



CERN's first Environment Report

Sonja Kleiner on behalf of CERN

Workshop on Carbon Emissions at Future Facilities

9 November 2011

Outline

- ❑ Background of environmental protection at CERN
- ❑ Current environmental objectives
- ❑ CERN's carbon emissions accounting for the first Environment Report
- ❑ Environmental evaluation process for the Future Circular Collider (FCC) feasibility study
- ❑ Conclusions

About CERN

23 Member States

~ 3600 employees

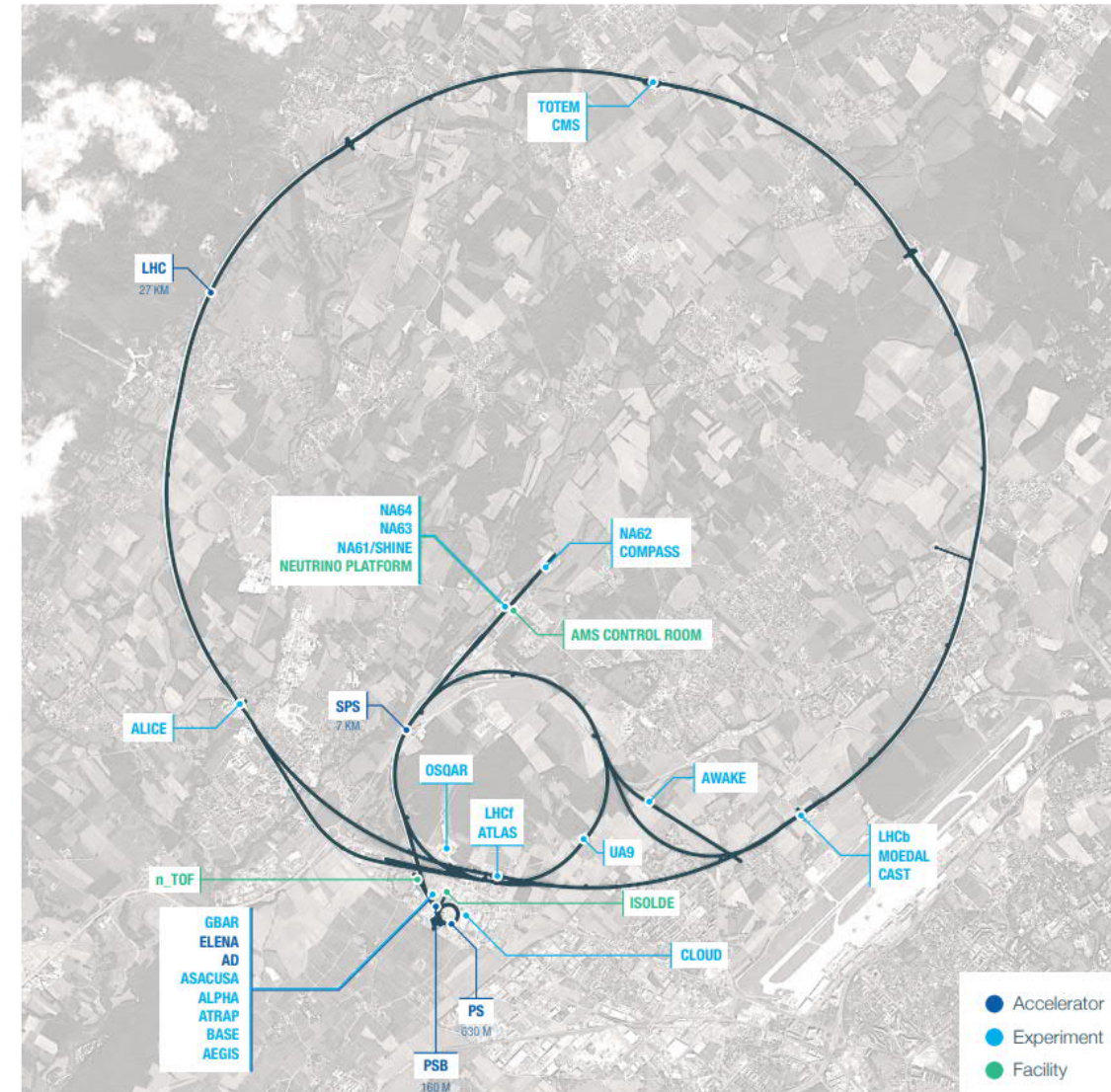
~ 12'500 scientists using the Laboratory's facilities

18 fenced sites

Globe of Science and Innovation

3 Hotels, 3 Canteens, Kindergarten

~ 653 Buildings (421'811 m²)



CERN's accelerator complex and its experiments in 2019-2020.

Background of environmental protection at CERN (1/2)

- ❑ The vision of CERN Director-General Fabiola Gianotti
- ❑ Safety at CERN includes the protection of the environment
- ❑ Dedicated panel on **Energy Management** established in 2015, incl. exchanges with other Large-Scale Research Infrastructures → **Increase efficiency – Use less – Recover more**
- ❑ **CERN Environmental Protection Steering Board** established in 2016 – 11 Environmental Domains – prioritized objectives
- ❑ Site maintenance and renovation – Masterplan 2030 (2015) → Masterplan 2040 (2022)

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A new type of coating to chase the clouds away

Safety first!

Latest news from the YETS: all restarting except the LHC

LIGO: The strong belief

ICTR-PHE 2016: Strength in numbers

Of data and dust

Organising a conference? Think about what you can do for start-ups!

The next generation of experts in trigger and data acquisition gather at ISOTD4/2016

Three new students selected for the ATLAS PhD-Guest Scheme

From the CERN web: The Art of Science, Theory courses, DAHPE and more

Computer Security: one click and BOOM...

