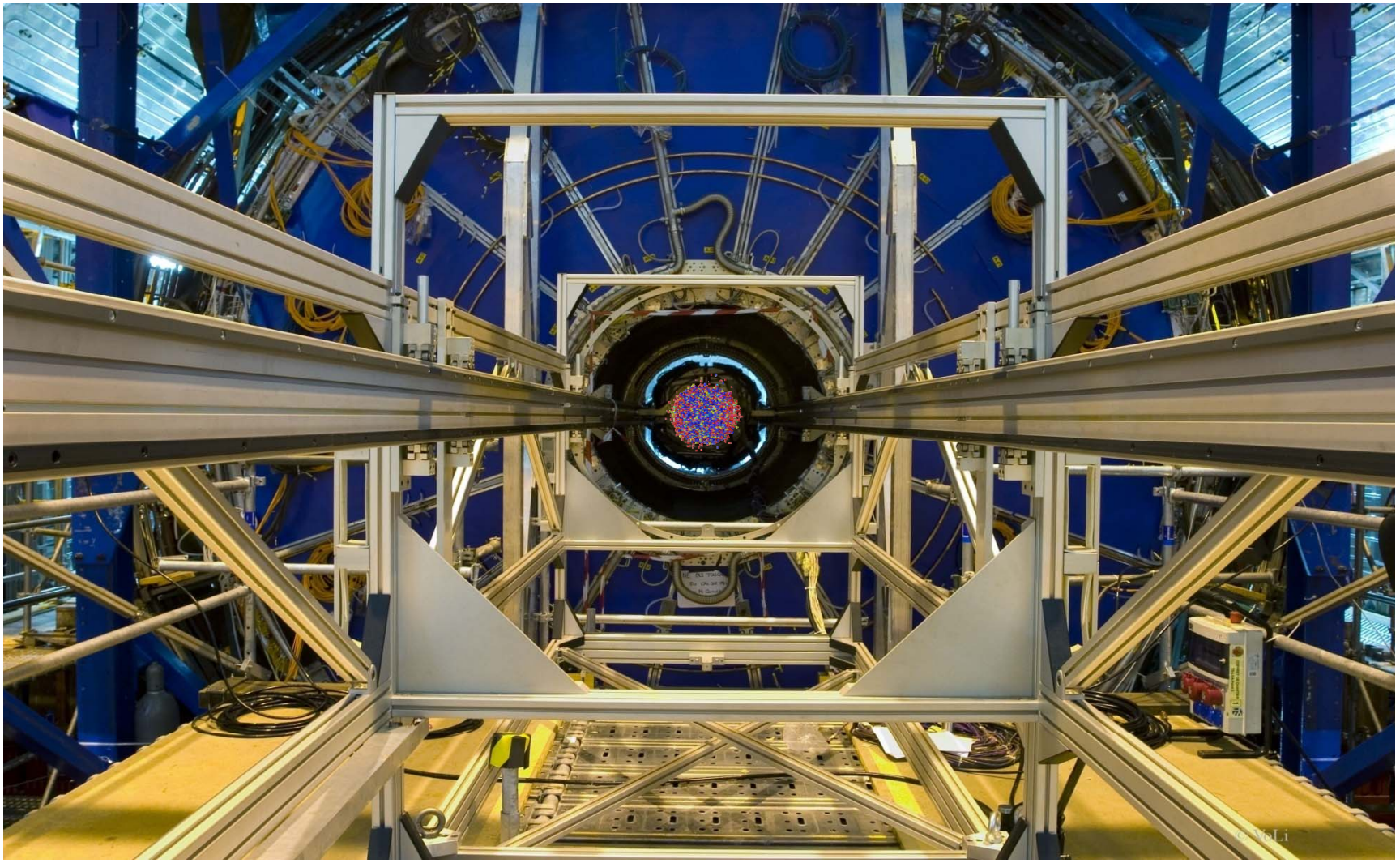


ECO@ LOEWE-CSC

LOEWE-CSC and it's data center

Volker Lindenstruth
FIAS, IfI, LOEWE Professur
Chair of HPC Architecture
University Frankfurt, Germany
Phone: +49 69 798 44101
Fax: +49 69 798 44109
Email: voli@compeng.de
WWW: www.compeng.de

GreenIT
Best Practice Award
2011

Sieger in der Kategorie 3
Visionäre Gesamtkonzepte
(System und Prozessgestaltung)

CSC – Center for Scientific Computing

GreenIT BEST PRACTICES
/ LOEWE-CSC /

Berlin, 21. November 2011

Thomas Leitert
Netzwerk GreenIT-BB
INITIATOR UND AUSRICHTER

Dr. Philipp Rösler
Bundeswirtschaftsminister
SCHIRMHERR

Staatssekretärin Cornelia Rogall-Grothe
IT-Beauftragte der Bundesregierung
SCHIRMHERRIN

Dr. Hans-Joachim Popp, CIO
Dt. Zentrum für Luft- und Raumfahrt
JURY-VORSITZENDER

Dr. Jürgen Sturm, CIO
Bosch und Siemens Hausgeräte GmbH

Thomas Schott, CIO
Rehau AG

MR Rudolf Herlitze, CIO
Bundesumweltministerium

Heinrich Vaske
Chefredakteur Computerwoche

www.greenit-bb.de

Heat Transmission via Air and Water

Required Volumetric Current: $$Q = \dot{V} = \frac{P}{c_p \cdot \rho \cdot \Delta T}$$

