

For a responsible and sustainable digital future

HOW TO REDUCE THE ENERGY CONSUMPTION AND CARBON FOOTPRINT OF DATA CENTRES AND IT ROOMS?

Use case with Flexible Datacenter from Orange Business
An expert report by AdVaes



BACKGROUND



REDUCING THE ENVIRONMENTAL FOOTPRINT OF A DATA CENTRE AND THE IT ROOMS THAT ARE HOUSED IN IT REQUIRES SPECIALISED EXPERTISE.

THE "FLEXIBLE DATACENTER" OFFERING BRINGS TOGETHER ALL THE KNOW-HOW OF ORANGE BUSINESS IN THIS FIELD.



Growing demand for data centres

Today, cloud computing services, virtual reality and artificial intelligence play a major role in the digital world. Projections show that by 2025, every person will be interacting with connected devices every 18 seconds [1], necessarily activating applications hosted in a data centre. As the demand for data flows and bandwidth increases, the need for data centres grows, leading to a significant expansion in the infrastructure and energy consumption required to run them.

Reducing the environmental impact

Global electricity consumption by data centres is estimated at between 240 and 340 TWh (terawatt hours), or around 1% to 1.3% of global final electricity demand [2]. Data centres also contribute more than 1% of global GHG* emissions [3].

In addition to the GHG emissions linked to the use of carbon-based energy, data centres contribute to air pollution when diesel-powered emergency generators are triggered or refrigerant leaks are detected.

Building and operation of data centres involves the consumption of increasingly stressed resources, such as water and raw materials.

Waste produced, particularly electrical and electronic equipment ending life, has a harmful impact on the environment if not properly treated.

Investing in green data centres to reduce the environmental impact of digital technology



Making data centres more sustainable is gaining ground. IT service providers have begun to implement actions to contribute more broadly to global carbon neutrality and to favour the use of renewable energies for their operations.

The environmental dimension of data centres is a key element of Orange Business' strategy, underlining its actions for a sustainable digital future. The company uses eco-responsible data centres for its offerings and also advises its customers in their choice, as well as in the optimisation of their IT infrastructures in order to reduce their impact.

Orange Business relies on its expertise, particularly in the designing of IT rooms in data centres, to optimise energy consumption through strategic choices such as the layout of cabling and the best density for equipment.

The company also stands out for its ability to identify areas for improvement in its customers' projects, proposing solutions and best practice in terms of equipment selection and rack design.

[1] IDC study "Data Age 2025: The Evolution of Data to Life-Critical", 2017

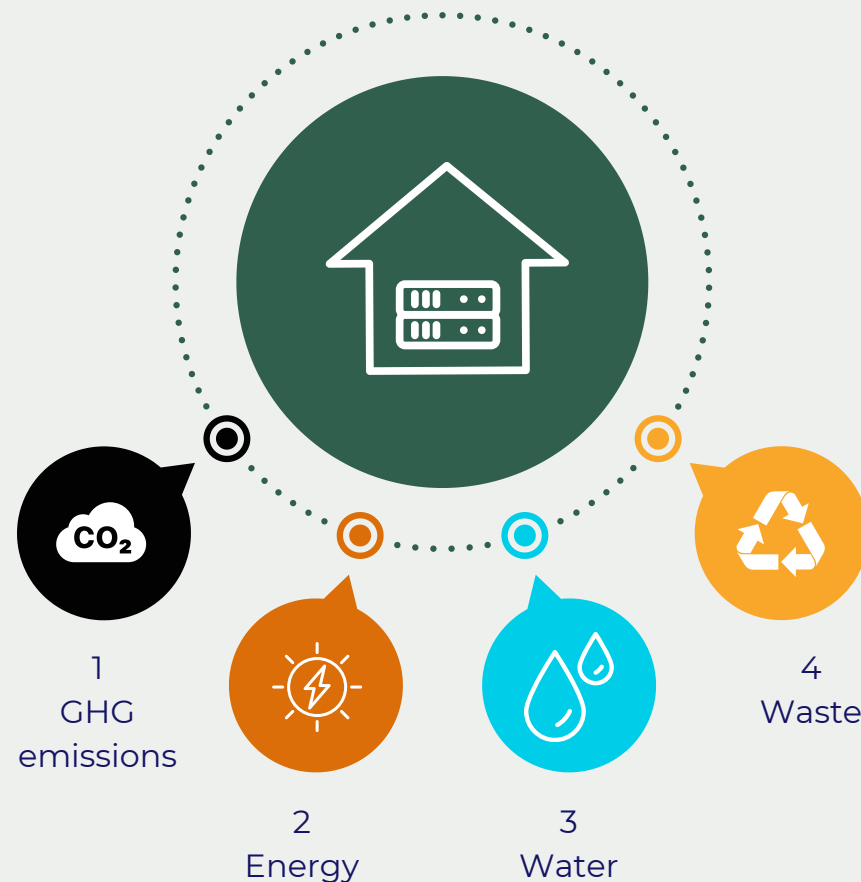
[2] International Energy Agency (IEA) "Data Centres and Data Transmission Networks", 2022

