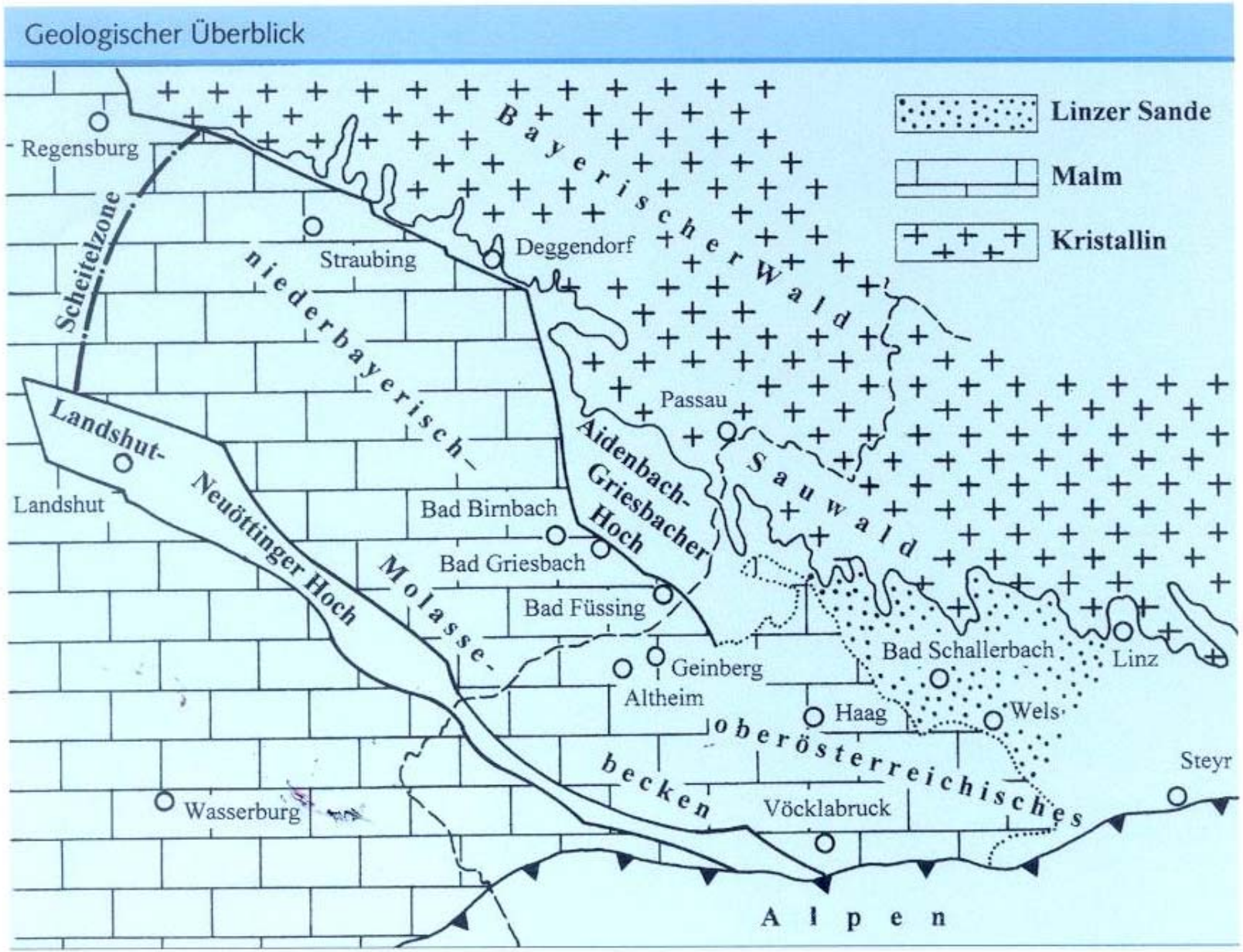
1990

2001

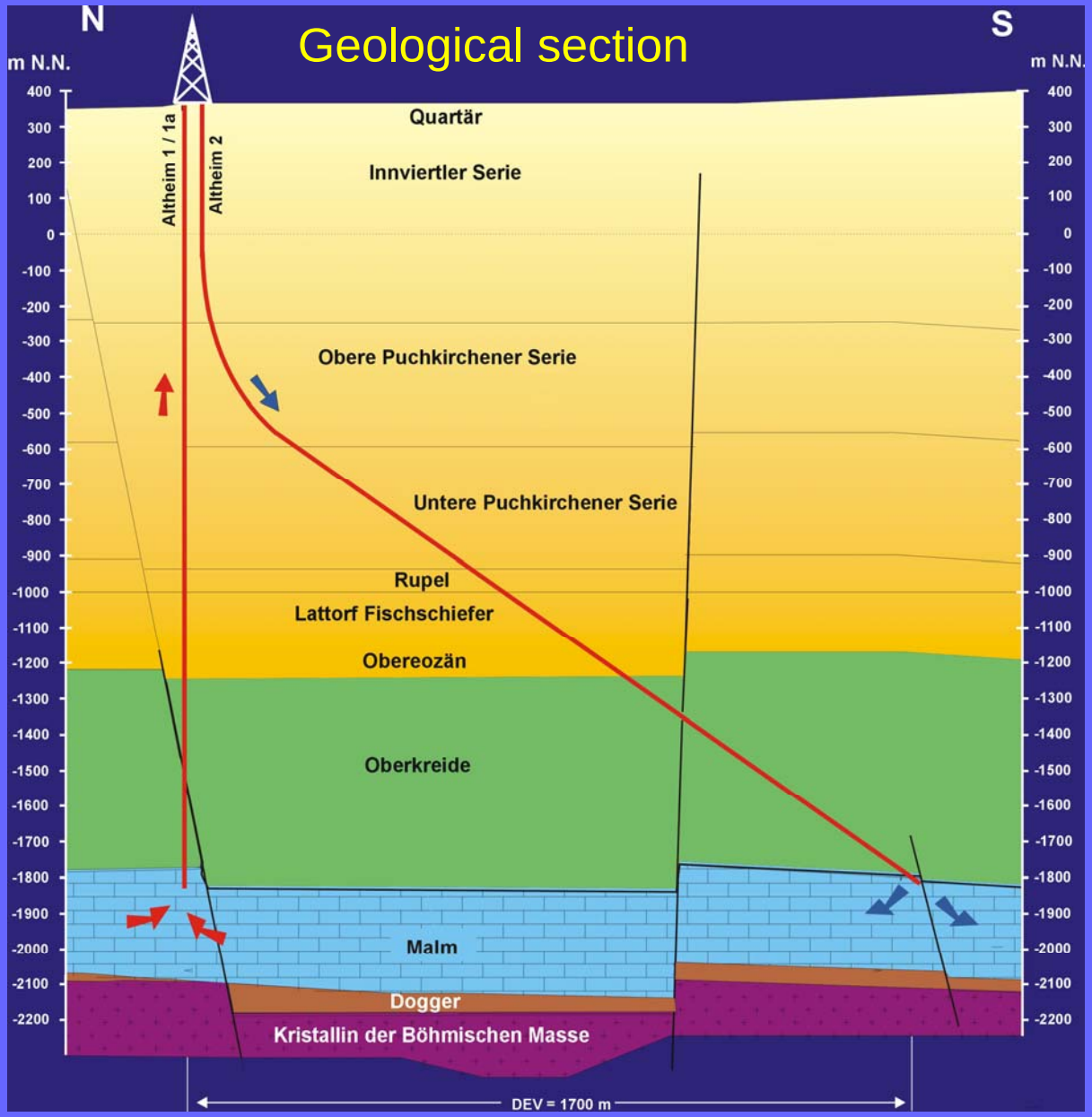
City of Altheim

Geothermal Energy Supply

Abb. 3
Geologi



Geological section



Geotec Consult, Markt Schwaben, Germany

Reinjection well

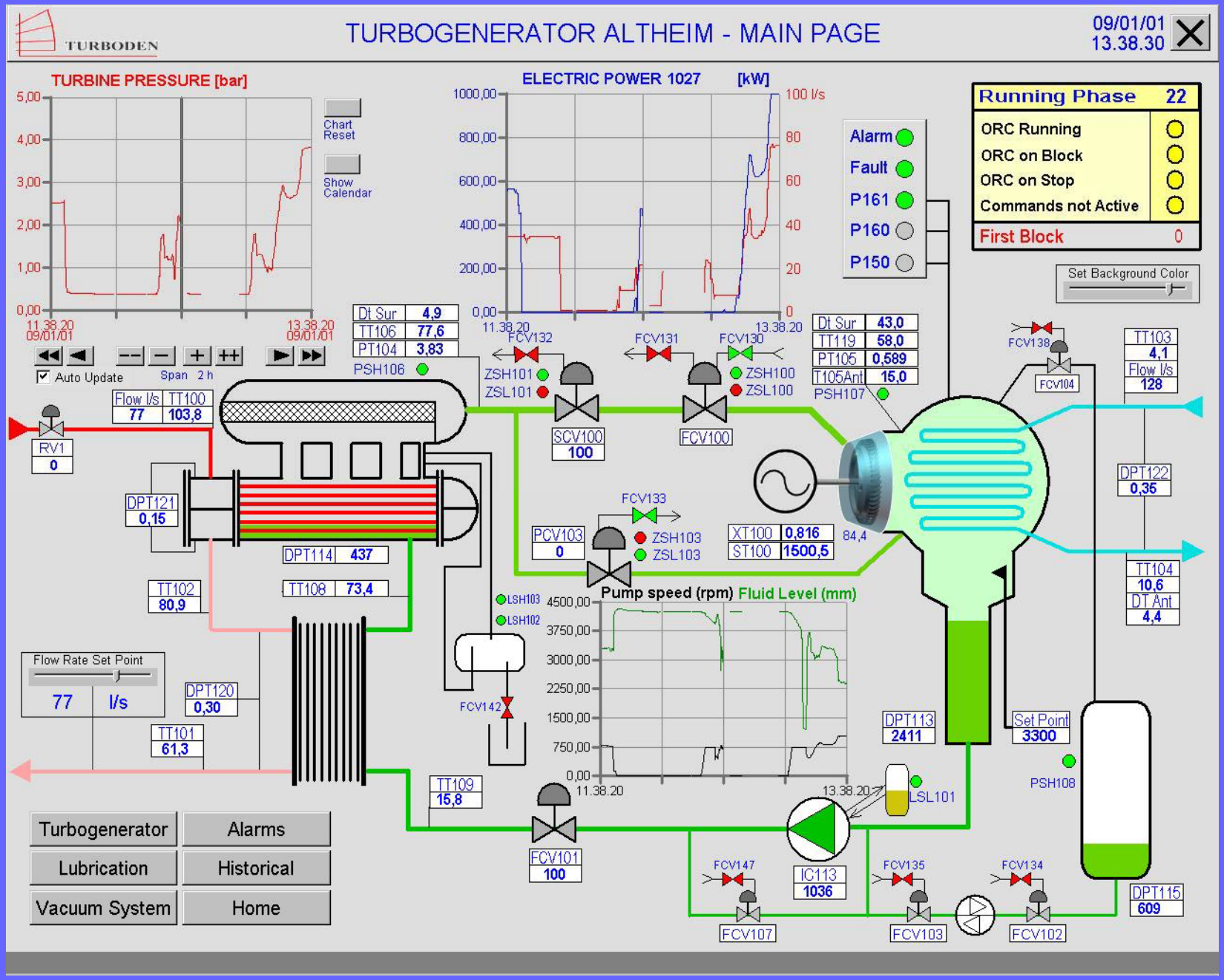
- 2.165 m TVD
- 3.078 m MD
- 1.700 m deviation
- 100 l/s
- End-Ø 6 1/4“,
- open hole