P : Thermal Power Loss

ΔT : Temperature Difference

Air Specific Heat Capacity: $c_p = 1{,}005 \frac{\mathrm{kJ}}{\mathrm{kg \cdot K}}$ Density: $\rho = 1{,}184 \frac{\mathrm{kg}}{\mathrm{m^3}}$ (Standard Conditions)

Example: Notebook-Computer (30 W)

Room: 25 °C

max. 50 °C

$\Delta T = 25\,\mathrm{K}$

$\Rightarrow Q = 1{,}0 \frac{\mathrm{l}}{\mathrm{s}}$

Example: Data Center (1 MW)

Supply Air: 18 °C

Exit Air: 43 °C

$\Delta T = 25\,\mathrm{K}$

$\Rightarrow Q = 33.600 \frac{\mathrm{l}}{\mathrm{s}}$

BEAUFORT FORCE 12
WIND SPEED: 64 KNOTS

SEA: SEA COMPLETELY WHITE WITH DRIVING SPRAY, VISIBILITY VERY SERIOUSLY AFFECTED. THE AIR IS FILLED WITH FOAM AND SPRAY

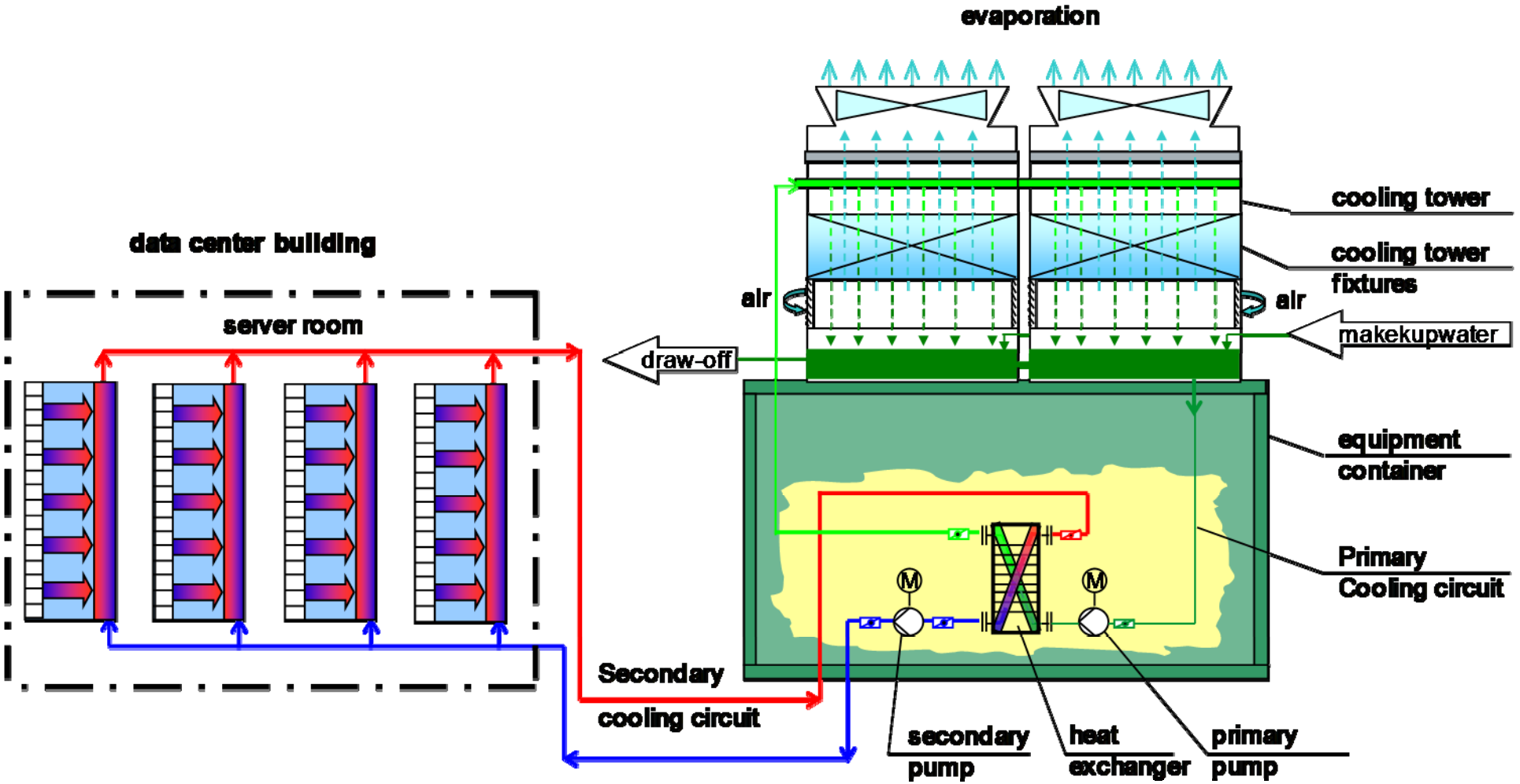
Water Specific Heat Capacity: $c_p = 4{,}183 \frac{\mathrm{kJ}}{\mathrm{kg \cdot K}}$ Density: $\rho = 997{,}0 \frac{\mathrm{kg}}{\mathrm{m^3}}$ (Standard Conditions)