[3] McKinsey "The Datacenter Carbon Footprint: A Global Perspective", 2020

DATA CENTRES: 4 MAIN ENVIRONMENTAL IMPACTS

Integrating the environmental impact of data centres into its sustainable digital agenda means taking action to minimise it.

These actions focus on 4 priority areas:



1- GHG emissions

A data centre emits GHGs in two main ways: directly through diesel-powered backup generators and refrigerants in cooling systems, and indirectly through the consumption of energy that is more or less carbon-based.

These emissions can be reduced by using renewable and/or low-carbon energy sources and lower-impact cooling systems.

2- Energy

Data centres consume energy to operate and cool IT equipment. To reduce this consumption, it is essential to take action at various levels:

- In the layout of IT rooms, by adopting measures to improve their energy performance (e.g. confining corridors*);
- By investing in equipment that consumes less energy and in solutions that help to optimise consumption (data analytics, artificial intelligence, etc.).

3- Water

Water is used in data centres upstream in their building (cf. concrete) and in operations to cool IT rooms. Reducing water consumption is all the more important as water stress develops or can be high in some regions.

Resorting to cooling systems that use little or no water is a strategy increasingly favoured by data centre operators.

4- Waste

The electrical and electronic waste (WEEE*) collected, and also that resulting from the destruction of data centres, contains toxic and harmful components. They are a danger to the environment, biodiversity and human health.

The depletion of resources also calls for efficient management of this waste through various mechanisms (life extension, recycling, reuse and reconditioning).