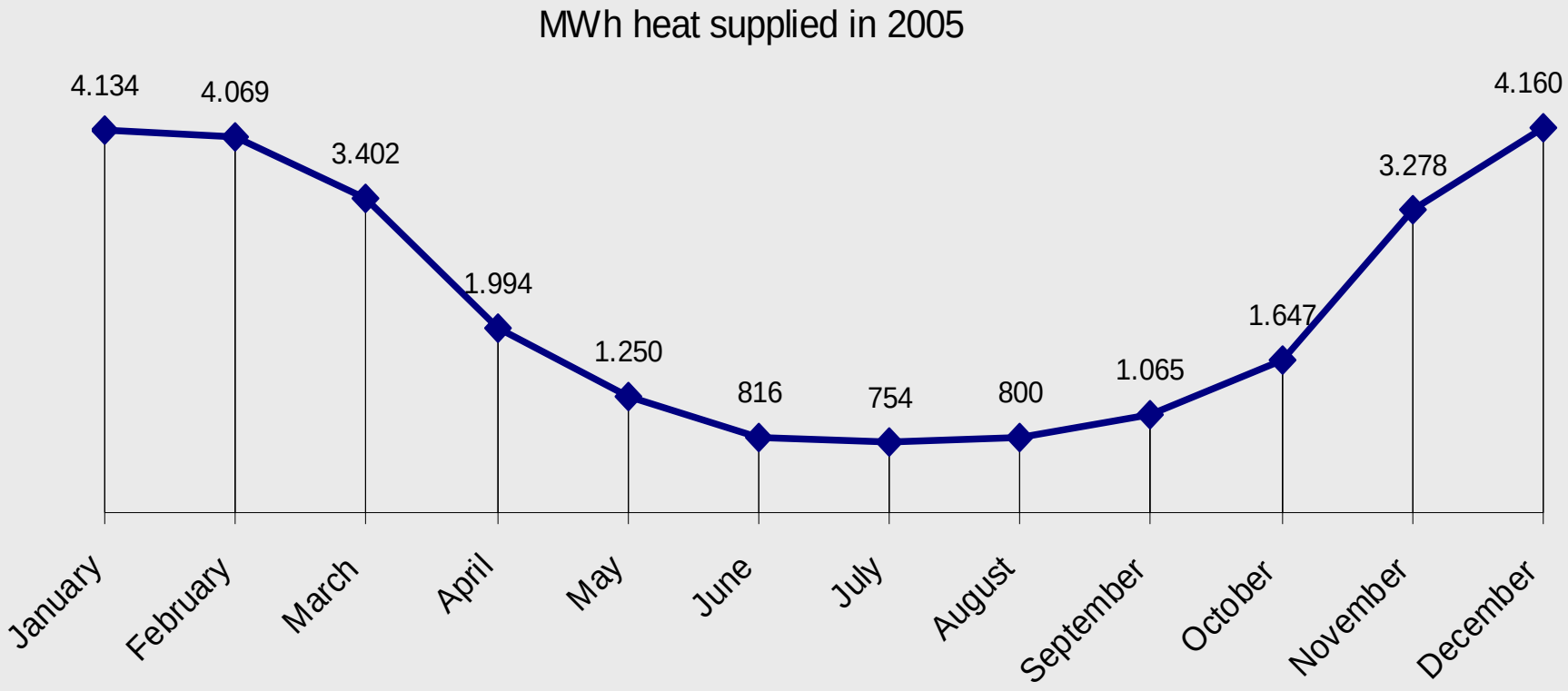
Production well

- 2.306 m
- 100 l/s
- End-∅ 5 5/8“,
- open hole

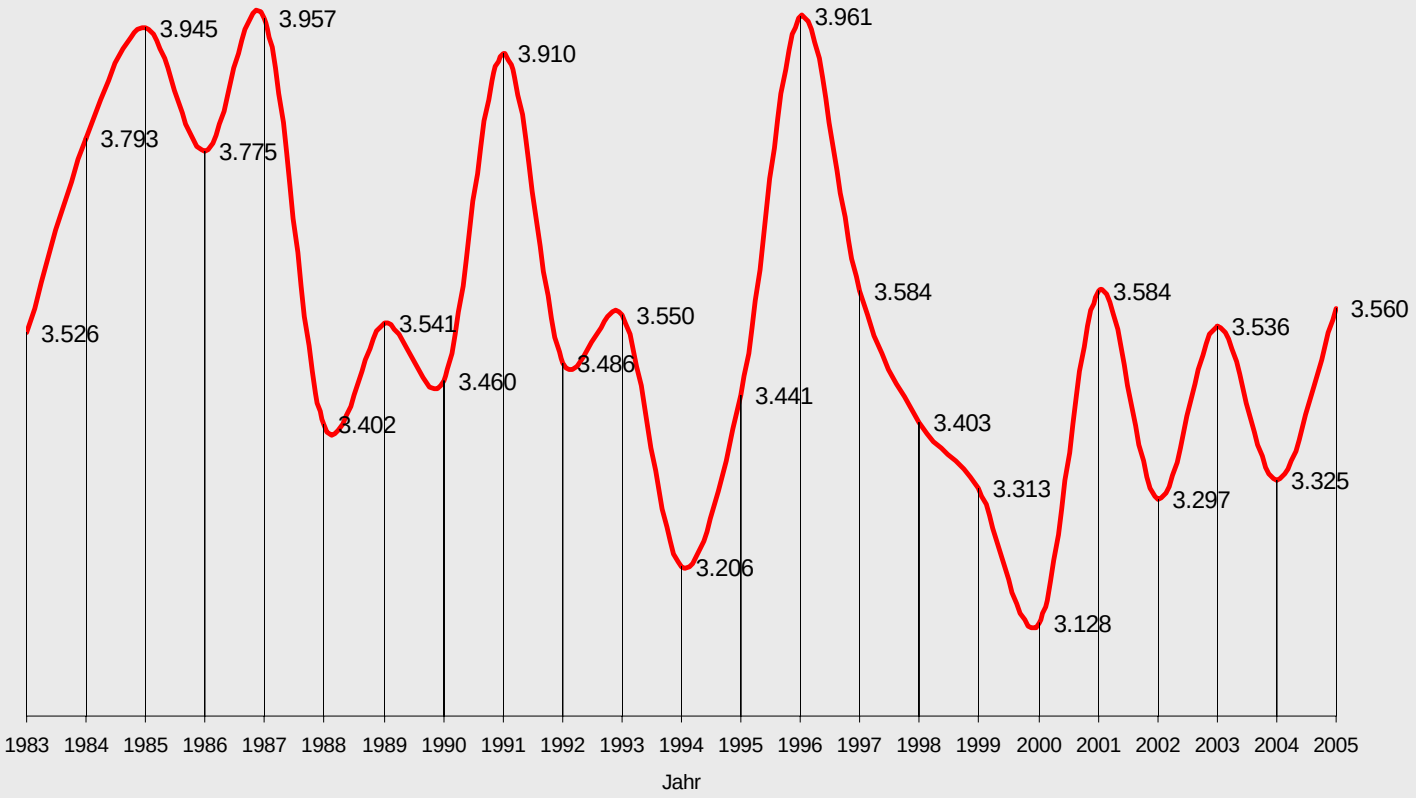
Data sheet ORC / nominal conditions (final design)

