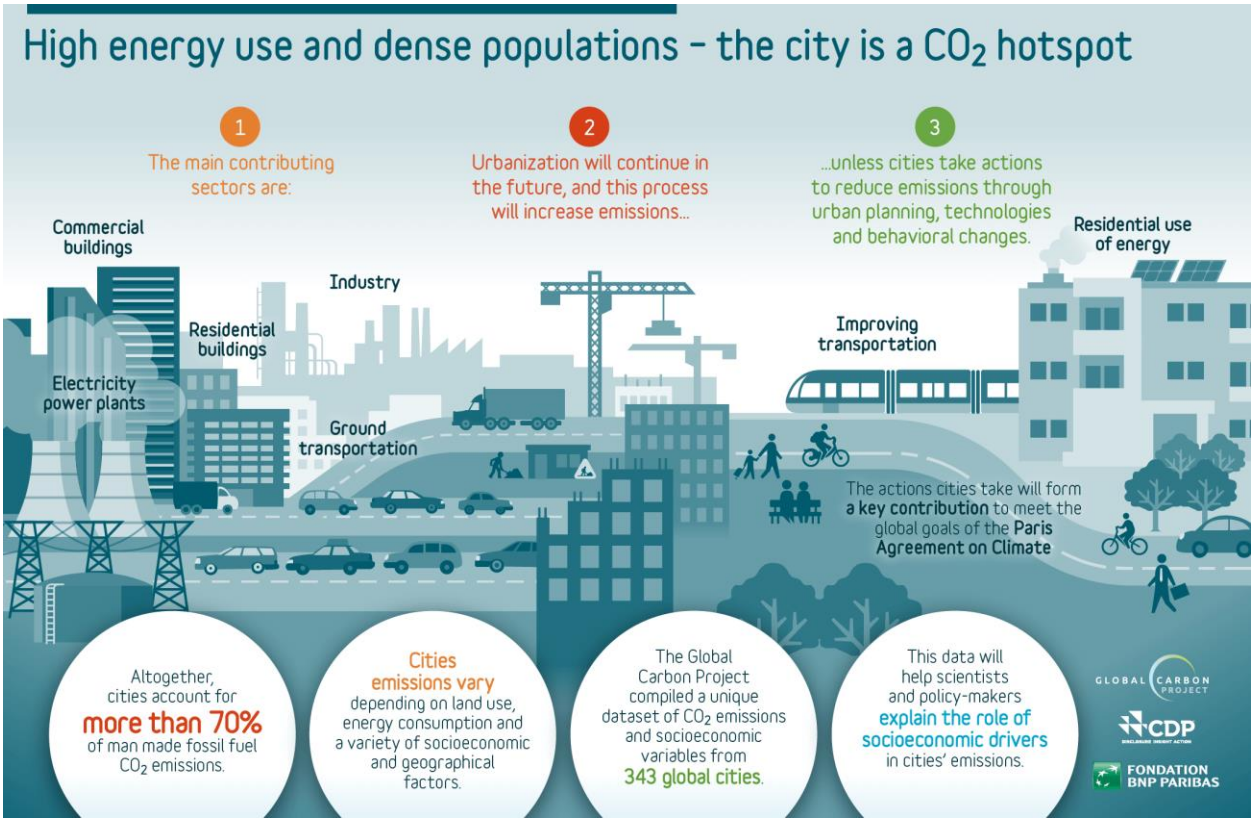
Topic A: Preparing Cities for Climate Change

Introduction

The world's urban areas have a significant impact on the Earth's environment. Cities generate air, water, heat and noise pollution in ways that can destroy local ecosystems. Through industrial production, resource consumption, and waste produced by urban populations, cities account for a significant proportion of carbon in the atmosphere. Although cities cover only 2% of the Earth's land surface, they are responsible for around 70% of the world's total human-created greenhouse gas (GHG) emissions.[1] Rapid urbanization has resulted in the disappearance of many carbon-reducing ecosystems such as marshes and forests.[2] The predominant land-use and land cover changes in cities (e.g., more asphalt, glass, and steel) result in heat reflection rather than absorption, thus accelerating atmospheric warming.[3] (Figure 1)[4]

