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FLO Friday

FLO Friday: Climate Conscious AI Use – Wrestling with Environmental Impacts

Facilitated by Emily Simpson

Host: Helena Prins
BCcampus
hprins@bccampus.ca
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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.

Collaboration tools: Padlet and Chat

What do we know about GenAI's environmental costs?

AI: Environmental Positive or Negative?

- Challenge because there isn't a complete life cycle assessment for Generative AI and there's lots of hidden information about models

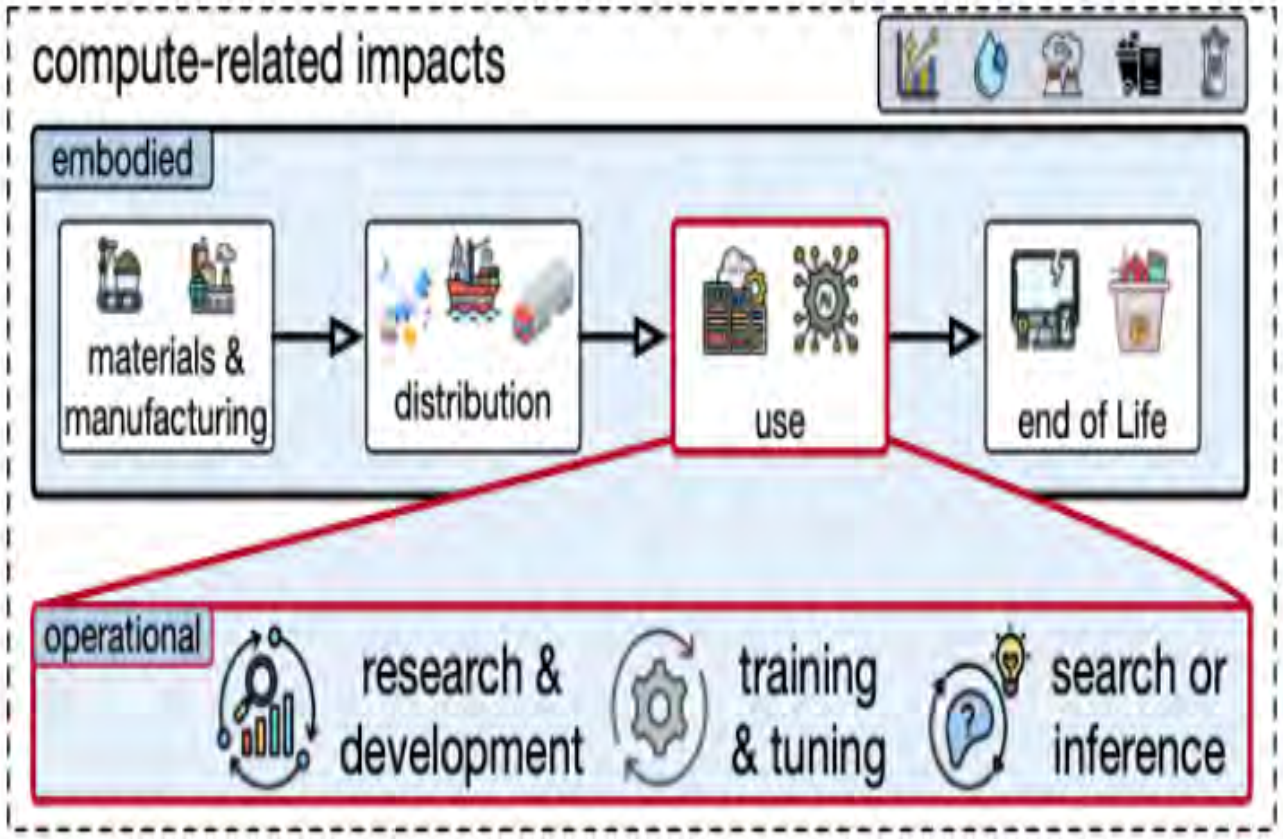
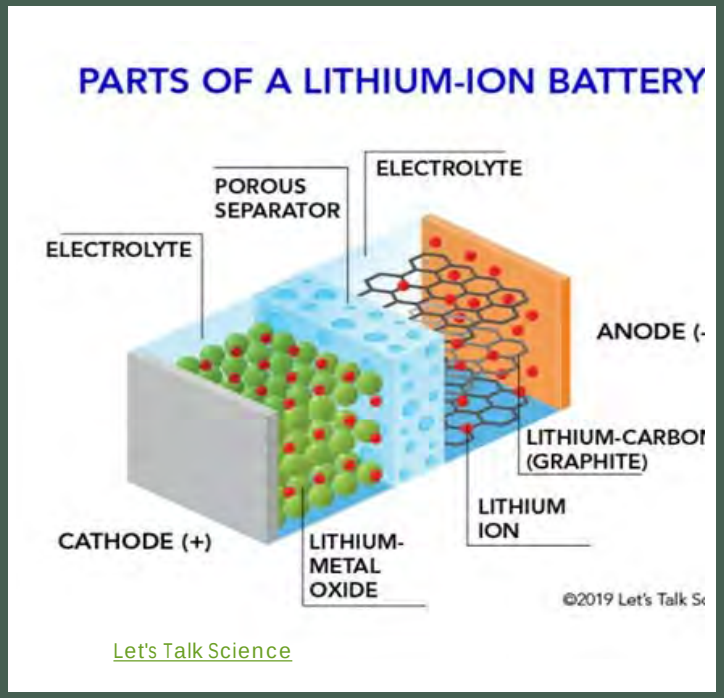
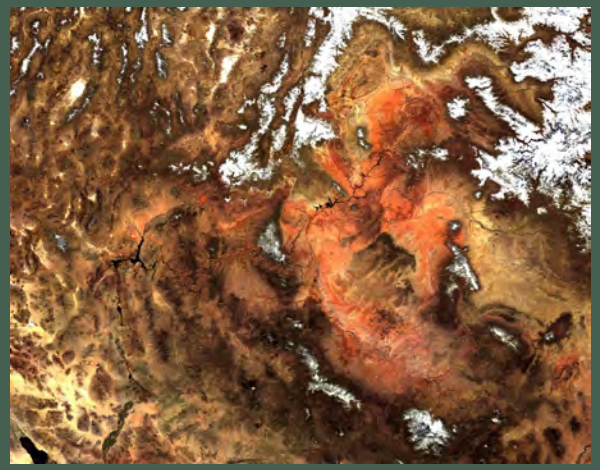
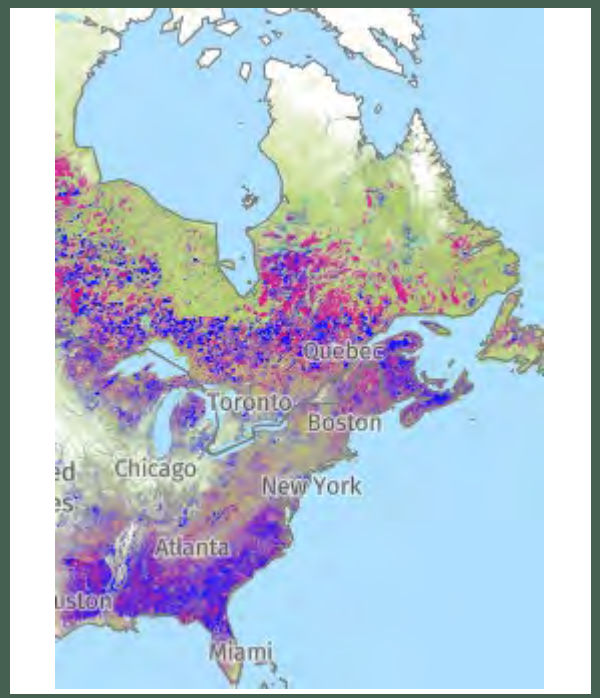


