Energy Audit Summary Report
Austrian Energy Agency
Audit no. 02 - AT02

Service/Production
Industrial Laundry

AUSTRIAN ENERGY AGENCY

25.07.2011

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AUDIT no. 02 – AUT02

Industrial Laundry

1. Data of the auditor

1.1. Contact data of the auditor

2. Introduction

2.1. Objectives

Status-Quo analysis on efficiency level of this industrial laundry plan, strategy for energy efficiency improvements.

3. Status Quo: processes, distribution, energy supply

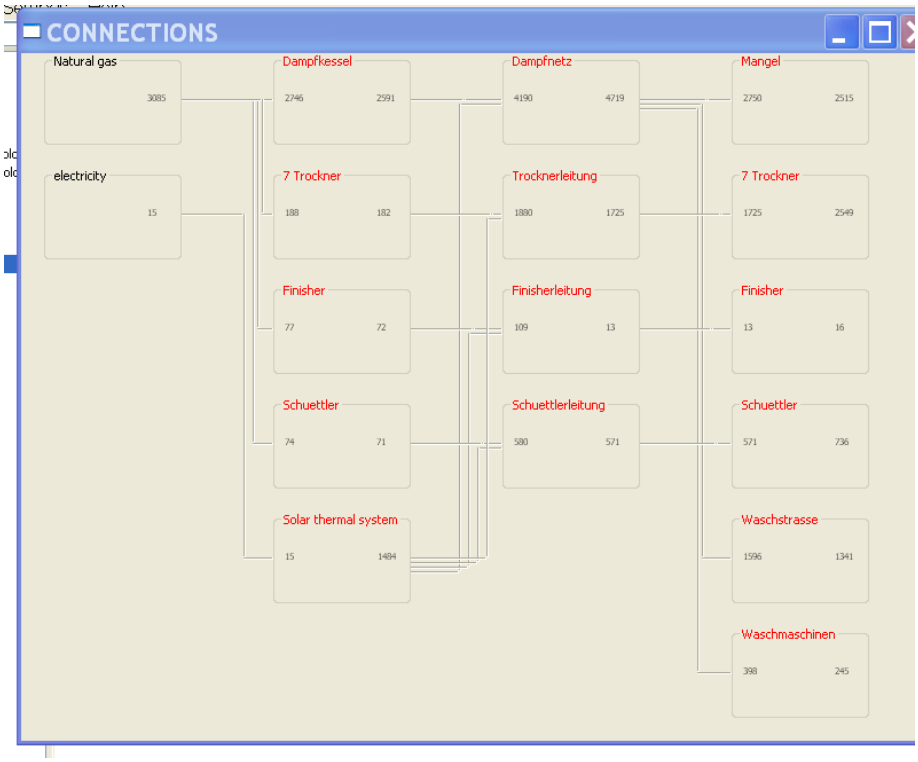
3.1. General info of company

Industrial laundry, (laundry of hotels, professional clothes, hospitals, old peoples home)

Production capacity: more than 20000 kg/day Working time: 5-6 days (16 h/day), 250 days a year

3.2. Flow sheet of the whole manufacturing side (processes, distribution, energy supply)

in form of a block diagram



Main processes are:

- **Washing:** washing extractors, 1 tunnel washer
- **Drying:** Tumble Dryers, 1 Dryer (for pre-treating); Press
- **Finishing:** Mangles (Calander), tunnel finisher

