Laundry Cases – Austria

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Background Information

Concentration Energy Balance, Heat Recovery

Solar, CHP were no economic alternatives in Austria (but very easy to evaluate in EINSTEIN)

Personal Contact to Laundries

- ✓First EINSTEIN national Workshop in combination with other events
- ✓Contact within national branch concept (2011 for laundries)
- ✓**Free-Audits**
- ✓Done within EINSTEIN II Project, co-financed by Austrian klima:aktiv programme energy efficient companies

Relevant Questions?

For washing laundry for what process you need usually most of thermal energy?

The answer seems clear: Washing?

Is it useful to make an Energy Balance?

All Laundries have (more or less) the same equipment: Energy Balance is the same?

Companies visited

Energy consumption-FEC

400-10,000 MWh

Amount of washed Laundry

60 kg/h-1,000 kg/day

1,600 kg/day-above 25,000 kg/day

Share of Electricity 10%-25%

Share of Thermal Energy (all Natural Gas!)

75%-90%

Status Quo-Energybalance

Status Quo Without EINSTEIN

- ✓No overview on energyconsumption of all relevant machines per year (or day)
- ✓Power times hours is NOT kWh effectively used! (E.g. Washing machines need a lot of start up heat!)
- ✓Usually no estimation of losses in distribution

EINSTEIN-Energybalance

Energybalance with EINSTEIN

- ✓Bases for all calculations is estimation of energy consumption of processes:
- ✓Therefore real data on temperature and flows improve calculation!!
- ✓Furthermore EINSTEIN differs between Start-up and e.g. Heat Loss…
- ✓Time Schedule improves estimations of running hour (Load Profile)

Energy Audit-Data Gathering

With EINSTEIN

- ✓Concentration on relevant points, quite deep!!
- ✓Data-Sheets of Machines in FIRST Meeting
- ✓Load Estimation for Machines during FIRST Meeting/on-Site visit
- ✓Therefore usually have a very good overview on available data after 3-4 h!!
- ✓And can start modelling! Usually no second visit necessary!

Data Gathering

First step within EINSTEIN was the data collection phase

- Gas- and Electricity Consumption
- Amount of laundry and production times of the main areas (laundry balance…)
- Steam or Gas connected power input consumption full load for all machines
- Water Consumption (usually per month and year)
- the estimated Part Load Condition (laundry treated)

EINSTEIN Method-Processes

What should be considered?

The main thermal heat consumers within laundries are:

- ✓Washing: Washing Tunnels, Washer Extractors
- ✓Drying: Tumbledryers
- ✓Finishing: Calender, Finisher, Press

Washing

Tunnel washers and **washer extractors** at 50-75°C

Waste water has a temperature between 30 up to 50°C, depending of existing heat recovery and mixing with cold water.

Data available: Washing Temperatur, Temperature of inflowing water, amount of water (for whole company, for tunnel washers (l/cycle)

Drying

- Usually done with tumble dryers at 45° to above 100°C (160°C, usually 10 bar), sometimes direct heated (gas)
- Waste heat usually around 70°C and above (120°C?)
- **Data available:** air flow (m^3/h) for full load (with or without circulation), T-of incoming air (30°C)

Calender

- Usually steam (10 bar), sometimes direct heated (gas)
- **Data available:** full load steam and/or gas power input, air flow of exhaust air, estimation of temperature of outgoing air-flow

