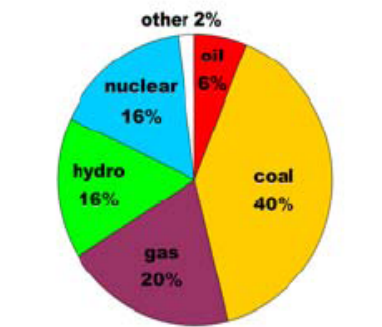
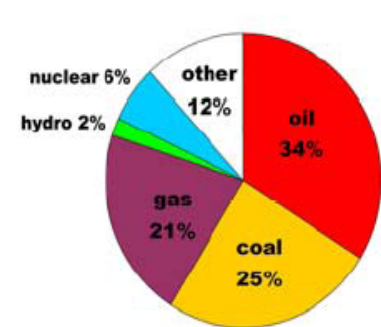
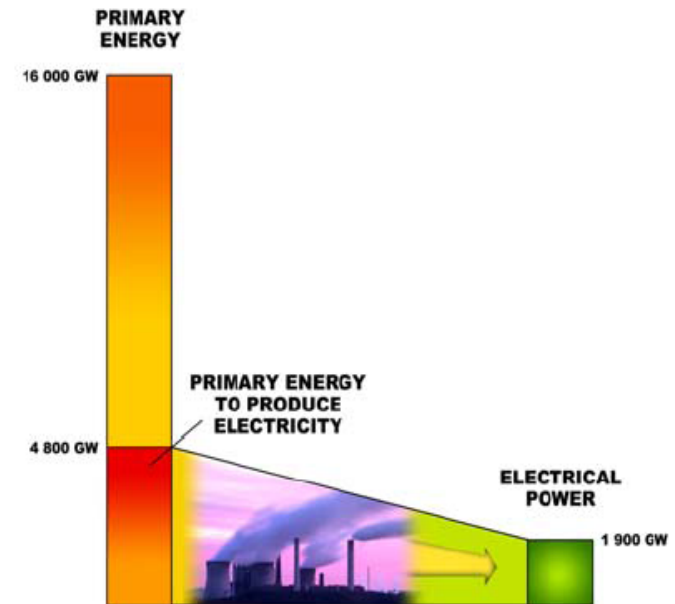


Estimating and mitigating the energy footprint of ICTs

W. Vereecken, D. Colle, B. Vermeulen, M. Pickavet, B. Dhoedt, P. Demeester

- Average energy production 2007
- 16000 GW
- 30% electrical power production.
- Electrical Power Production has a yield factor of 40%
- Primary Energy growth rate of 2% p.a.
- Electrical Power growth rate of 3% p.a.



■ Data center

- Servers, storage, cooling, UPS, ...

■ PCs

- Desktop, Laptop, Screen, ...

■ Network Equipment

- Datacom and Telecom infrastructure, User Premises Equipment
- Not: Data Center Network Equipment, Built-in network interface in PC

