BOUW EEN "COOL" DATACENTER

CONSTRUIRE UN DATACENTER "COOL"

EFP
25 jan 2012

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The energy savers

- 32 years experience in ventilation & air conditioning in almost any application or sector
- Specialized in energy recuperation and – saving
- 32 years know-how in measuring & control
- more than 20 patents active
- Wide range of products for air conditioning & ventilation, compact hybrid chillers, energy recuperation from waste water.
- Present in 27 countries
- Local service support available

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Presentation ....

Available to download at
www.atic.be

Build a “cool” Data Center

Lowering power consumption,
CO_2 emission…

Getting to the real Green IT !

Build a "cool" Data Center

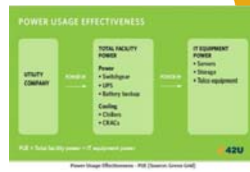
Lowering power consumption,
CO_2 emission…

Getting to the real Green IT !

Topics

- Importance of cooling on total energy consumption (Facts & Figures)
- Design Basics
- Different cooling systems compared
- Principle of the indirect adiabatic cooling system
- Advantages of indirect vs. direct free cooling
- Energetic comparison
- Intrinsic redundancy
- References

Facts & Figures (1)



- Definitions :
  - PUE = Power Usage Effectiveness
    = Total Facility Power / IT Equipment Power
  - DCiE = Data Center infrastructure Efficiency
    = IT Equipment Power / Total Facility Power

➔ PUE = 1 / DCiE

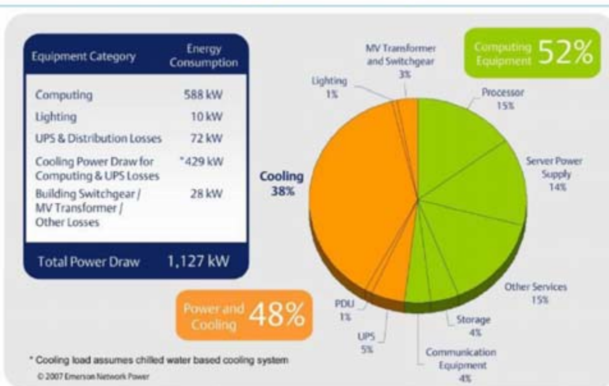
PUE = Total Facility Power / IT Equipment Power
DCiE = IT Equipment Power / Total Facility Power

PUE	DCiE	Level of Efficiency
3.0	33%	Very Inefficient
2.5	40%	Inefficient
2.0	50%	Average
1.5	67%	Efficient
1.2	83%	Very Efficient

Source: Green Grid

Facts & Figures (2)

- What is the Total Facility Power?



Equipment Category	Energy Consumption
Computing	588 kW
Lighting	10 kW
UPS & Distribution Losses	72 kW
Cooling Power Draw for Computing & UPS Losses	*429 kW
Building Switchgear / MV Transformer / Other Losses	28 kW
Total Power Draw	1,127 kW

* Cooling load assumes chilled water based cooling system

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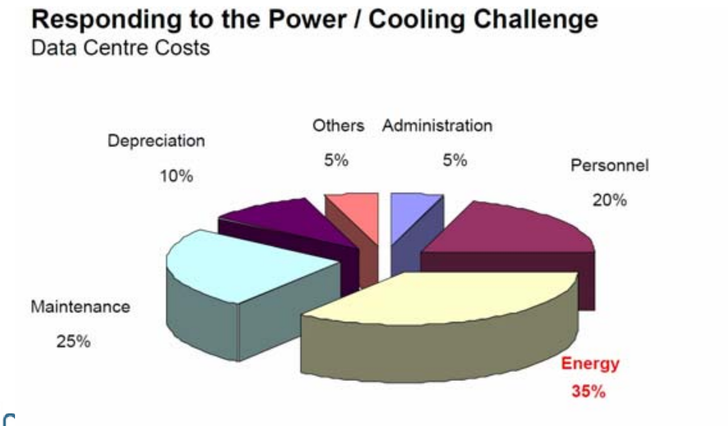
Facts & Figures (3)

- What is the cost for cooling ?



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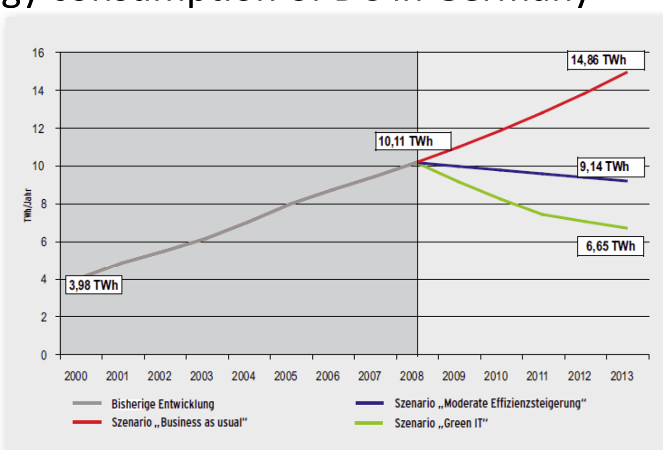
Facts & Figures (4)

- Energy consumption of DC in Germany



Quelle: Borderstep 2008

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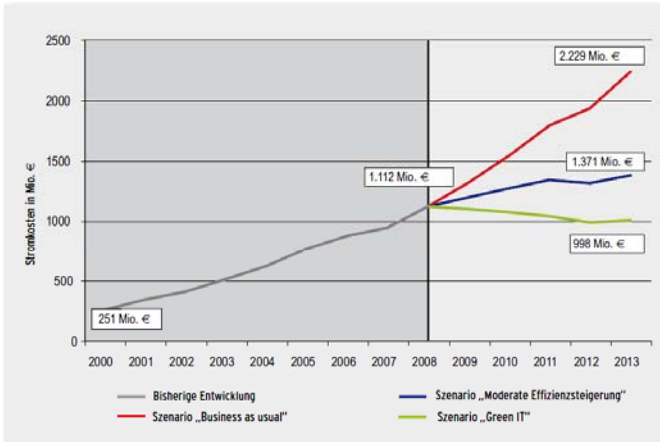
Facts & Figures (5)

- Energy costs of DC in Germany

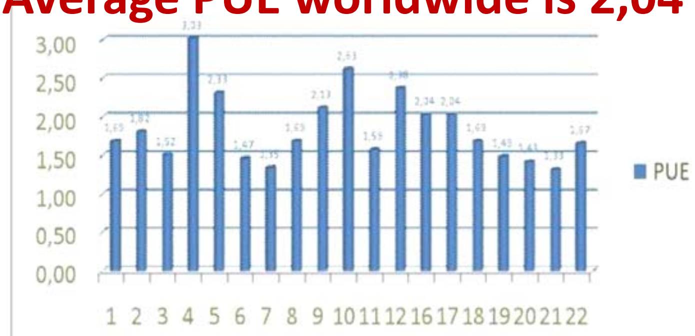


Quelle: Borderstep 2008

Facts & Figures (6)

- What is the average PUE of DC worldwide ?

Average PUE worldwide is 2,04 !



*1 = Best Practices for Data Centers: Lessons Learned from Benchmarking 22 Data Centers, Steve Greenberg, Evan Mills, and Bill Tschudi, Lawrence Berkeley National Laboratory, Peter Rumsey, Rumsey Engineers, Bruce Myatt, EYP Mission Critical Facilities

Facts & Figures (7)

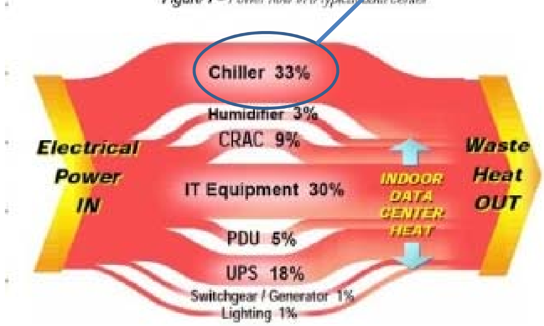
- Maximum allowed PUE :
  - Amsterdam : permit only if PUE < 1,3
    Extra taxes for existing DC with PUE > 1,3
  - London : CO_2 taxes for DC based on PUE
  - Luxembourg : only 2% VAT for Green DC
  - …

Facts & Figures (8)

- How to reduce the PUE ?

