Education and Culture

Leonardo da Vinci

Sustainability in commercial laundering processes

Module 5

"Energy in laundries"

Chapter 2

Usage of energy in laundries

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Content

- Distribution/supply of energy in laundries
- Kind of energies in laundries
- Heat content of different energy sources
- Heat supply in a small and a big laundry
- Steam generation – types of boilers
- Energy conversion at the example of steam heating
- Comparison of direct heating with gas and steam
- Energy saving at mangling
- Active and passive measures for energy saving

Learning targets

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After finishing this chapter, you will

- Know energy distribution and the most important kinds of energy sources in laundries
- Be able to compare the heat contents of different energy sources
- Know the meaning of heating energy, be able to differentiate the different kinds of energy generation and be able to compare those regarding advantages and disadvantages
- Be able to assess the different ways of steam generation
- Recognize the advantages of direct heating by the example of dryers
- Be able to explain possibilities of energy saving at mangling
- Be able to apply active and passive measures for energy saving

Usage of energy in laundries

- In laundries, energy is necessary to generate **process heat** (steam, hot water)
- **Energy sources** are gas, electricity and fuel oil (extra light) and fuel oil (heavy: S), that is:

- *Gas and Electricity for*
  - Direct *machine heating* as well as for
  - Indirect application to heat *transfer media*
- *Heavy fuel oil* is normally applied in industrial plants only due to complex legal requirements for its application

Conversion of thermal units

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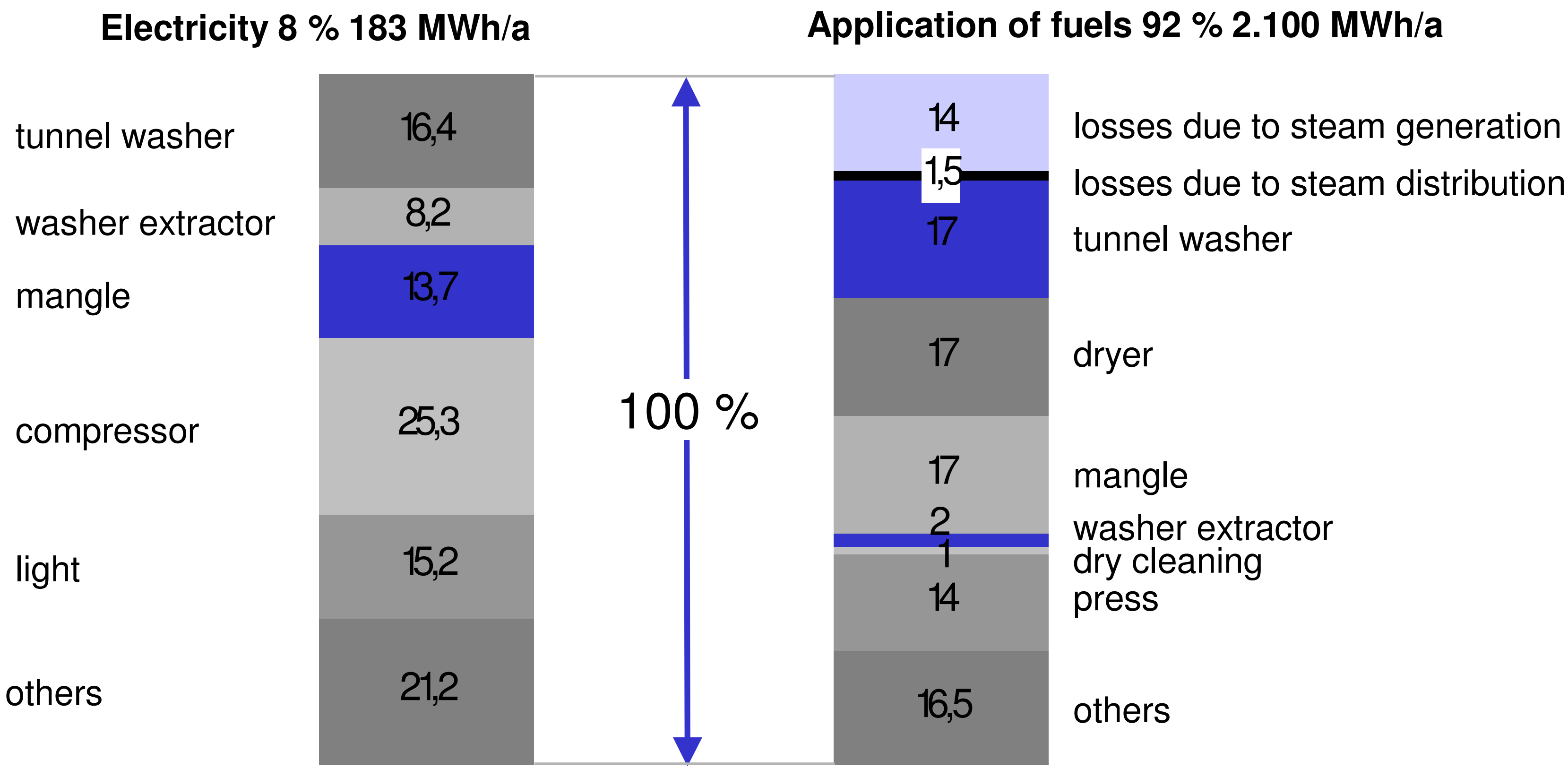
	cal	kcal	Mcal	J = Ws	MJ	kWh
1 cal	1	0,001	0,000001	4,1868	0,0000041868	0,000001163
1 kcal	1.000	1	0,001	4.168,8	0,0041868	0,001163
1 Mcal	1.000.000	1.000	1	4.186.800	4,1868	1,163
1 J = Ws	0,2388	0,0002388	0,0000002388	1	0,000001	0,0000002778
1 MJ	238.800	238,8	0,2388	1.000.000	1	0,2778
1 kWh	860.000	860	0,86	3.600.000	3,6	1

