SUSTAINABILITY

the Future of Memory and Storage

Sustainability & Circular Economy for Storage – With Open Compute Project Involvement

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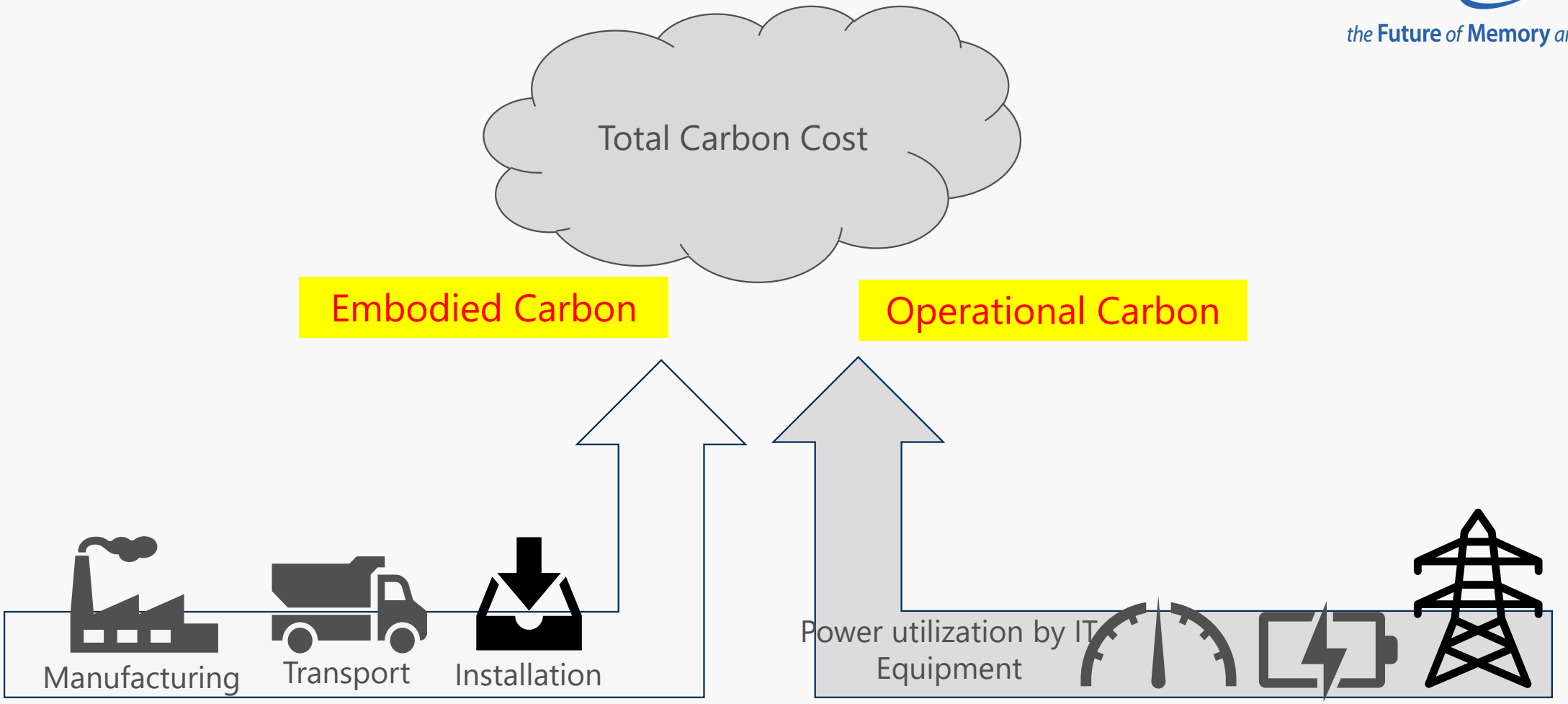
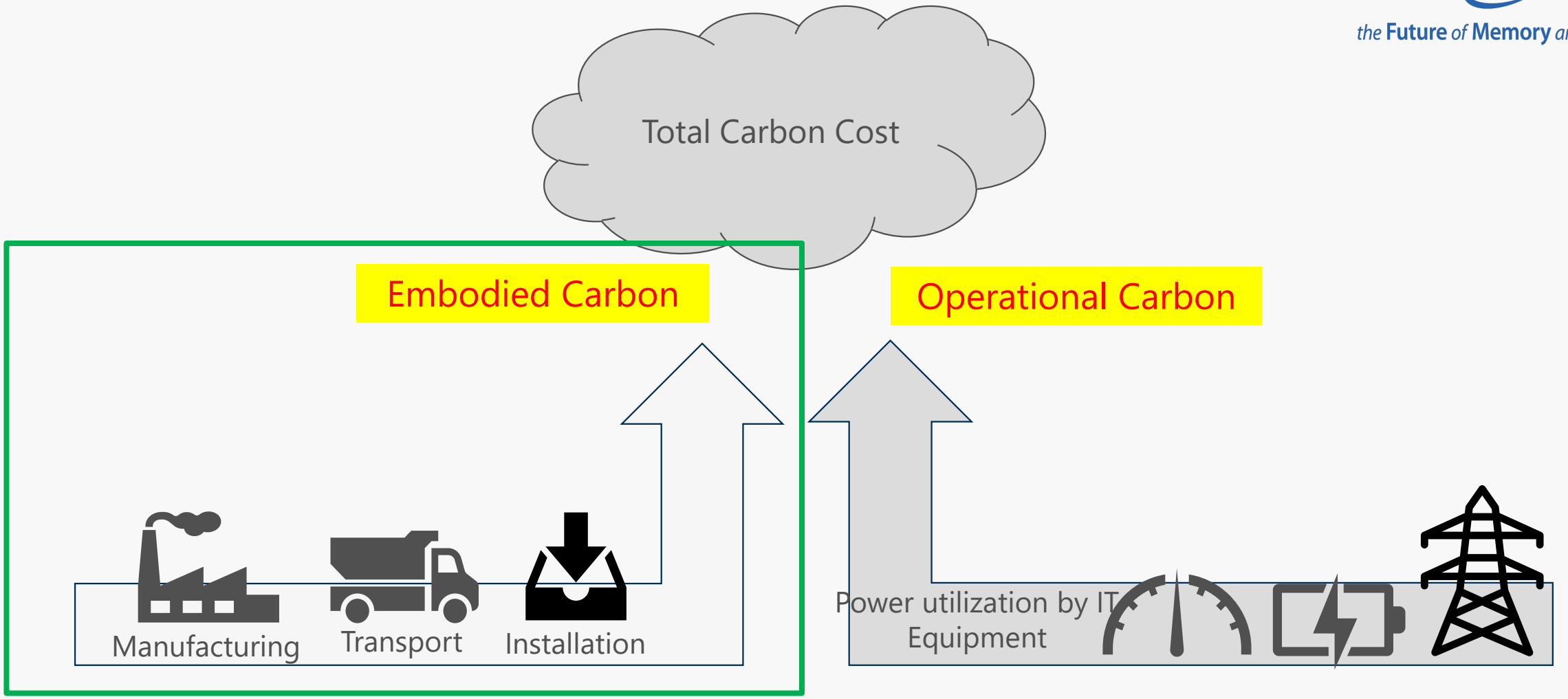

