PURESTORAGE®

2021 ESG REPORT

UNDERSTANDING THE PURE STORAGE ENERGY ADVANTAGE

How Pure Storage Delivers Energy Savings

Pure Storage® delivers energy savings of up to 85% over competitive storage systems. In our 2021 ESG Report (released in March 2022), we provided competitive comparisons that detail the energy and greenhouse gas (GHG) emission savings for many of our data storage array products. The purpose of this document is to provide an understanding of how we arrived at the results and the factors that drive the Pure energy advantage.
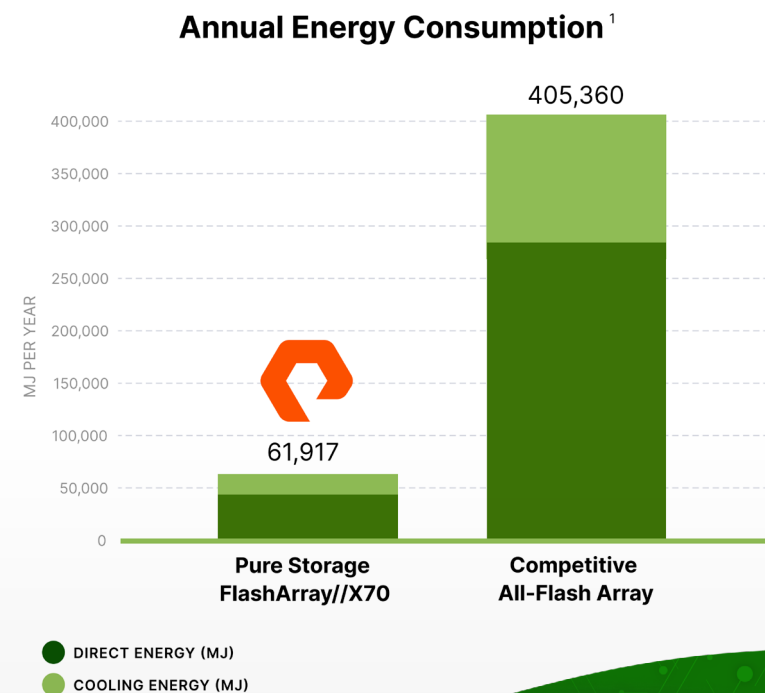
The goal of this analysis was to produce an "apples-to-apples" comparison between the most commonly purchased configurations of Pure products and the most similar competitive all-flash products with respect to effective capacity and performance. Competitive product configurations were based on publicly-available data as well as information gathered from competitive sales engagements and customer case studies. This data is supported by third-party analysis. Our work with the third party on FlashArray//X70 shows that our methodology produces a valid comparison for a variety of Pure Storage products.

Below, we describe the methodology used in the comparisons in more detail. While we have decided not to disclose the brand and model of the comparable competitive systems, we have included the relevant configuration specifications for both the Pure and competitive products. If you would like to compare your current storage system with our products, we are happy to engage with you to help you develop your own comparison.

1: Realize energy consumption savings of up to 85% with Pure Storage FlashArray//X70.
   Please see the Pure Storage 2021 ESG Report for further comparisons.

In 2021, we embarked on our first life cycle assessment (LCA) of our portfolio, specifically the FlashArray™ products. As part of this LCA, Pure Storage engaged an outside environmental consulting firm to assess how the FlashArray//X70 product compares to competitive all-flash arrays, and then expanded the assessment internally using the same methodology across the FlashArray line to include FlashArray//C™ and FlashArray//XL™.

PURE STORAGE 2021 ESG REPORT

Annual Energy Consumption [1]

Bar chart comparing annual energy consumption (MJ per year). Pure Storage FlashArray//X70: 61,917. Competitive All-Flash Array: 405,360.

- DIRECT ENERGY (MJ)
- COOLING ENERGY (MJ)

Methodology

The goal of our analysis was to compare the energy usage of Pure Storage products to potential competitive alternatives. We used the following process:

1. Identify the most commonly deployed workload and environment for a given Pure Storage product.

2. Determine the most commonly deployed Pure Storage product configuration for that workload.

3. Determine the most commonly encountered competitive product and its most-equivalent configuration to match the capacity and performance of the Pure Storage system.

