Initiatives to decarbonate the cloud

How carbonated is the cloud?
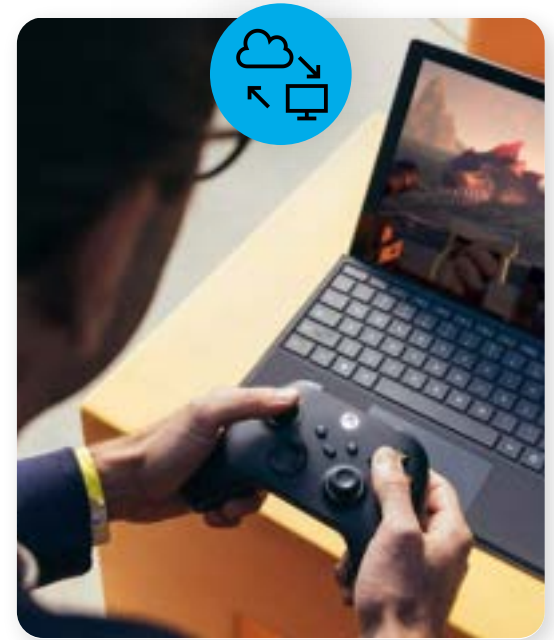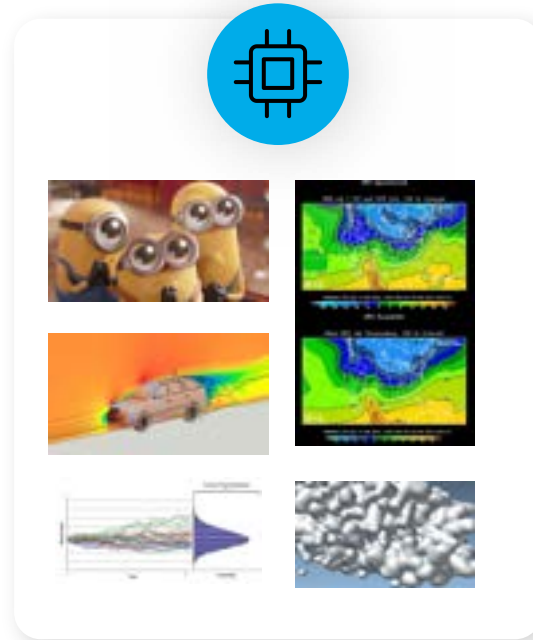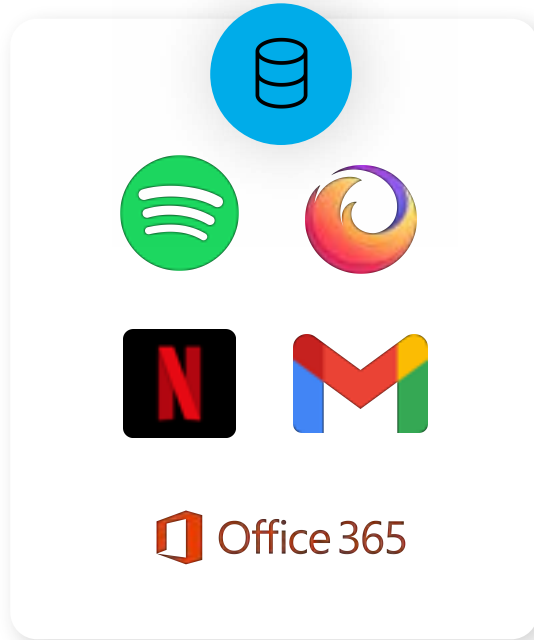
What are the levers to reduce it?

What about reusing heat?

