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# Energy analysis, conservation and management

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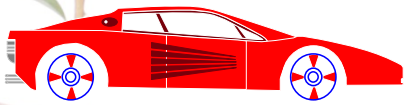
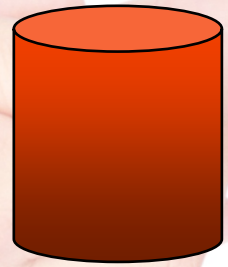
# Just to give you an idea:
# What can 1 kWh do?

- **Lift 1 ton of steel 367 m!**



- **Accelerate a car weighing 1 t to 60 km/h (without losses 305 km/h)!**



- **Heat 1000 l water by 0,86 K!**

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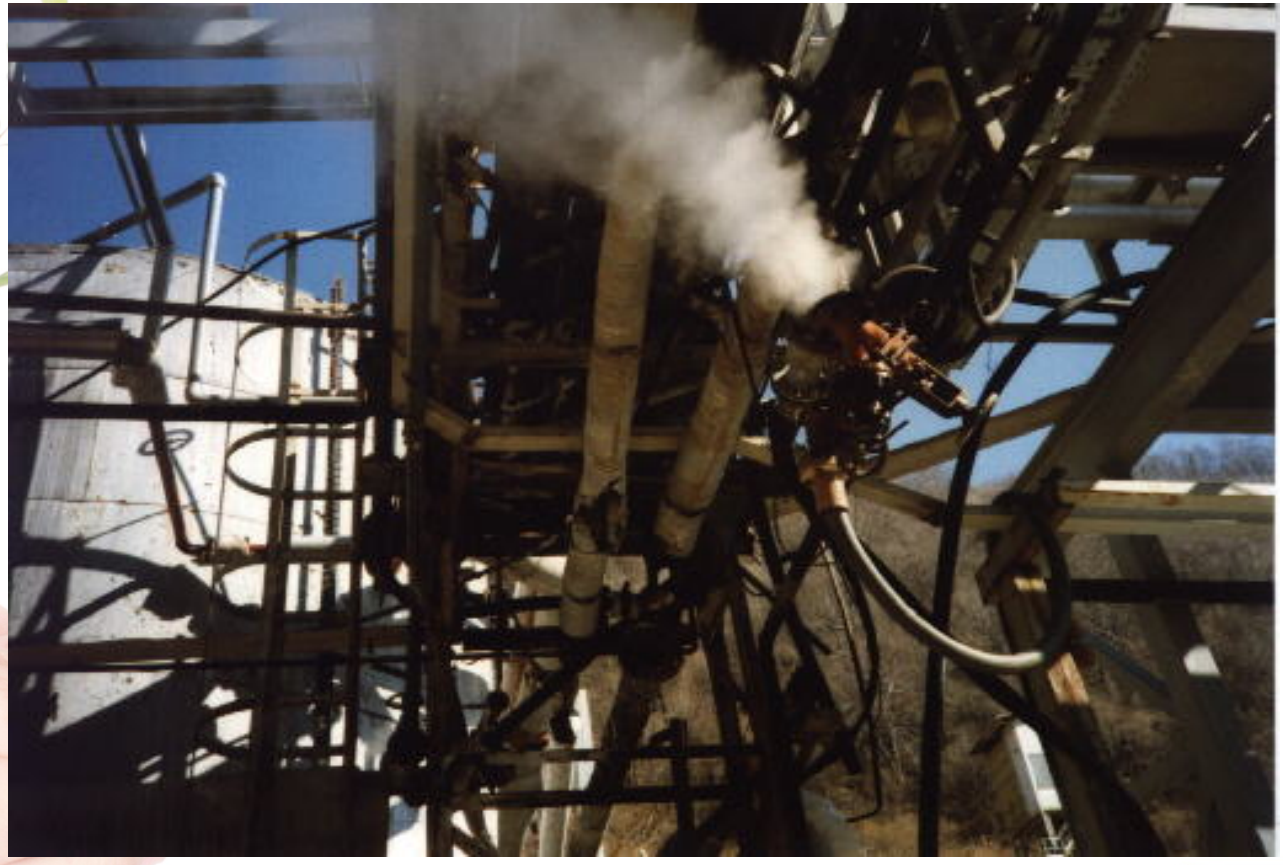
# Energy efficiency is not a question of the latest technology!



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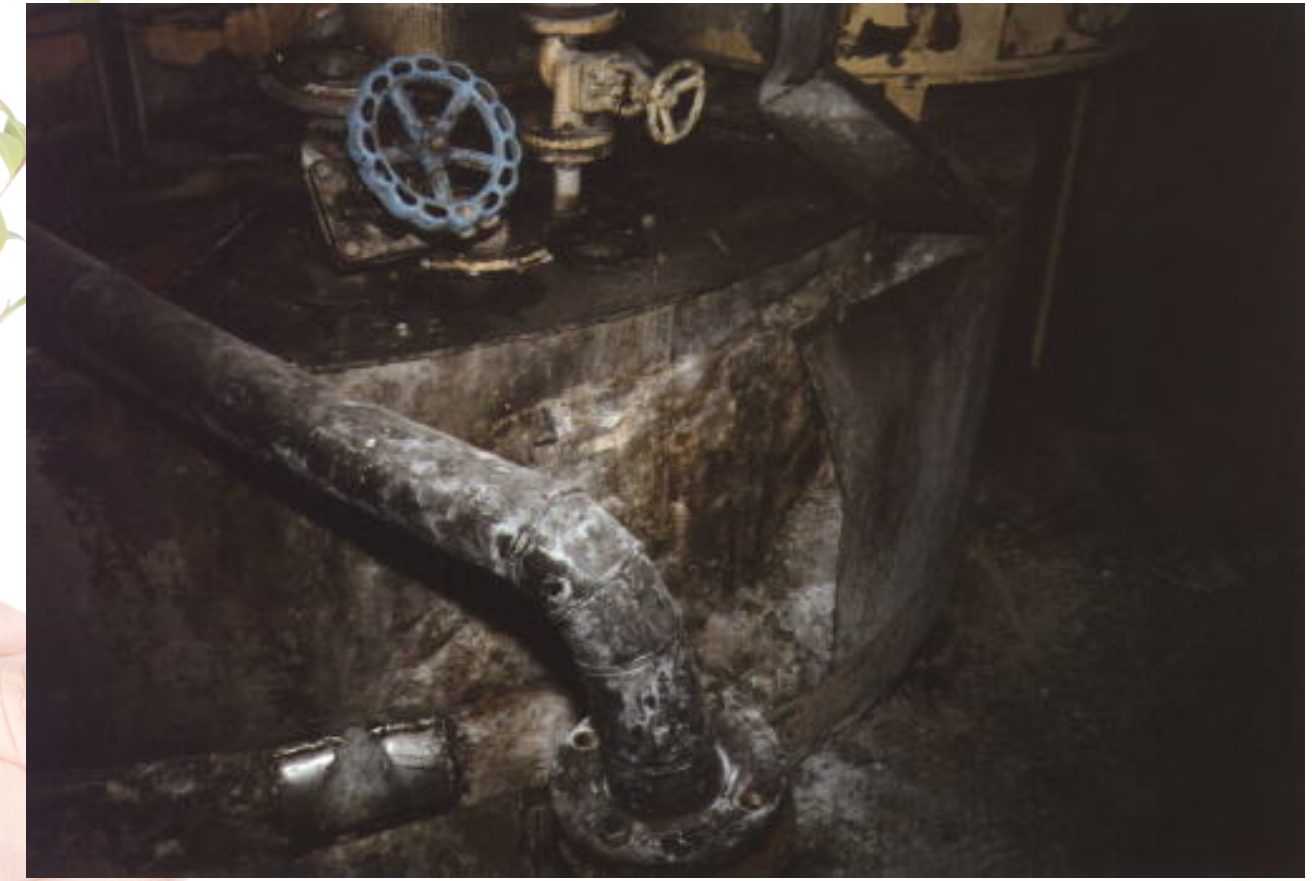
# Energy efficiency is not a question of the latest technology!