ENVIRONMENTAL PRACTICES IN DATA CENTRES

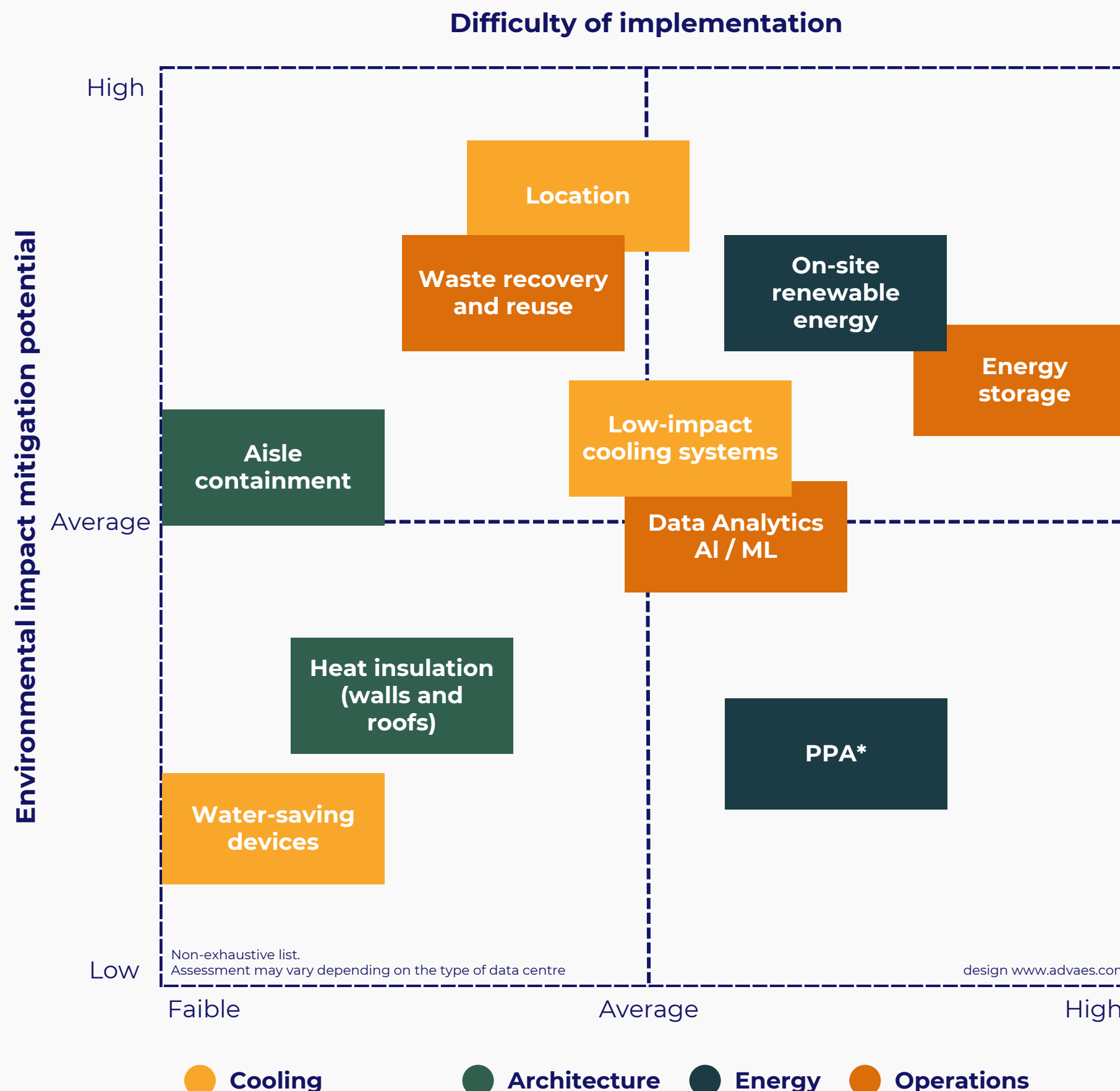
Some environmental measures adopted in data centres



Various approaches have been adopted to reduce the environmental impact of data centres. They are often correlated with factors such as buildings' age, site locations, energy sources available, size, and capacity in terms of technological support.

Choosing between all that approaches is not always easy. There is often a trade-off between the difficulty of implementing them and their potential to reduce the environmental impact of the data centre.

The following matrix positions some of the most frequently encountered measures according to two axes: the potential of mitigation and the difficulty of its implementation, by evaluating them on a scale from low to high. The list is not exhaustive, nor is detailing specificities of each of these practices. It provides an overview of what is possible.



Le Groupe Orange a lancé un programme local d'amélioration continue des performances énergétiques de ses data centers, englobant ceux historiques confrontés à des contraintes de vieillissement. Ce programme comprend, entre autres :

- Cloisonnement des flux d'air en salle informatique ;
- Urbanisation des salles avec calfeutrage ;
- Audits de salle ;
- Optimisation des automates de régulation thermique.



THE “FLEXIBLE DATACENTER” OFFERING FROM ORANGE BUSINESS

Presentation

"Flexible Datacenter" from Orange Business is a colocation* and first-level hosting offering, to which local services are added (racking or cabling, for example, carried out by the company's experts). For specific customer contexts, Orange Business can offer colocation without additional services.

