HCI-TERRA: HCI Towards EnviRonmentally Responsible AI

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Abstract

The rapid adoption of generative artificial intelligence (GenAI) has come with a significant environmental burden due to increased resource usage. Such material and environmental impacts are no surprise. This workshop is a call for HCI researchers to critically reflect on the energy, water, and other resource overuse of AI systems by not only developing tools but also by supporting researchers, artists, activists and local communities to collect, understand, and equip themselves with knowledge. The goal is to lay solid foundations of a community of HCI researchers interested in mitigating the environmental impact of AI and accordingly bring methods from our inherently interdisciplinary domain that go beyond solutionist narratives. Following a successful workshop at FAccT '25, this workshop will consolidate ideas and create a grand challenges and opportunities map of this emerging topic of interest in HCI. Participation will be open to seasoned and early career researchers and we will solicit descriptions of completed projects, works-in-progress, and provocations.

CCS Concepts

• **Human-centered computing → Human computer interaction (HCI)**.

Keywords

Sustainability, Sustainable AI, HCI Grand Challenges

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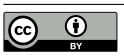

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1 Background

Generative AI (GenAI) has enhanced productivity [19] and attracted a large global user base [51]. Yet, as this adoption accelerates and system architectures grow more complex, its environmental impacts have become increasingly evident especially in terms of water, energy, and mineral resources, along with the associated carbon emissions [7, 11, 12, 40]. Data centers, fueled in large part by rising AI workloads, are expected to account for 9.1–11.7% of total U.S. total energy demand by 2030 [50]. This surge in resource intensity has slowed the phasing out of coal power plants [20] and intensified tensions with local communities in regions such as the United States, Brazil, and Spain [15, 37, 38]. Although some of the required energy can be sourced from renewables, these options remain limited, costly to the environment and may even take away from other potential uses of green energy [5, 8]. This impact is not only significant but also challenging to measure [34, 39], with terms such as "cloud" computing and "artificial" intelligence making this process even more intangible and abstract [11, 12, 24, 43].

However alarming, these material and environmental impacts of AI are no longer a surprise. Yet many of the approaches so far for mitigating the environmental impacts of AI, center around technical hardware and software optimizations. We argue that there are targeted tactics that HCI can lead to support more environmentally sustainable AI as well as bring justice to impacted communities. This workshop thus aims to unpack HCI research's challenges and opportunities when it comes to AI and environmental sustainability and plans to map the socio-technical contributions we can make to this emerging interdisciplinary topic. As part of an initial mapping exercise of existing published research, we have identified some fronts where HCI can be of use and believe that this workshop will help identify even more. These include promoting awareness, transparency, community empowerment and action, as well as engaging with the elephant in the room which is the environmental impact of HCI-research itself and its (over)use of GenAI.

In 2025, we hosted a FAccT'25 Craft workshop, on 'Tactics for supporting agency in AI environmental action'[1] where we brought together various actors interested in the environmental impacts of AI and introduced them to the tools and tactics used 'on the ground' to map, measure, understand, and mitigate these various impacts. This was a successful workshop with over 25 participants and speakers from academia, activism and NGOs bringing their perspective and experiences. The outcomes of the session indicated a need for more socio-technical handling of the issue and specifically going beyond the techno-solutionist approach that is currently dominating the discourse. Accordingly, we believe that this workshop at CHI'26 can lay solid foundations of building a community of HCI researchers interested in mitigating the environmental impact of AI and accordingly bring methods from our inherently interdisciplinary domain that go beyond solutionist narratives (like for instance by supporting communities, engaging with humor and speculative design futures and by understanding how to best support the design of eco-feedback tools among others).

2 HCI Challenges and Opportunities to support AI Environmental Sustainability

The five sub-themes below are our synthesis from literature and personal experiences of working in this domain. The workshop aims to collectively generate additional opportunities and challenges that go beyond our existing understanding. We will thus ensure that there is space for the participants to shape the workshop discussions and outputs based on their own interests and expertise (Section 5 has a detailed description on how we aim to achieve this).