Competitive product choices and configurations were based on products generally available for sale through March 30, 2022 (Q1 CY22). FlashArray//X70, the most commonly purchased array from Pure Storage, was modeled and analyzed as part of a larger Pure Storage Life Cycle Analysis (LCA) study which has undergone a critical review (completed in December of 2022) in conformance with ISO 14040 and ISO 14044 standards.

To create a more comprehensive set of energy comparisons, we used the same energy demand model for the FlashArray//X70 LCA to build use-phase comparisons for Pure Storage FlashArray//C and FlashBlade//S™ products.

85%

Less Power Than The Competitive All-Flash Alternatives

Key Findings

As detailed in our use-phase FlashArray//X70 analysis, the comparison showed that the Pure Storage product consumed 85% less power (and therefore created 85% less GHG emissions) than the competitive all-flash alternative.

The typical configuration of a Pure Storage FlashArray//X70 is shown below alongside a competitive offering that a customer might consider as equivalent for the same workload or use case.		
	Pure Storage FlashArray//X70R3	**Competitive All-flash Product**
Effective PB	2.3PB	2.3PB
Rack Units	6	> 50 RU
Drive Density (TB)	Nearly 3x competitive # TB per drive	Appropriate TB per drive for equivalent performance
Data Reduction Ratio (DRR)	2x competitive data reduction	Actual data reduction
Typical Power (W)	1,400	9,100
W/TB (Effective)	< 1	4

Key Energy Savings Drivers

The energy savings that Pure Storage products provide versus competitive alternatives are largely driven by three factors:
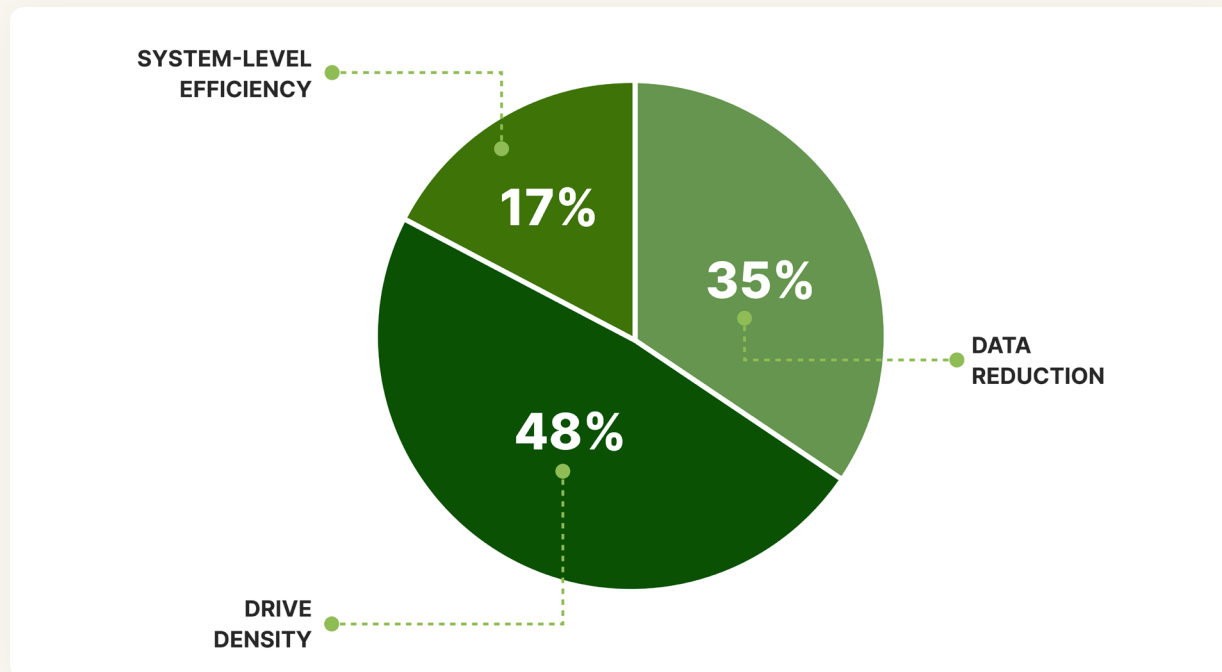
1

