so on.

MOBILITY TOWARDS A ZERO EMISSION ZONE

Grand Genève will be the first and largest Zero Emission Zone of the world. It will be served by a Mobility Loop, which is a zero emission, electrified, smart and connected system. The initial phases of implementation of the Zero Emission Zone in the project includes payment charges while in the final phase of implementation there would be no exception or payment; all vehicles including personal, public transport, shared mobility and urban freight will be electric. Park and ride stations will provide the possibility for changing to other electric modes both public transport and on-demand services for moving within or pass through the Grand Genève Zero Emission Zone.

The new infrastructure is a system of transport networks that will connect the densified polarities within the circular zone around the FCC perimeter. The new system is a mobility loop, comprising a seamless network of road and rail, that are pragmatically developed starting from the existing network. The system is made of two layers. The first is composed of the existing and planned railway system, allowing for an orbital access to the new centralities. The second is a seamless electric ring road, dedicated for e-vehicles only, connecting all new centralities through highways, and primary and secondary roads. In order to minimize the intervention costs and pollutions, the proposal uses the existing infrastructure where possible.

We propose to update the current road infrastructure as a new electric road that works as a wireless charging station to transfer electricity from lane to vehicle batteries. Charging pads that are built into the road are using the electricity from the energy distributer connected to the Future Circular Collider (FCC) and e-vehicle charging stations will be available at strategic locations within the loop. In addition, the entire loop will become smart and connected. Smart roads are digital networks connecting drivers to the internet, supporting driverless vehicle and providing true connectivity between smart cars and smart cities. The sensors in the roads will detect vehicular traffic and communicate valuable data to emergency services, other vehicles and traffic control centers.

AN ECLETIC ENERGY STRATEGY

All new buildings inside of Grand Genève will target zero carbon emissions on-site, calling for a maximized passive performance. LCCA (life cycle cost analysis) will be mandatory to decide whether replace or refurbish existing buildings. Also, Aiming to an electrical energy reduction logic, a cap (BUDGET) of electricity (plug-loads) per person is set. Higher energy rates will be applied for whom do not respect the cap.

Our energy strategy will not be radical, neither unilateral. We propose an articulated and eclectic strategy that includes several possible solutions. Low-density developments use more land but are also able to produce more energy than they need. Hence, low-density developments trade energy for land with the denser developments. And the other way around. New way of living (e.g. co-housing) will be used to make more efficient the use of land, hence, energy.

Energy will be produced only from renewable resources and on site, through centralized or decentralized stations, depending on the developments density. Dense developments will have a centralized system, and thermal energy will be locally distributed (district heating), whereas low-density developments will have decentralized systems which make the low/medium density

developments independent. Roof and facade surfaces will be used to generate energy from Photovoltaic and Solar Thermal panels, while a new Wind turbines field can be located on the upper part of the central mountain area, using as much wind intensity as possible.

All these systems will be connected to a smart grid, where energy is constantly moving, in line with the instantaneous energy demand, enhancing the load management. The FCC underground tunnel is used as high voltage transmission to connect areas with different densities and to move energy between them.

In order to reach the carbon neutrality on site, a solid storage system is required, for both thermal and electrical energy. Energy storage systems allow the seasonal balance between energy production and demand. The system generates a surplus of energy during summer season, taking advantages of the greater availability of solar radiations; the extra energy is stored in a combination of several systems, according to the different needs (thermal and electrical), located homogeneously along the 100 km long ring and its buffer area.
In Switzerland, 60% of energy is currently produced through Hydroelectric power. The easiest storage system combined with this production is pumped hydroelectricity storage.

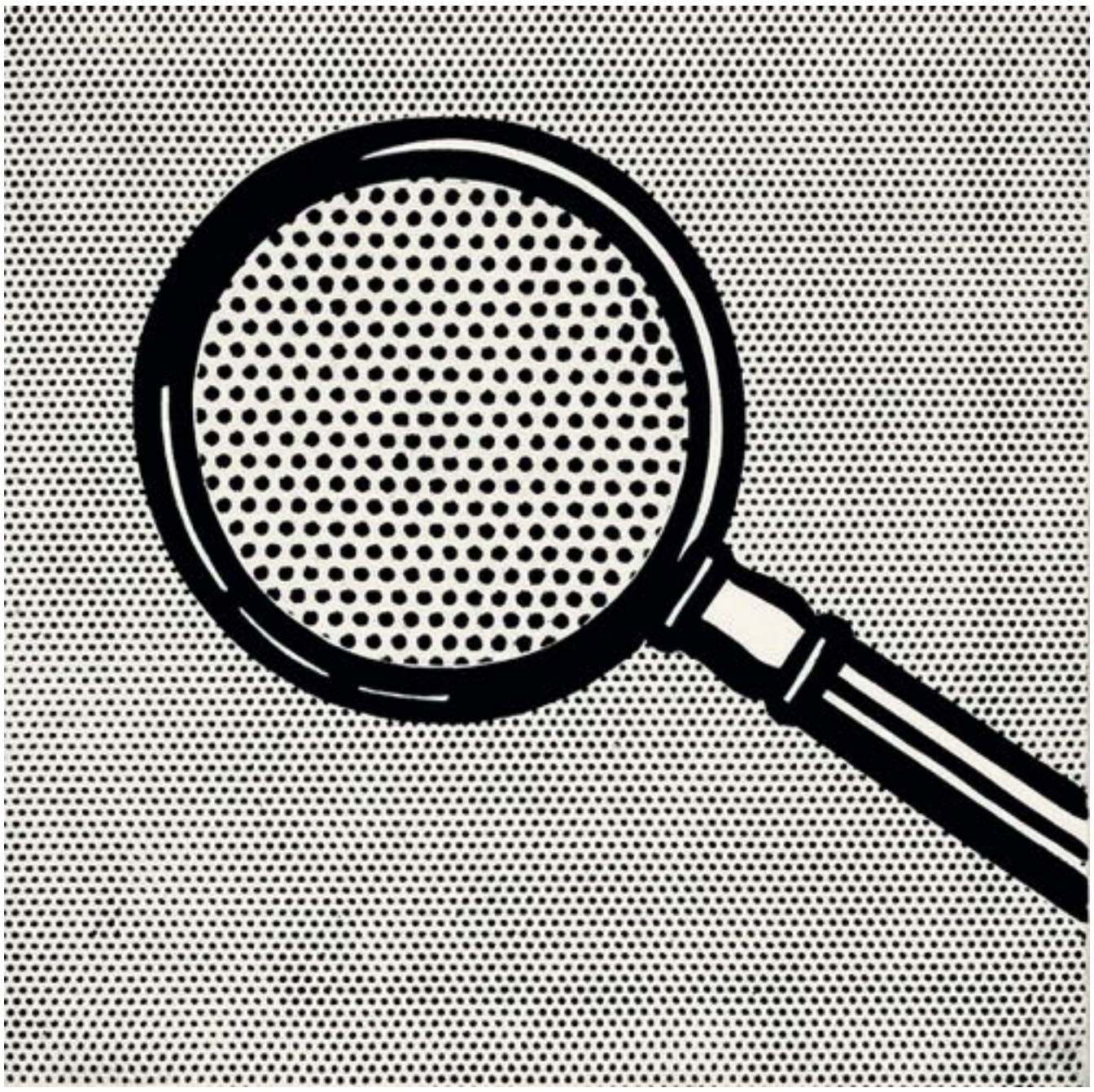
A dedicated storage system is exclusively assigned to CERN, in order to be able to trade energy based on price and avoid peaks demands while operating the FCC particle collider. The power to gas storage system is a chemical process that transforms firstly water in hydrogen, and then burns it through a co-generator, producing electricity and heating.

On the other hand, thermal energy can be stored through the lakes or using geothermal systems. Ground temperature as well as deep water temperature, has mainly constant values. During winter, the system can be used as preliminary pre-heating for residential and offices areas, while during summer it can absorb extracted heating to cool down buildings.

GOVERNANCE FOR A MULTINATIONAL ECOLOGICAL METROPOLIS
Starting from the Steering Committee of the Transnational Agglomeration Project, a planning initiative for Gran Genève must see the different territories concerned as the main protagonists. *The General States of the Grand Genève Transnational Metropolitan Constellation* will be called. Experimentation for new sustainable cities is not just technological or cultural, but political: new modes of governance need to be explored to face the challenges of the ecological transition. (Grand) Genève must go back to its amazing history of political experiments, and become once again a laboratory of collective decision-making.

The next and decisive step following the General States will be the elaboration of an overall territorial strategy, built on the priorities agreed in the discussion. The strategy may then be elaborated by the Steering Committee or by a specifically identified authority (Agency or Organisation), through an intense consultation process with the local governments' members and major stakeholders of Grand Genève Macro-Region.

The Grand Genève Macro-Region, through its territorial strategy and action plans, will be able to join Transnational Cooperation Programs financed by the European Regional Development Fund (ERDF) under objective of the "European territorial cooperation" of the cohesion policy. For the 2021-2027 programming cycle, 9.5 billion EUR are earmarked for transnational cooperation and institutional cooperation, contributing to the development of common services of public interest.



Roy Lichtenstein, Magnifying Glass, 1963

Ecologic urban transition: 2030-40-50. Defining transition landscapes.

Eugenio Morello

Why a transition project?
We want the idea of transition to be fully integrated in the planning for Grand Genève. The whole vision is shaped by spatial and temporal forces and flows occurring upon the proposed eco-system.

Achieving a carbon positive environment is an ambitious target. From a technological point of view, the target is feasible with solutions already available today. The challenge is rather societal, in terms of
acquisition of financial resources and their fair distribution over the territory.

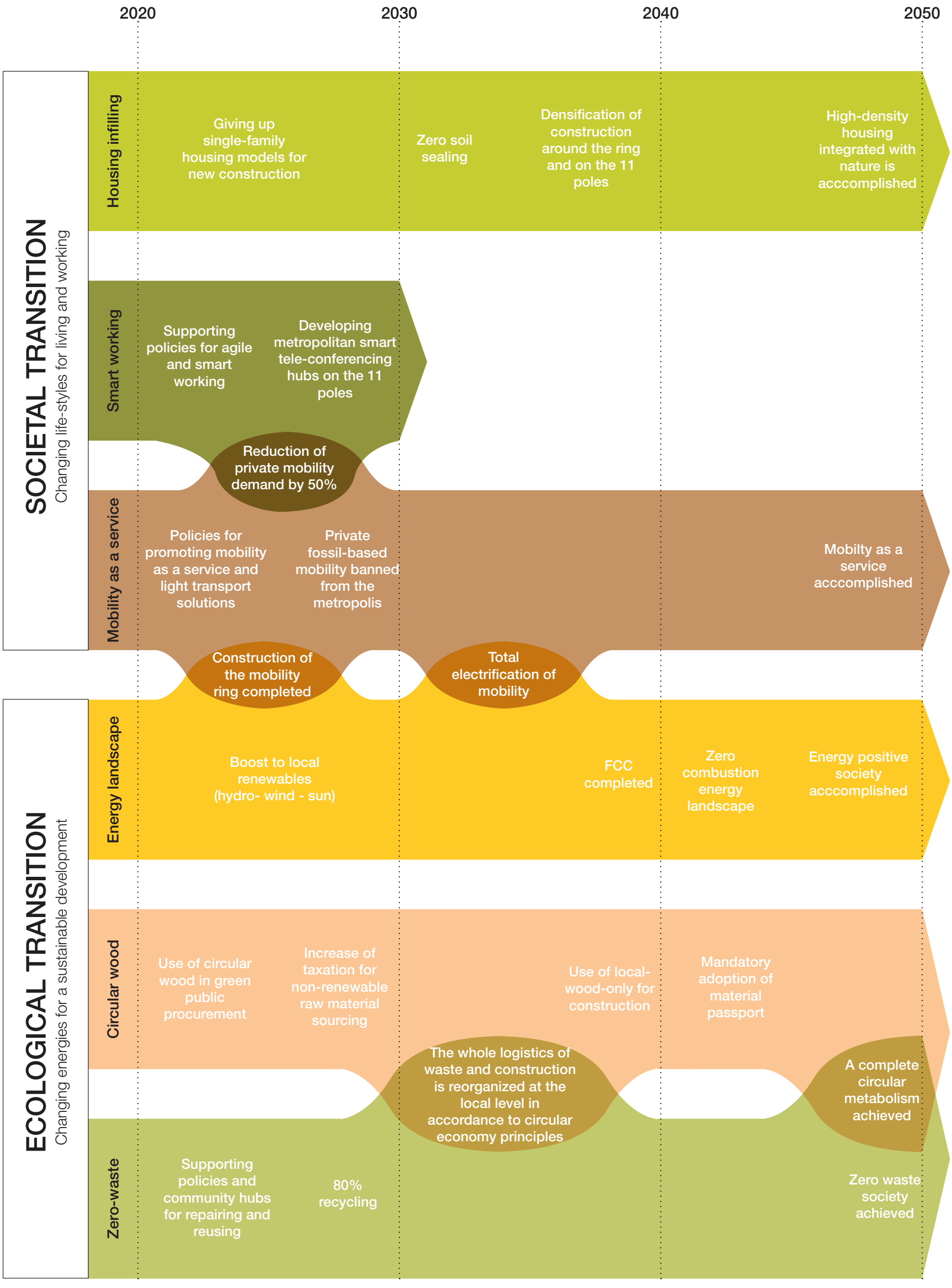
Radical change cannot happen in the form of disruptive events, especially if this change deeply impacts on people and nature. "No one has to be left behind" is the first slogan policy makers use as a premise towards a just and accessible society in the future. On the other hand, the pace of transition is put under pressure because of the global climate urgency, which calls for faster response.

Defining Transition Landscapes
According to the manifesto, concepts, masterplan and progress milestones that consolidate the ambitious vision of "1000 et Une Machines" by 2050, an approach to ecologic urban transition is proposed here.
Territorial challenges are many, but all linked to a main question, namely: how to guarantee a sustainable development trajectory for a territory that wants to increase its positioning and leadership at a global level. "1000 et Une Machines" attempts to respond to transitional challenges as follows.

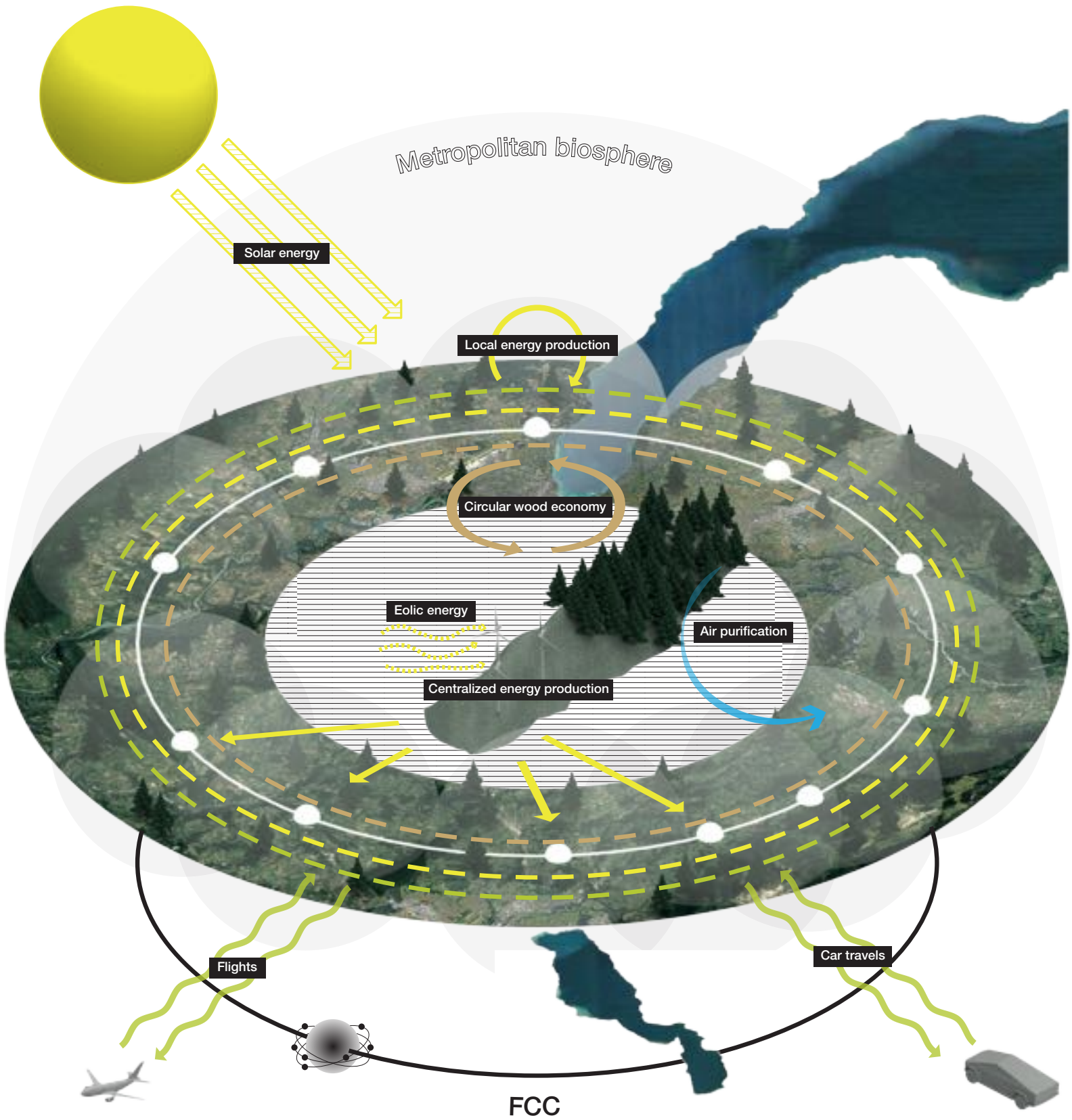
SOCIETY		
Challenge	*Solution*	*Transition*
Demographic pressure 1 350 000 inhabitants are expected to be hosted in the future metropoles.	**Urban Infilling** Densification of living and working spaces along the 11 poles on the PDC.	*Societal long term transition* Promoting new housing and working models and giving up low density life styles is a long term process which requires a deep life style change. High quality housing construction integrated with nature is the answer.
	Augmented urban poles Multifunctional concentration of services, energy and mobility interchange on the major nodes along the PDC orbit. The demand of local mobility will be reduced.	*Societal mid term transition* Offering new mobility and working modalities (places and services) both for local inhabitants and for global city users as a trend already started; agile work based on smart services and ICT tele-conferencing, mobility as a service, bring together increase of performances and quality of life improvement.
Increment of city users More global mobility and connections due to the role.		
	Smart logistics for the delivery of goods Rethinking the capillarity and sustainability for the logistics of goods in cities: new forms of distribution and facilities at the metropolitan and local scale (from big hubs, to last mile infrastructure).	*Societal short term transition* Behavioural change of consumerism is already happening. New planning capacity to host this change at the local 'level' is needed.

ENVIRONMENT, ENERGY AND CLIMATE		
Challenge	*Solution*	*Transition*
Resource depletion and increasing entropy due to the linear urban metabolism	**Zero Resources' depletion through complete circular metabolism** The sustainable deployment of natural resources to be mainstreamed in all societal dynamics; in particular:	
	Circular wood economy and productive forest landscape based on the wood cycle enabled by the forestation program; it will redirect the *construction industry* to wood technologies, and the availability of raw material will regulate the programmatic growth of new settlement in the long-term. Re-organizing locally the cycle and logistics of construction waste: collection, sorting, reusing, recycling, upcycling and regenerating (3D printing, fab-labs).	*Environmental mid-term transition* Natural growth in forestation programs to produce wood requires time to produce a virtuous cycle. *Societal mid-term transition* The organization of an economic chain based on industrial ecology principles is hard to implement and requires specific incentives and policies. A transition from traditional construction industry to local-based wood industry requires specific action in terms of knowledge building (education of the whole chain), capacity building (production)
	Zero soil sealing balance The project proposes the reorganization of urban settlement around the poles, promoting urban densification and de-naturalization strategies.	*Societal short term transition* Stop soil sealing is a top-down political will and economy measure. Hence, it could be a rapid change in theory, or a never happening change. *Environmental long-term transition* Reclamation and regeneration of brownfields is a long term natural process.
	Zero waste All goods and materials to be managed locally without generating combustion. The use of biodegradable materials and recycling of non-renewable matter will be the strategy.	*Societal long-term transition* This transition highly depends on global trend of consumerism and trade. Behavioural change is also required.
Increase of meteorological hazards - Higher temperatures will affect water cycle due to the melting of glaciers and impact on human comfort in summer. - More intense precipitations	**A territorial machine enabling man and nature co-evolution** Vegetation, and in particular forestation, is intended as the strongest regulatory machine in place, to be diffused over the region for creating the green blue grey nexus and improving: - *water management*, through water retention, sustainable urban drainage systems and depaving strategies - *climate mitigation*, through evapotranspiration and shadowing temperatures can be controlled in open spaces and minor effects on indoor energy demand can be achieved. - *air purification*, through CO_2 absorption and release.	*Societal and term transition* *Environmental long term transition* Easy to implement from a decision-making perspective, forestation requires long term for implementation of planning and construction and growth of vegetation. Effects will be in the long term.
Impoverishment of air quality due to demographic pressure and economy growth		

TRANSITION TIMELINE



GRAND GENÈVE AS AN ORBITAL SYSTEM



Energy
People
Resouces
Air

Wood constructions

with Fabio Salbitano and Eugenio Morello

Forests and their Wood as a MegaStore of carbon
Trees absorb CO2 from the atmosphere through photosynthesis, fixing it as carbon in their organic matter and releasing the remaining oxygen back into the atmosphere (see diagram 1).
As shown in the diagram 2, without management, a forest reaches a state of carbon equilibrium at around 165 tC/ha, where growth is balanced by natural losses.

If the forest is managed, the harvested timber will be used to create added-value timber products which continue to store carbon. Meanwhile, more trees are planted and the carbon sink effect of the forest is maintained.
Wood products are carbon stores, rather than carbon sinks. Their carbon continues to be stored through their lifecycle: use, re-use, recycling and recovering by burning or decay. Carbon accounts for about 49% of the mass of a wood product.
After wood products have been used in one application, they can often be reused or recycled, then eventually burnt or left to decay in landfills, while the stored CO2 is returned to the atmosphere. The longer the life of these products, the greater the benefit to the environment.
According to recent estimates, the average life of wood products varies from 2 months for newspapers to 75 years for structural timber (see diagram 3).

Substitution for other materials
While the carbon store effect of wood products helps keep CO2 out of the atmosphere, even greater carbon gain comes from the substitution effect of using wood in place of other, more fossil fuel-intensive, materials. Considerable CO2 savings can be made by using wood where appropriate instead of other materials. On average, the production of a cubic metre of wood creates around 1,1 tonnes less CO2 emissions than the production of an equivalent amount of fossil fuel-intensive materials, such as steel, concrete or plastics. This amount, coupled to the 0,9 tonne of CO2 stored in the wood, means that every cubic metre of wood substituting for fossil fuel-intensive materials saves a total of roughly 2 tonnes of CO2 (see diagram 4).

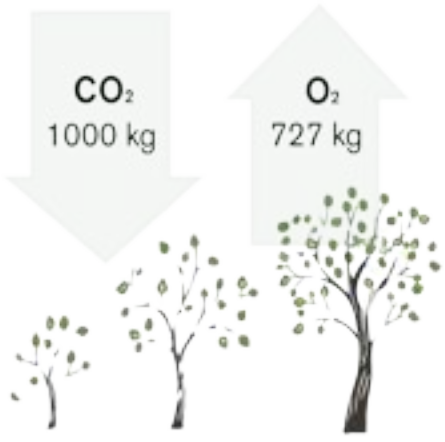
1. TREES PHOTOSYNTESIS

On average a typical tree absorbs, through photosynthesis, the equivalent of 1 tonne of carbon dioxide for every cubic metre's growth, while producing the equivalent of 727kg of oxygen.

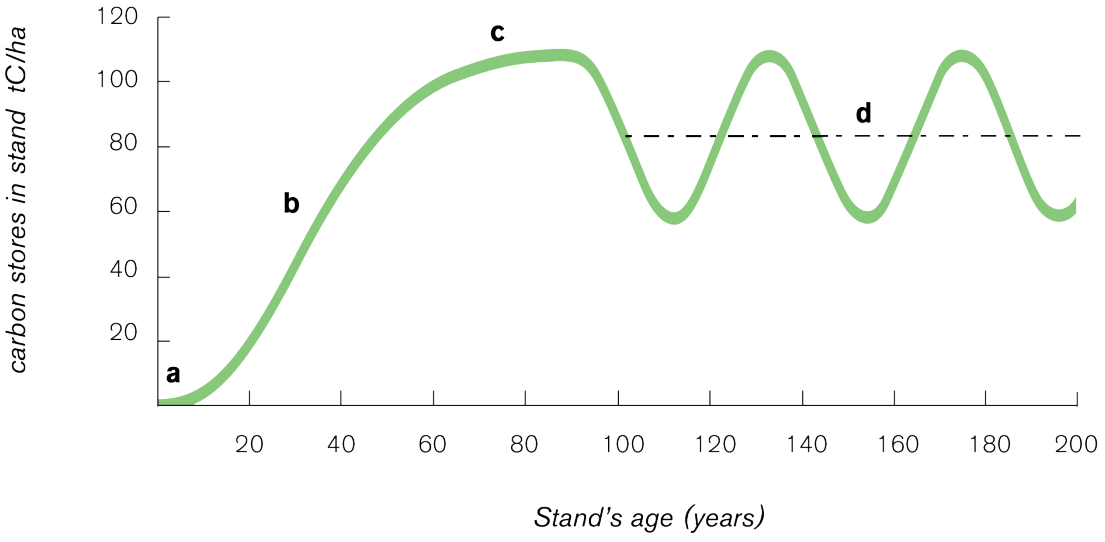
ECCM (Edinburgh Centre for Carbon Management)

Photosynthesis:

$6\,[\,CO_2 + H_2O] \longrightarrow C_6H_{12}O_6 + 6\,O_2$



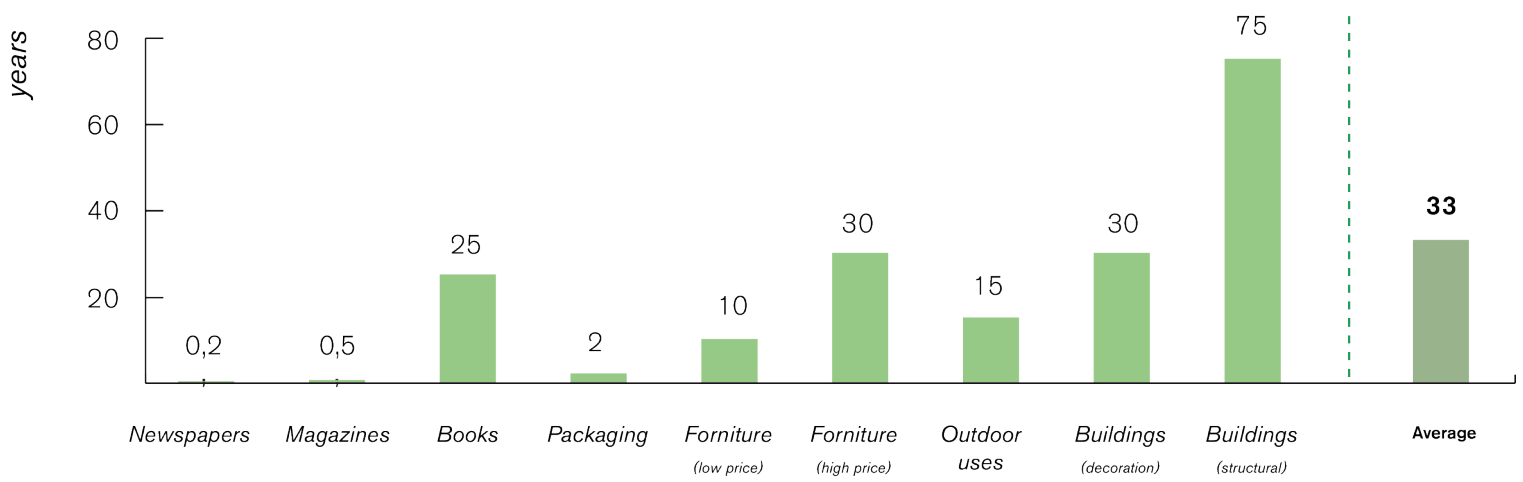
2. CARBON ACCUMULATION IN A STAND OF TREES



a. *establishment phase*
b. *full-vigor phase*
c. *mature phase*
d. *long term equilibrium phase*

Nabuurs, G.J., et al., 2002

3. AVERAGE LIFE TIME OF WOOD PRODUCTS



Dr A Frühwald, University of Hamburg, Centre for Wood Science and Technology, October 2002

4. TOT CO_2 SAVING FROM COMBINED CARBON STORE AND SUBSTITUTION EFFECT

Dr A Frühwald, University of Hamburg, Centre for Wood Science and Technology, October 2002

Previsions indicates that in the area of Grand Genève there will be an increase of + 350.000 inhabitants by 2040. Therefore, new constructions will be required in the region to meet the increasing housing demand.

Concrete is responsible alone for 4-8% of the world's carbon dioxide emissions: because of the great amount of energy required, the heat generated and the chemical processes needed, 1 tonne of CO_2 is released for every tonne of cement (the concrete's main component) manufactured.

Concrete production increased by 400% in the last thirty years[1]. Second only to water, concrete is the most widely used substance on earth.

Timber structures would allow us to draw carbon from the atmosphere and store it in the new housing demand. Timber construction embodies less grey energy and generates fewer greenhouse gases than conventional construction techniques: each additional cubic meter of wood saves one T of CO_2. If trees are transformed into sustainable wood products like houses or interior fittings, the carbon of CO_2 is also fixed during decades or centuries.

Not only does wood remove more CO_2 from the atmosphere than it adds through manufacturing, but by replacing carbon-intensive materials such as concrete or steel it doubles its contribution to lowering CO_2. Moreover, structures using wooden materials also tend to be quicker and easier to build, therefore reducing labour costs, transport fuel, on-site energy use, and the health risks related to dust generation by cast-in-place concrete [2]. Furthermore, since a timber building weighs 20% of a concrete building, the gravitational load is vastly reduced[3].

The amount of wood necessary to satisfy the whole housing demand can be calculated assuming that a 100 m^2 home host an average of 3 inhabitants.
The prevision of growth is of +350.000 inhabitants in 2040, therefore there will be a need for +120.000 new housing units.
To realize a 100 m^2 wooden housing unit in x-lam, are necessary about 48 m^3 of wood.
To realize a 100 m^2 wooden housing unit in a light frame, are needed about 40 m^3 of wood.

To meet the housing demand of +350.000 new inhabitants, considering an average of 45 m^3 of wood per housing unit, we need a total of 5.400.000 m^3 of construction wood.

The new Swiss emissions law makes it possible to actively take into consideration the ability of construction wood to store CO_2: every cubic meter of wood stores 1t of Co_2[4] , consequently with our intervention 5.400.000 t CO_2 are stored.
The average CO_2 emissions in Switzerland are 14 t/year/person[5] , therefore in the case of 350.000 new residents, the added emissions are equal to 4.900.000 t CO_2/year.

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[1] https://www.theguardian.com/cities/2019/feb/25/concrete-is-tipping-us-into-climate-catastrophe-its-payback-time-cement-tax

[2] https://www.hse.gov.uk/construction/healthrisks/cancer-and-construction/silica-dust.htm

[3] https://www.bbc.com/future/article/20190717-climate-change-wooden-architecture-concrete-global-warming

[4] *Bois: une matière première renouvelable avec du potentiel*. AEESuisse Organization faîtière de l'économie des énergies renouvelables et de l'efficacité énergétique. (2015)

[5] https://lenews.ch/2018/02/20/high-swiss-emissions-the-impact-of-imports-and-population-growth/

5.400.000 m^3 of wood, considering a growing stock of 350 m^3/ha, correspond to a forest of 15,428 ha.

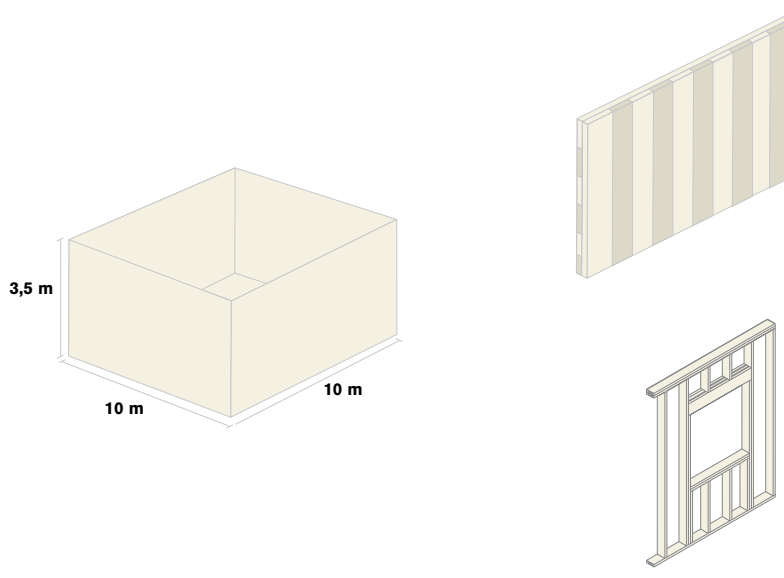
The 67% of Swiss forest is highly dominated by conifers, equal to 282.740.000 m3 of wood.
Considering that 50% of the cut wood is usable for construction, Switzerland has a potential of 141,370,000 m^3 of coniferous wood available for construction.

Since 2006, the surface of Swiss forests has grown by 4000 ha/year, equal to + 0.3%/year (n.b: by proportion the forests of Greater Geneva are growing by 270 ha/year.). The growth is observed on all mountain areas where mountain farmers have given up on managing alpine pastures and areas covered with unproductive vegetation.

The area of the forests of Grand Genève is 90,200 ha (41% of the total area).
The wood of the Geneva forests is used just by 10% for construction - the goal of the canton is to achieve at least a of 50% of timber in 50 years.
Today there is a great demand but there is not enough wood: the realization of 3 wooden constructions required all Geneva's wood production of the year.
The production of construction timber in the canton of Geneva is currently of 3500m^3/year [6] .

[6] Interview to Fabien Wegmüller, head of ForêtGenève

TIMBER QUANTITIES FOR A HOUSE



The amount of wood necessary to satisfy the whole housing demand can be calculated assuming that a 100 m2 home host an average of 3 inhabitants.
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To realize a 100 m2 wooden housing unit in x-lam, are necessary about 48 m3 of wood.

To realize a 100 m2 wooden housing unit in a light frame, are needed about 40 m3 of wood.

The strategies for wood provision

with Fabio Salbitano and Eugenio Morello

At a transnational level:
Greater Geneva will make agreements with the Swiss and French forestry companies in order to have the guarantee of acquiring all the wood material necessary for the realization of the interventions for the first years of the project.

At regional level:
The timber production chain will progressively become independent, shifting from Swiss and French sawn timber to Grand Genève wood, thanks to:

1) Compensation through urban forestry programs (with a double calculation because of the different issues given by the consume (net CO_2 stocking and carbon cycle) and inhabitants (i.e. quality of life of the people living in the new settlements):
- Urban nucleus: urban forestry
- Agricultural areas: agroforestry

Agriculture faces the challenge of producing more to meet the needs of the growing population while conserving natural resources and improving the state of the environment. Trees in agricultural landscapes provide important benefits for the environment. Nevertheless, they are disappearing from cultivated land due to economic and operational reasons. In modern agroforestry systems, trees are planted in rows on agricultural land in order to facilitate mechanical operations.
The economic and ecological potential of modern agroforestry systems in Switzerland was examined in some studies and the results show an up to 30 % higher productivity (per unit area) of agroforestry systems compared to monocultures. In the long term, agroforestry systems can become profitable. On fertile arable land, they may reduce soil erosion by 78 % and nitrate leaching by 46 % as well as sequester up to 133 tons of carbon in 60 years[1]. However, many farmers are sceptical of starting to plant more trees in the countryside. The possibilities of developing agroforestry systems and the fact that they can be productive and become profitable in the long term deserve to be better appreciated. First of all, there is a need to arouse interest in the production of timber, and with the prevision of +120.000 housing units, Grand Genève will very much need it. Second of all, agroforestry could be used as a way to do compensation with respect to future urban growth.

2) Strenghtening of the forestry in the next 60/70 years by growing *planted forests* which are intensively managed wood arboriculture plants that follow naturalistic forestry criteria suited to the ecological processes of the woods, in order to give continuity to the swiss policy of selective cutting and natural regeneration of the forest.
The *planted forests* are mainly composed of oaks and conifers (non-native), all of the same age and there is a regular spacing between trees.
It will be necessary to think of a legislative status different from the current one that defines a multifunctional program of forests: recreational, productive and of environmental benefit.

3) In addition, productive forests will be promoted on waiting land (mostly brownfields) and unused agricultural land. *Short rotation forestry* is based on the planting of rapid growing species to be cut in 3 or 4 years to produce biomass for wood construction.

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[1] *Agroforesterie en Suisse*. Alexandra Kaeser, Firesenai Sereke, Dunja Dux et Felix Herzog, Station de recherche Agroscope Reckenholz-Tänikon ART, 8046 Zurich

Circular wood economy

Eugenio Morello

In the long span, the wood generated thanks to the strengthening of the forestry within the region will meet the demand for construction materials required for the development of Great Genève.
Wood construction is being successfully applied world-wide, especially in small-to-medium-rise constructions, in both urban and suburban contexts. [1]

The woodworking will be centralized at a regional level, hosted within the 10km rings, in order to establish a short chain between harvesting activities, places of manufacturing and places of utilisation. Therefore, also the time and energy needed for transportation will be reduced.

The components realized by the woodworking companies are used for the construction of buildings within the region or for the energy retrofitting and volumetric expansion of the existing construction stock. In fact, thanks to its insulating, mechanical, and manufacturability properties, wood can prove himself useful for multiple purposes: structural applications (Mass/Laminated-timber construction); finishings (flooring, window frames and facade panels) and insulation (in the form of panels or insulating pulp).

At the end of the life-span of the timber buildings, the deconstructed wooden components will find new reuse and recycling possibilities within Great Genève.
Effective recycling or reuse will be allowed by the implementation of digital and physical solutions.

The introduction of Distributed Ledger Technologies (DLT), commonly referred to as Blockchain, in the construction industry has great potential for improving the management of resources within the built environment. [2]
At the moment of the realization of a building component manufacturers can be tasked with the generation of a Material Passport including a BIM model of the component itself, to be updated, in case of modifications, within the whole life-span of the component.
The material passport will be used by professionals within the construction industry for the designing of buildings. [3]
The integration between Blockchain and BIM will enable the generation of a “digital archive” of building components allowing people to see real-time data about the current or future availability of resources. Even before the deconstruction of a building begins the availability of building components and their characteristics will be known to designers within Great Genève, allowing for their immediate reuse in new constructions.

What does happen when a match in between offer and demand cannot be found? The project proposes the introduction of Material Deposits: regional storage facilities dedicated to the temporary storage of timber components in between one use-stage and the next one. Instead of sending wood, which still has reusing or recycling possibilities to landfills and incinerators, the deconstructed timber is stored until it will be in new demand. Material Deposits will afterwards sell the timber to

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[1] Shigeru Ban’s ‘*Tamedia Office Building*’ in the heart of Zurich is currently the largest timber construction in Switzerland, with 7 floors above ground and approximately 10000m^2 surface.
[2] Li, J. Greenwood, D. Kassem, M. (2019): *Blockchain in the built environment and construction industry: A systematic review, conceptual models and practical use cases*. Automation in Construction, Volume 102, Springer International Publishing
[3] Kovacic, I. Honic, H. Rechberger, H. (2019): *Proof of Concept for a BIM-Based Material Passport*. Advances in Informatics and Computing in Civil and Construction Engineering, Springer International Publishing

actors within the circular chain for its direct reuse or its remanufacturing into new products.
As for the woodworking, Material Deposits will be located within the 10 km circles, according to the same short-chain principle.

Within Great Genève's Circular Construction Economy a log can be transformed into a beam, then reused for structural purposes, then recycled into a table and finally shredded and made into particle boards or insulation panels.

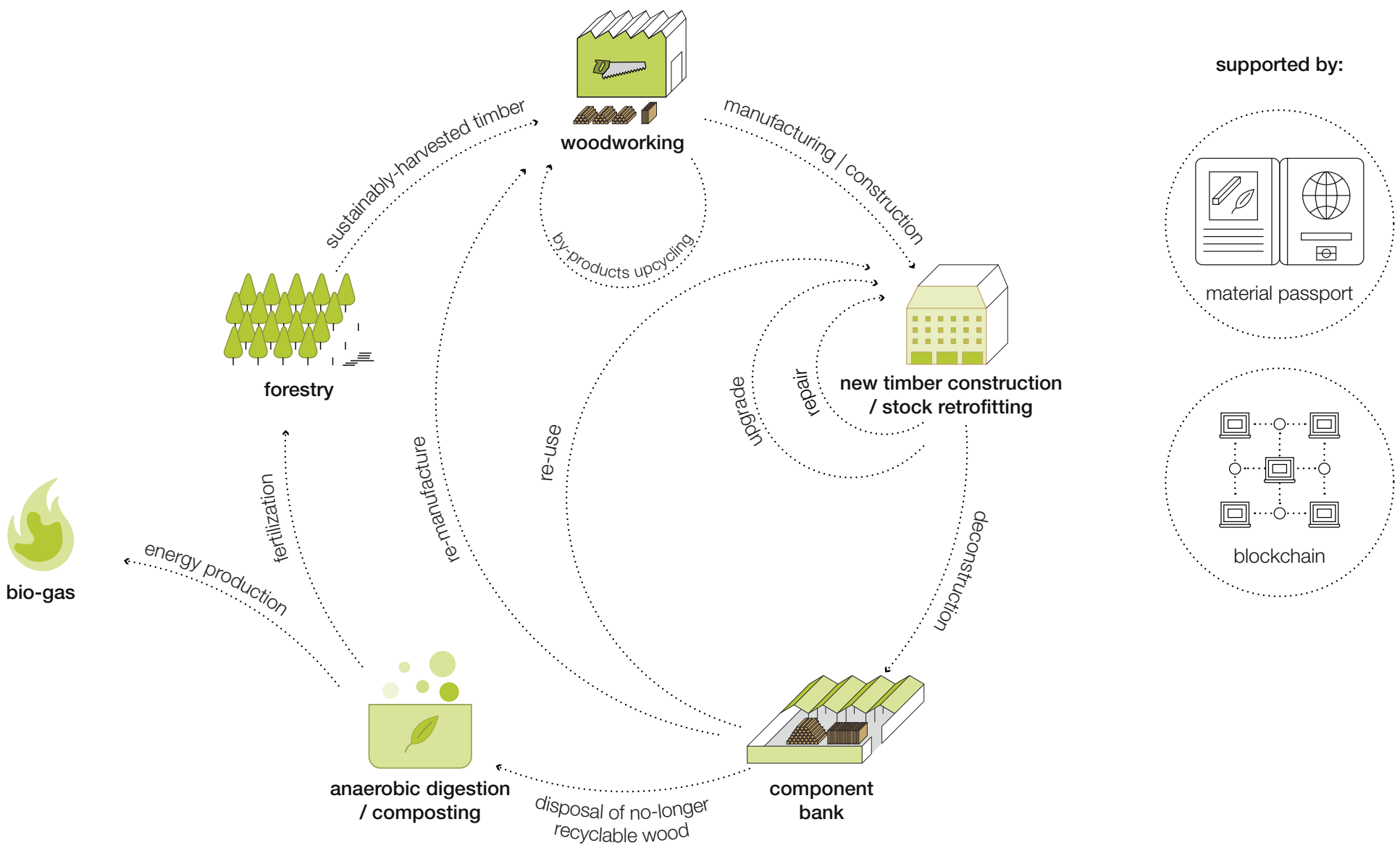
After several life-cycles, the timber that cannot be reused or recycled any more goes through composting and anaerobic digestion processes, generating on one side bio-gas that can be used to fuel manufacturing processes and on the other compost that can be safely returned to the soil of the forestries. In this way, all the nutrients collected by the tree are returned to the earth and participate in the regeneration of new construction timber.

A virtuous cycle is established that enhances the natural assets of Grand Genève, dramatically reducing carbon emissions while increasing the forestry within the region and generating new economies. By letting the wood go through this closed-loop, new job and business opportunities are created: carpenters, manufacturers, recyclers, and so on.

TIMBER STRUCTURE

The structure of the Tamedia Office Building, in Zurich, is realized with 2000 m3 of wood.

supported by:



Transnational cooperation and governance model

Transnational cooperation and governance
European transnational cooperation promotes the creation of highly integrated partnerships, with a sphere of influence able to overcome national borders in an area of transnational cooperation. These partnerships enclose and represent different levels of government and administration, involving public and private sector players, as well as different political bodies at the local and community levels.

Across the EU there are 15 areas of transnational cooperation. Territories belonging to neighbouring third countries may, under certain conditions, fall within the areas of transnational cooperation and benefit from assistance arising from Community cohesion policies.

Through these partnerships, transnational cooperation projects are able to develop, process and implement shared solutions to common problems and challenges that affect a large portion of the transnational cooperation territory concerned.
Emphasis is placed, especially, on the transactional management practices inherent to projects and to the transnational dimension of the expected results.

In 2013, the Steering Committee for the agglomeration project was set up for Grand Genève, consisting of an assembly of 24 representatives of Grand Genève's partners and two technical bodies for the implementation of projects. In 2016, the Committee signed a third-generation agglomeration project, defined as "Grand Genève territory project 2016-2030".
Starting from these elements and following the analyses and territorial studies developed for the Grand Genève vision of 2050, there is an incontrovertible indication of the need for the Grand Genève area to prefigure a series of transnational cohesion policies with France and in particular with the Nyons District, a neighbouring area with a strong territorial relationship.

The interesting aspect that is introduced by the Genève Macro-Region concept, is that the design scenario is not exclusively built around administrative or financial criteria, but is rather based on the criterion of functionality, that is, on the existence of problems common to multiple territories, to be addressed according to an integrated approach. This allows an improved coordination of the programs starting from those already active and the use of available resources in a more strategic way.

The functional approach proposed for the Grand Genève Macro-Region requires us to design and to experiment with forms of cooperation between urban systems, going beyond the traditional logic of territorial proximity, and focusing on functional networks that cross the different territories. These functional networks could well be environmental and infrastructural systems, according to different length configurations and to "variable geometry".

With this strategy the proposed vision of the Grand Genève Macro-Region within the territorial scenario of the transnational constellation can be implemented and supported by local governments, starting from the functional elements of a territory not defined by specific borders, but characterized by specific common potentials and criticalities.
Having clarified what the assumptions are that the project needs to integrate the concept of Macro-Region, it is important to understand what are the necessary steps for this Governance tool establishment, which has already been used for some transnational territories such as Genève and Strasbourg, based on an integrated multi-sectoral regional strategy.

1 The Initiative
Starting from the Steering Committee of the Transnational Agglomeration Project, the initiative phase of the Genève Metropolitan Constellation strategy must see the territories concerned as main protagonists. These, on the basis of common problems, will undertake and agree to deal with them

jointly and integrally.
The initiative will be achieved through the convening of the General States of the Grand Genève Transnational Metropolitan Constellation, in order to promote and initiate the local governments' sharing and accession path which will have a role of promotion and impulse, which will be followed by an activation phase of the States concerned, that will launch officially the goal of recognition by the EU of the Macro-Regional strategy, based on the proposed 2050 Grand Genève scenario.

2 Territorial strategy
The next and decisive step following the General States will be the development of an overall territorial strategy, built on the addressed priorities. The strategy may then be developed further by the Steering Committee or by a specifically identified authority (Agency or Organisation), through an intense consultation process with the local governments' members and major stakeholders of the Grand Genève Macro-Region.