Distribution of energy in laundry

Example: laundry with capacity of 600 t/a

(specific energy consumption: electricity/fuel 0,3/3,4 kWh/kg textiles)



Percentages depend on machines, machine load and washing programme

source: BGW

Energy sources in laundries

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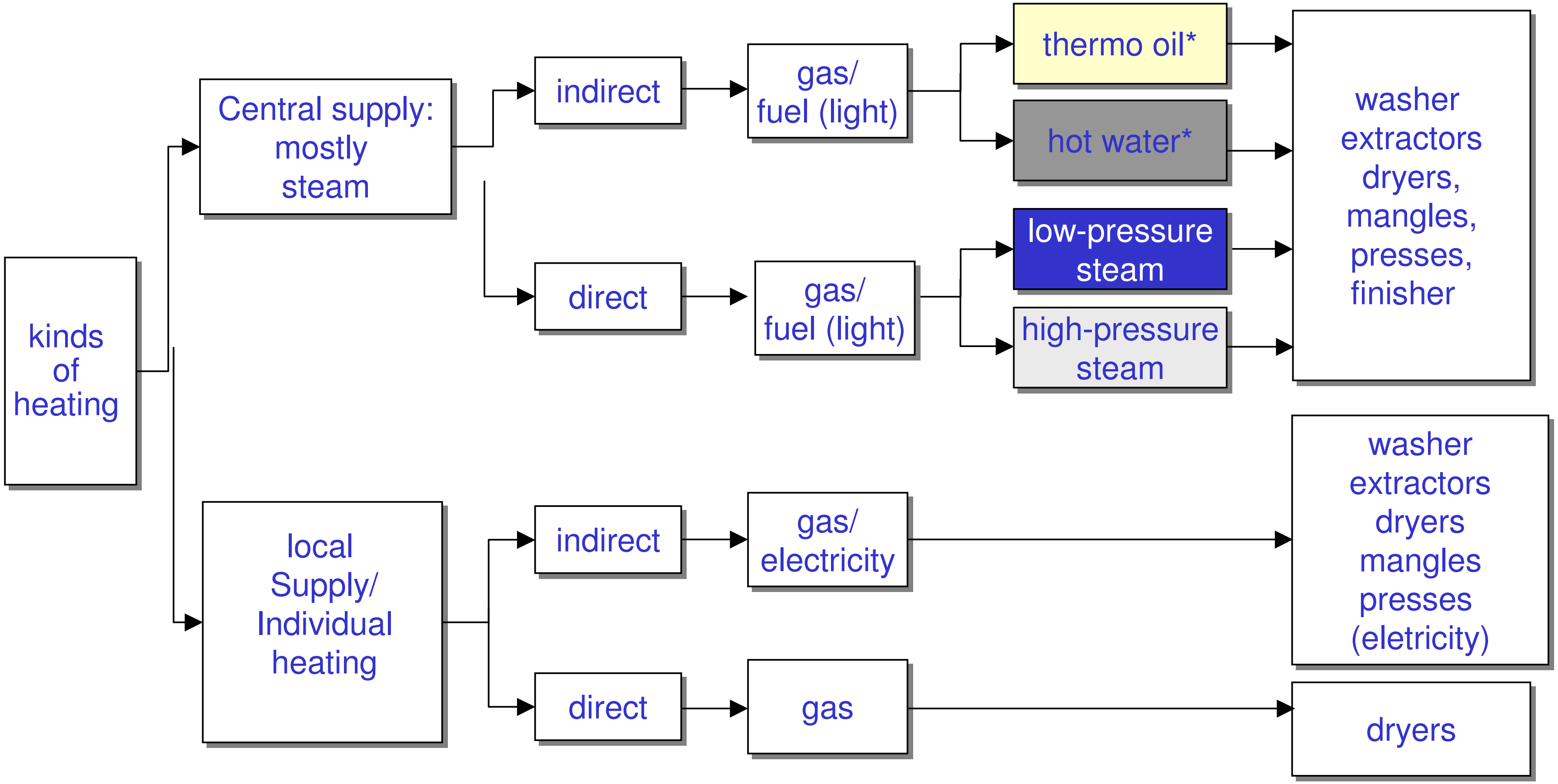