Figure 1: The City's Contributions to GHG Emissions



At the same time, cities are often located near coastlines or other areas subject to environmental hazards that are increasing with climate change. Urban residents will be in greater danger from floods and deadly storms.[5] Sea level rise will destroy urban neighborhoods and cause increasing salt water to enter urban water systems (salinization).[6] As temperatures increase, city populations will suffer more from deaths associated with heatwaves.[7] Thus, cities both contribute to and are affected by climate change. As city populations continue to grow, the lived experience of an

increasing majority of the world's population will be urban. Helping cities reduce their contributions to climate change and at the same time adapt to a changing climate must be a major focus of global climate strategy.

Current Situation

Sustainable Development Goal (SDG) target 11.6 aims at reducing cities' contribution to climate change through a reduction in urban waste and air pollution.[8] Targets 11.b[9] and 13.1[10] address preparing cities to adapt to climate change through disaster risk reduction strategies. The United Nations Environment Programme (UNEP) Cities Unit is located in the Climate Change Division and "supports cities, regions and countries in addressing the triple planetary crisis of climate change, biodiversity loss and pollution, by accelerating their climate change mitigation and adaptation efforts, and mainstream environmental sustainability principles into relevant economic and social policies and programmes."[11] To reduce the impact of cities on climate change, the UNEP has encouraged the adoption of many "green" strategies in urban development. Particularly, the focus has been on reducing automobile use through better transportation systems, encouraging the use (and reuse) of more sustainable building materials, and implementing planning and building codes that require green roofs, parks, and the preservation of sensitive environmental areas.[12] Ironically, as contentious national politics and special interests have made for slow progress in implementing climate change policies on a nationwide scale, city governments have been able to operate much more nimbly and been able to adopt and experiment with these strategies where national governments lag behind.[13] In fact, studies show that lack of national support is often an impediment to cities in these efforts.[14]

Figure 2: UNEP Priorities

Zero-emission, efficient, and resilient buildings and construction
Adopt building codes and standards to make buildings more green

Sustainable Energy and Cooling
Recognize that increased temperatures will require cooling systems that need to be powered in a sustainable way (e.g, passive cooling) and available to all residents

Net-zero, Circular, and Nature-positive Cities
Limit the city's environmental impact on the region and the world through an increase in urban agriculture, green spaces, and ecosystem restoration

Urban Food Systems and Food Waste
Reduce energy consumption and land degradation through more efficient use of food resources and less food waste

SDG target 11.b specifically calls on cities to implement adaptation to climate change and measures this through the implementation of recommendations made in the Sendai Framework for Disaster Risk Reduction.[15] This framework, adopted in 2015, advocates for the "substantial

reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries."[16] Several years in, evidence showed that the ability of cities to meet Sendai targets was hampered by rapid urbanization, lack of access to quality data and a lack of funding – particularly for smaller cities and those in developing countries.[17] In response, the General Assembly adopted a declaration that provided clear recommendations for making cities more resilient and sustainable in the face of climate change in 2023.[18] The UNEP has been working in four major areas to help cities address climate change issues (Figure 2).[19] While progress has certainly been made, there is a great deal more to do to ensure all cities and city residents have access to the information, funding, and technical assistance necessary to fully prepare them for climate change.

Questions to Address

- How can the UNEP encourage member states to prioritize climate change issues for cities?
- What additional priorities might UNEP pursue to help cities adapt to climate change?
- How can UNEP leverage more funding and technical assistance for cities in implementing sustainable and resilient development?