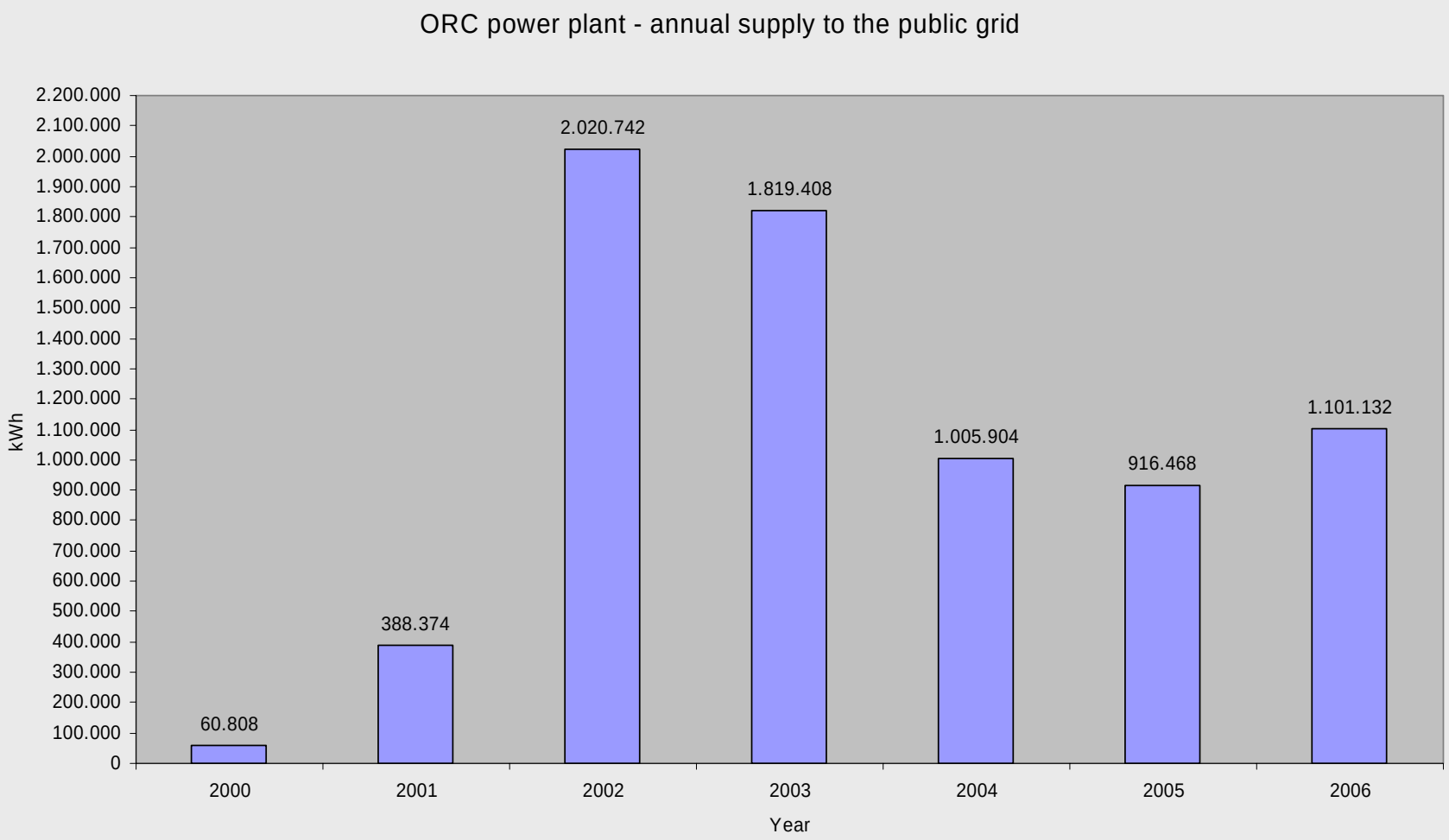
Thermal water inlet temperature	**106 °C**
Thermal water outlet temperature	**70 °C**
Thermal water flow rate	**81,7 kg/s**
Thermal capacity	**12.400 kW**
Cooling water flow rate	**340 kg/s**
Cooling water inlet temperature (mean)	**10 °C**
Cooling water out let temperature	**18 °C**
Electric net output	**1.000 kW**

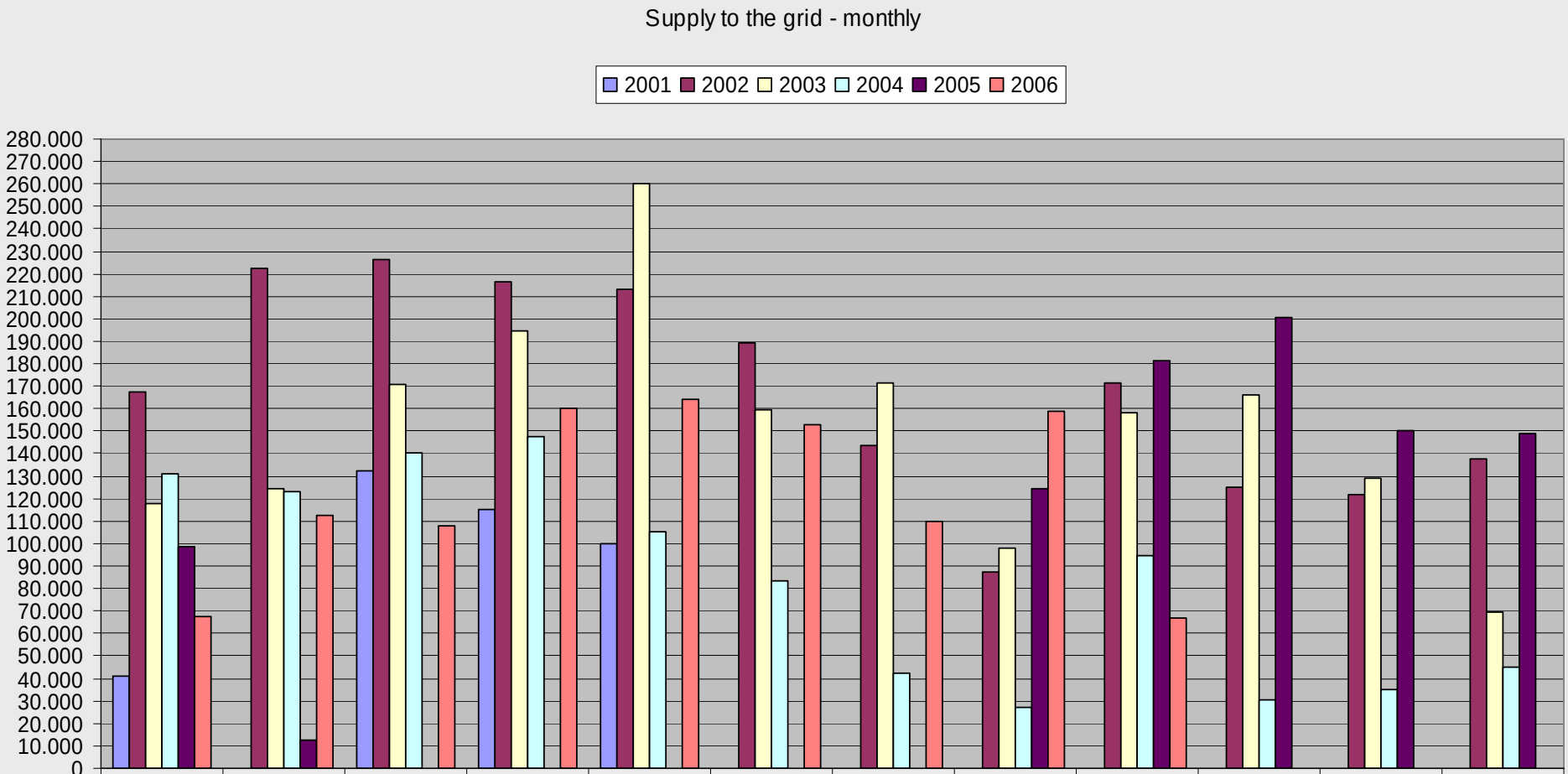

TURBODEN
TURBOGENERATOR ALTHEIM - MAIN PAGE
09/01/01
13.38.30
TURBINE PRESSURE [bar]
Chart Reset
Show Calendar
Auto Update
Span 2 h
ELECTRIC POWER 1027 [kW]
100 l/s
Alarm
Fault
P161
P160
P150
Running Phase 22
ORC Running
ORC on Block
ORC on Stop
Commands not Active
First Block 0
Set Background Color
Dt Sur 4,9
TT106 77,6
PT104 3,83
PSH106
Dt Sur 43,0
TT119 58,0
PT105 0,589
T105Ant 15,0
PSH107
TT103 4,1
Flow l/s 128
Flow l/s 77
TT100 103,8
RV1 0
DPT121 0,15
DPT114 437
TT108 73,4
TT102 80,9
FCV132
FCV131
FCV130
ZSH101
ZSL101
ZSH100
ZSL100
SCV100 100
FCV100
FCV138
FCV104
DPT122 0,35
FCV133
PCV103 0
ZSH103
ZSL103
XT100 0,816
ST100 1500,5
84,4
TT104 10,6
DT Ant 4,4
Pump speed (rpm) Fluid Level (mm)
LSH103
LSH102
Flow Rate Set Point
77 l/s
DPT120 0,30
TT101 61,3
FCV142
DPT113 2411
Set Point 3300
PSH108
TT109 15,8
LSL101
FCV101 100
IC113 1036
FCV147
FCV135
FCV134
DPT115 609
FCV107
FCV103
FCV102
Turbogenerator
Alarms
Lubrication
Historical
Vacuum System
Home


MWh heat supplied in 2005
4.134
4.069
3.402
1.994
1.250
816
754
800
1.065
1.647
3.278
4.160
January
February
March
April
May
June
July
August
September
October
November
December

Sum of the daily differences between the mean room temperature of 20 ° C and the mean outdoor temperature for days on which heating is necessary (=days with mean values below 15 °C)