Cooling is the first target

Figure 1 – Power flow in a typical data center



Design basics(1)

- 1 x 1 > 1
  - 1 Watt during 1 Year > 1 €
    - Each kW of continuous power use means a cost of more than 1.000€ yearly
    - DC uses 10s to 1000s of kW.
    - Power use must be lowered to its minimum level
    - Every Watt counts !

Design basics(2)

- 27
  - According to ASHREA, a room temp of 27°C is acceptable for IT-equipment.
    - The higher the room temperature is set, the more free cooling is possible
    - For comfort reasons, one might not accept 27°C, but that is no reason to set it at 18°C room temp.

Design basics(3)

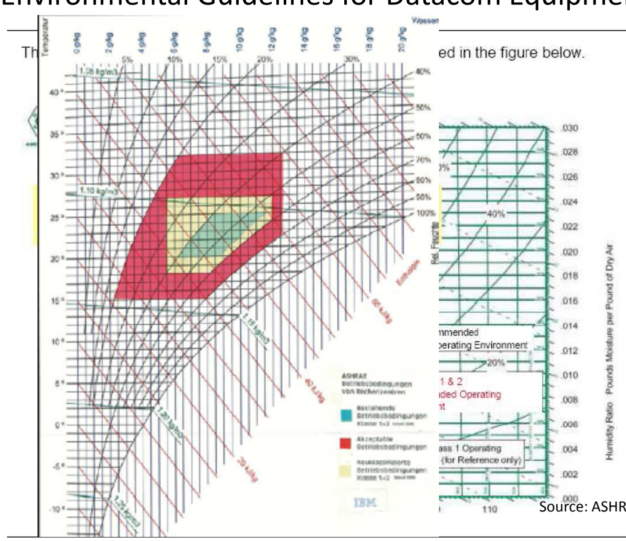
Table 2.1 Equipment Environment Specifications

Class	Product Operation[a,b]: Dry-Bulb Temperature (°C) Allowable	Product Operation: Dry-Bulb Temperature (°C) Recommended	Product Operation: Relative Humidity (%) Non-Condensing Allowable	Product Operation: Relative Humidity (%) Non-Condensing Recommended	Max. Dew Point (°C)	Max. Elevation (m)	Max Rate of	Product Power Off[b,c]: Dry-Bulb Temperature (°C)	Product Power Off: Relative Humidity (%)	Product Power Off: Max. Dew Point (°C)
1	15 to 32[d]	20 to 25	20 to 80	40 to 55	17	3050	5	5 to 45	8 to 80	27
2	10 to 35[d]	20 to 25	20 to 80	40 to 55	21	3050	5	5 to 45	8 to 80	27
3	5 to 35[d,e]	NA	8 to 80	NA	28	3050	NA	5 to 45	8 to 80	29
4	5 to 40[d,e]	NA	8 to 80	NA	28	3050	NA	5 to 45	8 to 80	29

Source: ASHRAE

Design basics(4)

ASHRAE Environmental Guidelines for Datacom Equipment



Source: ASHRAE

Design basics(5)

- 300
  - 1 kW Peak Power can cost up to 300€ !
    - Depending on MV-contract, extra Peak Power can have a high penalty
    - Reduce investments !
      MV-transformers, UPS and diesel no-breaks are very expensive. Reducing the peak power in summer will avoid a lot of investments.

      ➔ reducing the Peak Power for cooling in summer is very important!

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Design basics(6)

- 1,30
  - Total yearly PUE < 1,30 is the target !
    - Since cooling is the major power user, the PUE of the cooling needs to be under 1,11
    - The complete design of the DC needs to be focused on this target

	Actual		Indirect adiabatic
Processor	15		15
Server Power	14		14
Other services	15		15
Storage	4		4
Comm. Equip	4		4
UPS	5		5
PDU	1		1
Cooling	38		5,6
Lighting	1		1
MV transfo	3		3
Total facility Power	100		67,6
IT equipment power	52		52
PUE	1,9231	Target PUE	1,3
		PUE cool	1,1077

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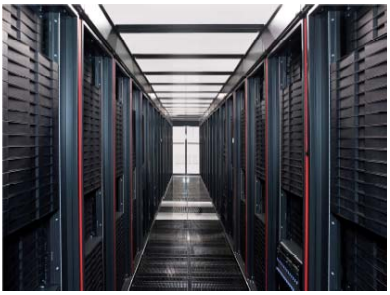
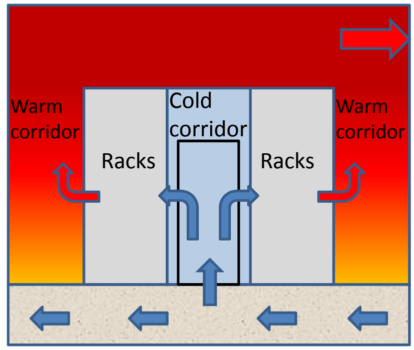
Design basics(7)

- Cold & warm aisle

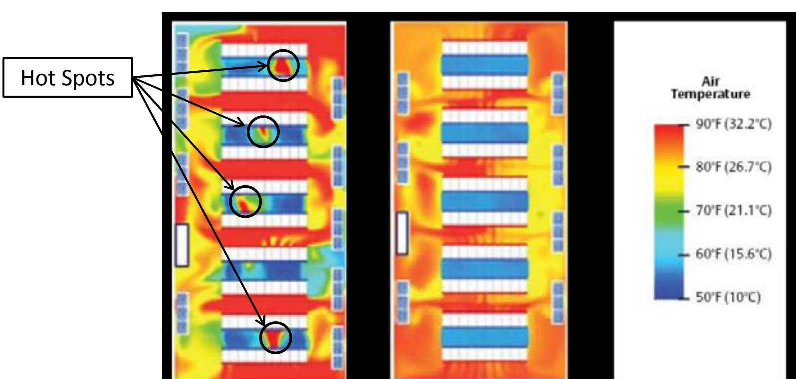


Source: IBM



Design basics(8)

- Cold & warm aisle



W/o cold/warm aisle   With cold/warm aisle   Source: IBM

Design basics(9)

- Cold & warm aisle
  Please provide space for cables AND air

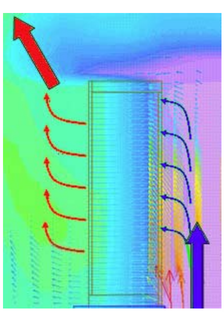
This is OK

This is getting tricky

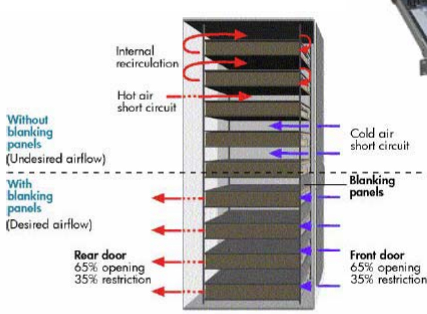
This is impossible

Design basics(10)

- Air inlet & outlet at server level



Source: INTEL



Source: HP

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Cooling systems (1)

- Which cooling systems exist?
  - Cooling by water distribution (provided by chiller)
    - Without free cooling
    - With free cooling to water circuit
  - DX systems in DC, with dry-cooler on the roof
  - Direct free cooling
  - Indirect free cooling
  - Indirect free cooling with evaporative “adiabatic” cooling

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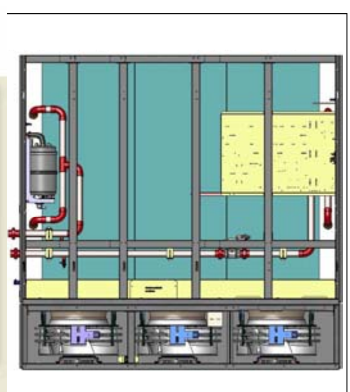
Cooling systems (2)

- Cooling by water distribution, without free cooling



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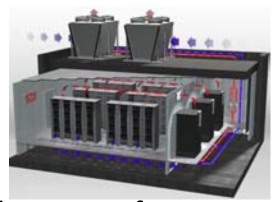
Cooling systems (3)