3 Action Plans
Adhesion to the overall strategy by local governments, as well as by their respective national states, will allow the activation of activating a set of multidisciplinary teams for the drafting of Action Plans and the presumed impact that the planned actions will produce with respect to the social, territorial and economic dimension of the macro region. The Action Plans will be built to implement the overall development strategy with respect to the specific critical issues that emerged by defining times and actions priorities.

4 Governance
Starting from the Territorial strategy and Action plans, local governments joining the Grand Genève Transnational Macro-Region will have to define governance model to adopt for the implementation of priority actions; Among these are: a) implementation of the strategy and action plan by local authorities already established in the area; b) implementation of the strategy and action plan by a regional or national governmental Organization; c) implementation of the strategy and action plan by a community Authority; d) implementation of the strategy and action plan by a multi-level governance, where policies' implementation occurs on multiple levels, through collaborations between Community institutions, States and local levels.

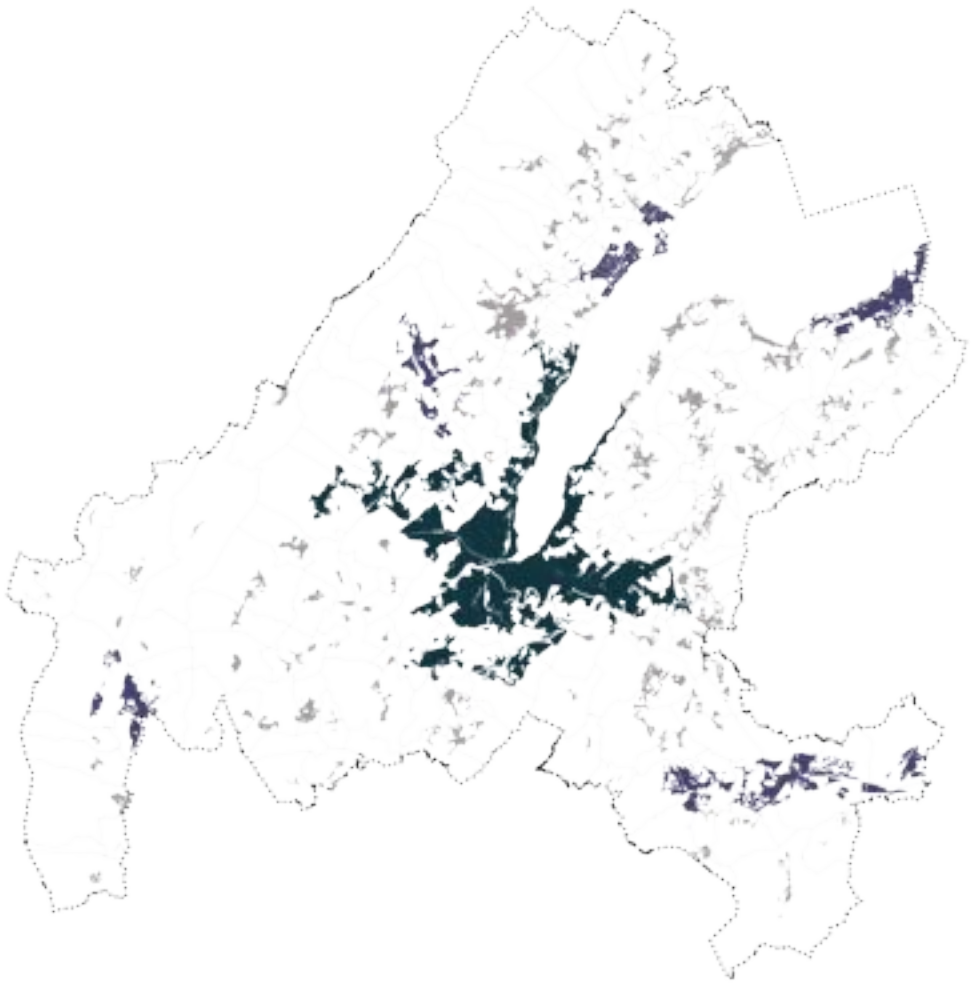
This last governance model seems to better respond to the characteristics of the proposed Vision for Grand Genève, ensuring a more harmonious and therefore functional action, especially regarding the implementation that would occur thanks to the partners already operating in the region. Their responsibility could be then adapted to the strategy's objectives, according to the so-called partnership principle.

5 Loans
The Grand Genève Macro-Region will, through its territorial strategy and action plans, be able to join Transnational Cooperation Programs financed by the European Regional Development Fund (ERDF) under the objective of the "European territorial cooperation" of the cohesion policy. For the 2021-2027 programming cycle, 9.5 billion EUR are earmarked for transnational cooperation and institutional cooperation, contributing to the development of common services of public interest.

6 Internationalization
The Grand Genève Macro-Region and the Grand Genève Vision will be the promoters of the World Committee of Transnational Cities, promoted to share territorial models and encourage initiatives for Transnational Territorial Development. The Committee may also be the monitoring and promotion Authority for cohesion policies between regions territorially linked by a functional relationship.


Project

GRAND GENÈVE TODAY



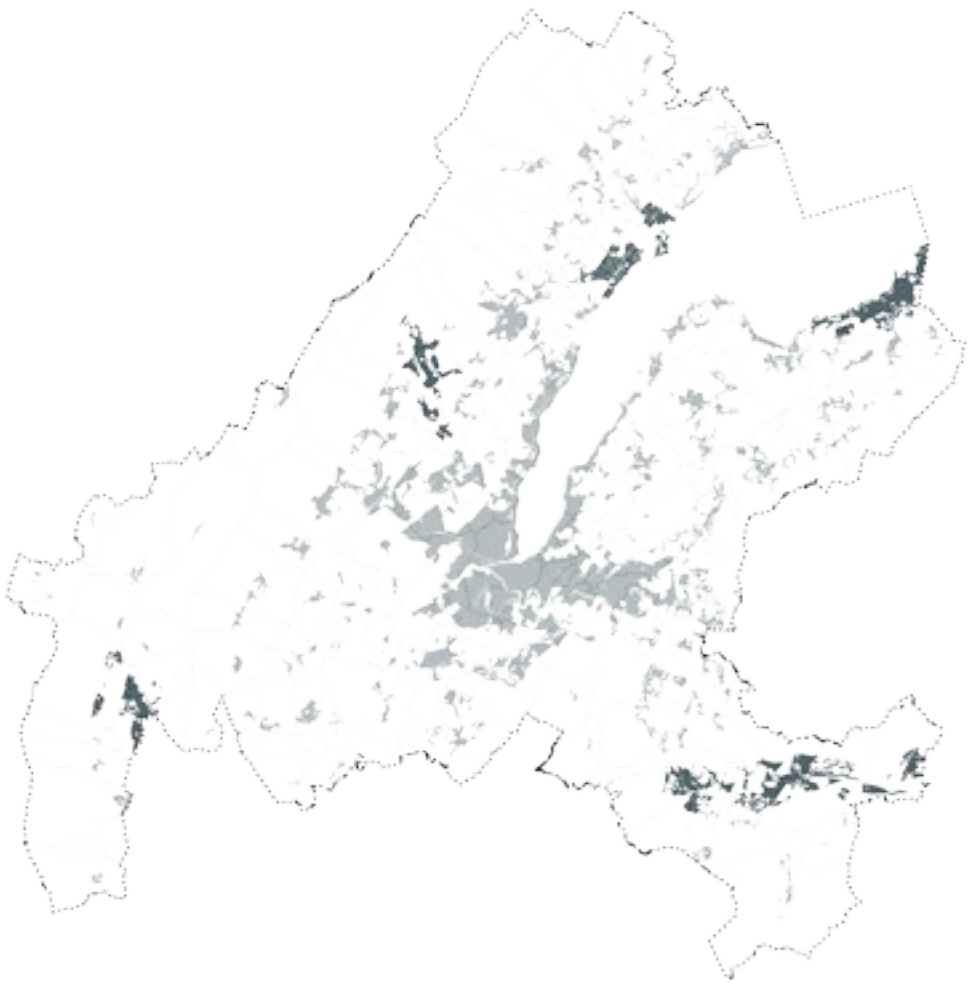
1.000.000
Grand Genève
inhabitants in 2018

+350.000
inhabitants in 2040

urban areas Grand Genève :

- central urban area
- regional centers
- peri-urban centers

COMPACT GROWTH SCENARIO, Project de territoire 2016/30



scenario I

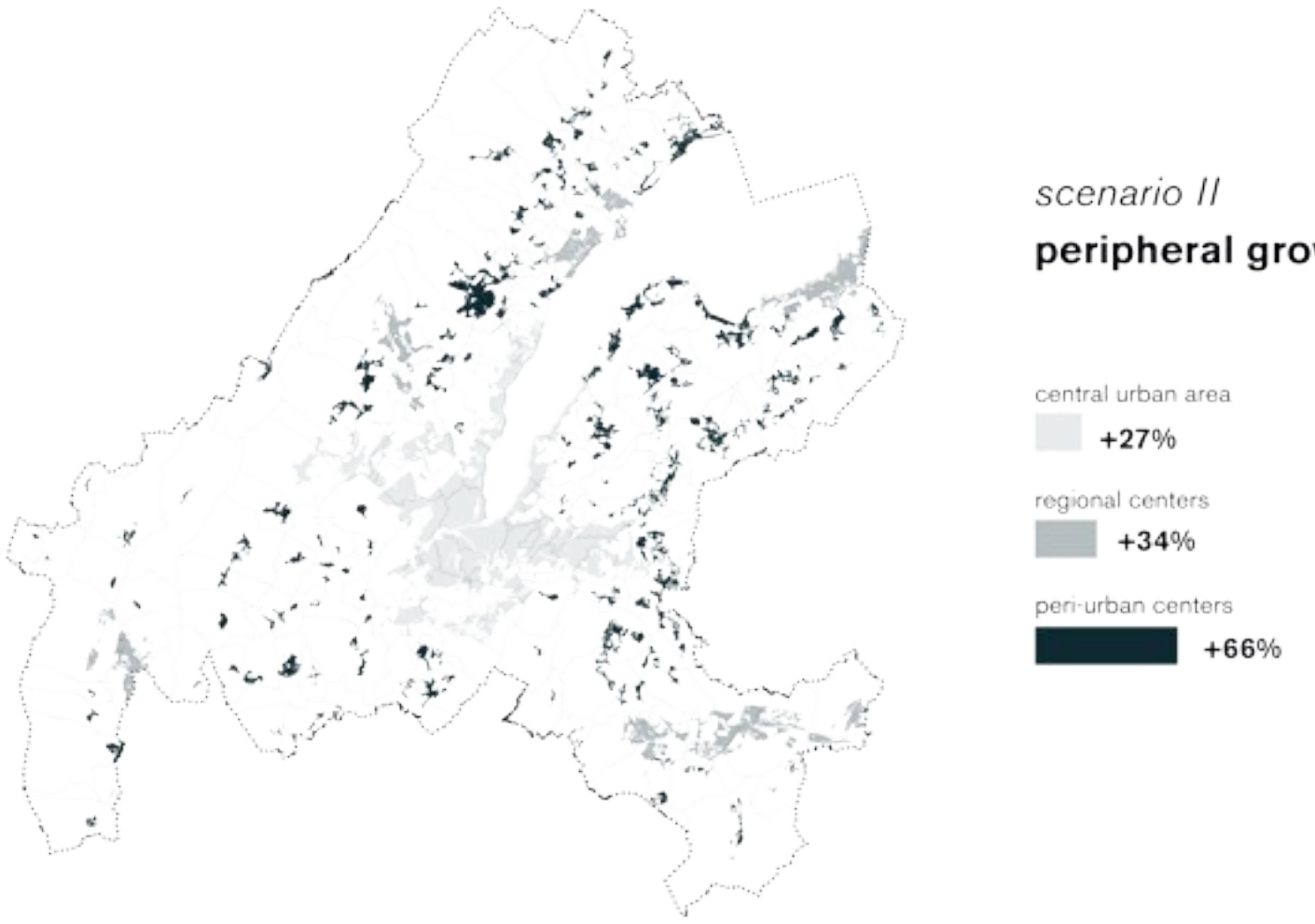
compact growth

central urban area **+34%**

regional centers **+50%**

peri-urban centers **+34%**

PERIPHERAL GROWTH SCENARIO, Project de territoire 2016/30



scenario II

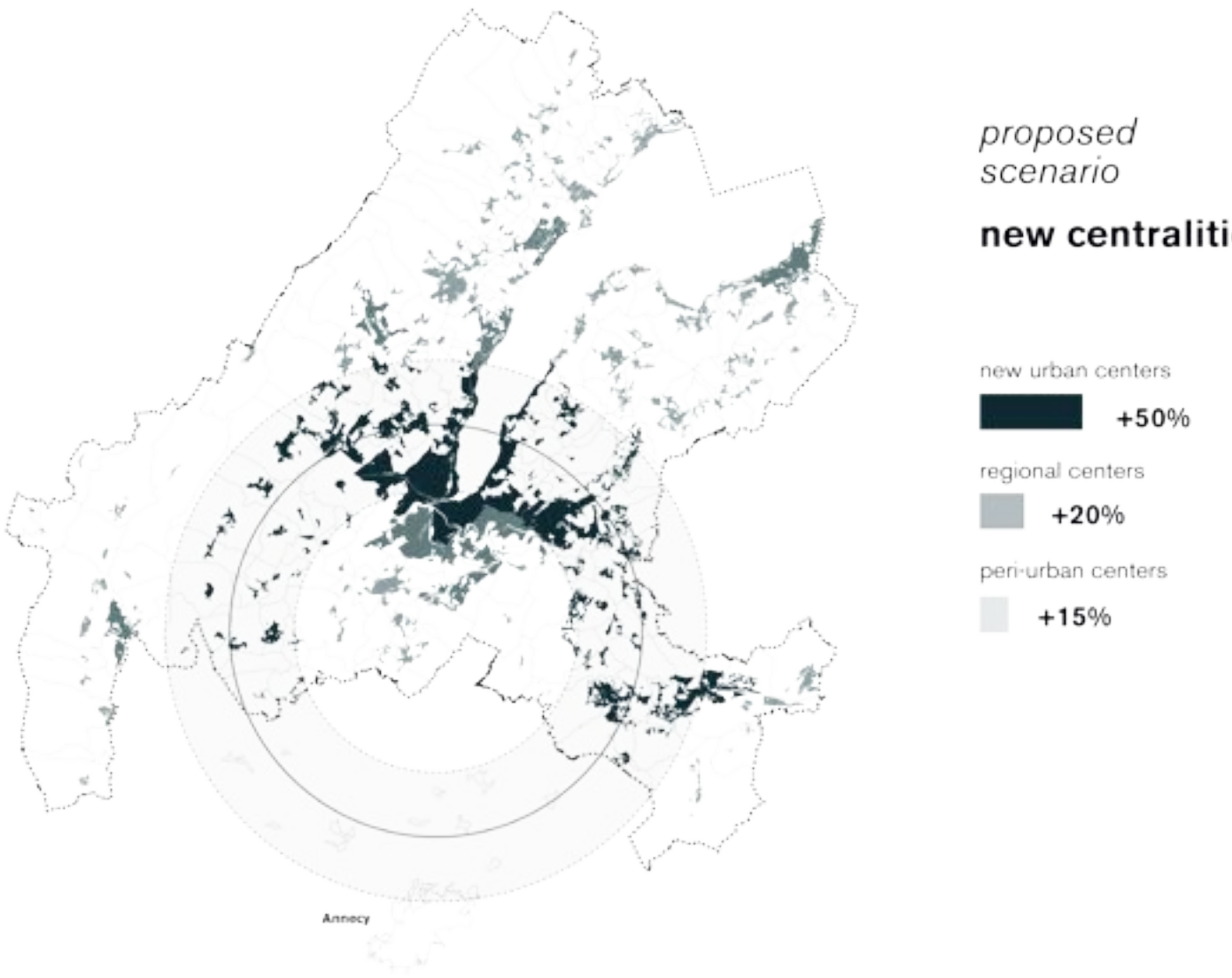
peripheral growth

central urban area
+27%

regional centers
+34%

peri-urban centers
+66%

PROPOSED SCENARIO



proposed scenario

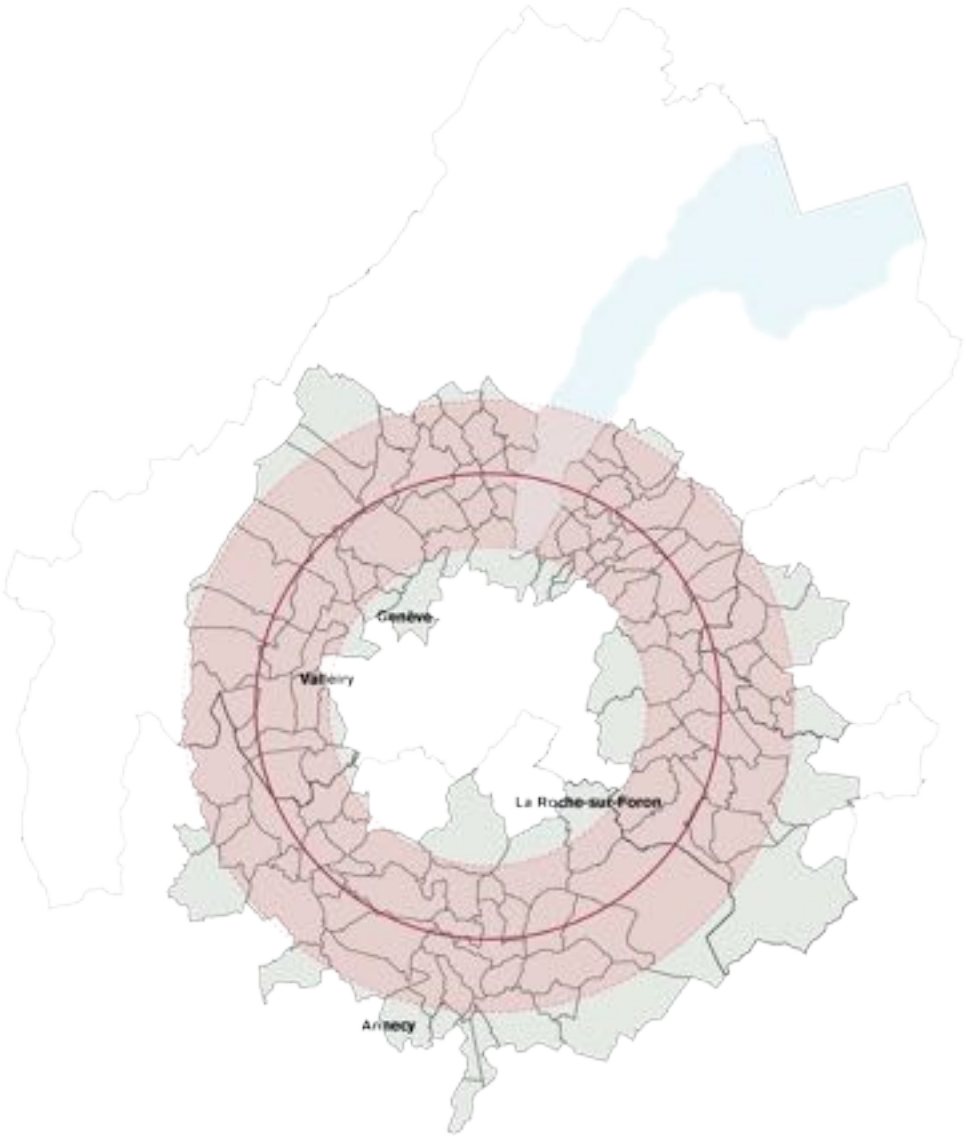
new centralities

new urban centers
+50%

regional centers
+20%

peri-urban centers
+15%

MUNICIPALITIES ON THE BUFFER ZONE



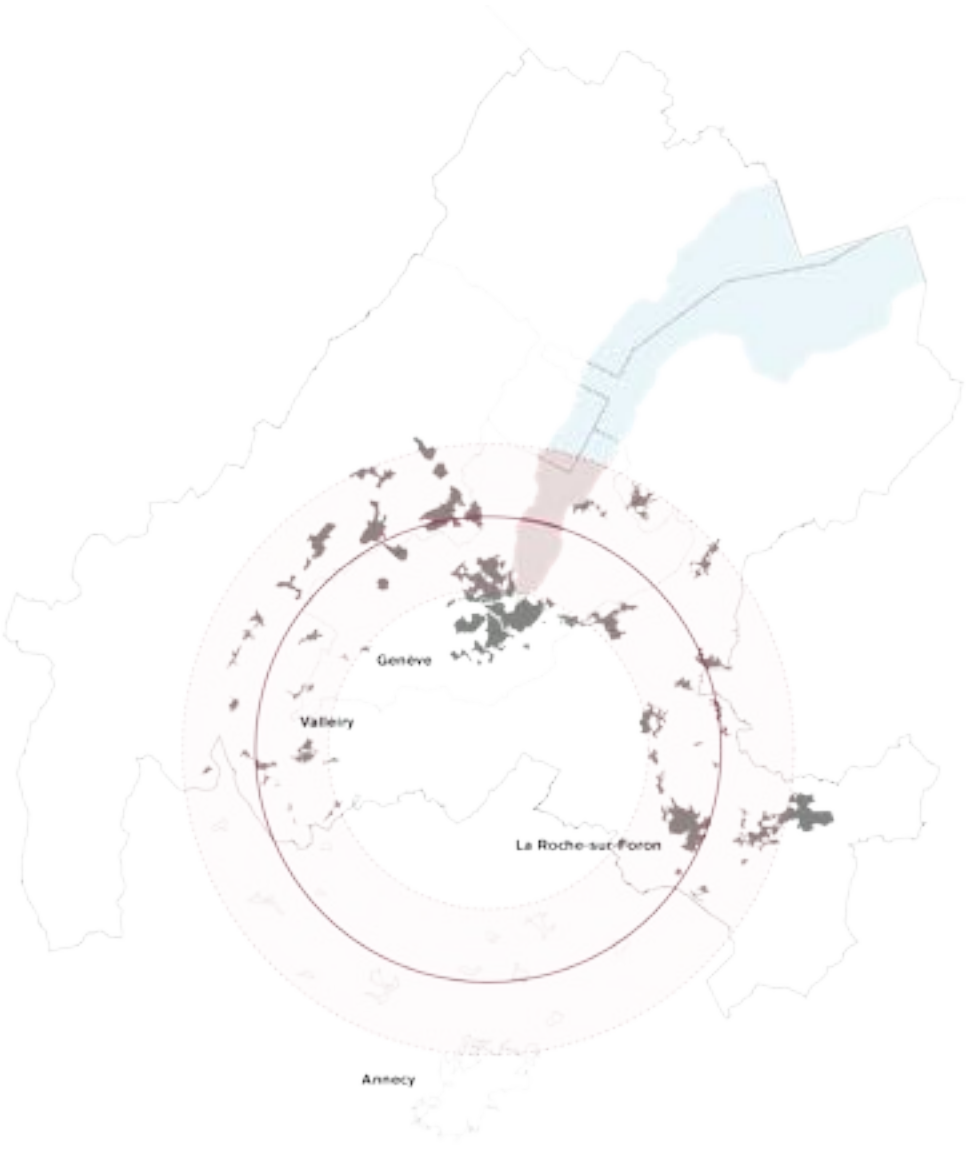
132
municipalities

32
Swiss municipalities
inside Grand Genève

50
French municipalities
inside Grand Genève

32
French municipalities
outside Grand Genève

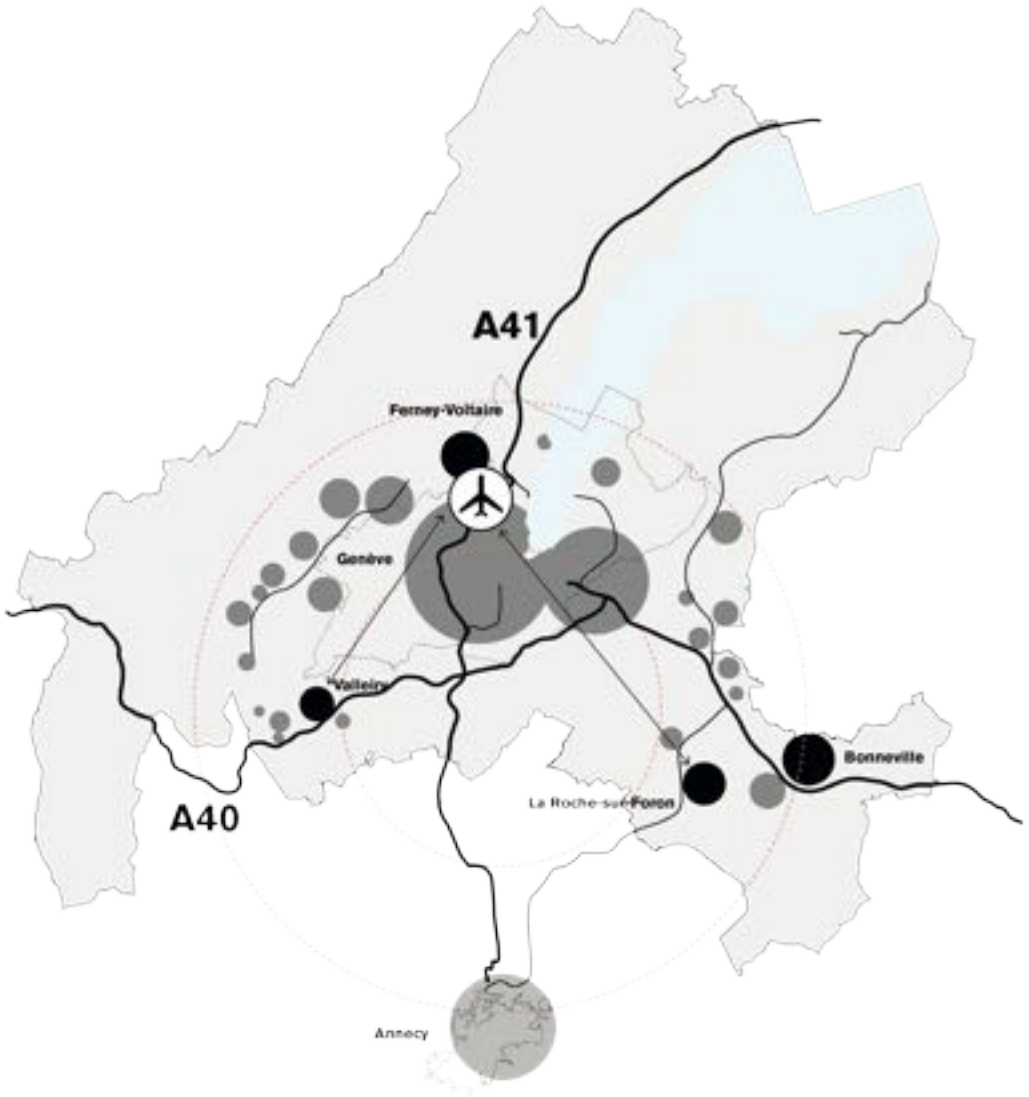
SETTLEMENTS ON THE BUFFER ZONE



47
settlements inside
Grand Genève

13
settlements outside
Grand Genève

CAR TRAVEL TIMES TO THE AIRPORT

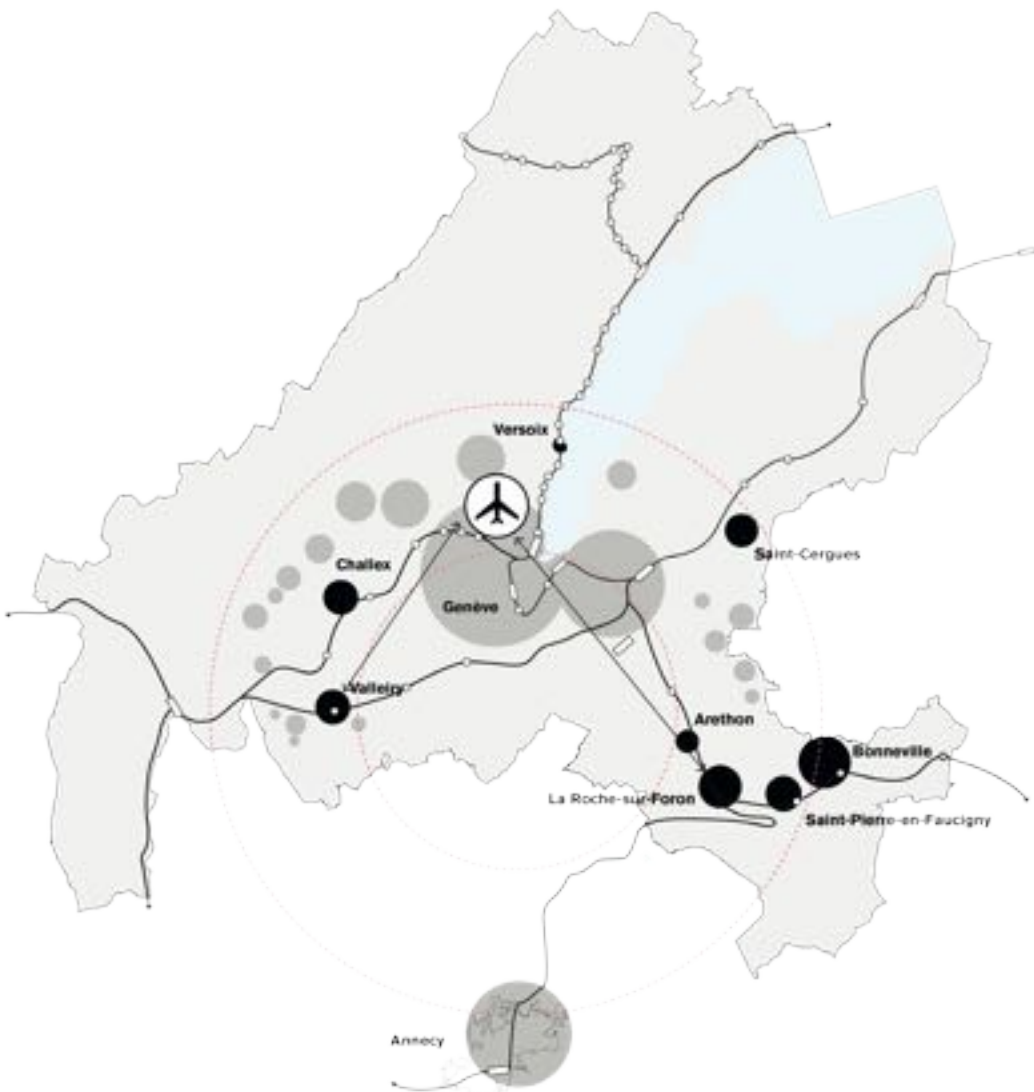


travel time by car

25 min
from
Valleiry to Genève Airport

40 min
from
La Roche-sur Foron to Genève Airport

PUBLIC TRANSPORT TRAVEL TIMES TO THE AIRPORT



travel time by public transport

85 min
from
Valleiry to Genève Airport by car

100 min
from
La Roche-sur Foron to Genève Airport

TOWARDS THE 2050 GRAND GENÈVE
The construction of the territorial scenario for a transnational city between Switzerland and France

The proposed scenario for the territorial development of Grand Genève aims to systematize the set of urban, environmental and infrastructures polarities that distinguish the transnational area between Switzerland and France.
The current territorial scenario frames two major urban polarities Genève and Annecy with their respective lakes; between the two polarities stands the Salève, the big mountain representing the green heart of this vast region.
Today, these three systems have a territorial dialogue that is merely functional to the needs of cross-border connection. The scenario we propose aims to start the ecological transition process through the large regional green frame.

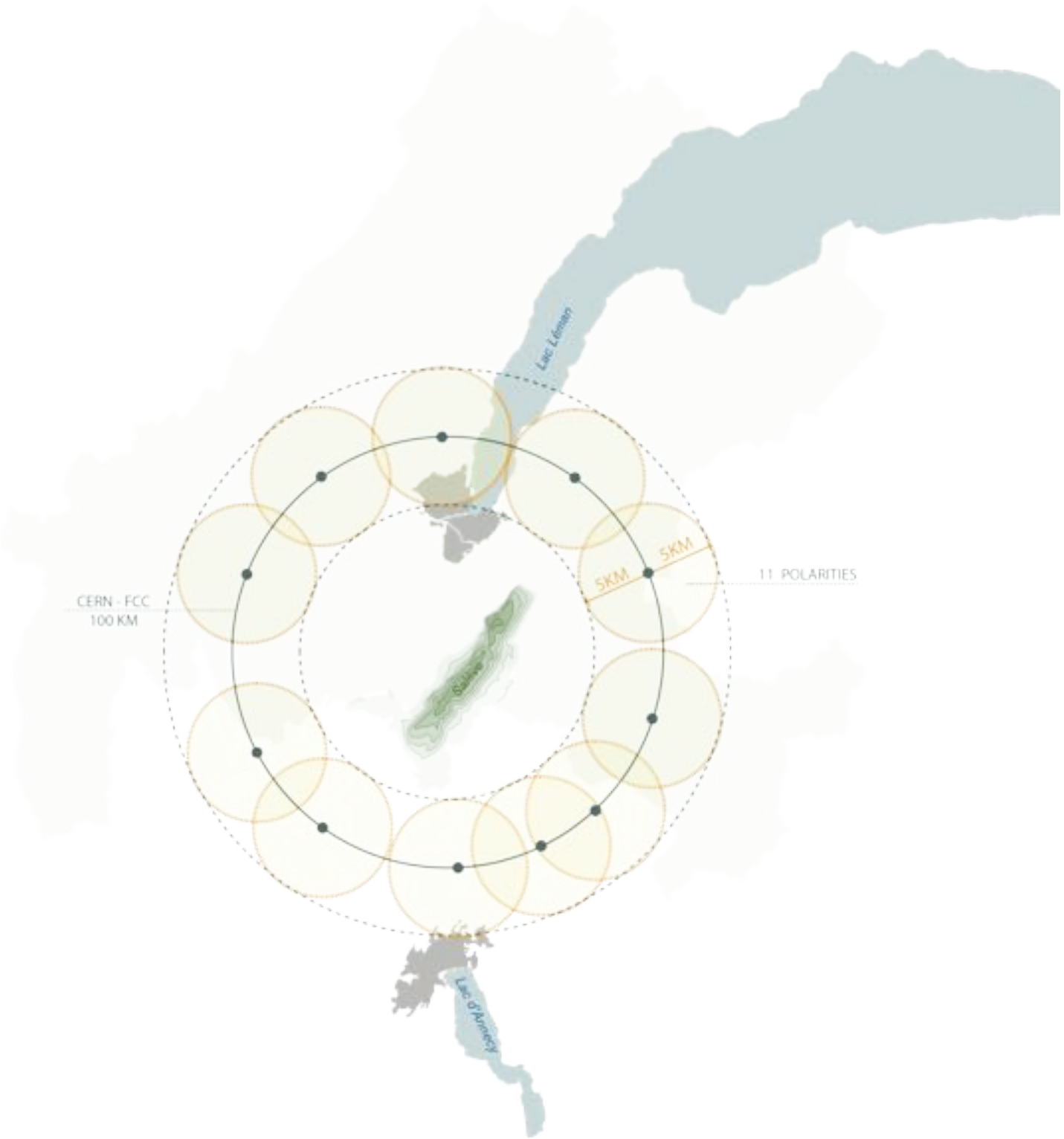
TOWARDS THE 2050 GRAND GENÈVE

A new circular particle collider, scheduled for 2050, will become the 100km circumference territorial infrastructure for the transnational urban development of Grand Genève

The scenario we propose for the 2050 Grand Genève starts from the great CERN infrastructuring potential, which intends to proceed with the programming of a large 100km circumference particle collider (FCC). This important territorial sign, that will connote Genève subsoil, will become the generating element of a new multipolar kaleidoscopic urban system in which the ecological transition will be conveyed by the use of renewable energy piped and distributed through the large FCC ring.
The FCC access points will become the fulcrums of these new urban poles, generated through a set of proximity relationships, defining the basic structure of the smart grid.

TOWARDS THE 2050 GRAND GENÈVE

The FCC access points become the fulcrums of the new transnational urban development through circular areas with a diameter of 10km.

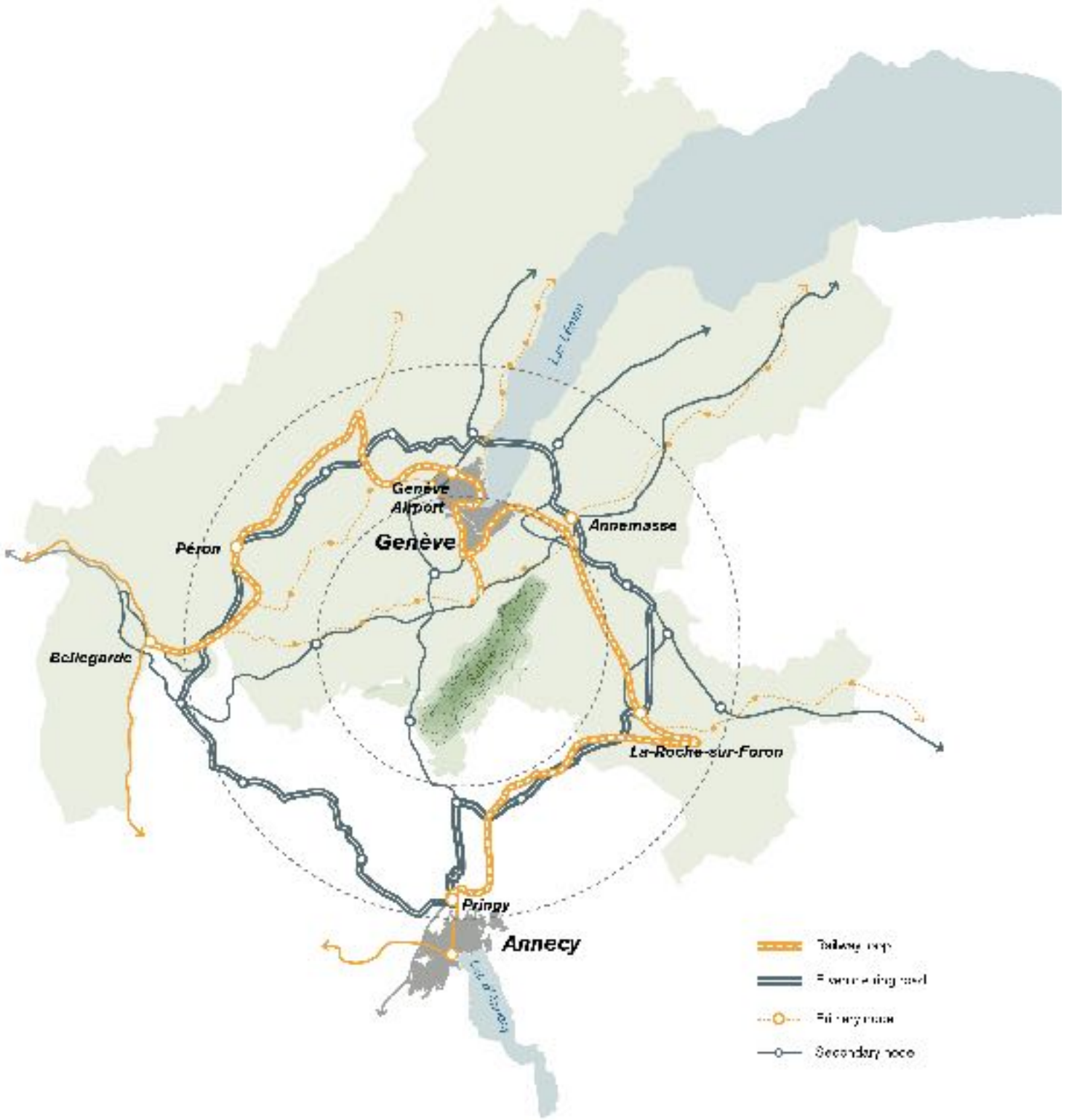


The FCC access points, 11 in total, will be the fulcrums from which the new urban polarities will be generated. Each pole, through its own energy production devices, will be completely energy self-sufficient and able to share surplus energy with the other poles through the FCC CERN infrastructure.

The urban development strategy also foresees that the construction of the new urban fabrics will be mainly built in wood, coming from Swiss and French forests, with the ultimate aim of limiting impacts and ensuring a new sustainability model.

TOWARDS THE 2050 GRAND GENÈVE

The intersection between the two rings defines the intermodal territorial interchange hubs.

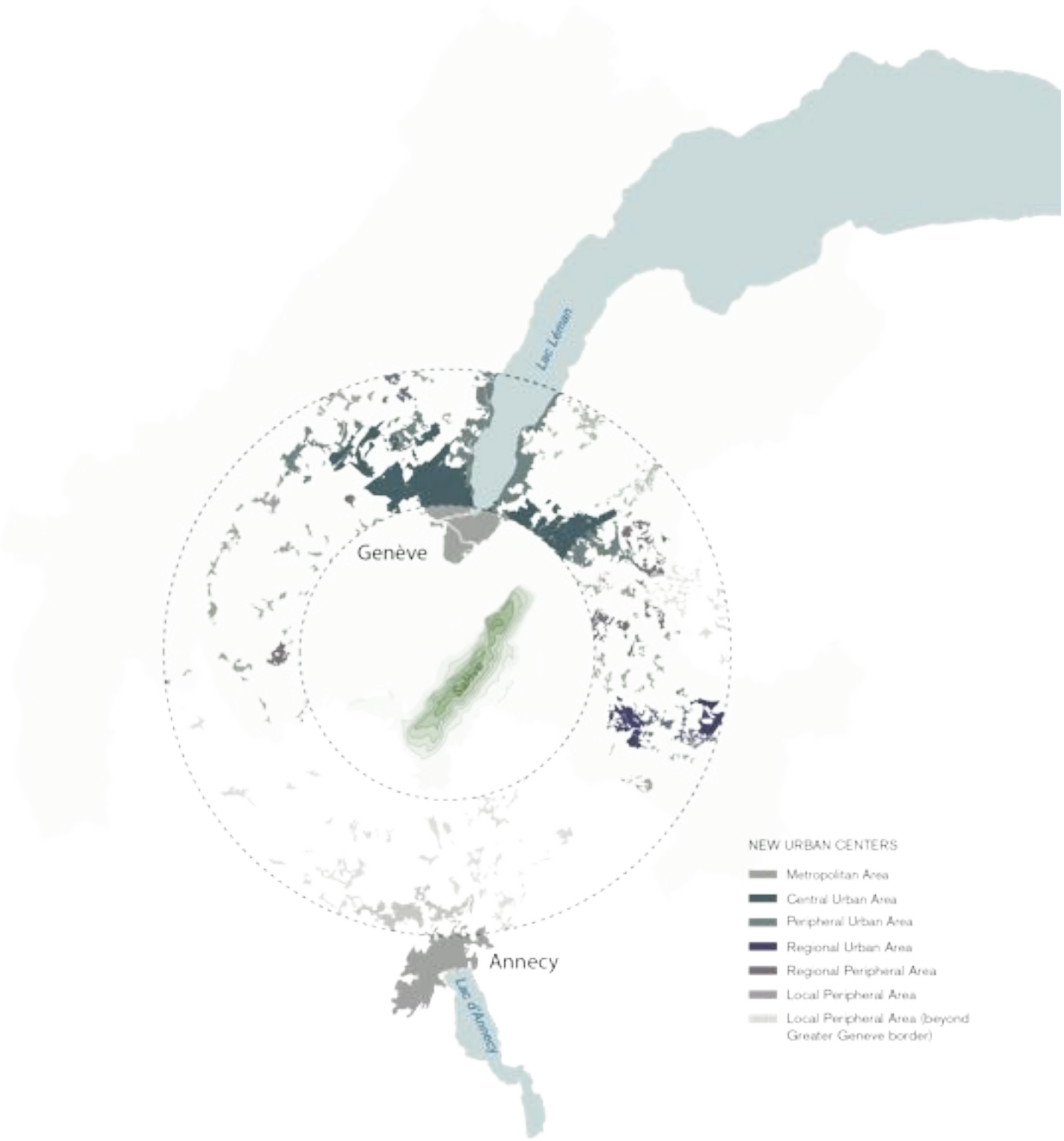


The definition of the territorial scenario provides for the systemisation and enhancement of the existing infrastructure network, identifies a semi-circular railway axis and a priority axis of electric mobility which develops in a circular shape.
The intersection between the two rings defines the intermodal territorial interchange hubs.
The ring system supports the territorial development scenario and the newly predicted urban polarities thus limiting the radial crossings to the supra-local scale journeys only.

The ring infrastructure enhancement preserves the central "green heart" and allows a tangential mobility of fast connection between the poles.

TOWARDS THE 2050 GRAND GENÈVE

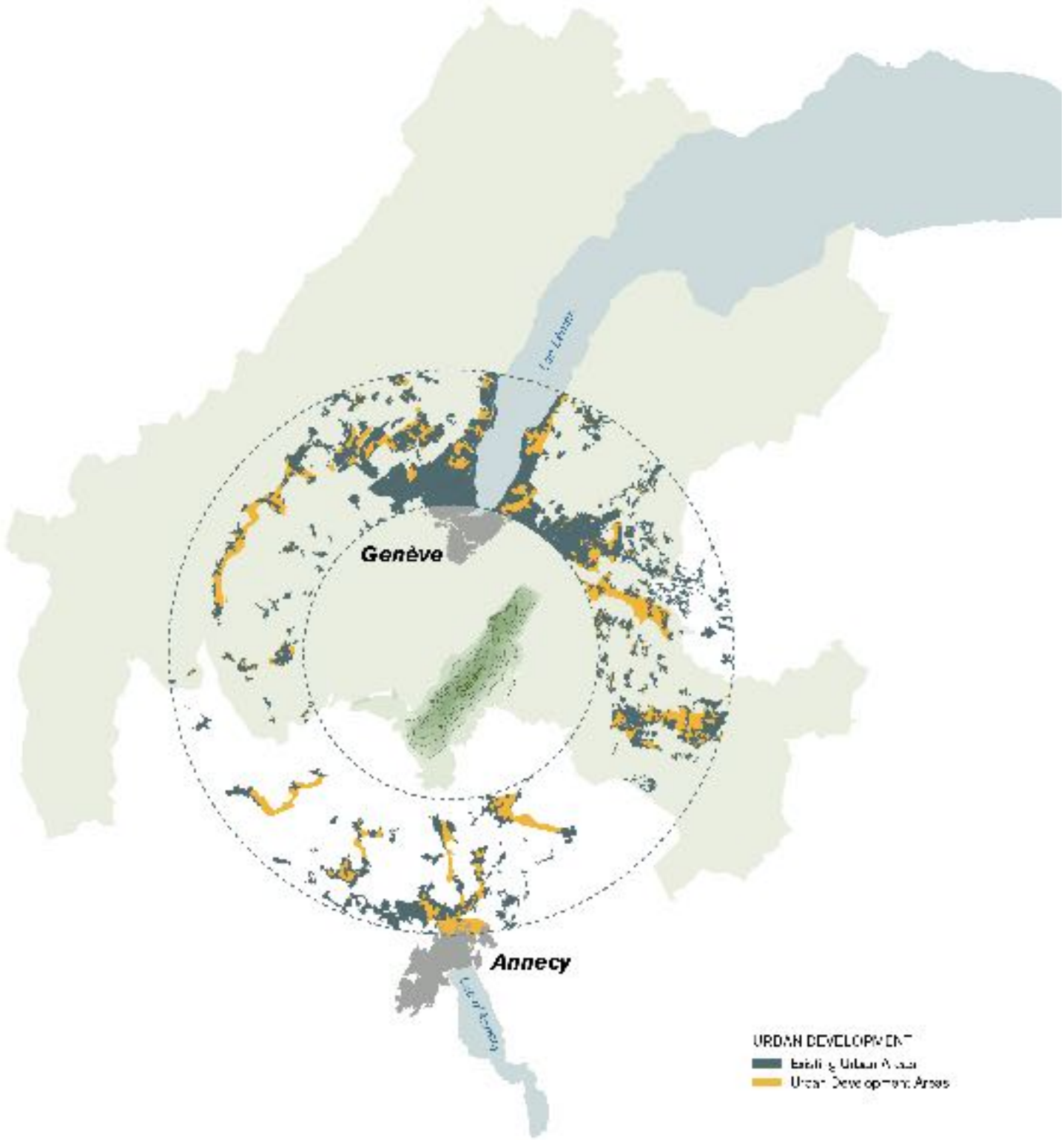
The existing urban fabrics have been classified into three macro areas.



