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AGENCE DE LA TRANSITION ÉCOLOGIQUE

# Environmental assessment methodology (PCR) for cloud services and data centers

## Presentation

*Digital Sobriety Service, Circular Economy Department*

# Speakers

**Alexis Perez**
Digital sobriety engineer
Technical co-coordination

**Anne Rabot**
Green IT expert at Resilio, project manager of the mission

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resilio

# Presentation Summary

## 1. Introduction and issues on data centers

- Introducing Alt Impact
- Main environmental issues in data centers
- Recent and ongoing work

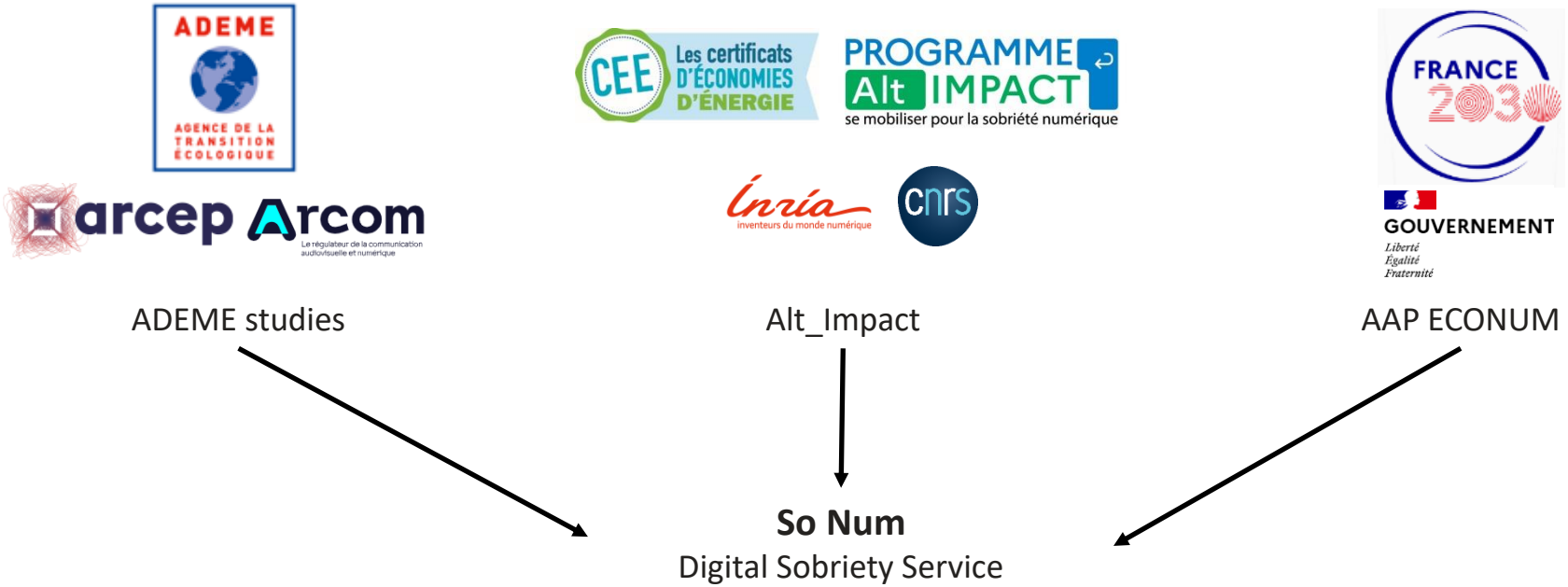
## 2. PCR Data Centers and Cloud Services

- Presentation of the methodology
- Example of a calculation based on PCR

## 3. Questions/Answers

# INTRODUCTION AND ISSUES
## on data centers

# THE DIGITAL SOBRIETY SERVICE
## A dedicated ADEME team



# Latest studies

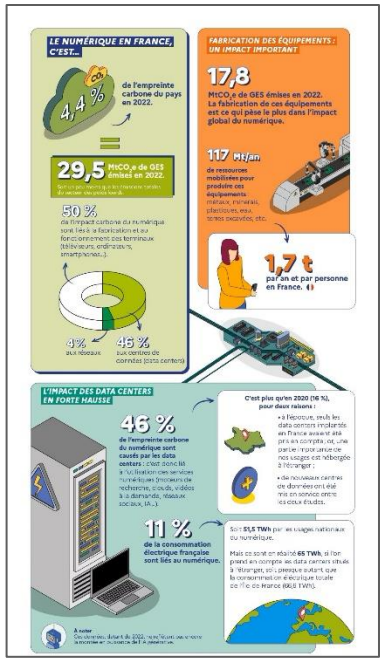
## Ademe

- **Studies**
  - ADEME opinion: digital and environment
  - Environmental impact of audiovisual uses
  - Digital and metals
  - IT for green – part 1
  - Environmental impacts of digital technology

