

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

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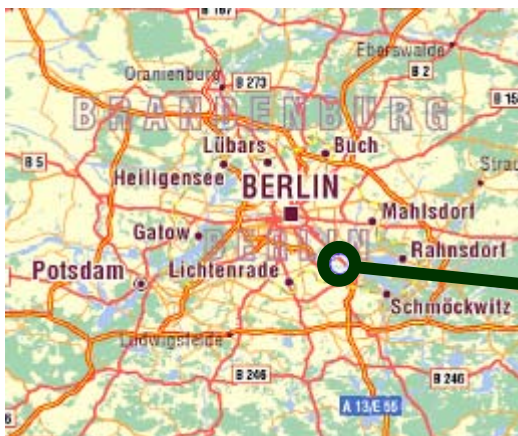
*lion*

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



Source: [www.viamichelin.de](http://www.viamichelin.de)



Source: [www.erneuerbare-energien.de](http://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 (CO<sub>2</sub>) emissions until 2010
  - restoration of old buildings with protection against heat losses
  - integration of solar systems
  - distribution of renewable energies

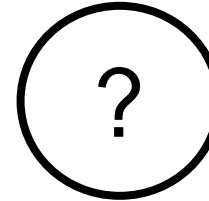
**RENERGIEPARTNER GmbH**

Eberswalde/Berlin, Deutschland

**DEIG  
Energietechnik-Insumma GmbH**

Berlin, Deutschland

- **Renergiepartner GmbH** – develops turnkey projects for energy conversion and for CO<sub>2</sub> reduction [www.renergiepartner.de](http://www.renergiepartner.de)
- **DEIG Energietechnik-Insumma GmbH** – project solutions for the rational use of energy domestically and abroad [www.deig-energie.de](http://www.deig-energie.de)
- DEIG cooperates with **ZGG** in this field test ([www.zgg.de](http://www.zgg.de))



New business field

## Our Competence

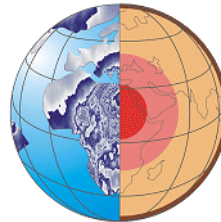
Wind energy



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<sup>®</sup>-Powerblock of OTAG
- The physical principle is a **steam-engine**



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



3 kWel; 16 kWth



1,2 kWel; 8 kWth  
Stirling



1 kWel; 15; 24; 36 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

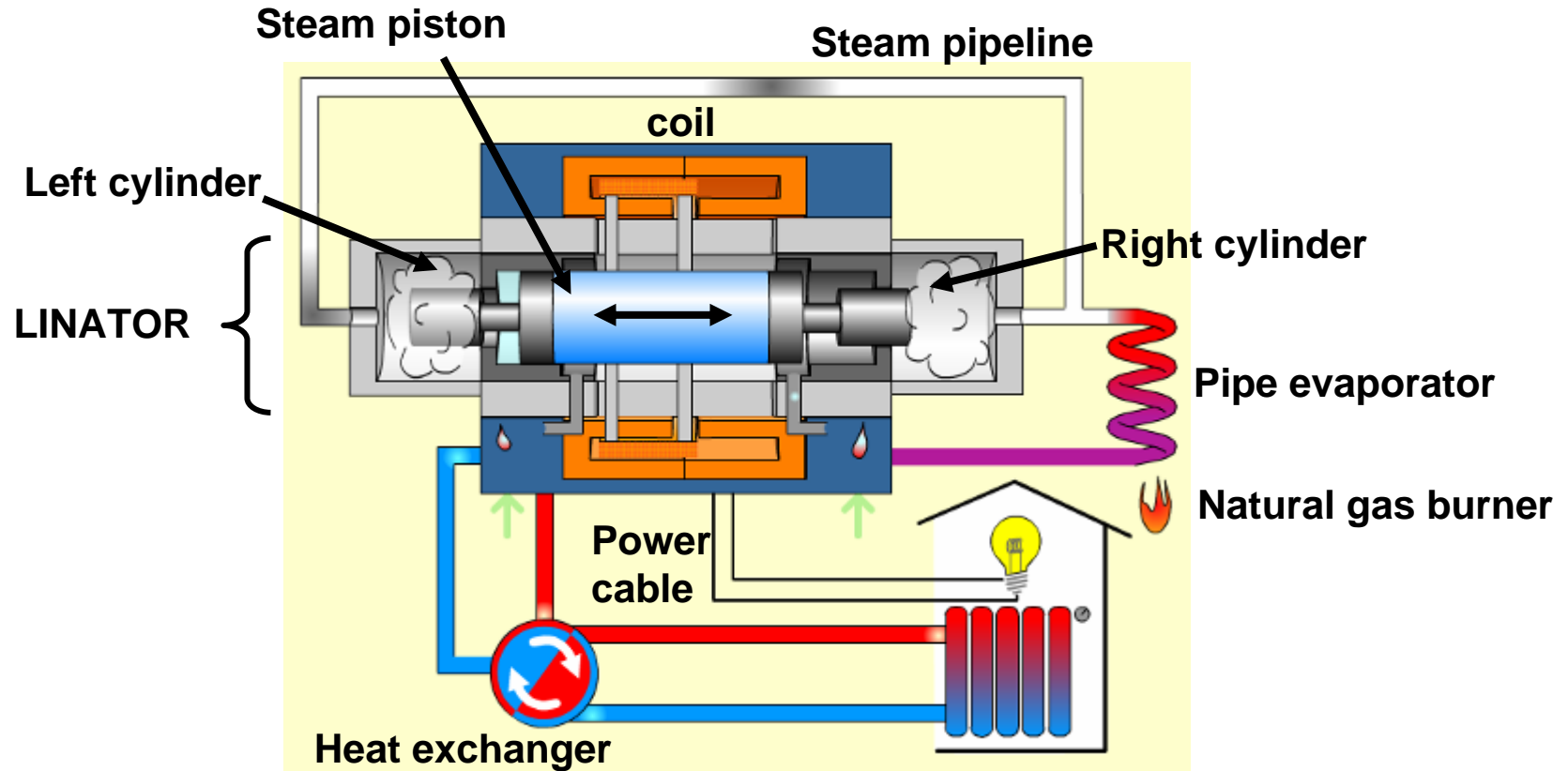
# What is a steam engine?