The existing urban fabrics have been classified into three macro areas: the central one consisting of medium-high density urban agglomerations, the regional one consisting of the conurbation fabrics that extends along the major road network axes and the local one, that stands out for its low density.
These areas have very different urban features according to the territorial, infrastructural and environmental elements. However, the overall image returns a strong urbanisation near the two reference centers, Genève and Annecy.

TOWARDS THE 2050 GRAND GENÈVE

The scenario envisages a development strategy which, starting from the existing urban nucleus, increases the settlement burden tangentially, with respect to the FCC layout.

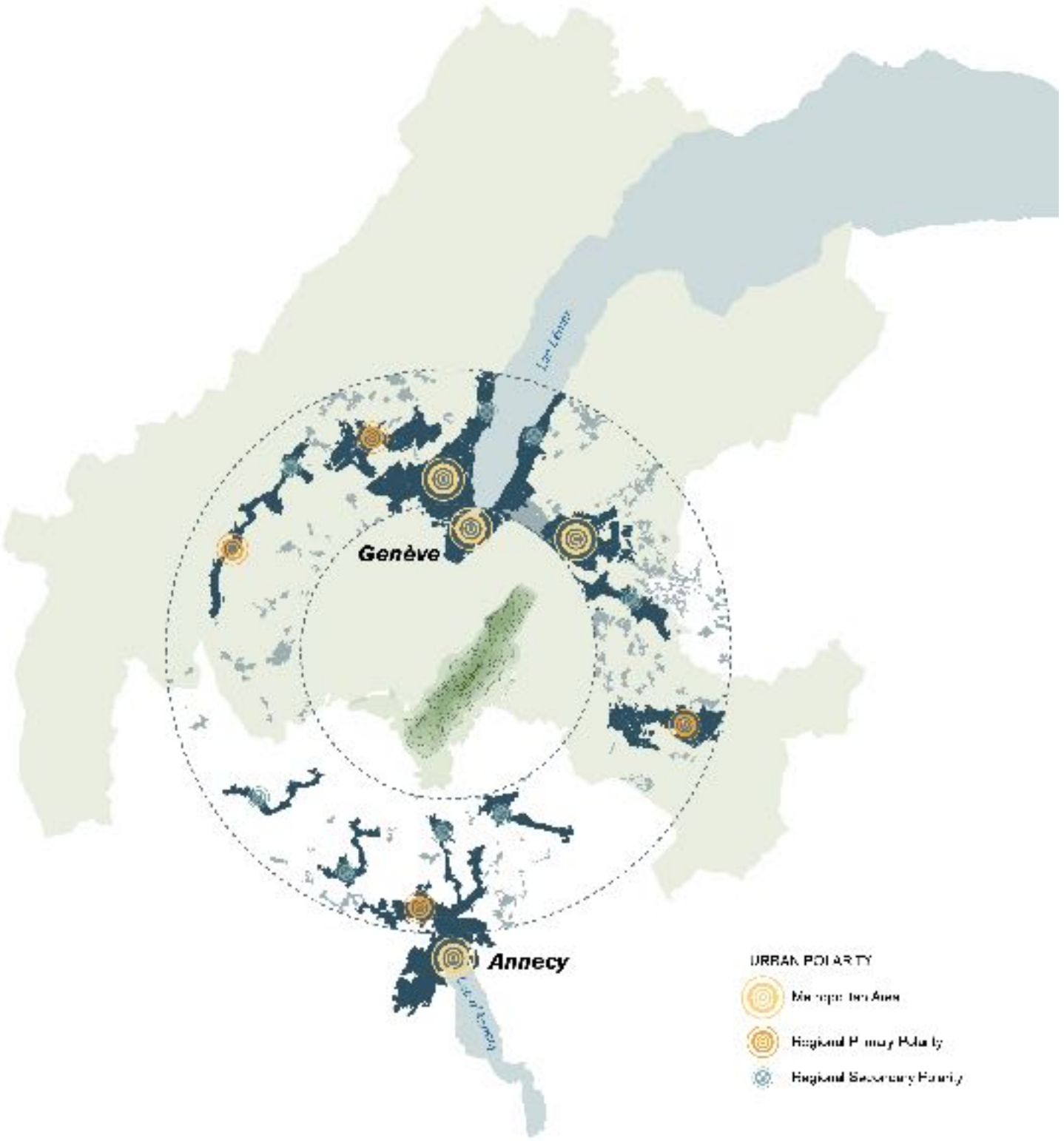


The scenario envisages a development strategy which, starting from the existing urban nucleus, increases the settlement burden tangentially, with respect to the FCC layout.

The 11 urban developments will host one or more wood transformation centers, to be used for the programmed buildings construction that will accomodate the new inhabitants.

Each pole will compensate for the share of consumed land with an equivalent forested area through the practice of forestry and agro-forestation.

TOWARDS THE 2050 GRAND GENÈVE
The scenario identifies three different types of polarities.

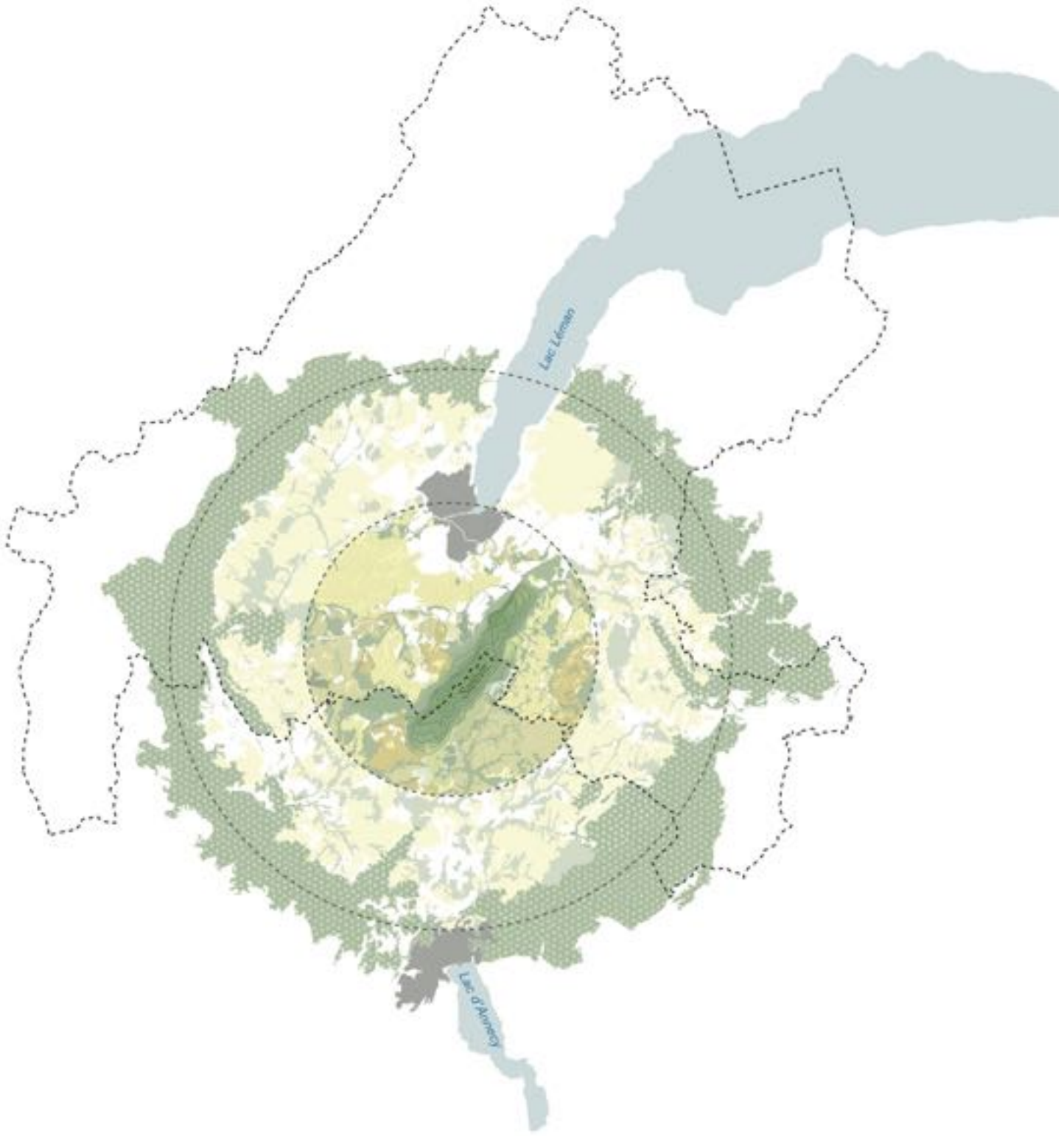


The scenario identifies three different types of polarities: the metropolitan ones, represented by the big centers like Genève, the regional ones like La Roche sur Furon and those regional of second level, like Peron.

This classification allows the definition of urban development priorities and the public services network, to be implemented for the construction of the public city.

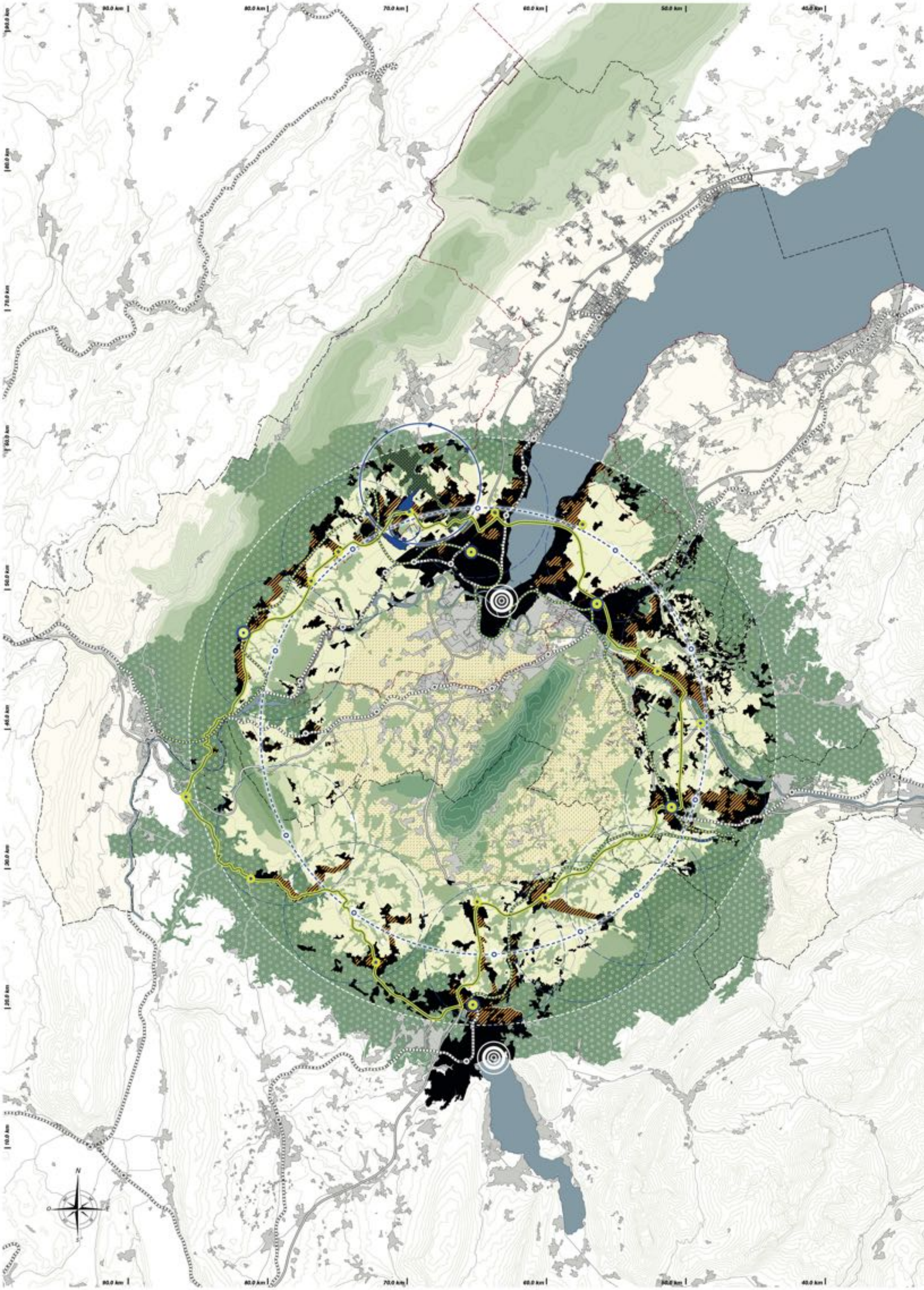
TOWARDS THE 2050 GRAND GENÈVE

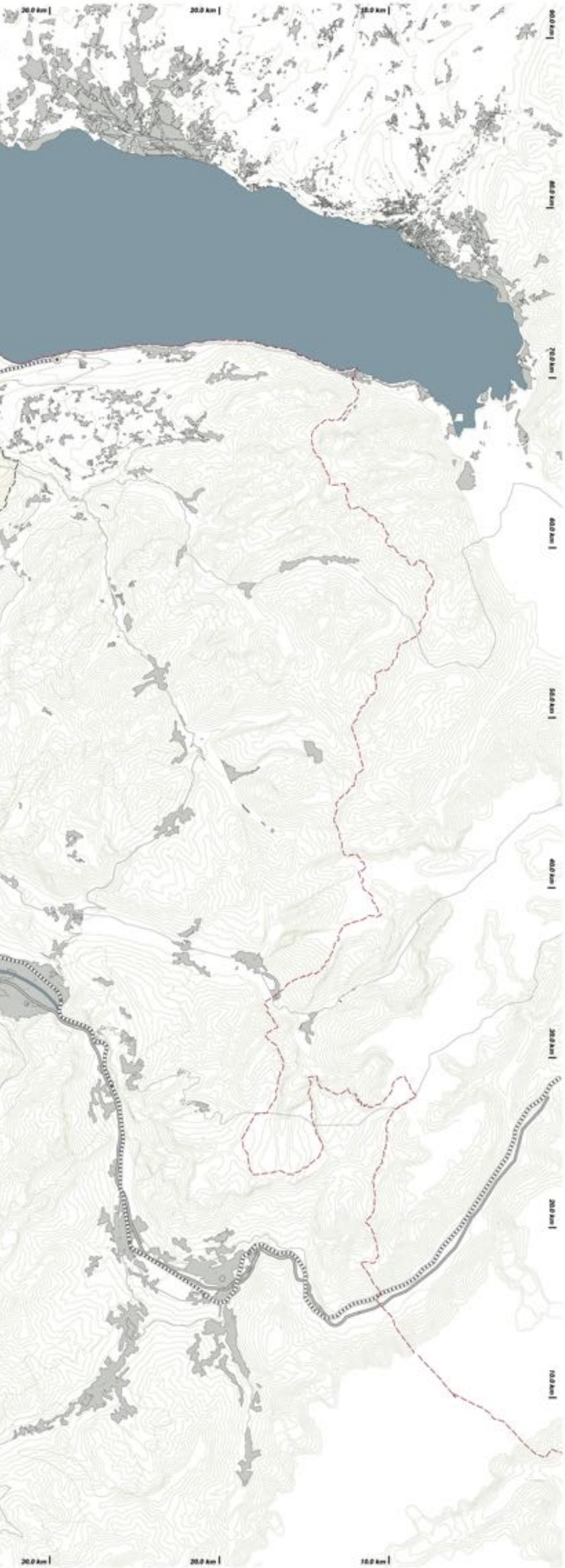
The central “green heart” will be gradually transformed into an oasis of biodiversity, where human activities will be severely limited in order to preserve biodiversity habitats and enhance them in their original natural features.



The central “green heart” will be gradually transformed into an oasis of biodiversity, where human activities will be severely limited in order to preserve biodiversity habitats and enhance them in their original natural features.
The three specific elements that have been taken into consideration for the masterplan development concern the strengthening strategy of the forested areas along the FCC ring perimeter, the central green heart linked to the agro-forestry practices and the Salève as a core element of fauna and flora biodiversity.

The external circumference will be the natural filter element that will protect and guarantee the new ecological transition for Grand Genève.


90.0 km
80.0 km
70.0 km
60.0 km
50.0 km
40.0 km
N



Masteplan Legend

TRANSNATIONAL FRAMEWORK

- National borders
- Grand Genève borders
- Urban settlements
- Hydrography
- Highways
- Primary and secondary road network
- Main railway network
- Transnational metropolitan centers

CERN'S INFRASTRUCTURE

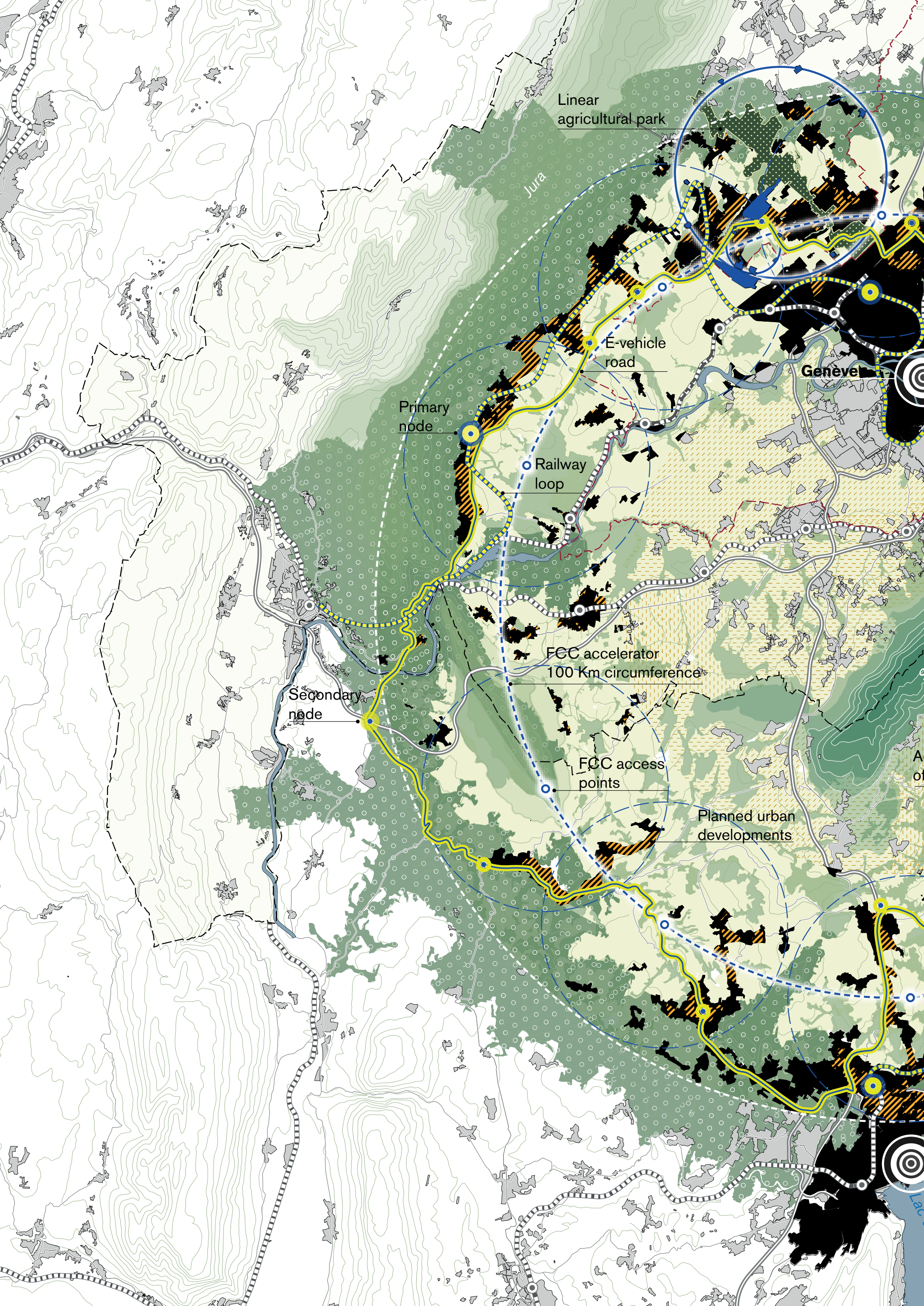
- Existing accelerators (LHC and SPS)
- Expected accelerator (FCC - 100 Km circumference)
- Existing CERN buildings
- Expected access points (FCC)

PRIORITY DEVELOPMENT AREA

- Transnational intervention area
- Local intervention area (10 Km diameter)
- Urban settlements within the intervention area
- Planned urban developments
- Railway loop
- E-vehicle road
- Primary node
- Secondary node

ENVIRONMENTAL SYSTEM

- Forests and natural areas
- Buffer forest system
- Agroforestry
- Agroforestry of biodiversity core
- Biodiversity protection area
- Linear agricultural park


Linear
agricultural park
Jura
E-vehicle
road
Genève
Primary
node
Railway
loop
FCC accelerator
100 Km circumference
Secondary
node
FCC access
points
Planned urban
developments

Lac Léman

Transnational
intervention area

Local intervention area
(10 Km diameter)

Biodiversity
protection area

Salève

groforestry
f biodiversity core

Buffer forest system

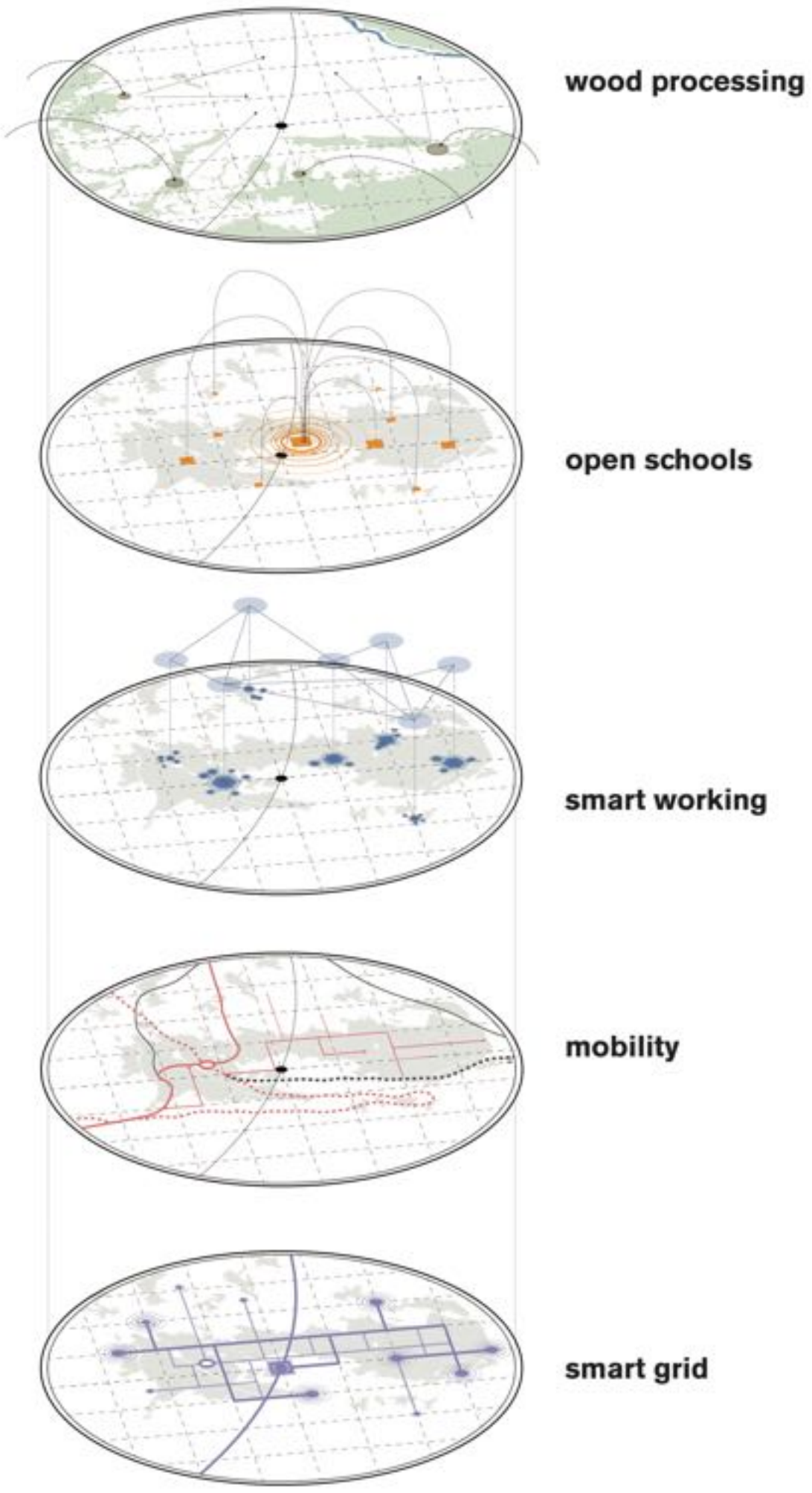
Annecy

d'Annecy

The 10km Urban Satellites

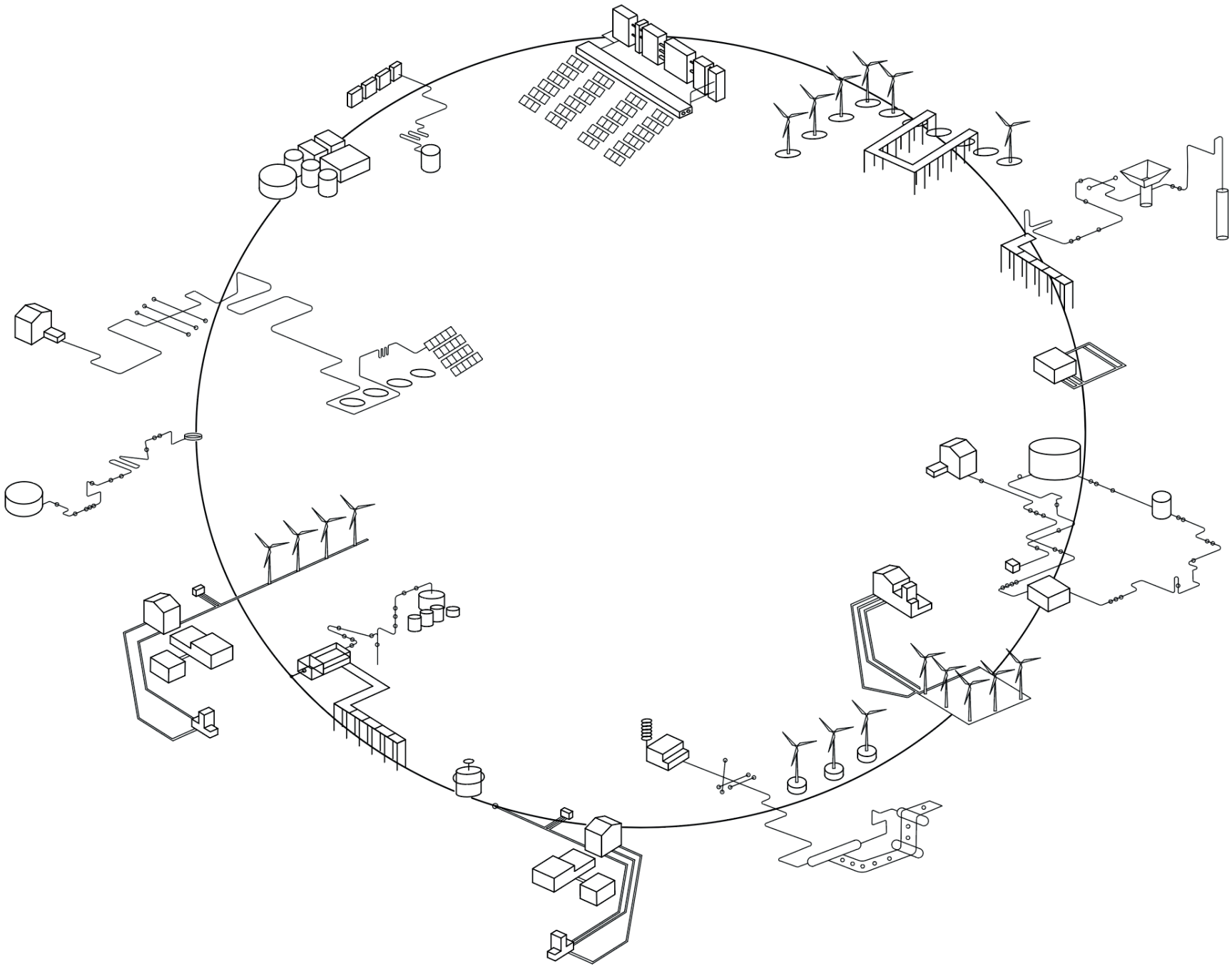
Each of the 11 urban satellites has an ideal diameter of 10 km and has its access point to the underground energy ring as its central core. The urban satellite was conceived with 3 main characteristics, the first concerns energy self-sufficiency and the smart grid network along which the buildings connect; the second is represented by urban biodiversity understood as a plurality of actions for the enhancement of natural systems; the third points to the concept of proximity and relationship for new urban communities. The combination of these three elements represents the habitat for a new model of urban life.

THE ELEMENTS OF THE URBAN SATELLITE



Each satellite is made up of a set of layers that distinguish the urban habitat. The smart grid as an energy distribution network, the network of electric mobility for reducing CO2 emissions, the digital cabling network of buildings that reduces work-related travel and allows proximity relationships, schools open as epicentres of collective life, the urban forests that contribute to initiating the ecological transition and building a new urban biodiversity.

THE ENERGY ORBIT



The 100 km underground orbit allows you to share the energy surplus produced by individual satellites through devices that use renewable sources such as photovoltaic roofs, geothermal and wind power plants.
The energy socket is equipped with special energy storage plants that allow you to power the system at all hours of the day.

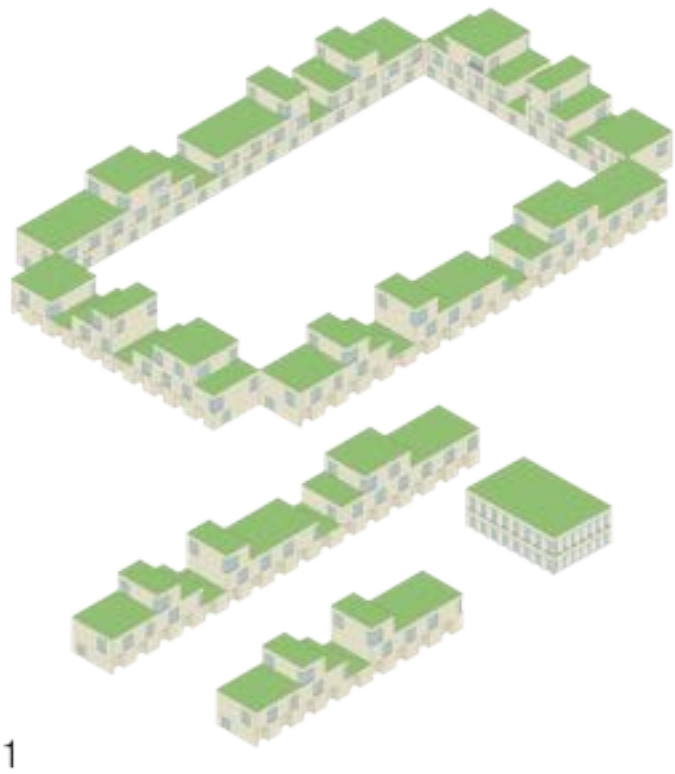
Abacus

Wood typologies abacus

low density

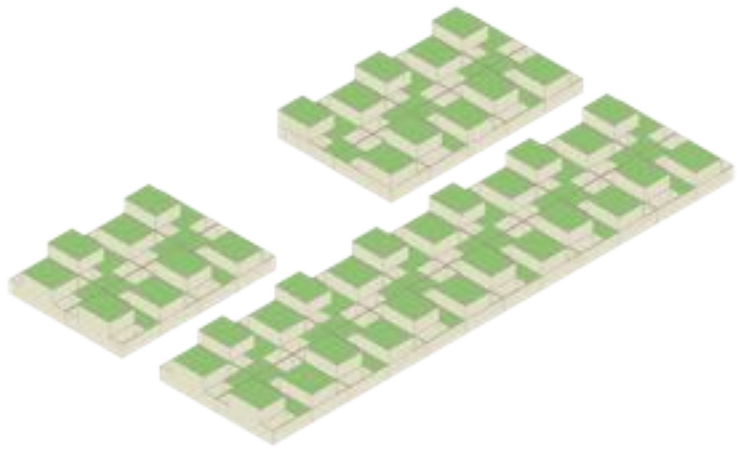
A.3

terraced houses
function: residential
maximum height: 3 floors
peculiarities: green roofs
with solar panels



A.1

townhouses
function: mixed use residential + commercial
maximum height: 3 floors
peculiarities: green roofs with solar panels

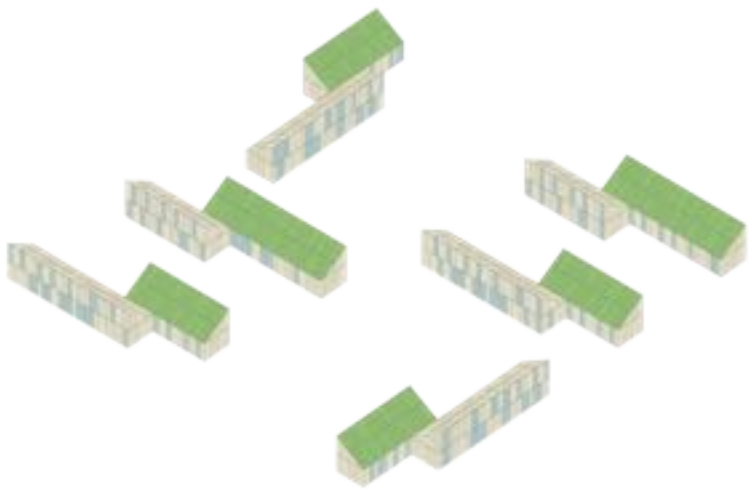


A.2

dense townhouses
function: residential
maximum height: 2 floors
peculiarities: green roofs with solar panels

A.4

isolated villas
function: residential
maximum height: 3 floors
peculiarities: green roofs with solar panels

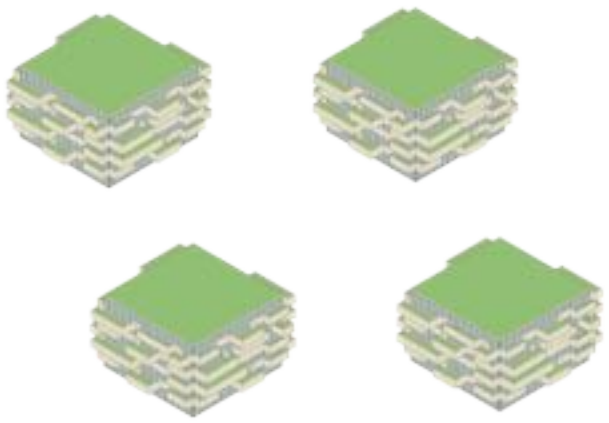


A.5

modular wood building
function: residential
maximum height: 3 floors
peculiarities: green roofs,
flexible structure

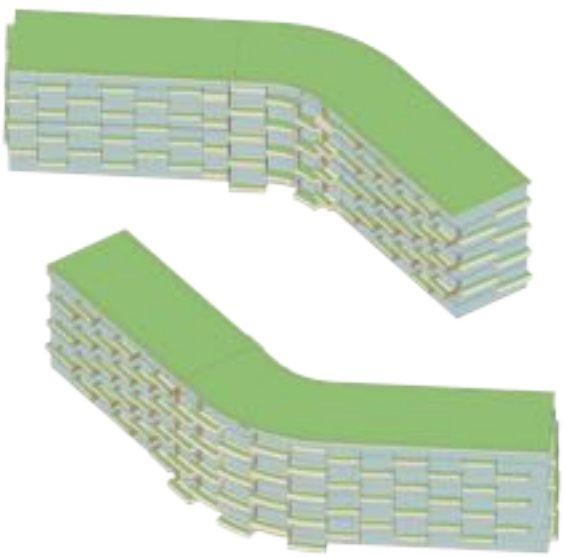
Wood typologies abacus

medium density



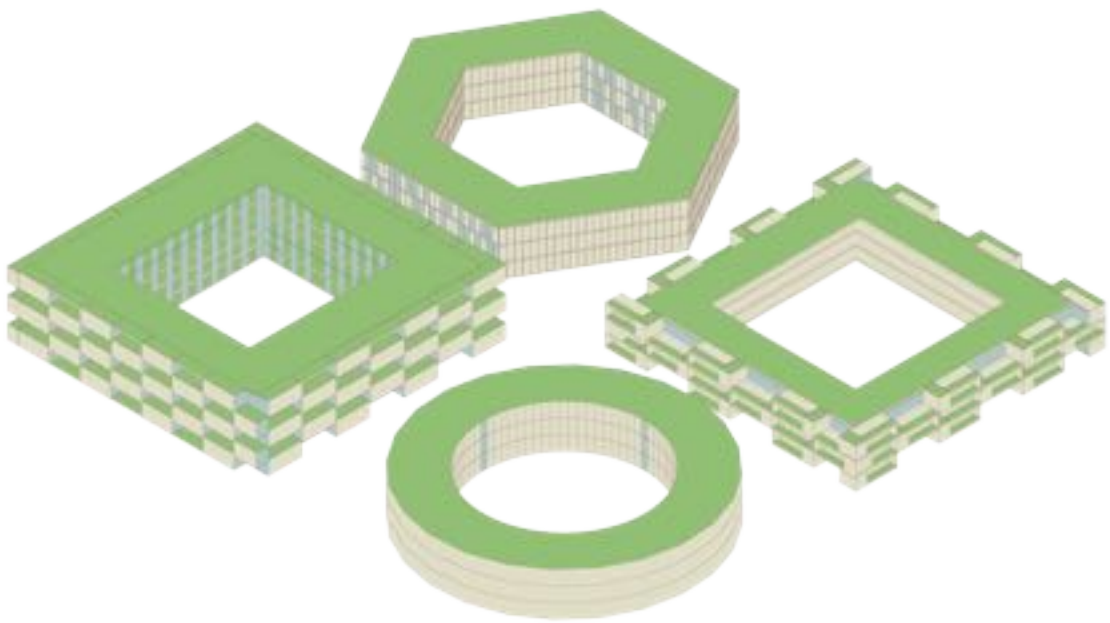
B.2

medium density building
function: residential
height: 5
peculiarities: green roofs
with solar panels



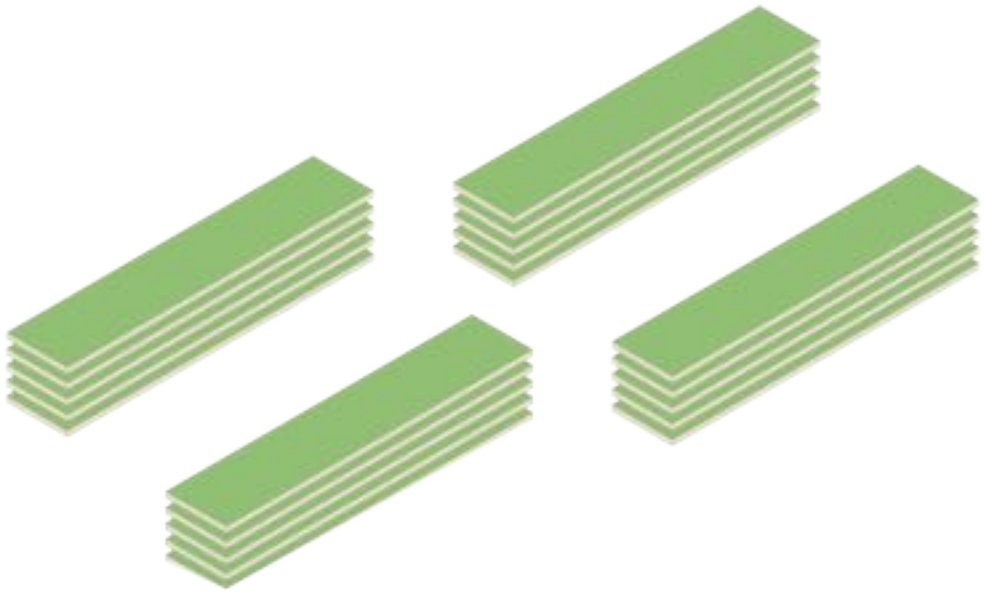
B.3

terraced building
function: residential
max height: 7 floors
peculiarities: green façade
and green roofs



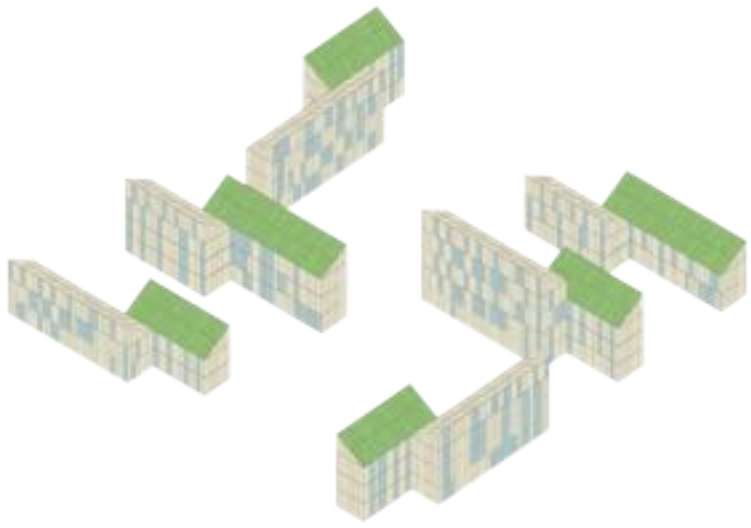
B.1

medium density courtyard
function: residential
courtyard size: 50m x 50 m
peculiarities: green façade,
green roofs with solar panels



B.4

medium density
linear residencies
function: residential
height: 5
peculiarities: green roofs
with solar panels

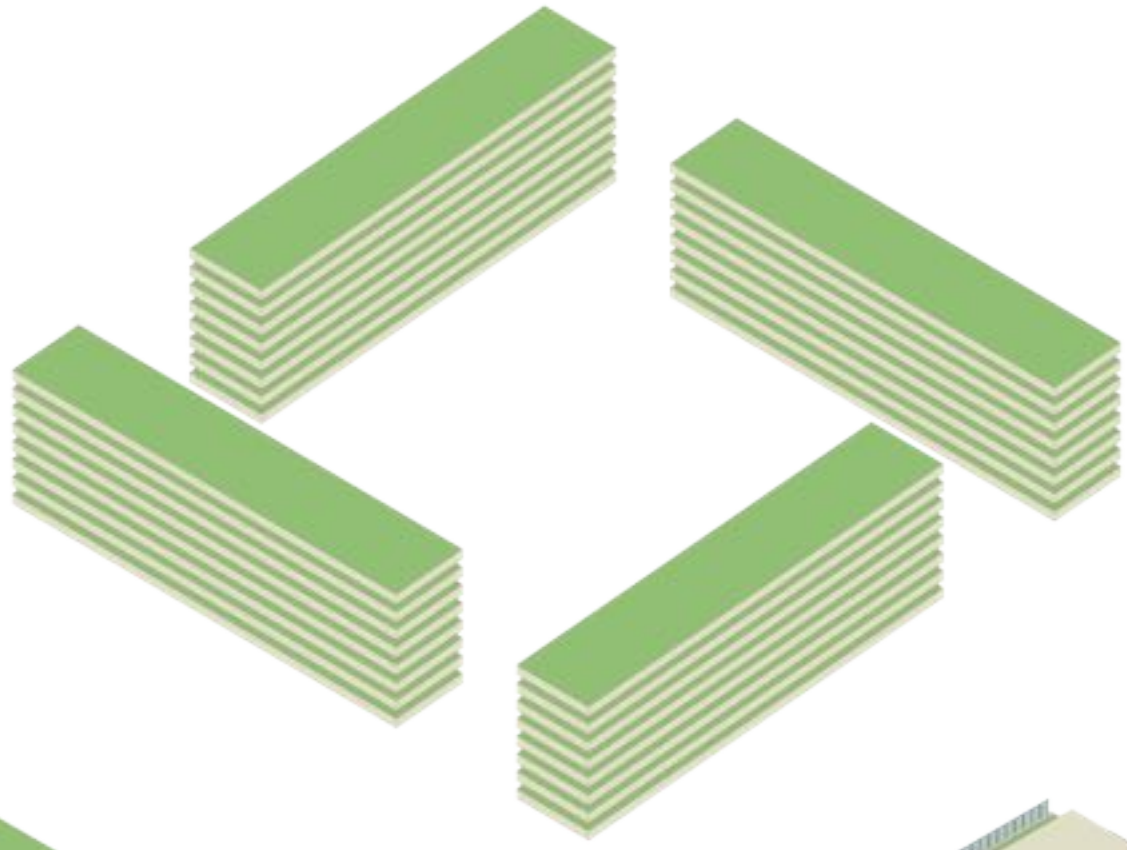


B.5

midium density
modular wood building
function: residential
maximum height: 3 floors
peculiarities: green roofs,
flexible structure

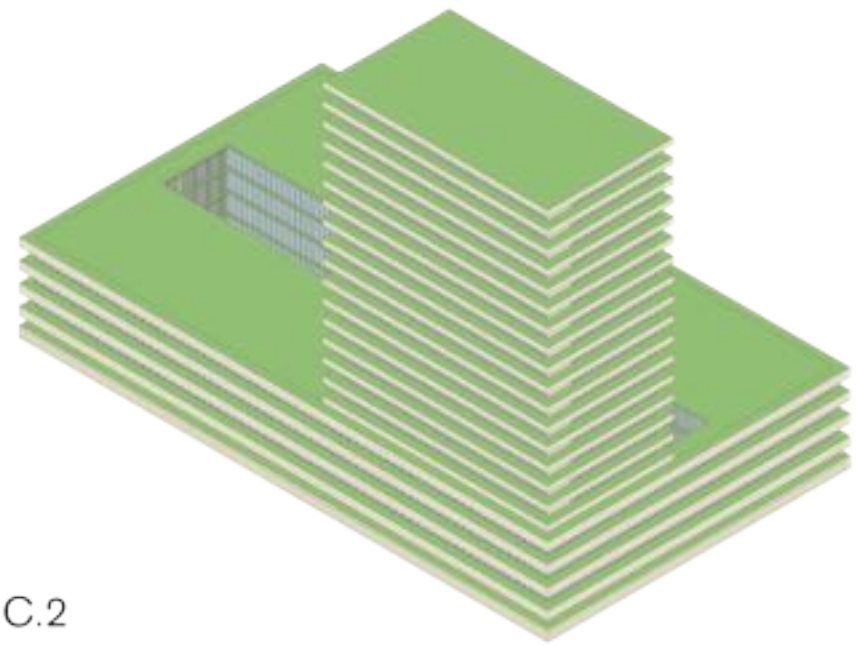
Wood typologies abacus

high density



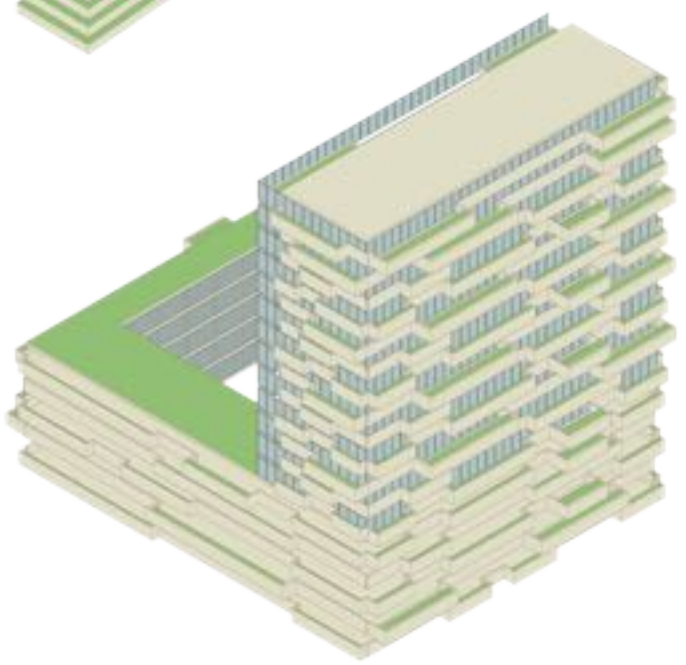
C.1

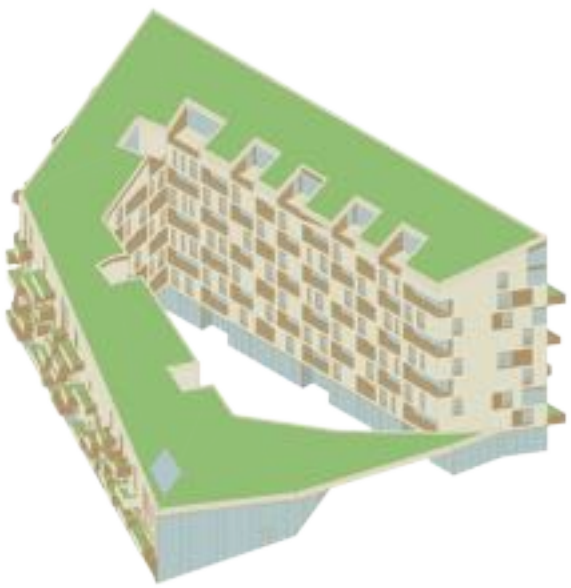
high density
linear residencies
function: residential
max height: 8 floors
peculiarities: green façade and green roofs



C.2

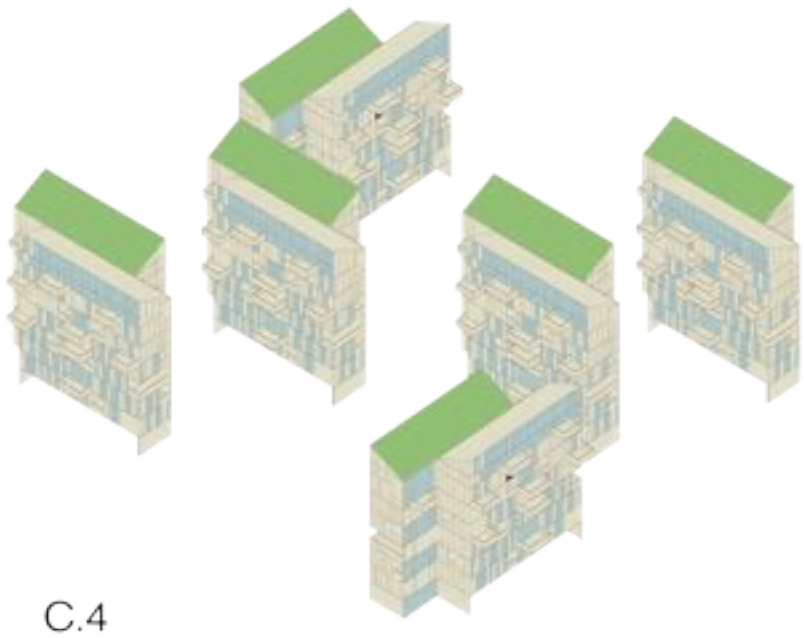
mixed use building
function: mix use -
offices and residential
height: 18
peculiarities: green roofs with solar panels





C.3

high density
courtyard
function: residential
max height: 14 floors
peculiarities: green façade
and green roofs

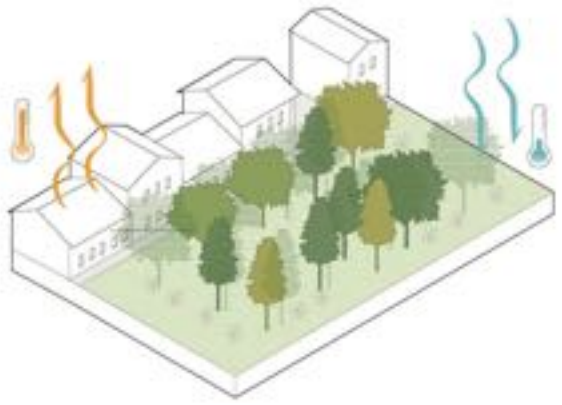


C.4

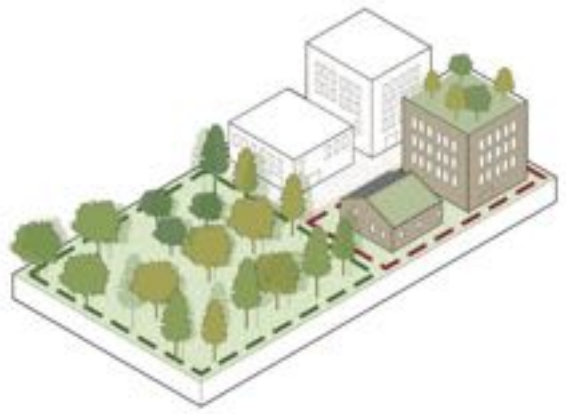
high density
modular wood building
function: residential
maximum height: 3 floors
peculiarities: green roofs,
flexible structure

Action Abacus

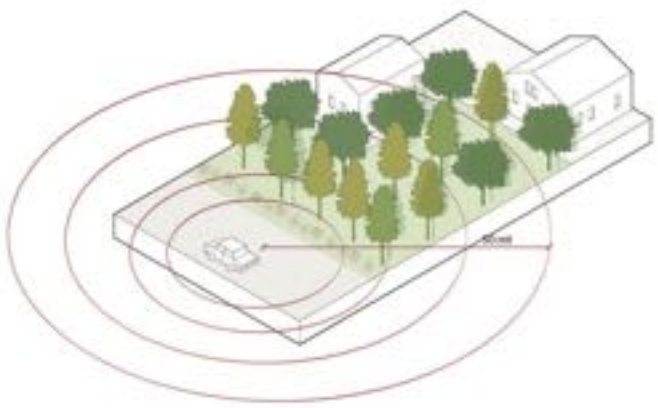
1. De-sealing
De-sealing allows to lower “heat island” effect and to drop in surrounding temperatures of 2/4°C.