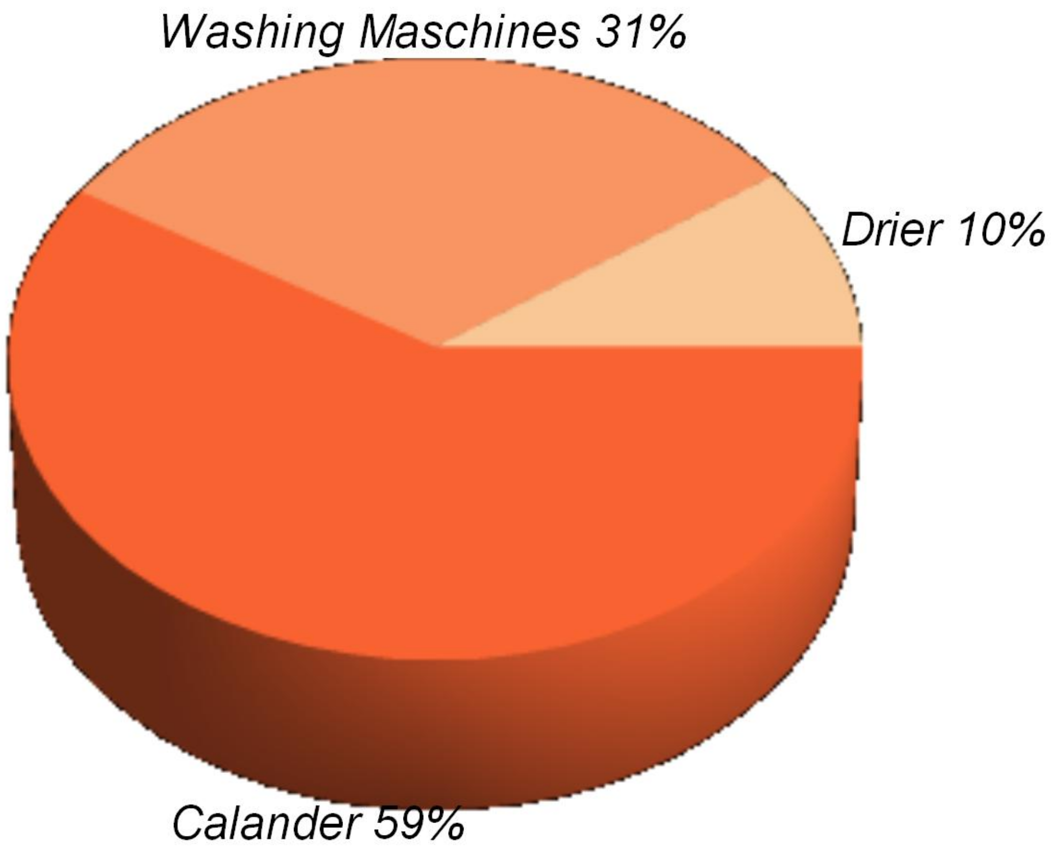
  

Finishing

Finishing: done at 180°C, also some hot exhaust gas available at least 100°C.