Alice-Anne Martin (1926 - 2016)

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SAFETY FIRST!

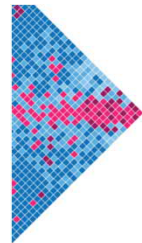
Among the many duties I assumed at the beginning of the year was the ultimate responsibility for Safety at CERN: the responsibility for the physical safety of the personnel, the responsibility for the safe operation of the facilities, and the responsibility to ensure that CERN acts in accordance with the highest standards of radiation and environmental protection.

A WORD FROM THE DIRECTOR-GENERAL



The Safety Policy document drawn up in September 2014 is an excellent basis for the implementation of Safety in all areas of CERN's work. I am happy to commit during my mandate to help meet its objectives, not least by ensuring the Organization makes available the necessary means to achieve its Safety objectives.

One of the main objectives of the HSE (Occupational Health and Safety and Environmental Protection) unit in the coming months is to enhance the measures to minimise CERN's impact on the environment. I believe CERN should become a role model for an environmentally-aware scientific research laboratory. Risk assessment and prevention and emergency preparedness are also key targets. An effective approach to handling radioactive waste is also important for CERN where we must work to limit the production of such waste, sort it effectively, store it safely and ensure safe disposal.



THE CERN SAFETY POLICY

CERN, an intergovernmental organization for fundamental research in particle physics, defines and implements a Safety Policy. Safety covers occupational health and safety, including radiation protection, the protection of the environment and the safe operation of CERN's installations, including radiation safety.

CERN strives for excellence in matters of Safety.

INTRODUCTION BY THE DIRECTOR-GENERAL

CERN strives for excellence, the quest for excellence in science, excellence in innovation, and excellence in everything we do. Safety is very much at the heart of that. The essence of CERN's Safety Policy is that the Organization's scientific and technical excellence be matched by excellence in matters of Safety. To this end CERN promotes occupational health and safety, radiation protection, the protection of the environment and the safe operation of CERN's installations, including radiation safety.

CERN's performance in matters of Safety is dependent on every one of us. I invite you to formulate yourself with the CERN Safety Policy and our Safety Rules, and I am confident that you will actively contribute to CERN's excellence in matters of Safety through exemplary conduct and the use of best Safety practices when carrying out your activities at CERN.

Fabiola Gianotti

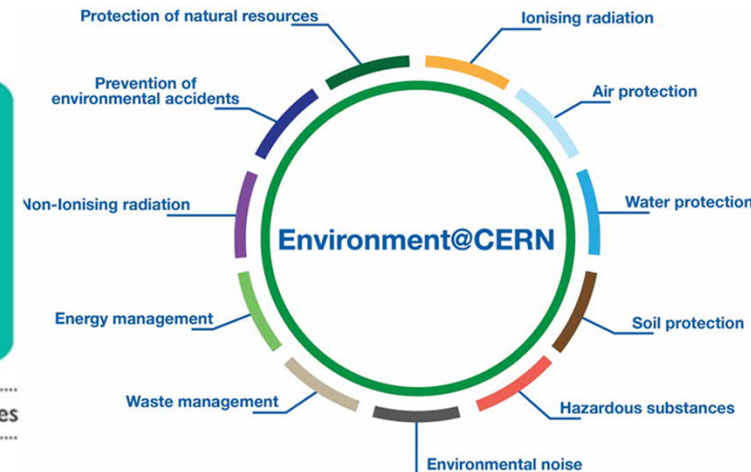
Director-General

8 July 2016

Fabiola Gianotti

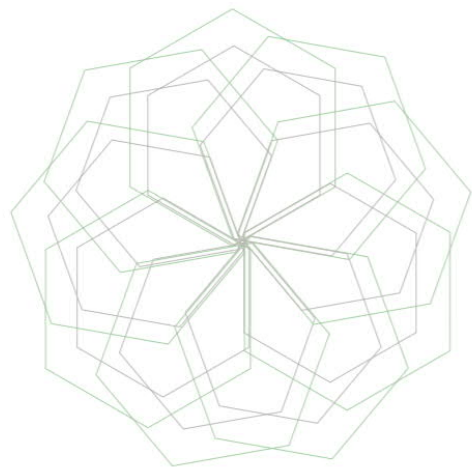


Energy Management for Large-Scale Research Infrastructures



Background of environmental protection at CERN (2/2)

- ❑ Publication of the first public CERN Environment Report → Sept 2020, covers 2017-2018
- ❑ Publication of the second report → Nov 2021, covers 2019-2020
- ❑ Next ones will be published every two years
- ❑ Following the *Global Reporting Initiative Standard*
- ❑ Materiality assessment carried out in 2019 with internal and external stakeholders