Total Carbon Cost
Embodied Carbon
Operational Carbon
Manufacturing
Transport
Installation
Power utilization by IT Equipment



Net Embodied Carbon can be reduced via Reuse / Circular Economy

Discussing Extending Life / Second Life as a means to reduce Storage Carbon & concerns with it …

“

Call for Research on Storage Emissions: Microsoft, Carnegie Mellon University

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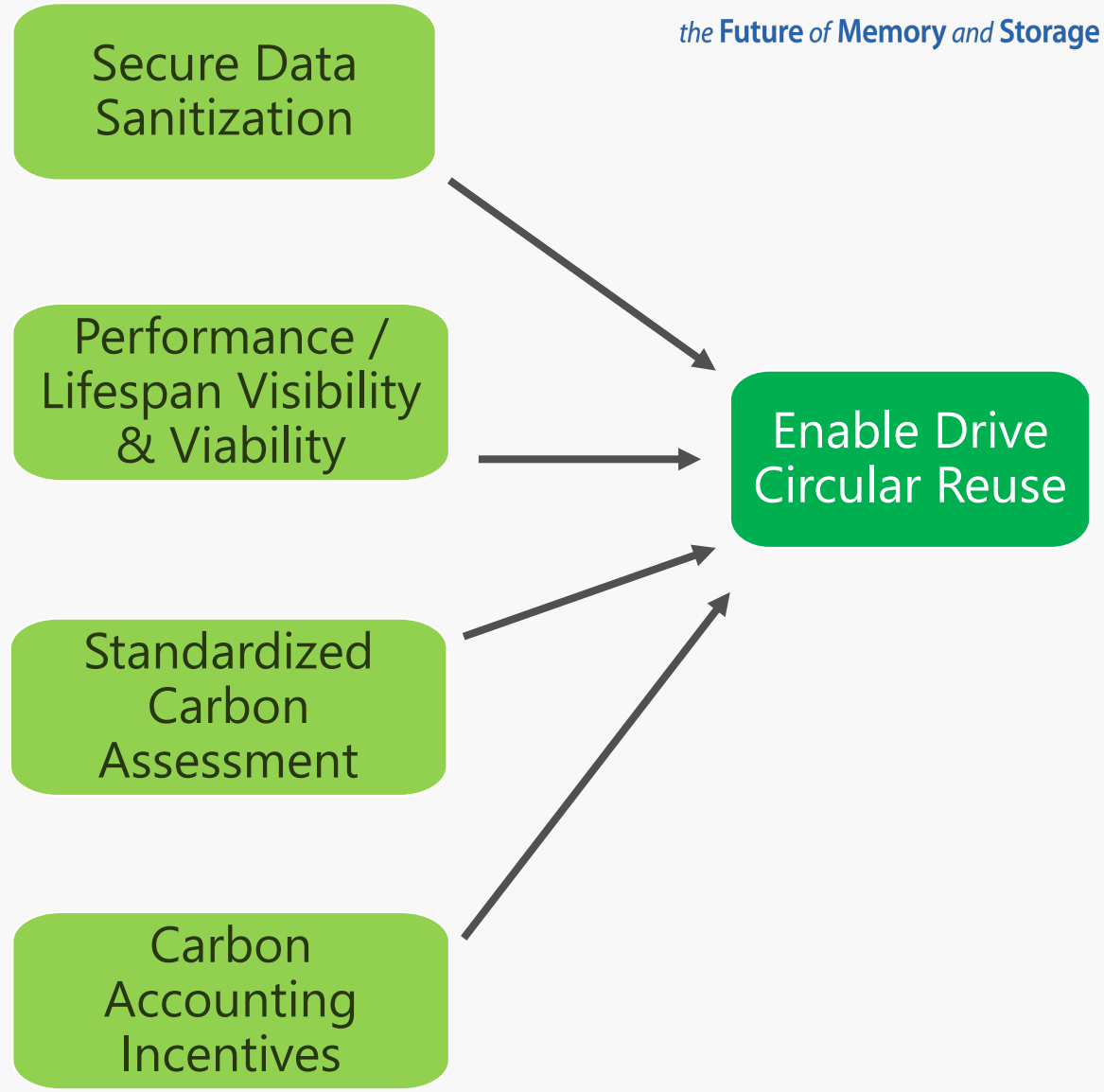
Source: A Call for Research on Storage Emissions (hotcarbon.org)

Embodied Emissions	CPU	DRAM	SSD	HDD	Other
Compute Rack	4%	40%	30%	0%	26%
SSD Rack	1%	9%	**80%**	1%	9%
HDD Rack	2%	11%	14%	**41%**	33%

Table 3: Embodied emission breakdown for Azure racks.

Operational Emissions	CPU	DRAM	SSD	HDD	Other
Compute Rack	42%	18%	19%	0%	21%
SSD Rack	32%	8%	**38%**	1%	21%
HDD Rack	26%	5%	7%	**41%**	21%

Table 2: Operational emission breakdown for Azure rack types.



