

Steam linear power engine – report on field tests of “lion®-Powerblock”

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lion

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WISTA – Berlin's largest Science and Technology Campus, domicile of “Renergiepartner Group”



Source: www.viamichelin.de



Source: www.erneuerbare-energien.de

- **State-energy-programme of Berlin**
- This programme stipulates the energy and climate protection politics in Berlin for the next four years
- The main parts of this programme are:
 - a 25 % reduction of the carbon dioxide (CO₂) emissions until 2010
 - restoration of old buildings with protection against heat losses
 - integration of solar systems
 - distribution of renewable energies

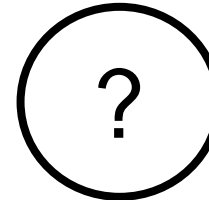
RENERGIEPARTNER GmbH

Eberswalde/Berlin, Deutschland

**DEIG
Energietechnik-Insumma GmbH**

Berlin, Deutschland

- **Renergiepartner GmbH** – develops turnkey projects for energy conversion and for CO₂ reduction www.renergiepartner.de
- **DEIG Energietechnik-Insumma GmbH** – project solutions for the rational use of energy domestically and abroad www.deig-energie.de
- DEIG cooperates with **ZGG** in this field test (www.zgg.de)



New business field

Our Competence

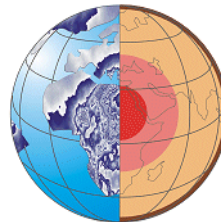
Wind energy



Biomass



Photovoltaic



Geothermal energy

A new competence for Renergiepartner Group



The new business field is a combination of energy efficiency and the local production of heat and electricity

- For the first field test we selected the lion[®]-Powerblock of OTAG
- The physical principle is a **steam-engine**



SOLO-Stirling-BHKW
9 kW el; 25 kW th



3 kWel; 16 kWth



1 kWel; 15; 24; 36 kWth
Stirling



1,2 kWel; 8 kWth
Stirling



(Source: OTAG Vertriebs GmbH & Co.KG)

Source: Barbara Achilles; GASAG; 6. Berliner Energietage „Mit neuen Erdgastechnologien zu mehr Energieeffizienz und Klimaschutz“; 03.05.2005