Environment
Report
2017 - 2018

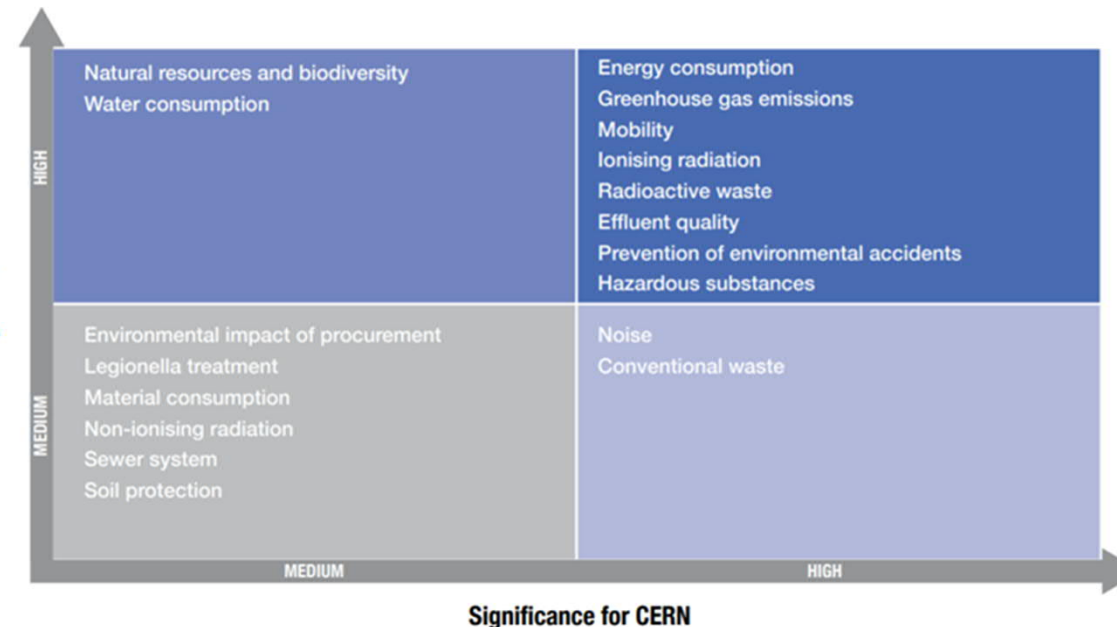


GRI CONTENT INDEX

For the Materiality Disclosures Service, GRI Services reviewed that the GRI content index is clearly presented and the references for Disclosures 102-40 to 102-49 align with appropriate sections in the body of the report. The service was performed on the English version of the report.

Standards and Disclosures	Title	Pages / Informations
GRI 101:2016 FOUNDATION		
GRI 102:2016 GENERAL DISCLOSURES		
Organizational Profile		
102-1	Name of the organization	8
102-2	Activities, brands, products, and services	8, 24
102-3	Location of headquarters	8
102-4	Location of operations	8
102-5	Ownership and legal form	8
102-6	Markets served	8
102-7	Scale of the organization	8
102-8	Information on employees and other workers	8
102-9	Supply chain	8
102-10	Significant changes to the organization and its supply chain	None
102-11	Precautionary Principle or approach	10, 16
102-12	External initiatives	9
102-13	Membership of associations	8
Strategy		
102-14	Statement from senior decision-maker	4, 5
Ethics and Integrity		
102-16	Values, principles, standards, and norms of behavior	9
Governance		
102-18	Governance structure	9
Stakeholder Engagement		
102-40	List of stakeholder groups	11
102-41	Collective bargaining agreements	The CERN Staff Association represents the CERN personnel, which is an important stakeholder group to the Organization. The Association represents the entire staff body on the Tripartite Forum on Conditions of

Significance
for external
stakeholders



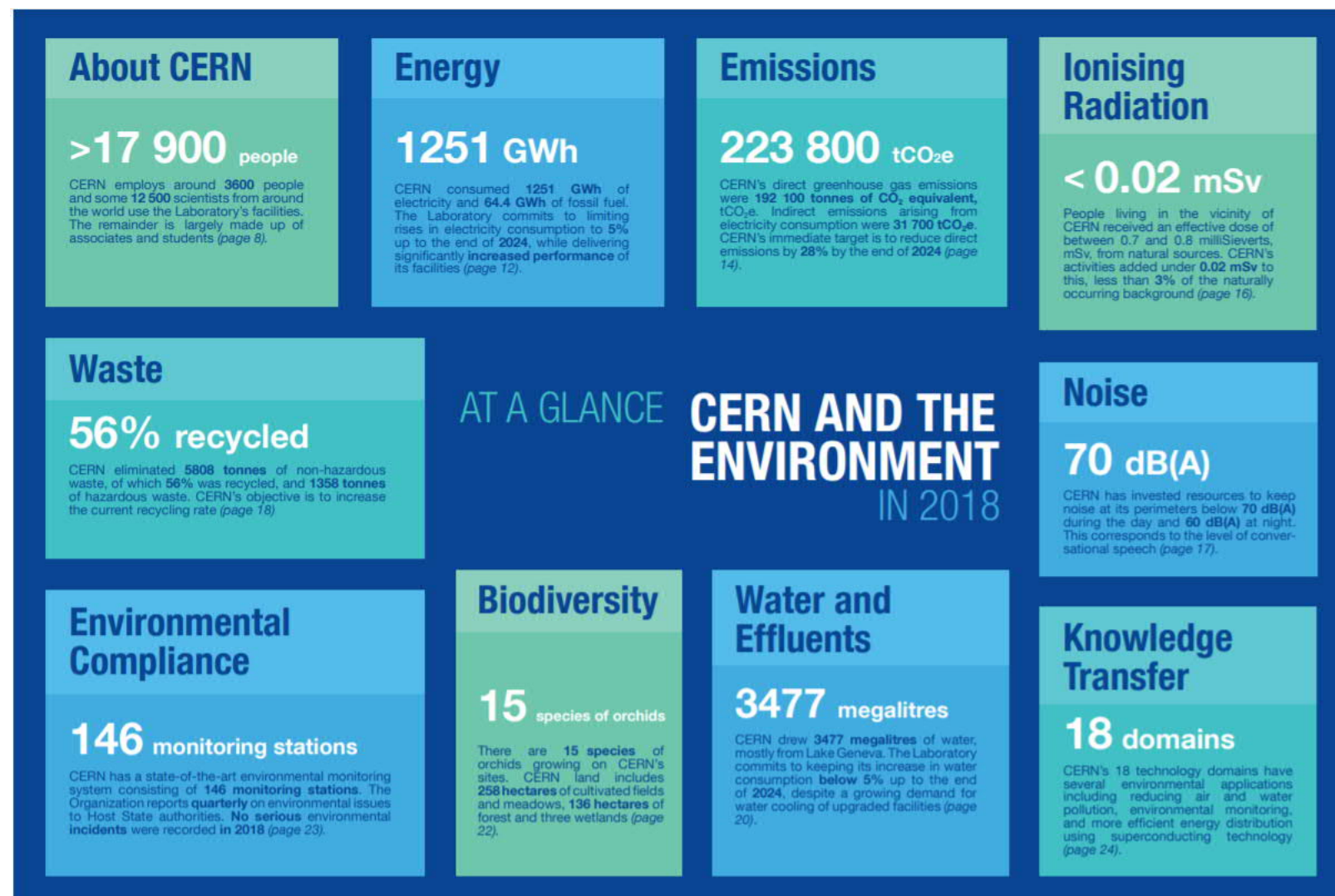
Current environmental objectives (1/2)