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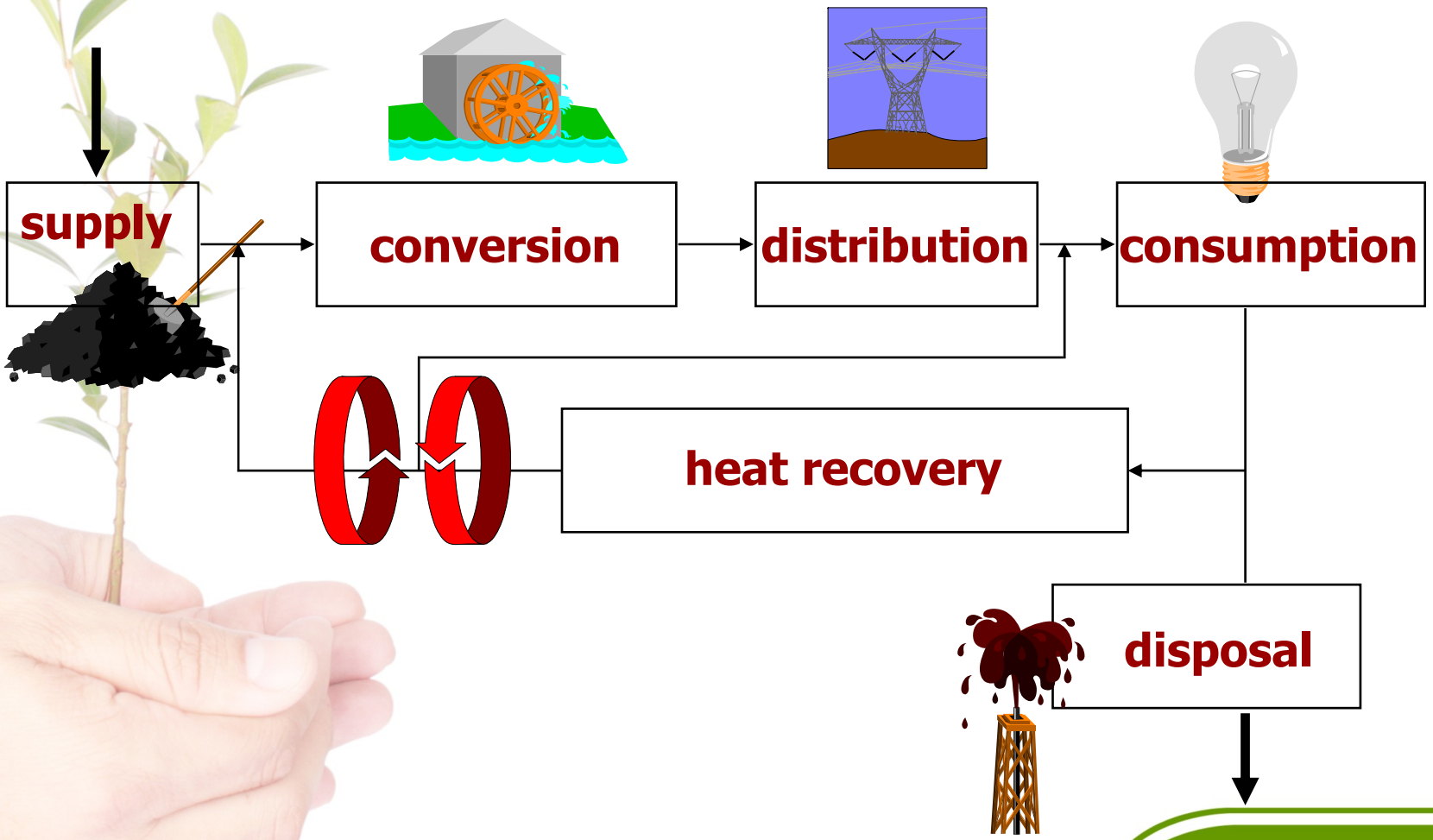
# Structure of a Company's Energy System:



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# Special Relevance on Energy Supply

## The Renewable Resources

- Documentation of renewable energy sources already used
- Planning for future use of renewable energy sources

## The Transport

- Documentation of consumption in the area of traffic caused by
  - supply
  - business trips
  - delivery
  - workers
- Identification and definition of potential savings

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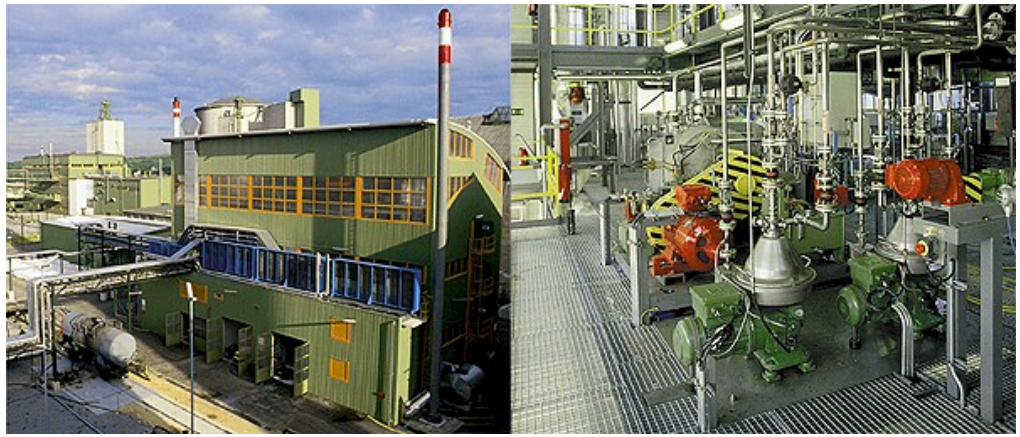
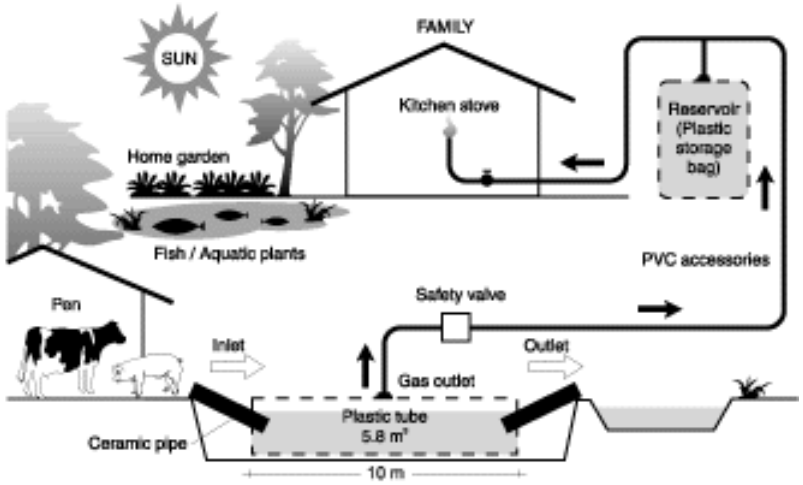
# Change to Regenerative Energy:

- Biofuels
- Biogas
- Water
- Wind
- ...





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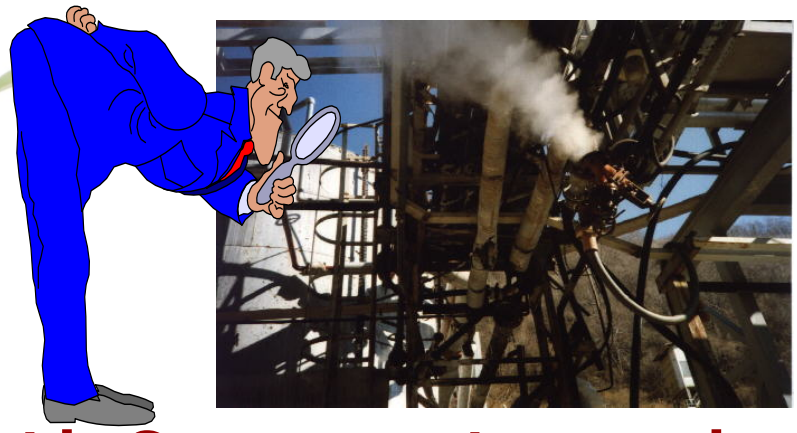
# Energy balancing:



- **Energy cost in German meat processing companies has typically a 2 - 4 % of turnover**
- **Potential for savings with favorable payback typically is 20 - 30 %**
- **Think about this: What is your specific consumption (kWh/100 kg product)?**
- **..... and,... do you know your bills for electric energy and fuels?**

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# So start with the Anual Energy Consumption:

**Collection and documentation for all energy carriers**

- Quantity
- Cost
- Reference quantities
- Definition of indicators

**Analysis and interpretation**

- Distribution of quantities
- Distribution of costs
- Variation of indicators
- Comparison of indicators with other companies or literature

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# Proceed with:
# Energy analysis of the input:

- **Annual consumption** — **bills**
  - **consumption**
  - **indicators**
- **monthly consumption** — **bills (supplier)**
- **weekly consumption** — **meter (supplier)**
- **daily consumption** — **meter(supplier)**

