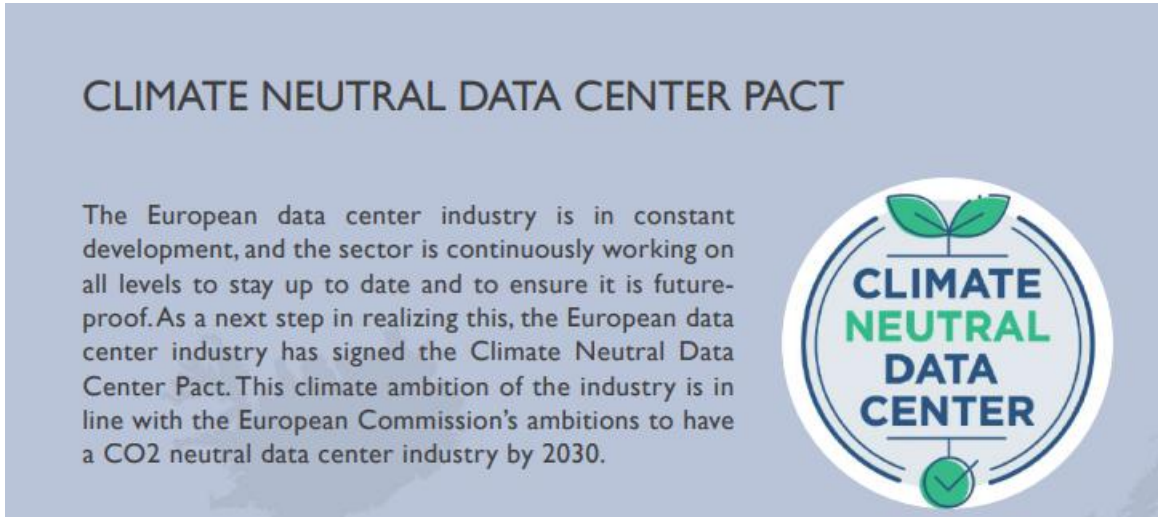
DC FORUM

COPENHAGEN – 14TH OCT 2021 – VINCENT LIEBE

ACHIEVING A HIGHER LEVEL OF ENERGY SAVINGS & SUSTAINABILITY BY APPROPRIATE WHITE SPACE AIRFLOW MANAGEMENT

Setting the scene

Climate Neutral Datacenter Pact

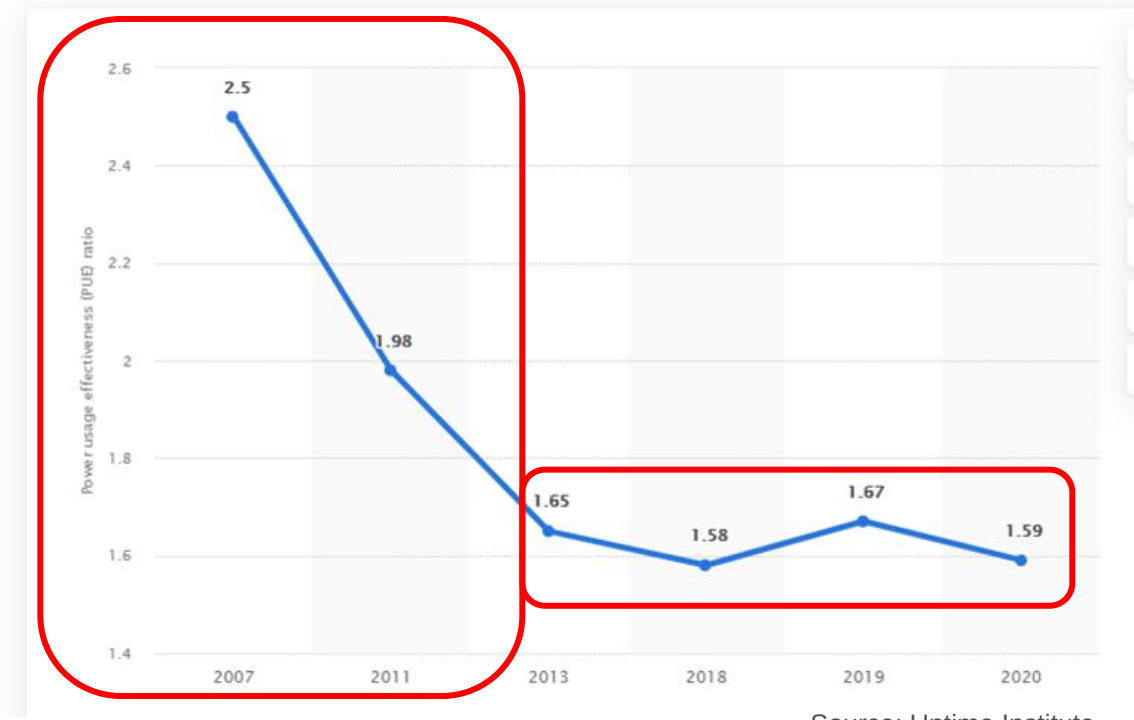


- **Demonstration of energy efficiency with measurable targets**
- Purchase of 100% CO2-free energy
- Prioritize water conservation
- Recycling and repair of servers
- Looking for ways to recycle heat
- Governance

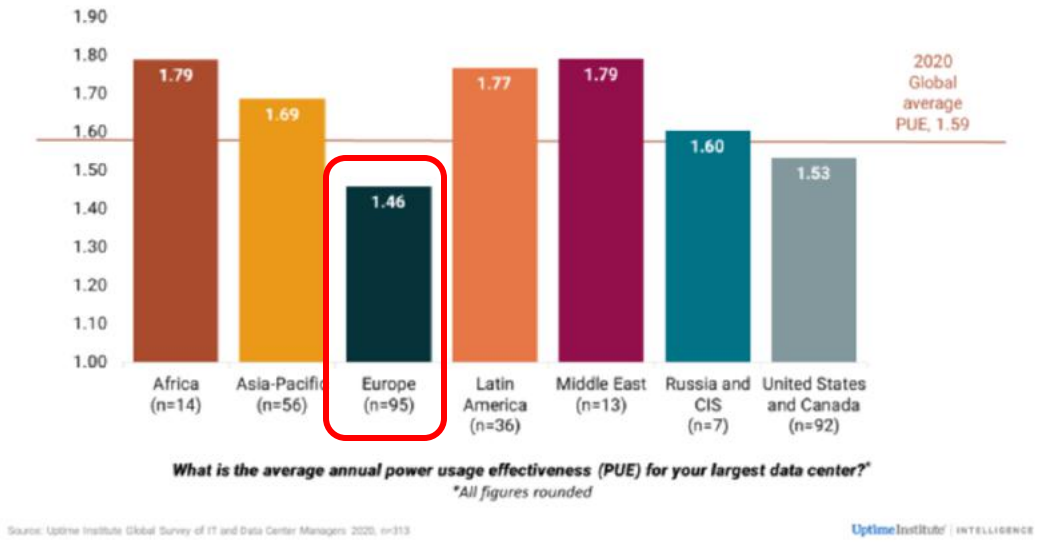
PUE = one off the key KPI's

Where are we with PUE?