3.3. Description of the existing system

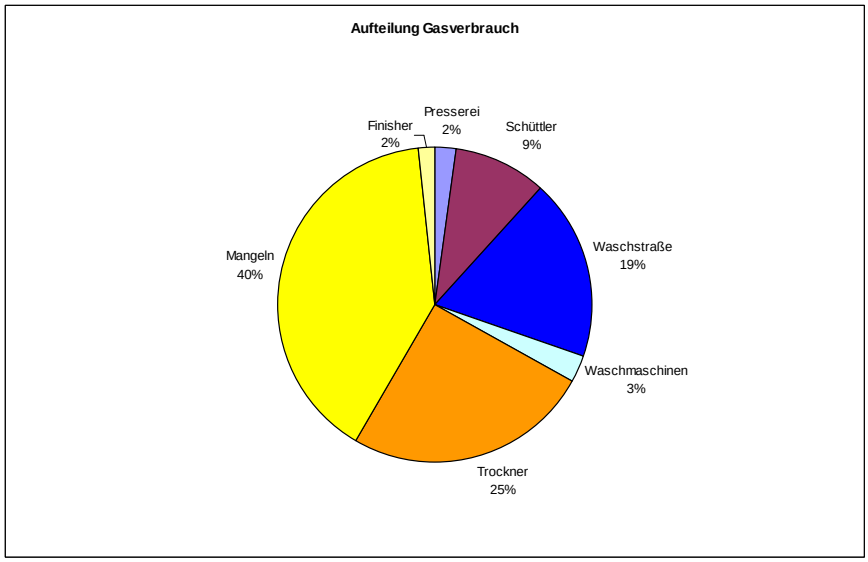
Gas consumption is only split up between production, office and domestic heat water. The main energy is supplied by two steam boilers (2,4 MW and 1,55 MW) (the first one is sufficient for the most operating times, the other one for peak loads). The flue gas temperature is 228 °C and 198 °C respectively. Steam of 9 bar is produced, the feedwater consumption per day is around: 12-13 m³/day. The dryers and the tunnel finisher are heated directly by gas.

The steam distribution net supplies:

- 9 bar calander
- 6 bar press (not modelled in EINSTEIN, because of minor energy consumption)
- 3-4 bar: washing extractors, tunnel washer

Direct gas supplied:

- Several dryers, one add. dryer
- tunnelfinisher



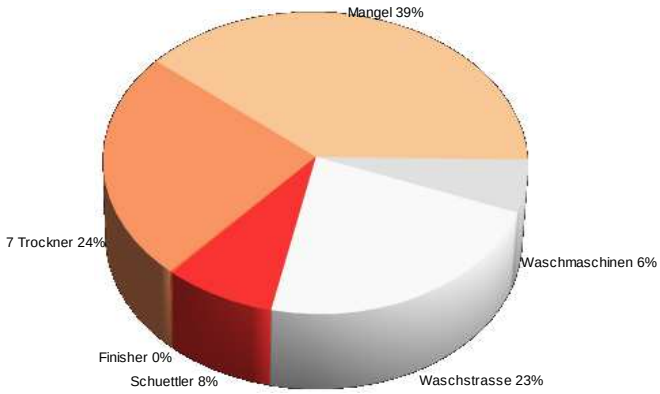


Figure 1: Useful process heat (UPH) by process

As several new equipment was installed recently, the FEC is only given for one month. (April, May). Those data was extrapolated to a whole year (on a working day basis).

Table 2.1.1 Total primary energy consumption (PEC) and primary energy consumption for thermal use (PET)

Energy type (fuels / electricity)	PEC		PET	
	[MWh]	[% of Total]	[MWh]	[% of Total]
Brennstoffe gesamt	11.307	88,39	11.305	100,00
Strom gesamt	1.485	11,61	0	0,00
Gesamt (Brennstoffe+Strom)	**12.792**	**100,00**	**11.305**	**100,00**

Table 2.1.2 Total final energy consumption (FEC) and final energy for thermal use (FET); present state.

Fuel type	FEC		FET	
	[MWh]	[% of Total]	[MWh]	[% of Total]
Natural gas	10.279	95,41	10.278	100,00
Strom	495	4,59	0	0,00
Total	10.774	100,00	10.278	100,00

Table 2.1.3. Final energy consumption for thermal use (FET) by equipment (present state).

Equipment	Fuel type	FET by equipment	
		[MWh]	[% of Total]
7 Trockner	Natural gas	1.976	19,04
Finisher	Natural gas	120	1,16
Schuettler	Natural gas	653	6,29
Dampfkessel	Natural gas	7.629	73,51
Total		**10.377**	**100,00**

There are two distribution systems: The main part is a steam distribution system 10/9 bar. The other main heat consumers are directly supplied with gas.

