Low Energy Data Centre

Final Presentation

Group D

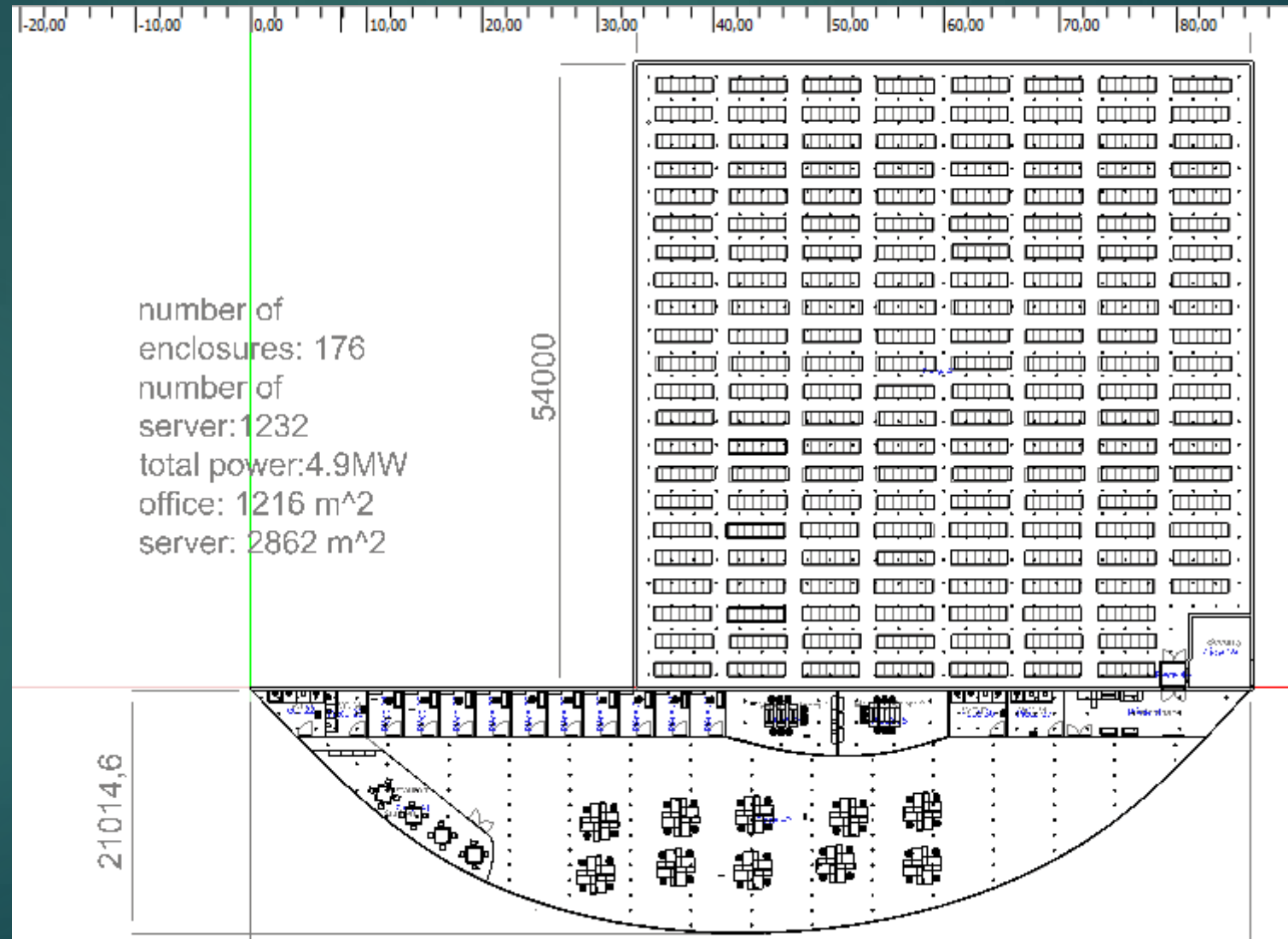MURILO PEIXOTO

YASMINE TRIKI

RAFAEL SANTIAGO

LOÏC VAUTRIN

Design Brief

- Data centre 5 MW
- Reference for future
- Local building materials
- Innovative design
- PassivHaus standard
- PUE

