Let’s talk about sustainable research

CERN, the Particle Physics Community, and LIP

LIP, 15 June 2023

Catarina Espírito Santo

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I. CERN

II. Particle Physics Community

III. LIP

I. CERN

Context

Minimising the environmental impact and contributing to combat global warming are increasingly a concern, and scientific research is no exception. The size and nature of particle physics projects and facilities make it even more relevant.

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- Communicate transparently
- Reduce impact
- Thrive to develop and transfer technology for the benefit of society

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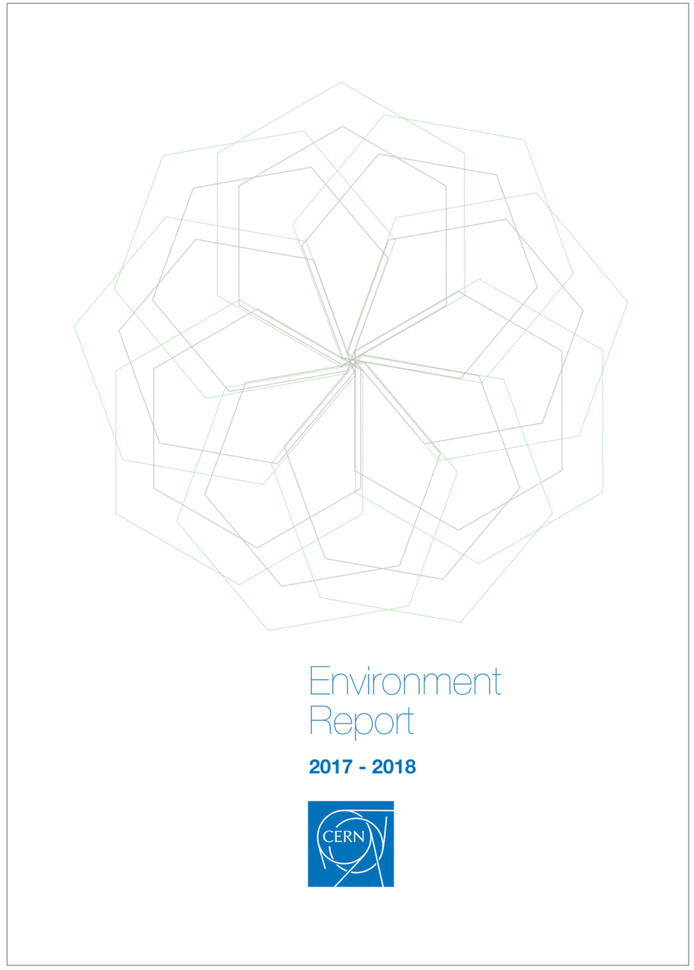
CERN decided to become a role model for environmentally responsible research

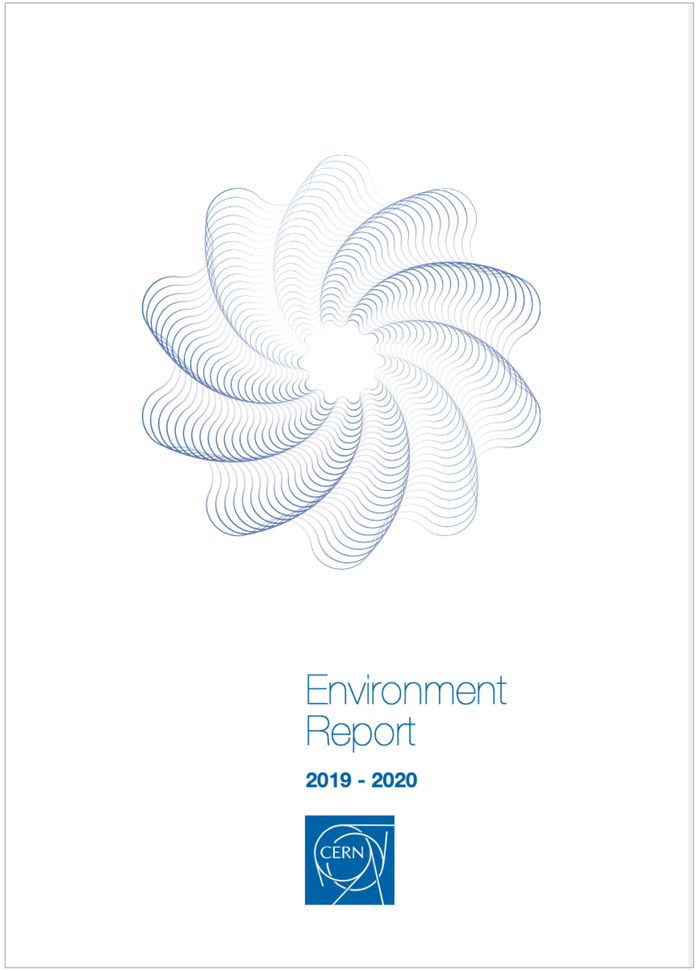
- Communicate transparently
- Reduce impact
- Thrive to develop and transfer technology for the benefit of society

Essential the save Earth as we know it, the biosphere, human kind…

… and for gaining support to particle physics research and future projects

CERN’s Environment Reports (public)





Environment Report 2021-2022

To be published later in 2023

https://hse.cern/environment-report-2017-2018 https://hse.cern/environment-report-2019-2020

AT A GLANCE CERN AND THE ENVIRONMENT IN 2018

About CERN

>17 900 people

CERN employs around **3600** people and some **12 500** scientists from around the world use the Laboratory's facilities. The remainder is largely made up of associates and students *(page 8)*.

Energy

1251 GWh

CERN consumed **1251 GWh** of electricity and **64.4 GWh** of fossil fuel. The Laboratory commits to limiting rises in electricity consumption to **5%** up to the end of **2024**, while delivering significantly **increased performance** of its facilities *(page 12)*.

Emissions

223 800 tCO_2e

CERN's direct greenhouse gas emissions were **192 100 tonnes of CO_2 equivalent,** tCO_2e. Indirect emissions arising from electricity consumption were **31 700 tCO_2e**. CERN's immediate target is to reduce direct emissions by **28%** by the end of **2024** *(page 14)*.