Finisher have very high recirculation rate

Useful supply heat (USH) by equipment



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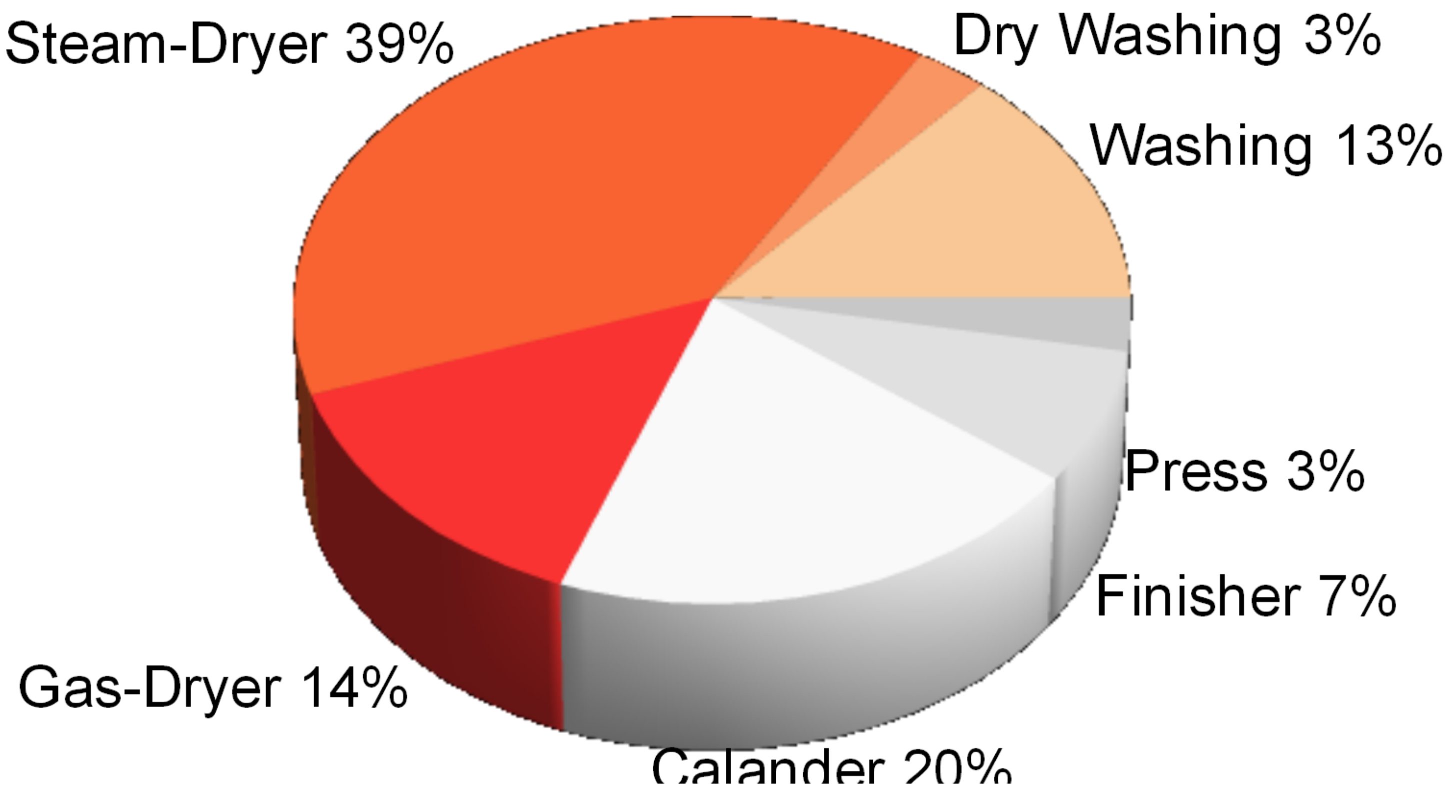

