DATA CENTER EFFICIENCY

FLYING BLIND

WHY DATACENTER SUSTAINABILITY NEEDS REAL DATA, NOT MARKETING CLAIMS

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asut

HSLU Hochschule Luzern

EPFL EcoCloud

REAL SUSTAINABILITY WITH **INDUSTRY LEADERS**

DIGITAL REALTY

Luxembourg Portus Data Centers

SIX

swisscom

checkmk

DME

ENUEL BUILDING EXCELLENCE

northshore

REWION

Schneider Electric

SICPA

swissenergy

TÜV SÜD Add value. Inspire trust.

ZogRox

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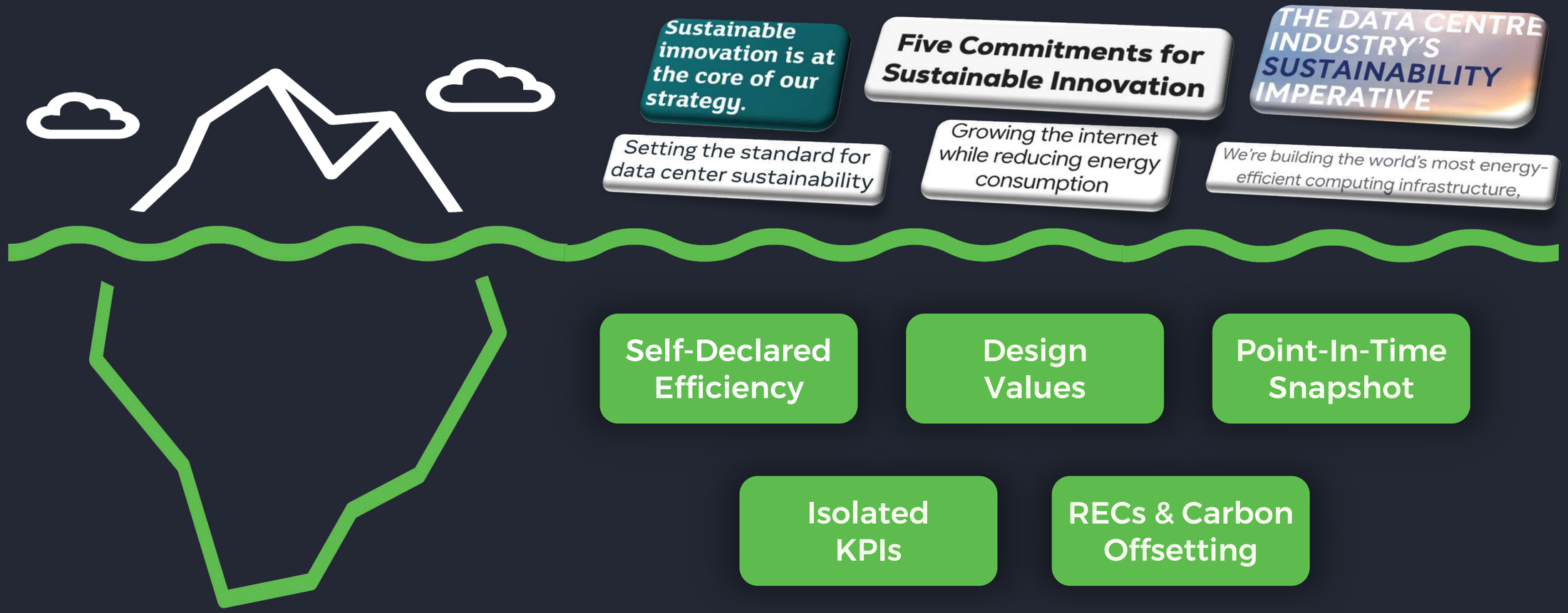
MARKET REALITY

IN SUSTAINABILITY CLAIMS



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EFFICIENCY

FOOTPRINT

OF A POPULAR LLM

> We estimate the median text prompt uses 0.24 Wh of energy, and emits 0.03 grams of CO_2

Median text prompt

0.24 watt-hours (Wh)

0.03g of CO_2

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EFFICIENCY

EFFICIENCY

OF A POPULAR CLOUD

> “Up to 4.1 times more energy efficient than on-premises and can reduce CO_2 by up to 99%”

4.1 times

Energy efficiency

99% less CO_2

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DC EMISSIONS

OF A POPULAR SoMe COMPANY

“273 metric tons of CO_2 emissions”