Example: Data Center (1 MW)

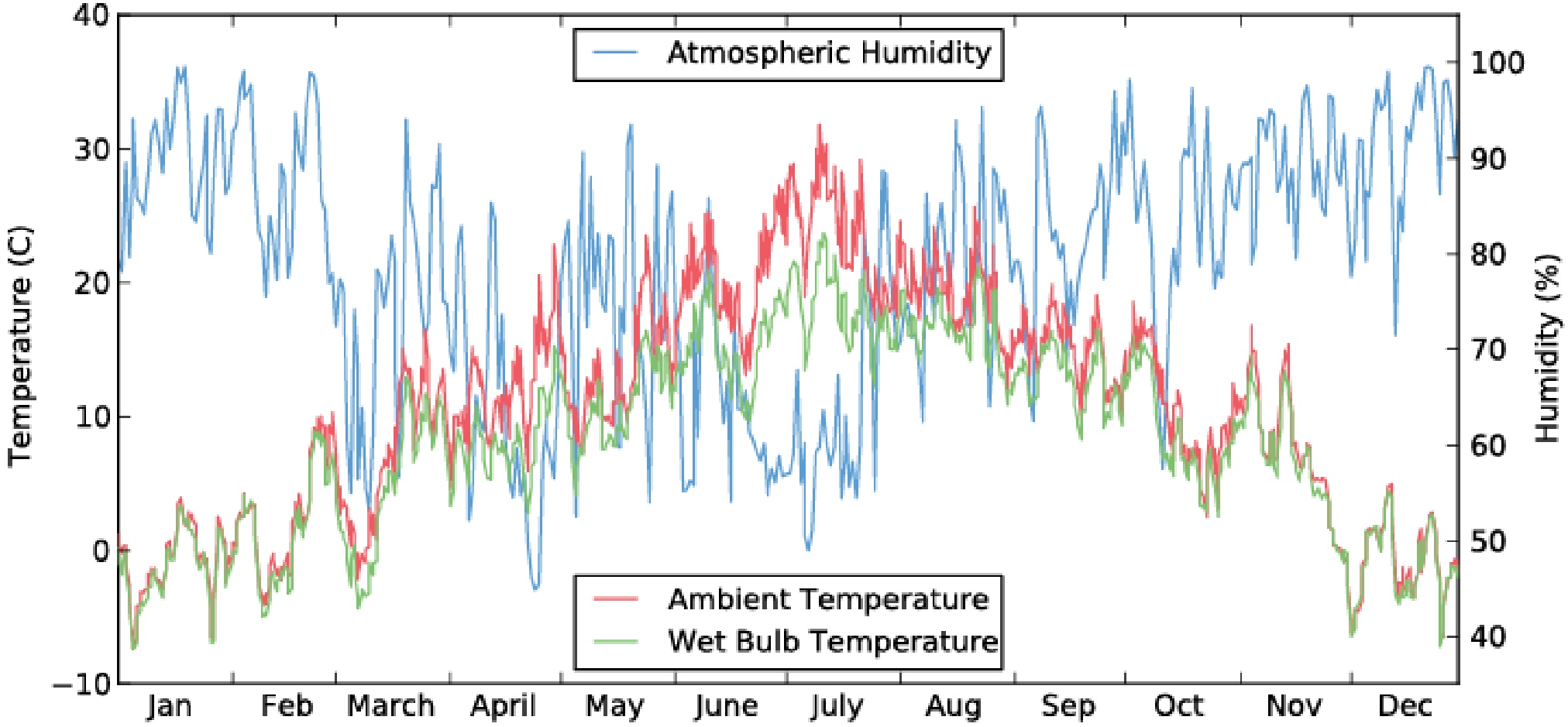
$\Delta T = 5\,\mathrm{K}$

$\Rightarrow Q = 48{,}0 \frac{\mathrm{l}}{\mathrm{s}}$

Cooling System Architecture



Feuchtkugeltemperatur 2010



LOEWE-CSC Cooling

- **Max cooling power** **600 kW**
- **Secondary pump** **28 kW**
- **Primary pump** **6 kW**
- **Cooling tower Fans** **2x4.5 kW**
  not required if outside temperature below 15 °C

