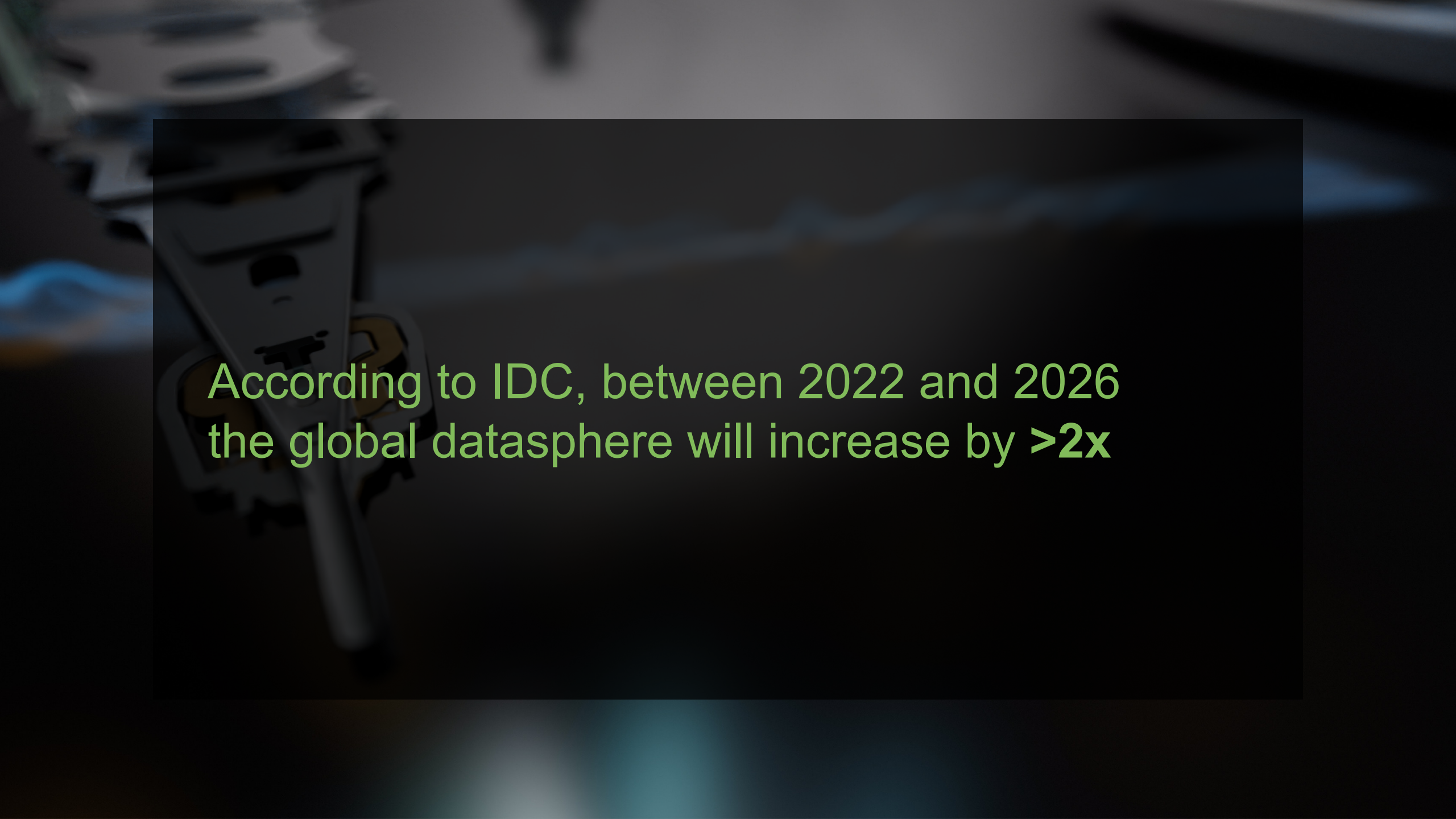




# Future of Hard Drives

**HUGO BERGMANN**

SENIOR PRODUCT MARKETING MANAGER



According to IDC, between 2022 and 2026  
the global datasphere will increase by **>2x**