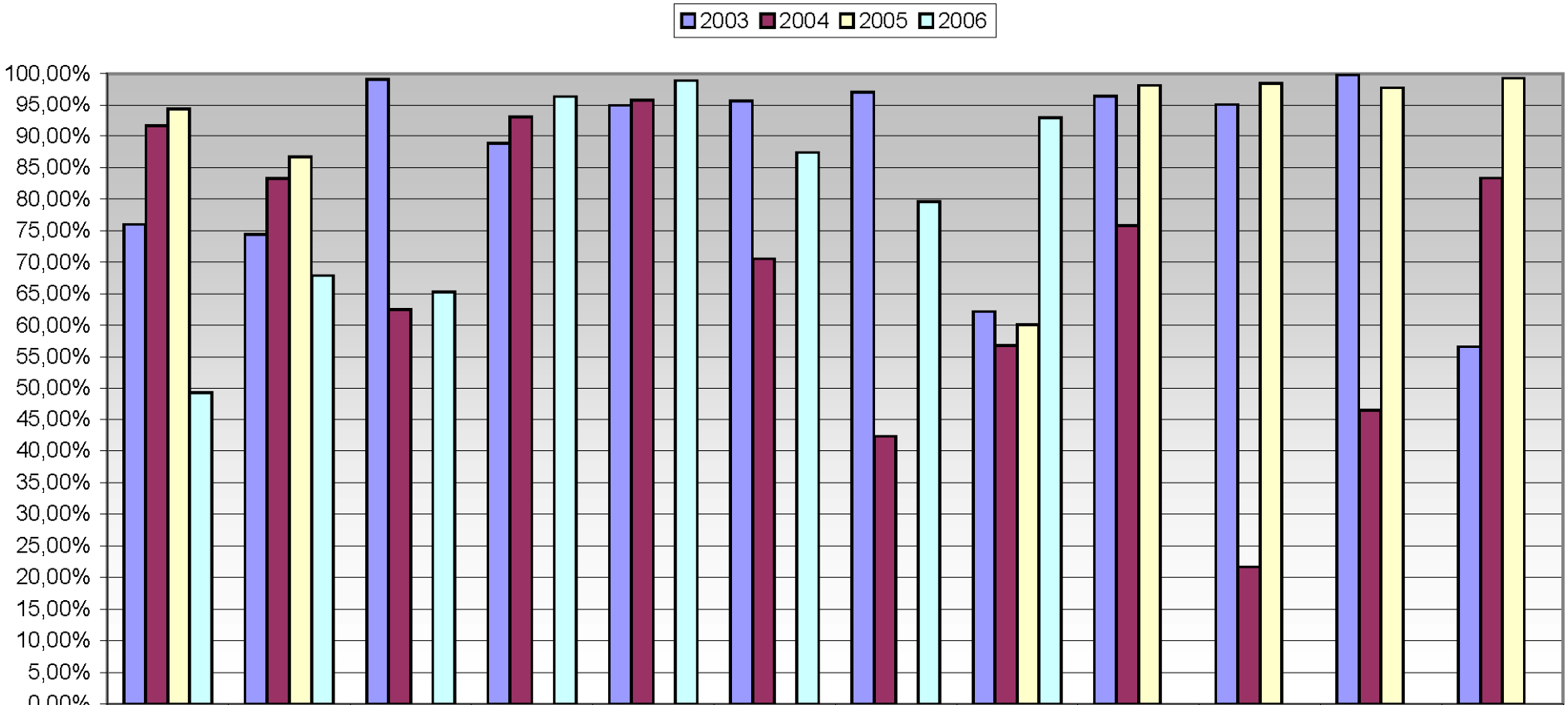

ORC power plant - annual supply to the public grid
kWh
2.200.000
2.100.000
2.000.000
1.900.000
1.800.000
1.700.000
1.600.000
1.500.000
1.400.000
1.300.000
1.200.000
1.100.000
1.000.000
900.000
800.000
700.000
600.000
500.000
400.000
300.000
200.000
100.000
0
60.808
388.374
2.020.742
1.819.408
1.005.904
916.468
1.101.132
2000
2001
2002
2003
2004
2005
2006
Year



	January	February	March	April	May	June	July	August	September	October	November	December
2001	40.907	0	132.694	115.103	99.670	0	0	0	0	0	0	0
2002	167.222	222.320	226.252	216.610	212.952	189.124	143.334	87.358	171.294	125.130	121.716	137.430
2003	117.832	124.496	170.568	194.786	259.966	159.576	171.380	97.876	158.330	166.470	128.814	69.314
2004	131.002	122.830	140.150	147.294	105.576	83.598	42.214	26.964	94.982	30.752	35.284	45.258
2005	98.540	12.476	0	0	0	0	0	124.408	181.318	200.472	150.278	148.976
2006	67.330	112.534	108.090	160.476	163.886	153.066	110.060	158.714	66.976			

kWh

ORC plant - connected to grid in % of the total hours of a month



	January	February	March	April	May	June	July	August	September	October	November	December
2003	75,97%	74,40%	99,13%	88,82%	94,96%	95,69%	97,04%	62,20%	96,46%	95,09%	99,79%	56,59%
2004	91,63%	83,26%	62,53%	93,06%	95,83%	70,52%	42,31%	56,75%	75,83%	21,67%	46,39%	83,33%
2005	94,29%	86,64%	0,00%	0,00%	0,00%	0,00%	0,00%	60,08%	98,16%	98,49%	97,74%	99,29%
2006	49,29%	67,89%	65,32%	96,39%	98,89%	87,36%	79,57%	92,88%	0,00%	0,00%	0,00%	0,00%

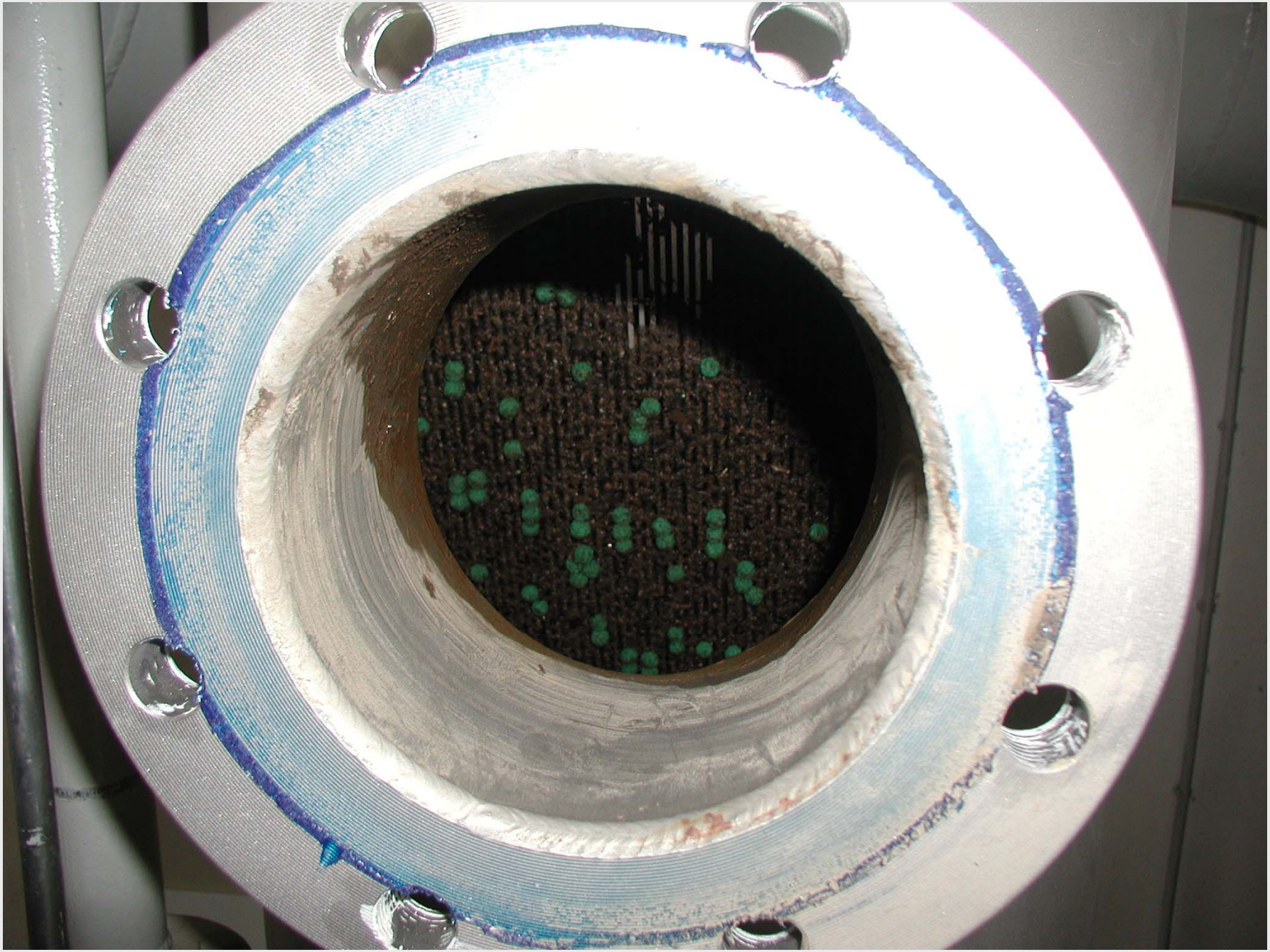
2003	hours	Out of operation – main reasons
January	178,75	Frost – no cooling water
February	172,00	Frost – no cooling water
March	6,50	Others
April	80,50	Maintenance condenser
May	37,50	Maintenance cooling water plant
June	31,00	Turbine – noise improvement
July	22,00	Lightning strike
August	281,25	Cooling water – temperature too high
September	25,50	Turbine – noise improvement
October	36,50	Leakage head reinjection well
November	1,50	Others
December	323,00	**Submersible pump – damage on cable (about 200 hours);** air in the condenser, cleaning condenser pipes
	1.196,00	Out of operation
	7.564,00	On the grid

