CLIMATE CONSCIOUS AI USE: WRESTLING WITH ENVIRONMENTAL IMPACTS

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Land Acknowledgement

Growing together

1. Environmental implications of Generative AI.

2. Guiding question framework to reflect on AI use.

3. AI use philosophy that embodies your environmental values.

4. Practical strategies to minimize carbon/water use of Generative AI.

Collaborating with Padlet and Chat today.

What do we know about GenAI's environmental costs?

AI uses for environmental challenges

- Gen AI can analyze vast amounts of data and identify patterns

- Improving efficiency of code and better coding language can reduce application energy use by up to 50%.
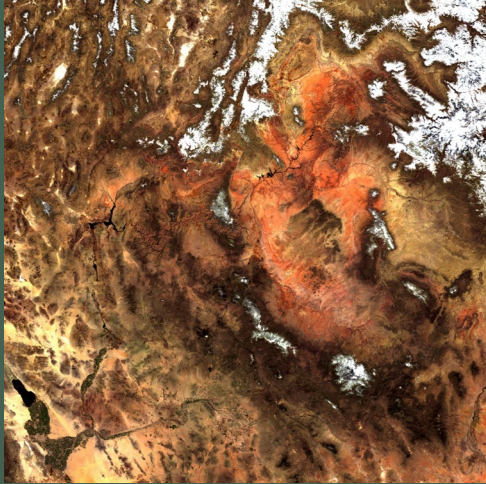
NOAA Fisheries.

How artificial intelligence is helping tackle environmental challenges

Striving to reduce AI environment impacts

- AI Energy Star Rating for AI models – S. Luccioni research group

- Capping power draw during training can reduce energy consumption by 12-15%

- New hardware – quantized computing

- Strategic optimization
  - Schedule jobs at night / during winter to reduce cooling needs.
  - Geophysical location of data servers to use renewable energy.
  - AI model pairing with hardware to decrease energy use by 10-20%
  - New algorithms significantly reduce the training energy required for new models

- Smaller AI models are now approaching the capabilities of larger ones

New Tools Available to Reduce AI Energy Model Consumption
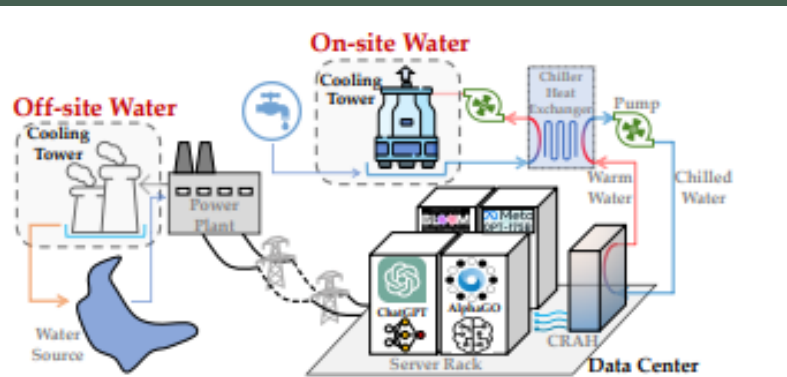
AI's Environmental Challenges

Figure 1: An example of data center's operational water usage: on-site scope-1 water for server cooling (via cooling towers in the example), and off-site scope-2 water usage for electricity generation. The icons for AI models are only for illustration purposes.

- Energy/carbon footprint
  - Computational power to sustain AI doubling every 100 days.
- Potable water used for cooling of data servers.
- Mineral mining and E-waste
- Widening disparity in impacts
  - Thirsty data centres spring up in water-poor Mexican town
  - Drought forces Big Tech to rethink LatAm data centers–
  - 2023 Landscape report AI Now Institute warns of uneven regional distribution of AI's environmental costs risks - settler colonialism and racial capitalism

Two Stages of GenAI: Training and Use (Inference)