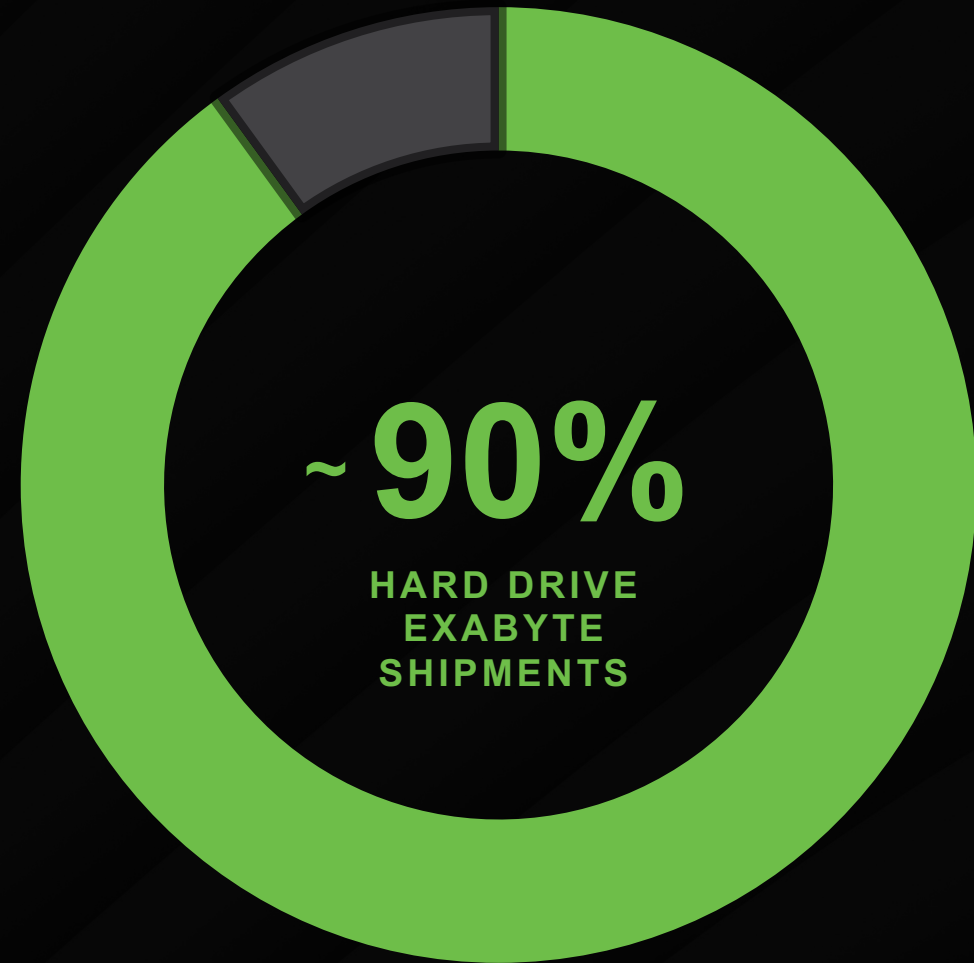


# The world's largest data centers choose hard drives to store 90% of their exabytes.

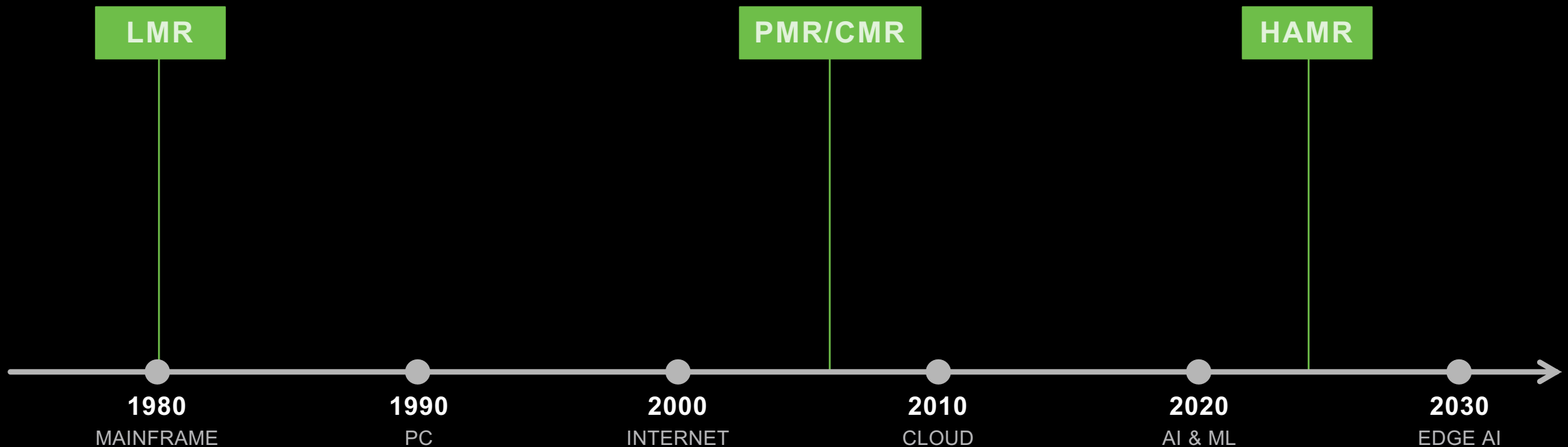
Image: Total hard drive and SSD exabyte shipments of the 5-year period ending CY22 into global hyperscale and cloud service provider firms.

