



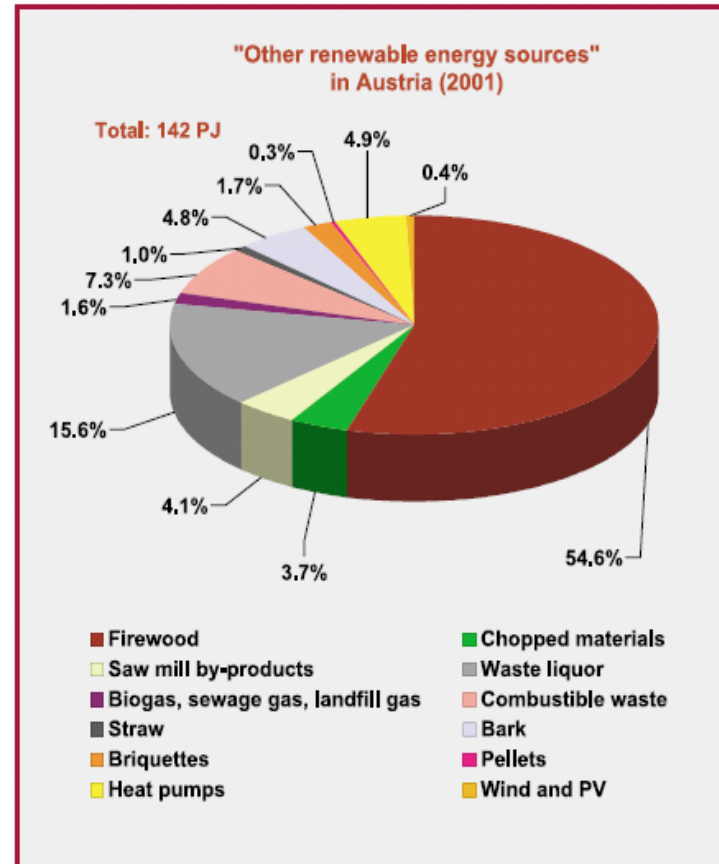
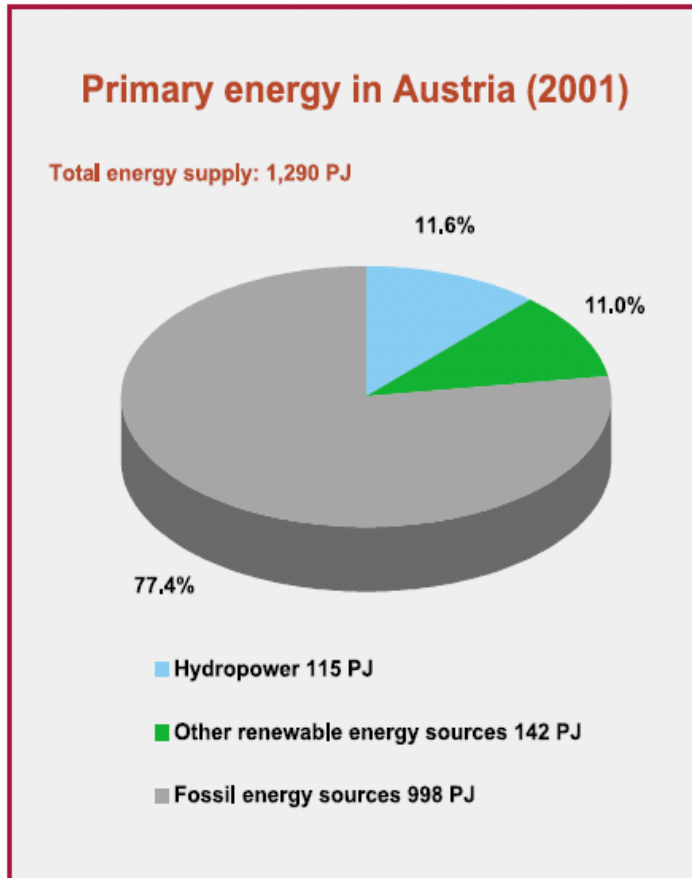
Ground Source Heat Pumps in Austria

24 Jan 2008, Athens

Patrice Pinel

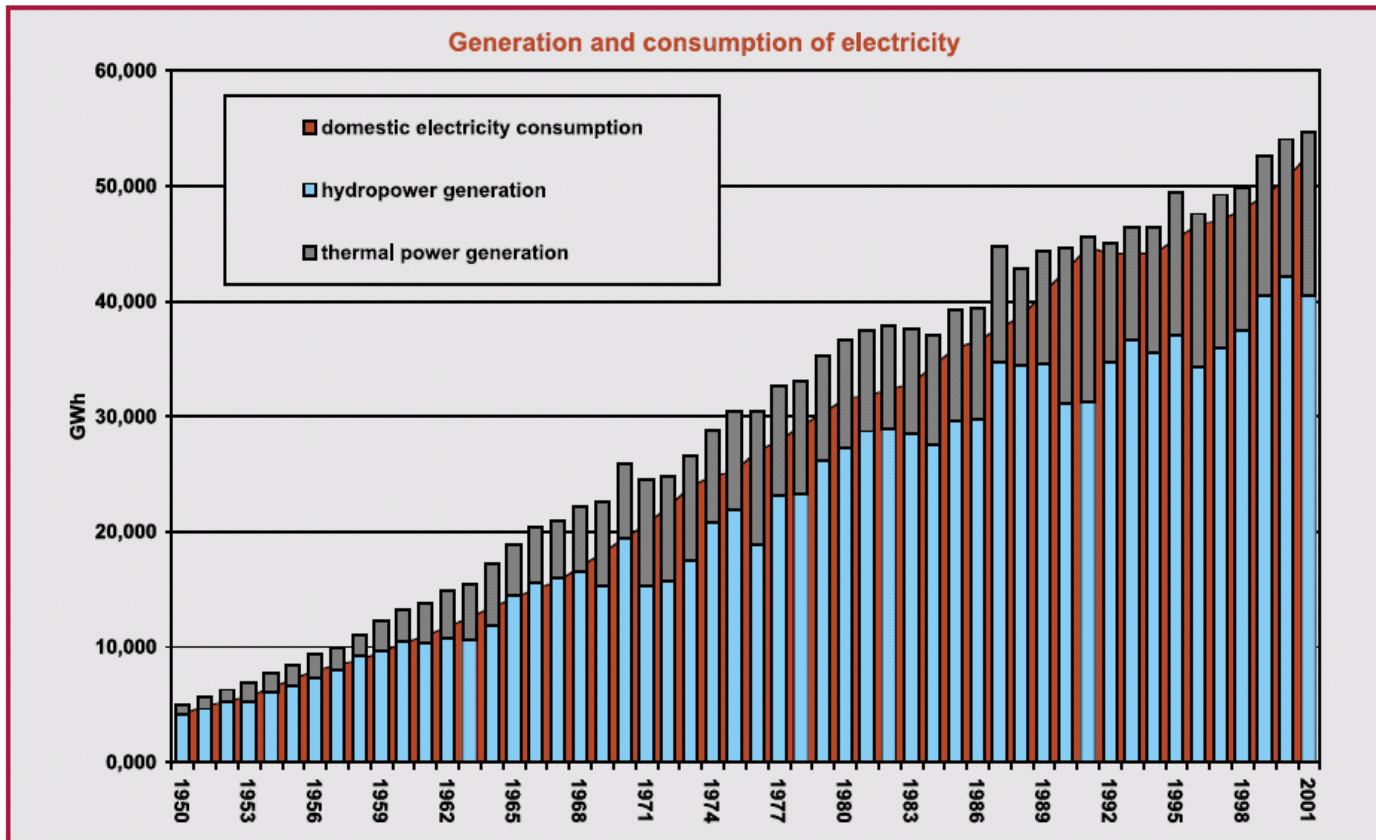
Sustainable Energy Systems, arsenal research

Energy Situation in Austria



Source: Statistik Austria; Lower Austrian Chamber of Agriculture; Federal Institute of Agricultural Engineering Wieselburg

Energy Situation in Austria



Source: E-Control GmbH

IEA 2004 (GWh)