- Cooling by water distribution, without free cooling
  - Draw backs :
    - Highest power consumption
    - Highest peak power level
    - No “green cooling” possible
    - Expensive UPS, diesel no-breaks and MV-transformer because of peak power level
    - Water circuit might have to be redundant.
    - Poor EER of chiller



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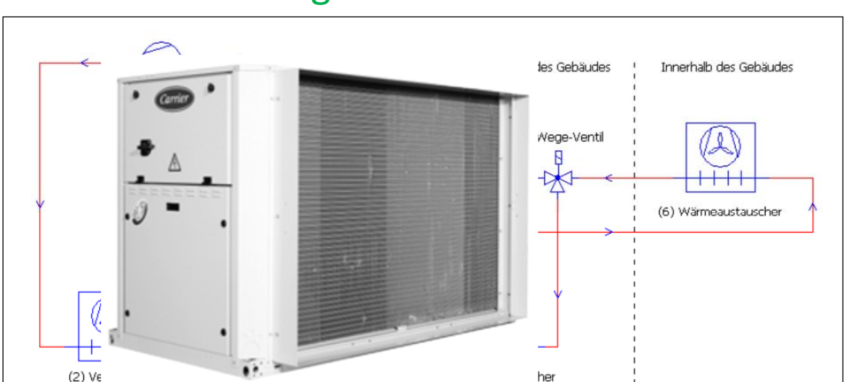
Cooling systems (4)

- Cooling by water distribution, with free cooling



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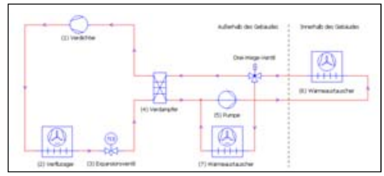
Cooling systems (5)

- Cooling by water distribution, with free cooling
  - Draw backs :
    - High power consumption
    - Highest peak power level
    - Only partial “green cooling” possible
    - Expensive UPS, diesel no-breaks and MV-transformer because of peak power level
    - Water circuit might have to be redundant.
    - Poor EER of chiller



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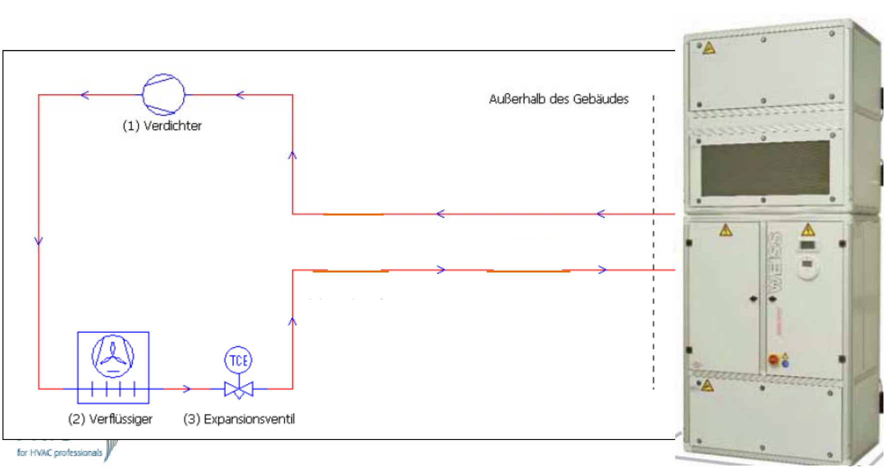
Cooling systems (6)

- DX systems in DC, with dry-cooler on the roof



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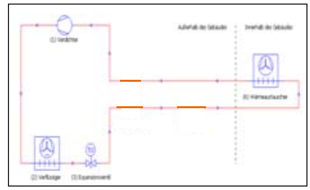
Cooling systems (7)

- DX systems in DC, with dry-cooler on the roof
  - Draw backs :
    - High power consumption
    - Highest peak power level
    - no “green cooling” possible
    - Expensive UPS, diesel no-breaks and MV-transformer because of peak power level
    - Redundancy expensive / difficult.
    - Poor EER of chiller



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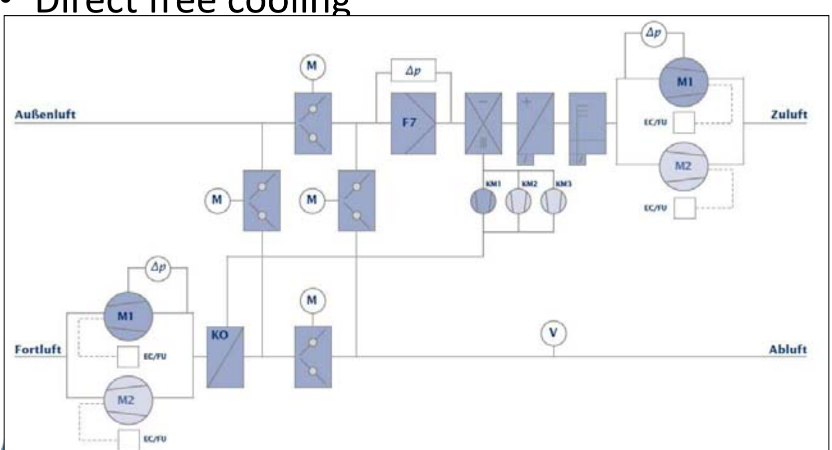
Cooling systems (8)

- Direct free cooling



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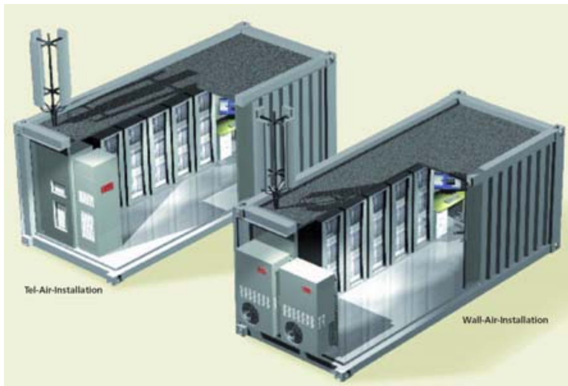
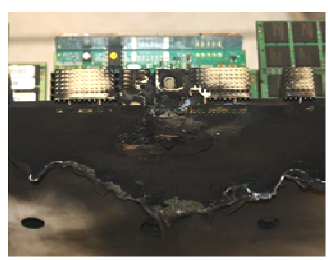
Cooling systems (9)

- Direct free cooling
  = not widely accepted in Europe



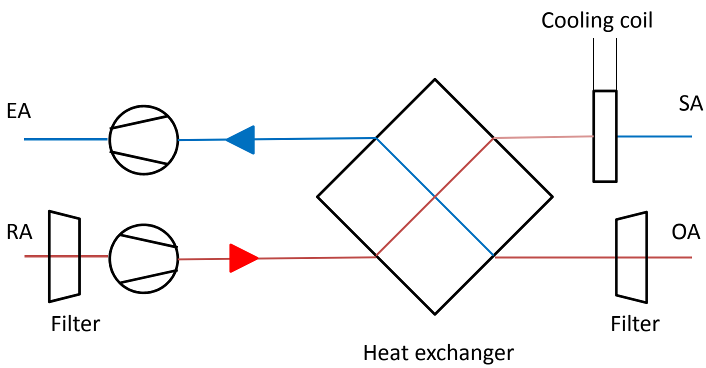
Cooling systems (10)



- Direct free cooling
  - Draw backs (ref : IBM)
    - Atmospheric influences (dust, gas)
    - Pressure drop by air filters
    - Humidity drops in winter
    - High power use for humidification
    - Problems with fire extinguishing (unable to use gas)
    - Chiller is still needed, at maximum capacity
    - High peak power level
    - Expensive UPS, No-Break, MV-transformer
    - Risk for sabotage or at the event of large chemical accidents

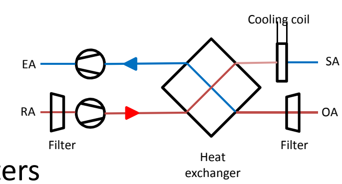
Cooling systems (11)