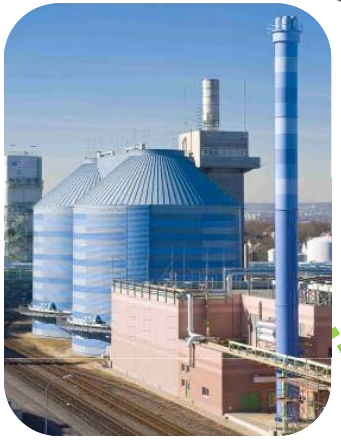
→PUE (best) **1.05**

→PUE @ 450 kW **1.07**

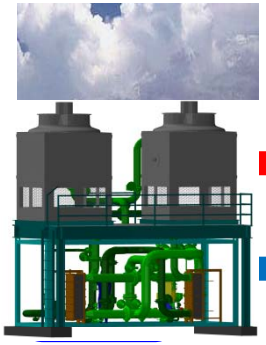
- **Server fan overhead** **6%**

LOEWE-CSC Green-IT

Klärschlamm-verbrennungs-anlage



Biogasanlage



Chemie-produktion

Ersatzbrenn-stoffanlage (EBS)
In Umsetzung

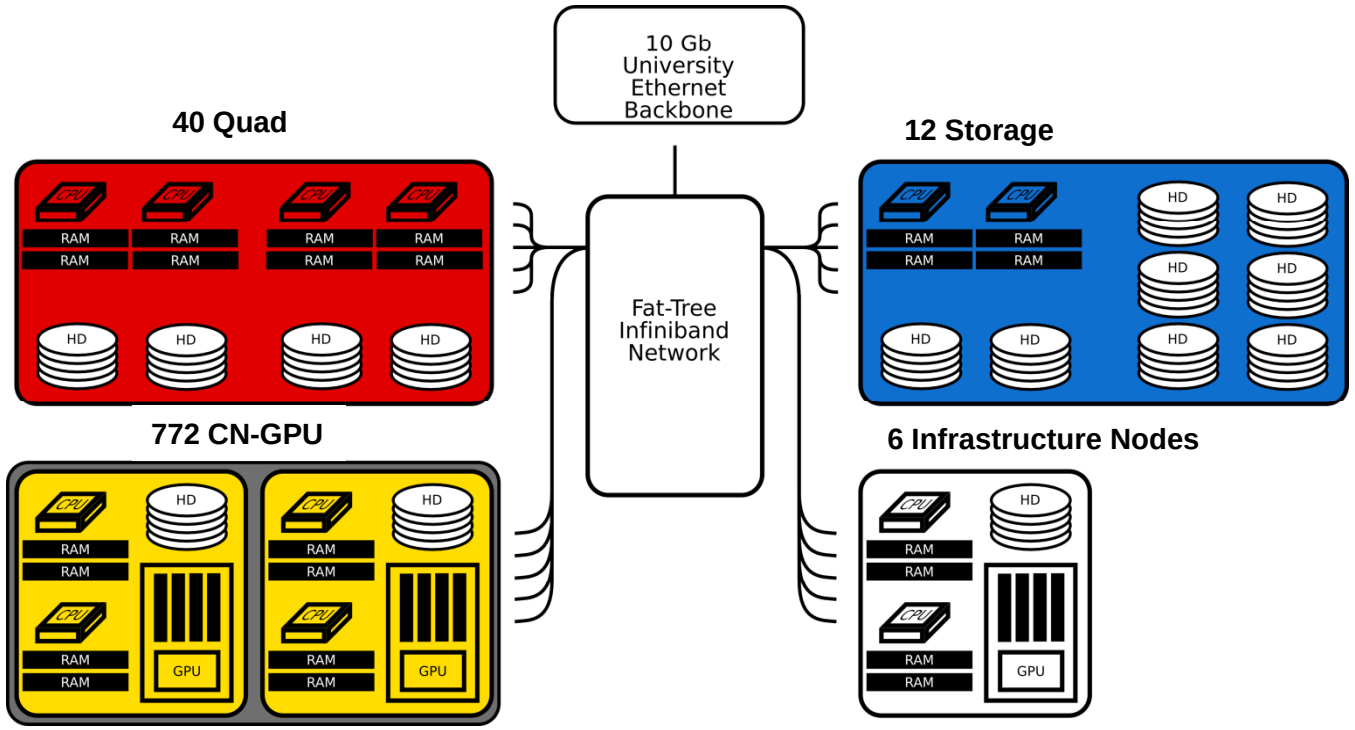
2. & 3. Gasturbine
In Umsetzung

PUE 1,08


LOEWE-CSC 2011