Source: Seagate's analysis of IDC's *Multi-Client Study, Cloud Infrastructure Index 2023: Compute and Storage Consumption by 100 Service Providers*, November 2023

- Hard Drives
- SSD



# Hard drives have upheld the world's digital infrastructure for decades







Why Does **Areal Density** Matter Today?



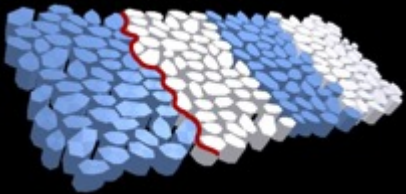
# Heat-Assisted Magnetic Recording Enables Continued Capacity Growth for Hard Drives

## Media Technology

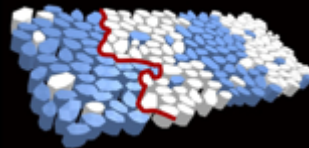
High coercivity material enables smaller, thermally stable grains

Glass substrate enables required sputter temperatures

### Areal Density Media Challenge:



Hold #Grains / Bit constant



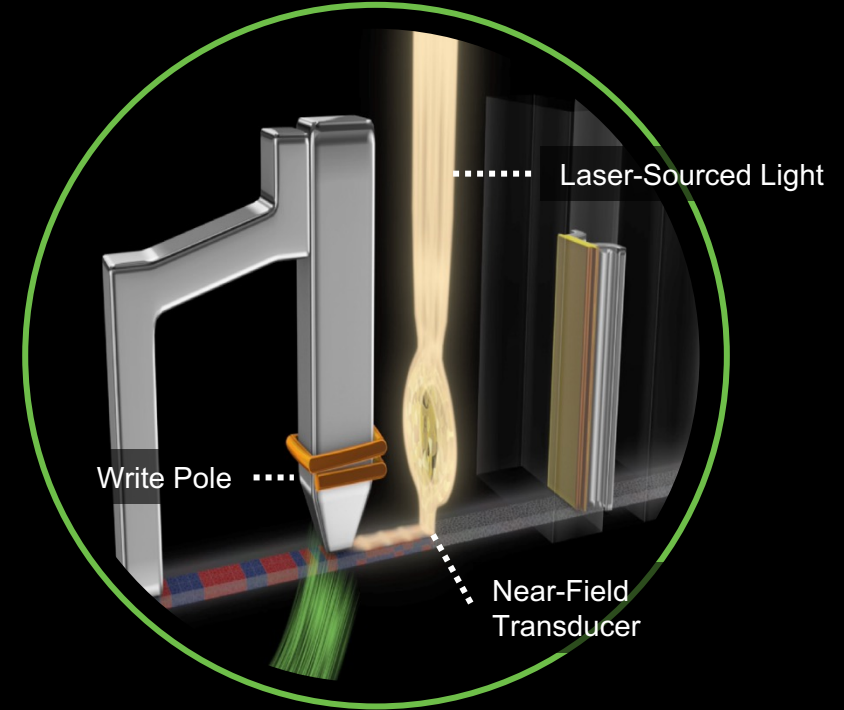
Higher areal density requires smaller grains

## Head Technology

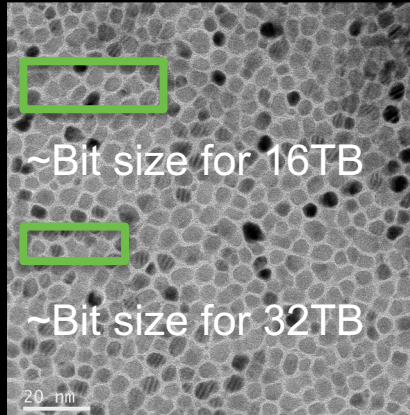
Focused heat provides local reduction in coercivity

