THE CURRENT STATE OF DATA CENTER ENERGY EFFICIENCY IN EUROPE

White Paper

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The Current State of Data Center Energy Efficiency in Europe

Purpose

The purpose of this white paper is to provide insight into the current European data center market – specifically in terms of energy efficiency. After reading, you'll have better insight into energy-efficiency struggles, challenges and opportunities; understand the regulations that impact energy use in data centers; and discover a few recent strides that have been made to improve energy conservation.

Executive Summary

The European data center sector power usage effectiveness (PUE) average is currently 1.70 (to compare, the U.S. average is 1.80). According to a 2016 survey of European data center managers, conducted by the Green Grid, 43% of data centers do not define or measure energy-efficiency objectives. Only 29% of those surveyed can quantify the environmental impact of their data centers. And 97% identified monitoring areas – including energy efficiency – that could be improved inside their data centers.

The bottom line: These facilities are consuming more energy than their owners would like, and they're looking for solutions to cut back – without requiring lots of upfront capital to make a difference. (Many expect a full return on their investment in two years or less.)

European policymakers have identified data centers as one of the fastest-rising sectors when it comes to energy consumption. The voluntary EU Code of Conduct provides data center owners with best practices to follow to improve energy efficiency, but many are looking for more ways to save.

Background

It's no secret that European data centers – just like data centers in other regions – consume lots of energy. According to the European Commission, by 2020, data centers in Europe will use 259 TWh of electricity, which represents 1.7% of the world's total energy consumption. Today, the average European data center's energy bill makes up between 10% and 15% of the facility's total operating costs.

In the next 10 years, according to Legrand, it's estimated that there will be *30 times more data and 1,000 times more servers*. As a result, the number of data centers (and the amount of energy they consume) will only be going up.

Many European policymakers have identified data centers as one of the fastest-rising sectors when it comes to energy consumption. The price of energy in Europe is also on the rise, which, according to the British Computer Society's Data Centre Specialist Group, has impacted data center business

models for many. As a result, energy security and availability are also becoming issues for data centers in Europe.

European data center owners and managers currently calculate their energy-usage performance in a few different ways:

- **PUE**, which is also a common metric in the United States for determining data center energy efficiency. It divides the amount of power coming into a data center by the amount of power used to run data center information technology equipment (cooling systems, UPSs, etc.).
- **SUE (server usage effectiveness)**, which is a complement to PUE but also takes IT equipment efficiency into account when calculating data center energy efficiency.
- **DCiE (Data Center Infrastructure Efficiency)**, which was developed by the Green Grid and is expressed as a percentage calculated by dividing IT equipment power by total facility power.

Geography

Depending on which region of Europe you consider, the data center landscape may look different.

Germany, for example, is often cited as the European country with the highest data center energy consumption. It also has the largest data center market, holding approximately 25% of Europe's total capacity. If these trends continue, it's predicted that data center energy consumption in Germany will reach as high as 16.4 billion kWh by 2025.

The United Kingdom, France, and the Netherlands are next on the list – both in terms of highest energy consumption and in greatest share of data center capacity. In 2015, these four countries made up 54% of total data center electricity consumption in Europe.

Germany, France, and the United Kingdom together provide 60+% of European data center capacity. The Netherlands' capacity is set to increase as well, with Microsoft and Google planning to invest more than 2.5 billion euros in cloud data centers there. Queensway Park Data Centres predicts that, by 2020, the United Kingdom will become the single largest European market for data centers (costing up to £7 billion per year in energy).

But even for countries not referenced as frequently when it comes to European data centers, like Ireland, data center energy consumption is still a concern. EirGrid (an Ireland -based electric power transmission operator) estimates that, by 2025, 1 in every 3 kWh generated in Ireland could be going to a data center.

Some say that countries in Northern Europe have an advantage when it comes to data center energy efficiency, simply due to the availability of natural resources there (such as wind and solar) to provide power. Because it's cooler in this part of the continent, countries located there

don't spend as much money or require as much energy to cool their data centers. For this reason, some data center operators are purposely looking to place their facilities in this region.