* of low market importance

Quelle: BGW

Heat sources in laundries

Steam	
High pressure	**Low pressure**
Steam pressure > 1,0 bar usually: 8 -12 bar (above air pressure) temperatures: 175 - 191 °C **Steam characteristics** • high heat capacity • excellent transfer capacity • constant efficiency at max. power **Application technology** + direct steam flow washing and steam process, therefore short heating up of heating washing liquor + high efficiency (economic) + reserve at high peaks of consumption (big boiler) - high acquisition costs - inspection by legislation required	Steam pressure 0,5 - 1,0 bar usually: 0,5 bar (above air pressure) temperatures: max. 120 °C **Steam characteristics** • high heat capacity • excellent transfer capacity **Application technology** + short heating up intervals + simple handling and maintenance/overhaul + low acquisition costs + no legal requirement of inspection (TÜV), registration of boiler only - temperature max. 120 ºC, therefore inapplicable for mangles, tumblers, presses etc.

Heat supply in small laundries

Local supply (heating)

- Individual heating of each machine
- Laundries at a capacity of up to 500 kg textiles/day can normally run with gas or electricity (prerequisite: local favourable fees)
- Advantage of individual heating:

  flexible usage of resources dependent on amount of textiles
- Economical: no higher use of energy than required
- Efficient and environmentally friendly

Local supply (heating)

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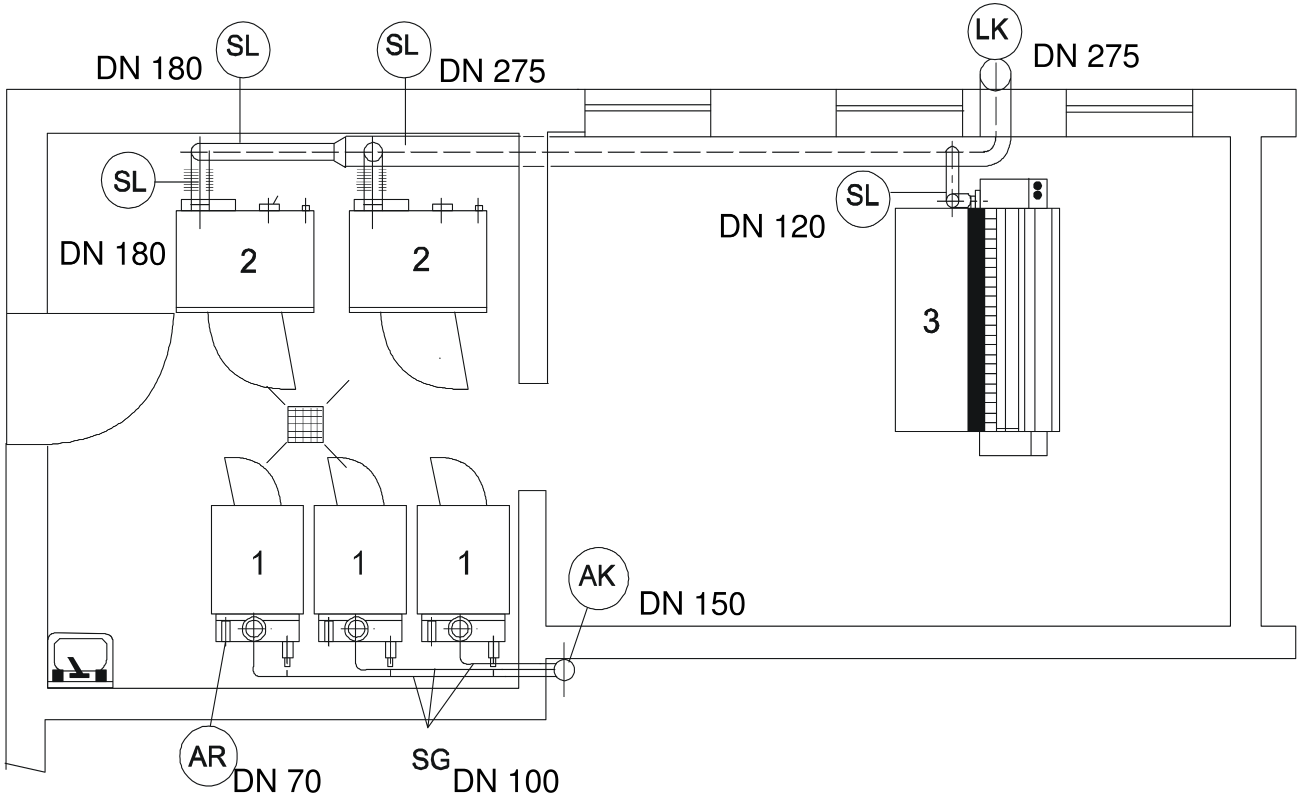
Hotel laundry with a capacity of 42 kg/h



