MODERATE

THE HIDDEN COST OF AI

ENERGY, RESOURCES AND SUSTAINABILITY

Science Film Festival

10–16 years | 40–55 min | 8–30 participants | Systems-mapping and decision-making activity

OVERVIEW

Participants trace what happens behind the screen when an AI system receives a request. Using process cards and resource tokens, they investigate how devices, networks and data centres require electricity, water, raw materials and physical infrastructure. They then consider how AI can create environmental costs while also helping people use resources more efficiently and address environmental challenges.

LEARNING OBJECTIVES

Participants will:

- recognize that digital and AI services depend on physical infrastructure
- identify resources used during the lifecycle of AI systems
- distinguish between training an AI model and using it after training
- understand that environmental impacts vary between systems, locations and types of use
- explore ways technology providers, institutions and users can reduce unnecessary impacts
- evaluate both the environmental costs and potential benefits of AI

MATERIALS

- AI journey cards
- Resource cards or tokens
- AI use-scenario cards
- Environmental benefit cards
- A board, flip chart or large sheet of paper
- Markers
- String, arrows or adhesive notes
- Optional world map
- Optional lifecycle worksheet

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MATERIALS

Suggested AI journey cards include:

- raw-material extraction
- chip manufacturing
- device production
- AI training
- user device
- internet network
- data centre
- cooling system
- AI response
- data storage
- device reuse or disposal

Suggested resource cards or tokens include:

- electricity
- water
- metals and minerals
- land and buildings
- human labour
- manufactured equipment

PREPARATION

Prepare one complete set of AI journey cards for each group or one large set for the whole room.

Prepare scenario cards representing different ways of using AI:

- asking an AI assistant one simple question
- generating many high-resolution images
- repeatedly requesting nearly identical answers
- analysing medical images
- monitoring energy use in a building
- identifying endangered animals in camera-trap images
- predicting equipment failures
- recommending videos continuously
- creating a summary of a long document
- training a large new AI model

Do not assign exact energy or water values unless they come from a reliable, clearly defined source. The environmental impact of AI use varies considerably depending on the model, hardware, data centre, electricity supply, location and task.

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INTRODUCTION

Ask the participants:

- **Where does an AI response come from?**
- **Does everything happen inside the phone or computer?**
- **What physical equipment is needed to provide an online service?**
- **Why might a digital activity use electricity or water?**
- **Can AI also help protect the environment?**

Explain: Digital services may feel invisible, but they rely on devices, cables, networks, computer chips and data centres. These systems use energy and materials. Some facilities also use water for cooling. Today, we will follow an AI request from the user to the computer system and back again.

Clarify that the aim is not to label all AI use as good or bad. Participants will consider its purpose, benefit, scale and environmental cost.

INSTRUCTIONS

1) BUILD THE AI JOURNEY

Give each group a set of journey cards. Ask participants to arrange the main stages in a logical order.

A simplified journey might be:

1. **The user enters a request on a device.**
2. **The request travels through a network.**
3. **Servers in a data centre process it.**
4. **The AI model generates a response.**
5. **The response travels back through the network.**
6. **The result appears on the user's device.**
7. **Some information may be stored.**

Ask groups to connect the cards using arrows or string.

Explain that some AI processing can occur directly on a device, while other systems rely on remote data centres.

2) LOOK BEHIND THE DATA CENTRE

Ask participants what a data centre needs to operate.

Add relevant cards:

- **electricity**
- **servers and computer chips**
- **cooling systems**
- **buildings**
- **network connections**
- **maintenance and replacement equipment**

Discuss why powerful computers produce heat and need cooling.

Explain that cooling methods vary. Some facilities use water directly, while others rely more heavily on air cooling or other systems. Electricity generation may also use water, depending on the energy source.

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INSTRUCTIONS

3) ADD THE LIFECYCLE

Tell participants that the environmental impact begins before anyone sends a prompt.

