



The 23<sup>rd</sup> International Asset  
Facility and Maintenance  
Management Conference

# Integrating Circular Economy and ESG with Asset Management in University Facilities

Towards More Sustainable and Efficient  
Energy Management

Mohammed AL-Sadig AL-Haj  
Sulaiman Al Rajhi University



12-14 January 2026

Riyadh, KSA

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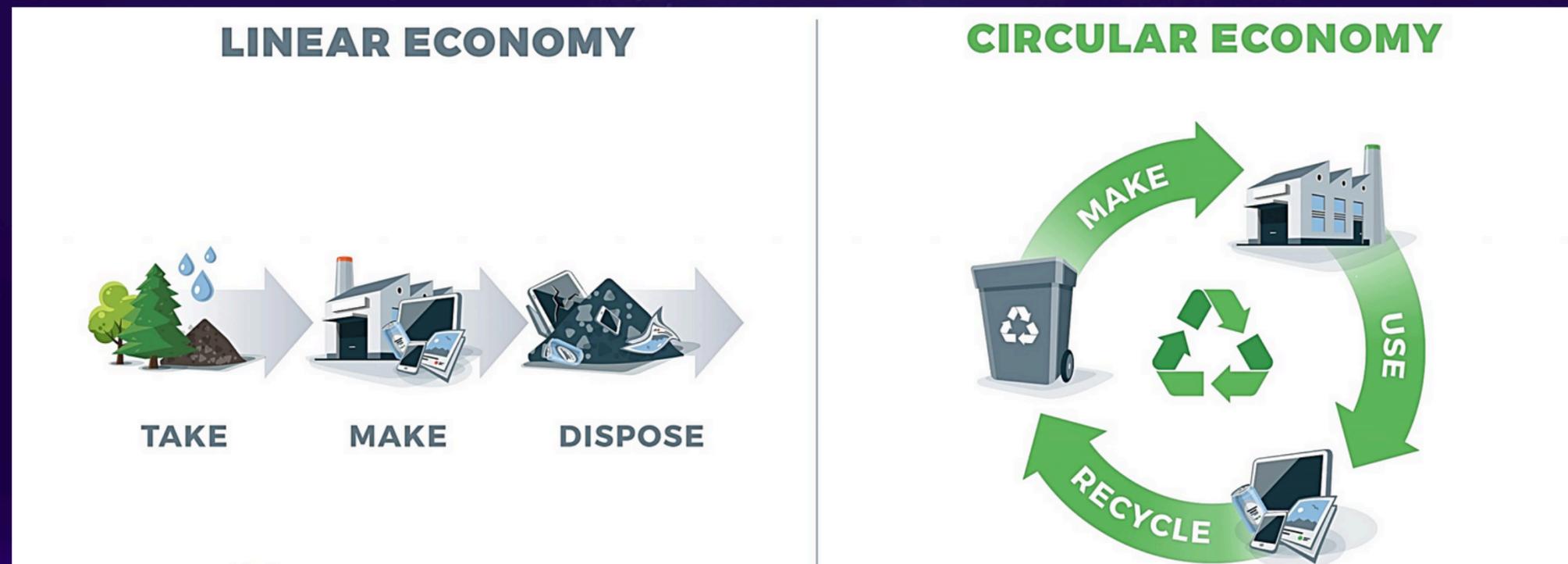