Figure from Bashir, N. et al. The Climate and Sustainability Implications of Generative AI retrieved from: https://mit-genai.pubpub.org/pub/8ulgrckc/release/2



Let's Talk Science

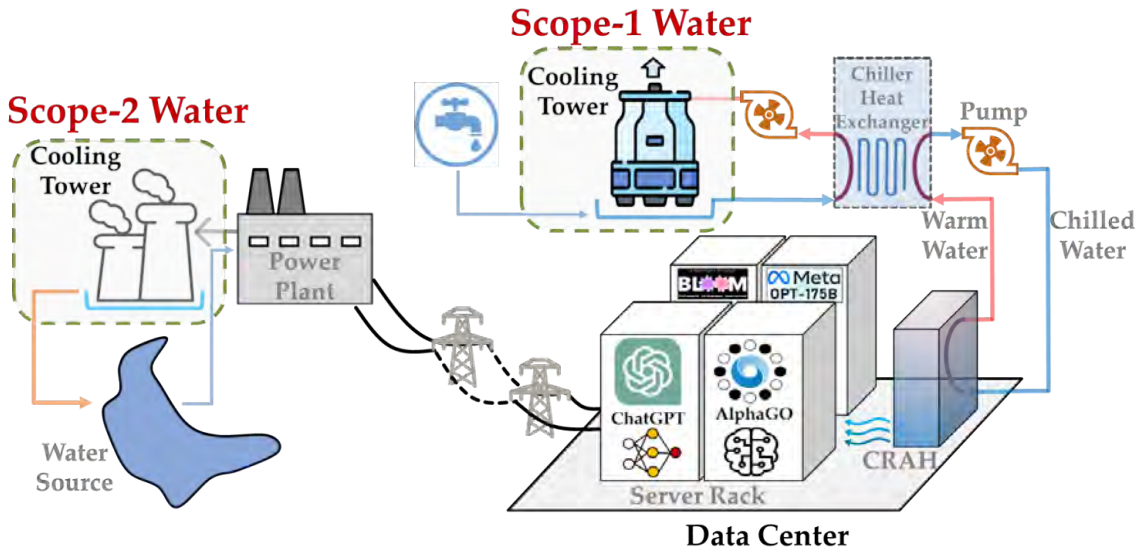




AI: Environmental Support or Threat?

- Gen AI can analyze vast amounts of data and identify patterns
- Climate prediction
- Life cycle assessment
- Contrail reduction
- Monitor deforestation
- Materials research
- Improve efficiency of code reduce application energy use by up to 50%.

Training Phase: Picture This



https://oecd.ai/en/wonk/how-much-water-does-ai-consume

- Data centers are currently 3% of global energy demand, AI is 15% of this (0.5%) (EPRI 2024).
- By 2027, AI energy demand =
- Training GPT3 (175 billion parameters) emits a 552 tons of CO_2
  = 39 Canadians' annual emissions
- = 890 flights from LA to New York
- ChatGPT-4 (~1.8 trillion parameters) emissions ~12x more
- Training GPT3 evaporated 700,000 litres freshwater
  = 3,139 Canadians daily water