Topic B: The Environmental Impacts of AI

Introduction

Artificial Intelligence (AI) has become a major force in society, culture, and economic development. There is no universally standardized definition of AI, but UNEP accepts UNESCO's depiction as a starting point:

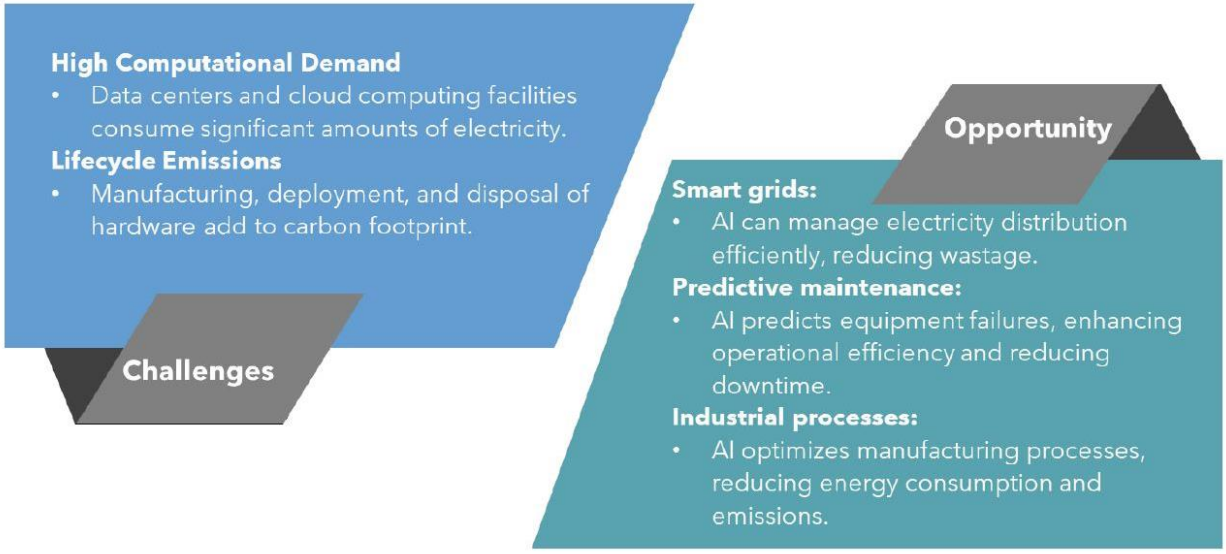
> "AI systems are information-processing technologies that integrate models and algorithms that produce a capacity to learn and to perform cognitive tasks leading to outcomes such as prediction and decision-making in material and virtual environments. AI systems are designed to operate with varying degrees of autonomy by means of knowledge modelling and representation and by exploiting data and calculating correlations."[20]

Such systems are capable of harnessing huge amounts of data to make complex decisions in real time, thus potentially having revolutionary applications to fields such as medicine, energy production, art, and manufacturing. To date, much of the discussion has focused on the ethical issues posed by the development of AI.[21] How do we balance AI with intellectual property rights? What is the appropriate use of AI in education? What happens to the massive amount of personal data collected and used in the training of AI models? While all of these issues are important to grapple with, AI also has environmental impacts that must be considered.

The *direct* environmental impact of AI stems from the large data centers created to house the machines that process data used in AI systems. There are three major issues: 1) the materials used in the production of machines, 2) the energy consumed in the operation of the centers, and 3) water resources diverted to cooling such centers.[22] AI also has *indirect* environmental impacts – such as encouraging the adoption of less sustainable forms of consumption (e.g., self-driving

cars). At the same time, AI has the potential for positive environmental impacts through making energy and agricultural production more efficient.[23] These trade-offs are illustrated in Figure 3.[24] Whether AI will have a net benefit on the environment will stem from minimizing its negative impacts and maximining its positive ones.

Figure 3: The Challenges and Opportunities of AI for the Environment



Current Situation

The data centers that house AI computers have a large environmental footprint. First, making a 2kg computer requires 800kg of raw materials.[25] Microchips require rare-earth minerals that are often mined in environmentally destructive ways and the retirement of these computers creates a lot of hazardous waste.[26] Second, the energy required to run AI systems is significant. One study suggests that a single LLM query requires 2.9 watt-hours of electricity, compared with 0.3 watt-hours for a regular internet search.[27] By 2026, global computation of AI is projected to require the electricity consumption equal countries like Japan.[28] The greater energy needs of AI require more energy production, largely using fossil fuels that contribute to greenhouse gas (GHG) emissions.[29] Figure 4 illustrates the amount of CO2 emissions generated by training an AI model compared to other activities. As AI models have become more complex and generative, these hardware and energy requirements have increased exponentially (Figure 5). In Ireland, for example, AI could consume as much as 35% of the country's total energy usage by 2026.[30] Third, cooling the machines in data centers requires a huge amount of water. Often, this water is diverted from other uses and this can be especially harmful in environmentally sensitive areas.[31] It is projected that the global AI industry will soon consume six times more water than the county of Denmark.[32] In addition, these negative environmental impacts are distributed unevenly across the globe, depending on where data centers are located. In 2022, Google operated its data center in Finland on 97% carbon-free energy; that number drops to 4–18% for its data centers in Asia.[33]

