CERN Masterplan 2040

Town Hall meeting

Raphaël BELLO, Director for Finance and Human Resources
Mar CAPEANS, Head of Site and Civil Engineering Department
CERN, June 9th 2022
Masterplan 2040
Raphaël BELLO, Director for Finance and Human Resources

Masterplan translated into the reality of the CERN site 2021-2025
Mar CAPEANS, Head of Site and Civil Engineering department

Q&A accompanied by
Pippa Wells, Deputy Director for Research and Computing (RSC)
Benoît Delille, Head of the HSE unit
Michael Poehler, Leader of the Technical Office and Geomatics Section (SCE)
CERN Masterplan 2040, a strategic document

- European Strategy for Particle Physics
- 2030 Agenda for Sustainable Development
  - 17 Sustainable Development Goals (SDGs)
- CERN Strategic Objectives 2021-2025
- Attractiveness of the site and personnel wellness
CERN Masterplan 2030 → 2040

- Integration of the latest projects
- Integration of SPS land and LHC points
- Integration of the Development Guide (CH)
- Integration of sustainable development
CERN Masterplan 2040 Use

It is a document to inform and inspire a reasoned and meaningful dialogue about the management and update of CERN’s site. It is therefore a key document to guide and improve the management and use of land and space at CERN.

The Masterplan will be used in a variety of practical ways such as:

- To deliver better on CERN’s environmental objectives;
- To support decisions in the approval process of infrastructure projects;
- To reveal trends and analyse effectiveness of land planning and management;
- To connect spatial and infrastructure planning with budgeting and investment decisions;
- To ensure that “privileges over” and “ownership of” space do not hamper the optimization of the existing space and potential savings;
- To favour Project Proposals initiated by a high-level objective;
- To plan better services for the Organization and its scientific community.
Control the resource requirements for the operation of tertiary infrastructures:
- Improve energy consumption and reduce greenhouse gas emissions
- Promote new energy-generation technologies
- Limit the increase in water consumption.

Initiate an action plan in favour of biodiversity, green spaces and protected species:
- Continue to implement the rainwater management strategy
- Draw up an inventory of the existing biodiversity, protected species and green spaces
- Continue the development of the ecological continuity of environments and wildlife corridors.

Control and mitigate CERN's environmental pollution:
- Limit noise pollution
- Increase the recycling rate and reduce waste production.
Installations and facilities that preserve a “Green Heart” in the region
Integration of sustainable development
**Masterplan 2040**

**DENSIFICATION**

Densify land occupation by ensuring flexibility of use
- Identify the areas set aside for development and define priorities
- Continue to monitor CERN’s development
- Draw up a land improvement plan
- Favour taller buildings where site conditions and building use so permit

**BUILDING MANAGEMENT**

Standardise the use of built-up areas:
- Develop a policy for the management of built-up areas with a specific strategy for each purpose
- Continue monitoring existing buildings
- Continue the renovation programme

**FUNCTIONALITY & READABILITY**

Consolidate the functionality of the Meyrin and Précessin sites and the experiment sites, and make the Précessin site autonomous:
- Enhance the organisation and coherence of the sites by creating specific zones: visitor, academic, scientific–technological
- Create one or more decentralised service hubs on the existing and future sites, notably bringing together amenities, restaurants, public spaces, lawns, gathering areas, etc

June 9 2022
Focus on functionality

1957: FOUR FUNCTIONAL AREAS

LIBRARY, OFFICES AND LABORATORIES

ELECTROMECHANICAL INSTALLATION

SC (SYNCHRO-CYCLOTRON)

PS (PROTON-SYNCHROTRON), 1959

1954 FIRST SOD ON MEYRIN SITE

June 9 2022
Two sites, two stories and parallel developments
The Internal Guide for the Development of the Meyrin site was launched in the framework of the Structure de Concertation Permanent (SCP) at the end of 2018.

Collaboration between CERN and Canton de Genève, Office de l’Urbanisme.

