IAITAM ACE

May 7-9, 2024 The M Resort Las Vegas, NV

Gary Paquette

Nlyte Software

Accelerating sustainability through integrated data center management (IDCM)

Finding your IAITAM Oasis

Agenda

1. Conversation baselines
2. Sustainability rules, standards
3. Initial action plans
4. Bringing it all together

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Finding your ITAM Oasis

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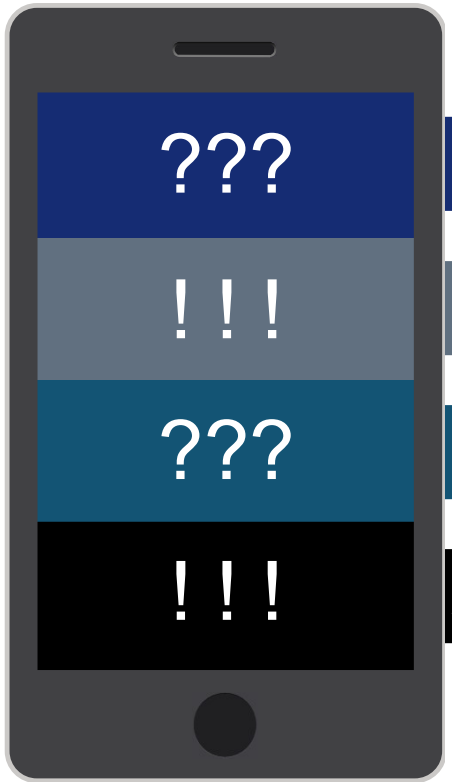
What is the purpose of a data center?



Directions to the airport?

Let's play a game of video poker!

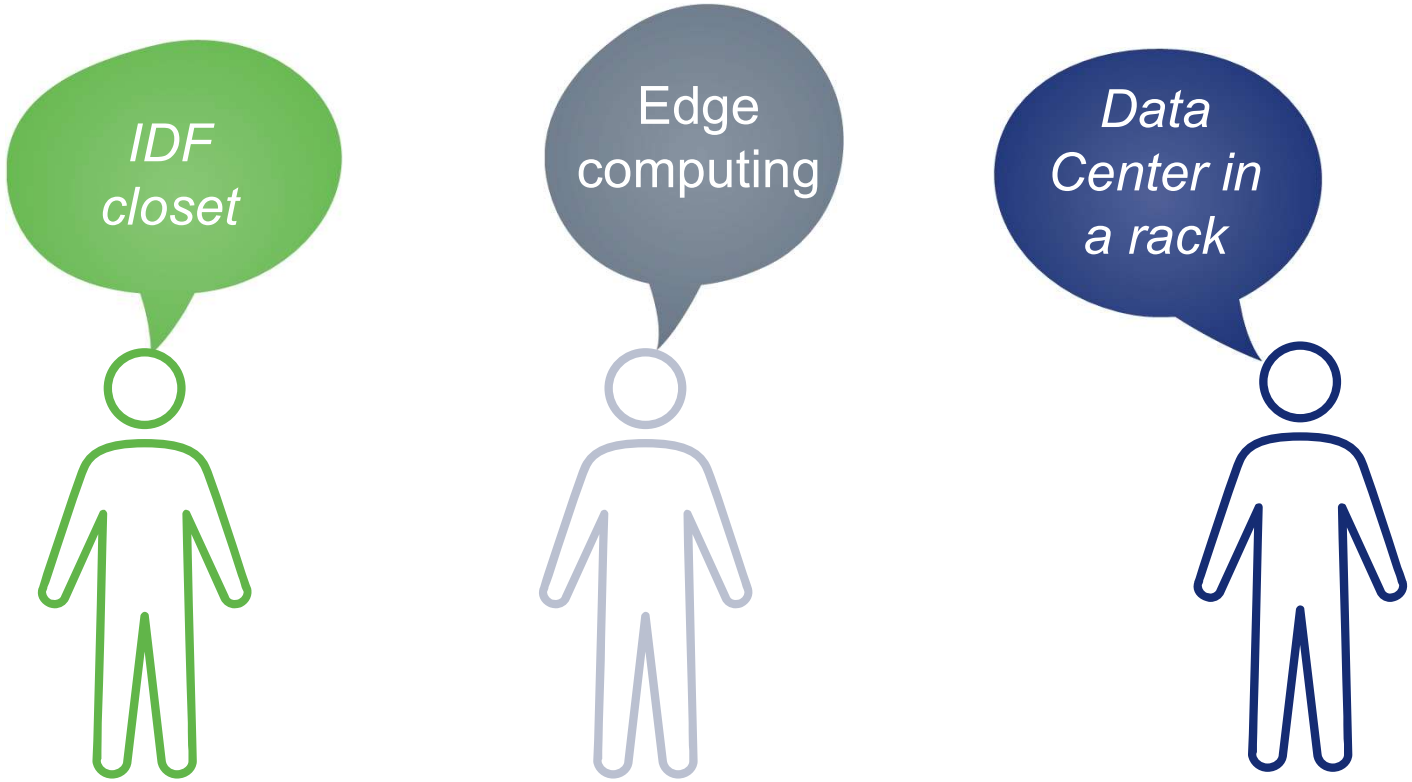
What is the exchange rate from Dollars to Euros?

Amazon, show me the best deal on men's winter coats!

To answer questions and process requests

Data centers are everywhere

There is some form of Data Center in every vertical – they're called different things



Data centers use a lot of resources and regulators have taken notice

- **An average data center consumes over 100x** the power of a large commercial office building. [1]
  A large data center uses the electricity equivalent of a small U.S. town. [1]
- **Data centers are estimated to be responsible for up to 3% of global electricity consumption** [2]
  and are projected to touch 4% by 2030. The average hyperscale facility consumes 20-50MW annually – enough electricity to power up to 37,000 homes.
- **One Google search** is equal to turning on a **60W light bulb for 17 seconds**,
  or about 0.0003 kWh of energy, or roughly 0.2g of carbon dioxide. [3]
- "**The typical data center uses about 3-5 million gallons of water per day** – the same amount of water as a city of 30,000-50,000 people." [4]
- **"2023 is shaping up to be a year of increased sustainability regulations** for the data center industry – both in the U.S. and globally." [5]

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1 US DOE – www.energy.gov/eere/buildings/data-centers-and-servers

2 DataCenter Magazine – https://datacentremagazine.com/articles/efficiency-to-loom-large-for-data-centre-industry-in-2023

3 TIME MAGAZINE - https://techland.time.com/2011/09/09/6-things-youd-never-guess-about-googles-energy-use/

4 Venkatesh Uddameri, professor and director of the Water Resources Center at Texas Tech University, via NBC News - *https://www.nbcnews.com/tech/internet/drought-stricken-communities-push-back-against-data-centers-n1271344*

5 *"Tougher Reporting Mandates Ahead for Data Centers"* – datacenterknowledge.com

