Germany largest data center market in Europe

Energy consumption of data centers continues to increase – 2015 update

Dr. Ralph Hintemann

The increasing digitization in all areas of the economy and society is resulting in an increasing need for processing power, which is also spurring the growth of the data center industry in Germany. In 2015, the capital investments for new construction and modernization of data center infrastructure increased by 10 % to approx. 900 million euros. This enabled Germany to consolidate its leading position in Europe as a data center location. In spite of further progress in efficiency, the electricity consumption of German data centers again increased markedly in 2015.

These are the results of a new Borderstep Institute analysis based in particular on a study for the Federal Ministry of Economic Affairs in which the Borderstep Institute examined the development of data centers in Germany (BMWi, 2015). The increasing prevalence of mobile internet devices such as smartphones and tablets as well as trends such as cloud computing, big data, and the increasing use of multimedia services by private consumers gave rise to a distinct increase in IT capacities in German data centers in 2015.

Germany has also benefited somewhat from the discussions about privacy and data security that intensified dramatically because of the NSA scandal. Today, German companies are attaching even more importance to their data being stored and processed in Germany. For three-quarters of all companies using cloud services, the fact that the data centers are operated in Germany is a must (KPMG & BITKOM, 2014). Cloud service providers such as Amazon, Salesforce, vmware, and Oracle are already building data centers in Germany (Hülsenbusch, 2014; Kalenda, 2014; Kuplent, 2014). The Safe Harbor ruling by the European Court of Justice, which declared the rules for transferring personal data between the US and the EU invalid, may give this trend a significant boost. In addition, operating their own data centers continues to be very important for companies in Germany as well. 93 % of persons responsible for IT in companies

consider operation of their own data centers important (Nebuloni & Olah, 2014).

Although further efficiency gains were achieved in IT hardware and data center infrastructure, the electricity consumption of the data centers in Germany increased by 3 % to 12 billion kilowatt-hours (kWh) in 2015 because of the developments mentioned above. Increasing energy consumption by data centers is to be expected for the future, too. If the current trends in IT usage continue, German data centers' energy consumption will increase further and reach more than 14 billion kWh in 2020 and possibly even 16.4 billion kWh in 2025 (Figure 1).
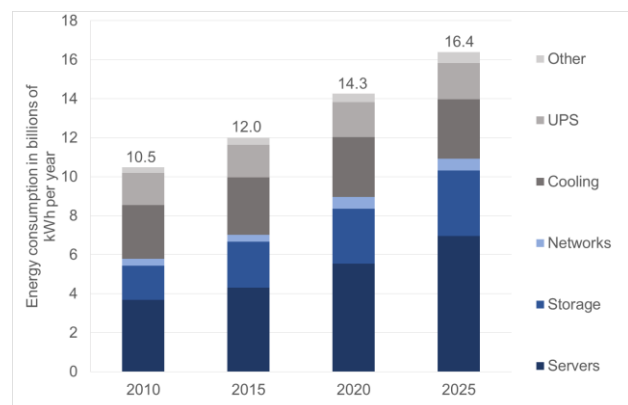

Figure 1: *Energy consumption of servers and data centers in Germany from 2010 to 2015 and forecast to 2025 (Source: BMWi, 2015)*

Besides the servers, the storage systems consume the largest amount of electricity in the data centers. In the recent study for the Federal Ministry of Economic Affairs and Energy, the electricity consumption of the storage systems was calculated in detail at 2.4 billion kWh in 2015, which amounts to one-third of IT hardware power consumption. This figure is markedly higher than those in previous studies, most of which used fairly general estimates for storage systems (Hintemann, Fichter &

Stobbe, 2010; Koomey, 2008; Prakash, Baron, Ran, Proske & Schlösser, 2014; Stobbe et al., 2009).

Data center capacity increased markedly in 2015

The amount of IT equipment in German data centers increased markedly overall in 2015. The number of physical servers increased to nearly 1.8 million, a plus of 6 % compared with 2014. Expenditures for the IT hardware in data centers increased by 3.5 % to 7.2 billion euros. The growth in turnover of IT hardware is supported in particular by the investments in storage hardware, where expenditures increased by more than 6 %. The investments in modernization and new construction of data center infrastructure increased very markedly in 2015 as well, by 10 % to approx. 900 million euros.

Taking individual industries into account, it is evident that especially in the area of IT services and health care, IT expenditures for data centers increased by approx. 6 % each from 2014 to 2015.

