ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

cepe
Centre for Energy Policy and Economics
Department of Management, Technology and Economics

How to Measure and Foster Energy Efficiency in Data Centres? Ongoing work in Switzerland.

Dr. Bernard Aebischer, CEPE/ETH Zürich

Code of Conduct for Data Centres, IEA, Paris, 2. 7. 2007

Summary

- What is a good metric/indicator of energy efficiency
- Why is it so difficult for IT?
- Energy efficiency of infrastructure
- Auxiliary metrics and/or technical specs for sub-systems of central infrastructure
- Quality label for IT-equipment
- Missing: quality of configuration of racks, layout of equipment and of operation/management

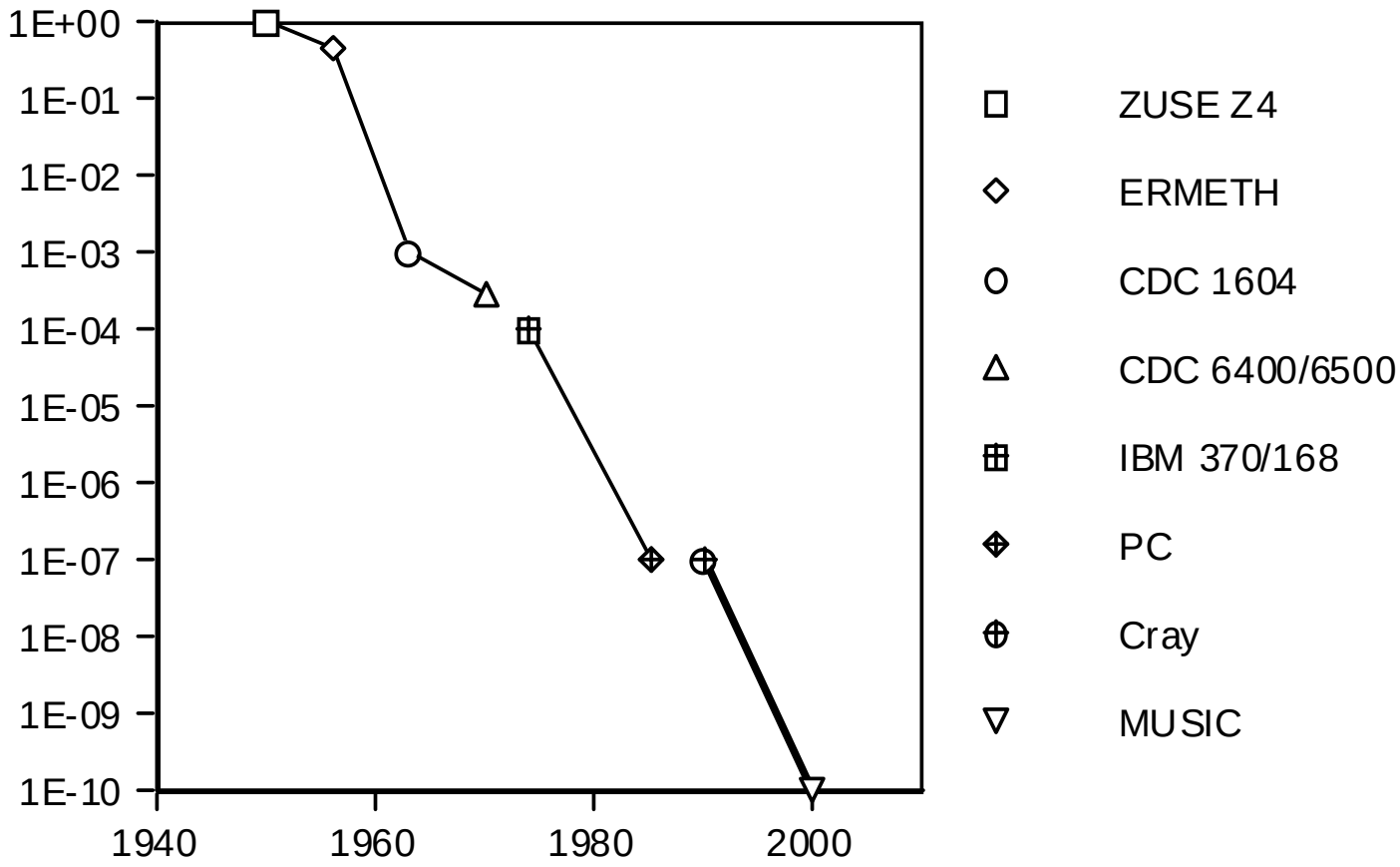
What is a good metric/indicator

1. Energy per energy service
2. Benchmarking: good – bad
3. Technical and organisational measures
4. Best practice/target values → compulsory standards or voluntary agreements

... and why is it so difficult/impossible for IT?