Conversation baselines

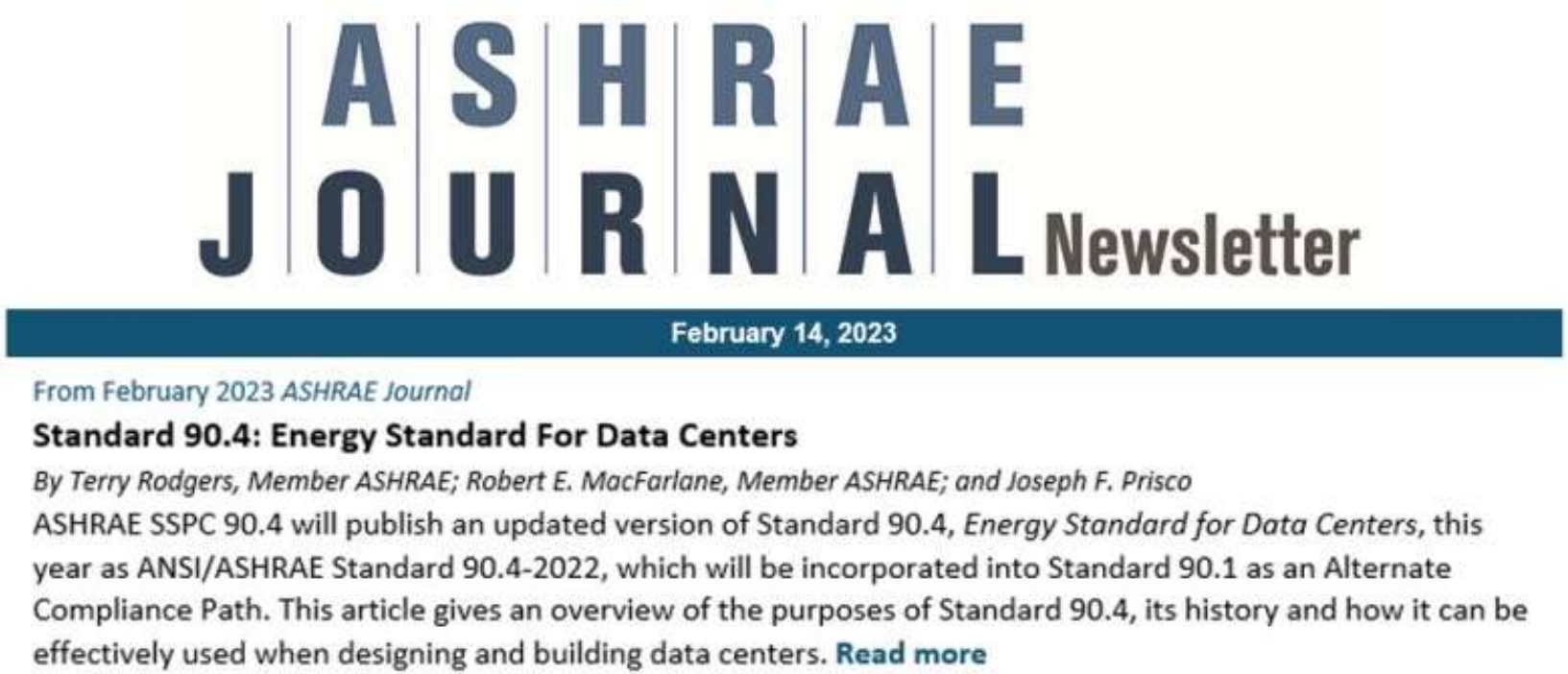
Sustainability compliance reporting legislation is on the rise

Market	Legislation	Key Points
EU	EU Energy Efficiency Directive (EED)	**Compliance failure can result in fines and other penalties.** The revised directive was published in the EU Official Journal and entered into force on 10 October 2023.The EU Energy Efficiency Directive (EED) is a European Union directive which mandates energy efficiency improvements within the European Union. The EU Energy Efficiency Directive (EED) is a European Union directive which mandates energy efficiency improvements within the European Union.
USA / Global	SEC Climate Risk Disclosures	**United States SEC's Enhancement and Standardization of Climate-Related Disclosures** On March 6, 2024, the SEC adopted final rules to enhance the transparency and standardization of climate-related disclosures required from registrants in their registration statements and annual reports. This move, initially proposed on March 21, 2022, marks a pivotal shift towards integrating climate considerations into corporate reporting, reflecting the growing investor demand for reliable and consistent climate-related information.
USA / California	Senate Bill 253 Senate Bill 261	**California's Climate Corporate Data Accountability and Financial Risk Acts** In October 2023, California made a significant leap forward in climate legislation by enacting two groundbreaking bills: Senate Bill 253, the Climate Corporate Data Accountability Act, and Senate Bill 261, the Climate-Related Financial Risk Act. These bills, passed with robust support in both legislative branches, mark a historic shift in corporate responsibility towards climate change.

"Most operators expect carbon emissions reporting requirements soon — yet many are unprepared."
Source: Uptime Institute in their Global Survey of IT and Data Center Managers 2022

Conversation baselines

ASHRAE Standard 90.4: Energy Standard For Data Centers - February 2023[1]



ASHRAE JOURNAL Newsletter

February 14, 2023

From February 2023 *ASHRAE Journal*

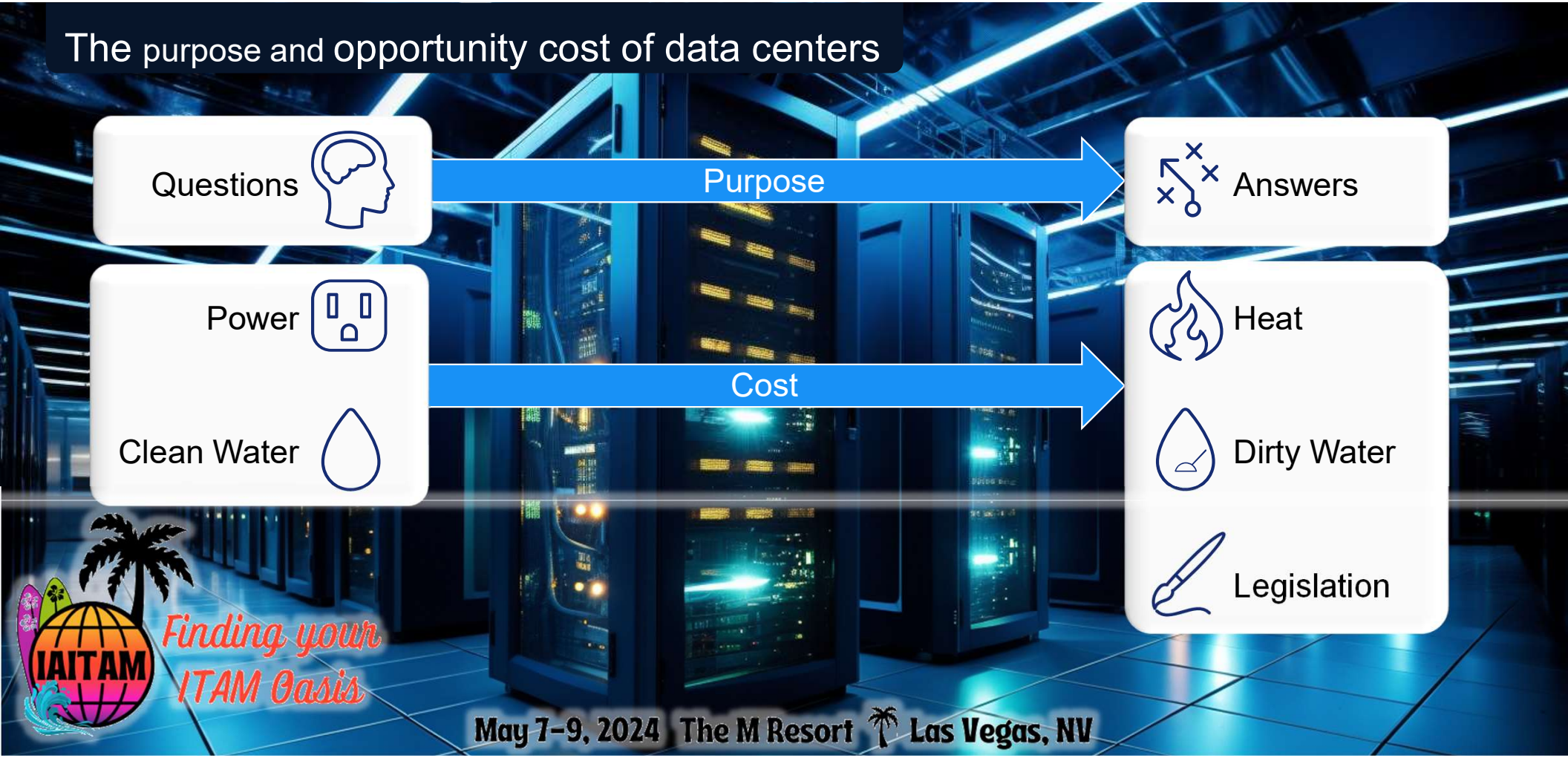
Standard 90.4: Energy Standard For Data Centers

