DREES & SOMMER

THINKING AHEAD

# GREEN DATA CENTERS AS A VISION OF THE FUTURE



THINKING AHEAD

# GREEN DATA CENTERS AS A VISION OF THE FUTURE

In an increasingly digitized world, data centers form the backbone of global infrastructure. But the rapidly increasing demand for cloud services and the boom in artificial intelligence means that the energy consumption of these facilities is also skyrocketing. At the same time, however, the global climate crisis is leading to a greater focus on the sustainability of data centers. Companies therefore face the challenge of operating their digital services efficiently, while at the same time minimizing their environmental footprint.

This report highlights the latest developments and technologies that are making data centers more sustainable – from renewable energy sources to innovative cooling technologies and the use of recyclable materials. It shows how leading companies are striking a balance between performance and environmental responsibility, and describes the economic benefits sustainable strategies can offer.



THINKING AHEAD

# ABOUT DREES & SOMMER

Drees & Sommer is a leading consulting firm with extensive expertise in the planning, development and implementation of data center projects. With more than 50 years' experience and a strong focus on Environmental, Social, Governance (ESG) criteria, Drees & Sommer stands for a consistent and holistic sustainability strategy.

Economy, ecology and social issues are inseparably intertwined. Our aim is not only to make progress within our own company in terms of climate protection and social engagement, but also to systematically integrate sustainability into our consulting and planning projects and to support our customers on their way to becoming sustainable organizations.



© Petmal – gettyimages.com

## VISION

A clear vision with innovative, holistic approaches offers crucial added value. But how can cost-efficiency and sustainability be combined?

## REQUIRE-MENTS

Statutory provisions increase the pressure to comply with environmental regulations and to report what measures have been taken. How can market requirements be efficiently integrated into the strategy?

## PACKAGES

Sustainability covers a broad spectrum. What data center solutions are already available on the market?

## HOLISTIC SOLUTION

Clever strategic integration for a green future. Which measures lead to success and should be prioritized?

VISION

# OUR VISION

THE SOLUTION LIES IN INNOVATIVE APPROACHES THAT NOT ONLY REDUCE THE ENVIRONMENTAL FOOTPRINT, BUT ALSO CREATE ECONOMIC ADDED VALUE. RENEWABLE ENERGY, RECYCLABLE MATERIALS AND THE SMART USE OF WASTE HEAT ARE JUST SOME OF THE NUMEROUS ELEMENTS THAT CAN SECURE A SUSTAINABLE FUTURE FOR DATA CENTERS. AGAINST THE BACKGROUND OF THIS PROFOUND CHANGE, DREES & SOMMER DATA CENTER EXPERTS HAVE DEVELOPED SOLUTIONS FOR SUSTAINABLE DATA CENTERS AND SHOW HOW THESE TECHNOLOGIES CAN BE SUCCESSFULLY USED TO FIND A BALANCE BETWEEN COST-EFFICIENCY AND ENVIRONMENTAL RESPONSIBILITY.



We hope this report will offer you inspiration on how your company can make a valuable contribution to a greener future by building a sustainable data center.