The number of virtual servers in data centers is increasing more strongly than the hardware stock; it increased to more than 3.5 million in 2015 (Figure 2).
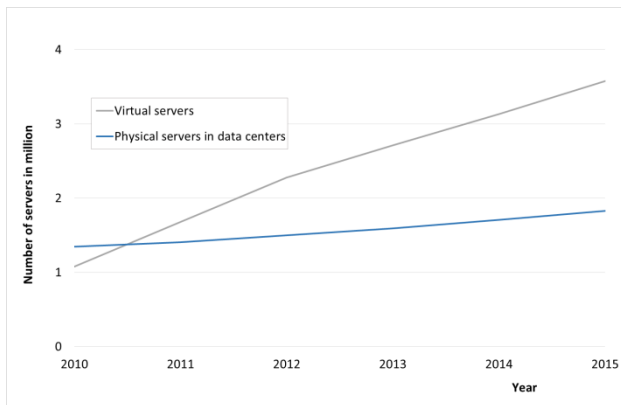
Figure 2: Development of the numbers of physical servers and virtual servers in data centers in Germany (Source: calculations by Borderstep on the basis of Techconsult eanalyzer)

Germany largest data center market in Europe

Compared with other European countries, Germany has the largest data center market with a share of approx. 25 % of European data center capacity, followed by the United Kingdom (22 %) and France (15 %). Taken together, these three countries currently provide more than 60 % of European data center capacity.

The increase of data center capacity—by more than 16 % per year—was particularly marked in the Netherlands, with a 6 % share of the total market and now in fourth place, the rank previously held by Italy. Because of Dutch electricity prices, which are moderate in comparison with Germany, and the trans-Atlantic Internet connection, this market appears to be attractive especially for major US cloud providers. According to media reports, Microsoft and Google alone are planning to invest more than 2.5 billion euros in cloud data centers there.

Compared with other countries in Europe, energy consumption by servers and data centers is also highest in Germany (approx. 12 TWh), the United Kingdom (approx. 10.8 TWh), France (approx. 8.6 TWh), and the Netherlands (approx. 4.3 TWh) (Figure 3). Taken together, they account for 54 % of the electricity consumption of all servers and data centers in Europe (65 TWh).
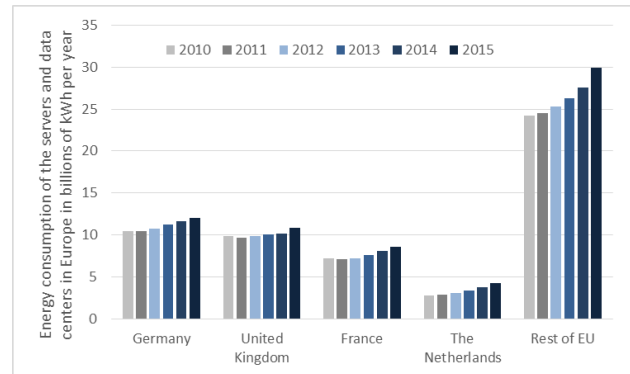
Figure 3: Development of energy consumption of the servers and data centers in Europe in the years 2010 to 2015 (Source: Borderstep)

Methodology of the study

The present study is an update of the study for 2014, and it also looks at the electricity consumption of storage systems.

According to the classification system on which the study is based, data centers are defined as all distinct spatial units such as server closets, server rooms, parts of buildings, or entire buildings in which at least three physical servers are installed. The development of data center capacities was calculated on the basis of the number and type of servers in the data centers. Servers' different performance categories were also taken into account.

The calculations were performed using a comprehensive structural model of the data center landscape in Germany that was developed at the Borderstep Institute and is updated annually (BMWi, 2015; Fichter & Hintemann, 2014; Hintemann et al., 2010). The data centers in Germany are described in the model in various sizes and the different types of servers, storage systems, and network infrastructures they encompass. The model also takes the age distribution of the servers into account as well as the electricity consumption of the various server types in different operating states. The model also includes data center infrastructure, such as climate control, electricity supply, UPS, etc. for different sizes of data centers and amounts of redundancy.

The following sources, among others, were used to update the data for 2014:

- Results of a market study on data centers in Germany carried out in the project AC4DC. In the context of this study, market data on the individual data center components were gathered, and members of the

BITKOM working groups "Data center & infrastructure" and "Servers, storage & networks" were surveyed as experts (Hintemann, 2014; Hintemann, Fichter & Schlitt, 2014),

- Data from the market research institute Techconsult on market development for servers, storage, and network components (eanalyzer) (Techconsult, 2014, 2015),
- Data from the market research institutes IDC and EITO on market development for servers in Germany and Europe (EITO/IDC, 2014),
- Scientific literature and manufacturer information on the development of the energy consumption of servers, storage and network products, as well as other efficiency technologies for data centers,
- Results of a Borderstep survey of data center operators in 2014 (Hintemann & Clausen, 2014).