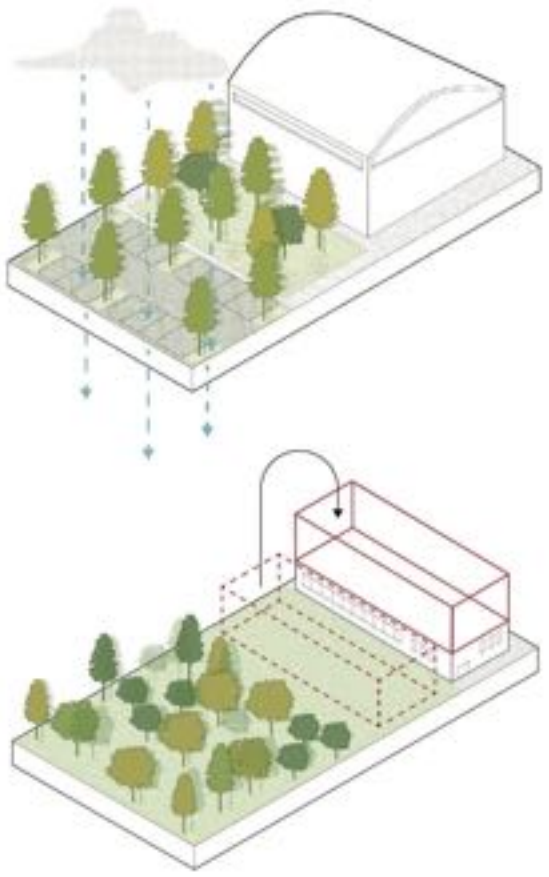
2. Urban Compensation
New construction compensation is achieved implementing green areas.



3. Infrastructural Mitigation
Infrastructure noise pollution is reduced through an environmental protection zone.



4. Water Compensation
Project permeable areas in order to ensure water flow and reduce urban runoff risk.



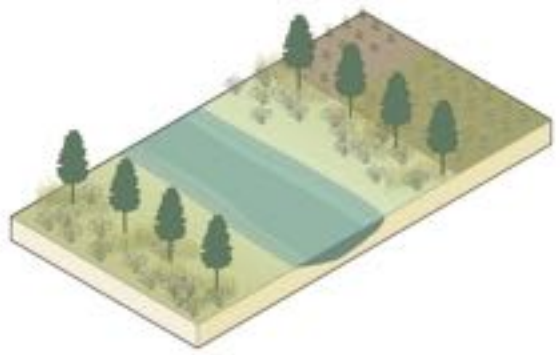
5. Densification
Reduce impermeable areas increasing height in buildings and favoring densification stategies.

6. Building Replacement
Building replacement of existing buildings with low environmental impact wooden constructions.

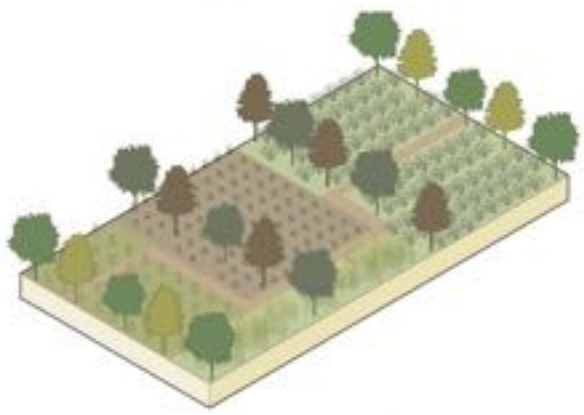
Landscape Abacus

1. Green riparian zone
Remediation of wetlands and agricultural areas through phytodepuration, using aquatic and autochthonous tree species

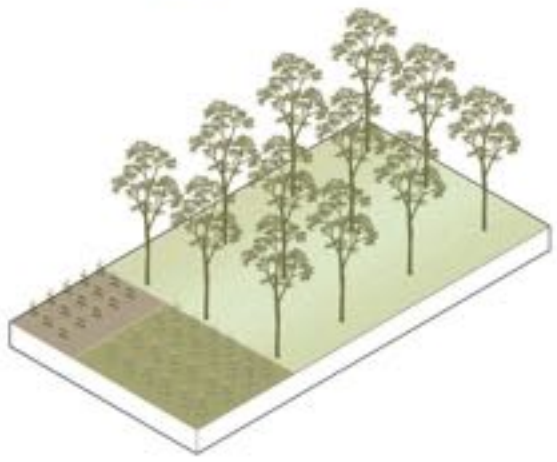
2. Green and blue corridor
An increase in the width of the areas subject to protection of canals and rivers will be expected, thus creating a real green and blue infrastructure with autochthonous species.



3. Agroforestry
Promote forestry, spread the use of rows of trees and hedges in agricultural areas and also spread.



4. Productive forest
The productive forest contributes to the development of a circular and sustainable economy.



5. Landscape mitigation zone
Creation of an agro-environmental protection zone that defines the boundaries of agricultural areas from urban areas.

6. Ecological corridor
Connection of intercluded green and agricultural areas thanks to the construction of ecological biodiversity corridors.


Strategies

FRESQUE
POTENTIALITIES

ATLAS
STRATEGIES

POTENTIALITIES	STRATEGIES
UN INTERNATIONAL CITY	UN Headquarter for Climate Change and Anthropocene
CERN FCC FUTURE CIRCULAR COLLIDER INFRASTRUCTURE	FCC High-voltage Energy distribution Infrastructure
CERN LHC RING TERRITORY	Linear Agricoltural Park
AGRICULTURAL HERITAGE	Agroforestry
FOREST PATRIMONY	Swiss and French Timber Production Forests
	Planted Forests
	Urban and Periurban Forestry
	Circular Wood Economy
CONCRETE BUILDING HERITAGE	Building Conversion
POPULATION GROWTH	Metropolitan Constellation
CLIMATE CHANGE RISKS	Ecological Transition
CARBON TRANSPORT BASED ROAD INFRASTRUCTURE	ZEZ - Zero Emission Zone
SALÈVE MOUNTAIN AND TERRITORIAL BIODIVERSITY	Green Heart of the Constellation
CERN ENERGY DEMAND	Storage System Strategy for Peaks Demand
URBAN ENERGY DEMAND	Autonomous Carbon Positive Energy Model
CROSS-BORDER COMMUTING	Teleworking stations on site
EXTENDED GEOGRAPHIC CONTEXT	Transnational District
MIXED SOCIAL LANDSCAPE	Creation of New Urban Communities

CHARTE
ACTIONS

- UN Research Center for the Ecological Transition
- 10 Km Smart Grid (Slow Mobility -Autonomous Energy - Community Facilities)
- Landscape Intensification
- Network of Pedestrian and Cycle Paths
- Park Leisure Facilities
- Conversion to a Sustainable and Natural Agriculture
- Agricultural Forestry
- Establishment of a Transnational Selvicoltural Agreement and Consortium
- Transnational Timber Production Chain System
- Productive forests on waiting lands and brownfields
- Characterization of productive forests planting areas
- New Legislative status for Planted Forests
- Short rotation Forestry
- Regional centralization of wood working - Sawmills
- Tree Planting and NBSs within the Metropolitan Constellation
- FCC Forest Buffer Ring
- Wood Life Cycle Cost Analysis
- Timber Recycling thanks to BIM-based Material Passport and Archive
- Material Deposits between Life Cycle Chain, located according to short chain principles
- Distributed Ledger Technologies (DLT) for resources management optimization
- Composting and Biogas production at the end of the timber Life Cycle
- Building Conversion and Substitution with Sustainable materials
- New Urban Nuclei
- 11 New Centralities
- FCC Ring Buffer Zone
- Protection of Natural land and Biodiversity
- E-vehicle Ring road
- Intermodal Park and Ride Hubs
- Carbon Mobility Taxes
- Low Carbon Transport Hierarchy
- Forestry and Agroforestry
- Biodiversity enhancement actions
- Creation of Ecological Corridors and Distruction of Biodiversity Barriers
- Research Center for the Salève Biodiversity Protection
- Leisure Facilities
- CERN FCC Power-to-Gas Storage
- Energy Budget per Citizen
- Eolic and PV Renewable Energy production
- Compressed Air Lake Underwater Storage System (Electrical Energy)
- Lake Underwater Coil Storage (Thermal energy)
- 5 Km Radius Working Stations
- Transnational Eurodistrict GG-Annecy Coop. Agreement
- Launch of a Transnational Grand Genève Eurodistric Agency
- Transnational Grand Genève Met. Constellation States General
- Round tables of Transnational Cities of the World
- Access to EU Funds as ERDF
- Construction of an economic, social and territorial Strategic plan
- Open Schools
- New Agricultural Parks and Gardens
- Physical proximity between life, work and leisure spaces
- Life quality and sustainable life model enhancement

Energy strategy

Carbon Neutral on Site

REDUCTION

NEW CONSTRUCTION = max 15 kWh/m2y*
REFURBISHMENT = 80 %*
(*for space heating)

ENERGY BUDGET

SPACE HEATING: 450 kWh/pers y
DOMESTIC HOT WATER: 800 kWh/pers y
PLUG LOADS: 1000 kWh/pers y

PRODUCT BUDGET

SPACE HEATING: 1 m2/pers STP
DOMESTIC HOT WATER: 2 m2/pers STP
PLUG LOADS: 5 m2/pers PV

STP: Solar Thermal Panels PV: Photovoltaic Panels

Energy

Transsolar KlimaEngineering

Circularity as efficiency
Wood represents an optimum candidate for construction material to follow the future necessity of new buildings due to the imminent population growth. The reasons are related to the big local availability and to the ancient swiss culture in that field, as well as to the passive energetic benefits, that perfectly fit the goal of reducing energy consumption, hence, CO2 emissions, by 2050.
It will take part of a circular strategy where new planted forests will be created converting current agricultural lands: it will compensate the considerable demand of construction material and it will reduce the CO2 debit, aiming to the 2050's carbon neutrality.

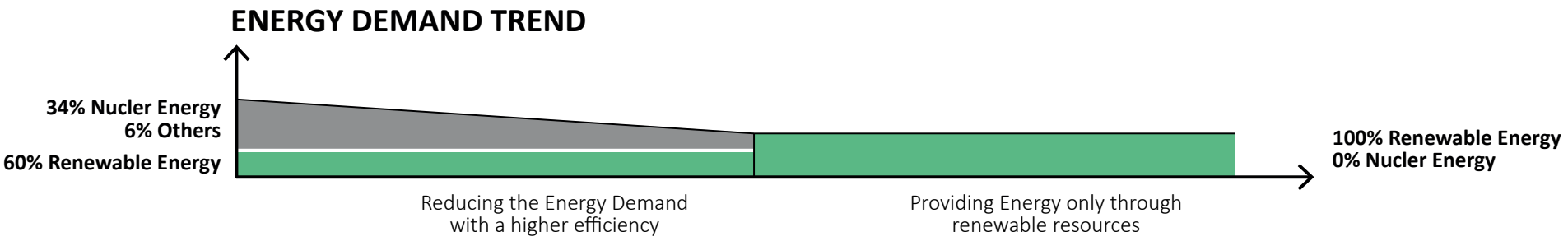
Refurbishment and New Constructions
New buildings will target zero carbon emissions on-site, calling for a maximized passive performance. LCCA (life cycle cost analysis) will be mandatory to decide whether replace or refurbish existing buildings. When convenient, existing building will be refurbished with all-in-one facades which, keeping the core of the building as it is, will bring a totally new envelope including the mechanical systems for conditioning the spaces.

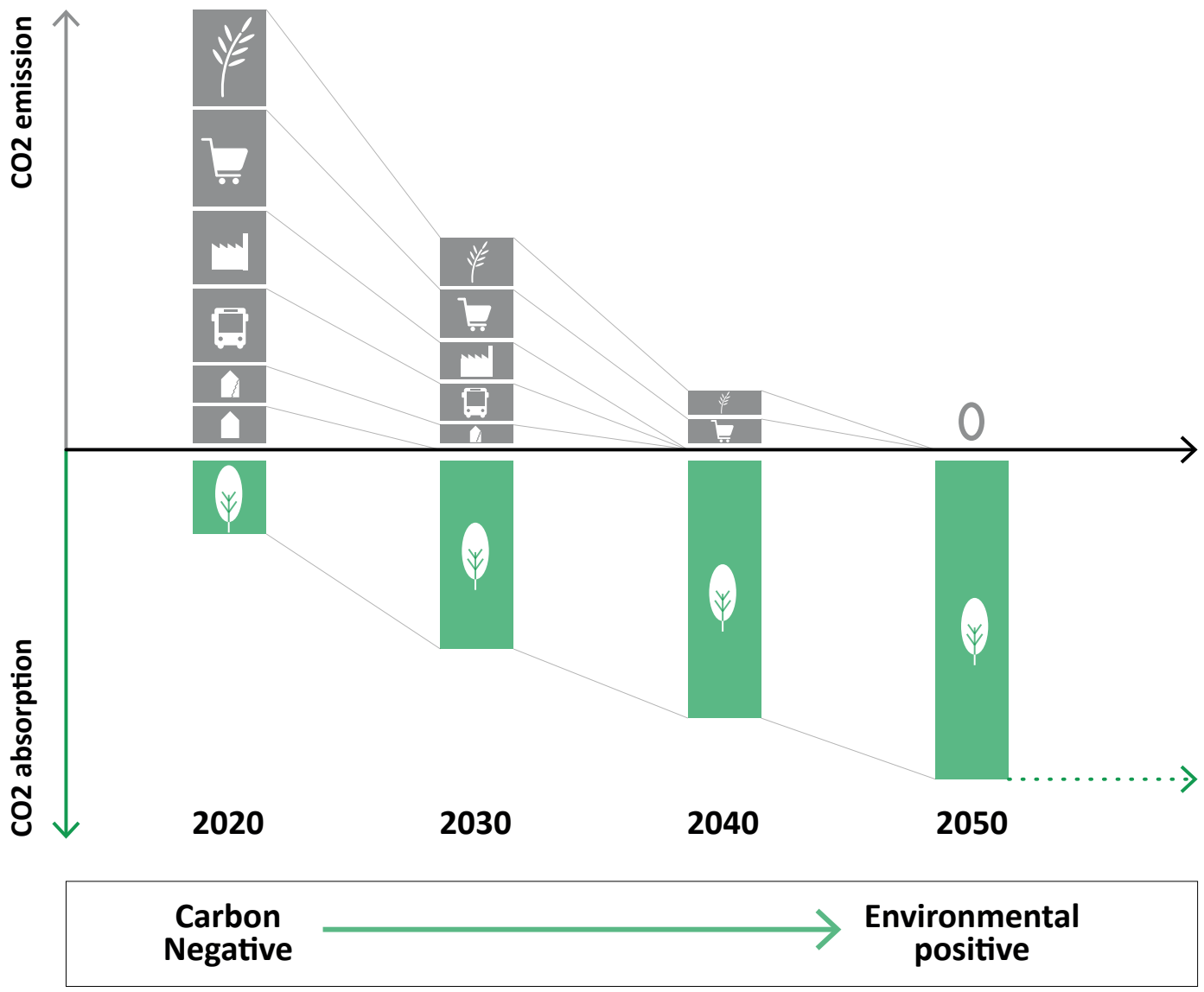
Urban Density
Low-density developments use more land but are also able to produce more energy than they need. Hence, low-density developments trade energy for land with the denser developments. And the other way around. New way of living (e.g. co-housing) will be used to make more efficient the use of land, hence, energy.

Energy System
Energy will be produced only from renewable resources and on site, through centralized or decentralized stations, depending on the developments density. Dense developments will have a centralized system, and thermal energy will be locally distributed (district heating), whereas the others will have decentralized systems which make the low/ medium density developments independent.
Roof and facade surfaces will be used to generate energy from Photovoltaic and Solar Thermal panels, while a new Wind turbines field can be located on the upper part of the central mountain area, using as much wind intensity as possible.
All these systems will be part of a smart connected grid where energy is constantly moving, in line with the instantaneous energy demand, enhancing the load management.

Aming to an electrical energy reduction logic, a cap of electricity (plug-loads) per person is set. Higher energy rates will be applied for whom do not respect the cap.

TRANSITION TIMELINE





How do we get to 0 CO2 emissions?

- High efficiency
- Energy Production from Renewable Resources
- Local and efficient materials
- LCCA
  Life Cycle Cost Analysis

There will be a gradual transition to reach the goal of carbon neutrality by 2050, that will involved every field: firstly buildings, reducing consumptions, adopting high efficiency refurbishment strategies and new constructions; secondly, transportations and industry will take part of the process, and at the end, agriculture and commerce.

Before getting to the final carbon neutrality, the carbon positive status is needed to pay back the current CO2 debit. In fact, the daily absorption of CO2 by plants is not enough to balance the CO2 emissions.

OVERVIEW

ARCHITECTURAL PROPOSAL

EXISTING BUILDINGS

LCCA- Life Cycle Cost Analysis

\+ Refurbishment, reducing demand

— Demolition and Reconstruction

NEW CONSTRUCTIONS

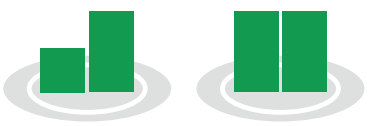
WOOD Constructions

Zero Carbon Emission on site + maximezed passive performance

URBAN DEVELOPMENT DENSITY

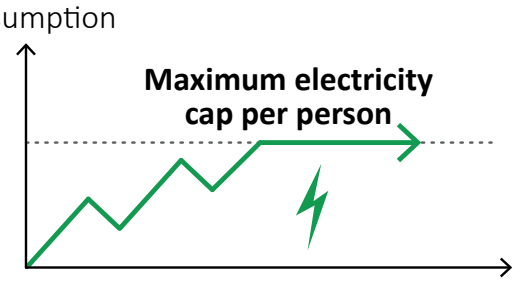
LOW DENSITY

MEDIUM HIGH-DENSITY



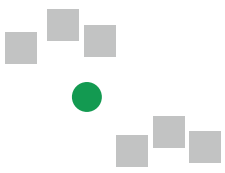
CO-HOUSING

Electricity Consumption



ENERGY SYSTEM

DECENTRALIZED



Low urban developments density
On site production + decentralized storage

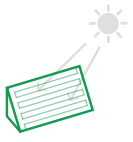
CENTRALIZED

Medium-High urban developments density
On site production+ on site storage

ENERGY PRODUCTION

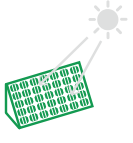
THERMAL ENERGY

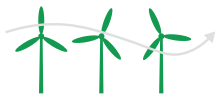
Solar Themal Panels



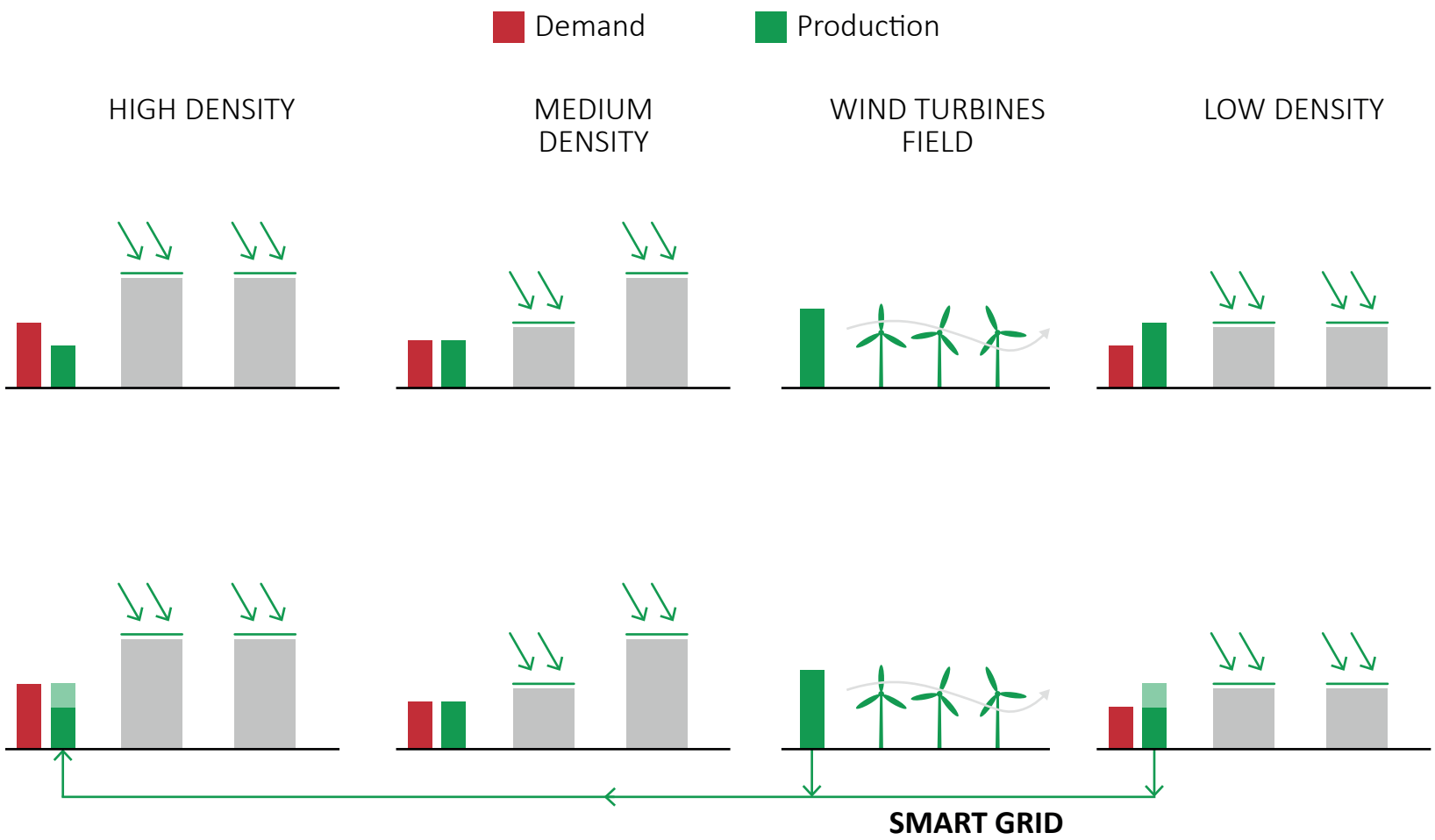
ELECTRICAL ENERGY

Photovoltaic Panels + Wind Turbines

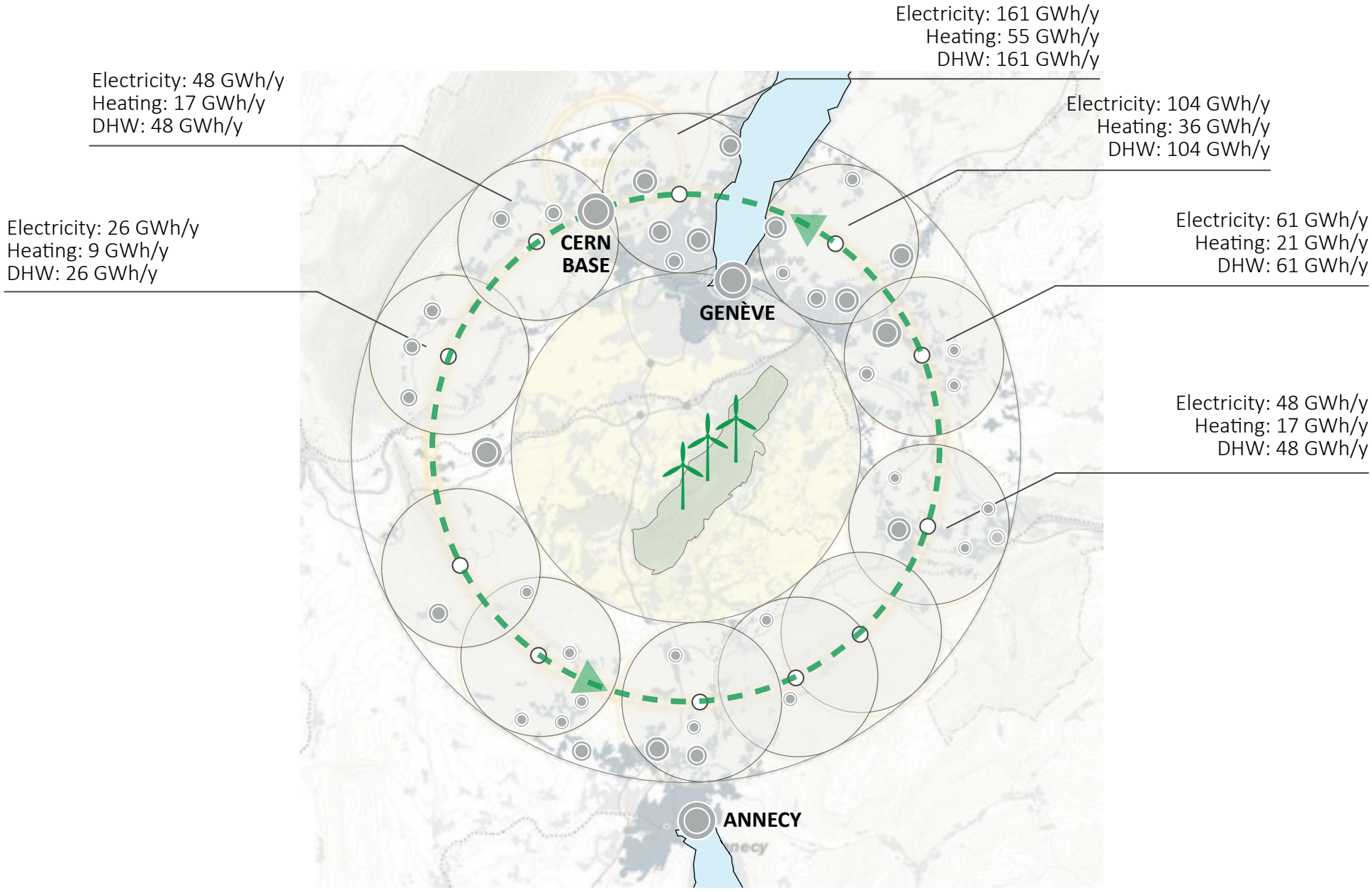




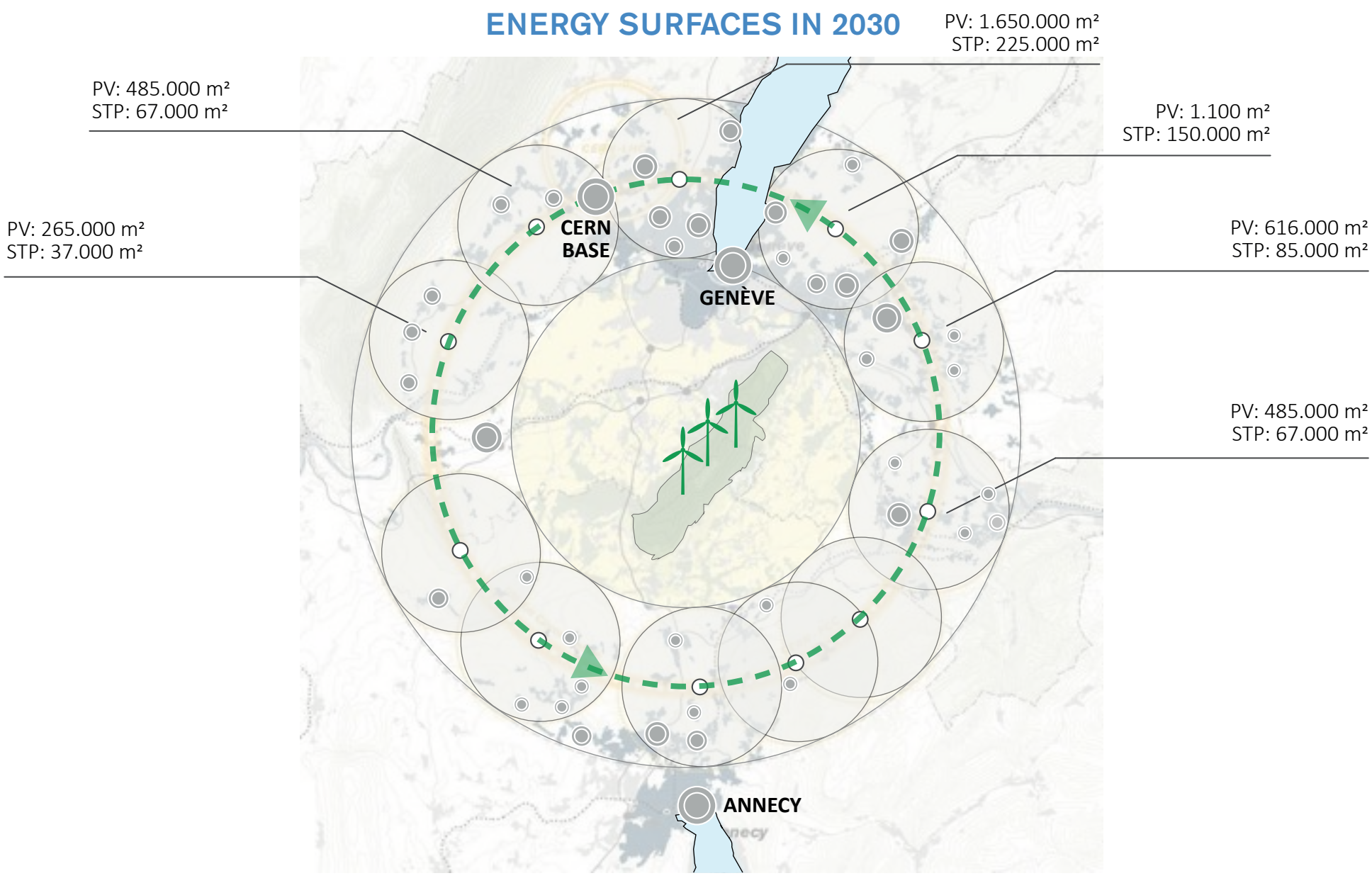
DYNAMIC BALANCED ENERGY SYSTEM



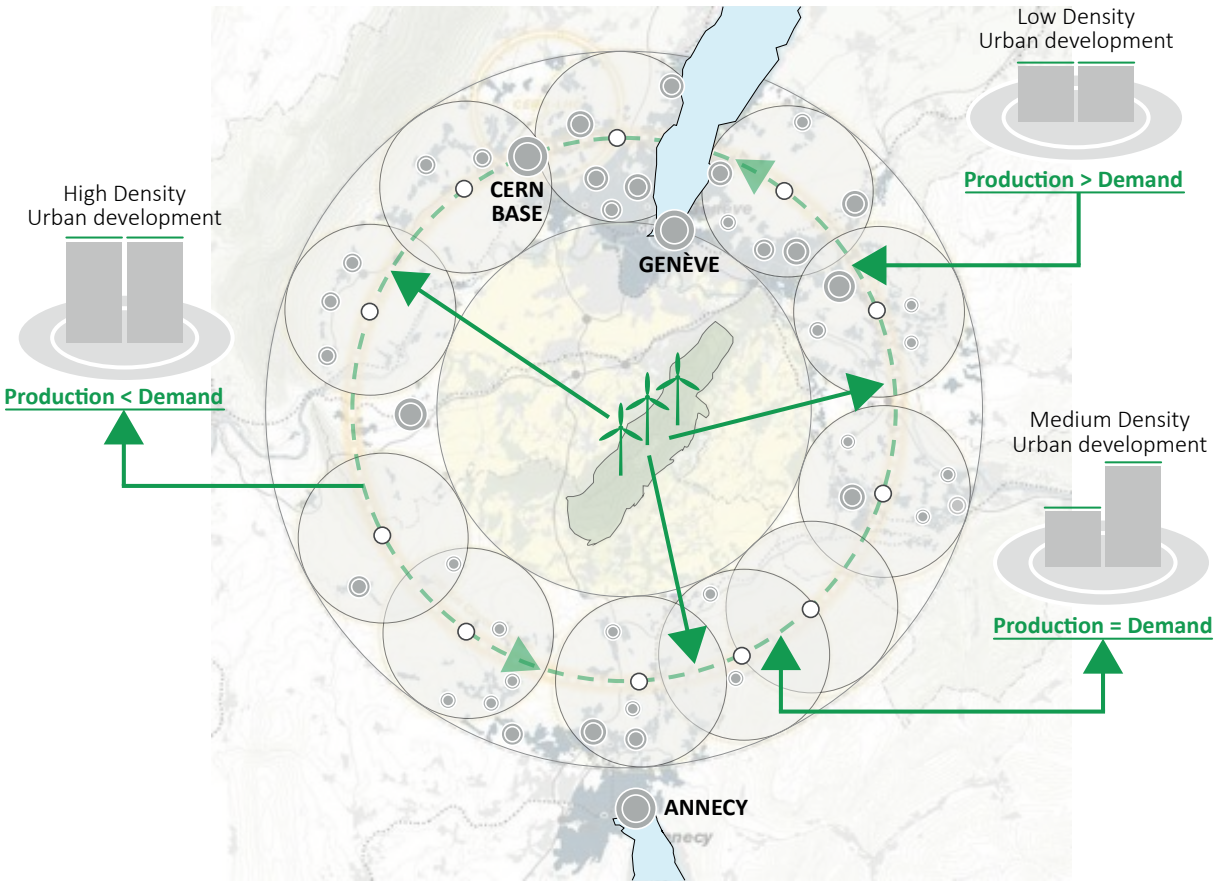
ENERGY DEMAND IN 2030



ENERGY SURFACES IN 2030



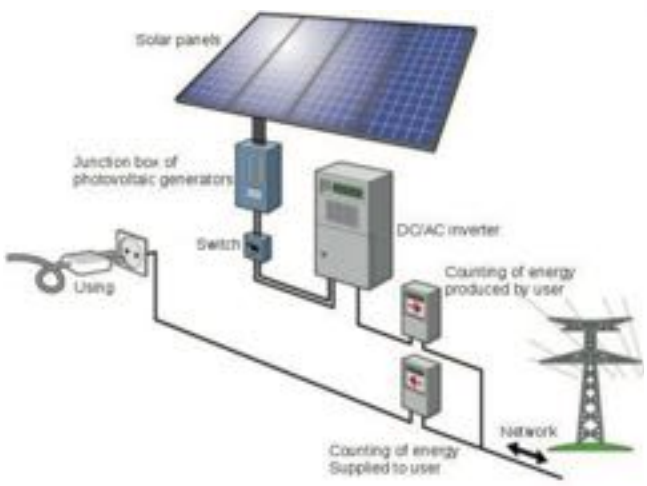
ENERGY PRODUCTION



Energy production and direction.

The production is totally on site, through photovoltaic panels located on rooftops of each urban development, and wind turbines, working on top of the central montanious area.

ENERGY REFERENCES



Operating Photovoltaic System scheme.

Operating Solar Thermal System scheme.

Distribution

The FCC is used as high voltage underground transmission to connect areas with different densities and to move energy between them.

Storage

In order to reach the carbon neutrality on site, a solid storage system is required, for both thermal and electrical energy.

Carbon neutrality, that mainly means "zero CO2 emissions", can have a different range of autonomy: from 0%, where there is no storage on site and the public grid connection is needed to exchange energy during maximum and minimum production periods, to 100% when there is a storage system and the connection to the public grid is needed only for back up. For both of them the energy production is on site. Aiming to the maximum autonomous system, even if it is more expensive than the standard case, it provides an independent management from the economical energy fluctuations market.

Energy storage systems allow the seasonal balance between energy production and demand. The system generates a surplus of energy during summer season, taking advantages of the greater availability of solar radiations; the extra energy is stored in a combination of several systems, according to the different needs (thermal and electrical), located homogeneously along the 100 km long ring and its buffer area.

In Switzerland, 60% of energy is currently produced through Hydroelectric power. The easiest storage system combined with this production is pumped hydroelectricity storage. It is the most known storage system, based on a well established structure and the most developed large scale storage technology currently available. The electricity is stored during off-peak times, and transformed, firstly, in mechanical energy and, secondly, in potential energy, by pumping water uphill into reservoirs; then, when electricity is required from the users, the water can be gravity fed through turbines to produce electricity.

Another option can be through the lakes using underwater compressed air systems. It is based on a conversion of electrical energy into high-pressure compressed air, that can be release at a later time to drive a turbine generator to produce electricity. It is normally driven in disused salt mines, but the pressure is slowly reduced while the air is releasing, affecting the amount of electricity produced by the turbines. The advantages to use that system underwater is, hence, the hydrostatic pressure, that keeps the air pressure leaving the underwater bags constant.

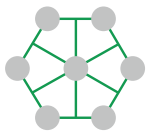
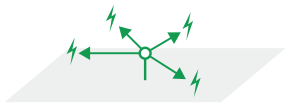
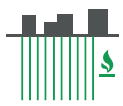
A dedicated storage system is exclusively assigned to CERN, in order to be able to trade energy based on price and avoid peaks demands while operating the FCC particle collider. The power to gas storage system is a chemical process that transforms firstly water in hydrogen, and then burns it through a co-generator, producing electricity and heating.

Moreover, gravity based storage systems could be another valid option: a big six-arm crane moves concrete blocks from the bottom to the top part of a dynamic tower, storing energy (potential energy when blocks are raised, cinetic energy when they are released). The released energy rotates turbines, generating new electricity.

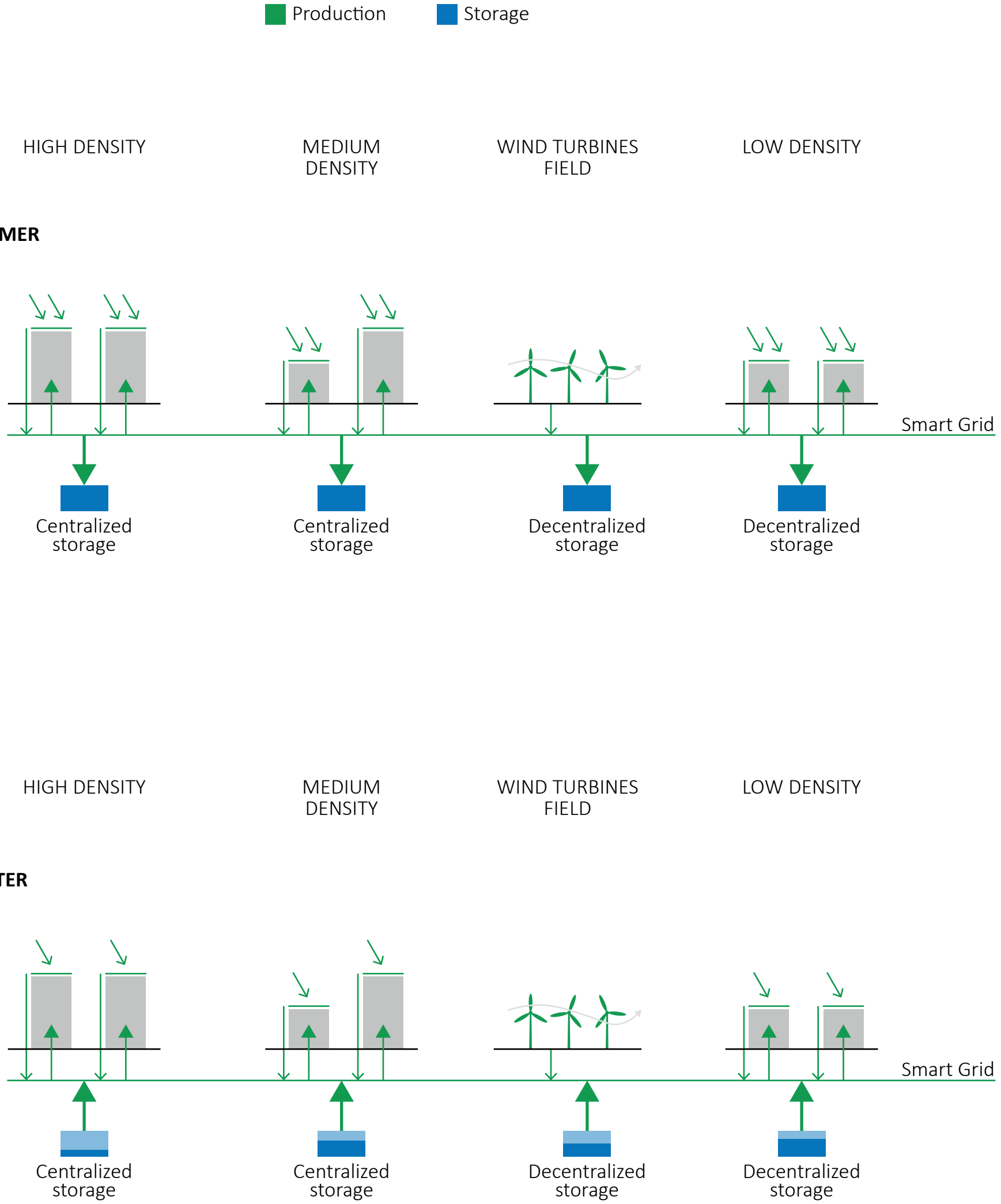
In the end, magnetic storage systems could be another chance to store electrical energy. The principle behind this is that when a material is cooled below is critical temperature, it exhibits zero electrical resistance. Under this condition, an electrical current in a loop, made of this specific material, persists indefinitely, with no power source. The original electrical energy is stored as magnetic energy and then, discharging the coil, it goes back to electricity. The 100 km long loop of FCC makes the perfect rail for this circulating storage.

On the other hand, thermal energy can be stored through the lakes or using geothermal systems. Ground temperature as well as deep water temperature, has mainly constant values. During winter, the system can be used as preliminary pre-heating for residential and offices areas, while during summer it can absorb extracted heating to cool down buildings.