Imports: 16 600

Exports: 13500

Production: 64 100

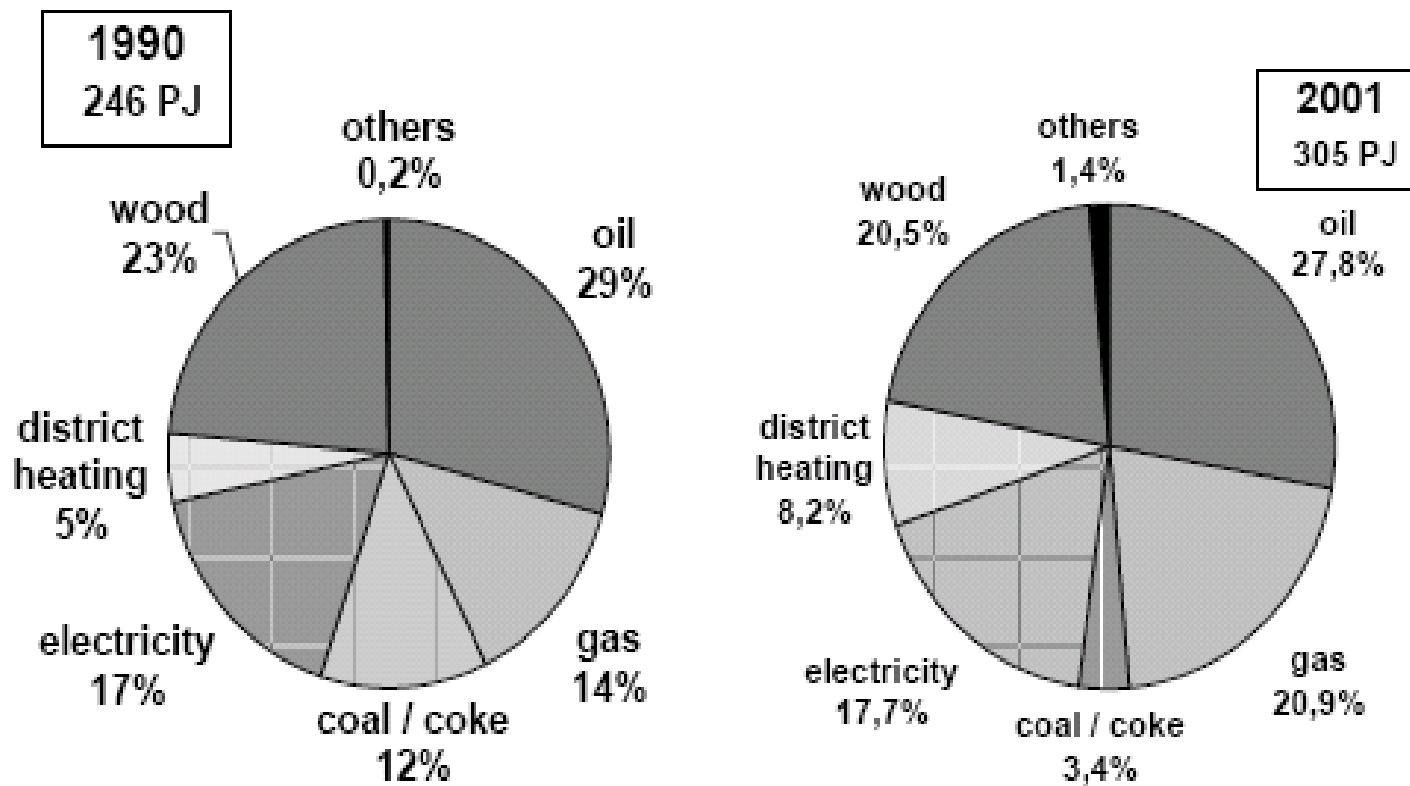
Supply: 67 200

Consumption: 58 200

Energy Situation in Austria

Residential Energy Demand by Fuel Type

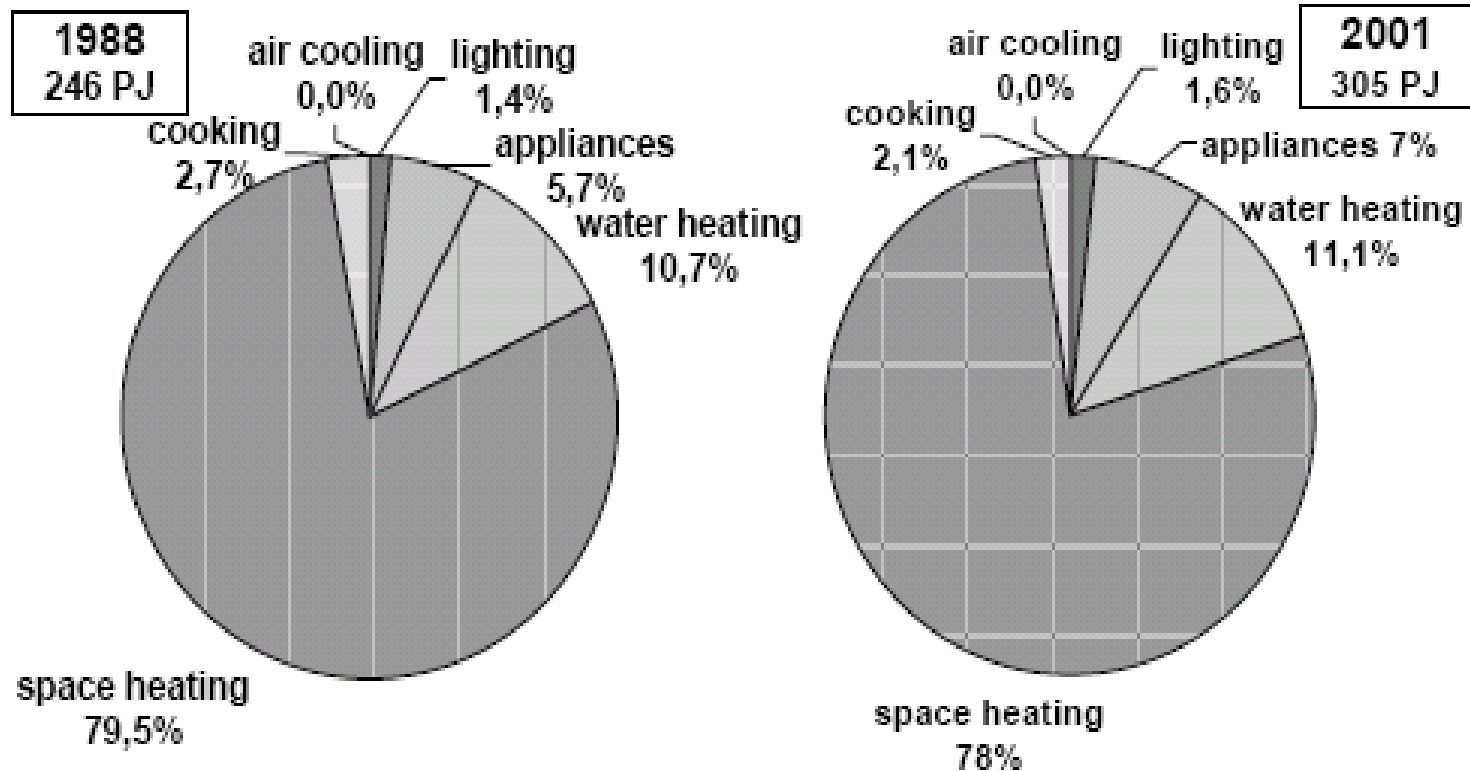
Source: ÖSTAT



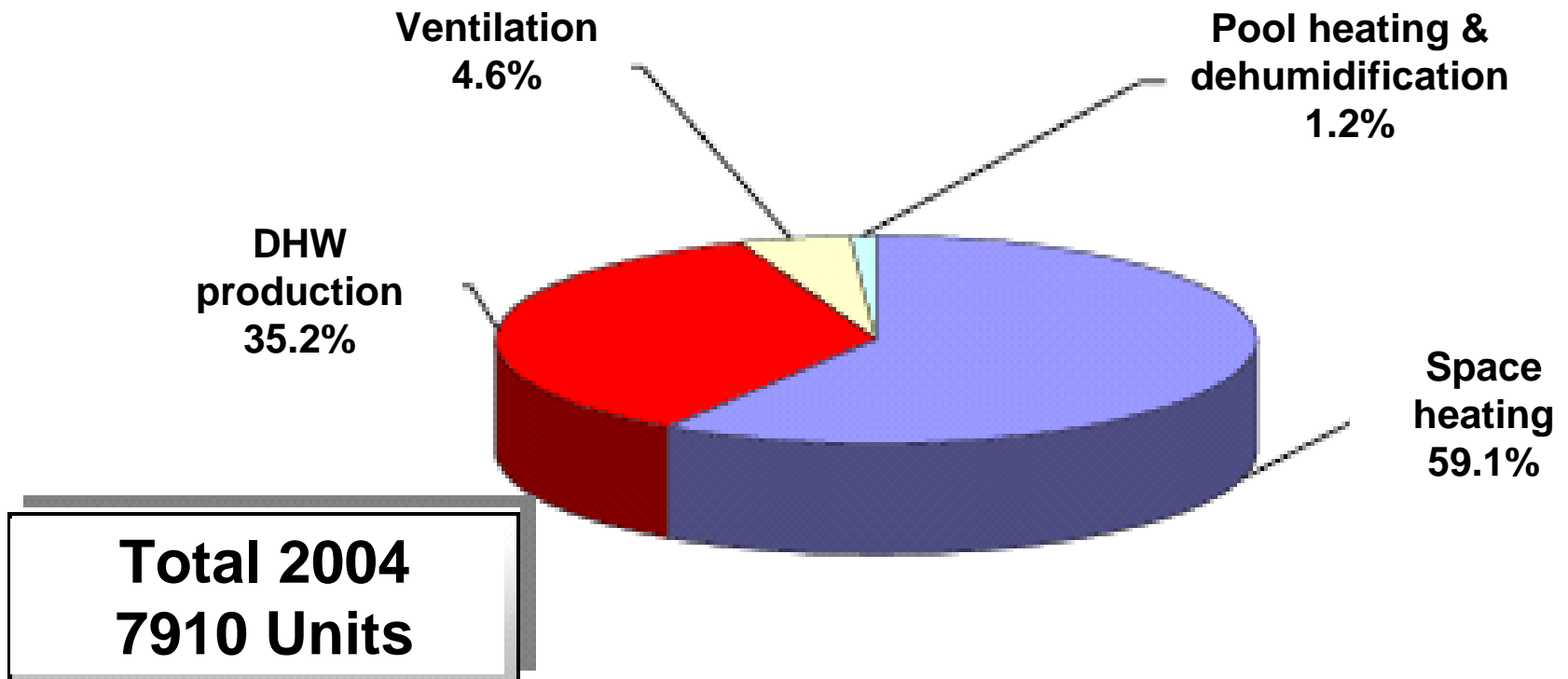