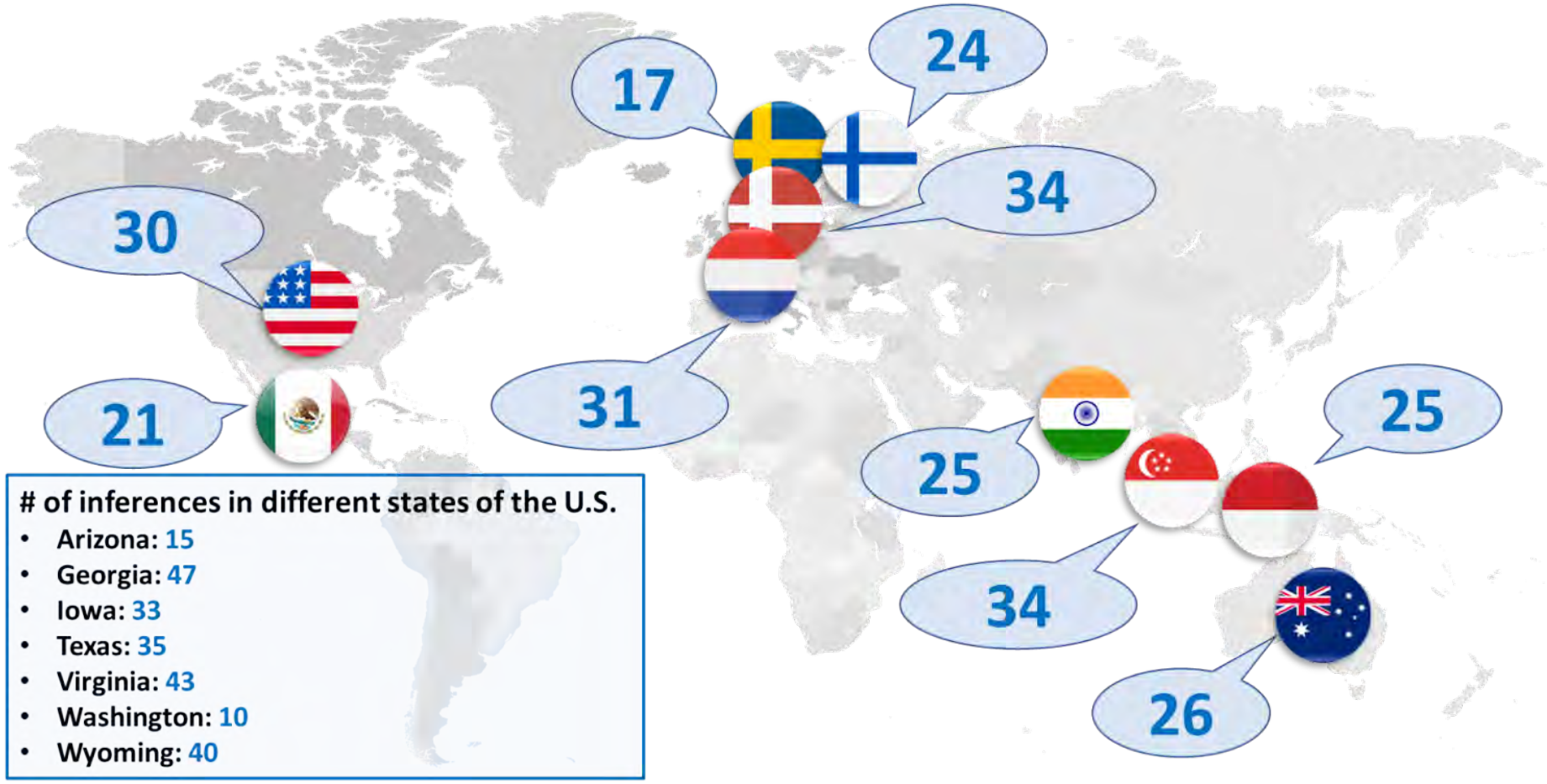
Inference Phase: Picture This

- Compare the water and energy usage of these common tasks.
  - 👥 1000 Wh / 4 L: hour-long Zoom call with 10 people (devices 600 + transmission 200 + server-processing 200).
  - 📺 200 Wh / .8 L: hour-long video streamed on a big TV (Kamiya 2020, Carbon Trust 2021).
  - 📝 30 Wh / 120 cc: generating a page with an online chatbot (Brown 2020, Ippolito 2025b).
  - 📱 20 Wh / 80 cc: charging a smartphone (EPA 2024).
  - 🖼 6 Wh / 24 cc: generating an image online (Luccioni 2024, Ippolito 2025a
  - 🖍 3 Wh / 12 cc: generating a sentence with an online chatbot (Luccioni 2024, Ippolito 2025a, EPRI 2024).
  - 🔍 .3 Wh / 1 cc: one non-AI Google search (Google 2009).
  - 💻 .01 Wh / .04 cc: Generating text with a local chatbot (30W x 1s).

"These are guesses based on incomplete and often contradictory sources."

- https://ai-impact-risk.com/ai_energy_water_impact.html - Jon Ippolito

Estimated Number of Inferences for 500 mL of water using GPT-3



# of inferences in different states of the U.S.

- Arizona: 15
- Georgia: 47
- Iowa: 33
- Texas: 35
- Virginia: 43
- Washington: 10
- Wyoming: 40

AI's Contribution to Environmental Challenges

- Energy/carbon footprint In 2022, carbon emissions from AI systems surpassed emissions by 137 individual countries. (Yu, Y. 2024)
- Water. Globally, AI-related infrastructure may soon consume 6x Denmark annually.
- Mineral mining and E-waste (62 million tonnes in 2022)
- Widening disparity in social/economic 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 - settler colonialism and racial capitalism

Reducing AI Environmental 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
  - Geophysical location of data servers – more renewable energy.
  - AI model pairing with hardware decrease energy use by 10-20%
  - New algorithms significantly reduce the training energy for new models
- Smaller, task-focused AI models
  - GPT-4 to write one 120-200 word email could cost 3 liters of water, compared to Lllama 3-70B could consume 0.13 liters of water (Shumba, S., et al., A Water Efficiency Dataset for African Data Centres, Dec 2024)

What stood out for you in what was shared?