Final 2D model
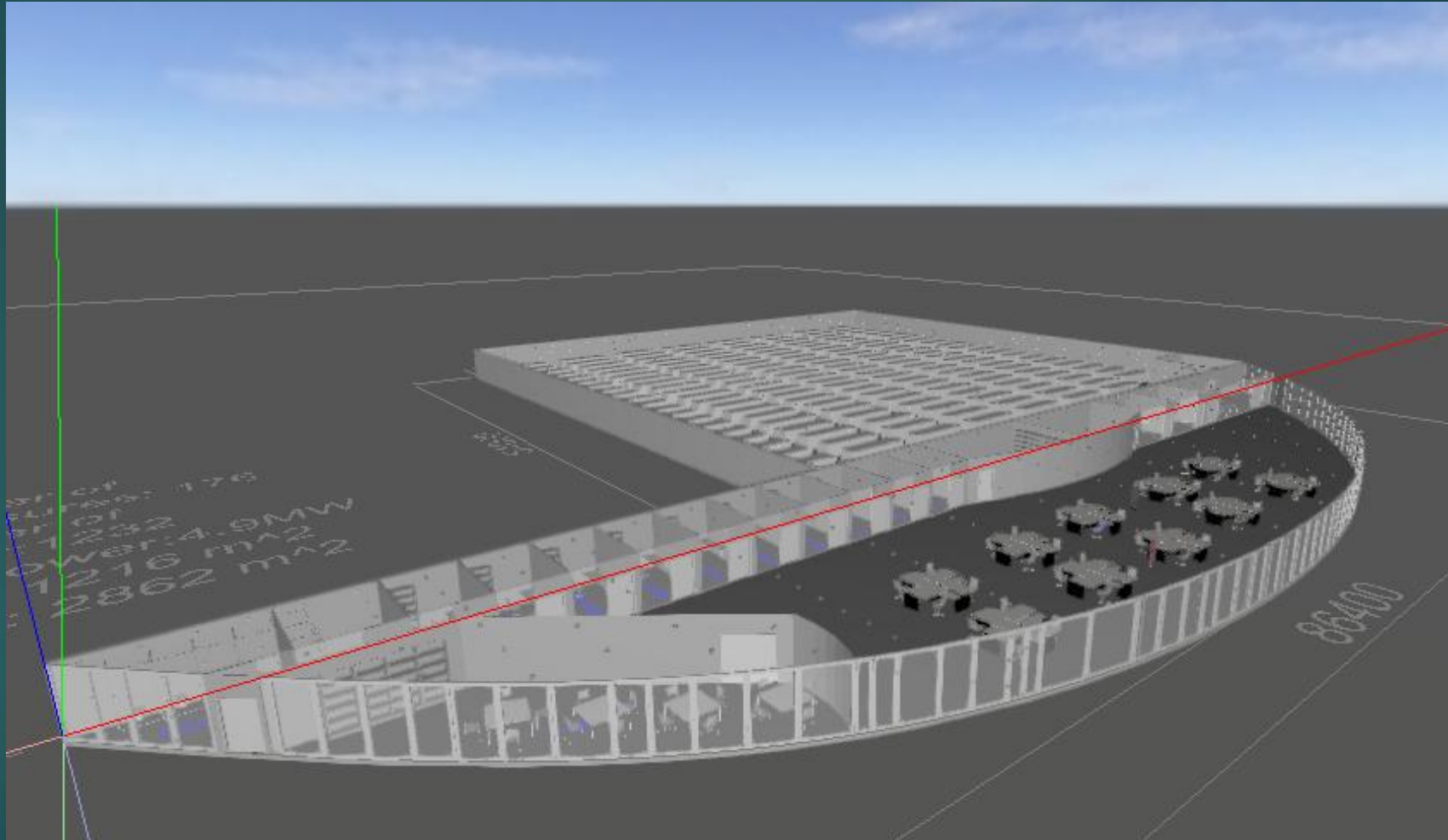
number of
enclosures: 176
number of
server:1232
total power:4.9MW
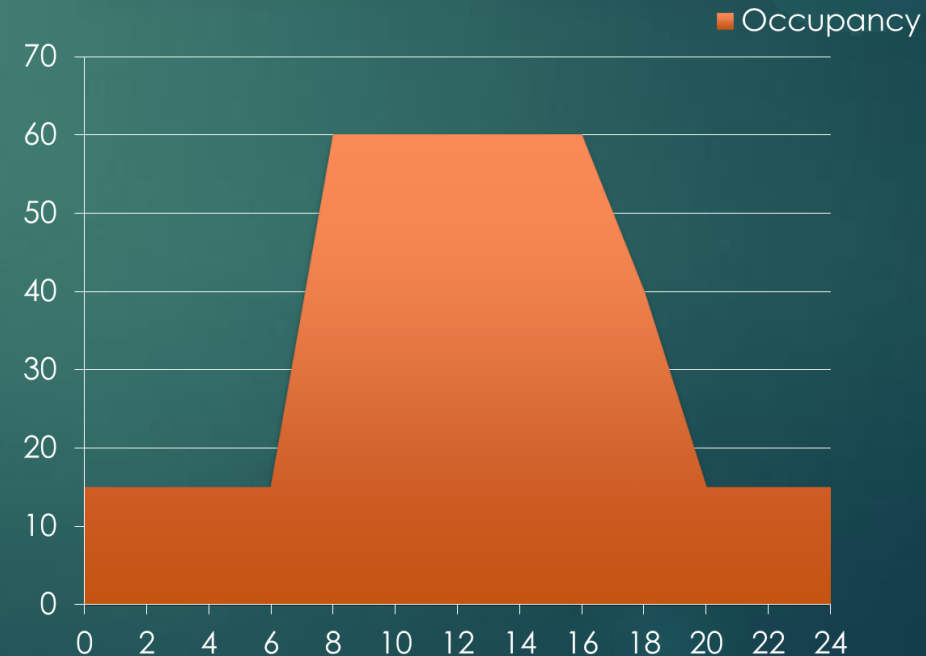office: 1216 m^2
server: 2862 m^2

Final 3D model

Sizing

▶ 1232 racks

▶ 4 kW per rack

▶ Total area for servers: 2862 m^2

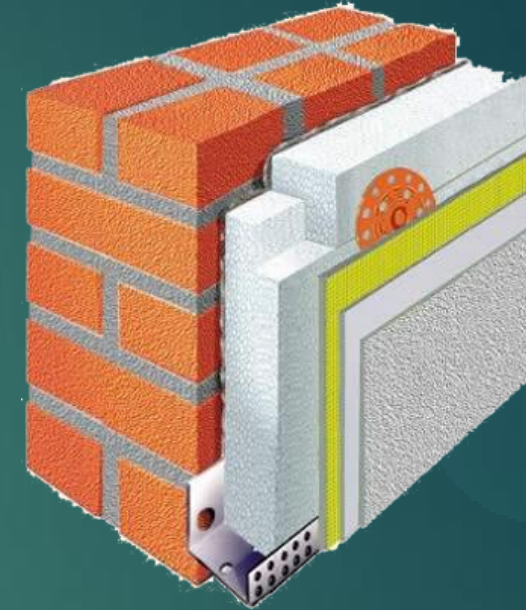▶ Open spaces for psychological comfort

▶ 90 employees

▶ Total area 1216 m^2

number of enclosures: 176
number of server:1232
total power:4.9MW

Occupancy

Materials

▶ Server room

Material	Lamb's wool and bricks
Average Thermal conductivity[W/m.K]	0.02

▶ Facilities

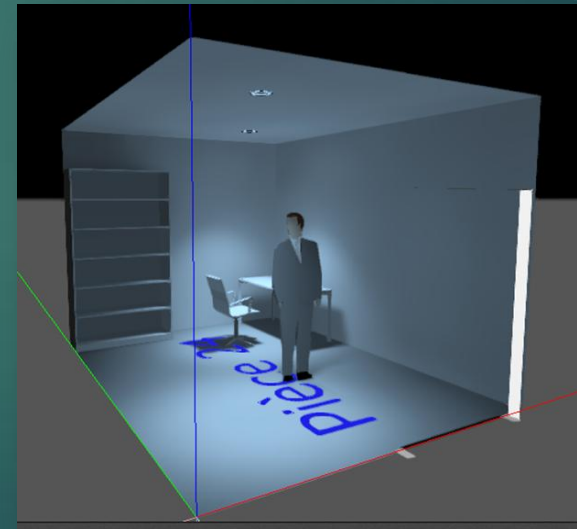Guarantee U<0.15W/m^{2}K

With wall 40 cm thick

Lighting

Server Room

- 2460 Ceiling Smart LED (10 W)
- 526 lux

Facilities

- 162 Ceiling Smart LED (45 W) for the open space , 2 LED in each cellular offices.
- 423 Lux