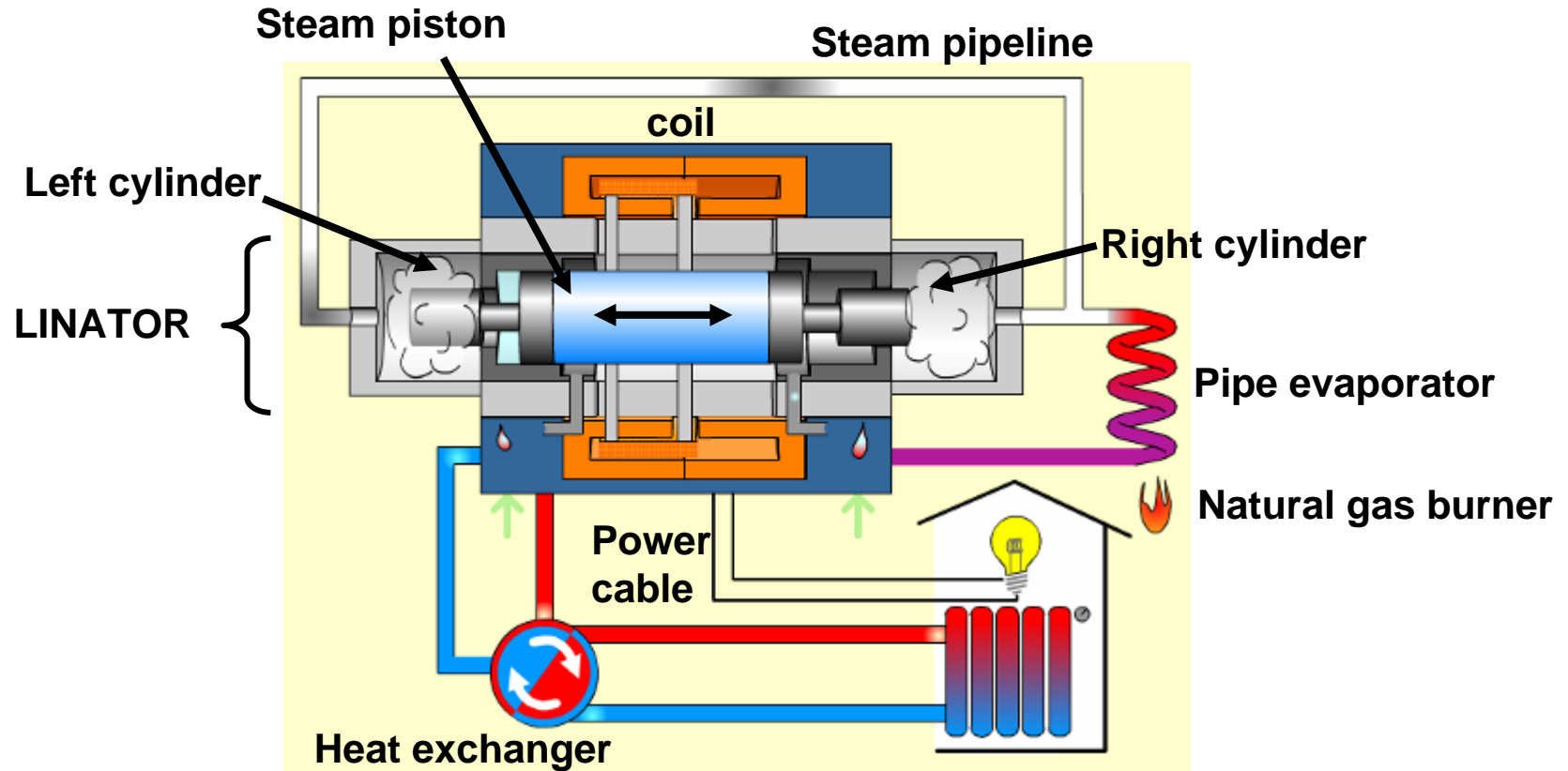
What is a steam engine?



Source: Heinz Rühmann; "Die Feuerzangenbowle"; Deutschland 1944

The operation of the steam engine

Important components of lion[®]-Powerblock



(Source: OTAG Vertriebs GmbH & Co.KG)