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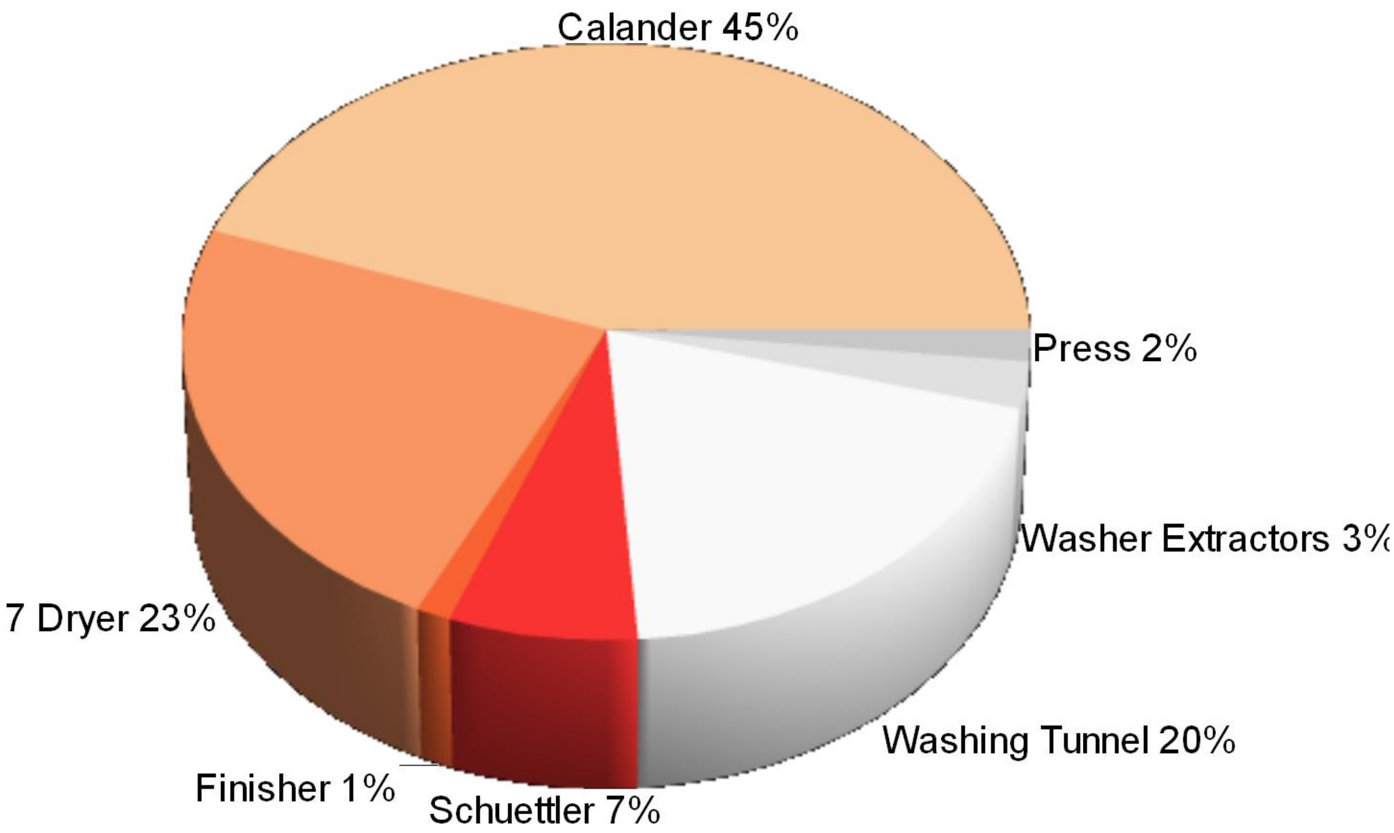