Its objective is to allow the development of CERN and to guarantee the functionality of the site while preserving the surrounding rural and forest space.
1. Heritage and historical qualities of buildings as a constraining factor;

2. Period of construction, considering that the older a building is, the more its depreciation justifies an intervention;

3. Function of the buildings, considering that offices, office-laboratories or storage are more conducive to relocation than spaces devoted to experiments, technical or production buildings;

4. Functional links with underground infrastructures a constraining factor.

1. Prioritize potential sectors identified as “intra-muros”;

2. Give priority to developments in the continuity of the existing site;

3. When particular conditions require it, extensions of the site extra-muros.
Internal Guide for the Development of the Meyrin site

Potential

Plan with the 16 development sectors – one sheet per development sector
Development plan for Meyrin and Préveuxin

- LHC – P1
- LHC – P2
- LHC – P3
- LHC – P4
- LHC – P5
- LHC – P6
- LHC – P7
- LHC – P8

*UAcern zone (PLU/H), special zone (CH) ............ U1.4
Development sector ........................................ U2.1
- priority
- secondary
- subject to tight development restrictions
- one-off development (satellite sites)
| | | | Potential land improvement ...................... U2.3
Future projects

HL-LHC (P1&P5): civil engineering works delivered end 2022

- Tunneling works
- Tunnel finalised
- Works in Point 1 - Meyrin
- Above-ground buildings

P1 - 60% of excavated material treated on site – topsoil reclaimed
PBC Studies & Locations

AION-100 @IP4 LHC
Oliver Buchmüller (Imperial College) & Jonathan Ellis (King’s College/ CERN)

Beam Dump Facility
Matthew Fraser (CERN) & Richard Jacobsson (CERN)

nuStorm
Kenneth Long (Imperial College)

LHC
Charlie Young (SLAC) & Henry J. Lubatti (University of Washington)

Forward Physics Facility
Jaime Boyd (CERN) & Jonathan Feng (UC Irvine)

MATHUSLA

FASEER
Jaime Boyd (CERN) & Jonathan Feng (UC Irvine)
Studies
Linear Colliders: CLIC at CERN (ILC in Japan)

Three stages plan

Compact Linear Collider (CLIC)
- 380 GeV - 11.4 km (CLIC380)
- 1.5 TeV - 29.0 km (CLIC1500)
- 3.0 TeV - 50.1 km (CLIC3000)

Electron-positron linear collider at CERN over the HL-LHC
The Future Circular Collider

Collision energy: 100 TeV
Circumference: 90 km
Feasibility Study: 2021 - 2025
CERN site key figures

- 590 ha (220 fenced)
- 2 main sites and 15 satellite sites
- 670 building from 10 m² to 20,000 m²
- 65% built before the 70s
- 70 km tunnels and 80 caverns
- 30 km roads
- 1000 km technical galleries and trenches

- 9000 persons/daily
- 490 hostel rooms
- 8500 working places
- >5000 parking places
- 25000 daily movements to- and inter-sites
- Public transport links in CH, not in FR
Impact on the site

- Infrastructure Request Process (IRP) procedure, IRP Board
- SCE Site Consolidation Steering Committee

- Global Space management
- Fluid dialogue with local communities/Host States
Purpose: The Contract is for the design, construction and 10-year M&O of the building and equipment.

Needs: Initial capacity of 4 MW available for IT equipment with stepwise future increases to 12 MW. To meet CERN’s environmental goals the project incorporates the following considerations:

- The PCC is designed to be energy efficient with a target PUE (Power Usage Efficiency) of 1.10 (1.15 contractual)
- Optimised water consumption via a recirculation system lowering consumption in hot periods
- All cleared vegetation will be reconsolidated
- The acoustic study used for design of the building follows CERN commitments
- Green terrace on the roof
- A heat recovery system is foreseen for up to 4 MW of power to be recovered to heat the entire site

TESTING & COMPLETION:
- PCC Testing – Mar to Sept 23
- Operational from October 23

PREVESSIN SUSTAINABLE HEATING PLANT: 2026
Key design information:

- Tertiary building (475 p.) + new restaurant (500 s.) + Parking
- Compliance Master Plan 2040
- Compliance RE 2020 (environmental regulation)
- Low embodied energy (mass timber structure)
- Preservation of nearby forest
- Integrate soft mobility

2026: end of works
B140 – densification (Meyrin)

B34 (Learning center), 4000 m²
Stakeholders: HSE, IR, HR

B90, 7500 m²
Stakeholders: DG, IR

B140, 13870 m²
Stakeholders: EP

Base assumptions:

• 18000 m²
• Office building, training center, light laboratories, cafeteria & parking
• Emphasis on sustainable design & construction: Minergie, low carbon...
• Beginning of works at ~LS3 start
MTE kickers to house the relocated kicker’s system and its operational equipment. Meyrin, 235 m², works 1/23 to 12/23

Extension and reconditioning of the Radioactive Waste Treatment Centre with offices and renovation of technical infrastructures. Meyrin, 315 m², works 12/22 to 12/23

Emphasis on sustainable design & construction
Site consolidation

Priorities

• Safety
• Strategic value with respect to scientific goals
• Sustainability: durability, environmental impact, energy performance

Process

• Data-driven decisions

![Current average conditions at CERN](image)

- Standardization of requirements definition according to Masterplan, IRP approval process for execution
- 5 and 10 year views

Specifications

• Global renovations
• Regulations compliance
• Energy efficiency improvement: > 60%
• Monitoring heating, electrical and lighting consumption
• Operation of HVAC, Heating and lighting consumption according to the outdoor temperature, occupation of the premises, eco-mode
• Favor centralized networks
Renovation works

- Global renovation of up to 2 buildings/year
- Densify consolidated space
- Emphasis on sustainable design & construction
- Reduced maintenance & operation costs
- Demolish depreciated space

Procurement from Summer 2022
B36, design procurement phase from Autumn 2022, followed by construction
B100, procurement phase in 2023
Demolish obsolete barracks at P1 (~400 m²) and replace it by a pre-fabricated building doubling the capacity within the same footprint. Minergie, low carbon footprint at construction and operation.
LIBRARY B52

Mid 2023

CERN Masterplan 2040

CAGI CULTURAL KIOSK

Sep 2022
Actions on Energy consumption

Increase efficiency

- **Technology:** PS East area power converters designed to supply the magnets on a cyclical basis, with an energy-recovery stage resulting into 90% electricity consumption reduction: (11 to 0.6 GWh/y)

Use less

- **Campus:** Building Global renovations for reduction of losses (energy, water, gas, cooling), densifying occupation

Recover

- Hot water from LHC cooling system (P8, 2 x 5 MW heat exchangers) to heat up a residential area (20 GWh/y at peak).
- Heat recover from the new Prévessin Computing Center to heat the FR site (3-4 MW)
- Heat recover from the LHC Cooling towers at P1 to heat the Meyrin CERN site (5-10 MW)

- **Annual Virtual Energy Bills**
- **Energy performance plan & ISO50001**
Linked to CEPS, HSE chaired a Working Group dedicated to biodiversity at CERN in 2020/2021 in collaboration with SCE: proposal of an action plan with 14 environmental measures

SCE and CEPS funding to work in 2021/2022 on priority measures linked to the integration of biodiversity in planning and implementing urban development:

- **Formal integration of biodiversity into the IRP process** – details within the Design Study template
- **Identification of CERN areas of biological interests**, floristic and faunistic inventories, diagnostic and integration into the CERN GIS
- **Plantation of trees**, tree heritage, internal compensation policy
Resources: Water

Consumption

Quality

Prevessin Site

Pond BR2 – 6000 m³

2019-2020

Pond BR1 – 3000 m³

2022-2023
MOBILITY

PARKING
Optimise the car-parking facilities and their management:
- Limit car parking
- Privilege car parks close to the main road network
- Continue the development of facilities for soft-mobility
- Develop communication promoting a reduction of the impact of people’s mobility at CERN