By Terry Rodgers, Member ASHRAE; Robert E. MacFarlane, Member ASHRAE; and Joseph F. Prisco

ASHRAE SSPC 90.4 will publish an updated version of Standard 90.4, *Energy Standard for Data Centers*, this year as ANSI/ASHRAE Standard 90.4-2022, which will be incorporated into Standard 90.1 as an Alternate Compliance Path. This article gives an overview of the purposes of Standard 90.4, its history and how it can be effectively used when designing and building data centers. **Read more**

1. ASHRAE Standard 90.4: Energy Standard For Data Centers https://images.magnetmail.net/images/clients/ASHRAE//attach/44-52_90.pdf

Conversation baselines



Data center sustainability rules and standards

Measures, calculations, and rules vary by region, are complex…

European Commission

Energy, Climate change, Environment

Building information	Public	Private	Reporting organization domain of control	Public	Private	Operation	Public	Private
			Answer yes / no					
*Data center name / ID	●		Physical building		●	Electrical infrastructure redundancy level		●
*Location: municipality where the data center is located	●		Mechanical and electrical plant		●	Cooling infrastructure redundancy level		●
Type of data center according to classification	●		Data floor		●	Number of modular capacity steps or separately provisioned halls		●
*Name of the owner and operators of the data center	●		Racks		●	Number of racks		●
Stand-alone or enclosed in		●	IT equipment		●	*Rated IT electrical load		●

Source: Uptime Institute

FACT SHEET

Enhancement and Standardization of Climate-Related Disclosures

The Securities and Exchange Commission proposed rule amendments that would require a domestic or foreign registrant to include certain climate-related information in its registration statements and periodic reports, such as on Form 10-K, including:

- Climate-related risks and their actual or likely material impacts on the registrant's business, strategy, and outlook;
- The registrant's governance of climate-related risks and relevant risk management processes;
- The registrant's greenhouse gas ("GHG") emissions, which, for accelerated and large accelerated filers and with respect to certain emissions, would be subject to assurance;
- Certain climate-related financial statement metrics and related disclosures in a note to its audited financial statements; and
- Information about climate-related targets and goals, and transition plan, if any.

The proposed disclosures are similar to those that many companies already provide based on broadly accepted disclosure frameworks, such as the Task Force on Climate-Related Financial Disclosures and the Greenhouse Gas Protocol.

Background

The Commission began efforts to provide investors with material information about environmental risks facing public companies in the 1970s and most recently provided related guidance in 2010. Many investors are concerned about the potential impacts of climate-related risks to individual businesses. As a result, investors are seeking more information about the effects of climate-related risks on a company's business to inform their investment decision-making. Investors also have expressed a need for more consistent, comparable, and reliable information about how a registrant has addressed climate-related risks when conducting its operations and developing its business strategy and financial plan. The proposed rules are intended to enhance and standardize climate-related disclosures to address these investor needs. Many issuers currently seek to provide this information to meet investor demand, but current disclosure practices are fragmented and inconsistent. The proposed rules would help issuers more efficiently and effectively disclose these risks, which would benefit both investors and issuers.

US SEC Enhancement and Standardization of Climate-Related Disclosures

CALIFORNIA ENERGY COMMISSION

CALIFORNIA ENERGY COMMISSION

Computer Rooms & Data Centers

When do the Standards Apply?

The 2019 Building Energy Efficiency Standards apply to all space conditioning systems serving computer rooms. The Energy Standards define a computer room as:

"A room within a building whose primary function is to house electronic equipment and that has a design equipment power density exceeding 20 watts/ft^2 (215 watts/m^2) of conditioned floor area."

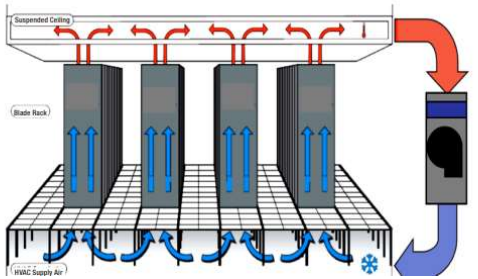
When the Standards apply, the energy requirements specific to computer rooms can be found in §140.9(a) of Title 24, Part 6. The requirements for computer rooms are prescriptive and may be traded off if the performance method of compliance is used. Computer rooms located inside healthcare facilities are exempt from these requirements.

capacity to existing computer room(s) in an existing building. This exception permits addition of new IT equipment to an existing facility originally built without any economizers.

Exception 3: Economizer requirements are not required when adding up to a total of 20 tons of new cooling capacity to new computer room(s) in an existing building.

Exception 4: Computer rooms served by a fan system with an economizer that also serves other spaces within the building are exempt from the economizer requirements if all of the following are met:

- The economizer system is sized to meet the design cooling load of the computer room when the other spaces within the building are at 50 percent of their design load; and



Data Centers - California Energy Commission

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Data center sustainability rules and standards

…and are moving targets

Upcoming SEC climate disclosure rules bring urgency to ESG data strategy planning

REUTERS®

European Energy Efficiency Directive published, with mandatory data center reporting

Data centers bigger than 500kW must report energy efficiency figures in May 2024

DIRECTIVE (EU) 2023/1791 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 13 September 2023

…n energy efficiency and amending Regulation (EU) 2023/955 (recast)

…ENT AND THE COUNCIL OF THE EUROPEAN UNION,

…nd every year thereafter, Member States shall require owners and operators of data centres in their …emand of the installed information technology (IT) of at least 500kW, to make the information set …available, except for information subject to Union and national law protecting trade and business …y.

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Power Usage Effectiveness (PUE) Monitoring

This submeasure proposal includes adding a mandatory requirement to install PUE monitoring in buildings whose primary function is to house computer rooms (defined as "data centers" in Title 24, Part 6). The major criteria triggering this requirement are a total computer room ITE design load over 2,000 kW and

Update – Germany tightens energy efficiency requirements: New challenges for companies and data centers

ALLEN & OVERY PUBLICATIONS 29 September 2023

On 21 September 2023, the German Parliament passed the heavily discussed German Federal Act on the Increase of Energy Efficiency (*Energieeffizienzgesetz* – EnEfG) that aims at significantly increasing energy efficiency requirements for companies and data centers in particular.

