

Solar Energy for Heating Paraffin-Wax

Industrial High Temperature Solar Energy – 3.11.2009



BE | NETZ
Bau und Energie

Peter Schlaufer

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4. Background / BE Netz AG

Theo Fischer AG / Fischer Kerzen AG

- **1962 founded in Sursee by Theo Fischer**
- **1976 taken over by Ruth and Franz Kretz**
- **1977 Relocation to Root**
- **Since 2005 Fischer Kerzen AG for production and sales and Theo Fischer AG for the real estates**

- **Candles sold p.a.: 3 – 4 Millions**
- **Paraffin-wax processed p.a.: 650 tons**

- **Workforce: 25 member of staff**

The Plant in Root



The Energy used for the process

160'000 kWh of electric power is needed to keep the 650 tons of paraffin-wax at minimum 65 C

The Technical Approach

Collectors:

- High temperatures for the process
- High performance with low and medium insolation
- High performance vacuum tube collector

Limitations:

- Energy at lower temperatures will accumulate
- In the season with low insolation, the process-temperature levels will seldom be achieved
- Direct the surplus-energy to other consumers of thermal energy → domestic use for heating and domestic hot water

Yield:

- Calculations with ordinary programs not possible
- Calculations (Estimations) with BWE Tables not possible
- This led to the creation of a BWE Table created with the Polysun 3.3

BWE Table – Created / Distribution

Ortschaft :	Root
Land :	CH
LTS-Nr. :	-1
Bezeichnung :	Test-Kollektor
Typ :	Röhrenkollektor
Orientierung :	20
Anstellwinkel :	30
Modul-Ausrichtung :	Hochgestellt
Horizont :	Nein

Kollektor im Polysun 3.3 simuliert mit den Daten: eta0: 0.805; a1: 1,14; a2: 0.095; K1: 0.999 (1,104); K2: 0.95

Einstrahlung in die Kollektorebene

	Jan.	Feb.	März	April	Mai	Juni	Juli	Aug.	Sep.	Okt.	Nov.	Dez.	Jahr
Globalstrahlung	40.5	57.3	109	120	147	146	167	150	118	73	41.4	33.3	1203 kWh/m ²
Diffusstrahlung	22	33.7	54.6	64	80.4	89.4	94.9	82.8	62.5	44.7	23.1	16.4	668.5 kWh/m ²

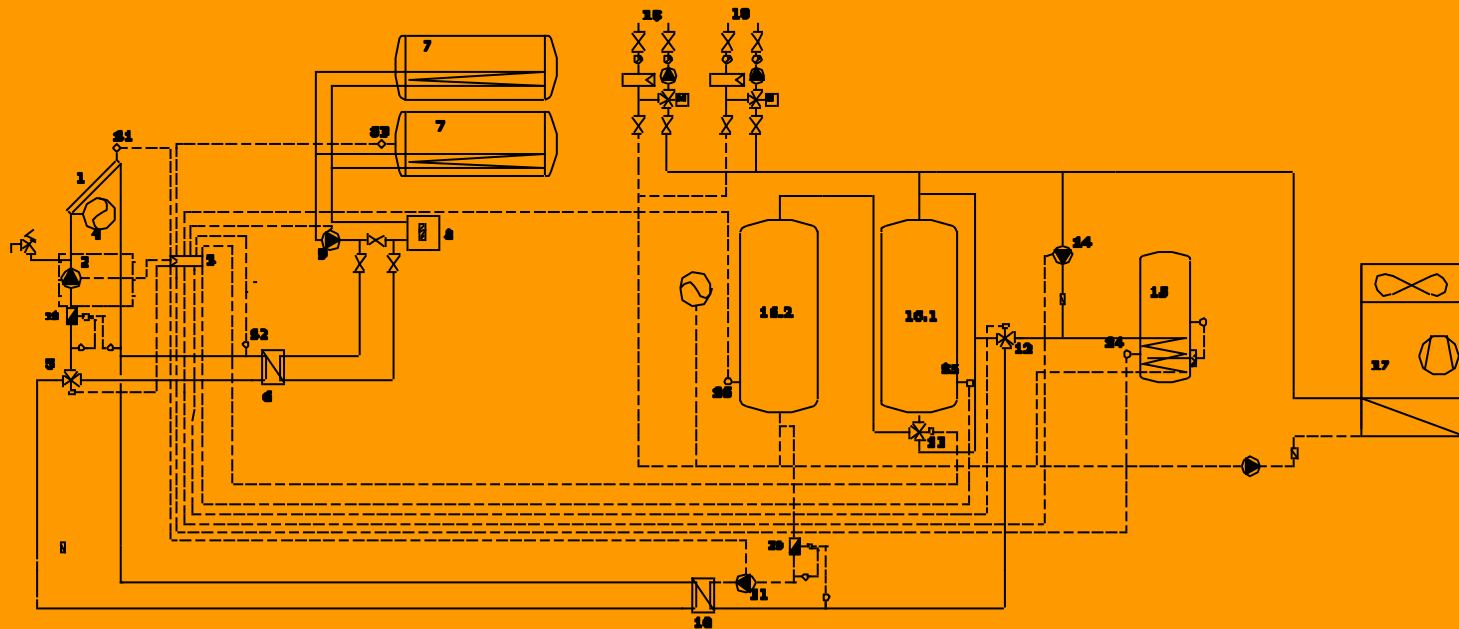
Kollektorertrag bei fester mittlerer Kollektortemperatur (Tm)