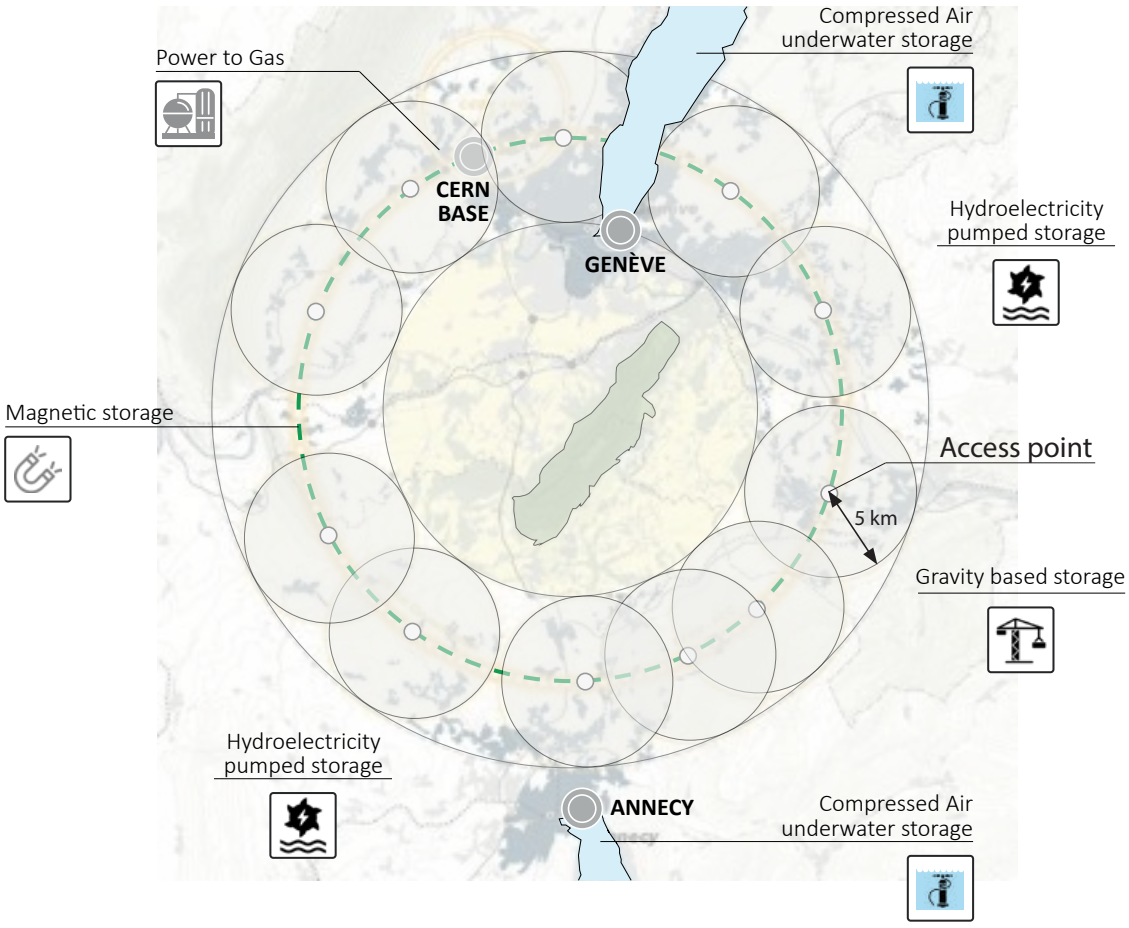
OVERVIEW

ENERGY DISTRIBUTION	SMART GRID  ACCESS POINTS 	Unificated grid + local interconnected grid
THERMAL ENERGY STORAGE	LAKE COIL SYSTEM  GEOTHERMAL SYSTEM 	
ELECTRICAL ENERGY STORAGE	POWER TO GAS*  HYDROELECTRICITY PUMPED  COMPRESSED AIR UNDERWATER  GRAVITY BASED SYSTEM  MAGNETIC ENERGY STORAGE 	*Exclusively for CERN

SEASONAL STORAGE

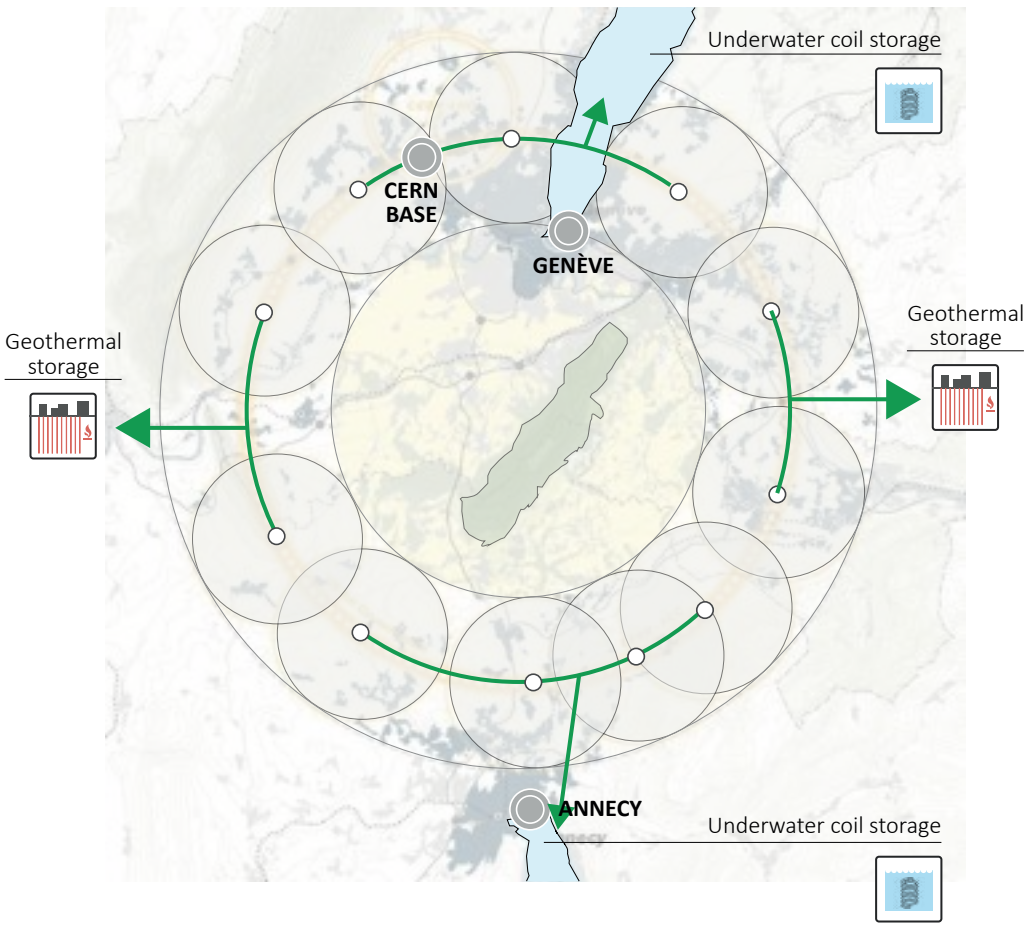


ELECTRICAL ENERGY STORAGE



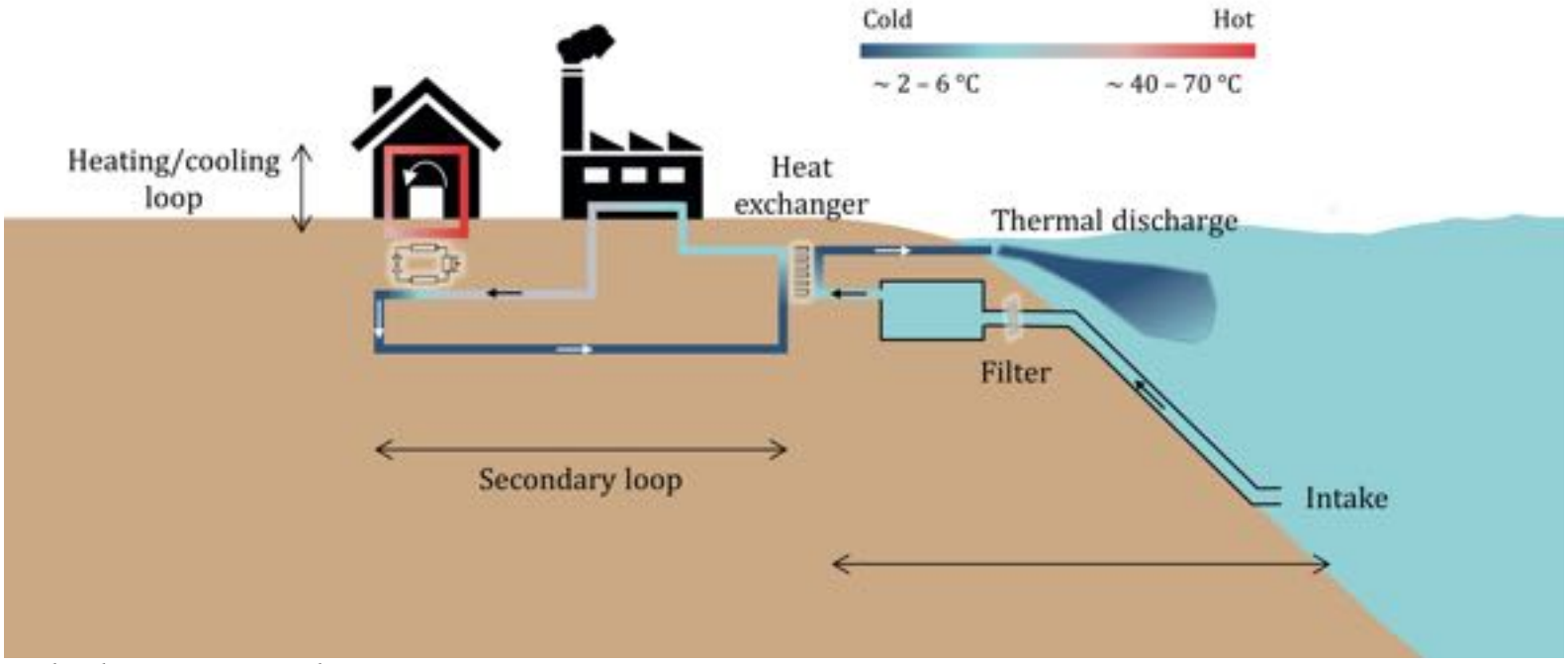
Homogeneous distribution of storage systems along the FCC ring. In case of centralized systems (for high-medium density urban developments) there will be a specific local energy storage, located at each access point.

THERMAL ENERGY STORAGE

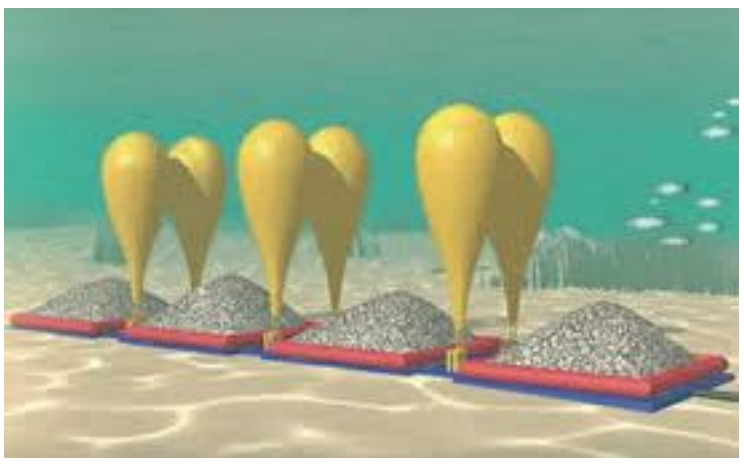


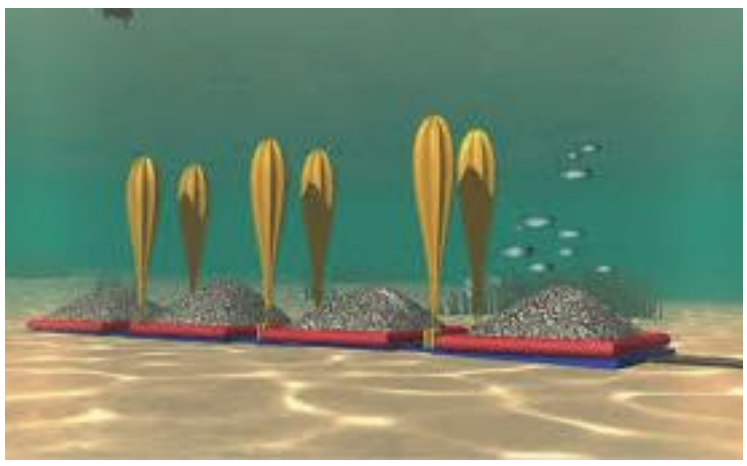
On a residential scale, heating will be supplied by radiant systems, which provide improved thermal and acoustic comfort, as additional supply as well as through biomass combustion. Cooling is normally not needed, but passive strategies, such as natural night ventilation, can be enough for the future increase temperature.

ENERGY STORAGE REFERENCES



Hydroelectricity pumped storage



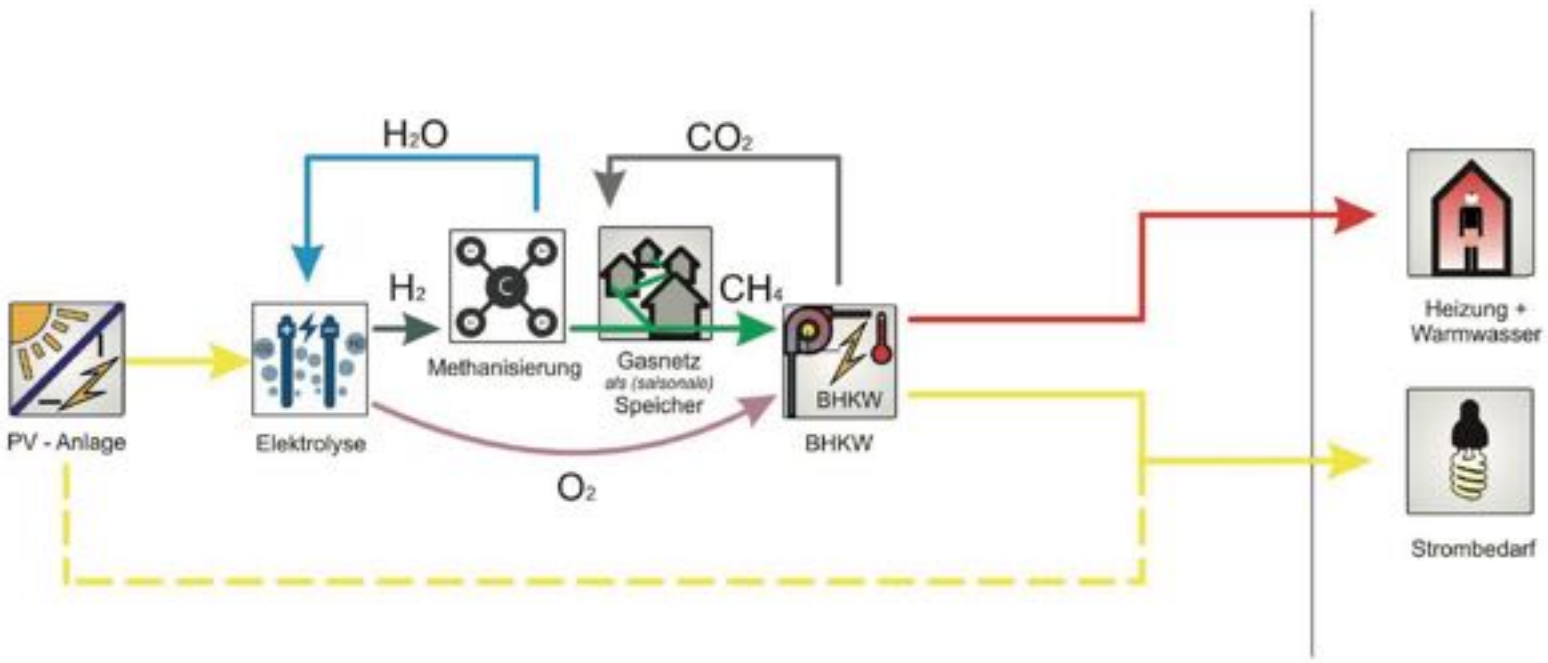


Air Compressed Underwater system

Gravity based storage

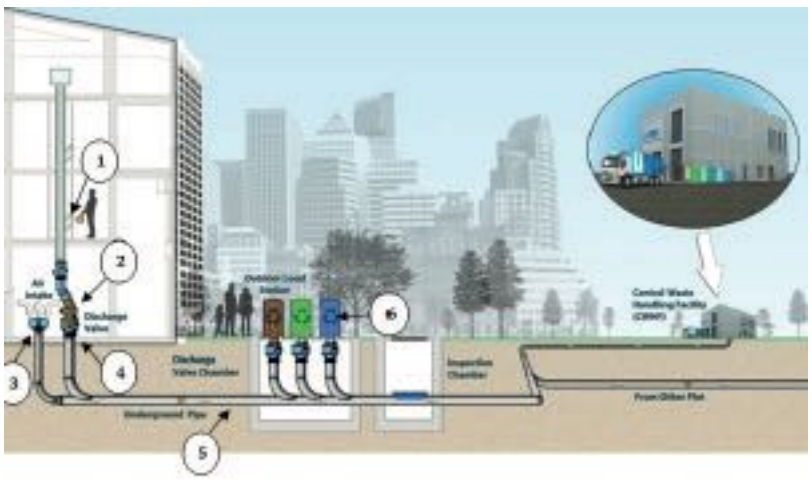
STORAGE REFERENCES

Power to Gas



DISTRIBUTION

WASTE MANAGEMENT



According to the waste management, a culture of re-use is adopted. New and existing commercial buildings or logistic facilities adopt a zero-waste policy. Waste to energy is used as extreme solution to manage only the small portion of waste which cannot be recycled. The proposal goes in the direction of an pneumatic automated system, where waste is pumped from the local inlets to the final station. Manpower is not needed (only some staff for maintanence the system) and the absence of vehicles (and fuel costs) decreases the level of CO2 emissions. Even if the initial costs are higher than a traditional system, the operating costs are definetly lower and the exstimated payback is set on short time.

First & Largest ZEZ

in the world

+ 35 km
NEW RAILWAY CORRIDORS

AN ELECTRIC MULTIMODAL
MOBILITY SYSTEM

120 km
SMART ELECTRIC ROADS

ZERO
CO_2 EMISSIONS
FROM MOBILITY SECTOR

Towards a ZEZ Greater Geneva

Systematica srl

The main challenge for the mobility sector of Greater Geneva is ensuring high quality accessibility between all the current and planned urban areas, improve accessibility from and to the city of Geneva, and within each of the urban areas. Improving multimodality and providing easy and accessible interchange options between different modes of transport especially public transport, soft mobility and shared mobility, is another important issue that should be considered while proposing new mobility strategies for Greater Geneva. In addition, considering the impact of transport sector on energy consumption and CO2 emissions, transitioning to zero-emission transport is a crucial step towards a liveable future.

As mentioned before in the mobility analysis chapter, currently the use of private cars has the highest percentage in the modal share in Greater Geneva, followed by soft mobility and public transport, therefore it is crucial to encourage a shift towards public and shared mobility modes by both improving the transport service and investing on transport infrastructure. The transport service improvements should be done through increased frequency at peak hours, smart and integrated payment methods, providing real-time data about the routes, waiting time and information regarding environmentally aware choices through transport smartphone apps and websites. The transport infrastructure should be improved by investing on missing public transport links and offering multimodal and reliable last mile solutions.

Emissions from the transport sector are a major contributor to climate change about 14% of annual emissions (including non-CO2 gases) and around a quarter of CO2 emissions from burning fossil fuels. Total energy consumption by transport increased around 44% in the first 15 years of the 21st century. Oil demand in the transport sector has increased by about 25%; transport remains extremely dependent on oil, and the sector accounted for about two-thirds of global oil consumption in 2015, with road transport alone accounting for half of oil consumption.

Electricity share in transport energy consumption has increased marginally from 0.7% in 2000 to 1% in 2015. Interestingly, railways are powered by a significant share of electricity (39%) compared to 56% by oil products. The rest of the energy consumption increase comes from a rise in gasoline, diesel, electricity and other fuel consumption. Therefore, electrification is an important part of the solution to the challenge of growing transportation sector emissions, although the emissions from electricity generation and transmission should also be taken into account to decide whether electrification makes sense in a given location.

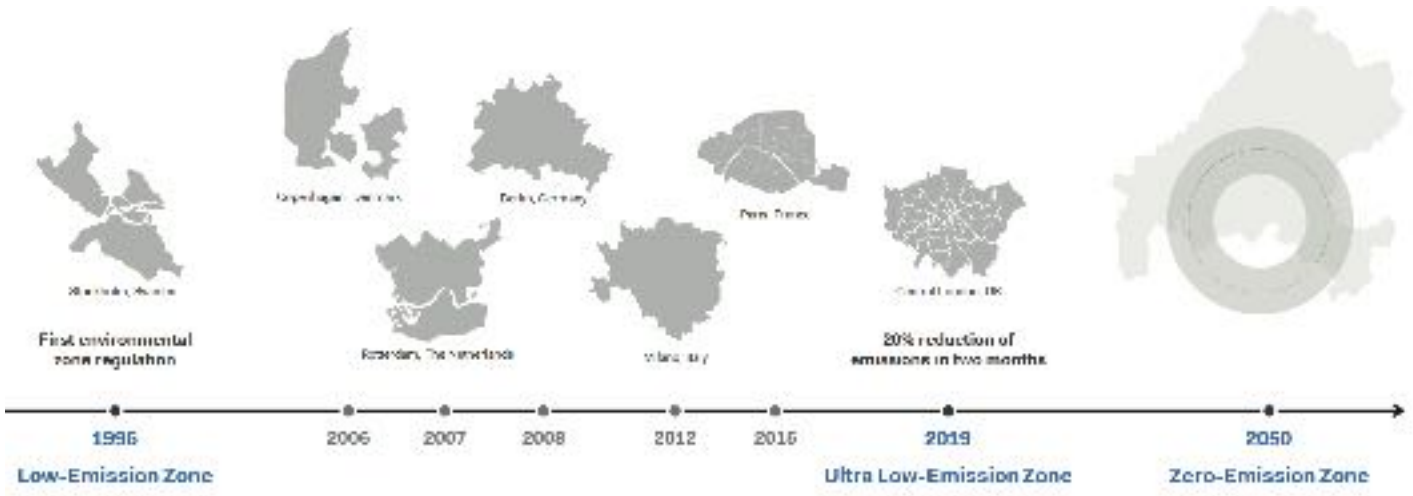
New mobility could promote the use of shared cars and bicycles while also integrating advances in electric, autonomous and data-driven technologies. Research shows cities could cut transport emissions by 80% by embracing automation, electrification, and ride sharing.

In addition, cities around the globe are decreasing transport footprint and fighting air pollution by implementing Low Emission Zones (LEZs). Air pollution can lead to poor health and to death. It is responsible for 310 000 premature deaths in Europe each year and causes more premature deaths than road accidents. The human health damage from air pollution is estimated to cost the European economy between €427 and €790 billion per year.

There are areas where the most polluting vehicles are regulated. Low Emission Zones are often the most effective measure that towns and cities can take to improve air pollution. Types of vehicles affected by LEZs includes: buses and coaches, heavy duty goods vehicles (usually over 3.5 tonnes Gross Vehicle Weight (GVW)) that are effected by most LEZs, and vans, minibuses, camper vans, cars and motorcycles that are effected by some LEZs.

The following illustration shows the evolution of LEZs in Europe. There are about 250 low-emission zones in Europe as of 2019, and an Ultra Low Emission Zone (ULEZ) is recently implemented in

EVOLUTION OF LOW EMISSION ZONES



central London to improve air quality. The ULEZ operates 24 hours a day for the entire year, with Christmas Day as the only exception and drivers are required to pay a daily charge if their vehicle does not meet the ULEZ emissions standards.

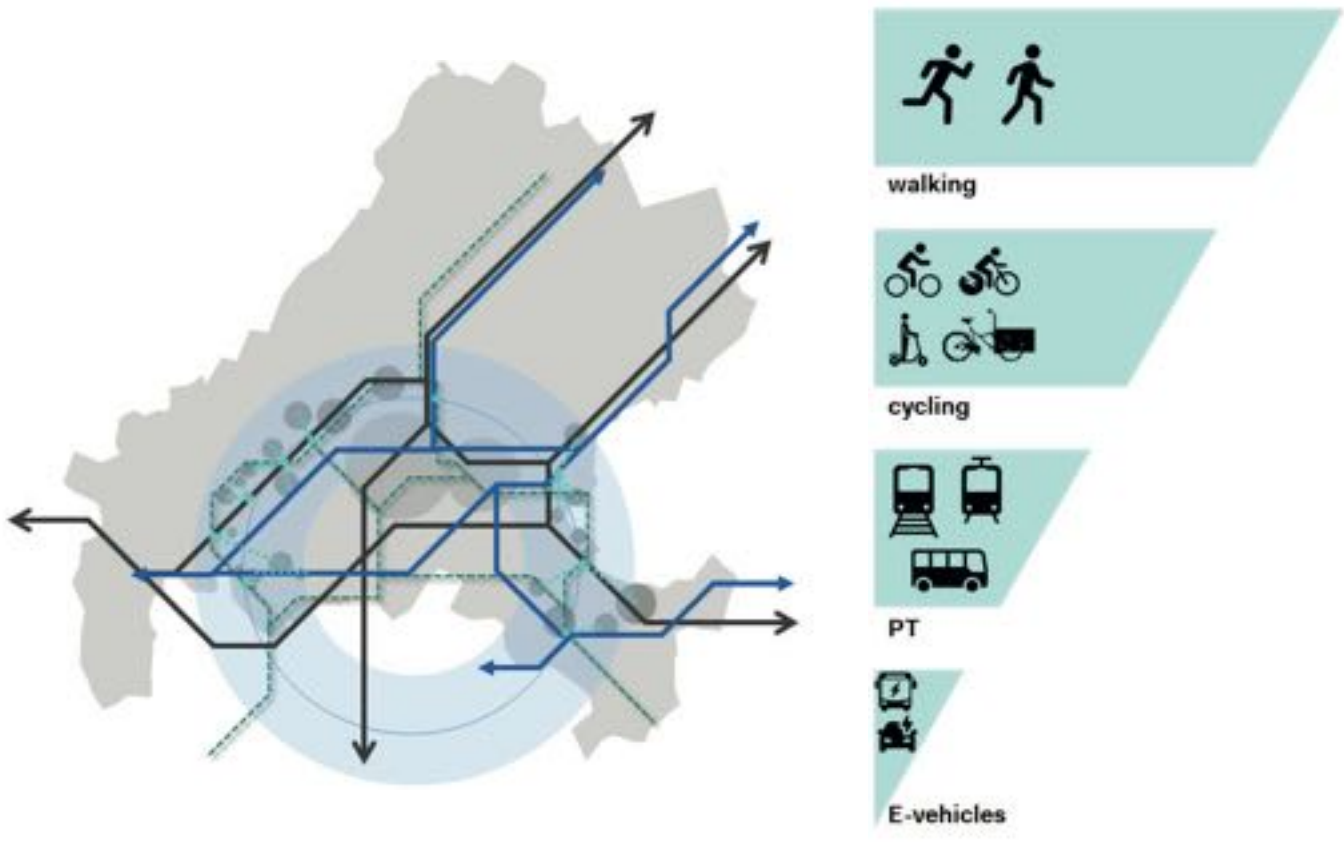
A Zero-Emissions-Zone (ZEZ) is a Low-Emission-Zone where only electric vehicles are allowed along with walking and cycling, fully electric public transport vehicles, and a ban of all combustion engine vehicles. There is currently no ZEZ in the world.
The main mobility vision is to make Greater Geneva the first and largest zero-emission-zone of the world. The Mobility Loop is an eco-system, which is zero emission, electrified, smart and connected.
The initial phases of implementation of ZEZ in the project includes payment charges while in the final phase of implementation there would be no exception or payment, all vehicles including personal, public transport, shared mobility and urban freight should be electric vehicles. There are park and ride stations provisioned for changing to other electric modes both public transport and on-demand services for moving within or pass through the Greater Geneva ZEZ.
The mobility proposal includes updating the current road infrastructure as a new electric road that works as a wireless charging station to transfer electricity from lane to vehicle batteries. Charging pads that are built into the road are using the electricity from the energy distributer of Future Circular Collider (FCC) and e-vehicle charging stations will be available at strategic locations within the loop.
In addition, the entire loop will become smart and connected. Smart roads are digital networks connecting drivers to the internet, supporting driverless vehicle and providing true connectivity between smart cars and smart cities. The sensors in the roads will detect vehicular traffic and communicate valuable data to emergency services, other vehicles and traffic control centers.
To reinforce the mobility vision, three main mobility concepts are elaborated in detail in the following pages.

INFRASTRUCTURE: FROM RADIAL TO ORBITAL

The first mobility concept is to envision a seamless radial connection to enhance the multi-polar urban strategy.
The current mobility infrastructure of Greater Geneva is based on outward centralized connections from Geneva to the rest of the agglomeration and beyond borders.

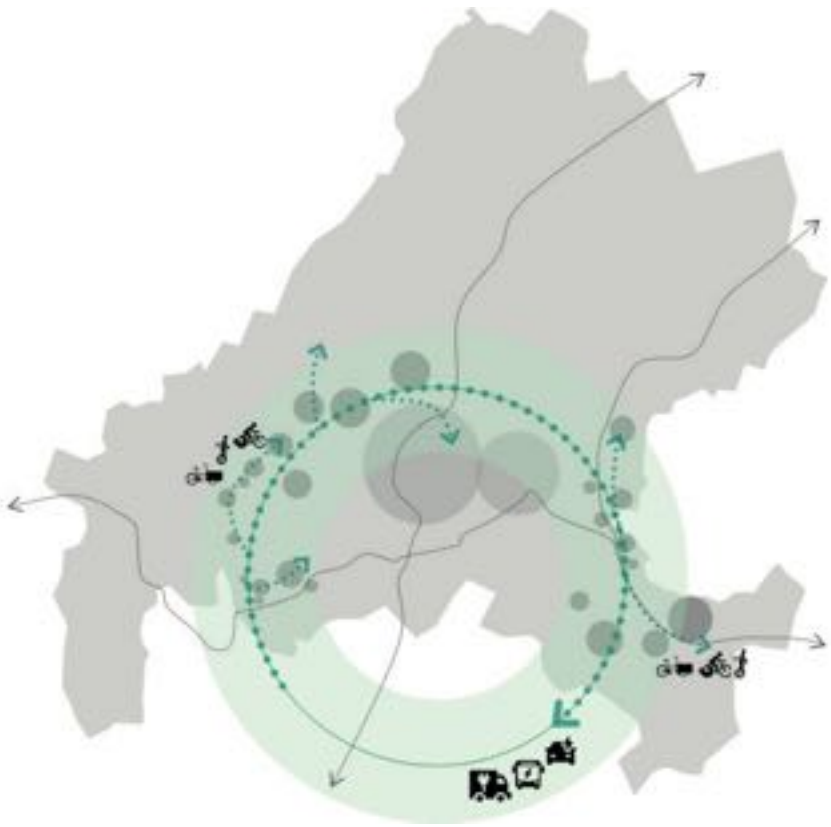
The proposed infrastructure is a system of transport networks that would connect the densified polarities within the FCC buffer. Hence, the Greater Geneva future mobility is envisioned through a mobility loop, comprising a seamless network of road and rail.

SERVICES: TRANSPORT HIERARCHY AND LAST-MILE SOLUTIONS



The second mobility concept is rooted in a low-carbon transport hierarchy to encourage sustainable travel and reduce emissions.
In order to promote shifting from private vehicle use towards public transport and shared mobility, it is essential to improve the available and reliable public transport, particularly during peak hours, followed by multimodal choices for last-mile connections. In addition, providing infrastructure for the safe use of active modes of transport including walking, biking, scooters and similar is crucial.
Moreover, upgrading the current fleet with low-emission and electric vehicles will encourage sustainable travel and reduces emissions.

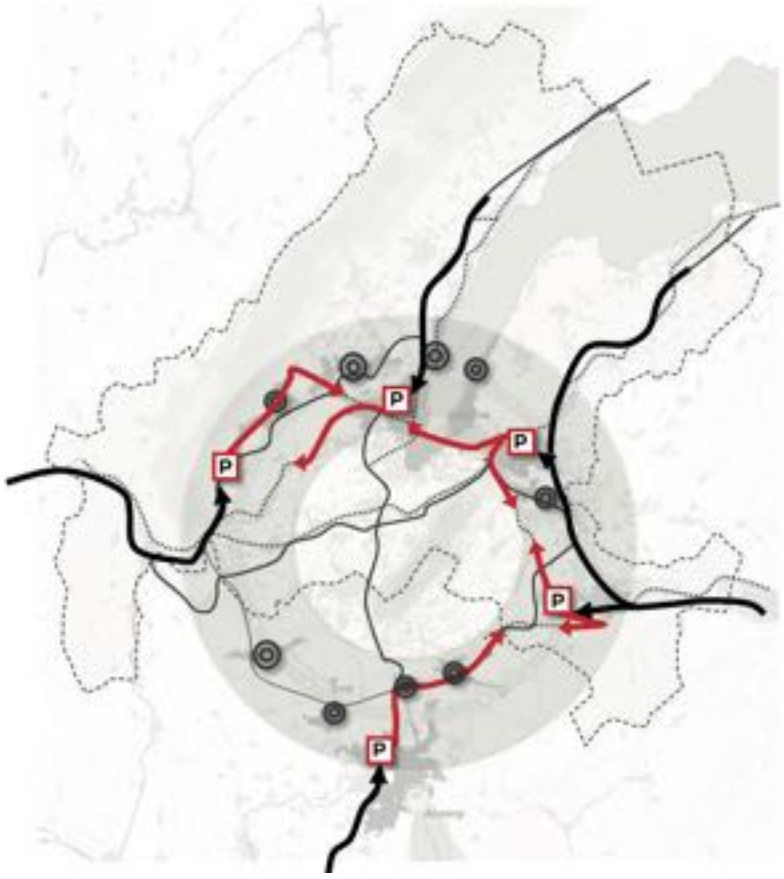
TECHNOLOGY: ELECTRIFICATION



The third mobility concept is the electrification of the entire fleet of transport. It includes public transport, shared mobility vehicles, urban delivery vehicles, private vehicles and other soft modes, including scooter and bikes.
The mobility loop is electrified as well with built-in batteries to charge vehicles while moving, and charging stations should be provided at optimized distances to ensure travel conveniences. The main benefit of the fully electrified network is the significant decrease of CO2 emissions. Currently in Greater Geneva, railway, trolleybus and trams are electrified, with only one electrified bus line. Less than 1% of private vehicle and around 7% of bikes are electric in the Geneva Canton.

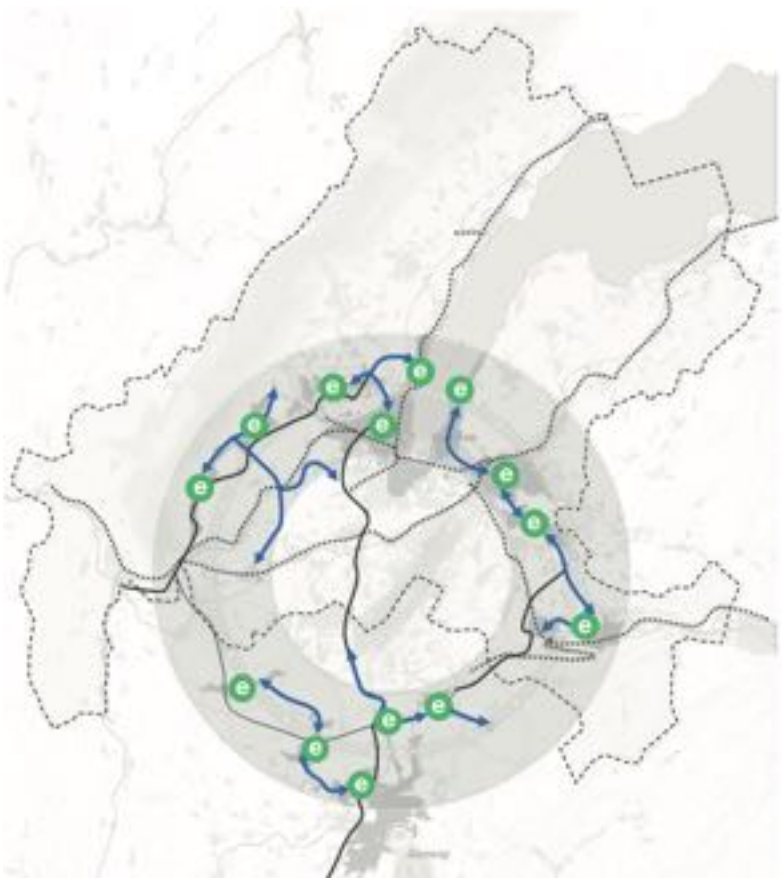
ELECTRIC TRANSPORT MODES AND TECHNOLOGIES

TOWARDS GREATER GENEVA ECOLOGICAL TRANSITION



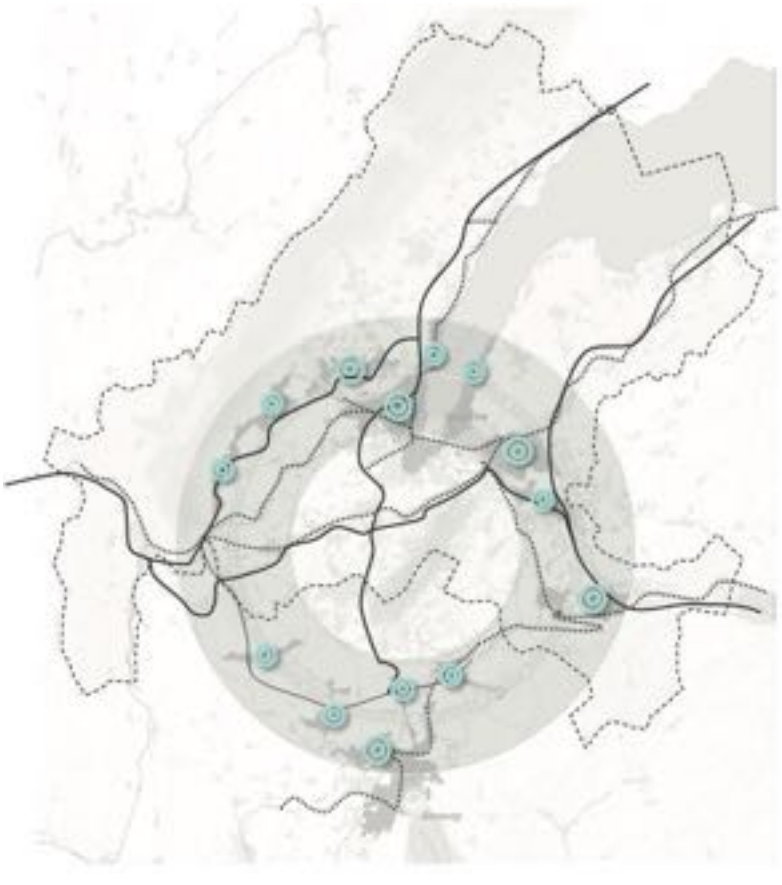
Strategy #1
At international and regional scales

Switch to the railway system and alternative electric means at interchange hubs located at strategic points.



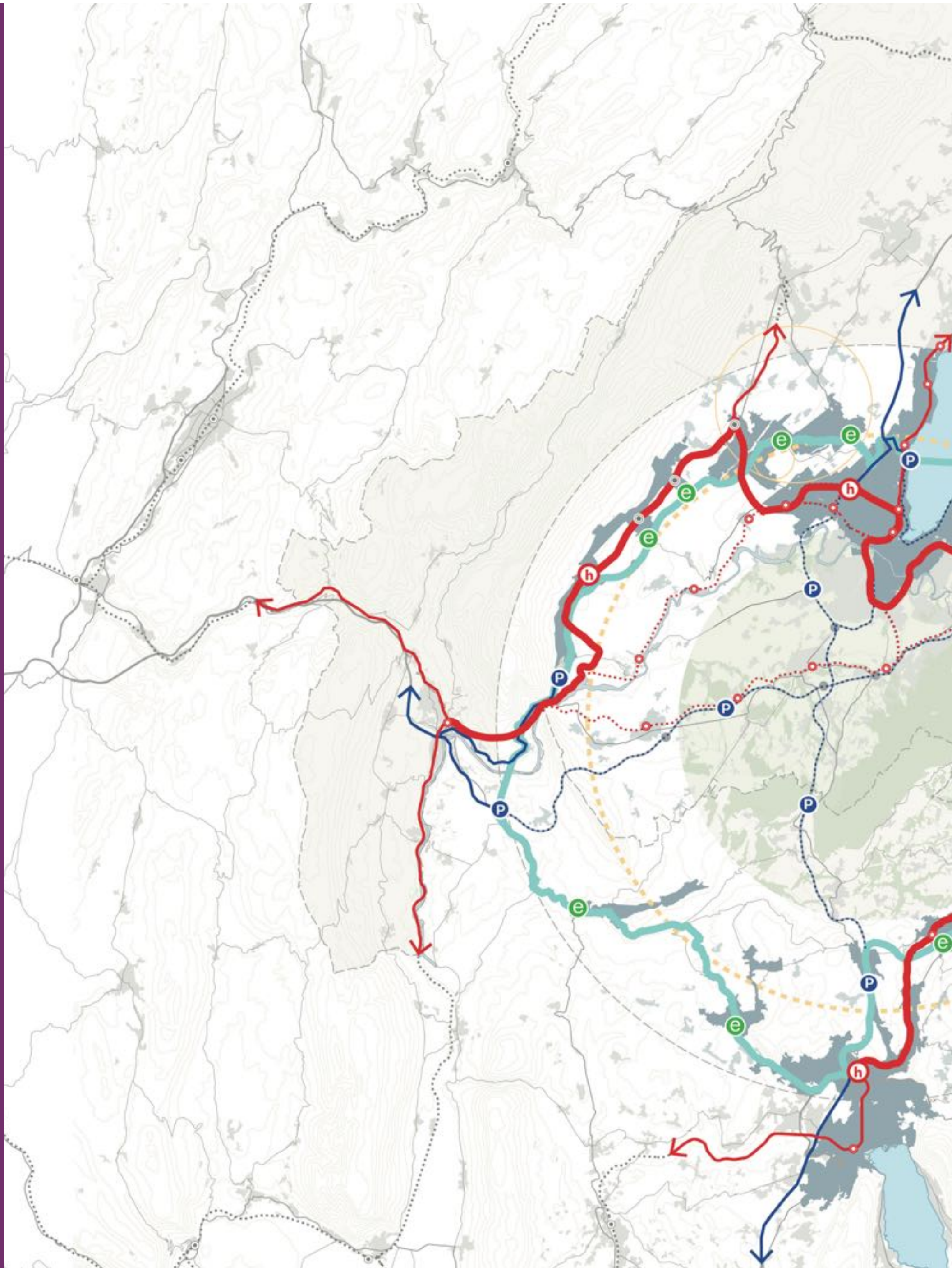
Strategy #2
At the Greater Geneva scale

Provide e-mobility stations within each centrality to allow for shorter inter-connections within the ZEZ.



Strategy #3
At the local scale

Plan for soft modes and micro-mobility stations for movements within the centralities.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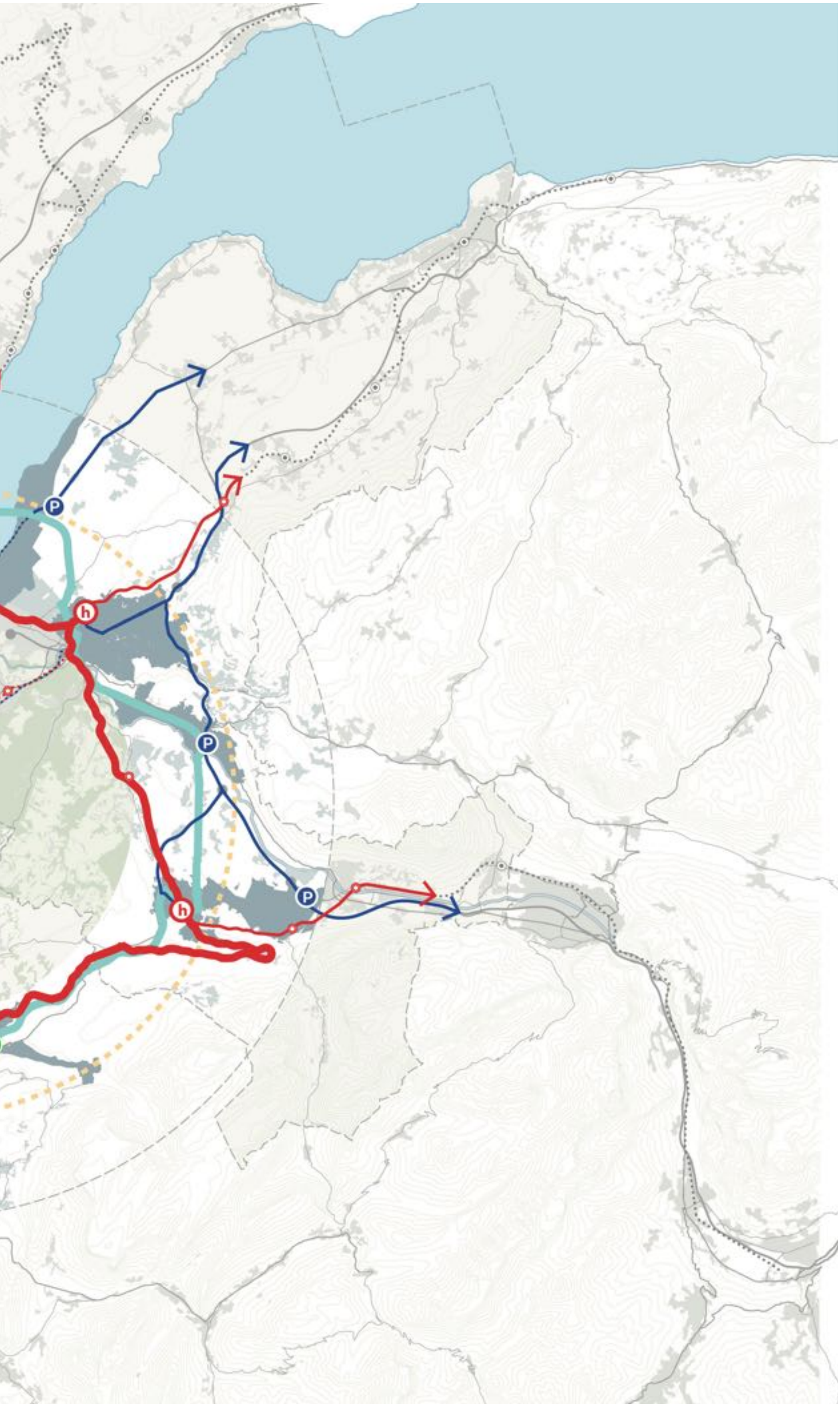


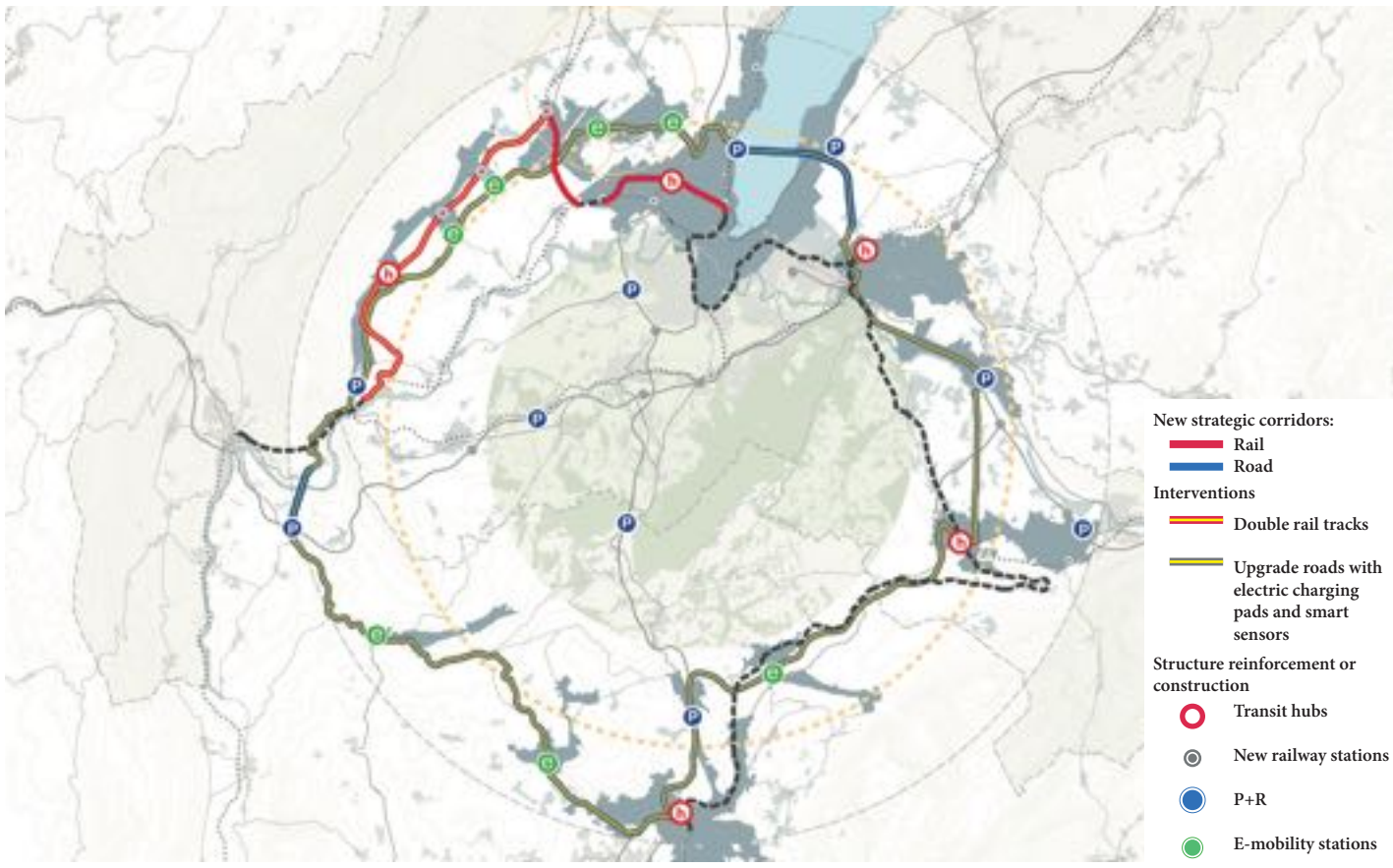
LEGEND:

- Railway loop
- Proposed railway stations
- E-vehicle ring road
- Existing highway within ZEZ
- Existing rail within ZEZ
- Access rail to ZEZ
- Access road to ZEZ
- Transit hubs
- Park and Ride
- E-mobility stations
- FCC

The electrified, smart and connected mobility loop is an eco-system of railway and road, with provisioned inter-modal transit hubs, park and ride facilities and e-mobility stations.