Highest priority objectives set for:

- ❑ reducing emissions of fluorinated gases from Large Experiments
- ❑ limiting the electrical power consumption
- ❑ limiting the water consumption
- ❑ reducing the impact of effluent water on receiving watercourses

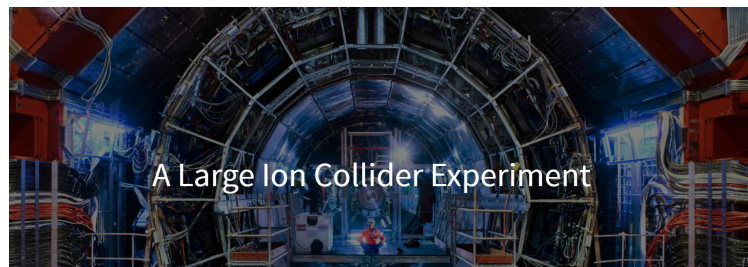
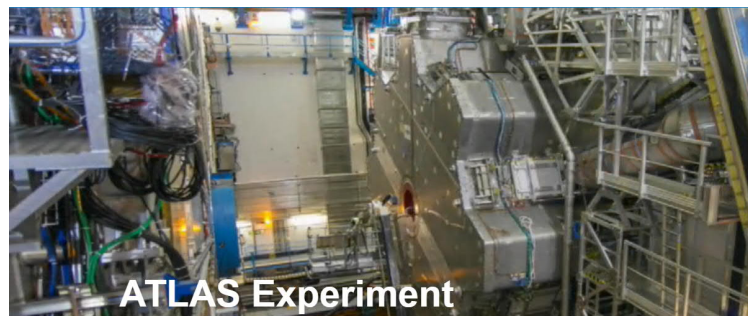
CERN Environment Report 2017-2018 available [here](#)

Publication of the 2019-2020 report after COP26



Current environmental objectives (2/2)

- ❑ Reduction target is focussed on direct greenhouse gas emissions
- ❑ Reduction target is directly linked to the emissions of fluorinated gases from the Large Experiments