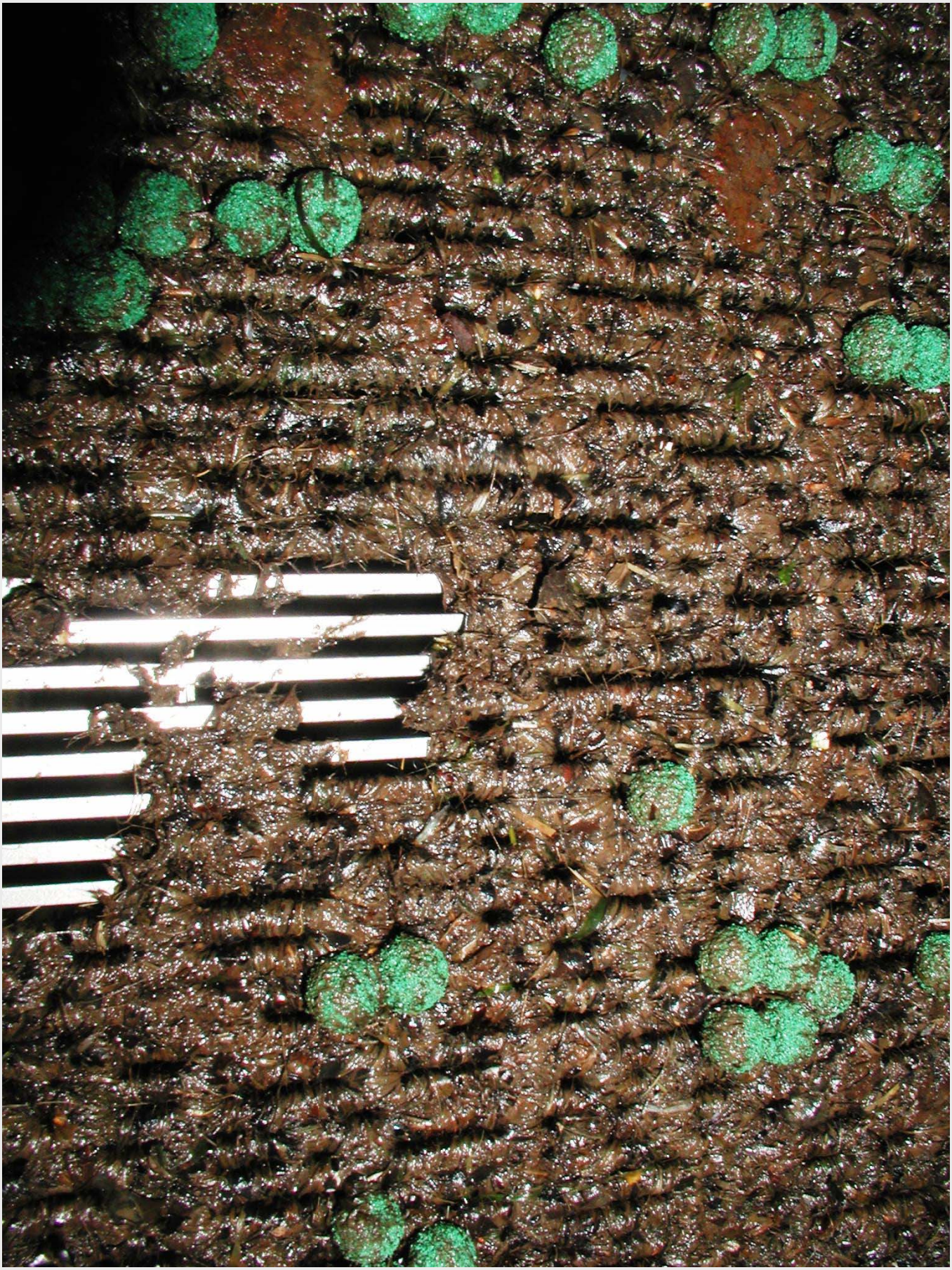
80
R
BR FF 80

2004		Out of operation - main reasons
	hours	
January	62,25	Dirty cooling water
February	116,50	Dirty cooling water
March	278,75	Leakage working fluid cycle
April	50,00	Dirty cooling water
May	31,00	Controlling problems
June	163,00	Dirty cooling water, annual maintenance
	49,25	Pumping test – ordered by the water authority
July	429,25	Pumping test – ordered by the water authority
August	321,75	Pumping test – ordered by the water authority
September	130,00	Pumping test – ordered by the water authority
	44,00	Condenser cleaning
October	582,75	Leakage working fluid cycle
November	386,00	Leakage working fluid cycle
December	124,00	Air in the working fluid cycle after topping of fluid, dirty feed pump filter
	2.768,50	Out of operation
	930,25	Part caused by the pumping test
	5.991,50	On the grid

2005		Out of operation - main reasons
	hours	
January	42,50	Cooling water problems (frost, dirt)
February	89,75	Cooling water problems, leakage evaporator
March	744,00	Lack of working fluid - supplier stopped the production
April	720,00	Lack of working fluid - supplier stopped the production
May	744,00	Lack of working fluid - supplier stopped the production
June	720,00	Lack of working fluid - supplier stopped the production
July	744,00	Lack of working fluid - supplier stopped the production
August	297,00	Lack of working fluid - supplier stopped the production; from mid of August **new working fluid**
September	13,25	Cleaning work cooling water filters
October	11,25	No cooling water
November	16,25	Maintenance feed pump
December	5,25	Maintenance feed pump
	4.147,25	Out of operation
	4.612,75	On the grid

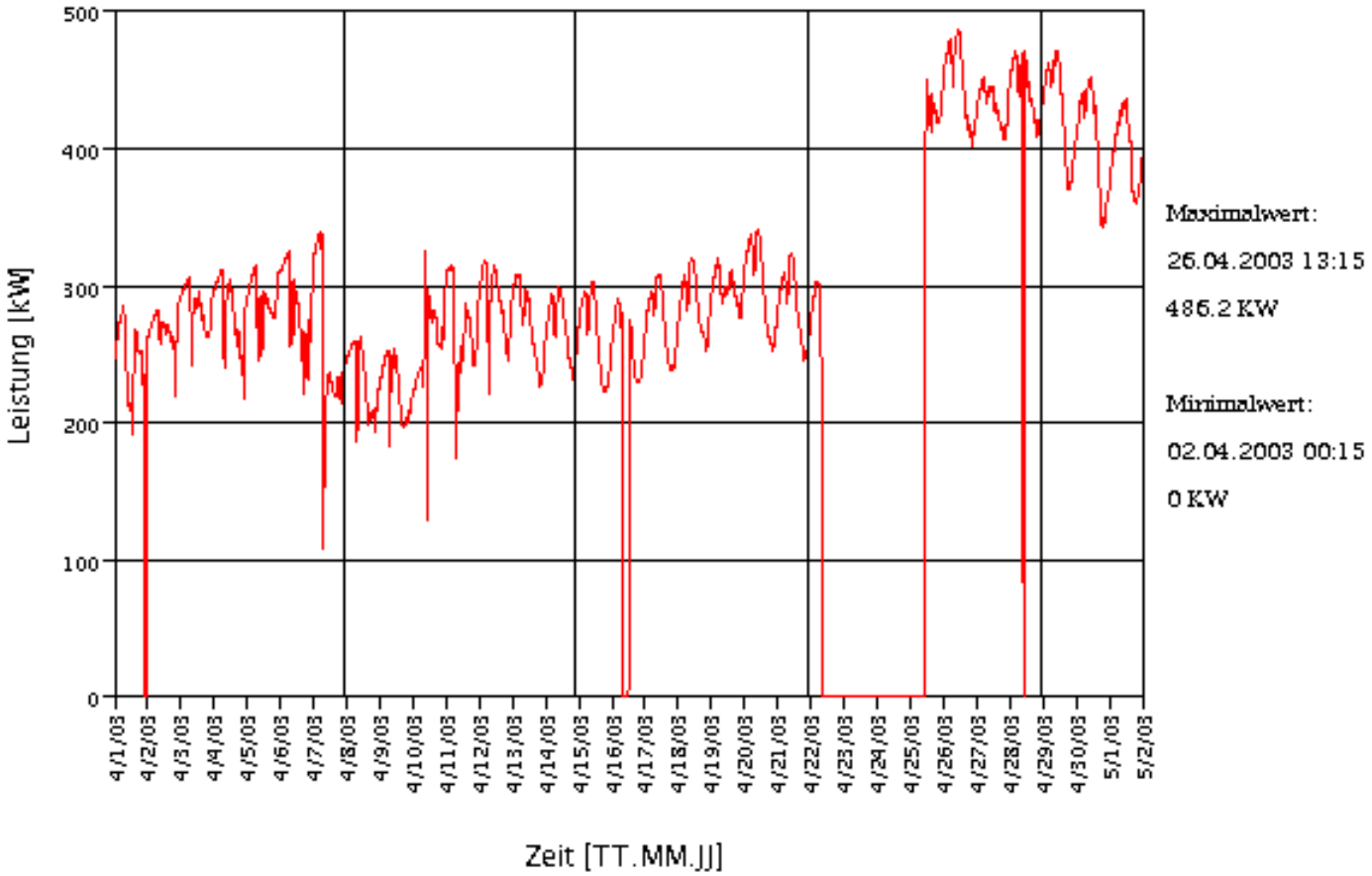
2006		Out of operation - main reasons
	hours	
January	377,25	No cooling water - frost
February	215,75	No cooling water - frost
March	258,00	No cooling water - high water/ cooling water very dirty -
April	26,00	No cooling water - high water/cooling water very dirty -
May	8,25	Cleaning cooling water filter
June	91,00	Cooling water very dirty after torrents of rain; lightning strike
July	152,00	Lightning strike, cooling water very dirty; cooling water to warm
August	53,25	Cooling water very dirty
September (status 13.)	0,25	Pressure test production well
Out of operation per 9/13	1.181,75	
Max. annual hours per 9/13	6.144,00	
On the grid per 9/13	4.962,25	