This offering enables customers to:

- Have the fundamental services of any hosting service. Orange Business operates buildings, space, square metres, network, energy and physical security on customer behalf;
- Evolve, at their own pace, to integrate value-added services from Orange Business, including the management of their equipment and IT environments, particularly in private cloud configurations. "Flexible Data Center" addresses both external private cloud offerings and the Group's internal needs (internal shared-cloud).

Orange Group data centre sites selected for this offering in France are listed below. They are among the Group's most efficient data centres.



Orange's next-generation data centres in France



Val-de-Reuil

PUE*
1.29 to 1.34

WUE*
< 0.00

Built in 2012, this site houses 2 data centres, the first of which has been in operation since 2012 and the second since 2021. Two other data centres can still be deployed on this 18-hectare campus.



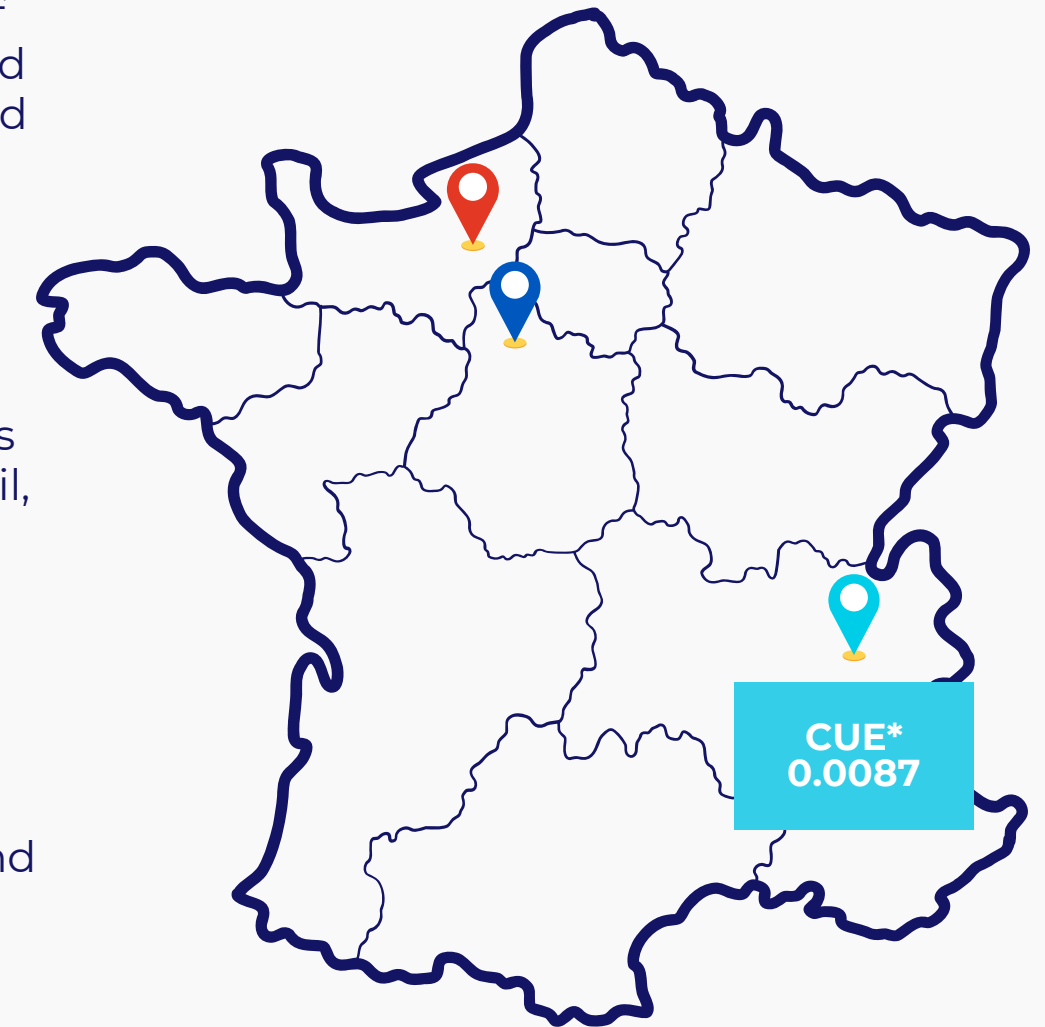
Chartres

This site houses 1 data centre, opened in 2022. It houses 5,000 m² of IT rooms. Located 100 km from Val-de-Reuil, it offers synchronous replication in less than 3 milliseconds (dual site).



Grenoble

This site houses 1 data centre commissioned in 2011 and managed locally by the Orange Business teams in Grenoble. It is a former industrial site that has been renovated. The special features of the renovated building and the site are an asset for this data centre.



Orange France has set ambitious targets for improving the energy performance of its data centres. The consolidation of its data centres over the period 2012 - 2030 is part of the environmental strategy adopted by its technical direction with :

- **Building new data centres with improved energy efficiency at the Val-de-Reuil, Chartes and Grenoble sites.**
- **The closure of historical data centres, which consume more energy.**

More details on this offering: [see the Orange Business website.](#)

FLEXIBLE DATACENTER SERVICES

How Flexible Datacenter came about

Over and above purely technical considerations, the environmental dimension is now an increasingly important part of customers' agendas. Their choice of data centres and associated services takes this factor into account: energy consumption and the carbon footprint of buildings and services delivered are being looked at more closely.

This environmental dimension has become an important factor in decision-making, particularly in the choice of cloud services.

Orange Business is incorporating it as a key differentiator, alongside security and trust.