Add the following stages:

1. Raw materials are extracted.
2. Computer chips and equipment are manufactured.
3. Equipment is transported and installed.
4. The AI model is trained.
5. People use the trained model.
6. Equipment is maintained, replaced, reused or discarded.

Place resource tokens beside each stage.

For example:

- minerals and water → chip manufacturing;
- electricity → training and use;
- fuel and infrastructure → transport and construction;
- materials and energy → device production;
- waste → disposal of old equipment.

Explain that this is called a lifecycle: the full sequence from producing a technology to using and eventually replacing or disposing of it.

4) DISTINGUISH TRAINING FROM USE

Introduce two terms:

- Training: The process of developing an AI model by analysing large amounts of data and adjusting the system.
- Inference: Using a trained model to produce a prediction, classification or generated response.

Ask which stage participants think may require more computing at one time. Explain that training a large model can require substantial computation, while inference happens every time people use the trained system. A widely used system can therefore also have significant cumulative impact.

Avoid treating one stage as universally dominant; this depends on the system and how extensively it is used.

5) COMPARE AI USES

Give each group several use-scenario cards.

Ask them to consider:

- What is the purpose?
- How much computation might it require relative to the other scenarios?
- How many times might it be used?
- Does it provide an important benefit?
- Could the same result be achieved with a simpler tool?
- Is any use unnecessary or repetitive?

Groups place the scenarios along a line:

Lower likely resource demand → Higher likely resource demand

Explain that this is a reasoned comparison, not an exact scientific measurement. Groups may reach different conclusions because important technical information is missing.

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INSTRUCTIONS

6) ADD ENVIRONMENTAL BENEFITS

Give groups environmental benefit cards or ask them to propose examples of AI supporting:

- renewable-energy management
- energy-efficient buildings
- climate and weather research
- wildlife monitoring
- precision agriculture
- public transport planning
- early detection of equipment failure
- reduced food or material waste
- ·environmental data analysis

Ask groups to match each benefit with possible costs or risks.

For example: An AI system helps reduce energy waste in a building, but the sensors, data transmission and computing also require resources.

Discuss the importance of comparing the resources used with the benefits achieved.

7) MAKE THREE LEVELS OF RESPONSIBILITY

Create three columns:

- Users
- Organizations and schools
- Technology companies and governments

Ask participants to suggest actions at each level.

Possible user actions:

- avoid repeatedly generating content that is not needed
- choose a simpler digital tool when it can perform the task
- keep devices for longer where practical
- use AI purposefully rather than automatically

Possible organizational actions:

- select efficient and appropriate systems
- avoid unnecessary data collection and storage
- maintain and reuse equipment
- measure energy and resource use
- establish responsible-use guidelines

Possible provider and government actions:

- improve hardware and software efficiency
- use lower-carbon electricity
- manage water responsibly
- disclose environmental impacts
- extend equipment lifetimes and improve recycling
- locate facilities with consideration for local resources
- support research and appropriate standards

Emphasize that meaningful change cannot depend only on individual users.

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INSTRUCTIONS

8) DEVELOP A RESPONSIBLE-USE PRINCIPLE

Each group completes the statement:

"AI use is worth its environmental cost when …"

Possible answers may include:

- it provides a clear and meaningful benefit
- an appropriate and efficient system is used
- unnecessary repetition is avoided
- environmental impacts are measured and reduced
- the benefit cannot be achieved more efficiently another way
- the people affected are included in the decision

Groups present and compare their principles.

DISCUSSION AND REFLECTION

Ask the participants:

- What physical infrastructure is hidden behind an AI response?
- Which stages of the lifecycle surprised you?
- Why is it difficult to give one environmental figure for every AI request?
- What is the difference between training and inference?
- Can a useful application still have environmental costs?
- Can an energy-intensive system create a larger environmental benefit?
- How should we compare the benefit of an AI application with the resources it uses?
- Who has the greatest ability to reduce AI's environmental impact?
- Should technology companies disclose energy, water and material use?
- Is avoiding all digital technology realistic or necessary?
- What would responsible and purposeful AI use look like?