CIRCULATION
Promote efficient and fluid access to and circulation on the CERN sites:
- Optimise the fluidity of access to the CERN sites.
- Improve the hierarchy of the road network.
- Continue developing accessible facilities for people with reduced mobility

ALTERNATIVES
Encourage alternatives to individual motorised transport for commuting:
- Encourage car sharing.
- Improve the continuity, safety and comfort of soft-mobility routes and provide parking for bicycles

INTERSITE TRANSPORT
Promote alternatives for travelling between the CERN sites:
- Continue developing facilities associated with collective transport on site.
- Optimise the management and supply of CERN vehicles.
- Expand and diversify CERN’s bicycle fleet.
- Continue developing the network of foot and cycle paths on site

Masterplan 2040:
Framework objectives and measures
Mobility

**Strategic principles**
- Focus on people needs
- Integrate transport modes
- Adaptable to the future needs of the organization
- Sustainable and eco-responsible
- Communicate, cooperate with local actors, and involve the community

**Roadmap**
- Data driven
- Targets
- KPIs

**Actions**
- 10 km Cycle paths (2020)
- 80 E-bikes (2021-2022)
- +40% Bike parkings (2022)
- E-charging stations for professional use (2022...)
- Increased car-sharing (2022)
- Optimization of the car fleet (2023)
- Mobility Report (yearly)
Masterplan 2040:
Framework objectives and measures

INTEGRATION WITH SURROUNDING LANDSCAPE

Integrate the CERN sites with the surrounding landscape:
- Integrate sites harmoniously with the existing features of the overall landscape and with the views onto that landscape
- Enhance the CERN site perimeters by planting diverse hedgerows that will contribute to the overall ecological network
- Implement an architectural strategy to enhance the image of CERN’s buildings and emblematic public areas

LANDSCAPE IDENTITY

Develop a landscape identity:
- Harmonise and enhance the attractiveness of the landscape developments and gathering areas, and create a furniture and signage catalogue
- Reduce islands of heat and plant trees and shrubs close to existing and future paved or tarmacked spaces, car parks and roads
Objective:
- Complete CERN working spaces with outdoor social and informal work areas;
- Give an urban identity to outside spaces;
- Exposition areas to share knowledge.

Implementation Criteria:
- Potential public (population density);
- Existing green area;
- Soft mobility easy connection;
- Proximity to cafeteria or vending machine’s room;
- User’s proposals;
- Biodiversity interest;
- Mutualization of renovation works (roads, parking...).
CERN-P1 : remplacement des clôtures et portes

Légende
- Clôtures prises en compte dans l’étude
- Portes prises en compte dans l’étude
- Tronçon à réévaluer dans le cadre du projet CERN-P2
- Clôtures déjà remplacées par le CERN
CERN Masterplan 2040 conserves the vision and framework objectives of the previous Masterplan dating of 2015, but it has been updated to reflect the 2020 update of the European Strategy for Particle Physics and the changing context. In particular:

- the **urbanisation measures** have been revised compared to the Internal Guide for the Development of the Meyrin site. The satellite sites of the SPS and the LHC are included in this update, as well as potential land use for CERN’s future evolution;
- the **mobility measures** have been aligned with the new Mobility Strategy;
- the **environmental measures** have been adapted to the CERN Environmental Reports and to the evolution of energy transition policies;
- the **landscaping measures** have been supplemented to take account of new challenges relating to integration on the territorial and local scales, as well as climate issues, an area where public policies have evolved considerably since 2015.
CERN’s Green Village

- From society to CERN to society
- Enabling rapid access to CERN campus as a test site for technologies linked to environment and sustainability
- Accelerating the commercialization of ideas, technologies and prototypes
- Involving Young Innovators, new ideas for unforeseen applications

Example Sustainability Challenges: waste management, zero-waste, smart mobility, energy efficiency for tertiary activities on campus, renewables, space management, IoT, urban analytics, intelligent buildings...
Thanks

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Raphaël BELLO, Director for Finance and Human Resources
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