QARNOT

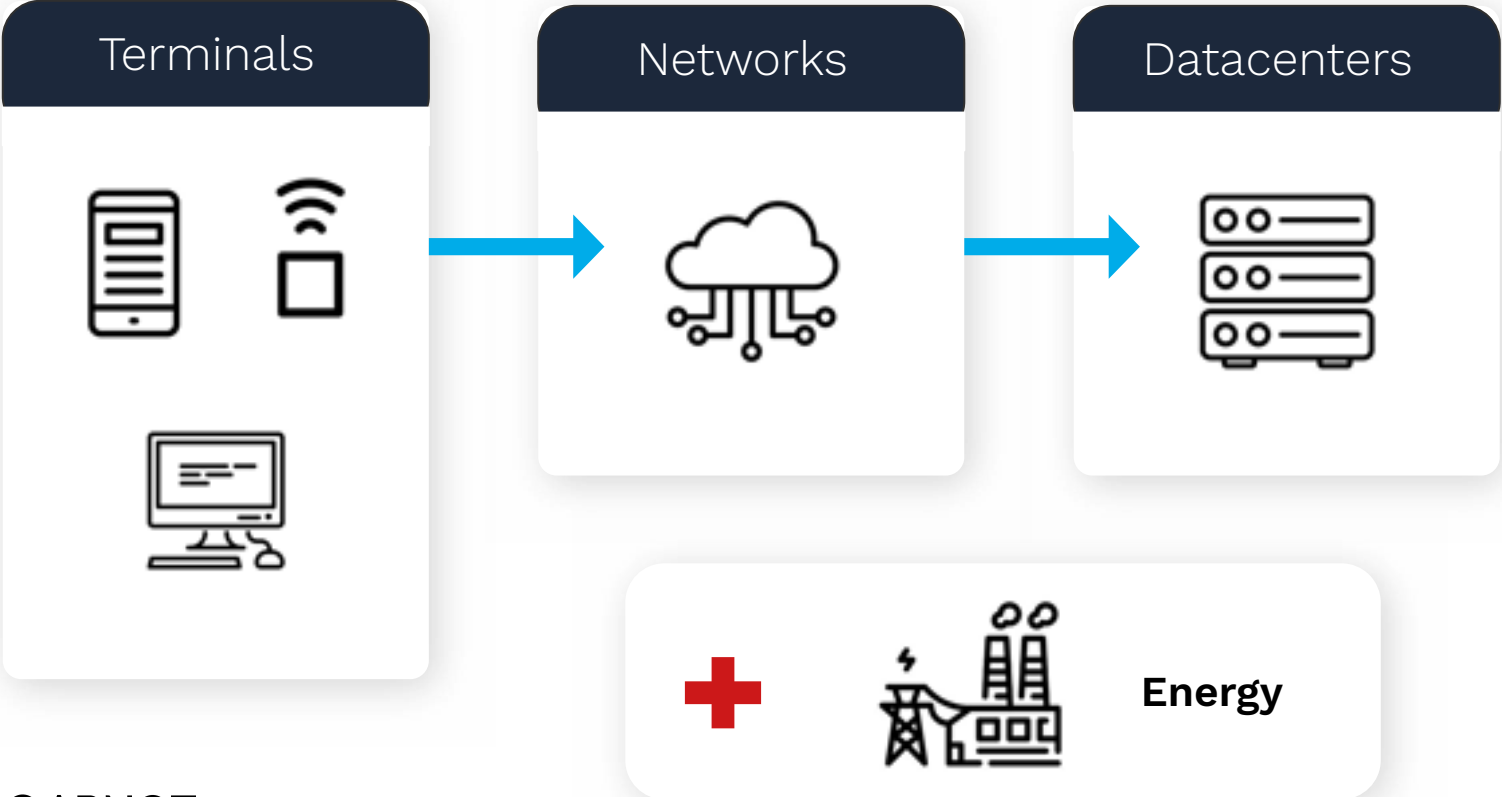# What is the cloud?

The cloud is composed of different services

What is the cloud?

QARNOT

What is the cloud?

Important infrastructures behind cloud services

Terminals → Networks → Datacenters

+ Energy

What is the cloud?

Internet cable laying vessel

Intel's Fab42 factory in Arizona, USA

Facebook datacenter in Texas, USA

Aluminium factory in Dunkerque, FR
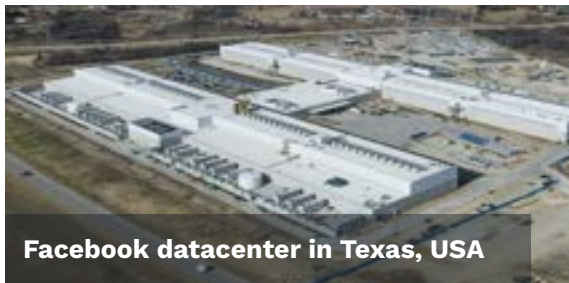
Digital pollution in a few figures