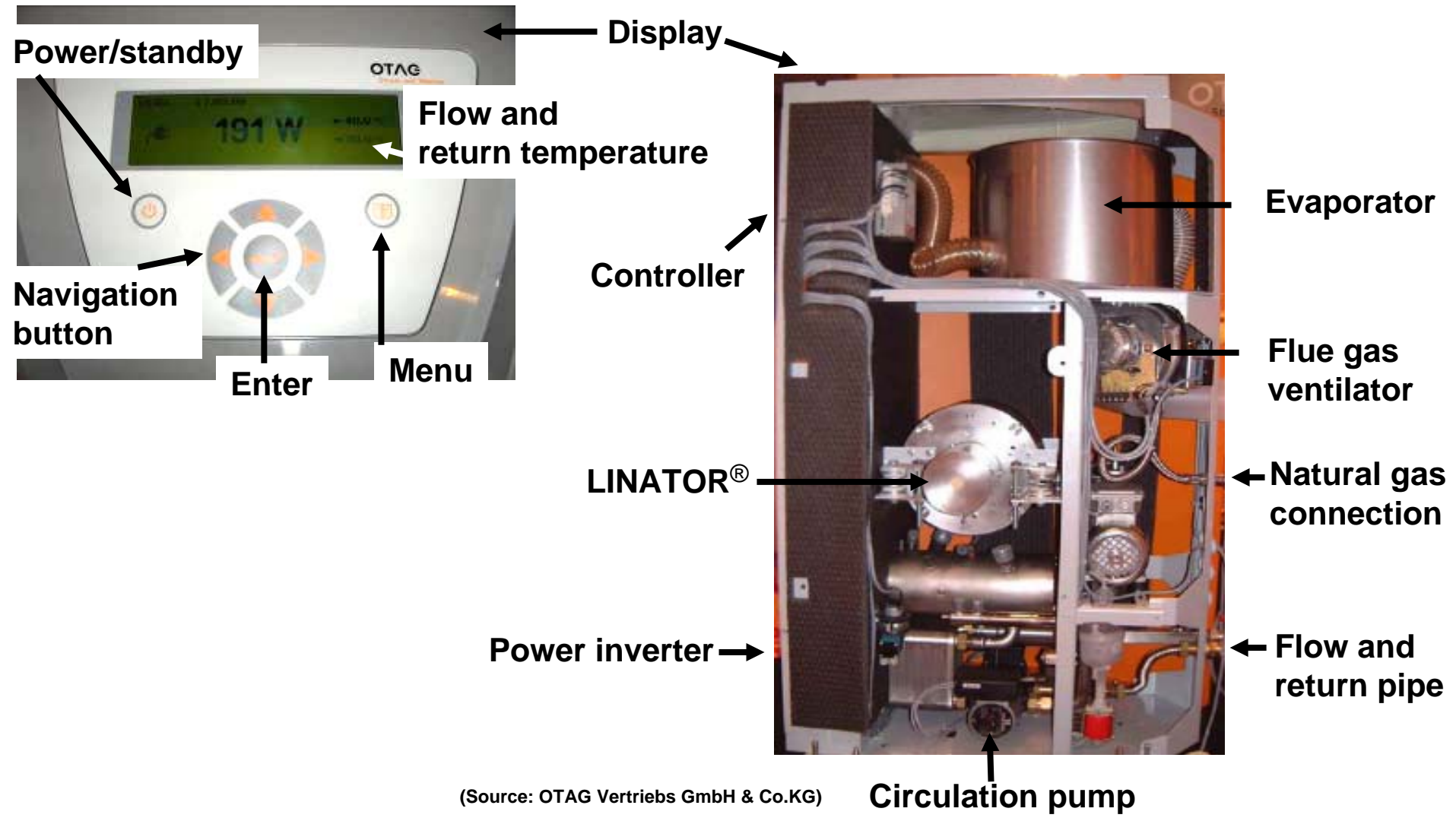
Technical data

- **Strength transducer LINATOR®**
 - free piston steam-driven engine with an integrated linear generator
- **Fuel**
 - natural gas
- **Voltage**
 - 230 V AC, 50 Hz
- **Power connection**
 - 3 phases
- **Performance (Detail of technical aim data)**
 - electric 0,2 kW to 3,0 kW
 - thermal 2,0 kW to 16,0 kW
- **Working frequency**
 - 40–75 Hz = 2.400–4.500 piston strokes/min.
- **Noise**
 - ca. 44 dB (A)
- **Dimensions**
 - 126 x 62 x 83 cm
- **Overall weight**
 - ca. 160 kg



