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ENTR Lot 9: Enterprise servers and data equipment: Task 6

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Task 6	**Table 4, 5** **Table 11,12** **2.1.1**	**11,12** **16** **20,21**	**Power use reductions for on/Standby mode for dual power supplies.**	**While the consultant briefly notes the operation difficulties posed by the on/standby mode for redundant power supplies in data centers which use dual power feeds (separate, distinct power feeds to ensure availability), those difficulties and their impact on the stability of a data center configured with that type of power system are largely ignored in the discussions of potential savings. One manufacturer has removed the on/standby options on its systems because of strong feedback from multiple customers regarding the operational instability introduced to their data centers by the on/standby function.**	**Provide a clear statement that redundant power supplies configured with an on/standby capability are not appropriate for some data center configurations and should not be a mandated solution for power supplies.**
Task 6	**1.1.3**	**18**	**ASHRAE A1**	**Current server products are by and large capable of achieving ASHRAE Class 2 levels. Some storage products are A2 capable, while some are only A1 capable. See the ASHRAE website for specific temperature and humidity specifications. We have several**	**1. Re-evaluate the energy savings available from setting ASHRAE standard requirements for server and storage products. The current savings are significantly overstated. Given the current state of the market (in 2014/15) and available server and storage products, we believe that there are no or minimal potential energy savings available by moving to ASHRAE A1 or A2 capable products, server products are largely designed for A2 environments and storage products for A1 or A2**

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				concerns with the analysis. **a. The consultant needs to get data on the current percentage of server and storage products currently on the market that are ASHRAE A1 and A2 capable. Savings calculations should only be based on the percentage of products that will increase their potential operating temperatures, not on the full count of unit sales.** **b. The EU Data Center Code of Conduct is currently specifying ASHRAE A2 as the level at which data centers should be operating.** **c. Data center operators purchasing equipment today are by and large purchasing equipment that is A2 capable, with some storage equipment only capable of meeting A1 standards. Data center operators by and large have the ability to operate their data centers at A2 if they so choose. A2 should be the baseline comparison for energy savings calculations. If data center operators are not currently operating with the A2 range, that decisions is not a result of the ASHRAE capabilities**	**environments. Data center operating temperatures are managed by the data center operator – current products give them the ability to operate at ASHRAE A1 or A2 inlet temperature and humidity levels.** **2. Adjust the achievable PUE to a range of 1.4 to 1.8 in all but new, purpose built cloud data centers with largely homogeneous server, storage and network infrastructure – i.e. there are only 2 to 4 configurations of each of the 3 product types. The choice of a potential PUE of 1.25 grossly overstates the energy consumption reductions which can be achieved. The SNIA reference was taken out of context. The best available assessment of current data center PUEs in 2014, the average of which is estimated at 1.70, is provided by Uptime at this url:** http://www.datacenterknowledge.com/archives/2014/06/02/survey-industry-average-data-center-pue-stays-nearly-flat-four-years/ **There is some uncertainty as to the actual current average PUE because the sample taken by Uptime may not be representative of the total installed base. There are also significant differences in PUE based on the geographic location of the datacenter. This link discusses that uncertainty.** http://www.computerworld.com/article/2496597/data-center/new-data-center-survey-shows-mediocre-results-for-energy-efficiency.html **3. The consultant needs to get data on the percentage of current machine types that are designed for operations in ASHRAE A1 and A2 environments. Making a blanket statement that current products need to be brought up**