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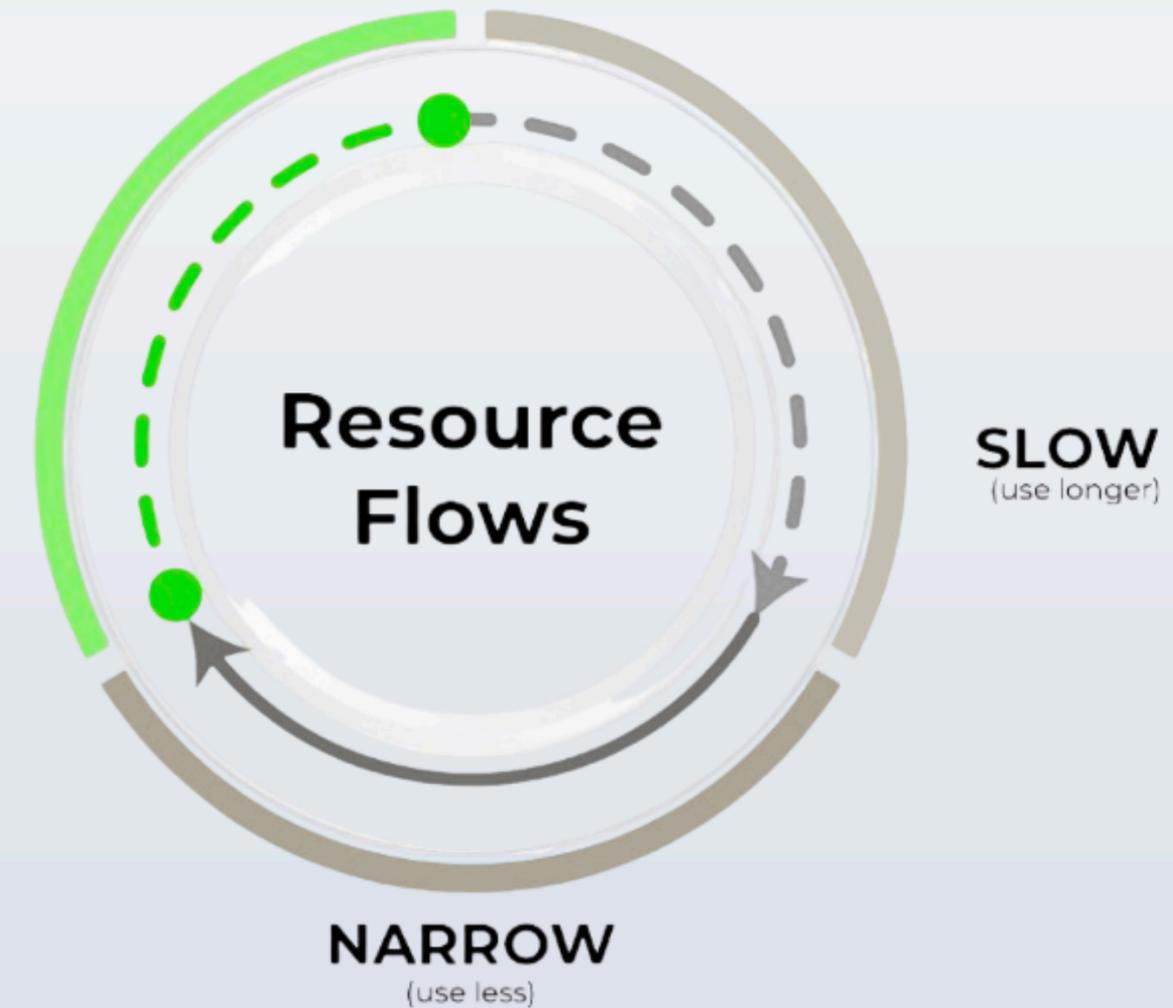
# Circular Economy Concepts

The Circular Economy is an economic and operational model that maximizes the value of resources and assets by keeping them in use for as long as possible, reducing waste and emissions shifting away from the linear “take – make – waste” model.



# Circular Economy Concepts

- **Slow the loop:**  
extend asset life through maintenance, repair, and refurbishment.
- **Narrow the loop:**  
reduce energy/material use per service via efficiency and operational optimization.
- **Close the loop:**  
reuse, remanufacture, and recycle through take-back and end-of-life pathways.



# CONCEPTS OF ESG

ESG is a framework to measure and manage an organization's performance across Environmental (E), Social (S), and Governance (G) dimensions.



