Energy Audit Summary Report
Austrian Energy Agency
Audit no. 25 – AUT07

Service/Production
Industrial Laundry

AUSTRIAN ENERGY AGENCY

7.12.2011

Supported by INTELLIGENT ENERGY EUROPE

This energy audit has been carried out with cofunding of the European Commission (EACI) in the Framework of the EU funded project EINSTEIN-II (ProjectNo. IEE/09/702/SI2.558239)

AUDIT no. 25 – AUT07

1. Data of the auditor

1.1. Contact data of the auditor

Konstantin Kulterer, Austrian Energy Agency, Austria, Vienna

Energy Expert (not Energy Auditor), several energy audits performed

Audit date: 23.11.2011

Duration: Several hours on-site for data acquisition and on-site visit

2. Introduction

2.1. Objectives

Main objective was to give an overview of the energy consumption and possible energy savings.

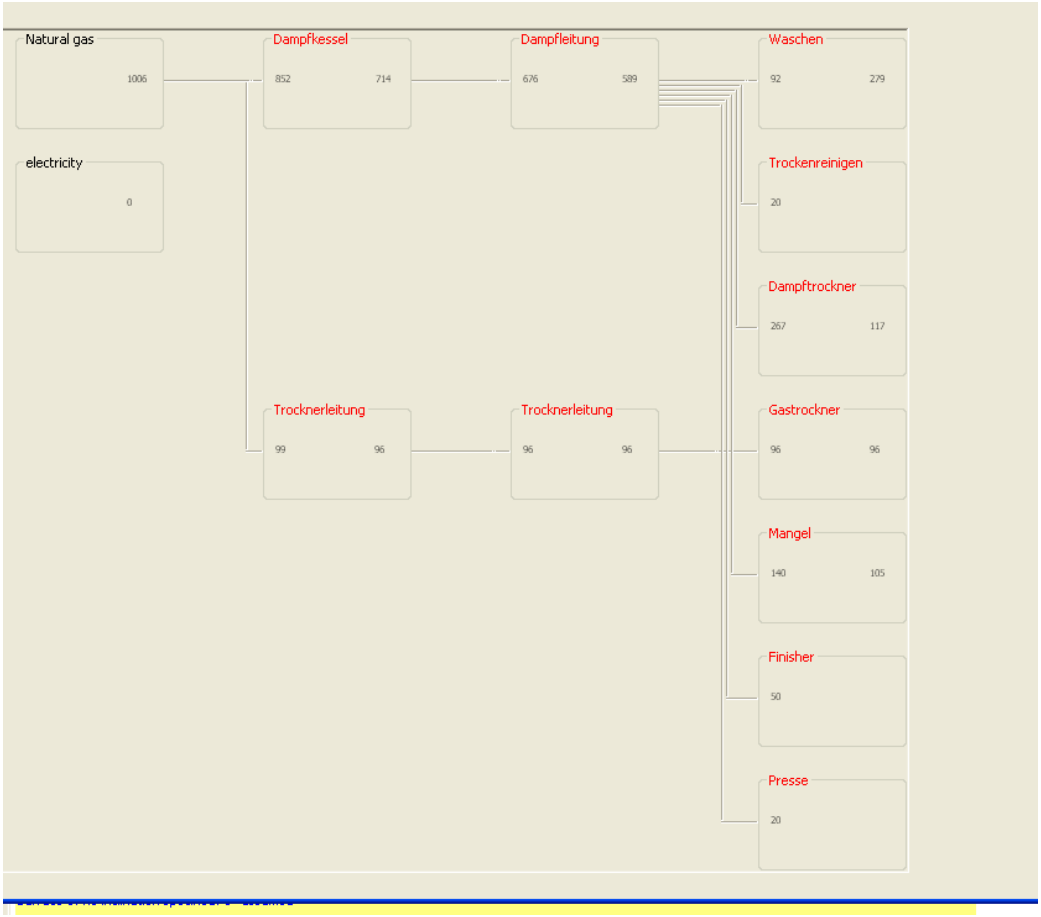
3. Status Quo: processes, distribution, energy supply

3.1. General info of company

Different laundries are washed, towels, bedclothes and especially a lot of mats.

Production capacity: 90 kg/h, around 800 kg/day, Working time: 5 days (8 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



3.3. Description of the existing system

- *Energy Supply*

The main heat supply system is a steam boiler with 800 kW. In addition one dryer is a direct gas dryer, all other equipment is supplied by steam.