The electricity from the FCC will supply the energy demand of the transport network and the entire area will become the first and largest ZEZ of the world.

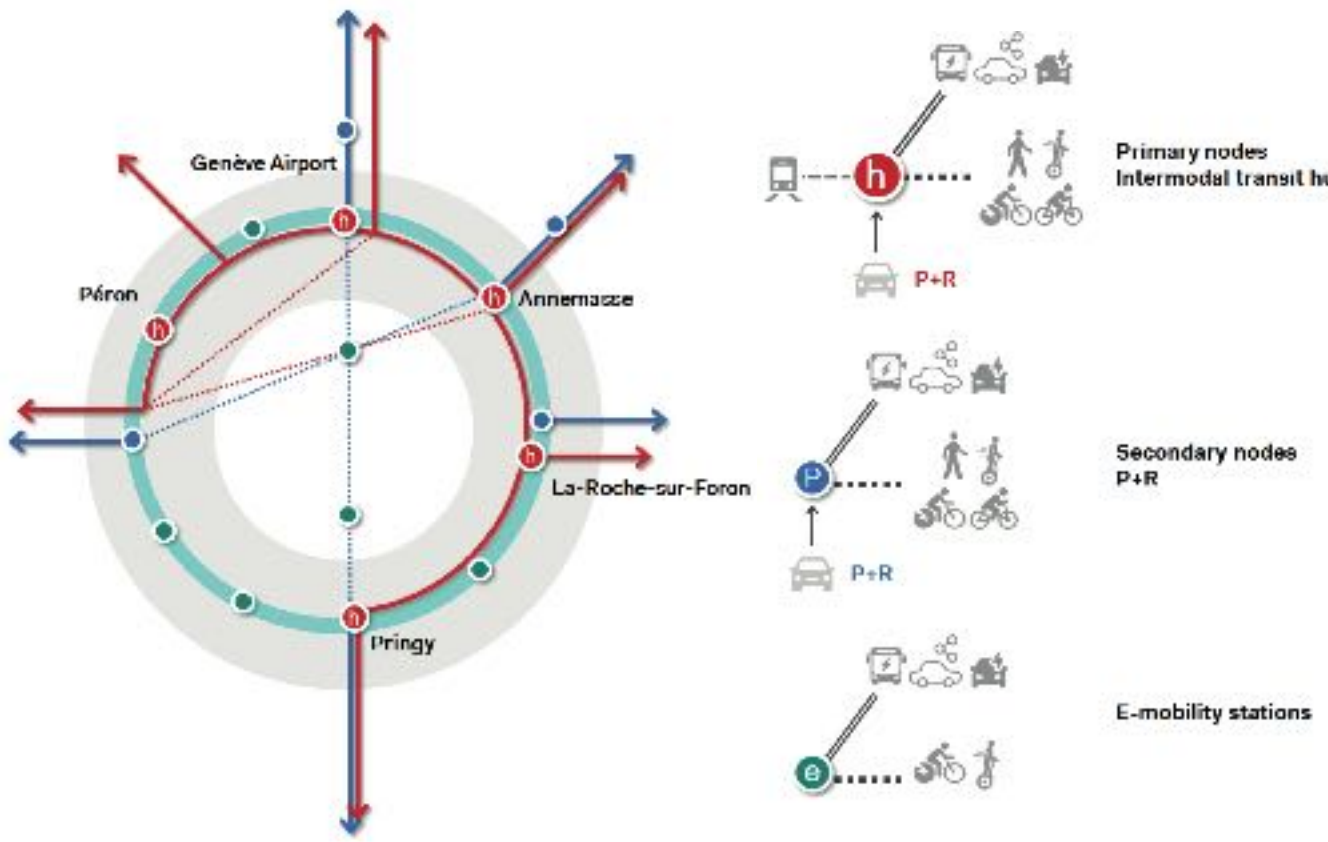
INFRASTRUCTURAL INTERVENTIONS



The proposal is to have a two-layered system of infrastructure. The first is composed of the existing and planned railway system, allowing for an orbital access to the new centralities. The second is a seamless electric ring road, dedicated for e-vehicles only, connecting all new centralities through highways, and primary and secondary roads. In order to minimize the intervention costs and pollution, the proposal uses the existing infrastructure where possible.

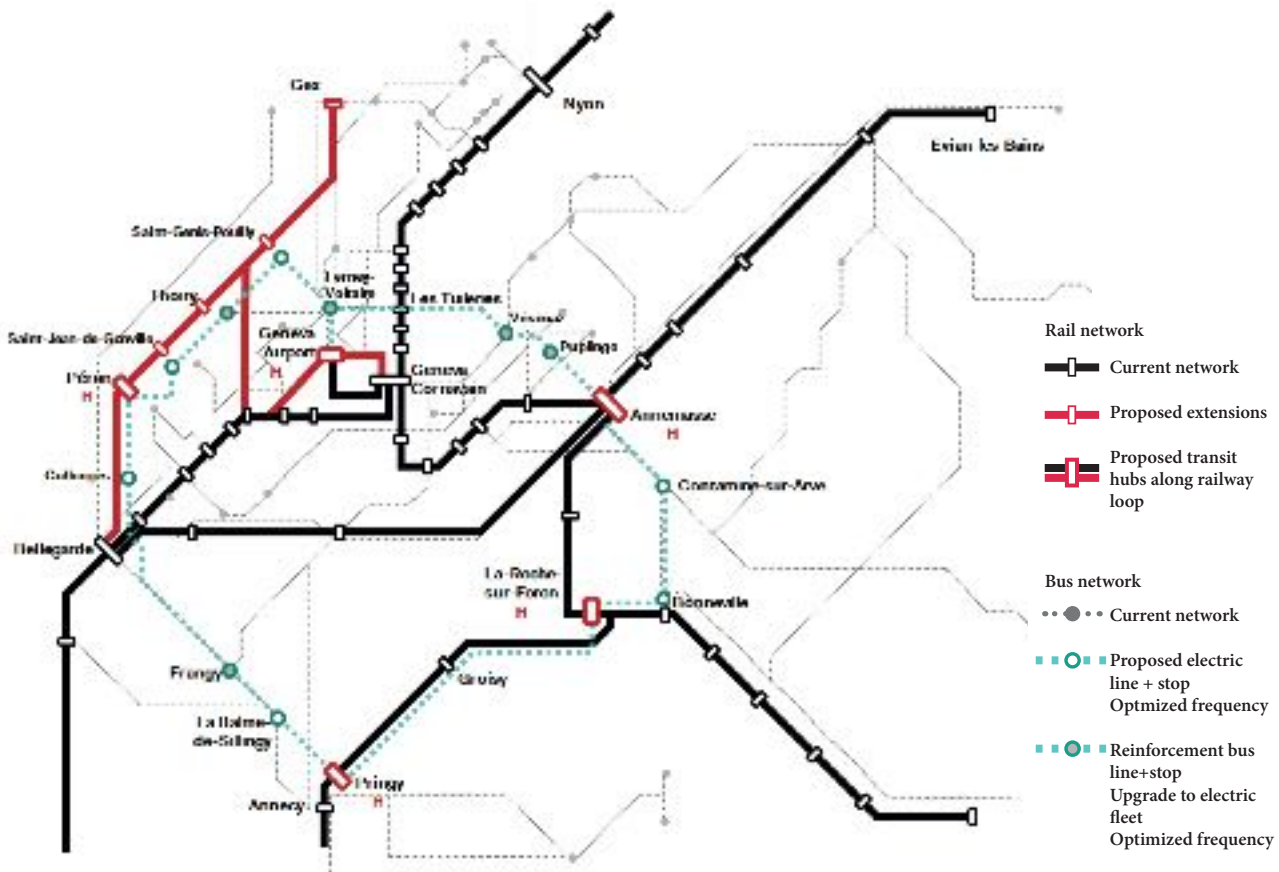
The endorsement of planned projects are essential to form the envisioned loop. These include the reactivation of the western railway, the construction of the Lake Bridge, and the proposed section of the 2030 Express Highway. The remaining road network should be upgraded with charging pads and smart sensors. In addition, providing mobility hubs to facilitate the last mile connections and change to e-mobility is crucial to ensure the feasibility of the ZEZ proposal.

HIERARCHY OF MOBILITY HUBS



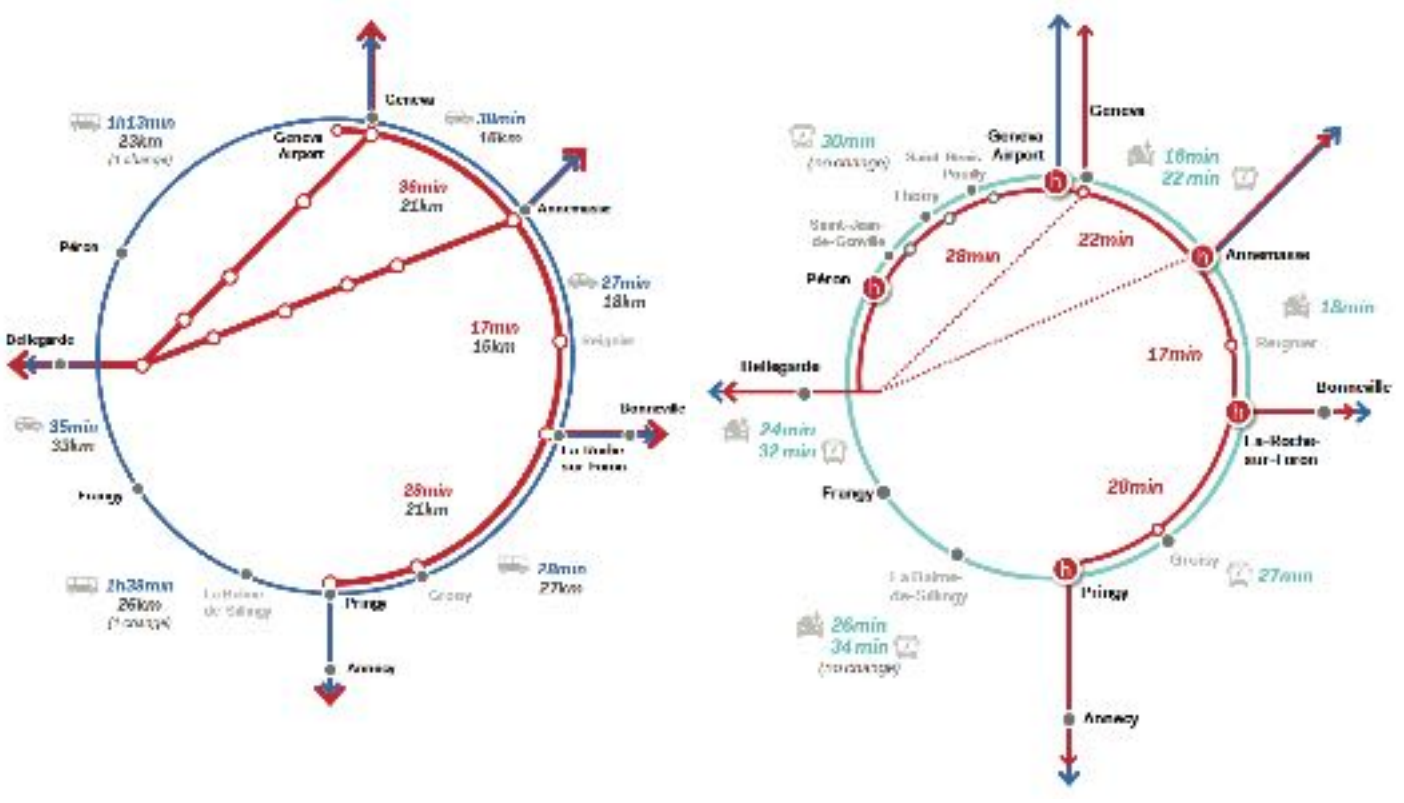
There are three types of transport hubs envisioned for the mobility loop.
The primary nodes are major intermodal transit hubs along the railway loop, facilitating interchanges to more sustainable and electric modes of transport.
The secondary nodes are the park and ride (P+R) facilities. In order to implement the ZEZ policy, it is recommended to provide commuters with road interchanges with a wide range of electric services (car-sharing, PT, e-bikes, etc.) at the park and ride facilities.
E-mobility stations within the new centralities are essential to provide last-mile solutions for internal movements and short trips within the ZEZ.

NEW PUBLIC TRANSPORT LINES



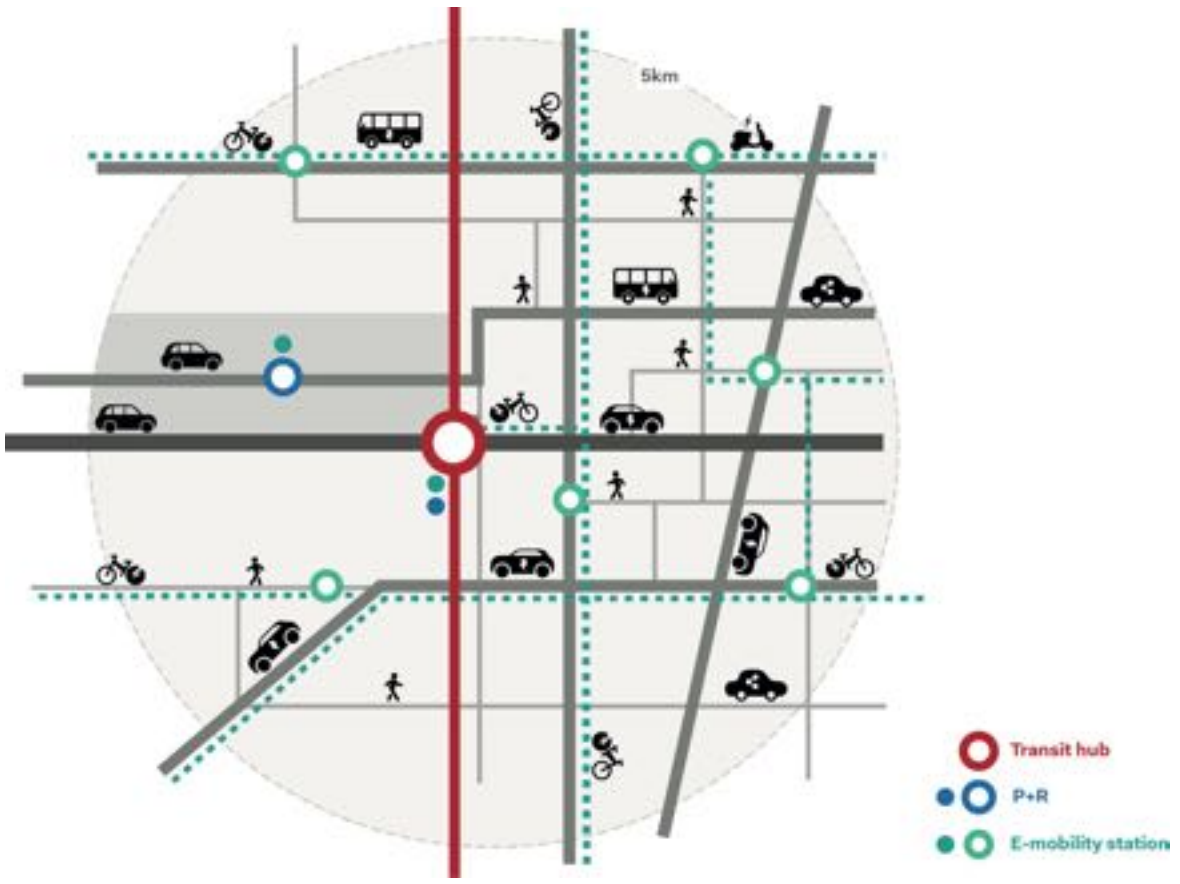
The diagram shows the improvements envisioned to the current regional public transport network at the level of rail and bus lines. The mobility proposal includes improving the addition of a railway line ensuring direct connections between Péron and Geneva Airport. It also comprises a circular transport corridor based on the reinforcement of the current situation and several routes with additional stops to provide seamless access between all of the urban centralities within Greater Geneva. Optimized frequencies are recommended to support the densification of the urban areas and ensure adequate services for the future transport demand due to population increase.

TRAVEL TIME ESTIMATION



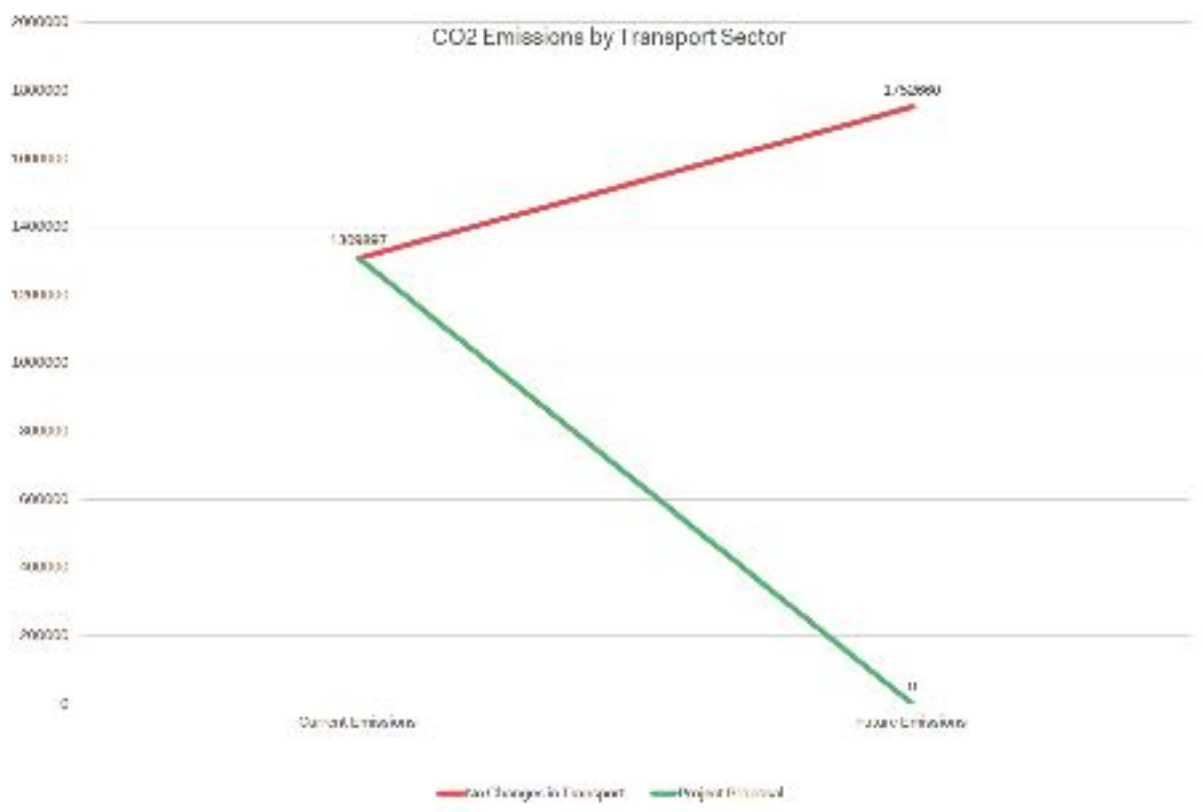
The diagram on the left illustrates the current distance and travel time using both public transport and road network between main urban areas within Greater Geneva. The proposed network has the main advantage of minimum infrastructural interventions but at the same time, it includes improvement of the service that will significantly increase the use of public transport and consequently reduce emissions. By connecting the entire Greater Geneva through the new mobility loop using direct and radial public transport lines, a reduction in travel time is provisioned, and dedicated lanes will encourage the shift towards e-vehicles in the private mobility market.
The new rail connections improves the service by reducing the number of line and mode changes.

SLOW MOBILITY WITHIN THE LOOP



The slow mobility strategy within the new centralities inside the ring relies primarily on electric and sharing solutions: e-bikes, e-scooters, e-car and bike sharing, micro mobility services, and also e-cars, e-buses, etc.
External trips end at a transit hub or P+R, where commuters switch to alternative modes and proceed with their journey. At the local level within polarities, e-mobility and charging stations are located at strategic places and points of interest, which allows access for everyone at a walking distance. The selected mode would then let users travel for short distances within the centrality, or commute from one area to another, where e-mobility stations are also provided for an optimal internal transport experience.

ENERGY CONSUMPTION AND CO2 EMISSIONS



Considering the current transport modal share and travel behaviour in Greater Geneva, it is estimated that the urban and extra-urban transport sector will be responsible for producing 1,309,897 tons of CO_2 per year. If the transport network remains the same and considering, the population increase of 350,000 people, the sector emissions will increase to 1,752,660 tons per year.

Implementing the mobility proposal for Greater Geneva, including defining a ZEZ, electrifying the fleet and encouraging a shift towards alternative and sustainable modes can reduce the CO2 emissions to zero. The estimated electricity demand of Greater Geneva inhabitants for the fully electrified transport network is approximately 1,360,171 MWh per year.

Intensifying the landscape framework

vegetal continuities
TO RESTAURE AND TO DEVELOP

landscape networks
TO SET

+ 1 mountain park
THE SALEVE

+ edge park
PER NEW URBAN SETTLEMENT

Agriculture and leisure overlapping

Michel Desvigne Paysagiste

Transplanting the idea of the 19th Century American parks system could serve in structuring urban periphery. Just as these parks served at the time to structure the growth of cities, their typology could help to constitute a structure for contemporary urban sprawl. Geographical elements and infrastructure networks are the potential tools for such urban reclamation.

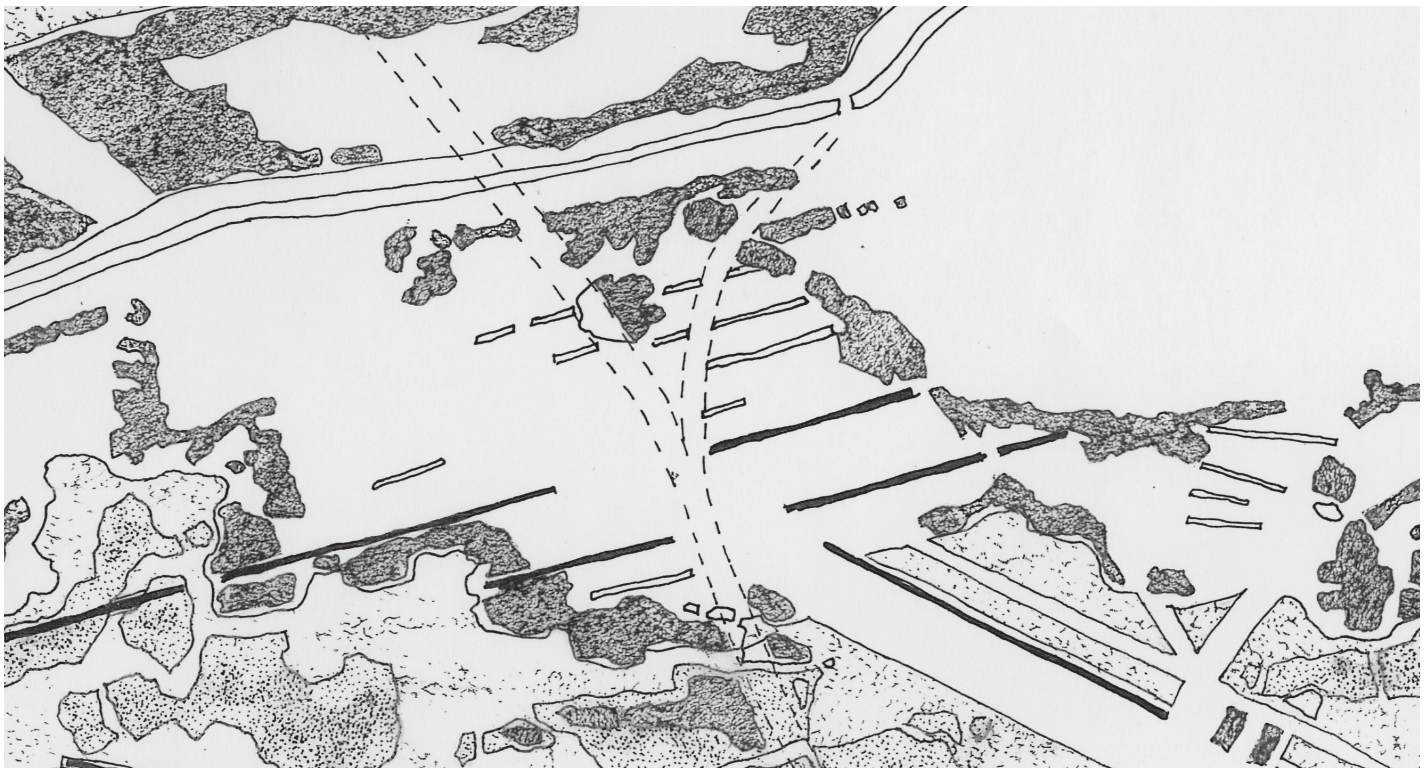
Preexisting geography should be very carefully analyzed in order to identify every structuring element. Hydrography is the first thing to look at because it is the great element that moulds the territory, together with tectonics and wind erosion. That is especially true in a mountainous territory like the Geneva metropolitan area. Streams and rivers always make their own way, which makes them a decisive source of territorial continuities. What is more, wetlands and riversides host specific flora and fauna. The road network is also a great continuity factor. Roadsides also benefit from strong visibility. The road network is identified by most people. Contrary to what could be presupposed, the vegetal structure is also very representative of human activities. It results from a specific management (or withdrawal) that is usually dictated by them.

Those three categories are visible structuring territorial elements. It makes sense to consolidate a territorial structure on them, to look for every clue of them and to intensify the framework that can be distinguished.

In Geneva, they are mainly directed by topography (for example, the bocage follows perpendicular lines to the Jura folds) and are polarized by the lake and the metropolitan area. South of the lake, the urban periphery extends thanks to the softer topography the valley offers. Geographical constraints being weaker, continuities are also less readable. That is where it would be decisive to enhance them in order to structure the urban sprawl and to connect it to its environment, to its territory.

The Salève creates a strong landmark in that not-that-well-structured urban area, a potential meeting point between the Swiss and the French sides. Obviously, the strong topography preserved the hill from the urban sprawl, even if urban scattering can be identified on the eastern, softer hillside. As the Salève offers a breath in the urban sprawl and is almost at the center of the projected urbanization ring, it would be relevant to put up strong policies in order to protect it and to make it a metropolitan park, a focus for the intensified landscape continuities mentioned earlier. Specific attention should be paid to the hills edges.

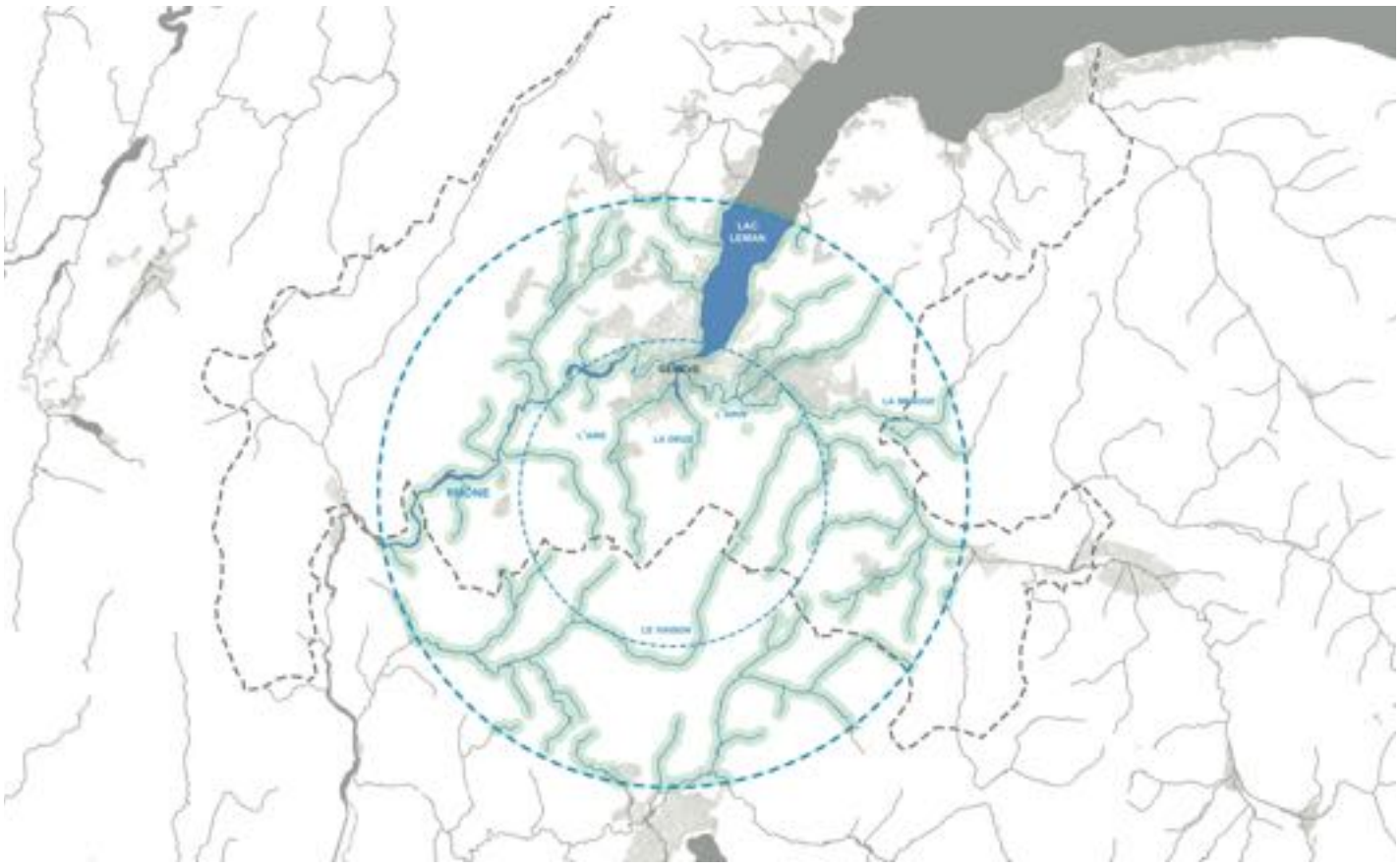
Urbanization edges must generally be treated with caution. It is necessary to materialize a landscaped limit, a soft transition between different environments. The pattern of forest progressively spreading on farmland on the plateaus, following land division limits, could be a model of how to develop landscaped urban edges, integrated to the general landscape territorial structure.



Courtine neighborhood in Avignon (MDP)
Paris Saclay cluster on Saclay plateau (MDP)

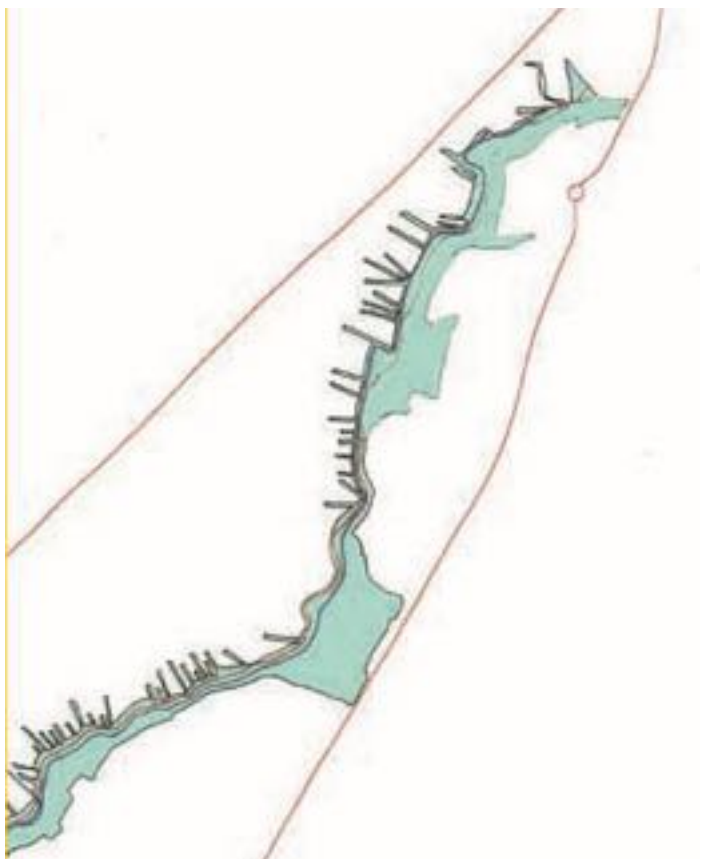
Amplifying the meeting of agricultural and naturalistic systems

AMPLIFYING THE HYROGRAPHIC STRUCTURE



The ring's hydrographic structure reveals is polarized by the Rhône river that links the Swiss and the French sides of the Greater Geneva area.

Amplifying this geographical element in order to make it the territory natural spin means expanding the hydrographic network by giving space to its specific environment and making it the basis for many uses, especially for human-powered transportation, and for planted continuities.



In order to amplify the hydrographic structure by giving streams and rivers wide dimensions back – at least symbolically, some prerequisites are :

- To protect natural spaces (no construction along the water, specific management of urban edges and of open spaces) ;
- Renaturation of the banks.

Their redevelopment can be reinforced by creating continuous promenades along the water, reconsituting riparian forest and connecting neighborhoods neerby thanks to perpendicular planted alleys.

Redesign the Croult valley, Michel Desvigne in association with Christine Dalnoky

The hydrographic system is an ecological continuity in itself as it is made of continuous corridors for biodiversity. Ecological infrastructures can be created along those corridors for watermanagement in order to mitigate pollution or rises in the water level.
Along streams and rivers can also be restored specific ecological environments.

MAKE THE ROAD NETWORK A VEGETAL FRAMEWORK

The road network consists in already identified continuities that can be used for developing a planted structure.

Not only landscapes roads can be part of large planted structure, but it can create a buffer zone between roads and their environment, thus limiting the impact of the latters.

Parkways consist in expanding the general width of a multi-lane road by separating each lane, every mode of transport with planted areas. It minimizes the general visual impact of the road system on its environment and gives an immersive experience to every user. As a matter of fact, it strenghtens the planted network within the infrastructure network.

Moreover, adding a landscape layer to the road system improves water infiltration and helps to mitigate overland flow. It can be expanded on road system relative spaces, such as parking lots.

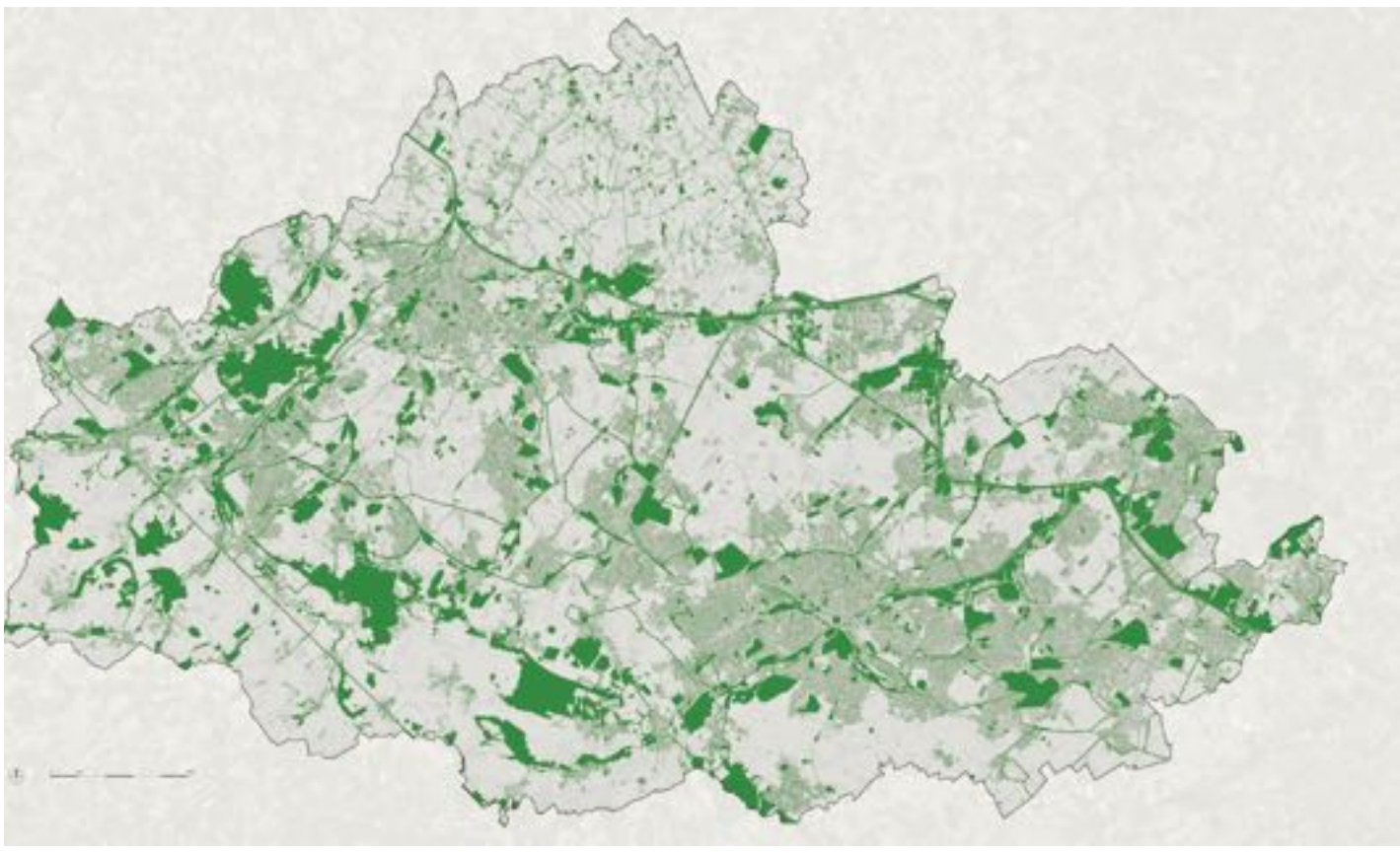
In Euralens (MDP), the landscape masterplan has been projected on the existing road network. One after the other, every road is generously planted with wooded strips in order to double the road network with a planted network.

Potomac parkway in Rock Creek, lansdcaped road in Euralens (MDP),

Potomac parkway in Rock Creek, parking lots in Euralens (MDP)

INTENSIFYING THE VEGETAL STRUCTURE

Intensifying the vegetal structure inside the ring would strenghten territorial readability and link urban environment to more natural ones, enabling planted reservoirs to irrigate and to structure urban development.



Parks network in Euralens (MDP)

Planted corridors link large protected planted areas. Each of the latters is considered as a park, but the network strengthens their impact and their visibility on the territory. They become structuring and create a strong territorial anchor.

Thanks to planted continuities, the vegetal structure can get from the wider landscape into urban areas, thus creating territorial anchoring within city cores.

Planted continuities can also materialize connections between parks, thus creating large parks networks.

What is more, planted corridors can integrate soft transports modes lanes. It makes the general vegetal structure passable and perceivable.

Detroit East Riverfront masterplan (MDP)
Euralens parks network (MDP)


JURA
GENÈVE
L'ARVE
L'AIRE
LA DRIZE
RHÔNE
SALÈVE
LE VIAISON
10000m

Today, Geneva's landscape structure is strong but lacks of links between city cores and their environment.


JURA
GENÈVE
L'ARVE
L'AIRE
LA DRIZE
RHÔNE
SALÈVE
LE VIAISON
10000m

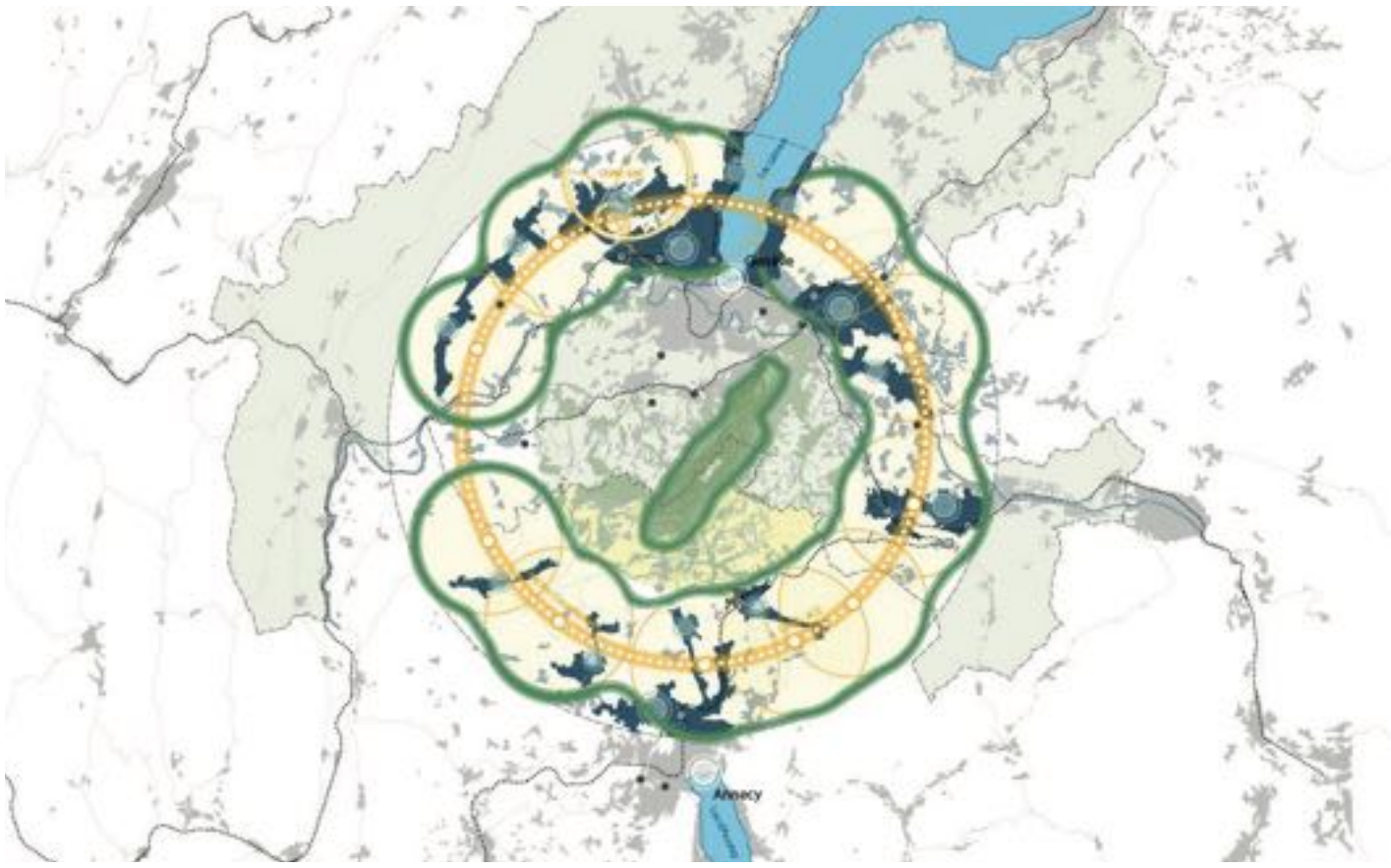
The Greater Geneva could benefit from intensifying its landscape framework (hydrographic, road and planted networks) in order to multiply links between different environments.

TODAY, INTANGIBLE OR POORLY ORGANIZED URBAN OUTSKIRTS DAMAGE GENEVA'S LANDSCAPE

Urban scattering, linear urban sprawl along transports infrastructures, industrial and business areas as city entrance.

Those are the result of undefined city edges and threaten landscape preservation.

ACCOMPANYING THE URBAN GROWTH WITH A SPECIFIC CARE BROUGHT TO URBAN EDGES



A specific interest should be brought to urban edges : they should be preserved and developed into wide edges areas by intensifying the exisitng landscape framework. Then, they can become a tool for containing the urban sprawl since they materialize a limit that can even be practiced. Those wide areas delimit a transition between urban and rural areas. They should be connected to the great territorial landscape continuities.

Paris Saclay cluster edges (MDP)

The aim is to avoid a brutal, frank confrontation that would be poorly perceived both from an urban neighborhood and from agricultural land. Actually, widening the transition helps to make it softer and create pororisites between environements.

When being defined before or simultaneously to the urban development, the edge area can structure the neighborhoods-to-be development by directing their landscape framework, their urban shape. It can also anticipate and integrate the road network ans enable water management.

Edges areas can host many different uses at the same time while preserving the bocage structure :

- productive ones, such as forestry or farming ;
- educational ones ;
- recreational ones.