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				of the equipment they are purchasing, it is a function of the ages of the individual equipment in the overall equipment inventory in their data center, the capability of their facilities systems and their ability to manage the risks of over-temperature in their data centers. **d. Suggesting that you can drop from a PUE of 2 or greater to 1.2 is unrealistic. Current experience suggests that a cooling optimized legacy data centers can achieve a PUE between 1.4 and 1.8 depending on the age and configuration of the data center, the age distribution of the IT equipment, and the installed (as opposed to potential) free cooling capability.** **e. It also needs to be noted that major temperature changes can be achieved only if new equipment is segregated into defined zones to take advantage of the higher allowable server inlet temperatures or where a data center is totally populated with A2 capable server and storage products.**	**to the A1 standards is incorrect. For servers, DE believes that setting a requirement for A2 will take out the bottom of the market. For storage it is less clear. DE is working with its members to provide a compilation of what ASHRAE level current server and storage products are warranted to.** **4. The report needs to acknowledge that there are still potential reliability issues if storage equipment and storage media that are run in the high end of the ASHRAE A2 limits. Some currently available storage media is designed to operate reliably only in the ASHRAE A1 zone.** **These adjustments need to be reflected through sections 1.2, 2.1, 2.2, and 2.3 and in all calculations and conclusions.**

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				f. Some current storage products are designed to operate at A1 levels and others at A2 levels. The consultant needs to understand what the distribution of products are in the market and determine if setting A2 as a minimum product standard is appropriate to remove the bottom of the market. However, savings estimates should be based on the current percentage products at A1, not the total universe of products sold.	
Task 6	**1.1.3**	**14**	**Increase in fan speed at higher server inlet temperatures**	**For servers built and sold in 2012, it is correct that the energy consumption resulting for the increase in fan speed required at higher server inlet temperatures will largely negate the energy savings from reduced cooling requirements. It should be pointed out that the servers used in the base cases may not be designed for operation under ASHRAE A2 temperature conditions. The consultant needs to discuss the fact that equipment designed for A2 operation should be designed that there are overall energy savings from running at the higher server inlet temperature.**	**Modify the discussion to clearly state that IT products designed to operate under A2 conditions should provide net energy savings, though perhaps minimal, at the upper end of the ASHRAE A2 allowable temperature range.**

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Task 6	**Table 8**	**14**		**The selection of free cooling time and operating PUE is completely arbitrary and is representative of only 10-15% of the installed data center base. The use of 1.25 as the target PUE grossly overstates the potential energy savings realized by driving improvements in the ASHRAE capabilities for server and storage products.**	**The consultant should use 3 or 4 data center operation scenarios: no free cooling and chillers/DX units > 10 years old, new chiller with 40% average free cooling, and then an A2 system with 90% free cooling. This could correspond to a PUE of 1.75; 1.45; and 1.1 respectively. The savings calculations should then be calculated against a PUE of 2.0 and the range of possible improvement should be discussed. Current average PUE based on a survey by the Uptime Institute for 2014 is 1.70.** http://www.datacenterknowledge.com/archives/2014/06/02/survey-industry-average-data-center-pue-stays-nearly-flat-four-years/ **These adjustments need to be reflected through sections 1.2, 2.1, 2.2, and 2.3 and in all calculations and conclusions.**
Task 6	**1.1.4**	**16**	**Power management**	**Digital Europe provided the consultant data that showed that x86 power management on a server released in 2013 showed only a 2-5% reduction in energy consumption between the power favoured and performance favoured power management settings. A 15-20% improvement was noted on resilient servers. Digital Europe can provide additional equipment data measured by the SERT test on x86 equipment. Calculation of possible energy consumption savings with a 10% -**	**Adjust the power use reduction range for the power preferred setting to 2-5% and recalculate the potential savings. These adjustments need to be reflected through sections 1.2, 2.1, 2.2, and 2.3 and in all calculations and conclusions.**