Ionising Radiation

< 0.02 mSv

People living in the vicinity of CERN received an effective dose of between 0.7 and 0.8 milliSieverts, mSv, from natural sources. CERN's activities added under **0.02 mSv** to this, less than **3%** of the naturally occurring background *(page 16)*.

Waste

56% recycled

CERN eliminated **5808 tonnes** of non-hazardous waste, of which **56%** was recycled, and **1358 tonnes** of hazardous waste. CERN's objective is to increase the current recycling rate *(page 18)*

Noise

70 dB(A)

CERN has invested resources to keep noise at its perimeters below **70 dB(A)** during the day and **60 dB(A)** at night. This corresponds to the level of conversational speech *(page 17)*.

Environmental Compliance

146 monitoring stations

CERN has a state-of-the-art environmental monitoring system consisting of **146 monitoring stations**. The Organization reports **quarterly** on environmental issues to Host State authorities. **No serious** environmental **incidents** were recorded **in 2018** *(page 23)*.

Biodiversity

15 species of orchids

There are **15 species** of orchids growing on CERN's sites. CERN land includes **258 hectares** of cultivated fields and meadows, **136 hectares** of forest and three wetlands *(page 22)*.

Water and Effluents

3477 megalitres

CERN drew **3477 megalitres** of water, mostly from Lake Geneva. The Laboratory commits to keeping its increase in water consumption **below 5%** up to the end of **2024**, despite a growing demand for water cooling of upgraded facilities *(page 20)*.

Knowledge Transfer

18 domains

CERN's 18 technology domains have several environmental applications including reducing air and water pollution, environmental monitoring, and more efficient energy distribution using superconducting technology *(page 24)*.

ENERGY

428 GWh

In 2019, CERN consumed **428 GWh** of electricity and **68 GWh** of fossil fuel. CERN's electricity consumption during this period was about 64% lower than when the accelerator complex is running.

The Laboratory is committed to **limiting rises in electricity consumption to 5%** up to the end of 2024 (baseline year: 2018), while delivering significantly increased performance of its facilities. CERN is also committed to increase energy re-use.

EMISSIONS

78 169 tCO_2e

In 2019, CERN's direct greenhouse gas emissions (scope 1) were **78 169 tonnes of CO_2 equivalent** (tCO_2e) which is less than half of the amount emitted annually over the period 2017-2018 when the accelerators were running.

Indirect emissions arising from electricity consumption (scope 2) were **10 672 tCO_2e**. In addition, indirect emissions from water purification, waste treatment, business travel, personnel commutes and catering (scope 3) were **12 098 tCO_2e.**

CERN's immediate target is to **reduce direct emissions by 28%** by the end of **2024** (baseline year: 2018).

2020 UPDATE OF THE EUROPEAN STRATEGY FOR PARTICLE PHYSICS

by the European Strategy Group

"The vision is to prepare a Higgs factory, followed by a future hadron collider with sensitivity to energy scales an order of magnitude higher than those of the LHC, while addressing the associated technical and environmental challenges."

- Energy efficiency
- Travel

https://europeanstrategy.cern

https://home.cern/sites/default/files/2020-06/2020%20Update%20European%20Strategy.pdf

European Particle Physics Communication Network

EPPCN

A network of communication officers representing each member or associate state. Established by the CERN Council in 2005 following the approval of the European strategy for particle physics (ESPP)

- Strengthen communication and share best practices
- Offer communications advice on long-term strategic issues to CERN Council
- Prepare and implement communication activities (mainly on LHC and future colliders)
- Foster long-term support for fundamental sciences related to CERN's mission and the ESPP

In 2021/2022, EPPCN in collaboration with the CERN-ECO team prepared the ESPP update Communication Strategy

High Lumi LHC WG

Environment WG

II. Particle Physics Community

EPPCN-ENV-WG

Goals and audiences

1. Establish a culture of environmental awareness and engagement
2. Raise awareness about what is being done within the particle physics community

EPPCN-ENV-WG

Goals and audiences

1. Establish a culture of environmental awareness and engagement

A change in culture

within the particle physics community

2. Raise awareness about what is being done within the particle physics community

A shift in perception

in society

EPPCN-ENV-WG

Goals and audiences

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   A change in culture

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   A shift in perception

   in society

Actions

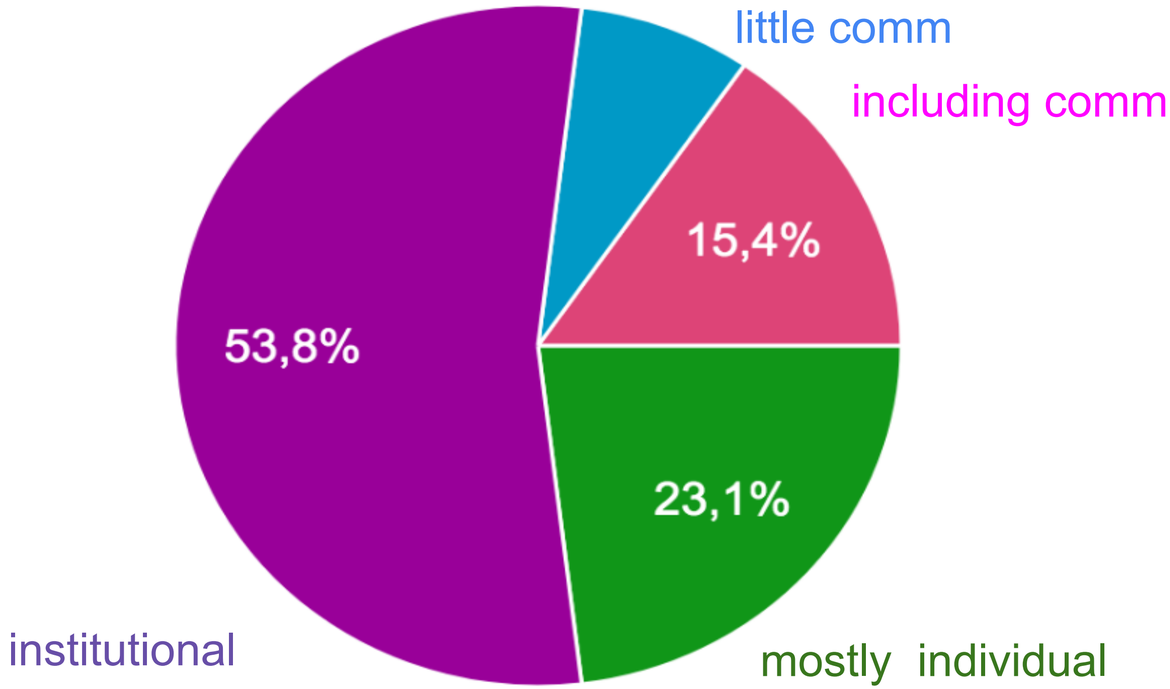
1. Collect info —> Survey
2. Spread info —> Campaigns
3. Contribute to a step forward (of the community, in each country) Call for (more) action