Energy Situation in Austria

Energy Consumption by End-users

Source: ÖSTAT

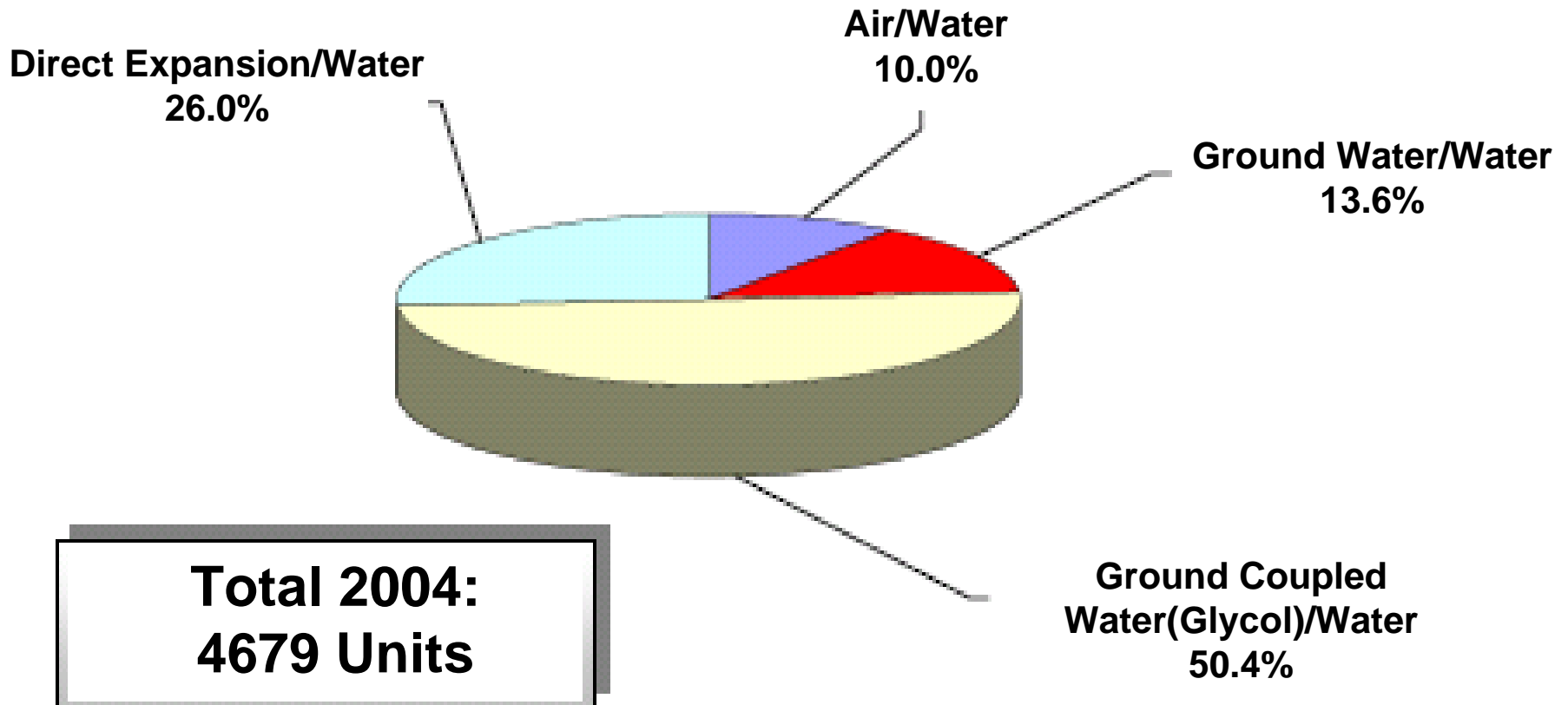


Austrian Heat Pump Market Total 2004



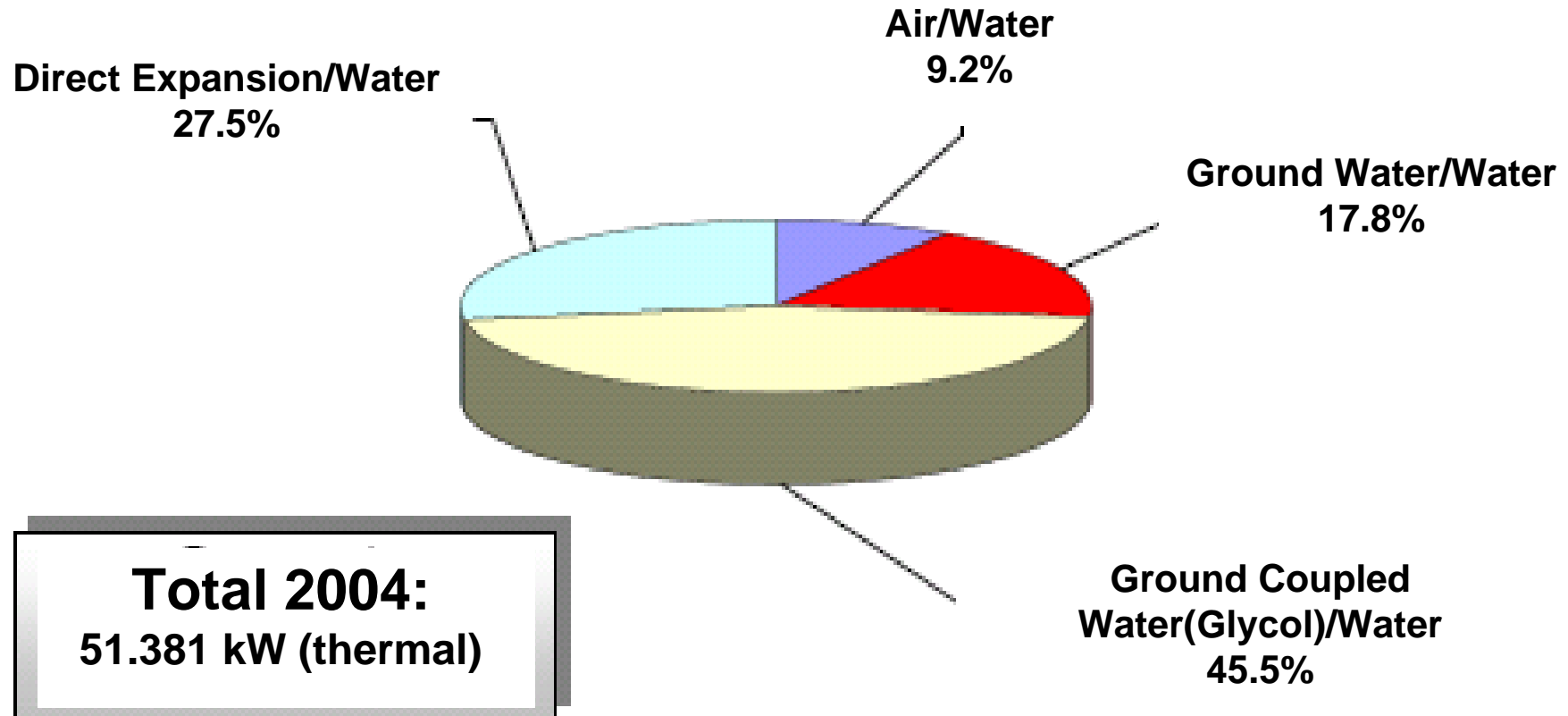
Source: Der Wärmepumpenmarkt in Österreich 2004
G. Fanningner