Open Compute Project - Sustainability Focus

Carbon Transparency, Reporting and Metrics

For data center operators: Reporting on energy and water usage and carbon (GHG) emissions - scope 1, 2, and 3

For suppliers: focus on Life Cycle Assessments (LCA) & upstream reporting accuracy

Circularity / Reuse

Materials maintaining their highest value possible

Products are designed to extend the use period of a product and consider the next use

Extension of use (life), reuse, repair, refurbish, remanufacture, disassembly, and recycling

Efficiency & Interoperability

Efficiency metrics beyond PUE and focus on impact of reporting, and gen over gen improvements

OCP standard firmware for multiple customers, open source tools. Hardware building blocks for servers and racks

OPEN Compute Project®

Workstreams

1

Carbon Transparency, Reporting and Metrics

- LCA Standardization
- Carbon Label / Disclosure Format

2

Circularity

- Promoting Data Sanitization for Reuse
- Carbon Accounting for Circularity

3

Efficiency & Interoperability

- Power Telemetry
- Sustainability Power Metrics
- Cooling efficiency & Heat Reuse

1

LCA Standardization

Carbon Label / Disclosure Format

OCP Partners: iMasons Climate Accord

Goal

- Standardize Carbon Disclosure Format for carbon information exchange among value chain members
- Guiding a taxonomy for Embodied Carbon disclosures related to data center materials and equipment, including a digital carbon label providing both calculated carbon levels and its corresponding methodology

**** For further Lifecycle Assessment (LCA) Standardization OCP is pushing for work on Product Category Rule establishment ****

2

Promoting Data Sanitization

Carbon Accounting for Circularity

OCP Partners: Circular Drive Initiative

Goal

- Formulate the criteria for Drive being “Secure Data Sanitized” → to provide drive reuse security
- Suggest Carbon Accounting for circularity → to incentivize primary & secondary users to enable circular reuse

** Details in further presentation by Jonmichael Hands**

3

Power Telemetry

Sustainability Power Metrics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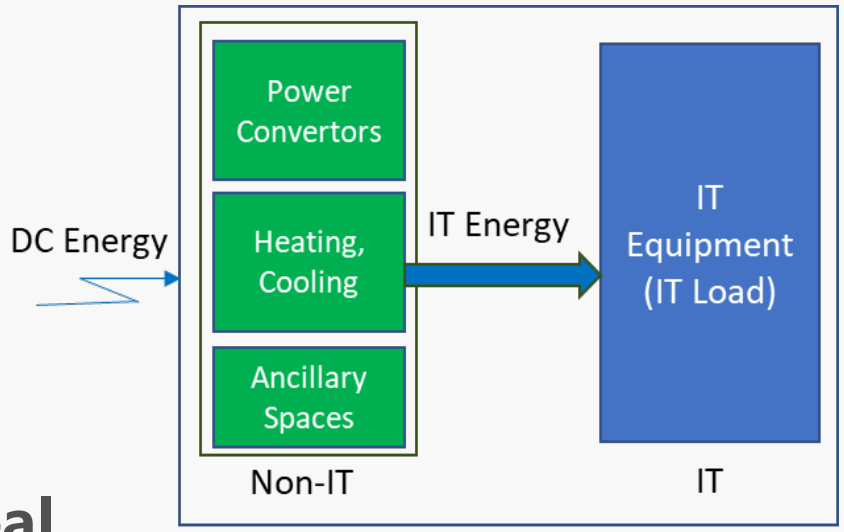