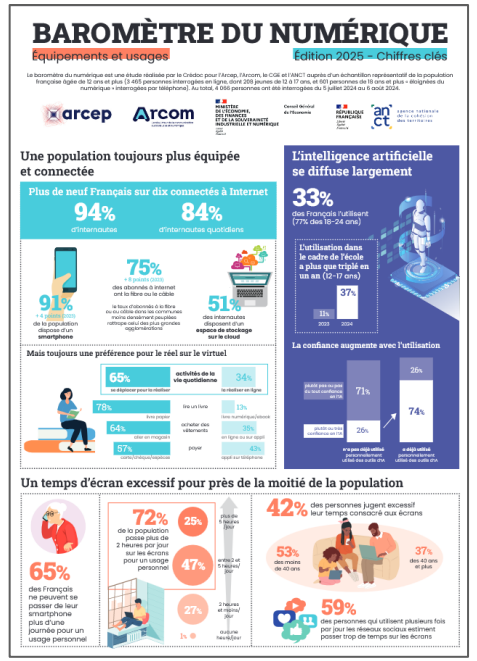
- **Methodological basis**
  - PCR Information Systems
  - PCR data center and cloud
  - PCR Internet Service Provision
  - Prefiguration Impact Factors Database

## And elsewhere

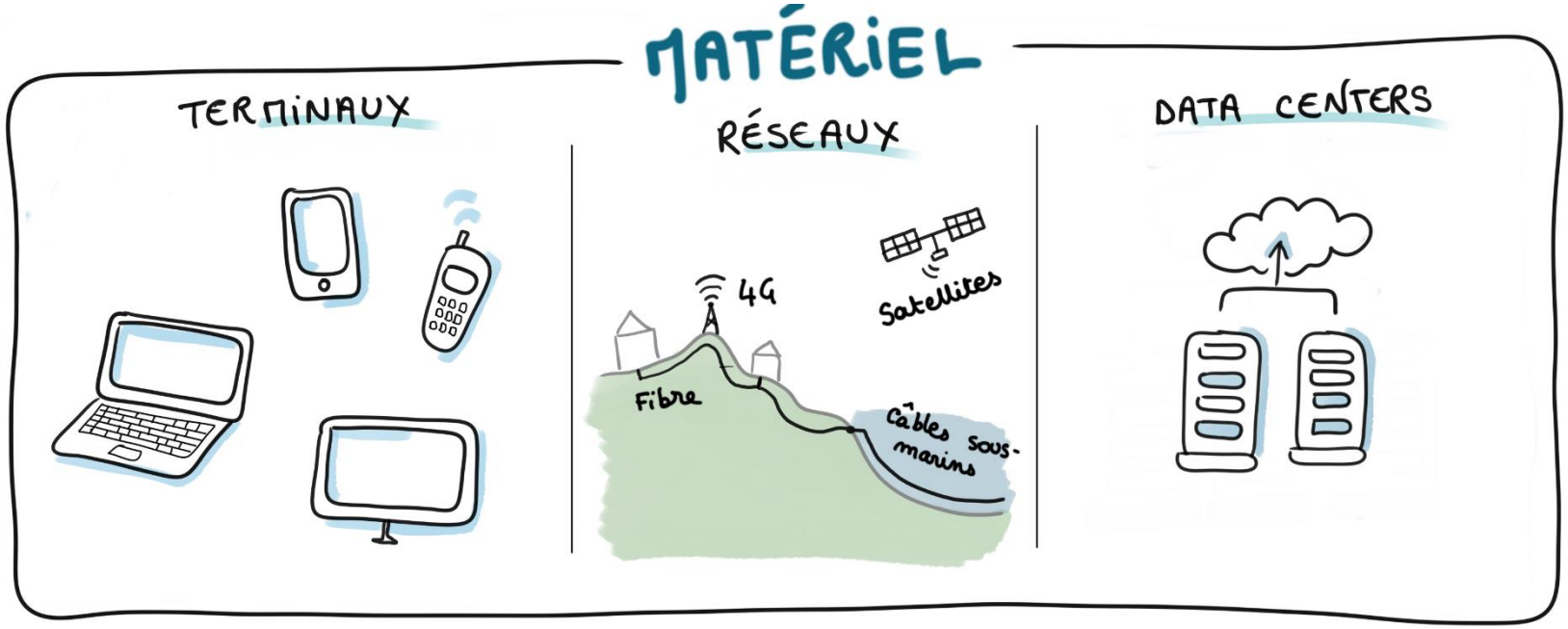
- **Studies**
  - Green IT : Environmental footprint of the digital world
  - ARCEP : Baromètre du numérique 2025 (FR only)