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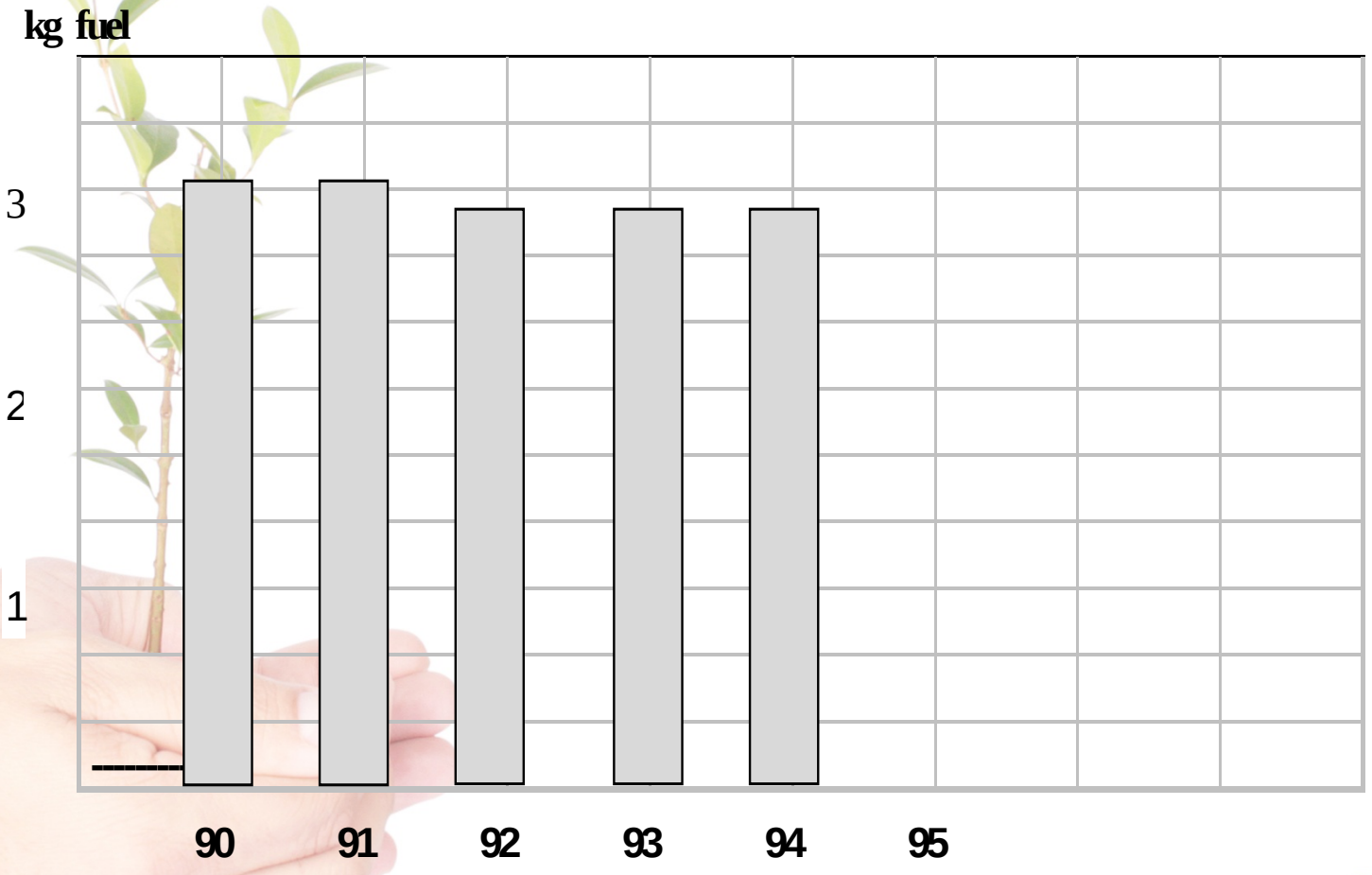
# Worksheet 1b: Graphical representation of the yearly consumption




Unit:

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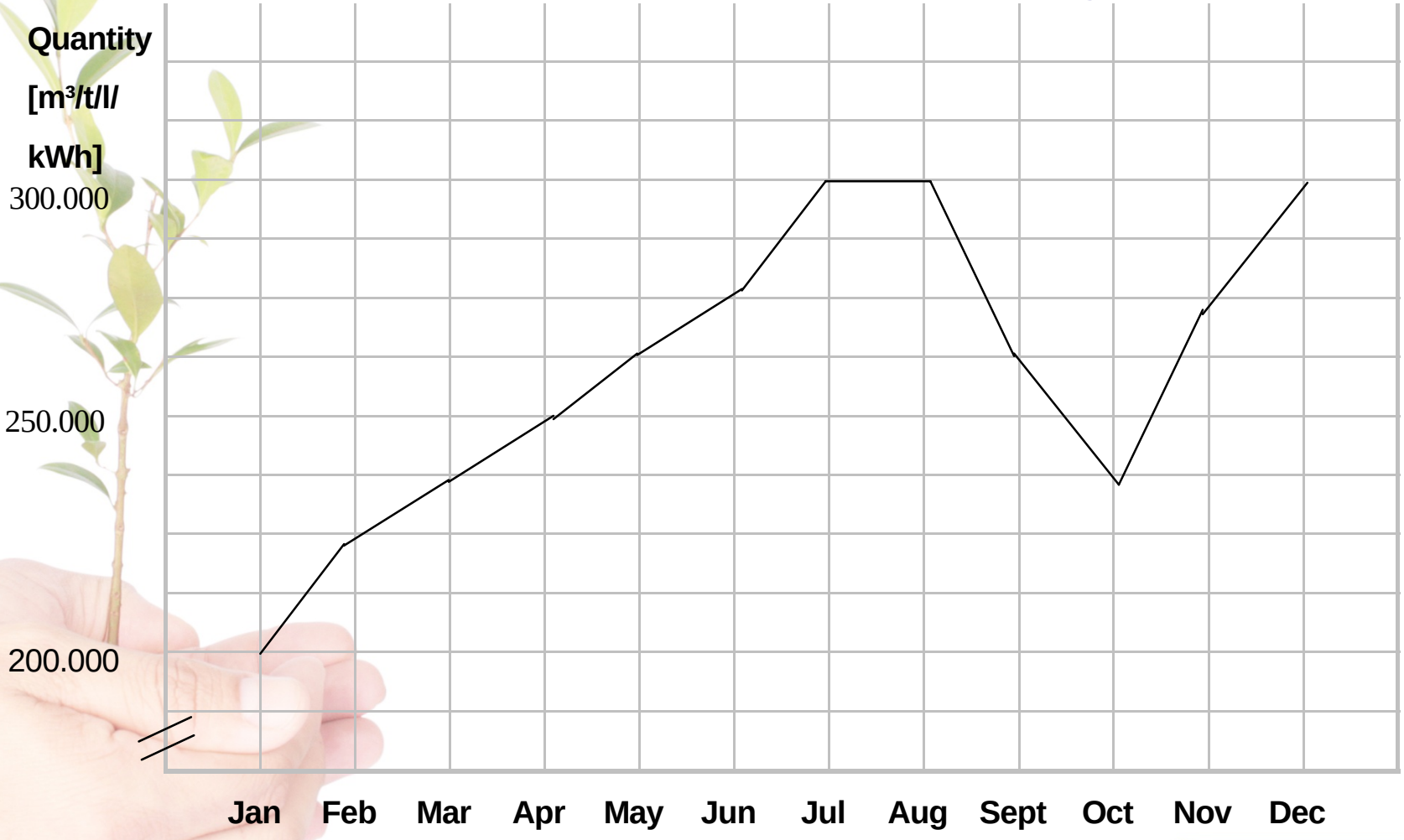
# Worksheet 4a: Monthly consumptions of energy sources



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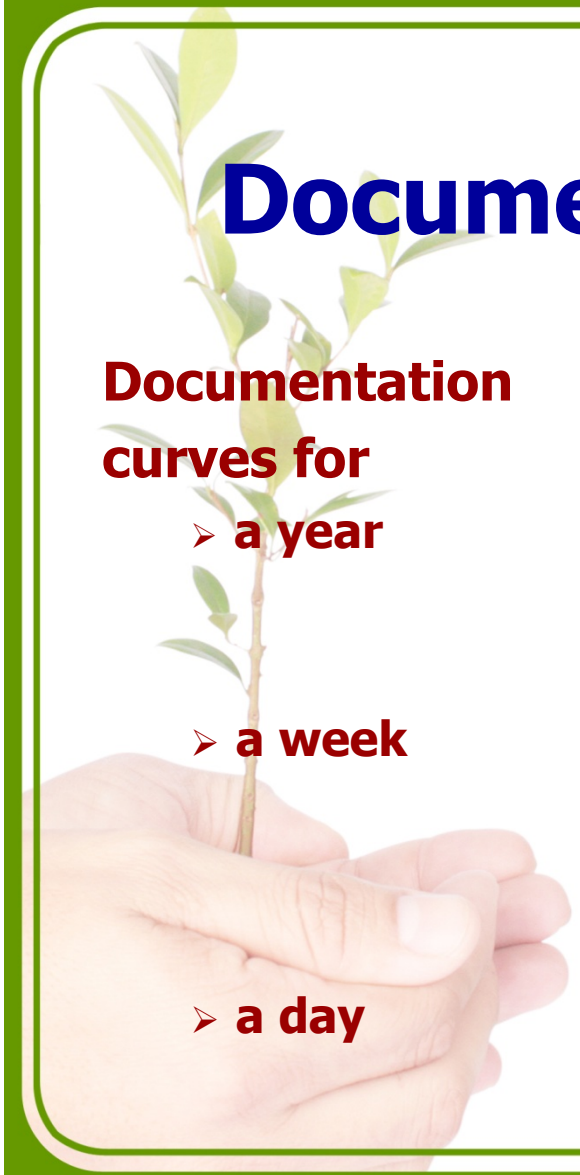
# Proceed with: Documentation of load curves:

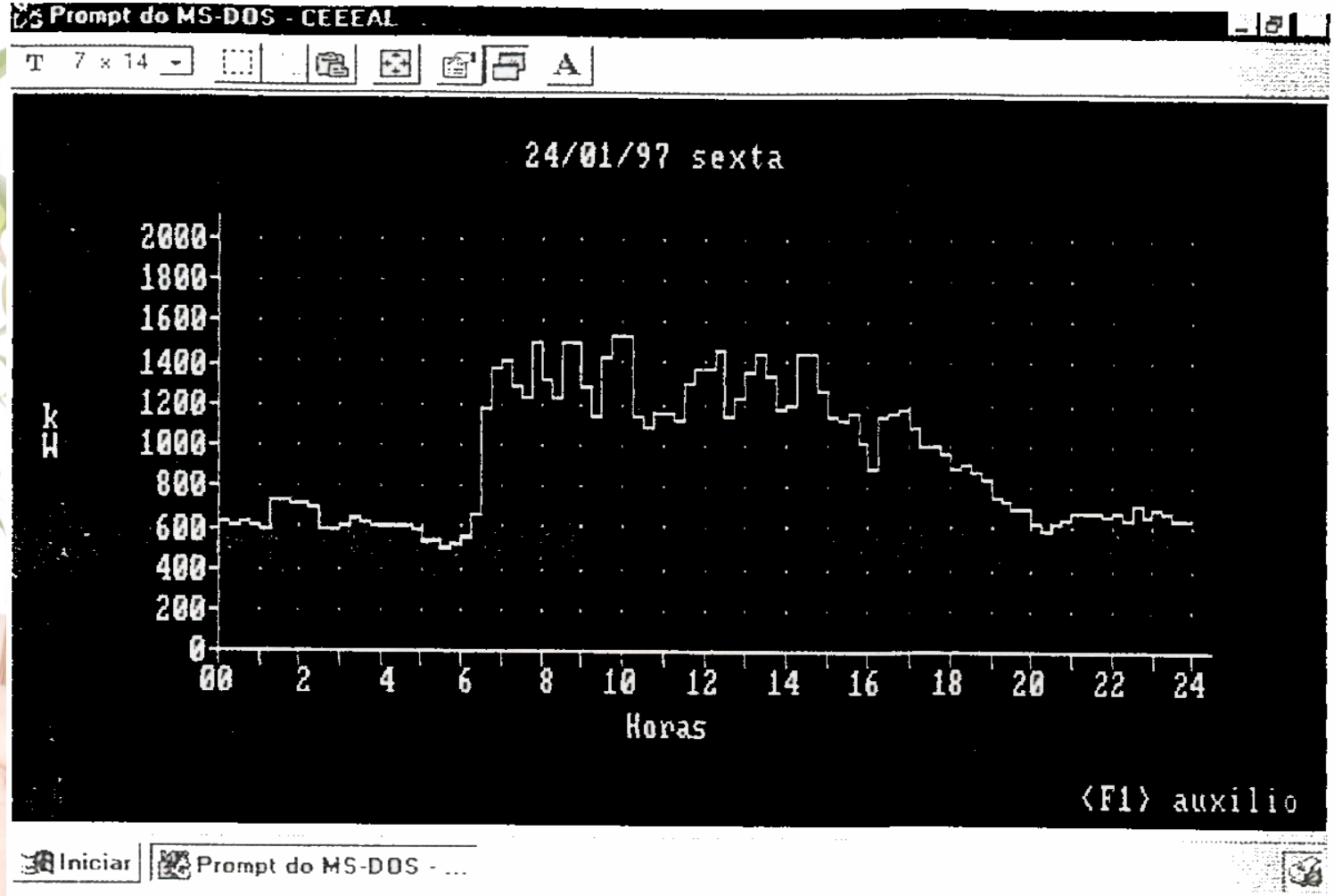


**Documentation curves for**

- a year
- a week
- a day

**Analysis of load curves**

- winter - summer relation
- combined use of heat and power
- switched of or decrased load on weekends
- days with high energy demand
- loads as bottlenecks
- energy demand after production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Iniciar
Prompt do MS-DOS - ...

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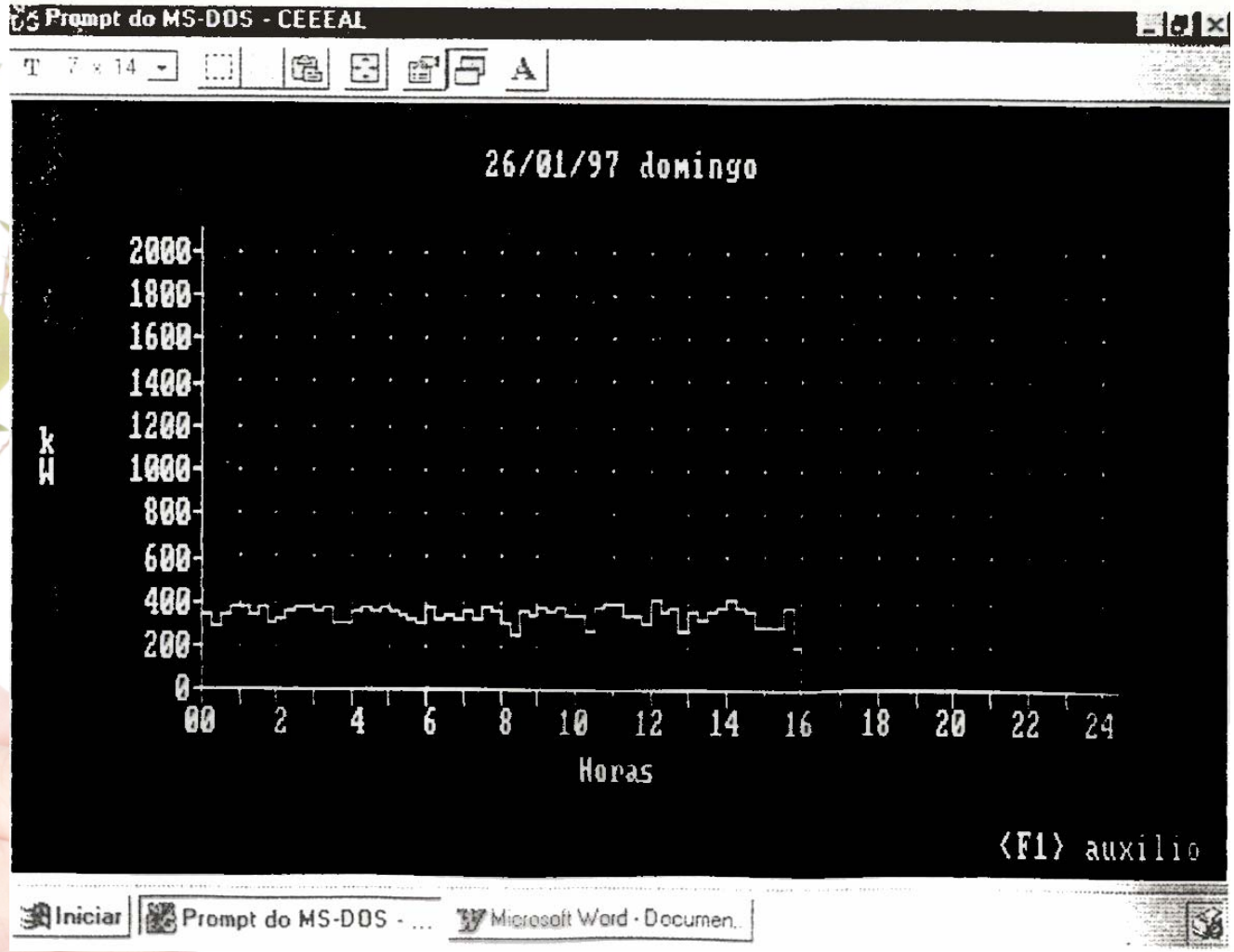

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# Think about a Peak load control:

- Single peaks can be responsible for your power costs
- Apparatus with heat and power storage capacity can be switched off for 3 - 5 minutes to eliminate simultaneous load

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# Proceed with : Documentation of power consuming equipment.

- Identification and documentation of equipment
- Allocation of consumption (= motivation for investment into power saving measures)
- Recognition of options through the development of microelectronics and new sensors
- Setting of priorities by showing the structure of consumption

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# Check your consumers:

## Heat:

- thermostatic valves
- separate control of plants
- adequate temperatures
- no internal sources of heat and humidity in cooled areas
- use shades for heat protection
- frequency controlled fans
- use heat cascades
- ...

## Electric power:

- avoid part load and use adequate machines
- adapt power (e. g. fans)
- optimize lights (cleaning, modern lighting, analyse demand)
- clean and maintain (air filter, nozzles, ...)
- compressor location and pressure
- think of peak load management