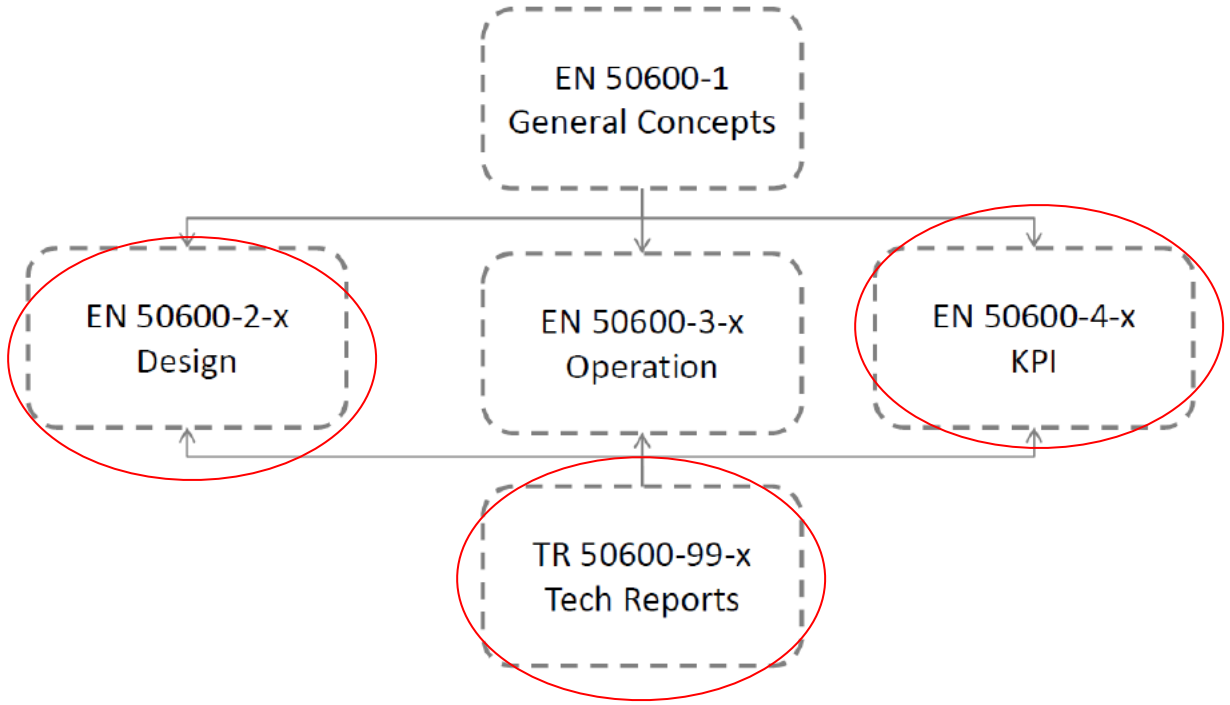
Global average PUE



Source: Uptime Institute



EN 50600 – Energy Efficiency is a choice!



Best practises

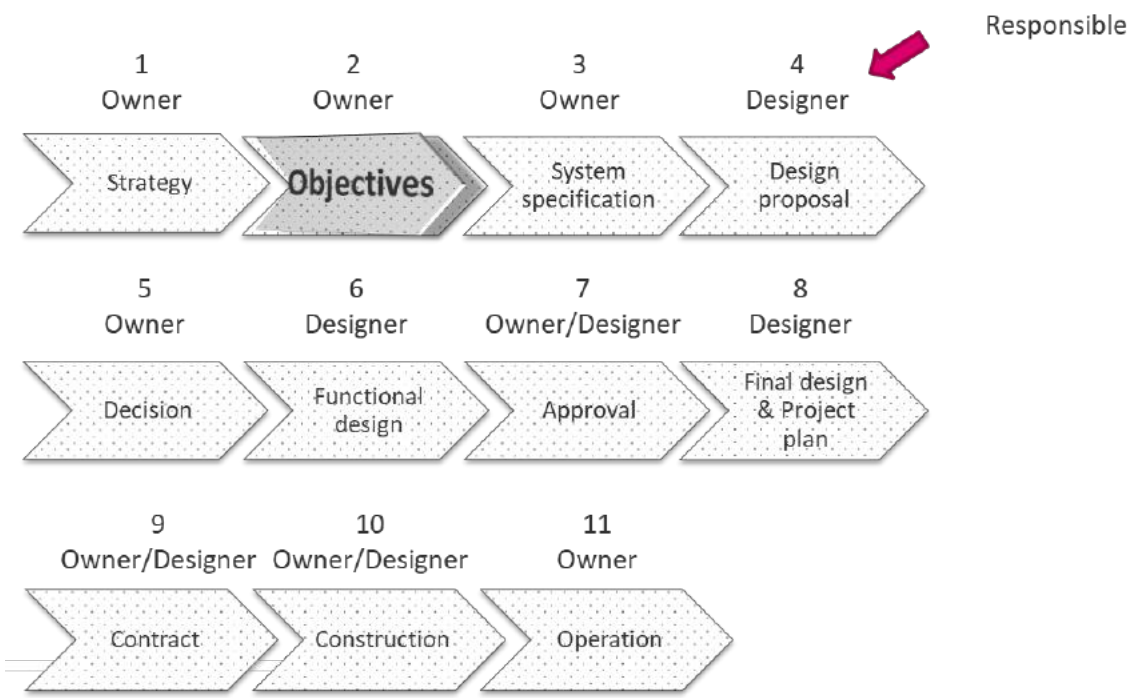
ISO/IEC 22237 EN 50600 Classification

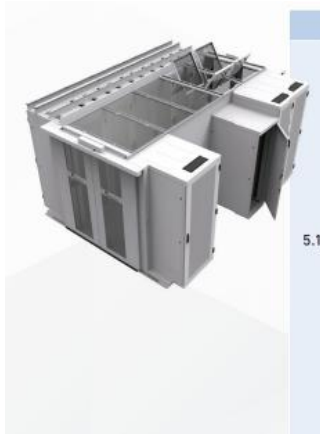
Availability

Energy Efficiency

Security

EN 50600 – Energy Efficiency is a choice!





DATA CENTRE COOLING: Airflow management and design *				
5.18.55	5.1.2	Contained hot or cold air	Utilize floor layout and equipment deployment design concepts whose basic intent is to contain and separate the cold air from the heated return air in the computer room. *Note 1 Examples of these concepts include:* • *hot aisle containment;* • *cold aisle containment;* • *contained supply, room return;* • *room supply, contained return, (inc. cabinet chimneys);* • *contained supply, contained return.* *Note 2 Failure to contain airflow results in both a reduction in achievable cooling efficiency and an increase in risk. Changes in ICT equipment and management tools mean that the airflow and heat output of ICT equipment might vary rapidly due to power management and workload re-allocation. This might result in rapid changes to computer room airflow pattern and ICT equipment intake temperature which cannot be easily predicted or prevented.*	3

TR 50600-99-x
Tech Reports

DATA CENTRE COOLING: Airflow management and design *				
5.18.56	5.1.5	Cabinet/ rack airflow management	Install aperture brushes (draught excluders) or cover plates and panels to minimize all air leakage in each cabinet/rack and across raised floor areas when a raised floor is used as a cooling air supply plenum. *Note 1 This includes floor openings at the base of the cabinet/rack and gaps at the sides, top and bottom of the rack between equipment or mounting rails and the perimeter of the cabinet.* *Note 2 This is in addition to Practice 5.18.10.*	3

CLC/TR 50600-99-1 Recommended practices for energy management

Designed PUE (dPUE)

The energy efficiency of a data centre can be predicted at the design stage based on:

01 Scenario for growth or expectation of occupancy

02 Timeline for increases and/ or decreases in energy consumption

Table D.1 – Example of dPUE calculation

Month	IT equipment	Cooling/ventilation/	Power	UPS	Lighting	Remaining	Total	

Google data center PUE performance

Our fleet-wide PUE has dropped significantly since we first started reporting our numbers in 2008. The TTM energy-weighted average PUE for all Google data centers is 1.12, making our data centers among the most efficient in the world.

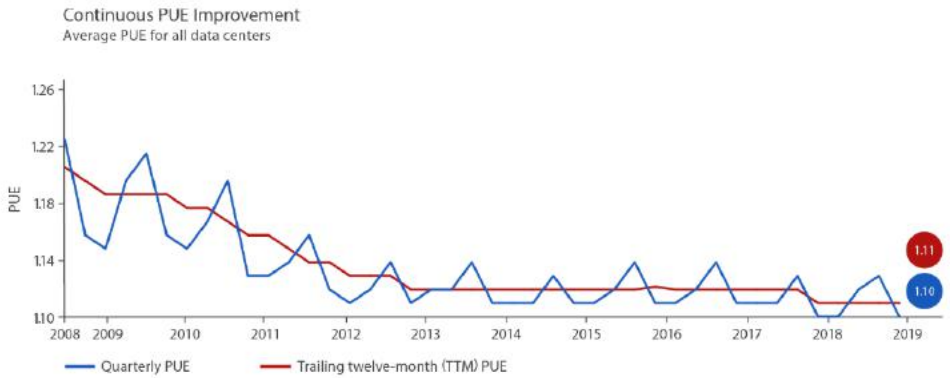


Figure 2: PUE data for all large-scale Google data centers

[a] Forecasted use or estimate.