Lighting

- ▶ Lights with presence control and natural light to reduce energy use
  - ▶ Reduction of 50% in energy use for lighting
  - ▶ Savings of £5400,00 a year

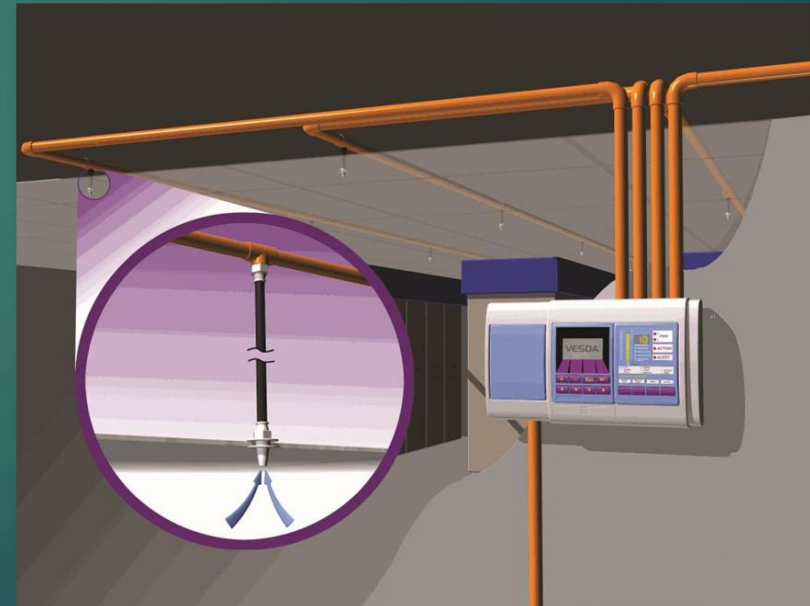- ▶ Building design optimised for natural light

Safety

Security

- Security offices
- CCTV
- Access control with electronic card

Fire System

- Multi point very early smoke detection
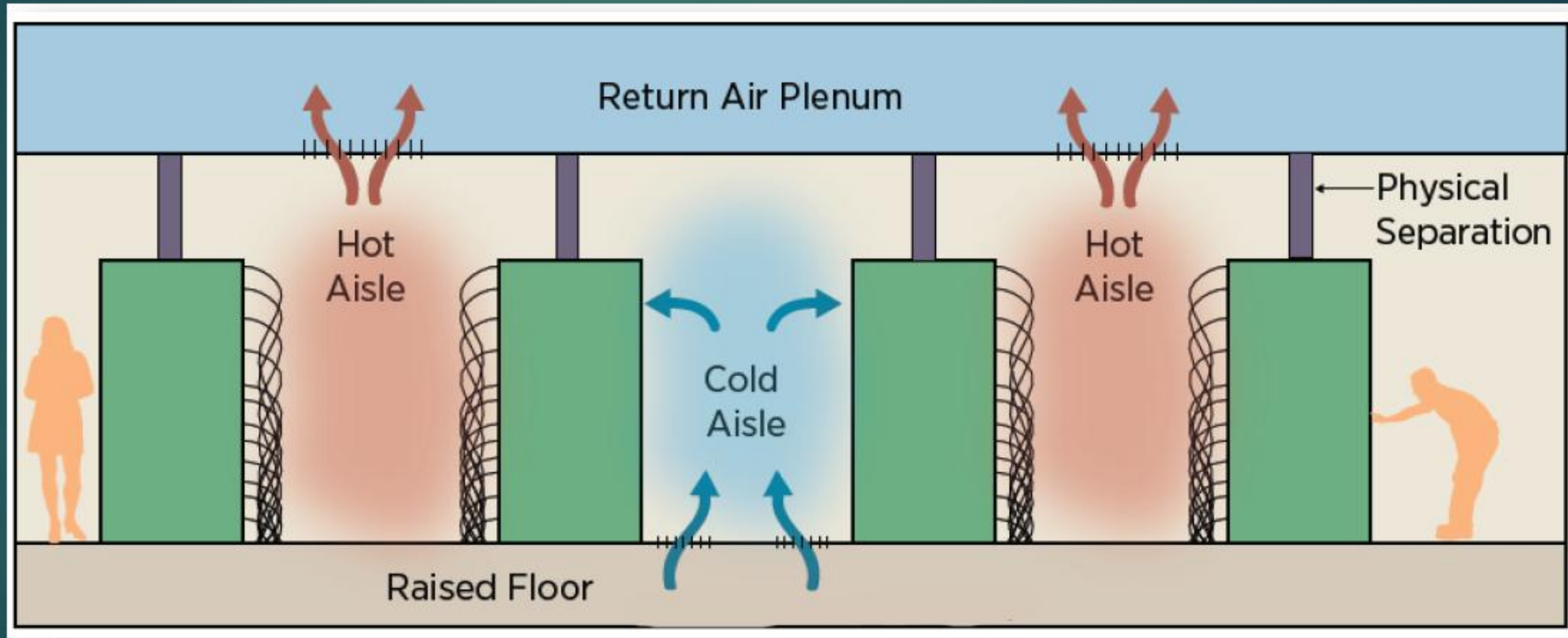- Exctinction by inert gas

Cooling

▶ Methodology: rack density:

$$P_{cooling} = \frac{P_{server} + P_{heat\ gains}}{n° \ of\ servers}$$

▶ Expansion Plan: 50% → P_{server} = 7.5MW

▶ $n° \ of\ servers$ = 1232

▶ $P_{heat\ gains}$ = 15.2 kW

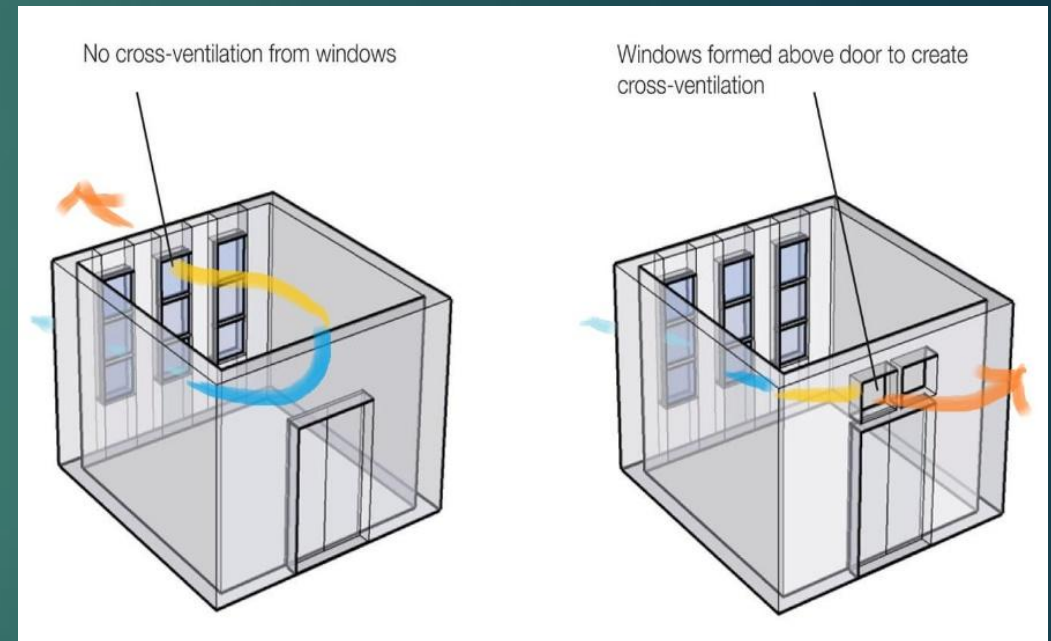▶ Rack Density: $P_{cooling} = 6.1\ kW/rack$

Ventilation

- Cold and Hot Aisle Isolation

Ventilation
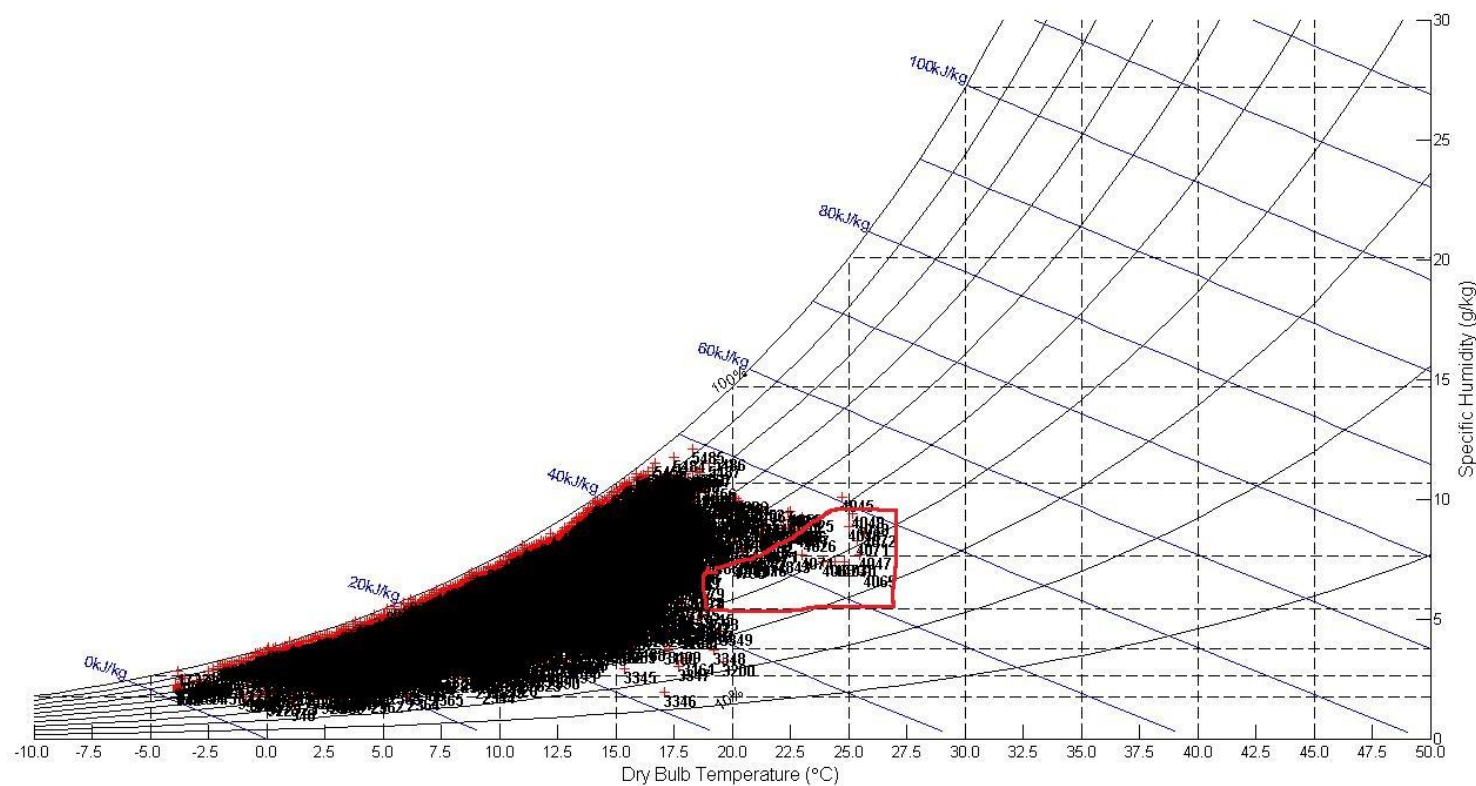
▶ Final ventilation plans

- Server cooling Mass Rate: (ASHRAE Recommendation): 0.4223 kg/s.rack

- Server Inlet air temperature:18C. Outlet air temperature: 34.7C

- Air flow in the office: (0.45Kg/s Recommendation)

- Air flow(Real): If heating: 0.65Kg/s. If cooling: 1.35Kg/s.