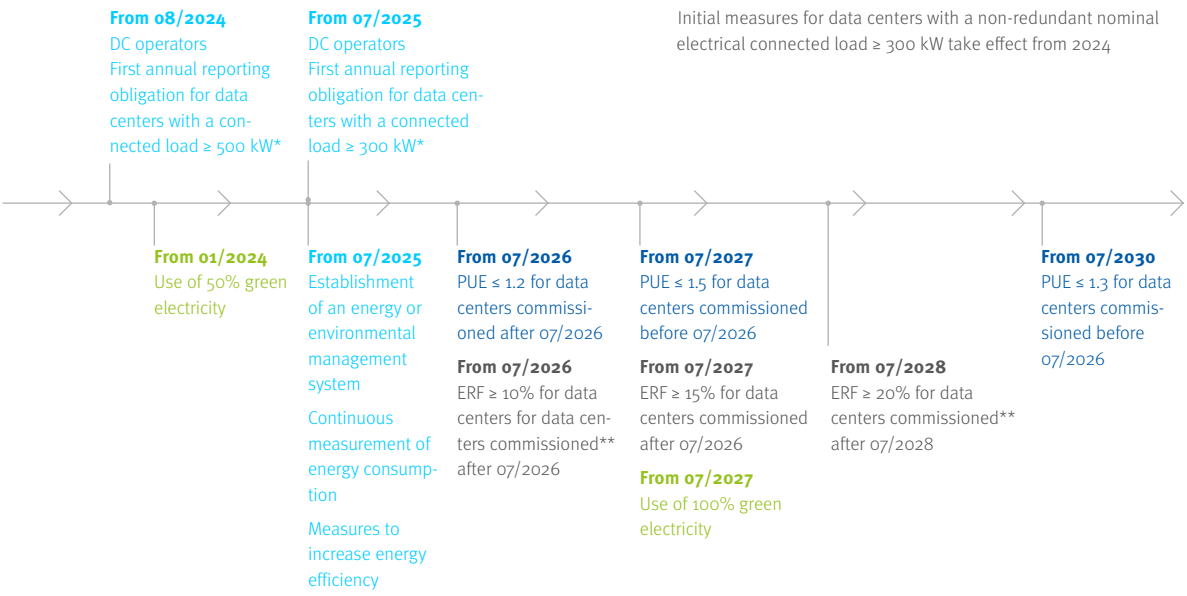
# NEW REQUIREMENTS FULLY UNDER CONTROL

MEETING **STRICT ESG REQUIREMENTS** IS AN ESSENTIAL PART OF TODAY'S CORPORATE REALITY. DEMANDS WITH REGARD TO SUSTAINABLE BUSINESS PRACTICES ARE CONSTANTLY INCREASING – AND WITH THEM THE PRESSURE TO COMPLY WITH ENVIRONMENTAL REGULATIONS.

Companies have to do more to live up to their environmental responsibilities. In addition, increasingly stringent regulations require comprehensive reporting and disclosure of the appropriate measures they have taken. Several directives are particularly relevant here: The Corporate Sustainable Reporting Directive (CSRD), which requires detailed sustainability reports, the Energy Efficiency Directive (EED), which regulates energy efficiency in companies, and the Energy Performance of Buildings Directive (EPBD), which is intended to make buildings more energy-efficient. In addition, the 'Fit for 55' program aims to achieve EU climate goals.

Compliance with national legal requirements is becoming increasingly complex, especially for data centers. The (German) Energy Efficiency Act (EnEfG) requires companies to take strict measures to reduce energy consumption. These include compliance with a maximum **Power Usage Effectiveness (PUE)** ratio of 1.2 (for new buildings), the use of **waste heat**, and the obligation to switch to 100 percent use of **green electricity**. But that's not all: The forthcoming amendment to the Energy Efficiency Act ('EnEfG 2.0') may result in further tightening of these requirements, which will require additional adjustments and investment.

REGULATORY ROADMAP FOR DATA CENTERS IN GERMANY THROUGH 2030




Regulatory update:
At the time of publication, further amendments to the German Energy Efficiency Act (EnEfG) are under discussion and may affect future requirements for data centers.

* Note transitional provisions as per s. 20 apply from 15 May 2014. From 07/2025, reporting obligations will also apply to operators of data centers with a non-redundant connected load of 200 KW or more. Submission to the Public Energy Efficiency Register for Data Centers (PEER-DC).
** ERF: Energy Reuse Factor

# REQUIRE-MENTS

## MARKET DYNAMICS FURTHER EXACERBATE THE SITUATION:

The high demand for data centers, driven by the digital transformation and the boom in artificial intelligence, is leading to a rapid increase in energy consumption.

Competitive pressure is growing – both with regard to technological innovation and sustainable practices.

Choosing the **right site** for data centers is becoming a strategic challenge that must take into account **geographical and infrastructure criteria**, the **availability of renewable energy**, as well as **power grid and district heating network connectivity**.

And to make matters worse, lenders' requirements also present hurdles: Lending is dependent on fulfilment of ESG criteria, with investors requiring clear evidence of sustainable and energy-efficient practices, as otherwise there is a risk of financial losses and competitive disadvantages.

**Do these challenges sound familiar to you?**

If so, you're not alone.

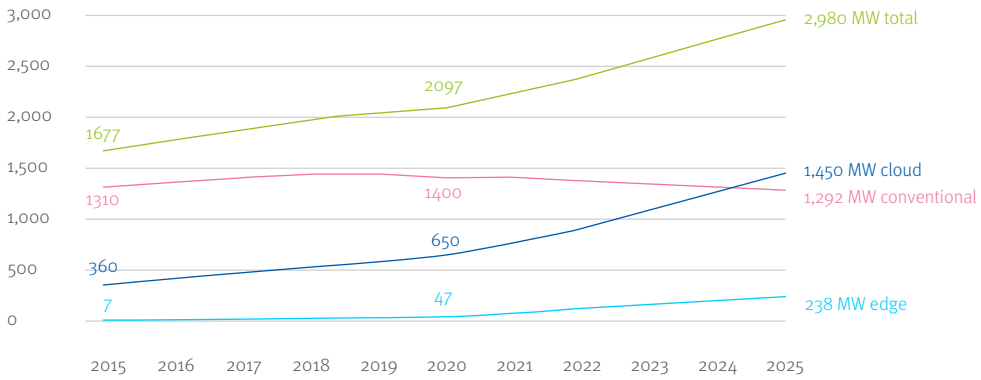
Companies are currently faced with the urgent task of meeting these complex requirements, while at the same time strengthening their market position. The solution lies in adopting a strategic, holistic approach that efficiently integrates both legal requirements and market needs.