If applied, this edges areas plan of actions can contain the surface area of planned urbanization, help to the general intensification of the landscape structure and be a way to implement a park (as parts of the edge area) in every new urban settlements.

Paris Saclay cluster edges (MDP)

Intense and polycentric Metropolis

11
URBAN EPICENTERS

10km
DIAMETER OF EACH CENTRALITY

132
MUNICIPALITIES INVOLVED IN THE TRANSNATIONAL AREA

6
PRIMARY INTERMODAL MULTIFUNCTIONAL NODES

Metropolitan Constellation

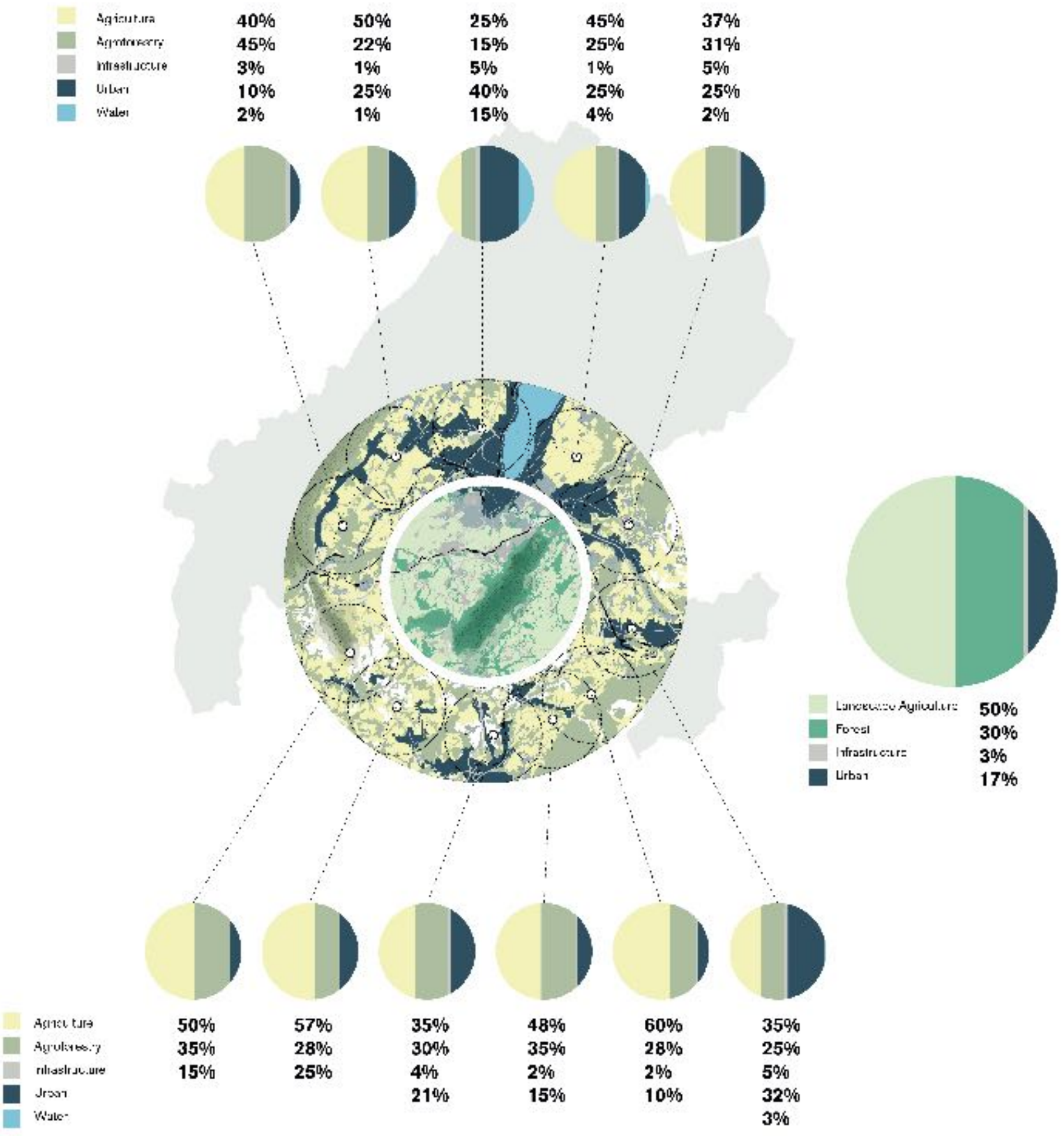
Great Geneva will become an intense and polycentric metropolis that will depict a real transnational metropolitan constellation. The vision we propose for the GG identifies a series of 11 urban epicenters along an ideal orbit of 100km around the city of Geneva.
Imagining Geneva as an urban constellation where the intensity of relationships, flows and functions and with a new focus on biodiversity, prefigures the ecological transition that cities will have to set as a goal in the coming years.
Great Geneva is therefore a varied, multifaceted and intense urban constellation that develops radially around the great green heart of Salève.

The 11 urban satellites, which have been hypothesized as gravitational elements around the GG, are energy self-sufficient and can share the surplus of energy produced through a smart grid network that feeds the entire system; the core of each satellite is represented by the ring access points to which the regional interchange poles that filter the incoming flows of the large metropolis coincide.
But the urban constellation of Geneva is innervated by a system of genuine ecological corridors that connect the green heart of Salève with the external territory.
The satellite view of the GG allows us to welcome the significant increase in population expected in the next 30 years, which will in fact duplicate the current urban dimensions. The vision that we propose pays particular attention to the containment of soil consumption and to the policies that will enable the ecological transition process to start.
The new urban developments will mainly saturate the areas included in the existing fabrics and strengthen the external territorial systems affected by the sphere of influence of the urban satellites, increasing proportionally to the current housing densities.

The creation of the 11 urban satellites takes place through different urban densities that find a balance through an organic design of the public spaces also defined by the new buildings. The new varied and dense urban design allows urban communities to live, work and spend their free time in a close relationship thanks to the location of public services and in particular of schools intended as a social driving force of the new collective urbanity, but thanks also to the network of new squares and collective spaces, they will enrich the system by equipping the 11 satellites with cultural activities and service to the citizen.

The urban constellation of the GG incorporates resolves the critical issues of the current metropolitan area starting from its role on a regional scale towards a logic of territorial rebalancing. Today, the city of Geneva has a flow of people and vehicles that must be managed and programmed in an integrated and large-scale perspective.
The system of services defines a model and a methodological approach for the redistribution, within a polycentric urban conception, of macro services, on the scale of the territory, and on widespread services, on the scale of local realities. The constellation of networked cities, intended to overcome the center-periphery dichotomy and the highly hierarchical distribution of land values, allows a redistribution of the system of services linked to the actual needs of the different parts of the city. The organization and distribution of new urban satellites according to the principle of "morphological stability and sustainability", defined in relation to places, offers an increase in the range of services offered to citizens and limits "dependence" on the city center.
The overall image that we intend to return to the GG is that of a kaleidoscopic city that favors a non-anthropocentric ethical conception and proposes a new conception of urbanity, understood in the sense of a humanity that is located in the new spatial context where a designed cohabitation with the kaleidoscope of life has been created.
This means establishing a fair distribution of conditions of social mobility; experiencing the coexistence of different species; recomposing a different relationship with the components of plant-based nature. It means introducing an inclusive concept of ethics into urban policies, which protects principles and values that affect the entire ecosphere.

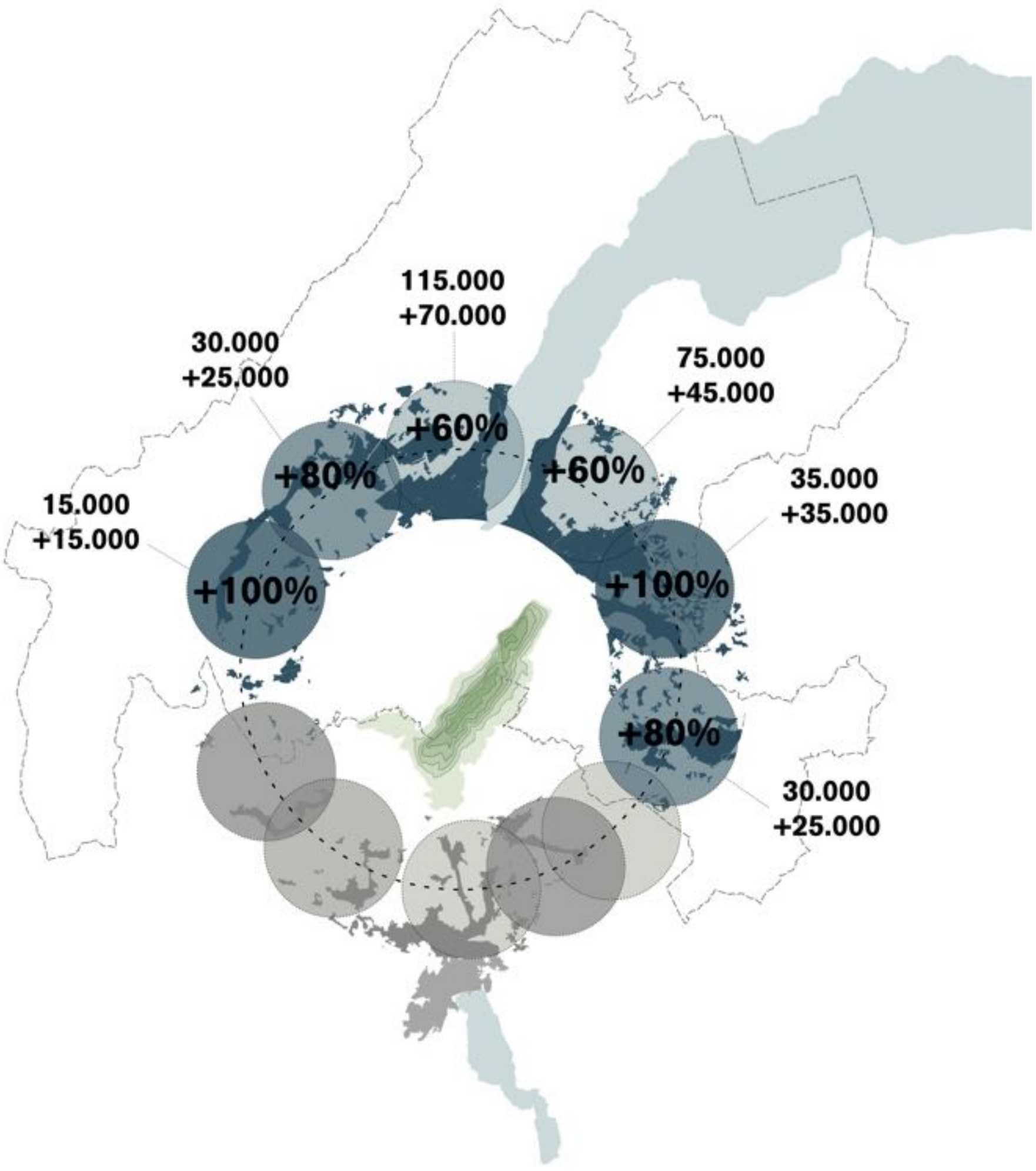
DISTRIBUTION OF LAND USE



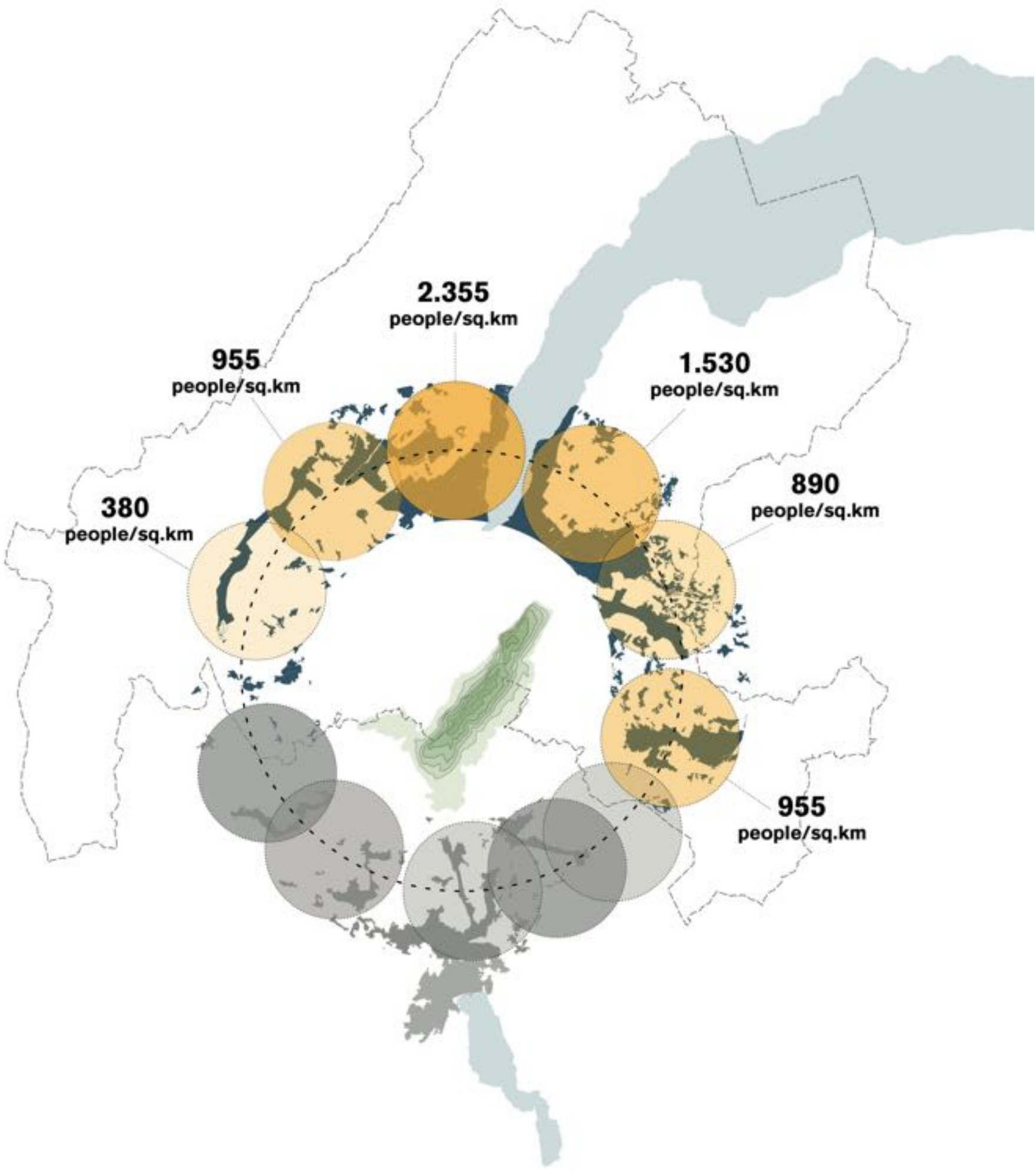
POPULATION DISTRIBUTION AND INCREASE

300.000
Inhabitants of
Kaleidoscopic Metropolis 2018

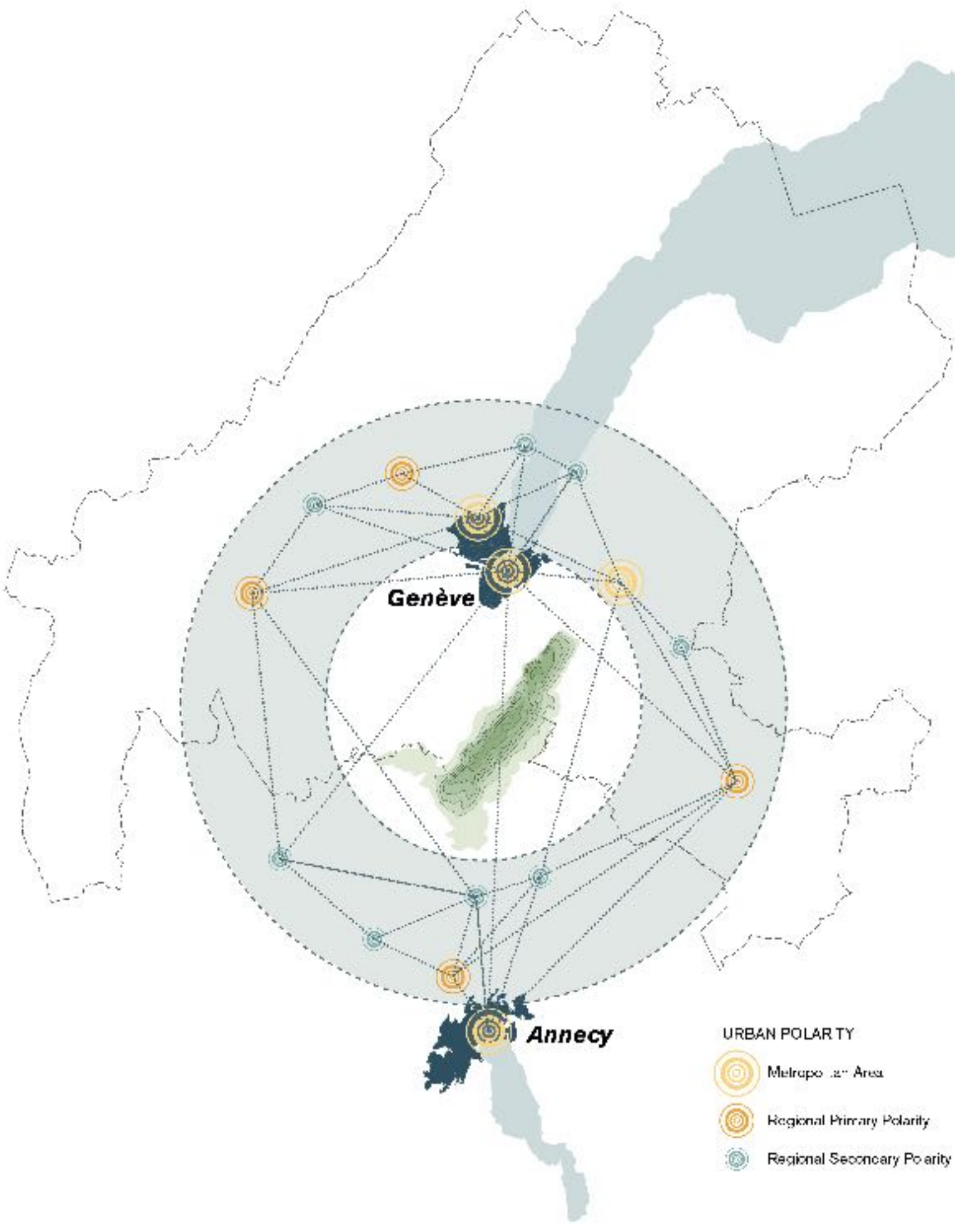
+210.000
Inhabitants in 2040



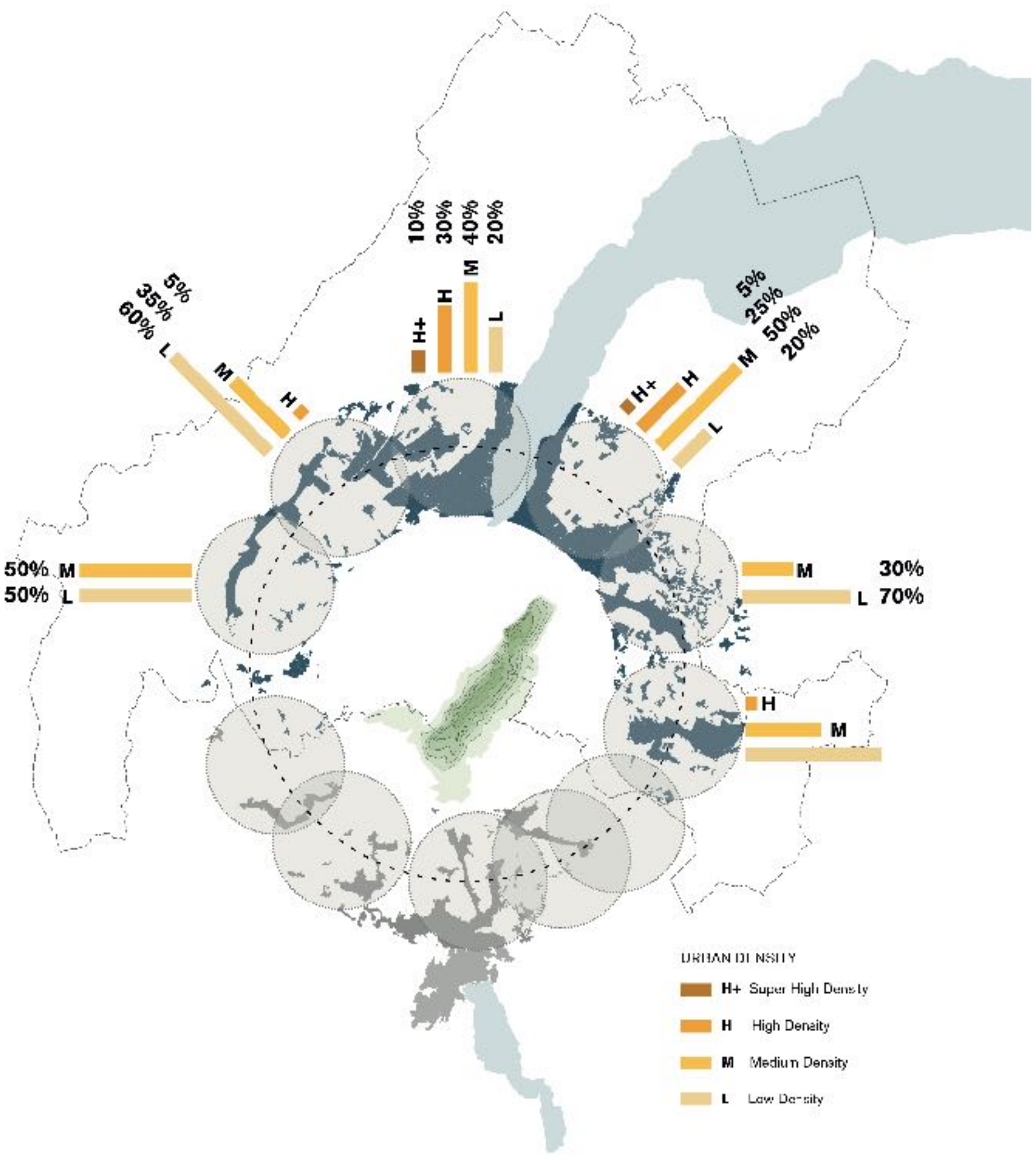
URBAN DENSITY



POLYCENTRISM



TYPOLOGIES


10%
30%
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M
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5%
35%
60%
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M
L
50% M
50% L
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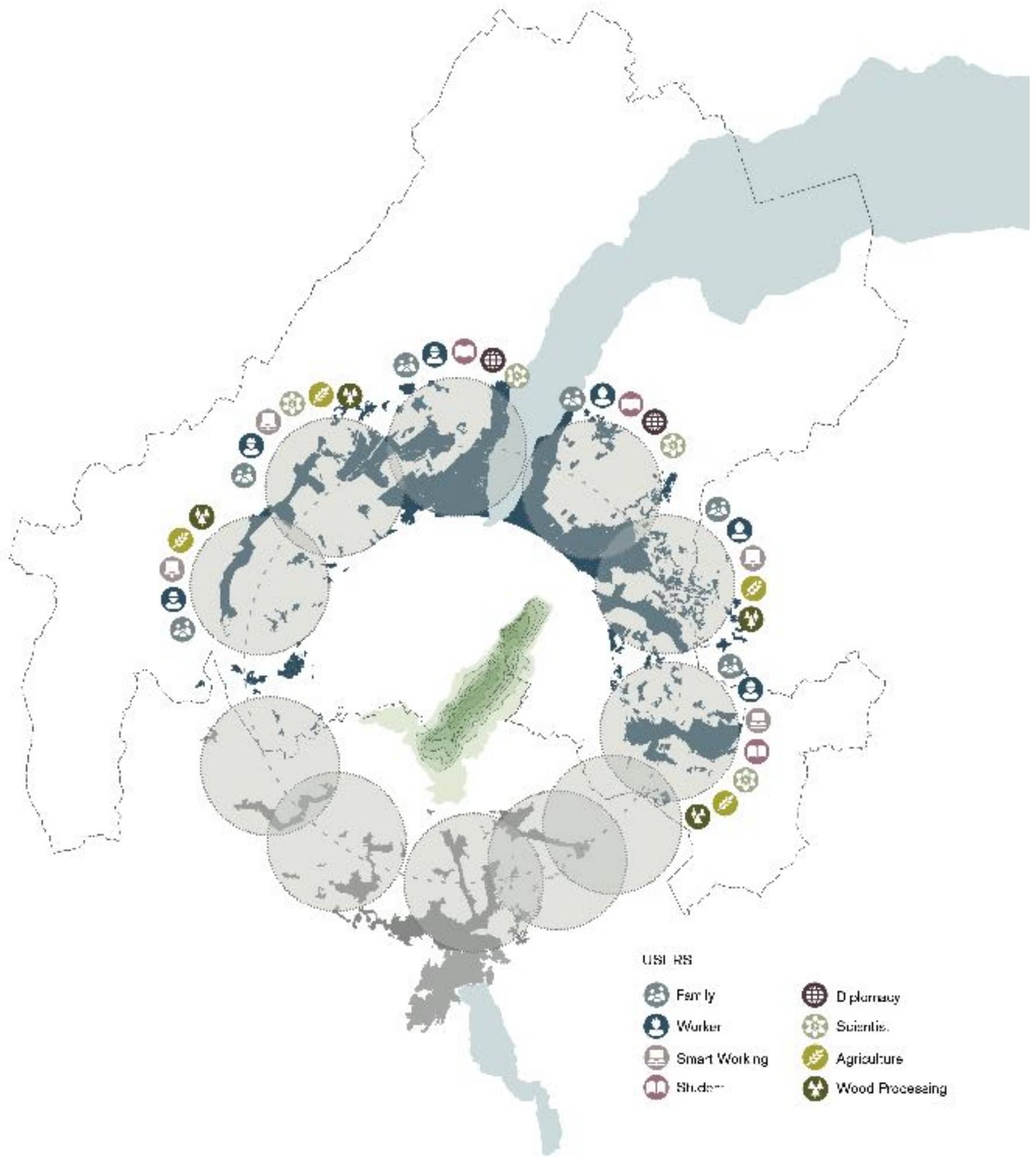
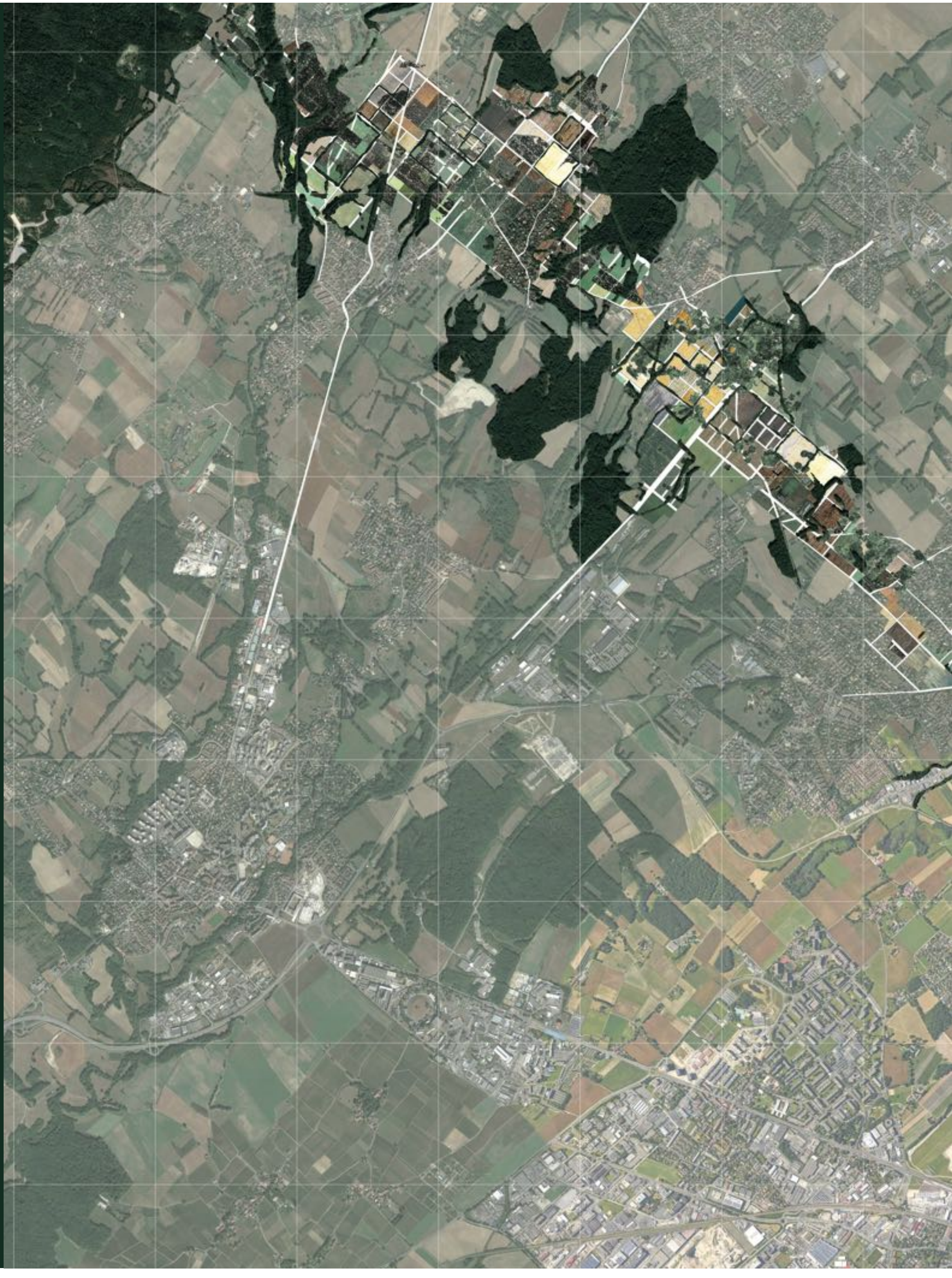
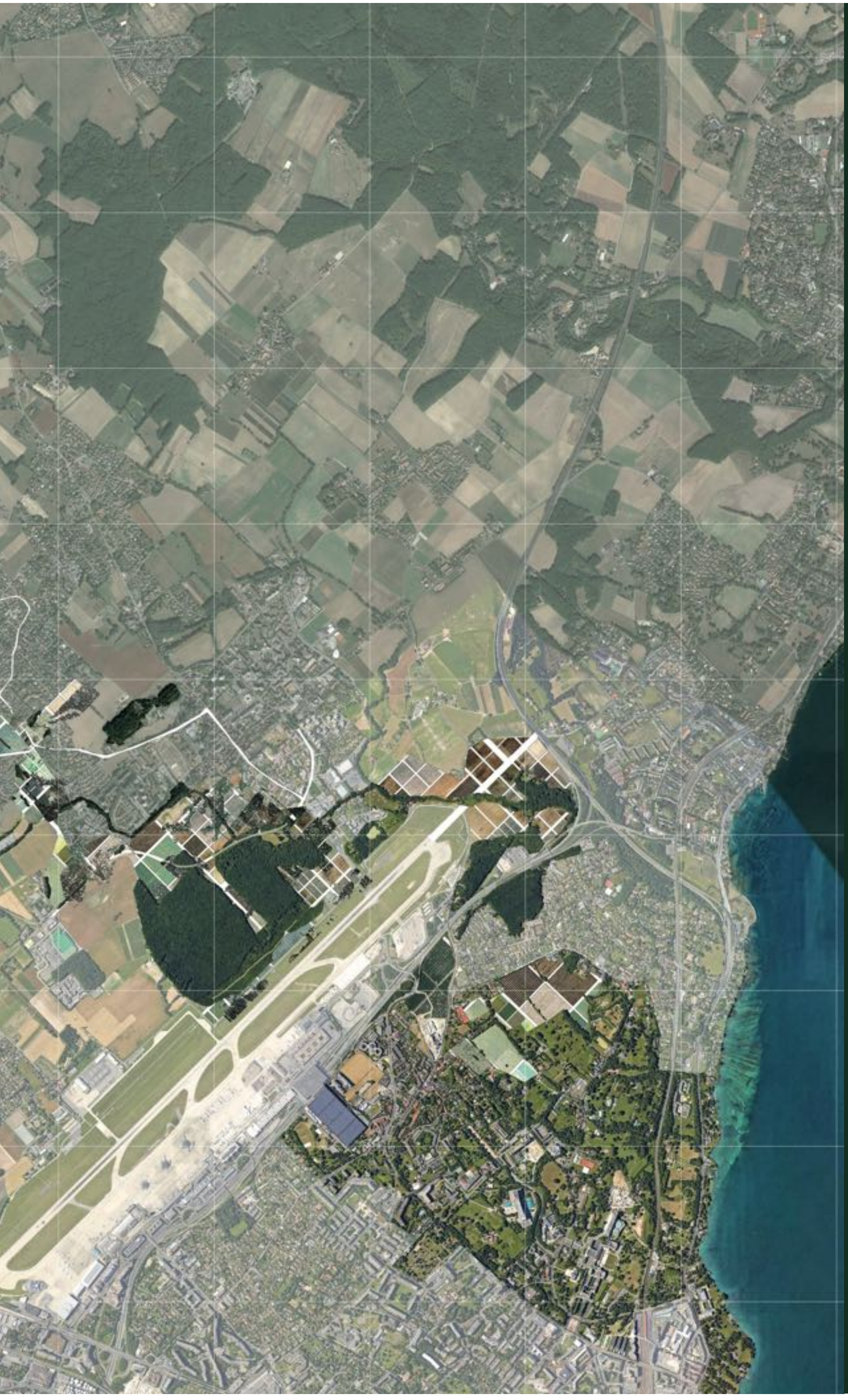
30%
70%
H
M
URBAN DENSITY
H+ Super High Density
H High Density
M Medium Density
L Low Density

USERS


USERS
Family
Worker
Smart Working
Student
Diplomacy
Scientis.
Agriculture
Wood Processing


Pilot Projects





A Linear, Agricultural Park

Michel Desvigne

Paysagiste

THE LINEAR PARK,
A SIGNIFICANT SECTION
OF GENEVA'S TERRITORY

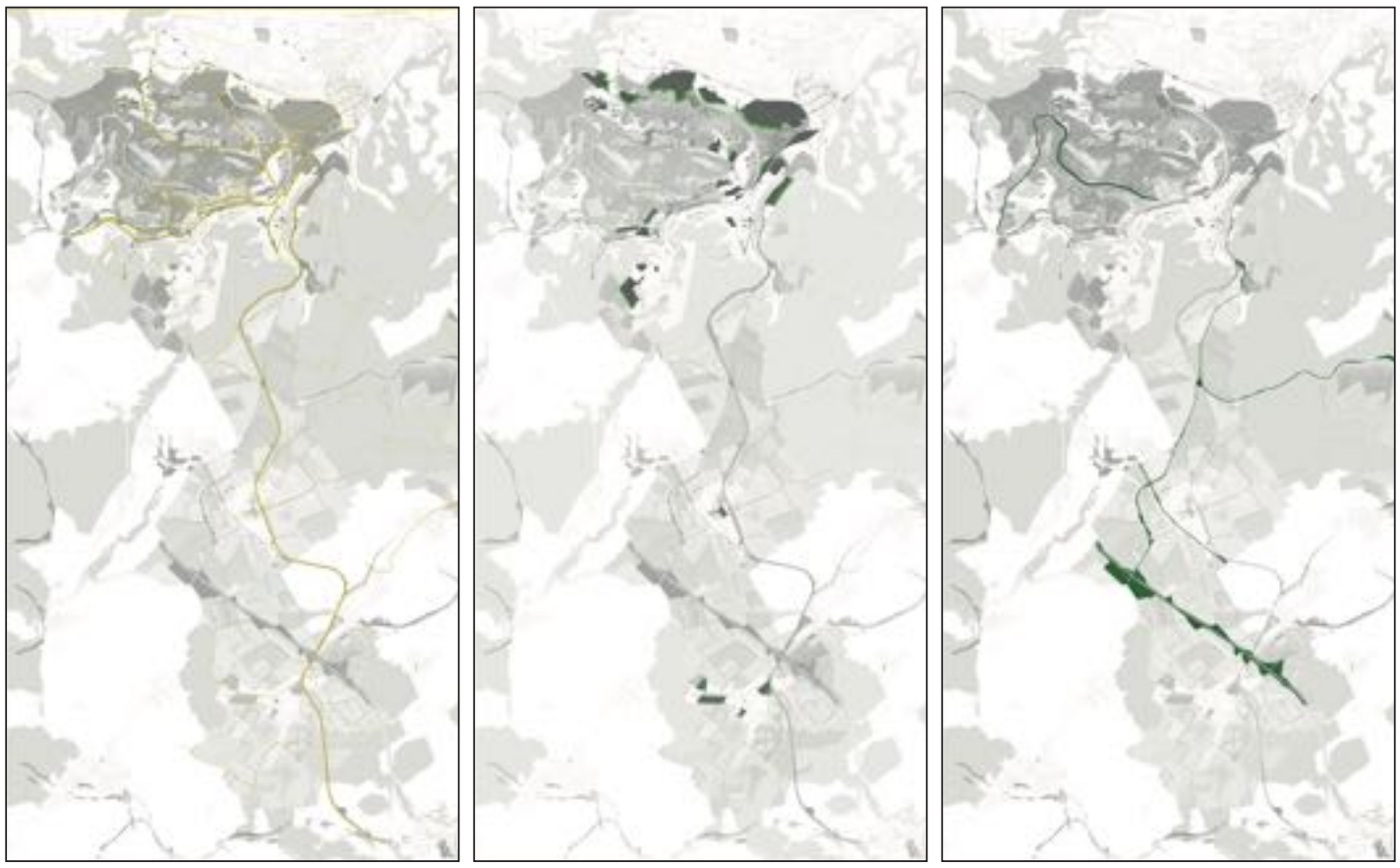
The linear park corresponds to the upper degree in enhancing the existing landscape. It has a progressive and varied implementation depending on existing uses. It could be considered as a reproducible prototype.
It is clearly not a nineteenth century park, but a contemporaneous version, adapted to such a scale, offering the same promenade and halt uses but exhausting an existing landscape – not recreating one. It is a composite garden maintained and managed by many different players.

It relies on specific protection policies and on a series of actions in a definite but non-arbitrary perimeter. It discontinuities and landscape intensity that draw the park, that make it perceivable, usable and legible.

THE LINEAR PARK,
A SIGNIFICANT SECTION
OF GENEVA'S TERRITORY

Preservation of agriculture, amplification of the bocage structure, creation of new continuous paths and of some public spaces.

LINEAR PARK IMPLEMENTATION: TRANSVERSE ACTIONS



Landscape materplan for Alzette Belval territory

The park aims at having productive and recreational uses to cohabit.

Actions :

1. A human-powered mobility network, promenades : creating new paths dedicated to walking and cycling within the linear park. It also requires to requalifiy and organize existing paths.

2. Create identifiable places in the park

3. Intensifying the landscape framework : hedgerows, riparian vegetation, groves...

4. Define park entrances and develop them as such

5. Put in place a relevant signage

Policies :

1. Protect the agricultural land purpose

2. Set a management charter : landscape recommandations, edges treatment...

3. Set specific policies and prescriptions for every redevelopment, change of landowner or of use, within or in a close perimeter around the park

4. Encouraging horticulture, arboriculture, agroforestry

Proceed depending on land opportunities and individual cooperations.

ACTION 1 - CREATE PEDESTRIAN PATHS, WALKING ROUTES

Those paths are a way to encourage people to discover tha agricultural and natural landscape, hence to highlight the latters. But at the same time it channels visitors flow and contributes to protect productive uses and the environment.

Bicycle path in Orne bay
Sausset park, Michel Corajoud
Paris Saclay cluster edges park, MDP

ACTION 2 : CREATE IDENTIFIABLE PLACES IN THE PARK

Simple interventions can create strong locations, reveal their existing potential.
A simple bench can sometime be enough to define a place, create a destination or a halt.
Landscape management can also contributes : for example, the mere opening of a clearing.

Belvedere Drentsche Aa, Strootman Landscape Architects
Eaux & Paysages masterplan, Nantes-Saint-Nazaire, MDP

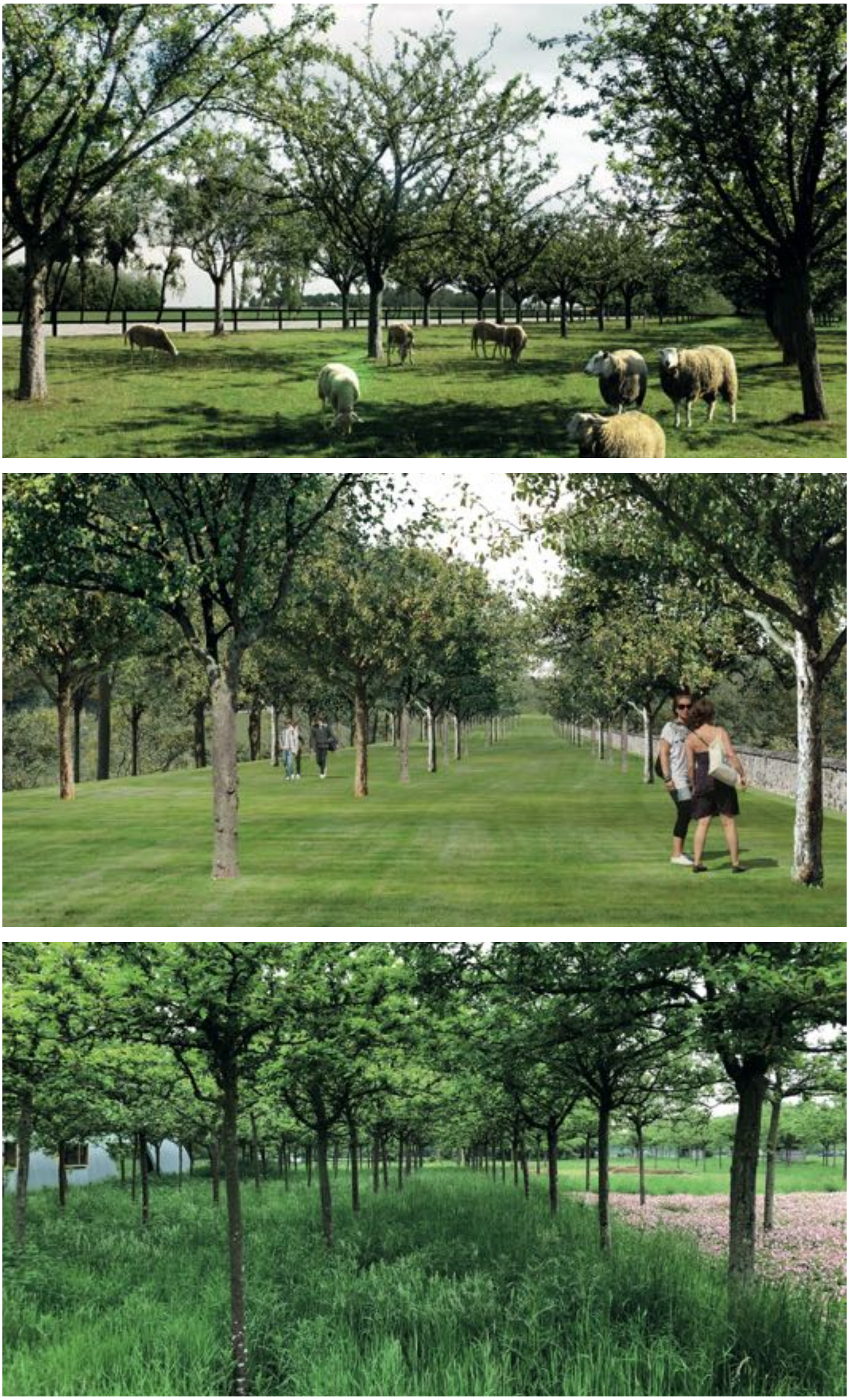
ACTION 3 : INTENSIFYING THE LANDSCAPE FRAMEWORK

Among intensifying geographical landscape components, it is also possible to enhance agricultural patterns by planting trees and hedgerows. It aims at making the bocage as complete as possible.