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Initial action plans

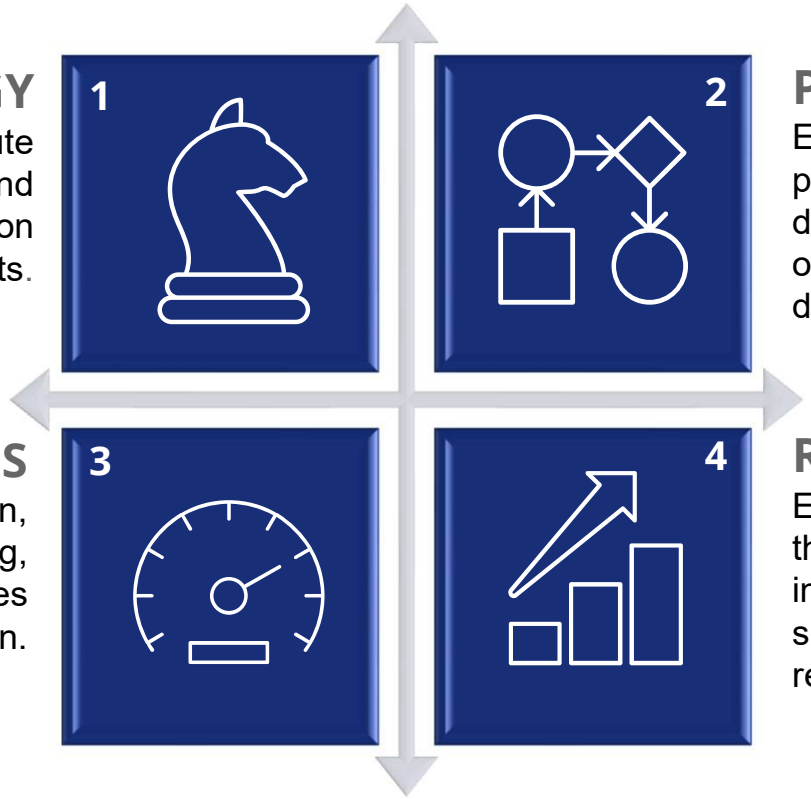
Improve sustainability and prepare for stricter reporting mandates

STRATEGY

Create a strategy to execute sustainable practices and comply with information reporting requirements.

METRICS

Establish data collection, management, dashboarding, and reporting processes for the needed information.



PROCESS

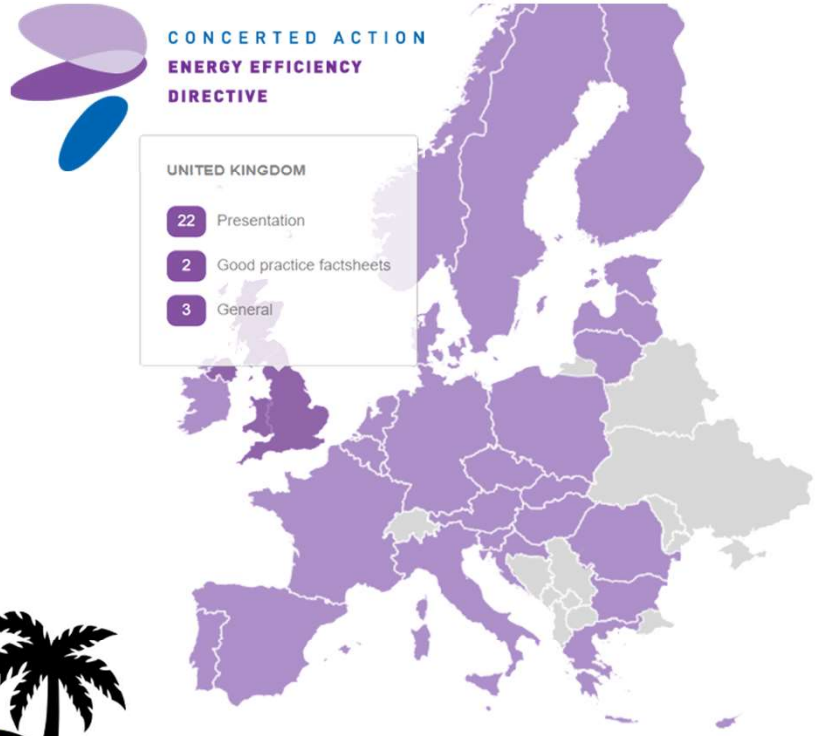
Enact processes to ensure projects increase the work delivered per megawatt-hour of energy consumed across data center operations.

REPORTING

Enable a reporting framework that supports real-time information and annualized sustainability compliance reporting.

Initial action plans

STRATEGY → Determine requirements by location



Source: https://www.ca-eed.eu/

Document	Author	Organisation	Type	Date
Reflections on Scotland's Approach - UK	Yvette Sheppard	Scottish Government		Jan 20
Community Energy in Scotland - UK	Craig Egner	Scottish Government		Jan 20
Minimum Standards in the Private Rental Sector - United Kingdom	James Kerry	Department for Businesses, Energy and Industrial Strategy		Mar 19
Energy poverty in England - United Kingdom	James Kerry	Department for Business, Energy and Industrial Strategy		Mar 19
Audit and reporting evaluation - United Kingdom	Gary Shanahan	BEIS		Oct 18
Good practice factsheet: Tailoring advice based on consumer values - UK	Caitlin Bent	Energy Saving Trust		Oct 17
Article 4 Building Renovation Strategy. Overview of national building stock - UK				Aug 16

Initial action plans

STRATEGY → Align cooling with workload demand

- Increase efficiency by matching workloads to available free cooling and renewable energy sources at optimal times
- Utilize autonomous and remote management, particularly in edge locations
- Leverage energy-efficient cooling options in high-density environments
- Ensure Building Automation Systems and Data Center Infrastructure Management solutions are integrated so that infrastructure appropriately serves the workloads being run

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Initial action plans

STRATEGY → Target carbon-intensive infrastructure

Microsoft Plans to Stop Using Diesel Generators by 2030

BY RICH MILLER - JULY 22, 2020 — 6 COMMENTS

Image Source: licensed under CC BY-SA

- Identify infrastructure with heaviest carbon footprint
- For new builds, design in alternative energy sources
  - Solar PV arrays
  - Hydrogen fuel cells

