



Study for the review of Commission Regulation 2019/424 (Ecodesign of servers and data storage products)

Task 2 Markets – DRAFT v4

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2 Introduction to Task 2 Markets

The prime objective of this report is to outline the economic, market and stock data of the products covered by the Ecodesign Regulation 2019/424 on servers and data storage products.

2.1 Generic Economic Data

The European Union's (EU) official source of statistics is PRODCOM and data are published annually by EUROSTAT¹. PRODCOM data is based on manufactured goods whose definitions are standardised across the EU, therefore guaranteeing consistency and comparability between Member States. Although these statistics are often used and referenced in other EU policy documents when it comes to trade and economic policy, they have their limitations. Many data points are unreported, estimated, or confidential. There is also a lot of overlap of products with the same PRODCOM code. Thus, it can be difficult to get an accurate statistic for servers and data storage products. The study team has chosen the following PRODCOM codes which it feels best represent servers and data storage products.

There are seven categories defined by PRODCOM that cover servers and data storage products². PRODCOM classifies servers and data storage products in the categories:

- NACE 26.20 "Manufacture of computers and peripheral equipment" and
- NACE 26.30 "Manufacture of communication equipment"³.

The products covered under these categories which are relevant to this study are presented below separated out by product type:

2.1.1 Servers

- **26201400** – Digital data processing machines: presented in the form of systems;
- **26201500** – Other digital automatic data processing machines whether or not containing in the same housing one or two of the following units: storage units, input/output units;

2.1.2 Servers and storage-related network equipment

- **26302320** – Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus;
- **26302370** – Other apparatus for the transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network), other than transmission or reception apparatus of HS 84.43, 85.25, 85.27 or 85.28.

¹ <https://ec.europa.eu/eurostat/web/prodcom>

² <https://ec.europa.eu/eurostat/web/main/home>

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R2119>

2.1.3 Storage equipment

- **26202100** – Storage units;
- **26203000** – Other units of automatic data processing machines (excluding network communications equipment (e.g. hubs, routers, gateways) for LANs and WANs and sound, video, network and similar cards for automatic data processing machines);
- **26202200** - Solid-state, non-volatile data storage devices for recording data from an external source (flash memory cards or flash electronic storage cards), unrecorded

These categories include a wide range of products, and it is not clear exactly which devices each category covers, as the aggregation level of data remains relatively high. There are some concerns when using the PRODCOM data, where the codes and their scope are not completely clear:

- The scope of 26.20.14.00 code is not completely clear but this code is more likely to represent coding for computer mainframes.
- The scope of 26.20.15.00 code is not completely clear but it is more likely to represent coding for computer servers.
- 26.20.21.00 storage units may not apply to data storage devices as intended in the study. This is because it is possible the code is covering units such external hard drives, or USB keys.

Table 2.1 Market data for servers and data storage equipment in 2021 (EU-27)⁴.

PRODCOM NACE Code	Quantity in 1000 units				Value in million €			
	Production	Import	Export	Apparent EU consumption ⁵	Production	Import	Export	Apparent EU consumption
26201400	3,720	1,064	1,000	3,784	48,800	10,910	14,706	45,004
26201500	2,000	16,868	6,508	12,360	1,671	6,690	6,472	1,889
26202100	6,000	95,120	21,794	79,326	590	8,555	3,548	5,597
26203000	3,325	n/a*	n/a	n/a	428	n/a	n/a	n/a
26202200	390	5,187	640	4,937	144	2,616	574	2,186
26302320	53,625	n/a	n/a	n/a	3,558	27,958	14,075	17,441
26302370	13,735	n/a	n/a	n/a	1,408	640	654	1,394

*n/a – Data not available.

The data presented in Table 2.1 represents the overall EU-27 production, trade, and apparent consumption in 2021 according to the seven PRODCOM categories. The 2021 data are the latest available at the time of writing this report. These values are compared below in Figure 2.1 and Figure 2.2.

⁴ Source: PRODCOM

⁵ Apparent EU Consumption = EU production + EU imports – EU exports

Figure 2.1 Market size for servers and data storage products in the EU-27 in 2021⁶

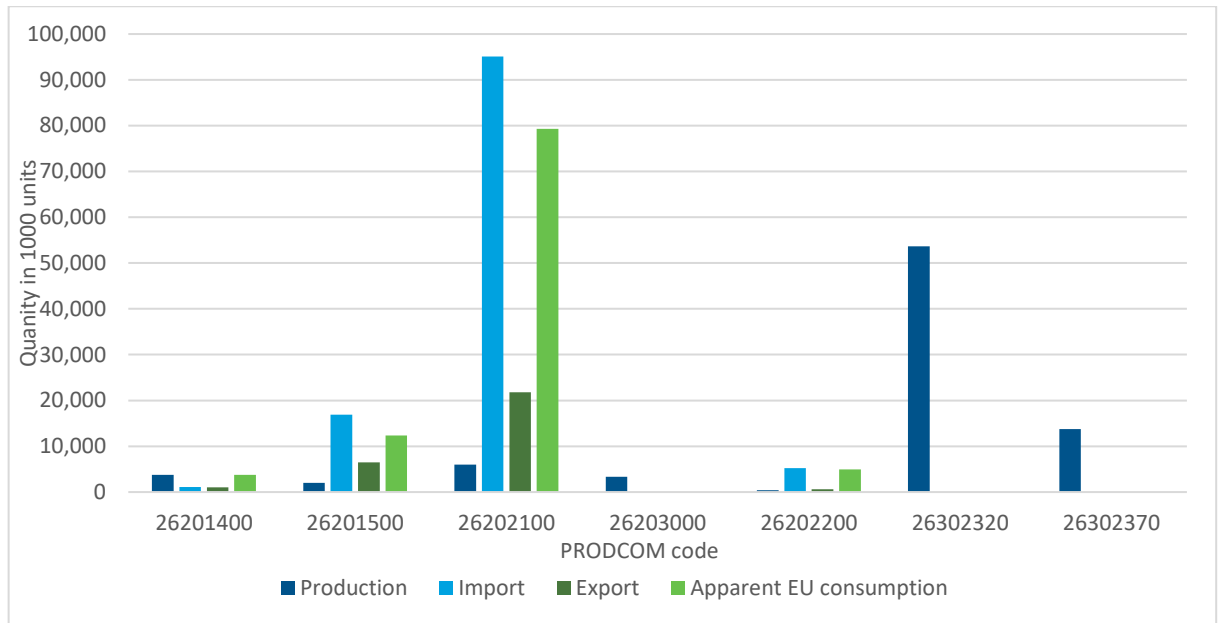


Figure 2.1 demonstrates that data storage products have the highest unit sales. However, due to the discrepancies in the PRODCOM code for 26202100 “Storage Units”, it is not clear what type of storage units are specifically included. It should also be noted that it is common practice to count storage products in terms of GB of storage, rather than number of devices as is presented by PRODCOM. Consequently, this may explain the order magnitude difference for this category. Hence, later on in this report we have analysed the capacity of data storage products as well as the number of shipments. This is displayed in **Error! Reference source not found.** and **Error! Reference source not found.**

For servers, imports are greater than exports, which is expected, with most servers manufactured outside of the EU, as described in Section 2.4. Figure 2.1 demonstrates that production of servers and storage related network equipment is also one of the major markets for the EU regulation. However, there was no data on imports/ exports for these PRODCOM codes. Thus, a full picture of the EU market is not available for servers and storage related network equipment.