3,921,611

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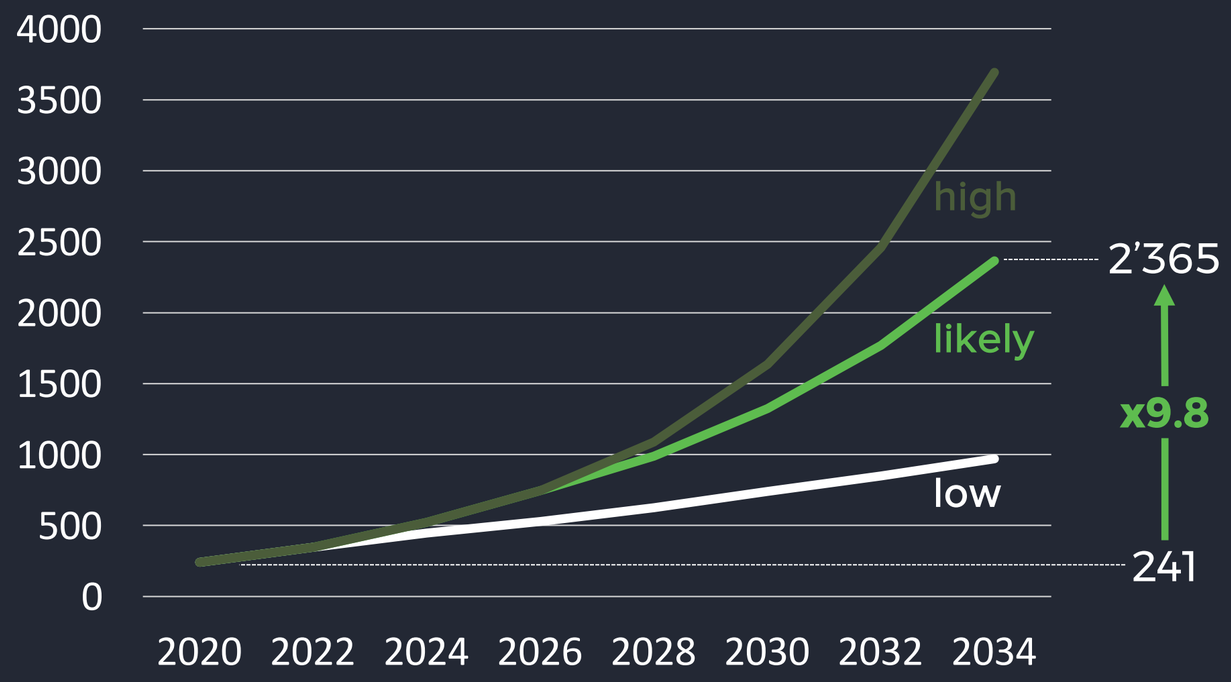
DATACENTERS ARE
ENERGY GUZZLERS AND POLLUTERS

GLOBAL DC ENERGY USE (TWh)



© Bain & Company

GLOBAL DC CO_2 EMISSIONS

“DCs are expected to produce **2.5 billion metric tons of CO_2e** emissions through the end of the decade.

© Goldman Sachs

DATACENTERS ARE

HIGH CO_2 EMITTERS

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EMBODIED EMISSIONS
Scope 3

OPERATIONAL EMISSIONS
Scope 1 & Scope 2

24% **76%**

> “ The **use stage** GHG emissions relating to electricity use account for the **majority of total GHG emissions.**

© Malmodin et al. (2020)

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EFFICIENCY

KEY METRICS

ENERGY, EFFICIENCY, SUSTAINABILITY

Energy Allocation Metrics

- Power Usage Effectiveness
- Carbon Usage Effectiveness
- Water Usage Effectiveness

Efficiency-Related Metrics

- Data Center Infrastructure Efficiency
- IT Equipment Utilization Sv
- Cooling Efficiency Ratio