Figure 4: Carbon Footprint of AI vs Other Activities

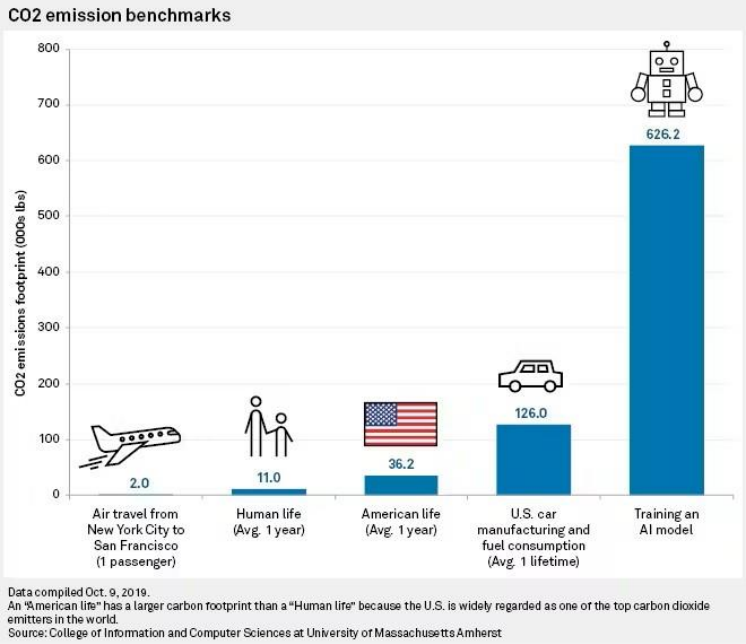
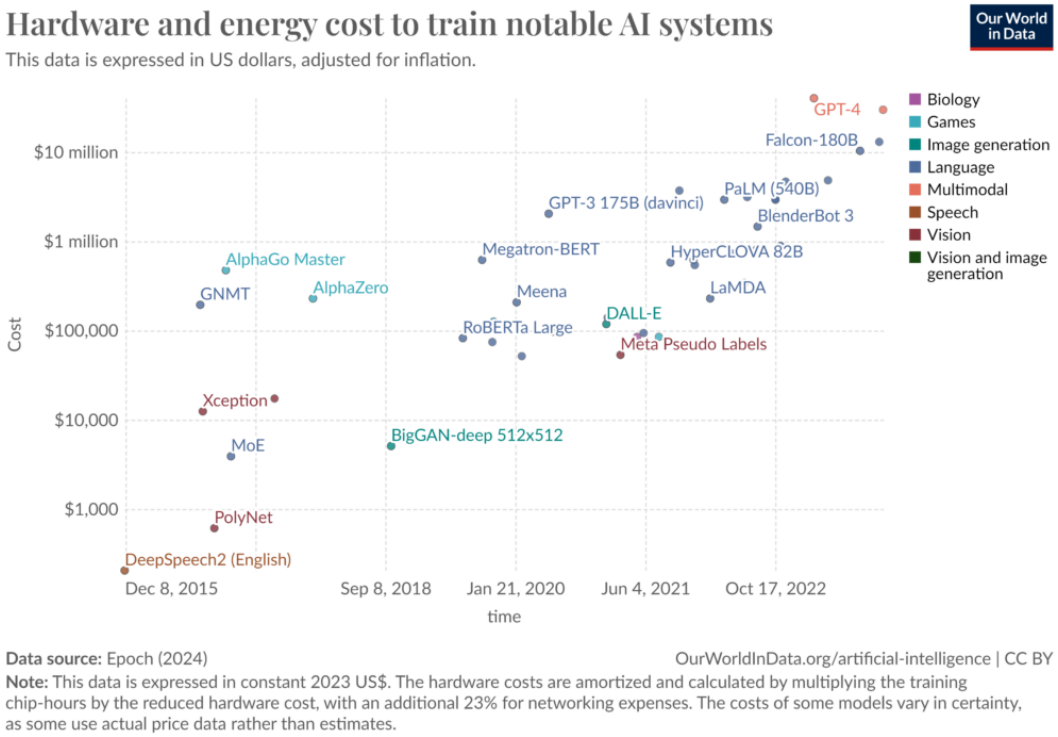