Survey results (I)

Attitude of the particle physics community towards environmentally responsible research

- CERN
- Norway
- Switzerland
- Germany
- Netherlands
- Sweden
- Finland
- Italy
- France
- Spain
- Portugal
- Hungary
- Israel

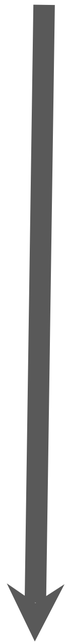
There is a consistent strategy



Some action is being taken

Survey results (II)

Actions mentioned by several countries



- Selective waste collection
- Avoid use of plastic and other disposable materials
- Printing policy
- Energy saving guidelines
- Traveling policy
- Calculation of the lab carbon footprint

Survey results (III)

Mentioned difficulties / problems

External: perception of particle physics as a threat

- Energy consumption (operation of accelerators, computing resources)
- CO2 emissions (accelerator construction and operation, detector R&D)
- Despite the actions already taken, CERN is often perceived as a polluter
- Care needed in comms to avoid the risk of being taken as “greenwashing”

Survey results (III)

Mentioned difficulties / problems

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Internal: particle physics community

- Gap between the engaged people and those who seem to see science as an exception
- How many people in the lab are aware and committed to the existing sustainability goals
- “It is done at top-level in our university. It doesn't concern us too much”

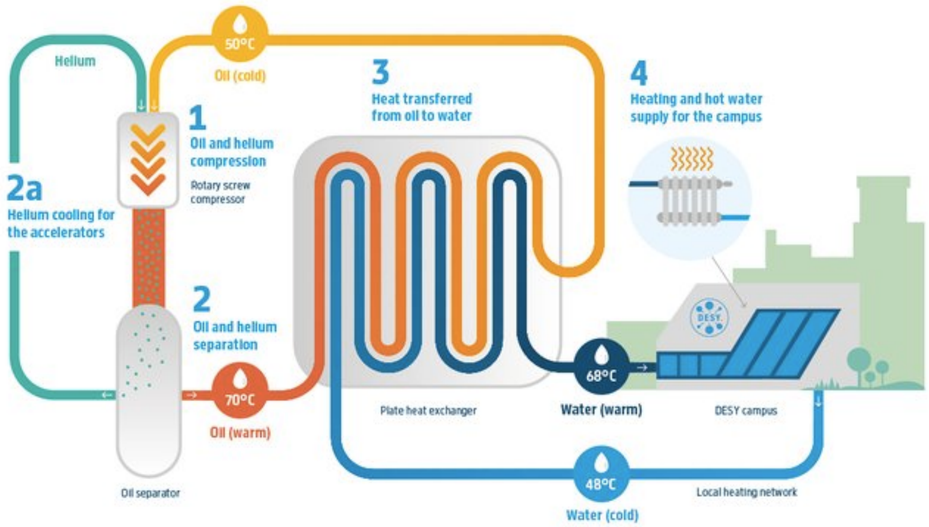
The first campaign

- 5 June 2023 - Monday [CERN] to Saturday
- Based on a pool of stories that can be used in different contexts in the different countries
- EPCCN Environment WG + SoMe WG
- Social media [Twitter+….] + Web-based articles
- Local events (seminars, Institute news, newsletters, thematic lunch/coffee…)

DESY (Germany)

DID YOU KNOW THAT…

DESY already heats one third of its campus with waste heat from the accelerators, and this is just a starting point ?



Learn more about this project in DESY's first sustainability report https://nachhaltigkeit.desy.de/sustainability_report/index_eng.html

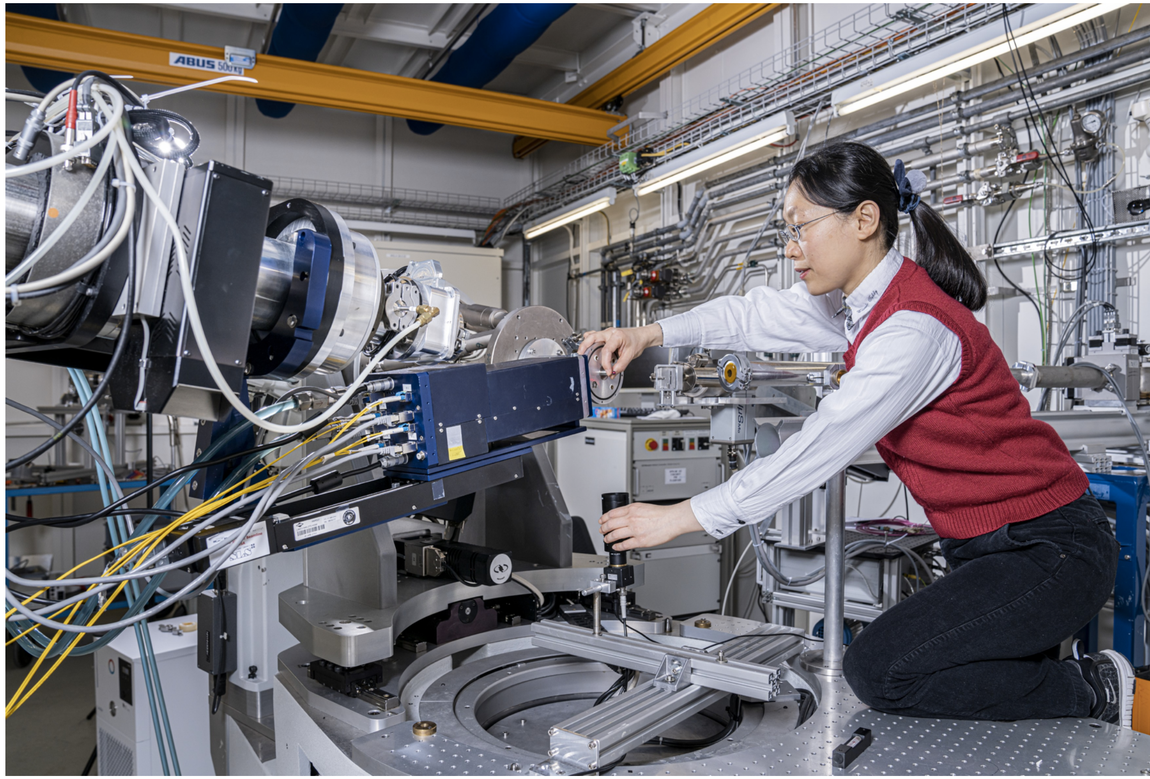
SUSTAINABLE
DESY.