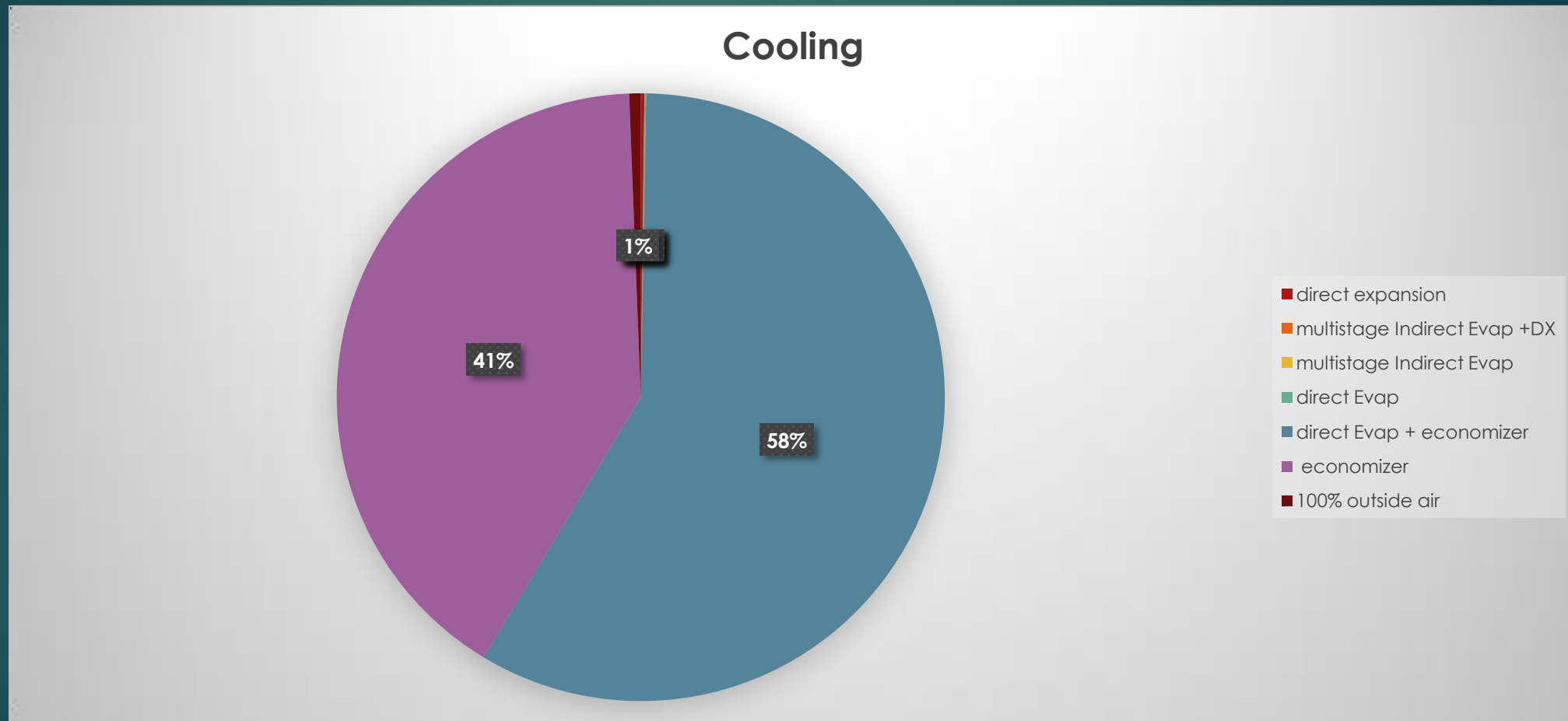No cross-ventilation from windows

Windows formed above door to create cross-ventilation

Psychometric Bin Analysis – from Falkirk

Cooling viability

Cooling

1%

41%

58%

- direct expansion
- multistage Indirect Evap +DX
- multistage Indirect Evap
- direct Evap
- direct Evap + economizer
- economizer
- 100% outside air

PUE

- For high efficient datacentre <1.2

Technology

coolers							
AFL34R220							
air flow/rack m^3/s	power/rack W	total power	total airfllow (m^3/s)	power/cooler W	airflow/cooler m^3/s	number of coolers using power	number of coolers using air flow
0.344772	6100	7515200	424.7591	220000	30.9	34.16	12.4344
for N+1	**36coolers**						

humidifier				
ENS 18 30 960				
Worst case humidity Kg_water/kg_air	Minimum required Kg_water/kg_air	Total Air flow kg/h	Water added Kg_water/h	Water/humifier kg_water/h
0.0013348	0.0063	1873188	9300.751	18
total	**517humidifiers**			

Energy spent in the server room

Energy and costs for the server room
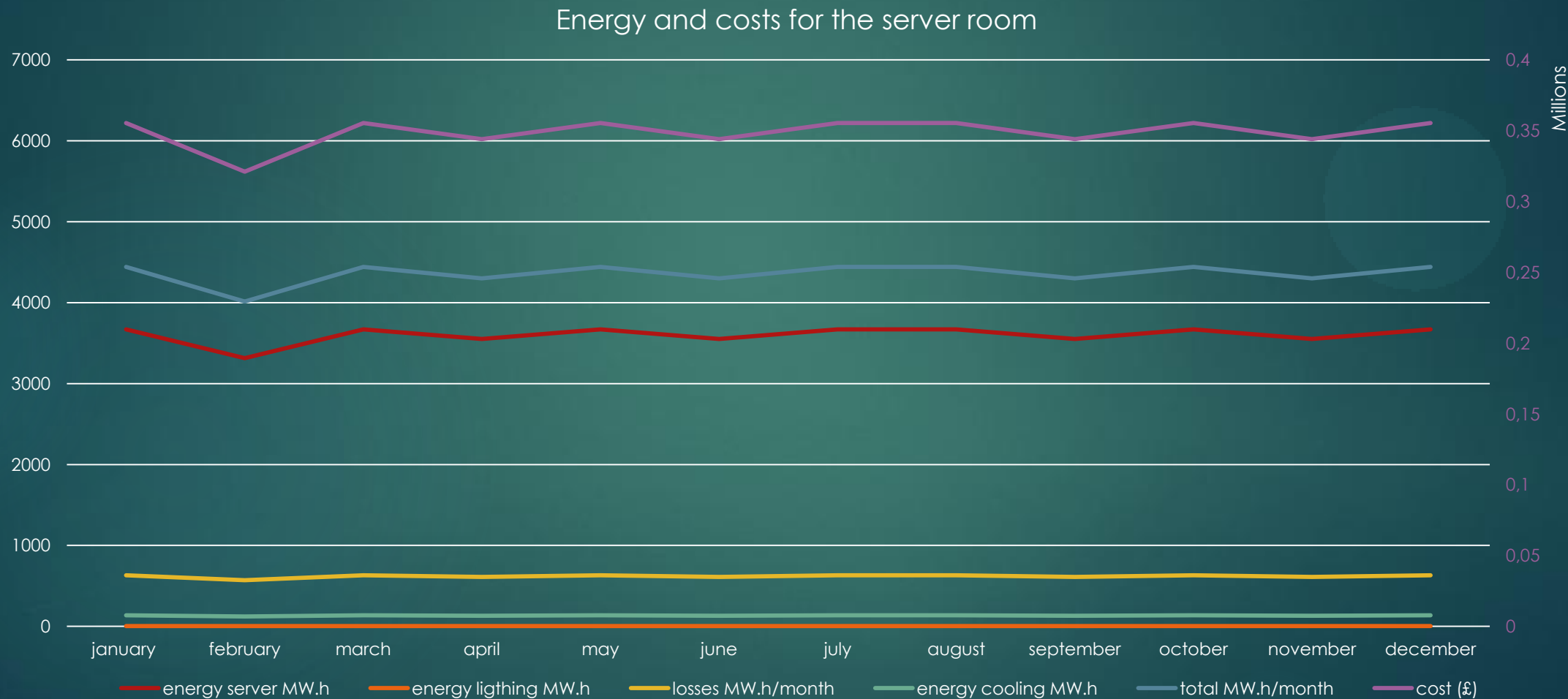
Energy and costs for running the office