1 Washer extractor, heating by gas/electricity/steam

2 Dryer, heating by gas/electricity/steam

3 Mangle, heating by gas/electricity/steam

source: BGW

Heat supply in big (industrial) laundries

Central supply

- For laundries at a capacity of more than 500 kg laundry application of central heat supply is useful
- Those huge laundries normally heat by steam, sometimes with hot water or thermo oil
- Most important heating source is steam.
- Advantage: distribution of heating medium constantly possible as well as the possibility of direct heating of the washing liquor
- Performance of steam generator is very important.
- At high utilization, all machines may require heating energy at same time
  - Boiler should be capable to supply all machines with enough steam, even at high production peaks

Steam boiler

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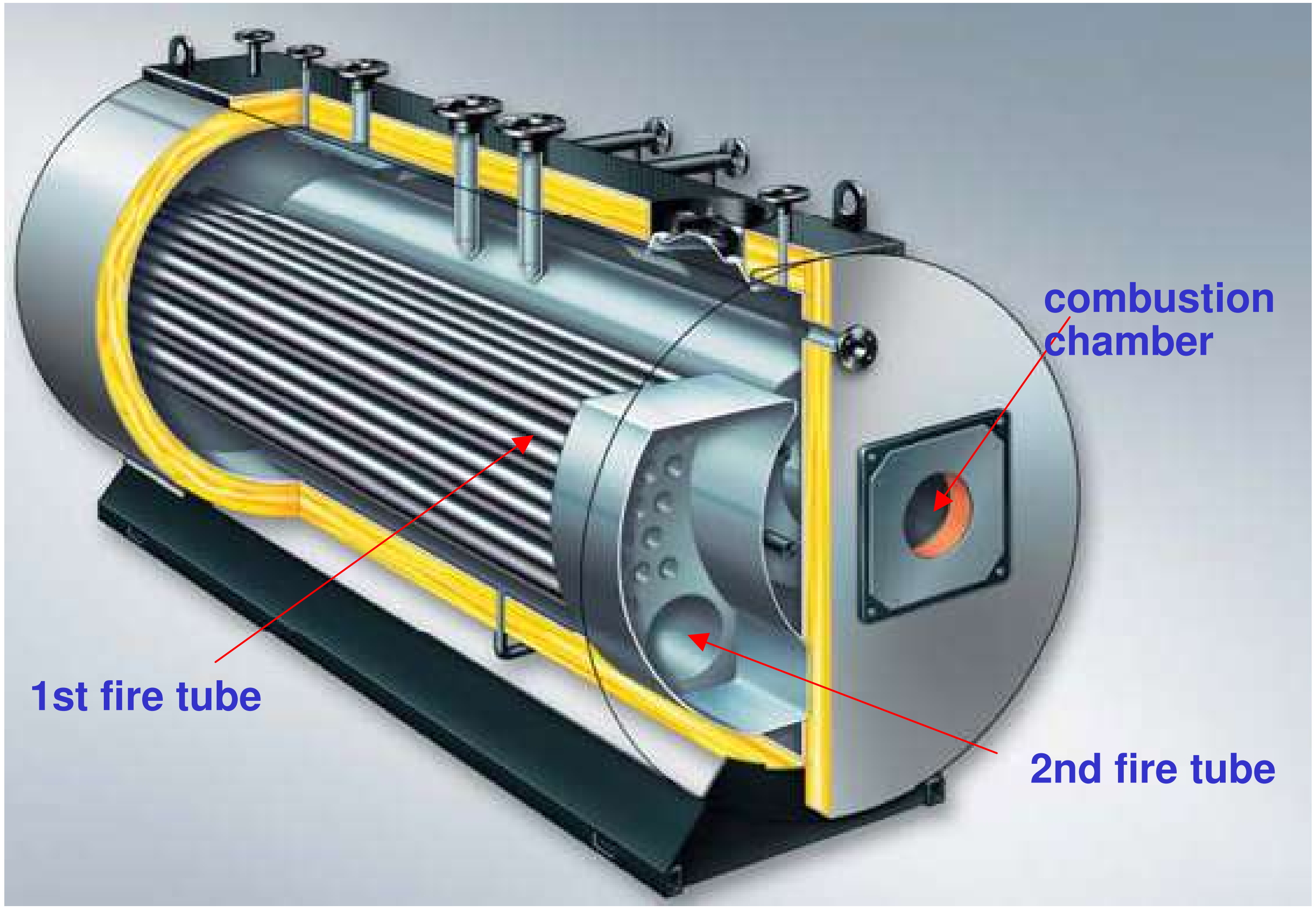