Austrian Heat Pump Market - Heating



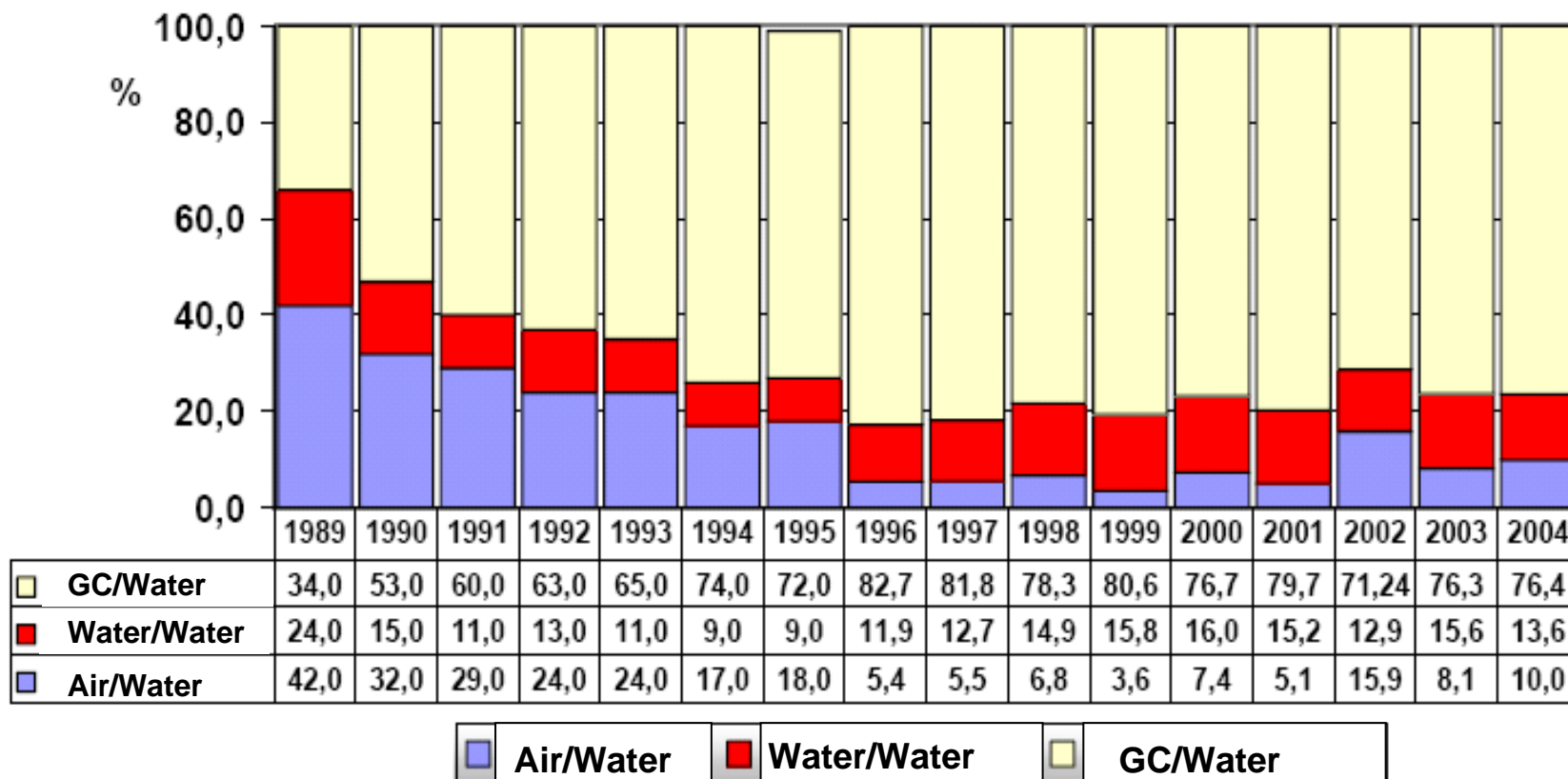
Source: Der Wärmepumpenmarkt in Österreich 2004
G. Fanningner

Austrian Heat Pump Market - Heating



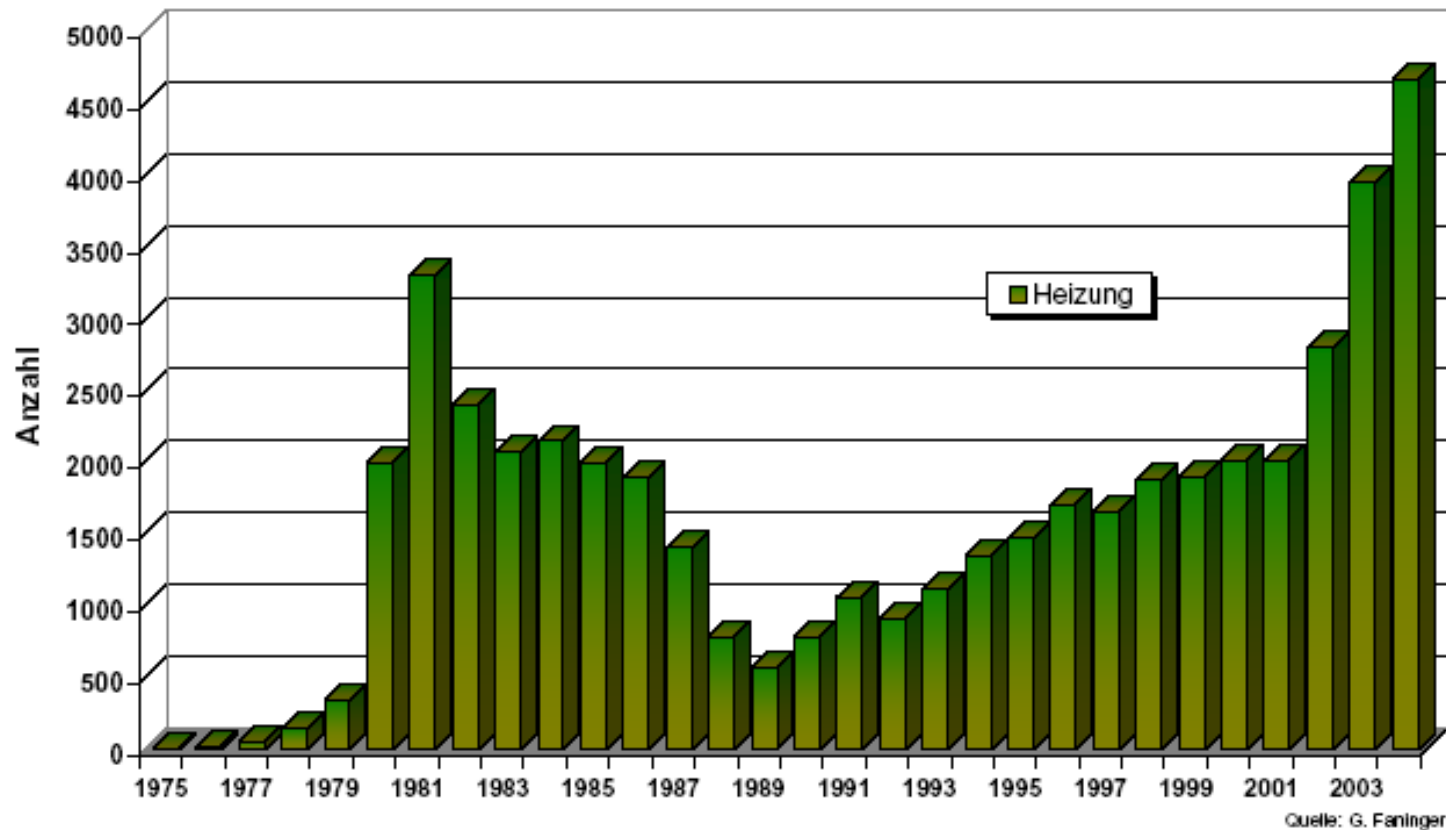
Source: Der Wärmepumpenmarkt in Österreich 2004
G. Fanningner

Austrian Heat Pump Market



Source: Der Wärmepumpenmarkt in Österreich 2004
G. Fanningner

Market development of heat pumps for space heating in Austria



Source: Der Wärmepumpenmarkt in Österreich 2004
G. Fanning

Quality Assurance

Or how to make sure the market remains healthy and improves

Requirements of quality assurance

- Quality standards for the heat pump unit
- Training of the designers and installers (practitioners) of heat pump systems
- Evaluation of the quality assurance measures by monitoring of installed heat pump systems

D-A-CH Heat Pump Association

founded 1995 ...