Energy savings in the office

energy (kW.h)   costs (£)
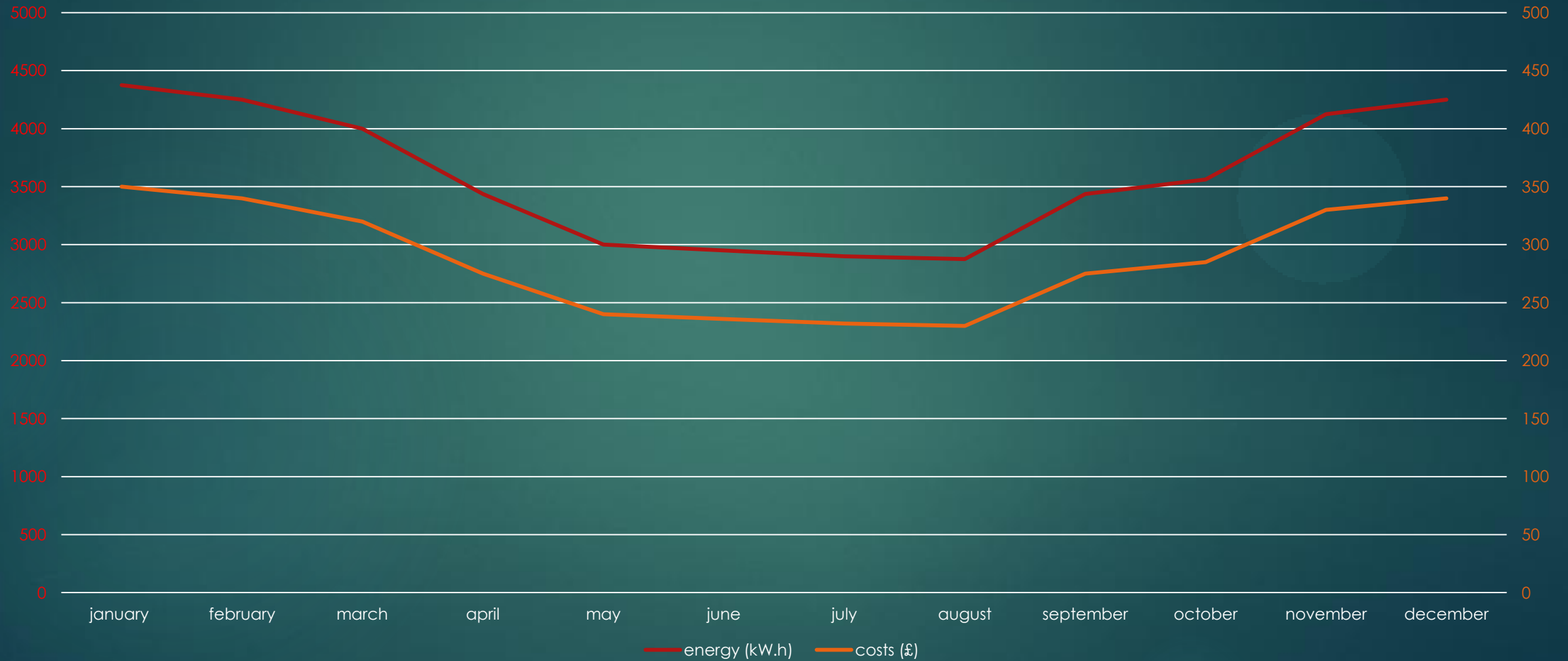
Energy savings in the office