Stakeholders

Scope for Today

PUE reduction by White space Airflow Management

EN50600 KPI set

- PUE – Power Usage Effectiveness
- WUE – Water Usage Effectiveness
- ERF – Energy Reuse Factor
- REF – Renewable Energy Factor
- CUE – Carbon Usage Effectiveness

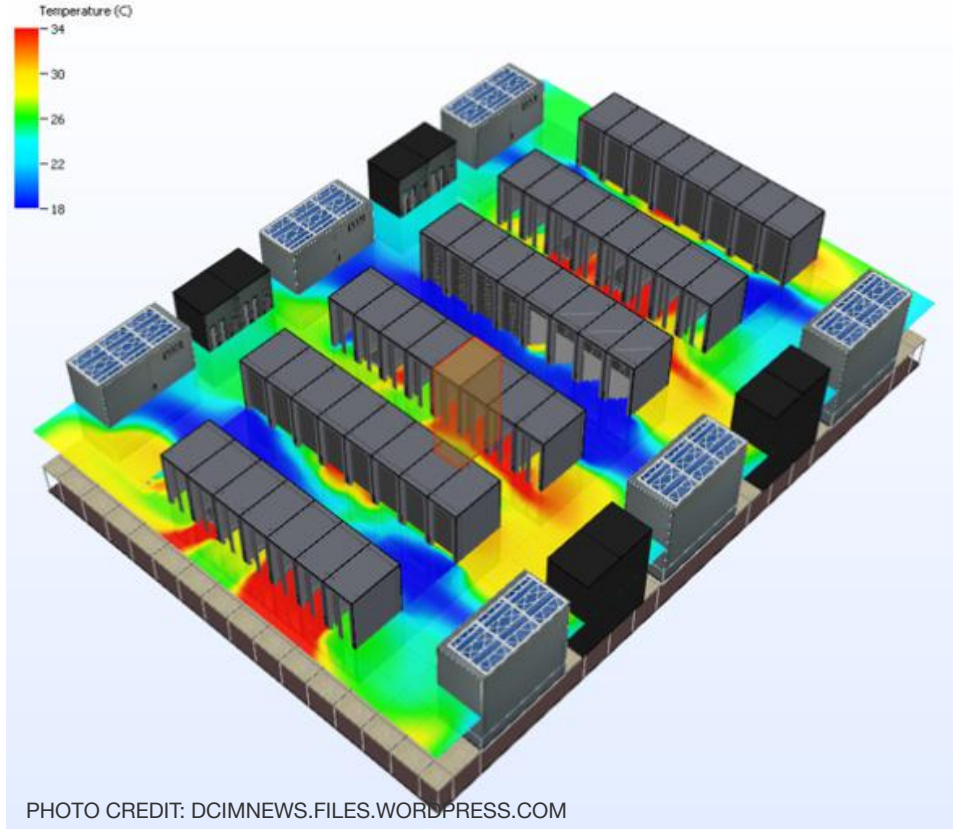
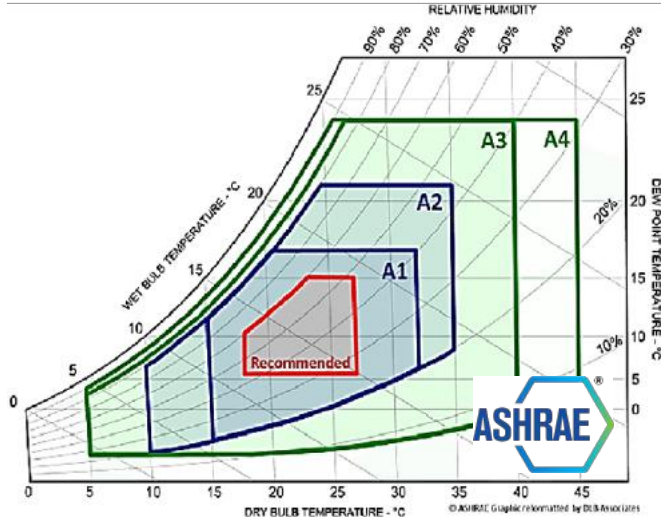


PHOTO CREDIT: DCIMNEWS.FILES.WORDPRESS.COM

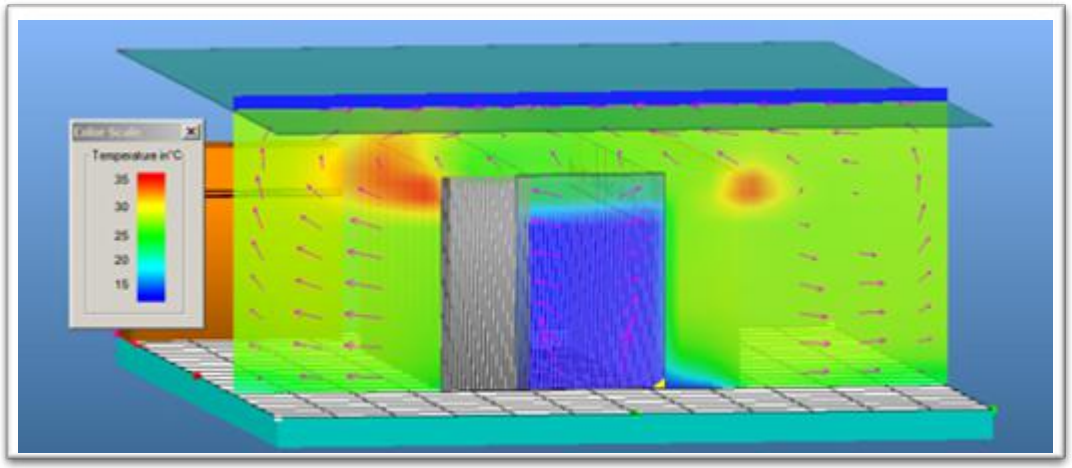
Basic Strategy for Airflow Management

Design for the highest possible inlet temperature for your servers

Design for the lowest possible amount of airflow



Basic Strategy for Airflow Management



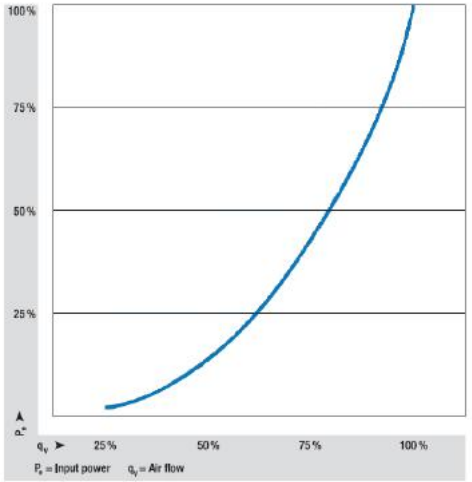
Design for the highest possible inlet temperature for your servers

Separation of hot and cold air flows

Uniform temperature in the datacenter → Higher Temperatures → **More Freecooling**

- Better control irt SLA's
- Higher temperature differences (dT) for more efficiency of equipment

Basic Strategy for Airflow Management



Design for the lowest possible amount of airflow (m3/h)

Reduction of losses for air transport & high dT

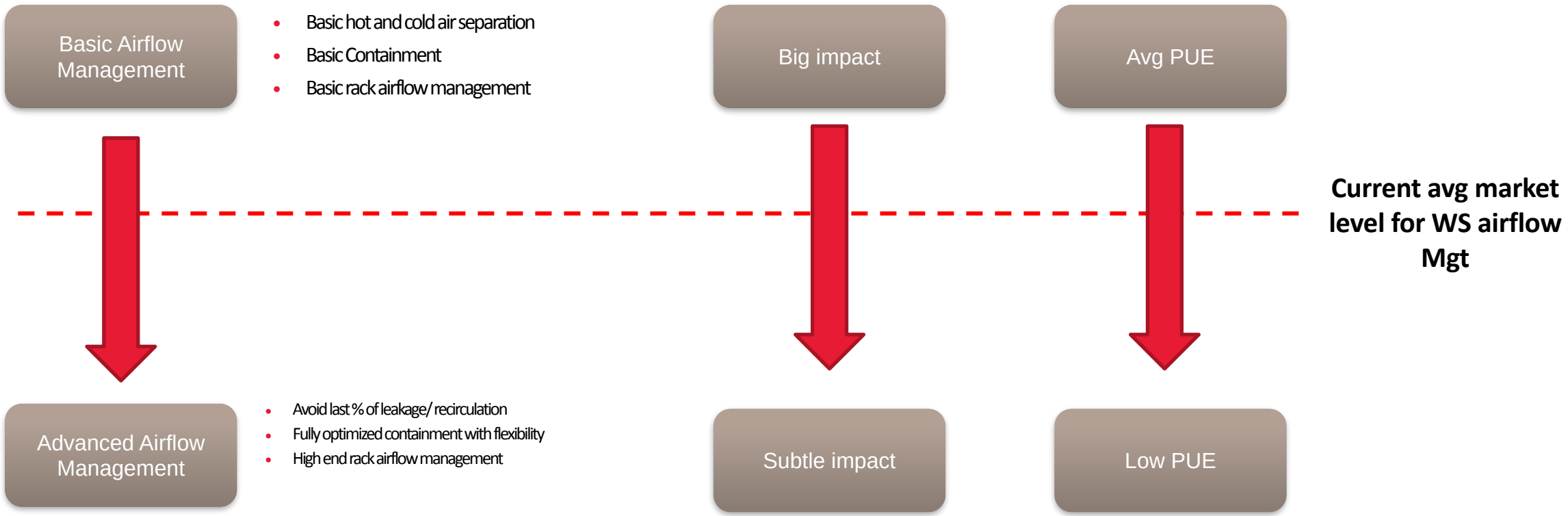
Less airflow required to cool the same IT load

