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Key points to consider across the Lot 9 task reports

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1. **Base cases**, as presented in the Task 4 document, are representative of specific subsets of the server and storage product groups.

   a. One and two socket x86 volume servers, excluding 4 socket servers and resilient servers.
   b. OL-2 and small OL-3 (up to 24 Large Form Factor or 48 Small Form Factor with up to 2 drawers) storage systems that would typically be found in small and medium enterprises or satellite office locations. The base cases would exclude large OL-3 and OL-4 to OL-6 storage systems typically found in medium and large enterprises.

   Given the selected base cases, the consultant either needs to limit the scope of the study by explicitly excluding server and storage product categories listed above or expand the base cases to include base cases representative of the product categories the consultant intends to include in the next steps of the Lot 9 Study.

2. The **storage base case is not representative of storage systems installed in enterprise data centers**.

   a. Data center products typically have redundant power supplies and controllers.
   b. Data center products populate full drawers with a single form factor. Mixed systems are built with drawers of different drive types, not with different drive types mixed in a single drawer.
   c. Mixed drive systems are found in OL-3 or OL-4 systems with at least 3 drawers, and typically four or more drawers. As a rule, you need a system of this size or larger to enable the use of Capacity Optimization Methods (COMS).
   d. For storage products, the current product set has two different levels of implementation for power supply efficiency depending on whether the Power supply provides a single or multiple output voltages.

      - Many storage power supplies are multi-output, which lowers efficiency because of losses driven by additional conversions in the power supply.
      - Storage power supplies are 2 to 4 years behind server power supplies. They are generally custom designed to fit the system, which requires long qualification periods and have higher power use requirements as compared to servers. Currently, storage multi-output powers are primarily silver equivalent supplies with some gold level equivalent supplies offered.
      - It is important to separate the requirements for single volt and multi-output power supplies as they are very different technologies with different development paths. Industry currently is early in the transition to Gold level PSUs in multi-output power supplies and is much more

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mature in the availability of Gold with some amount of platinum in the single output power supplies. For both single output and particularly for multi-output power supplies the larger, higher output power capable supplies are slower to transition to higher efficiency levels.

e. Power consumption for the proposed base case is 374 Watts, which is at the low end of power use for storage products installed in data center environments.

3. **Product scope**: the consultant needs to clarify the intent for network equipment, as different task documents provide different viewpoints on what is in and out of scope. Digital Europe continues to encourage the consultant and the directorate to initiate separate studies for network and storage products due to their complexity and the need to develop a better understanding of the power profiles, efficiency and markets for these products.

4. The ASHRAE discussion in Task 6 references attainment of the ASHRAE A1 temperature and humidity standards. **Existing IT equipment and data center infrastructure are largely capable of attaining the ASHRAE A2 standards for the temperature and humidity.** Many data centers companies are moving their data center temperatures to the upper end of the ASHRAE A2 range, though there is some increased risk of storage media failures at the elevated temperatures.

Implementation of the ASHRAE A2 standards across an existing data with a range of equipment types and ages will require turnover of the installed base and procurement of purpose made equipment to enable going to the next increment of higher temperature. In some cases, A2 capable equipment can be grouped in a single cooling zone of the data center to enable the delivery of higher inlet temperature air and realization of the energy savings. Many of the machine types in the current generation of server and storage products are built for A2 environments. You need to balance floor temperature with reliability (storage devices) with free cooling availability etc.

5. **The overall Data center PUE objective of 1.25 is unrealistic.** Optimal PUE for existing enterprise data centers is 1.4 to 1.5 with substantial free cooling and 1.65 to 1.8 for data centers with limited free cooling. The heterogeneity of the existing IT equipment and the limitations of the cooling infrastructure in enterprise data centers limit the improvements that can be made. Achieving the 1.1 to 1.25 range of PUE requires a homogeneous IT environment, 2 to 6 standard configurations of server, storage and network, and infrastructure which works toward the ASHRAE A3 limits with high percentages (>80%) free cooling. Right now, perhaps 20% of the IT space can work to the 1.1 to 1.25 PUE; the remaining space will be in the 1.4 to 1.8 range, with 1.4 to 1.6 represent 30% of the space and the remaining 50% in the 1.65 to 1.8 category.

6. **Idle power should not be used as an efficiency indicator** for any of the 3 enterprise data center products. Efficiency is a combination of capacity, ability to proportion power to the workload present, and average utilization of the capacity. These three characteristics do not lend themselves to metrics, which can be easily assessed for regulatory thresholds. The use of power proportioning and increased virtualization and utilization depend on how the data center operator provisions and manages their IT equipment and provision

workload within the data center. An idle power limit ultimately favors low power servers, with lower power processors and light component configurations. Low power systems are not the best for activities such as computational intensive workloads and highly virtualized servers. An idle power limit can preclude server products with the best quantity of workload delivered per unit of energy consumed. Similarly, low idle power thresholds for storage favor small, independent systems, which hinders the use of larger data sets for business transaction processing or big data applications.

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