Green500: 10→41(!)
Top500: 22→33
Cost: 200 €/core
CO_2 neutral

LOEWE-CSC

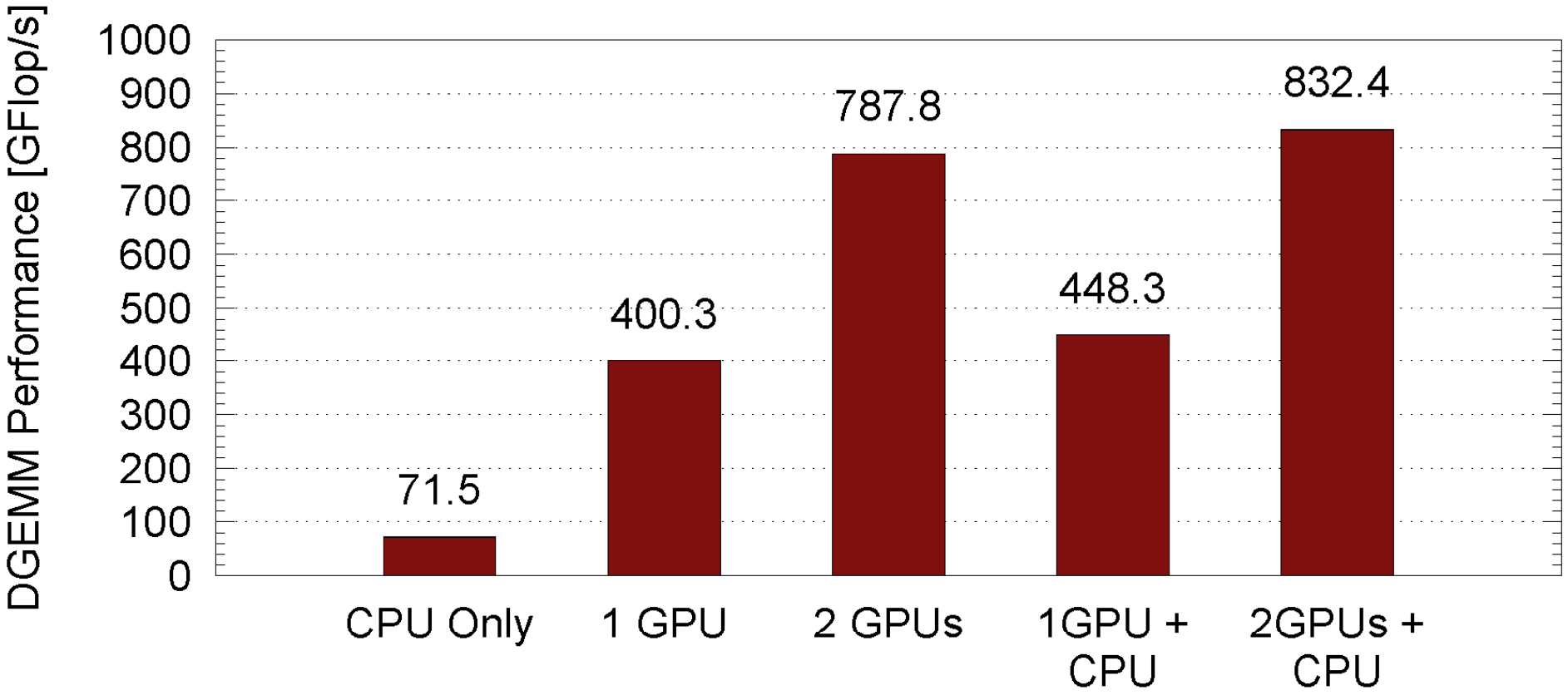
Local had drives	1.62 PB
Core memory	55,8 TB
Nodes	830
Mass storage	420 TB (net)
CPU cores / GPUs	20880 / 772
Power	500 kW
Cost	4200 k€ net; 200 €/Core



Cool-Overhead	7%	
DGEMM GPU	494	Gigaflop/s (90.8% peak) world wide fastest
System LINPACK	299	Teraflop/s
Compute power/W	736.8	Megaflops/w