⁶ Source: PRODCOM

Figure 2.2 Market value for servers and data storage products in the EU-27 in 2021⁷

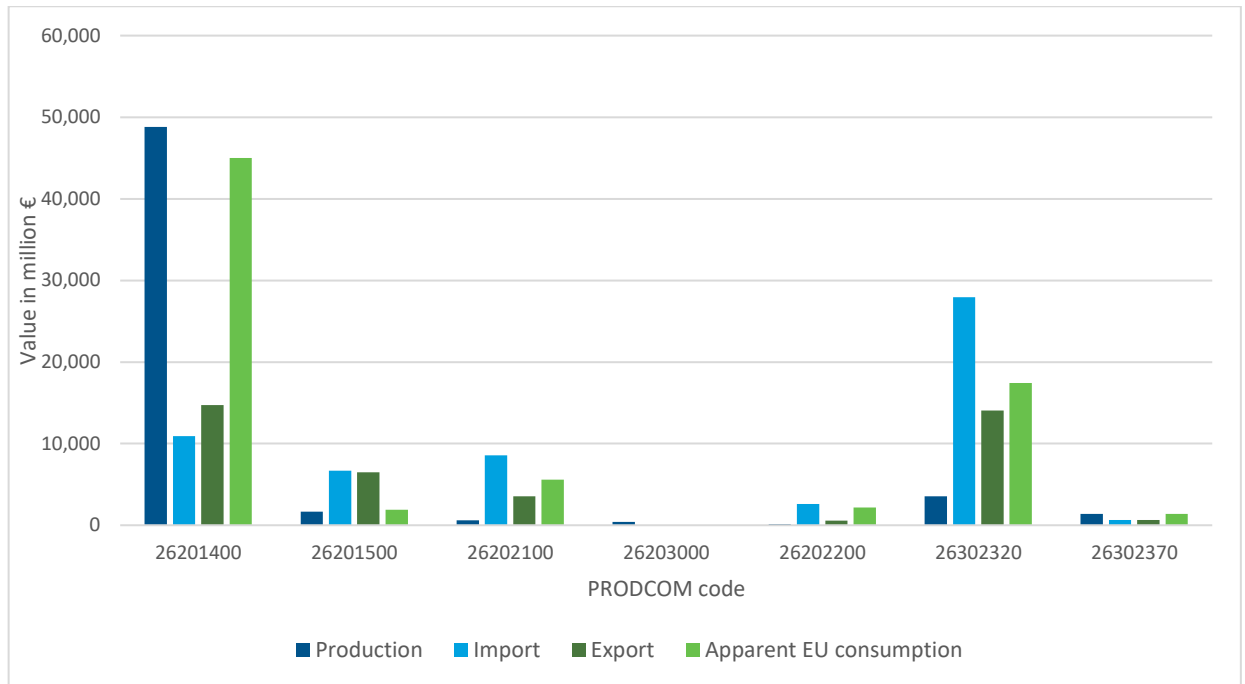


Figure 2.2 demonstrates the market value of imports, exports. From Figure 2.2 it is clear that the values of imports are far superior than exports for servers and storage-related network equipment. In addition, for the individual categories for servers and data storage products imports, imports appear to be greater. There is a significantly high production value for the “*Digital data processing machines: presented in the form of systems*”. However, it is difficult to determine how servers impact this value, judging by the import values in Figure 2.1 it looks to be quite small, as imports are high in the EU.

Overall, due to the heterogenous nature of the data collected from PRODCOM this data does not present the best available source of sales, production, and trade. However, PRODCOM does provide a reference point to ensure that data utilised later on in the document is accurate. This breakdown limitation that the PRODCOM codes presented above will only serve for informational purposes. PRODCOM data will not be considered in the environmental and life cycle assessment analysis during this study.

2.2 Market and stock data

This section looks to provide the market analysis for servers and data storage products further than the PRODCOM data. Providing market and stock data for servers and data storage products covered by the Regulation 2019/424.

2.2.1 Manufacturer and Supplier Engagement

To collect data, we have circulated qualitative and quantitative questionnaires with over 150 stakeholders. Table 2.2 demonstrates the level of engagement received for both the questionnaires.

⁷ Source: PRODCOM

Table 2.2 Number of responses to questionnaires circulated.

Type of Questionnaire	Number of responses
Qualitative Questionnaire	19
Quantitative Questionnaire	3

Off the back of this, we very much hope stakeholders will engage further with the study, in light of this information. Following the publication of the draft Task 2 report and the data requests that were highlighted by the draft reports, the study team has received significantly more feedback.

2.2.2 Sales data at global and EU level

2.2.2.1 Servers

Sources such as Statista, provide figures for the global and EU server market value and shipments. Table 2.3 below presents this data. Calculations have also complemented certain gaps in the data, such as by assuming that the EU percent share of the global market has continued to decrease at the same rate since 2019, and that the average price per unit has not changed significantly since 2020.

Table 2.3 Server market and Shipment data (Statista and ICF calculations)⁸

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Global server market revenue (\$bn)	87.18	91.02	<i>90.94</i>	<i>90.86</i>	90.78	96.04	101.60	107.48	113.70
Global server shipments (million units)	11,74	12,15	<i>12,14</i>	<i>12,13</i>	<i>12,12</i>	12,82	13,56	14,35	15,18
EU server market revenue (\$bn)	<i>12,68</i>	<i>13,18</i>	<i>13,10</i>	<i>13,03</i>	12,95	13,63	14,35	15,10	15,9
EU server shipments (million units)	<i>1,71</i>	<i>1,76</i>	<i>1,75</i>	<i>1,74</i>	<i>1,73</i>	1,82	1,92	2,02	2,12
EU percent of global market share	<i>14,55%</i>	<i>14,48%</i>	<i>14,41%</i>	<i>14,34%</i>	<i>14,27%</i>	<i>14,19%</i>	<i>14,12%</i>	<i>14,05%</i>	<i>13,98%</i>

Figures in italics have been calculated from the statista data

The data shows how the server market is currently expected to grow until 2027. This has changed since 2020, as the Covid-19 pandemic slowed sales between 2020 to 2022. The EU share of the global market is approximately 14%, but has been decreasing, despite continued growth of the EU revenue. This is due to the strong growth of the Asian market. Additionally, the UK exit from the EU has had a

⁸ [Servers - EU-27 | Statista Market Forecast](#) ; [Servers - Worldwide | Statista Market Forecast](#) ; [Server shipments worldwide 2020 | Statista](#); [Server market revenue worldwide 2020 | Statista](#) ; [End user server spend worldwide 2019-2024 | Statista](#)

significant impact on the EU's server market because it was found that around 24% of the EU's total datacentre equipment was located in the UK, in 2019⁹.