Write pole sets magnetic bit

Heats and cools in less than 2 nanoseconds



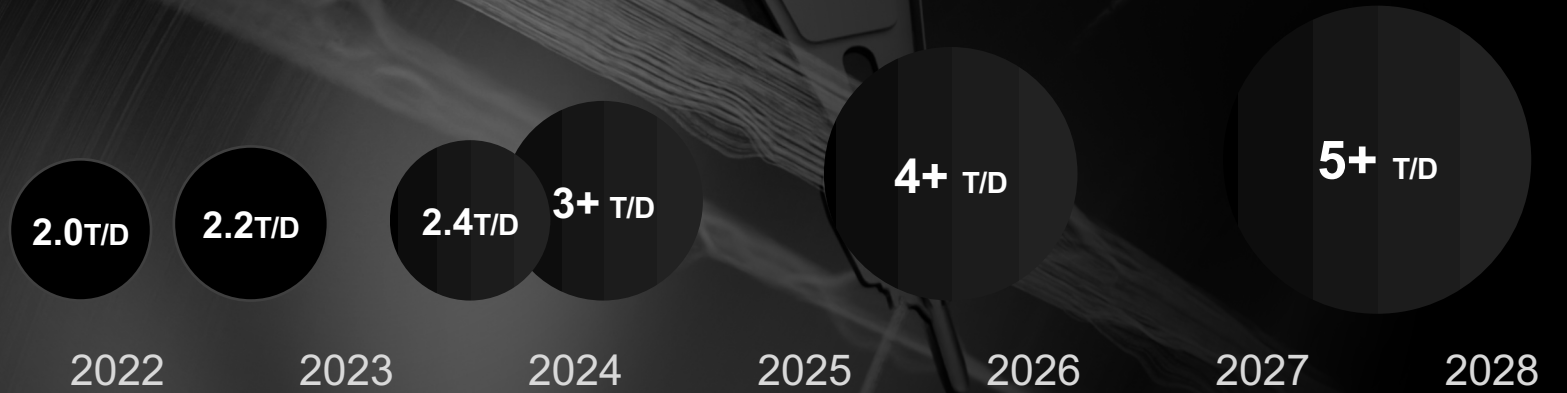
### 5.6nm HAMR Media



Mozaic Technology Video




The most meaningful measurement of technology progression is **areal density innovation**—not merely unit capacity



**2×** capacity gain per platter in under 4 years\*

\*AD-driven capacity growth from 2023 (2.4TB/platter) to 2027 (5.0TB/platter) more than doubles in 4 years. When compared with PMR technology, capacity took 9 years to double.