Energy Use
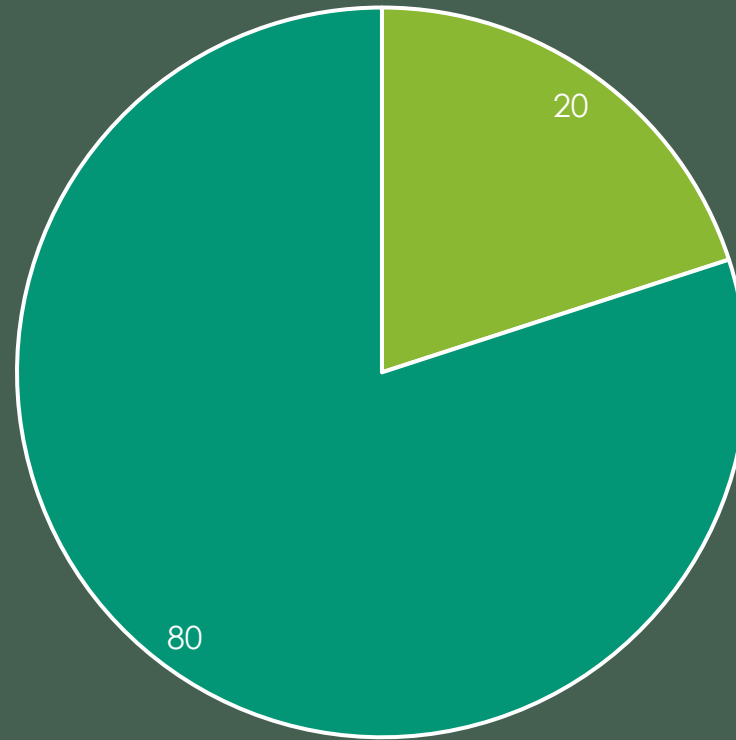
- Training Phase
- Inference Phase

https://news.climate.columbia.edu/2023/06/09/ais-growing-carbon-footprint/

Training Phase: Picture This

- Training a large AI model can emit as <u>much carbon as five cars over their lifetimes</u>.

- Equivalent to energy use <u>1,450 average</u> U.S. households per month.

- Training GPT-3 is estimated to have <u>evaporated 700,000 litres of clean freshwater</u>. = 3,139 Canadians daily use of water (based on 2021 stats Canada averages).

Inference Phase: Picture This

- A ChatGPT text request takes 2.9 Watt-hours,
  -10x energy of simple web search

  - 3.5 minutes watching Netflix

- If ChatGPT were part of 9 billion searches a day = 1.5 million European residents energy use.

- Energy to generate a single image = average smartphone charge

https://www.theverge.com/24066646/ai-electricity-energy-watts-generative-consumption

Estimated Number of Inferences for 500 mL of water
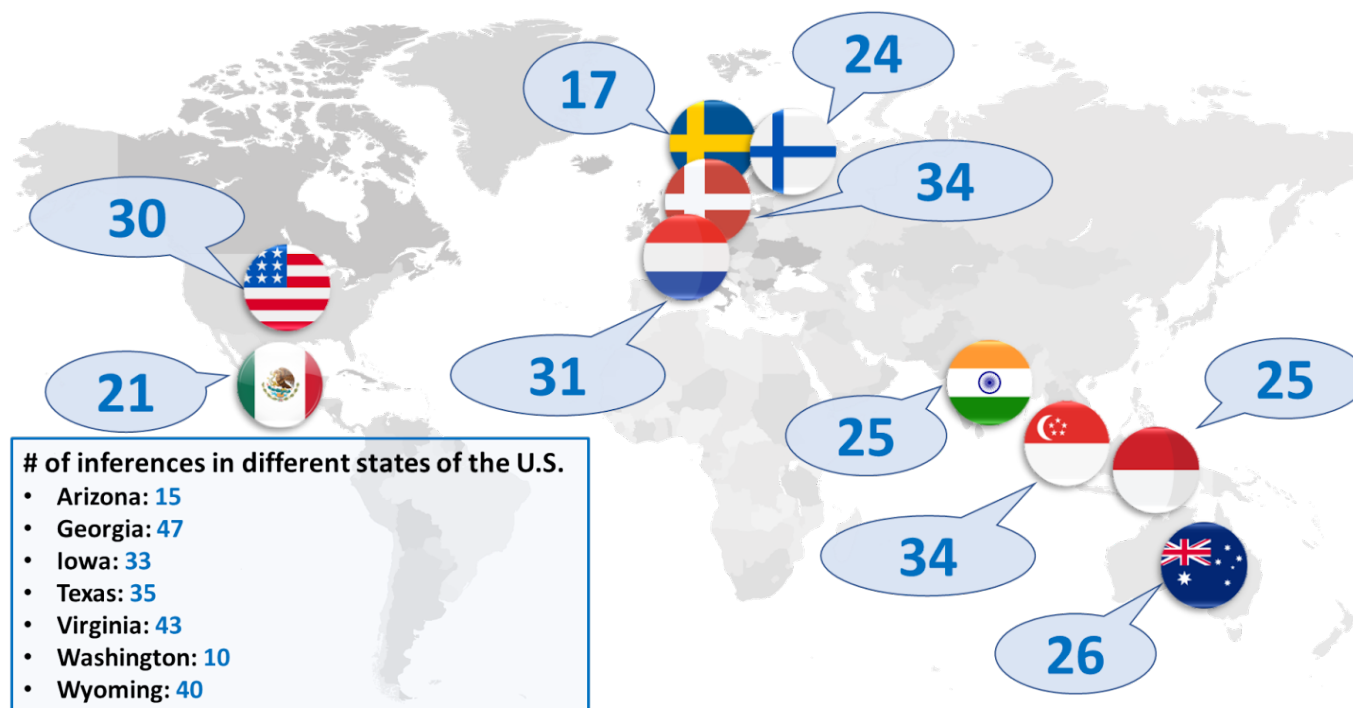
What stood out
for you in what
was shared?

