



Sustainable HECAP

Striving towards Environmental Sustainability in High
Energy Physics, Cosmology and Astroparticle Physics

Frauke Poblitzki, 27.02.2023

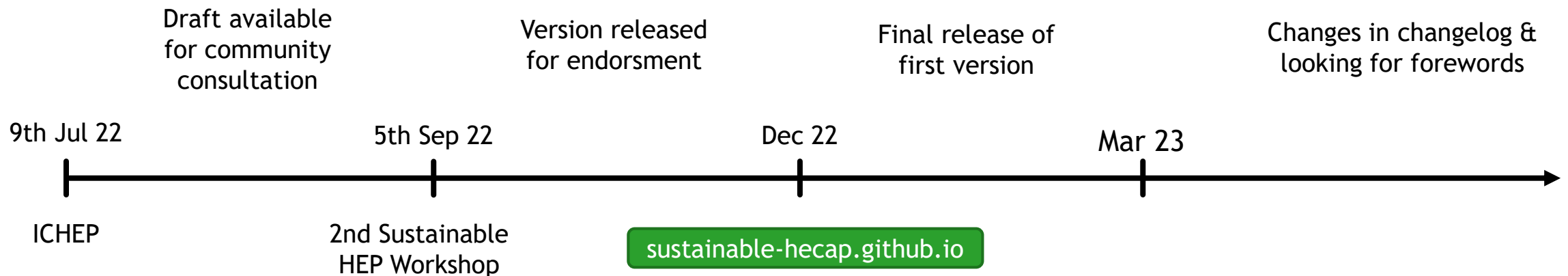
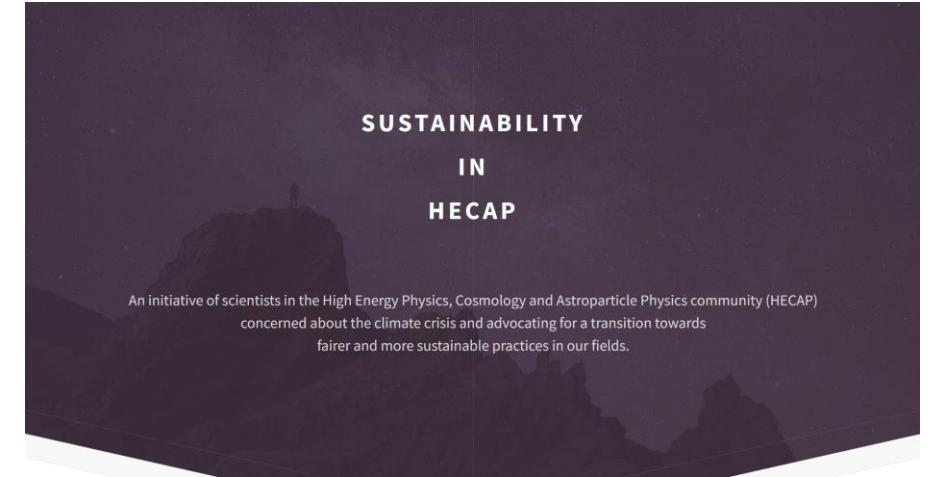
on behalf of everyone working towards this document



sustainable-hecap.github.io

Origins and goals of the HECAP Sustainability Document

- ▶ The initiative started with the 1st Sustainable HEP Workshop, in June 2021 at CERN.
- ▶ Currently 19 international authors plus many more contributors.
- ▶ The aim is to state our concerns as a group of concerned physicists,
 - ▶ to build upon and consolidate existing work and efforts, and
 - ▶ to reflect upon how we as a community can make positive changes w.r.t. environmental sustainability and social justice.



The Reflection Paper

► The initiative wrote a **reflection paper**, which is not finished yet, but is already open for **feedback** and **additional contributions**.

sustainable-hecap.github.io

► What the reflection paper is **NOT** supposed to be:

► a white paper, a mandated status report, a document reflecting the consensus of the whole HECAP community

► What it is:

- a document written by a grassroots initiative
- a synthesis of current data and best practices from research in climate science and sustainability, as applied to our field to the best of our ability as physicists,
- and a reflection on the roles that our community can play in limiting negative environmental impacts due to our research work and scientific culture.