... by the
German, Austrian and Swiss
heat pump associations ...

... with the objective of
international market development
and to establish high quality and
uniform criteria



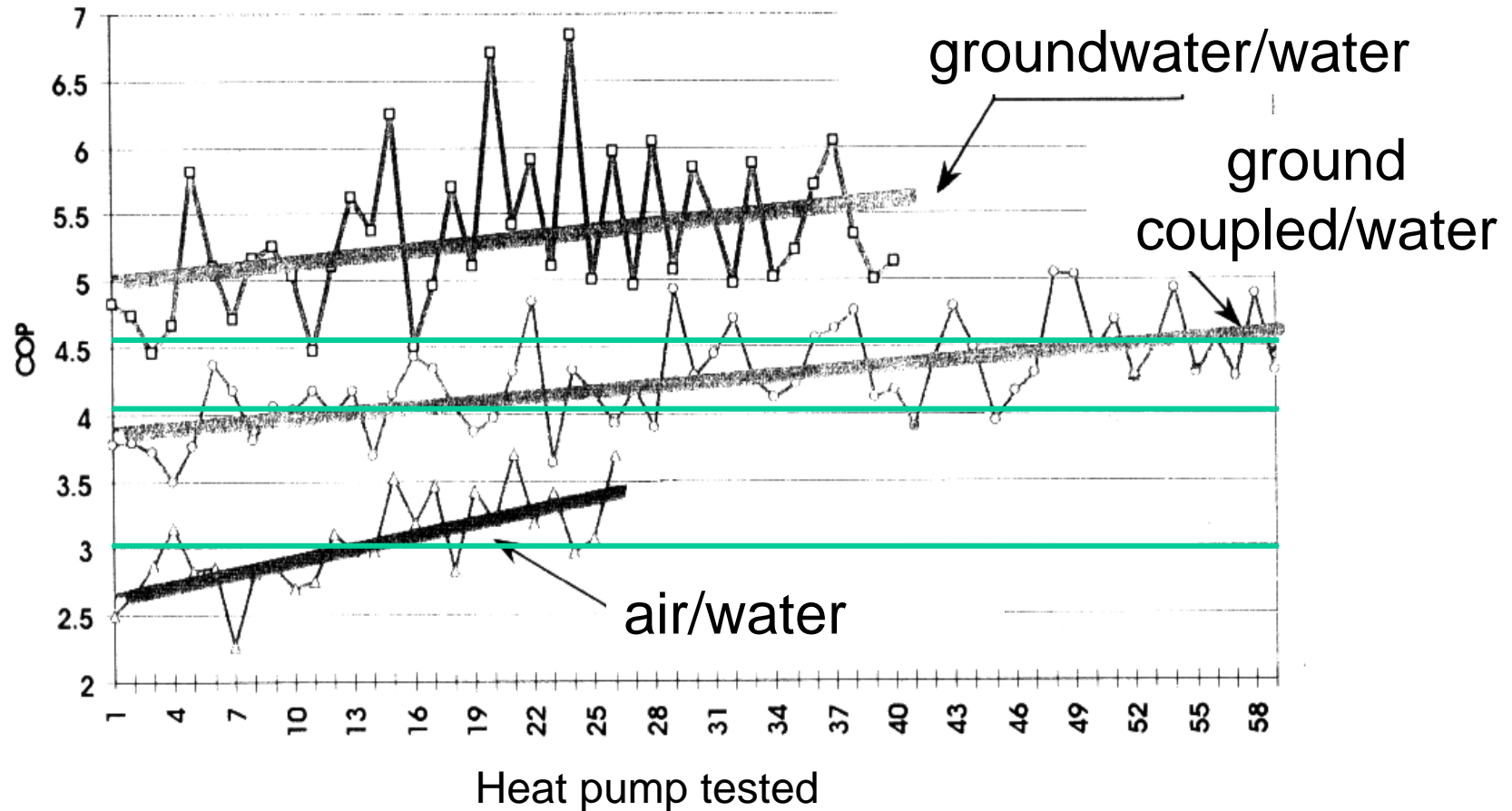
D-A-CH Quality Label

High quality standards by:

- standardised testing criteria
- verified fabrication standards
- minimum COP requirements
B0/W35 4.0, W10/W35 4.5, A2/W35 3.0, S4/W35 4.0
- safety testing
- noise testing
- spare parts guarantee for a period of 10 years
- customer service reacting within 24 hours

Evolution of Heat Pump performances

Evaluations in chronological order



Heat pump remote monitoring

- Quality evaluation of installed heat pumps (field test)
- Collect data on heat pump systems operation
- Arguments for environmental policy, political decision makers, project subsidies, heat pump manufacturers



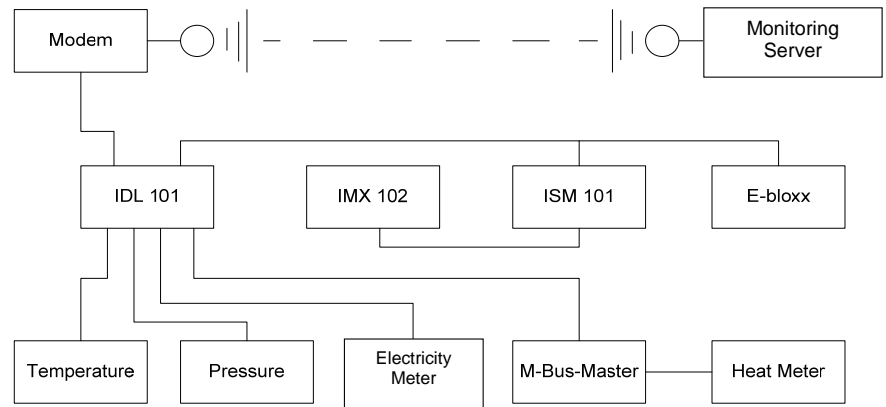
Heat pump remote monitoring

Furthermore the monitoring provides answers to the following questions:

- state-of-the-art of the technology
- further optimisation potential
- impacts on the environment
- comparison with conventional heating systems
- feedback on:
 - efficiency
 - operational costs
 - operational characteristics

Heat pump remote monitoring

...how does it work?



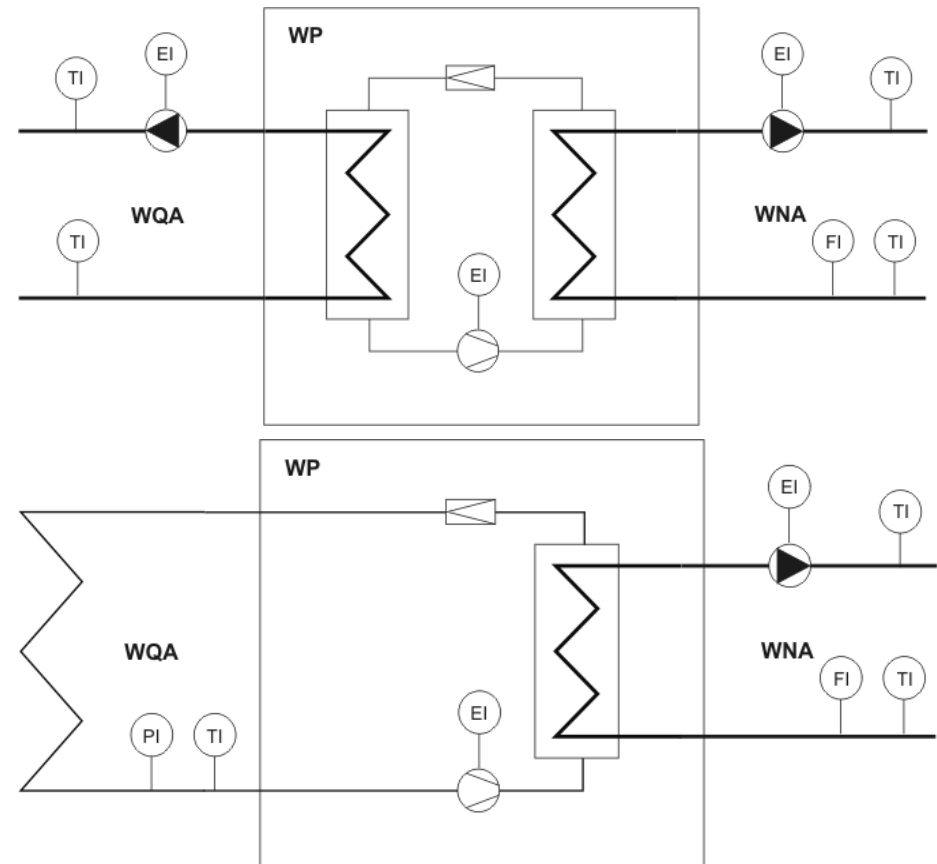
everywhere...