Dryers, Tumble dryer produce heat of 200°C but only at the beginning of the drying process, later on this temperature goes down to 120°C. The calanders (Mangel) are heated with 200°C. The washing processes have a temperature of around 70°C.

The main energy using processes are as mentioned above:
Several dryers, 1 dryer for pre-treating (before calanders), calanders, tunnel washer, washing machines and finisher. For the heating of the building only minor energy consumption was reported and not modelled in EINSTEIN.

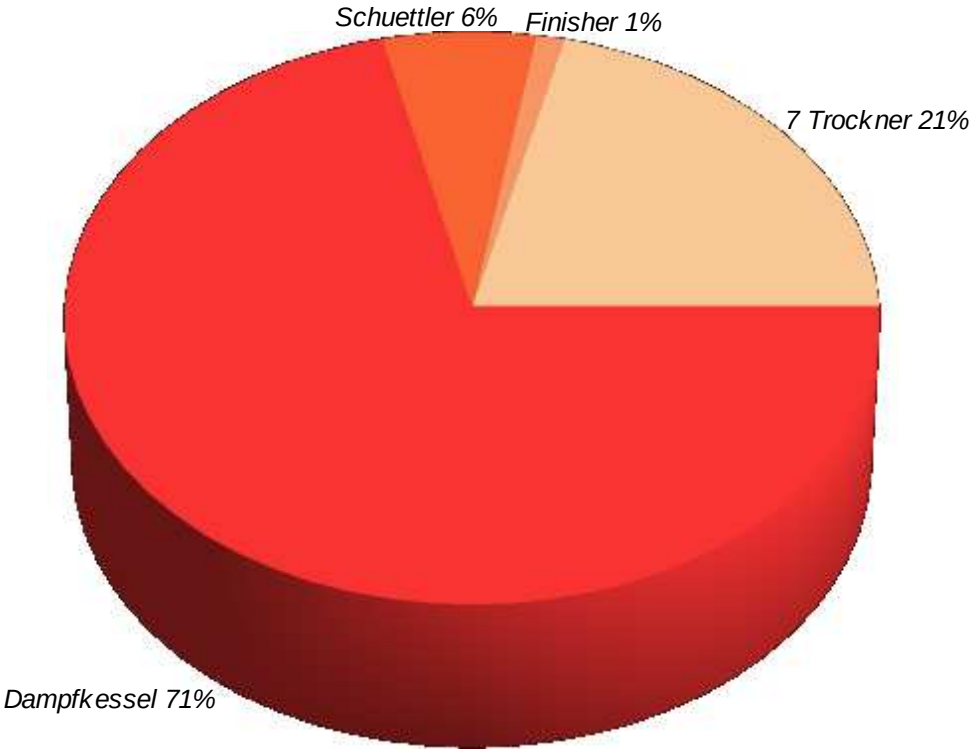


Table 2.3.1.1 Useful process heat demand (UPH) by process. Present state.

Process	Total	Circulation	Maintenance	Start-up
	[MWh]	[MWh]	[MWh]	[MWh]
Mangel	3.759	0	3.708	51
7 Trockner	1.976	1.824	152	0
Finisher	108	0	108	0
Schuettler	587	529	58	0
Waschstrasse	1.659	1.508	150	0
Waschmaschinen	212	193	19	0
Presserei	145	0	145	0
Gesamt	**8.445**			