The financial go-ahead has recently been given for a 8 M€ project to use waste heat to heat the whole campus and beyond… this will be in the next sustainability report!

PSI (Switzerland)

DID YOU KNOW THAT…

The Swiss Light Source SLS 2.0 will significantly improve the intensity of the synchrotron light at the experimental stations from 2025 onwards, while reducing energy consumption by 30% ?



The PSI is researching novel, more efficient and sustainable energy technologies and also using them in its own facilities.

Learn more in https://www.psi.ch/en/media/energy-and-climate

Lund University - Physics Dep (Sweden)

DID YOU KNOW THAT...

The use of scientific software and Machine Learning algorithms can have a significant environmental cost and green software development is an active field of research and innovation?

Projects studying this issue are arising in several research institutions. Learn about the new project “Tackling the energetic cost of scientific software” in which Lund University researchers are involved.

https://www.fysik.lu.se/en/article/towards-green-software-tackling-energy-cost-scientific-software

Finland (Univ. Helsinqui)

DID YOU KNOW THAT…

Every summer about 20 master students from Finland address sustainability and other challenges in a Bootcamp at @CERN.

Meet Summer 2022 participant Juniper Tyree and learn more about the study concept and the “Sustainable City Contest”

https://helsinki.fi/en/news/sustainability-transformation/eurovision-inspired-sustainable-city-contest

NIKHEF (The Netherlands)

DID YOU KNOW THAT…

Nikhef's Roadmap for Sustainability aims at making the institute climate neutral by 2030?

Meet Nikhef's Sustainability Ambassadors! Learn about the 5 pillars in the Roadmap and the actions that have already been taken.