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	1.132	77,21	1.107	100,00
Strom gesamt	334	22,79	0	0,00
Gesamt (Brennstoffe+Strom)	**1.466**	**100,00**	**1.107**	**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	1.029	90,23	1.006	100,00
Strom	111	9,77	0	0,00
Total	1.141	100,00	1.006	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]
Dampfkessel	Natural gas	852	89,60
Trocknerleitung	Natural gas	99	10,40
Total		**951**	**100,00**

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

Process	Total	Circulation	Maintenance	Start-up
	[MWh]	[MWh]	[MWh]	[MWh]
Waschen	92	92	0	0
Trockenreinigen	20	0	20	0
Dampftrockner	267	267	0	0
Gastrockner	96	96	0	0
Mangel	140	0	140	0
Finisher	50	0	50	0
Presse	20	0	20	0
Total	**685**			

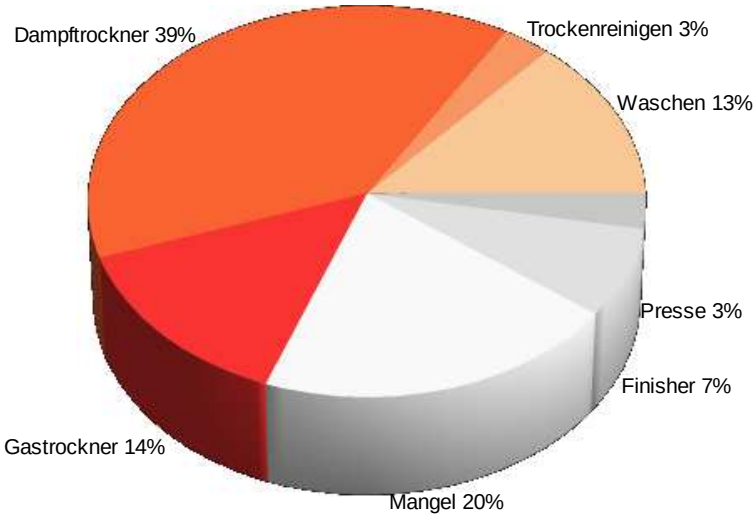


Figure 2.3.1.1 Useful process heat (UPH) by process

- *Distribution system*

The main distribution system is the steam system on different pressure levels. The hot condensate is used to preheat the water for the washing machines. (below 10 bars)
In addition a direct gas burner for the gas dryer is installed.
The radiation system and the direct heater for the production hall was not considered for EINSTEIN as no data is available and it is estimated that this consumption is very low.

- *Main energy consuming energy processes and buildings*

Washing
For washing 7 washing machines are installed with a capacity of more than 280 kg. In reality 90 kg of laundry is washed on average. Especially three washing machines are used intensively. The washing temperature is dependent on the product but mainly 70-80°C, for EINSTEIN 75°C on average were used.

The washing tunnel is not used very often and was not considered for the EINSTEIN study.

In addition two machines for dry cleaning are used. From the data known on the amount of clothes for dry cleaning, it is estimated that one machine runs on full load, the other would not have to be used in this case.

Drying
There are 4 dryers with different capacity installed. The main dryer (40 kg, 125 kW thermal power) is supplied by steam, for the EINSTEIN study it was estimated that this dryer runs full time. The drying temperature is 180°C, the temperature of the exhaust gas was estimated at 80°C.

The second dryer is supplied by gas and is used partly for the pre-treatment of the laundry for the calander, therefore it was estimated that the thermal power is used in half load.
The other two dryers were not considered in the EINSTEIN study, as they are used not very often.

Finishing

For the finishing process a big calander (thermal capacity: 192 kW) is installed with a high drying capacity. For EINSTEIN it was estimated that around half of the thermal power is used.

In addition a finisher, a press and a machine for finishing shirts is installed. They are only part time and were considered in EINSTEIN with full thermal capacity but with small running hours.