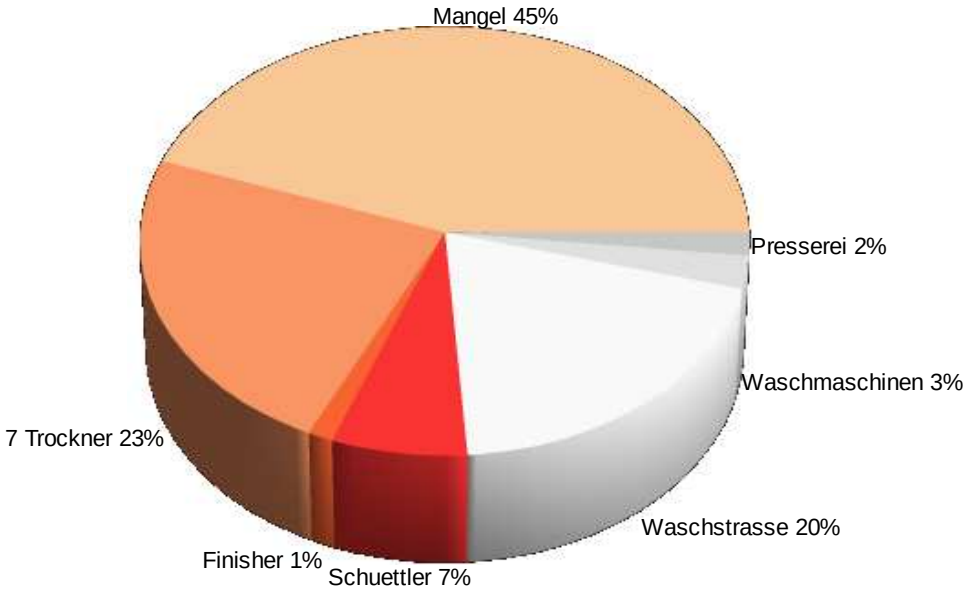


Figure 2.3.1.1 Useful process heat (UPH) by process

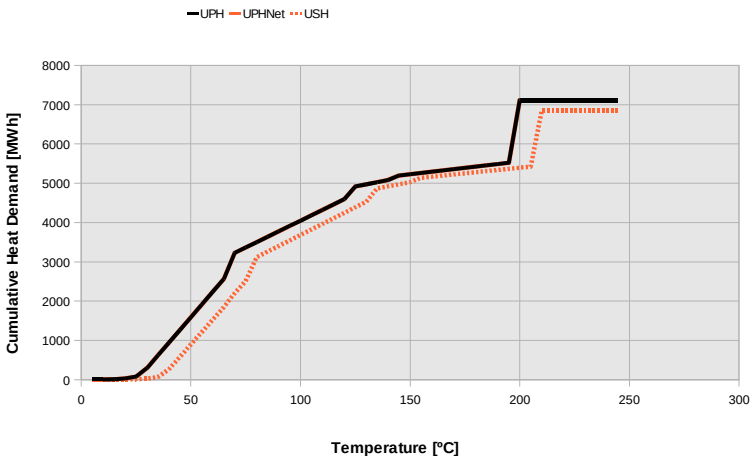


Figure 3: heat and cold demand over the temperature – present state.

3.4. General

No additional measurements were made, but the technician of the company made (based on suggestion of AEA) an estimate of the energy consumption for all processes. The most relevant missing data is the temperature of the waste heat flows (esp. dryer and Mangel).

4. Comparative study

4.1. Proposed alternatives

New Proposal HX EINSTEIN	This proposal consists of one heat exchanger: For the preheating of the air inflow for the dryers by the waste heat of the main steam dryer. It has a high saving effect and reasonable costs.
New Proposal HX Manuell	Further energy savings are possible with the installation of another heat exchanger between the waste heat of the calander and the inflow of the tunnel washer. This alternative has also excellent pay back time and was therefore chosen as alternative.

Solar Thermal and CHP were calculated but did not deliver relevant results.

Table 4.1. Primary energy consumption: present state and alternative proposals.

Alternative	Primary energy consumption	Savings	
	[MWh]	[MWh]	[%]
Present State (checked)	12.792	---	---
HX	11.367	1.424	11,13
HX Manuell	10.169	2.623	20,51

5. Selected alternative(s) and conclusions

5.1. Selected alternative

5.1.1. Heat Recovery

Table 5.1.1.2 Heat exchanger network and amount of recovered energy

Heat Exchanger	Power	Heat Source	Heat Sink	Heat transferred	
	[kW]			[MWh]	[%]
Mangel Waschstrasse	208	Mangel	Waschstrasse	859	44,50
Trocknerzuabluft	210	7 Trockner	7 Trockner	864	44,77
Schuettler	50	Schuettler	Schuettler	207	10,73
	468			**1929,62**	**100**

