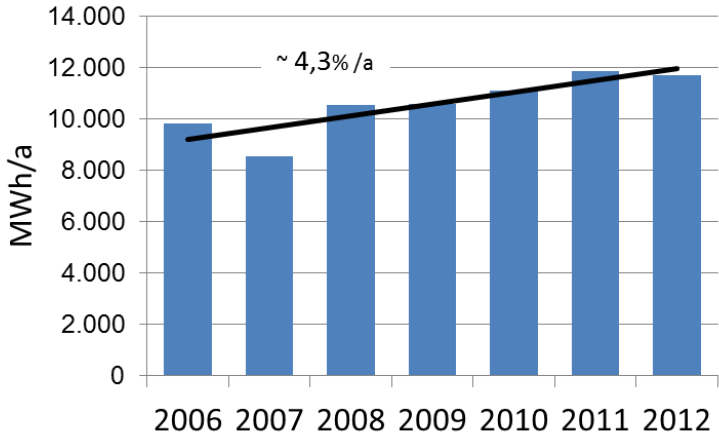
The secrets of load profiles

Status Quo

- Relevant achievements in terms of reduction of heat demand
- General trend to electricity
- Little to no achievements by the use of electricity
  - Electricity consumption still raise in the tertiary sector
  - Energy monitoring consume time and money
- Energy efficiency becomes more relevant
  - EC directive
  - ISO 50001

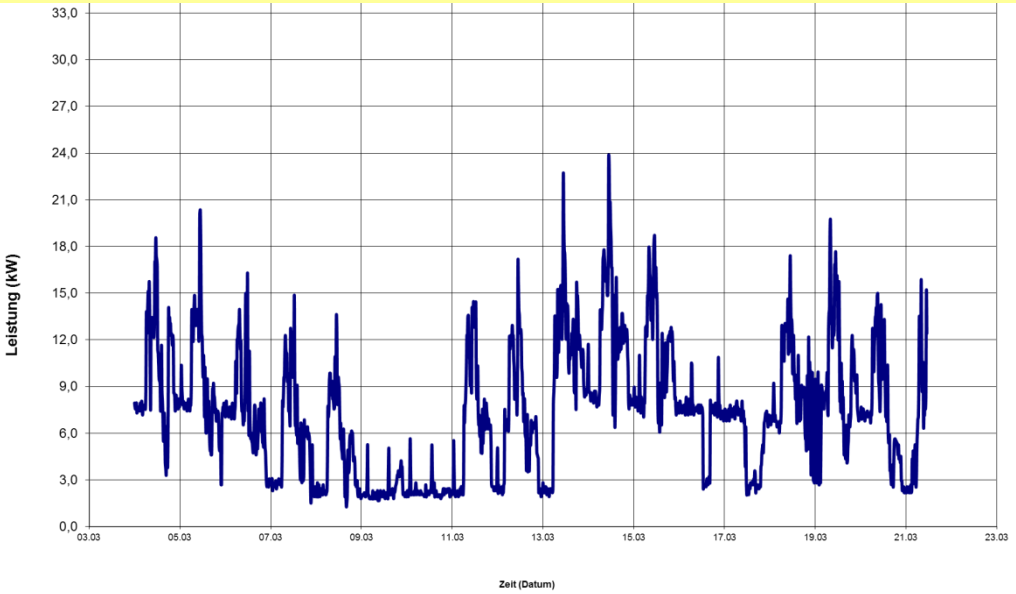


Electricity demand of an hospital

Available Data

date	Power (kW)
01.01.2013 00:00	800,0
01.01.2013 00:15	801,3
01.01.2013 00:30	765,3
01.01.2013 00:45	793,3
01.01.2013 01:00	778,7
01.01.2013 01:15	778,7
01.01.2013 01:30	801,3
01.01.2013 01:45	766,7
01.01.2013 02:00	789,3
01.01.2013 02:15	780,0
01.01.2013 02:30	761,3
01.01.2013 02:45	798,7
01.01.2013 03:00	757,3
01.01.2013 03:15	782,7
01.01.2013 03:30	766,7
01.01.2013 03:45	754,7
01.01.2013 04:00	784,0
01.01.2013 04:15	756,0
01.01.2013 04:30	768,0
01.01.2013 04:45	781,3
01.01.2013 05:00	849,3

- If >**50 kW or > 100.000 kWh/ a**
  - utility recorded load profile (15´)
  - At least 1x year free provision
  - future : SMART Meters !!!!
- 15 min interval => 35.040 value / a



Research Question

Includes the recorded load profil (15 min) so much information that it can be used for an analysis in terms of energy demand structure and savings?

YES!

…. Supplemented by the outside temperature
…especially for objects< 1 GWh

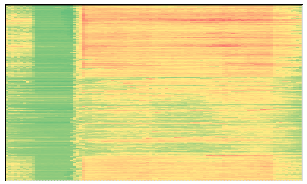
Bisher durchgeführte Auswertungen

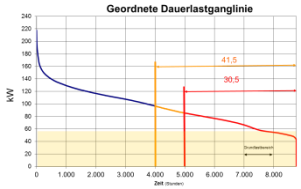
- **About 300 analysis made so fare**
  - about 50 analysis with a written report (20 Pagea)
  - about 40 with only graphical analysis (Power Point presentations)

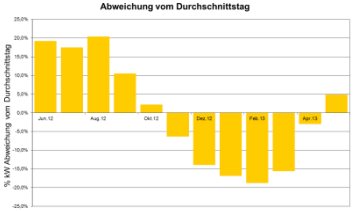
kindergarten
Primary school
secondary school
professional school
Office buildings
Retirement homes
hospitals
Soccer stadion
Ice stadion
ski lift

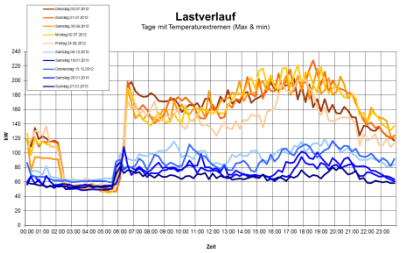
Food Retails
food wholesale
do it yourself market
clothing Market
hotels
Various commercial production plant
Butchers, car dealers,
sawmills,
patrol station

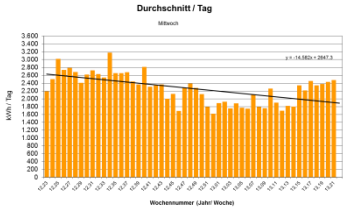
Graphical Analysis (Example hotel, 230 beds)

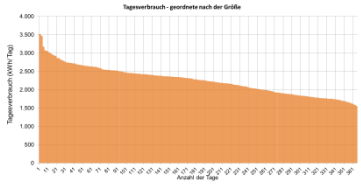


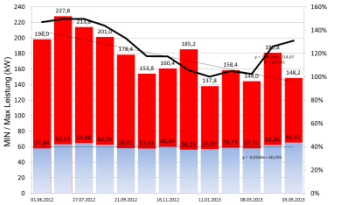


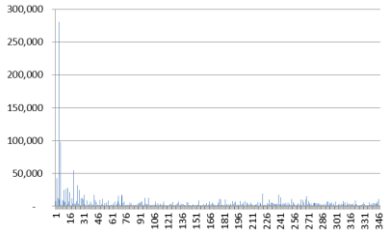


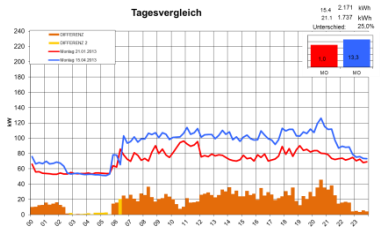


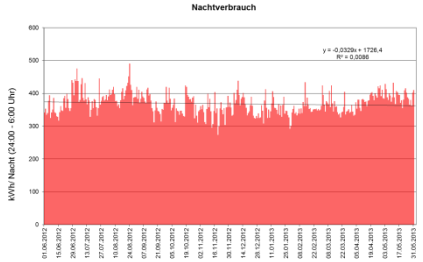


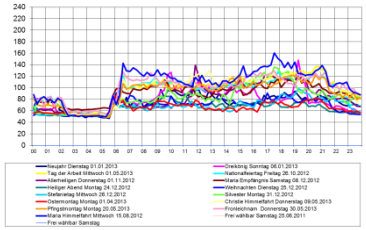


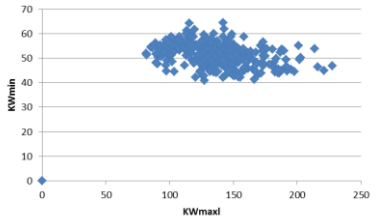


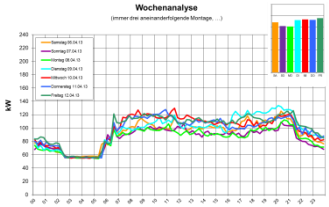


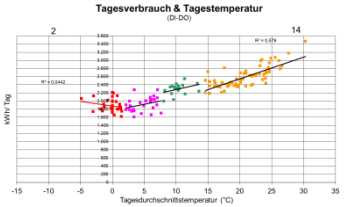


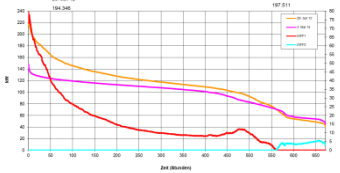


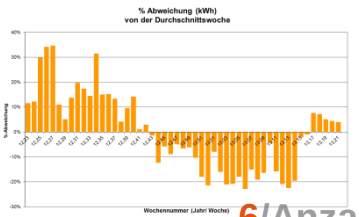












Numerical evaluation

	Jahr
Startzeit	1. Jänner 2013
Gebäudeart	XXXXX
Jahresenergieverbrauch	8.958.117 kWh
Volllaststunden	4.244,2 h
Grundband	76,6% %
Grundlast7000-800	783,4 kW
Verhältnis SP/GL	2,69 [ ]