anywhere GSM works, monitoring also works

Heat pump remote monitoring

...Principal aims of analysis and evaluation:

- Energy-Output (Heat)
- Energy-Input (Electric power consumption)
- SPF (Seasonal Performance Factor)
- Operational hours of the heat pump
- Switching frequency / 24h
- Outdoor / Indoor temperature
- Supply and return temperatures + flow rate of the heat distribution system
- Temperatures of the heat source system
- TEWI (Total Equivalent Warming Impact)
- comparison with conventional heating systems

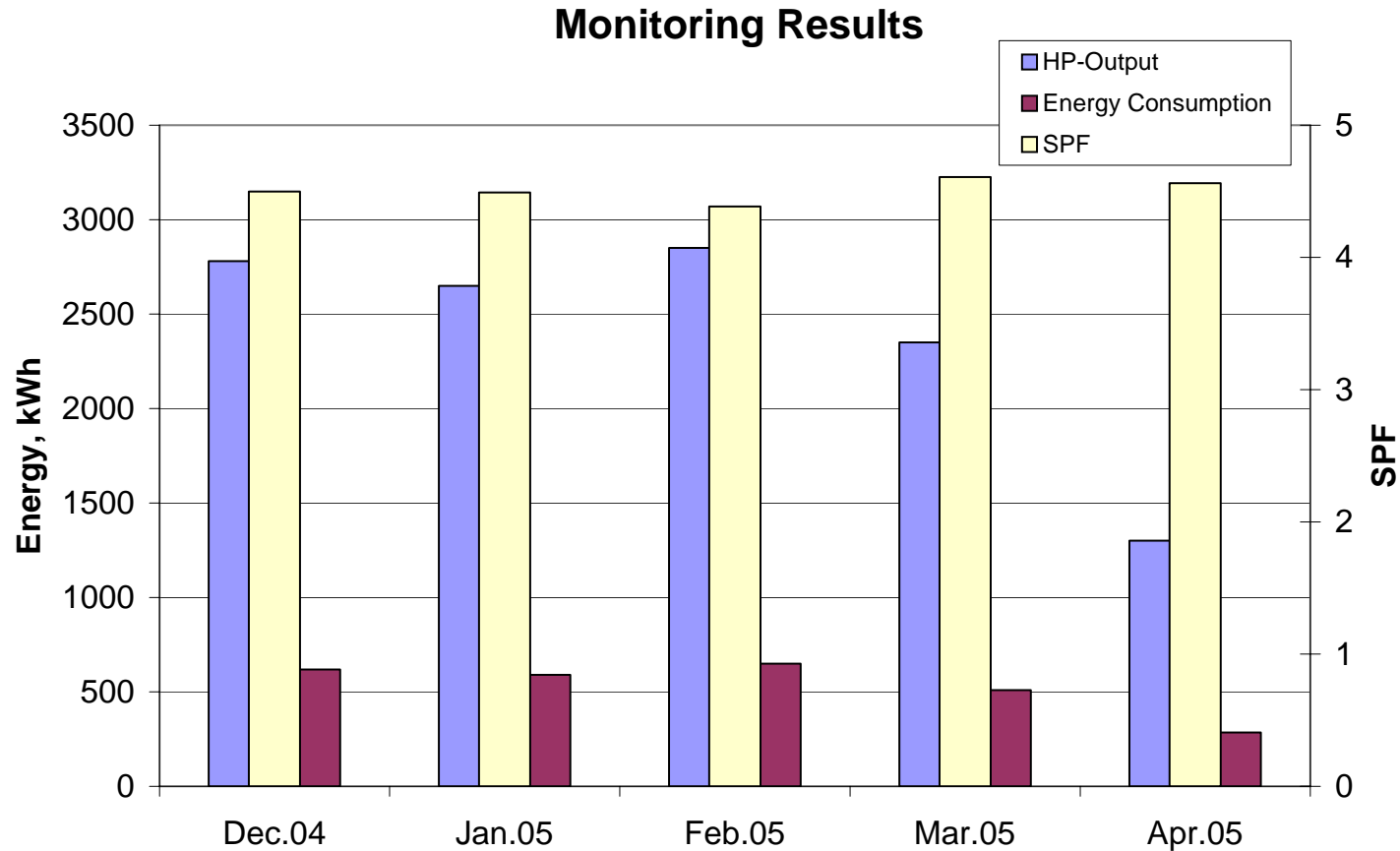


Monitoring I

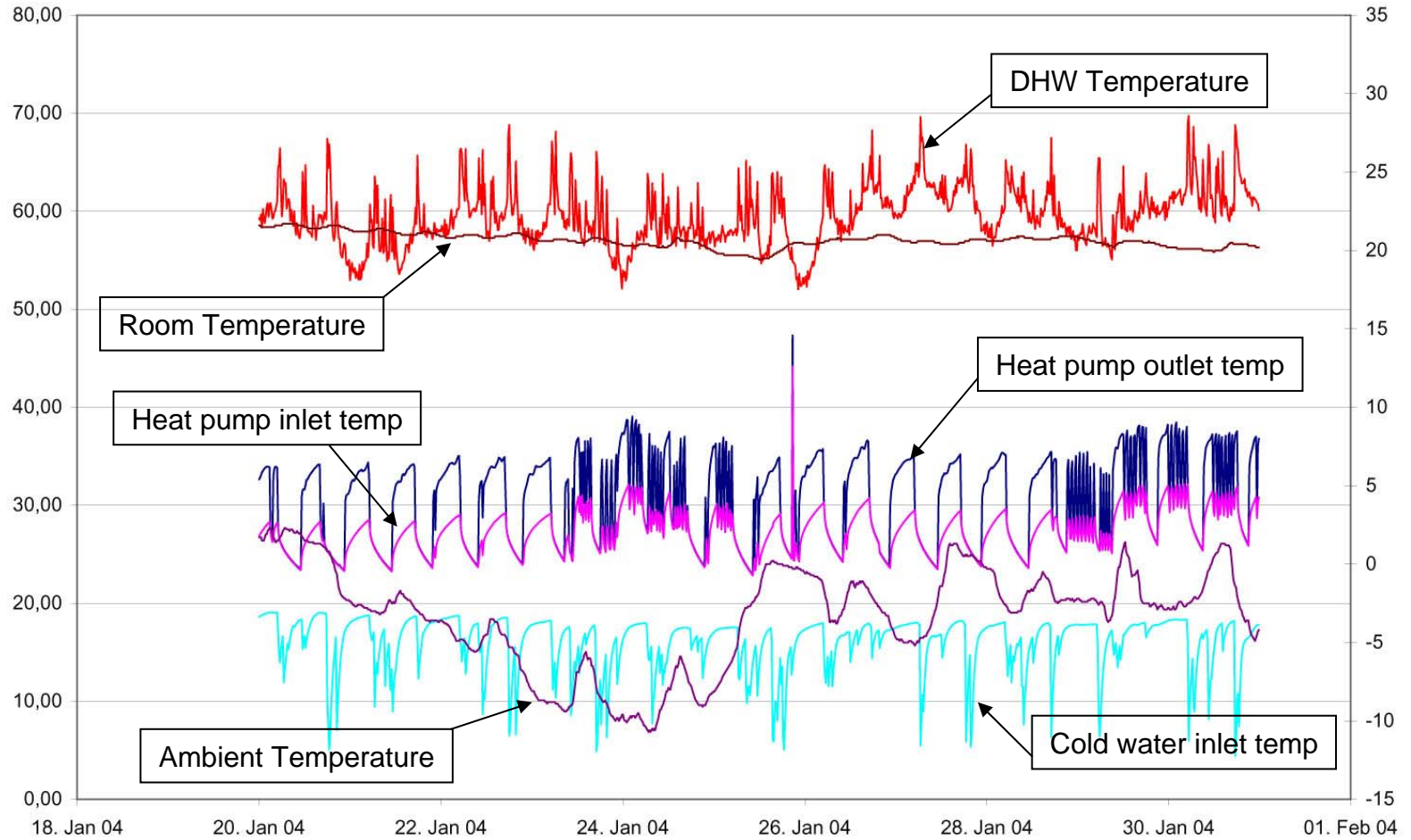
- Single family house
- Heating area 240 m²
- Heating load 14 kW
- Horizontal Collector (DX)