AI-generated

# REQUIRE-MENTS

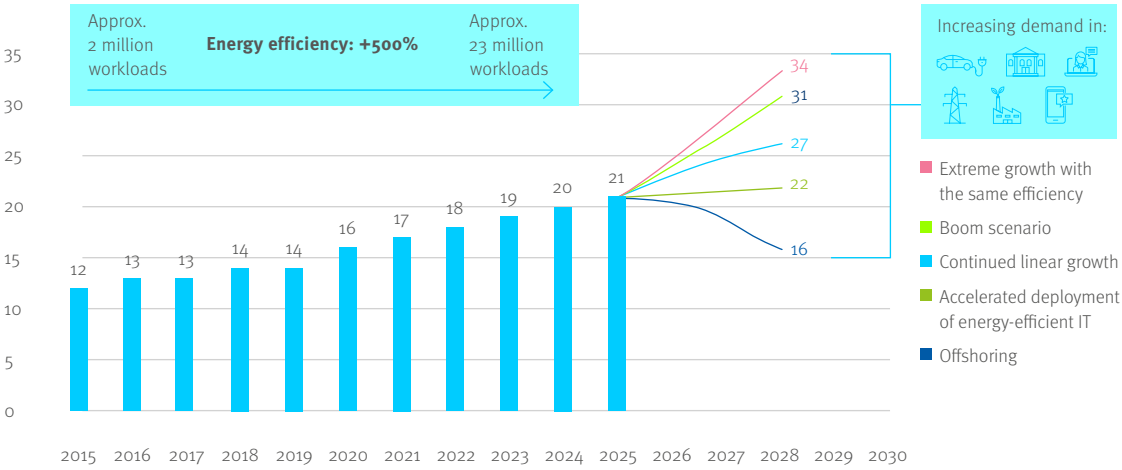
## DATA CENTER CAPACITY IN GERMANY HAS NEARLY DOUBLED IN 10 YEARS




Capacities of data centers and smaller IT installations (IT minus performance in MW)

Source: Bitkom study: 'Data Centers in Germany: Current Market Development – Update 2025', conducted by the Borderstep Institute

## ENERGY DEMAND IN GERMAN DATA CENTERS: STATUS QUO AND FORECAST




Energy demand of data centers and small IT installations per year (in billion kWh/year)

Sources: Bitkom/Borderstep studies 'Data Centers in Germany: Current Market Developments', 2024 and 2025 editions

# PACKAGES OF MEASURES FOR SUSTAINABLE DATA CENTERS

SUSTAINABILITY COVERS A BROAD SPECTRUM – AND THERE IS AN EQUALLY DIVERSE RANGE OF SOLUTIONS AND LEVERS TO MAKE DATA CENTERS MORE SUSTAINABLE AND MORE EFFICIENT.

Experience from numerous data center projects shows that the complex interplay at the interface between infrastructure and the building often leaves potential for a comprehensive sustainability strategy untapped. The decisive success factor here is the bundling of competencies in the areas of IT, process and construction planning, and exploitation of the resulting synergies.

Below you will find five topics – ranging from architecture and energy supply to site selection – that can be found in many draft strategies for enhanced sustainability.



© Andriy Onufriyenko – gettyimages.com

PACKAGES

MEASURE 1:

# VISION AND PROJECT PLANNING:

## DEVELOPMENT OF A SUSTAINABILITY STRATEGY

It is crucial to set the right guardrails from the outset of a new data center construction project. A clear understanding of the sustainability goals and compliance with legal and regulatory requirements are crucial. For example, Environmental Due Diligence (EDD) – which examines the project to identify significant sustainability aspects – is a key element of planning. This analysis covers topics such as EU Taxonomy, climate pathways and risk factors in order to identify their potential environmental risks at an early stage and propose measures to mitigate them.

ESG sustainability screening, which evaluates the project on the basis of ESG criteria, can also be applied. Such screening enables comprehensive analysis of the planned sustainability measures, identifying potential and any vulnerabilities. The results are then visualized using a traffic light system to illustrate compliance with ESG requirements and boost sustainability from the outset.

This approach creates a sound foundation for a future-proof data center right from the planning phase.



© Petmal – gettyimages.com

PACKAGES

MEASURE 2:

# ARCHITECTURE:

## SUSTAINABILITY THROUGH MATERIAL SELECTION AND INNOVATION

Data center sustainability and environmental awareness start with the architecture. Many modern projects choose to use regionally sourced materials to minimize transport costs, while at the same time allowing the building to be harmoniously integrated into its surroundings. Local materials not only reduce carbon emissions, but also strengthen the connection to the local culture and landscape. It is important that the materials used meet the specific requirements of the different areas of the building.

By taking these approaches to material selection and architecture, modern data centers are setting new standards and actively contributing to reducing their environmental footprint.

EPEA has developed the so-called Circularity Passport® to support the recycling of structural materials in line with the Cradle to Cradle® design principle.

The Circularity Passport is a planning and documentation tool that can be used by architects, planners and building owners to measure and improve the circularity of a building during the planning phase. It enables the planning of buildings that:

- Reduce the carbon footprint
- Promote the use of healthy materials
- Conserve resources
- Support local value creation
- Are both flexible and sustainable

© Zocha_K – gettyimages.com

PACKAGES

MEASURE 3:

# ENERGY SUPPLY AND ENERGY EFFICIENCY:

## A SUSTAINABILITY AS DATA VOLUMES INCREASE

Energy supply and energy efficiency are central issues when planning modern data centers, especially in view of the constantly growing data volumes. A sustainable and efficient energy supply is essential to meet the increasing demand for energy. Power Purchase Agreements (PPAs) allow data centers to enter into long-term contracts with renewable energy producers, ensuring a constant supply of green energy while promoting the expansion of renewable energy. In this context, it is crucial to have a good overview of market offerings and to select the right products.