Regulations

The European Union's Ecodesign Directive (Directive 2009/125/EC) establishes design requirements for servers and online data storage products that will be placed on the market.

The regulations declare that, beginning on Jan. 1, 2019, internal PSU (power supply unit) efficiency at 20%, 50%, and 100% rated load level and power factor at 50% rated load level must meet specific efficiency and power factor requirements.

Four years later, on Jan. 1, 2023, the efficiency and power factor requirements will increase again. On January 1, 2026, they increase once more. By 2030, these design requirements are estimated to result in annual energy savings of approximately 9 TWh.

Similar to the U.S. Department of Energy's ENERGY STAR program, which offers voluntary energy-efficiency guidelines for all types of buildings – including data centers – Europe also has its own voluntary energy-efficiency program: the EU Code of Conduct for Data Centers.

Created as a resource for owners who are facing ever-increasing energy costs, the voluntary Code of Conduct provides energy-efficiency best practices, minimum procurement standards, and a means for reporting annual energy consumption.

Individual companies that own or operate data centers of any size can commit to following this Code of Conduct with the intention of reducing energy consumption through the adoption of best practices. The goal is to reduce energy consumption in a cost-effective way without negatively impacting the mission-critical function of data centers. This is done through improving understanding and awareness of data center energy demand, as well as providing energy-efficiency best practices and targets to follow.

In addition, EN 50600-4 and ISO/IEC 30134-2:2016 provide key performance indicators (KPIs) for data center PUE levels that European data centers can follow.

In addition, there are several energy-efficiency projects (many of which support the EU Code of Conduct) that European data centers can reference. A few include:

- DOLFIN, which aims to monitor and measure energy consumption and promotes seamless migration of virtual machines between servers within the same data center to reduce energy consumption.

- GENiC, which focuses on improving data center energy efficiency through cooling strategies. Its goal is to develop a control and management platform for energy-producing/-consuming components, as well as provide decision-support tools to help data centers make changes to reduce energy consumption.
- GreenDataNet, which is designing and validating a new smart energy management system for urban data centers to use to improve energy and environmental performance.

When it comes to guidelines for general energy usage in Europe, the EU's 2020 climate and energy package is a set of binding legislation that will help Europe meet its climate and energy targets. As part of this package, EU has set a target for all new buildings to be nearly zero-energy by 2020.

Key EU climate and energy objectives for 2020 include:

- 20% cut in greenhouse gas emissions from 1990 levels
- 20% of EU energy coming from renewables
- 20% energy-efficiency improvement overall

This legislation is what will ultimately force managers to make changes to the way they operate their data centers, and compel them to look for other untapped options – such as adoption of Open Compute Project (OCP) initiatives – to reduce energy consumption so they can meet these requirements.

Challenges/Opportunities

Many sources report that data center capacity is growing very quickly, especially in certain parts of Europe. For example, London, Frankfurt, Paris, and Amsterdam added nearly 200 MW of data center energy consumption alone in 2017.

A senior IT analyst at Greenpeace says that most Europeans who operate data centers are experiencing higher energy demands – and are looking for ways to reduce them. According to a 2016 survey of European data center managers, conducted by Green Grid, 43% of data centers do not define or measure energy-efficiency objectives. Only 29% of those surveyed can quantify the environmental impact of their data centers. And 97% identified monitoring areas – including energy efficiency – that could be improved inside their data centers.

Most experts agree that, in this industry, the main driver for energy efficiency is cost savings. While many people understand the other positive impacts associated with more efficient, more sustainable data centers, it ultimately comes down to this: "Will it save me money?"

In a Green Grid webinar about energy-efficiency trends in European data centers, several experts agreed that most European data center owners/managers don't want to commit capital funds to an energy-reduction tactic if the full return on investment isn't realized in less than two years.