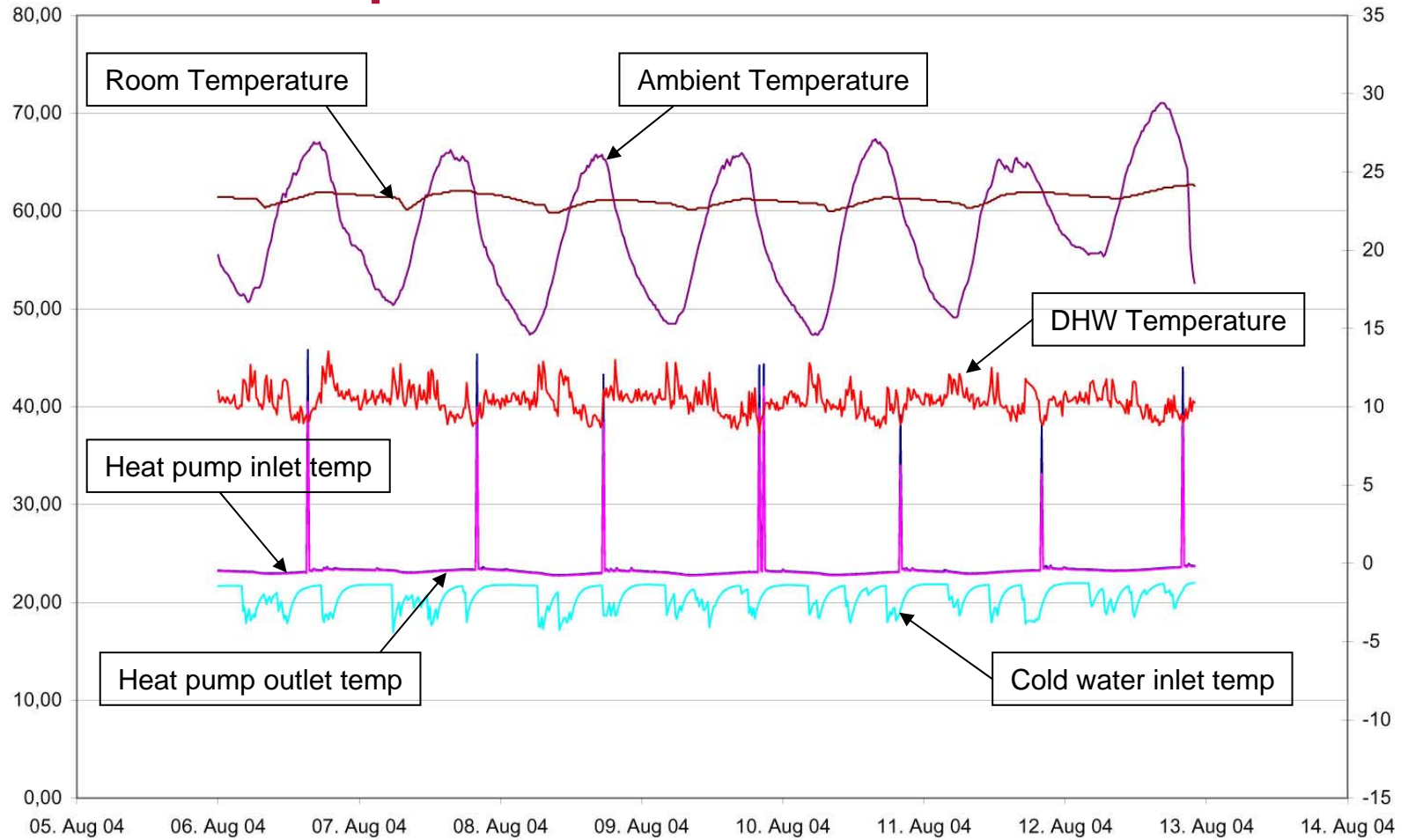
Monitoring Results I



Winter period

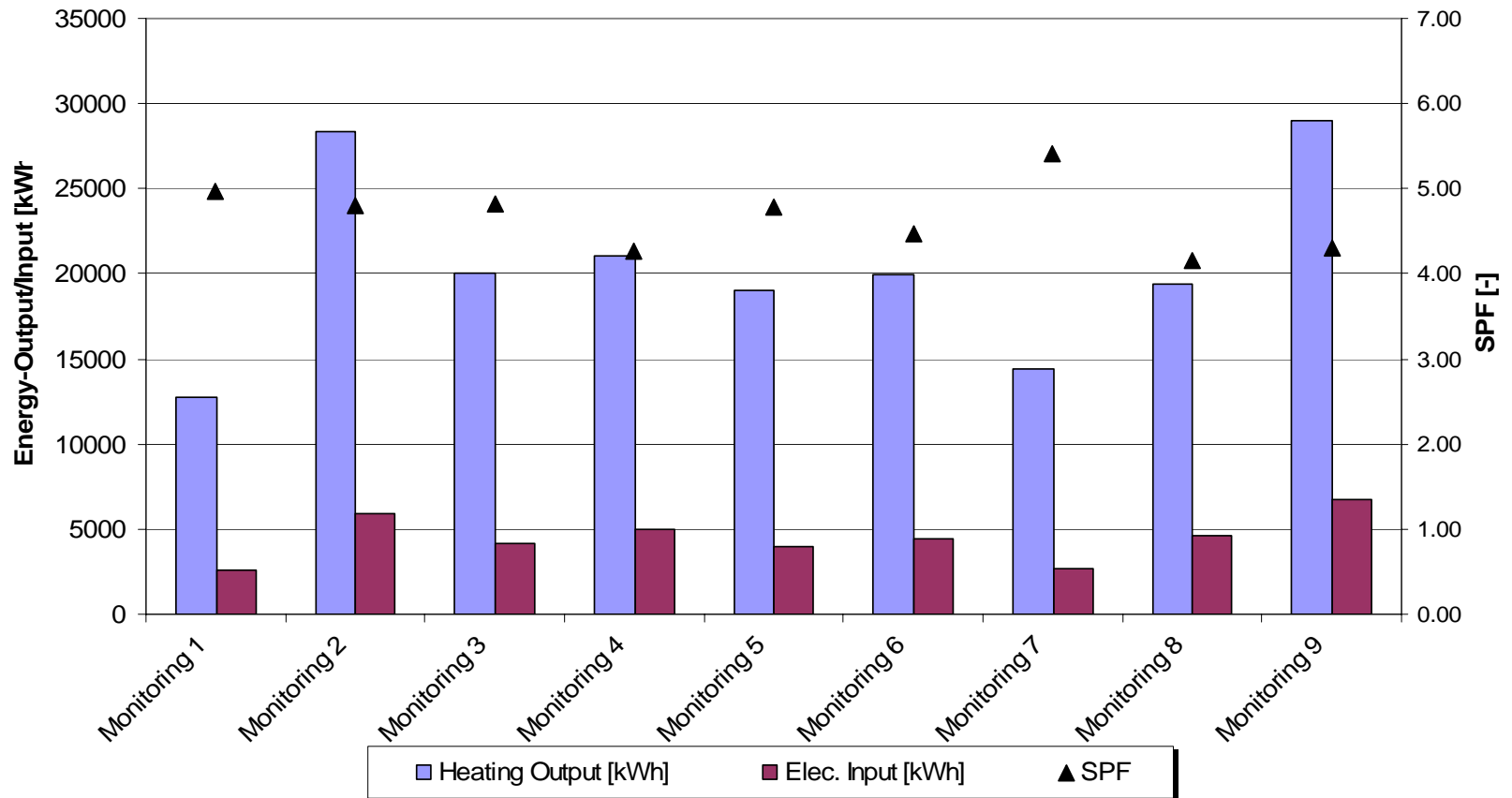


Summer period



Monitoring II - DX-HP-Systems (Entire season – 9 systems)