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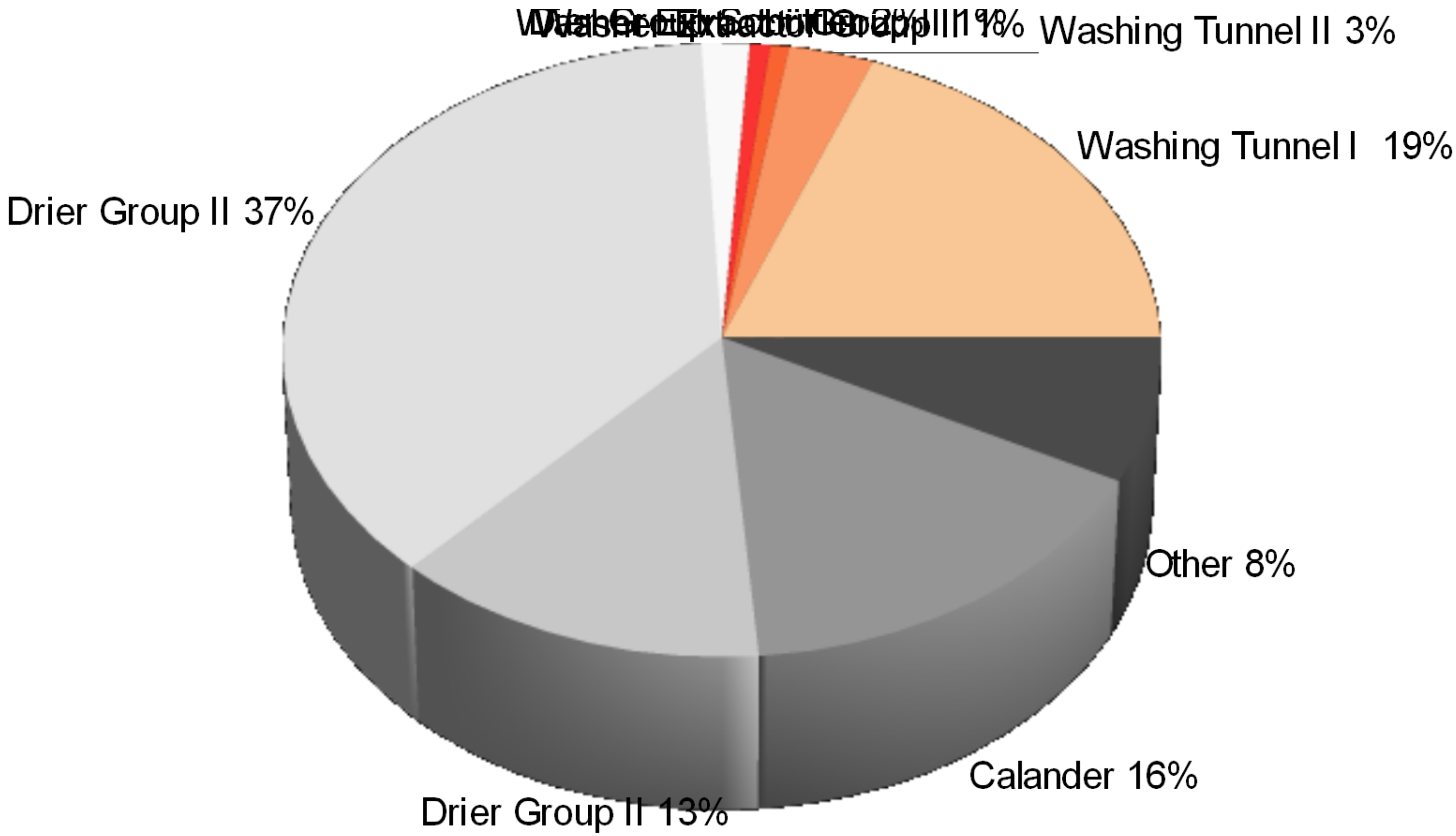


Design of Heat Exchanger-Network

With this data the EINSTEIN Heat Exchanger Network was designed.

Especially heat recovery from the main waste heat flows from

- ✓ dryers and
- ✓ washing tunnels

usually to the inflow of the same processes have quick pay back times and can save process heat for those processes from 10 up to 40%.

Current Constraints to Heat Recovery

- ✓ Water sometimes not heated above 40°C for washing-process (co-agulation)
- ✓ Dirty Water (fibrous material)!!
- ✓ Direct Gas heated Dryer: Fear that Heat Exchanger has too high pressure loss (flue gas would not get through)
- ✓ A lot of waste heat from calenders is from radiation (hot surface area, heat in production hall)
- ✓ Heating System no Heat Sink: usally not a lot of energy needed…(not known), no storage tanks at 60°C available (fear of contamination)
- ✓ Final waste water in canal usually more than 30°C;

EINSTEIN - Result

Table 5.1.1.2 Heat exchanger network and amount of recovered energy

Heat Exchanger	Power	Heat Source	Heat Sink	Heat transferred	
	[kW]			[MWh]	[%]
Calander/Washing Tunnel	208	Calander	Washing Tunnel	859	44,50
Dryergroup In-Outflow	210	7 Dryer	7 Dryer	864	44,77
Schuettler	50	Schuettler	Schuettler	207	10,73
	468			**1929,62**	**100**

EINSTEIN - Result

Heat Exchanger	Power	Heat Source	Heat Sink	Amount of recovered energy	
	[kW]			[MWh]	[%]
WT Washing Tunnel	141	Waschstrasse 1	Waschstrasse 1	295	23,94
HX Dryergroup 1	330	Trocknergruppe 1	Trocknergruppe 1	690	55,98
HX Dryergroup 2	172	Trocknergruppe 2	Trocknergruppe 2	247	20,08
	644			**1232,48**	**100**