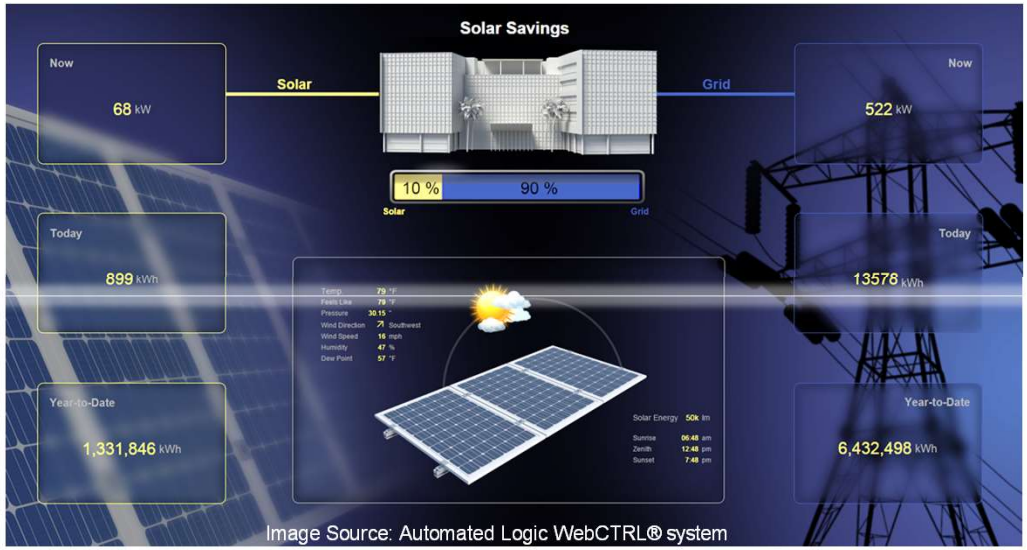

Image Source: Automated Logic WebCTRL® system

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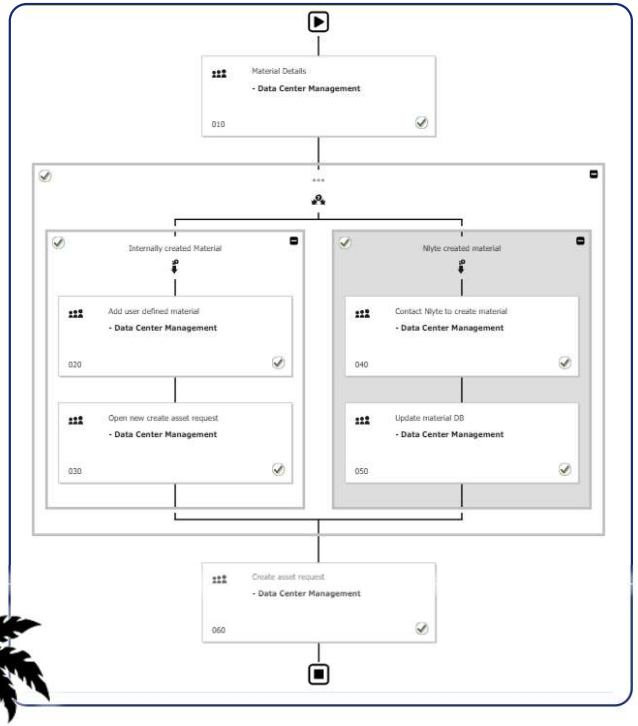
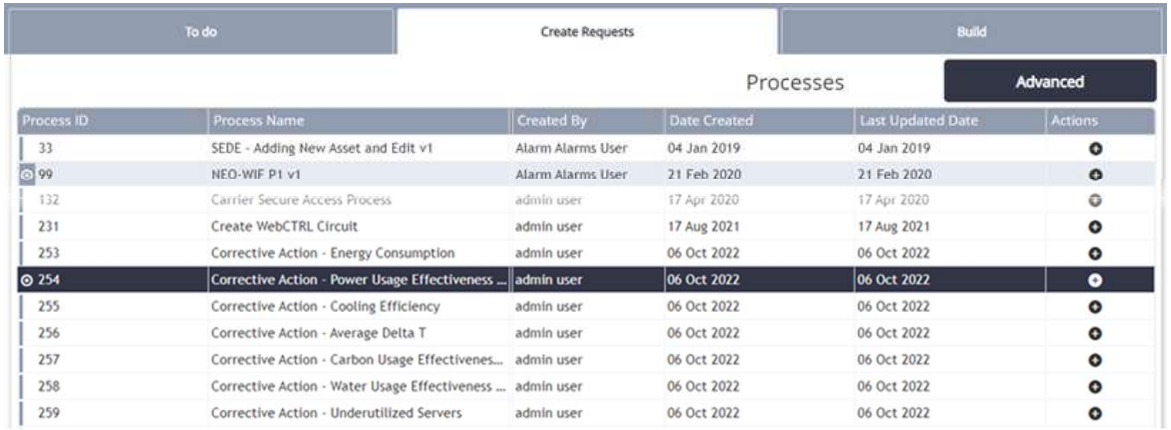
Initial action plans

PROCESS → Implement workflow management



- Develop organizational processes for sustainability certifications / compliance / reporting
- Establish procurement guidelines to ensure purchase of efficient equipment
- Identify points in equipment deployment processes for inserting or tweaking efficiency gains
- Define processes for optimizing metrics



Process ID	Process Name	Created By	Date Created	Last Updated Date	Actions
33	SEDE - Adding New Asset and Edit v1	Alarm Alarms User	04 Jan 2019	04 Jan 2019	
99	NEO-WIF P1 v1	Alarm Alarms User	21 Feb 2020	21 Feb 2020	
132	Carrier Secure Access Process	admin user	17 Apr 2020	17 Apr 2020	
231	Create WebCTRL Circuit	admin user	17 Aug 2021	17 Aug 2021	
253	Corrective Action - Energy Consumption	admin user	06 Oct 2022	06 Oct 2022	
254	Corrective Action - Power Usage Effectiveness ...	admin user	06 Oct 2022	06 Oct 2022	
255	Corrective Action - Cooling Efficiency	admin user	06 Oct 2022	06 Oct 2022	
256	Corrective Action - Average Delta T	admin user	06 Oct 2022	06 Oct 2022	
257	Corrective Action - Carbon Usage Effectivenes...	admin user	06 Oct 2022	06 Oct 2022	
258	Corrective Action - Water Usage Effectiveness ...	admin user	06 Oct 2022	06 Oct 2022	
259	Corrective Action - Underutilized Servers	admin user	06 Oct 2022	06 Oct 2022	

Image(s) source: https://www.nlyte.com/solutions

Initial action plans

METRICS → Start with the basic metrics for your region

Power Usage Effectiveness (PUE) – The total facility power divided by the IT equipment power consumption.

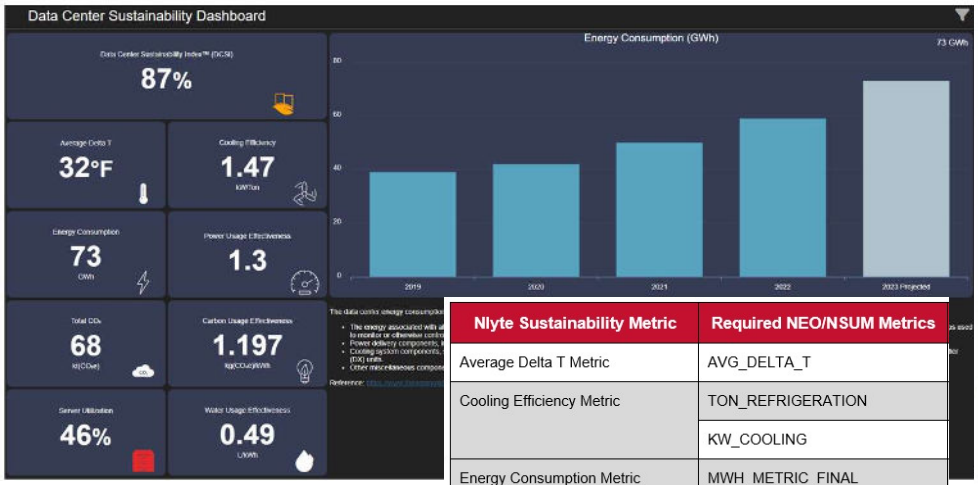
Carbon Usage Effectiveness (CUE) – The ratio of Total CO2 emissions (kg) divided by Total IT Energy (kWh) .