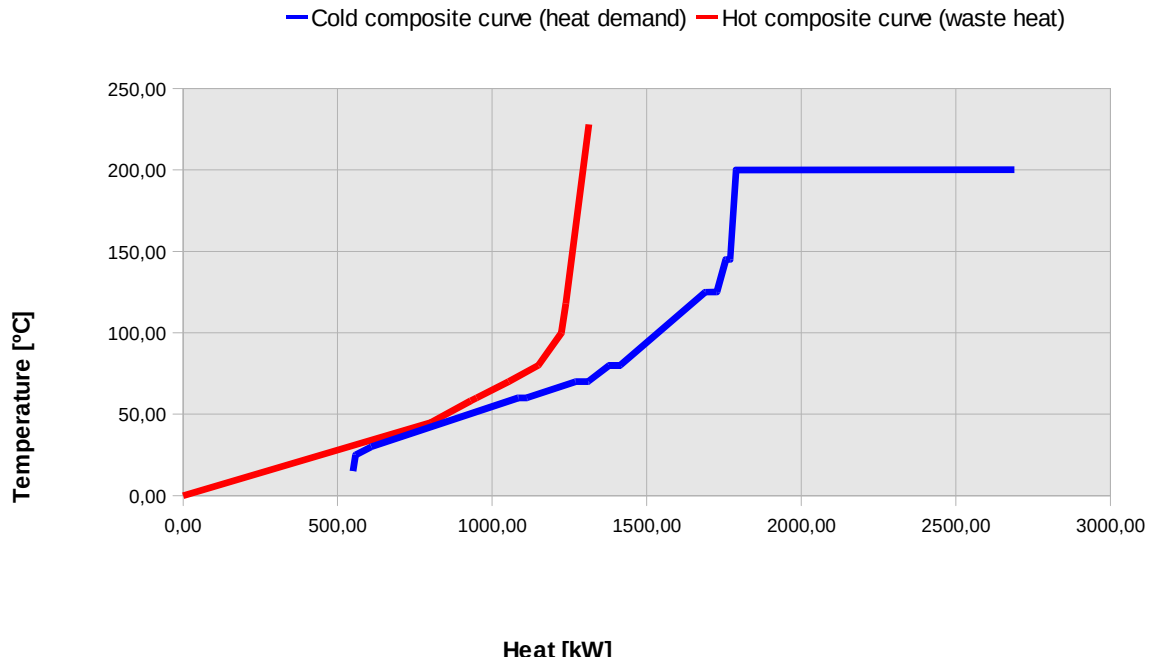


Figure 3.1.2.1. Pinch Analysis - Composite Curves

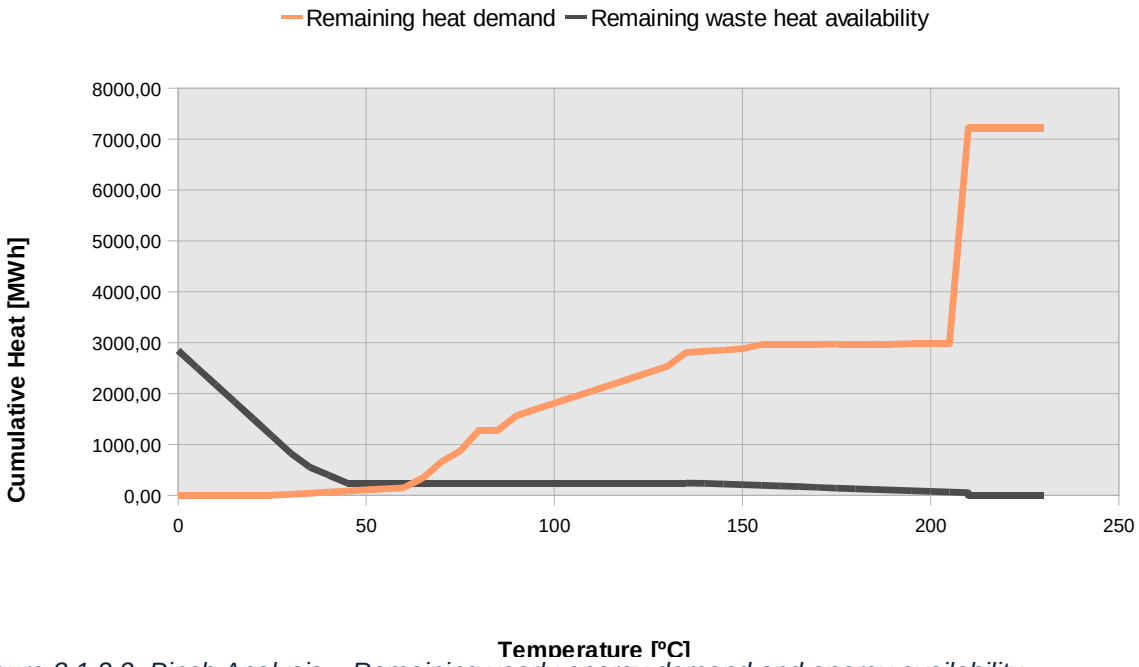


Figure 3.1.2.2. Pinch Analysis – Remaining yearly energy demand and energy availability

		Present state	Alternative	Saving
Total primary energy consumption (1)	*[MWh]*	12.792	10.169	2.623 20,51
- total	*[MWh]*	12.792		
- gas	*[MWh]*	11.307	8.684	*2623* *23%*
- electricity	*[MWh]*	1.485	1.485	*0*
Primary energy saving due to renewable energy	*[MWh]*		*0*	*-0*
CO_2 emissions	*[tons/a]*	2817,16	2221,04	*596* *21%*
Annual energy system cost (2)	*[EUR]*	513.830	416.819	97.011 19%
Total investment costs	*[EUR]*		244.000 170.000 (incl. subisidies)	
Payback period (3)	*[years]*		*1,6*	

(1) including primary energy consumption for non-thermal uses

(2) including energy cost (fuel and electricity bills), operation and maintenance costs and annuity of total investment.

(3) Supposing 30% of funding of total investment (subsidies or equivalent other support mechanisms)

5.1.2. Energy and environmental analysis

The primary energy consumption could be reduced by 20,5 % by installation of three groups of heat exchangers, the corresponding CO2 emissions would by reduced by 21%.

Table 4.1. Primary energy consumption: present state and alternative proposals.

Alternative	Primary energy consumption	Savings	
	[MWh]	[MWh]	[%]
Present State (checked)	12.792	---	---
HX	11.367	1.424	11,13
HX Manuell	10.169	2.623	20,51

Table 4.2 Useful process and supply heat: present state and alternative proposals.