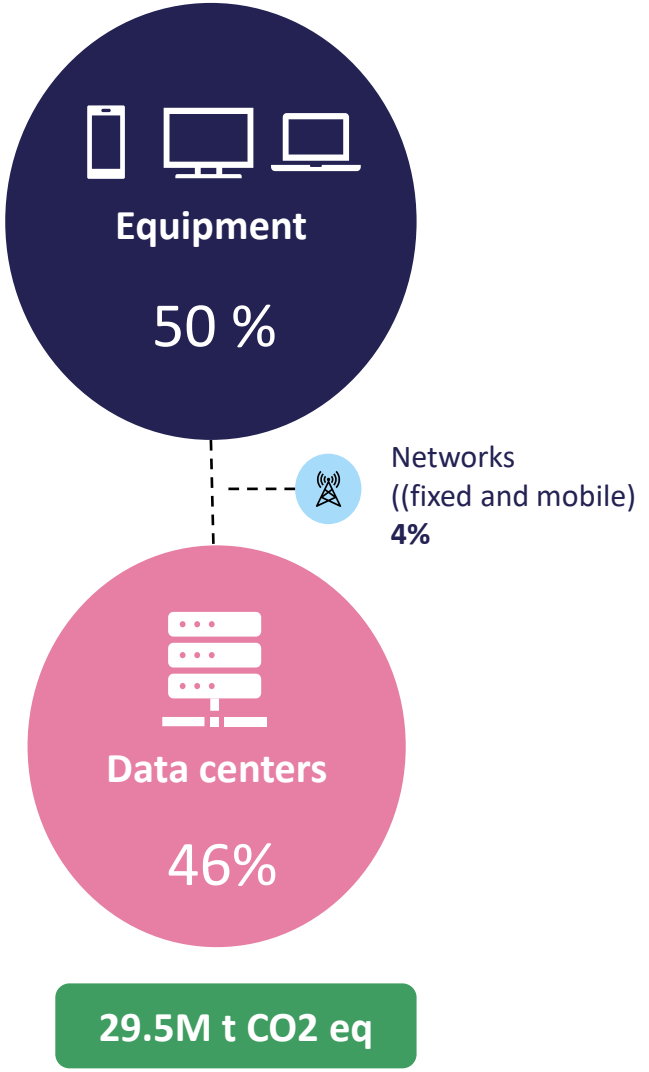






# An environmental impact of digital technology already significant and growing rapidly



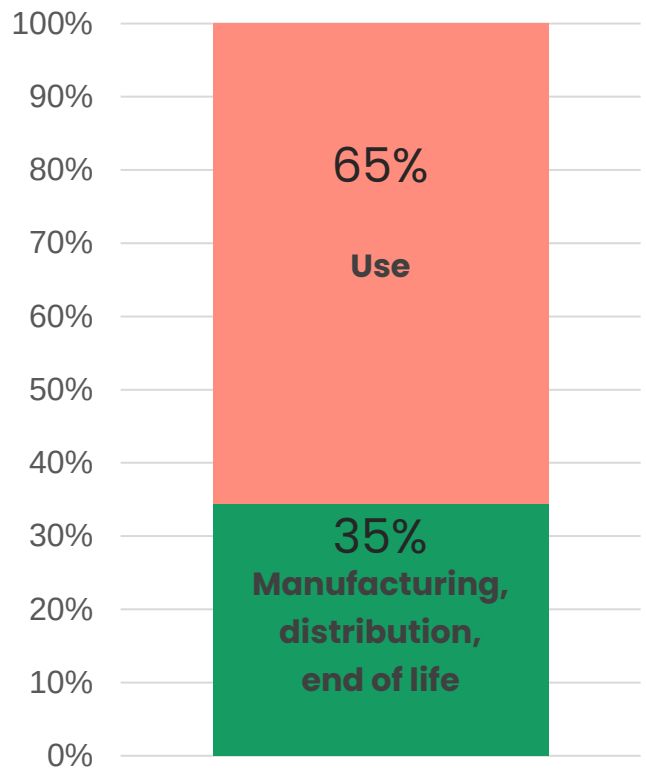



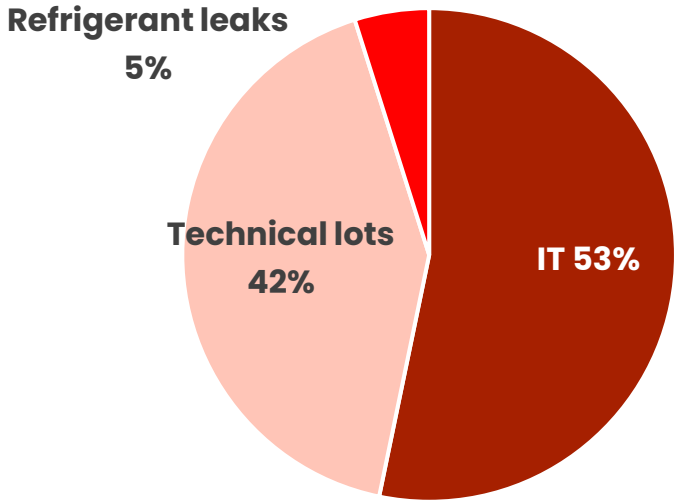

**4.4%** of France's carbon footprint

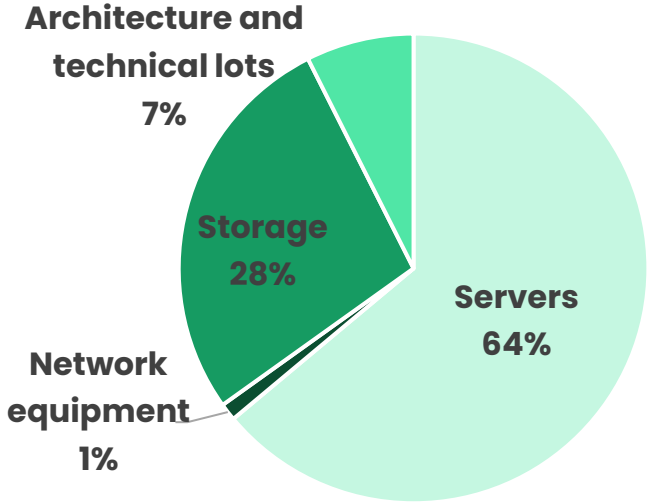
**11%** of electricity consumption

# Data centers: what impacts?

Contribution to the “Climate Change ” indicator by phase




*Source: ADEME Arcep, 2025*

*Source: ADEME Arcep, 2022*

# Data centers: regulatory context

## National framework:

- **Tertiary Eco Energy Decree (DEET):**
  - For commercial buildings > 1000 m²
  - Obligation to reduce final energy by 40% in 2030 to 60% in 2050

- **SREN Law:**
  - Decree to come to specify the cloud players concerned
  - Publication of information on their carbon footprint, water consumption and energy consumption.

- **But also:** collection of environmental data from Arcep, roadmap for decarbonizing data centers, REEN law

# Data centers: regulatory context

## European framework Energy Efficiency Directive (EED):

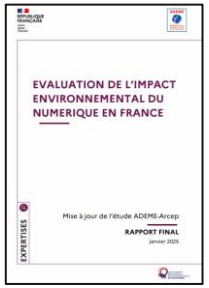
**For data centers > 500 kW**

- Making certain data available to the public

- **For data centers > 1 MW**
  - Taking into account the good practices of the European code of conduct on data centers
  - Obligation to recover waste heat
  - Obligation to carry out a cost-benefit study

- **But also:** CSRD