2.2.2.2 Data Storage Products

Data storage units can either be host based or external controller based as displayed in Table 2.4.

Table 2.4 Storage options for data storage products

Host Based	External Controller Based
Internal	All External
External	iSCSI
SATA	Fibre Channel
SCSI	
JBOD Enclosures	

Table 2.5 Data storage product market revenue data (Statista and ICF calculations)¹⁰

	2020	2021	2022	2023	2024	2025	2026	2027
Global data storage market revenue (\$bn)	41,15	43,41	45,79	47,92	50,59	53,41	56,38	59,52
EU data storage market revenue (\$bn)	6,04	6,32	6,61	6,86	7,18	7,52	7,87	8,23
EU percent of global market share	14,68%	14,56%	14,44%	14,32%	14,19%	14,07%	13,95%	13,83%

Figures in italics have been calculated from the statista data

As with servers, the data storage market is expected to continue growing until 2027. However, unlike for computer servers, the demand for storage did not decrease in 2021-2022 due to the covid-19 pandemic. The EU share of the global market is approximately 14%, but has been decreasing, despite continued growth of the EU revenue. This is due to the strong growth of the Asian market.

2.2.3 Sales growth rate

The global server market is estimated to grow by 5.79% Compound Annual Growth Rate (CAGR) from 2023 to 2027. For the EU, this growth is forecast to be 5.26% from 2023 to 2027, raising the market share from 12.95\$bn to 15.9\$bn.¹¹ It is noted that the growth rate of the EU market is lower than that of the global figure, as although the industry continues to develop, the Asian market is expected to grow at a faster rate, justifying the difference.

Similarly, the data storage market is expected to continue to grow by 5.57% CAGR globally, and by 4.67% in the EU, from the years 2023 to 2027. The EU market is expected to grow from 6.86\$bn to 8.23\$bn from 2023 to 2027.

⁹ https://photonicsuk.org/wp-content/uploads/2016/12/ktn_a4_big-data_v9_released.pdf

¹⁰ [Storage Report 2021 | Statista](#) ; [Storage - EU-27 | Statista Market Forecast](#)

¹¹ Source: [Servers - EU-27 | Statista Market Forecast](#)

2.2.4 Product Lifetimes

There are two different types of “lifetimes” that need to be clarified to avoid confusion:

- **The economic lifetime:** is the time after which equipment is renewed by the owner/operator for economic and business reasons; and
- **The technical lifetime:** is the time after which the product no longer functions and cannot be repaired. This is usually longer than the economic lifetime.

When considering the lifetime of a product it is important to consider both reliability and durability of a product. The *reliability of a product or part is the probability that it performs its intended function(s) under given conditions, including maintenance, for a given duration without failure.* The *durability of a product or a part is the ability to function as required, under defined conditions of use, maintenance and repair, until a limiting state is reached. Durability is a broader concept than reliability because it includes repair*¹².

Servers and data storage equipment can have a technical lifetime of greater than 10 years for certain equipment. However, this can be impacted by the modularity of the equipment because this makes it difficult to determine the composition of the equipment. This can be caused by failing components (e.g., memory) which are replaced meaning after a several years in service the product could be composed of completely different components, while still being the same product.

There are several reasons why servers and data storage products may undergo early replacement before the end of the technical lifetime, and even before the end of their economic lifetime. This revolves around improving the energy efficiency of a data centre. It may become apparent that the latest technologies are significantly more efficient than current installations. Improvements include a new capacity, service contracts and operating system conversions. For example, technologies such as virtualisation and those arising from software defined hardware structures (e.g. Software Defined Data Centres, etc.) will reconfigure or accelerate retirement of older systems. An additional reason for early replacement is that end-users may want to avoid repairing products themselves.

Table 2.6 provides an overview of the estimated lifetime for servers and data storage products. This data had originally been extracted from the previous Task 2 preparatory study conducted for this regulation. However, following stakeholder feedback the below updates were made to the previous study’s values for lifetime. It is clear from Table 2.6 that there is a significant difference between the economic and average lifetime of these products.

Table 2.6 Average lifetime, by type of equipment¹³

Equipment type	Average economic lifetime (in years)	Average technical lifetime (in years)
Rack-blade, rack-mounted, tower/ standalone and multi-node servers	3 for lease 3 to 5 for primary users Up to 5 to 7 for secondary user	5 - 12

¹² Stakeholder feedback

¹³ Source: Preparatory study for implementing measures of the Ecodesign Directive 2009/125/EC, DG ENTR Lot 9 - Enterprise servers and data equipment, Task 2: Markets, July 2015: Final report, bio by Deloitte & Fraunhofer IZM

Equipment type	Average economic lifetime (in years)	Average technical lifetime (in years)
Mainframe servers	7 - 15	20
Data storage products (HDD, SSD, storage shelf and hybrid drives)	5 – 7	HDD: 10-15 SDD: 7-10 Storage shelf: 15-20

2.2.5 Replacement rates and new sales

Overall sales figures are determined by the new sales and replacement sales. It is important to distinguish between these two sale types:

- **New sales:** result from new service needs
- **Replacement sales:** involve replacing products that reach their economic lifetime

The previous preparatory study indicated that the sales growth rates would diminish due to increased utilisation rates through virtualisation. However, stakeholder feedback indicates that utilisation rates have not significantly increased, meaning that server sales have continued to increase.

2.2.6 Installed base (stock)

The objective of this section is to present forecasts of the installed stock development of the different products in scope of Regulation 2019/424. The forecasted stocks are geographically limited to EU-27. It should be noted that that servers and data storage products undergo very fast technological changes. It is for this reason that the long estimations required by the MEErP tool must be considered with caution. These estimations are based on the current knowledge and perspectives of the market and new calculations based on updated data may result in variations to the outcome.

2.2.6.1 Installed stock for servers.

Installed stock data was collected from stakeholder feedback during the consultation process of this review. This data originated from the Borderstep Institutes 2020 report¹⁴ on cloud services in the EU-28. The study team was able to extract stock data for servers from this report with actual data provided up to 2018 and forecasts up to 2025.