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				20% power use reduction using the power preferred mode will overstate the possible savings by a factor of 2 to 5 times.	
Task 6	**1.1.4**	**16**	**Power Management**	**The discussion only mentions CPU power management. Memory power management and energy efficient Ethernet cards should also be considered and discussed.**	**Include memory and energy efficient Ethernet capabilities in the energy power management savings in the discussion.**
Task 6	**1.2**	**15**	**Sectioning**	**It is unclear why the blade analysis is done in section 1.2 and the rack analysis is done in 2.1.**	**The Base Case analysis should be started as section 2. Section 2.1 should be the rack analysis, Section 2.2 blade and section 2.3 storage.**
Task 6	**Figure 22**	**24**	**Operational savings**	**As discussed in comments concerning sections 1.1.3 and 1.1.4, the calculations shown in figure 21 significantly overstate the average savings and result in misleading conclusions. Adjustments need to be made, as discussed, in the power management savings and the savings generated by making products ASHRAE A1 or A2 capable (PUE savings) and different conditions need to be considered.**	**The ASHRAE A1 and power management savings calculations need to be done and restated, including an analysis of the potential range of savings given different PUE and power management percent savings outcomes. As discussed above, the consultant needs to get current data on the percentage of products that are A1 and A2 capable to properly assess potential savings. It is Digital Europe's belief that current products are either A1 or A2 capable.**
Task 6	**2.3.3**	**34**	**ASHRAE A2 Operation for Storage**	**Digital Europe provided data indicating that storage products operating at higher temperature ranges as will be be found at the**	**Address the issue of increased drive failure in the analysis in this section.**

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			products	**higher temps for ASHRAE A1 and A2, are likely to experience increased failure rates. There is an economic cost that needs to be considered: increased maintenance costs and lost productivity.**	
Task 6	**1.3.1, 3.3**	**19-20, 40**	**Storage Product Improvement Assessment**	**Titanium power supplies for storage systems are largely not available, as titanium power supplies have not been qualified in storage products. Titanium is achievable for server systems because they are single voltage power supplies.** **Titanium certified power supplies have been used in a very limited number of server products, but the qualification requirements for storage and server products can be different especially where the storage product uses a multi-output power supply** **Storage products often use a multi-voltage power supply. Storage is running 2 to 3 years behind server systems with regards to use of a given 80 plus power supply (or equivalent) efficiency level.** **Storage products typically require a larger output energy because of the**	**Storage power supplies need to be analysed independent of server power supplies.** **Use gold supply as best available for OL-3 and above storage products.**

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				fact that spinning drives have a consistent power use with little variation between maximum and idle power use. **The on/standby mode for redundant power supplies is difficult to apply to storage products. Per the 4 base cases Digital Europe provided to the consultant for storage products, the difference between max and idle power ranges from just 5% to 20%. In some cases, depending on the configuration of the storage product and the size of the power supply chosen the single power supply may have limited power overhead and it may not be desirable to routinely operate on a single power supply. The use of a single power supply is only desirable as an emergency back-up on a power supply failure, not as a routine mode of operation.** **Storage systems for OL-3 and OL-4 typically are not "off-the-shelf" models but are application specific.** **Current power supply technologies are not capable of meeting titanium requirements for multi-volt power supplies and platinum is a stretch because of the range and type of voltage conversions that must occur**	

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				within a multi-volt power supply.	
Task 6	**General Comment**		**Storage Products**	**In general, Digital Europe is concerned that the consultant and the directorate do not have an adequate understanding of storage product capabilities, functionality, and power profiles. The selection of a base case which does not represent actual product configurations and is focused on storage products sold to small and medium enterprises for use in office and data closet environments is acceptable if that is the part of the market that the directorate wants to address with the Lot 9 requirements. However, the base case is not representative of storage products installed in enterprise data centers.**	**Remove storage products from the scope of the current study and move them to a separate study activity.** **If the consultant wishes to maintain the storage base case, then the base case should be done based on a controller matched with one or two drawers of individual drive types: SSD, Large form factor and small form factor. That would provide 3 base cases, but it accurately represents how those products would be sold and allow the consultant to assess the material implications of the different drive types available for the system. As noted in the task 5 document, mixed drive systems do not appear until you have four or five drawers of drives.**
Task 6	**General Comment**		**Selection of base case systems from 2012.**	**Based on the discussions at the stakeholder meeting, there is an increased concern about the choice of the server and storage base case models that were released to the market in 2012. Available data demonstrates that server models released in 2014 have improved performance per watt capabilities with comparable or improved idle power levels as compared to products introduced to market in**	**Set the base cases products released to the market in 2014, not 2012.**