Alternative	Useful process heat (UPH)	Savings UPH	Useful supply heat (USH)	Savings USH
	[MWh]	[MWh]	[MWh]	[MWh]
Present State (checked)	8.445	---	9.348	---
HX	8.445	0	8.197	1.151
HX Manuell	8.445	0	7.216	2.132

Table 4.4 Environmental impact: present state and alternative proposals.

Alternative	Production of CO2	Highly Radioactive Nuclear Waste	Water consumption
	[t]	[kg]	[m3]
Present State (checked)	2817,16	2,48	0,00
HX	2493,50	2,48	0,00
HX Manuell	2221,04	2,48	0,00

5.1.3. Economic analysis

The total energy costs could be reduced by 97.011 EUR, which means a reduction by almost 20%. The corresponding investment would be 170.800 EUR which means a pay back time of less than 2 years.

Table 4.5 Investment cost: alternative proposals.

Alternative	Total investment	Own investment	Subsidies
	[€]	[€]	[€]
Present State (checked)	---	---	---
HX	144.000	100.800	43.200
HX Manuell	244.000	170.800	73.200

Table 4.8 Internal rate of return (IRR) and net present value (NPV) of investment: alternative proposals.

Alternative	Modified Internal Rate of Return	Pay-Back Period	Benefit Cost Ratio	Own Investment	Net Present Value (30 years)
	[%]	[years]	[-]	[€]	[€]
HX	12,4	1,7	---	100.800 €	1.457.698 €
HX Manuell	12,7	1,6	---	170.800 €	2.689.693 €

5.1.4. Conclusions and outlook

Significant energy savings are possible by the installation of heat exchangers for the main waste heat flows. (calander, dryers)

The company is evaluating heat exchangers for those purposes.