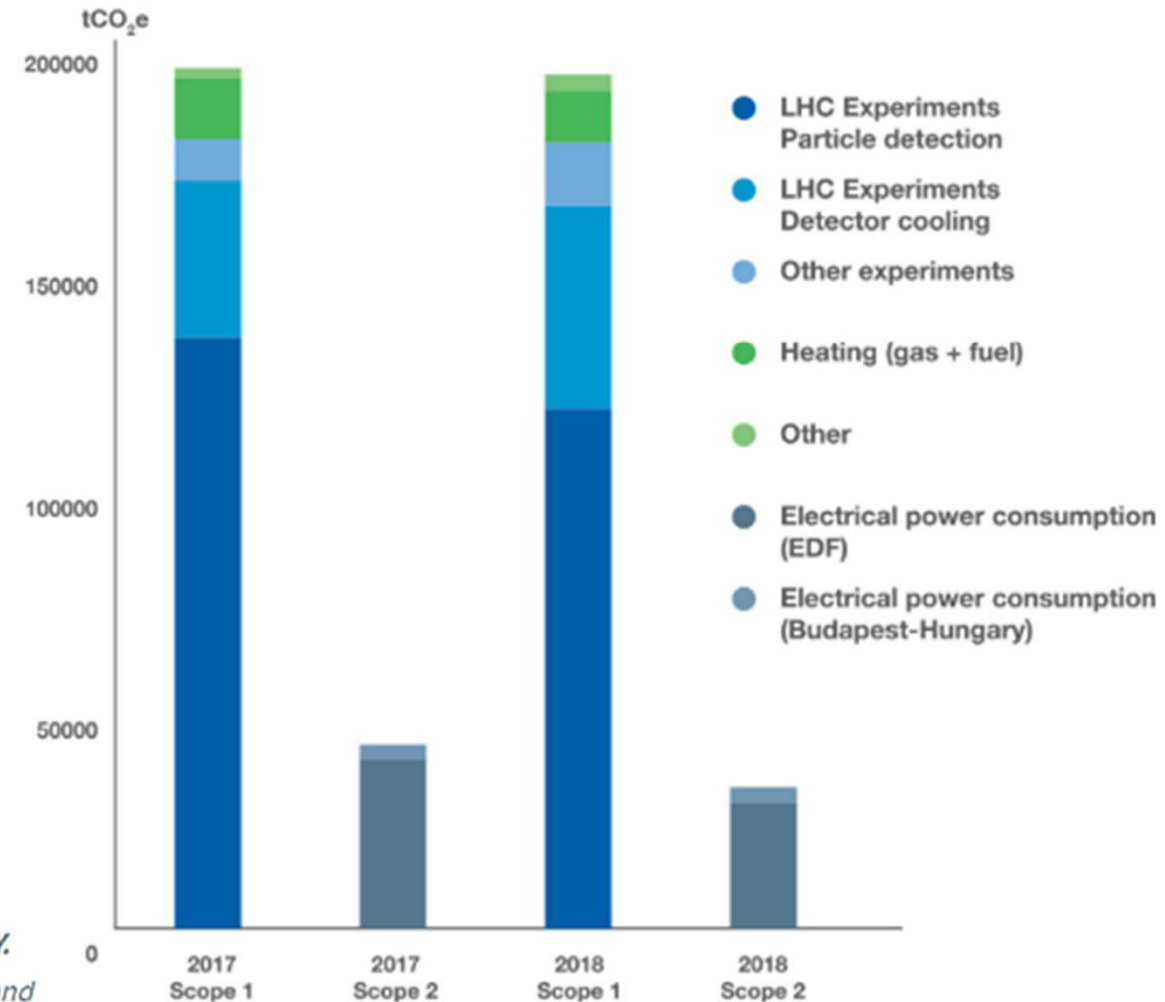
Emissions *Year 2018*

223 800 tCO₂e

CERN's direct greenhouse gas emissions were **192 100 tonnes of CO₂ equivalent, tCO₂e**. Indirect emissions arising from electricity consumption were **31 700 tCO₂e**. CERN's immediate target is to reduce direct emissions by 28% by the end of 2024 (page 14).

CERN's carbon emissions accounting (1/4)

- ☐ Scopes aligned to the Greenhouse Gas Protocol
- ☐ **Scope 1** = direct on-site emissions (combustion processes & fugitive emissions of fluorinated gases)
- ☐ **Scope 2** = indirect emissions linked to the electrical power consumption of CERN. Most of the electricity is fed by the 400kV French electricity network, with low carbon power footprint due to nuclear and hydroelectric power



CERN SCOPE 1 AND SCOPE 2 EMISSIONS FOR 2017 AND 2018 BY CATEGORY.
Other includes air conditioning, electrical insulation, emergency generators and CERN vehicle fleet fuel consumption.

CERN's carbon emissions accounting (2/4)

- ❑ Main source of CO₂e within Scope 1 linked to fugitive emissions of F-gases such as HFC's, PFC's and SF₆ from the experiments
- ❑ F-gases are used in the experiments for detector cooling (mainly PFC's) and for particle detection (mainly HFC's)
- ❑ Continuous follow-up of the gas consumption and annual reporting of the CO₂e emissions
- ❑ Global Warming Potential (GWP) associated to the F-gases, based on the EU Regulation No 517/2014

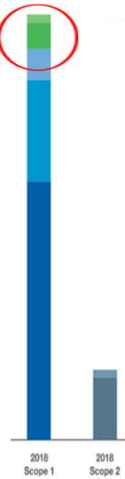
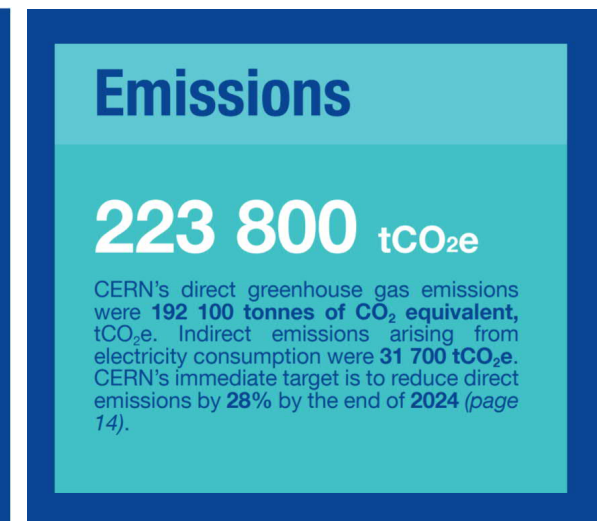
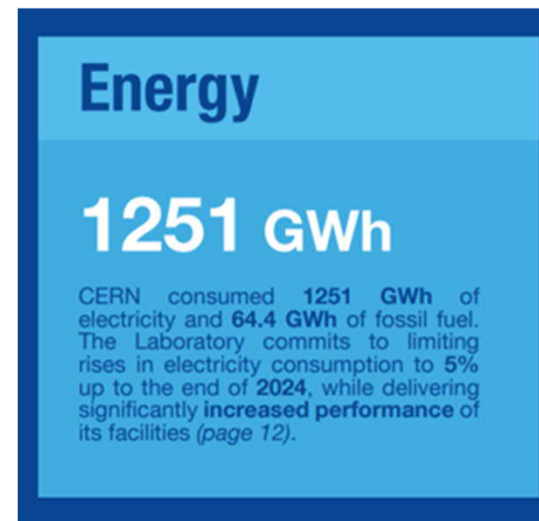


GROUP	GASES	tCO ₂ e 2017	tCO ₂ e 2018
PFC	CF ₄ , C ₂ F ₆ , C ₃ F ₈ , C ₄ F ₁₀ , C ₆ F ₁₄	61 984	69 611
HFC	CHF ₃ (HFC-23), C ₂ H ₂ F ₄ (HFC-134a), HFC-404a, HFC-407c, HFC-410a, HFC R-422D, HFC-507	106 812	96 624
	SF ₆	10 192	13 087
	CO ₂	14 612	12 778
TOTAL SCOPE 1		193 600	192 100

BREAKDOWN OF SCOPE 1 EMISSIONS BY GAS TYPE. Global warming potential, GWP, based on EU Regulation 517/2014 on fluorinated greenhouse gases, while HFC-407c, HFC-410a, HFC-404a, HFC R-422D, and HFC-507 are based on the IPCC Fifth Assessment Report, 2014 (AR5).