2.1 Tools for Eco-feedback

There are now many tools that emphasize the monitoring, visualization, and provision of feedback on energy usage to AI model developers (e.g., [6, 36]). This sub-theme will focus on such eco-feedback systems and analyze them as socio-technical artifacts meant to support behavior change. The value of eco-feedback technology is based on the double hypothesis that most people lack awareness and understanding about how their behaviors affect the environment and that technology can bridge this literacy gap by presenting related data through computerized means such as ambient displays or visualizations [18]. However, since their inception, eco-feedback technologies—especially when they relate to energy communication—have undergone considerable critique and evolution [9] for instance due to their focus on individual change rather than systemic considerations. Previous work from the organizing committee analyzing machine learning eco-feedback tools for developers identified a gap in their their collaborative design and evaluation [22, 23]. Yet many more tools have been developed since even for the inference stages of the AI lifecycle [13, 46]. This round-table discussion will use these tools as a starting point to unpack how sustainable HCI research can inform better collective, collaborative, and even more-than-human centered tools to serve this purpose.

[1] https://fourcoffees.github.io/environmentaltactics/

2.2 Supporting communities with resistance on the ground

Focusing research and advocacy toward developers and tech companies is valuable, yet it risks reducing the battle for environmental justice to questions of efficiency and optimization. Such a framing sidelines the broader supply chains and the actors who bear the consequences of AI infrastructures. To move beyond the narrow debate on accurate emission data, it is essential to gather various perspectives about impacts, including insights from indigenous, quilombola, and other frontline communities.

Recent investigations across Latin America have documented how the expansion of data centers, driven by the AI boom, intensifies pressure on water and energy systems under regimes of corporate secrecy and permissive incentives. Reporting reveals opaque corporate-state arrangements, limited verification of renewable energy claims, low job multipliers, and mounting conflicts over water and electricity access in places such as Mexico, Brazil, and Chile [4]. In Brazil, indigenous communities have begun contesting proposed hyperscale projects on both procedural and material grounds. In Ceará, the Anacé people demanded prior consultation and questioned projected water withdrawals for a large data center, catalyzing broader coalitions that also challenge licensing opacity [16] and the use of simplified environmental assessments for high-impact facilities [31]. These cases demonstrate that the harms of AI infrastructures are material, unevenly distributed, and often racialized, affecting groups that have been historically excluded from techno-economic decision-making [32].

Design-oriented HCI can help shift power and expertise toward communities, by co-producing capabilities that strengthen situated governance over land, water, energy, and data. Concretely, this includes: (i) participatory mapping of decisions, resource flows, and cumulative impacts; (ii) community-led evidence infrastructures (monitoring water withdrawals, thermal, air, and noise pollution, grid costs) aligned with legal and administrative routes; and (iii) toolkits for narrative reframing and mobilization that contest inevitability tropes around AI. Resources such as the *People Say No: Resisting Data Centers Toolkit* [42] consolidate strategies for local organizing and policy engagement, offering a transferable repertoire that HCI can integrate and extend. By engaging with journalism- and activism- led mappings (e.g. [1–3]) and community toolkits while co-developing participatory monitoring and accountability infrastructures, HCI can help transform documentation of harm into durable, collective agency to contest the uneven geographies of AI.

2.3 Participatory approaches for building awareness

To meaningfully communicate the responsibility of AI practitioners in addressing the environmental footprint of their work, there is a need to foster situated awareness grounded in practitioners' own contexts and that goes beyond generic, abstract and guilt-inducing narratives. HCI can try to address this need and explore how creative communication strategies, and participatory approaches can support situated, collective change beyond the remits of toolkitification [25]. With this challenge/opportunity we seek to expand

into the cultural, social, and organizational dimensions of sustainability in AI by addressing the need for diversified levels of awareness that are approachable, critical and communal, among AI practitioners and the general public.

Drawing inspiration from the climate justice movement's use of memes to counter-guilt and normalize collective discourse [33, 35], this track will investigate how HCI can involve humor and sarcasm through the use of memes[2] into a conversation that is often sidestepped due to dislocated responsibility, perceived lack of agency, and the pressure of guilt-inducing narratives [23].