More Effective Logical Data Reduction

2

Higher Efficiency Drive Density (DirectFlash®)

3

System-level Efficiency of Hardware and Software

SYSTEM-LEVEL EFFICIENCY — 17%

DATA REDUCTION — 35%

DRIVE DENSITY — 48%

Logical Data Reduction

Pure Storage FlashArray uses a combination of data compression and deduplication to store data more efficiently than competitor systems. Effective data reduction satisfies a user's data storage needs with a smaller amount of raw physical storage, resulting in a smaller overall physical and energy (and therefore carbon emission) footprint.

While data reduction technology is not unique to Pure Storage, our data reduction is more comprehensive and efficient than competitive systems. For example: one issue with traditional data reduction techniques—especially those used by competing storage products—is that the processing power required for the highest-level reduction can negatively affect system performance. Therefore, in real world use, many customers opt for less data reduction by turning these features off in order to maximize performance. This often results in the need for more physical storage, which increases energy use and emissions.

By contrast, we created our flash-native software with novel techniques and algorithms purpose-built for flash and designed it to be "always-on." This approach results in much more efficient data reduction with less of a performance trade-off than competing all-flash systems.

In the compared configurations, we used representative data-reduction rates observed by actual Pure customers (based on measurement of our install-base fleet), and typical data-reduction rates achieved by competitive systems based on customer, field, and partner surveys.

These data reduction advantages account for about one-third of the energy savings that the FlashArray//X70 shows versus the competitive all-flash array.

It should be noted that data reduction rates can vary in actual usage, primarily based on the user's data set (and how reducible that data set is) and the the storage system's ability to identify and provide that data reduction. This is true for all storage systems, not just those from Pure Storage.

Drive Density

We have designed and built our solutions using a proprietary approach to integrated hardware and software, creating denser, more reliable, and more performant flash drives. We call our approach DirectFlash. FlashArray and FlashBlade//S software directly and efficiently manages the flash media within the drives. This approach removes many of the bottlenecks found in traditional systems based on all-flash, solid-state drives (SSDs). As a result, Pure can offer much higher flash densities in our storage arrays, without sacrificing system performance.

In contrast, competing systems take a more commoditized view of storage, largely treating flash SSDs as if they were spinning disks. That leaves the media management, I/O translation, and maintenance behaviors up to each individual SSD—just as was the case with spinning disks. This approach creates a lot of overhead processing, and introduces performance bottlenecks into the storage system. The issue often becomes more pronounced with competitive systems when they use larger SSD sizes: the larger the drive size, the more that performance can be adversely affected. As a result, the performance, density, and reliability of competitive SSD-based systems are all significantly impacted.

These trade-offs often lead competitive system configurations to use higher quantities of smaller drives—which means greater space and energy needs—in order to meet a user's capacity and performance needs.

But users with DirectFlash-based systems are able to benefit from both higher drive density and high performance without trade offs. The drive density advantages from Pure Storage DirectFlash help deliver about half of the energy savings edge over the competition.

The Pure Difference

Pure Storage was able to take these novel, energy-saving approaches to flash storage because we are constantly innovating. While many competitors take a commoditized view of storage, we've invested in R&D throughout our history at a much higher rate than they have. This approach leads to storage with not only better performance and more powerful features, but also with higher energy efficiency.

For example: Because we were born in the early days of the all-flash era, we had to offer high data reduction from the start to be cost-effective when competing with the less-expensive spinning disk-based systems prevalent at the time. This is what led us to create always-on data reduction that is usually twice as effective as that offered by competitive all-flash systems —without affecting storage performance.

Through the years we've continued to innovate, adapting to new workloads and maintaining this competitive edge in data reduction. As proof of this work, Pure Storage has over 100 patents (granted and pending) for data reduction technologies.