CO_2 Saving / year: 8.000 T

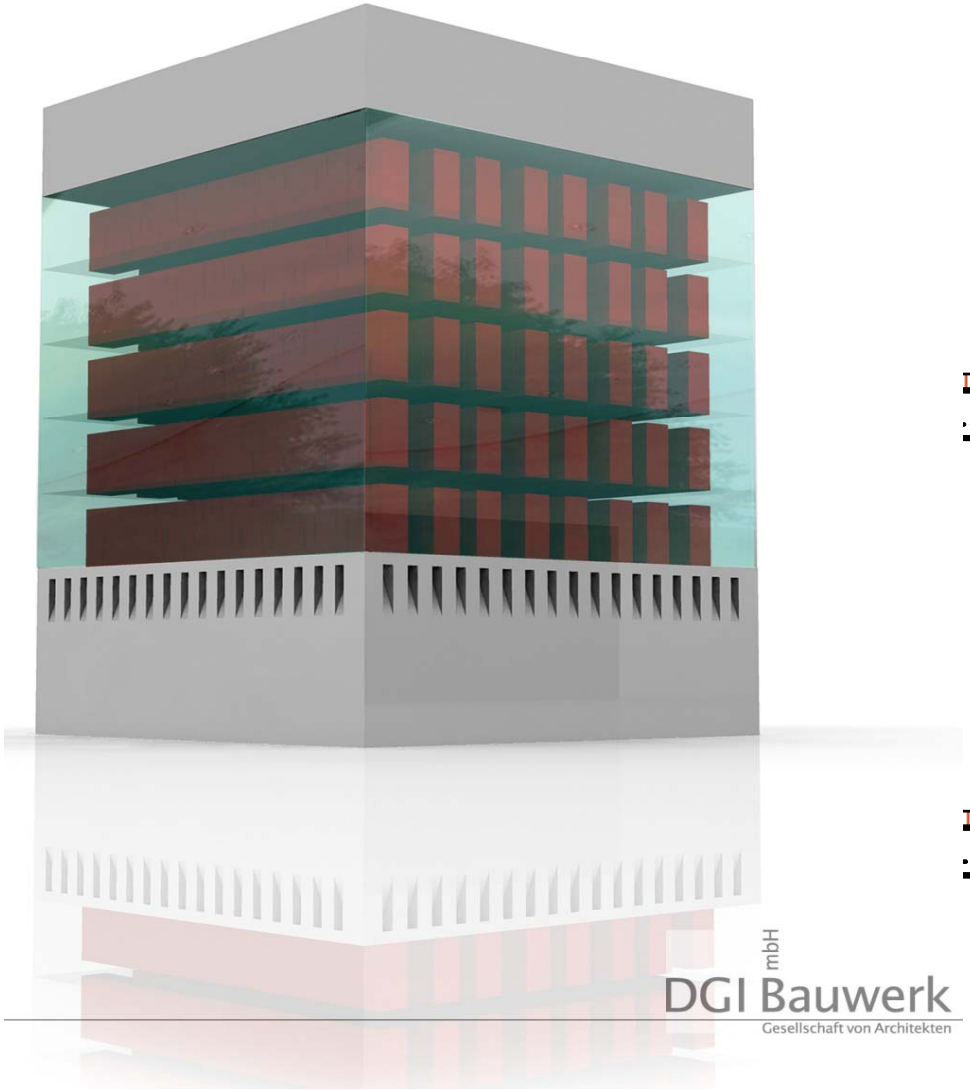
DGEMM Scalability

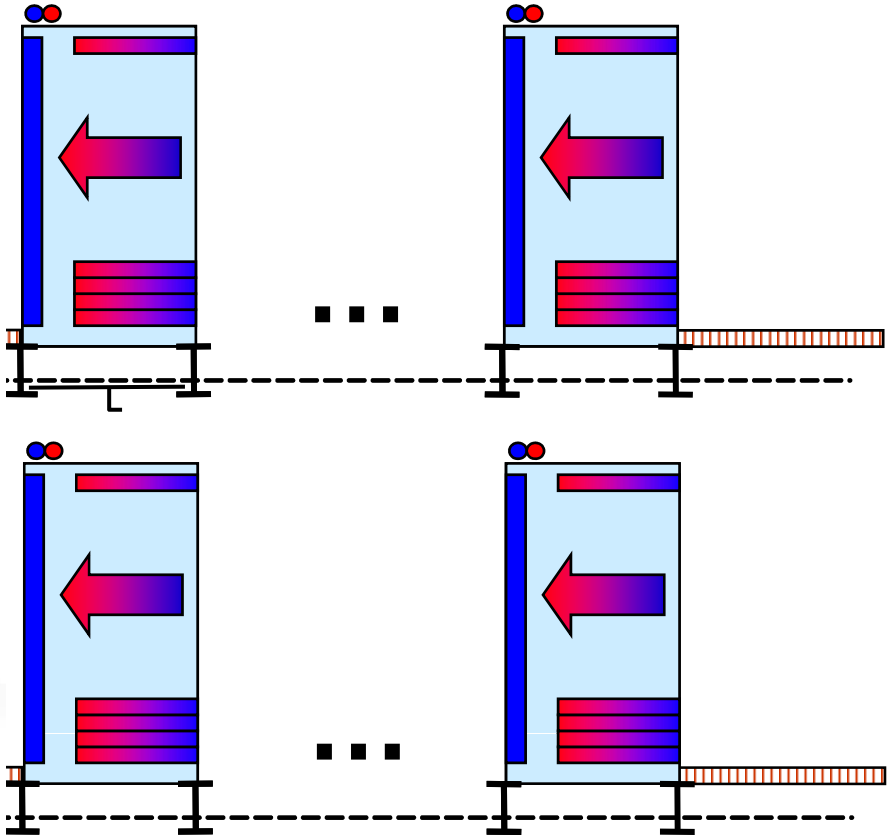


Optimized HPL for AMD GPU and Multi-Core CPU Usage, ISC June 2011


COFELY
COFELY

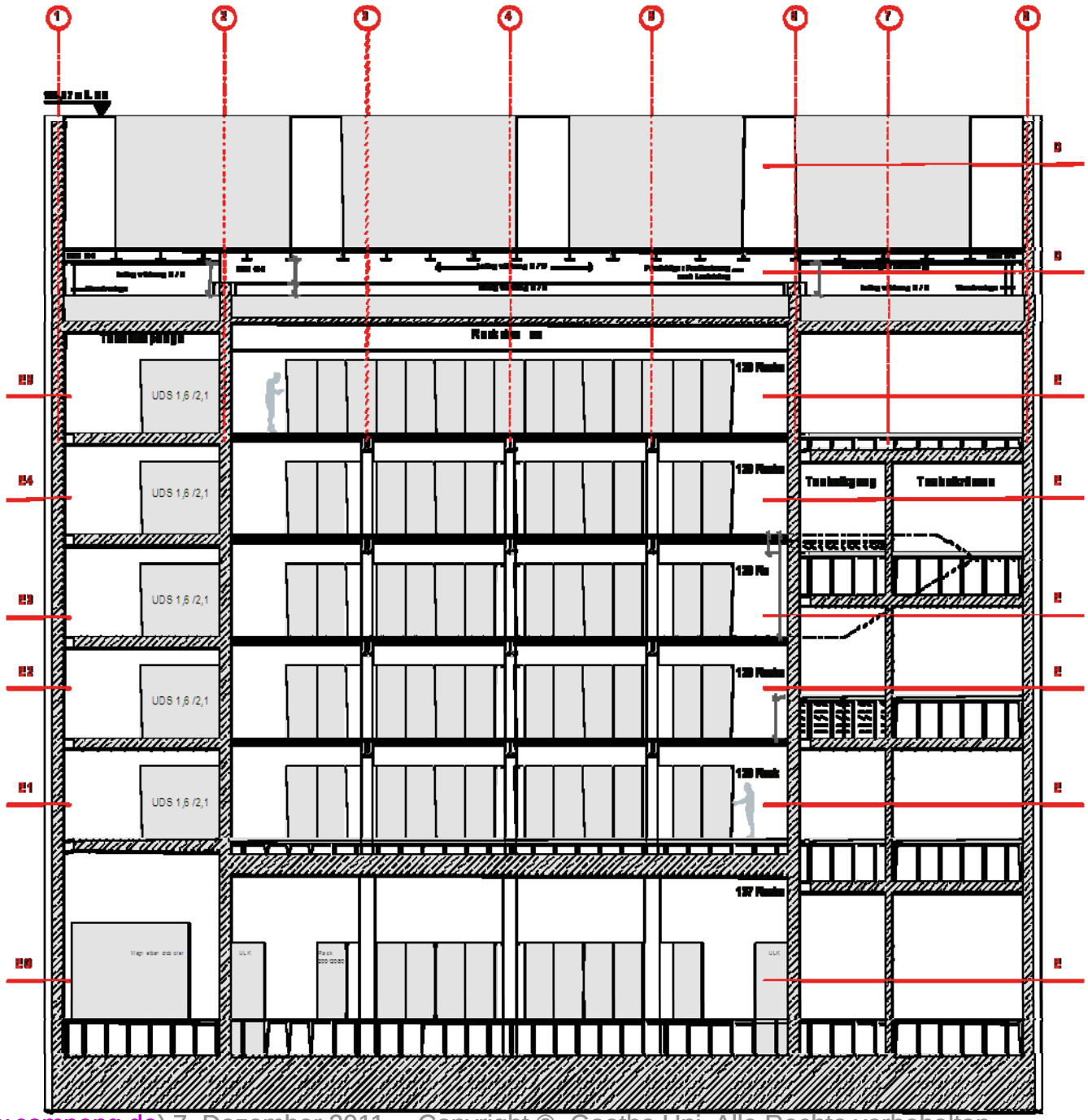
Next Generation Data Center





DGI Bauwerk mbH
Gesellschaft von Architekten