Energy spent in the office
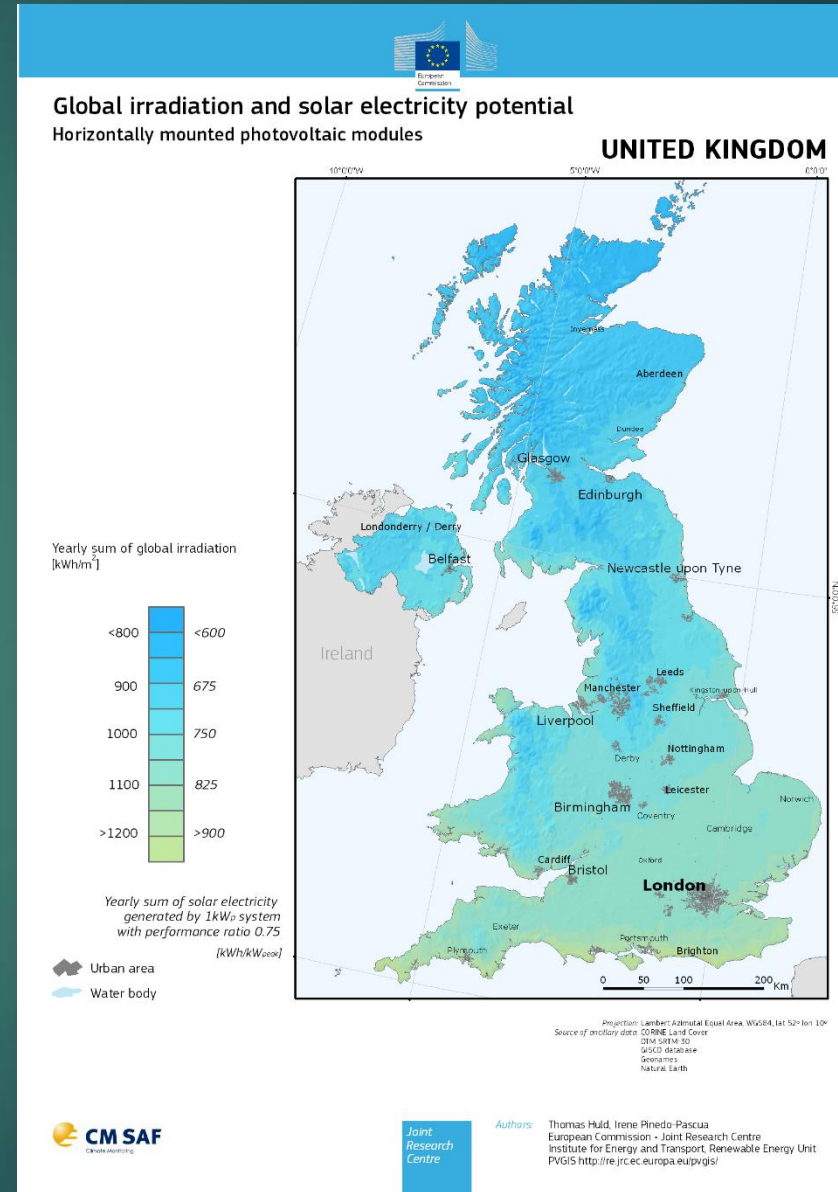

| energy (kW.h) | costs (pounds) |
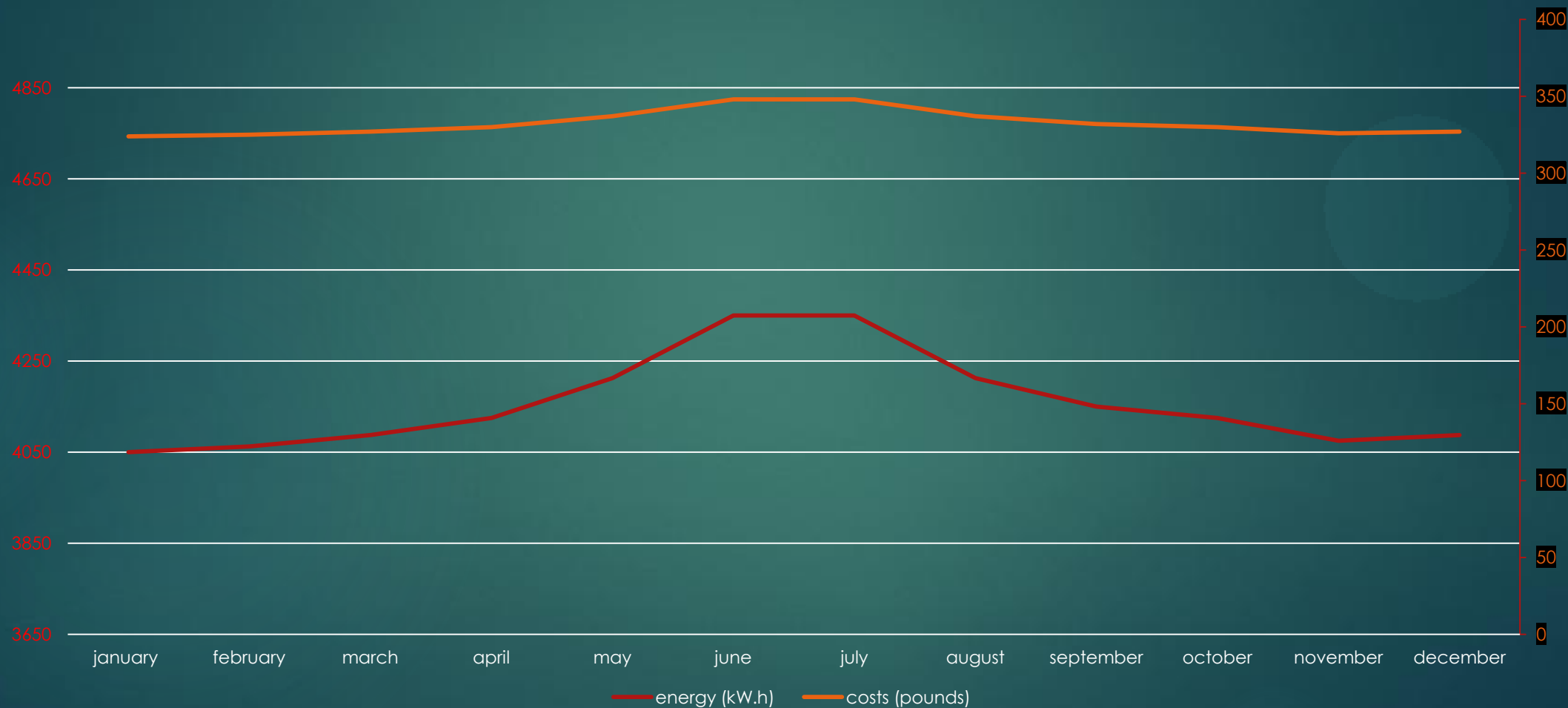
Hot water supply

- Hot water 40°C, occasionally heated to 60°C.

- 55l/person/day -> 1200l storage.

- 87% to 99% of hot water supplied by solar. (142m² of SPC)

- Biomass boiler will supply the rest and heat water to 60°C

Energy generation

- ▶ Part of solar electricy: with 50000m² (¾ of the site area + the server room roof)

- ▶ Savings of 14%

total energy	in 1 year		total cost	
data centre	52366	MW.h	4189280	pounds
solar	7527.656	MW.h	602212.4	pounds
savings	14.37508229		%	