Striving towards Environmental Sustainability in High Energy Physics, Cosmology and Astroparticle Physics (HECAP)	
Important: Statement of intent	
The climate crisis and the degradation of the world's ecosystems require humanity to take immediate action. Given this, the High Energy Physics, Cosmology and Astroparticle Physics (HECAP) communities have a responsibility to limit the negative environmental impacts of their research.	
This incomplete document is being developed as part of a grassroots initiative <i>Striving towards Environmental Sustainability in High Energy Physics, Cosmology and Astroparticle Physics</i> . It is intended to be a synthesis of current data and best practices from research in climate science and sustainability, as applied to our field to the best of our ability as physicists, and a reflection on the roles that our community can play in limiting negative environmental impacts due to our research work and scientific culture. Its scope is inspired by the holistic approach of annual environmental reports of major institutes, which include emissions directly related to research and cultural emissions, such as from personal commutes and institutional catering. Addressing this broad scope requires input from across the community, in particular to identify the technical challenges of limiting the environmental impacts of our current and future research infrastructure. We need your help to complete it.	
We need new contributors, new contributions, and constructive feedback on this document to help us to achieve the goal, particularly in relation to: energy consumption and recovery (e.g., of research infrastructure, inc. computing), material resource consumption, waste production and management, direct emissions (i.e., from gases in detectors and cooling systems), and ways that our expertise can be applied directly to sustainability projects .	
Please get in touch with us via the online platform at: https://sustainable-hecap.github.io/ .	
Thank you.	
Version: Draft, September 2022 Please read this document in electronic format where possible and refrain from printing it unless absolutely necessary. Thank you.	
Draft Striving towards Environmental Sustainability in HECAP	
8 Waste and Resources	67
Summary	67
Recommendations — Waste and Resources	68
8.1 Reduce, Reuse, Recycle	69
8.2 Resources	71

Contents	
Forewords	3
Executive Summary	4
Outline	6
1 Preliminaries	7
1.1 Introduction	7
1.2 Previous and Parallel Initiatives	12
1.3 Impelling Positive Change	13
Recommendations — Impelling Positive Change	14
1.4 United Nations Sustainable Development Goals	15
2 Computing	21
Summary	21
Recommendations — Computing	22
2.1 Hardware	23
2.2 Software	24
2.3 Infrastructure	25
3 Energy	29
Summary	29
Recommendations — Energy	31
3.1 Low-Carbon Energy	32
3.2 Energy Saving and Recuperation	37
4 Food	40
Summary	40
Recommendations — Food	41
4.1 Agriculture	42
4.2 Food, Health and Inclusivity	43
4.3 Canteens and Conference Catering	45
4.4 Catering Tableware	46
5 Sustainability Projects	48
6 Technology	49
Summary	49
Recommendations — Technology	50
6.1 Life-Cycle Assessment	50
6.2 Initiatives	51
7 Travel	53
Summary	53
Recommendations — Travel	54
7.1 Commuting	55
7.2 Business Travel	57
1	

Draft Striving towards Environmental Sustainability in HECAP	
Forewords	
In the past century the ever increasing resource demands of humans have a devastating impact on the climate of our planet. The resulting heat waves, droughts, strong rain falls, violent storms, melting ice and rising sea levels are posing an existential threat to many people world-wide.	

The Reflection Paper



► Contribution

- We are finishing up the current version and release it next month. After that comments with changes will be within a changelog.

► Endorsment

- After the first version will be finished we will look for endorsers.
- If you see issues and you cannot support it, please contact us NOW and discuss your concerns with us.

Executive Summary



... to limit our impacts on the world's climate and ecosystems must become an integral part of how we plan and undertake all aspects of our research.



Target groups & decisions

What can YOU do?

What can YOU do?



Are you a single person in the particle physics community?

Think about your daily choices - private and at work are close to each other!

- ▶ What do you eat?
- ▶ How do you travel and how do you commute?
- ▶ Can you turn off your computer(s) in the evening?
- ▶ How efficient is your code?
- ▶ ...
- ▶ You probably already know this...

What can YOU do?



Are you a single person in the particle physics community?

Think about specifically your more strategic choices at work and in your personal life

- ▶ What equipment do you buy and for what? Include resource efficiency as a criterion when making decisions.
- ▶ Rethink specifications and be precise to reduce oversizing.
- ▶ If you are working on developing experiments, what materials will you use or can you reduce energy consumption during operation?

What can YOUR GROUP do?



Are you a group in the particle physics community?

Think about your daily choices

- ▶ Could you carpool?
- ▶ Can you organize meetings online?
- ▶ Can you store excess hot tea water in a thermos for everyone?
- ▶ ...
- ▶ Can you save energy and/or resources by making small changes to your routines?

What can YOUR GROUP do?



Are you a group in the particle physics community?