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

# The operation of the steam engine

## Important components of lion<sup>®</sup>-Powerblock



(Source: OTAG Vertriebs GmbH & Co.KG)

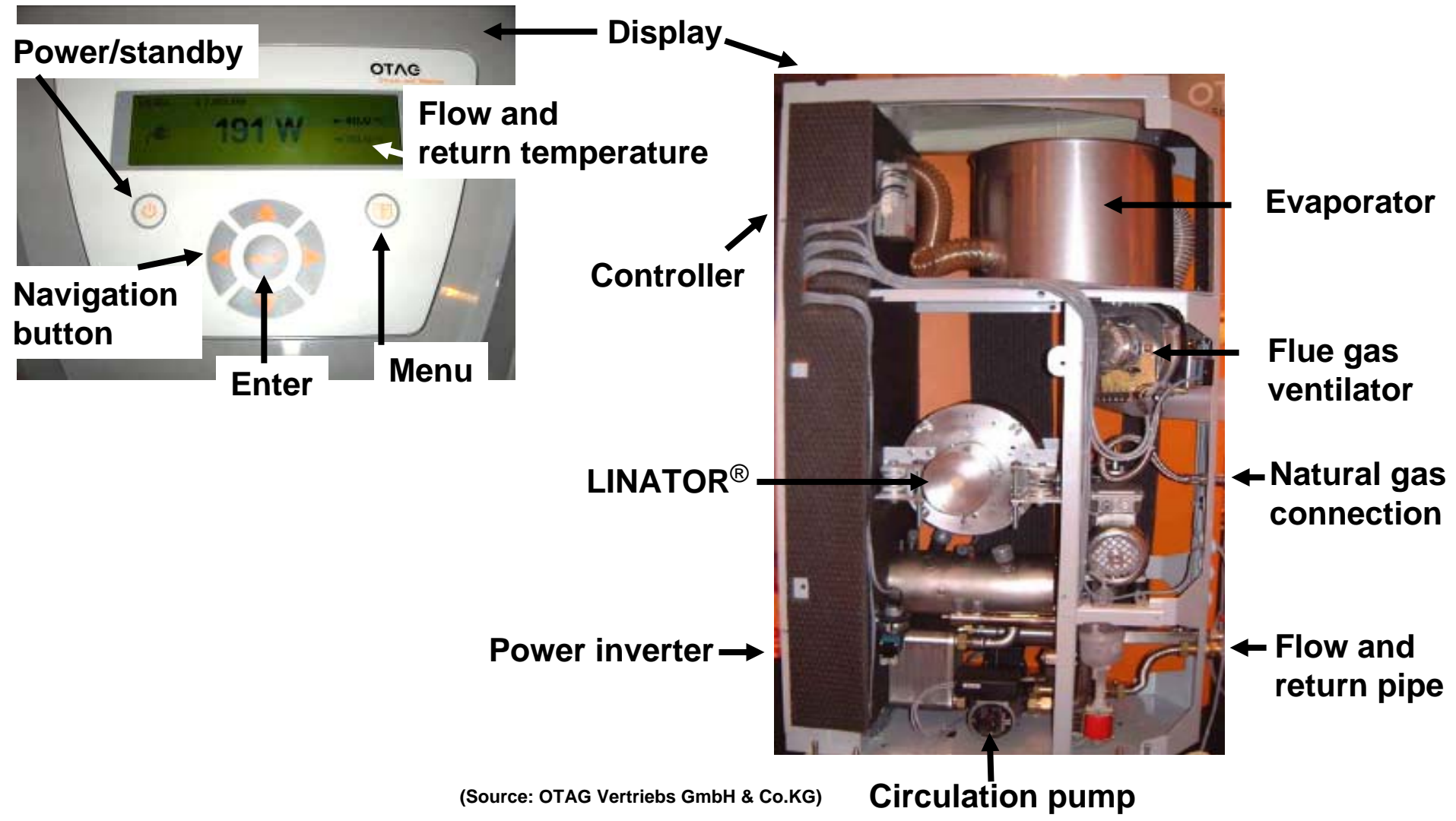
# Technical data

- **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

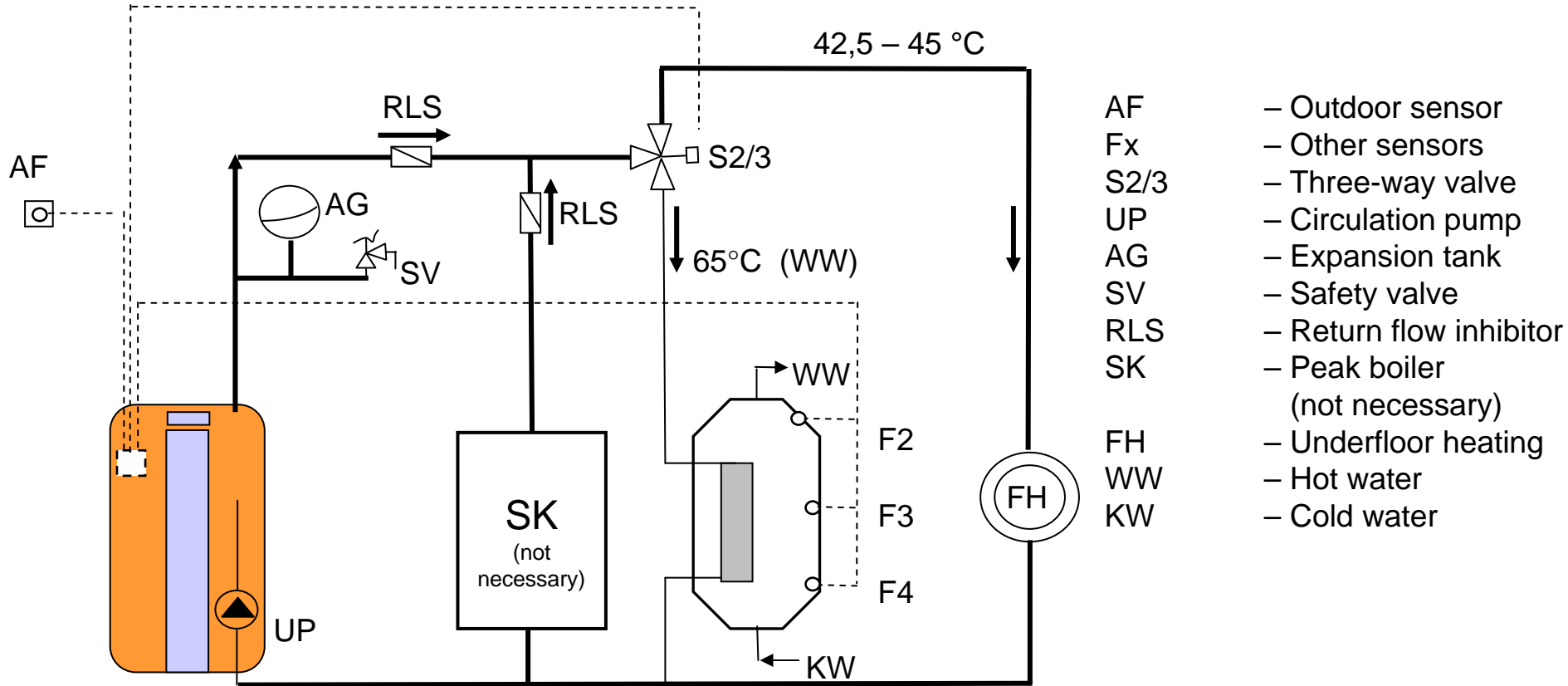


(Source: OTAG Vertriebs GmbH & Co.KG)