- Reduce air transport path length
- Reduce air speed
- Avoid leakage / recirculation

➡ Less energy cost for fans

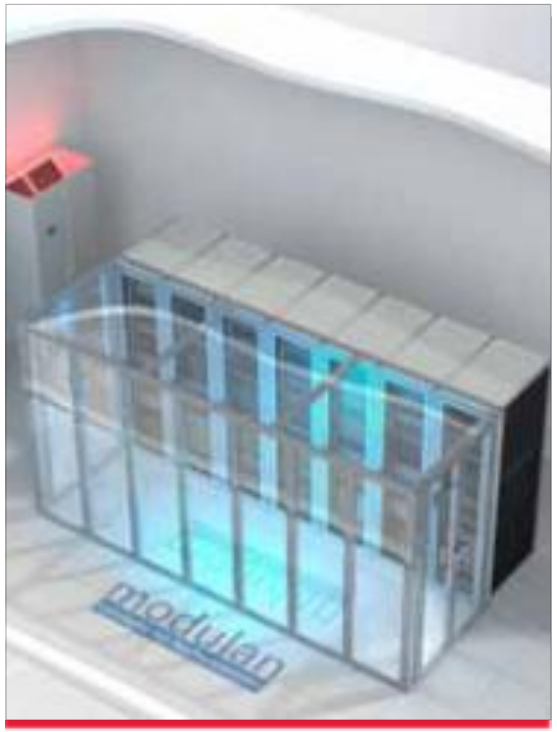
Additional benefit:
Lower fan RPM is far less noise!

Basic Strategy for Airflow Management



Advanced airflow mgt is not necesarily expensive!!

Examples basic airflow management



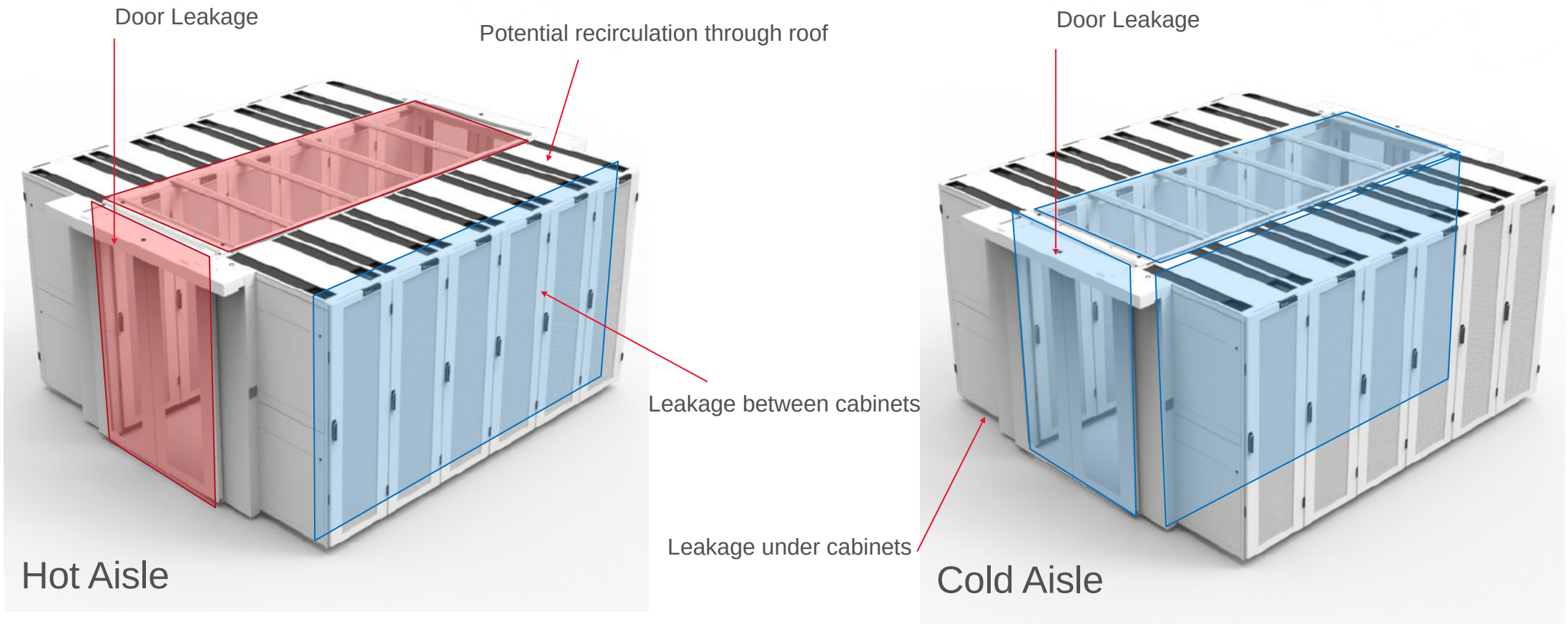
Single row containment in a server room

Standard 19” – blind panels

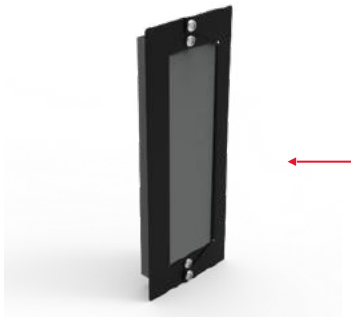
Datacenter cold aisle containment

Vertical Exhaust ducts - Chimneys

Advanced airflow management – Hot & Cold air separation barrier

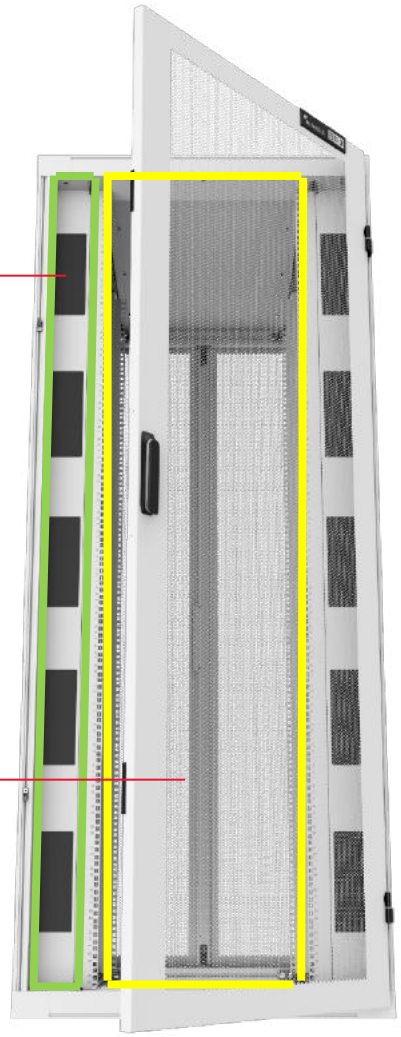


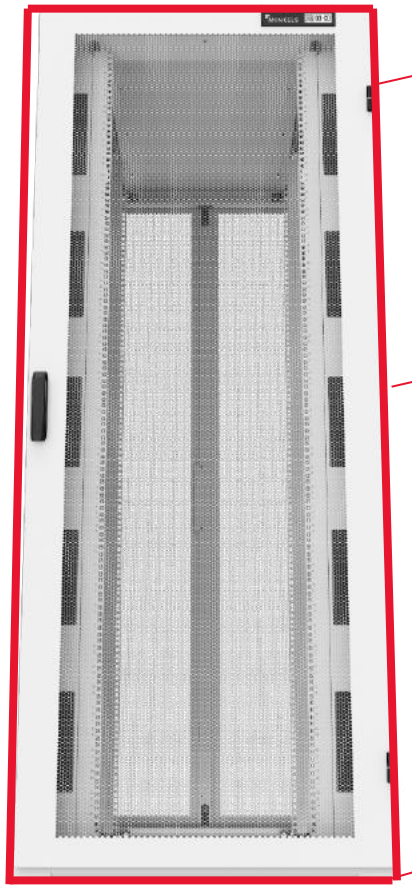
Advanced airflow management – In Cabinet