1,600 million tons of CO2 per year

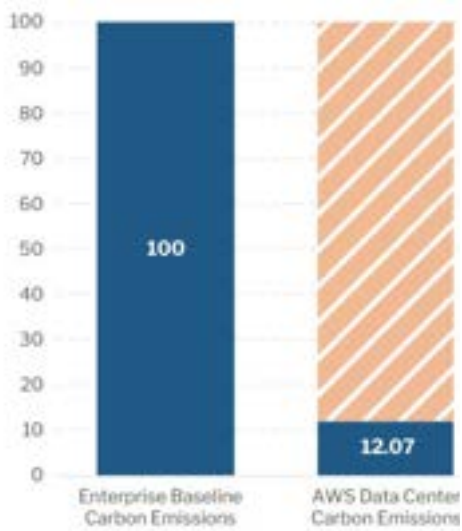**4%+** **of global carbon footprint**
More than the aviation industry

9% yearly increase

QARNOT

Qarnot

Communication of the hyperscalers

"Switching from on-prem to the cloud will save 90% of your carbon footprint"

Energy savings / Emissions savings with renewables — 52%, 79%, 92% 98%

Azure

Enterprise Baseline Carbon Emissions: 100
AWS Data Center Carbon Emissions: 12.07

aws

Communication of the hyperscalers

"The cloud is carbon neutral"

Neutres d'ici 2040

« Nous avons pour objectif d'atteindre zéro émission nette de CO_2 d'ici 2040 »

Négatif d'ici 2030

« D'ici 2030, Microsoft aura une empreinte carbone négative »

Neutre depuis 2007

« En 2007, nous étions la première grande entreprise à s'engager et à atteindre un bilan neutre en carbone »

Qarnot

How carbonated is the cloud?

What are the levers to reduce it?

What about reusing heat?

QARNOT

Carbon footprint of the cloud

Carbon footprint =
   energy consumption x **electricity mix**
   – energy double usage
   + manufacturing
   + end of life
   – carbon offset
   + …

QARNOT

Carbon footprint of the cloud

Carbon footprint =

    energy consumption x **electricity mix**

    – energy double usage
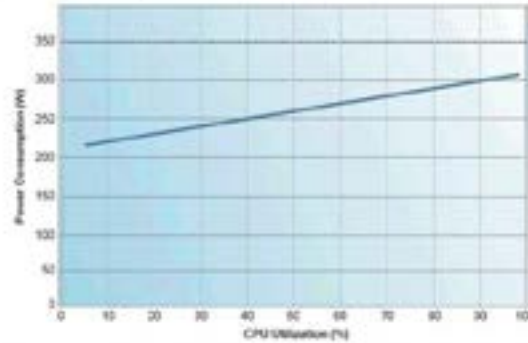
    + manufacturing

    + end of life

    – carbon offset
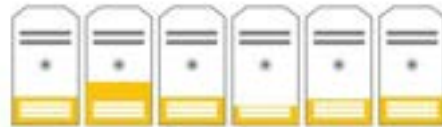
    + …

Reduce energy consumption

Increase utilization rate

CPU Utilization and Power Consumption (Source: Blackburn 2008)

Option 1: traditional solution

Option 2: cloud-based solution

Servers

Large number of servers with low utilization and (often) sub-optimal efficiency
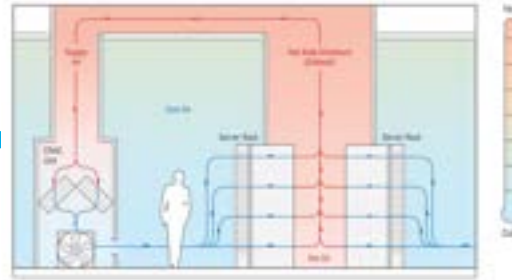
Smaller number of cloud servers with high utilization and efficiency