Beyond building awareness, participatory design approaches can also empower communities to build and influence their own versions of AI technologies, including them as core stakeholders rather than only via consultations [52]. This is already starting to take place for instance in pilot projects to build participatory foundational models for journalism [53] and for aboriginal dialect preservation [26]. However, to ethically involve communities without risking extractive practices, researchers need to provide ongoing infrastructural support that considers invisible labor, organizational boundaries, and individual abilities [44]. For example, when marginalized communities engage in collaborative data work they can build new skills and workflows to then integrate those practices into their lives [14]. HCI can further support and embrace such initiatives for instance through making participatory processes of tool-making more power-transparent across stakeholders [10].

2.4 Understanding and promoting sufficiency

Calls from interdisciplinary consortia argue the need to also promote digital sufficiency when addressing issues of AI's sustainability, looking beyond much more widespread efficiency efforts [54]. Closely related to the concepts of post-growth and de-growth, Santarius et al. [47] define digital sufficiency as *"any strategy aimed at directly or indirectly decreasing the absolute level of resource and energy demand from the production or application of ICT,"* which includes hardware, software, user, and economic sufficiency. For AI, the AI + Planetary Justice Alliance propose a de-growth framework around three pillars: objectives, values, and action and argue that *"a de-growth-oriented AI doesn't mean rejecting technology altogether. It means redefining the goals, design practices, and governance of AI systems around values like sufficiency, plurality, and ecological care."* [41]. Such arguments also align closely to recent post-growth calls in HCI [48, 49]. This workshop will build on such exercises to unpack how HCI can help promote (AI) sufficiency through building awareness around the situated concept of sufficiency but also through practical action by incorporating sufficiency in the tools (Section 2.1), community (Section 2.2), and participatory processes (Section 2.3) we develop. Existing work in HCI by Gujral et al. [21] have already started such exercises by examining digital sufficiency preferences in data centers.

2.5 The impact of HCI research itself

Naturally, every such exercise on grand challenges should also look inwards to HCI's internal use of GenAI in research and applications. Recent work from Inie et al. [29] finds that 16% of accepted papers to the CHI 2024 conference described active use of GenAI (non-disclosed use notwithstanding), and that the estimated accumulated use of GenAI in accepted and rejected papers accounts for *at least* 10.000 CO_2e. This number is likely to have grown substantially since 2024. This type of examination is directly connected to CHI sustainability efforts that for instance started recently to award sustainable research practices. Within this theme we hope to discuss how we can support and further incentivise HCI researchers to be more transparent and frugal in their use of GenAI methods. Earlier work, before the AI boom, documented the role that UX design can have on promoting more carbon emission saving behaviors when streaming video [45]. Given the overall impact of ICT [17] and, accordingly, data centers [27] on emissions, HCI's artifacts, probes and methods cannot be excluded from scrutiny.

[2]See for instance https://savethe.ai and https://memetivism.github.io

3 Organizers

Our team of organizers represents a range of research approaches and disciplines (e.g. qualitative, computational, experimental, design, arts, social sciences) as well as some diversity in global locations (e.g., Continental Europe, South America, UK) and levels of seniority. Each brings unique expertise and vision to the topic with all of the committee having published on the topic of AI's and ICT's sustainability through a different lens (end users, developers, tools, hardware, communities around data centers), making this a strong constellation of initial topics.

Georgia Panagiotidou (main contact) is an Assistant Professor at King's College London in the department of Informatics. Her work broadly centers around how people engage with environmental data exploring key challenges such as biases, uncertainties, and friction in collective data use. Georgia investigates the environmental impact of AI commencing from the tools and interfaces that developers, end-users and communities experience as probes. Leading this workshop and similar efforts at FAccT, she is building bridges between the domains of HCI, STS and sustainable AI.

Sinem Görücü is a PhD student at King's College London researching the environmental sustainability of machine learning through a Human–Computer Interaction (HCI) lens. Her work examines how practitioners perceive and engage with sustainability in AI development, and explores participatory and tangible approaches to making environmental costs of computing visible and actionable. Her research spans sustainable HCI, data physicalization, and participatory design.