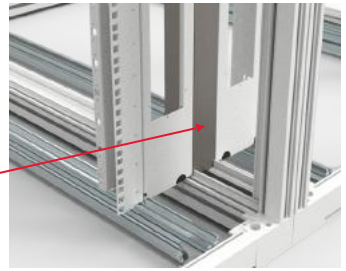


Foam seal instead of brushes

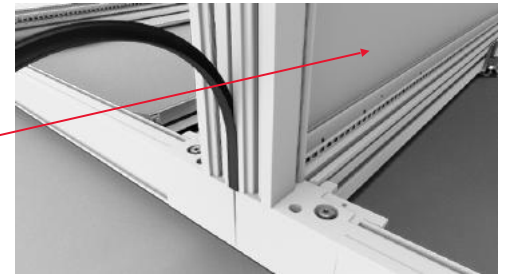
Optimized blanking panels



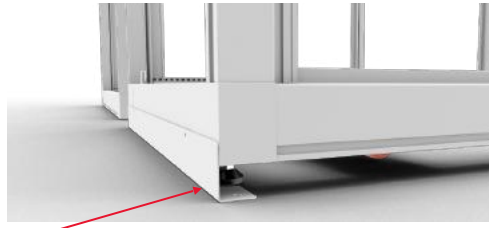




Inside cabinet-to-cabinet seal

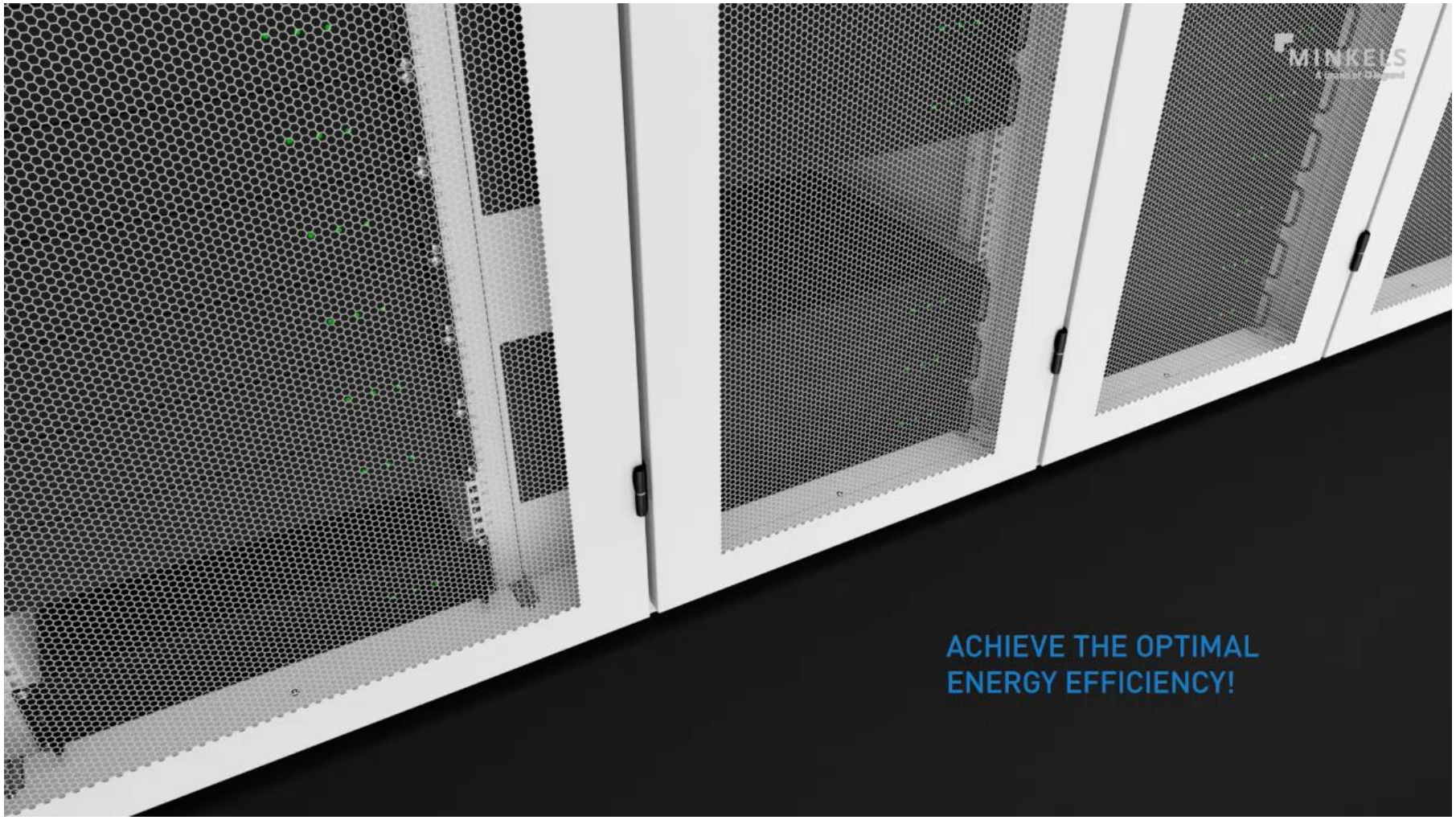


Outside cabinet-to-cabinet seal

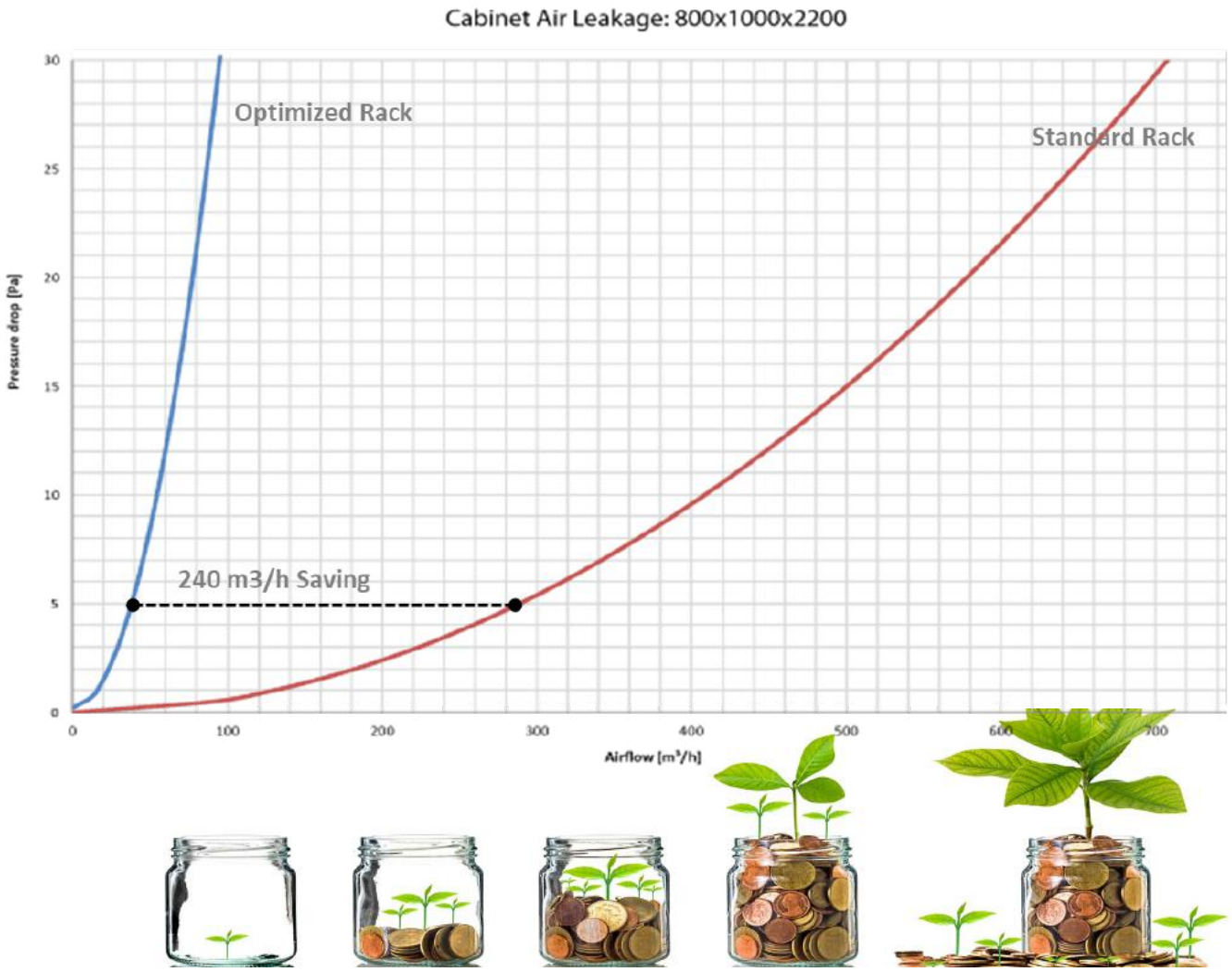


Cabinet-to-floor seal

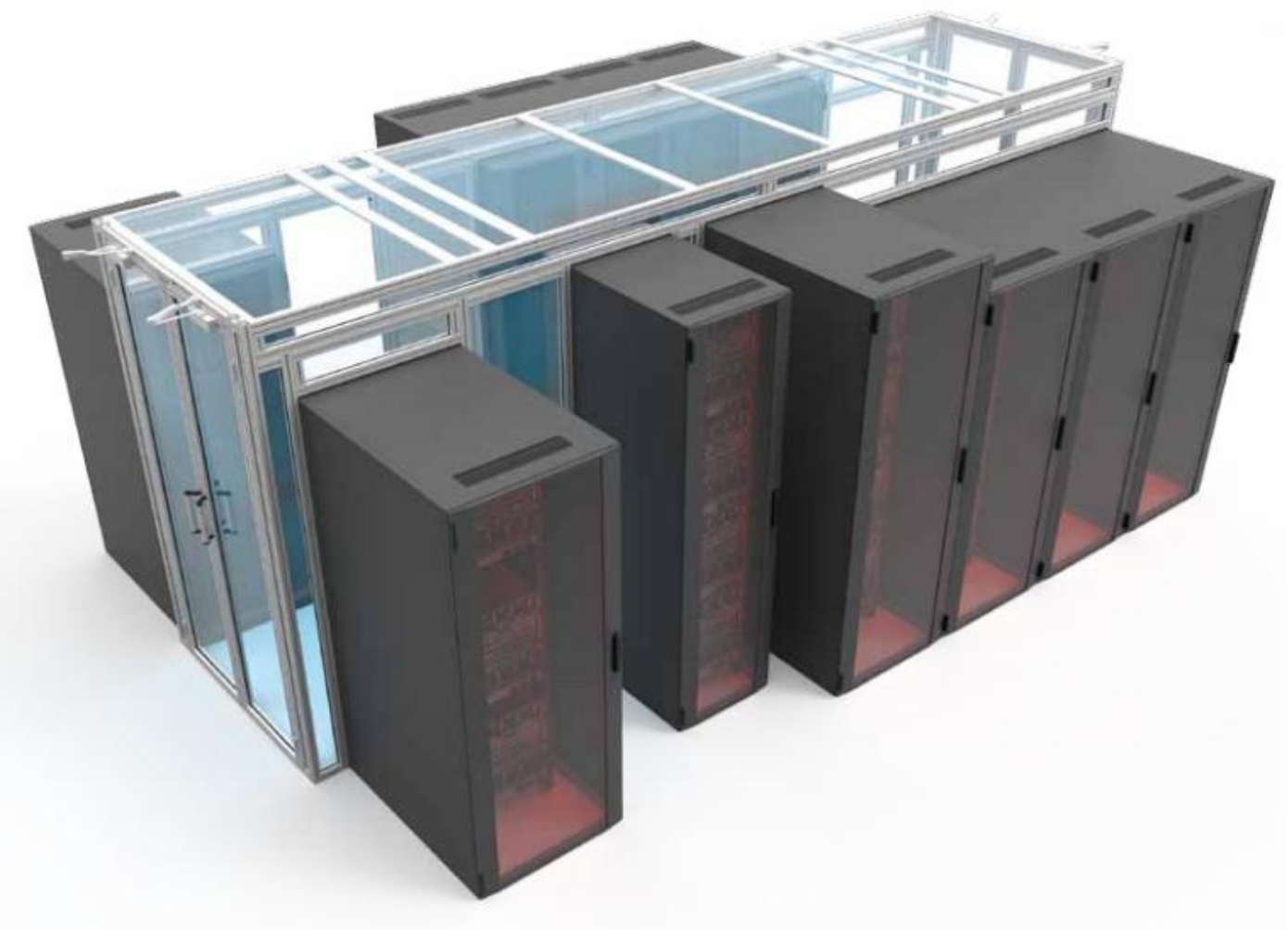
Advanced airflow management – In Cabinet