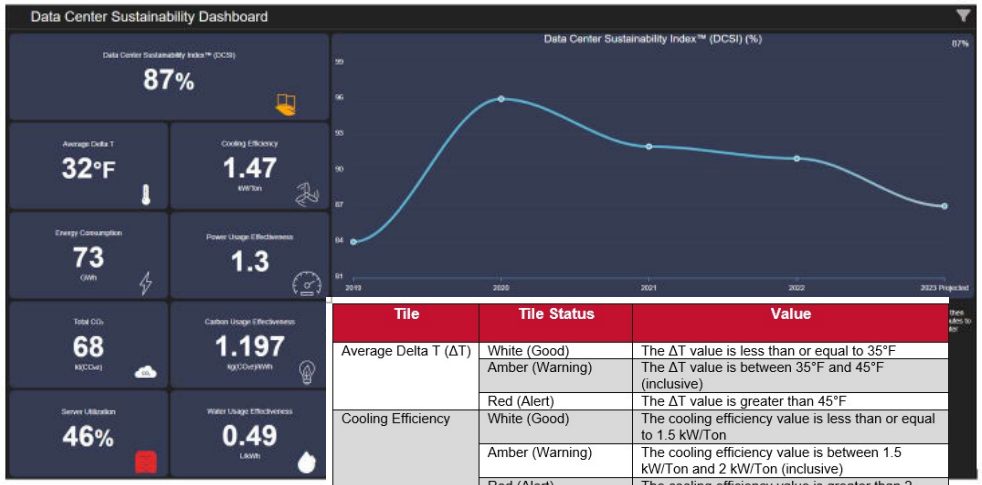
Water Usage Effectiveness (WUE) – The ratio of the annual site water usage in liters to the IT equipment energy usage in kilowatt-hours (kWh) during the same period.

Total CO_2 - An estimate of the total greenhouse gas emissions produced by a data center. It's usually measured in metric tons of carbon dioxide equivalent (CO_2e).

Initial action plans

REPORTING → Real-Time Dashboarding → Thresholds, Alarming, and Visual Indicators





Nlyte Sustainability Metric	Required NEO/NSUM Metrics
Average Delta T Metric	AVG_DELTA_T
Cooling Efficiency Metric	TON_REFRIGERATION
	KW_COOLING
Energy Consumption Metric	MWH_METRIC_FINAL
Power Usage Effectiveness (PUE) Metric	FACILITY_LOAD
	IT_LOAD
Total CO2 Metric	TCO2_METRIC_FINAL
Carbon Usage Effectiveness (CUE) Metric	TCO2_METRIC_FINAL
	IT_LOAD_KWH
Server Utilization Metric	CPU_UTILIZATION_SERVERS
Water Usage Effectiveness Metric	IT_WATER
	IT_LOAD_KWH

Tile	Tile Status	Value
Average Delta T (ΔT)	White (Good)	The ΔT value is less than or equal to 35°F
	Amber (Warning)	The ΔT value is between 35°F and 45°F (inclusive)
	Red (Alert)	The ΔT value is greater than 45°F
Cooling Efficiency	White (Good)	The cooling efficiency value is less than or equal to 1.5 kW/Ton
	Amber (Warning)	The cooling efficiency value is between 1.5 kW/Ton and 2 kW/Ton (inclusive)
	Red (Alert)	The cooling efficiency value is greater than 2 kW/Ton
Carbon Usage Effectiveness (CUE)	White (Good)	The CUE value is less than or equal to 1.5 kg(CO_2e)/kWh
	Amber (Warning)	The CUE value is between 1.5 kg(CO_2e)/kWh and 2.0 kg(CO_2e)/kWh (inclusive)
	Red (Alert)	The CUE value is greater than 2.0 kg(CO_2e)/kWh
Power Usage Effectiveness (PUE)	White (Good)	The PUE ratio is less than or equal to 1.3
	Amber (Warning)	The PUE ratio is between 1.3 and 1.7 (inclusive)
	Red (Alert)	The PUE ratio is greater than 1.7
Server Utilization	White (Good)	The value is greater than or equal to 60% (inclusive)
	Amber (Warning)	The value is between 50% (inclusive) and 60%
	Red (Alert)	The value is less than 50%
Water Usage Effectiveness (WUE)	White (Good)	The WUE value is less than or equal to 0.5 L/kWh
	Amber (Warning)	The WUE value is between 0.5 L/kWh and 1.1 L/kWh (inclusive)
	Red (Alert)	The WUE value is greater than 1.1 L/kWh

Source: https://www.nlyte.com/solutions/data-center-sustainability

Initial action plans

REPORTING → Real-Time Dashboarding → Example Detail: Water Usage Effectiveness(WUE)

Water Usage Effectiveness Metric Formula [1]

Description: Data Center water consumption (in liters) required in the operation of IT equipment measured

Formula: Water in liters / kWh

Unit: L / kWh

Sustainability Metric Formula

Data Center Water Consumption (in liters) / IT Equipment Energy (in kilowatt hours)

Required NEO Metric(s) for Generating Needed Data

Metric Names	Metric Unit
IT_WATER	Liters
IT_LOAD_KWH	kWh

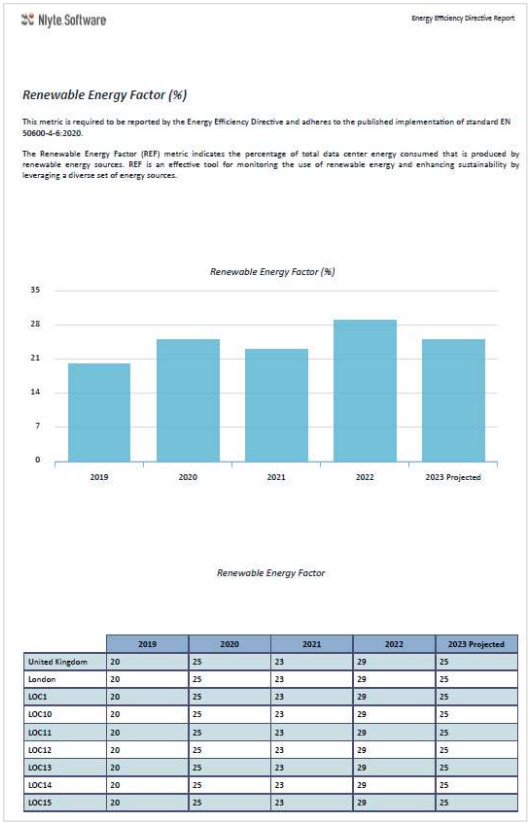
"While data center water consumption may not be a core focus for operators, it is non-trivial, with U.S. data centers estimated to consume over 400 million gallons per day (Nature, 2018). It is estimated that less than a third of data center owners and operators in the U.S. measure and track water consumption. Metrics such as water usage effectiveness, or WUE, have emerged to enable assessment of water efficiency performance relative to other data centers." [2]

1 Source: https://www.nlyte.com/solutions/data-center-sustainability

2 Source: https://datacenters.lbl.gov/water-efficiency

Initial action plans

REPORTING → Annualized Compliance Reporting



Nlyte Software — Energy Efficiency Directive Report

Renewable Energy Factor (%)

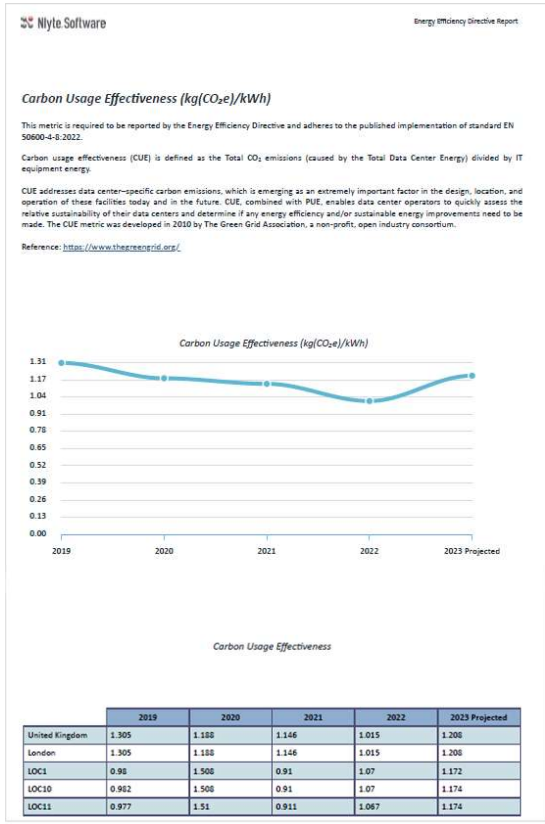
This metric is required to be reported by the Energy Efficiency Directive and adheres to the published implementation of standard EN 50600-4-6:2020.