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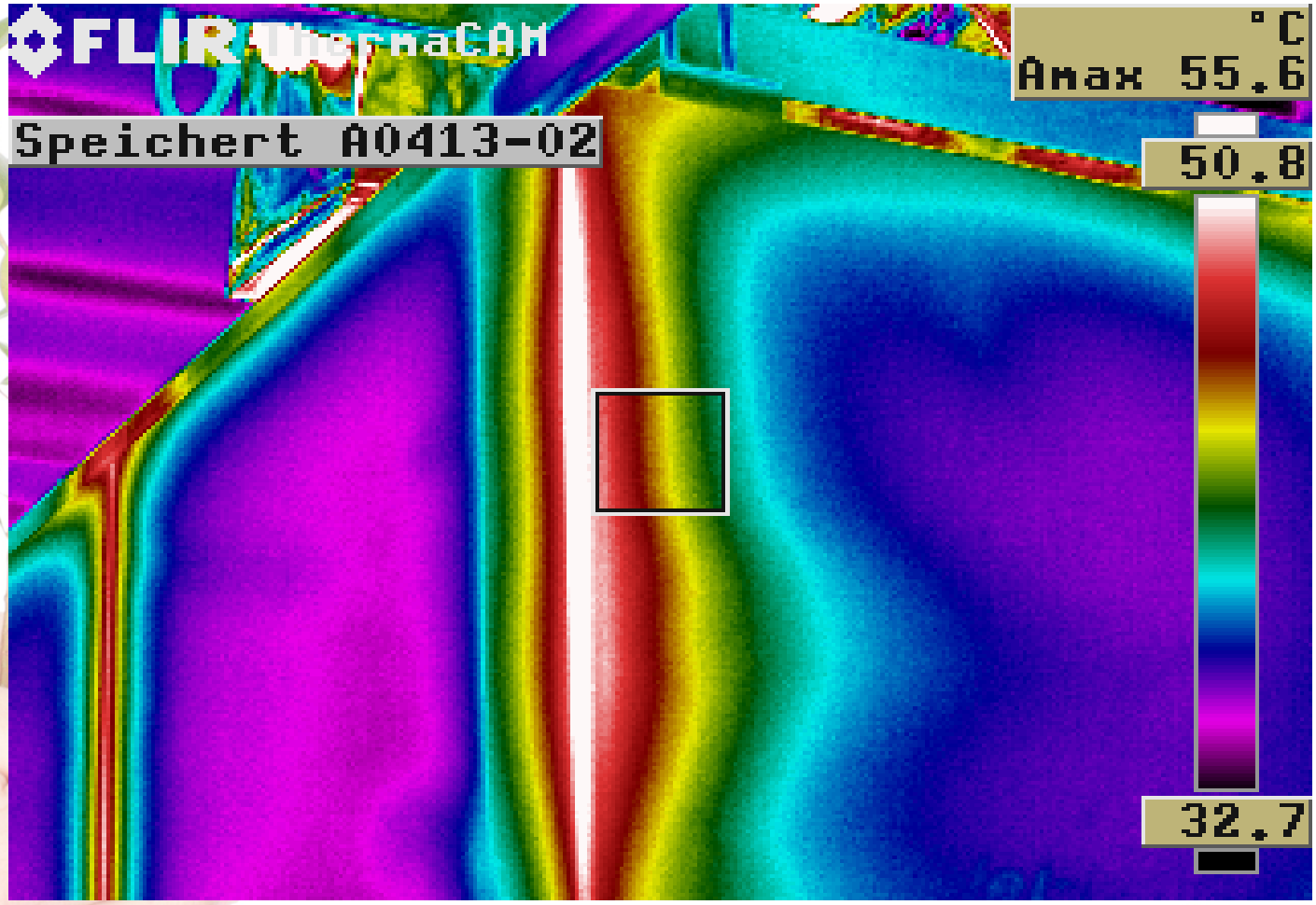
# Think of bad insulation on tanks:



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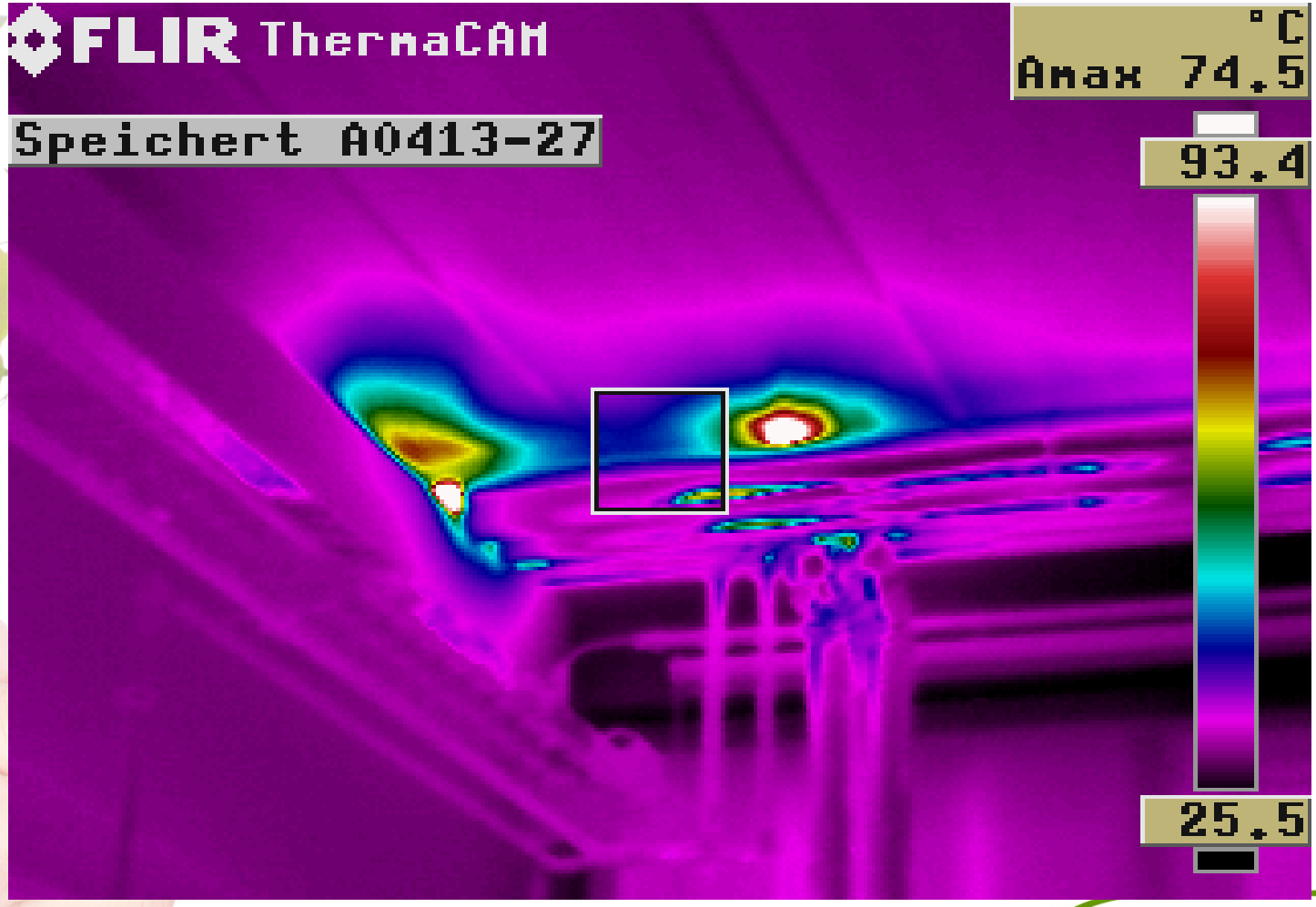
# Think of bad insulation on pipes:



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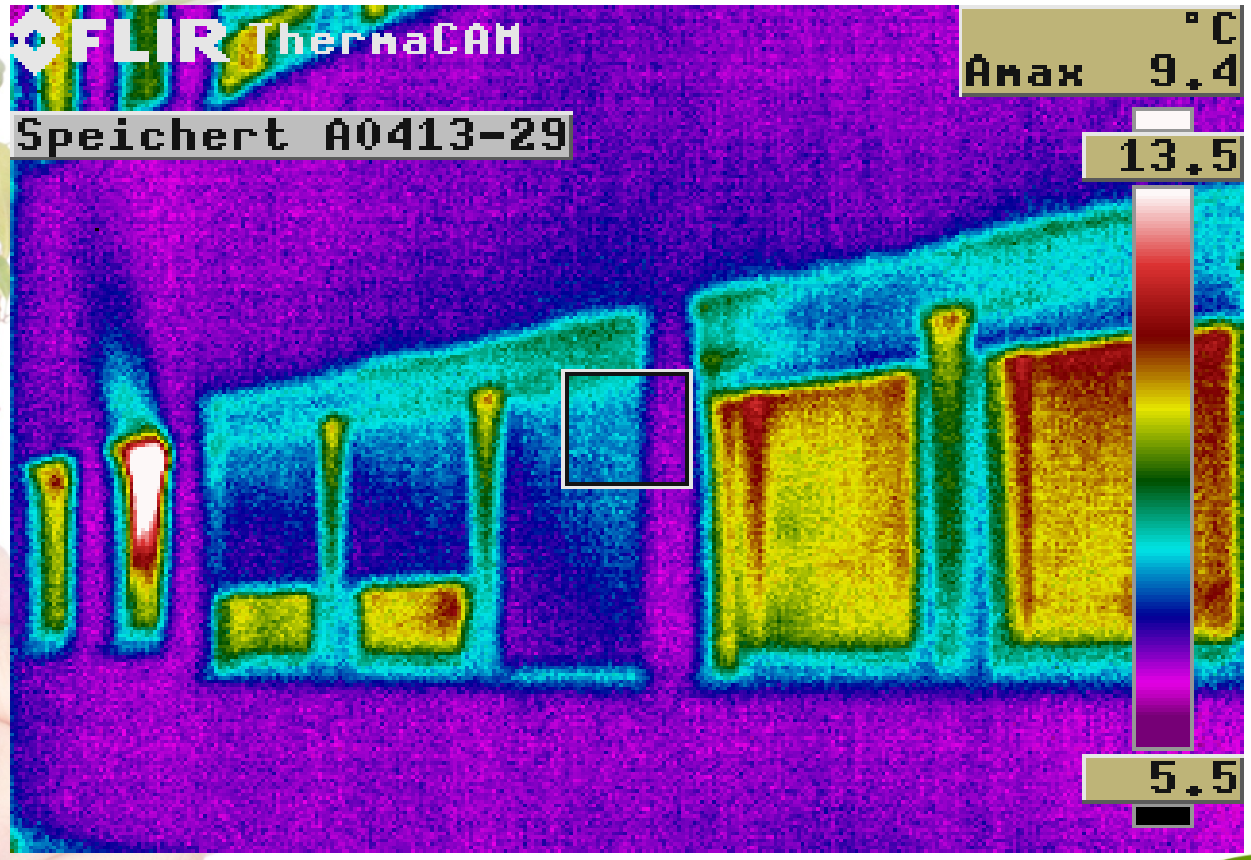
# Overthink your windows and shades:



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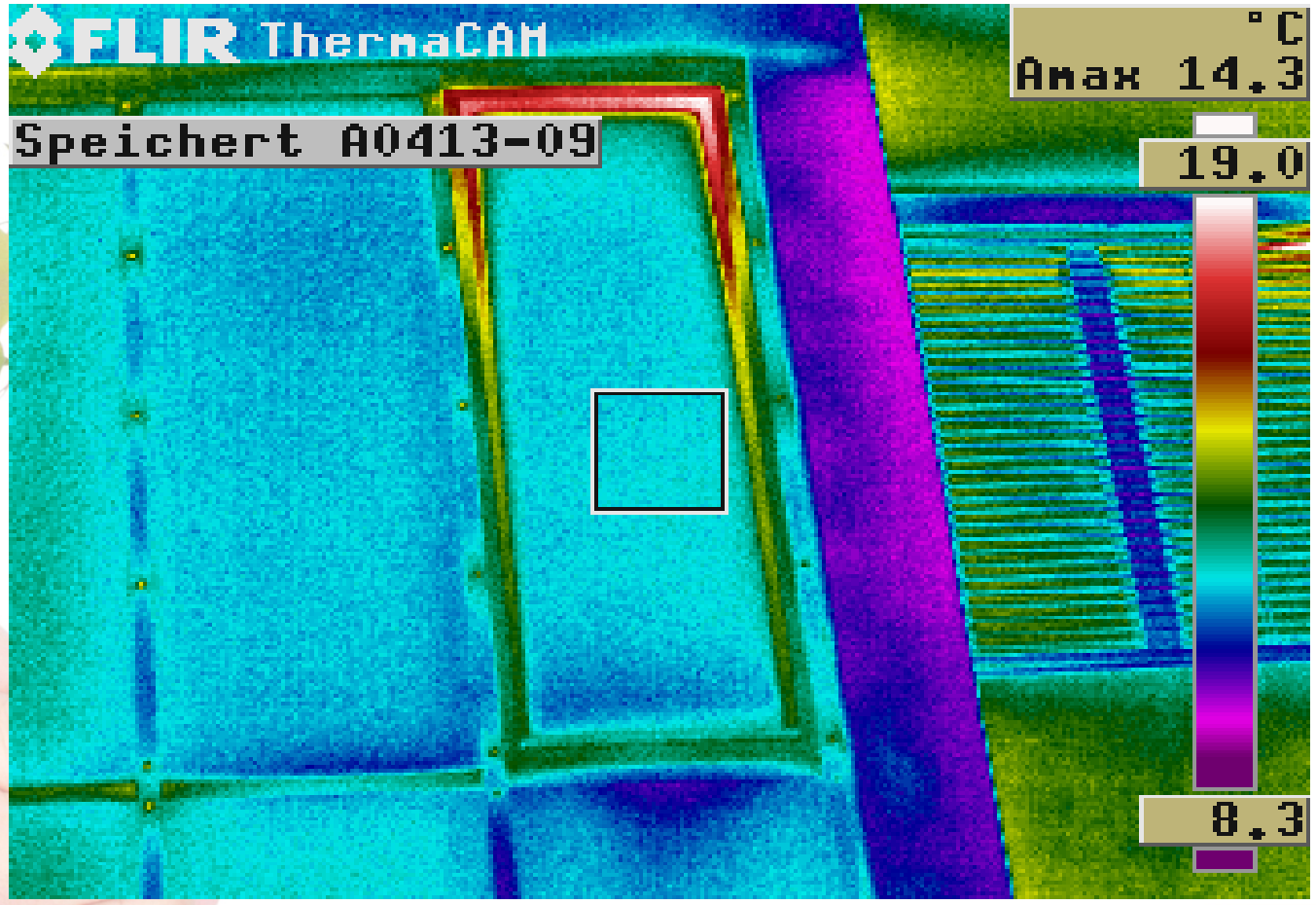
# All time open windows:



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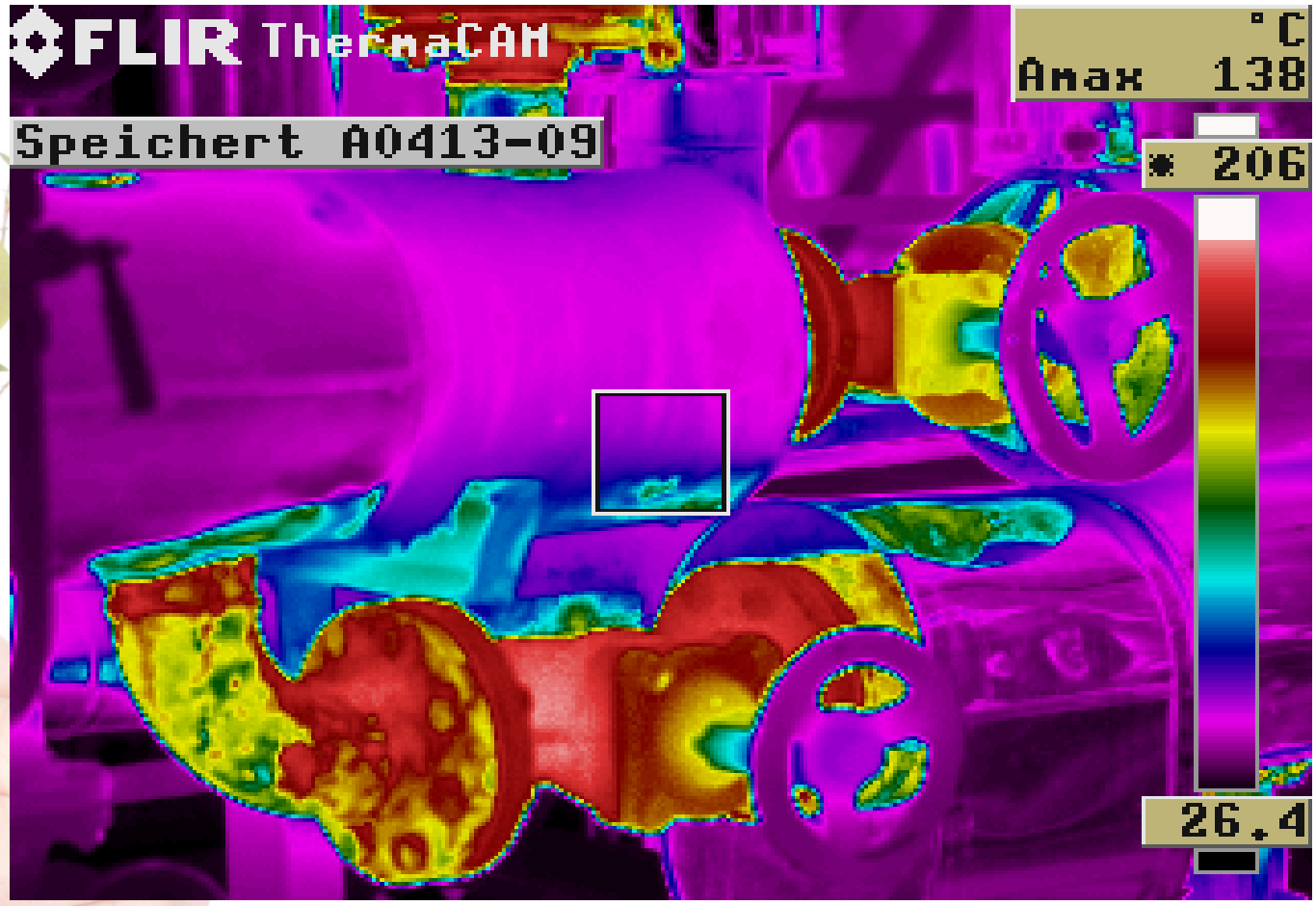
# Investigate bad insulation on valves:



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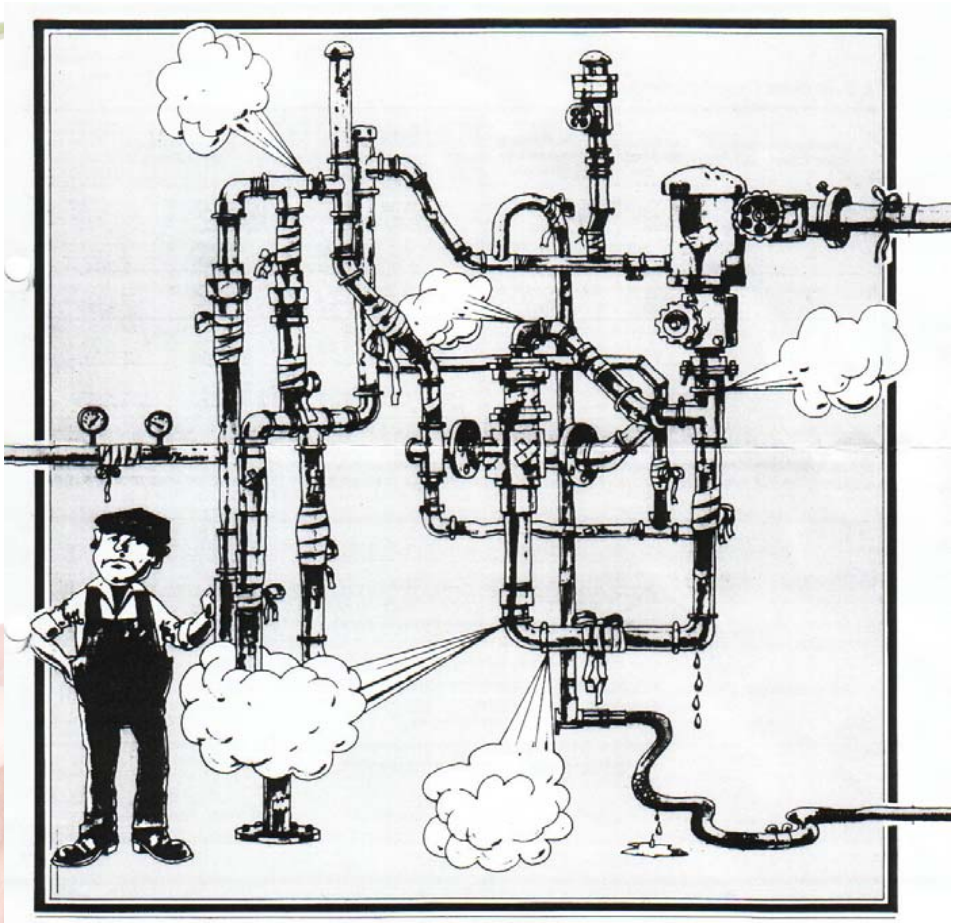
# Think about the problem of compressed air, don't blow your money into the air!