Think about your specific choices

- ▶ Is it possible to develop common and reusable software solutions?
- ▶ If you work on developing experiments and setups, can you make them more environmentally friendly? Can it be recycled afterwards?
- ▶ Is there a project where you can do an "environmental & sustainability risk analysis"?
- ▶ Can you take time together to look at your very specific environmental impacts?
- ▶ Can you start a sustainability initiative in your environment/institute?

What can YOUR INSTITUTION do?



Do you have a senior position in an institute in high energy physics?

Think about the daily decisions of your institute

- ▶ Food selection in the canteen, cleaning agents for the buildings, white recycled printer paper, ...!
- ▶ How is business travel handled? Can you switch from flying to e.g. taking the train or carpooling for commuting? Do you promote bicycle infrastructure in the immediate vicinity of the campus as well?
- ▶ Is there consistent waste separation on campus? Can old equipment be donated for reuse or given away instead of disposed of?



LENA Handreichung - nachhaltig-forschen.de

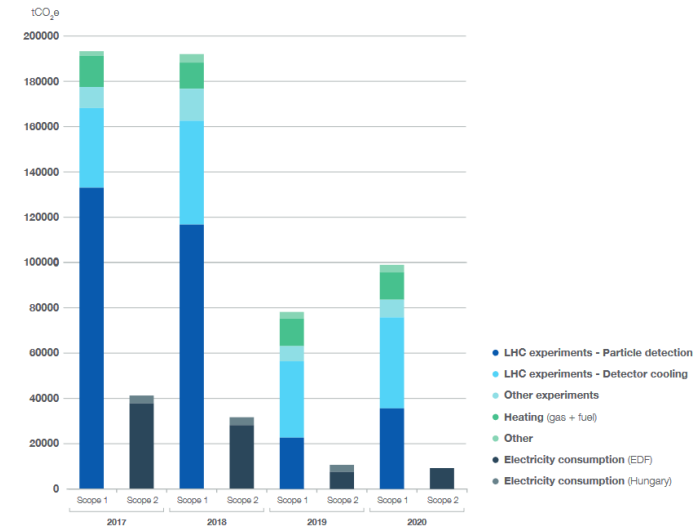
What can YOUR INSTITUTION do?



Do you have a senior position in an institute in high energy physics?

Think about your specific strategic choices

- ▶ Try to collect data on where your biggest impacts are, e.g. CERN: gas emissions from detectors - A good start is to look at what you spend money on and how much.
- ▶ Where does the energy for your institute come from? Are there analyses of energy efficiency and recovery, and energy storage capacity?
- ▶ Use resources in a "reduce, reuse and recycle" manner, including establishing life-cycle awareness and end-of-life planning for hardware.
- ▶ Implement procedures to consider sustainability in project proposals, infrastructure work, and purchasing.
- ▶ Make sustainability research a priority in high-energy physics. Find other sources of funding for this.
- ▶ If you give funding, make sustainability a criterion.
- ▶ Consider how to embed sustainable thinking in processes and in the minds of your employees.



CERN SCOPE 1 AND SCOPE 2 EMISSIONS FOR 2017-2020 BY CATEGORY.
Other includes air conditioning, electrical insulation, emergency generators and CERN vehicle fleet fuel consumption. Emission factors for electricity: EDF Bilan des émissions de GES 2002-2020 for EDF and Bilan Carbone® V8 for Hungary.

(Not) the end

- ▶ The document is done by volunteers.
- ▶ It is intended to serve as a stimulus for thought and action.
- ▶ Support the document as soon as version 1 is finished!

... to limit our impacts on the world's climate and ecosystems must become an **integral part** of how we plan and undertake all aspects of our research.

<https://sustainable-hecap.github.io/>

- ▶ Read, join in the discussion and of course become active in your own environment!
- ▶ Contact:
 - ▶ Email via <https://sustainable-hecap.github.io/> (hep-sustainability@protonmail.com)
 - ▶ Forum on Mattermost: <https://mattermost.web.cern.ch/sustainable-hep>

Bibliografy

- ▶ sustainable-hecap.github.io
- ▶ 1st sustainable HEP workshop (June 2021): <https://indico.cern.ch/event/1004432/>
- ▶ 2nd sustainable HEP workshop (Sept 2022): <https://indico.cern.ch/event/1160140/>
- ▶ CERN, Vol. 2 (2021): CERN Environment Report—Rapport sur l'environnement 2019-2020. Geneva: CERN, 2021. [Online]. Available: <https://doi.org/10.25325/CERN-Environment-2021-002>