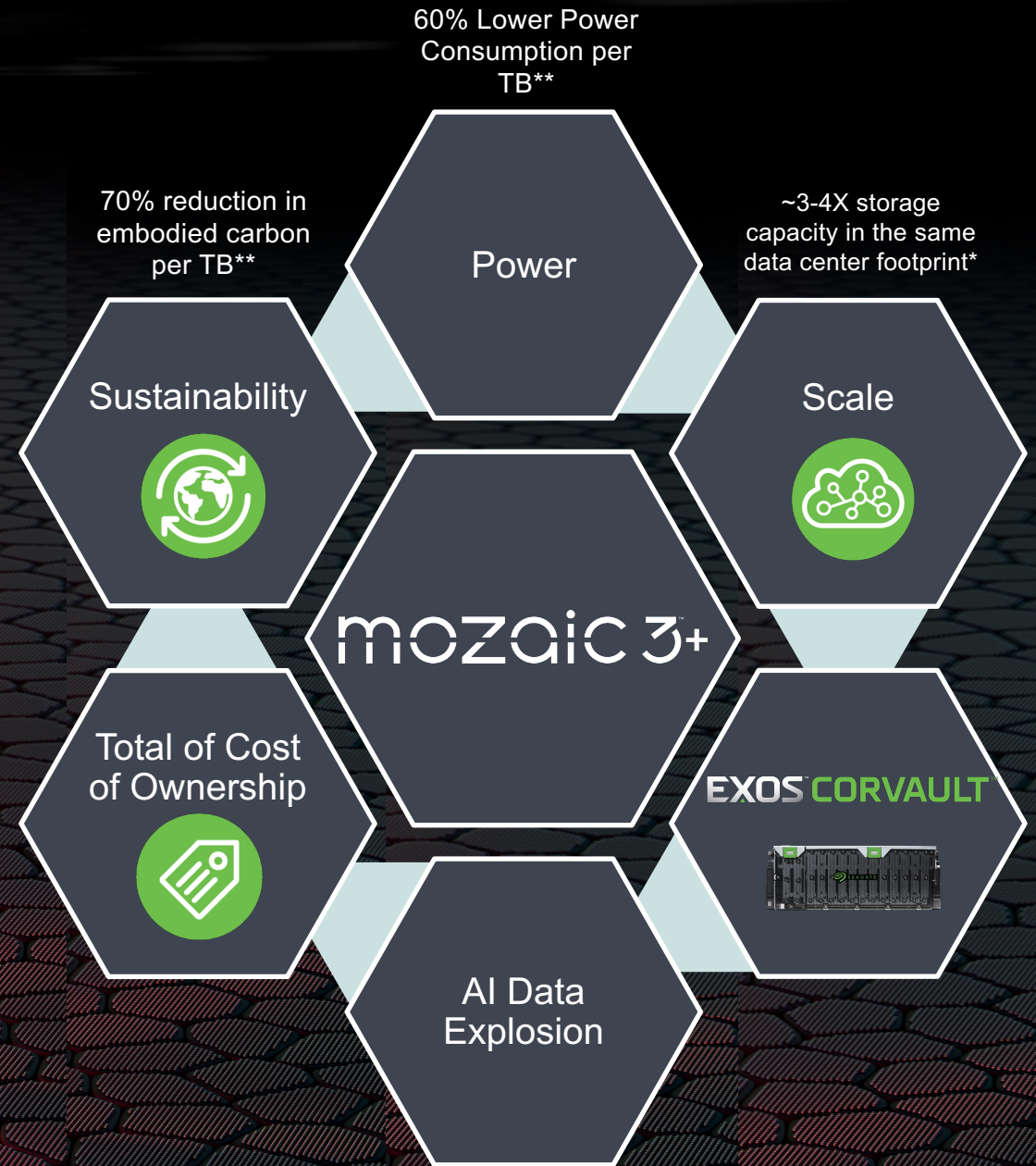
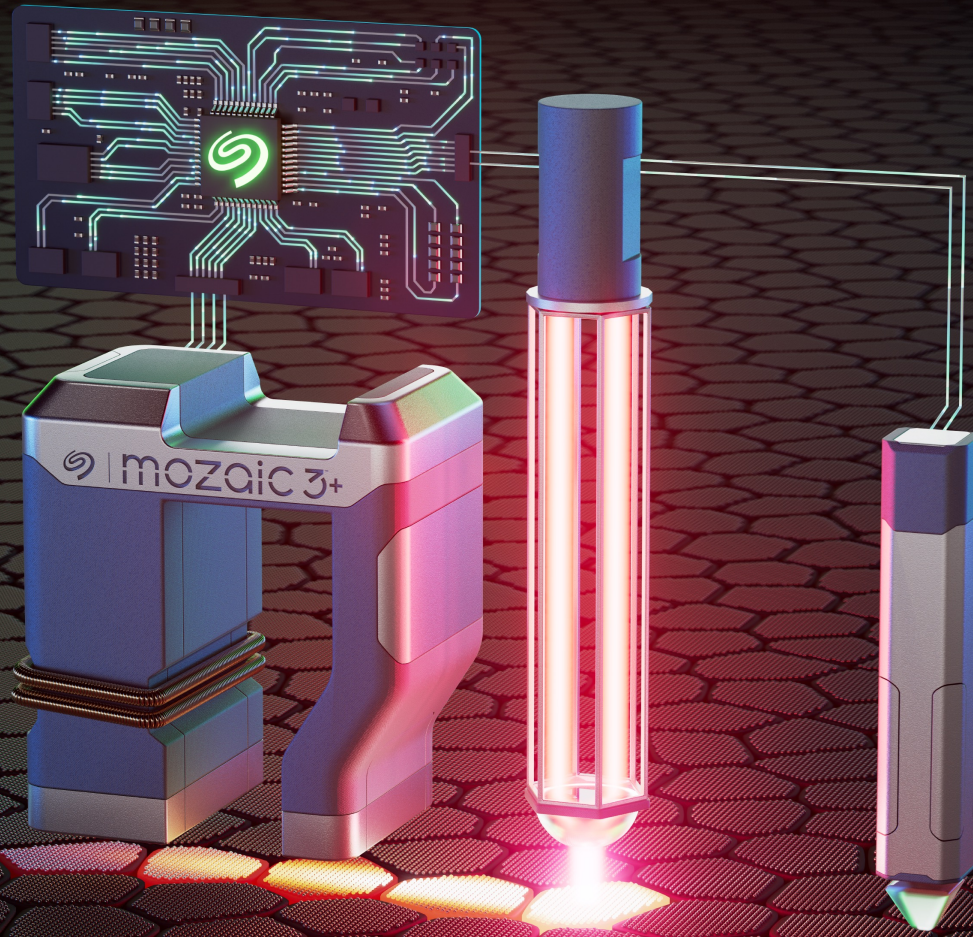