EINSTEIN - Result

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

Alternative	Primary energy consumption	Savings	
	[MWh]	[MWh]	[%]
Ist-Zustand (überprüft)	14.078	---	---
Heat Exchanger Network	12.311	1.767	12,55
CHP	11.927	2.151	15,28
Heat Exchanger Network Plus CHP	11.026	3.053	21,68

EINSTEIN - Result

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 (20 years)
	[%]	[years]	[-]	[€]	[€]
Heat Exchanger Network	11,9	3,3	---	210.000 €	972.863 €
CHP	10,4	4,4	---	337.500 €	1.133.866 €
Heat Exchanger Network plus CHP	11,6	3,5	---	423.300 €	1.865.962 €

Summary of Audit-Results

Calculated Primary Energy Savings for Alternative: 10-28% (20%)

Calculated CO_2 Savings for Alternative:

Current Emissions: 18.000 t CO_2

Savings: 3.000 t CO_2 (17%)

500.000 EUR Savings (20%)

Pay-Back Time: 1-4 Jahre

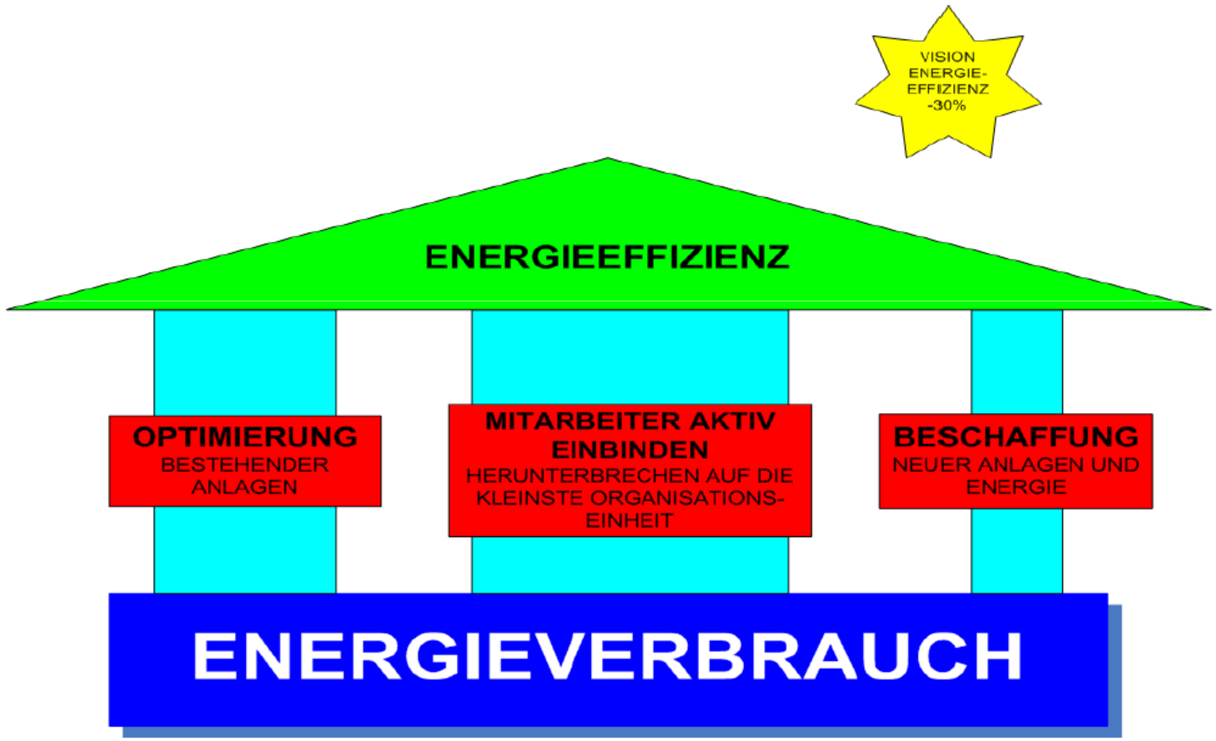
EINSTEIN Methodology

- ✓Very usefull for laundries, 2-4 hours main data collected (very quick method to getting good results during first visit)
- ✓Second step: Excel file for checking if data is consistent; (e.g. how much laundry can be dried/on calander, how much is dried…)
- ✓Estimation of temperature and flows vs. maximum power available
- ✓Questions to, Review of data by company