In addition to external energy sources, data centers are increasingly relying on locally generated energy, for example from photovoltaic arrays and wind turbines, as well as battery storage systems that allow the storage and use of surplus energy. Modern concepts such as the use of hydrogen as an energy source also reduce carbon emissions and dependence on fossil fuels.

Customized strategies that focus on compliance with the Energy Efficiency Act and the increasing Power Usage Effectiveness (PUE) are being developed to further enhance energy efficiency. The goal is to reduce energy consumption and improve operational sustainability.



© Daniel Bosma – gettyimages.com

PACKAGES

MEASURE 3:

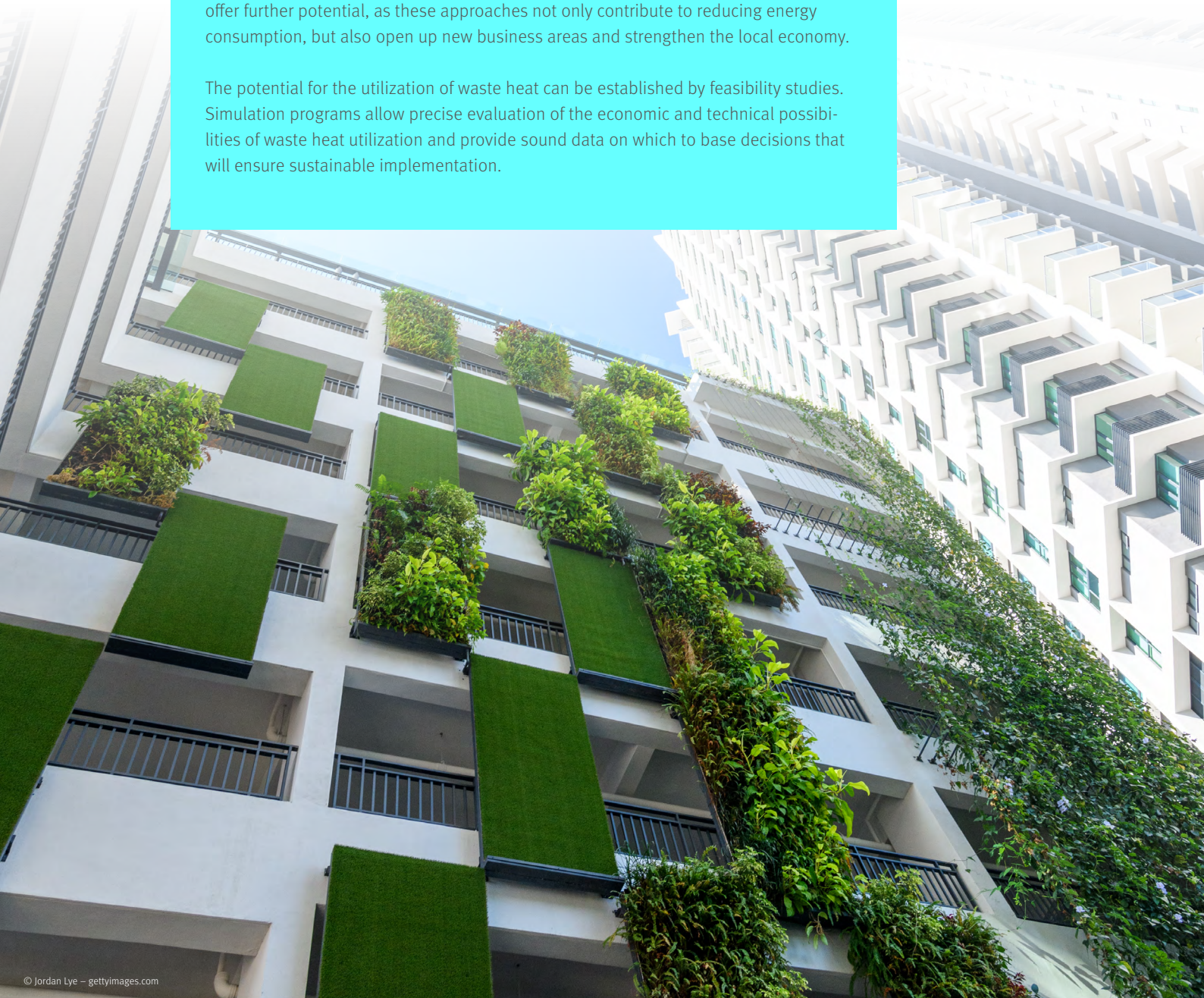
# ENERGY SUPPLY AND ENERGY EFFICIENCY:

## B EFFICIENT USE OF WASTE HEAT: MORE THAN JUST SAVING ENERGY

Data centers produce huge amounts of waste heat, which can be put to good use through clever integration into district heating systems. Applications include efficient heating of residential and commercial buildings. Industrial processes that require low to medium temperatures can also benefit from the use of waste heat. Cooperative ventures with local companies offer additional synergies here.