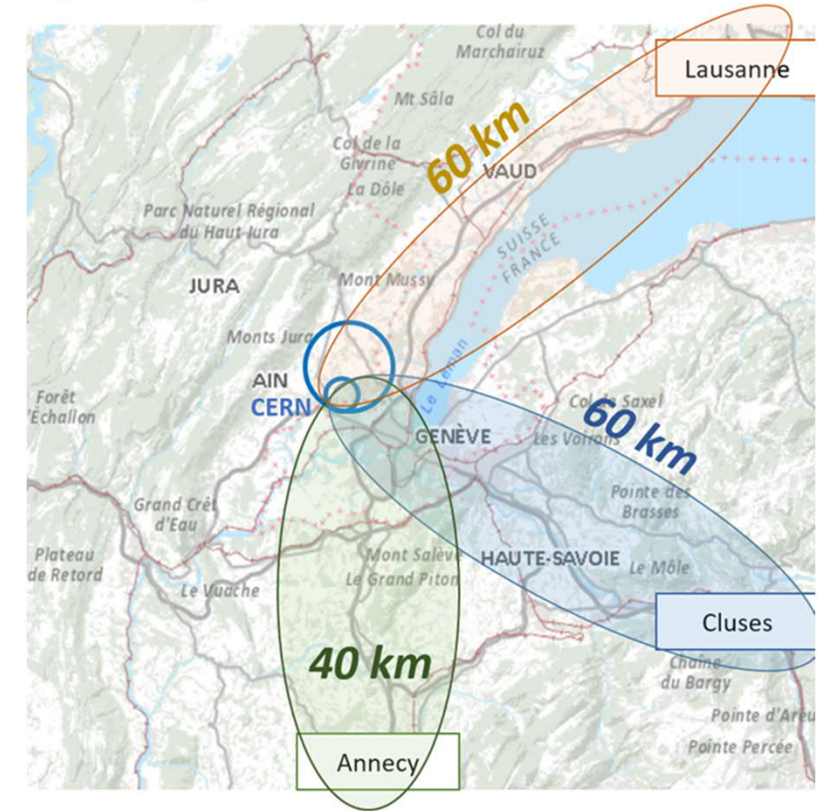
CERN's carbon emissions accounting (3/4)

- ❑ Other emissions sources linked to combustion processes within Scope 1 = mainly 2 Gas Heating Plants + CERN vehicle fleet
- ❑ Annual fossil fuel consumption from these categories converted in CO₂e through the **Bilan Carbone®** tool of the *Association Bilan Carbone*
- ❑ **Scope 2** = indirect emissions linked to the electrical power consumption of CERN. Annual consumption converted in CO₂e by using an averaged conversion factor provided by the supplier (*Electricité de France – EDF*)