Sources:

BMWi. (2015). Entwicklung des IKT-bedingten Strombedarfs in Deutschland - Studie von Fraunhofer IZM und Borderstep im Auftrag des Bundesministeriums für Wirtschaft und Energie. Berlin. Verfügbar unter: http://www.bmwi.de/BMWi/Redaktion/PDF/E/entwicklung-des-ikt-bedingten-strombedarfs-in-deutschland-abschlussbericht,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

EITO/IDC. (2014). EITO Costumized Report for Borderstep. Berlin: EITO/IDC.

Fichter, K. & Hintemann, R. (2014). Beyond Energy. The Quantities of Materials Present in the Equipment of Data Centers. Journal of Industrial Ecology, 18 (6), 846–858.

Hintemann, R. (2014). Consolidation, Colocation, Virtualization, and Cloud Computing – The Impact of the Changing Structure of Data Centers on Total Electricity Demand. In L.M. Hilty & B. Aebischer (Hrsg.), ICT Innovations for Sustainability. Advances in Intelligent Systems and Computing. Berlin, Heidelberg: Springer.

Hintemann, R. & Clausen, J. (2014). Rechenzentren in Deutschland: Eine Studie zur Darstellung der wirtschaftlichen Bedeutung und Wettbewerbssituation. Studie im Auftrag des Bundesverbandes Informationswirtschaft, Telekommunikation und neue Medien e.V. (BITKOM). Berlin.

Hintemann, R., Fichter, K. & Schlitt, D. (2014). Adaptive computing and server virtualization in German data centers - Potentials for increasing energy efficiency today an in 2020. Gehalten auf der Enviroinfo 2014 - ICT for Energy Efficiency, 28th International Conference on Informatics for Environmental Protection, September 10-12, 2014, Oldenburg.

Hintemann, R., Fichter, K. & Stobbe, L. (2010). Materialbestand der Rechenzentren in Deutschland-Eine Bestandsaufnahme zur Ermittlung von Ressourcen-und Energieeinsatz. Studie im Rahmen des UFO-Plan-Vorhabens "Produktbezogene Ansätze in der Informations-und Kommunikationstechnik "(Förderkennzeichen 370 893 302), Beauftragt vom Umweltbundesamt.

Hülsenbusch, R. (2014). Amazon Web Services nimmt deutsches Rechenzentrum in Betrieb. Zugriff am 5.12.2014. Verfügbar unter: http://www.heise.de/ix/meldung/Amazon-Web-Services-nimmt-deutsches-Rechenzentrum-in-Betrieb-2430879.html

Kalenda, F. (2014, März 4). Salesforce eröffnet 2015 Rechenzentrum in Deutschland. Zugriff am 20.10.2014. Verfügbar unter: http://www.zdnet.de/88185967/salesforce-eroeffnet-2015-rechenzentrum-deutschland/

Koomey, J.G. (2008). Worldwide electricity used in data centers. Environmental Research Letters, 3 (3), 034008. doi:10.1088/1748-9326/3/3/034008

Kuplent, F. (2014, Oktober 15). VMWare baut für Cloud-Angebote neues Rechenzentrum in Deutschland. Zugriff am 20.10.2014. Verfügbar unter: http://www.onlinekosten.de/news/artikel/59830/0/VMWare-baut-fuer-Cloud-Angebote-neues-Rechenzentrum-in-Deutschland

Nebuloni, G. & Olah, A. (2014). Wachstumsmotor IT: So fördern effiziente Rechenzentren das Unternehmenswachstum. Frankfurt: IDC/Rittal.

Prakash, S., Baron, Y., Ran, L., Proske, M. & Schlösser, A. (2014). Study on the practical application of the new framework methodology for measuring the environmental impact of ICT - cost/benefit analysis (Studie) (S. 373). Brussels: European Commission.

Stobbe, L., Nissen, N., Proske, M., Middendorf, A., Schlomann, B., Friedewald, M. et al. (2009). Abschätzung des Energiebedarfs der weiteren Entwicklung der Informationsgesellschaft (Abschlussbericht an das Bundesministerium für Wirtschaft und Technologie No. D 4 – 02 08 15 – 43/08) (S. 164). Berlin, Karlsruhe: Fraunhofer IZM.

Techconsult. (2014). Daten des eanalyzers. Verfügbar unter: www.eanalyzer.biz

Techconsult. (2015). Daten des eanalyzers. Verfügbar unter: www.eanalyzer.biz

Contact:
Dr. Ralph Hintemann
Senior Researcher
Borderstep Institute for Innovation and Sustainability
Clayallee 323
D-14169 Berlin, Germany
Phone +49.(0)30.306 45-1005
Fax +49.(0)30.306 45-1009
E-Mail: hintemann@borderstep.de
www.borderstep.de