In France, the data centres operated by Orange Business for its cloud services are those of Orange located in Val-de-Reuil, Chartres and Grenoble. They use free cooling* as the cooling system for IT rooms. This technology saves 80% of energy per year compared with a data centre using older-generation cooling systems, such as refrigerated towers or air conditioning.

Value-added services

Orange France has recognised expertise in data centre urbanism, enabling it to optimise the energy consumption of infrastructure deployed in its data centres: how to rack and cable, to densify racks and equipment (e.g. deploying consoles of more than 7 or even 10 kW instead of 5 racks, each of which consumes 2 to 3 kW), to deploy on a minimum number of racks, to reduce the footprint as much as possible.

Orange Business relies on this expertise, which sets it apart from other traditional colocation offerings on the market. In addition, consulting services help customers to better organise and deploy their IT rooms.

Another of Orange Business' strengths lies in its ability to question and challenge customer specifications at a very early stage, and to deliver best practice (advice on equipment selection, rack design, etc.).

STRENGTHS OF FLEXIBLE DATACENTER

Through partnerships with major data centre operators (Equinix, Digital Realty and other local players), "Flexible Datacenter" extends beyond France to provide global coverage with physical and virtual locations based on:

-  **Security**
-  **Sovereignty**
-  **Availability**
-  **Environmental commitment**
-  **Cutting-edge technologies**



A brief history of the Grenoble data centre

The building previously belonged to Alstom (an industrial site used for radiography and quality control of turbine welds manufactured by the company). The original features of this building are one of the strengths of this data centre. The concrete walls are 2 metres thick and the ceiling 1.5 metres (the thickness that protects the surrounding area from the X-rays taken by Alstom at the time). In addition to security level, the excellent heat inertia means that electricity consumption is more effectively controlled, unlike other building materials used by competing data centres.

ECO-RESPONSIBILITY IN ORANGE FRANCE DATA CENTRES AND ORANGE BUSINESS SERVICES

WASTE

WEEE is collected and processed by Ecologic, a government-approved eco-organisation. Since 2019, efforts have been made to extend the lifespan of equipment, to use it for longer than the manufacturer's warranty, and to encourage re-use (circular economy).