# The Mozaic 3+ Difference

**Areal density that delivers**



# Mozaic 3+ Benefits

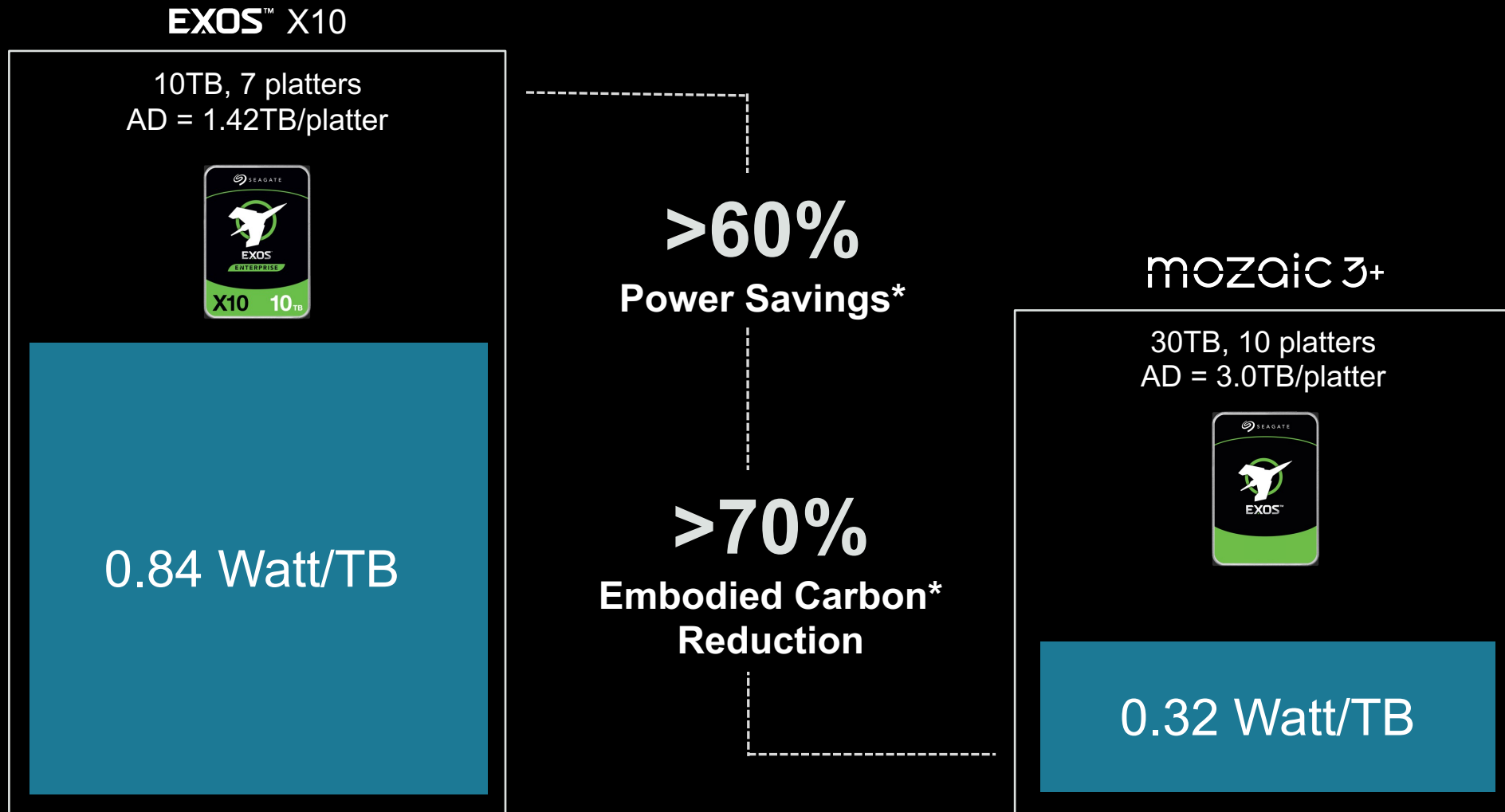


\*Method: 10TB to 30TB capacity upgrade (or 1.42TB/platter to 3TB/D) comparing Exos X10 to 30TB Exos Mozaic drive, max operating power.