ACTIONS 4 AND 5 : DEFINE PARK ENTRANCES, PUT IN PLACE A RELEVANT SIGNALS

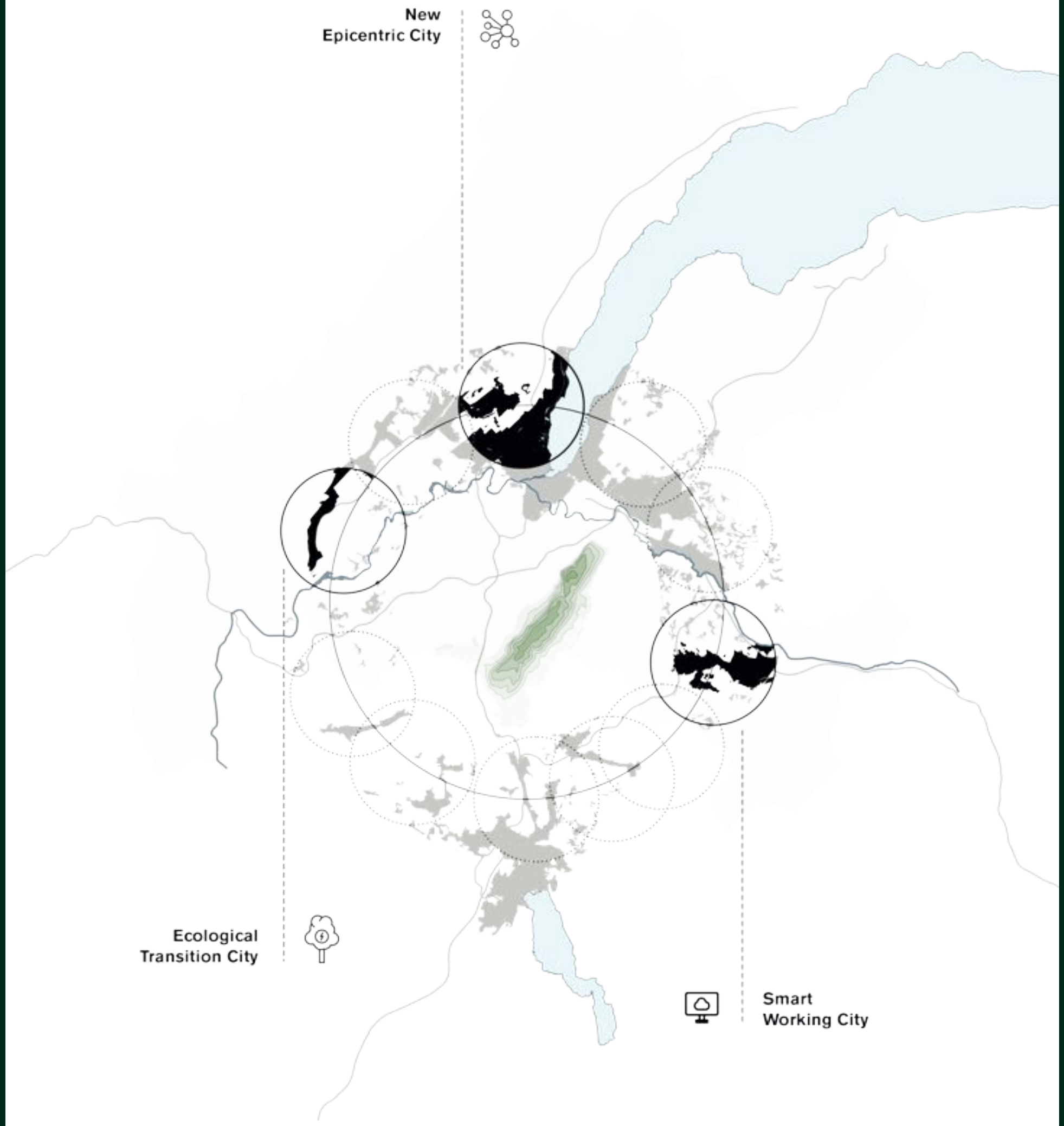
Euralens signage by Atelier des Signes and Inessa Hansch
Marking at La Roche Solutré
Prefiguration garden on Seguin Island in Boulogn-Billancourt, MDP

POLICIES : POSSIBLE SUPERPOSITION OF USES IN ORCHARDS



Paris Saclay cluster edge area, MDP
Pion neighborhood in Versailles, MDP
Middleheim museum park, Antwerp, Michel Desvigne in association with Christine Dalnoky

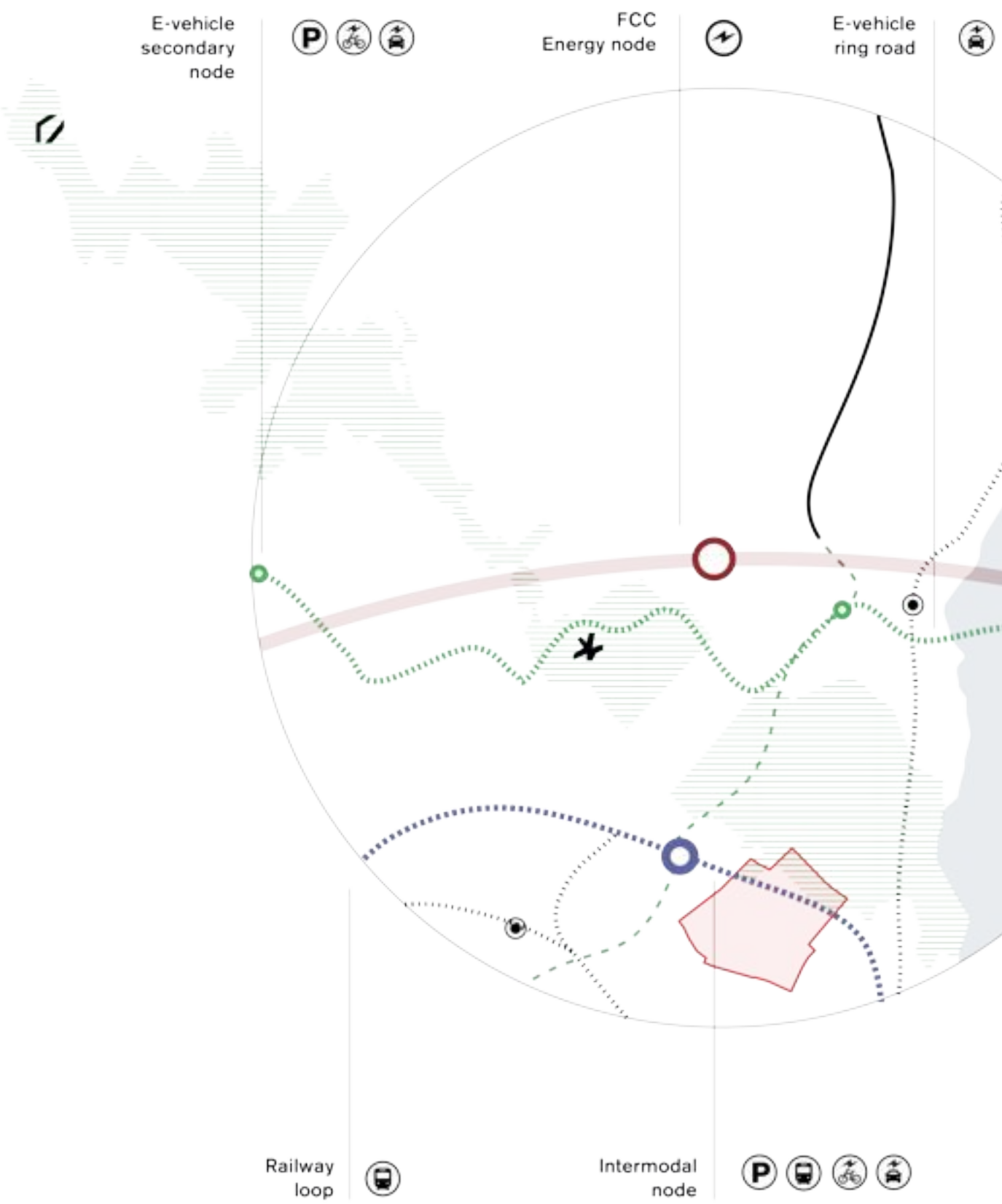
PILOT PROJECTS



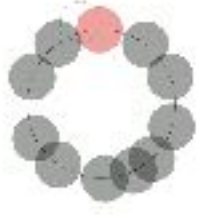
PILOT CASE STUDY 1:
DENSIFICATION AND SUBSTITUTION IN GENÈVE

New Epicentric City

New Epicentric City



New Epicentric City



Green Surface **200.000 sqm**

Residential GFA **600.000 sqm**

Services and Other function GFA **150.000 sqm**

Inhabitants **+20.000**

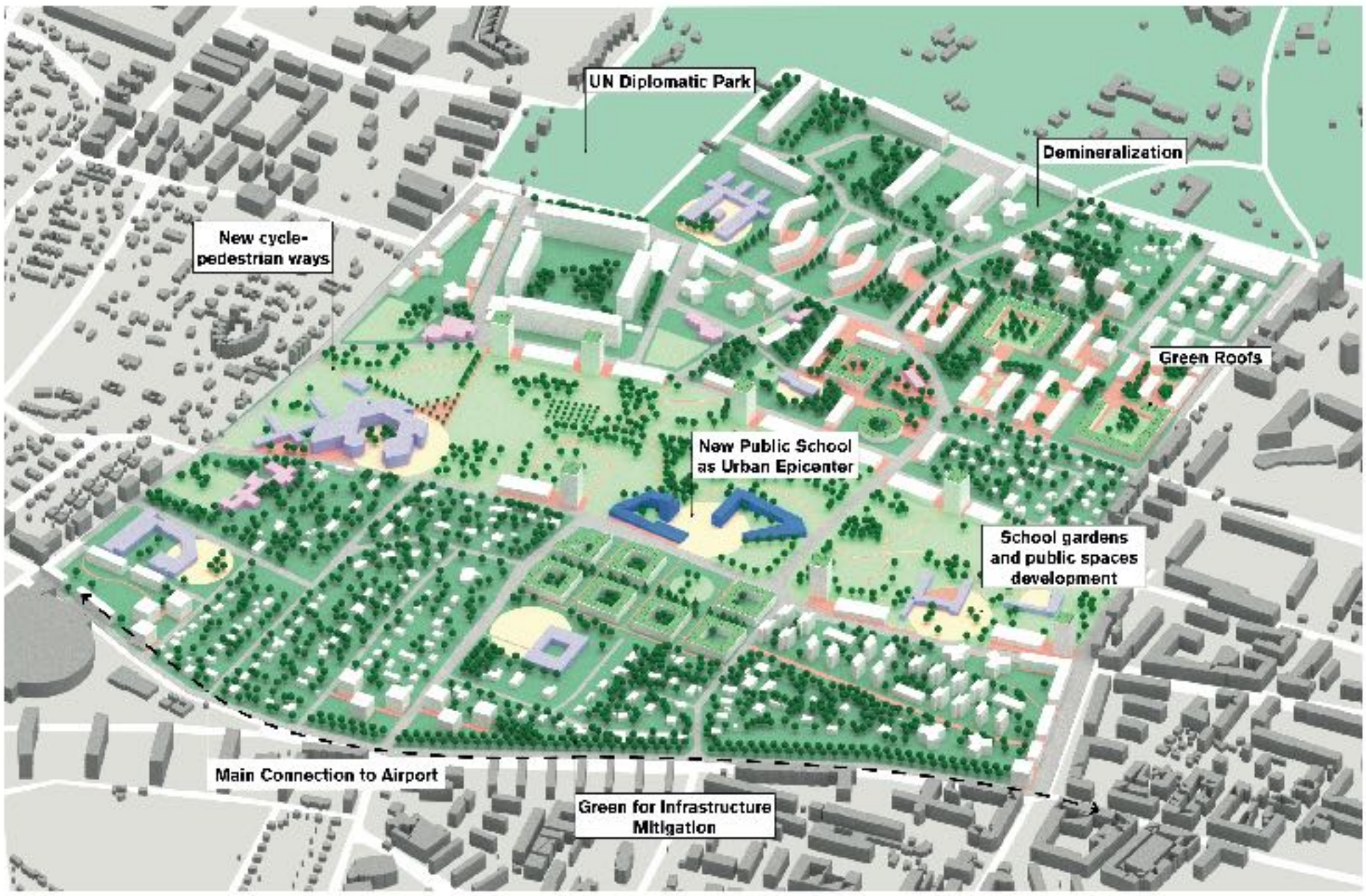
Residential Units **+6.000**

Timber demand **240.000 m³**

Photovoltaic Panels **100.000 sqm**

Green Roofs **40.000 sqm**

New Trees **+ 35.000**



OPEN SCHOOL manifesto

A school open all hours of the day,
every day of the year, for all ages.

01. The School as **LOCAL EPICENTER**: the grafting of the school complex creates a new centrality in the territory, the building becomes a new reference point for public and social life.

02. The **OPEN** School: a school that operates 24 hours a day, 7 days a week, 365 days a year, lived by students during the curricular hours, and by the community on weekends and on holidays.

03. The School as a **PROTECTED, PERMEABLE and CONTROLLED** organic element: the new school campuses in Grand Genève Metropolis are configured as multifaceted objects in strong dialogue with the urban and natural surrounding.

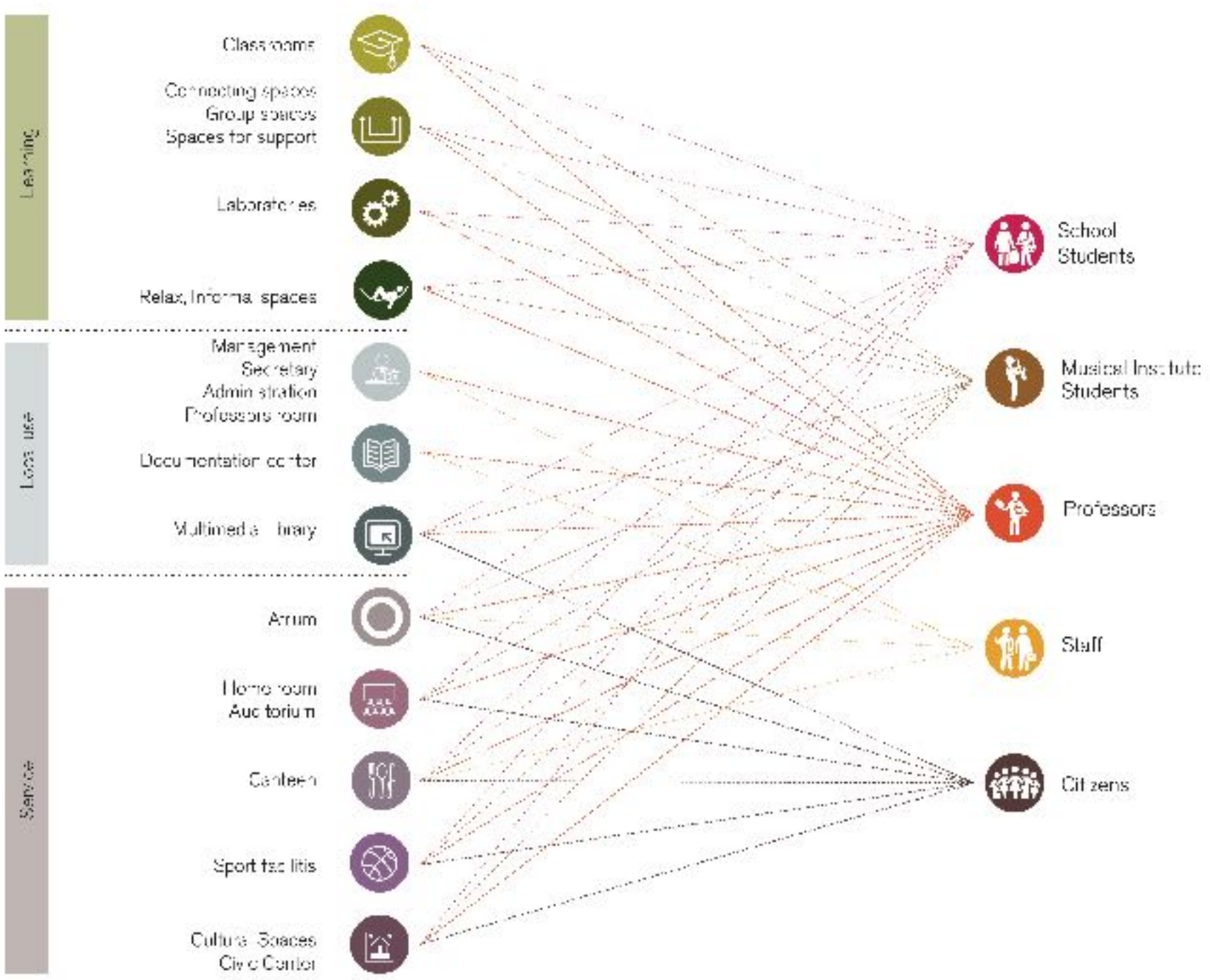
04. The School as a **SQUARE**: the architectural structure is built starting from the **OPEN SPACES**. The design of open spaces, with their great flexibility, is a priority compared to the more traditional design of closed spaces. Consequently, this structure lays their organization and distribution principles.

05. The School as a **PLURAL AND COMPLEX BODY**: in addition to the traditional spaces, hybrid spaces are placed within the school complex, favouring the introduction of innovative teaching methodologies and the inter-generational interaction between students of different ages and courses.

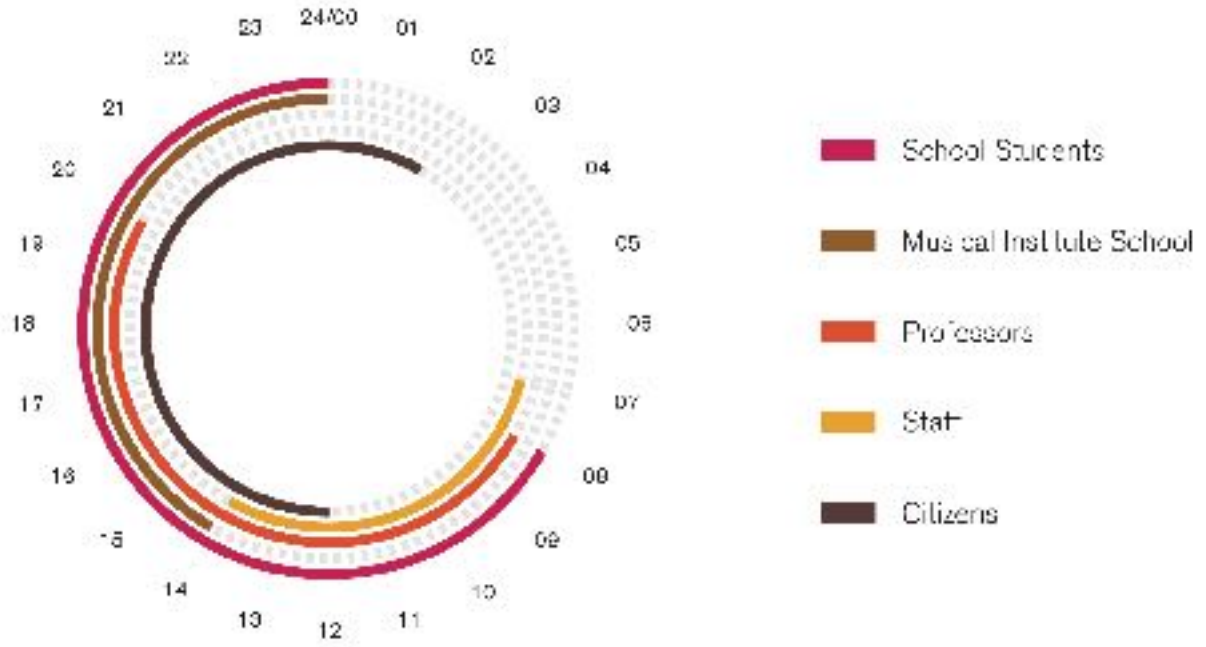
06. The school that **BREATHES** together with the surrounding **URBAN SYSTEM**: students learn from the urban infrastructure, citizens learn thanks to the school's teaching programme, activating a dynamic process of knowledge exchange.

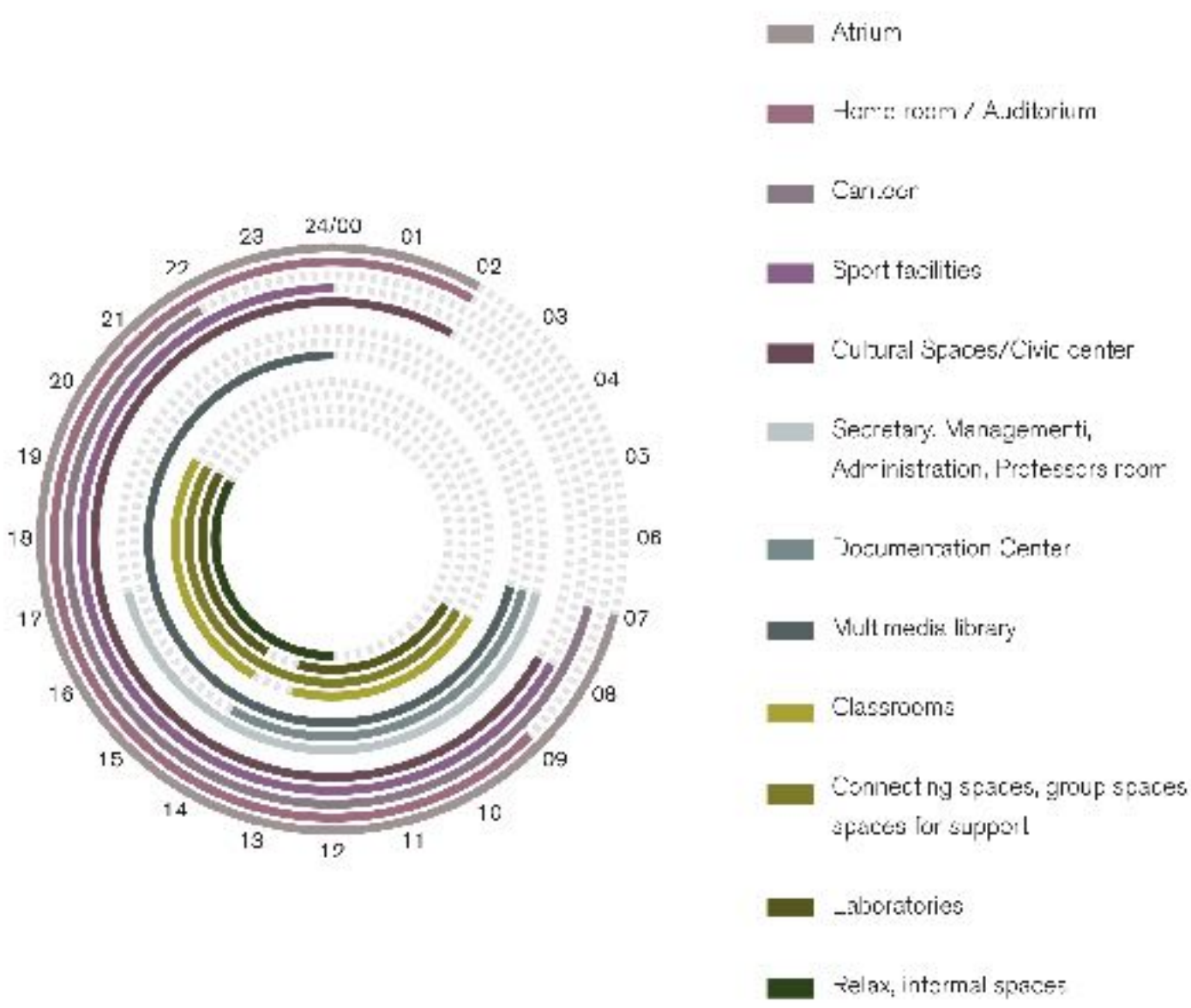
07. The School as **SUSTAINABLE ARCHITECTURE**: through the choice of materials and techniques for saving and producing energy, such as Timber, the building is configured as a self-sufficient organism.

AN INNOVATIVE SCHOOL OPEN TO EVERYONE

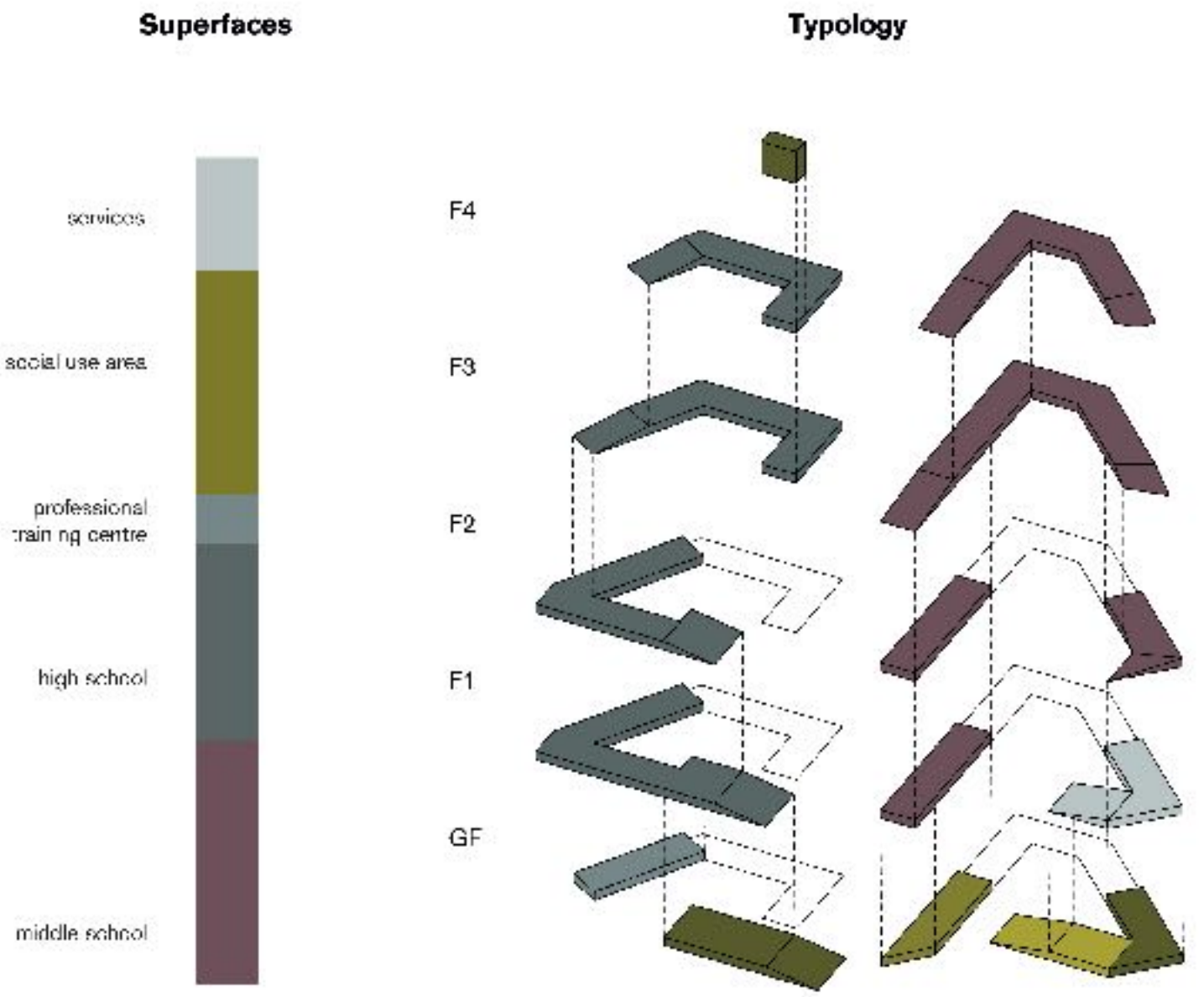


TIMING, SPACES AND USERS

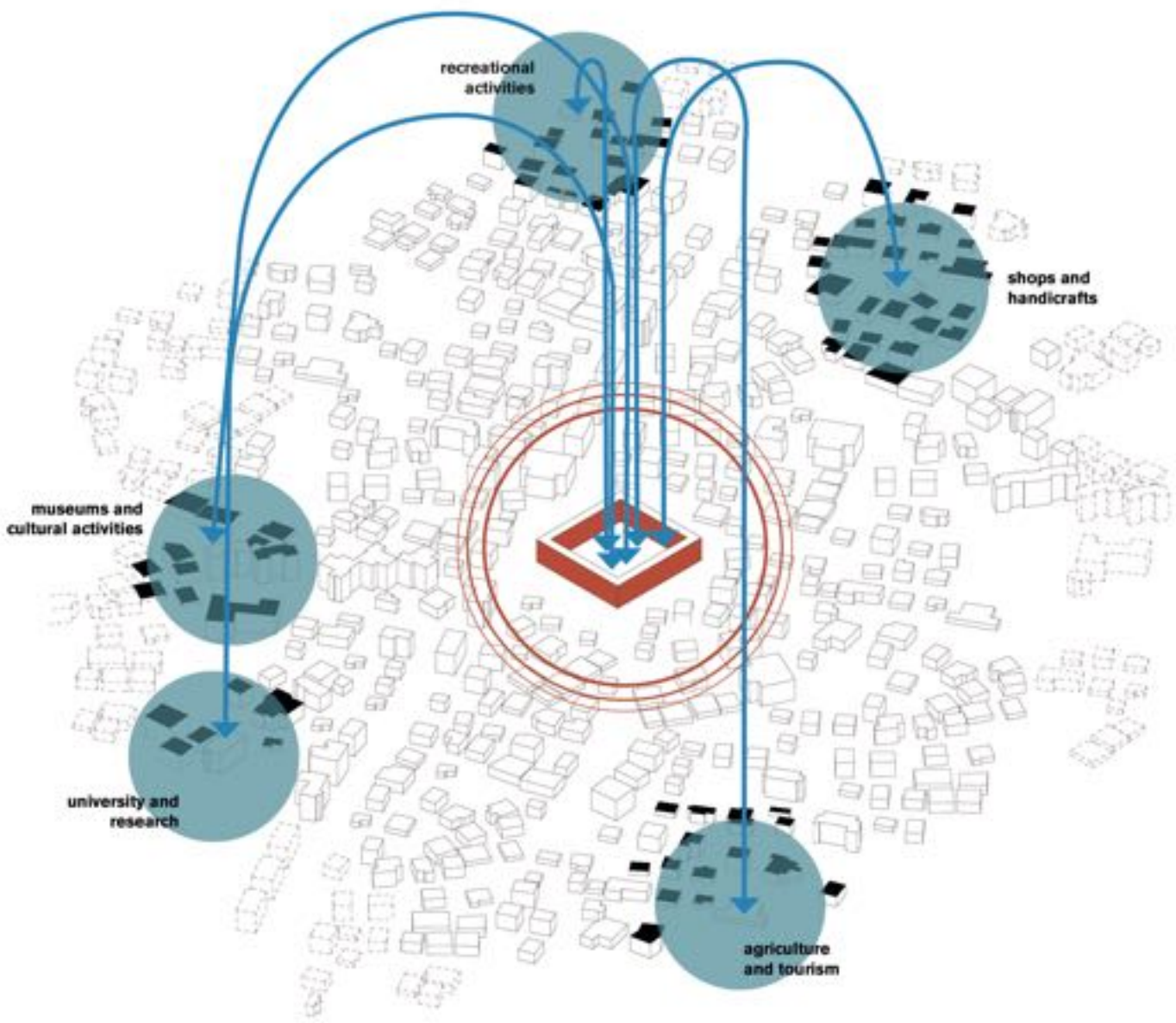




SCHOOL PROGRAM



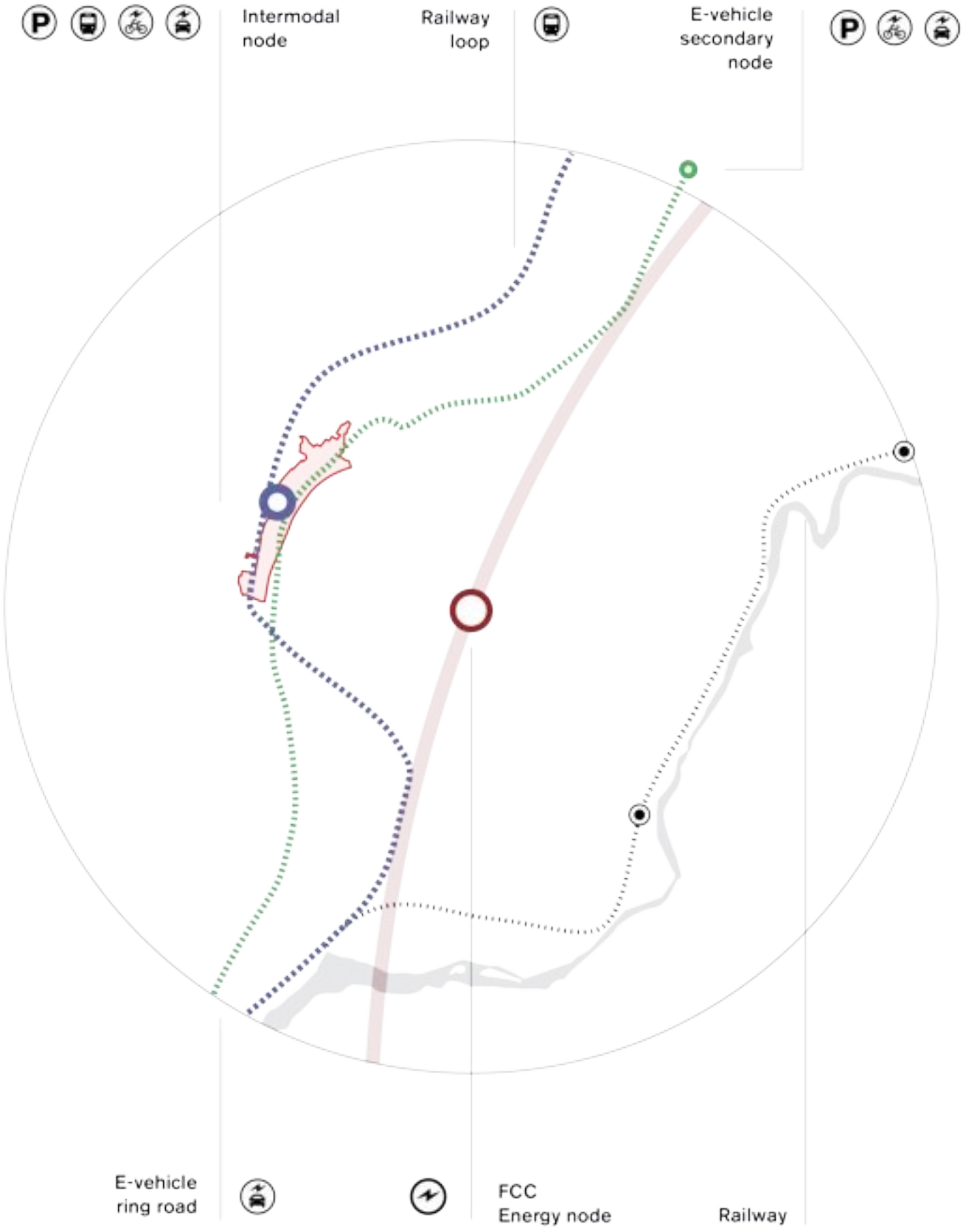
SCHOOL AS EPICENTER



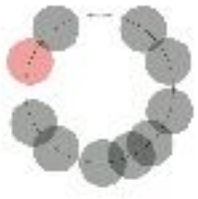
PILOT CASE STUDY 2:
EXPANSION AND SUBSTITUTION
IN A LOW DENSITY MINOR NUCLEOUS

Ecological Transition City

Ecological Transition City



Ecological Transition City



Green Surface **150.000 sqm**

Residential GFA **45.000 sqm**

Services and Other function GFA **130.000 sqm**

Inhabitants **+2.000**

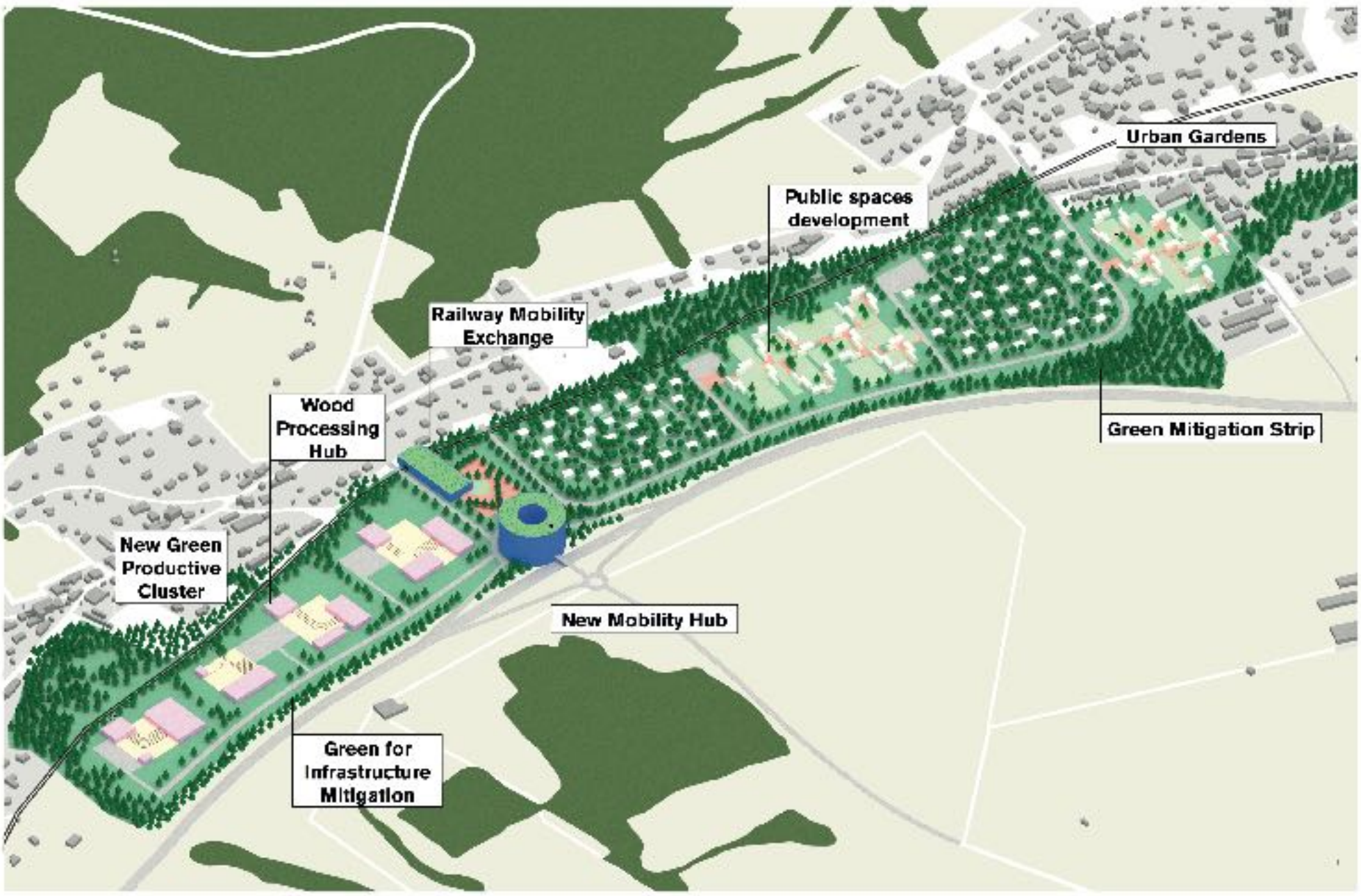
Residential Units **+1.000**

Timber demand **40.000 m³**

Photovoltaic Panels **27.000 sqm**

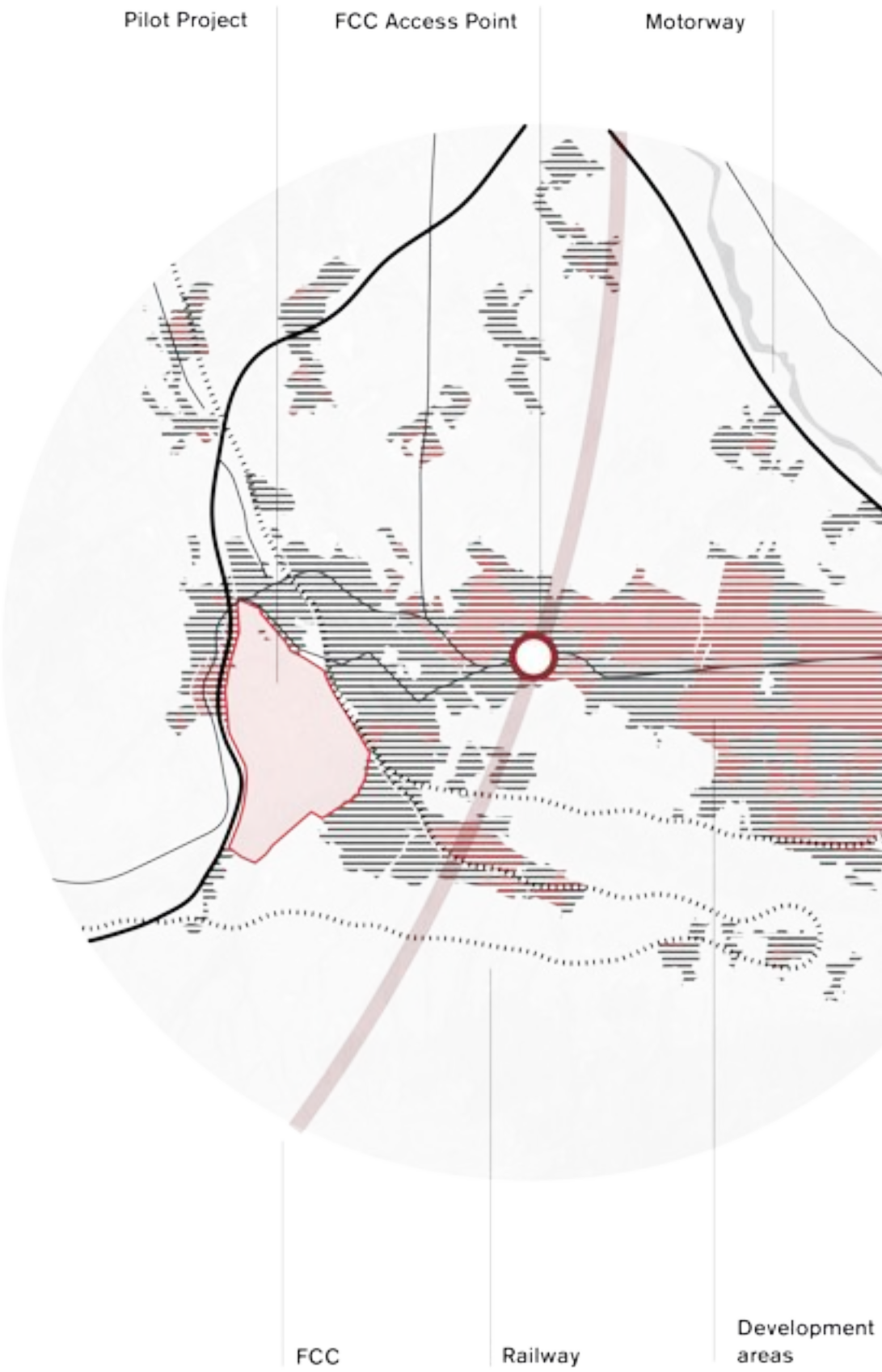
Green Roofs **12.000 sqm**

New Trees **+ 30.000**

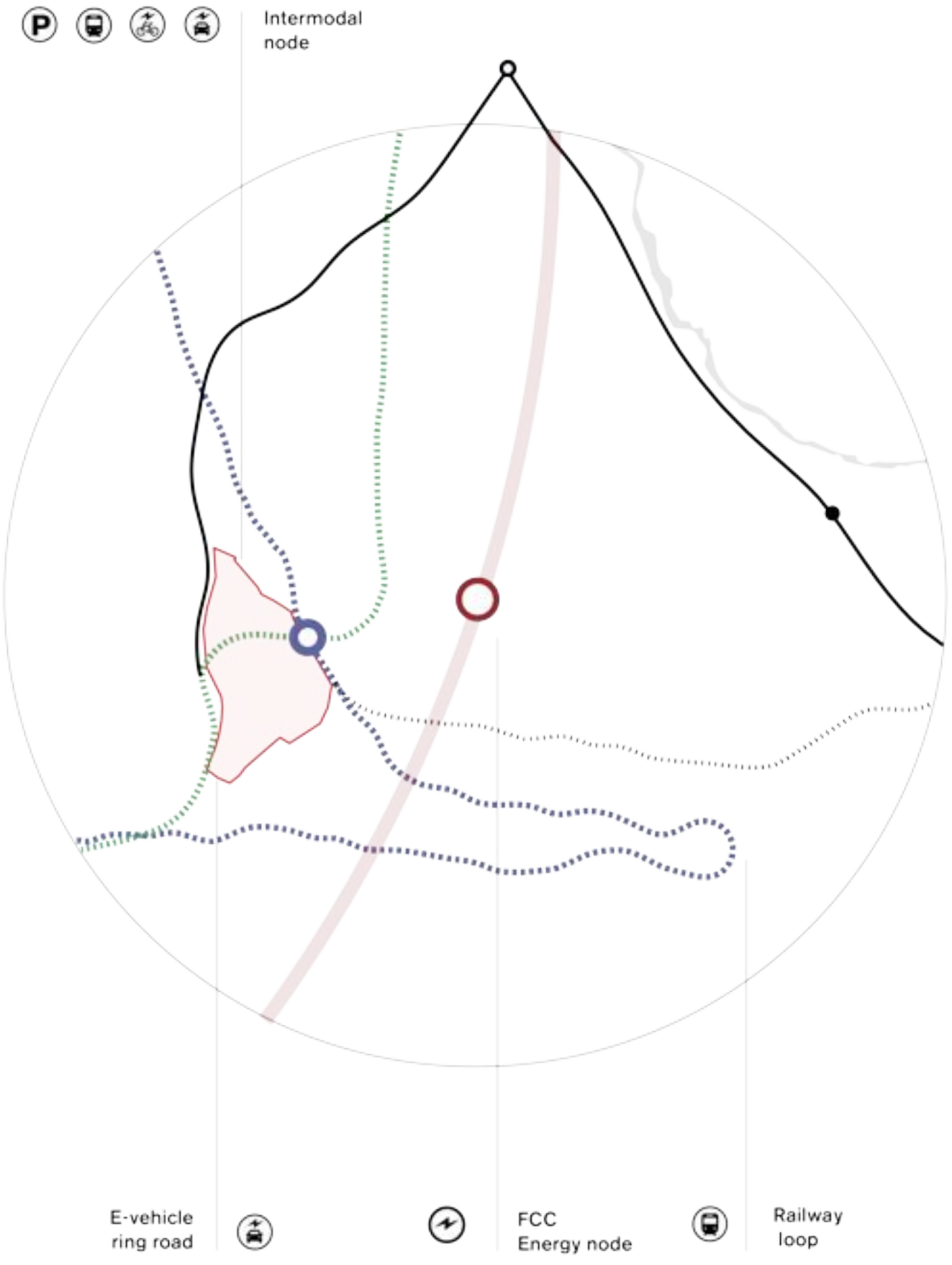


PILOT CASE STUDY 3:
DENSIFICATION AND EXPANSION IN THE PERICENTRAL NUCLEOUS OF LA ROCHE SUR FURON

Smart Working City



Smart Working City



Smart Working City

Green Surface **220.000 sqm**

Residential GFA **240.000 sqm**

Services and Other function GFA **25.000 sqm**

Inhabitants **+8.000**

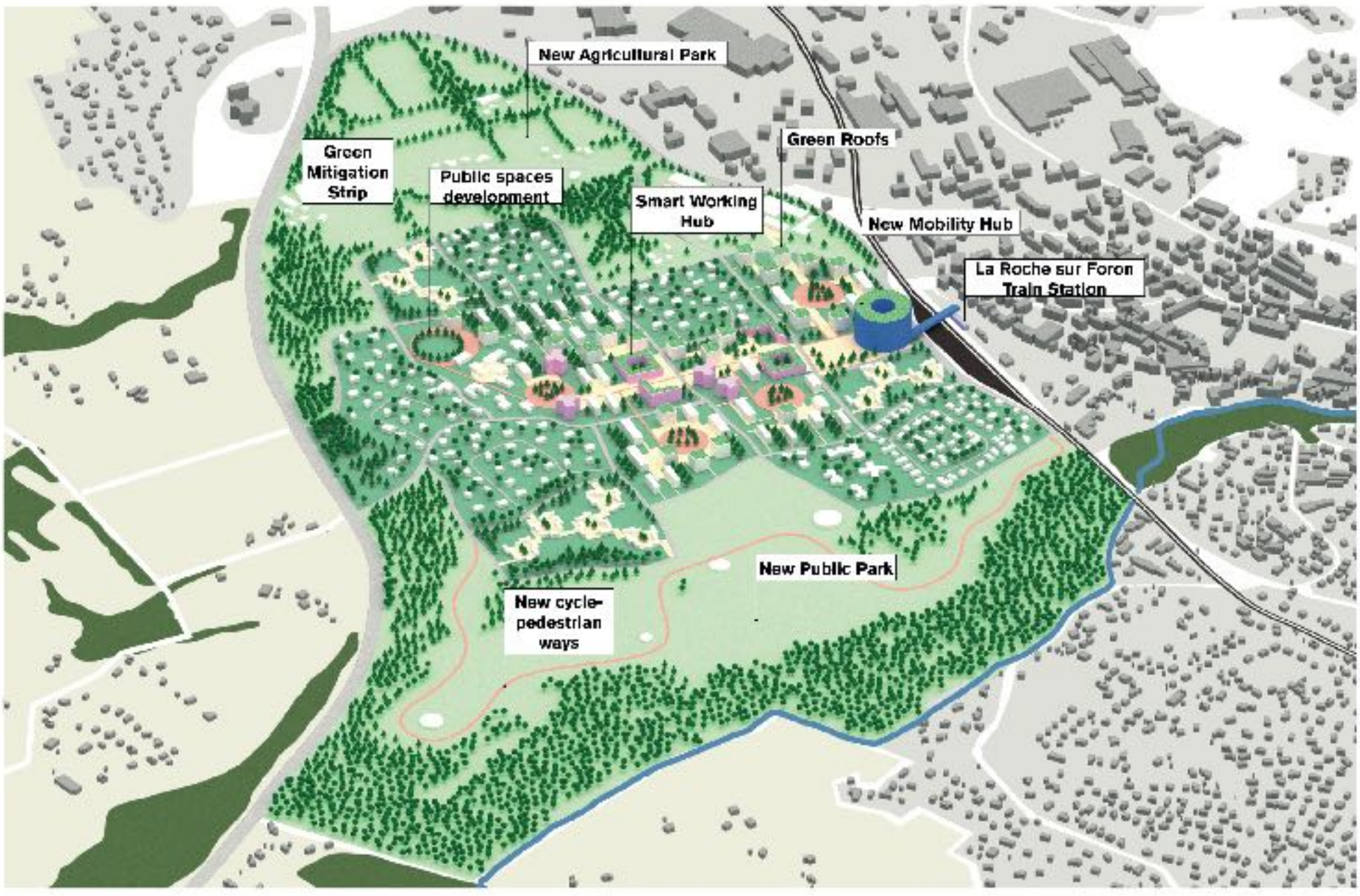
Residential Units **+3.000**

Timber demand **120.000 m³**

Photovoltaic Panels **35.000 sqm**

Green Roofs **15.000 sqm**

New Trees **+ 40.000**



Milano, 27th January 2020