To calculate stock levels up to 2050 a linear growth approximation was applied to the existing data from the report. It should be noted that the data provided accounted for the EU-28. Thus, adjustments were made to ensure that it accounted for the EU-27 only. To remove the UK's influence on the EU's server stock data a 24% reduction was applied to the extracted values. This market split was sourced from a KTN (Knowledge Transfer Network) report published in 2019¹⁵. As a result, the size of the UK market was assumed to be 24% between 2010 and 2025. A linear

¹⁴ <https://digital-strategy.ec.europa.eu/en/library/energy-efficient-cloud-computing-technologies-and-policies-eco-friendly-cloud-market>

¹⁵ https://photonicsuk.org/wp-content/uploads/2016/12/ktn_a4_big-data_v9_released.pdf

growth was then applied to the values once the UK's market stock value was removed.

Table 2.7 illustrates the calculated data from the KTN report up to 2025 (excluding the UK) and ICF's calculated values for the EU's stock of servers from 2030 to 2050. The values 2010, 2015 and 2018 are actual data points, while the 2020 to 2050 are forecasts (2030-2050 ICF's assumptions).

Table 2.7 Servers stock in the EU-27 in thousands of units (forecast: 2020-2050)¹⁶

Server type	2010	2015	2018	2020	2025	2030	2035	2040	2045	2050
Volume servers	6841	7947	8066	8149	9467	9709	9957	10212	10473	10741

The report provided data for several types of servers for example the report included data for high and mid-range servers. However, it was felt only those presented by Table 2.7 represent the only relevant type of server for the Regulation.

Table 2.7 demonstrates the calculated linear growth of 2.56% in volume server stock from 2025 to 2050. Overall, there was a 57% increase in the market stock of volume servers between 2010 and 2050. However, Table 2.7 does not break down the servers by its form factor therefore, not closely aligning with the scope of the Regulation.

To ensure that the stock values we had for servers aligned with the Regulation we calculated a percentage market share for rack bladed and rack mounted servers. This percentage share was calculated based on the data provided in the previous preparatory study where in 2013, 14% of the market were rack bladed and 70% of the market were rack mounted servers. This market split for rack bladed and rack mounted was used to calculate the stock of these form factors up to 2050, based on the volume server values originally presented in Table 2.7. The market share was assumed to remain constant up to 2050.

Table 2.8 Rack bladed & rack mounted stock data for the EU-27 in thousands of units (2030-2050: ICF forecasts)

Form factor	2010	2015	2018	2020	2025	2030	2035	2040	2045	2050
Rack bladed	937	1088	1104	1116	1296	1329	1363	1398	1434	1471
Rack mounted	4757	5526	5609	5666	6583	6751	6924	7101	7283	7469
Total	5693	6614	6713	6782	7879	8080	8287	8499	8717	8940

2.2.6.2 Installed stock for data storage products.

Like servers, the stock data for data storage products was analysed from the Borderstep Institutes report¹⁷. The study team was able to extract stock data from this report with actual data provided up to 2018. The original data presented by the Borderstep Institute represented stock values for the EU-28. Therefore, the same

¹⁶ Stakeholder feedback

¹⁷ <https://digital-strategy.ec.europa.eu/en/library/energy-efficient-cloud-computing-technologies-and-policies-eco-friendly-cloud-market>

24% reduction in stock values was applied to the data storage products to ensure the UK's influence on the EU market was removed. A linear approximation was used in order to calculate the stock values for hard disk drives (HDD) and solid-state drives (SSD) from 2030-2050. For HDD, a 5% growth rate was calculated based on growth observed between 2010 and 2025 in the Borderstep Institute. Table 2.9 demonstrates that there was a significant increase in the stock levels of SSD between 2010 and 2025, however, this growth rate was not expected to continue. Thus, following market research, it was found that in Europe the growth rate for SSD products was 13.6%. This percentage value was extracted from a KBV research report on the European SSD market¹⁸. The study team felt that this value provided a more conservative value of market growth for SSD products and ensured that the large exponential growth experience up to 2025 did not continue. The data that was calculated for SSD and HDD stock is presented below in Table 2.9.

Table 2.9 Hard disk drives and solid-state drives stock in the EU-27 in thousands of devices (2030-2050: ICF forecasts).

Storage type	2010	2015	2018	2020	2025	2030	2035	2040	2045	2050
HDD	35119	54609	66228	68285	60915	77744	99224	126637	161625	206279
SSD	1078	10184	26325	38170	67313	127348	240926	455801	862317	1631393

Table 2.9 illustrates how the market is expected to switch from predominantly HDD products to mostly SSD products. Nevertheless, the HDD market is expected to continue to grow, although, the stock growth rate is much slower than the growth rate for SSDs. As a result, by 2025 SSD stock has overtaken HDD as the main storage product on the market in the EU. SSDs have become the popular choice over HDD because they have no moving parts. Thus, meaning they can access data at a much higher speed than HDDs. SSDs are also becoming more cost effective and developing at much faster rate than HDDs. For example, the highest capacity 7.2k RPM HDDs are around 20 TB while the highest capacity SSDs are around 100 TB and growing¹⁹. However, HDDs are expected to remain popular for many reasons such as, they have a longer lifespan and they are remain at a competitive price in comparison to SSDs.

2.3 Market channels

2.3.1 Link to Phase 1 report

The Phase 1 report introduced the procurement practices for servers and data storage products in Section 2.7. This section of the Task 2 report will introduce the procurement practices for servers and data storage products. Section 2.4 and Section 2.4 and Section 2.7 of this Task 2 report will also provide information on the procurement practices of servers and data storage products.

¹⁸ <https://www.kbvresearch.com/europe-solid-state-drive-ssd-market/>

¹⁹ Stakeholder feedback

2.3.2 Channels to market

Servers deliver a data service which can be delivered anywhere around the globe with an internet connection. However, despite the capability of delivering a service remotely, there are considerations for the market to be aware of around economic, political and security concerns.

- Servers are heavily tied to the financial sector, which relies on servers for processing financial information, and therefore regulations around servers may have impacts on the finance industry.
- On political matters, data privacy concerns, notably the development of GDPR, has led to the development of servers to host data domestically. For security reasons, countries may not only want servers to be hosted domestically but also manufactured domestically, as there may be concerns of the creation of backdoor access mechanisms created during the manufacturing process.

2.3.3 Direct sales to customers

There is mixed feedback from stakeholders on the route to market for servers and data storage products. The North American market is dominated by purchasing occurring directly from Original Equipment Manufacturers (OEM) to the end user client. These purchasing decisions are made primarily around the technical performance capabilities of the product. With regards to energy efficiency, the procurement metric in North American market is to ensure that devices meet the Energy Star criteria.

In Europe, purchasing decisions are similarly focused on technical performance. However, stakeholder feedback discussed in the Phase 1 report, provides a mixed picture that distributors may have a more active involvement in the sales of servers and data storage products, instead of sales coming directly from manufacturers.