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				2012. Given that the consultant is evaluating potential improvement in energy consumption for a regulation that will go into effect in 2016 or 2017 savings calculations should be made against the server and storage equipment that will represent the preponderance of data center equipment at that time. Tying potential savings to the 2012 products will significantly overstate potential savings as we have noted, and for which we have provided specifics, in our comments elsewhere. Our concern was further heightened by the statement of one consultant that it is appropriate for the commission to take into account "learning" or capacity/performance cost reductions that will accrue from future technology advances and the cost benefits of volume production of components. If the commission considers it appropriate to consider the savings projected from "learning" then the base cases should reflect the current state of server and storage product capabilities, not the capabilities represented by n-1 or n-2 technology generations.	
Task 6	**General**		**Discussion of Idle Limits**	**At the Stakeholders meeting the consultant showed a slide (page 14**	**When developing the Task 7 document, the consultant should not focus solely on idle power limits, for the**

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	Comment		**at Stakeholder Meeting on April 24, 2015**	**of the task 7 presentation) of the idle limits for one and two socket servers from the ENERGY STAR® requirements and the additional proposed silver and gold level idle limits proposed for the National Sanitation Foundation's proposed Environmental Leadership Standards for Servers. Digital Europe is very concerned that the consultant is referencing idle limits from two product energy efficiency programs designed to identify leadership or "top runner" products, both of which are voluntary, and one of which is still in draft. These concerns exist at two levels:** **1. As we stated in the comments to the Final Draft Task 3 document, Section 1.1.2.4, idle power is not a good indicator of energy efficiency. A low idle power limit is biased to servers with low power, low core count, and low frequency processors which have a relatively low compute capacity and workload capability. Server efficiency is a function of the compute capacity, the ability to proportion power use to workload demand, and the ability to maximize the output, functionality and/or utilization of**	**reasons explained in the comment. In fact, Digital Europe has repeatedly stated its belief that idle power limits are not an appropriate metric for server or storage energy efficiency requirements. If it is determined that energy efficiency metrics are required for server and storage products, then the threshold requirements need to:** **1. Be based on a performance/watt metric, specifically SPEC SERT, to properly characterize the functional capabilities of the product.** **2. Use the ENERGY STAR product categories to differentiate the product types under server and storage products. These product categories recognize specific differences in product performance capabilities and power profiles which affect the ability to compare the capabilities and energy consumption of the products.** **3. Recognize the complexity of server and storage products and avoid creating inadvertent market barriers to server and storage products which offer customers the best workload delivered per unit of energy consumed.**

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				the server or storage product over time. In some cases, servers with a higher idle power demand are able to do significantly more work per unit of energy consumed. In our comments to the draft task documents, we provided the consultant with data on how workload can be quadrupled while power use is increased by 10% to 20% when average server utilization is increased. Limiting the market to low power servers will have unintended consequences, as it will result in the need for significantly more servers to perform the workload on a range of complex and compute intensive workloads. **2. Any effective energy efficiency requirements has to include a performance per watt metric as the basis for setting threshold requirements. It cannot be based on idle limits. Digital Europe has recommended to the consultant and the commission that they designate the SERT metric for this purpose. Digital Europe has provided SERT metric data on over 90 server machine types and 500 machine type**	

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				configurations to the consultant for evaluation. **3. Any thresholds developed proposed or developed under Lot 9 will be thresholds set for market entry. These will be significantly different than thresholds set for "top runner" or "energy efficient, leadership" products. It is inappropriate to reference idle limits from these programs in discussion of potential thresholds for the Lot 9 server requirements.**	
Task 6	**General Comment**		**Material Analysis**	**Digital Europe is concerned by the consultant's statement at the stakeholder meeting that increasing the product reuse rate from 25% to 50%, as recommended by comments, did not generate the increase in environmental benefit that the consultant expected. Based on this, the consultant was exploring other material impact models to get an answer that fit their expected outcome.** **We are concerned that changes to a defined process are being considered because the process did not deliver the "expected" outcome. If one considers that material and**	

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				reuse impacts are 10% of the total impacts and that reuse increases the life of products and components by a factor of roughly 2 (estimated by increasing the useful life from 5 years to 10 years), then the change in environmental impacts of a few percent makes sense.	