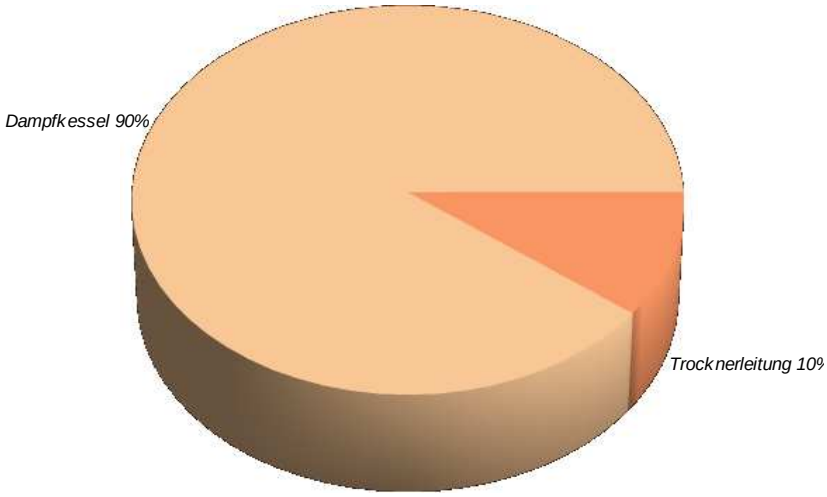


Figure 2.1.3 Final energy consumption for thermal use (FET) by equipment

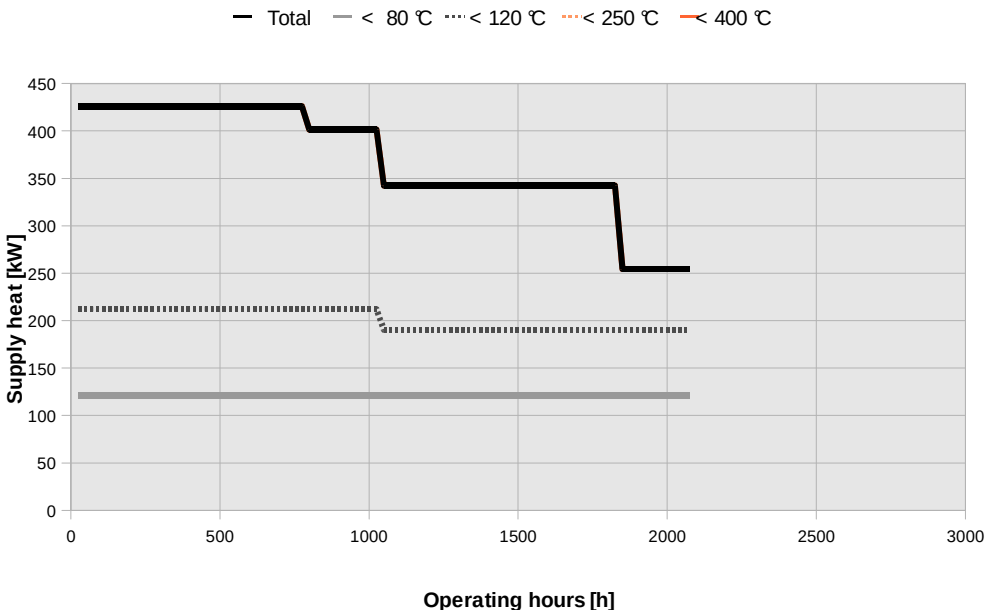


Figure 2.2.2.1 Distribution of supply heat by temperature levels and annual operating hours. Present state.

3.4. General

The specific energy consumption per kg washed laundry of this company is very high. The reason for this is not so obvious. On reason could be the high capacity of the calander and the dryers, which are never full loaded.

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 KWK	Significant primary energy saving effects are possible with the installation of a combined heat and power plant. The economic situation is not very good.
New Proposal Solarthermal	This alternative consists of a solar thermal plant only, it has very high costs, the primary energy saving effect is not so high (as only 12,3% can be achieved by the solar system)

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

Alternative	Primary energy consumption	Savings	
	[MWh]	[MWh]	[%]
Ist-Zustand (überprüft)	1.466	---	---
Neuer Vorschlag 1 WT Netzwerk	1.321	146	9,94
Neuer Vorschlag 2 KWK	1.222	245	16,70
Neuer Vorschlag 3 Solarthermie	1.339	127	8,69

5. Selected alternative(s) and conclusions

5.1. Selected alternative

This alternative (new proposal HX) was selected as it has the highest energy saving effect and reasonable costs.