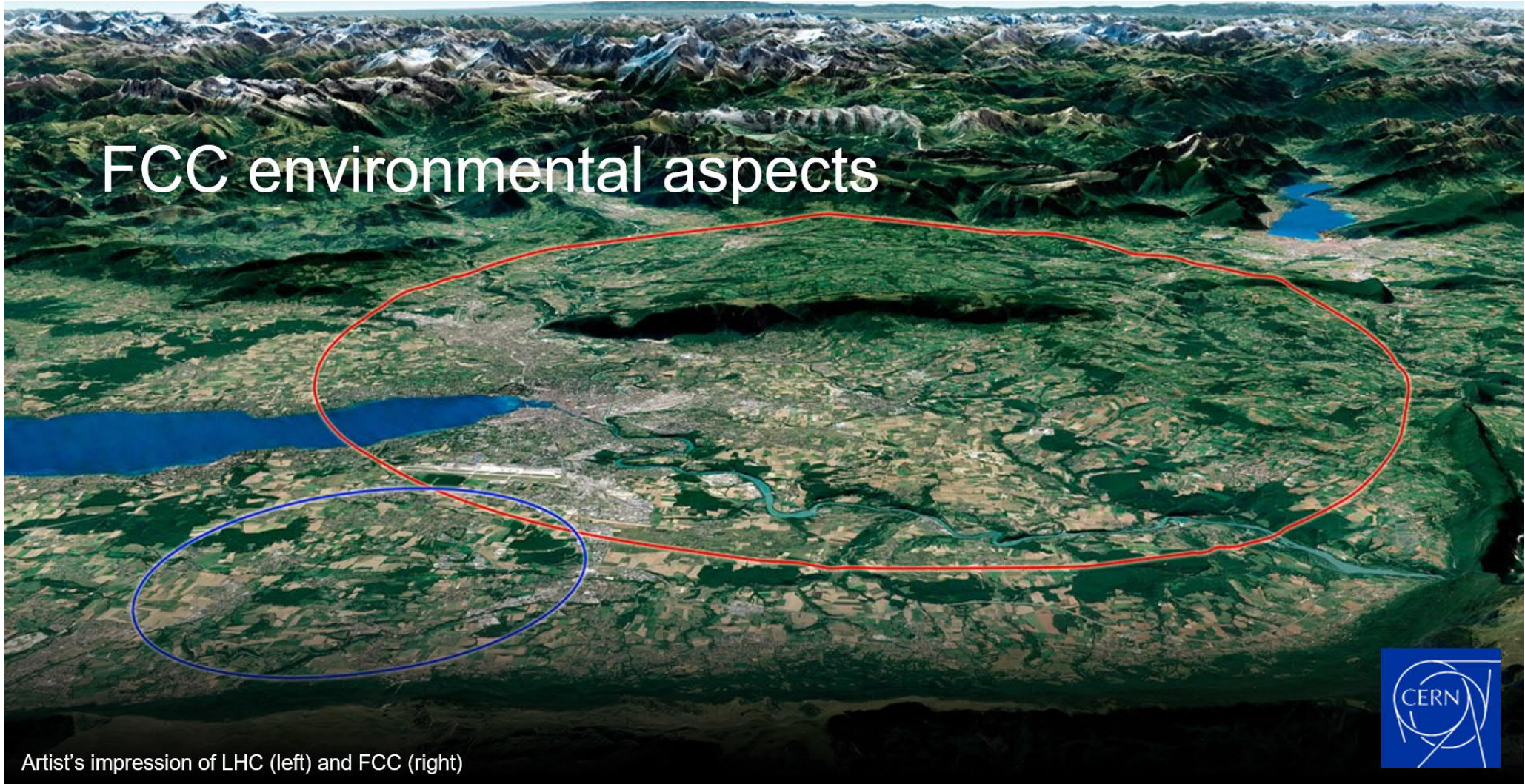


CERN's carbon emissions accounting (4/4)

- ❑ In the next report (2019-2020), data on **Scope 3** emissions will be available
- ❑ Categories investigated were Business travel, Personnel commutes, Catering, waste and water purification. About 5% of the CERN's 2018 carbon footprint. Within these categories, Personnel commutes has the highest CO₂e footprint
- ❑ CERN's procurement related CO₂ emissions were also investigated but are not included yet. "Sustainable procurement" project launched this year
- ❑ Accounting for Scope 3 carried out by a consultant through the **SimaPro** software (using ecoinvent v3.6 and Exiobase databases)

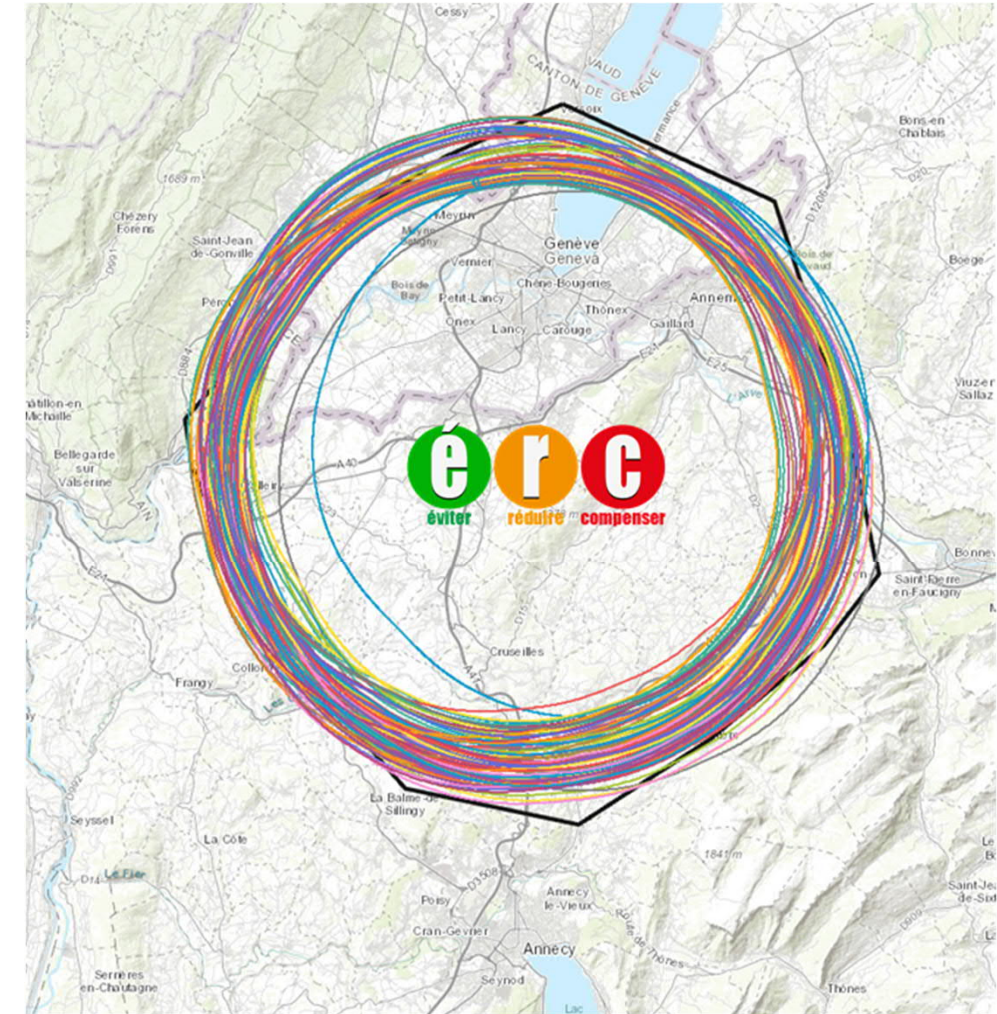


Environmental Evaluation Process for FCC feasibility study (1/4)



Environmental Evaluation Process for FCC feasibility study (2/4)