source: Loos International

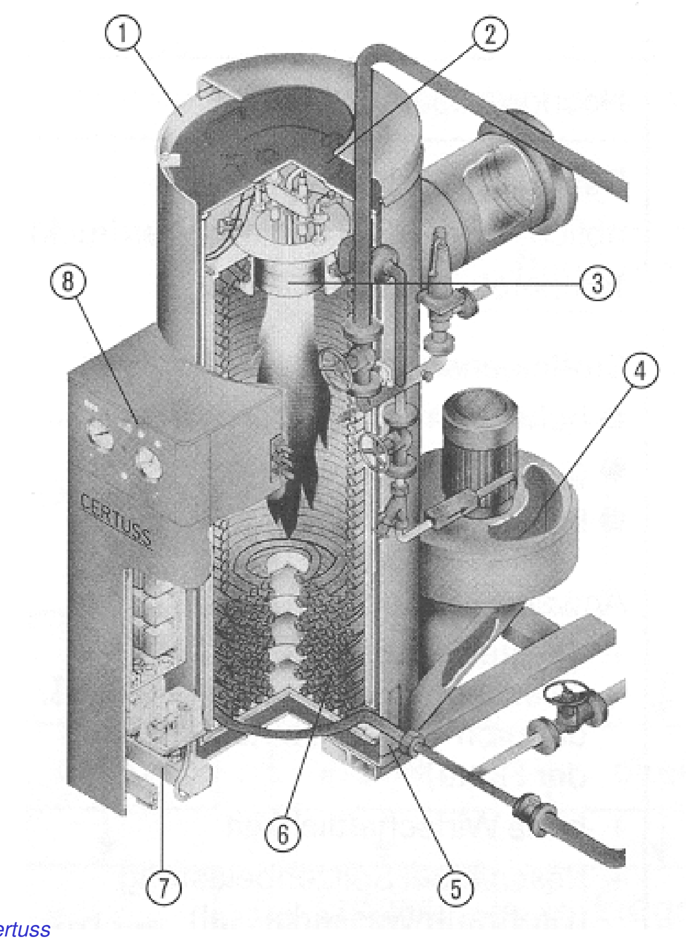
Steam boiler

Advantages	Disadvantages
• Dry steam • Constant pressure • Robust pumps applicable • High heat capacity (storage capacity) • Controlling possibilities • Low soot production due to less ignitions • Low maintenance costs • Good implementation in supply systems consisting of several boilers	• Costs • Size • Space requirement • Legal permission • Inspection needed • Higher maintenance/overhaul expenditure • Long heating intervals • Higher heating energy losses at a closedown for several days • Start of boiler by expert required