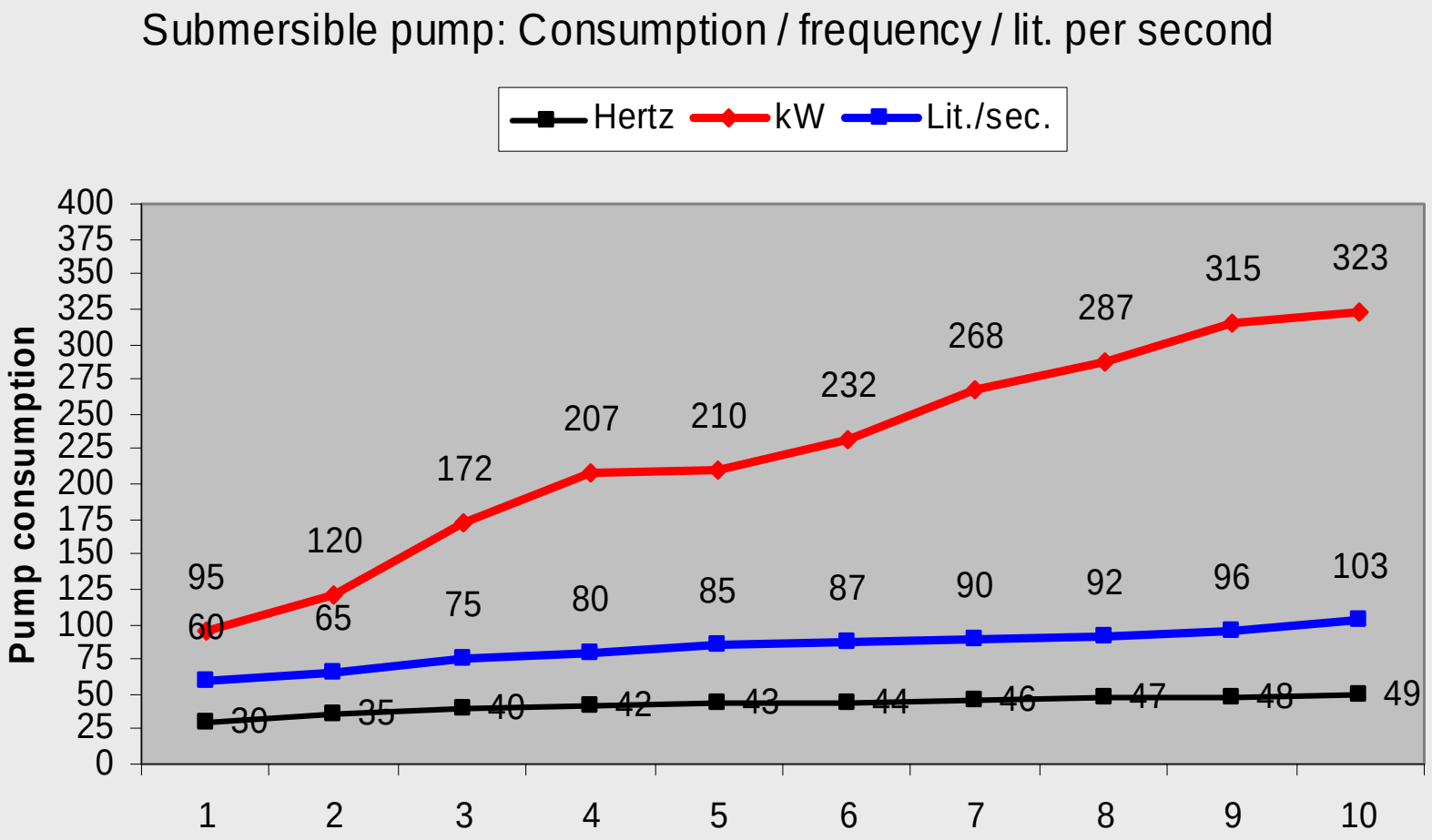


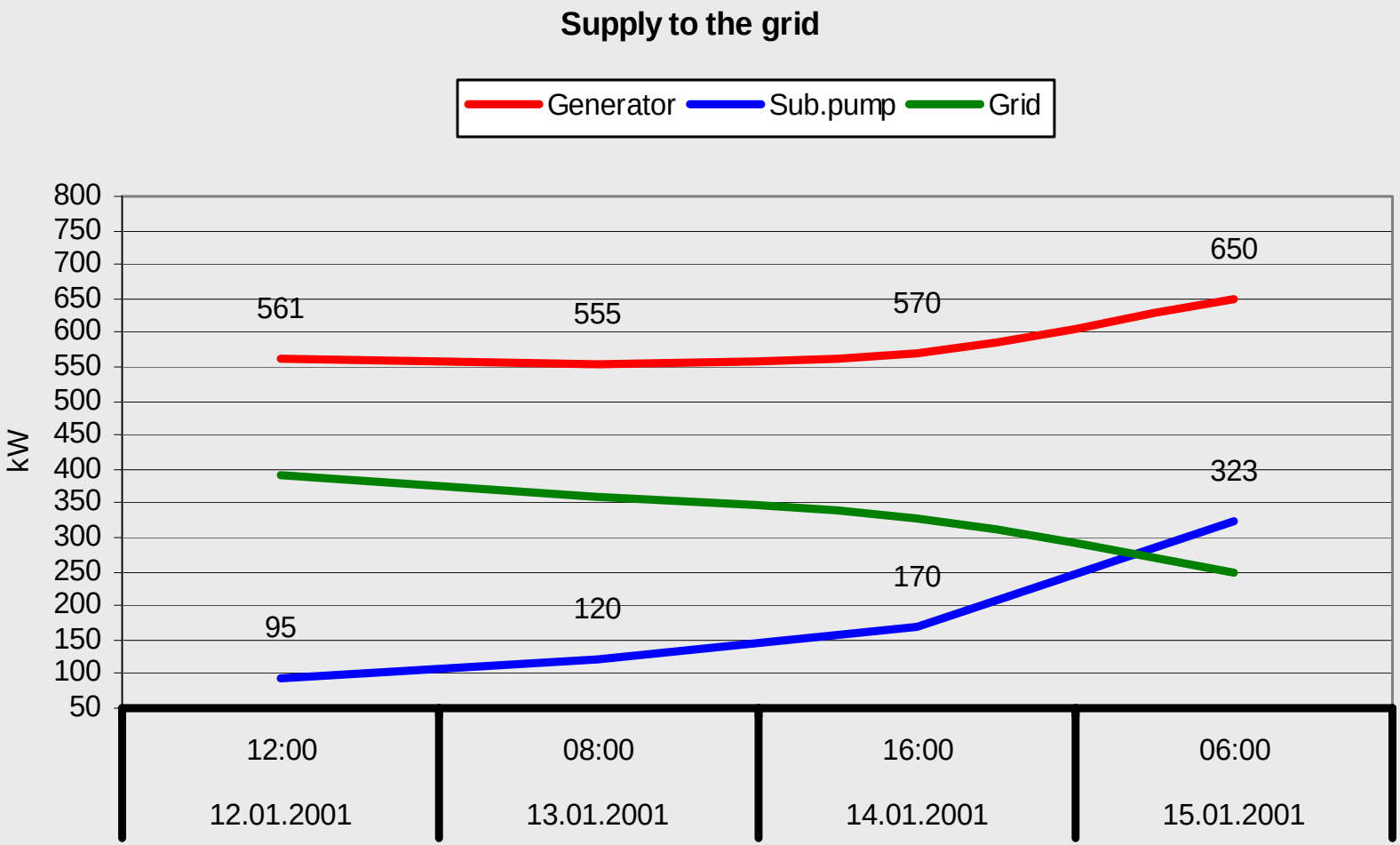


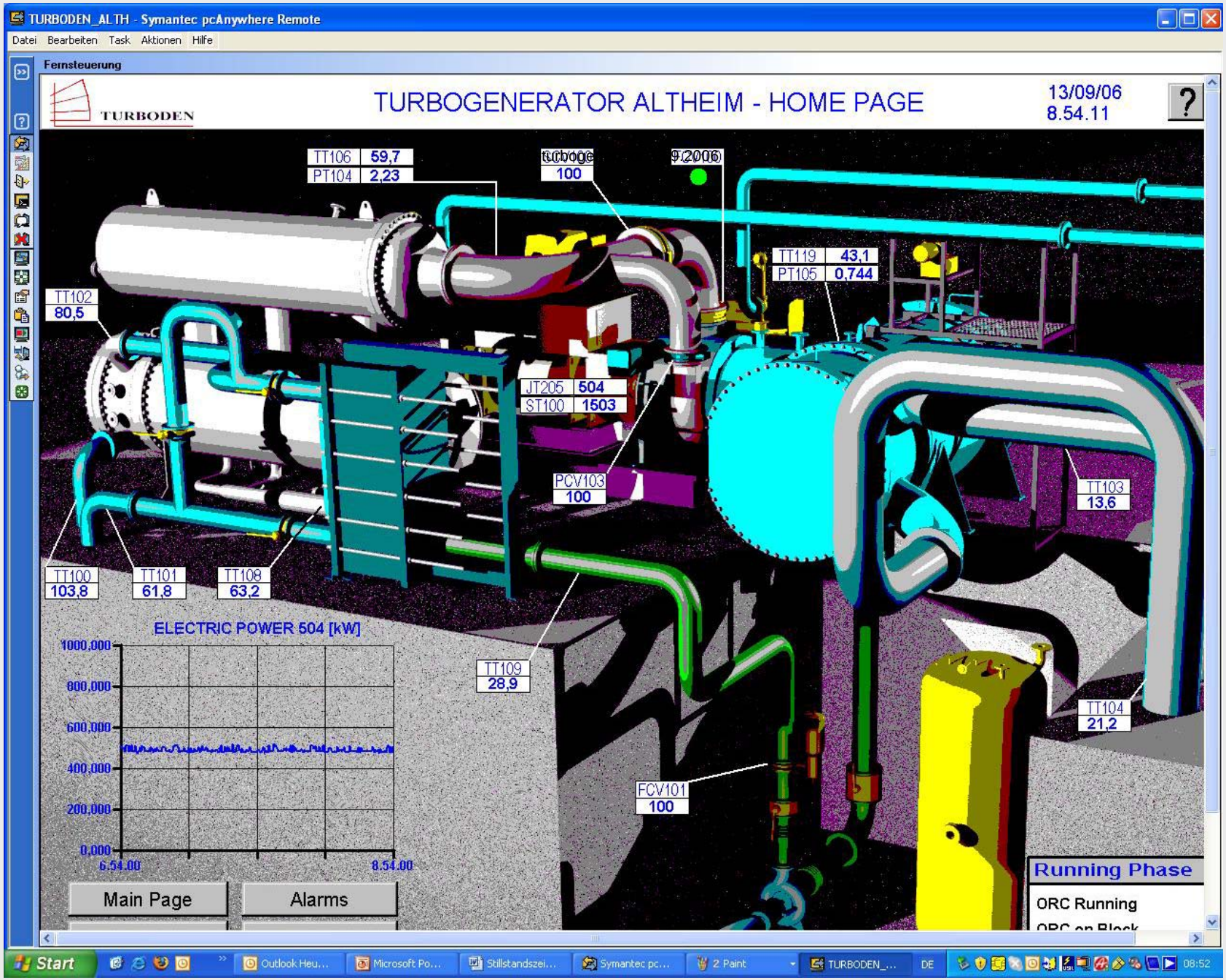
Monatsübersicht vom 01.04.2003 bis 02.05.2003