One of our most important innovations to date has been our proprietary DirectFlash storage modules. The density and performance gains that DirectFlash has delivered to our users not only helps them meet their IT and business objectives, but it is also a major factor for the energy efficiency of Pure Storage products.

Our move to DirectFlash came as a result of a new technology on the horizon in the early days of our company—NVMe. To take full advantage of the performance this technology could deliver, we designed DirectFlash to cut through the system bottlenecks inherent in SSD-based systems. We also took the opportunity to redesign our system chassis, adapting it for the NVMe future, a 10+ year lifespan, and higher energy efficiency as well. This is another example of Pure continuing to innovate and invest in R&D, with our customers reaping the benefits in energy and emissions savings.

System Level Efficiency

Pure Storage FlashArray drives further power savings advantages from its per-rack unit, per-controller, and per-enclosure hardware design features. As a result, our products deliver more physical storage behind the same amount of compute and connectivity power, which translates into just the right amount of hardware and raw capacity to support the performance and data storage needs of our customers.
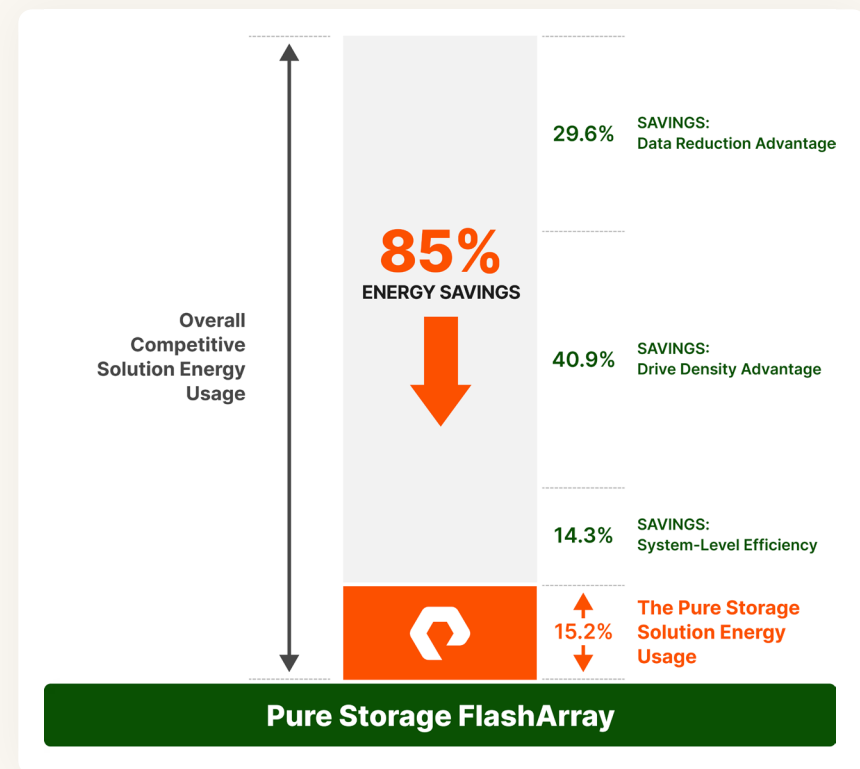
These system level efficiencies make up the remaining 15% of our energy savings compared to the competing solution.

Below you'll find a chart breaking down the overall 85% of energy savings you could realize upon switching to a FlashArray from Pure Storage. Our unique combination of data reduction, drive density, and system-level efficiencies compared to equivalent competitive systems can help your organization lower energy usage, costs, and your GHG emissions.

Have more questions on how Pure Storage can help you save energy?

Our webpage shows your potential savings, or you can contact your Pure account team for more information about your environment.

Learn More: Download the Full 2021 ESG Report

Overall Competitive Solution Energy Usage

85%
ENERGY SAVINGS

29.6% SAVINGS: Data Reduction Advantage

40.9% SAVINGS: Drive Density Advantage

14.3% SAVINGS: System-Level Efficiency

15.2% The Pure Storage Solution Energy Usage

Pure Storage FlashArray

*Normalized power consumption (WTB)

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