Figure 5



In 2024, the UNEP released its first issue note on the environmental costs of AI.[34] The main recommendations are summarized in Figure 6.[35]

Figure 6: UNEP Recommendations on AI

1. **Countries need to establish standardized procedures for measuring the impact of AI**
2. **Governments should establish regulations requiring companies to disclose the direct environmental consequences of AI products and services.**
3. **Tech companies need to be more energy efficient and use more renewable energy and recycled water.**
4. **Countries need to encourage companies to "green" their data centers**
5. **Countries should include AI products in their broader environmental regulatory systems**

Some of this work has already started. For example, the International Telecommunication Union (TCU) has begun working on universal standards for measuring AI's impact.[36] Nevertheless, the rate of development in AI could quickly outpace existing government capacity to monitor and regulate its effects. This is particularly the case in lower and middle-income countries. AI is an exciting frontier in addressing climate change and a host of other environmental problems. The UNEP must be sure that these benefits are not outweighed by its negative impact on the environment.

Questions to Address

- How can UNEP encourage member states to prioritize monitoring and regulating the environmental impacts of AI?
- What can the UNEP do to provide technical assistance and resources to governments in lower-income countries?
- What changes in AI – both in the production of models and the use of those models – could lessen its environmental footprint?

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[2] Ibid, p. 54
[3] Ibid.

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[6] *Global Environment for Cities*, p. 46
[7] "Urban Cooling and Extreme Heat", United Nations Environment Programme, https://www.unep.org/topics/cities/cooling-and-heating-cities/urban-cooling-and-extreme-heat, Accessed 3 December 2024.
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[14] Ibid, p. 32
[15] "Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable."
[16] "What is the Sendai Framework for Disaster Risk Reduction?", United Nations Office for Disaster Risk Reduction, https://www.undrr.org/implementing-sendai-framework/what-sendai-framework, Accessed 3 December 2024.
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[20] *Artificial Intelligence (AI) end-to-end: The environmental impact of the full AI lifecycle needs to be comprehensively assessed*. United Nations Environment Programme: Nairobi, Kenya. 2024, p. 2
[21] Hodgkinson, Ian R., et al. "Everyone must understand the environmental costs of AI.", OECD.AI Policy Observatory, 4 October 2024, https://oecd.ai/en/wonk/understand-environmental-costs, Accessed 20 December 2024.
[22] "AI has an environmental problem. Here's what the world can do about that.", United Nations Environment Programme, 21 September 2024, https://www.unep.org/news-and-stories/story/ai-has-environmental-problem-heres-what-world-can-do-about, Accessed 20 December 2024.
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[26] Ibid.
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[28] Shekar, Himanshu and Soenke Kreft, "Artificial Intelligence – Help or Harm for the Climate?", United Nations University Institute for Environment and Security, 28 September 2024, https://unu.edu/ehs/series/artificial-intelligence-help-or-harm-climate, Accessed 20 December 2024.
[29] "AI has an environmental problem…"
[30] Ibid.
[31] Ren, Shaoli and Adam Wierman, "The Uneven Distribution of AI's Environmental Impacts", Harvard Business Review, 15 July 2024, https://hbr.org/2024/07/the-uneven-distribution-of-ais-environmental-impacts,Accessed 20 December 2024.
[32] "AI has an environmental problem…"
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[34] *Artificial Intelligence (AI) end-to-end…*
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