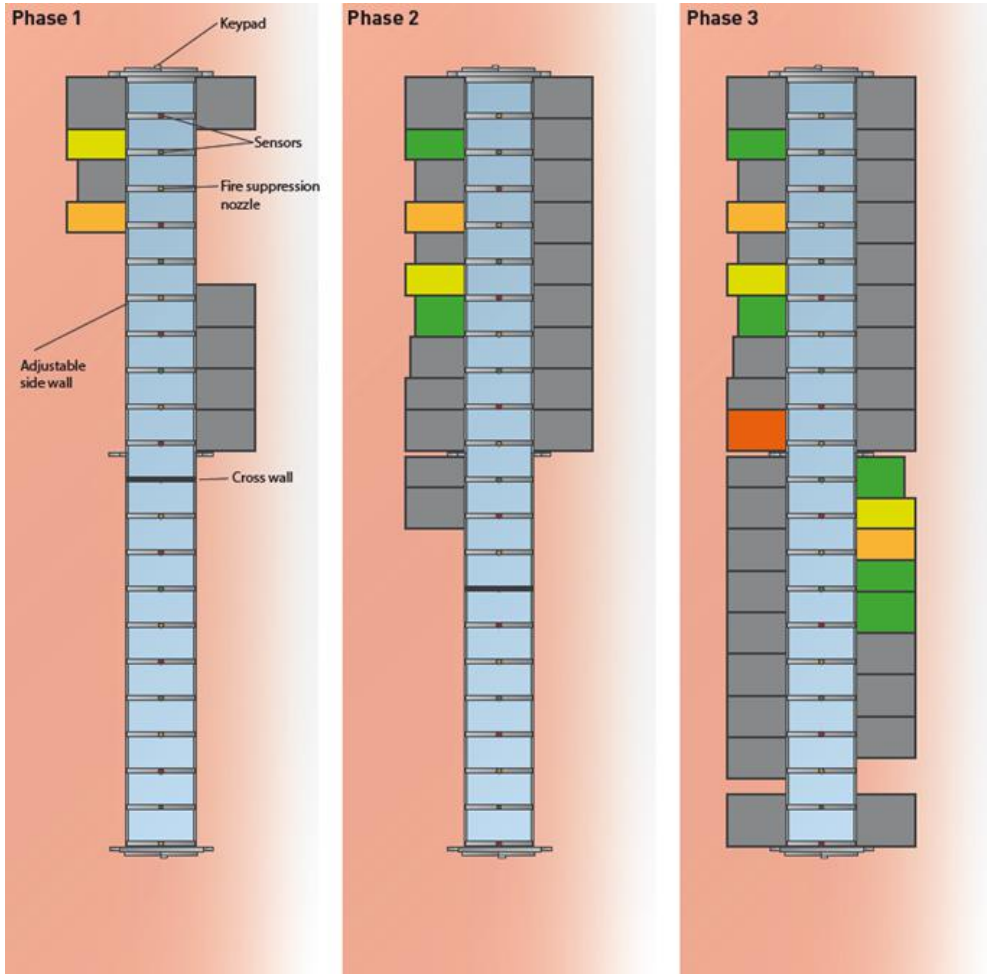


Examples advanced airflow management

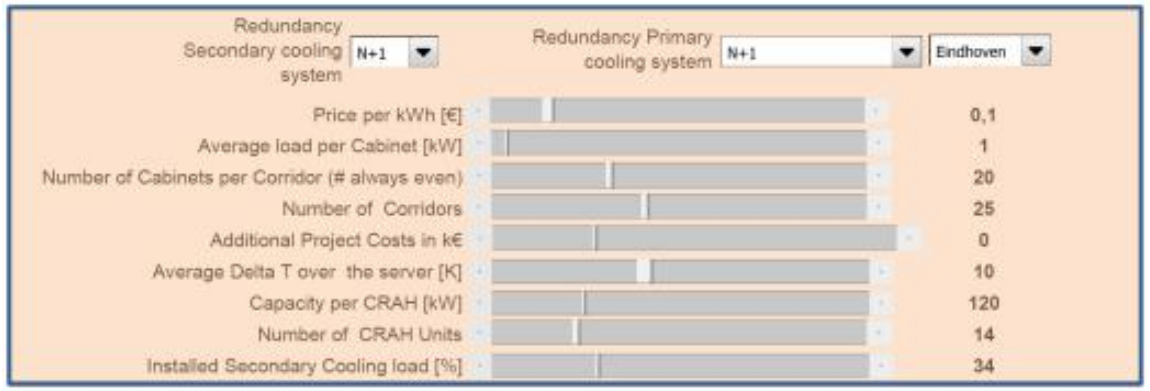


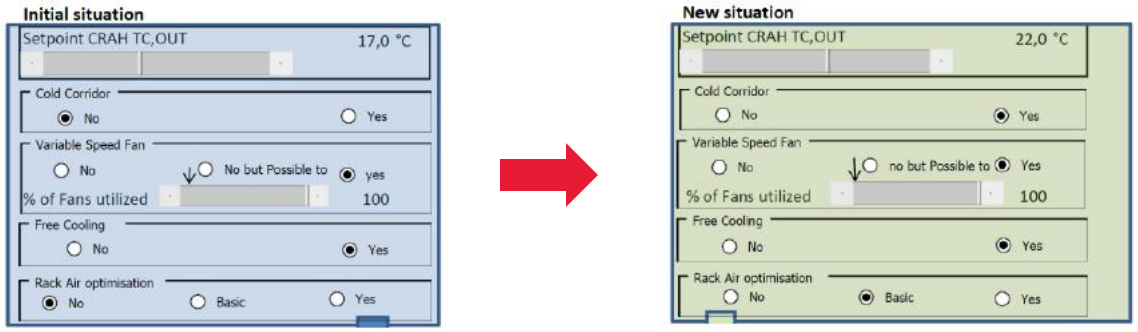
Energy Efficiency vs Datacenter Load





Results Example



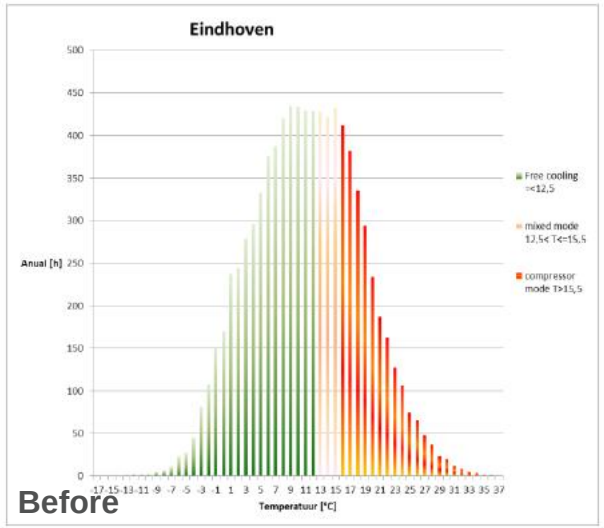


Airflow Optimization project

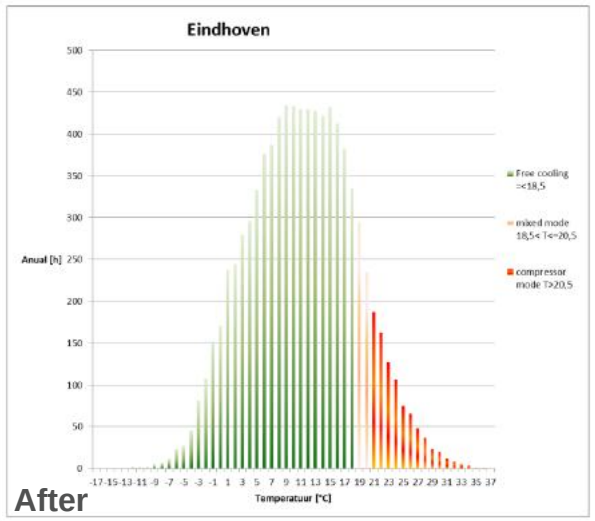
- 500 Cab Site
- No containment – Rack Airflow mgt
- The Netherlands

Results Example

Result:			annual Saving	Saving
IT load	500 kW	500 kW		
pPUEcooling	1,34	1,21		
Annual Energy for Cooling	1497035 kWh	901275 kWh	€ 59.576	40 %
SEER(COP)	2,93	4,86		
Temp CRAH out:	17,0 °C	22,0 °C		
Delta T over CRAH	5,0 K	8,0 K		
Primary Pcooling	1299 kW			