https://nikhef.nl/en/focusblokken/nikhefs-ambition-climate-neutral-in-2030/

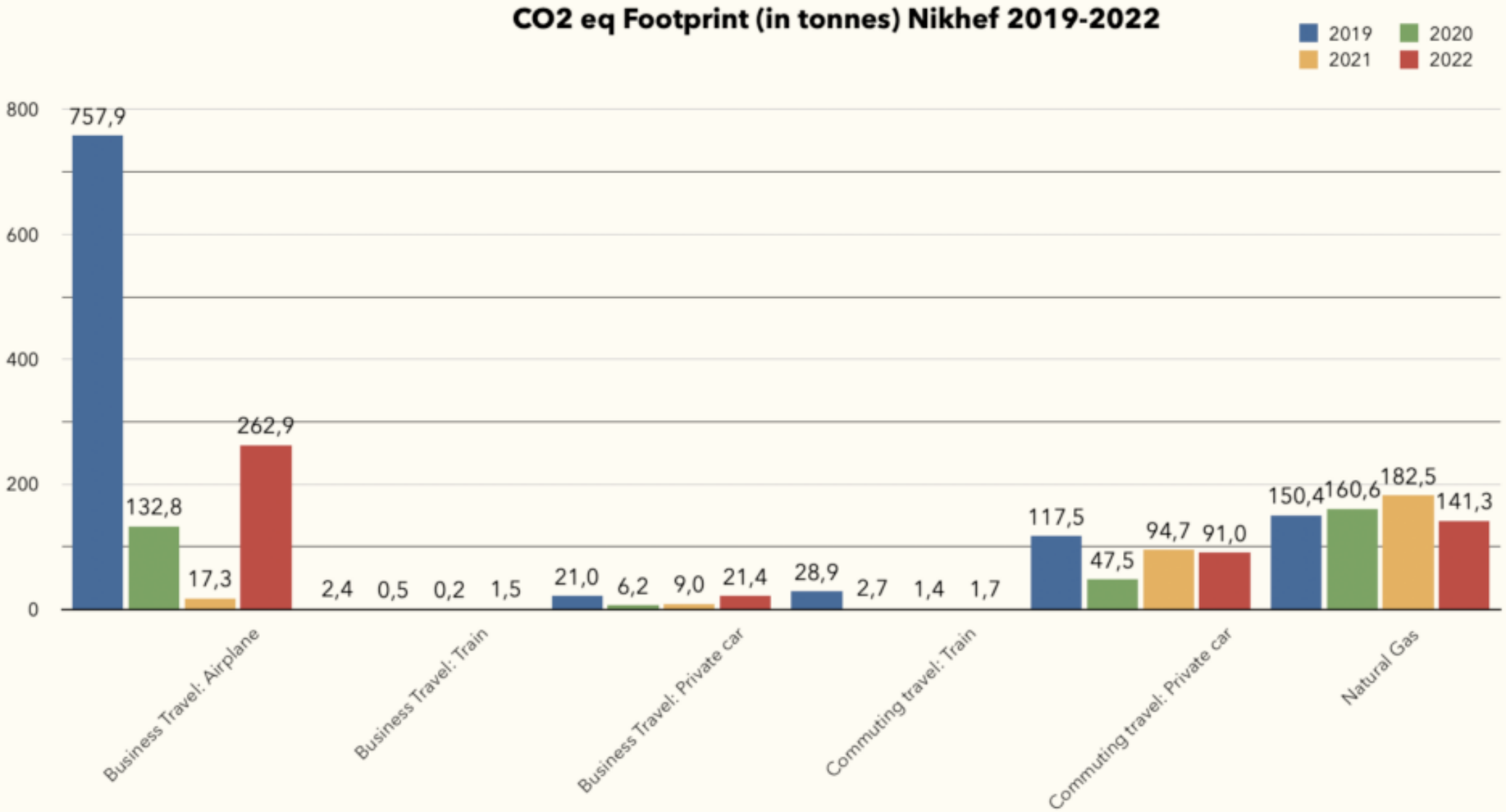
NIKHEF

GOALS 2030 AND INTERIM GOALS 2025

Ambition: climate neutral

	Energy	Mobility	Waste	Awareness & Behavior	Primary
2030	All Nikhef buildings are energy neutral	50% less environmental impact from business	Produce no residual waste at Nikhef	Sustainability is standard part of thought processes	Have European plan ready for sustainable science (CERN)
	All Nikhef employees are very conscious of building-related energy use	Commuting climate neutral	Have European plan ready regarding detector waste and reuse parts	Ecological impact is considered by default in (investment) decisions	Science projects are climate neutral
2025	Submetering of major energy flows	25% Less business travel due to sustainable travel policy (2019)	Electronic waste is handled responsibly	Rewarding sustainable	25% of research proposals include sustainability aspects
	Improved energy performance building: insulation, green power, waste heat utilization	Organize meetings more online and clustered	Substantial portion of leaked liquids in nature, has been reduced	Sustainability standard chapter in application reporting of research projects	Understanding the energy use of computing

NIKHEF


CO2 eq Footprint (in tonnes) Nikhef 2019-2022
2019
2020
2021
2022
800
600
400
200
0
757,9
132,8
17,3
262,9
2,4
0,5
0,2
1,5
21,0
6,2
9,0
21,4
28,9
2,7
1,4
1,7
117,5
47,5
94,7
91,0
150,4
160,6
182,5
141,3
Business Travel: Airplane
Business Travel: Train
Business Travel: Private car
Commuting travel: Train
Commuting travel: Private car
Natural Gas

NIKHEF

- *For Nikhef, **travel is the main source of CO2 emissions**. We work internationally, so we will continue to travel. But with much more policy than in the past. Back then you flew to CERN ten times a year, sometimes even back and forth on the same day. We really don't want that anymore. But we are not going to ban anything for the time being, we mainly want people to think more carefully*

- *The institute in Amsterdam, which includes a large data center, already runs on green electricity from the Netherlands. Gas consumption for heating the building at Amsterdam Science Park is the largest remaining source of emissions. In the coming years, gas consumption will become virtually zero if **heat from the expanded data center can be used. Heat from Nikhef has been used for years in student housing** in and around Amsterdam Science Park*

- *An international sustainability study of scientists from particle physics and other fields (HECAP+) identifies Nikhef as an institute with **below-average CO2 emissions** per researcher: about 4.5 tons per year, compared to 6 tons on average*

III. LIP

LIP and the scientific community in PT

What is happening… at LIP?

… in the scientific community around us?

… in our host universities?

… in our towns?

… How can we take a good step forward?

Ciência Viva

Os centros de ciência devem reflectir as preocupações e interesses da sociedade e a sustentabilidade é hoje uma questão existencial, que se coloca a nível planetário e em todos os sectores da vida humana.

O Pavilhão do Conhecimento posiciona-se como instituição de referência no debate sobre a ciência e a tecnologia ao serviço do desenvolvimento sustentável e como exemplo de práticas sustentáveis.

A Sustentabilidade encontra-se reflectida no Plano Estratégico da CV

1.
A UM FUTURO MAIS SUSTENTÁVEL

2.
NÃO ESTAMOS A COMEÇAR
2.1 Menos é mais
2.2 Deslocações casa-trabalho

3.
A NOSSA ESTRATÉGIA, O NOSSO COMPROMISSO
3.1 A estratégia de sustentabilidade e os Objetivos de Desenvolvimento Sustentável

4.
MEDIDAS A IMPLEMENTAR
4.1 Energia Verde
4.2 Poupança de recursos
- 4.2.1 Energia
- 4.2.2 Papel
- 4.2.3 Plástico
- 4.2.4 Água

4.3 Sustentabilidade de recursos
4.4 Gestão de resíduos
4.5 Mobilidade
4.6 Bem-estar e sustentabilidade de recursos humanos
4.7 Sensibilização e ação interna e externa