## Why Universities?



**.Universities are mini-cities**



**ESG impact is amplified in universities.**

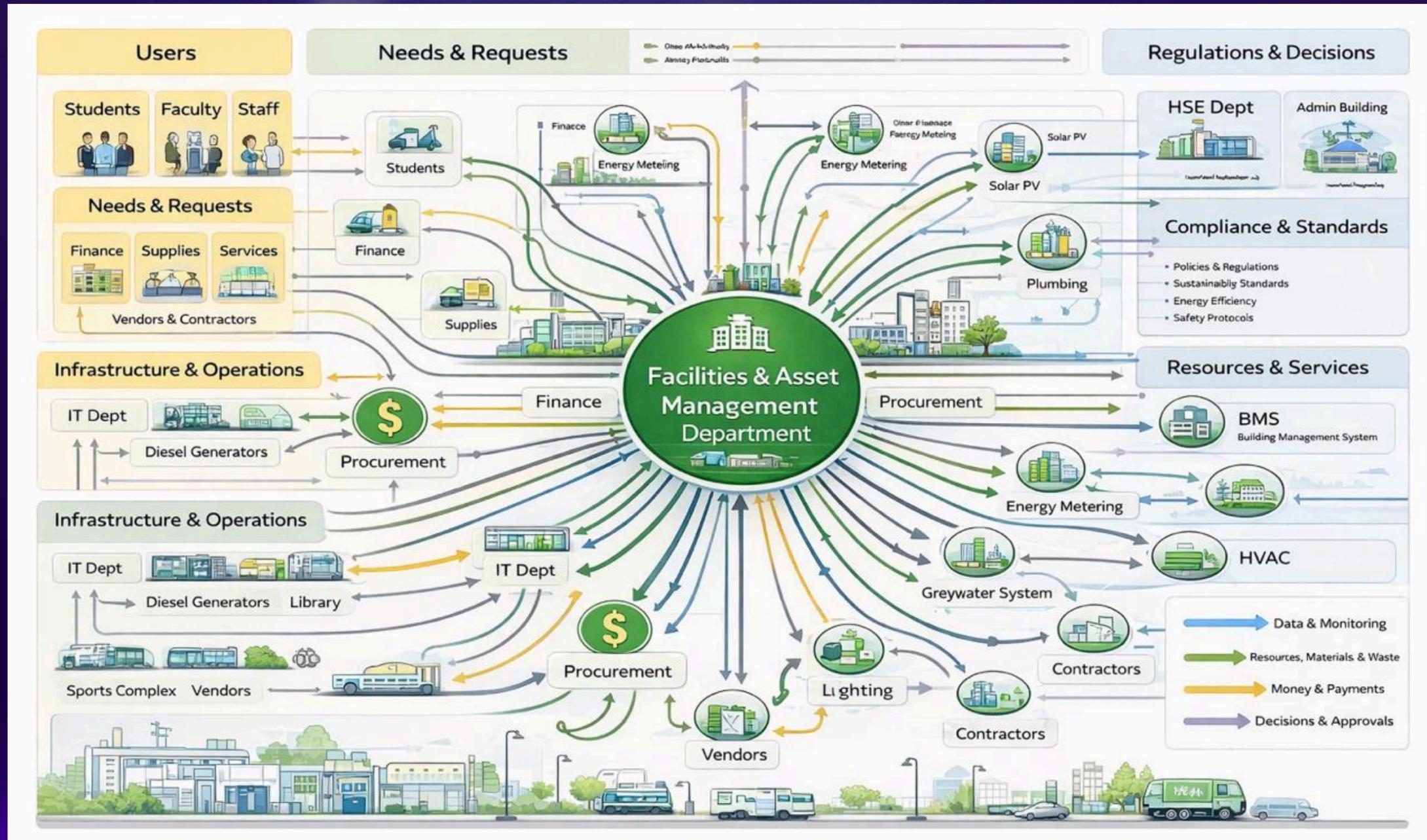


**University campuses are among the largest consumers of energy and water.**

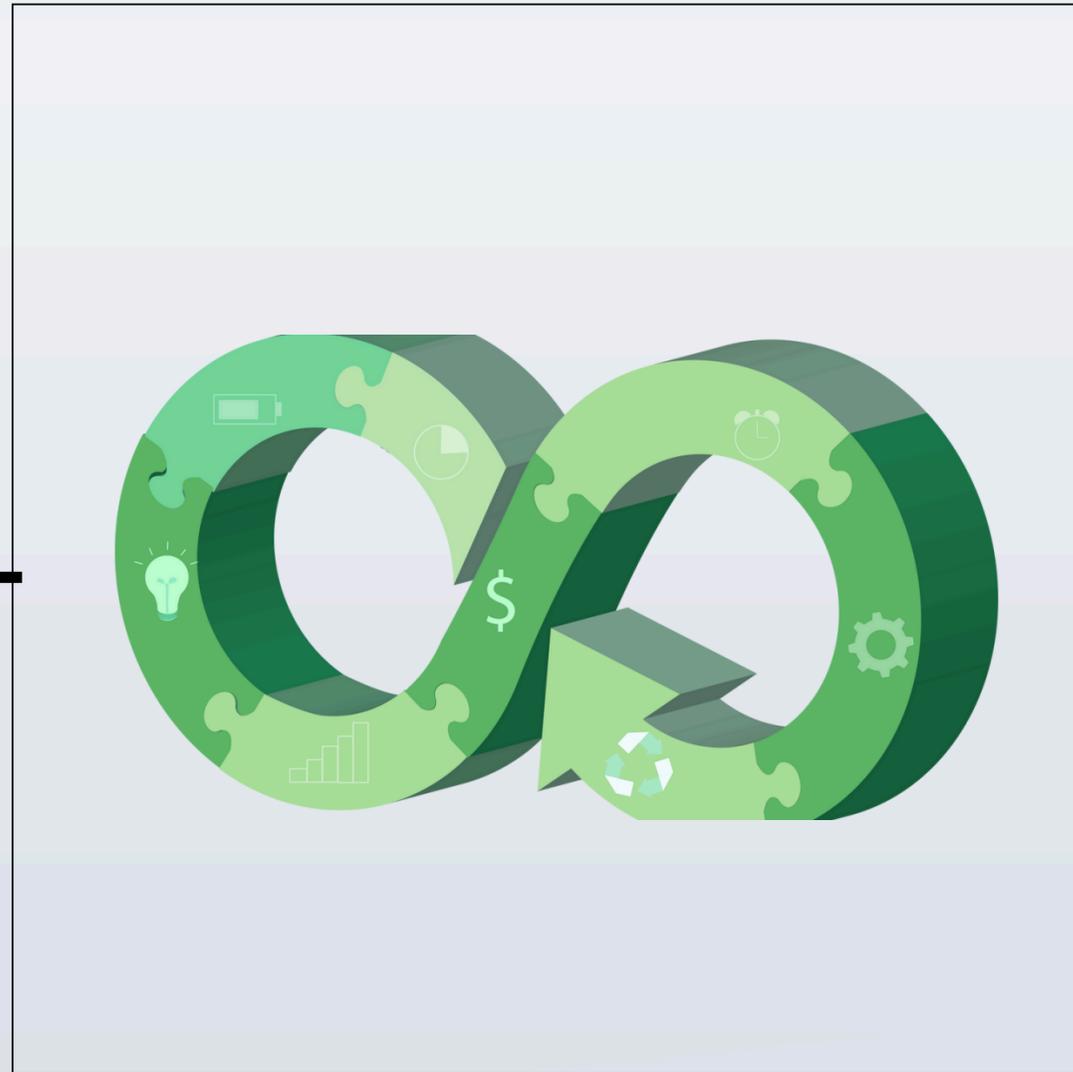


**Facility Management is not only technical it is a strategic lever for sustainability.**

# Universities as Mini-Cities



# CIRCULAR ECONOMY AND ESG INTEGRATION



# CIRCULAR ECONOMY AND ESG INTEGRATION FRAMEWORK



# Circular levers for energy

## **SLOW (Extend life)**

- Predictive maintenance for transformers, switchgear, UPS.
- Retrofit/retrofill instead of full replacement.
- Re-commissioning of BMS/EMS.
- Modular upgrades & spares strategy.

## **NARROW (Use less per service)**

- LED + sensors + daylight control.
- Reduce losses (balancing, PF correction).
- Peak shaving & load management.
- Efficient HVAC operation (smart scheduling).

## **CLOSE (Recover & loop back)**

- Take-back for batteries & electronics.
- Closed-loop contracts for cables & luminaires.
- E-waste compliance and traceability.

# Asset decision model (risk–value–circularity)

Higher  
Criticality  
& Risk  
↑

## Resilience First

High risk, low circularity  
→ redundancy, PQ controls

## Circular-by-Design

High risk, high circularity  
→ performance contracts +  
take-back

## Optimize & Monitor

Low risk, low circularity  
→ efficiency tuning, EMS rules

## Retrofit / Upgrade

Low risk, high circularity  
→ modular upgrades, reuse

Higher Circularity Potential →

## Decision criteria

- Lifecycle cost (LCC)
- Carbon & energy intensity
- Reliability & safety
- Power quality impact
- Compliance & E-waste
- Procurement circularity (CPR)
- Asset circularity (ACI)