■ TVs

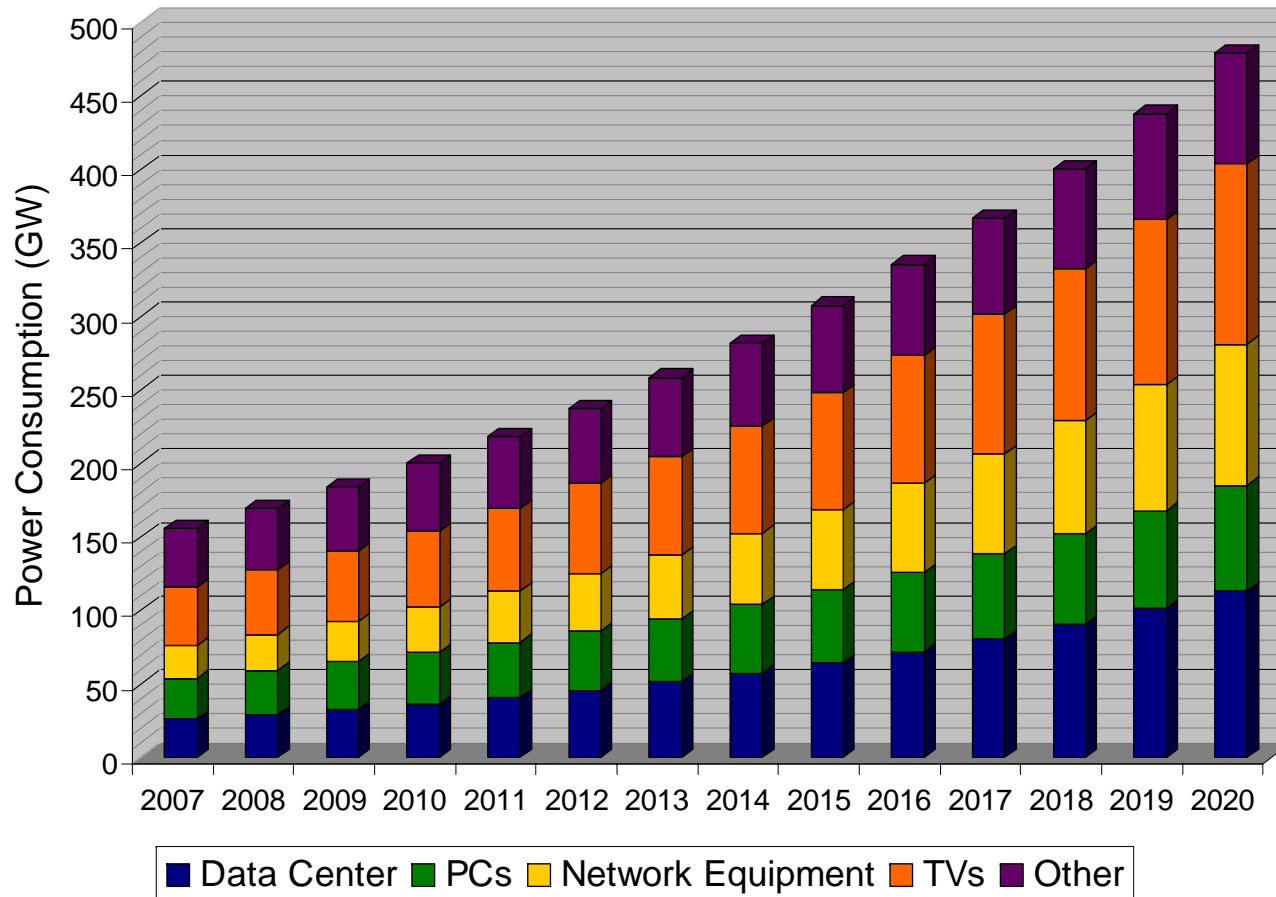
- TV, DVD player, Decoder, ...

■ Other

- Audio Equipment, Game Consoles, Telephones, ...

Equipment Type	Est. Consumption 2007 (GW)	Est. Annual growth rate
Data centers	26	12%
PCs	28	7.5%
Network Equipment	22	12%
TVs	40	9%
Others	40	5%
Total	156	

Yearly Power Consumption Forecast



■ Production of a PC

- 4850 MJ non-electrical energy
- 1550 MJ electrical energy
- \Rightarrow 8700 MJ primary energy

■ Use phase of a PC

- Average use time of 4 years
- 28 W average power consumption
- \Rightarrow 8800 MJ primary energy

- **Currently 2.5 – 3% of worldwide energy consumption**
- **8% of the annual electricity production**
- **In 2020 approx. 14% of worldwide energy consumption**

- **Only use phase!**

■ Individual Devices

- Optimize Hardware
- Optimize Software
- Easy to measure

■ New network paradigms

- Optimize use of network elements
- Eliminate redundant network elements

■ Policy Supporting Studies

- Standards for Power Consumption
- Energy Labels

- **Power consumption growth in ICTs is unsustainable.**
- **When comparing to other sectors primary energy consumption needs to be calculated (\leftrightarrow electrical energy)**
- **Life Cycle Analysis needs to be taken into account**
- **When optimizing focus both on individual devices and network paradigms**
- **Overall impact of new solutions must be taken into account (e.g. FTTH: consumption of network equipment and customer premises equipment)**

Thank you for your attention