Rapid steam generation

Advantages in comparison to steam boilers with high capacity	**Disadvantages**
• Less space requirement • Short heating intervals • Quick adoption to needs • Low acquaintance costs • Low losses of heating energy	• No storage capacity • Higher maintenance/overhaul expenditure • Strict specifications for feed liquor • Steam contains relatively high water volume • Not applicable at high production peaks

Rapid steam generation technique



1 Feed-head
2 Compressed-air supply
3 Burner
4 Intake-pipe
5 Opening for cleaning
6 Heating system
7 Pressure-regulating valve
8 Burner monitoring

source: Certuss

Comparison of gas and direct steam heating

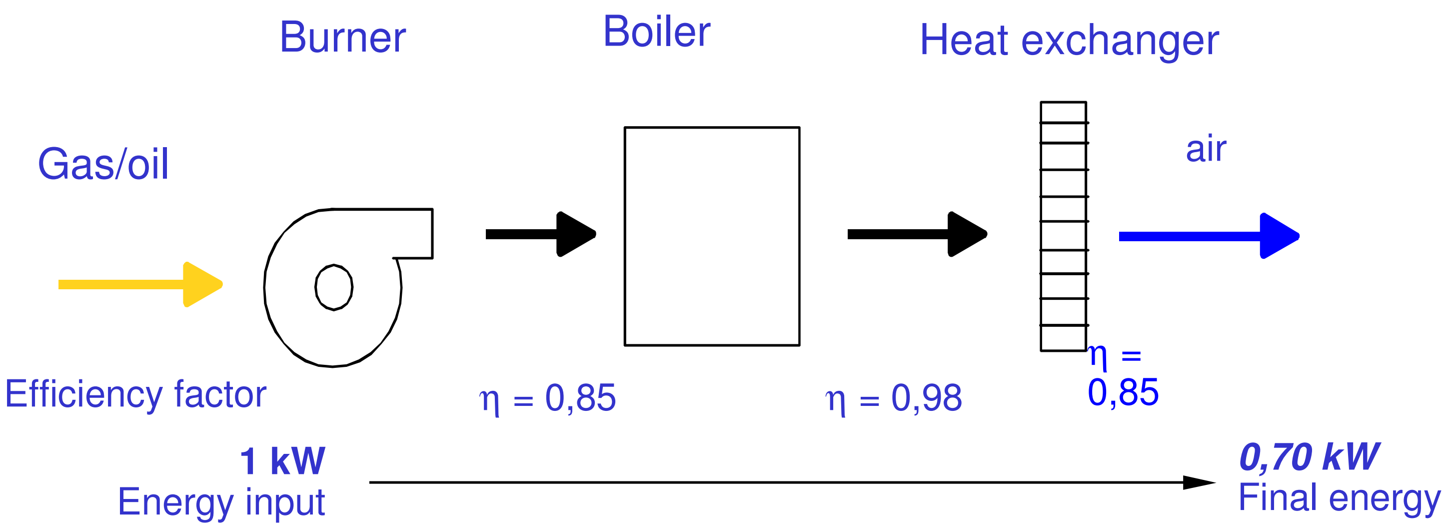
example: tunnel finisher

Steam heating		**Gas heating**	
Steam consumption	Costs for steam	Gas consumption	Costs for gas
285 kg/h	8,72 Euro / h	157 kWh	7,07 Euro / h
at 8 h/d (300 d/a)	20.928 Euro / a		16.968 Euro / a

Machine capacities per hour are practically identical

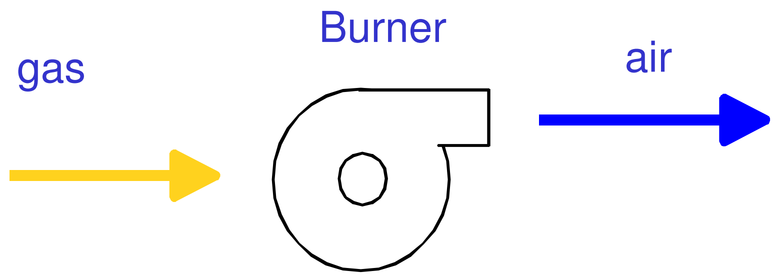
Energy conversion at steam heating

Final energy at **steam heating**



Energy conversion at direct heating

Final energy at **direct heating** (gas)