# Data centers: recent and ongoing work




**Update of figures from the ADEME Arcep report:**

- Taking into account French data center uses abroad
- Data centers = 46% of the digital carbon footprint in France in 2022

**Expert advice - data centers:**

- Issues related to territorial integration, energy consumption and other environmental impacts
- Priority actions to limit the impact of data centers



**Data center outlook for 2060:**

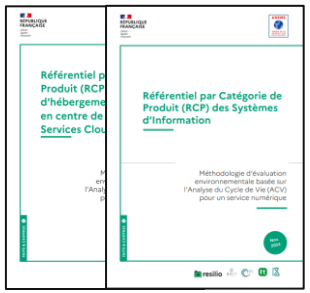
- Development of 5 scenarios
- Analysis of energy, water and land consumption

**Study on data center cooling:**

- State of play of practices
- Comparison of technologies and assessment of potential savings
- Exploring emerging technologies

# Presentation of the Product Category Rule (PCR)

ADEME is participating in the development of common methods for **assessing the environmental impacts** of a digital service: **PCR**





A PCR defines the rules for carrying out the Life Cycle Analysis (LCA) of a service category. The objective is twofold:

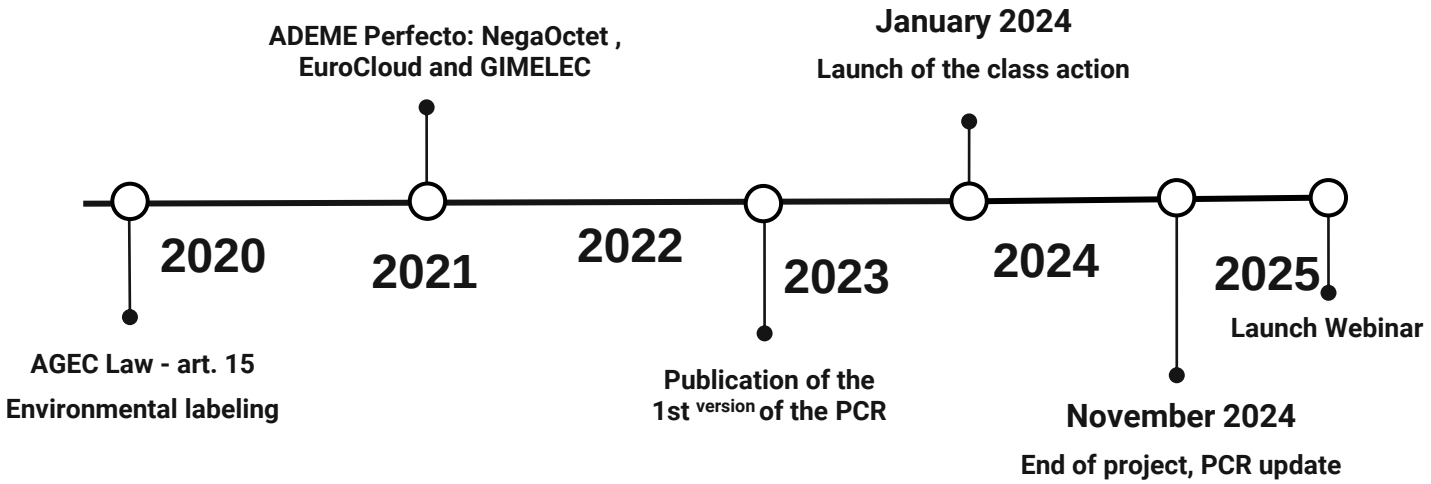
1. **Inform consumers about the environmental impact of their products/services** and understand the actions to be implemented for more sober digital uses;
2. **Encourage manufacturers/distributors to have a global vision of the environmental impacts** of their products/services and the main levers to reduce them in an eco-design approach.