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# Air leak costs

## (based on 100 PSIG, 8760 hours per year, 0.22 $/m³)

| Diameter of leak [feet] | Cubic feet per minute | Loss per year [US$] |
|---|---|---|
| 1/16" | 6,5 | 744,0 |
| 1/8" | 37,2 | 2.981,0 |
| ¼" | 103,0 | 11.904,0 |

# Potentials in a pressurized air system:

- Switch off compressor and dryer (also the grid)
- Reduce pressure to the minimum necessary level
- Repair leaks
- Use cold air on the input side of compressor
- Proper maintenance and cleaning
- Use electric tools

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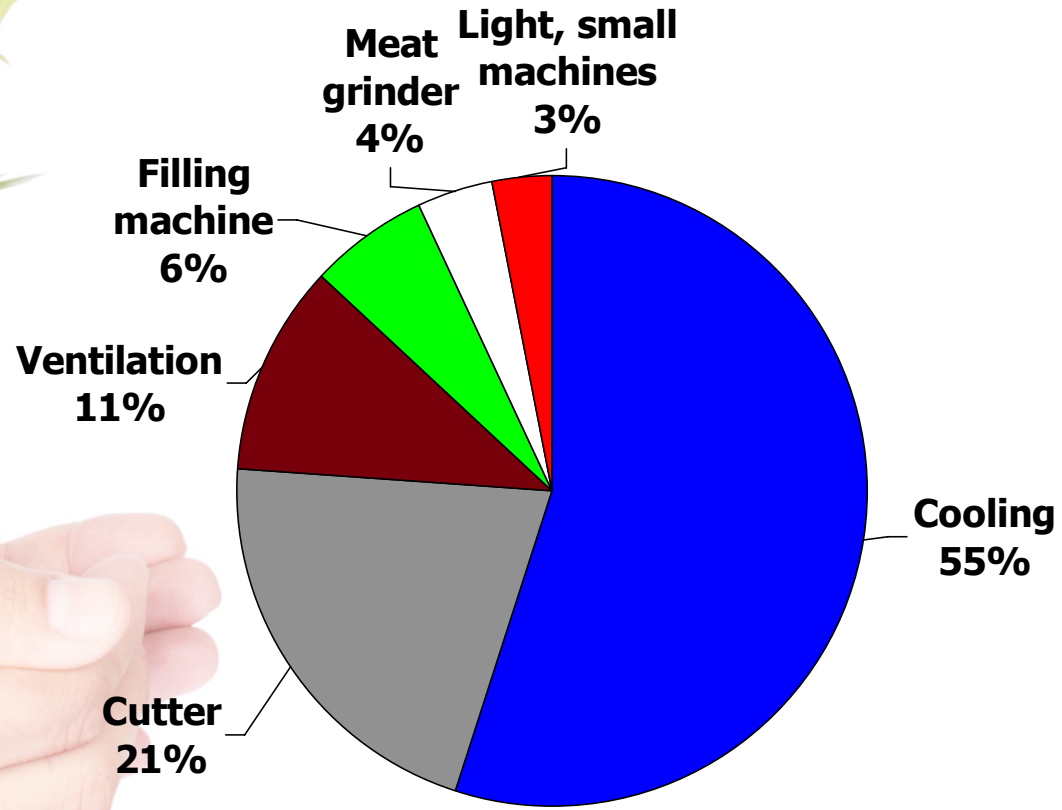
# Potentials in Cooling:
# Typical consumption of energy in a meat processing company - electricity



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# Potentials in Refrigeration:

- Switch off light in cooling chambers
- Minimize frequency of opening doors
- Defrost regularly
- Use curtains
- Control temperature to highest possible level
- Seal e.g. doors
- Cleaning and maintenance

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# Recover heat of cooling machines:

- Off-heat at 45°C
- Economical for cooling machines > 10 kW cooling power
- Approx. 45% of power can be reused as heat
- Favorable: good integration to existing heating system

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# Potentials in Cooling and freezing:

- Raising the temperature of storage for 1°C results in saving appr. 4 % of the electric energy
- Choose the right storage temperature: Frozen meat at -20 °C, cooling at 0 °C to -4 °C
- Clean the condenser regularly and allow for sufficient and cool air supply
- Use the capacity of the storage rooms, collect goods, switch off unnecessary cooling machines
- Keep storage rooms closed to avoid entrance of humidity and warm air
- Defrost in cooling rooms

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# Potentials in Ventilation and air conditioning:

- Check temperatures
- Check clothing
- Switch on equipment only if needed
- Reduce air flow
- Increase recycling of air
- Check sealing
- Minimize demoistening and moistening
- Check valves and flaps

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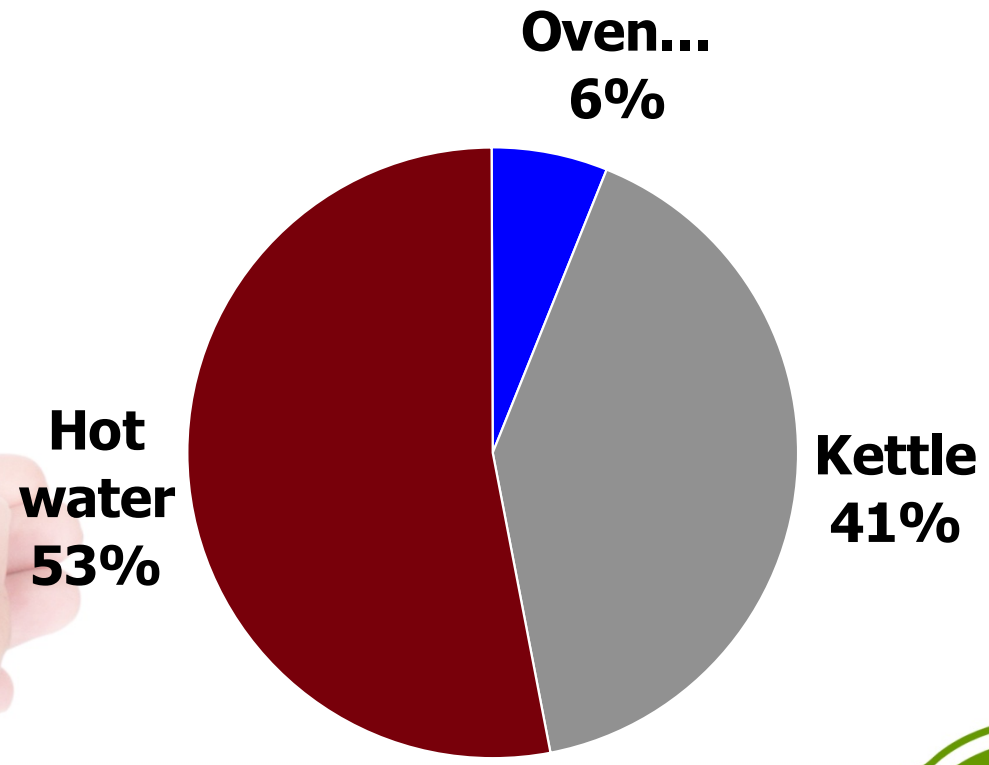
# Typical consumption of energy in a meat processing company – Heat potentials:



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# Potentials in hot water:

- Reduce temperature
- Reduce circulation during night, etc.
- Supply small users decentralized
- Remove unused taps
- Check sealing
- Check insulation

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# Potentials in Heating:

- Check temperature
- Lower temperature (at night, during the weekend)
- Seal doors and windows
- Use the storage capacity of the building
- Check insulation
- Check boiler, control, burners, regularly
- Switch off circulation pumps
- Allow for free convection from radiators

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# Potentials in Lights:

- Switch off bulbs which are not needed
- Use time controlled switches for shop windows and outside illumination
- Use daylight
- Clean windows regularly
- Use energy efficient bulbs