	25h	100h	1000h	
Spitze	1830,7	1680	1344	kW
Anteil Leistung	13,3%	20,4%	36,3%	

	4000h	5000h	6000h	
Spitze	973,344	902,672	854,672	kW
Verbrauch	4.992.664	5.927.071	6.804.761	kWh
RESTVERBRAUCH	44,3%	33,8%	24,0%	

	Y-Achse	Max Tag	Max Woc
START	2200	38000	220
	200	3000	20

	Bezugsgröße 1	Bezugsgröße 2	Bezugsgröße 3
Bezugsgröße	Gesamtfläche	Betten	
Einheit			
Menge	85.000,0	700,0	

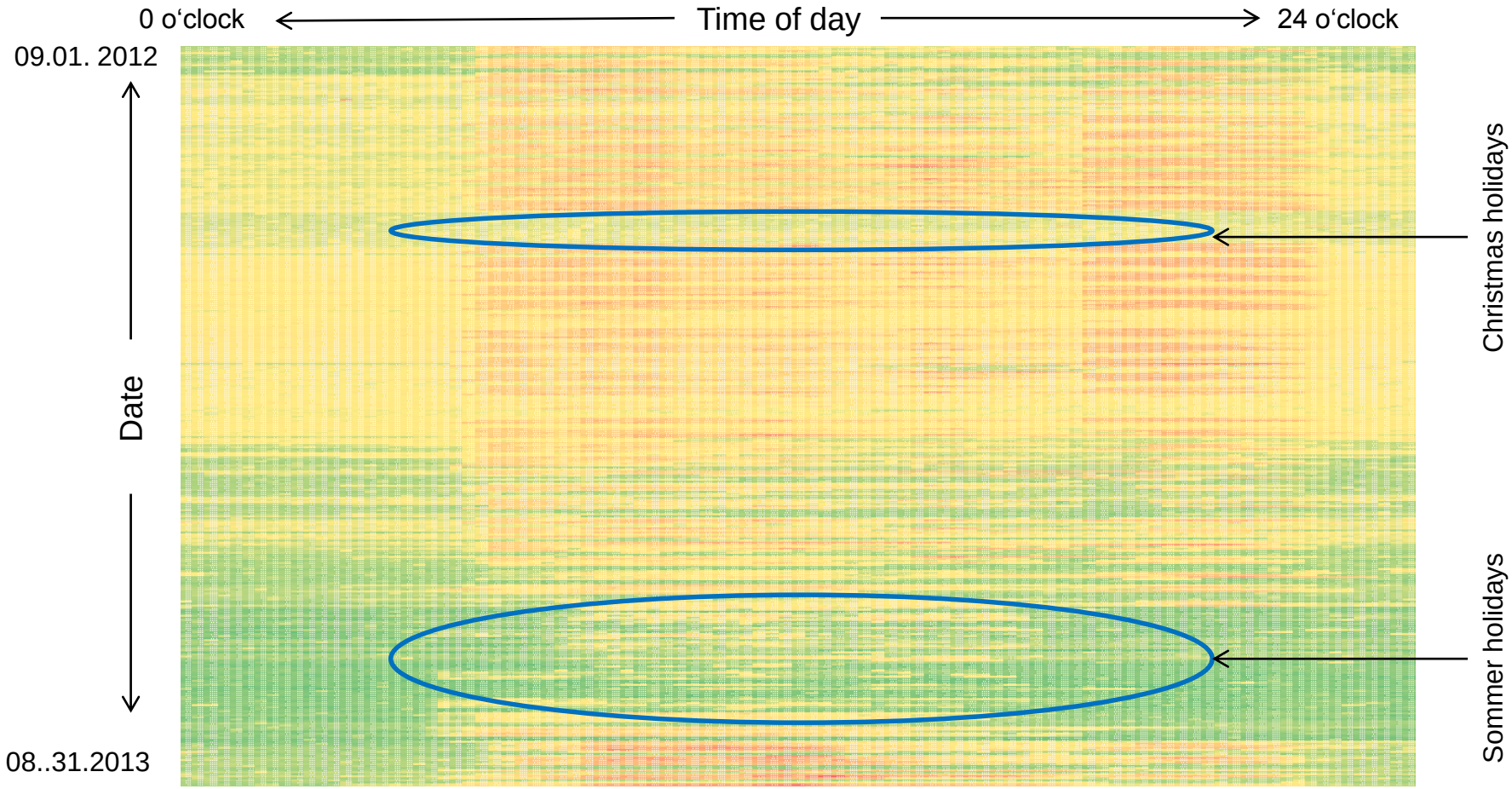
	Gesamtfläche	Betten
spez. Verbrauch (kWh)	105,39	12.797,3
spez. max Leistung (Watt)	24,83	3015,22
spez. Grundlast (Watt)	9,22	1119,14

MAX Leistung:

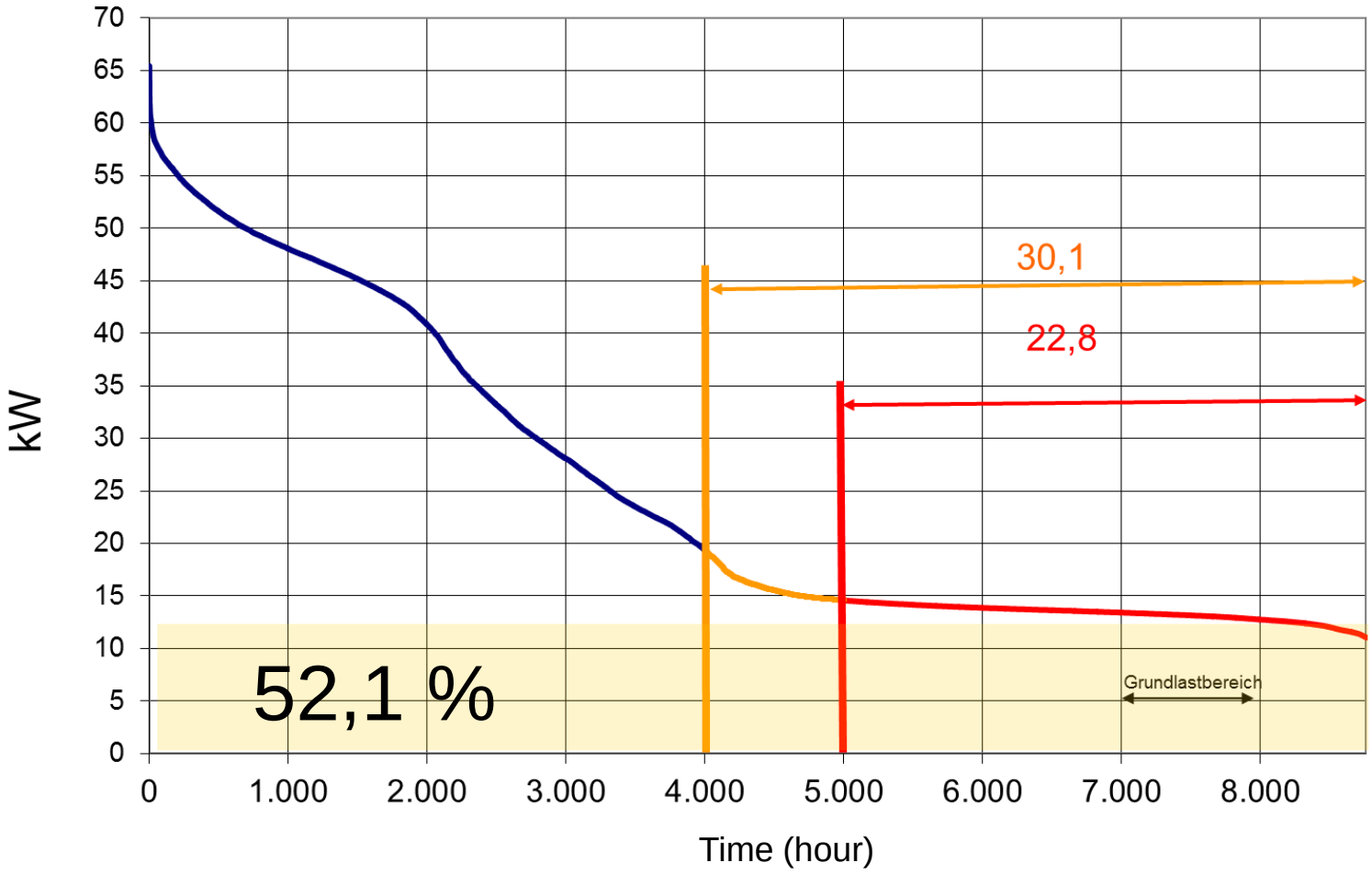
Leistung kW	spezifische Leistung [W/]	Datum & Zeit	Wochentag
2110,656	24,83	19.06.2013 11:00	Mittwoch
2038,67	23,98	19.06.2013 16:15	Mittwoch
2018,66	23,75	19.06.2013 15:30	Mittwoch
2012,00	23,67	19.06.2013 13:00	Mittwoch
2009,33	23,64	19.06.2013 12:15	Mittwoch
1990,67	23,42	20.06.2013 14:00	Donnerstag
1988,00	23,39	20.06.2013 11:00	Donnerstag
1981,33	23,31	19.06.2013 10:15	Mittwoch
1966,67	23,14	07.08.2013 11:30	Mittwoch
1960,00	23,06	18.06.2013 11:30	Dienstag