- **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"



(Source: OTAG Vertriebs GmbH & Co.KG)

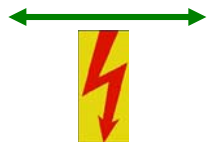
<p><b>OTAG</b> Strom mit Wärme lion® - Powerblock</p>	Titel		hydraul. Einbindung	
	Zusatz		Objekt: DEIG, Bruchlandstr. 29, Berlin	
	gez.	Dat.	Name	Maßstab
	gepr.	6.3.2006	fjs o	
Änder A			Blatt Nr	1
Änder B			Anz. Blatt	1
Ersetzt durch			Zeichnungs Nr	60302_DEIG

# 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



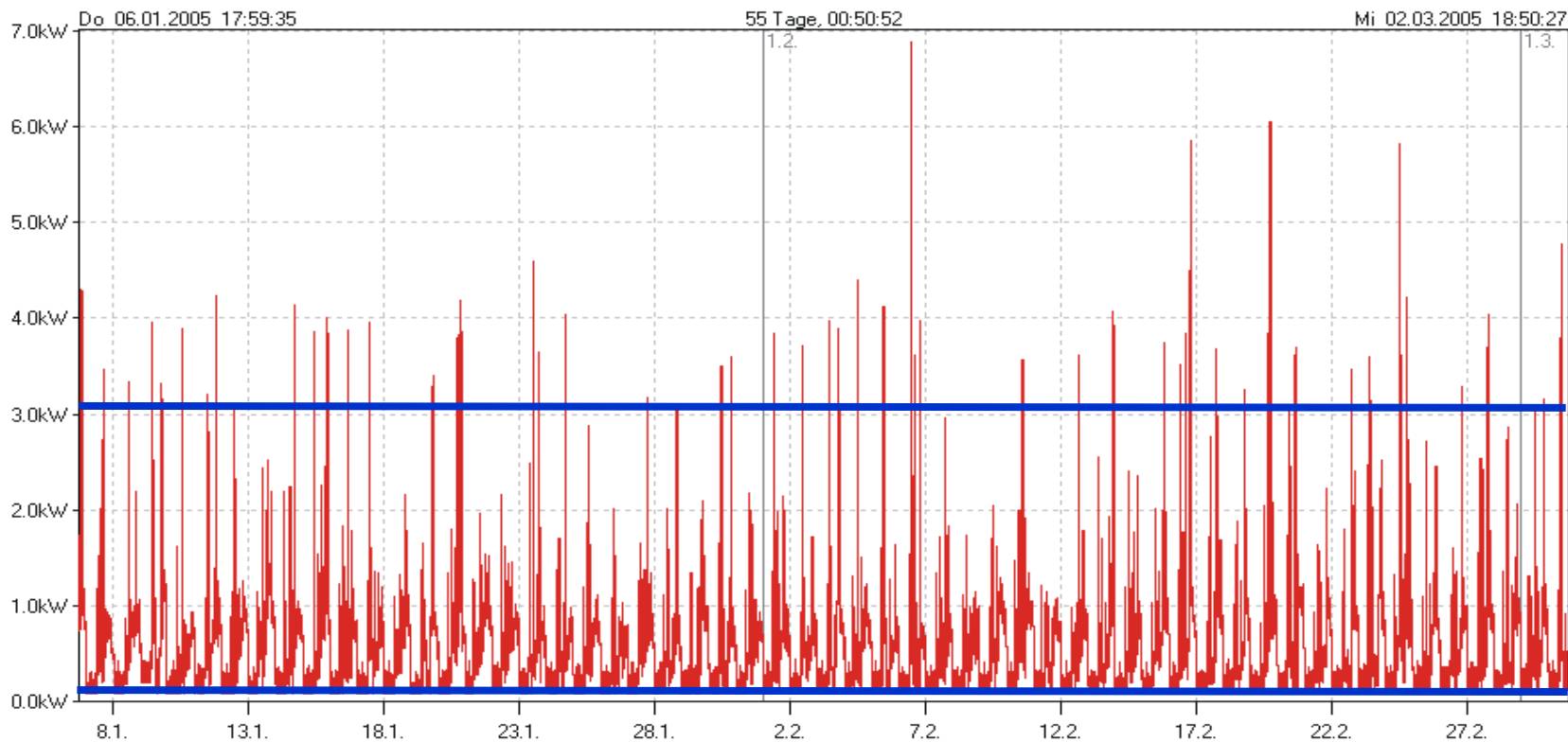
Gerät: 403

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)