Sustainability

- Renewable Energy Factor
- Energy Reuse Factor

INDUSTRY STANDARD

POWER USAGE EFFECTIVENESS

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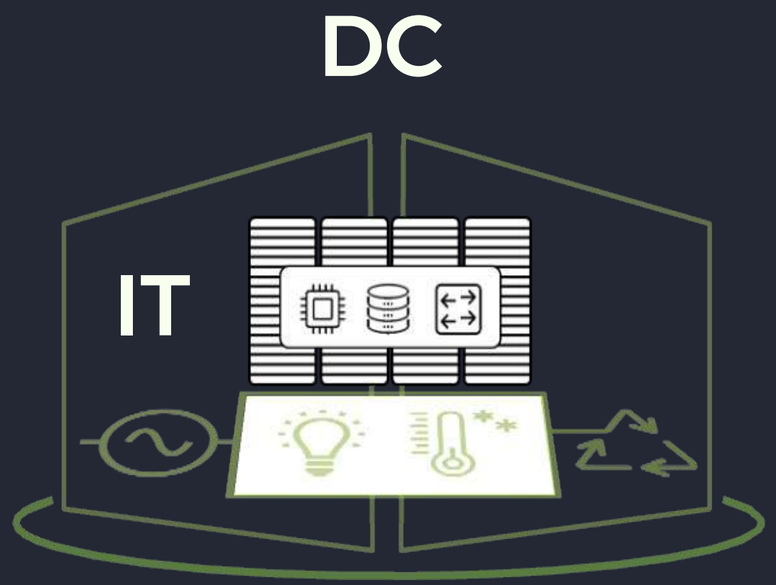
$$PUE = \frac{\text{Total DC Power}}{\text{IT Power}}$$



- PUE has been around for two decades
- Easy to calculate, industry-wide adoption, benchmarking
- Led to significant improvements in building efficiency

PUE
HAS HIT A WALL

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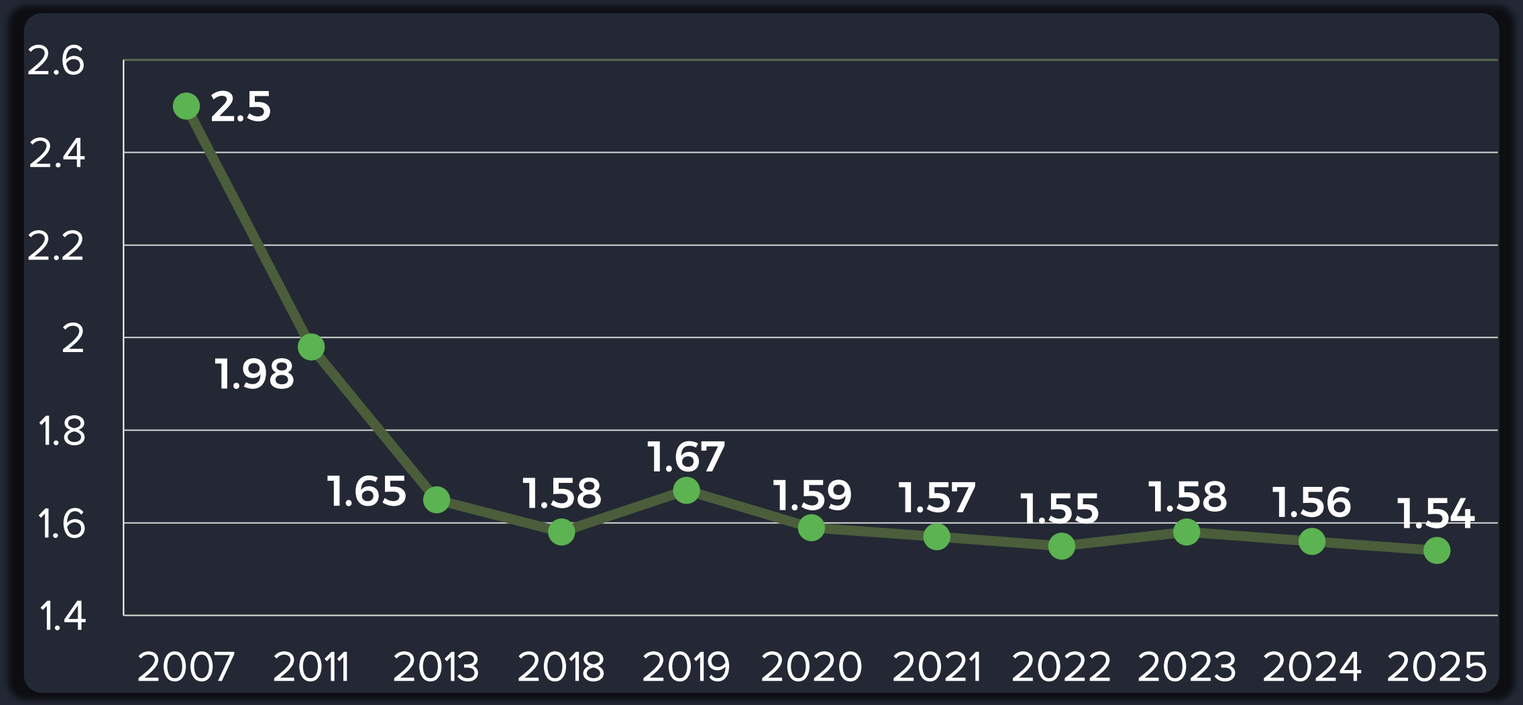

➢ No more efficiency gains possible?