	MAX Änderung PLUS KW			MAX Änderung Minus kW		
1	933	24.10.2013 20:15	Donnerstag	-919,97	24.10.2013 19:15	Donnerstag
2	787	09.10.2013 17:45	Mittwoch	-877,33	20.06.2013 17:00	Donnerstag
3	784	05.08.2013 18:00	Montag	-865,32	09.10.2013 16:45	Mittwoch
4	705	11.07.2013 17:45	Donnerstag	-781,32	24.10.2013 19:00	Donnerstag
5	677	14.11.2013 19:45	Donnerstag	-743,96	01.01.2014 00:00	Mittwoch
6	617	24.01.2013 18:00	Donnerstag	-735,97	14.11.2013 16:45	Donnerstag
7	589	24.10.2013 20:00	Donnerstag	-731,95	09.12.2013 16:45	Montag
8	589	09.10.2013 18:00	Mittwoch	-728,01	24.01.2013 17:00	Donnerstag
9	587	24.01.2013 17:45	Donnerstag	-717,31	31.12.2013 23:45	Dienstag
10	577	18.09.2013 17:45	Mittwoch	-693,32	18.09.2013 17:00	Mittwoch
11	560	13.03.2013 15:30	Mittwoch	-665,28	09.10.2013 17:00	Mittwoch
12	556	09.12.2013 17:30	Montag	-662,64	05.08.2013 17:00	Montag
13	545	14.11.2013 19:30	Donnerstag	-645,34	13.03.2013 14:30	Mittwoch
14	543	20.06.2013 17:45	Donnerstag	-619,97	09.12.2013 16:30	Montag
15	541	18.09.2013 18:00	Mittwoch	-595,98	11.07.2013 16:45	Donnerstag
16	519	05.08.2013 17:45	Montag	-546,66	20.06.2013 16:45	Donnerstag
17	519	13.03.2013 15:15	Mittwoch	-542,64	15.05.2013 17:00	Mittwoch
18	508	11.07.2013 18:00	Donnerstag	-525,31	05.08.2013 16:45	Montag

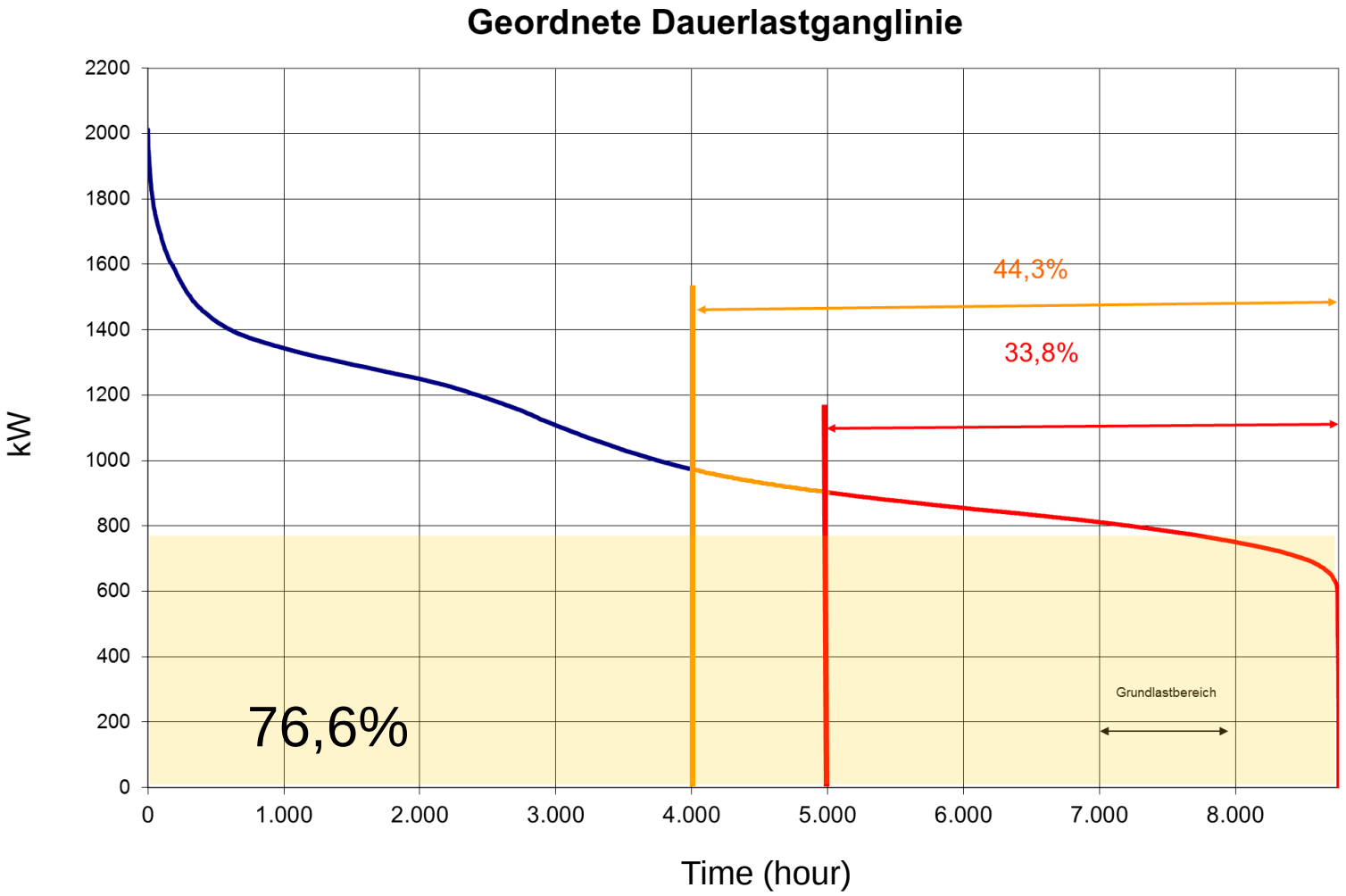
Distribution of power over the year secondary school



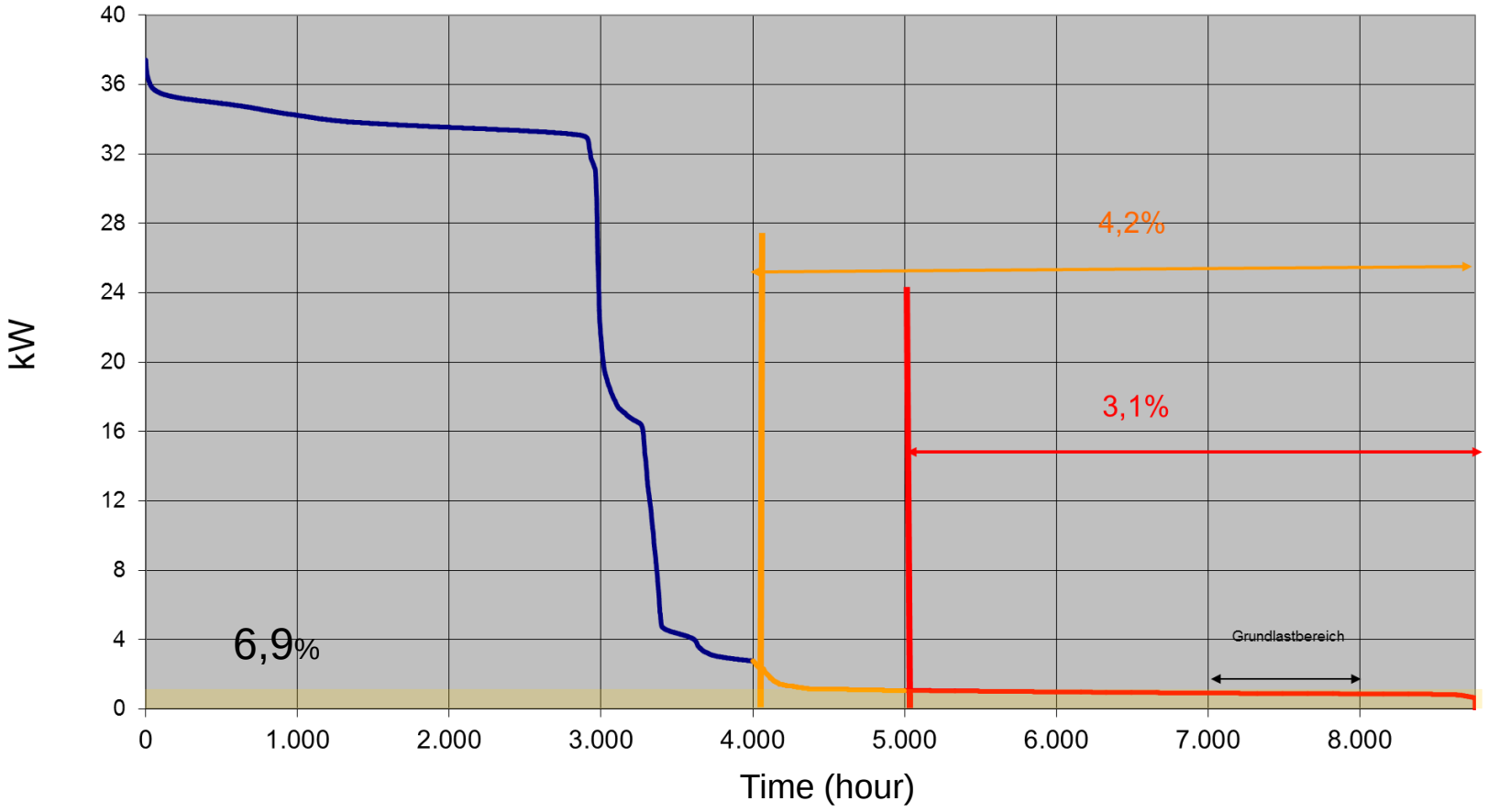
sordet load demand curve
Office building (without AC- system)