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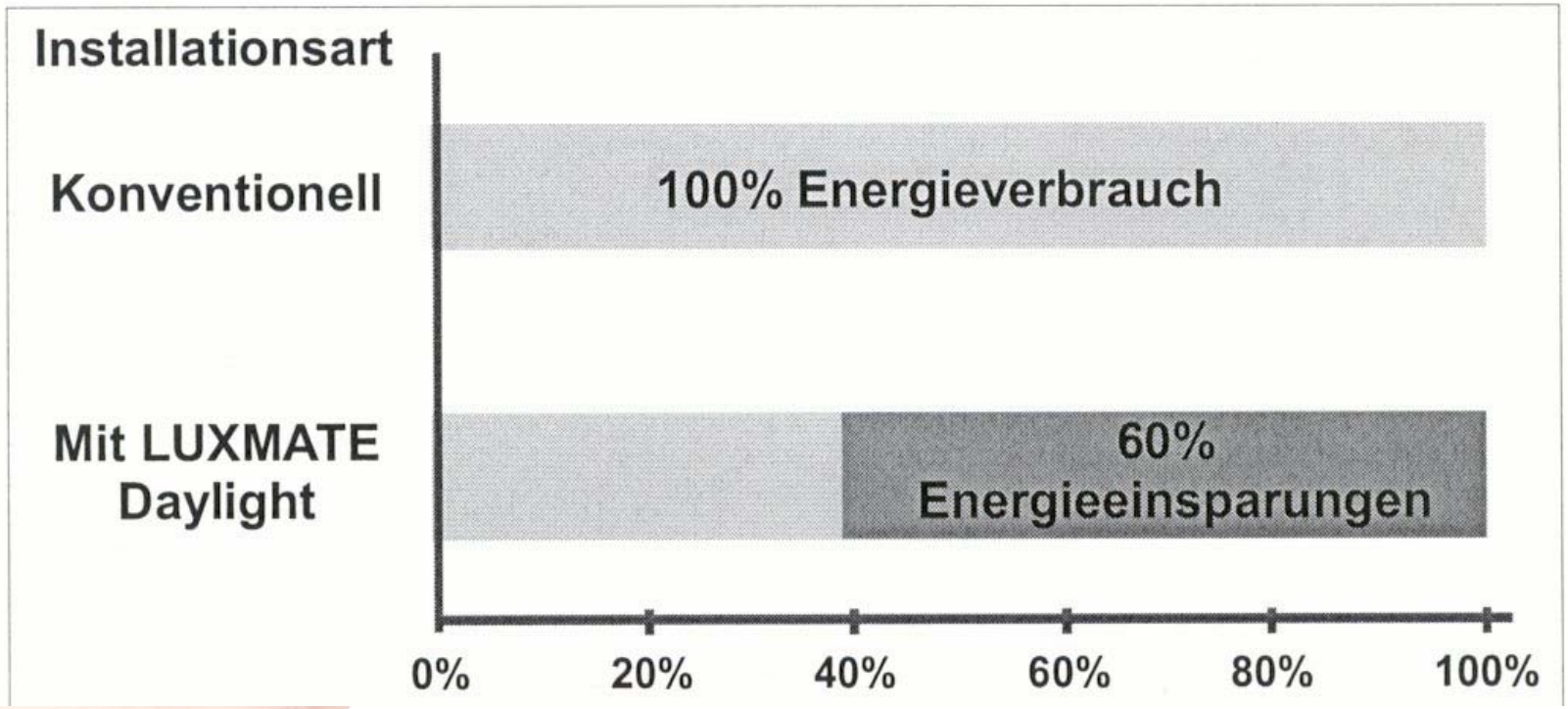
# LUXMATE Daylight - Energieeinsparung



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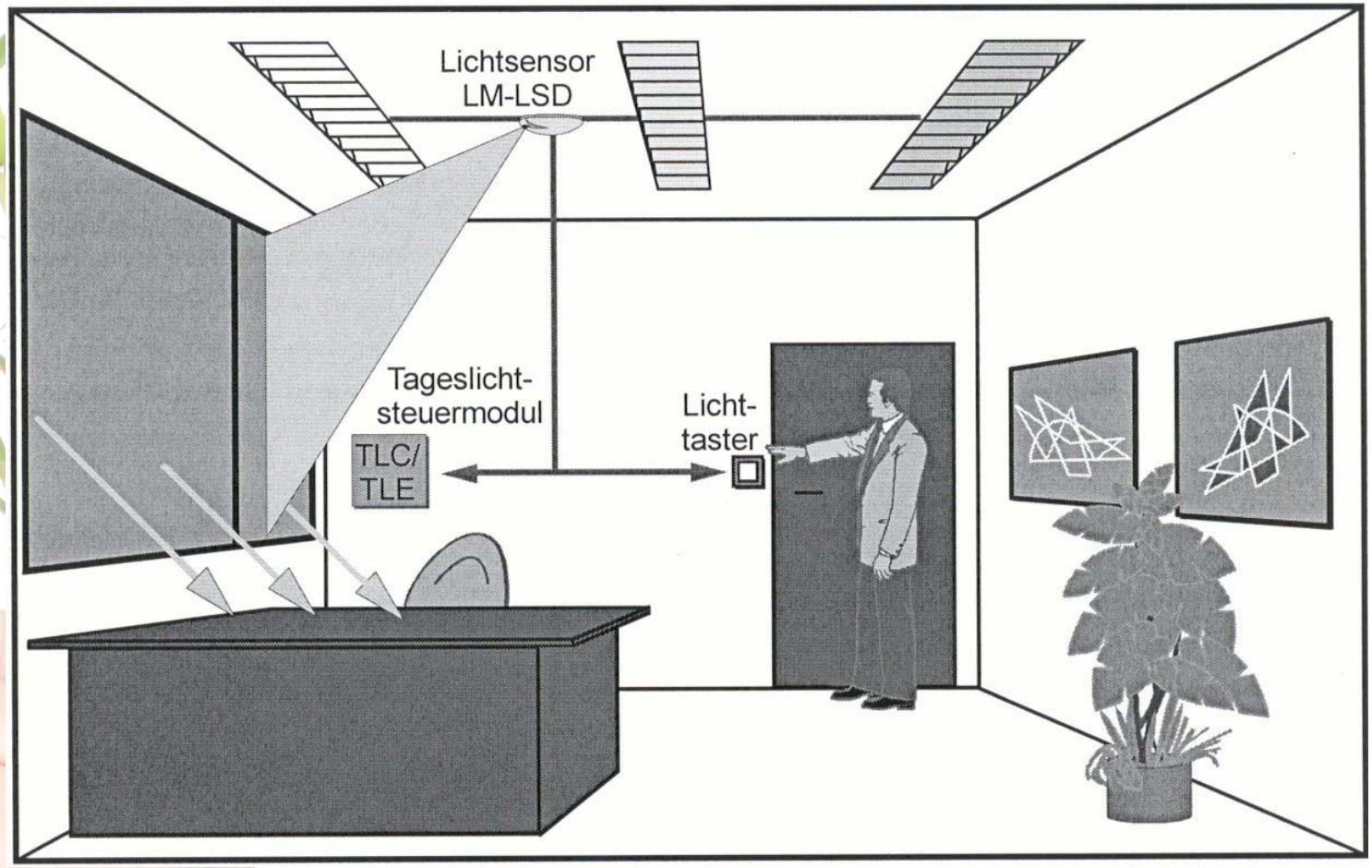

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# Potentials in the office :

- Switch off computers
- Switch off monitors
- Switch off printers
- Joint use of printers
- Use enrgy saving functions (sleeping mode) of copying machines, etc.

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# Potentials in the kitchen:

- Switch off machines which you do not use
- Use heat storage capacity
- Keep pots etc. closed by lid
- Defreeze in fridge

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# Potential for machines in the production lines:

- Organize production flow
- Optimize use of machines
- Switch off machines when not used

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# Documentation of power consuming equipment:

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- Allocation of consumption (=motivation for investment into power saving measures)
- Recognition of options through the development of microelectronics and new sensors
- Setting of priorities by showing the structure of consumption

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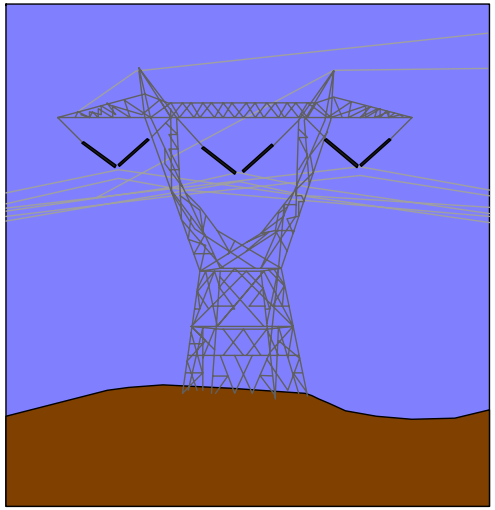
# General Energy savings:

- reduce heat losses
- reduve distribution losses
- heat recovery
- peak load management
- higher electrical effeciency, speed controlled machines
- change energy carrier
- heat and power co-generation
- turn off / reduce heating and lighting outside of working hours



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# Ongoing Energy Management:

- **Organization:** set up an organizational unit,
  clarify responsibilities and financial budget
- **Analysis and Planning:** inventory and description
  of the energy situation
  search for energy saving optiond
- **Control:** control of the energy plants,
  work out energy indicators
- **Consulting:** energy reports,
  internal consulting and market analysis
- **Implemenation:** implemetation of energy saving options
  maintenance of energy plants