Reduce energy consumption

Traditional cooling

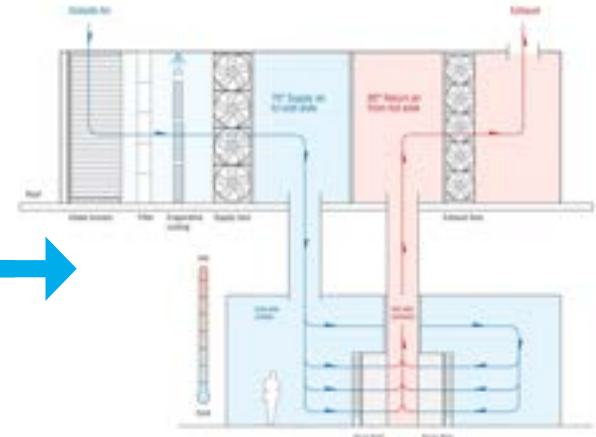**Hot aisle enclosure**

Free and evaporative cooling

QARNOT

Qarnot

Reduce energy consumption

Evolution of the cooling technology

Direct Liquid Cooling
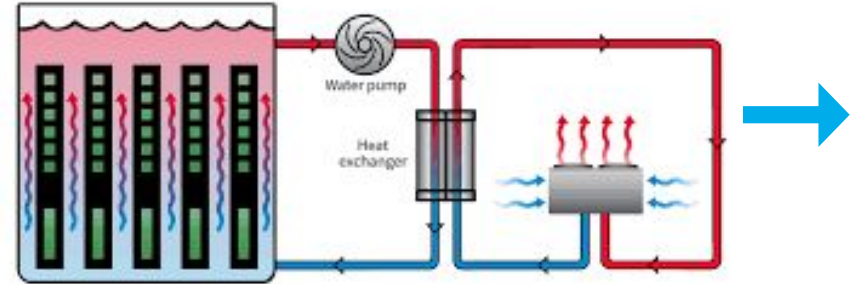
Immersion cooling

QARNOT

Qarnot

Reduce energy consumption

PUE

Power Usage Effectiveness

$$\frac{EnergyIT + EnergyCooling + EnergyMisc}{EnergyIT}$$

QARNOT

Qarnot

PUE : impact de la métrique

DC efficiency gains have flattened out, we need new perspectives
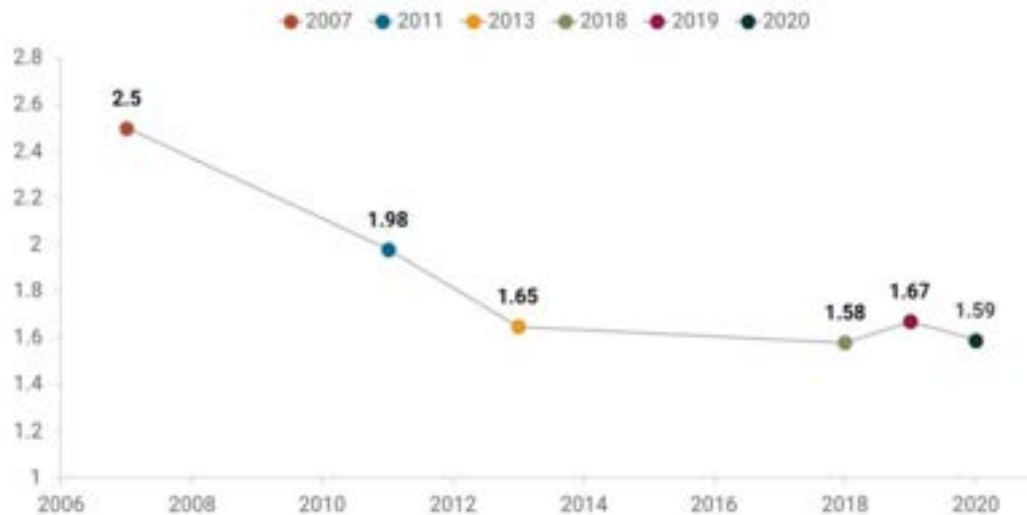
Source: Reported data center PUE figures in global Uptime Institute surveys from 2007 to 2020
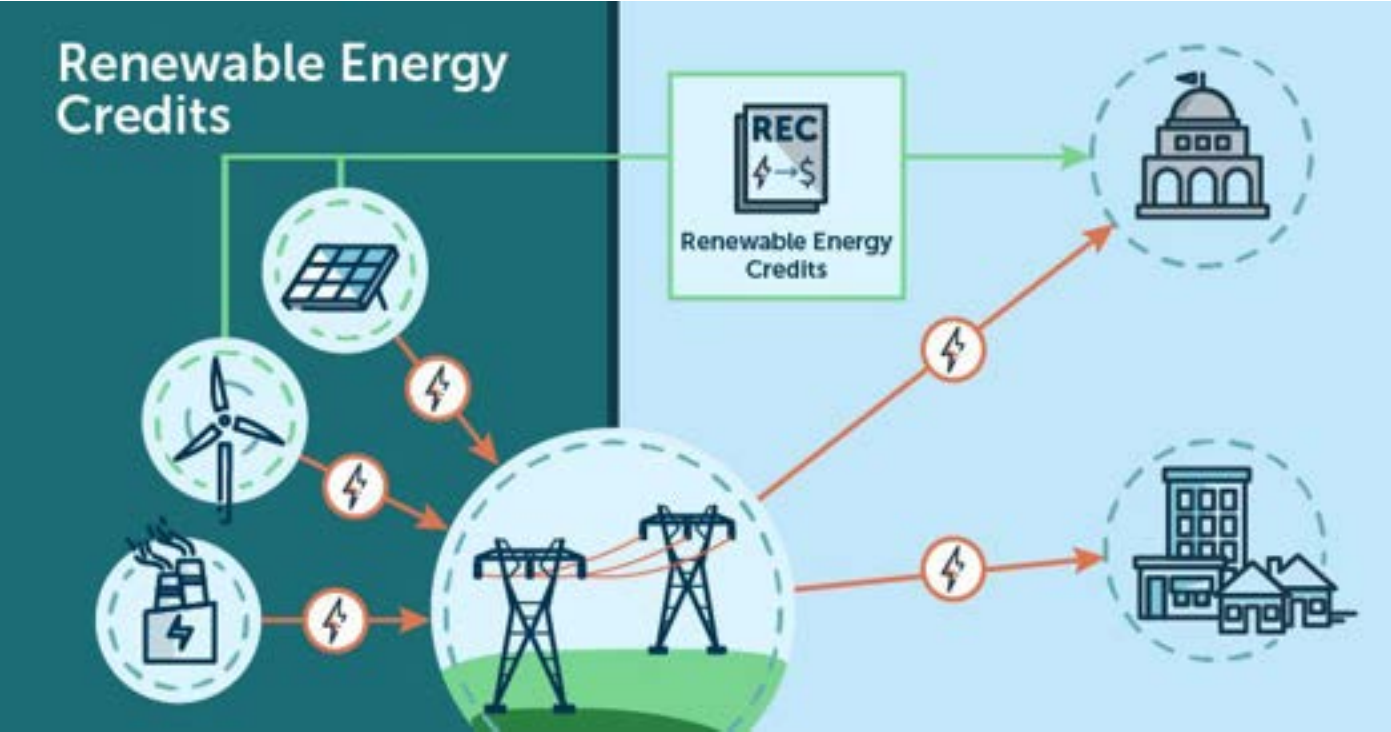
Uptime Institute | INTELLIGENCE

Carbon footprint of the cloud

Carbon footprint =
  energy consumption x **electricity mix**
  – energy double usage
  + manufacturing
  + end of life
  – carbon offset
  + …

QARNOT

Electrical mix

Buying renewables certificates doesn't help reaching Paris agreement targets

Carbon footprint =
      energy consumption x **electricity mix**
      – **energy double usage**
      + **manufacturing**
      + **end of life**
      – **carbon offset**
      + **…**

QARNOT

Carbon offsetting

Carbon offset is part of the solution but comes with a great deal of uncertainty

Today

In 30 years ???

Carbon footprint of the cloud

Carbon footprint =
 energy consumption x **electricity mix**
 – **energy double usage**
 + **manufacturing**
 + **end of life**
 – **carbon offset**
 + **…**