Secondairy Pcooling	1680 kW			
ROI		X [day]		
Investment		X €		
Saving by Cabinet			€ 119	



Before

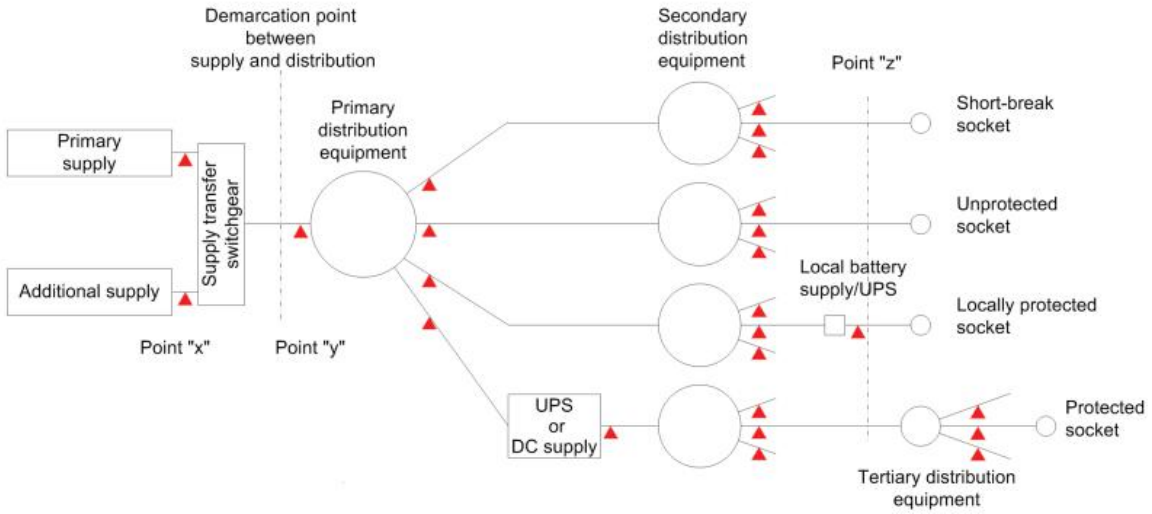


After

Airflow Optimization Results

- Applying containment & basic rack airflow management
- 40% savings on cooling (free cooling)
- pPUE from 1,34 -> 1,21
- 5°C higher server inlet temperature
- 3K higher dT

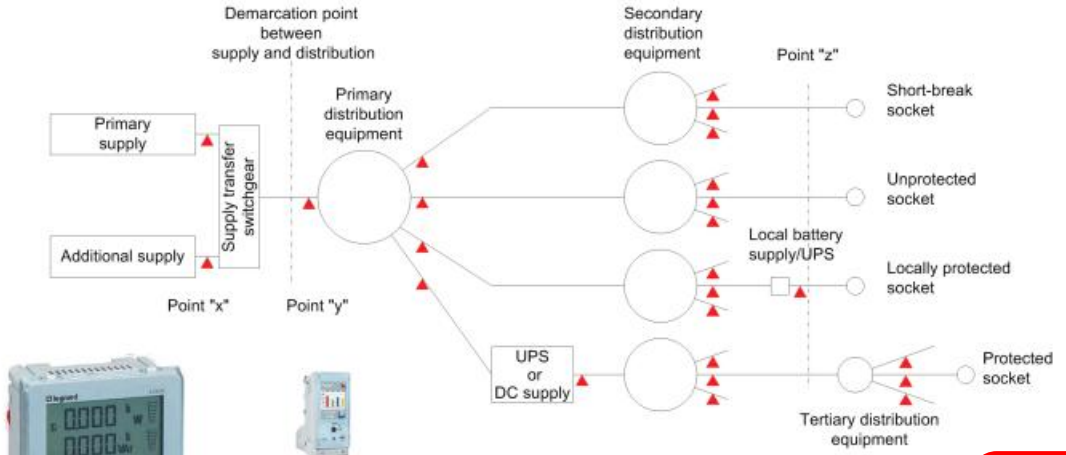
You cannot manage what you cannot measure

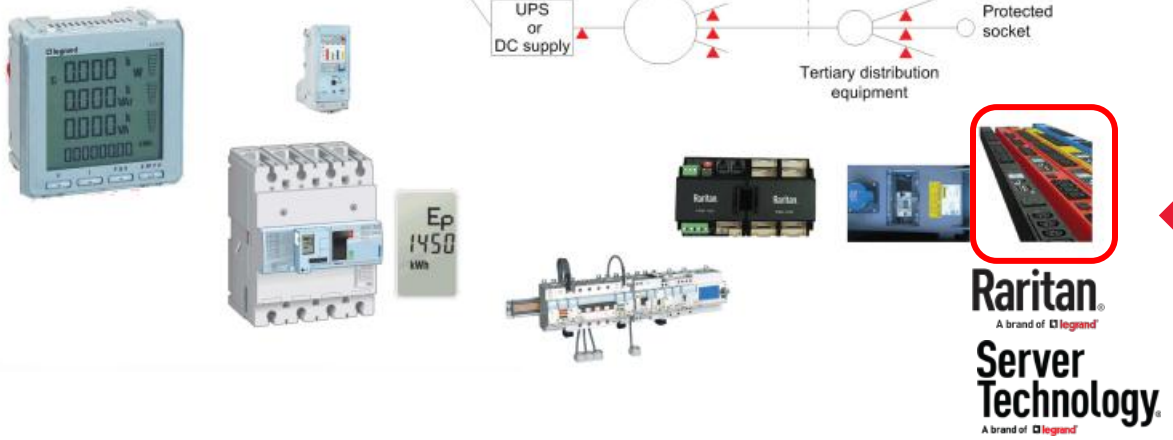


- **Demonstration of energy efficiency with measurable targets**
- Convert KPI (PUE) to measurement strategy
- CFD/ Thermal imaging is not the same!
- Use the standards at your benefit