\*\*Compared to conventional Exos X10 10TB PMR drives, one of the most likely drive types to be replaced by data centers



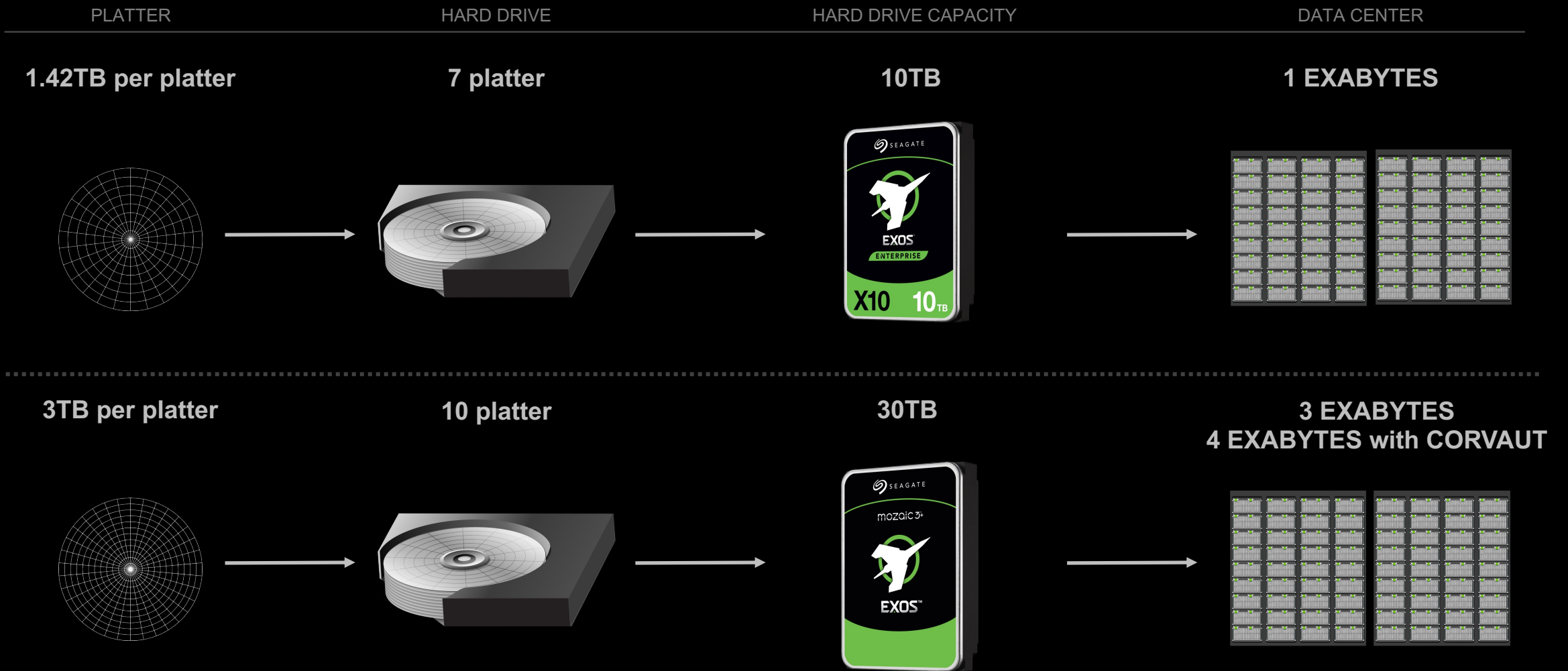
# Typical data center upgrade



\*Savings calculated per TB. Method: 10TB to 30TB capacity upgrade, comparing Exos X10 10TB to Exos X 30TB Mozaic drive, max operating power,