Efficiency factor $\eta = 0{,}85$

1 kW
Energy input → ***0,85 kW***
Final energy

Advantages direct heated - dryer

- Improved temperature-controlling of drying process (modulating burner)
- Constant machine performance during machine-life-cycle
  - + Performance of machines with steam-heat exchangers decrease because the heat exchanger gets dirty
- Significant higher drying performance of direct-heated dryers
  - + Higher performance/capacity means lower costs
- Lower maintenance expenditure
  - + Especially lower cleaning costs
- Capacity of dryers is expandable in any order of magnitude
  - + Capacity of boiler limits expandability (at application of steam-heated machines)

Comparison gas-/steam heated dryers

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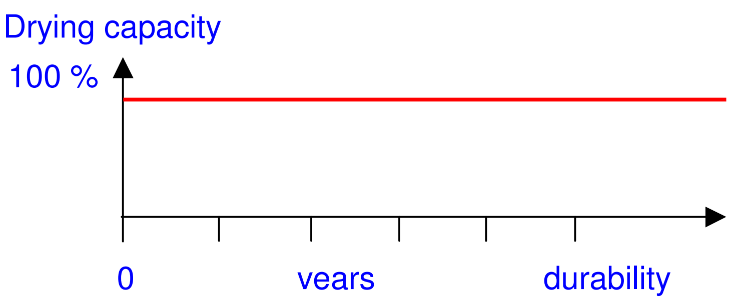
Direct and indirect heating of dryers

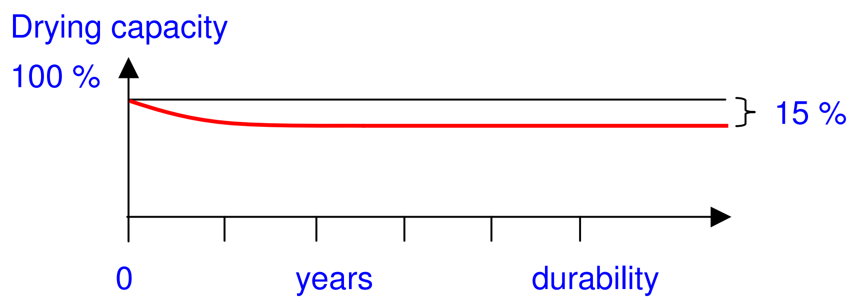
Gas dryers (direct)



losses

- exhaust gas
- machine

Steam dryers (indirect)



losses

- exhaust gas
- steam generation
- steam distribution
- machine
- loss of power of radiator

Comparison of gas-/steam heated dryers

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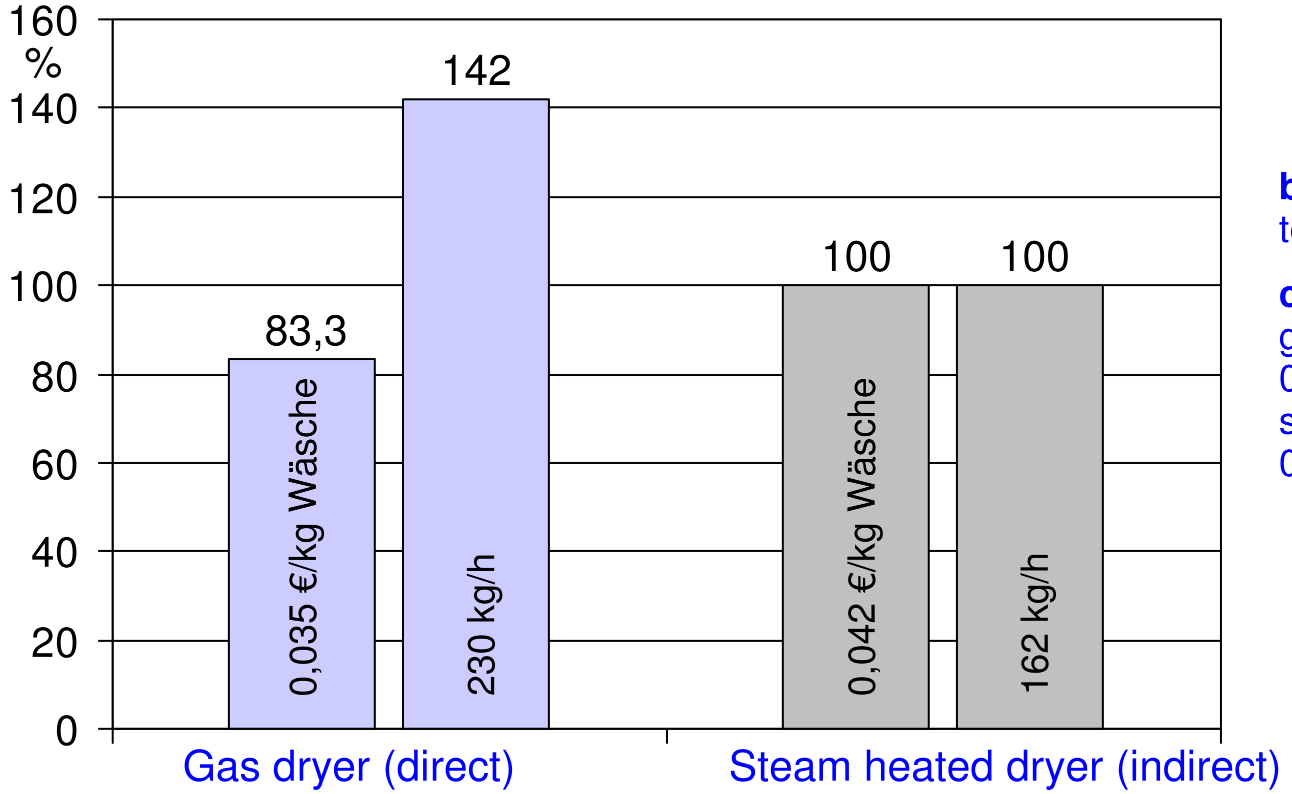