How are you feeling?

Padlet

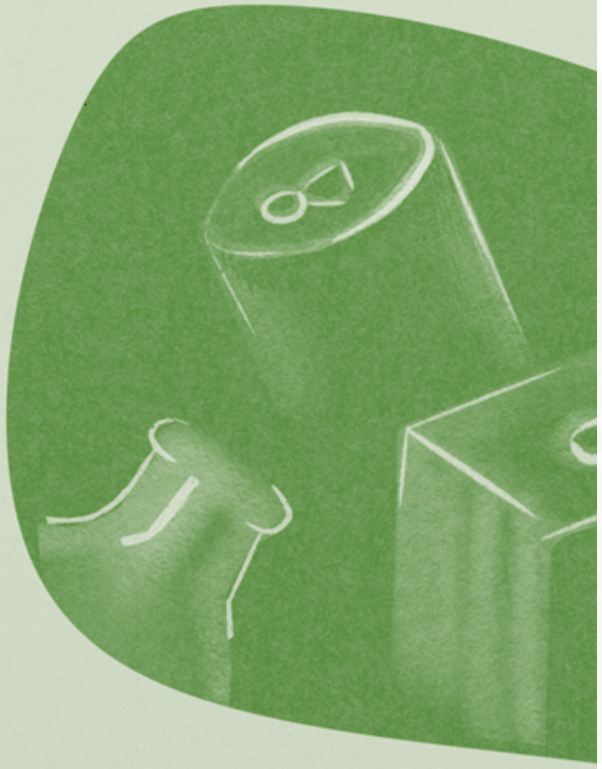
Guiding Questions

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 or for fun?
- Is speed/resources critical?
- 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?
- Who is bearing the cost?
- 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: Create your Philosophy