5.1.1. Heat recovery

Table 3.1.2. Heat exchangers and amount of recovered energy

Heat Exchanger	Power	Heat Source	Heat Sink	Amount of recovered energy	
	[kW]			[MWh]	[%]
WT Dampftrockner	39	Dampftrockner	Dampftrockner	82	100,00
	39			**82,35**	**100**

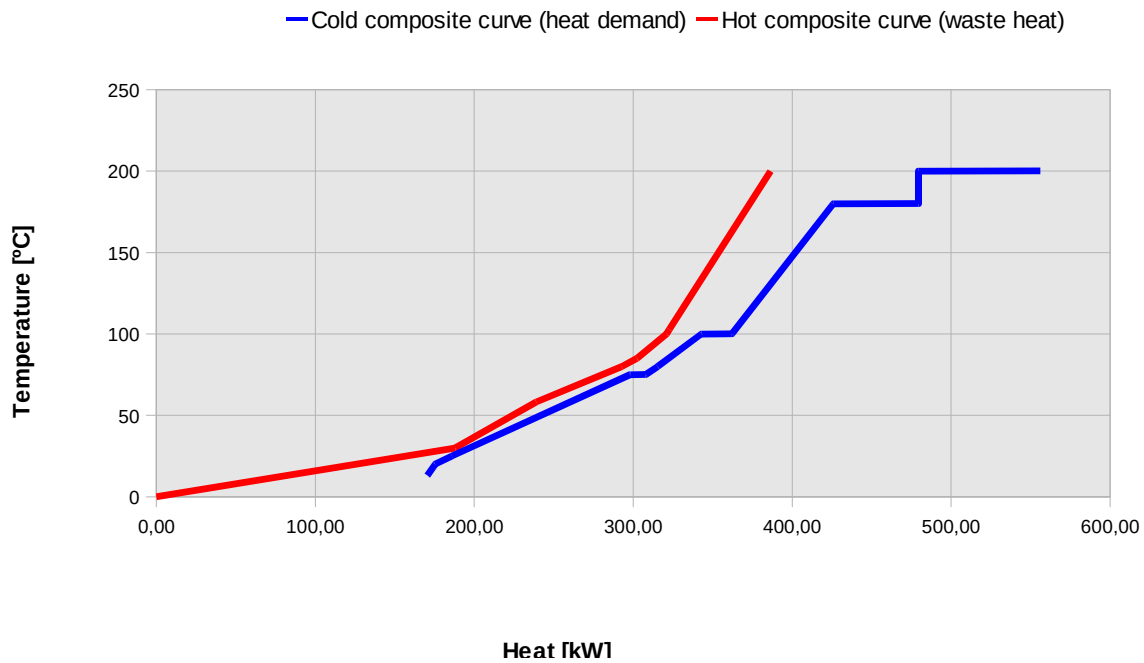


Figure 3.1.2.1. Pinch Analysis - Composite Curves

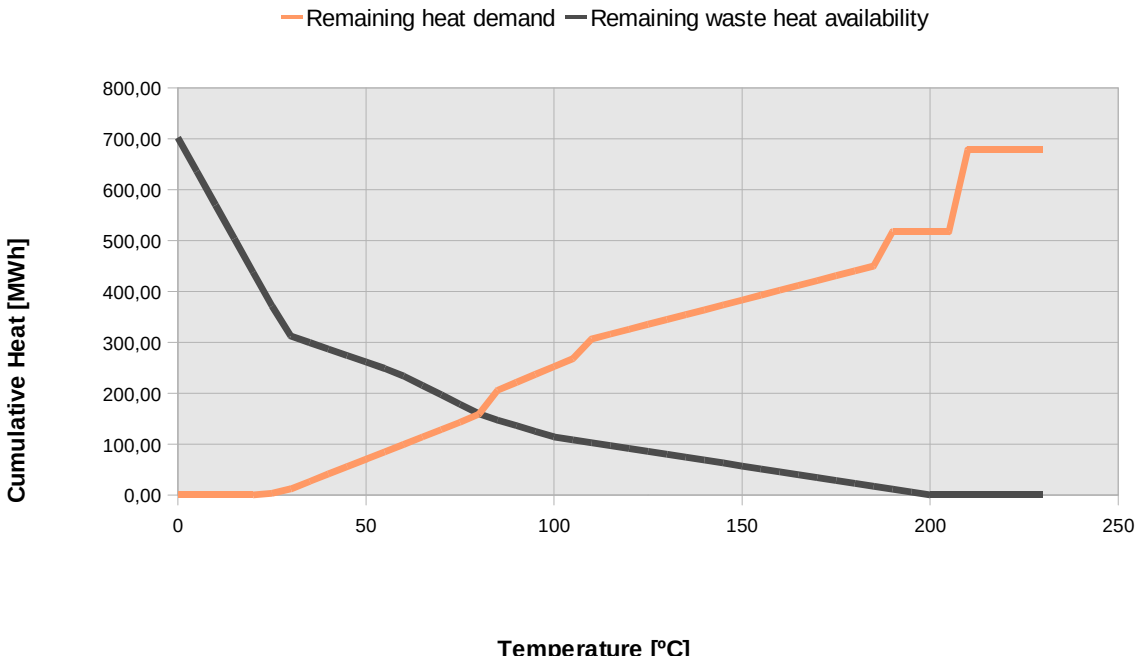


Figure 3.1.2.2. Pinch Analysis – Remaining yearly energy demand and energy availability

5.1.2. Heat and Cold Supply

No additional equipment is needed.

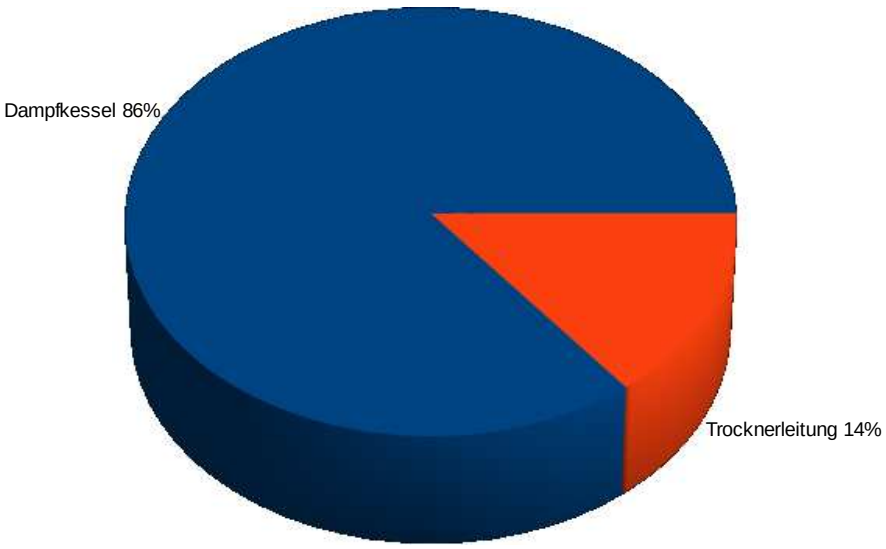


Figure 3.1.3. Contribution of each equipment to the total useful heat and useful cooling supply (USH & USC).

5.2. Comparative study and conclusions

		Present state	Alternative	Saving
Total primary energy consumption (1)		*1466*	*1.321*	*146* *10%*

- total	[MWh]	*1466*		
- gas	[MWh]	*1.132*	*986*	*13%*
- electricity	[MWh]	*334*	*334*	*0*
Primary energy saving due to renewable energy	[MWh]	*0*	*0*	*-0*
CO_2 emissions	[t/a]	*313*	*280*	*11%*
Annual energy system cost (2)	[EUR]	*57.529*	*53.757*	*6.5%*
Total investment costs	[EUR]		*24.000*	
Payback period (3)	[years]		*4*	

(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)

5.2.1. Energy and environmental analysis

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

Alternative	Primary energy consumption	Savings	
	[MWh]	[MWh]	[%]
Ist-Zustand (überprüft)	1.466	---	---
Neuer Vorschlag 1 WT Netzwerk	1.321	146	9,94
Neuer Vorschlag 2 KWK	1.222	245	16,70
Neuer Vorschlag 3 Solarthermie	1.339	127	8,69

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]
Ist-Zustand (überprüft)	685	---	841	---
Neuer Vorschlag 1 WT Netzwerk	685	0	678	163

Neuer Vorschlag 2 KWK	685	0	773	68
Neuer Vorschlag 3 Solarthermie	685	0	773	68

Table 4.4 Environmental impact: present state and alternative proposals.

