

Data Centre Efficiency

The EU Code of Conduct, operated by JRC

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My Background and Some Data-Centre History

'75..'82 Search for Nuclear Particles: Heavy Ions $Z > 103$

- Cyclotron @ Hahn-Meitner Institute Berlin $\text{Kr}^{84} \rightarrow \text{Pb}^{208}$
- UNILAC @ GSI Darmstadt ($\text{Mt}^{278}, \text{Ds}^{281}$) $\text{Ni}^{62,64} \rightarrow \text{Pb}^{208}, \text{Bi}^{209}$

Magnetic Spectrometer Focal-Plane Detector (6 par.)

- Capable to identify Z (12...120), M (10..300), E (< 8 MeV/amu; ~ 0.8 GeV)
- Event Rates

Experiment	Detector	Electronics /ADC
100'000	-> 10'000	-> 2000 events/s

Data Rates:	360 Mbyte / hour	(100kb/s)
Data Transfer:	360 Mbyte / 5 min	(1.2 Mb/s, walking with disk-packs)
Data Analysis:	10x...30x Beam time	(3x DEC VAX 11/780+ Vector Proc.)

I walked away in 1982.....

(...just before $Z=109$ was detected...)

... having **not the faintest idea about energy consumption**

... but having a clear idea on:

- **how particles behave in electromagnetic fields**
- **how particles interact with matter**
- **how particles separate in electric fields**

... and moved from ionization chambers
to

photovoltaic solar cells

anyway... bosons

The Renewable Energy Unit Portfolio

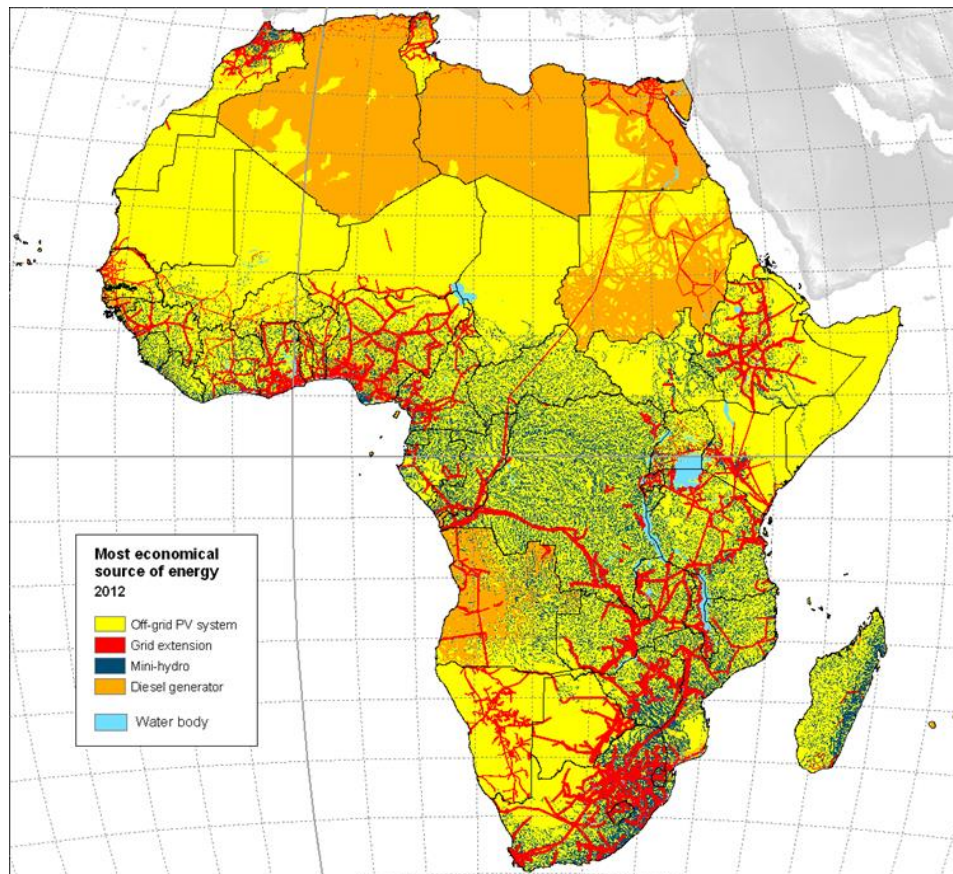
Renewable Energy Mapping & Monitoring

- Resource maps solar, wind, biomass
- Monitoring Memberstate's progress
- Capacity building in Africa
- Costs of technologies