5.
RESULTADOS PREVISTOS
5.1 Potenciais poupanças
5.2 Benefícios esperados

6.
PARCERIAS MAIS SUSTENTÁVEIS

7.
JUNTOS VAMOS MAIS LONGE

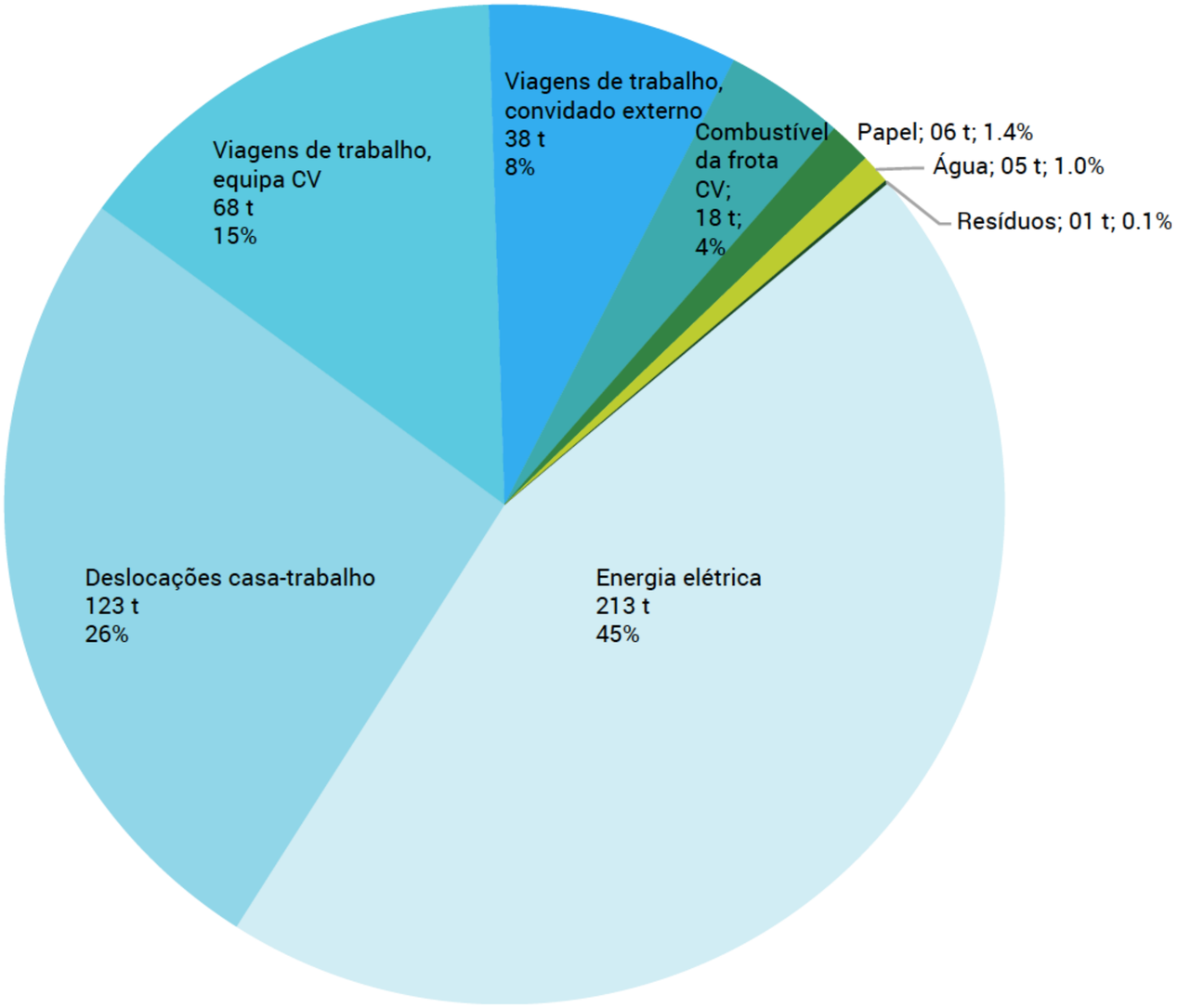
Ciência Viva

- ***Visita técnica*** *ao Pavilhão para melhor conhecer a situação e investigar os pontos relacionados aos consumos que necessitem de uma maior atenção*

- ***Análise de consumos*** *de energia, água, papel, combustível e de produção de resíduos*

- ***Inquéritos e entrevistas*** *a todos os departamentos, para conhecer as diferentes realidades e as medidas que a equipa considera que devem ser implementadas;*

- ***Avaliação da exequibilidade e impacto*** *das medidas existentes e propostas*