- ❑ For the Future Circular Collider feasibility study, integration of an “**Eco-design**” approach from the first conceptual design phase onwards, balancing – Scientific excellence – Territorial compatibility – Implementation and operation aspects
- ❑ The environmental evaluation process follows the “**Avoid-Reduce-Compensate**” approach of the French environmental law
- ❑ Multi-year development of the accelerator system and infrastructures requires an iterative approach
- ❑ Early engagement of stakeholders, so that performance for scientific research is maintained



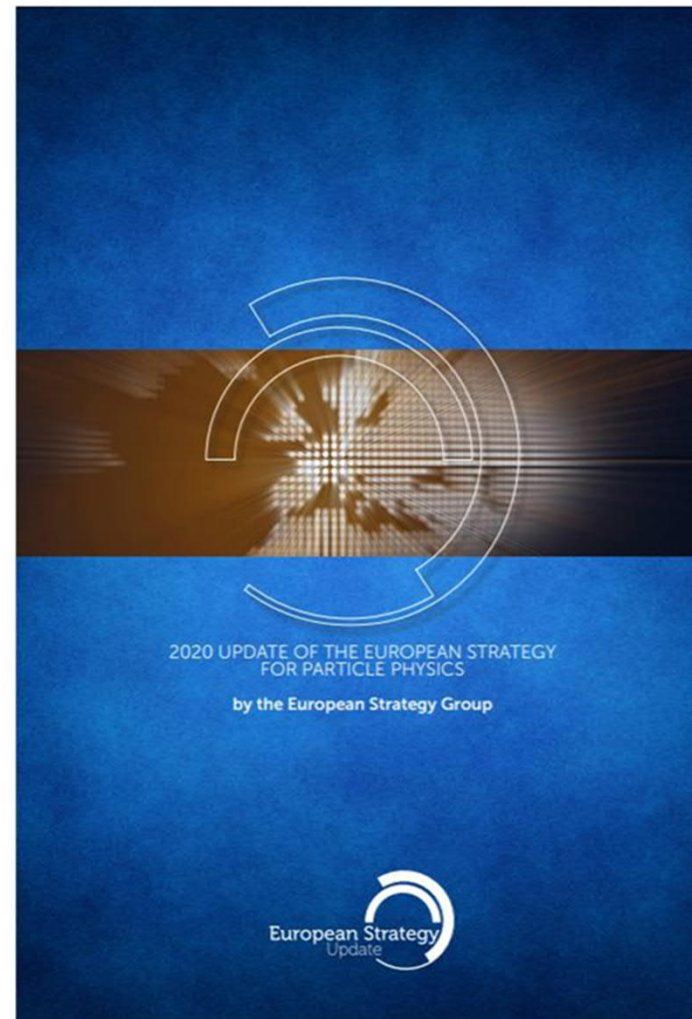
About 100 alignments of 12 site and 8 site scenarios studies together with French and Swiss Host State partners between 2015 and 2021.

Environmental Evaluation Process for FCC feasibility study (3/4)

- ❑ **Environment** within the environmental evaluation process includes aspects such as geology, urbanism, society health and safety, technical development opportunities, synergies and conflicts with other planned projects, technical risks...
- ❑ Transboundary aspects are considered (European *Espoo* and *Aarhus* Conventions)
- ❑ Iterative co-development with the Host State partners on high-priority topics such as:
 - Consumption of resources: land, soil, water
 - Limitation of impacts, e.g. through re-use of **excavated materials**, reduction of surface footprints, energy efficient designs, reduction of traffic and nuisances during construction
 - Creation of added value, e.g. supply of waste heat, sharing of technical infrastructures (e.g. electricity, telecommunications, water supply and treatment)
- ❑ Environmental Evaluation process is currently in a preparatory phase (initial state analysis, methodology setup, concept approval by the Host State partners)

Environmental Evaluation Process for FCC feasibility study (4/4)

- ❑ Process takes into account the recommendations established in the framework of the **Update of the European Strategy for Particle Physics** in June 2020
- ❑ Carbon footprint assessment(s) for various categories will be done progressively, also under guidance of the Host State partners



7



Environmental and societal impact

A. The energy efficiency of present and future accelerators, and of computing facilities, is and should remain an area requiring constant attention. Travel also represents an environmental challenge, due to the international nature of the field. ***The environmental impact of particle physics activities should continue to be carefully studied and minimised. A detailed plan for the minimisation of environmental impact and for the saving and re-use of energy should be part of the approval process for any major project. Alternatives to travel should be explored and encouraged.***

B. Particle physics, with its fundamental questions and technological innovations, attracts bright young minds. Their education and training are crucial for the needs of the field and of society at large. ***For early-career researchers to thrive, the particle physics community should place strong emphasis on their supervision and training. Additional measures should be taken in large collaborations to increase the recognition of individuals developing and maintaining experiments, computing and software. The particle physics community commits to placing the principles of equality, diversity and inclusion at the heart of all its activities.***

C. Particle physics has contributed to advances in many fields that have brought great benefits to society. Awareness of knowledge and technology transfer and the associated societal impact is important at all phases of particle physics projects. ***Particle physics research centres should promote knowledge and technology transfer and support their researchers in enabling it. The particle physics community should engage with industry to facilitate knowledge transfer and technological development.***

Conclusions

- ❑ CERN's carbon accounting methodology is regularly revised. The accounting will be extended according to needs and international approaches
- ❑ A recent event between the eight European EIROforum organisations and the seventeen NLDC laboratories in the United States on climate issues demonstrated the need to exchange on carbon accountings in research facilities and to share experiences on reduction actions (<https://www.eiroforum.org/news/uniting-science-to-address-climate-change/>)
- ❑ For potential future large research facilities, such as FCC, carbon accounting is part of the process, as local impact assessments in many other environmental domains