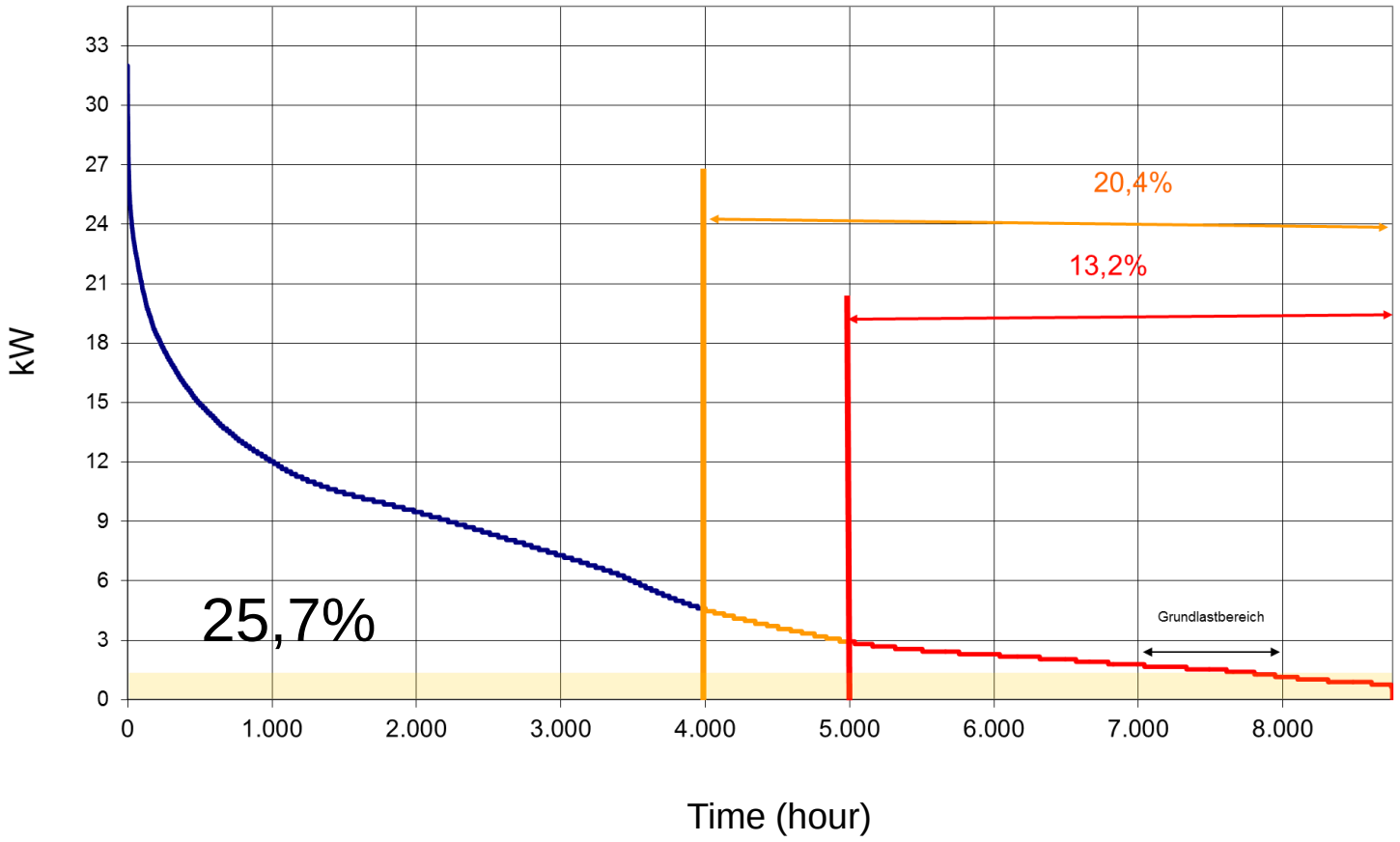
sordet load demand curve hospital (700 beds, 11 GWh)



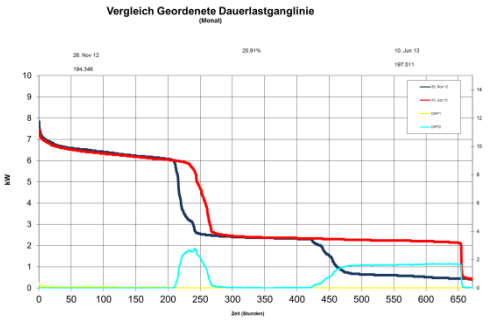
sordet load demand curve
Clothe market
(chain, 1.000 m², external air conditioning System)

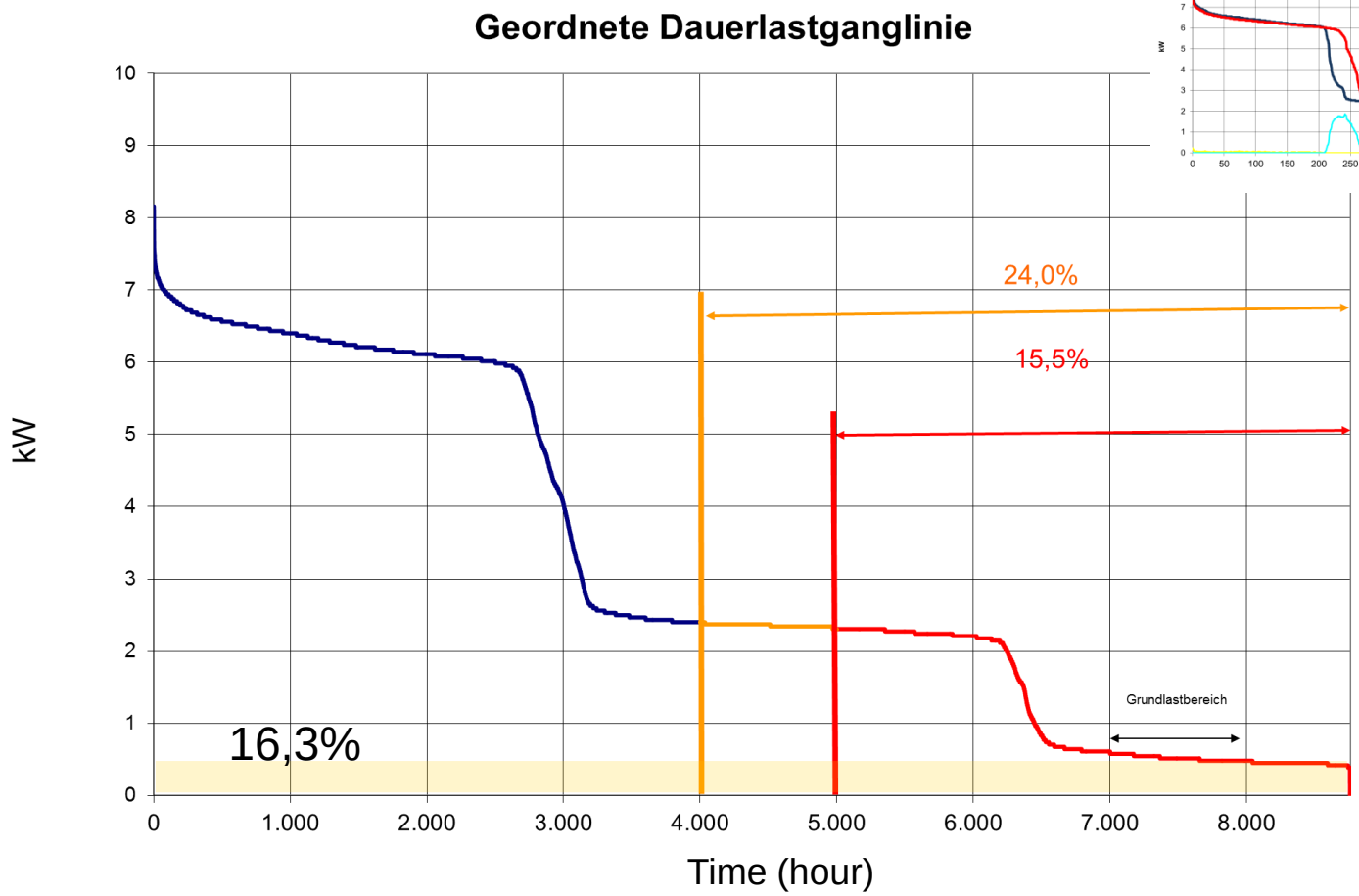


sordet load demand curve primary school (8 classes)

