# Case Studies: Sustainability 2

## Case 1 - Causal Loop Diagram applied to Data Centers and Sustainability

### Context

A technology company, operates a network of data centers that support its global digital infrastructure. These data centers are essential for providing cloud services, data storage, and high-performance computing to millions of customers worldwide. However, it is facing increasing investigation from regulatory bodies and the public due to the significant environmental impact of its operations. The company is committed to enhancing its sustainability practices and reducing its carbon footprint.

The company has several key components and processes within its data centers that affect its overall sustainability. These include the **energy consumption** of servers and cooling systems, the **carbon footprint** resulting from this energy use, and the efficiency with which the data centers operate. **Operational efficiency** in data centers is typically a combination of energy efficiency (reducing the energy cost of non-IT infrastructure such as cooling) and resource optimization (reducing the energy cost related to idle servers).

The company sources its energy from a mix of renewable and non-renewable sources. Partly driven by **regulatory compliance** requirements, which are becoming increasingly demanding, the company is exploring ways to increase its reliance on **renewable energy.** It is also increasing its **adoption of greener technologies** such as upgrading to more advanced cooling techniques and buying energy-efficient servers, to improve its operational efficiency. In addition, the **efficiency of its existing cooling systems** (i.e. lowering the energy per unit of heat removed) is a major investment area, as these systems are critical for preventing overheating and ensuring reliable operation. Finally, optimizing the utilization of servers is another important aspect, as higher **server utilization** can lead to greater operational efficiency. However, this must be balanced against the **risk of overloading servers,** which could lead to failures and increased energy consumption due to non-linear power draw.

### Task

You have been appointed by the company to understand the complex interactions between these different elements and identify strategies to improve sustainability. Your task is to develop a causal loop diagram that maps out these interactions and answer several key questions based on this diagram.
The key variables of the diagram you are supposed to build are the following - you are expected to add the causal links:

1. energy consumption
2. carbon footprint
3. operational efficiency
4. regulatory compliance
5. renewable energy use
6. adoption of green tech
7. cooling efficiency
8. server utilization
9. risk of overloading servers

After creating your diagram (you can do it on paper or use LOOPY), answer the following questions:

1. How would a significant improvement in the efficiency of existing cooling systems affect the energy consumption?
2. What happens to operational efficiency if the server utilization decreases?

3. What happens to the energy consumption if the carbon footprint increases?
4. Which type of actions from the company could decrease the overall carbon footprint?
5. What is the effect of stricter regulatory compliance on the adoption of greener technologies and renewable energy use?
6. What is an important downside of adopting greener technologies in a datacenter as a strategy to improve sustainability?

## Case 2 - Ethical Decision Making: where to train my AI model?

EthicModSolutions is a tech company which is developing an AI model designed to moderate online content for several large social media platforms. The goal is to create a model that minimizes harmful content while allowing for free expression.
The company faces a tough decision about where to train the AI model:

**Option 1: Train the Model in India**

- ***Pros:*** Training the AI model in India is significantly more cost-effective due to lower electricity and operational costs. This allows the company to allocate more resources to training, such as using larger and more diverse datasets, running more extensive experiments, and fine-tuning the model for better accuracy. The result would be a more sophisticated and reliable AI model that performs better in content moderation.
- ***Cons:*** However, India's electricity grid relies heavily on coal, resulting in high levels of sulfur and particle pollution, generating some of the worst air pollution in the world. The local environmental impact is significant, having important consequences on the health of local communities.

**Option 2: Train the Model in Switzerland**

- ***Pros:*** Switzerland offers a much cleaner energy grid, relying heavily on renewable energy sources such as hydroelectric power. Training the model in Switzerland would result in significantly lower pollution, aligning with the company's commitment to sustainability and reducing the negative impact on the environment and public health.
- ***Cons:*** However, the higher costs associated with electricity and operational expenses in Switzerland would limit the resources available for training the AI model, and this would result in a less accurate model. As a result, the AI model might not perform as well in content moderation, leading to potential issues such as the exposure of users to harmful content or unjust censorship, placing a greater burden on human moderators.

To arrive at a decision in such a dilemma, you can use the Ethical Decision Making strategy. Look at the problem through **four ethical lenses: Rights, Justice, Utilitarian, and Common Good**, and write down your analysis for each lens. The final choice does not really matter, what is important is the different points of view that the ethical lenses can bring to the decision.

**Fill out the following table:**

| Lens | Justification | Option chosen |
|---|---|---|
| Rights | | |

| | | |
|---|---|---|
| Justice | | |
| Utilitarian | | |
| Common Good | | |

**What option would you choose? Why?**