WHY PUE ISN'T ENOUGH

MISSING CRITICAL SUSTAINABILITY METRICS

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NO IT EFFICIENCY

Inefficient or underutilized servers make PUE look good

NO END-TO-END ENERGY FLOW

Ignores heat recovery or on-premise renewables

NO CARBON FOOTPRINT

PUE is just ingress electricity – ignores the source and CO_2

LIMITS OF PUE

PUE SAYS NOTHING ABOUT CO_2 EMISSIONS

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PUE IGNORES THE SOURCE OF ELECTRICITY

PUE: 1.2

20 MW – 100% Coal Power

PUE: 1.5

20 MW – 100% Renewables

LIMITS OF PUE

PUE IGNORES END-TO-END ENERGY FLOW

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PUE IGNORES ON-PREMISE RENEWABLES OR HEAT RECYCLING

PUE: 1.2

20 MW

PUE: 1.5

20 MW

LIMITS OF PUE

PUE IGNORES IT EFFICIENCY

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INEFFICIENT OR UNDERUTILIZED SERVERS

MAKE THE PUE LOOK GOOD

PUE: 1.2

Av. Server Utilization: 15%

PUE: 1.5

Av. Server Utilization: 60%

- Fewer Servers
- Fewer Licenses
- Fewer Energy

THE UNTAPPED
IT EFFICIENCY POTENTIAL

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MARKET
REALITY

- **OVER-PROVISIONING**
  Many servers running at low capacity or idle
- **INEFFICIENT INFRASTRUCTURE**
  Copper vs. Fiber, HDD vs. SSD, PSU Standards, ...
- **LACK OF MEASUREMENT**
  Organizations flying blind when it comes to IT efficiency

Highly Inefficient IT Stacks

swisscom

- **VIRTUALIZATION**
  Fewer physical servers through workload optimization
- **MODERNIZED INFRASTRUCTURE**
  Newer racks and PSUs, phaseout of copper technology
- **MEASUREMENT & MONITORING**
  Measure full-stack energy and utilization data

Savings 2024: 15.5 GWh = in CHF 2.5M

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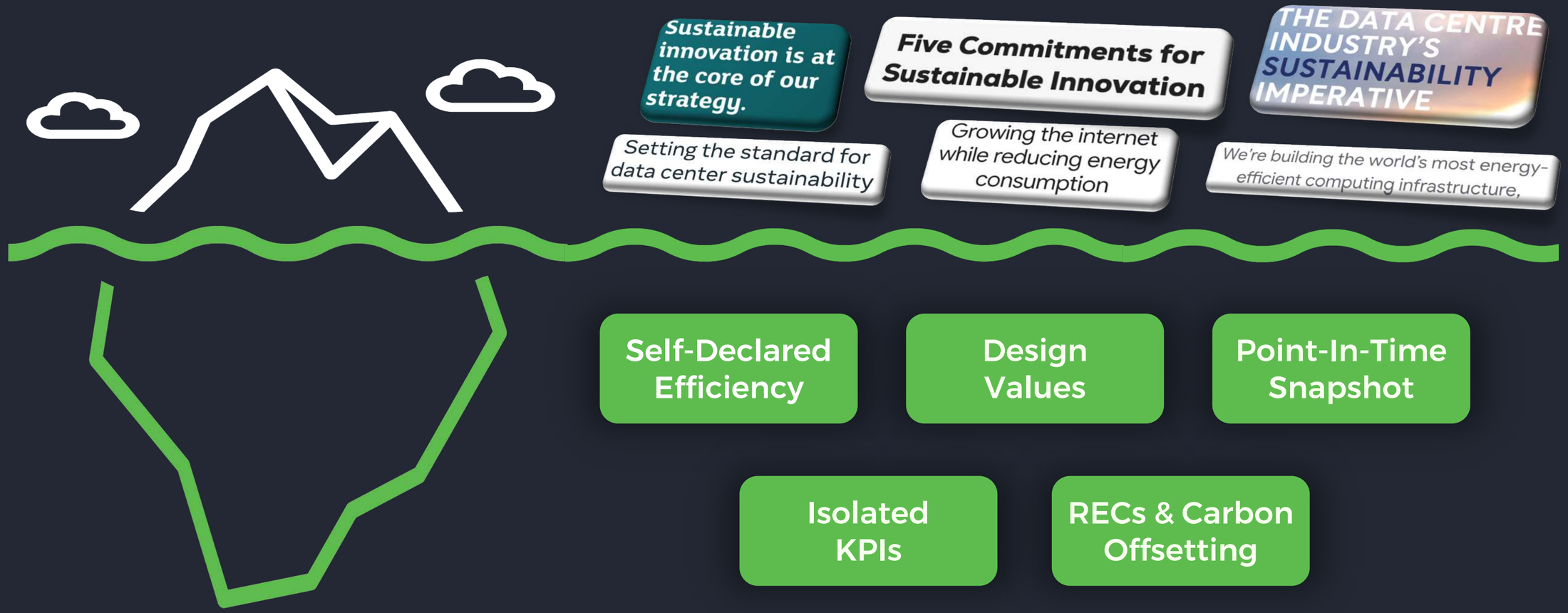
MARKET REALITY