## The CE–ESG KPI engine (what gets measured gets improved)

**Energy KPIs:** Total electricity (GWh), EUI (kWh/m<sup>2</sup>), per-capita electricity.

**Water & waste KPIs:** RO/STP production, solid waste, diversion rate (WDR).

**Governance & circularity:** Circular Procurement Ratio (CPR), Asset Circularity Index (ACI).

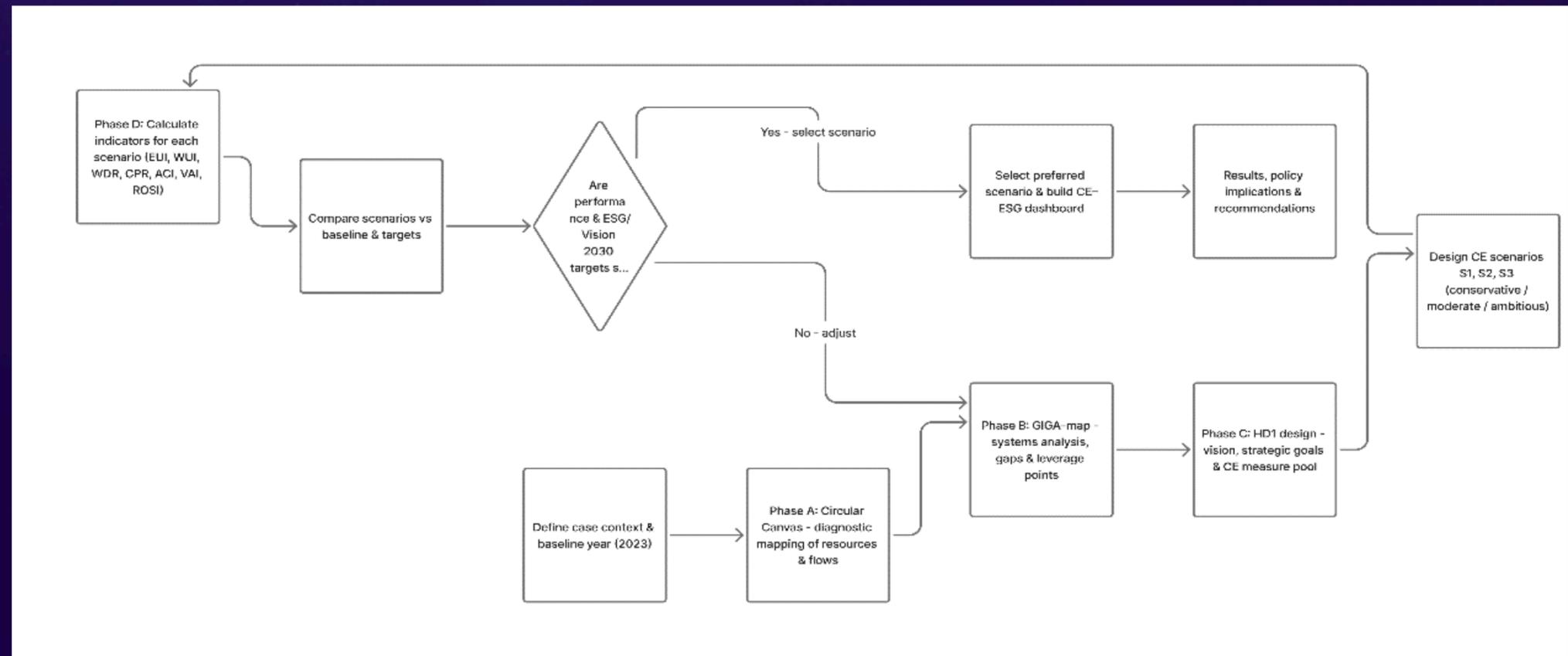
# Methodology

For electricity, the baseline consumption of each end-use category is:

where  $C_{obs}$  is the observed share of category in total campus electricity use (derived from the campus energy audit). Under scenario  $S$ , adjusted consumption is computed as:

For water, the RO and STP volumes in scenario  $S$  are given by:

Solid waste generation and diversion are calculated as:



# Asset decision model (risk–value–circularity)

**Scenario 0**  
**Baseline**



**Scenario 1**  
**Energy Focused CE**



**Scenario 2**  
**Integrated Energy and Water CE**



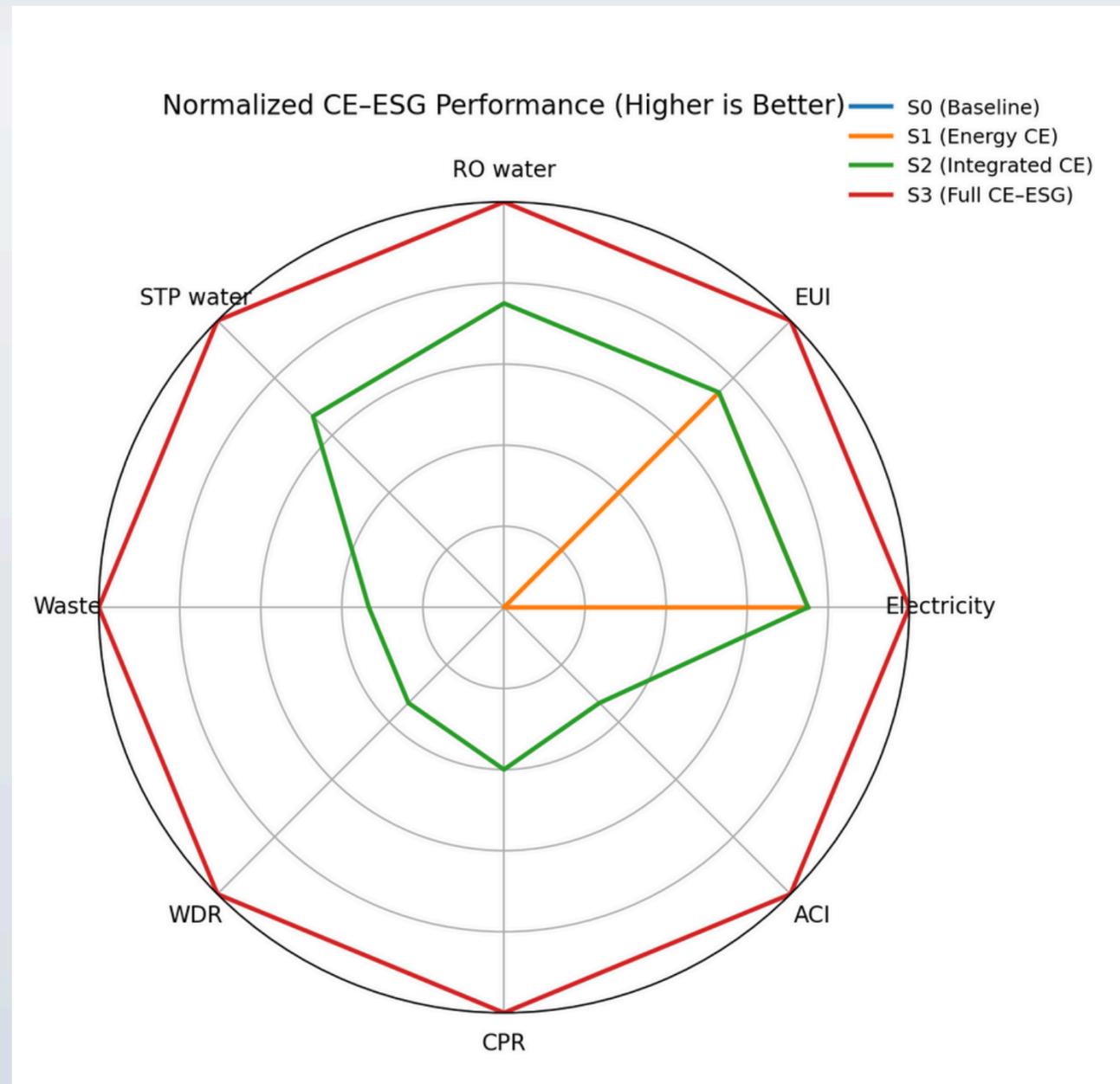
**Scenario 3**  
**Integrated Energy, Water and Waste CE**



# Asset decision model (risk–value–circularity)

KPI	S0	S1	S2	S3
Total electricity use (GWh/yr)	10.34	9.05	9.05	8.62
Energy Use Intensity (kWh/m <sup>2</sup> ·yr)	98.50	86.20	86.20	82.10
Electricity per capita (kWh/cap·yr)	4 419	3 868	3 868	3 684
RO water production (m <sup>3</sup> /yr)	178 026	178 026	151 322	142 421
STP treated water (m <sup>3</sup> /yr)	253 705	253 705	228 335	215 649
Total solid waste (t/yr)	683.0	683.0	649.0	581.0
Waste diversion rate (%)	0	0	20	60
Circular Procurement Ratio (CPR)	0.0	0.0	0.2	0.5
Asset Circularity Index (ACI)	0.0	0.0	0.1	0.3

# Results



## Electricity & EUI

S1 reduces electricity from 10.34→9.05 GWh/yr and EUI from 98.5→86.2 kWh/m<sup>2</sup>·yr.

## Integrated resource gains

S2 keeps energy gains and improves water and waste.  
S3 achieves highest waste diversion and governance scores.

## Governance indicators

CPR and ACI appear strongly only when CE is linked to procurement and asset lifecycle decisions.



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# THANK YOU!



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