ARCHITECTURE AND URBANISM

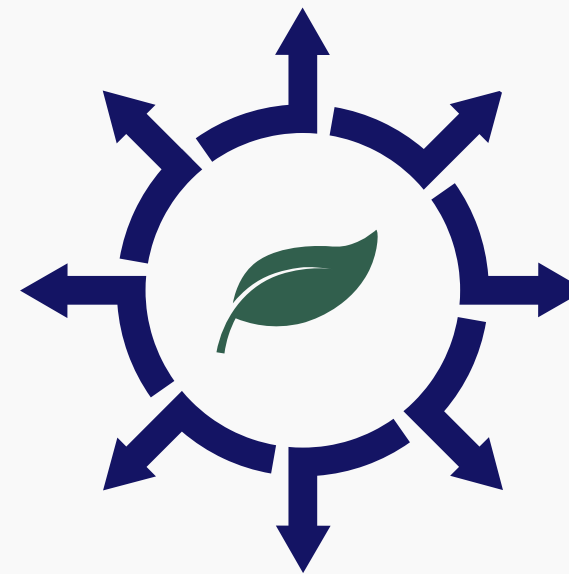
The architecture of Orange France's data centres enables energy consumption to be optimised (partitioning of air flows, wider temperature and humidity ranges, draught-proofing, etc.). Automatic controls ensure that only the energy that is strictly necessary is used.

COOLING

The Chartres and Val-de-Reuil data centres use a cooling system based on free cooling*. The Grenoble data centre uses a cooling system that draws on groundwater, similar to river cooling. All consume very little water.

RENEWABLE ENERGIES

The aim is to achieve a 50% share of renewable energy* in total energy consumption, compared with 26% in 2023. The Orange Group has signed a PPA* with Boralex, France's leading producer of nearshore wind power. The Grenoble data centre uses energy from photovoltaic panels installed on the roof and façade of the building.



UPS*

Work has been carried out on UPS in order to renew the batteries so that they have less impact.

UPS with efficiencies in excess of 95% from 25% load have been deployed, along with very low-loss electrical transformers and vegetable oil transformers for the Grenoble site.

BACK-UP SYSTEMS

At the Grenoble data centre, discussions have been launched with local players to replace the generators with hydrogen fuel cells. At the Chartres and Val-de-Reuil sites, the Tier-IV certified architecture requires 2N+1 redundancy for the oil-fired generators.

AUDITS AND CERTIFICATIONS

The data centre operating teams are responsible for maintaining energy performance levels. The data centres are certified :

- ISO 14001*
- ISO 50001
- HQE* CERTIFIED

Audits are carried out every year by AFNOR.

THE GROUP'S COMMITMENTS

The Orange Group has strong commitments to decarbonisation by 2025: reducing CO₂ emissions by -30% compared with 2015.

These ambitions directly affect its data centres as well as all its offerings and those of its subsidiaries, such as Orange Business.

key results



Free cooling saves up to 80% of energy per year compared with traditional data centres.

A saving of 240 MWh per year, per room, according to Orange Labs Network.



Cooling systems chosen for Orange France's data centres, which house IT rooms managed by Oranges Business, consume virtually no water. Their WUE is close to 0.



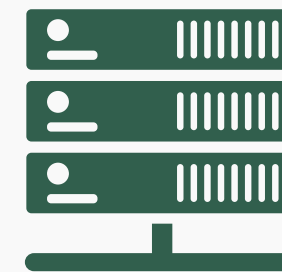
Measures adopted in data centres have led to a reduction in electricity consumption since 2015.



Rack and equipment densification allows configurations can exceed 7 kW per rack, or even 10 kW, instead of deploying 5 racks that consume 2 to 3 kW each.



IT rooms managed by Orange Business in Orange France's data centres has enabled a major retailer to halve its demand for KVA.