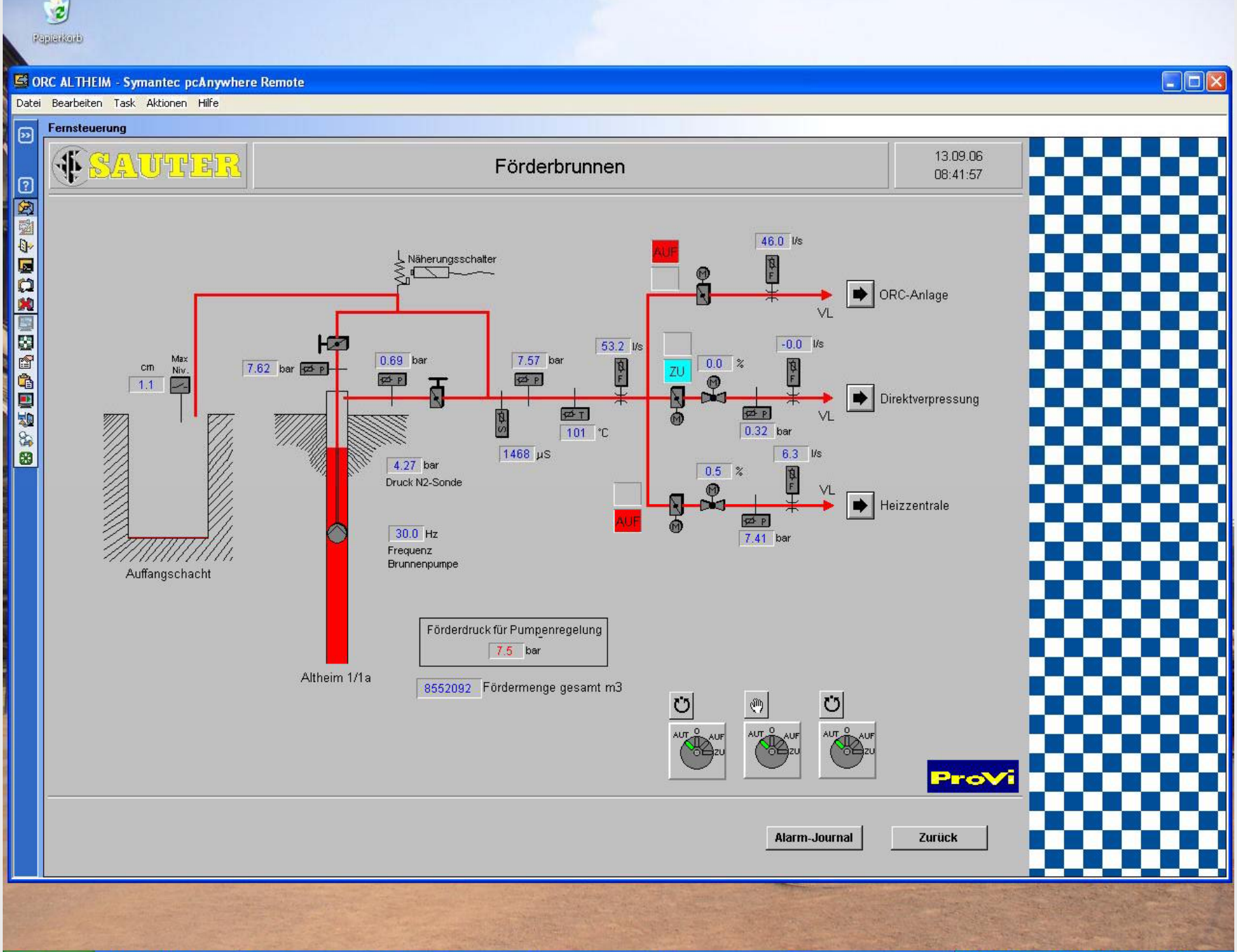
Kunde: Geothermie Altheim B




Submersible pump: Consumption / frequency / lit. per second
Hertz
kW
Lit./sec.
Pump consumption
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
1
2
3
4
5
6
7
8
9
10
95
120
172
207
210
232
268
287
315
323
60
65
75
80
85
87
90
92
96
103
30
35
40
42
43
44
46
47
48
49


Supply to the grid
Generator
Sub.pump
Grid
kW
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
561
555
570
650
323
170
120
95
12:00
12.01.2001
08:00
13.01.2001
16:00
14.01.2001
06:00
15.01.2001


TURBODEN_ALTH - Symantec pcAnywhere Remote
Datei Bearbeiten Task Aktionen Hilfe
Fernsteuerung
TURBODEN
TURBOGENERATOR ALTHEIM - HOME PAGE
13/09/06
8.54.11
TT106 59,7
PT104 2,23
turboge 100
9/2006
TT119 43,1
PT105 0,744
TT102 80,5
JT205 504
ST100 1503
PCV103 100
TT103 13,6
TT100 103,8
TT101 61,8
TT108 63,2
ELECTRIC POWER 504 [kW]
1000,000
800,000
600,000
400,000
200,000
0,000
6.54.00
8.54.00
TT109 28,9
TT104 21,2
FCV101 100
Main Page
Alarms
Running Phase
ORC Running
Start
Outlook Heu...
Microsoft Po...
Stillstandszei...
Symantec pc...
2 Paint
TURBODEN_...
DE
08:52


ORC ALTHEIM - Symantec pcAnywhere Remote
Datei Bearbeiten Task Aktionen Hilfe
Fernsteuerung
SAUTER
Förderbrunnen
13.09.06
08:41:57
Näherungsschalter
cm
1.1
Max Niv.
7.62 bar
0.69 bar
7.57 bar
53.2 l/s
46.0 l/s
AUF
ZU
0.0 %
-0.0 l/s
ORC-Anlage
VL
Direktverpressung
0.32 bar
101 °C
1468 µS
4.27 bar
Druck N2-Sonde
0.5 %
6.3 l/s
Heizzentrale
7.41 bar
30.0 Hz
Frequenz
Brunnenpumpe
Auffangschacht
Altheim 1/1a
Förderdruck für Pumpenregelung
7.5 bar
8552092 Fördermenge gesamt m3
AUT
AUF
ZU
ProVi
Alarm-Journal
Zurück
Start
Outlook Heute - ...
Microsoft PowerP...
Stillstandszeiten ...
Symantec pcAny...
ORC ALTHEIM - S...
DE
08:46