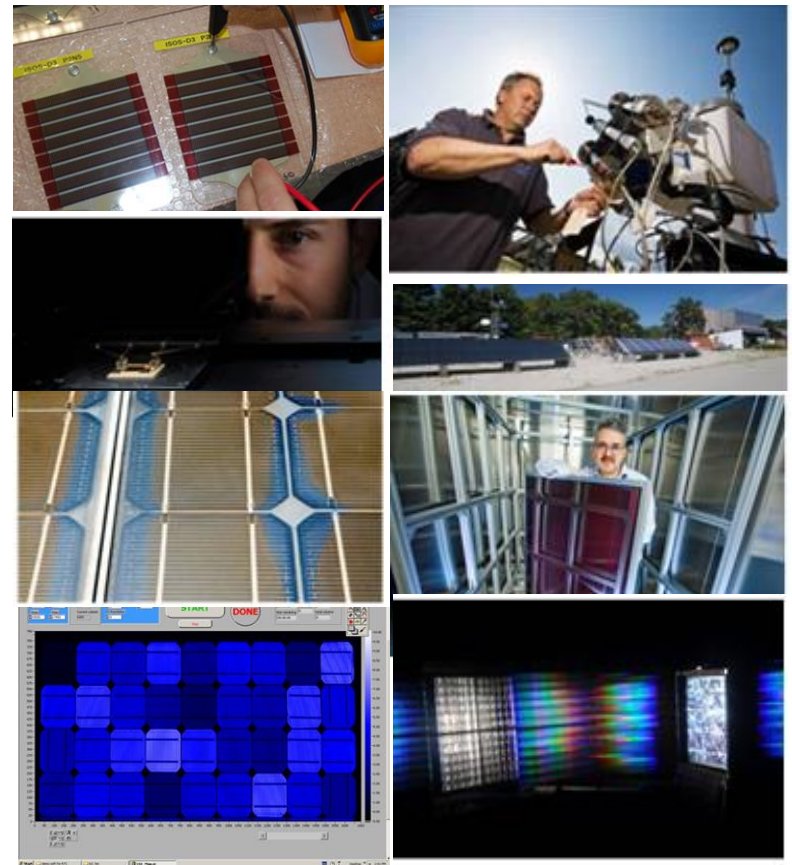
Photovoltaic Test Lab

- Operational Lifetime
- Electrical Performance
- Quality Standards
- New Technologies

Renewable Maps



PV-Test Lab ESTI



The Renewable Energy Unit Portfolio (2)