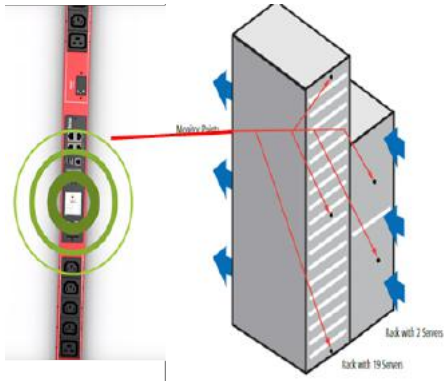
You cannot manage what you cannot measure

Power measurement – Level 3 PUE





Temperature measurement – Level 3



Requirement	Granularity Level		
	Level 1	Level 2	Level 3
Inlet Air Temperature	Single sensor in proximity to IT equipment	One sensor per cold aisle	One sensor per 10 cabinets or racks (5 on each side of the aisle)
Return Air Temperature	Single sensor in proximity to intake of return air to the cooling equipment	One sensor at the air intake per CRAH	One sensor at the air intake per CRAH

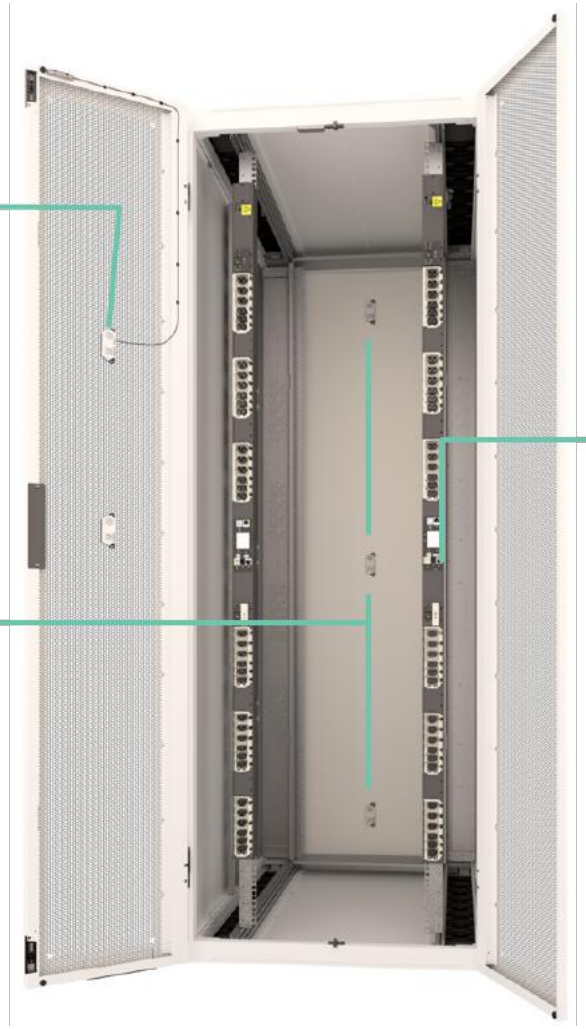
You cannot manage what you cannot measure

Contact Closure Wireless Sensor
(Cat.No 6 460 04)

- Manages door contact and alerts in case of door opening/closing
- Enables you to:
  - directly manage and configure alerts inside your PDU firmware
  - track work orders into the rack verifying if a door has been left open unintentionally

Temperature & Humidity Wireless Sensor
(Cat.No 6 460 03)

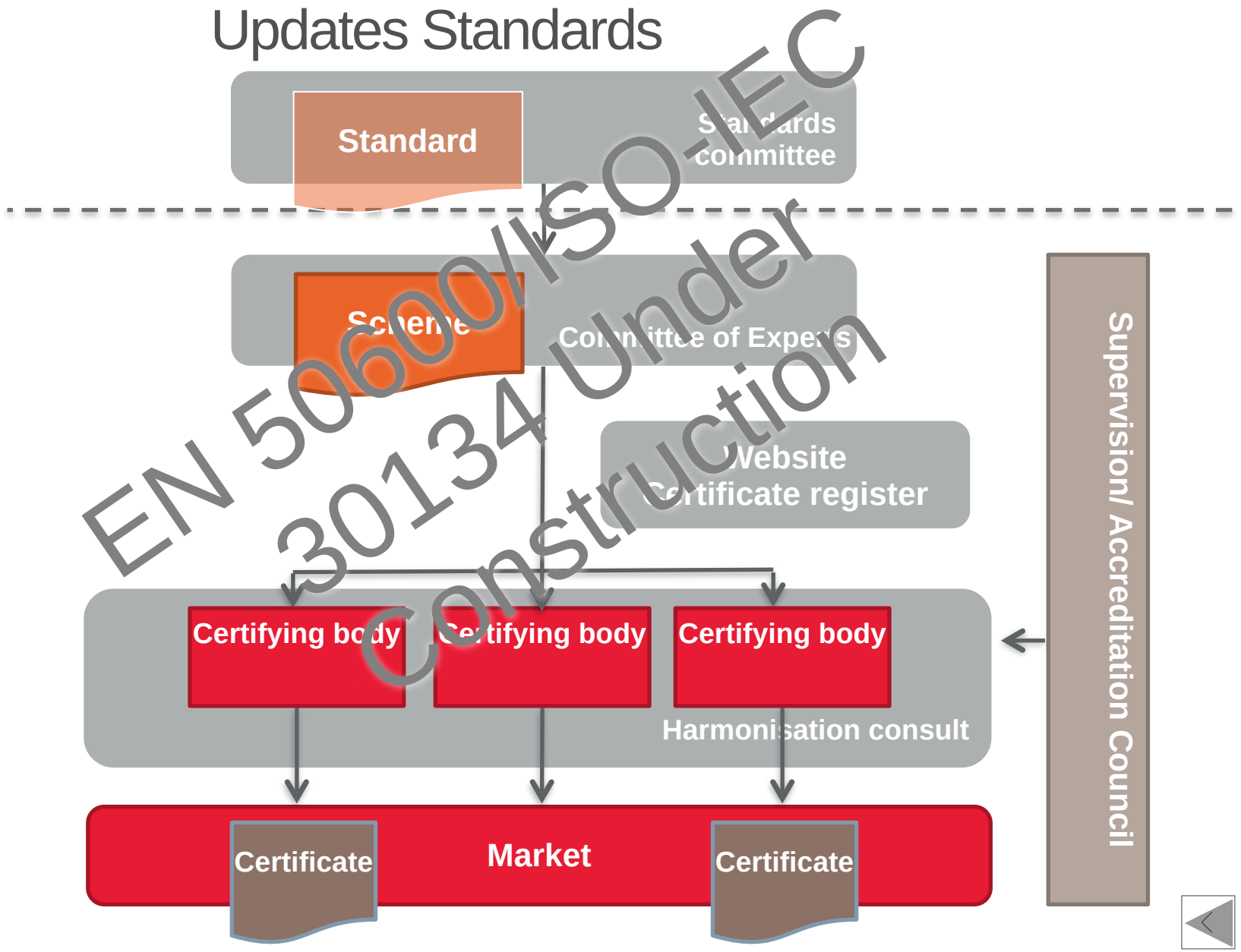
- Monitors cool air entering and/or hot air being expelled
- Enables you to:
  - optimize your cooling infrastructure
  - efficiently control temperature and humidity levels in order to prevent equipment damage due to hot spots and to reduce energy costs



USB Dongle
(Cat.No 6 460 05)

- Directly pluggable to the iPDU controller USB port
- Plug & Play with Legrand Intelligent PDUs
- Enhanced security: each wireless sensor has a unique encrypted ID (Zigbee Green Power technology) which prevents the USB Dongle from confusing them with other equipment
- Instantly detects and pairs with available sensors, and aggregates their data into your PDU firmware

Updates Standards



CODE OF CONDUCT DATA CENTRES Endorser

legrand® DATA CENTER SOLUTIONS

Conclusion

- Pressure for further lowering of energy consumption is coming
- White Space airflow management is a topic with impact
  - Energy cost reduction
  - DC management/control
- It is not so hard/ expensive to do
  - Standards are there to help you
- Measurement of your results is key to further success.
  - Certification might help you

Continue to improve white space airflow management.

We are there to help you!