QARNOT

Carbon footprint of the cloud

Consider the full Life Cycle Analysis

Manufacturing   VS   **Usage**

QARNOT
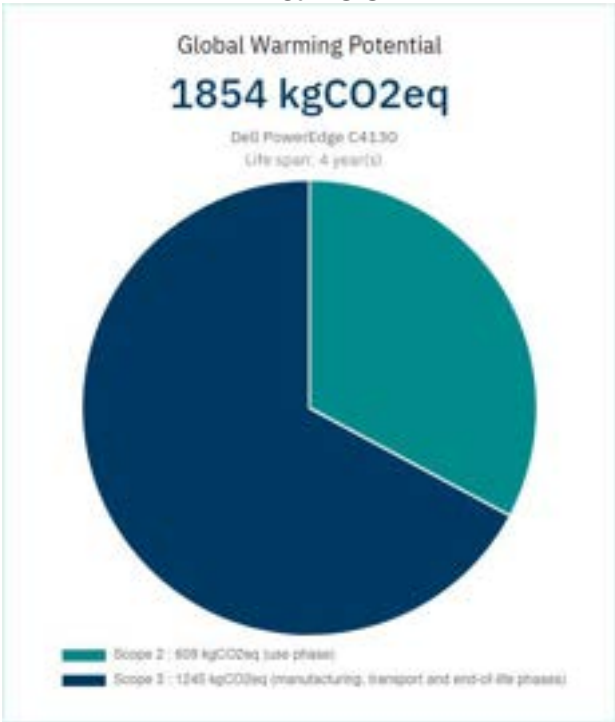
Carbon footprint of the cloud

Consider the full Life Cycle Analysis
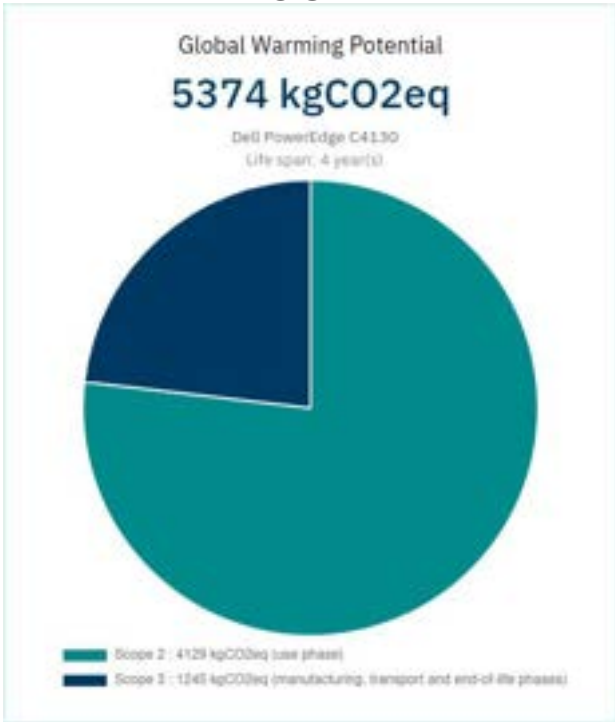
DC initiatives

Microsoft underwater datacenter

Scandinavian Datacenter

**Jean Zay supercomputer
heating IDRIS CNRS labs**

DC initiatives

Microsoft underwater datacenter
Pure marketing

What about maintenance?

Scandinavian Datacenter
Better

Reduced cooling
Better electricity mix?