How are you
feeling?

Padlet

Guiding Questions

1. **Purpose**: Why am I using AI?

2. **Reusability**: What is the reusability of what I'm creating with AI?

3. **Impact**: Who will gain through my use of AI? What are the costs/who bears them?

Inspired by **Brent De Waal's Ethical Framework for AI image generation**.

Purpose: Why am I using AI?

- Is this necessary task or for fun?

- Is speed/resources a critical factor?

- Am I trying to create/do something I couldn't on my own?

- Has someone already done this?

- Is this the right tool for the task?

- Is this aligned with my pedagogy/ethics?

Reusability: What is the reusability of what I'm creating with AI?

- One-time use or multi-use?

- Am I saving/storing generated content?

- Am I labelling AI generated materials? *Note currently, AI generated content can't be labelled as Creative Commons.*

- If for student use, will their generated content be reused?

Impact: Who benefits from using GenAI? What/who does it cost?

- Who benefits the most?

- Will it increase accessibility?

- Will it solve a significant problem?

- Is a company benefiting off the data I put in for training? Am I giving up intellectual property rights?

- Am I willing to use 2 cups of clean water to do this? Whose 2 cups of clean water am I using?

- If I had to pay for each prompt, would I use it as much as I am? (using an API)

Putting it into Action: Your Philosophy/Framework

Photo by Adam Kring on Unsplash

- Personal Life: Will not use except to help my children learn AI literacy.
- Work: Will not use for image generation, image captioning or writing emails.
- Work: Will use:
  - Support major curriculum development when limited resources
  - Develop first drafts of major reports or social media posts for wide audiences
  - Collating research or documents
- Will reuse as much generated content as possible.
- Will prioritize web browsers without embedded genAI (duck duck go/firefox).
- Will raise conversations about environmental impacts

My personal philosophy for AI use (for now)

Start Your Personal Philosophy

- What use aligns with your values and/or feel worth the cost?
- What uses do not feel aligned with your values?

# Practical Strategies to Reduce Environmental Costs

Practical Strategies: Use your whole toolbox

1. **Choose the right tool for the task.**
   - Internet search vs AI tool.
   - Choose tools without embedded AI (eg. Firefox, Duck Duck Go browser)

   Use the right AI model for the task.
   - Use smaller, less resource- intensives models like GPT-3.5 for simpler queries.
     - Don't log into ChatGPT
     - Use <u>POE</u> to access smaller models
   - Set up a custom chatbot with smaller AI model for common simple tasks.
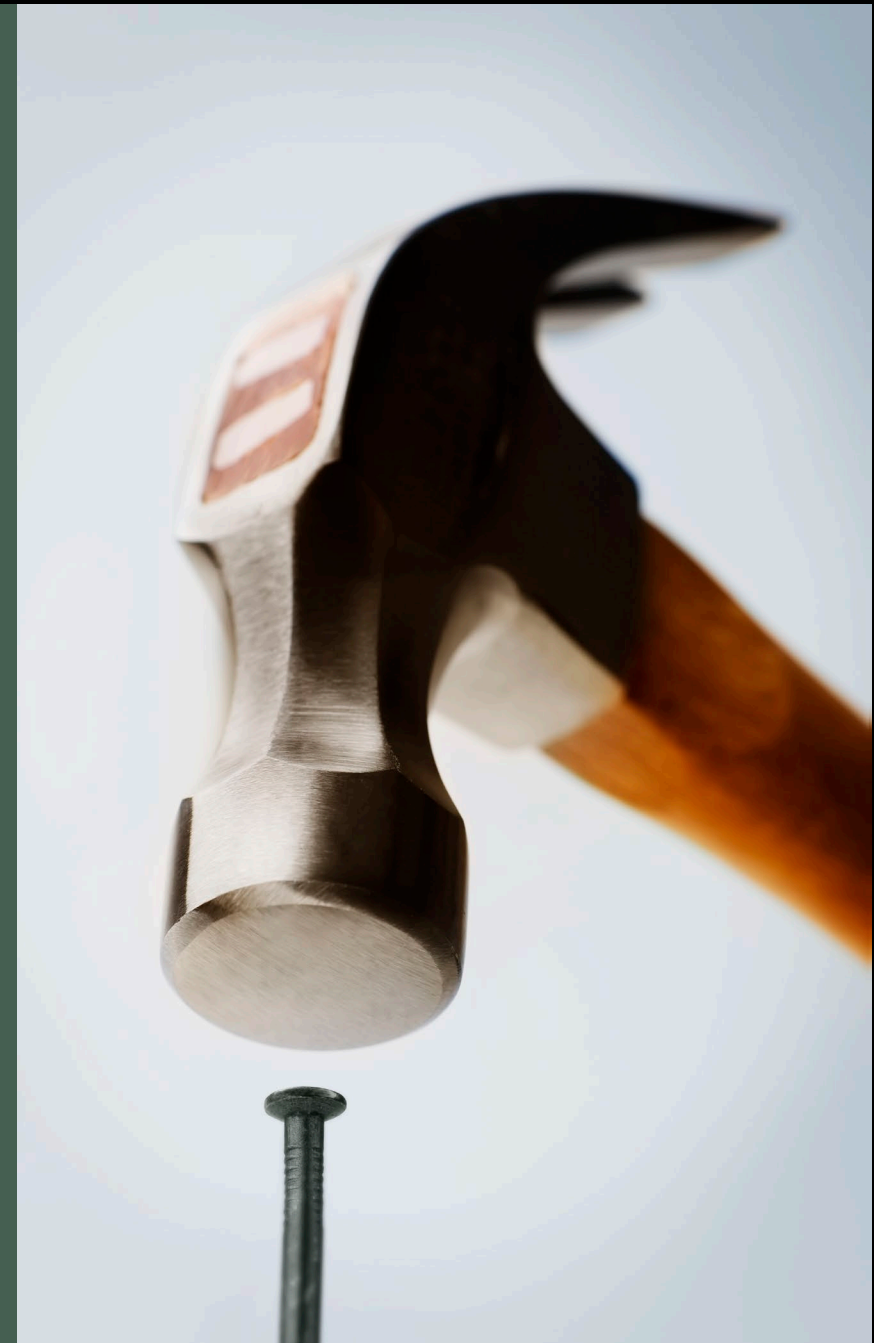
Practical Strategies: Recycle and Reduce