The Renewable Energy Factor (REF) metric indicates the percentage of total data center energy consumed that is produced by renewable energy sources. REF is an effective tool for monitoring the use of renewable energy and enhancing sustainability by leveraging a diverse set of energy sources.

Renewable Energy Factor (%)

Renewable Energy Factor

	2019	2020	2021	2022	2023 Projected
United Kingdom	20	25	23	29	25
London	20	25	23	29	25
LOC1	20	25	23	29	25
LOC10	20	25	23	29	25
LOC11	20	25	23	29	25
LOC12	20	25	23	29	25
LOC13	20	25	23	29	25
LOC14	20	25	23	29	25
LOC15	20	25	23	29	25



Nlyte Software — Energy Efficiency Directive Report

Carbon Usage Effectiveness (kg(CO_2e)/kWh)

This metric is required to be reported by the Energy Efficiency Directive and adheres to the published implementation of standard EN 50600-4-8:2022.

Carbon usage effectiveness (CUE) is defined as the Total CO_2 emissions (caused by the Total Data Center Energy) divided by IT equipment energy.

CUE addresses data center–specific carbon emissions, which is emerging as an extremely important factor in the design, location, and operation of these facilities today and in the future. CUE, combined with PUE, enables data center operators to quickly assess the relative sustainability of their data centers and determine if any energy efficiency and/or sustainable energy improvements need to be made. The CUE metric was developed in 2010 by The Green Grid Association, a non-profit, open industry consortium.

Reference: https://www.thegreengrid.org/

Carbon Usage Effectiveness (kg(CO_2e)/kWh)

Carbon Usage Effectiveness

	2019	2020	2021	2022	2023 Projected
United Kingdom	1.305	1.188	1.146	1.015	1.206
London	1.305	1.188	1.146	1.015	1.206
LOC1	0.98	1.508	0.91	1.07	1.172
LOC10	0.982	1.508	0.91	1.07	1.174
LOC11	0.977	1.51	0.911	1.067	1.174

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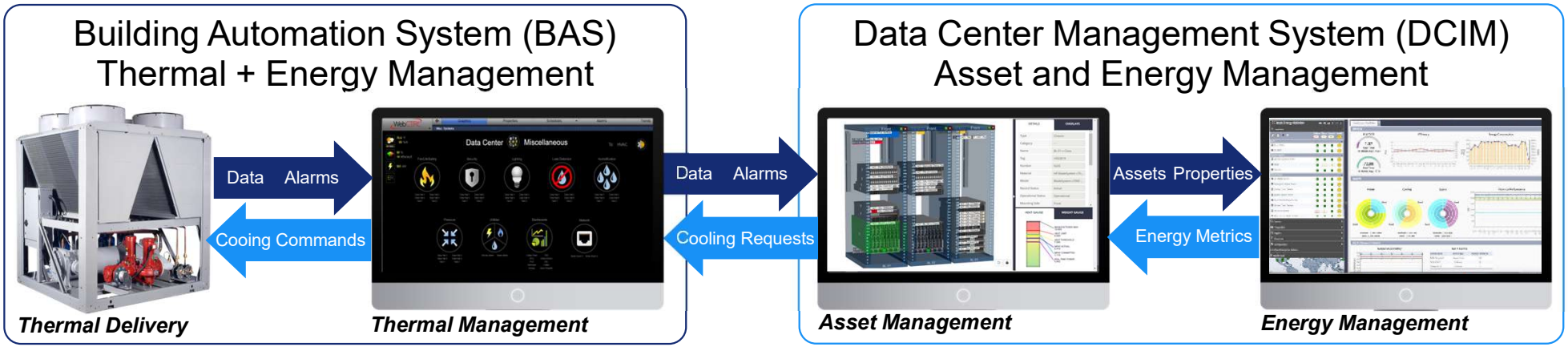
Bringing it all together

Integrated Data Center Management (IDCM) enables sustainable data centers and reporting



- Creation and delivery of thermal change to one or more zones
- Context: zones and schedules

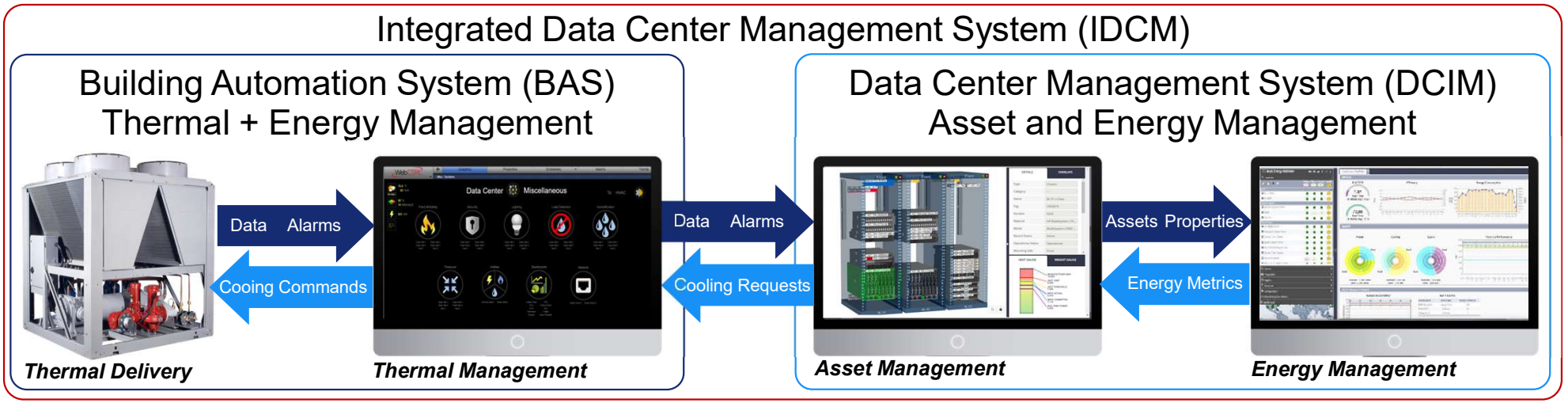
- Orchestration of thermal management, facility system visualization, monitoring and reporting
- Context: entire building / campus, schedules, sophisticated capabilities, flexible, programmable

- Monitor, manage, report on IT / computing assets
- Context: data center, data center equipment, workloads

- Monitor, manage and report on energy
- Context: data center, data center equipment

Bringing it all together

Integrated Data Center Management (IDCM) enables sustainable data centers and reporting



Integrating building control infrastructure with data center infrastructure and workloads

- Reduce costs (efficiency)
- Improve uptime (servers and HVAC mechanical)
- Provide operational insight (multi-sourced metrics)