1. Definition and/or measurement of the energy service
2. Technical progress is too fast / life cycle too short

Technical progress in IT: 1/100 in 10 years

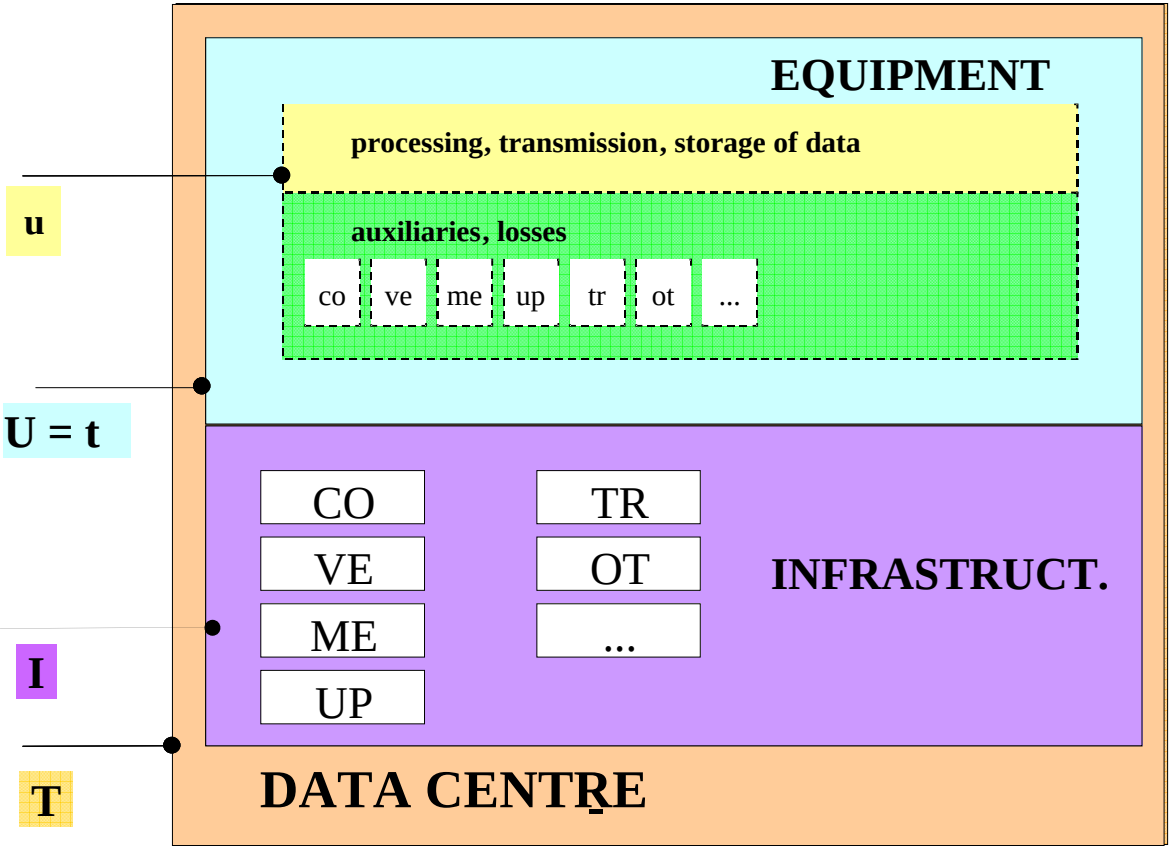


Source: Aebischer/Mutzner/Spreng, 1994, und Aebischer/Bradke/Kaeslin, 2000

What to do?

- Optimise infrastructure (supply of electricity, heat evacuation, “reliability measures”) and operation
- → indicators / metrics considered (Geneva)