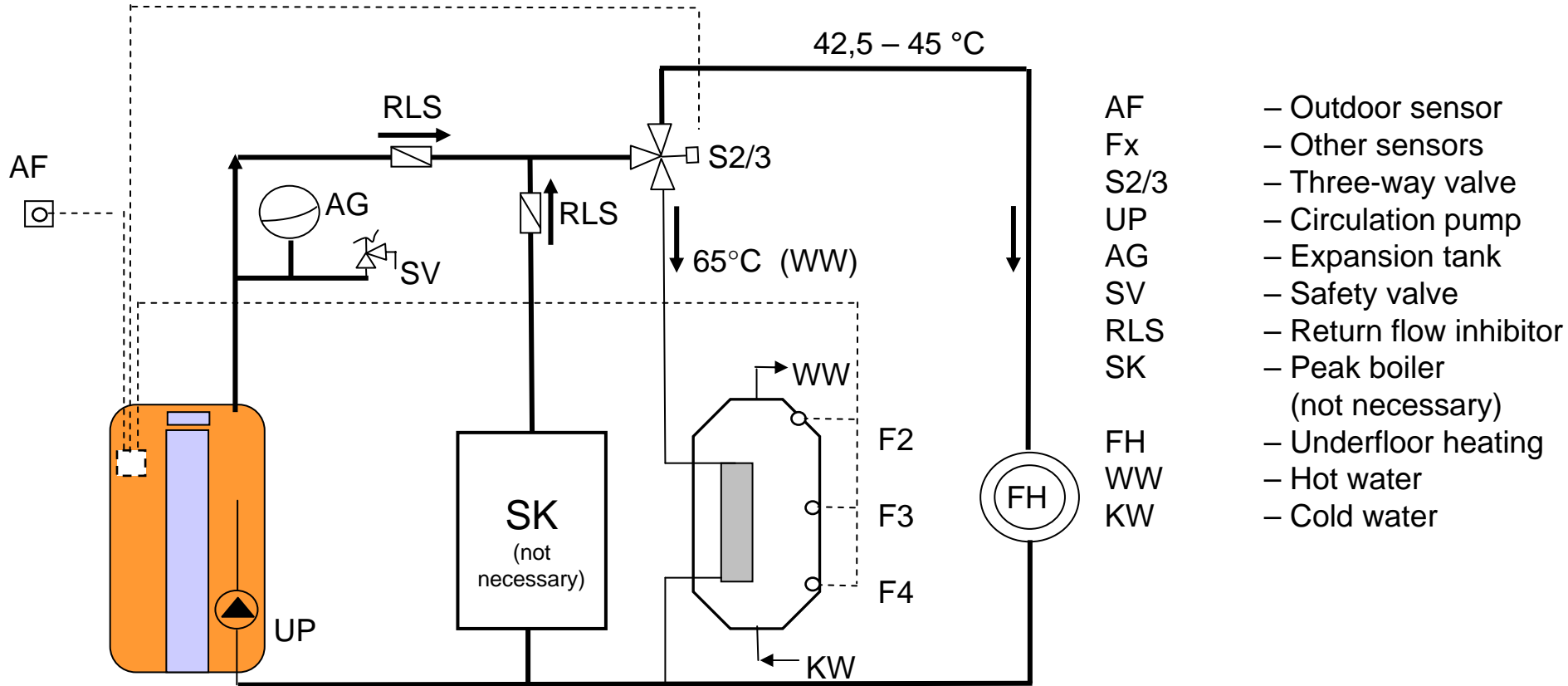
lion®-Powerblock
 field-test of GASAG,
 OTAG and DEIG - in
 cooperation with ZGG

Inner life



- **An application must be made for the refund of the mineral oil tax (only for CHP)**
 - the plant is not classified as CHP plant yet
(under discussion with (Zoll))
- **Problems with the underfloor heating**
 - too low flow pipe temperatures (45 °C)
- **Return flow inhibitor have not closed (outside lion-Powerblock)**
 - hydraulic short circuit
- **Ground frost**
 - electric cable could not be transferred
- **Too low tension in the public net (218 V)**
 - the lion-Powerblock did not produce electricity
 - (not a problem any more, electricity from 217 Volt up to 255 Volt possible)
- **Three gas meters for the entire plant necessary**
 - 1. Calibrated gas meter
 - 2. Gas meter for the remote enquiry
 - 3. Gas meter for the peak boiler

Liquid connection plan "field test"



- AF – Outdoor sensor
- Fx – Other sensors
- S2/3 – Three-way valve
- UP – Circulation pump
- AG – Expansion tank
- SV – Safety valve
- RLS – Return flow inhibitor
- SK – Peak boiler (not necessary)
- FH – Underfloor heating
- WW – Hot water
- KW – Cold water

(Source: OTAG Vertriebs GmbH & Co.KG)

OTAG
Strom mit Wärme
lion® - Powerblock

Titel		hydraul. Einbindung	
Zusatz		Objekt: DEIG, Bruchlandstr. 29, Berlin	
	Dat.	Name	Maßstab
gez.	6.3.2006	fjs o	
gepr.		RL-b	
Änder A			Blatt Nr 1
Änder B			Anz. Blatt 1
Ersetzt durch			Zeichnungs Nr 60302_DEIG