- Indirect free cooling



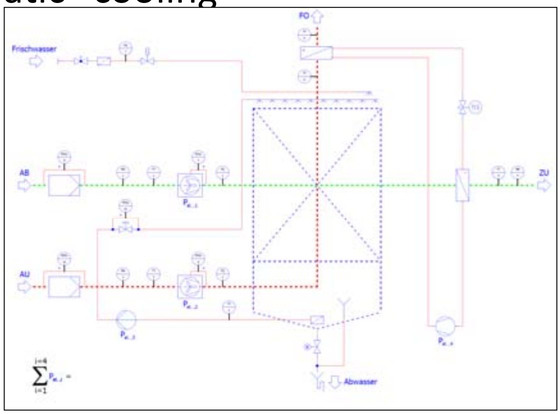
Cooling systems (12)

- Indirect free cooling
  - Draw backs
    - Pressure drop by fresh air filters
    - Chiller is still needed, at maximum capacity
    - High peak power level
    - Expensive UPS, No-Break, MV-transformer
    - High fresh air volume (same quantity as return air) inducing higher energy consumption



Cooling systems (13)

- Indirect free cooling with evaporative “adiabatic” cooling



Cooling systems (14)

- Indirect fr
  cooling
  - Draw-ba
    - Water
      to be c
  - Benefits
    - Lowes
    - Lowes
    - Lowes
    - Lowes
    - Low fr
    - Compa

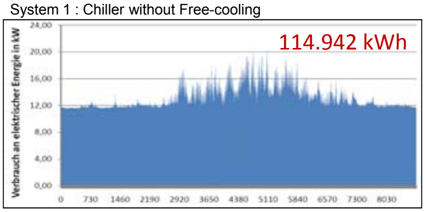
Cooling systems (15)

- Comparison of 4 systems
  - System 1 : Chiller without free cooling
  - System 2 : Chiller with free cooling
  - System 3 : Direct free cooling
  - System 4 : Indirect adiabatic free cooling with DX
- System design :
  - 35°C/40% outside air
  - 34/20° return/supply air
  - 40 to 60% rh room
  - Climate conditions @ Essen (Germany)
  - 50 kW Server load

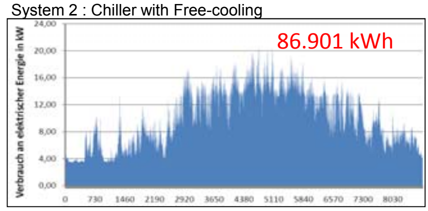
Cooling systems (16)

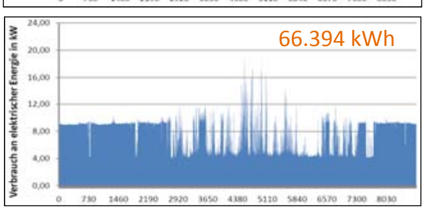
- Comparison

System 1 : Chiller without Free-cooling

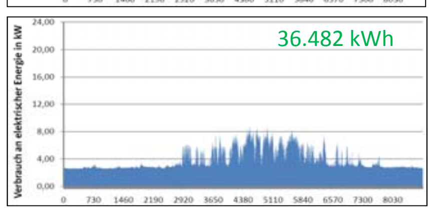


System 2 : Chiller with Free-cooling





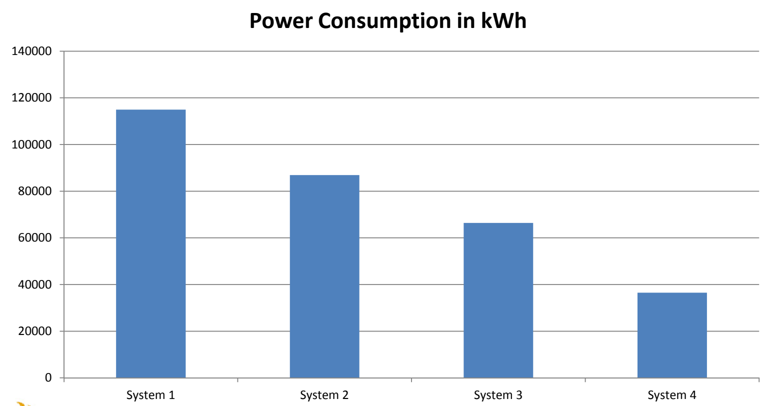
System 3 : Direct free cooling with chiller in supply air



System 4 : Indirect „adiabatic“ free cooling with DX

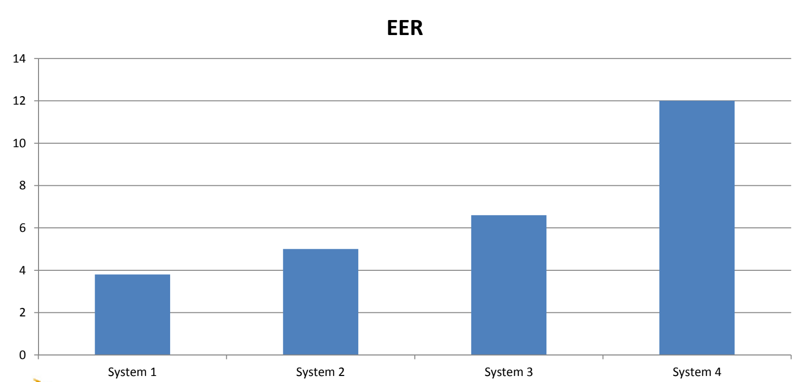
Cooling systems (17)

- Comparison



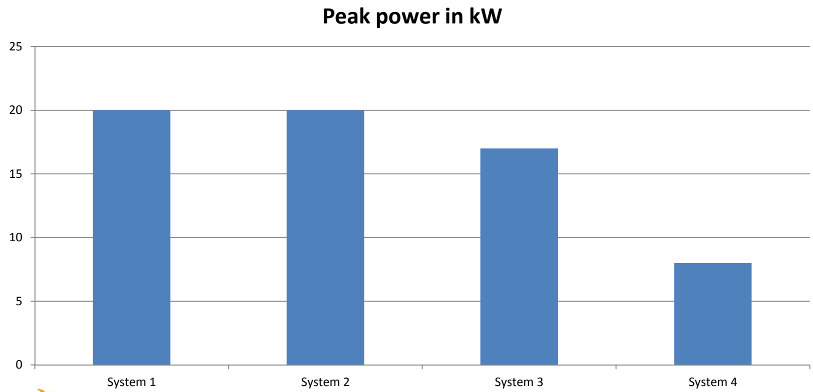
Cooling systems (18)

- Comparison



Cooling systems (19)

- Comparison



System Design (1)

- PUE calculation for :
  - Data Center with 375 kW of server load
  - Region of Brussels
  - Cold corridor : 20°C
  - Warm corridor : 30°C

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System Design (2)

- PUE calculation includes :
  - Pumps for Adiabatic Cooling
  - DX cooling
  - Fans
    - Don’t forget : the power consumption of the fans is cooling load too!
  - Climate data for Uccle (Brussels)

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System Design (4)