Papierkorb

ORC ALTHEIM - Symantec pcAnywhere Remote

Datei Bearbeiten Task Aktionen Hilfe

Fernsteuerung

SAUTER

Schluckbrunnen

13.09.06
08:42:13

ORC-Anlage
RL
62.0 °C
T

Direktverpressung
VL=RL
61.9 °C
T

Heizzentrale
RL
61.9 °C
T

7.11 bar
P

FU
100.0 %

6.0 bar
SW Verpresspumpe

61.9 °C
T
S
1442 µS
F
55.1 l/s
7.14 bar
P

8997454 Verpressmenge gesamt m3

Altheim 2

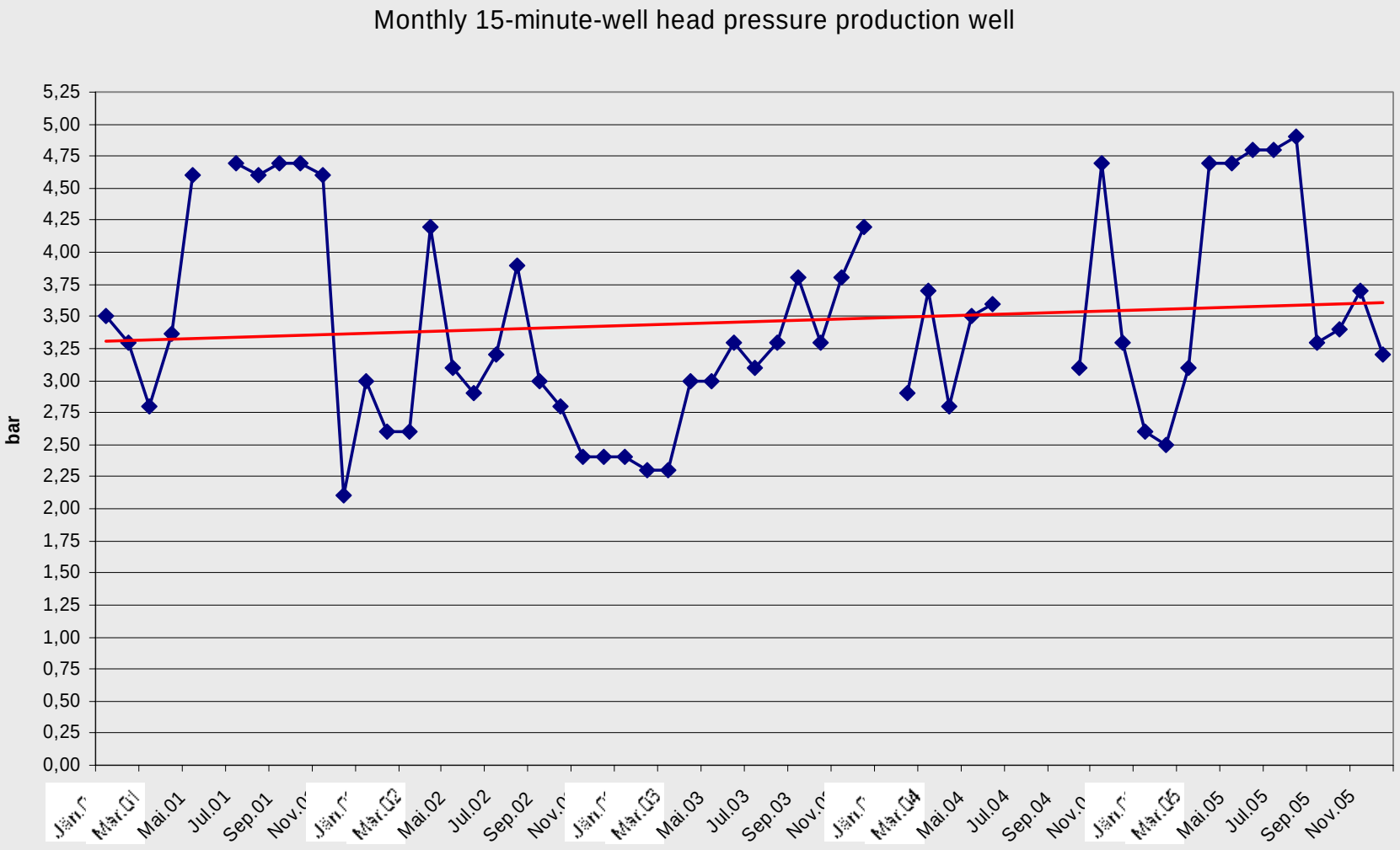
AUT 0 EIN

ProVi

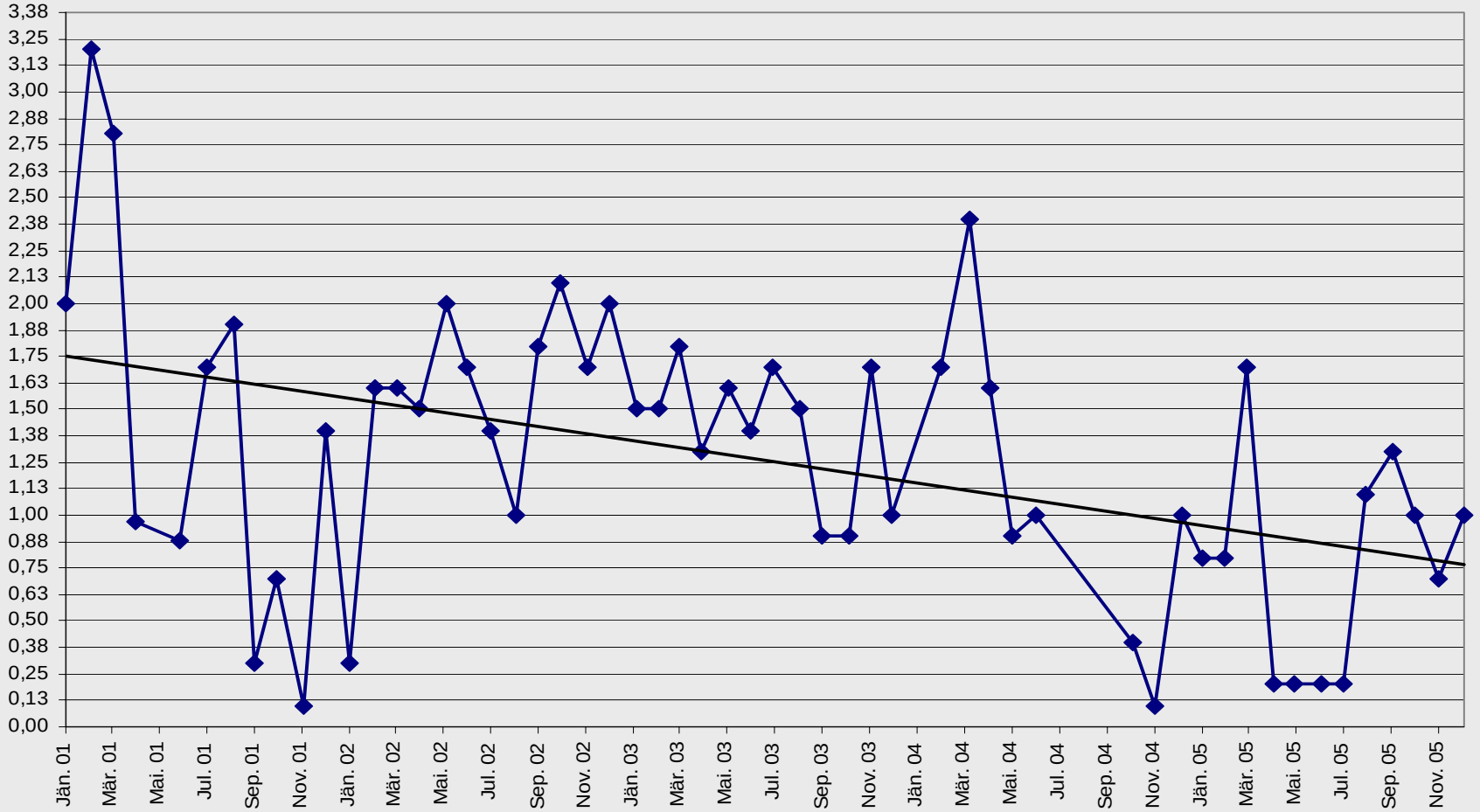
Alarm-Journal

Zurück

	Date	Time	l/s thermal water	Cooling water inlet temp.	DtAnt	Generator kW el	kW th	Efficiency	
	26.04.01		59	9,5	6,0	717	12.128	*5,91%*	highest
	19.11.01	16:50	27	7,8	5,5	312	7.042	4,43%	
	03.12.01	19:45	25	6,0	1,6	323	7.243	4,46%	
	15.01.02	12:24	43	3,3	2,3	560	10.154	5,52%	
	16.10.02	7:54	60	13,4	7,5	471	9.722	4,84%	
	09.02.03	11:09	42	3,0	10,9	565	10.023	5,64%	
	02.05.03	20:36	61	16,8	3,6	601	10.675	5,63%	
	01.08.03	7:12	64	**18,4**	6,9	513	10.209	5,02%	
	13.03.04	11:02	30	5,9	5,1	450	7.875	5,71%	
	03.08.04	7:36	**65**	16,0	**15,3**	357	9.633	**3,71%**	lowest
	21.01.05	9:16	43	3,6	6,6	384	10.352	3,71%	
	27.01.05	14:00	36	0,6	5,8	366	8.983	4,07%	
Aug.05	**14.10.05**	7:24	40	9,1	5,8	489	8.106	6,03%	
new	**30.11.05**	7:12	36	2,8	6,3	487	7.506	6,49%	
working fluid	**02.12.05**	7:12	28	0,7	5,8	444	6.635	6,69%	
	11.01.06	8:31	29	0,0	7,5	460	6.739	6,83%	
	20.01.06	17:53	35	1,7	6,2	540	7.327	7,37%	
	23.01.06	21:50	30	0,1	5,4	530	7.134	**7,43%**	highest
	23.01.06	8:01	29	0,3	5,2	469	6.921	6,78%	
	08.02.06	20:31	30	1,8	5,5	510	7.172	7,11%	
	11.02.06	11:17	41	1,2	6,6	620	8.428	7,36%	
	12.02.06	16:54	41	1,8	6,3	577	8.566	6,74%	


Monthly 15-minute-well head pressure production well
bar
5,25
5,00
4,75
4,50
4,25
4,00
3,75
3,50
3,25
3,00
2,75
2,50
2,25
2,00
1,75
1,50
1,25
1,00
0,75
0,50
0,25
0,00
Mai.01
Jul.01
Sep.01
Mai.02
Jul.02
Sep.02
Mai.03
Jul.03
Sep.03
Mai.04
Jul.04
Sep.04
Mai.05
Jul.05
Sep.05
Nov.05

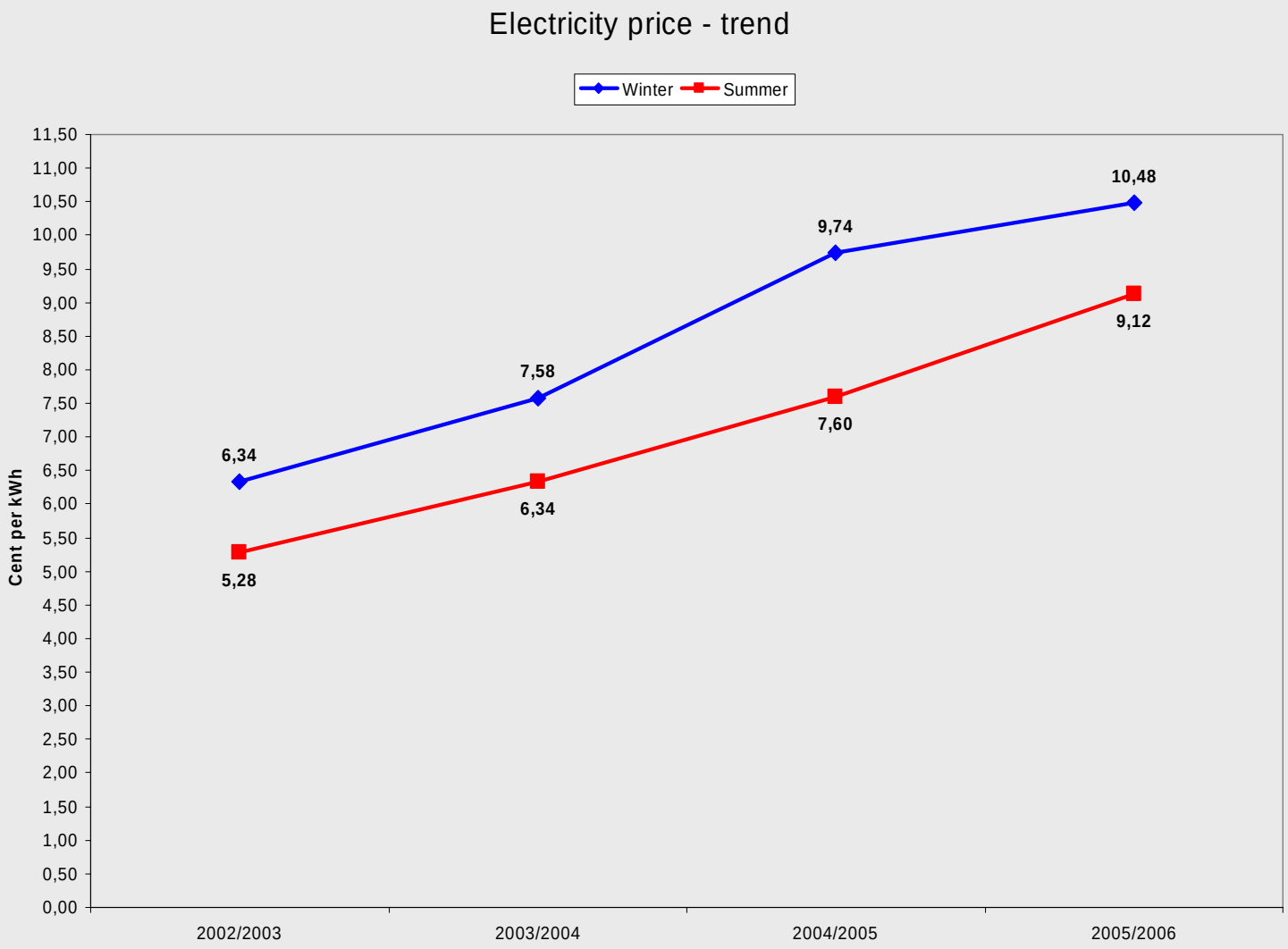
Monthly 15-minute-well head pressure reinjection well



Current electricity price per kWh
(1.10.2005 - 30.9.2006)

Winter time (October – March)	10.48 Cent
Summer time (April – September)	9.12 Cent

Price depends on the Future Market of the European Energy Exchange, Frankfurt.


Electricity price - trend
Winter
Summer
Cent per kWh
11,50
11,00
10,50
10,00
9,50
9,00
8,50
8,00
7,50
7,00
6,50
6,00
5,50
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
6,34
7,58
9,74
10,48
5,28
6,34
7,60
9,12
2002/2003
2003/2004
2004/2005
2005/2006

Thank you for your attention!

Geothermal energy is hot!