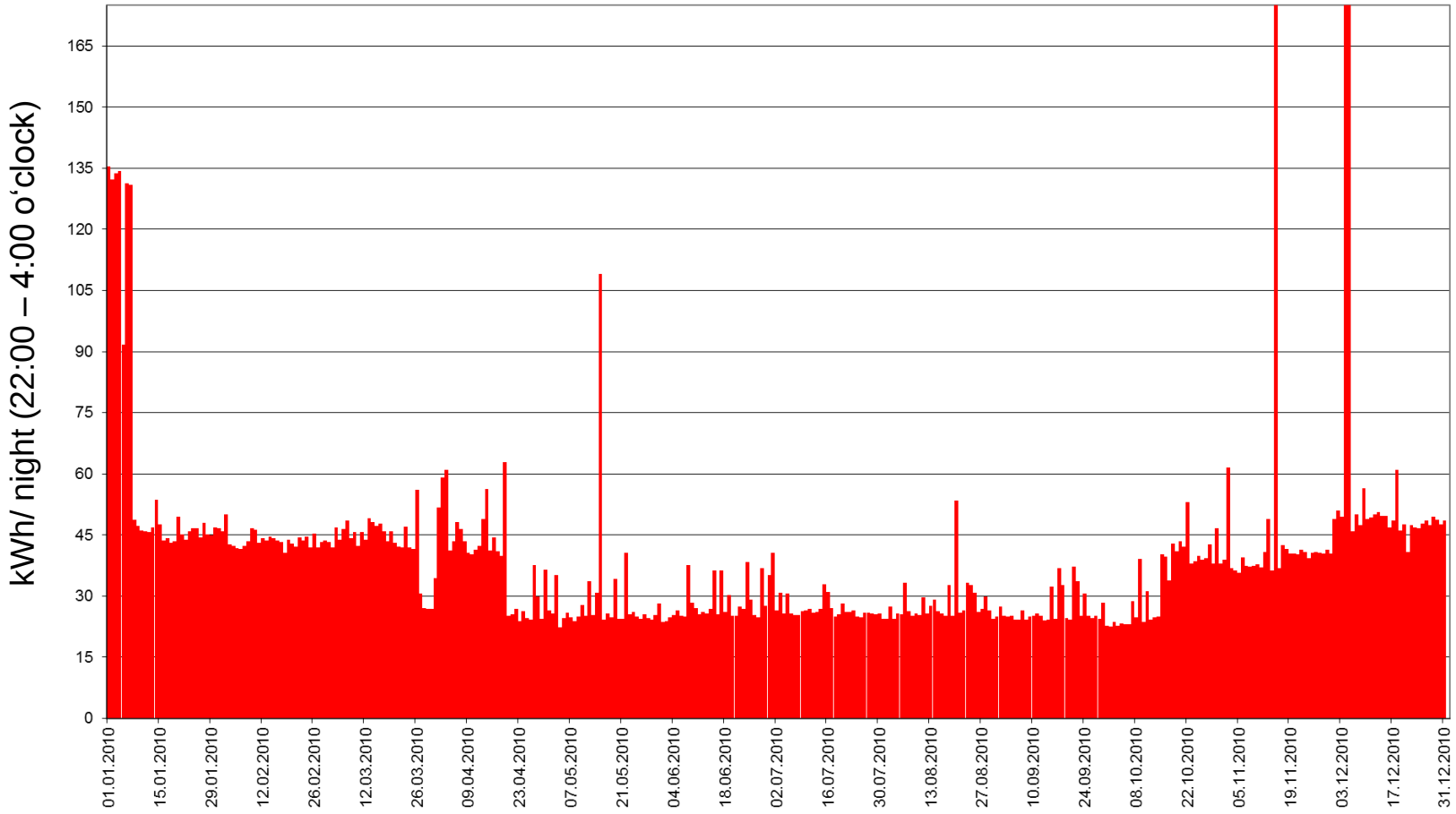


sordet load demand curve
IT-room in secondary school

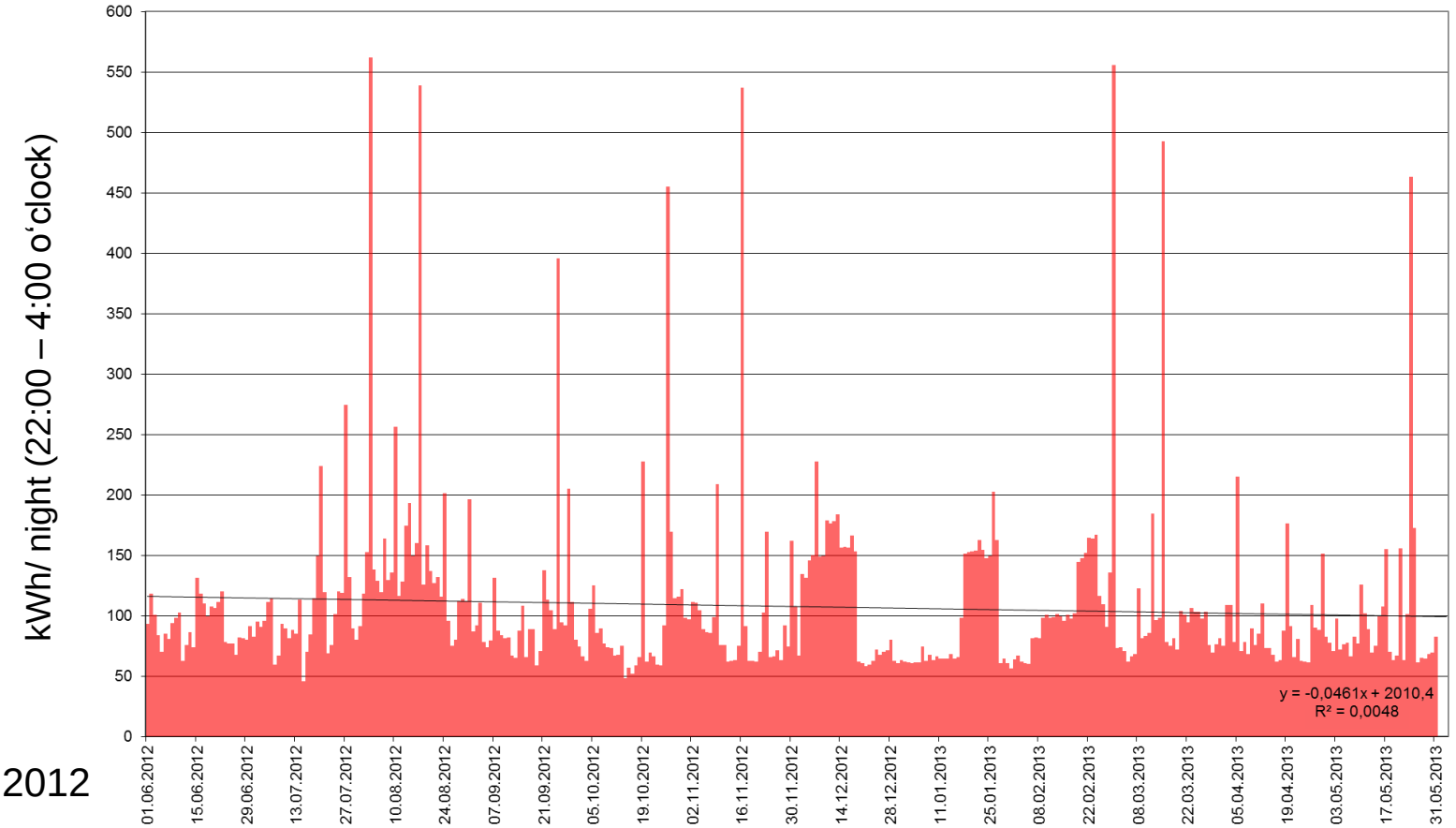




Energy consumption during the night do it yourself store (12.000 m²)