Christina Bremer is a Research Associate at the University of Cambridge. She is working on the Green Algorithms Initiative, a project that focuses on quantifying and reducing the environmental impacts of computational science. More generally, by applying an HCI lens and combining efficiency with sufficiency principles, her works aims to help limit the environmental impacts of computing technology and use computing to facilitate environmentally sustainable decision-making and behaviors.

Silvia Cazacu is a PhD student at KU Leuven and a Marie Curie fellow in the 'Towards Sustainable Open Data Ecosystems' project where she focused on the inclusiveness of participatory data practices. Her research applies a feminist lens to critically analyze the power dynamics that emerge between diverse stakeholders who collaborate on infrastructural decisions about data. She combines

participatory methods with tangible thinking tools such as data physicalization and serious games to make complex issues visible and negotiable.

Nanna Inie is an Assistant Professor at the IT-University of Copenhagen, Denmark. Her research focuses on ethical, safe, and sustainable deployment of GenAI. She has extensive organization experience inside and outside of academia and has, among other events, founded and organized the largest TEDx event in Denmark. She did the CO_2e accounting for GenAI in the CHI 2024 corpus [29], and has published on LLM security as "demon summoning" [30], as well as on the effect of anthropomorphization of so-called AI systems on people's trust [28].

Luiz A. Morais is an Assistant Professor at the Centro de Informática of the Universidade Federal de Pernambuco, in Brazil, and co-founder of the VIXE (Visualizações, Interfaces e eXperiências Emergentes) research group. His research bridges the fields of Human-Computer Interaction and Data Visualization, with a focus on sustainability and decoloniality. Morais critically examines how digital systems—especially artificial intelligence—affect the planet and society. His involvement in national and international workshops reflects a commitment to expanding the global debate from the margins, repositioning the Global South as a center of critical innovation.

Raghavendra Selvan is an Assistant Professor at the Machine Learning (ML) Section, Dept. of Computer Science, University of Copenhagen (UCPH). His research interests broadly lie at the intersection of sustainability and ML where he is investigating sustainability with ML, and also the sustainability of ML. He is the author of the book "Sustainable AI" (2025).

Ben Snaith is a Visiting Researcher at King's College London researching data empowerment, environmental intelligences and internet infrastructures. His work looks to ground ecological and activist thinking within critical research on datafication and media infrastructures.

Ana Valdivia is a Departmental Research Lecturer in Artificial Intelligence (AI), Government, and Policy at the Oxford Internet Institute (University of Oxford). She investigates how datafication and algorithmic systems are transforming political, social, and ecological territories and communities. Her current research agenda focuses on the AI supply chains, by investigating trade-off between environmental costs and social benefits of AI, from mineral extraction to chip manufacturing, data centers, and electronic waste dumps across different geographies.

4 Pre-workshop Plans

We will advertise the workshop via ACM, HCI, and AI distribution lists and social media. We will also reach out to selected researchers to encourage them to submit their work. We will invite submissions of research, provocation or case study papers of up to 4 pages long in the standard ACM CHI submission format excluding references. The submission process will take place via a (Microsoft/Google) form or via email. Each submission will be evaluated by at least two members of the organizing committee and the final selection will be based on uniqueness of content, multiplicity of perspectives they represent, engagement with the themes and topics in the workshop call, and potential for contribution to this evolving community. Relevant topics include but are not limited to the open challenges/opportunities mentioned in Section 2. The goal of these submissions will be to elicit dynamic community interaction and discussion during the workshop, rather than serve as formal finalized work.

4.1 Website

Our workshop website will be https://hci-terra.github.io.

4.2 Plans to Publish Workshop Proceedings

Submissions which opt in will be linked to by the workshop website so that they can be easily found and viewed by interested community members. Moreover, per the purview of this workshop we will seek to ensure the long term sustainability of these submissions by bundling the proceedings together and publishing them through ArXiv or a similar long-term open-access repository.