**Existing PCR:** Digital service, Information system, Provision of internet access, LAN networks and corporate telephony, Data centers and cloud services

# PCR DC/Cloud: Participants and Schedule

## Update Participants:

## Calendar :




## Coordination and technical partners:

1st version

Update :

# PCR
# Data centers and cloud services

# Presentation of the PCR Data centers and Cloud services

Method dedicated to the environmental assessment of IT hosting in data centers and cloud services.

**Document available in the ADEME bookstore:**

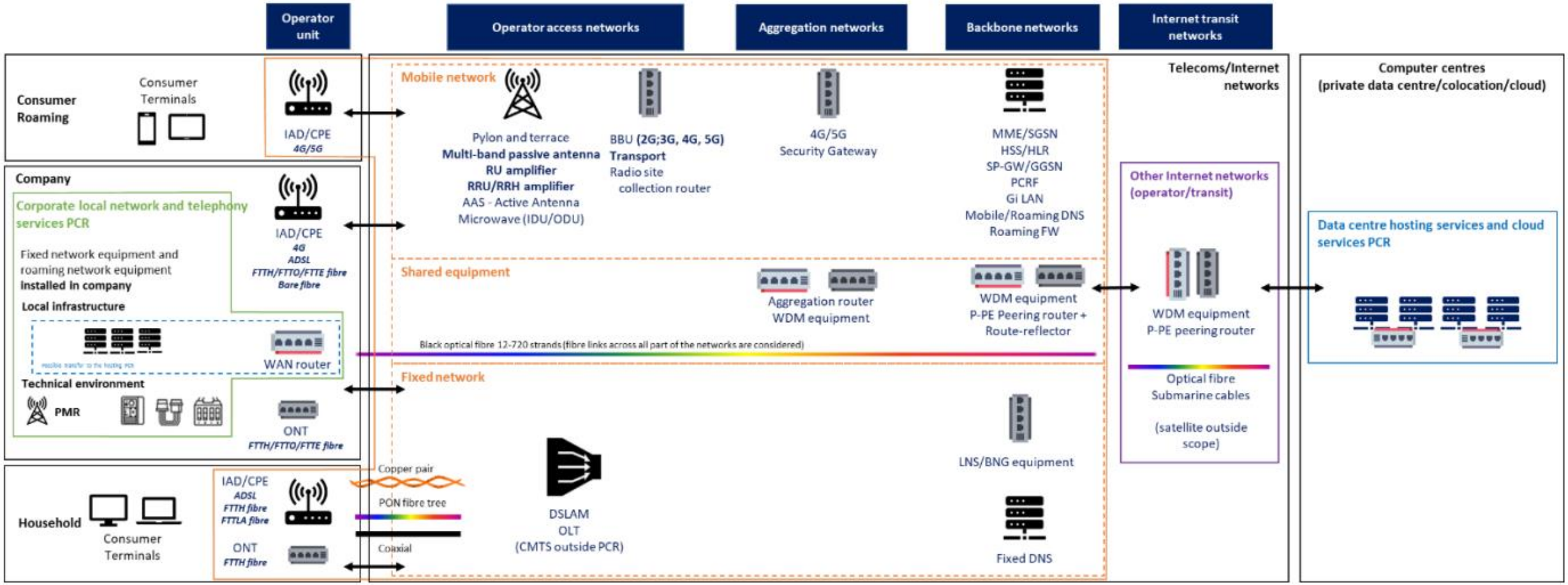
la Librairie

https://librairie.ademe.fr/


In French


In English

# Scope of the PCR Data centers and Cloud services



# Presentation of functional units (FU)

PaaS/ SaaS / FaaS

IaaS

Baremetal

Housing

**“Custom” FU**

**FU 5:** Run 1 hour of **processor calculation**

**FU 6:** Provide a **virtual server** with a given capacity

**FU 7:** Provide a 'block' **storage space with given characteristics**

**FU 2:** Provide a **physical server** hosted in a data center with a given computing capacity

**FU 3:** Provide **storage equipment** hosted in a data center with a given storage capacity

**FU 4** : Provide **network equipment** hosted in a data center with given characteristics

**FU 1:** Provide **hosting services** for operation of the IT equipment

# Example of a description of a functional unit: FU 2

- **Description of the Functional Unit (FU):** “Provide a physical server hosted in a data center with a given computing capacity”
- **System boundaries/inclusions and exclusions:**
  - Scope: dedicated IT equipment, here physical server, shared IT equipment of the provider…
  - Life cycle phases considered: extraction of raw materials, production of IT equipment, etc.
- **Allocation rules: example for a physical server in use phase**

$$\mathbf{Impact}_{\mathbf{Eqt}}^{\mathbf{Utilisation}}(\mathbf{dU}) = dU \times PuissEqt \times \mathrm{ImpactMixElec}$$

  - dU: Duration of the study (by default, 1 month according to the FU definition)
  - PowerEqt: Average power consumed by the physical server considered in the functional unit
  - ImpactMixElec: Environmental impact of the electricity mix in the geographical area concerned, per kW of electricity supplied

# Updated from 1st PCR version

**Main goal** : Make the PCR easier to understand and apply

| Objectives | Work done |
|---|---|
| Avoid ambiguities | ▪ Adding definitions, glossary, acronyms<br>▪ Adding graphs and examples for FU<br>▪ Clarify inclusions and exclusions |
| Correct errors and inconsistencies | ▪ Make the FU definitions consistent with each other |
| Provide default parameters and data | ▪ Generic data for FU1, consumables, etc. |
| Add method to follow when missing | ▪ PPA, power measurements, heat reuse, etc. |
| Simplify existing method when it is too complex | ▪ Technical configuration of network equipment |
| Allow various uses of PCR | ▪ Temporal representativeness of data |
| Clarify alignment with other standards | ▪ Addition of an appendix on this subject |