All of which can be used to drive sustainable operation and deliver required reporting

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You don’t have to
do it all yourself
Partner for success
IAITAM
Finding your
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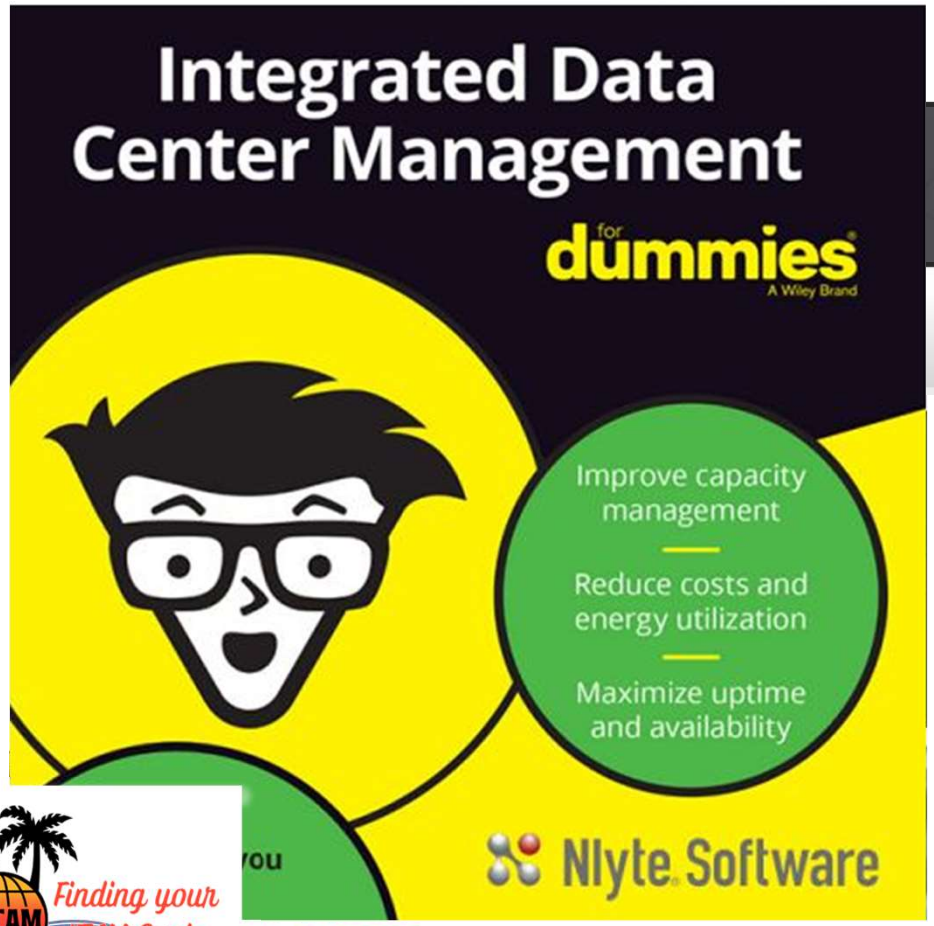
Thank you

Finding your IAITAM Oasis

Additional Resources



Nlyte.com and go to our **resources > white papers** page

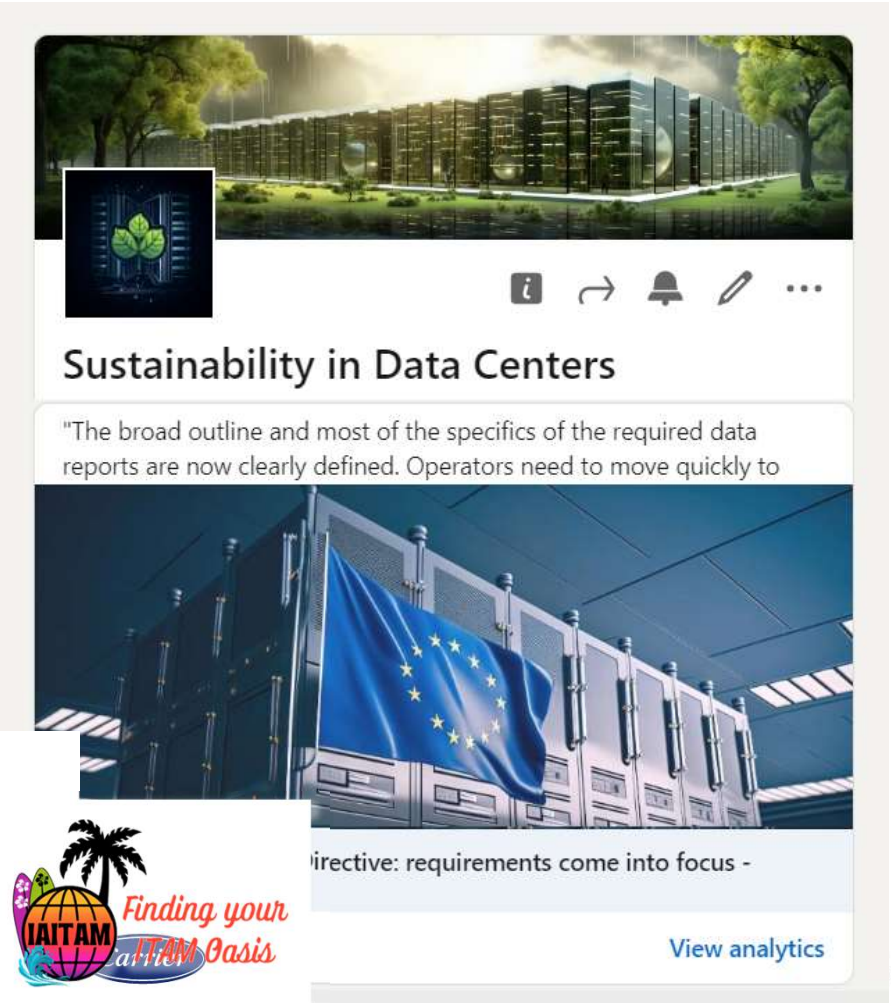
eBook Chapters include:

- What is IDCM and Why Do You Need It?
- Exploring IDCM Building Blocks
- Defining IDCM Use Cases
- Getting the Most Value from IDCM
- 10 Benefits of Integrated Data Center Management

Finding your ITAM Oasis

May 7-9, 2024 The M Resort Las Vegas, NV

Additional Resources

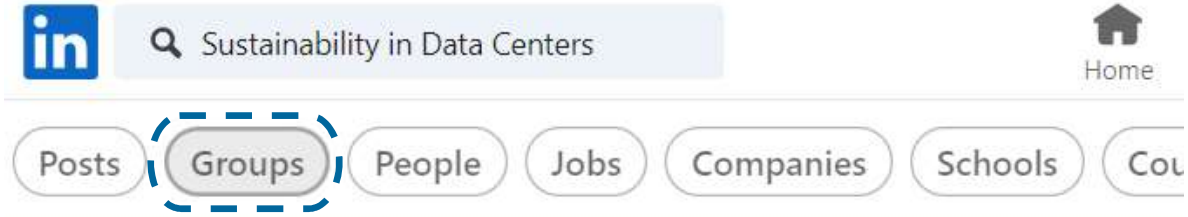


LinkedIn Group

Sustainability in Data Centers

This public group explores energy efficiency, carbon footprint reduction, waste management, water conservation, green infrastructure, sustainable innovation, legislation, standards, policies, and case studies.

On LinkedIn, Search "Sustainability in Data Centers."



The M Resort Las Vegas, NV