Implementation-Best Case

3 Säulen der Energieeffizienz

Wozabal
Unternehmensgruppe



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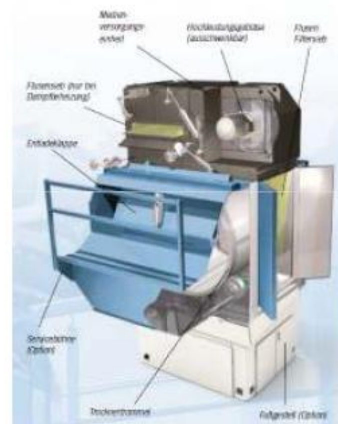
Source: Arno Frield, Wozabal, Dec. 2011

Implementation-Best Case

Hochenergieeffizente Waschstraße

Wozabal Unternehmensgruppe

Einbau einer modernen Waschanlage mit Entwässerungspresse und energieoptimierten Trocknern



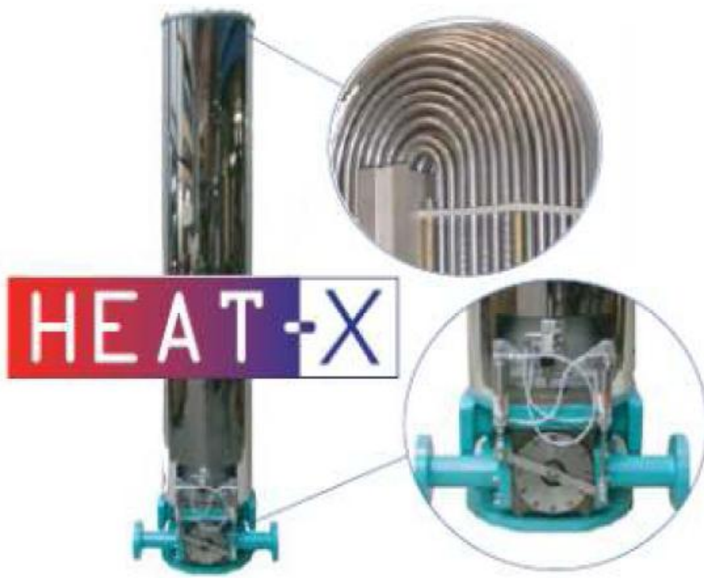
Source: Arno Frield, Wozabal, Dec. 2011

Implementation-Best Case

Abwasserwärmetauscher
MBK- Waschstraße

Wozabal
Unternehmensgruppe

- zur Vorwärmung des Prozesswassers



Source: Arno Frield, Wozabal, Dec. 2011

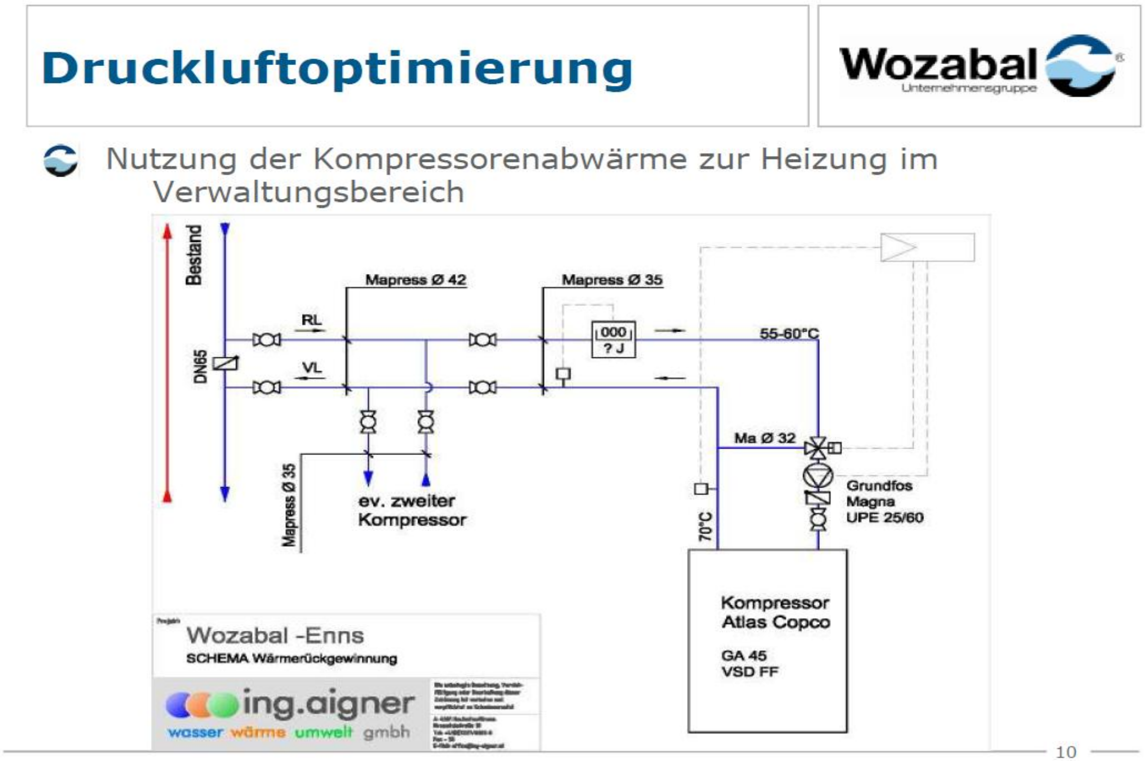
Abwärmenutzung Mangel

- Der Abluftwärmetauscher ist erst seit Anfang September 2011 in Betrieb und somit in der vorangegangenen Betrachtung auch nicht enthalten;

Aufgrund des eingebauten Wärmemengenzählers ist trotz gewollten und geplanten produktspezifischen Minderauslastung der Anlage eine erfasste Wärmemenge von rd. 700 kWh/d bereits aufgezeichnet worden.

Source: Arno Frield, Wozabal, Dec. 2011

Implementation-Best Case



Source: Arno Frield, Wozabal, Dec. 2011

Implementation-Best Case