Original concept: CEE = C1 * c2



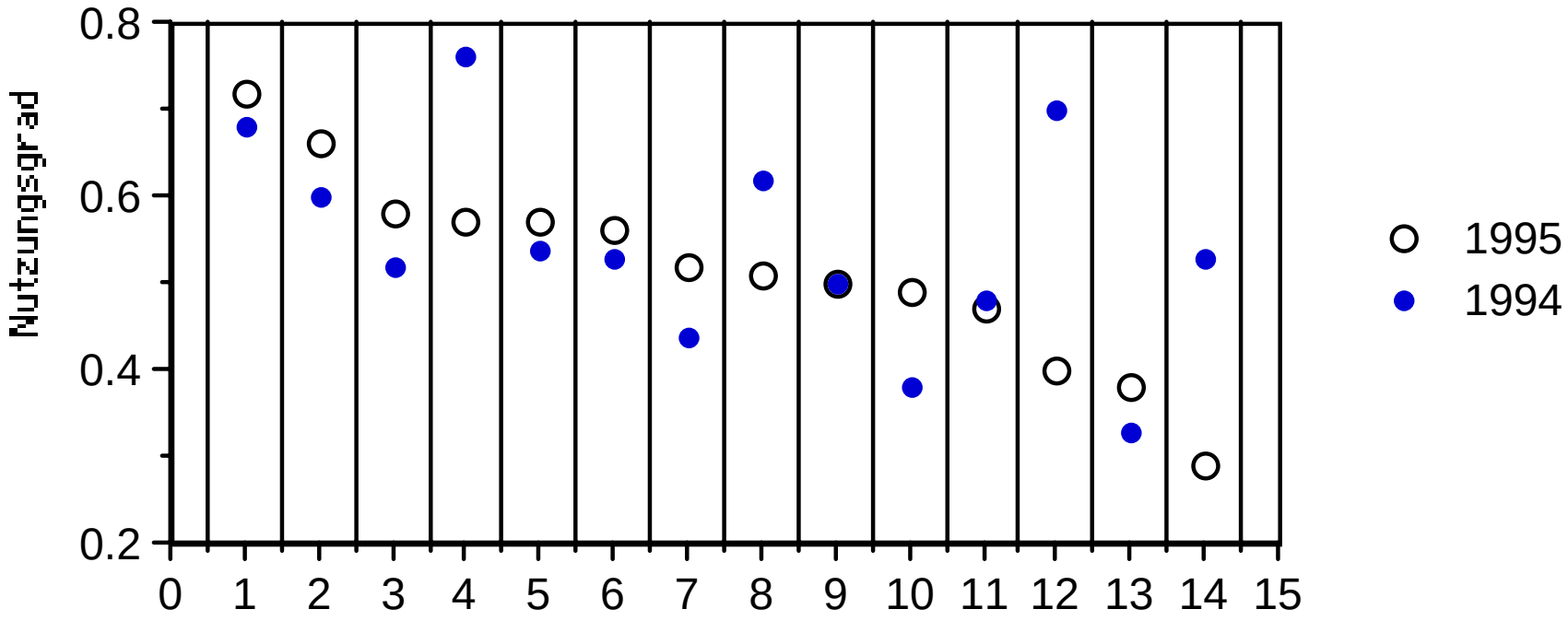
Indicator for over-all energy efficiency:

CEE = u/T
= U/T * u/t
= C1 * c2

- C1 = indicator for energy efficiency of central infrastruct.
- c2 = indicator for energy efficiency of infrastructure of ICT-equipment

C1 is a good indicator

… but a well defined **measurement concept** is essential



C1 in 1994 and 1995 in 14 computer centres in Switzerland
(source: Bänninger (1996) in Aebischer (1996))

Use target values for C1 (voluntary agreement)

Construction and operating permission with target values for C1 (Geneva weather conditions): 0.65 new d. c.

0.55 existing d. c.

Monitoring, benchmarking, adjusting targets

If target not reached → detailed technical specifications to be met ("stick"!)

→ Auxiliary metrics and/or technical specs for sub-systems of central infrastructure, e.g. cooling (Ashrae TC 9.9), supply of electric power (CoC UPS)

c2 is not a good indicator

… because it can not be measured easily

What to do?

- Define efficiency indicators for power supplies, heat evacuation, “reliability” measures , …?
  - Too complex?
  - e.g. how to deal with DC-DC conversions “outside” power supplies?
- Go for quality label of IT equipment and/or
- **Go for CoC with manufactures of IT equipment (e.g. servers)!?**

Problem: from 1 server -> 1000 IT equiment

How to define/measure quality of

- configuration of racks (including redundant layout of power supplies and local UPS) and
- use of equipment (including capacity utilisation)?

→ Education/formation

→ Demonstration/best practice examples

→ **CoC with selected operators** of many data centres**!?**

References/Links

Aebischer B., 2007. Aebischer, 2007. Energieverbrauch und Energieeffizienz in Rechenzentren. Präsentation am 4. Rechenzentrum-Thementag der IBM Schweiz, 25. April http://www.ethlife.ethz.ch/articles/tages/GruenesRZ.html

Aebischer B., Eubank H. and Tschudi W. (2004). Energy Efficiency Indicators for Data Centers, Proceedings of the International Conference on "Improving Energy Efficiency in Commercial Buildings, IEECB'04", Frankfurt, 21 – 22 April. http://www.cepe.ch/download/staff/bernard/Aebischer_IEECB04_final.pdf

Aebischer et al., 2003: Energy- and Eco-Efficiency of Data Centres. Report commissioned by the Canton of Geneva, Geneva, Switzerland http://www.cepe.ch/research/projects/datacentres/data_centres_final_report_05012003.pdf