End-use Energy Efficiency Instruments and Policies for

Products

Eco Design Directive

Electrical Products

Industrial Motors

Data Centers

Buildings

Labelling Standards

Net-Zero Buildings

Financing Retrofit

Scenarios

Green Bldg. Award

Cities

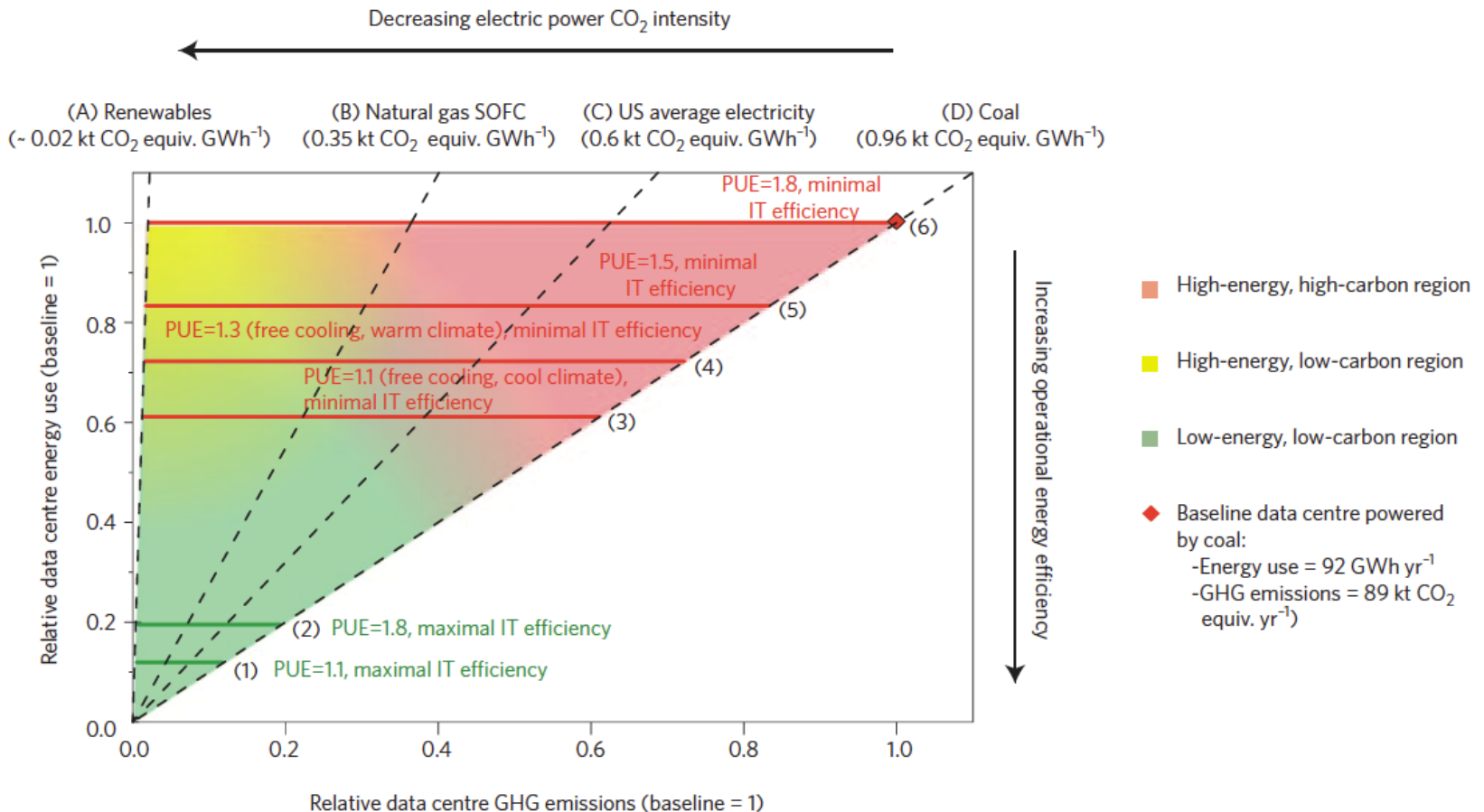
Covenant of Mayors

Sustainable Energy

Action Plans

Smart Cities

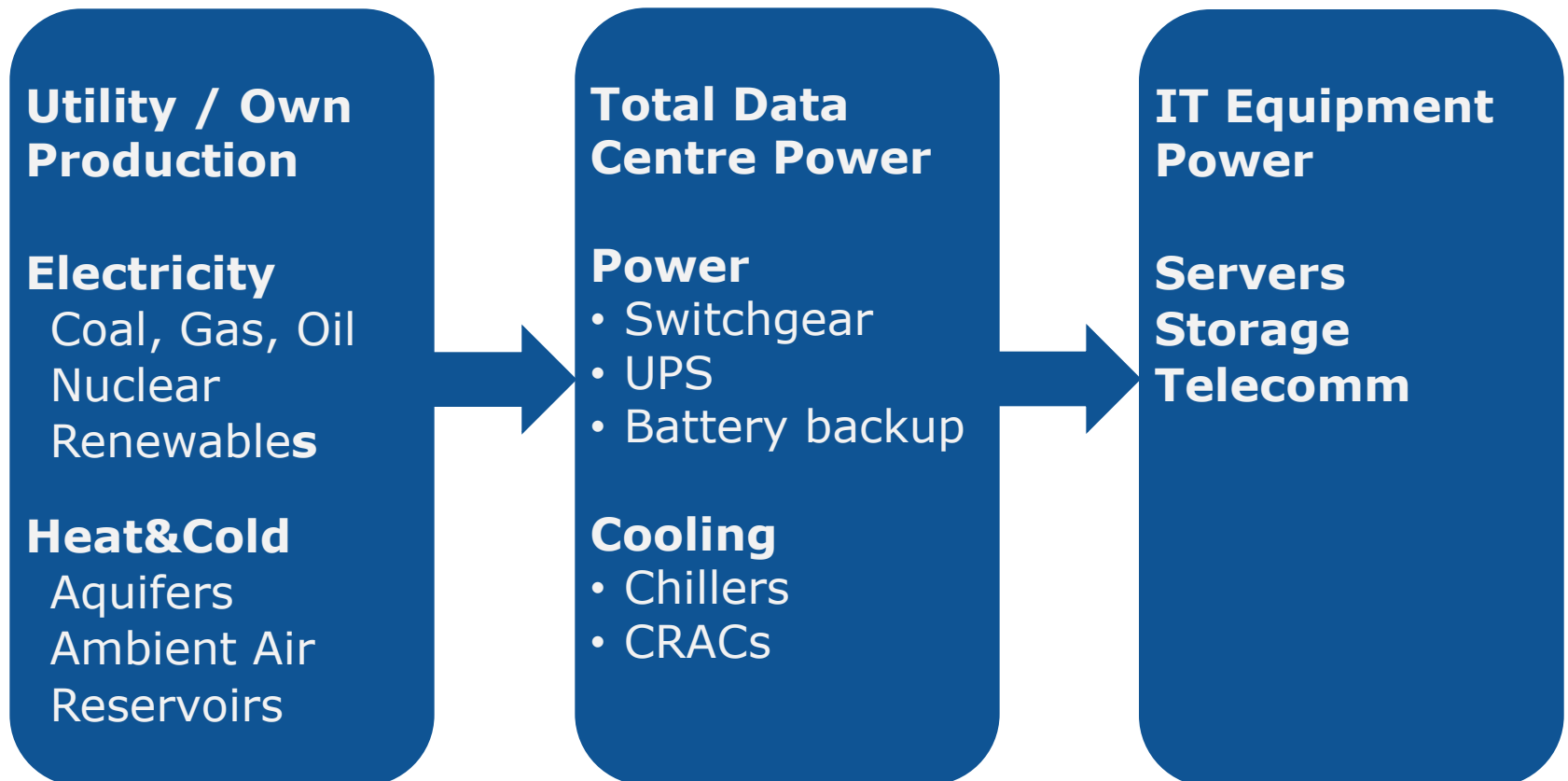
Low Carbon Data Centres



Metric: Power Usage Effectiveness (PUE)

$PUE = \text{Total data centre power} / \text{IT equipment power}$

$(DCiE = 1/PUE)$



EU Research "Renewables for Data Centres"

RenewIT develop a web-based planning tool to estimate costs related to building a facility that uses renewable energy, such as wind, solar and biomass, for power, as well as for cooling, with air and sea water.

- Catalonia Institute for Energy Research (IREC)
- Barcelona Supercomputing Centre (BSC)
- Loccioni Group of Italy
- AIGUASOL
- Amsterdam-based datacentre design specialist DEERNS
- Technische Universität Chemnitz.

The EU Code Of Conduct for Data Centres



- responding to increasing energy consumption in data centres
- informing and stimulating operators to reduce energy consumption
- understanding data centre's energy demand; raising awareness and recommending best practice and targets
- is a voluntary initiative aimed to bring interested stakeholders together
- Operated and maintained by the JRC

Joining the EU Datacentre CoC

As Endorser

Supply chain

- Develops products, solutions and programmes to meet the goals of the CoC
- Intervenes in the building, design and operation
- Energy Efficiency Charter, training, demand side management, Financing
- Best Practice Commitments

As Participant

Owners and Operators

- Implement action plan
- Monitor energy consumption
- Report results annually
- Communicates Scope Nature and initial measurement

**More than 250
Endorsers / Participants 2013**

Yearly Data Centre Code of Conduct Awards

Categories

1. New Data Centres
2. Refurbished Data Centres
3. Endorsers



ARM Ltd - Cambridge, UK



- **Power Usage Effectiveness 1.05**
- High-Density data centre (up to 24kW per cabinet)
Tier-3, lights out facility
365 Freon-Cooling
- Efficient Flywheel UPS (98% at 100% load and still 96% at 40% load)
- 100% Renewable Energy
- Rain Water recapture
- Energy Efficient Transformer
- No Waste in the Construction