Einsparungen durch die umgesetzten Veränderungen

Wozabal Unternehmensgruppe

	je kg	in m³	in €	in kWh	CO_2/kg
Reduktion Abwasser in l/m³	4,5	30.087,28	€ 9.627,93		
Reduktion Gas in m³	0,0620	414.169,97	€ 178.093,09	4.559.626,61	828.339,95
Reduktion Strom in kWh	0,0859		€ 60.804,37	573.991,82	344.395,09
Summe für das gesamte Jahr			€ 248.525,39	5.133.618,42	1.172.735,04
Summe für das 2. Halbjahr			***€ 99.410,16***	***2.053.447,37***	***469.094,02***

Hier wurde der Durchschnittliche Verbrauch der Monate Juli und August als Berechnungsgrundlage herangezogen. Die Veränderung der Medienverbräuche den Werten von 2010 gegenüber gestellt und mit der (hochgerechneten) Produktionsleistung die fiktive Reduktion für 2011 ermittelt.

Dies wäre demnach die Einsparung für 2011 wenn wir das gesamte Jahr die umgesetzten Maßnahmen bereits genützt hätten.

Die Summen für das 2. Halbjahr sind die tatsächlich (hochgerechneten) Einsparung noch für 2011.

Für den erhöhten Energieverbrauch in den Wintermonaten wurden hier jedoch noch 20% in Abzug gebracht

Source: Arno Frield, Wozabal, Dec. 2011

Thank you very much for your attention!

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