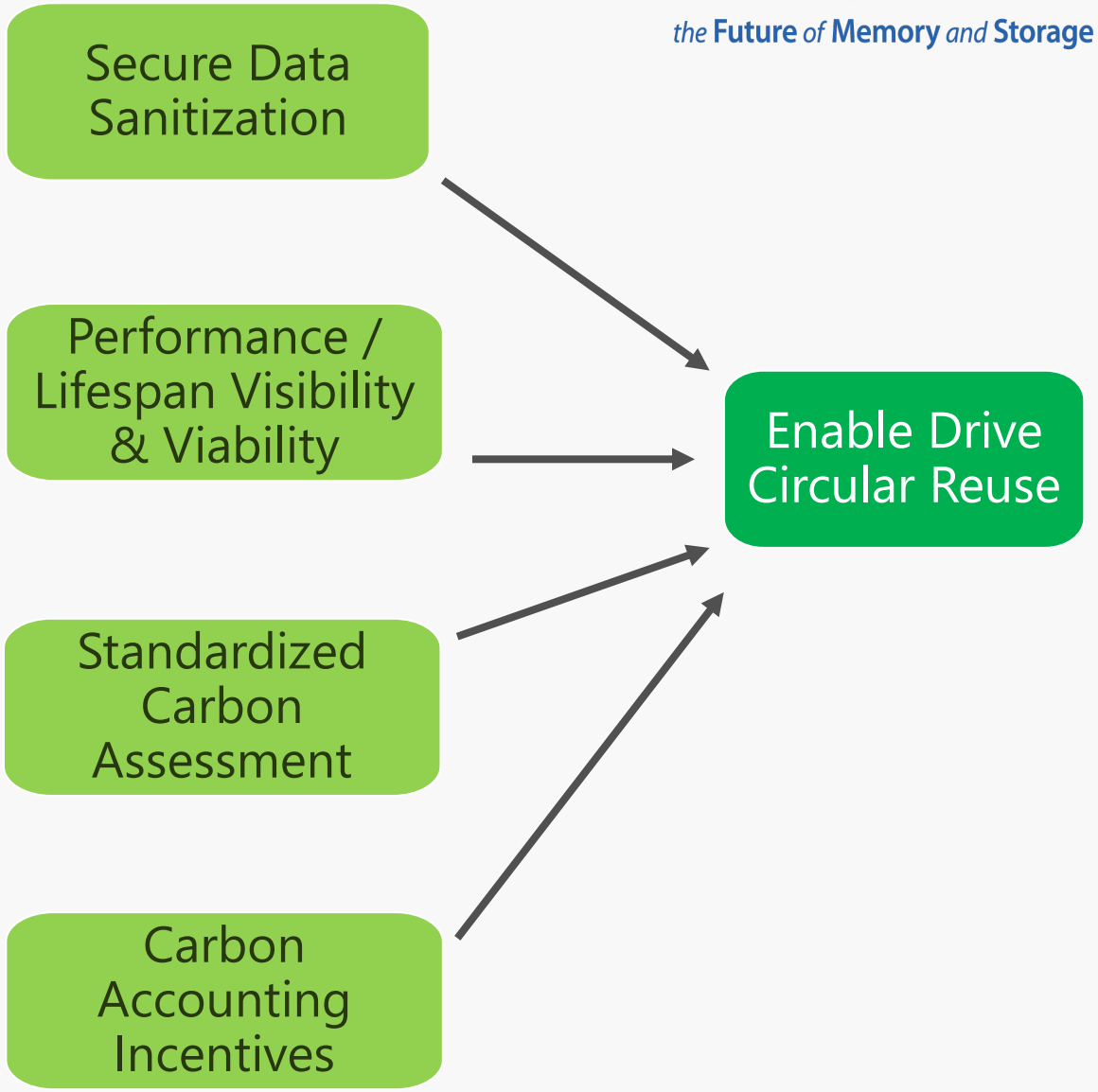
PUE
IUE
CUE

Goal

- SUSTAINABILITY POWER PROFILE: Template requirements for providing power data related to sustainability efforts. This includes power and energy (use phase) measurements, location data, and device identification.

- POWER METRICS: Improving / Establishing definitions for PUE (Power Utilization Efficiency), IUE (Infrastructure Usage Efficiency) & CUE (Carbon Utilization Efficiency) metrics to reflect sustainability impact

OCP Sustainability Work for Circularity & Sustainability :
https://www.opencompute.org/projects/sustainability



Thank you

Vision & Growth

"Offer an open framework and standardized resources for data center industry to deploy industry best practices that promote reusability & circularity"

Sustainability is the youngest established Core Project under OCP