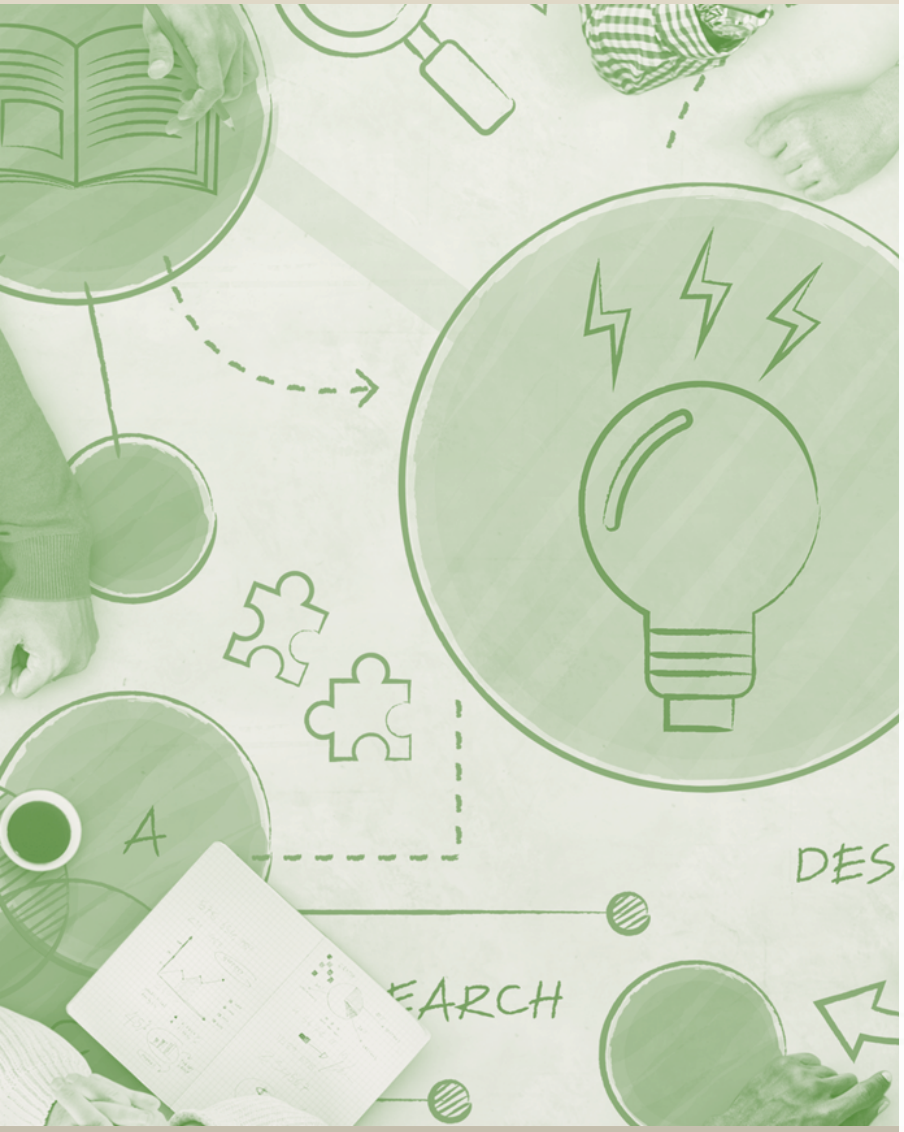
Photo by Adam Kring on Unsplash

My personal philosophy for AI use (for now)

- 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/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

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

5 Practical API Techniques to Lower Your AI Environmental Footprint - tilburg.ai

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. Duck Duck Go browser, Firefox)

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 POE to access smaller models
   Set up a custom chatbot with smaller AI model for common simple tasks

Practical Strategies: Reduce and Recycle

2. Reduce

Group work or demonstration to minimize computation requests with AI.

Check OER, literature for what already exists.

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.

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 number of server requests.

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.**

Small local models don't use cloud storage or communication, consume less energy than ChatGPT, etc.
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 campaigns to support UN Sustainable Development Goals (SDGs).

Is AI factored into the sustainability conversation, including when measuring institutional environmental/ carbon (and water, labour, human rights, equity, etc.) footprint?
If you are part of the purchasing an AI tool –communicate values of sustainability and transparency re: environmental impacts of products.

Choose right model and be clear on why you're using AI.

Develop smaller, task-specific AI models

Demanding lifecycle analysis or information on data servers being used to power your service.

Crowd Sourcing Ideas

What hasn’t been considered in this workshop?

How else could we approach this, either generative AI on its own or our overall use of technology?

Resources

- AI's Impact on the Environment, Explained (Snopes, Jan 2025)
- From Efficiency Gains to Rebound Effects: The Problem of Jevon's Pardox in AI's polarized Environmental Debate (Luccioni, Strubell and Crawford, Jan 2025)
- Power Hungry Processing: Watts Driving Cost of AI Deployment Luccioni, Oct 2024
- Video; Global Risk Institute – Dr. Sasha Luccioni talk (Oct 2024)
- The carbon footprint of an average day of email whatsapp and more (Oct 2024)
- 5 Practical API Techniques to Lower your AI Footprint (Matthijs Ten Tije, Sep 2024)
- Carbon Emissions in the Tailpipe of Generative AI (hbr.org July 2024)
- The Uneven Distribution of AI's Environmental Impacts (hbr.org) July 2024
- AI bring soaring emissions for Google and Microsoft (NPR July 2024)
- AI is posed to drive 160% increase in data center power demand (Goldman Sachs,May 2024)
- The mechanisms of AI hype and its planetary and social costs (Markelius, A., Wright, C. et al., April 2024, AI and Ethics)
- Sam Altman wants 7 trillion for AI Chips - Natural Resources required mind-boggling (Feb 2024)
- New tools available that reduce AI Energy Use (MIT News, Oct 2023)
- AI carbon footprint climate change (CBS news, Aliza Chanson Aug 2023)
- Intelligent Computing - Latest Advances and Challenges (Zhu, S. et al, Jan 2023 – Intelligent Computing)
- Zoom vs Teams –whats more sustainable? https://www.forbes.com/sites/charlesradclyffe/2021/09/02/zoom-vs-teams-heres-who-is-most-sustainable/
- Haudenosaunee Confederacy

Thank you!

Please complete the survey to provide your valuable feedback and ideas for future professional development!