Global irradiation and solar electricity potential
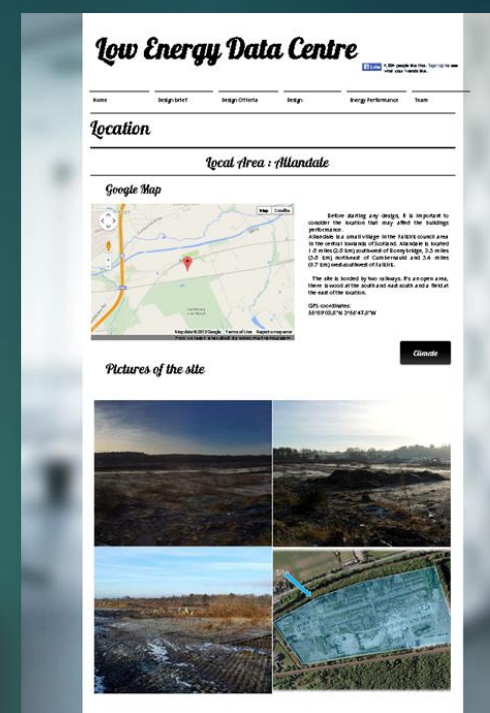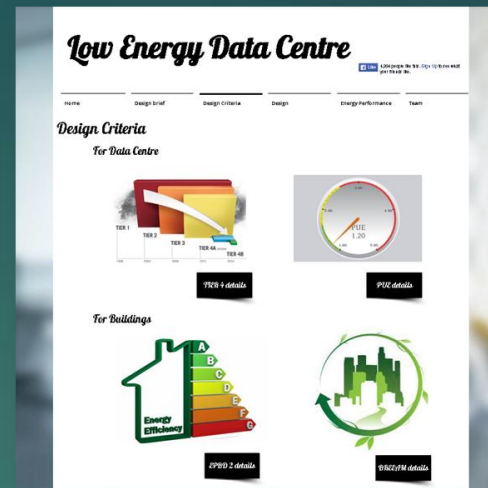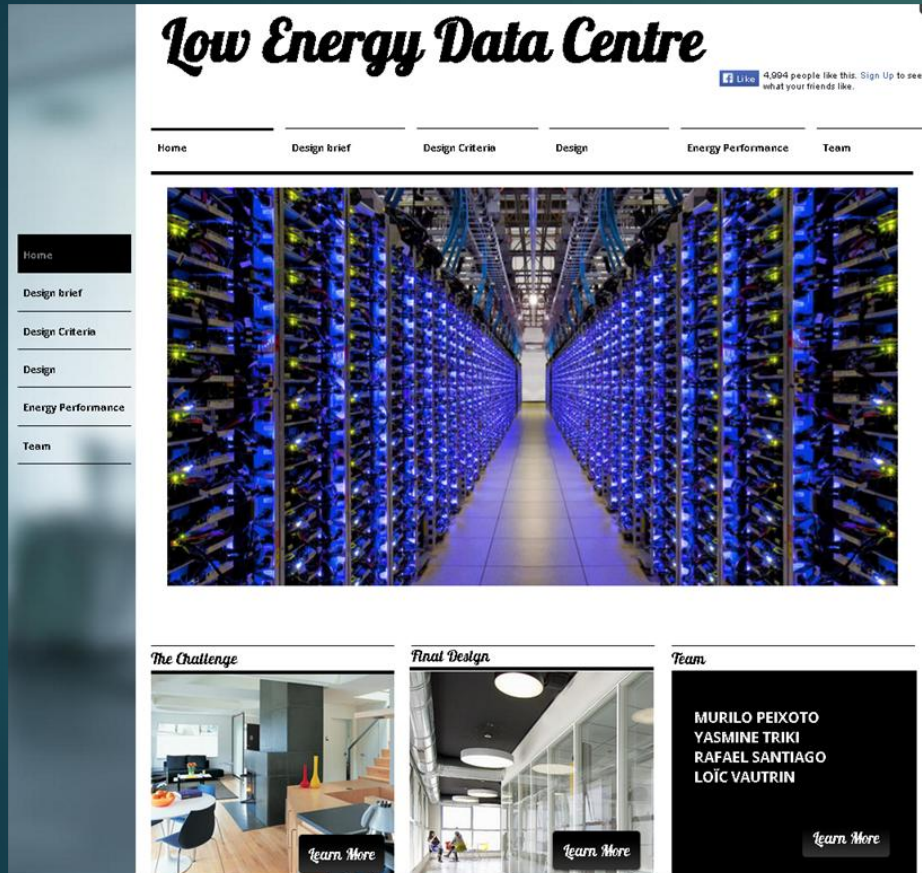Horizontally mounted photovoltaic modules

UNITED KINGDOM

Conclusion

- 99% of free cooling
- PUE=1.2
- Tier 4 standard
- 100% office heating
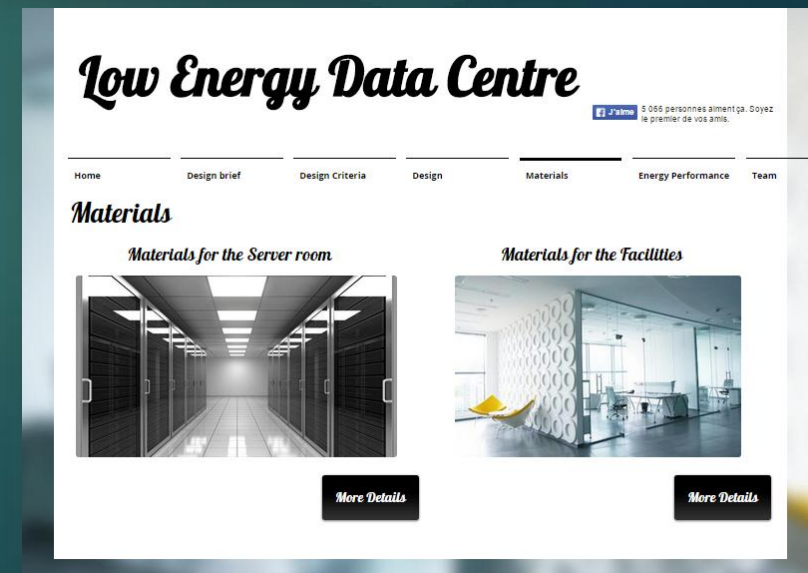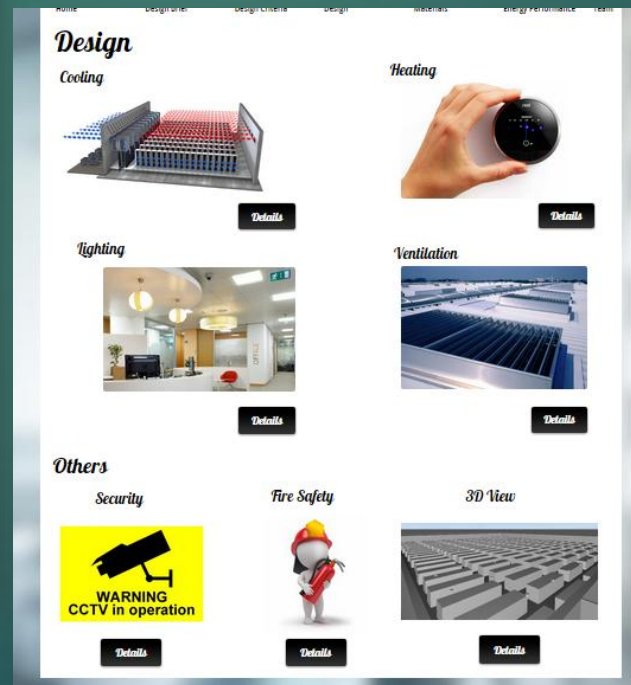- Amount of renewables used

Thanks for your attention.

Any Questions ?

Web Site

Backup power

- Diesel generators

- 1.5 MW generators

- N+1=5 generators