Innovative applications, such as aquaculture heating or use in agricultural processes, offer further potential, as these approaches not only contribute to reducing energy consumption, but also open up new business areas and strengthen the local economy.

The potential for the utilization of waste heat can be established by feasibility studies. Simulation programs allow precise evaluation of the economic and technical possibilities of waste heat utilization and provide sound data on which to base decisions that will ensure sustainable implementation.



© Jordan Lye – gettyimages.com

PACKAGES

MEASURE 4:

# SITE SELECTION:

## STRATEGIC EFFICIENCY AND SUSTAINABILITY CONSIDERATIONS

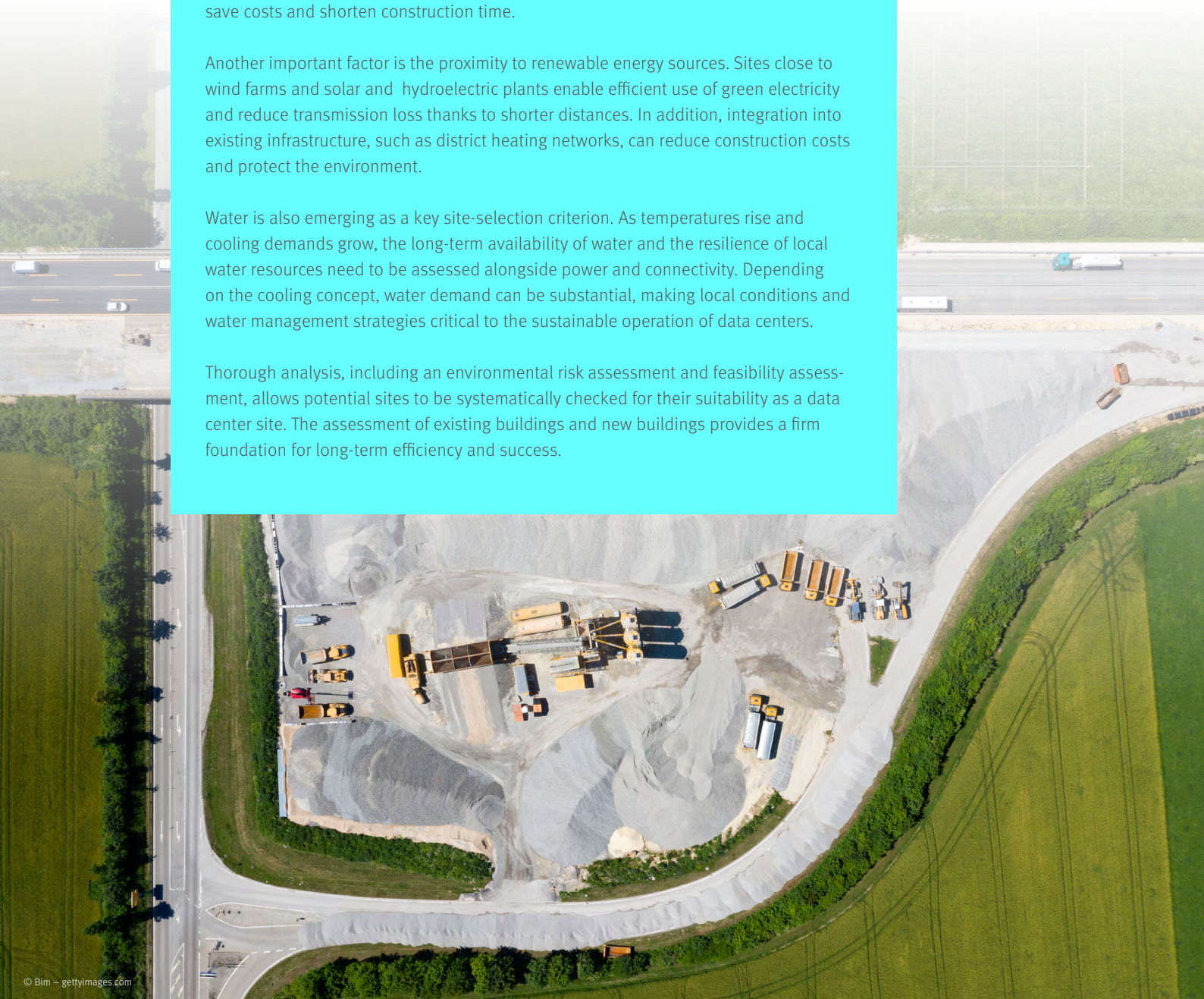
Choosing the right site is essential in order to fully exploit potential in terms of efficiency and sustainability. For example, densely built-up urban areas should be avoided to minimize potential environmental impact.

Locations outside urban heat islands, on the other hand, can benefit from natural cooling, which has a positive impact on the environmental footprint. The use of existing buildings, such as decommissioned power plants and underground buildings, can also save costs and shorten construction time.