**Jean Zay supercomputer
heating IDRIS CNRS labs**
Much better

Reduce used energy
Not reduced cooling

QARNOT

Sustainability is not just about carbon

Water usage

Environmental footprint =
carbon footprint
+ water usage
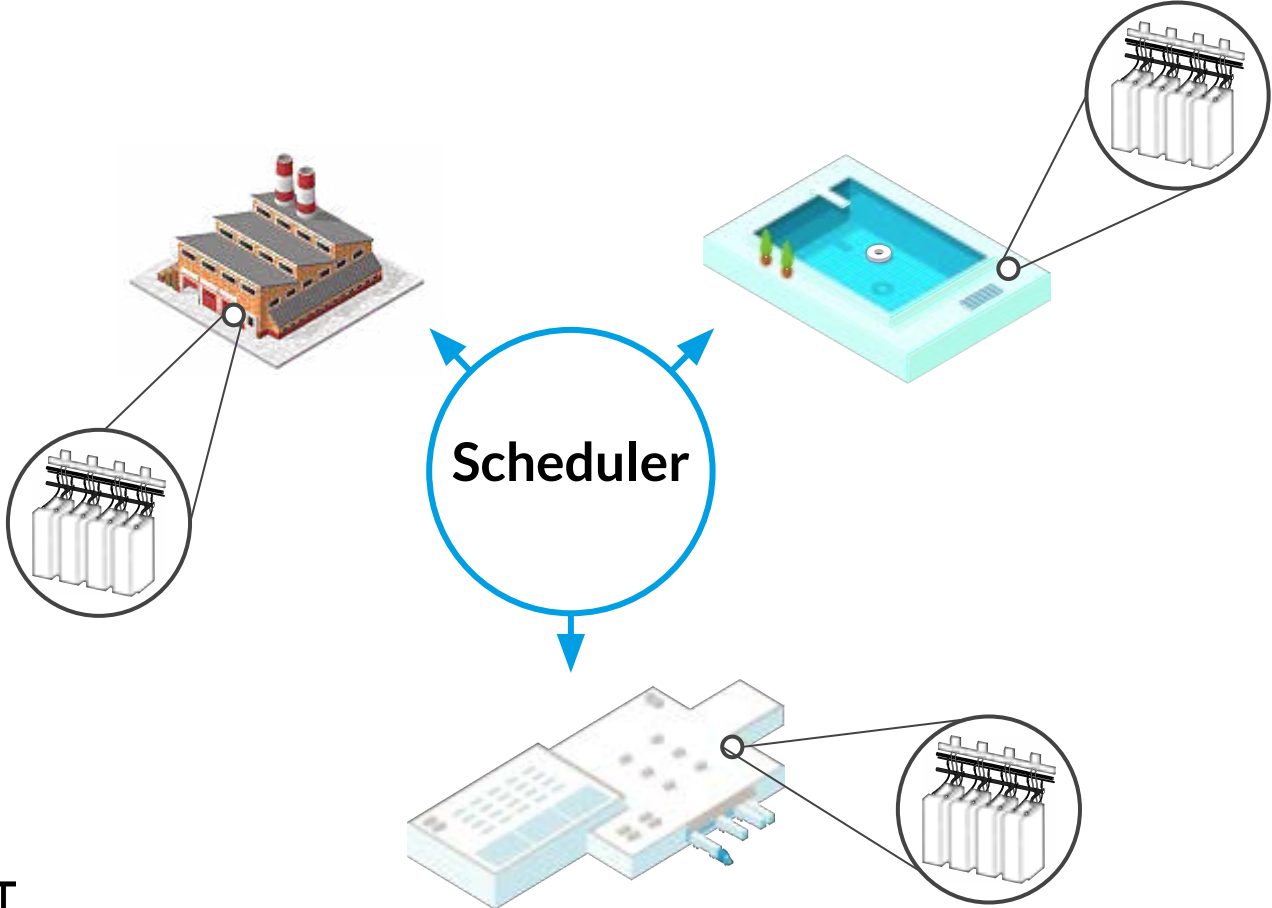**+ abiotic depletion**
+ …