Energy-Output/Input and SPF



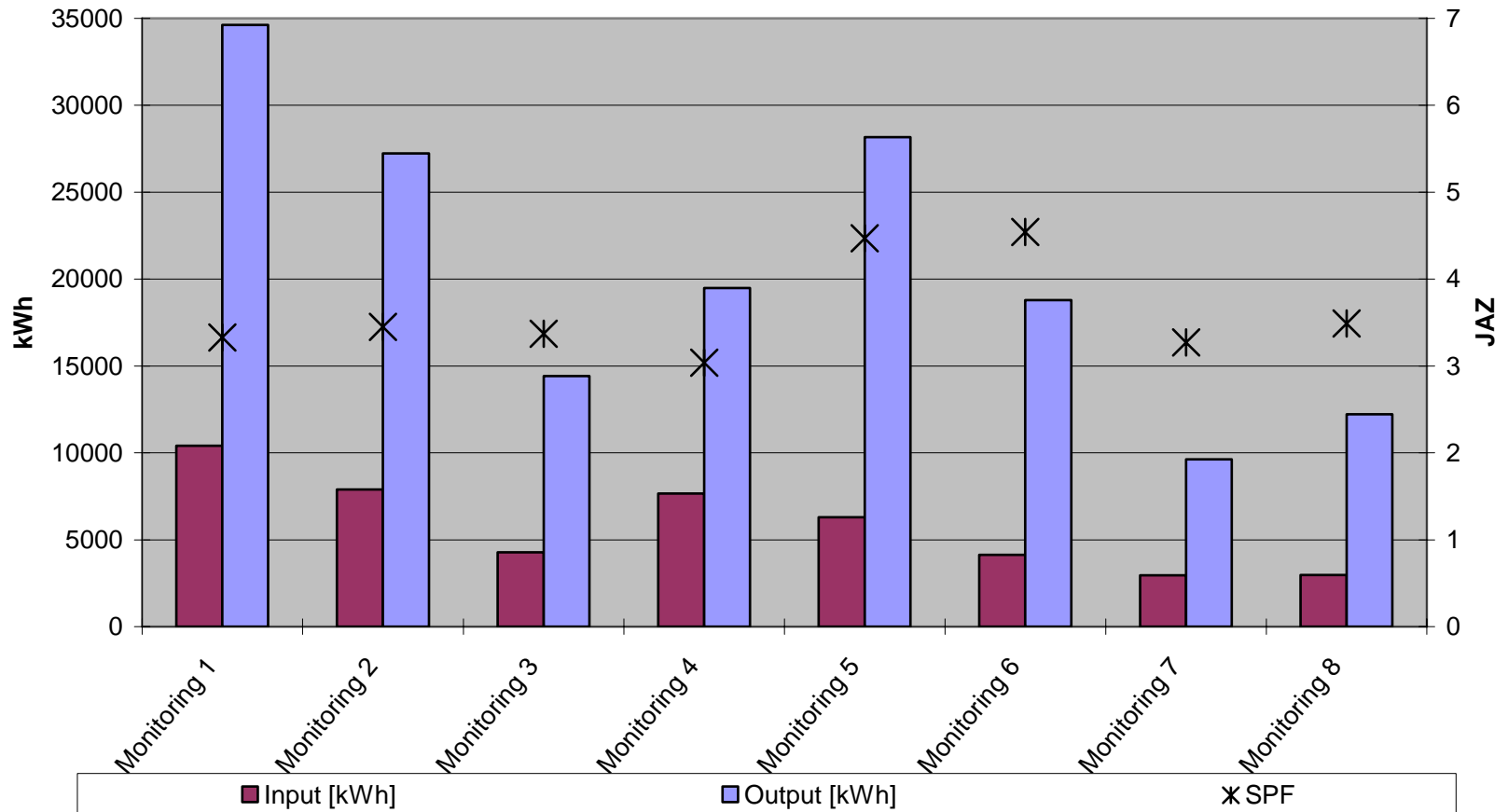
Monitoring III

Field test measurements including detailed monitoring of soil

	Heat Source	Areas (m ²)		Construction year	Building Heat Load		Heating distribution			Operating Mode		Refrigerant	DHW Production	SPF
		Living	collector		kW	W/m ² (collector)	floor	wall	radiator	monovalent	monoenergetic			
Monitoring 1	DX	265	600	1997	17.6	29.3	X	X		X		R 1270	X	3.3
Monitoring 2	DX	130	350	1999	12.9	36.9	X	X		X		R 407C		3.5
Monitoring 3	DX	320	400	2001	13.5	33.8	X			X		R 407C		3.5
Monitoring 4	DX	159	240	1986	11	45.8	X		X	X		R 22	X	3
Monitoring 5	DX	230	390	2000	11.2	28.7	X			X		R 407C		4.5
Monitoring 6	DX	240	360	1999	14.2	39.4	X	X		X		R22	X	4.6
Monitoring 7	GC	180	310	1994	11.4	36.8	X			X		R 410A		3.3
Monitoring 8	DX	180	300	1998	15	50	X				X	R 407C		3.5

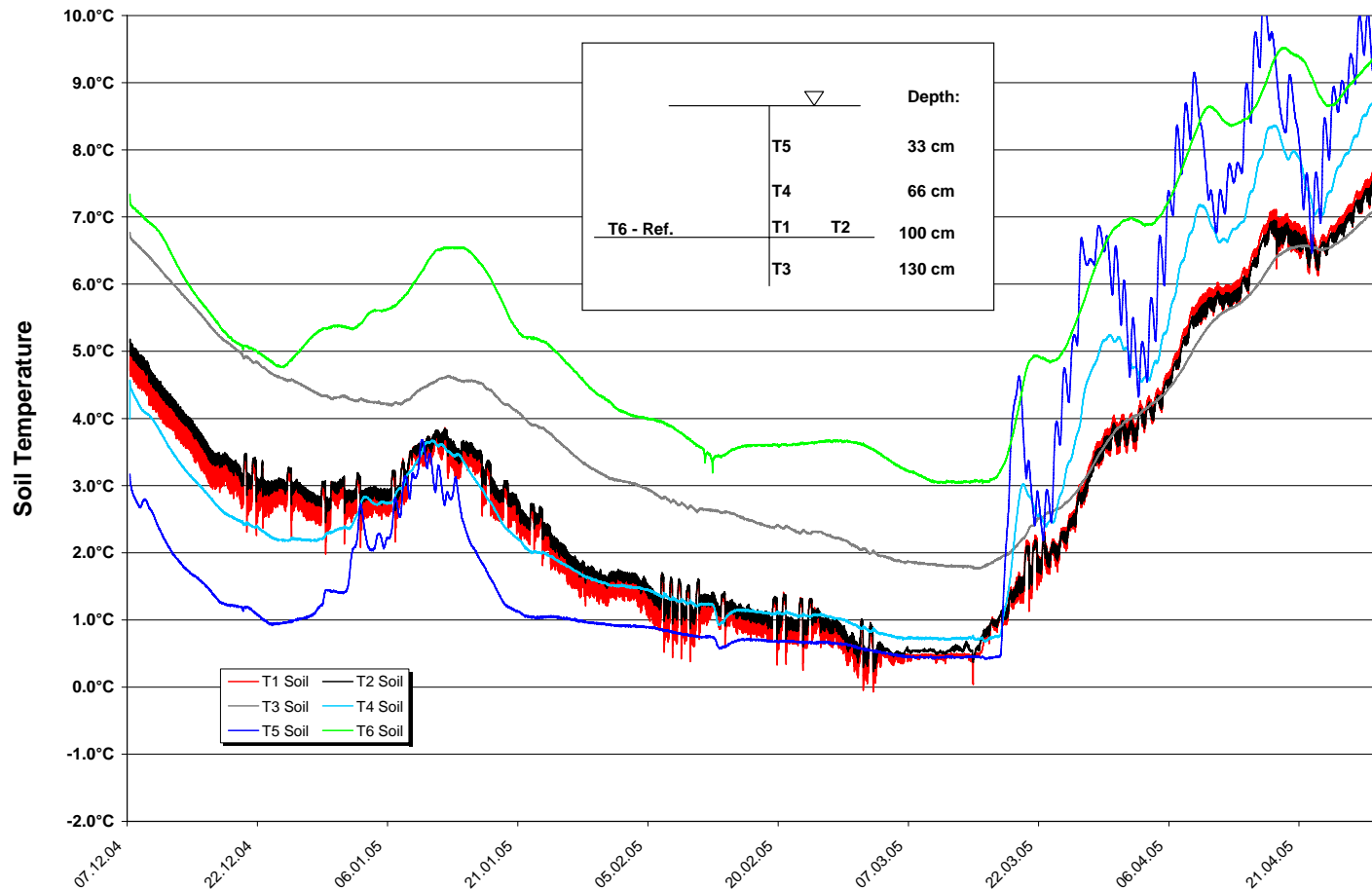
Monitoring III

Field test measurements including detailed monitoring of soil



Monitoring III

Field test measurements including detailed monitoring of soil



Monitoring IV



- STRABAG HOUSE, Vienna
- Office area: 21.000 m²
- Cooling output / heating output:
2,1 MW / 1,7 MW
- 250 energy piles
- Total pipe length: 68.000 m

For detailed results of the first year of operation see proceedings
8th IEA International Heat Pump Conference: "Analysis of a ground coupled
heat pump heating and cooling system for a multi storey office building"

arsenal research in brief

Description

- Non university research center
 - Sustainable energy and efficient transport systems
- Application oriented
- About 180 employees

Mission

- Improving the innovative capacity of our partners
- Advanced simulation methods, precision measurements and testing technology
- Interlinking regional, national, international innovation systems



arsenal research - Heat Pump Test Centre

Testing and development possibilities for three types of compression heat pumps:

GC/water – up to 100 kW heating capacity

water/water – up to 100 kW heating capacity

DX/water – up to 30 kW heating capacity

Testing and development possibilities for absorption heat pumps up to 100 kW heating capacity

arsenal research - Heat Pump Test Centre



soil simulator for direct expansion heat pump

arsenal research - Heat Pump Test Centre



Ground source simulator

- temperature range: source: -10°C to 20°C sink: 25°C to 65°C
- heat extraction: up to 26 kW
- temperature constancy: ± 0.2 K



arsenal research

Sustainable Energy Systems

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