basis
terry cloth

costs
gas:
0,045 €/kWh
steam:
0,036 €/kg steam

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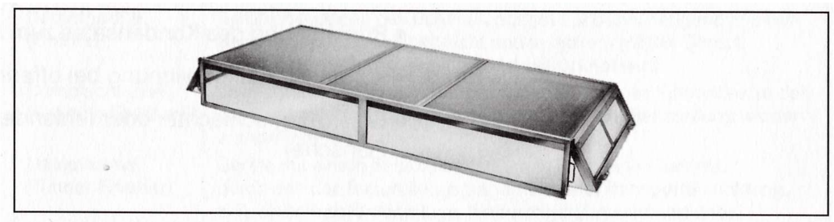
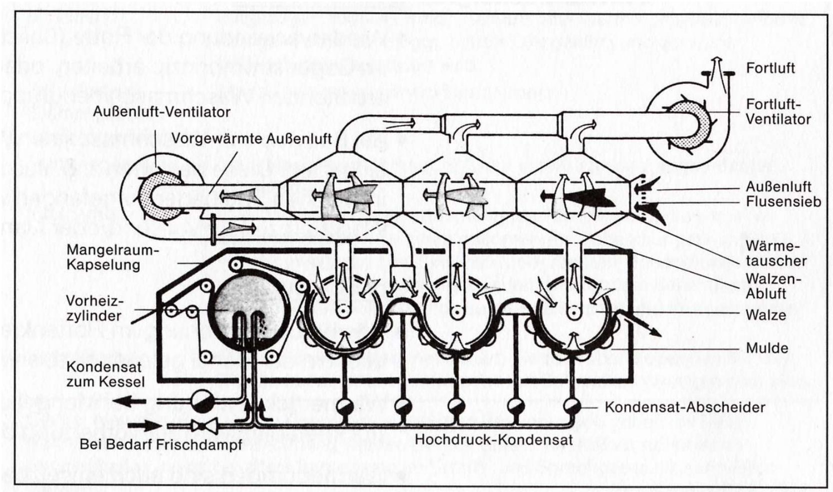
Heat recovery at mangling





Heat balance at mangling

textile heating	4 %
heating of water	5 %
vaporization of water	40 %
heating of air	17 %
heat losses	37 %

optimisation of mangle by

- Adoption of mangling velocity
- Controlling of residual textile moisture
- Controlling of cylinder press temperature
- Adoption of contact pressure/ thickness of textile layer

Measures to reduce energy consumption

active environmental protection

Optimize energy consumption by

- ⇨ Burner optimization
- ⇨ Use of adapted burners
- ⇨ Reduced washing temperatures
- ⇨ Optimized washing mechanics

without negative influence on washing performance as well as life cycle of textiles

passive environmental protection

Reduce energy consumption by

- ⇨ Technical measures to reduce energy consumption
- ⇨ Application of heat exchangers to reduce temperature of effluent water