Abiotic depletion

How carbonated is the cloud?
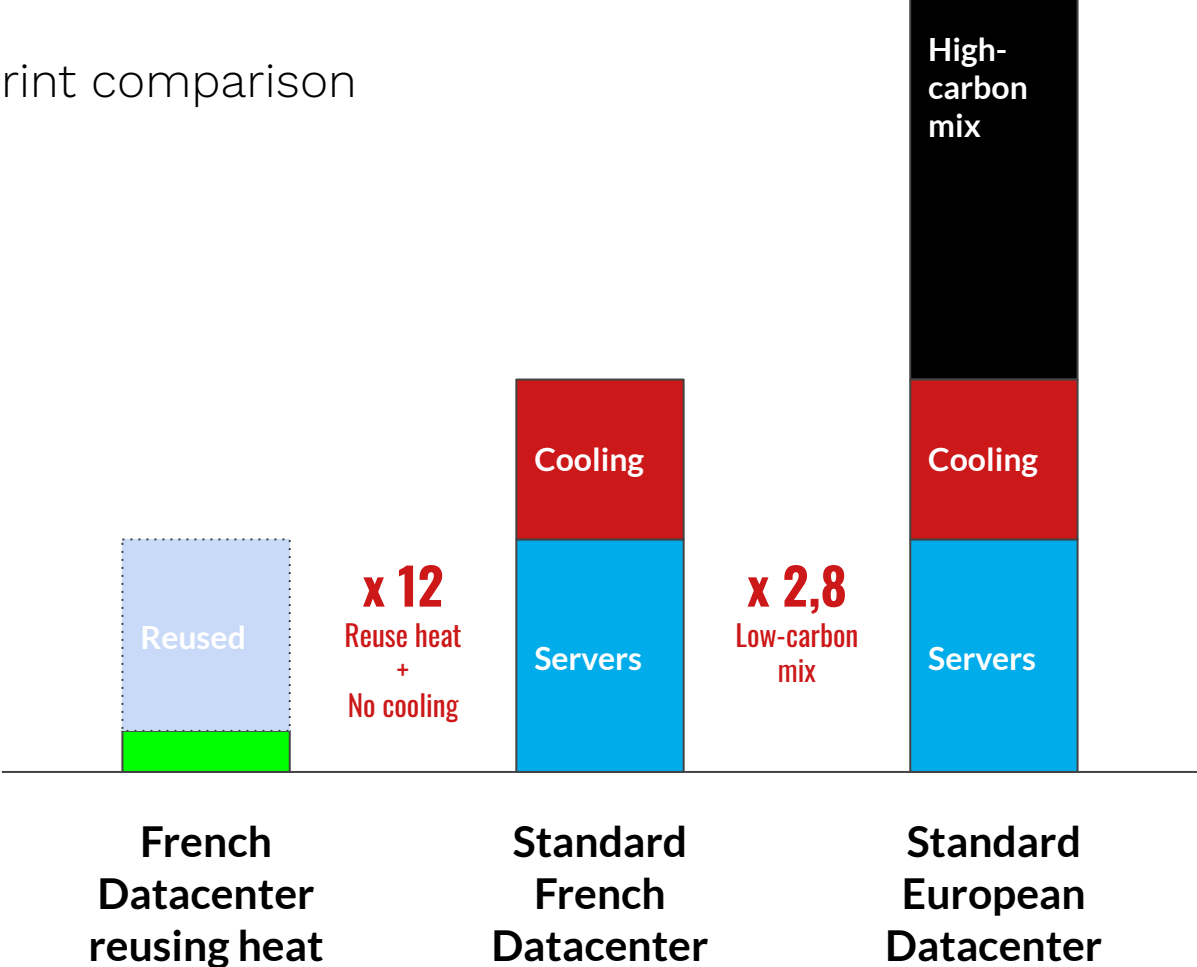
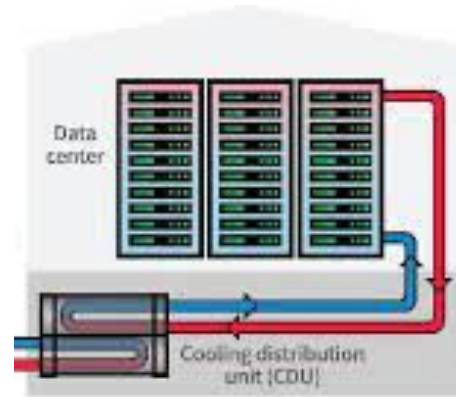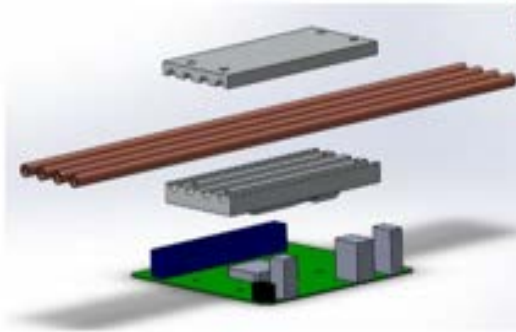What are the levers to reduce it?

What about reusing heat?

QARNOT

Installing our servers where the heat is needed

Scheduler

QARNOT

Carbon footprint comparison

French Datacenter reusing heat

Reused

x 12
Reuse heat
+
No cooling

Standard French Datacenter

Cooling

Servers

x 2,8
Low-carbon mix

Standard European Datacenter

High-carbon mix

Cooling
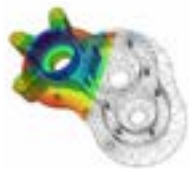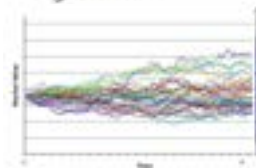
Servers

QARNOT

Qarnot

A specific hardware solution

Liquid to Liquid

Scalable to Data Center
Direct to Chip (D2C)

Computing
Clients who need computing power

Computing boiler

Building
Clients who need heat

QARNOT

Questions ?

Website: https://qarnot.com/fr

Blog: https://blog.qarnot.com/

Jobs or internships: https://qarnot.com/fr/rejoignez-nous
or email jobs@qarnot.com or remi@qarnot.com

QARNOT