Category: New Data Centre

Capgemini Merlin, Swindon, UK



- **Power Usage Effectiveness 1.2**
- fresh air cooling
- modular sized rooms
- highly efficient air 3-stage climate cooling unit on module level: fresh air, evaporative, direct expansion R410a (DX)
- flywheel UPS
- The *Trend* Building Management System (BMS)

Category: New Data Centre

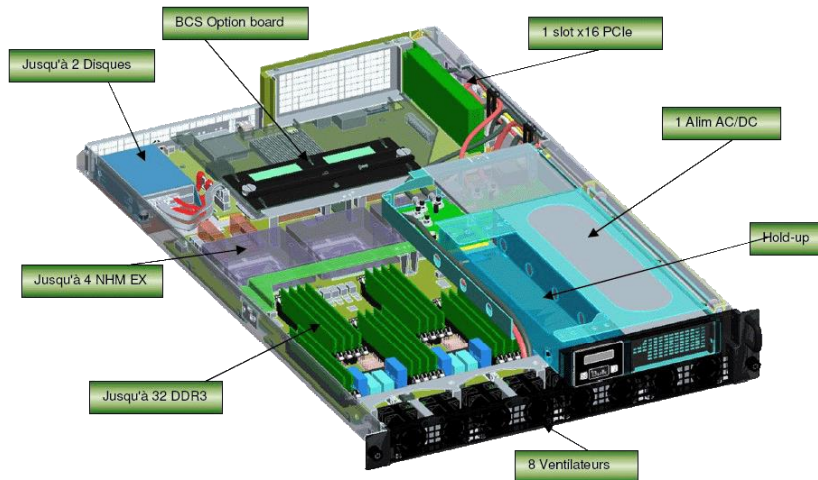
Equinix – Amsterdam, NL



- **Power Usage Effectiveness <1.2**
- 17,800 m² of gross space in Amsterdam Science Park, one of Europe's most network-dense locations.
- Aquifer Thermal Energy Storage (ATES) combined with hybrid-cooling towers.
- Fresh air cooling
- generates hot water for the neighbouring University
- PUE of 1.2 or less

Category: New Data Centre

CEA-DAM TERA 100, Bruyères-le-Châtel, FR



- For Tera-100, the first petascale system hosted at CEA with the vendor of the supercomputer in a joint R&D effort
- high density racks; passive devices to reduce the usage of UPS units.
- Water cooled doors with air/water heat exchanger, big fans and a regulation system.
- Ultra Capacitor Module (UCM) in each enclosure.

Category: Refurbished Centre

eBay Inc –Phoenix (AZ), US



- 6,039 square meters of raised floor technical space. rack line-ups in a hot aisle/cold aisle arrangement;
- Site wide use of blanking panels .
- High Efficiency Cooling Plant CRAC
- VFDs on all white space CRAH units
- floor wide temperature sensor network
- installation of ultrasonic humidification

CRAC: Computer Room Air Conditioning
CRAH: Computer Room Air Handler
VFD: Variable Frequency Drives

Category: Refurbished Data Centre

Unilever, Chester Gates, Chester, UK



- **PUE now 1.41 down from 1.68**
- fresh air as a free cooling medium
- closed cell-close control ("4C")
- replacement of legacy non-free cooling chillers, pumps and CRAC units with high capacity components
- smart LED lighting
- ultrasonic humidification.
- newer server and storage technologies

Category: Refurbished Data Centre

Migration Solutions Ltd, Norwich, UK



- Fresh air cooling chillers
- cooling is only when outside temperature is above 20°C
- Metering at every point in the electrical systems
- All cabinets in a Cold Aisle arrangement
- Blanking panels in all cabinets
- 100% LED lighting throughout the data centre
- Equipment to capture and re-use the heat

Category: Refurbished Data Centre

Google, St. Ghislain, Belgium



- **PUE of 1.10 for 2010**
- 100% "free cooled" using cooling tower evaporative cooling
- 100% recycled water, pulled from an industrial canal
- elevated cold aisle temperatures
- 99% efficient on-server batteries replace traditional UPS
- 90% efficient power supplies for servers
- emissions offsetting through Google's corporate carbon neutral commitment

Category: Refurbished Data Centre

Thanks for Attention!

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iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct

www.linkedin.com/groups/EU-Data-Centre-Code-Conduct-1280197