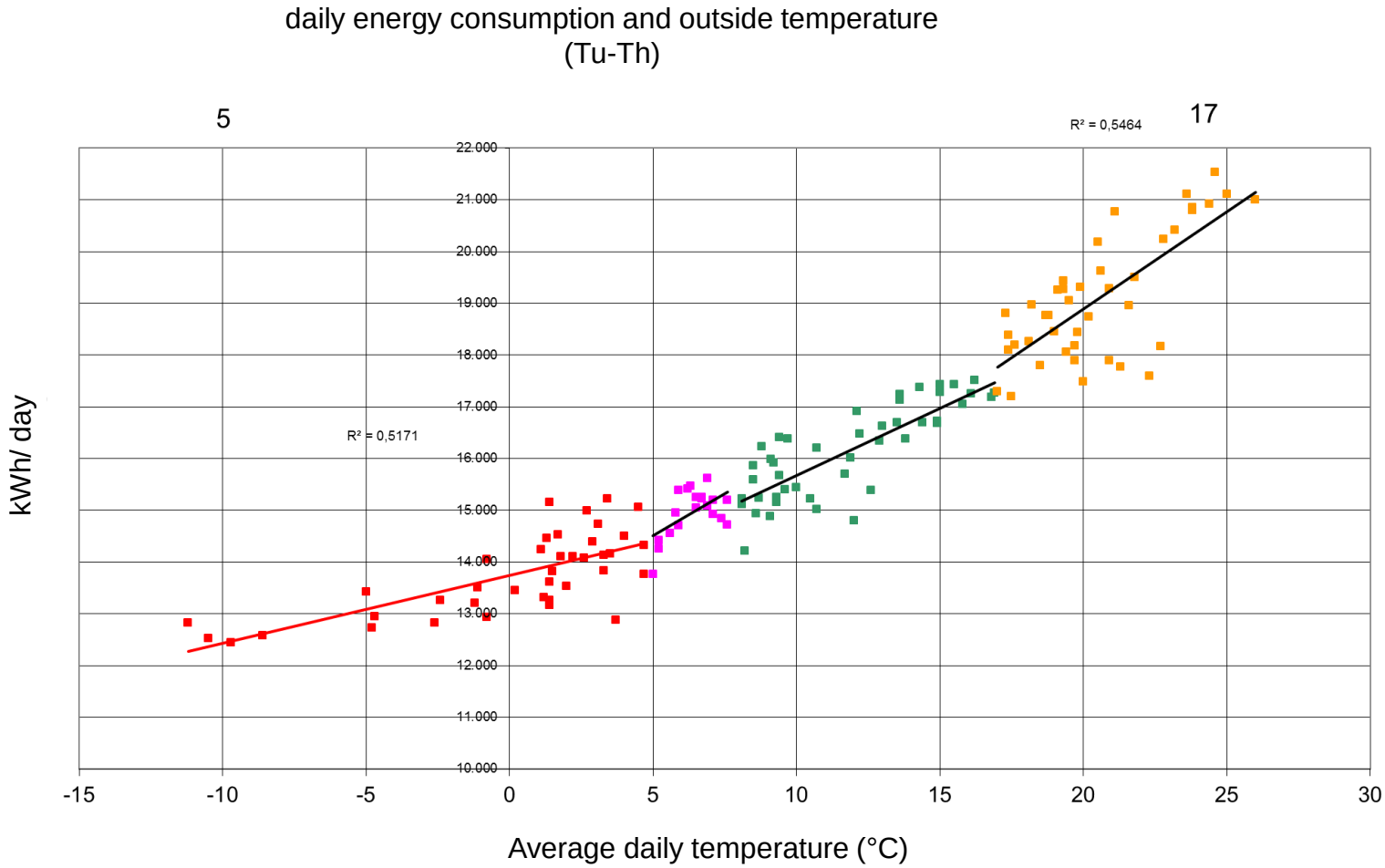


Energy consumption during the night soccer stadion

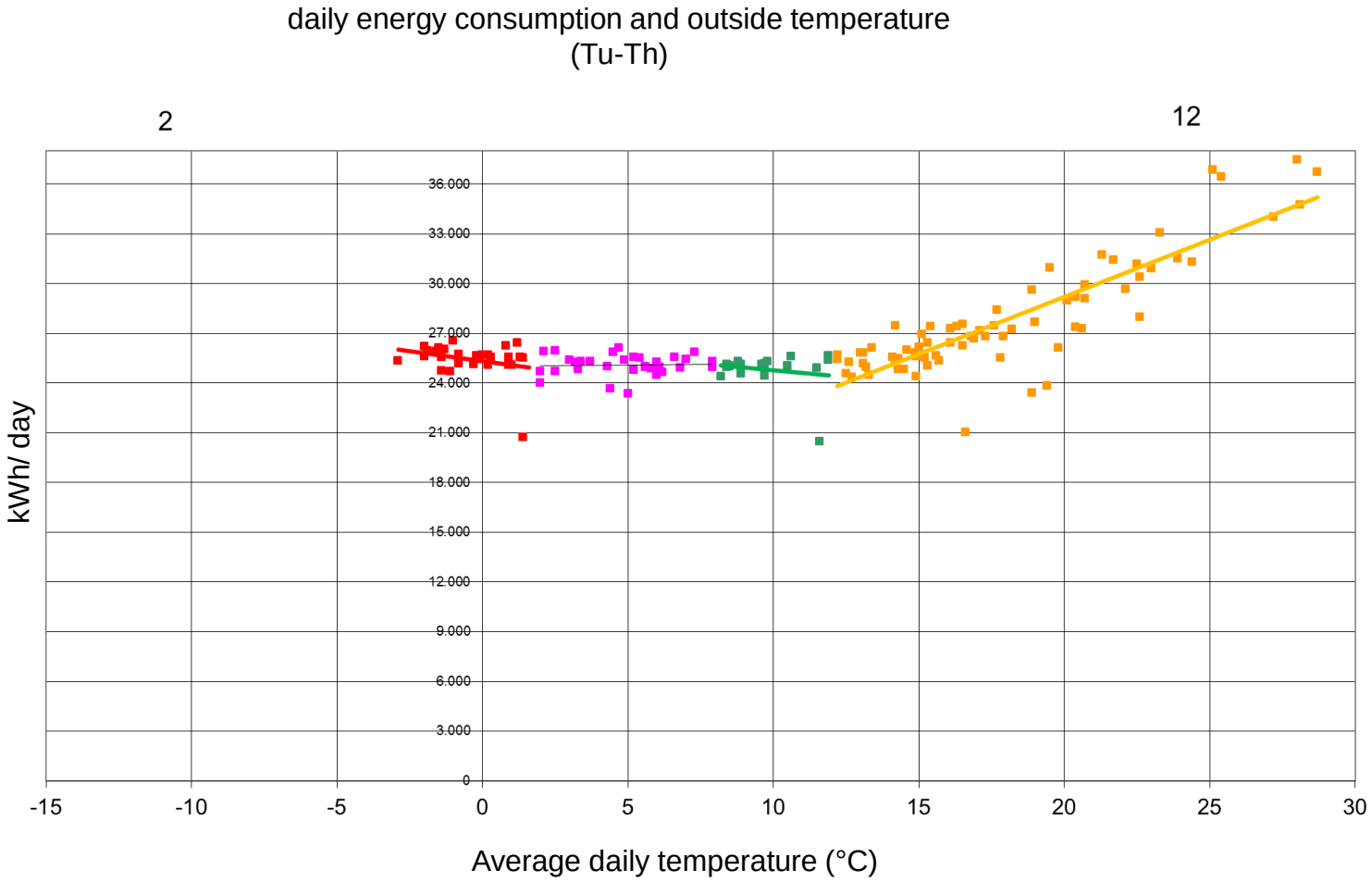


start
June 2012

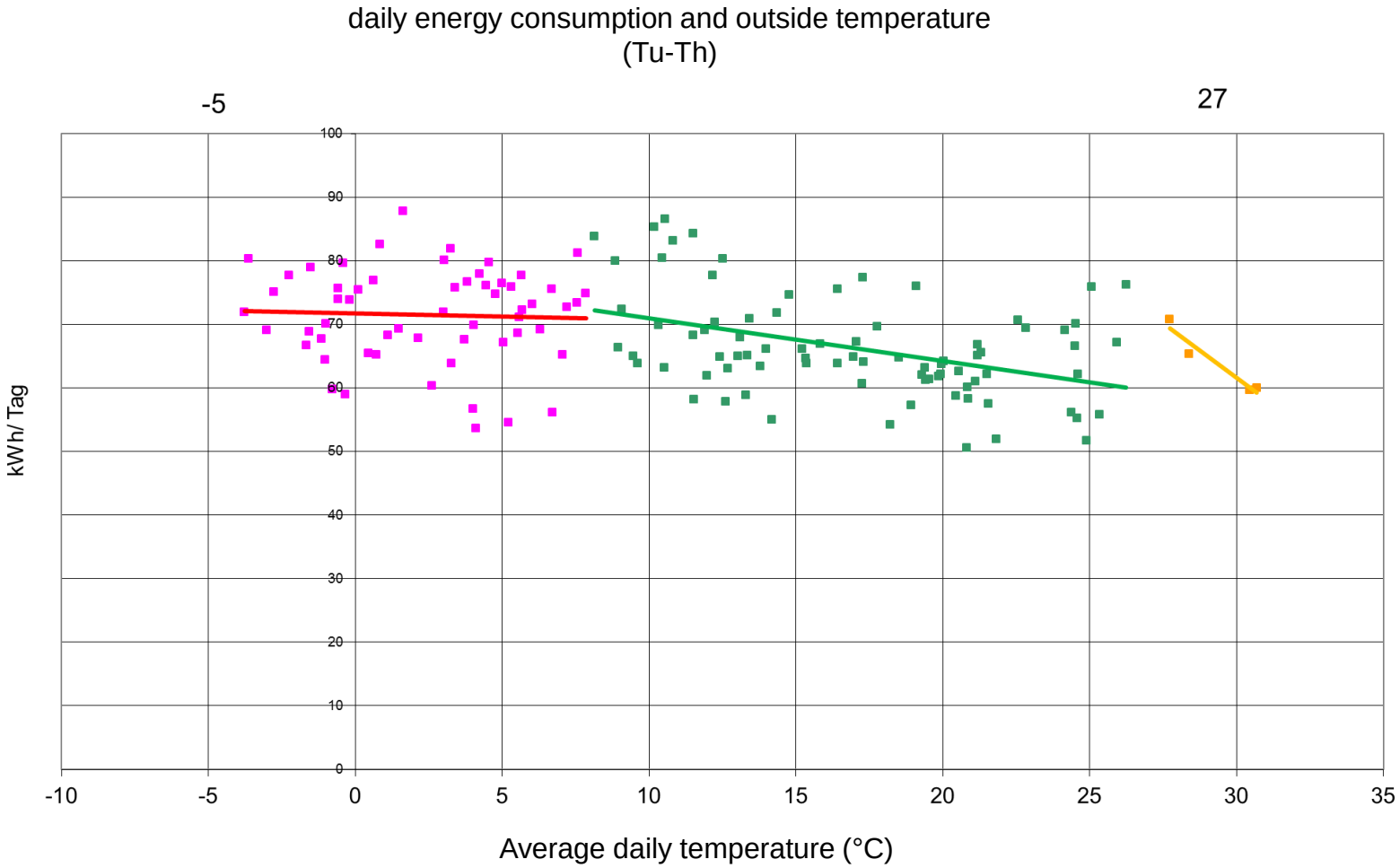
Depending from the outside temperature Food wholesale market (about 8.500 m²)



