ENERGY EFFICIENT DATA CENTER STORAGE:
AN ASSESSMENT OF STORAGE PRODUCT POWER EFFICIENCY

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The Green Grid Data Center Energy Efficiency Technical Working Group (DCEE TWG) acknowledges the Storage Networking Industry Association (SNIA®) Green Storage Initiative (GSI) and Green Storage Technical Working Group (Green TWG)'s strong collaboration and significant contributions in gathering and analyzing the data presented in this paper.

Executive Summary

The Green Grid Association's — a consortium that works to improve IT and data center resource efficiency worldwide — goals are to evaluate the efficacy of the SNIA Emerald™ test suite as a tool to assess the energy efficiency of storage products and to consider its application and use in developing and setting performance/power efficiency thresholds for storage products. Toward these goals, the Green Grid sponsored the SNIA analysis effort reported in this white paper.

The Storage Networking Industry Association (SNIA®) released Version 4.0 of the SNIA Emerald™ Power Efficiency Measurement Specification on July 3, 2020, in support of the publication of the ENERGY STAR Data Center Storage V2.0 Program which was released May 28, 2020. The SNIA Green Storage Technical Work Group (Green TWG) collected the SNIA Emerald results published by the EPA for 160 systems certified by the Energy Star Data Center Storage Program, as well as additional idle measurement data. The SNIA Green TWG analyzed this data to understand the impacts of configuration type and component selection on the SNIA Emerald performance power metrics for the three workload types tested: Capacity, Sequential and Transactional. This white paper details the working group's findings and provides storage product manufacturers, regulators, and other stakeholders information on the efficacy of the SNIA Emerald methodology for assessing the power efficiency of data storage products.

This white paper makes recommendations for regulators regarding what product criteria and test metrics should be used to assess power efficiency. It also provides information regarding how Online Data Storage Products work and the various characteristics of Online Data Storage Products. This information includes how they are configured, what capacity optimization techniques are incorporated, how the integrity and security of the data stored is ensured, and what goes on during the ready idle state. Information regarding new trends in enterprise storage is also provided.

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Table of Contents

Table of Figures

Table of Tables

1. INTRODUCTION

The SNIA Green Storage Technical Working Group has analyzed the SNIA Emerald™ Power Efficiency Measurement test (SNIA Emerald test) data for storage products certified to the ENERGY STAR Program Requirements for Data Center Storage products. The data set includes 160 systems certified on the Energy Star Data Storage website across the Online 2, 3 and 4 product categories. The analysis has evaluated the efficacy of the SNIA Emerald test suite as a tool to assess the power efficiency of storage products and considers its application and use in developing and setting power efficiency thresholds for storage products. Based on the analysis, recommendations for data center storage power efficiency characterization are offered. These include simplified testing and product criteria.

Data centers typically have service level requirements that must be met; the selection of storage and other components is driven by the need to meet these requirements. Within the set of products that meet these requirements, power efficiency is a consideration. Power efficiency metrics provide the basis for comparing various storage products and the comparisons enable more effective utilization of power. While the power efficiency metrics do not allow the direct prediction of actual data center power consumption, they are a meaningful relative measure of power consumption, i.e., for a given workload, products with higher efficiency metrics can be expected to consume less power than products with lower efficiency metrics.