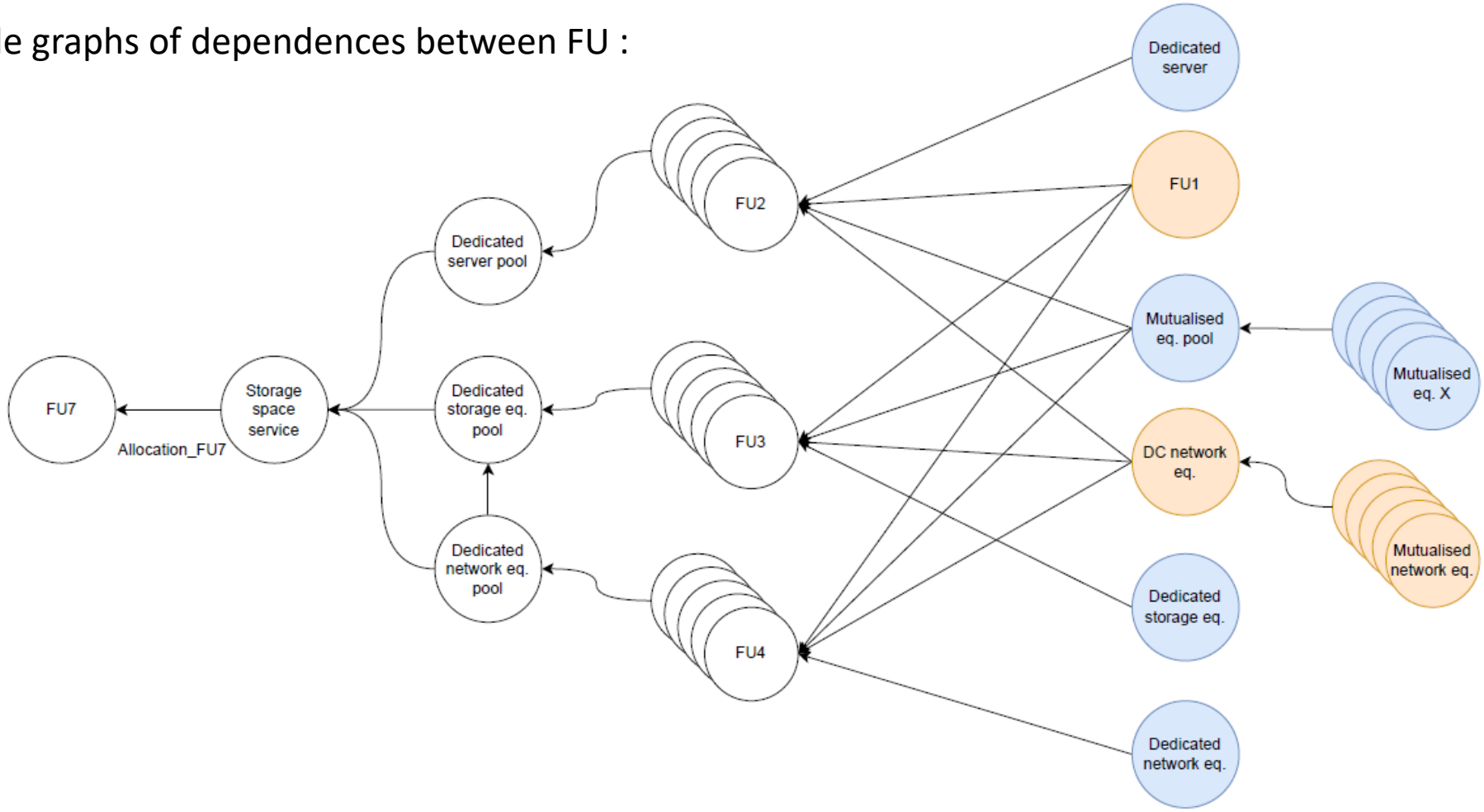
# Avoid ambiguities

## Scope clarification

- ❑ The **common inclusions and exclusions** have been grouped together in a section at the beginning of the document (3.2).
- ❑ The **exclusions** have been justified.
- ❑ For each FU, the **mandatory or optional life cycle stages** are clearly stated.
- ❑ The **data** to be taken into account is stated for each FU. A table summaries the list of data in Appendix.

# Avoid ambiguities

Provide graphs of dependences between FU :



# Produce generic data

## Generic data

Data sources and methodology are detailed for:

- Impacts of 1 $m^2$ datacenter
- Impacts of buildings and technical env. for 1 kW commercialized power (= UF1)
- Impacts of consuming 1 kg of diesel
- Impacts of 1 kg refrigerant fluid leak

## Environmental indicators

Environmental impacts are given on the five mandatory environmental indicators from the "parent" PCR:

- Abiotic depletion, minerals & metals – ADPe (kg eq. Sb)
- Global Warming Potential – GWP (kg eq. $CO_2$)
- Acidification – AE (mol eq. $H^+$)
- Particulate Matter – PM (desease occurrence)
- Ionizing radiation– IR (eq. $U_{235}$ kBq)

# Add methods

## Power Purchase Agreement (PPA)

Only **physical on-site PPA** are taken into account:

- Electricity from on-site PPA: Use electricity impacts specific to the renewable energy source
- Electricity not from on-site PPA: Use the country's average electricity mix (production and imports).

Definitions and justifications are given in Appendix of the PCR.

*Remark : Self-consumption is different than on-site PPA and is also taken into account in the PCR.*

## Heat reuse

Separate display of results:

- Environmental impacts of **FU without** taking into account **heat reuse**
- The **'avoided'** environmental **impacts** associated with heat reuse

'Avoided' environmental impacts :

- Environmental impacts saved when a source of energy is replaced by the data centre's waste heat
- Minus the environmental impacts of downstream heat treatment when it occurs

# Various use cases of PCR

**Temporal representativeness:**

Average approach

- Data collected over 1 year and averaged back to the duration of the study, to account for seasonal variations