Electricity connection plan

Consumers are partly served by CHP and sometimes by the electric utility company



Four quadrant meter



Switch



Combined Heat and Power unit CHP



Current reading course in an one-family house



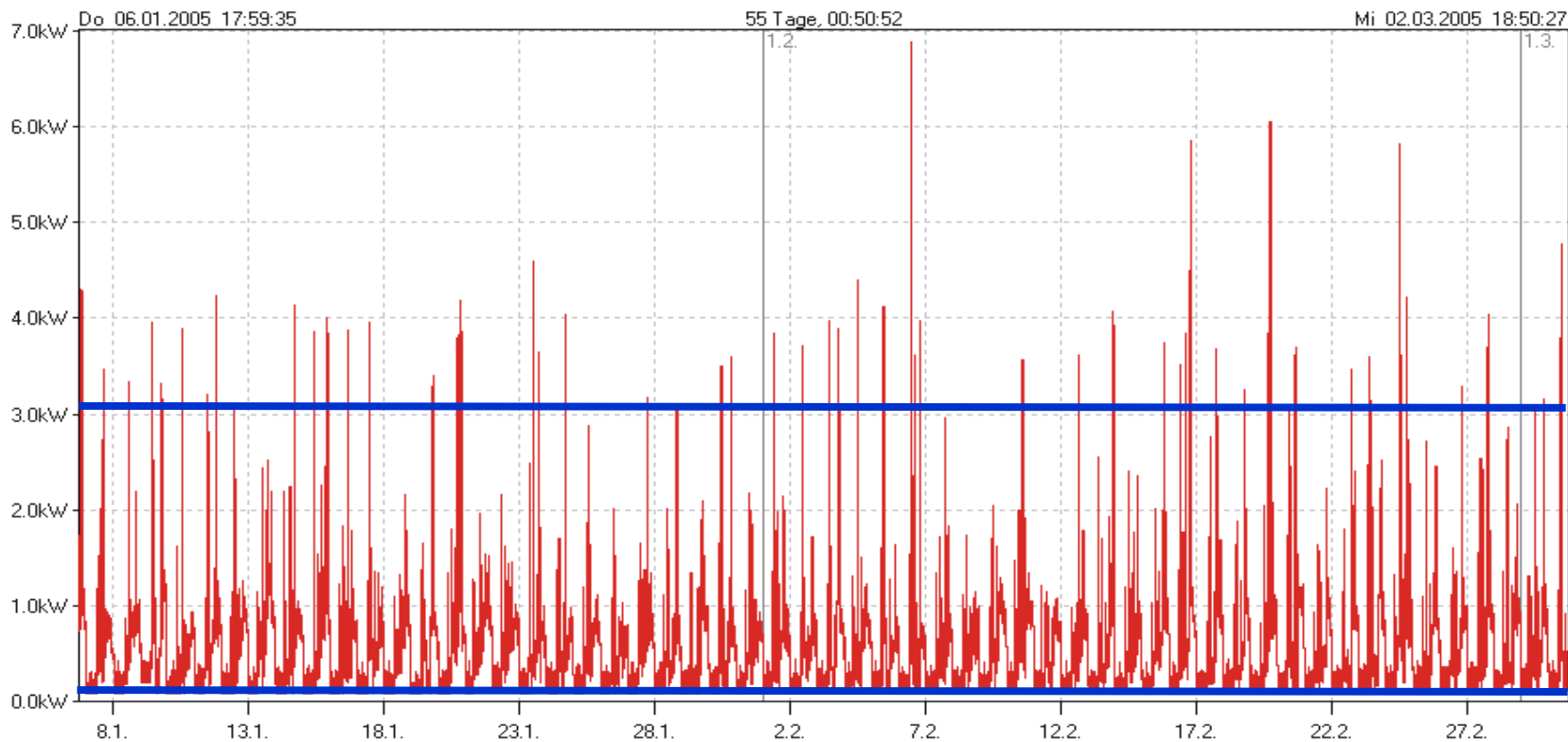
Gerät: 403

Daten: Do 06.01.2005 17:59:35 - Mi 02.03.2005 18:50:27

Kanal 1: EFH, 4.400 kWh / a

Meßintervall: 5 Minuten

15811 Werte, 600 U/kWh



(Source: OTAG Vertriebs GmbH & Co.KG)

➤ **Many thanks for your attention**

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(Source: OTAG Vertriebs GmbH & Co.KG)