	Jan.	Feb.	März	April	Mai	Juni	Juli	Aug.	Sep.	Okt.	Nov.	Dez.	Jahr	Anteil Ertrag		Ertrag kWh
														%		
BWE Tm= 10°C	27.6	40	79	88.4	111	113	130	118	91.3	55.3	29.5	22.8	906.2 kWh/m ²	0	0	0
BWE Tm= 20°C	24.8	36.8	74.7	83.3	105	107	124	111	85.8	50.6	26.7	20.3	850.5 kWh/m ²	0	0	0
BWE Tm= 30°C	22.1	33.6	70.4	78.3	99.6	102	118	106	81.3	46.7	23.9	18	799.8 kWh/m ²	11	87.978	87.978
BWE Tm= 40°C	19.6	30.4	66	73.1	93.9	95.7	112	101	76.5	42.6	21.3	16.1	748.3 kWh/m ²	15	112.245	112.245
BWE Tm= 50°C	17.2	27.3	61.4	67.9	88	89.7	106	95.2	71.4	38.4	18.9	14.4	695.8 kWh/m ²	15	104.37	104.37
BWE Tm= 60°C	15	24.2	56.6	62.8	82.1	83.7	99.6	89.2	66.3	34.2	16.7	12.8	643.2 kWh/m ²	30	192.96	192.96
BWE Tm= 80°C	11.1	18.4	46.7	52.3	70.2	71.1	85.8	77.1	55.8	26.3	12.6	9.8	537.1 kWh/m ²	15	80.565	80.565
BWE Tm= 100°C	7.6	13.1	37.6	42.1	58.7	59	72.1	64.4	45.6	19.2	8.9	7.1	435.5 kWh/m ²	10	43.55	43.55
BWE Tm= 120°C	4.8	8.6	28.8	33	47.2	46.7	57.7	51.6	35.8	13	5.9	4.8	337.8 kWh/m ²	4	13.512	13.512
BWE Tm= 150°C	1.7	3.7	16.3	20.9	31.3	29.4	38.5	33.8	21.8	6.4	2.4	2	208.1 kWh/m ²	0	0	0
														100	635.18	635.18

Plan: Erstellung einer Solaranlage für Prozesswärme für die Kerzenfabrik Root. Vakuumröhrenkollektoren geben die Wärme bei einem Temperaturniveau zwischen 65 und 110°C. Der unweigerlich anfallende Ertrag bei tieferen Temperaturen kann an das hauseigene Heiz / Warmwassersystem abgegeben werden.

Details: 100m² Vakuumröhrenkollektoren; Abgabe der Prozesswärme via Wärmetauscher an Wärmeträgeröl. Abgabe der Restwärme via Wärmetauscher an bestehende Speicher / Boiler

The Hydraulic Circuit



LEGENDE

- 1 Röhrenkollektoren 92.4m² Conergy Xinox DF
- 2 Solargruppe, Pumpe UPS...
- 3 Solarsteuerung RESOL DeltaSol E
- 4 Steambackgefässe Solar (12 Stk.)
- 5 Umschaltventil 1
- 6 Wärmetauscher Paraffin
- 7 Paraffintanks
- 8 Elektroheizung bestehend
- 9 Pumpe bestehend
- 10 Wärmetauscher Heizung
- 11 Sekundärpumpe Heizung
- 12 Umschaltventil 2
- 13 Umschaltventil 3
- 14 Boileradepumpe
- 15 Wasserrwärmer / E-Einsatz bestehend
- 16 Heizwasserspeicher bestehend
- 17 Luft-/Wasser-Wärmepumpe beiseits
- 18 Wärmeverteilung bestehend
- 19 Wärmehähler Rasol
- 20 Wärmehähler Heizung

Kerzenfabrik Root
Schema Solaranlage
Prozesswärme, Warmwasser, Heizung



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Gez.	Datum	Rev.	Debat
W. Müller	17.04.09	W. Müller	18.09.09

2009038

The Process-Control

Controller - Limitations:

- Commercially obtainable controllers are not built for maximum temperatures of more than 90 C
- Special programming needed

Limitations:

- Energy at lower temperatures will accumulate
- In the season with low insolation, the necessary temperature levels may seldom be achieved
- Direct the solar energy to other consumers of thermal energy → domestic uses heating and domestic hot water.

Yield:

- Calculations with ordinary programs not possible
- Calculations with BWE Tables not possible
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The Optimizations Anticipated

Rapid High Temperatures at high insulations:

„Force up“ the Temperatures by

- **Starting the circulation only at temperatures >60 C**
- **Circulating the fluid in the primary circuit until process-temperatures are achieved**

Upmost use in Wintertime:

- **Limited energy can be expected from December until February for the process**
- **Direct the low temperature solar energy to domestic uses**
- **Try to force up temperatures at times with high insolation with the domestic needs already fed.**

BE Netz AG – founded in 2004 by Adrian Kottmann and Peter Schlaufer

- **1994 – 2003** **kottmann energie ag**
- **1992 – 2003** **Peter Schlaufer with
Rüesch Solartechnik AG**
- **2004 – heute** **BE Netz AG**

Work Force 2009:

- **28 Employees**
- **up to 10 temporarily employed**