Alternative	Production of CO2	Highly Radioactive Nuclear Waste	Water consumption
	[t]	[kg]	[m3]
Ist-Zustand (überprüft)	313,01	0,56	0,00
Neuer Vorschlag 1 WT Netzwerk	279,87	0,56	0,00
Neuer Vorschlag 2 KWK	282,30	-0,13	0,00
Neuer Vorschlag 3 Solarthermie	283,89	0,56	0,00

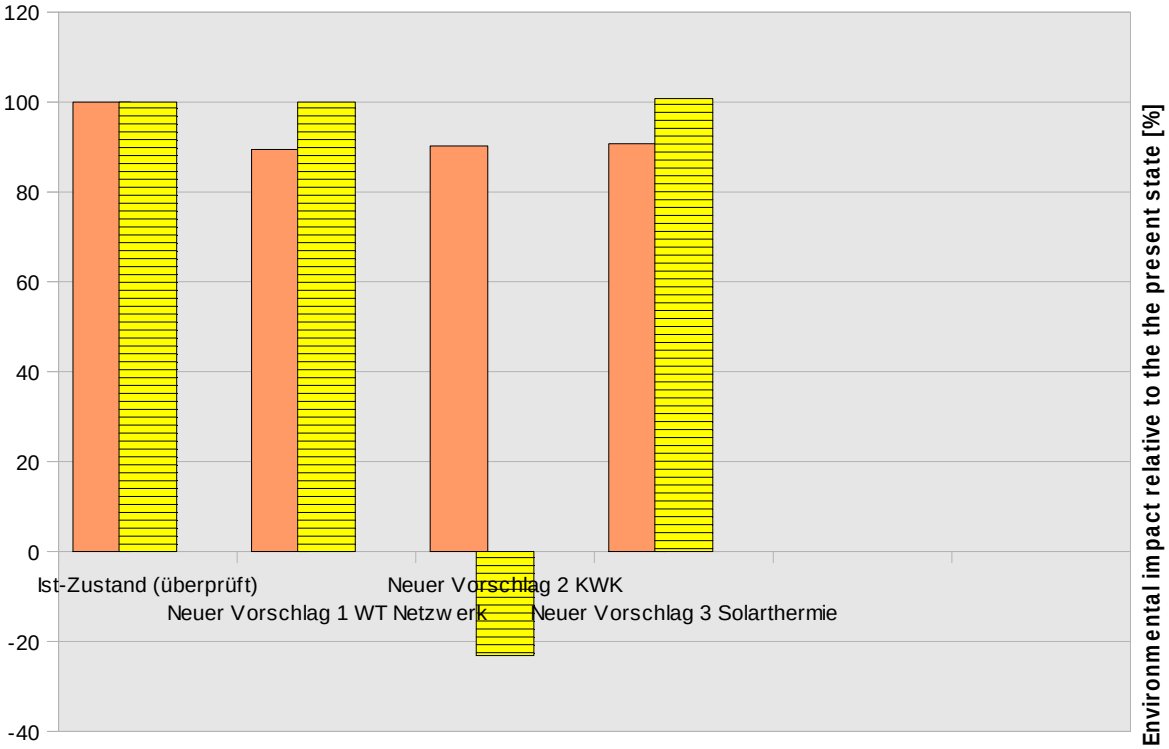


Figure 4.4 Comparison of alternatives: environmental impact

The suggested alternative could reduce the primaryenergy consumption by 10%, the gas consumption by 11%. The CO2 Emissions would be reduced by 33t, a reduction of 11%.

5.2.2. Economic analysis

Table 4.5 Investment cost: alternative proposals.

Alternative	Total investment [€]	Own investment [€]	Subsidies [€]
Ist-Zustand (überprüft)	---	---	---
Neuer Vorschlag 1 WT Netzwerk	24.000	16.800	7.200
Neuer Vorschlag 2 KWK	62.500	56.250	6.250
Neuer Vorschlag 3 Solarthermie	176.654	123.658	52.996

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 [years]	Benefit Cost Ratio [-]	Own Investment [€]	Net Present Value (20 years) [€]
Neuer Vorschlag 1 WT Netzwerk	10,9	4,0	---	16.800 €	63.171 €
Neuer Vorschlag 2 KWK	-3,1	19,0	---	56.250 €	-39.367 €
Neuer Vorschlag 3 Solarthermie	-1,0	19,0	---	123.658 €	-63.756 €

The suggested heat exchangers would cost (after subsidy) around 16.800 EUR, but would save energy costs of 6.240 EUR. Including the maintenance costs (of 500 EUR), this would mean a Pay-Back Period of 4 years.

5.2.3. Conclusions and outlook

The main assumption refers to the energy consumption of the main dryer. But as this dryer runs more or less on full load the above mentioned saving potential of 32% of this single process is realistic. There would be enough place for the installation of the heat exchanger module.