Time	Session
2:00 - 2:10 pm	Introduction to workshop theme and agenda
2:10 - 2:40 pm	Presentation of submitted contributions
2:40 - 3:15 pm	Brainstorming of grand challenges and opportunities
3:15 - 3:30 pm	Voting on challenges
3:30 - 4:00 pm	Coffee Break
4:00 - 4:45 pm	Challenge work-shopping in break-out groups
4:45 - 5:15 pm	Presentation of action plans
5:15- 5:30 pm	Plenary discussion of next steps

Table 1: Tentative workshop schedule (assuming a session block starts at 2pm local time)

5 Workshop Activities & Structure

Due to our goal to collect grand challenges in the domain and to build a new community around this topic, we are requesting a long format for the workshop (2 x 90 min sessions). However, we can accommodate a shorter, more compact version of the workshop if there are logistical limitations.

The first block of 90 minutes will be structured as 10min introduction to the workshop and then 30min presentation of submitted contributions. If we receive a considerable number of submissions we will then select a subset of submissions to be presented or simply encourage participants to go through the submissions of peers prior to the session. With that background inspiration and preparation in mind from the presentations, participants will then take part in a collective brainstorming activity with the workshop's core question as a guide: i.e. ***How can HCI research and practice support more environmentally responsible AI?*** The aim is to expand the suggested topics of this workshop proposal towards the participants' interests and expertise. The brainstorming discussion (35min) will take place in groups of 5-8 participants facilitated by one of the organizers in each table who will collect notes and post-its that will subsequently be presented to all the groups (last 15min). This first workshop block will end with a plenary vote on what subset of themes participants would want to continue working on for the next session.

The second block of the workshop will set up the tables on the most voted themes to continue work-shopping. Specifically, tables will be formed for each topic and the discussion (45min) will be driven by questions for instance on: what is the current status of HCI or other research on this sub-theme? What is still missing to engage with that state-of-the-art? How can we collectively organize around these gaps and who else is missing from these discussions? Each table will thus prepare a brief plan of action explaining the grand challenge and opportunity for HCI research and practice in the domain. The last 45min will be dedicated in debriefing on these action/work plans collectively and having a plenary discussion on how we would like to move forward as a newly emerged community of practice.

6 Post-Workshop Plans

We hope to build a persistent hybrid research area among sustainable HCI and AI. Toward that goal, we plan to submit an Interactions article for a general HCI audience as well initiate a mailing-list, reading group and/or Discord channel to maintain the momentum of the group and to ensure its continuity.

7 Accessibility

Since CHI '26 has no hybrid or remote attendance we will structure the workshop for the best experience and accessibility of the in-person participants. Specifically, we will do our best to accommodate requests for special assistance from our participants. By default we will include captioning and slides to facilitate cognitive accessibility and to promote comprehension. Authors submitting to our workshop will also be encouraged to work on improving the accessibility of their papers and presentations in compliance with the SIGCHI's Guide to an Accessible Submission.

8 Call for Participation

The rapid adoption of machine learning AI has come with a significant environmental burden due to increased resource usage, yet such material and environmental impacts of AI are no surprise anymore. Following a successful workshop at FAccT'25, this workshop will consolidate ideas and create a grand challenges and opportunities map of this emerging topic of interest in HCI. The goal of this workshop is to lay solid foundations of building a community of HCI researchers interested in mitigating the environmental impact of AI and accordingly bring methods from our inherently interdisciplinary domain that go beyond solutionist narratives. Topics include but are not limited to how we can support communities impacted by data centers, how we can engage with humor, participatory methods and speculative design futures to build awareness and how to best support the design of eco-feedback tools among others. Participation is open to all seasoned scholars and early career researchers. We will solicit descriptions of completed projects, works-in-progress, and provocations of up to 4-pages in the ACM CHI submission format excluding references. Details on submission format and location can be found on the workshop's website: https://hci-terra.github.io. The submissions will be reviewed by the workshop organizers and all accepted papers that opt-in will be published through our website and presented at the workshop. Note that according to CHI26 regulations this will be an in-person workshop and at least one author of each accepted submission must attend the workshop.

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