Another important factor is the proximity to renewable energy sources. Sites close to wind farms and solar and hydroelectric plants enable efficient use of green electricity and reduce transmission loss thanks to shorter distances. In addition, integration into existing infrastructure, such as district heating networks, can reduce construction costs and protect the environment.

Water is also emerging as a key site-selection criterion. As temperatures rise and cooling demands grow, the long-term availability of water and the resilience of local water resources need to be assessed alongside power and connectivity. Depending on the cooling concept, water demand can be substantial, making local conditions and water management strategies critical to the sustainable operation of data centers.

Thorough analysis, including an environmental risk assessment and feasibility assessment, allows potential sites to be systematically checked for their suitability as a data center site. The assessment of existing buildings and new buildings provides a firm foundation for long-term efficiency and success.



© Bim – gettyimages.com

PACKAGES

MEASURE 5:

# MODULARITY:

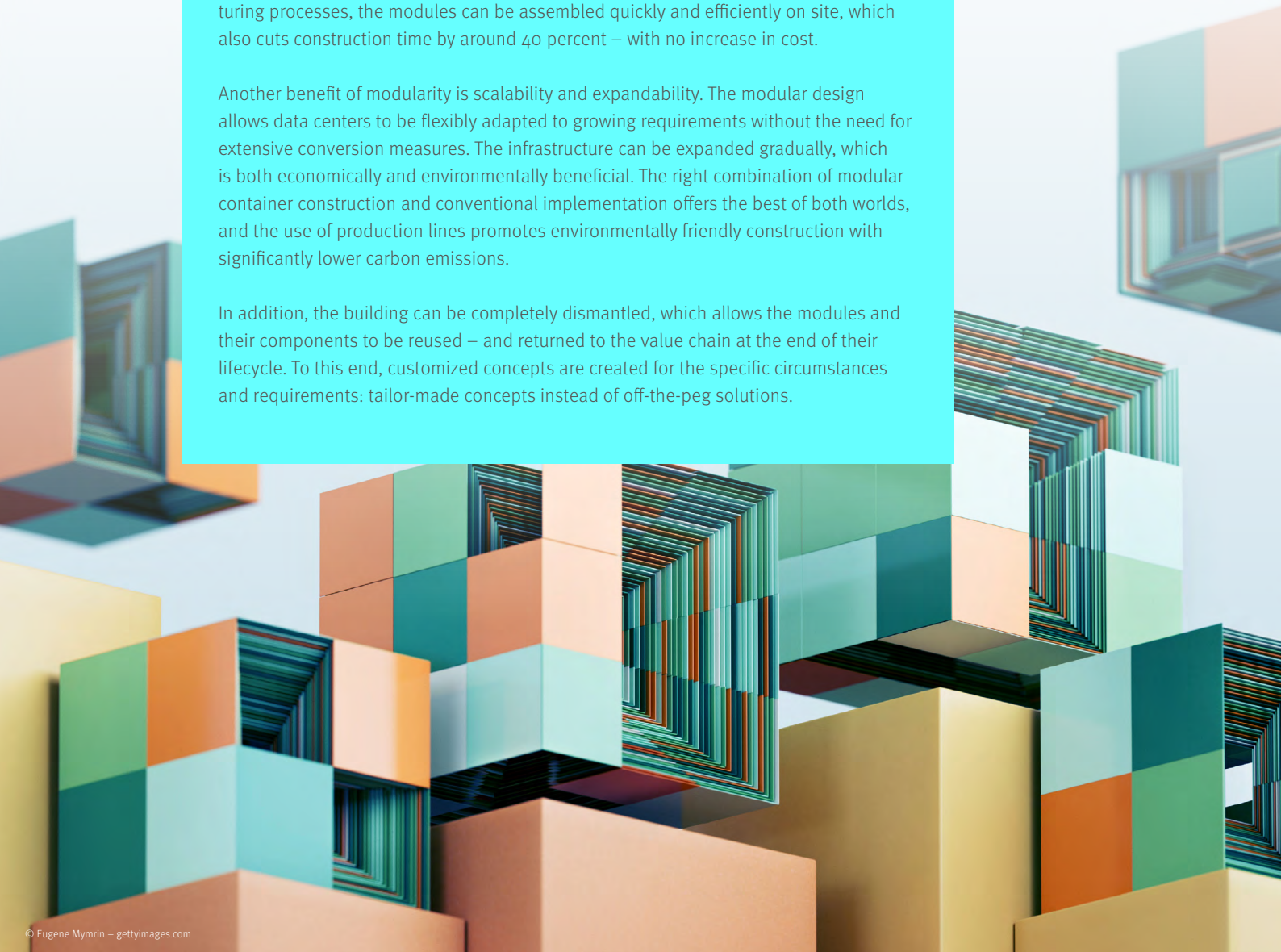
## SUSTAINABILITY THROUGH PREFABRICATION AND FLEXIBILITY

Modularity also plays a central role in creating sustainable and future-proof infrastructure in modern data center architecture. Thanks to the high degree of prefabrication and the use of production lines, construction can be made much more environmentally friendly. This not only enables a drastic reduction in the carbon footprint, but also results in a much shorter construction time.