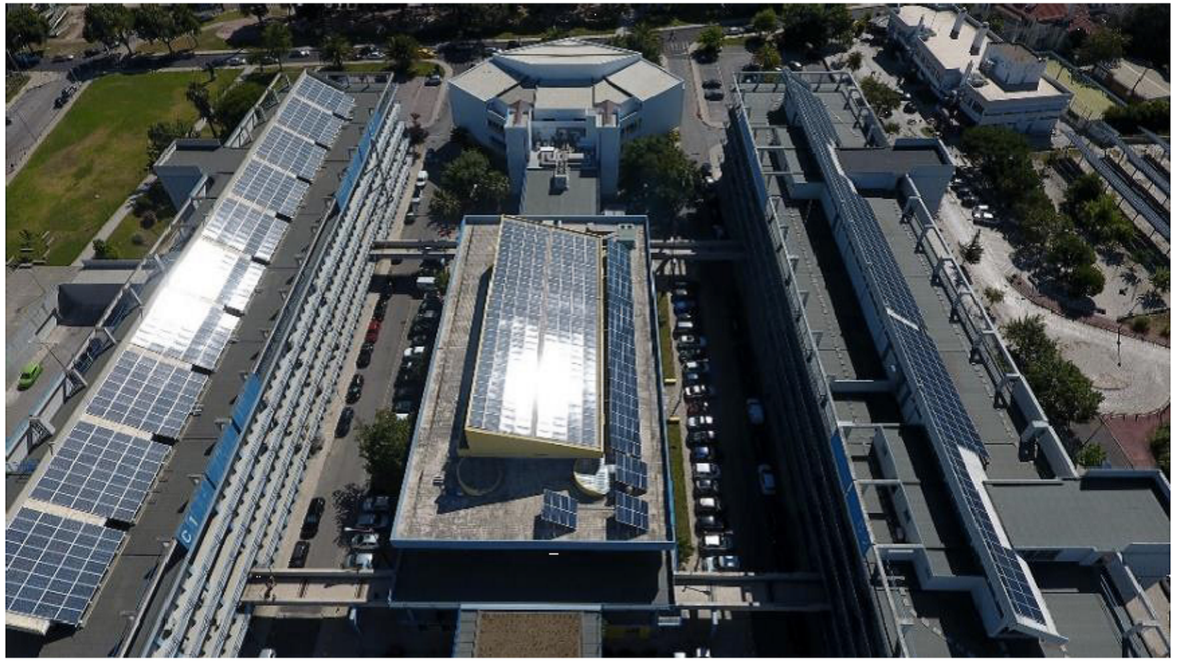


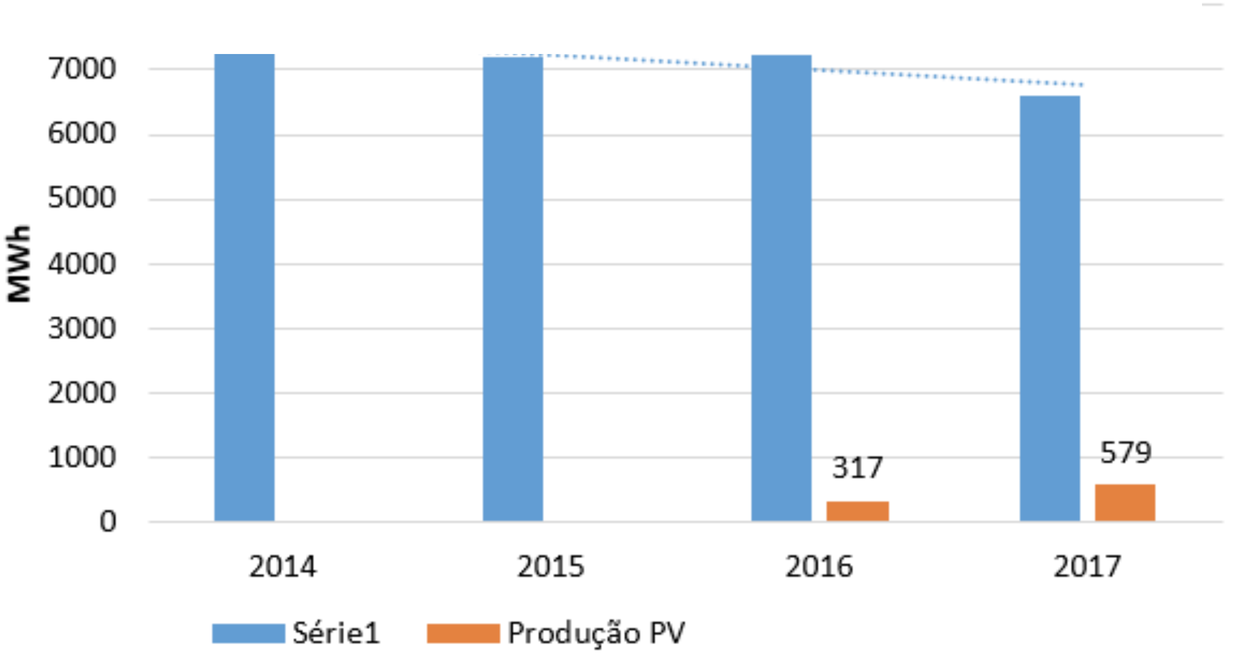
Pegada carbónica Ciência Viva/ Pavilhão do Conhecimento (2019)

472.4t CO_2e/ano

Sustentabilidade no campus @Ciências

Eficiência energética	Gestão de água
Gestão de resíduos	Pegada Carbónica (campus do Campo Grande)
Espaços verdes	Serviços de ecossistemas
Ciências Solidária	





Sustentabilidade no campus @Ciências

Eficiência energética	Gestão de água
Gestão de resíduos	Pegada Carbónica (campus do Campo Grande)
Espaços verdes	Serviços de ecossistemas
Ciências Solidária	

- **ABC21** – Modelos de construção bioclimáticos
- **+Biodiversidade @CIÊNCIAS** – Caracterizar e monitorizar a biodiversidade
- **Campus solar** – Caracterização, teste e experimentação de sistemas de energia solar
- **Caravana AgroEcológica** – Projeto participativo entre agricultores, consumidores e investigadores
- **Chaminé solar** – Sistema de isolamento para habitações (Projeto Concluído)
- **Ciências Connect** – Serviço baseado na localização
- **FCULresta** – Minifloresta em centro urbano
- **Laboratório de ventilação natural** – Arrefecimento passivo de espaços interiores
- **Permalab** – Soluções inovadoras propostas pela permacultura
- **Qualidade do ar - RESPIIRA** – Sensores de poluição de baixo custo
- **SATO** – Autoavaliação e otimização de energia em edifícios
- **SMART2B** – Atualizações à inteligência dos edifícios existentes
- **Telhado verde** – Cobertura ecológica com espécies nativas

The **ITQB NOVA Sustainability Committee** aims to propose solutions to help reduce both our common footprint and the resources we dedicate to keep ITQB NOVA running, without compromising the quality of our work. These proposals include both structural changes and behavioral changes, to which we can all contribute.

The Committee
Ana Sanchez – Coordinator - Head of Advanced Training
Nelson Saibo – Coordinator - Group Leader of the Plant Gene Regulation Lab
Carina Valente - Post Doc at the Molecular Microbiology of Human Pathogens Lab
Dalila Farinha - Executive Administrator
Joana Belo - PhD Student at the Plant Functional Genomics Lab
Nuno Monteiro - Head of Maintenance
Renata Ramalho - Head of Science Communication & Image

ITQB Community Challenges

Every week we propose a new sustainability challenge to collectively contribute to a better ITQB NOVA and a more sustainable world.

- Green Labs Plastic Collection
- Separate general use plastics and packaging
- Reduce electricity consumption in offices and laboratories
- Reduce water consumption
- Reduce the amount of paper printed
- Reduce the consumption of natural gas
- Make Christmas decorations with waste
- Avoid food waste
- Start the New Year with sustainable practices
- Wear warmer clothes
- Recycle Electrical Appliances, electronic devices and metal objects
- Recycle toners and ink cartridges.
- Learn about good sustainability practices in laboratories.
- Aderir à campanha de caracterização de resíduos da nova. De 13 de fevereiro a 17 de março
- Partilhar conteúdos online de sustentabilidade que possam ser disponibilizados a toda a comunidade
- ....

LIP and the scientific community in PT

What is happening… at LIP?

… in the scientific community around us?

… in our host universities?

… in our towns?

… How can we take a good step forward?

- Organize a workshop for the scientific community?
- Hold regular environment talks / coffee discussions /…
- Propose ustainability challenges?
- Approach our partners?
- Collect ideas?
- …

U LISBOA | UNIVERSIDADE DE LISBOA

ICS INSTITUTO DE CIÊNCIAS SOCIAIS

PRR Plano de Recuperação e Resiliência

REPÚBLICA PORTUGUESA

Financiado pela União Europeia NextGenerationEU

ESCOLAS DO ICS-ULISBOA

VI ESCOLA DE VERÃO EM SUSTENTABILIDADE

OS DESAFIOS DA TRANSIÇÃO ENERGÉTICA

12 A 16 DE SETEMBRO DE 2022 | REGIME HÍBRIDO
10H00 - 17H30

CANDIDATURAS ABERTAS ATÉ 6 SET!