Orange Business is extending to 7 and 8 years the lifespan of the servers deployed in Orange France's data centres and used for its cloud offerings.



The Grenoble data centre: a unique cooling system

The Grenoble data centre uses a cooling system that takes advantage of groundwater [4]. This is a particular geological feature of the Grenoble triangle.

The data centre's internal cooling water circuits exchange heat with water from the water table, whose temperature of 13 degrees Celsius is constant in both summer and winter, and to which no solvents or other products are added.

At the end of the circuit, the water is discharged a few degrees warmer, at around 17 degrees Celsius.

The electricity consumed for cooling is relative to that consumed to power the pumps that capture the water from the water table and discharge it at the end of the circuit.

The de facto WUE of this data centre is 0.

[4] Note: this is the water table that supplies the whole of the Grenoble urban area, between the Drac and Isère rivers, and is found at a depth of 30 metres.

CONCLUSION, AREAS FOR PROGRESS AND NEXT STEPS

A dedicated division at Orange Business

Orange Business' Global Delivery & Operations division manages all the issues associated with the global lifecycle of a data centre:

- It supports customers in their choice of data centre infrastructure (internal vs. external, for example) and location;
- It helps them define whether a 'multi-site' approach is necessary and, if so, the best location and even the distance to be respected between sites;
- It also helps them to specify their operational policy in terms of hosting or with regard to suppliers, based on local expertise where necessary.

This division manage the operations of Orange Business and its customers in nearly 110 buildings around the world in 2023, including around 15 internal buildings (including Eolas data centres, those of Orange France, as well as points of presence or PoPs hosting Group's major networks).

Major results for customers

Between square metres of building used, the architecture chosen for the IT rooms and for equipment deployment, optimisation actions carried out, energy supply contract negotiated, etc., differences in budget and energy consumption can be enormous for customers.

Beyond that, they reduce the environmental impact of IT. For data centre operations, the lever for reducing environmental impact mainly concerns buildings and reducing energy consumption. Beyond that, it's up to customers to take action on their own usage, and to use it as sensibly as possible. Orange Business can also help them to do this through its other areas of expertise (e.g. eco-design).

Developing tools for customers

Orange Business receives requests from customers as to better understand and follow their energy consumption. This is currently a very difficult exercise, for a number of reasons: complexity of network component integration, level of shared environments, etc.

At the Grenoble site, however, there are PDUs* that measure power consumption rack by rack. This means that customers can manage their consumption and carry out operations remotely (view, control, restart a rack, get a certain amount of information on consumption).

Areas of improvement

There is still work to be done to improve the KPIs (PUE, WUE, CUE) and to have comparable assessments depending on data centres. There is a need for commitment and a collective effort on the part of the industry to organise controls and ensure that the figures used to assess the environmental footprint of data centres are not open to question.

“

CUSTOMERS MUST ALSO ACT CHANGING THEIR HABITS BY DESIGNING APPLICATIONS AND ADOPTING IT SERVICES THAT ARE MORE SUSTAINABLE AND RESPECTFUL OF INFRASTRUCTURES.

”

GLOSSARY

Containment: The containment in data centres allows cold air flows to be optimally separated from hot air flows, contributing to cooling efficiency and reducing associated energy consumption.

Colocation: A hosting model that allows an organisation to rent space in a third-party data centre to house its IT room. The organisation is responsible for installing and maintaining the equipment deployed in its IT room, while the data centre operator is responsible for the building infrastructure and associated services, such as air conditioning, power supply, security and network connectivity.

CUE (Carbon Usage Effectiveness): Indicator used to assess the quantity of CO₂ emitted per unit of IT energy consumed in a data centre.

Free cooling: A cooling system that uses outside air to cool a data centre. Outside air is drawn into the data centre and circulated through ducts, usually through the floor, cooling the IT rooms where servers and other IT equipment are housed. The cold air absorbs the heat emitted by this equipment and the resulting warmer air is exhausted outside via another corridor. When the outside temperature is too high, other cooling systems can be activated as a relay (such as adiabatic systems). Free cooling is generally used in areas where outdoor temperatures are relatively stable and low.