FIAS Patent submitted @ DPMA/PCT 5.7.2008 (Lindenstruth, Stöcker)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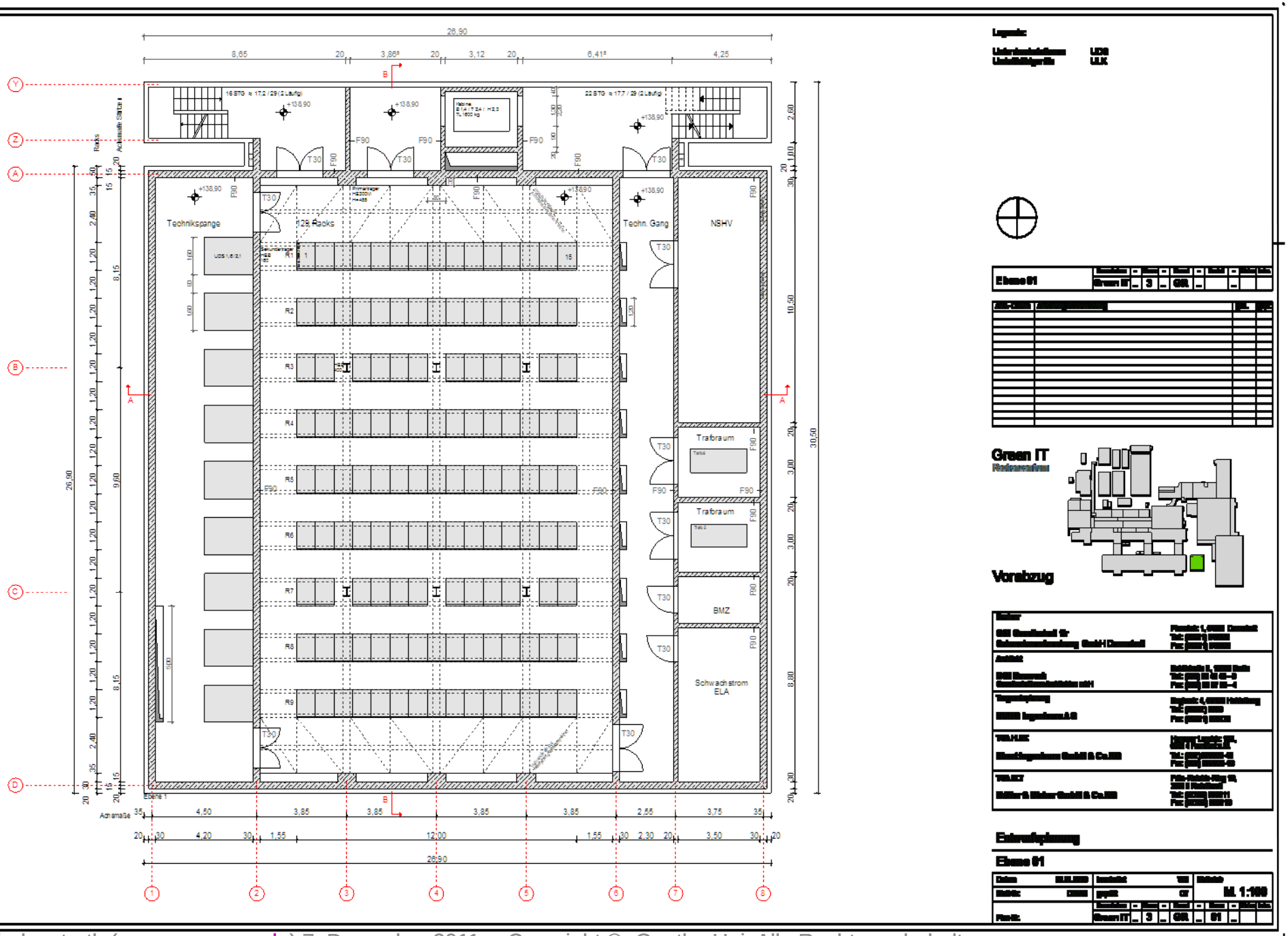
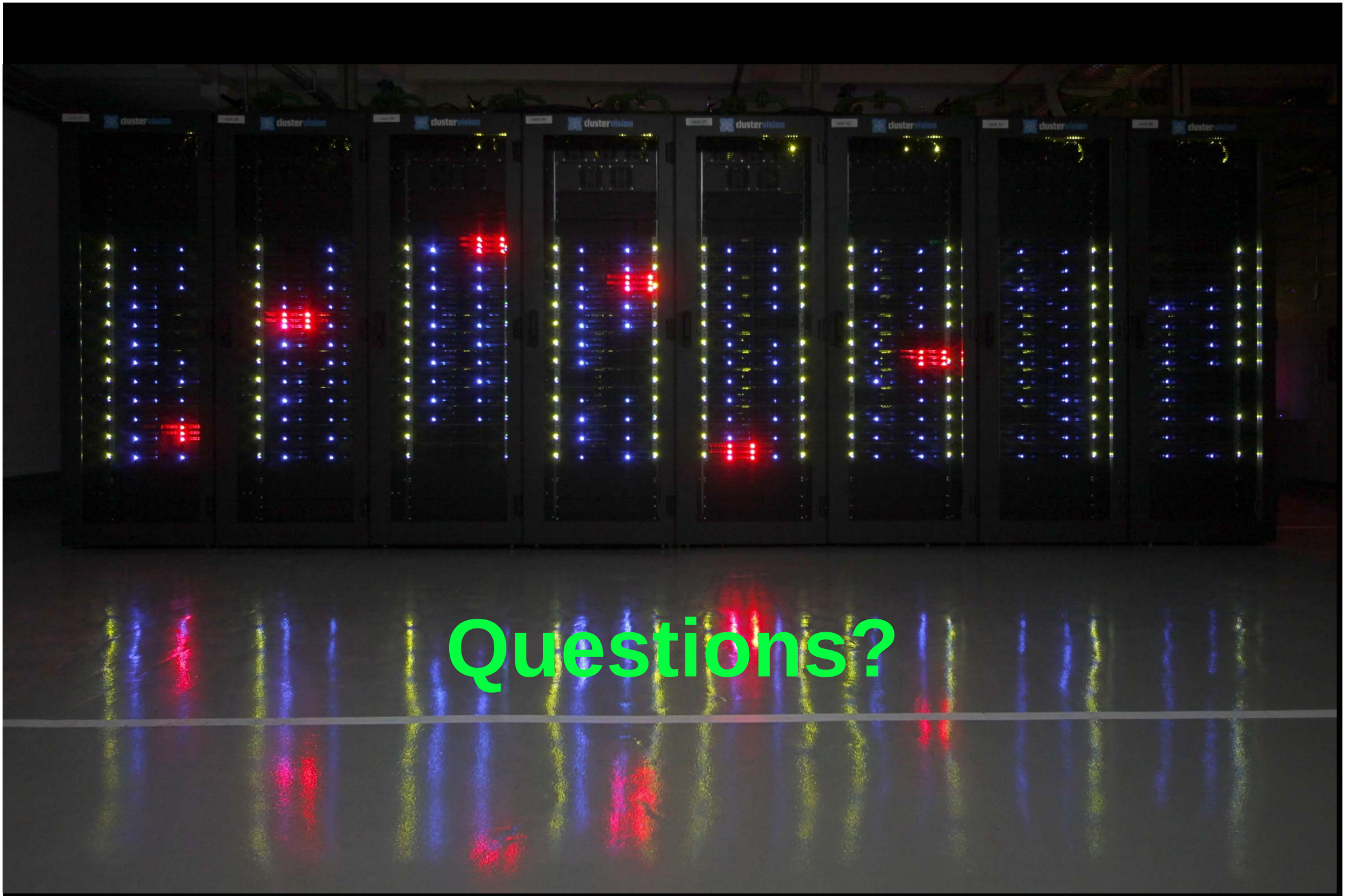

Technikspange
128 Racks
Techn. Gang
NSHV
Trafraum
Trafraum
BMZ
Schwachstrom
ELA
Green IT
Vorabzug
Ebene 01
M. 1:100

Conclusions, Outlook

- **Indirect passive cooling generates very efficient cooling of PUE<10% in European climate**
- **Ambient temperatures in Germany support entire year operation**
- **Any commercial servers are supported**
- **No active components in the data center**
- **No air ducts of any kind**
- **Highest power density of 20kW/m² per floor**
- **Efficient programming one of the largest savings potentials**


Questions?