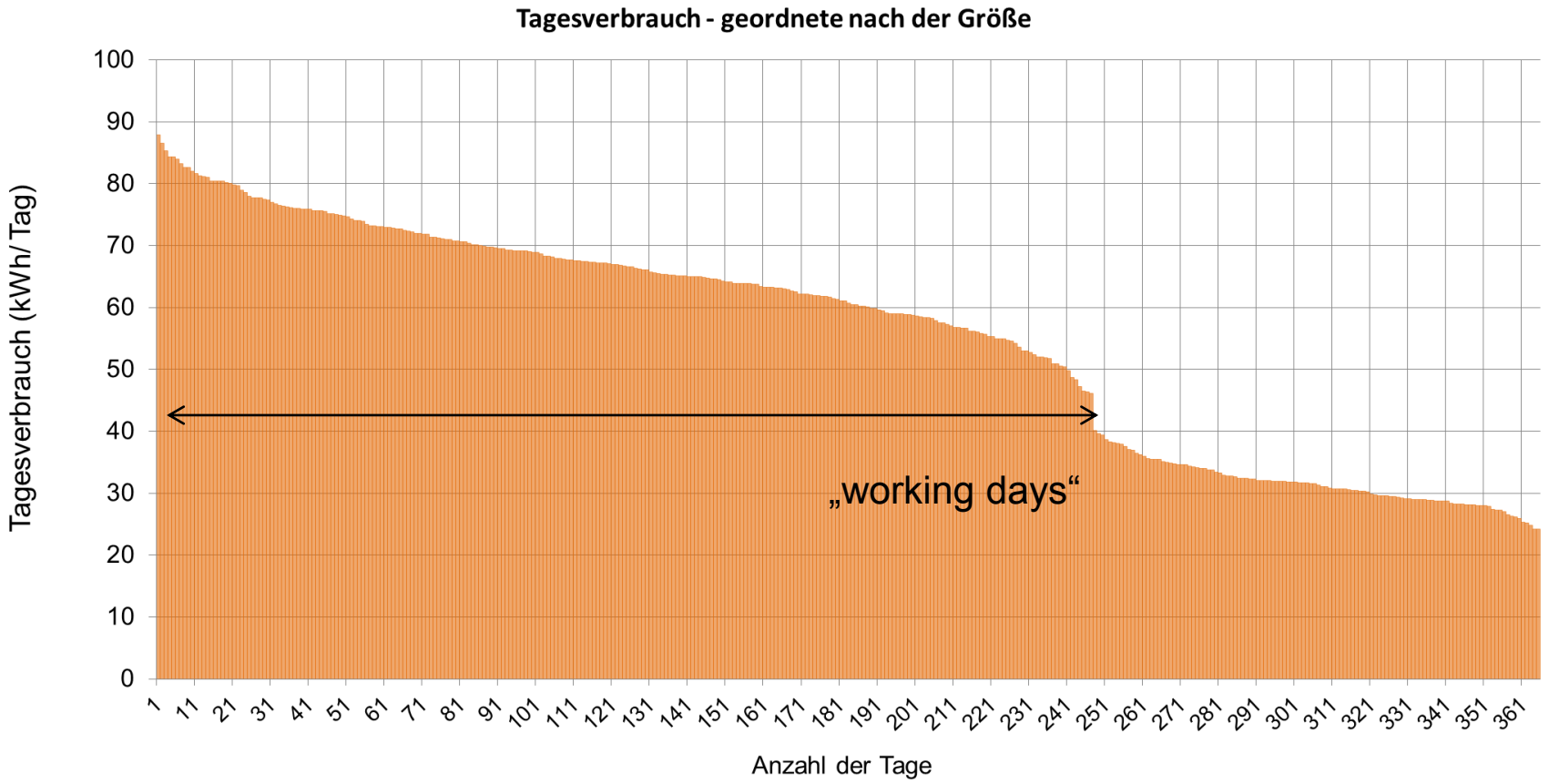
Depending from the outside temperature hospital (700 beds, 11 GWh)



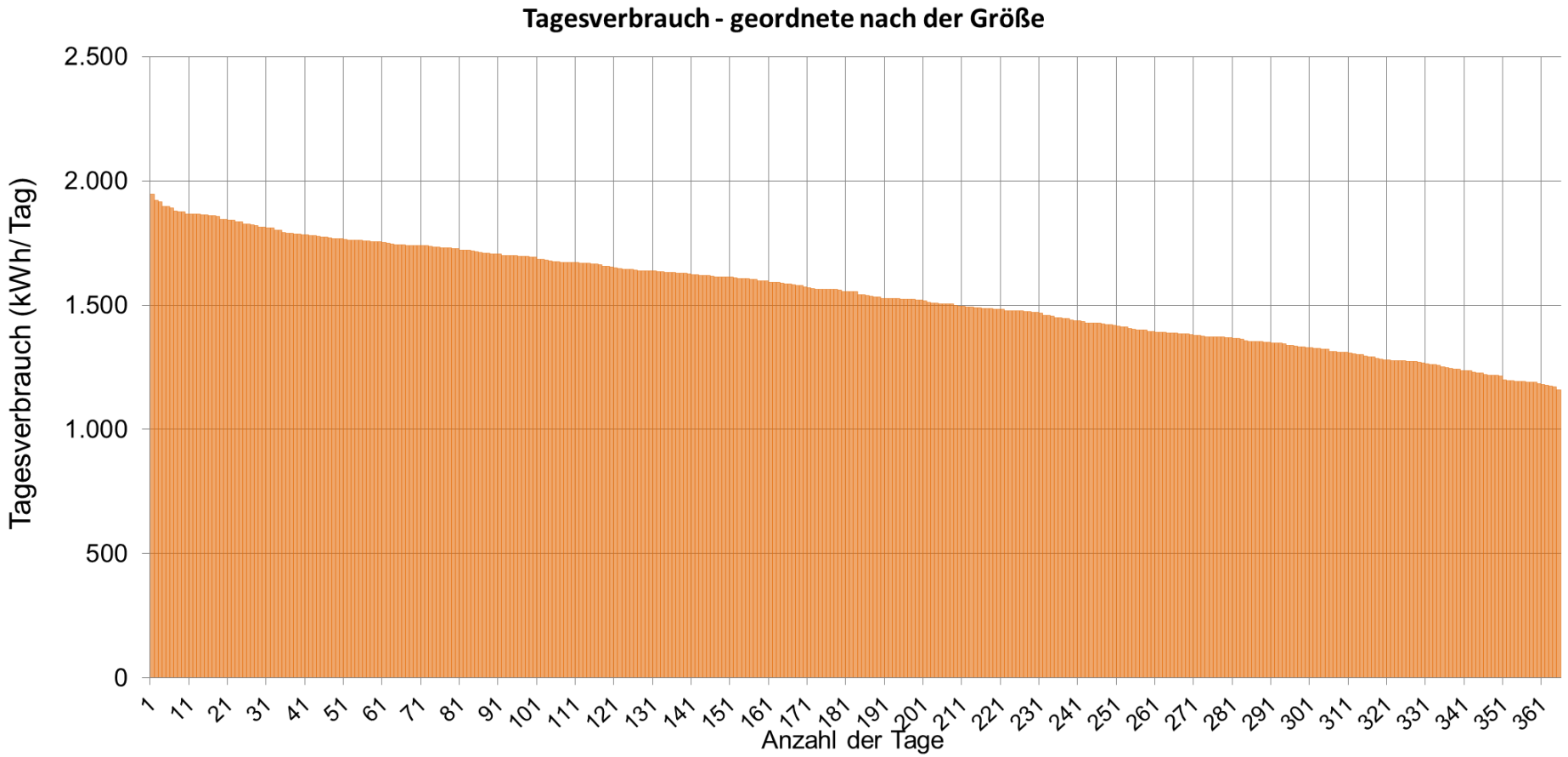
Depending from the outside temperature office building



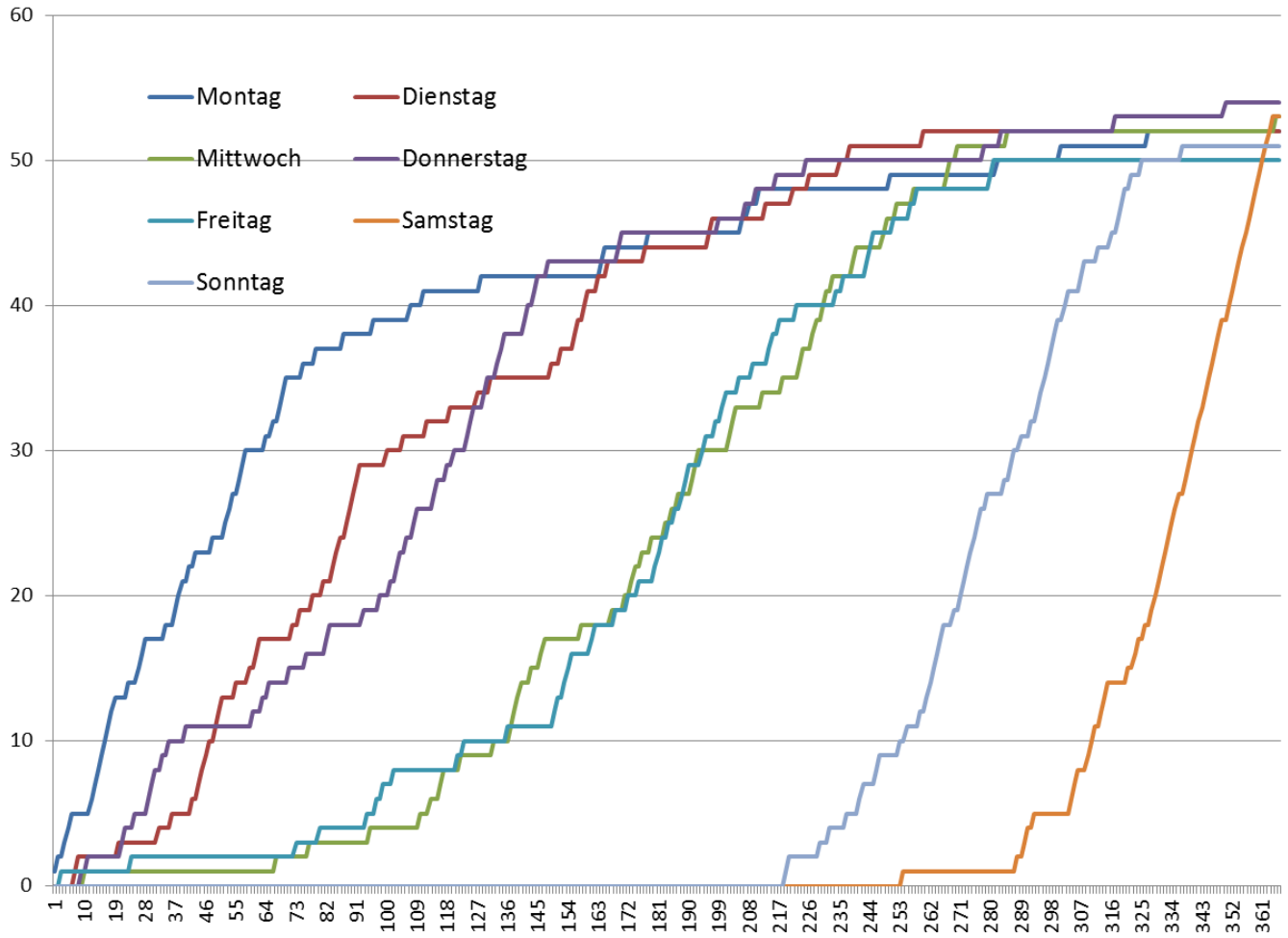
sordet daily consumption office building