This is because a decisive advantage of modular construction is the use of low-carbon concrete. This special concrete can reduce carbon emissions by up to 30 percent compared to conventional concrete. The modules are manufactured in production facilities under controlled conditions, often using green electricity and self-generated electricity, which further minimizes the environmental footprint. Thanks to standardized manufacturing processes, the modules can be assembled quickly and efficiently on site, which also cuts construction time by around 40 percent – with no increase in cost.

Another benefit of modularity is scalability and expandability. The modular design allows data centers to be flexibly adapted to growing requirements without the need for extensive conversion measures. The infrastructure can be expanded gradually, which is both economically and environmentally beneficial. The right combination of modular container construction and conventional implementation offers the best of both worlds, and the use of production lines promotes environmentally friendly construction with significantly lower carbon emissions.

In addition, the building can be completely dismantled, which allows the modules and their components to be reused – and returned to the value chain at the end of their lifecycle. To this end, customized concepts are created for the specific circumstances and requirements: tailor-made concepts instead of off-the-peg solutions.



© Eugene Mymrin – gettyimages.com

HOLISTIC SOLUTION

# STEP BY STEP TOWARDS SUSTAINABILITY TOGETHER

## WHICH MEASURES ARE PARTICULARLY IMPORTANT? AND WHICH ISSUES SHOULD BE PRIORITIZED IN YOUR CATALOG OF MEASURES?

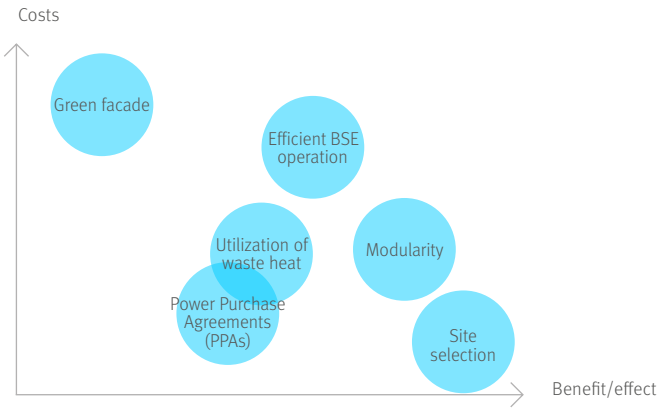
Drees & Sommer has used its extensive project experience to evaluate the various factors that influence the sustainability of data centers. This evaluation takes into account both the benefits and impact of the measures as well as the associated costs. The result of this analysis offers valuable guidance for the selection of suitable sustainability measures in planning processes.

The study shows that not all measures contribute equally to sustainability. For example, it has been found that the installation of a green facade has only a limited impact on the sustainability of a project, but involves considerable additional cost. The main advantage of the green facade lies in its visual appeal, rather than in any actual reduction of the carbon footprint.

The choice of site is much more important for a data center's sustainability. A good site can contribute significantly to the sustainability of the project, especially if it is close to district heating networks or benefits from favorable climatic conditions that help cool the data center.

The efficient operation of building services equipment (BSE) also plays a key role. More efficient BSE can reduce operating costs in the long term, while at the same time increasing the building's sustainability. This shows that well-thought-out planning and efficient operation are essential levers for the sustainability of a data center.

COST-BENEFIT COMPARISON OF SUSTAINABILITY STRATEGIES FOR DATA CENTERS




The following figure illustrates some of the measures assessed and gives a first insight into priorities when selecting sustainability strategies. Drees & Sommer can support you in identifying and successfully implementing the most effective measures for your project.

HOLISTIC SOLUTION

# CLEVER STRATEGIC INTEGRATION FOR A HOLISTIC VIEW

FOR DATA CENTERS TO BE WELL POSITIONED FOR THE FUTURE, THE COMBINATION OF THE ABOVE ELEMENTS IS NOT ONLY SENSIBLE, BUT IMPERATIVE. THE ELEMENTS ARE CLOSELY RELATED AND INFLUENCE EACH OTHER IN NUMEROUS WAYS. THIS MEANS THAT COMPANIES CAN ONLY REMAIN COMPETITIVE AND MEET INCREASING DEMANDS BY TAKING A HOLISTIC VIEW AND INTEGRATING THESE ELEMENTS.



AI-generated

For example, the combination of on-site electricity generation and waste heat recovery not only reduces operating costs and the environmental footprint, but also improves energy efficiency. Strategic site selection, in turn, can exploit the proximity to renewable energy sources and make use of existing infrastructure, which leads to a further increase in efficiency.

This integrated approach is crucial for long-term success. It is no longer simply a matter of meeting individual requirements, but of understanding these issues as interconnected elements of a sustainable business strategy. This approach also strengthens your market position.