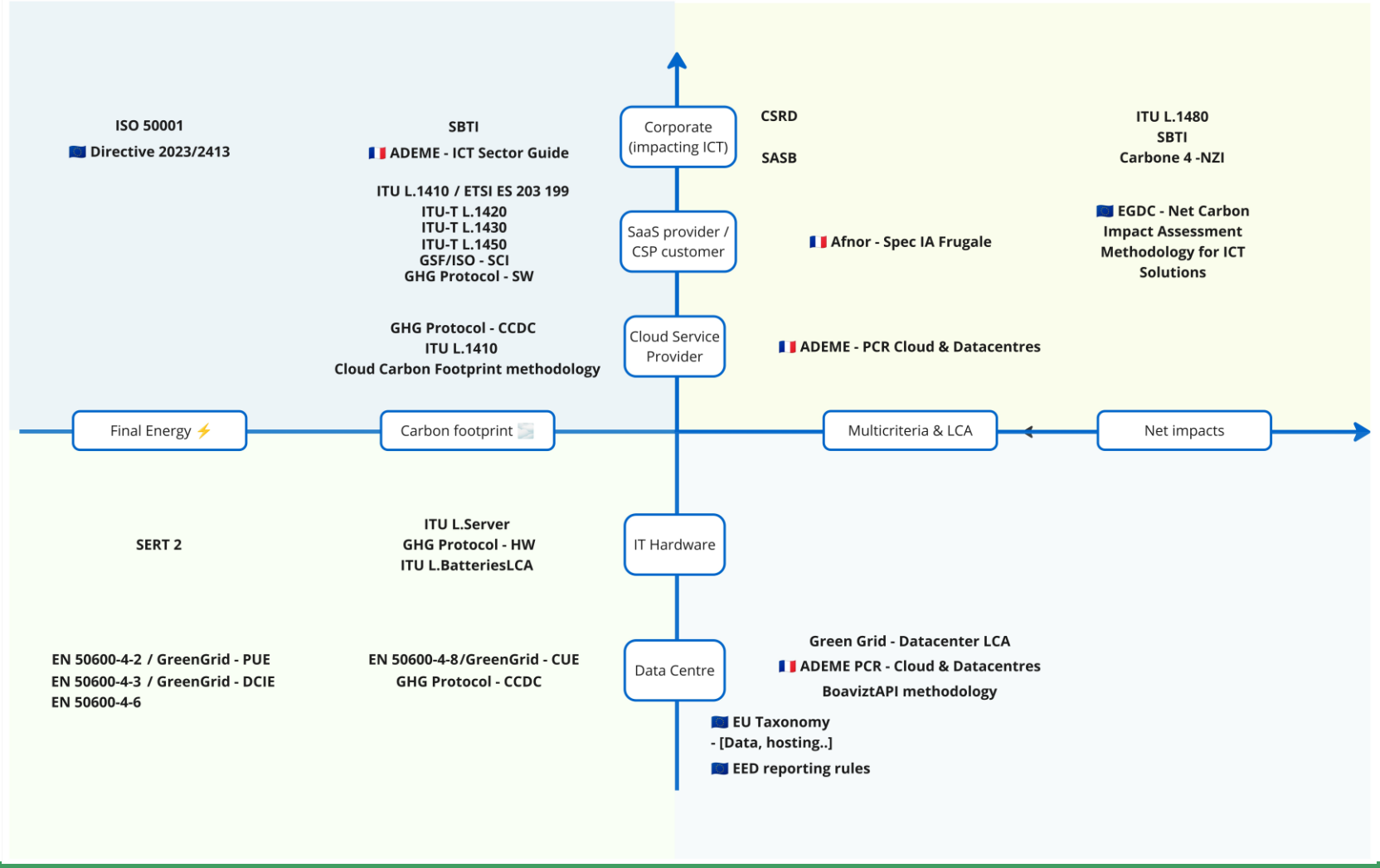
Instantaneous approach

- No need to collect data over one year
- Data updated every hour / day / etc.

**Ramp-up period :**

- Allow the use of target data during a period of ramp up.
- Constraints to be considered on the communication format.

# Clarify alignment with other standards




## Differences with the GHG Protocol

- Several environmental indicators
- Reuse of waste heat
- Allocation of infrastructure emissions
- Allocating computer equipment to a virtual machine

# Example of a calculation based on PCR

**Usage data**
Number of vCPUs reserved
Amount of RAM and/or storage reserved

**Infrastructure Data / DC**
Number of equipment
Ex: server
- Number of U
- Number of CPUs
- RAM capacity
- Storage capacity
- Power

**Environmental data**
Database

## Calculator

CloudAssess, LCA software, “home” calculator

**Allocations**
Calculating the footprint with PCR Cloud rules

## The footprint of your service

- To be integrated into invoices or dashboards.
- To determine eco-design levers.

$$Allocation_{UF7}^{Embodied} = \left( \frac{RatioFabCPU}{nbvCPU.H} \times \frac{nbvCPU.H}{nbvCPUPool.H} + \frac{RatioFabSto}{volSto.H} \times \frac{volSto.H}{volStoPool.H} \right)$$