- PUE calculation

T [°C]	RV [%]	uur [h]	T VL reku in [°C]	T PL na recu [°C]	mPL [kg/s]	mVL [kg/s]	nuttig koelverm. Recuperator [kW]	totaal koelverm. Recuperator [kW]	Koelverm. Koelbatterij [kW]	Koelverm. Totaal [kW]	Opgen vermogen compressor [kW]	Opvoerhoogte EL-PL [Pa]	Opgen vermogen PL venti [kW]	Opvoerhoogte EL-PL [Pa]2	Opgen vermogen PL venti [kW]2	Opgen vermogen pompAK [kW]	Totaal opgen vermogen [kW]	Water verbruik [L/h]	Totaal water verbruik [m³]
- 8,0	100%	1,0	- 7,7	20,0	37,1	6,3	375,0	387,7	-	375,0	-	340,0	17,3	22,4	0,2	3,4	21,0	289,9	0,3
- 7,0	98%	6,0	- 6,7	20,0	37,1	6,4	375,0	387,7	-	375,0	-	340,0	17,3	23,3	0,2	3,4	21,0	293,4	1,8
- 6,0	98%	10,0	- 5,7	20,0	37,1	6,6	375,0	387,7	-	375,0	-	340,0	17,3	24,3	0,3	3,4	21,0	296,4	3,0
- 5,0	92%	38,0	- 4,7	20,0	37,1	6,7	375,0	387,7	-	375,0	-	340,0	17,3	25,1	0,3	3,4	21,0	301,2	11,4
- 4,0	90%	31,0	- 3,7	20,0	37,1	6,9	375,0	387,7	-	375,0	-	340,0	17,3	26,2	0,3	3,4	21,0	305,0	9,5
- 3,0	84%	42,0	- 2,7	20,0	37,1	7,0	375,0	387,7	-	375,0	-	340,0	17,3	27,1	0,3	3,4	21,0	310,4	13,0
- 2,0	87%	82,0	- 1,7	20,0	37,1	7,2	375,0	387,7	-	375,0	-	340,0	17,3	28,6	0,3	3,4	21,1	312,7	25,6
- 1,0	89%	139,0	- 0,7	20,0	37,1	7,5	375,0	387,7	-	375,0	-	340,0	17,3	30,4	0,4	3,4	21,1	315,4	43,8
-	89%	178,0	0,3	20,0	37,1	7,7	375,0	387,7	-	375,0	-	340,0	17,3	32,1	0,4	3,4	21,1	318,8	56,7
1,0	87%	244,0	1,3	20,0	37,1	7,9	375,0	387,7	-	375,0	-	340,0	17,3	33,8	0,4	3,4	21,2	323,3	78,9
2,0	84%	253,0	2,3	20,0	37,1	8,2	375,0	387,7	-	375,0	-	340,0	17,3	35,5	0,5	3,4	21,2	328,4	83,1
3,0	86%	275,0	3,3	20,0	37,1	8,5	375,0	387,7	-	375,0	-	340,0	17,3	38,2	0,5	3,4	21,2	331,1	91,0
4,0	85%	299,0	4,3	20,0	37,1	8,8	375,0	387,7	-	375,0	-	340,0	17,3	40,8	0,6	3,4	21,3	335,5	100,3
5,0	83%	432,0	5,3	20,0	37,1	9,1	375,0	387,7	-	375,0	-	340,0	17,3	43,4	0,6	3,4	21,4	340,8	147,2
6,0	82%	377,0	6,3	20,0	37,1	9,5	375,0	387,7	-	375,0	-	340,0	17,3	46,6	0,7	3,4	21,4	345,7	130,3
7,0	82%	438,0	7,3	20,0	37,1	10,0	375,0	387,7	-	375,0	-	340,0	17,3	50,7	0,8	3,4	21,5	350,0	153,3
8,0	82%	421,0	8,3	20,0	37,1	10,5	375,0	387,7	-	375,0	-	340,0	17,3	55,5	0,9	3,4	21,7	354,5	149,2
9,0	81%	472,0	9,3	20,0	37,1	11,0	375,0	387,7	-	375,0	-	340,0	17,3	60,7	1,1	3,4	21,8	360,2	170,0
10,0	79%	444,0	10,3	20,0	37,1	11,6	375,0	387,7	-	375,0	-	340,0	17,3	66,0	1,2	3,4	21,9	367,4	163,1
11,0	79%	513,0	11,3	20,0	37,1	12,3	375,0	387,7	-	375,0	-	340,0	17,3	74,0	1,4	3,4	22,2	372,9	191,3
12,0	81%	528,0	12,3	20,0	37,1	13,4	375,0	387,7	-	375,0	-	340,0	17,3	86,1	1,8	3,4	22,6	376,2	198,6
13,0	79%	469,0	13,3	20,0	37,1	14,3	375,0	387,7	-	375,0	-	340,0	17,3	96,3	2,2	3,4	22,9	385,4	180,7
14,0	78%	405,0	14,3	20,0	37,1	15,4	375,0	387,7	-	375,0	-	340,0	17,3	110,6	2,7	3,4	23,4	394,2	159,7
15,0	76%	400,0	15,3	20,0	37,1	16,6	375,0	387,7	-	375,0	-	340,0	17,3	126,2	3,3	3,4	24,0	406,1	162,4
16,0	74%	372,0	16,3	20,0	37,1	18,0	375,0	387,7	-	375,0	-	340,0	17,3	145,6	4,1	3,4	24,9	419,9	156,2
17,0	73%	396,0	17,3	20,0	37,1	25,5	373,3	386,0	1,7	375,0	0,4	340,0	17,3	270,0	10,8	3,4	32,0	447,0	177,0
18,0	70%	317,0	18,3	20,4	37,1	25,5	361,5	374,2	13,5	375,0	3,4	340,0	17,3	270,0	10,8	3,4	35,0	461,7	146,4
19,0	69%	261,0	19,3	20,9	37,1	25,5	342,6	355,3	32,4	375,0	8,1	340,0	17,3	270,0	10,8	3,4	39,7	453,3	118,3
20,0	65%	218,0	20,3	21,1	37,1	25,5	333,1	345,9	41,9	375,0	10,5	340,0	17,3	270,0	10,8	3,4	42,0	468,0	102,0
21,0	63%	169,0	21,3	21,5	37,1	25,5	318,9	331,7	56,1	375,0	14,0	340,0	17,3	270,0	10,8	3,4	45,6	474,8	80,2
22,0	59%	123,0	22,3	21,7	37,1	25,5	311,9	324,6	63,1	375,0	15,8	340,0	17,3	270,0	10,8	3,4	47,4	487,6	60,0
23,0	57%	101,0	23,3	22,1	37,1	25,5	297,7	310,4	77,3	375,0	19,3	340,0	17,3	270,0	10,8	3,4	50,9	498,6	50,4
24,0	54%	88,0	24,3	22,3	37,1	25,5	288,2	301,0	86,8	375,0	21,7	340,0	17,3	270,0	10,8	3,4	53,3	510,7	44,9
25,0	53%	75,0	25,3	22,7	37,1	25,5	274,1	286,8	100,9	375,0	25,2	340,0	17,3	270,0	10,8	3,4	56,8	507,6	38,1
26,0	49%	56,0	26,3	22,8	37,1	25,5	269,3	282,1	105,7	375,0	26,4	340,0	17,3	270,0	10,8	3,4	58,0	535,4	30,0
27,0	48%	36,0	27,3	23,2	37,1	25,5	255,2	267,9	119,8	375,0	30,0	340,0	17,3	270,0	10,8	3,4	61,5	535,3	19,3
28,0	46%	30,0	28,3	23,5	37,1	25,5	243,3	256,1	131,7	375,0	32,9	340,0	17,3	270,0	10,8	3,4	64,5	547,8	16,4
29,0	51%	6,0	29,3	24,6	37,1	25,5	203,2	215,9	171,8	375,0	43,0	340,0	17,3	270,0	10,8	3,4	74,5	488,9	2,9
30,0	44%	8,0	30,3	24,3	37,1	25,5	215,0	227,7	160,0	375,0	40,0	340,0	17,3	270,0	10,8	3,4	71,6	551,4	4,4
31,0	45%	5,0	31,3	24,9	37,1	25,5	191,4	204,1	183,6	375,0	45,9	340,0	17,3	270,0	10,8	3,4	77,5	532,3	2,7
32,0	45%	2,0	32,3	25,4	37,1	25,5	172,5	185,2	202,5	375,0	50,6	340,0	17,3	270,0	10,8	3,4	82,2	515,8	1,0

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System Design (5)

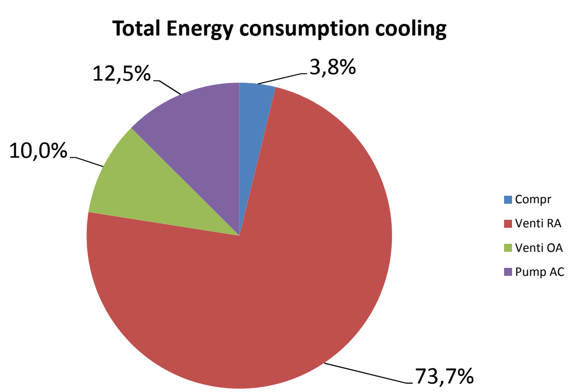
- PUE calculation

Total energy consumption for cooling	232	MWh	
Total net cooling energy	3.285	MWh	
Total indirect cooling energy	3.316	MWh	
Total DX cooling energy	81	MWh	
Peak DX cooling power	202,5	kWcool	
Peak power consumption	82,2	kWe	
100% free cooling up to	17,0	°C	
50% free cooling up to	31,0	°C	
PUE	1,071		
Evaporated water	3.375	m³	
Water consumption	6.749	m³ at thicking =	2
	5.062	m³ at thicking =	3
	4.500	m³ at thicking =	4

only 2,4% of cooling energy is delivered by DX !