HOLISTIC SOLUTION

WE WORK WITH YOU TO PUT TOGETHER A **'DREES & SOMMER SUSTAINABLE DEVELOPMENT KIT'**, YOUR INDIVIDUAL PACKAGE OF MEASURES WITH CORRESPONDING PRIORITIES AND GOALS. WE CAN SUPPORT YOU FROM THE INITIAL IDEA TO IMPLEMENTATION AND BEYOND:

- In the planning phase, we jointly define the foundations and sustainability goals of your project.
- On this basis, our architecture experts develop a customized concept and architecture that systematically implements these goals.
- During the technical planning phase, we adapt the building services systems to your specific requirements.
- During the construction phase, we ensure that all planned sustainability standards are met.
- In the final step, the so-called Sustainable Operations Bundle, we ensure that efficiency and sustainability targets are achieved during long-term operation and maintenance.

Based on the 'Drees & Sommer Sustainable Development Kit' and our comprehensive categorization of sustainability topics, we have developed our 'Sustainable Data Center Blueprint'.

**We would be happy to support your project with our innovative concept and set new standards with you.**

SUSTAINABLE DEVELOPMENT KIT



**Sustainable Starter Bundle:** Vision and planning

**Sustainable Design Bundle:** Concept and architecture

**Sustainable Engineering Bundle:** Technical planning

**Sustainable Implementation Bundle:** Implementation and construction

**Sustainable Operation Bundle:** Operation and maintenance

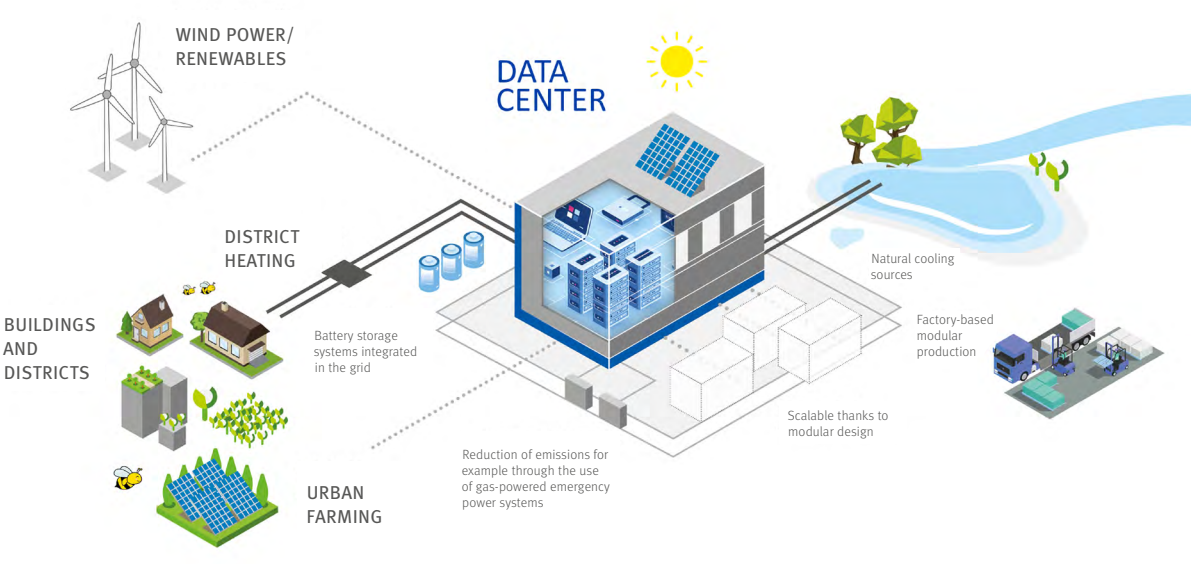
HOLISTIC SOLUTION

# ACHIEVING SUCCESS WITH CUSTOMIZED SOLUTIONS

In a world in which efficiency and sustainability are becoming increasingly important aspects of data center operation, customized solutions are the key to success. Drees & Sommer can support your project with comprehensive know-how and set new standards with you.

The **DREES & SOMMER PARTNERSHIP MODEL** ensures close cooperation to jointly develop solutions to meet your specific requirements. Acting as the interface between technical specifications and sustainability goals, Drees & Sommer supports projects from concept development through to implementation and commissioning. Continuous monitoring ensures that the solutions are future-proof and remain sustainable in the long term.

We also offer workshops and training courses as an important part of the transformation process to promote awareness of energy efficiency and develop best practices.



# CONTACT

Drees & Sommer looks forward to making your project a success – and working with you to turn your vision into reality.

Please write to **dc@dreso.com** to set up an initial no-obligation discussion.

**Drees & Sommer: Uniting opposites to create a world we want to live in.**
Drees & Sommer is a partner-managed, global consulting company that provides a single source of consultation and implementation services. We focus on sustainable, innovative, and economical solutions for the real estate, infrastructure, and industry markets. Founded in 1970, today the company employs more than 6,500 people at over 80 offices. Our interdisciplinary teams are involved in around 7,000 projects worldwide, working to create a livable future and unite apparent opposites: tradition and future, economy and ecology, analog and digital, efficiency and well-being. As ‘intrapreneurs’, the Drees & Sommer Partners are personally responsible for managing the company.