Greenhouse gas emissions: Greenhouse gases (GHGs) are present in the atmosphere, retaining some of the heat received from the sun's rays and having a major impact on climate regulation (rising temperatures). Some GHGs are emitted naturally and/or as a result of human activity. The main GHGs include: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases.

HQE (High Environmental Quality): A global approach that aims to reconcile the challenges of sustainable development and economic performance in the building sector.

ISO 14001: International standard for environmental management systems (EMS).

ISO 50001: International standard for energy management systems (EMS).

PPA (Power Purchase Agreement): Energy contracts negotiated over the long term, increasingly targeting renewable or low-carbon energies certified as "guarantee of origin".

PDU (Power Distribution Unit): A device that distributes electrical power to several pieces of equipment in a data centre. Usually located in the data centre's power rack, it is connected to the main electrical network.

PUE (Power Usage Effectiveness): Indicator of the energy efficiency of a data centre. This is the ratio between the total energy consumed by the data centre and the energy consumed exclusively by the hosted IT systems. An indicator close to 1 means that the data centre is efficient in its energy consumption.

Renewable energy (RE): Energy that comes from natural sources that renew themselves at a higher rate than they are consumed. It should not be confused with low-carbon energy, which is energy that emits little or no greenhouse gases. Low-carbon energies include renewable energies and other energy sources, such as nuclear or hydrogen.

UPS (Uninterruptible Power Supply): System used as a back-up by data centres. This is a device that provides emergency power to critical equipment in the event of a power failure.

WEEE (Waste from Electrical and Electronic Equipment): Waste that uses electricity or electromagnetic fields, such as computers, televisions, refrigerators, mobile phones, etc. This hazardous waste contains regulated substances such as mercury, lead and cadmium.

WUE (Water Usage Effectiveness): Indicator that measures the amount of water used by a data centre for cooling and other building needs. The closer it is to 0, the better.

ABOUT

Methodology

The information analysed and published in this report comes from internal Orange Business documents (reports, technical documentation, use case studies, notes and internal work), interviews with experts on the subject addressed, supplemented by information from recognised external public sources and/or AdVaes internal databases and analyses.

CSR at Orange Group

As a subsidiary of the Orange Group, Orange Business follows the charter of its majority shareholder.

[This charter is available on the Group's website.](#)

The Orange Group's Corporate Social Responsibility (CSR) policy focuses on the following areas:

- Governance;
- Fundamental freedoms;
- Digital inclusion and territories
- Ecological and energy transition;
- Responsible products, services and uses;
- And the responsible employer.

Detailed information on the Orange Group's CSR policy and commitments is available on the online media library: gallery.orange.com/RSE.

About Orange Business

Orange Business is a digital services company belonging to the Orange Group, with expertise in networks, connectivity and digital solutions integration (service platforms, data analysis, cloud solutions, etc.).

The company supports private companies and public organisations worldwide in their sustainable digital transformation. It combines a global presence with a local approach, supported by more than 29,000 employees who are experts in business issues. It defends an ethical, responsible and inclusive vision of digital, while helping its customers to reinvent their services.

About AdVaes

AdVaes is a neutral and independent market intelligence and operational strategy consultancy specialising in the analysis of cloud computing and data markets and the ESG approaches of digital service providers.

The company helps organisations to develop and implement their strategy, to enhance the value of their actions and investments, and to make informed decisions in terms of innovation with the cloud, and on ESG issues of digital and reducing the environmental impact of IT activities. The company supports executives, their managers and their employees in 4 operational areas: insights, assessments, anticipation and/or awareness.



ORANGE BUSINESS THANKS ADVAES AND ITS INTERNAL TEAMS FOR THEIR CONTRIBUTION TO THE PREPARATION OF THIS REPORT.



Business



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