System Design (6)

- PUE calculation



System Design (7)

- Indirect “adiabatic” cooling
  - Developed by Menerga in 1993
  - Used for cooling and ventilation of all kinds of buildings
  - Since 1994 DX cooling as option
  - Since 2007 with DigiScroll® compressors from Copeland®
  - System was adapted in 2010 for rooms with high thermal loads, like Data Centers.
  - Mathematic model confirmed by long-term measurements

System Design (8)

- Practical design
  - Most important elements are
    - Polypropylene recuperator with huge thermal surface

System Design (9)

- Why recuperator in polypropylene?
  - Totally inert to corrosion or degradation in time
  - Possible to integrate adiabatic cooling IN the recuperator
  - Resists to high pressure differences between air flows (important in combination with fire dampers)
  - Can be built in greater dimensions than aluminum recuperators
  - Low air pressure drop
  - Can easily be cleaned
  - High thermal efficiency (only 0,8% loss compared to alu)
  - Carbon footprint is 5 times lower at production of PP compared to Alu
  - PP is totally recyclable in the same product quality

System Design (10)

- Practical design
  - Most important elements are
    - Polypropylene Recuperator with huge thermal surface
    - Integrated humidification all over the recuperator
    - Integrated DX cooling with DigiScroll compressor
      ➔ 10 to 100% capacity control
    - Intelligent DDC controller with mathematic model can predict behavior of the system at different air conditions or thermal load
      ➔ automatically best running conditions are selected

System Design (11)

- Practical design
  - Water for adiabatic cooling
    - Different types of water sources can be used e.g. rain water, tap water, source water, lake water (with water treatment)
    - No risk for legionella
  - Intrinsic redundancy
    - Multiple fans
    - Option: Integrated DX cooling selected for full thermal capacity
    - Double adiabatic pump

System Design (12)

- Practical design
  - Option : Water condensor to heat offices in winter using water at 40/30 °C,

➔Cheapest heating energy for offices

➔In one or more units installed

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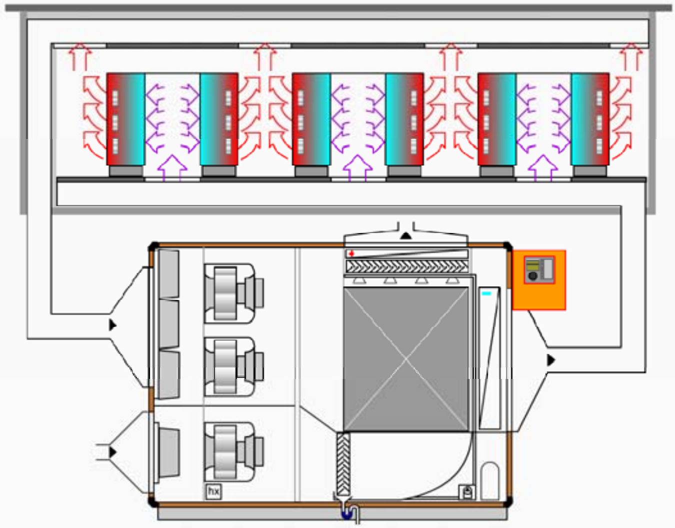

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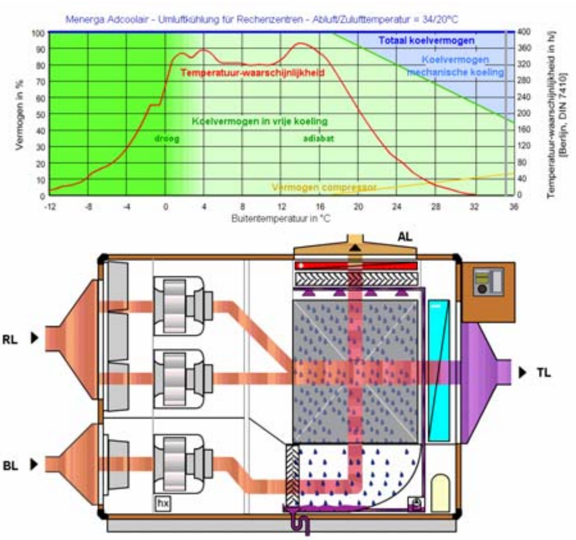

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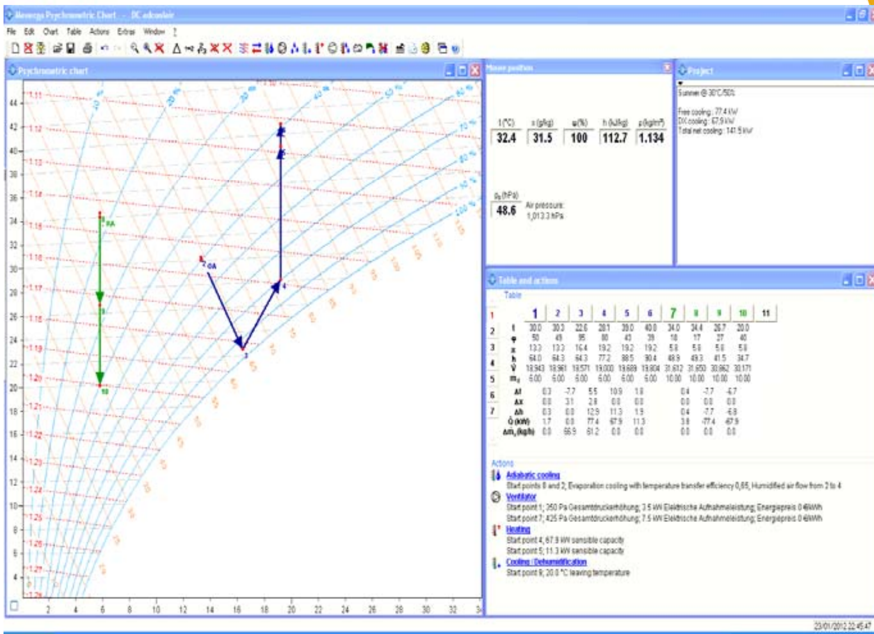

	1	2	3	4	5	6	7	8	9	10	11
t	30.0	30.3	22.6	28.1	39.0	40.0	34.0	34.4	26.7	20.0	
φ	50	49	95	80	43	39	18	17	27	40	
x	13.3	13.3	16.4	19.2	19.2	19.2	5.8	5.8	5.8	5.8	
h	64.0	64.3	64.3	77.2	88.5	90.4	48.9	49.3	41.5	34.7	
V̇	18.943	18.961	18.571	19.000	19.689	19.804	31.612	31.650	30.962	30.171	
m_g	6.00	6.00	6.00	6.00	6.00	6.00	10.00	10.00	10.00	10.00	
Δt	0.3	-7.7	5.5	10.9	1.0		0.4	-7.7	-6.7		
Δx	0.0	3.1	2.8	0.0	0.0		0.0	0.0	0.0		
Δh	0.3	0.0	12.9	11.3	1.9		0.4	-7.7	-6.8		
Q̇ (kW)	1.7	0.0	77.4	67.9	11.3		3.8	-77.4	-67.9		
Δm_w (kg/h)	0.0	66.9	61.2	0.0	0.0		0.0	0.0	0.0		

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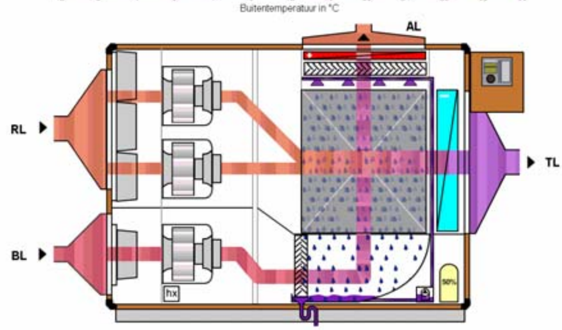