COORDENAÇÃO
LUÍSA SCHMIDT
JOÃO GUERRA

TAXA DE FREQUÊNCIA:
COMUNIDADE ICS | ESTUDANTES | ONG - 150€
SETOR PÚBLICO - 250€
PÚBLICO EM GERAL - 300 €

ORGANIZAÇÃO
observa
ZERO
APREN

MAIS INFORMAÇÕES
ESCOLAS@ICS.ULISBOA.PT

VI ESCOLA DE VERÃO EM SUSTENTABILIDADE

OS DESAFIOS DA TRANSIÇÃO ENERGÉTICA

Público-Alvo:
- Membros de associações
- Técnicos da administração
- Profissionais nas empresas
- Investigadores e cientistas
- Mestrandos e doutorandos
- Outros interessados com atividade profissional, académica e/ou cívica na área

Informações :
escolas@ics.ulisboa.pt

Local: ICS-Ulisboa (Regime híbrido)

A conjuntura socioeconómica marcada pela guerra num contexto ainda a refazer-se da pandemia, veio evidenciar de uma forma premente a necessidade de repensar o atual paradigma energético. Neste sentido, torna-se urgente problematizar e refletir em torno dos desafios de uma **transição energética** assente nos princípios da eficiência, suficiência, segurança, fontes renováveis, neutralidade climática, justiça e bem estar social, a todas as escalas: do local ao global.

A **VI Escola de Verão em Sustentabilidade** – uma parceria entre o Observa/ICS-ULisboa, a Zero e a APREN - promove o intercâmbio interdisciplinar, incentivando o aprofundamento de questões prementes e transversais, este ano centradas na transição energética, assumida numa perspetiva sistémica, simultaneamente social, ambiental, política e económica.

Convidamo-lo/a a juntar-se a nós nas palestras e discussões de aprofundamento avançado sobre a transição energética e a sustentabilidade que iremos promover, convocando para isso atores e responsáveis centrais para esta mudança.

12-16 setembro 2022

Entidades organizadoras:
Observa/ ICS-Ulisboa – Instituto de Ciências Sociais da Universidade de Lisboa
Zero – Associação Sistema Terrestre Sustentável
APREN – Associação Portuguesa de Energias Renováveis

Candidaturas:
https://fenix.ics.ulisboa.pt/accountCreation

PROGRAMA

VI Escola de Verão em Sustentabilidade ● Os desafios da transição energética

Hora	Segunda-feira – 12 setembro	Hora	Terça-feira – 13 setembro	Hora	Quarta-feira – 14 setembro	Hora	Quinta-feira – 15 setembro	Hora	Sexta-feira – 16 setembro
1ª Sessão 10:00 às 13:00	**Apresentação e enquadramento** *Luísa Schmidt, João Guerra* – ICS-ULisboa *Susana Fonseca* – ZERO *Pedro Amaral Jorge* – APREN Escalas internacional, europeia e nacional DG-ENER Francisco Ferreira – ZERO Carlos Pimenta - APREN	3ª Sessão 10:00 às 13:00	**Pobreza Energética** Enquadramento *João Pedro Gouveia* *FCT-NOVA* *A perspetiva da saúde pública* *Armando Brito de Sá* *ISAMB, e ACES-Arrábida* *Estratégia Nacional de combate à pobreza energética* Secretaria de Estado do Ambiente e da Energia	5ª Sessão 10:00 às 13:00	**O futuro do sistema energético** A Perspetiva portuguesa Filipe Pinto - DGEG O Roteiro para a Neutralidade Carbónica *Pedro Martins Barata* *Get2c* O papel das cooperativas de energia - Dirk Vansintjan RESCOOP	7ª Sessão 10:00 às 13:00	**Visita a um parque fotovoltaico**	9ª Sessão 10:00 às 13:00	**Modelos inovadores** O caso de uma autarquia Câmara M. Cascais Empresa de serviços de energia CleanWatts Energy O caso do Pego – mudança e perspetiva Pedro A. Fernandes ENDESA*
	Pausa		Pausa		Pausa		Pausa		Pausa
2ª Sessão 14:00 às 17:30	**PRR e a reabilitação de edifícios** Apoio financeiro à reabilitação de edifícios Nuno Baptista - ADENE Exemplo de Espanha Javier Tobias e Cecília Foronda - ECODES Exemplo de Itália Ellena Allegrini – ENEA*	4ª Sessão 14:00 às 17:30	**Prosumo – consumir a energia que se produz** O caso de uma indústria Frederico Pisco (NAVIGATOR) Experiência do prosumidor *Vítor Cóias (Gecorpa)* Comunidade de Energia *Guilherme Luz* – Coopérnico	6ª Sessão 14:00 às 17:30	**Mobilidade – o desafio da transição** José M. Viegas TIS-ULisboa Mário Alves Estrada Viva/MUBI Tiago Farias IST-ULisboa	8ª Sessão 14:00 às 17:30	**Visita a uma comunidade de energia** **Condomínio da Torre Alta de Lisboa (Vasco Pimenta)**	10ª Sessão 14:00 às 17:30	**Balanço e Avaliação** Conferência final em Sophie Howe, the Wales Commissioner for Wellbeing and Future Generations Avaliação de Escola de Verão Debate e conclusões

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Thank you 

	Structure	HR	Funding	CERN contribution	Country indicators
LIP/PT	National lab 3 nodes partner universities	100 researchers 40 tech + 10 Suport 150 “staff” + students	2.3 M base funding 1.0 M fellowships 2.2 M competitive calls	12.5 MCHF (1%) 1.3 CHF/person	GDP/capita 20000 € Pop 10 M
NIKHEF/NL	National lab 2 nodes partner universities	200 researchers 75 tech + 25 Support 300 “staff” + students	at least 10 M base 15 M competitive calls? https://www.nikhef.nl/en/funding-2019/	52 MCHF (4.5%) 3 CHF/person	GDP/capita 43000 € Pop 17.5 M