Conclude with the key idea: AI is not an invisible or weightless technology. It depends on physical resources and infrastructure. Responsible use means considering whether the purpose justifies the cost and how the system's impacts can be reduced throughout its lifecycle.

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CONNECTION TO ARTIFICIAL INTELLIGENCE

AI systems require computing equipment to be developed and operated. Their environmental impacts can include:

- electricity used for training and inference
- greenhouse-gas emissions associated with the electricity supply
- water used directly or indirectly for cooling and electricity generation
- raw materials used to manufacture chips, servers and devices
- construction and operation of data centres and networks
- electronic waste when equipment is replaced

The size of the impact varies according to:

- the type and size of the AI model
- the amount and kind of content generated
- the efficiency of the hardware and software
- how many people use the system
- how long information is stored
- the cooling technology
- the local climate
- the electricity sources supplying the system

AI can also support environmental goals by analysing complex data, improving efficiency, detecting changes and helping manage resources. These benefits are not automatic. The system must be designed and used appropriately, and its own environmental cost should be included in the assessment.

EASIER VARIATION

Use five large cards:

- device
- internet
- data centre
- electricity
- response

Finish by sorting simple actions into:

- useful digital activity
- unnecessary repetition
- technology helping the environment

Ask participants to stand in a line holding the cards. Pass a paper “question” from the user device through the network to the data centre and return a paper “answer.”

Add cards representing electricity and cooling to show what is needed behind the process.

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MORE CHALLENGING VARIATION

Give groups fictional proposals for new AI projects:

- **AI cameras for monitoring endangered wildlife**
- **personalized advertising screens throughout a shopping centre**
- **an AI system managing energy use in public buildings**
- **an application generating unlimited decorative images**
- **an AI diagnostic assistant for a rural hospital**

Groups conduct a simplified environmental assessment:

1. What problem does the project address?
2. Who benefits?
3. What infrastructure does it require?
4. What resources might it use?
5. How frequently will it operate?
6. What environmental benefit or harm could result?
7. Could a simpler system achieve the same goal?
8. How could the project reduce its impact?
9. What information is still needed before making a decision?

Groups recommend whether to:

- **proceed**
- **proceed with conditions**
- **redesign the project**
- **reject the proposal**

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FACILITATOR NOTES

- Avoid giving a universal energy or water figure for “one AI prompt.” Estimates depend heavily on the system and measurement method.
- Do not rank scenarios as exact scientific measurements unless verified data are available.
- Distinguish between the environmental impact of training and the cumulative impact of repeated use.
- Explain that data centres use different cooling systems and electricity sources.
- Avoid placing responsibility only on individual participants. Providers, institutions and policymakers influence system-level impacts.
- Discuss benefits and costs together rather than presenting AI as entirely harmful or environmentally beneficial.
- Remind participants that keeping unnecessary devices or storing unlimited data also has material consequences.
- Use locally relevant environmental examples where possible.
- If comparing AI with another activity, ensure the comparison uses equivalent tasks and reliable evidence.
- Encourage participants to ask whether an AI system is necessary, appropriate and proportionate to its purpose.
- Do not frame reduced digital access as the solution for communities that already face unequal access to technology.

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KEY WORDS

DATA CENTRE	A facility containing computer systems that store and process digital information.
SERVER	A computer that provides data or services to other devices.
TRAINING	The process through which an AI model learns patterns from data.
INFERENCE	The use of a trained AI model to generate a result or prediction.
LIFECYCLE	All stages of a product or system, from raw materials and manufacturing to use and disposal.
COMPUTING POWER	The capacity of computer hardware to perform calculations.
CARBON FOOTPRINT	Greenhouse-gas emissions associated with an activity, product or service.
ELECTRONIC WASTE	Discarded electrical or electronic equipment.
RESOURCE EFFICIENCY	Achieving a useful result while minimizing energy, materials and other resources.