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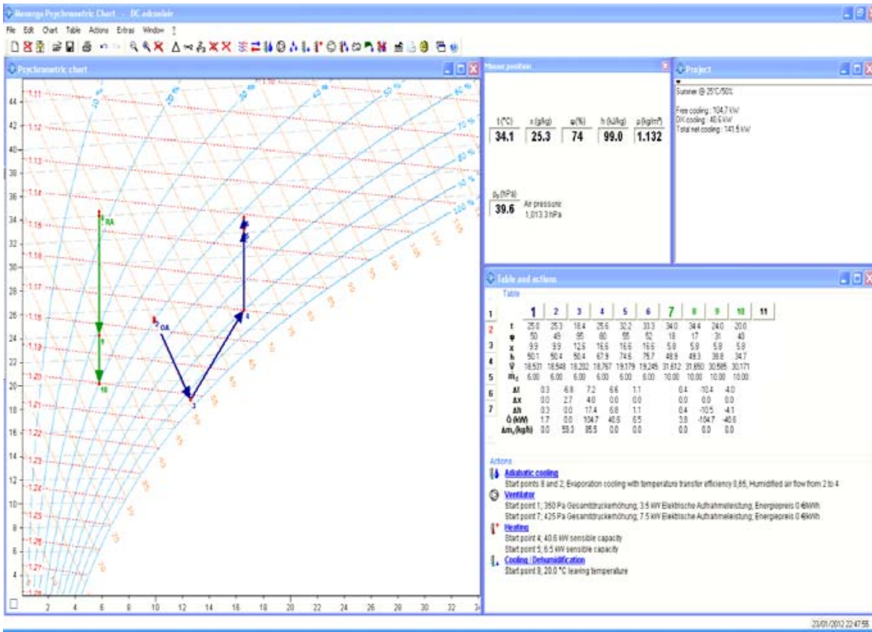
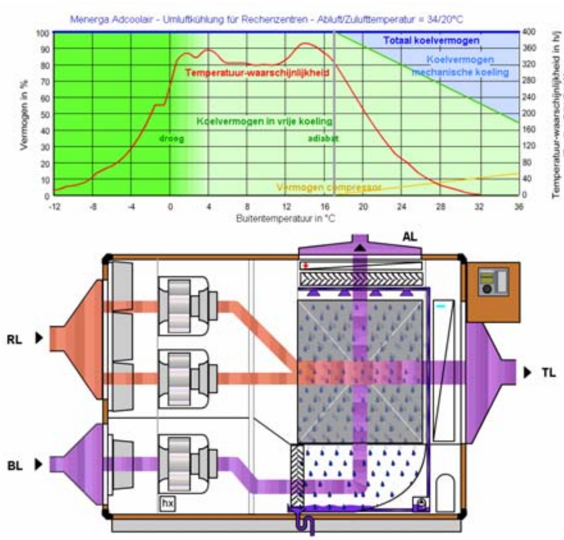

Psychrometric chart
Mouse position
t(°C) 34.1
x (g/kg) 25.3
φ(%) 74
h (kJ/kg) 99.0
ρ(kg/m³) 1.132
39.6
Air pressure 1,013.3 hPa
Project
Summer @ 25°C/50%
Free cooling : 104,7 kW
DX cooling : 40,6 kW
Total net cooling : 141,5 kW
Table and actions
Table
Actions
Adiabatic cooling
Start points 8 and 2, Evaporation cooling with temperature transfer efficiency 0,85, Humidified air flow from 2 to 4
Ventilator
Start point 1; 350 Pa Gesamtdruckerhöhung; 3.5 kW Elektrische Aufnahmeleistung; Energiepreis 0 €/kWh
Start point 7; 425 Pa Gesamtdruckerhöhung; 7.5 kW Elektrische Aufnahmeleistung; Energiepreis 0 €/kWh
Heating
Start point 4; 40.6 kW sensible capacity
Start point 5; 6.5 kW sensible capacity
Cooling / Dehumidification
Start point 8; 20.0 °C leaving temperature
23/01/2012 22:47:55


Menerga Adcoolair - Umluftkühlung für Rechenzentren - Abluft/Zulufttemperatur = 34/20°C
Totaal koelvermogen
Koelvermogen mechanische koeling
Temperatuur-waarschijnlijkheid
Koelvermogen in vrije koeling
droog
adiabat
Vermogen compressor
Vermogen in %
Buitentemperatuur in °C
Temperatuur-waarschijnlijkheid in h/j [Berlijn, DIN 7410]
AL
RL
TL
BL
hx

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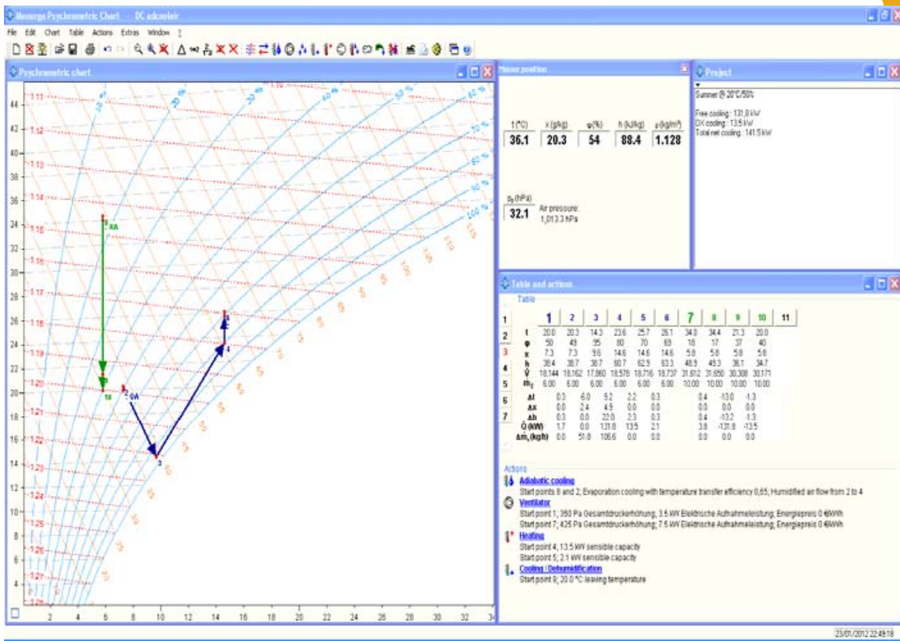
The energy savers



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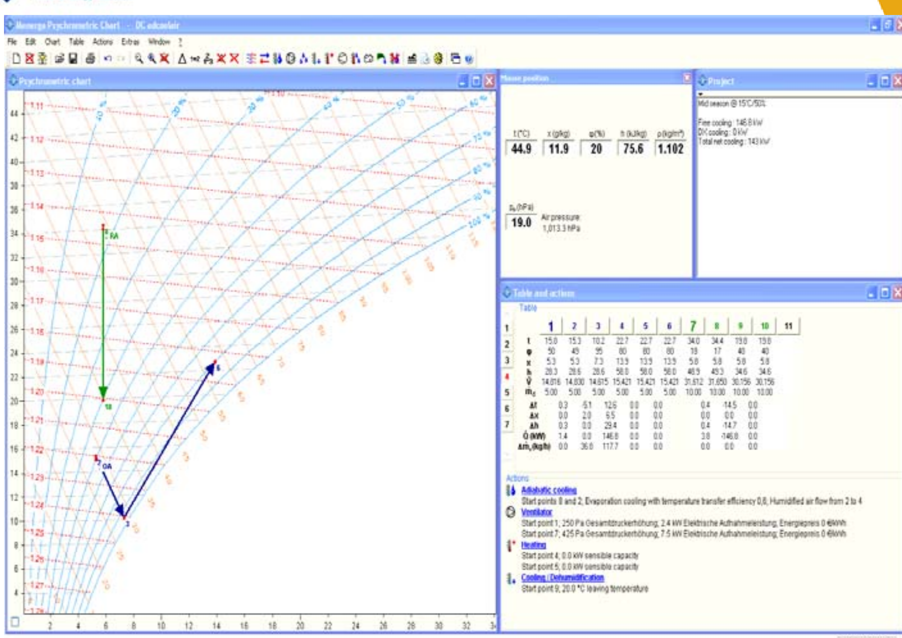