# Example of a calculation based on PCR: UF2

## Inventory

| | Kind | Lifetime | CPU | RAM | Storage | Power |
|---|---|---|---|---|---|---|
| Srv-01 | Rack – 1U | 6 years old | 1x Xeon E5-1650 | 4x 16 GB | 1x 512 GB | 500 W |

## Environmental impacts

400 kg eq. $CO_2$

...

**Service usage: 1 month of server use**

Example of impact on manufacturing

$$\mathbf{Impact}_{\mathbf{Eqt}}^{\mathbf{Embodied}}(\mathbf{dU}) = \frac{dU}{DDV_{eqt}} \times \mathrm{ImpactEqt}^{\mathrm{Embodied}}(\mathrm{DDV_{Eqt}})$$

$$Impact_{Eqt}^{Manufacturing}(1month) = \frac{1month}{12months \times 6years} \times 400 = 5.6\ kg\ eq.CO_2$$

$$\mathbf{Impact}_{\mathbf{UF1}}^{\mathbf{Embodied}}(\mathbf{dU}) = dU \times PuissEqt \times \mathrm{ImpactUF1}^{\mathrm{Embodied}}$$

$$Impact_{Building}^{Manufacturing}(1month) = \frac{1month}{12months} \times 0.5kW \times 91 = 3.7\ kg\ eq.CO_2$$

# Next steps

- Global PCR DC/cloud development prospects
- Appropriation of the PCR: Excel calculator, collection of feedback, explanatory pages
- TCO certified : New Sustainability Certification for Cloud Infrastructure
- Leitmotiv EU Digital Policy Summit in May 2025

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# Thank you for your attention

## Any questions?