2. Recycle

- Use what already exists : collaborate, find CC licensed materials
    - Creative Commons ; Open Education ; Open textbooks
    - Discover AI-generated Images Styles | Freepik,
- Reuse previous AI-generated outputs to save unnecessary re-computation.

Reduce

- Group work or demonstration to minimize computation requests.

Practical Strategies: Be brief.

3. Limit output length.

Reduces the computational effort/energy.
Be very precise in original prompt to tailor output.

Basic Prompt: "Explain climate change." vs Contextualized, Audience-Specific Prompt: "For a policy briefing, summarize in 100 words the primary causes of climate change, emphasizing human activities."

Phrases you can add to limit output length.

a. "Summarize briefly in X words…"

b. "Focus on the main idea, please."

c. "Keep it short and simple."

Practical Strategies: Batch Prompts

4. **Group multiple questions or tasks into a single request.**
   Uses less computational resources by reducing the number of requests to server.

EXAMPLE:

Please complete the following tasks, restating each prompt before providing the answer:

Task 1: ENTER TASK 1 HERE
Task 2: ENTER TASK 2 HERE

Format your responses as follows:
Prompt: Restate Task 1.
Answer: [Your answer here]

Prompt: Restate Task 2.
Answer: [Your answer here]

Practical Strategies: Local and Institutional

5. **Run a local model on your device.**

Smaller local model doesn't use cloud storage or communication, so consumes less energy than applications like ChatGPT.
3 Ways for Educators to Run Local AI and Why You Should Bother – Leon Furze

6. Institution Level: **Advocacy and procurement**
Many post-secondary institutions have campaigns to support the UN Sustainable Development Goals (SDGs). Is AI factored into the sustainability conversation, including when measuring their institutional environmental / carbon (and water, labour, human rights, equity, etc.) footprint?

If you are part of the purchasing an AI tool – clearly communicate values of sustainability and transparency about the environmental impacts of products. Choose the right model and be clear on why you're using AI

Crowd Sourcing Ideas

- Any other ideas / knowledge about how to reduce Gen AI costs in our use?

QUESTIONS

CONTACT

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Resources

- Carbon Emissions in the Tailpipe of Generative AI
- The Uneven Distribution of AI's Environmental Impacts (hbr.org)
- New tools available that reduce AI Energy Use
- Intelligent Computing - Latest Advances and Challenges
- How to Manage AI's Energy Demand
- AI bring soaring emissions for Google and Microsoft
- Sam Altman wants 7 trillion for AI Chips - Natural Resources required mind-boggling
- **The mechanisms of AI hype and its planetary and social costs | AI and Ethics (springer.com)**
- Power Hungry Processing: Watts Driving Cost of AI Deployment Luccioni, 2024
- AI carbon footprint climate change (CBS news)
- The carbon footprint of an average day of email whatsapp and more
- https://thesustainableagency.com/blog/environmental-impact-of-generative-ai/