2.3.4 Secondary Market for servers

Since a large focus of this study lies on the reuse of servers and data storage products the secondary use of these products should be discussed. In 2015 the ICT aftermarket was worth \$46 billion in Europe and employed more than 220,000 people²⁰. Third party companies control the majority of sales of equipment in ICT aftermarkets, with a clear separation between them and the original manufacturer of the hardware and software. Independent service providers account for 15% of the hardware support market and 5% of the software support market²¹.

2.3.5 Distribution routes

The product distribution channels of the products eligible for Regulation 2019/424 are mostly business-to-business. This is because servers and data storage products usually require experience and engineering knowledge for proper installation and configuration. Within the Phase 1 report, stakeholder feedback has indicated that the route to market in Europe is directly from manufacturers and through distributors.

²⁰ Stakeholder feedback

²¹ Stakeholder feedback

2.3.6 Installation services

Servers are expensive to not only purchase, but also to install. Therefore, installation costs must also be considered when purchasing the product. Installation services are usually offered by the manufacturer selling the product at an additional fee. In addition, most manufacturers include warranties within their purchase prices for servers and data storage products. Usually, these warranties stand for three years from the date of purchase. However, this can be as low as one year for low-end models or as high as seven years, in some instances.

Installation costs are discussed in greater detail in Section 2.7.3 of this report.

2.4 General market trends

There are several market trends that can influence the sales and stock of IT equipment, these include:

- **Cloud services:** this includes software as a service such as productivity software. It also relates to media and data storage, video streaming, customised media services and gaming platforms. Cloud services demand high volumes of storage capacity.
- **Big data:** this incorporates ubiquitous and automatic sensor data acquisition, automatic filing and analysis, software-defined IT resource utilisation and increased data security provisioning. In recent years there has been an increased collection of sensor data, transportation, energy grids, environmental applications, customer relationships and other end-user data. The development of these data sources has seen servers and data storage products evolve to adapt to the increased storage needs.
- **Fixed-mobile conversion:** mobile computing and communication is an important market driver for servers and data storage products.
- **Security and encryption:** the secure communication and data handling will always drive evolution of the design and architecture of products. Encryption technology continues to grow, especially with the likes of Crypto currency becoming ever popular. This growing trend has led to both software and hardware-based solutions. The SPEC SERT test standard reflects the demand in encryption technology by testing a specific encryption workload (worklet).
- **Real time computing:** immediate communication (latency and bandwidth) is continuing to increase in demand, especially post Covid-19 with hybrid working practices still being popular.

2.5 General trends in product design and product features

The key drivers with respect to product features are expandability, reliability, energy efficiency and cost. There is significant recognition of the resource limitations within a data centre, therefore, most market segments will aim to maximise useful output.

Servers tend to be hosted in two types of locations: distributed IT (where servers are used in offices or other buildings which are not dedicated for servers), and datacentres (which are specialised locations for server usage, with dedicated power and HVAC services).

The bulk of servers are operated within datacentres. The trend has been to consolidate data operations in data centres as their operation is optimised, allowing

for better tracking of energy usage across devices and support systems. These buildings can also be reinforced in terms of data connectivity and power availability.

Within the datacentre ecosystem, there are a few different models: Enterprise IT (which are locations which are owned by a single operator, with only their servers present), Colocation IT (which are datacentre spaces which provide a space with appropriate temperature, power, and internet connection for operators to rent for their servers).

The services provided by servers may be directly for owners or could be provided under the following cloud services: Infrastructure as a Service (IaaS) or Platform as a Service (PaaS). IaaS provision allows for a user to hire the control over a virtual machine, with a set storage and workload capabilities. PaaS is used for general software development and hosting the software after development, for example to host a website. The markets of IaaS and PaaS are globally dominated by AWS, Microsoft Azure, Alibaba cloud and Google cloud (GCP), with a combined forecasted revenue estimated at 167.3 billion US dollars.

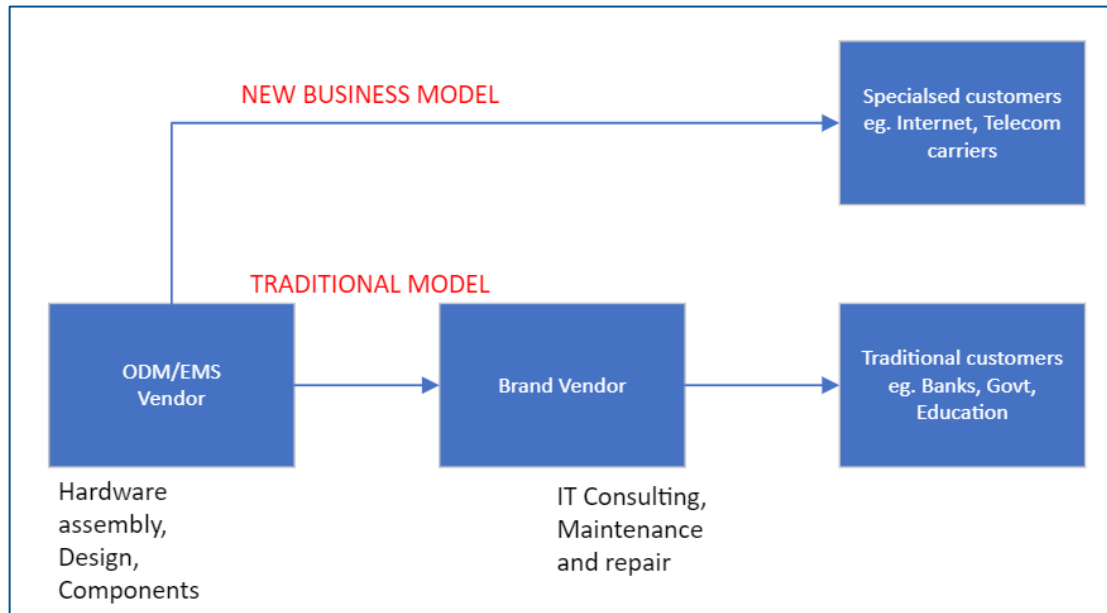
Lastly datacentres are crucial for the delivery of Software as a Service (SaaS), often called web services. SaaS makes applications available to the end user via the internet, such as Gmail, Microsoft 365, OneDrive, Netflix, etc.

It is important to note that nearly one third of the server market sales are comprised of white box original design manufacturers (ODM) servers which are customised by or for customers²². These products are produced by manufacturers including Quanta, Wistron, Inventec and shipped unbranded directly to customers. These products are currently exempt from providing information requirements within the regulation. They make up a notable portion of the market and are often deployed in hyperscale data centre environments where the server is designed to maximise efficiency for a specific corporate or research workload at reduced cost (typically 25-30%)²³. Figure 2.3 illustrates the divergent pathways that split the servers and data storage market.