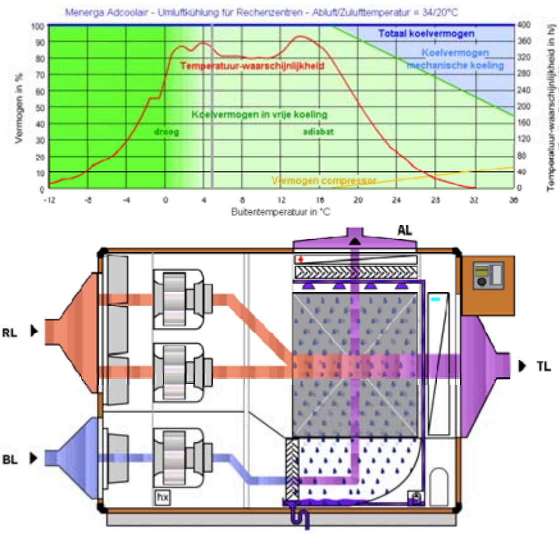
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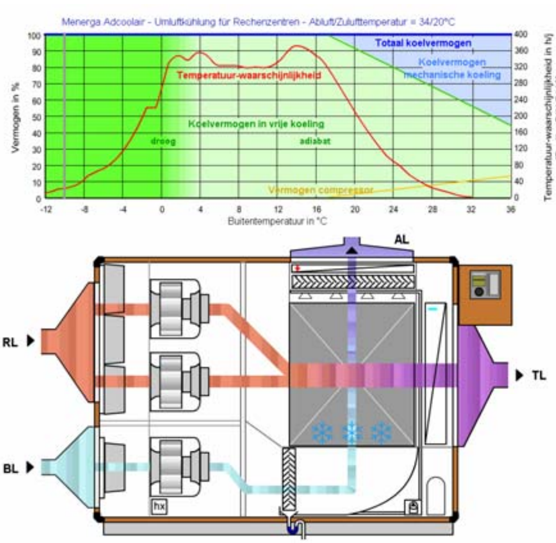
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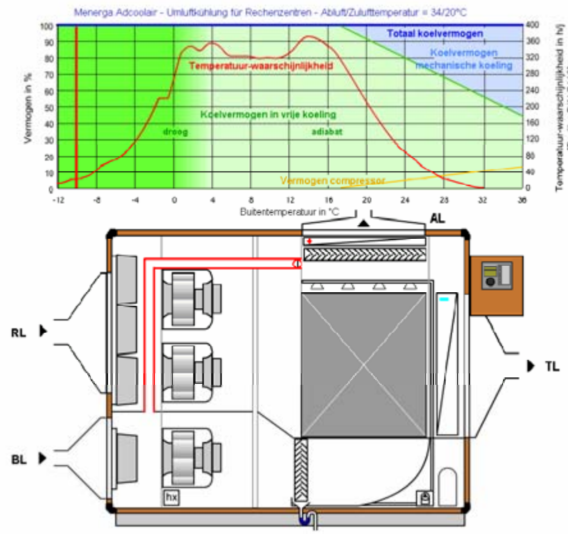

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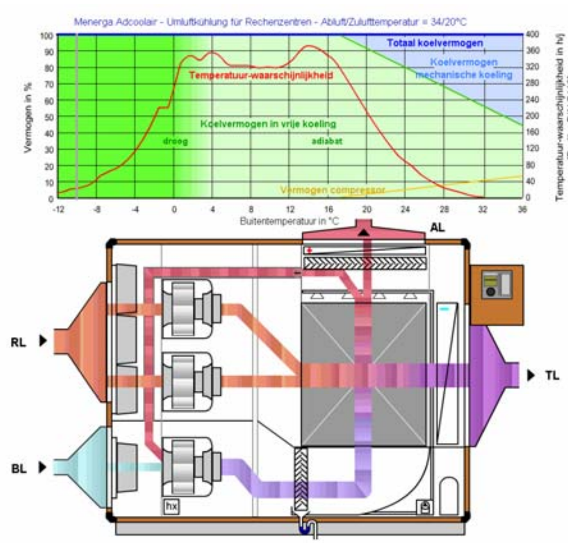

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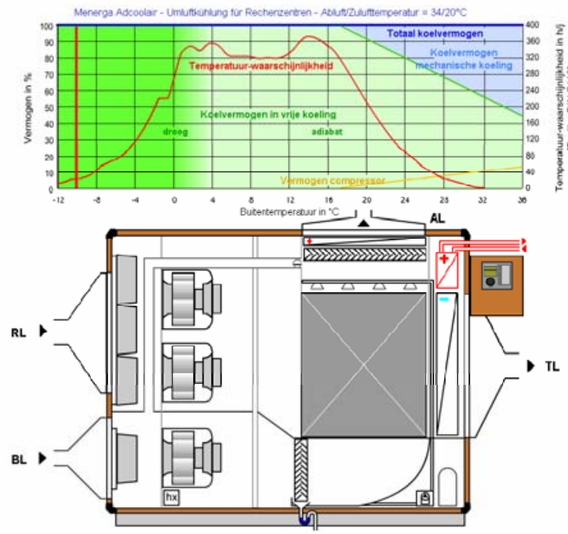
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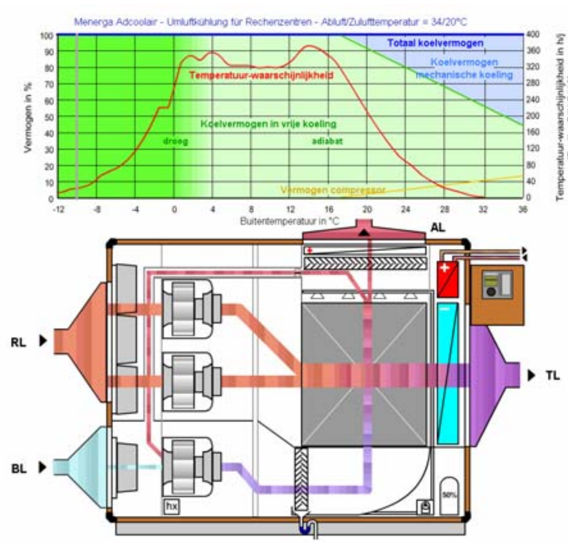
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BL
hx

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Intrinsic Redundancy (1)

- Number of units defined by redundancy rule:
  - Mostly N+1
- Few huge units
  - ➔ high investment for redundancy
- Many smaller units
  - ➔Higher redundancy and lower investment
  - ➔Easier maintenance
  - ➔Better MTTR
  - ➔Possibility to let the data center “grow”

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Intrinsic Redundancy (2)

- **Menerga® AdCoolAir®** is built with:
  - Multiple fans in airflow
    - ➔drop-out of 1 fan still maintains the functioning
    - ➔Easy to replace (< 40 kg) and short MTTR
    - ➔Smaller fans with longer lifetime of the bearings
  - DX can be selected to backup the indirect cooling
  - Double adiabatic pump (except for smallest units)
  - Control cabinet with redundancy control by “heartbeat-check” at different levels

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Intrinsic Redundancy (3)

- Back up unit is running too,
  - ➔shorter reaction time at unit breakdown
  - ➔Even better performance during summer

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References

- Biggest
  - Banco Santander, Spain
    - 17 MW total cooling power
    - Units of 450 kW each
    - Redundancy N+2
- Smalest
  - Comunicode, Germany
    - 20 kW cooling power
    - 1 unit
    - No redundancy

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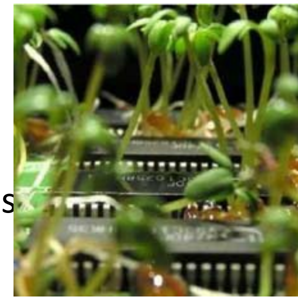
Build a “cool” Data Center



Lowering Power consumption, CO_2 production…

Is also a matter of

- virtualization : use CPU power at its max to get the same IT power for less energy consumption
- Intelligent server : temporarily shut down ¼ or ½ of a quad-core CPU

➔ www.sizingservers.be

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Build a “cool” Data Center

Lowering Power consumption, CO_2 production…

Thank You for your attention !

Having the real Green IT !

More information at our booth at Ifest, Ghent

Ifest 2012 – Flanders Expo Gent – 14 tot 16 februari 2012

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