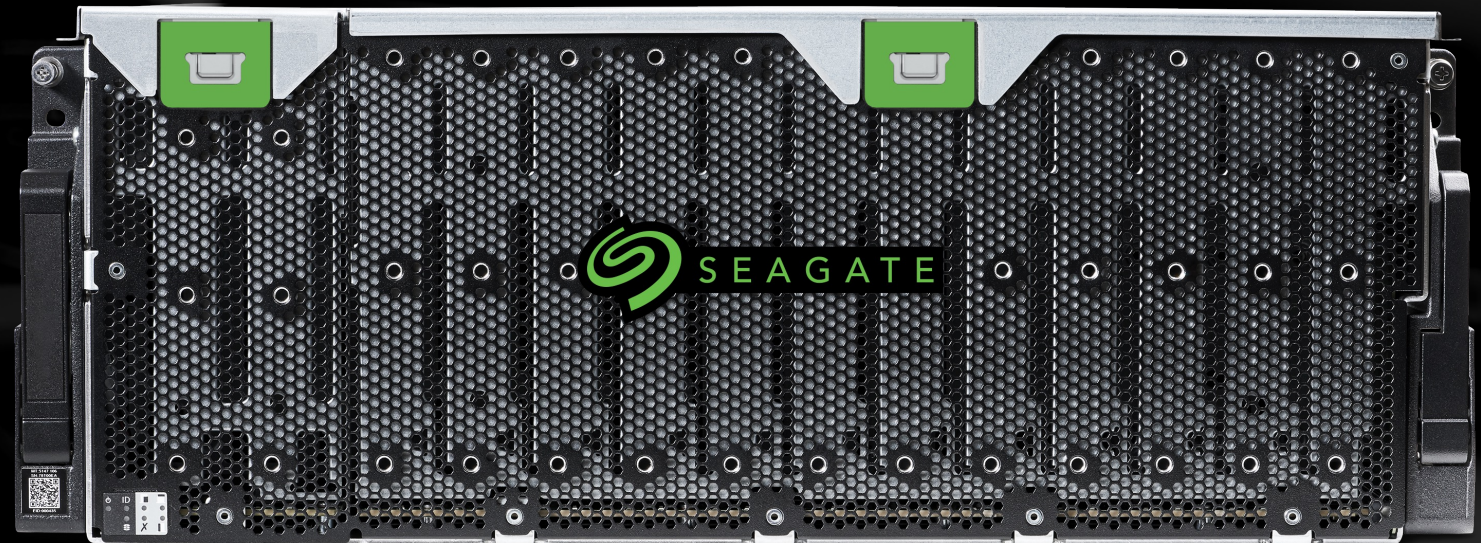
# The impact of areal density at scale is profound

Upgrading a fleet of 10TB with 30TB drives delivers 3x the data center capacity in the same floor space



# Mozaic 3+ in Seagate Systems

EXOS CORVAULT Intelligent Storage





# Data Durability & Sustainability

ADAPT + ADR technology reduces human intervention and e-waste.



ADAPT: Spare Pool: Drives & Capacity



ADR: Spare Pool: Drives & Reduced Capacity



- Extending HDD lifetime saves 275x more CO<sup>2</sup> than recycling and avoids e-waste<sup>1</sup>
- Drive replacements cost data centers over \$1,000 per device replacement
- All HDDs feature Instant Secure Erase for easy reuse or retirement
- Additional benefits: compute + networking, software licenses savings and faster hard drive rebuild time without performance impact.

# Power-Efficient Data Accessibility


Parallel data streams enable performant deployment of dense storage

2X  
BANDWIDTH



< 25%  
INCREMENTAL  
POWER

MULTI-ACTUATOR TECHNOLOGY



# Where Future is Read and Written

mozaic 3+

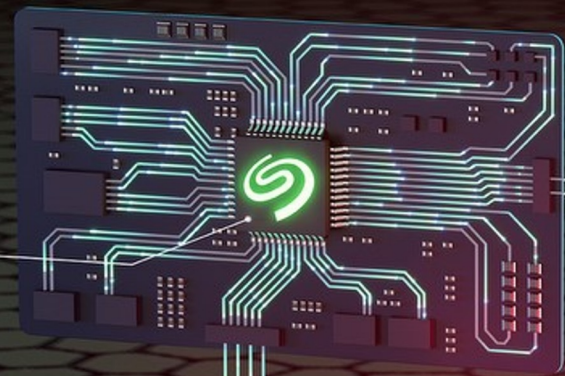


**Thank you**





12nm integrated controller



magnetic core



superlattice platinum-alloy media

nanophotonic laser



photonic funnel

quantum antenna

gen 7 spintronic reader



plasmonic writer