IN SUSTAINABILITY CLAIMS



THE SDEA JOURNEY

TO REAL EFFICIENCY

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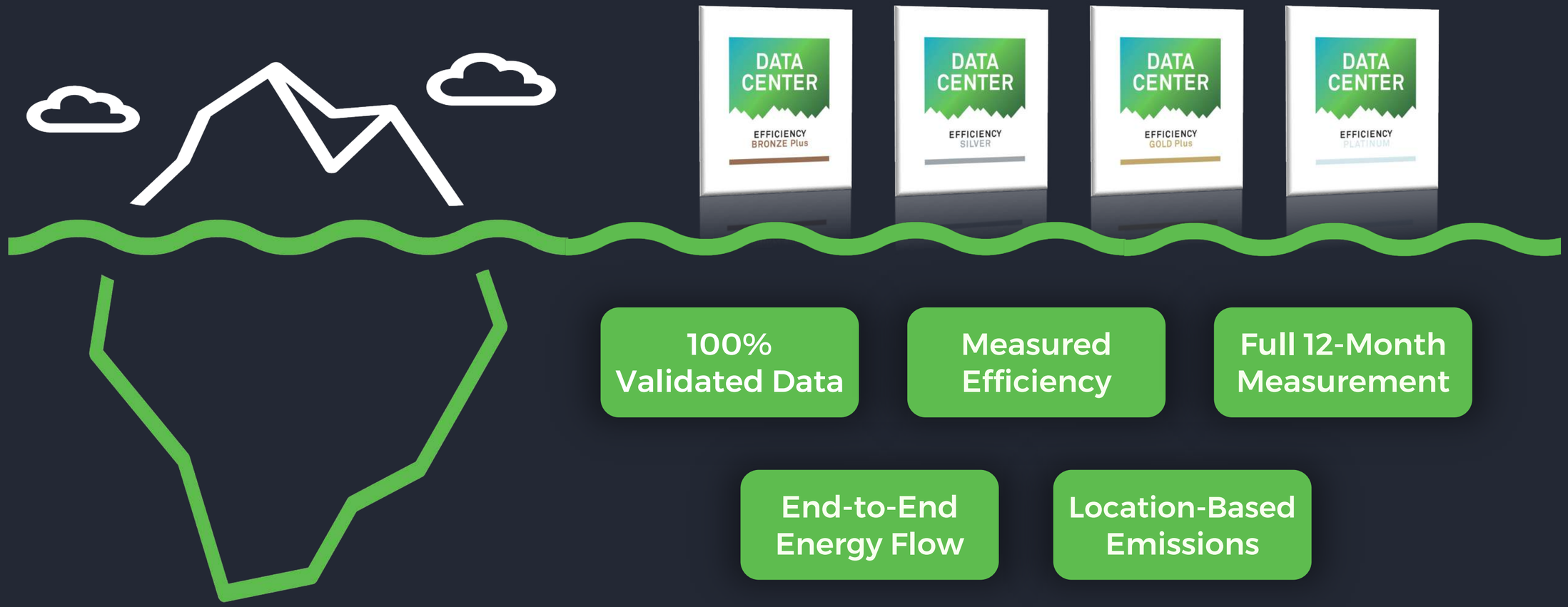
EFFICIENCY



100% Validated Data

Measured Efficiency

Full 12-Month Measurement

End-to-End Energy Flow

Location-Based Emissions

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EFFICIENCY

?

Website

LinkedIn

Navigator Tour

Email