sordet daily consumption Seniorenheim

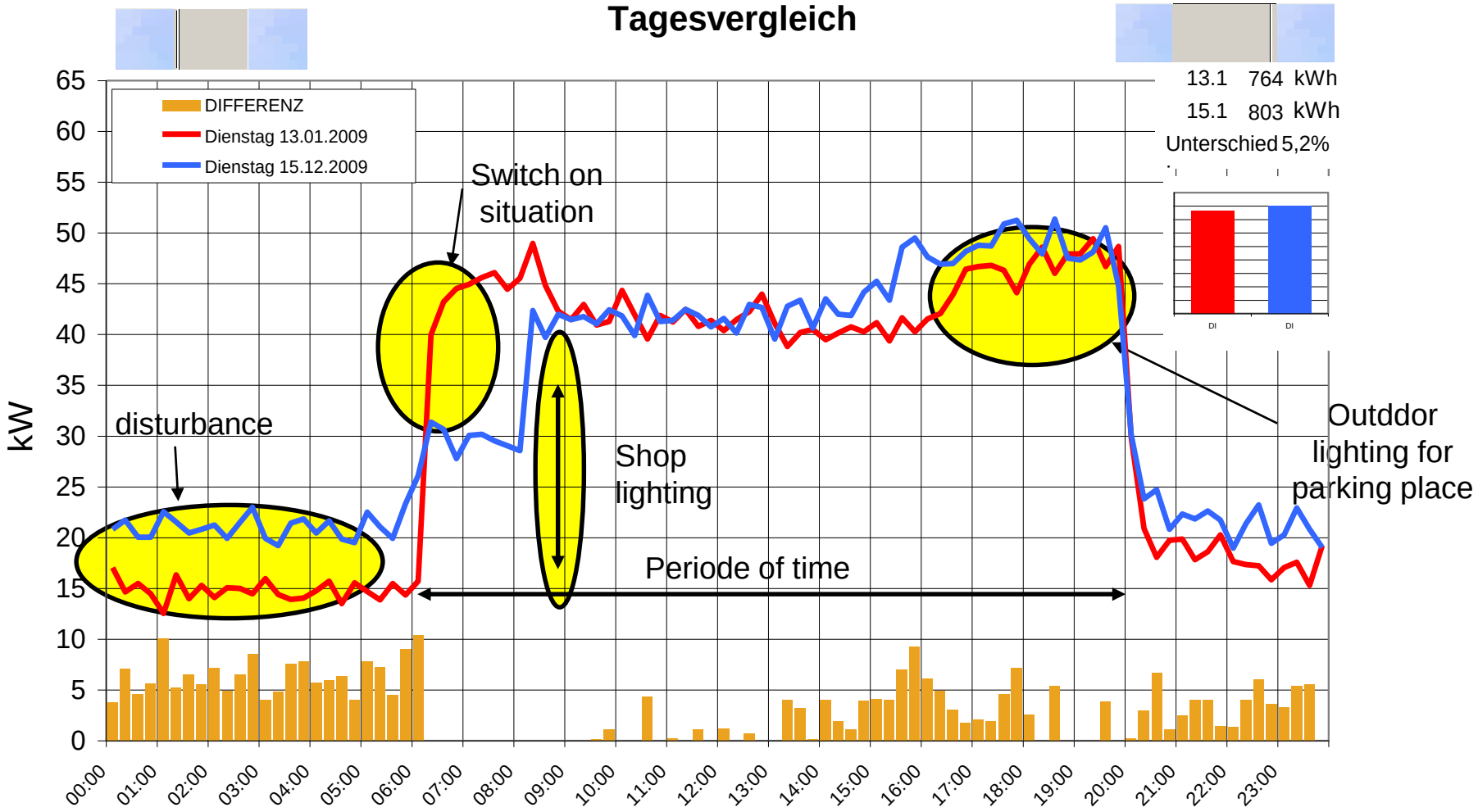


Relevance of weekdays retirement home

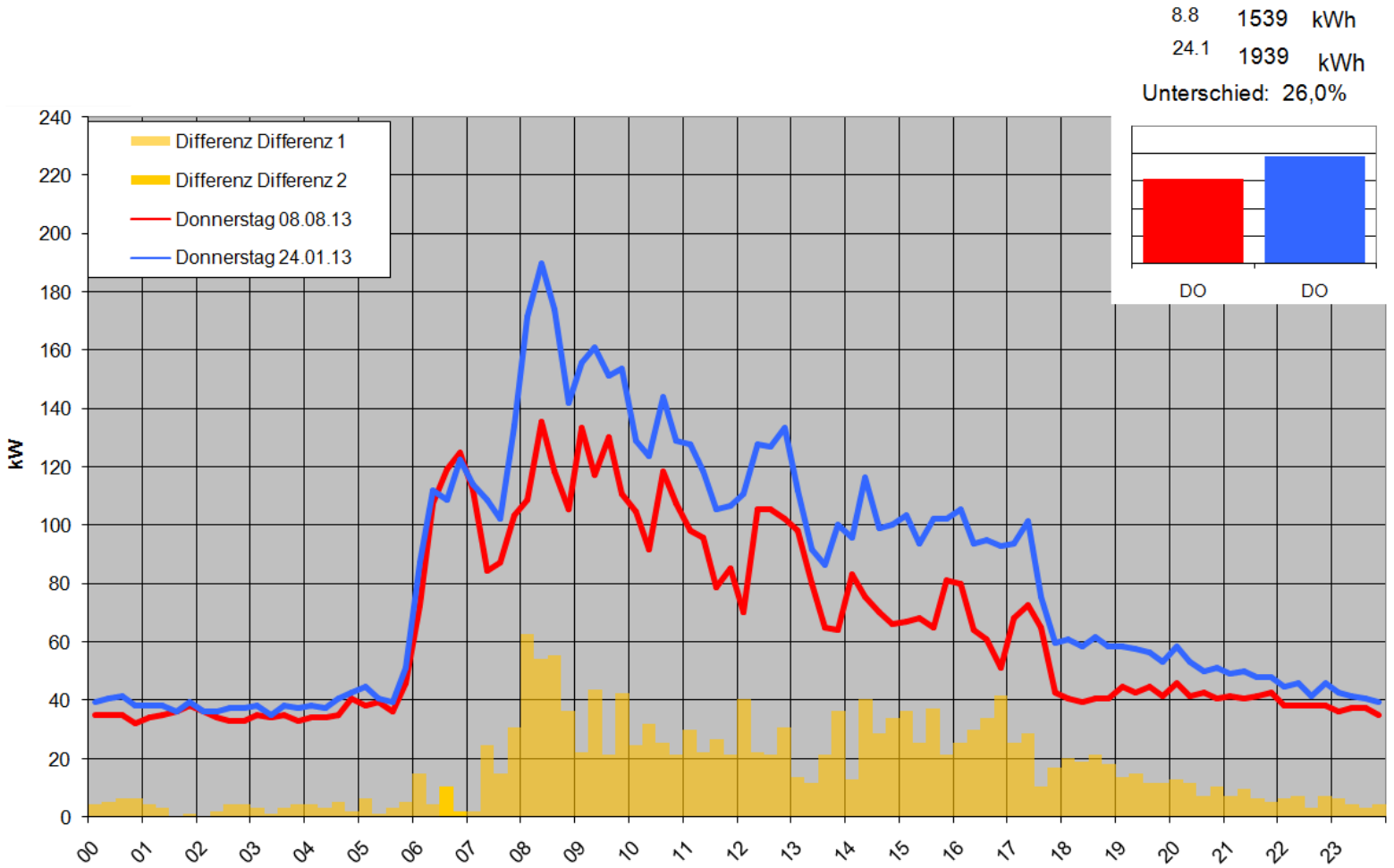


Lebensmitteldiskonter

Tagesvergleich Jahresbeginn /Jahresende



Compare of season days winter – summer



experience (1)

- The main aim is not so much to find energy savings, but to understand how the building "ticks" “
  - => This will give logical conclusions for hints saving energy
- Standardization allows to get the view for discrepancies and irregularities
- Graphical representation increased the understanding of the customer and thereby support further implementation of saving measures

experience (2)

- Analysis approach is particularly well suited for objects with an annual consumption <1 GWh
- Energy saving potential is about 10%
  - Usually organizational measures
  - Maximum savings: 18% - DIY market /Swiss
- Economic energy advice even by Consumers < 300.000 kWh
  - Duration < 1,5 days
  - No need of energy audit by the object
- „Pre-Audit“
  - Support of the energy advise
- Simple detection of energy efficient measures
- Graphical representation increased the implementation of measures

Outlook

- **Ongoing expansion of the query routines**
  - Currently, about 35 different forms of representation
  - Increasingly integration of parameters and calculation routines
- **Development of a tool for heat demand**
  - Automated determination of the share of hot water
- **Still using Excel ????**

Danke

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