²² <https://datacenters.lbl.gov/sites/default/files/EnergyUsageWebinar12062016.pdf>

²³ <https://www.ventureoutsource.com/contract-manufacturing/focus-odm-quanta-it-shift-cloud-infrastructure-leaving-dell-hp-traditional>

Figure 2.3 OEM vs. ODM sales channels in computer server market²⁴



In terms of product diversity, it is expected that this will continue to increase through the EU. This is being driven by the big data, fixed-mobile convergence, encryption and secure communications and cost considerations. It is common for vendors to introduce new products approximately every 18 to 24 months. These products are usually much more powerful than the previous generation and cost roughly the same.

On a technical level there are several emerging technologies that the project team has identified and that it believes should be considered when updating the regulation requirements. These technological, market and regulatory evolutions include:

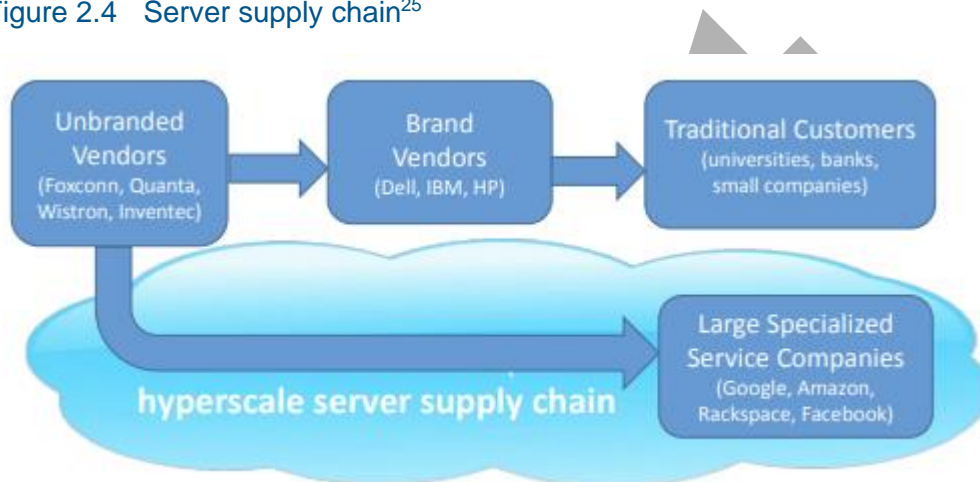
- The emergence of storage “heavy” servers, or servers with an abnormally high capacity of storage devices which make it difficult to distinguish with storage products.
- Persistent memory, and how that creates a grey area between DRAM and traditional storage in both servers and storage products.
- Better defining and addressing hyperconverged servers which perform server, storage, and network functions in a single enclosure, presenting a very challenging testing case as testing all functions simultaneously is not currently possible.
- Updates in HPC, AI, and machine learning architecture, and how those updates may allow those products to be regulated more easily.
- Ebbs and flows in the adoption of virtualisation in server deployments.
- Impacts of broader data centre consolidation, along with the recent push back towards the edge particularly in telecom operations due to increased bandwidth needs and 5G infrastructure support. Particularly how increased rack density is impacting both deployment models as well as product design.

Emerging from the growth of cloud platforms, social media and big data are large hyperscale data centres. These are large warehouse sized data centres which have

²⁴ Source: ICF

hyperscale servers with them. As a result, the server market is seeing a shift in the traditional sales channels involving different elements of the market. This new avenue of sales moves away from sales being made by the global computer companies (e.g., Dell, IBM, HPE). Instead, the hyperscale server sales are bypassing these brand vendors in the supply chain and brought directly from the manufacturing companies that build the servers (e.g., Quanta). The purchasers of these hyperscale servers are the large internet companies (e.g., Goggle, Facebook), who typically use these within their hyperscale data centres. Figure 2.4 illustrates this new approach to the supply chain for hyperscale servers. Branded vendors represent the global computer companies, unbranded vendors are the manufacturing companies.

Figure 2.4 Server supply chain²⁵



2.6 Market segmentation

2.6.1 Market share

The market for servers and data storage products in the EU is dominated by a few large manufacturers, who are key global players and produce their products outside of the EU-27. Meanwhile, small, and medium enterprises (SMEs) have a low share of the EU market.

Manufacturers of OEM servers and storage products are mostly based in the US (HPE, IBM, Oracle, Cisco, Dell, NetApp) and the Far East (Lenovo, Fujitsu, NEC, Inspur, Huawei). This correlates with the data in Table 2.1, which demonstrates how the EU is dependent on imports. Sales for servers and storage are mostly conducted as a business-to-business transaction by manufacturers themselves.

Many of the manufacturers are well represented by industry associations at the Member State level, mainly through DIGITALEUROPE²⁶ and The Green Grid²⁷ in the U.S. DIGITALEUROPE represents the European digital technology industry, which includes large and small companies in the Information and Communications Technology and Consumer Electronics Industry sectors. Containing more than

²⁵ <https://www.osti.gov/biblio/1372902>

²⁶ <https://www.digitaleurope.org/>

²⁷ <https://www.thegreengrid.org/>

10,000 companies all over Europe. Key global equipment manufacturers of servers and data storage industry are listed below in Table 2.10.

Table 2.10 List of manufacturers of servers and data storage products.

Servers	Data storage equipment
<ul style="list-style-type: none"> • Cisco • Dell • Fujitsu • Hitachi • HP • IBM • Inventec • Lenovo • NEC • Oracle • Quanta • Supermicro • Wistron 	<ul style="list-style-type: none"> • Dell • EMC • Fujitsu • HGST • Hitachi • HP • IBM • NEC • Netapp • Oracle • Seagate (Xyratex) • Western Digital

The product distribution channels of Regulation 2019/424 products are usually conducted via the business-to-business route. This is because these products usually require experience and engineering knowledge for proper installation and configuration.

The main customers for server manufacturers are hyperscale data centres and large business enterprises (LBE). Table 2.11 presents the server buyer market split, demonstrating that hyperscale and LBE account for 57% of EU's server purchases in 2022. SMBs and cloud service providers are the next largest purchasers accounting for 12% and 13% of the market split respectively.

Table 2.11 EU's server market split by purchaser type²⁸

Server Buyer	EU Market Share (2022)
Hyperscale	31%
Large Business Enterprise	26%
Cloud Service Provider (Non-hyperscale)	13%
Small and Medium Business (SMB) Enterprise	12%
Communication Services	8%
Managed Services	5%
Digital Service Provider	4%

2.6.2 Manufacturer product ranges

Overall, it is expected that product diversity of the market for servers and data storage products will continue to increase. This is driven by specialised applications such as big data, fixed mobile convergence, encryption, and secure communication. Manufacturers introduce new products approximately every 18 to 24 months that are more powerful than the previous generation and at roughly the same price.