The European data center sector PUE average is 1.70 (the U.S. average is 1.80). Google, however, has set an impressive benchmark for the energy-efficiency potential of European data centers. The company's data centers have been able to reduce PUE to an average of 1.12. According to a February 2018 report by *Copenhagen Economics*, if other European data centers could achieve this same level of energy efficiency, total data center energy consumption would decrease from 76 TWh to 50 TWh.

It's also predicted that significant energy savings could be made if more organizations in Europe utilized cloud computing. Only 31% of spending on cloud computing is currently done in Europe; 6% of spending on the adoption of infrastructure as a service is done in Europe. When compared to the United States, Europe has been slower to warm to the idea of cloud computing overall.

For now, owning and operating enterprise data centers seems to be the preferred option. One 2014 study by Nebuloni & Olah indicates, for example, that 93% of data center professionals in Germany consider this important (owning their own data centers vs. using a third party).

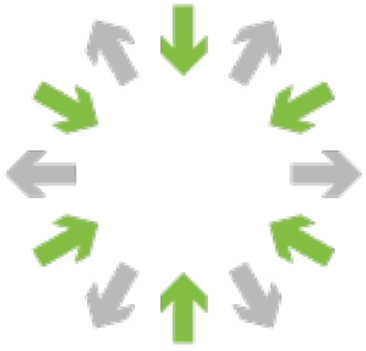
It's also important to this group that the data generated in Germany be stored and processed *in Germany*. If third-party services *are* used, according to a KPMG & BITKOM study, 75% say that it's an absolute must for the third-party data centers to operate in Germany.

With GDPR regulations now in full effect, this may continue to encourage European enterprises to ensure that their data centers stay local so these data-protection laws are being followed.

It has been reported, however, that third-party providers are still increasing as compared to in-house data centers (in 2016 across Europe, for example, it was 60% in-house and 40% third party, but is expected to be nearly 50% in-house and 50% third party by 2026).

The Future

Some European data centers are making interesting and impressive strides to reduce energy usage.



For example, 4D Data Centres credits its 1.14 PUE to the use of evaporative cooling (using water evaporation to reduce inside air temperatures). An ITB2 data center also uses evaporative cooling to significantly reduce energy consumption. Telehouse Europe claims to have one of the world's greenest data centers thanks to evaporative cooling, with a 1.16 PUE.

Because data center energy consumption is expected to continue to increase in Europe, there are many technology trends that may impact future energy-efficiency initiatives, such as:

- Lithium-ion batteries and fuel cells
- Free cooling to take advantage of cold outside air
- More serious pursuing of renewable energy as an option, whether it's onsite generation, hiring an outside source to produce it, or purchasing renewable energy
- Using artificial intelligence for data center management (Google has cut energy usage by 15% by doing this)

Conclusion

Because the European data center market is set to grow, there's an opportunity for data center owners to try new ways to cut energy usage and costs.

This environment also supports the adoption of OCP initiatives. By questioning the way things have been done in the past – and finding more efficient ways to support server, storage, and hardware – data center owners can benefit from designs created by the OCP community, which make it possible to independently choose networking hardware and software based on specific needs.

By re-examining hardware, and keeping in mind how it impacts other data center infrastructure, OCP has reduced excess hardware materials (decreasing production and assembly costs as a result). OCP designs also create more airflow to improve cooling efficiency, reduce unneeded power redundancy and power loss, and support more power density per rack.

If owners aren't ready to make the full switch from traditional to OCP designs, they can still reap the benefits by slowly incorporating OCP and phasing out legacy hardware as timelines and budgets allow.

In its 2017 report, *Traditional vs. Open Compute Monitoring Fabrics: A Cost Analysis*, IHS Markit indicates that data centers experience significant savings when implementing an open networking approach like OCP. A cost comparison of three different network monitoring fabrics – traditional, standard, and OCP (open) approaches – shows that an open networking approach can save tens of thousands of dollars (or more).

With 43% of data centers not defining or measuring energy-efficiency objectives, and only 29% being able to quantify the environmental impact of their data centers, there's definitely room for improvement. The one caveat, however: Suggested improvements or changes must be backed by numbers – and owners must feel confident that they'll see a relatively fast return on investment.