²⁸ Stakeholder feedback

2.6.3 Market segmentation by technologies

2.6.3.1 Servers

The server's market is typically segmented by several factors such as its operating system (Windows, Linux, UNIX etc), server classification (high-end, mid-range, volume servers), server type (rack, blade, multi-blade and tower), end use (IT and telecommunications, retail, healthcare, media etc) and finally, geography²⁹.

The Regulation splits server types based on the form factor of the server. The form factor represents the size, configuration and physical arrangement of the server. Regulation 2019/424 covers the following four form factors for servers:

- Rack-blade servers
- Rack mounted servers
- Tower/ Standalone servers
- Multi-node servers.

2.6.3.2 Data storage products

Table 2.4 displayed the storage options that are present for data storage products, with storage options either host based, or external controller based. External based controller storage options are the focus of the Regulation, these are displayed below. External controller-based disk storages devices are a system that has one or more embedded controllers.

As discussed previously in Section 2.2.2.2, there are four dominant external controller-based storage units into the following four categories:

- Storage Area Network (SAN)
- Direct Attached Storage (DAS)
- Network Attached Storage (NAS)
- Content Addressed Storage (CAS)

2.6.3.3 Emerging datacentre operations

Cloud computing is changing the way that IT equipment is used, with cloud services becoming the dominant form of IT use globally³⁰. This trend towards cloud services couples with an increase in the number of hyperscale data centres. As a result, the number of hyperscale data centres doubled between 2015 and 2020³¹. With the European hyperscale market expected to grow by 22.5% per year between 2023 and 2030³². More businesses that are now using cloud services has grown significantly in the last decade. Figure 2.5 demonstrates the global increase in cloud computing use within businesses. In Europe (including the UK) the number of businesses that use cloud computing has increased from 19% in 2014 to 39% in 2021.

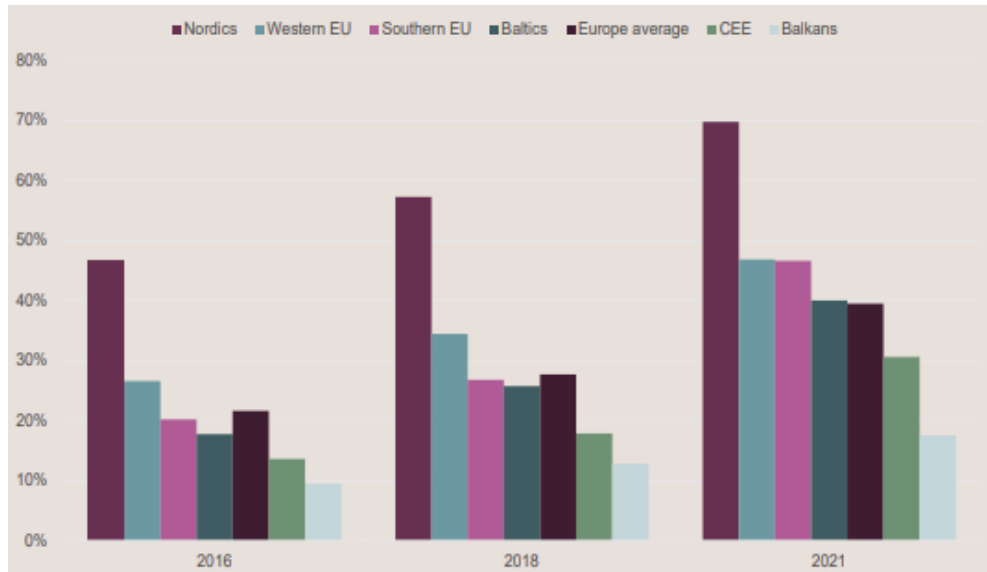
²⁹ <https://www.mordorintelligence.com/industry-reports/enterprise-servers-market>

³⁰ <https://digital-strategy.ec.europa.eu/en/library/energy-efficient-cloud-computing-technologies-and-policies-eco-friendly-cloud-market>

³¹ <https://pdf.euro.savills.co.uk/european/spotlight-european-data-centre---november-2020.pdf>

³² <https://marketresearchcommunity.com/hyperscale-data-center-market/>

Figure 2.5 Use of cloud computing by businesses globally³³



2.6.4 SMEs

As discussed in Section 2.6.1 large manufacturers dominate the market, meaning that SMEs have a very small share of the EU market share of products. This was also confirmed by the manufacturer's responses in the questionnaires and is highlighted in the Phase 1 report. It was communicated with the study team that SMEs are a key driver for the secondary market for servers and are the experts in life-cycle extension.

2.7 Consumer expenditure base data

2.7.1 Prices as sold

2.7.1.1 Servers

Server price ranges were separated by the four form factors displayed below, with the number of sockets being considered as well. This data was obtained from the previous preparatory study, inflated to the 2022 rates rounded to the nearest 100³⁴ after being compared and adjusted with current market prices as advertised on company websites.

³³ <https://pdf.euro.savills.co.uk/european/european-commercial-markets/spotlight-eu-data-centre---november-2022-.pdf>

³⁴ [Statistics | Eurostat \(europa.eu\)](https://statistics.eurostat.eu)

Table 2.12 Purchase prices (excl. VAT) of typical server products in Euros (€) / unit³⁵

Product Type		Range of purchase price (€/ unit)
Servers	Number of sockets	
Rack managed	1	1112-7880
Rack managed	2	6489-46,350
Tower managed	2	4635-27,810
Blade managed	4	3893-12,978
Rack resilient	2	5900-8000
Rack resilient	4	4000-85700

Table 2.12 illustrates that there is a wide range of prices for servers, in particular servers with two or four sockets. This again relates to the fact that servers are highly customisable products. Since there are many configurations that a consumer can choose for the same product, prices vary greatly. On the manufacturers websites there are often starting prices presented for simple configurations, with the prices increasing based on the configurations which are chosen. The following types of configurations are likely to have the greatest influence on the price of a server:

- Number and speed of CPUs;
- Type, speed and capacity of the memory;
- Type, number and size of disk drives;
- Operating system;
- Years of warranty included.

2.7.1.2 Data storage products

Price ranges for storage systems are given in Table 2.13 for the four different types, namely CAS, DAS, NAS and SAN. This data was obtained from the previous preparatory study, compared with current prices online and inflated to the 2022 rates rounded to the nearest 100³⁶.

Table 2.13 Purchase prices (excl. VAT) of typical data storage products

Type of storage system	Range of purchase price (€/ unit)
CAS	118,900 - 243,800
DAS	4,700 - 75,600
NAS	3,300 - 556,200 ³⁵
SAN	5,800 - 370,800 ³⁵

Like servers the price ranges for data storage products are very broad. This is dependent on several features related to the maximum amount of storage of the storage system. Additionally, the maximum number of drives and hence the capacity impacts the price. The number of drives is characterised by their type (HDDs or SSDs). Drive features and read/ write intensity significantly impact the price of drives. For example, a storage system with a write-intensive drive, with the same

³⁵ Source: Feedback from stakeholders provided in Dollars, converted to Euros on 09/02/2024 at 16:00 using (<https://www.forbes.com/advisor/money-transfer/currency-converter/usd-eur/>)

³⁶ [Statistics | Eurostat \(europa.eu\)](https://www.eurostat.eu)

speed and size costs twice as much as a drive without this³⁷. This is because write drives are able to transfer large amounts of data to the drive.

Prices also vary because of the following two technical specifications: high performance tiering, which increases the array of input-output performance; and SSD cache, which accelerates application performance by utilising SSDs as extended controller read cache.

Table 2.13 illustrates that CAS are the most expensive storage products on the market. This is because CAS storage units have a high number of drives and hence, a large capacity. They are significantly more expensive than SAN and NAS storage products which have a smaller capacity.

2.7.2 Production costs

Manufacturers were invited to provide feedback on the production costs for servers and data storage products. This is commercially sensitive information, which most manufacturers did not report.

2.7.3 Installation costs

An estimate can be made from the fact that the cost of an IT professional is on average €90-100 per hour³⁸. However, this is an estimate and not a certain total.

Installation costs for servers and data storage products are usually available via the manufacturer for an additional fee. Costs can vary dramatically depending on the size of the installation, while some manufacturers do not perform installations for certain types of servers. For example, Dell charges around €340 for the installation of a blade server, but they do not offer installations for rack and tower servers. It should also be noted that different labour requirements may be required depending on the product category.

Data storage product installation is a little more expensive than server installation, costing around €425 for installation of remote onsite hardware installation with remote configuration. The costs really depend on the type of size of the storage product being installed.

2.7.4 Energy & water costs

Electricity and water prices are presented in Table 2.14, this data has been extracted from the MEErP methodology. These values will be used during the modelling that is conducted in Task 5.

Table 2.14 Electricity and water prices in the EU-27, 2022 (Source: MEErP³⁹)

	Unit	Domestic incl. VAT	Long term growth p/a	Non-domestic excl.VAT
Electricity	€/ kWh	0.18	5%	0.11
Water	€/ m ³	3.70	2.50%	

³⁷ <https://www.dell.com/nl-be>

³⁸ <https://www.serverpronto.com/spu/2019/04/how-much-does-a-server-cost-for-a-small-business/#:~:text=Cost%20of%20Installation&text=The%20average%20cost%20for%20an,talking%20about%20%24400-%24500.>

³⁹ [MEErP Methodology Part 1 Final__ \(2\).pdf](#)

	Unit	Domestic incl. VAT	Long term growth p/a	Non-domestic excl.VAT
Energy escalation rate	%		4%	
VAT	%		20%	

Servers and data storage products require a lot of energy in order to maintain their functionality. Therefore, this section will describe how they consume large amounts of energy and what can be done to combat this soaring energy consumption. This is especially important given the increased energy security vulnerability that have arisen from the Ukraine War. With the EU's energy prices having been heavily impacted, saving energy in data centres is vital to ensure running a facility remains economically viable in the EU.

Current practice is that heat from servers in a data centre is not normally reused and is instead released externally into the atmosphere surrounding the exterior of the data centre, an action that increases the local and surrounding temperature. Sustainable or green IT is increasing in popularity and therefore the waste heat recovery is an aspect worth exploring within this study along current applications, possibilities and practice. This is more relevant to a building level requirement and less of a product consideration.

This niche application is being put in practice in certain situations such as at city/campus level. One of the innovators in this area, constructor of data centres, combines the locations of the centres to the surroundings, with the aim to utilise surplus heat⁴⁰. Preference is integration with existing CHP plants or other electricity plants that enables energy recovery in combination with renewable energy. An existing example is the Main Site of EcoData centre in Falun, Sweden.

One of the most recent practices on waste heat from data centres is an initiative from Microsoft to build a new data centre region in Finland, which will support the digital transformation and at the same time enable large scale district heating. It is expected that the waste heat produced in the data centres will be converted to district heating, serving Finland's second largest city Espoo and neighbouring Kauniainen, and the municipality of Kirkkonumm. Microsoft plans to create the world's largest scheme to recycle waste heat from data centres⁴¹

Liquid cooling of servers typically provides higher energy efficiency when compared to air cooled systems and could enable the driving of data centre industry forward. Manufacturers state that liquid cooling allows optimum energy use within the IT suite so that more power drives the applications on the servers rather than the cooling systems⁴². At the same time there are free air-cooled data centres in the US and adoption of free air cooling (at least part time) is preferred at Government data centres where possible.

Proposing requirements around proper deployment or quality of water-cooled solutions could be the way forward, however as these systems are still at their infancy, comprising of less than 5% of the server market, to impose requirements on water cooled solutions in a regulatory setting requires further review and analysis. In addition, liquid cooling introduces several new considerations including safety,

⁴⁰ <https://ecodatacenter.se/sustainability/>

⁴¹ [Microsoft announces intent to build a new datacenter region in Finland, accelerating sustainable digital transformation and enabling large scale carbon-free district heating - Microsoft News Centre Europe](#)

⁴² Solving Data Center hunger, EiBi, issue June 2022

proper fluid handling and maintenance (to avoid mould and/or corrosion etc.) and proper system design to minimise long term problems that specifically arise with the complications of liquid cooled solutions. Liquid cooling recommendations for this review study have been put forward in Section 2.11 of the Phase 1 report.

2.7.5 Repair and Maintenance costs (€/product life);

Servers and data storage products not only have a high CAPEX but are also expensive to operate and maintain. Therefore, the cost of ownership is one of the top criteria in purchasing decisions. Often manufacturers offer a three-year repair warranty with servers, however, for the low-end products this can be as low as one year. An estimate can be made from the fact that the cost of an IT professional is on average €90-100 per hour⁴³. However, the exact price of repair will be unique to each product.

2.7.6 Disposal tariffs/ taxes (€/product);

Electricity, fossil fuel, water, interest, inflation, and discount rates will use the values for Jan. 2011 in MEErP Chapter 2, including the average annual price increases mentioned there. For regional differentiation of consumer prices (for sensitivity analysis) also see Chapter 2 of the MEErP.

⁴³ <https://www.serverpronto.com/spu/2019/04/how-much-does-a-server-cost-for-a-small-business/#:~:text=Cost%20of%20Installation&text=The%20average%20cost%20for%20an,talking%20about%20%24400-%24500>