GEOTHERMAL ENERGY UTILIZATION IN SEKULE

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SLOVGEOTERM

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HYDROGEOLOGICAL PART

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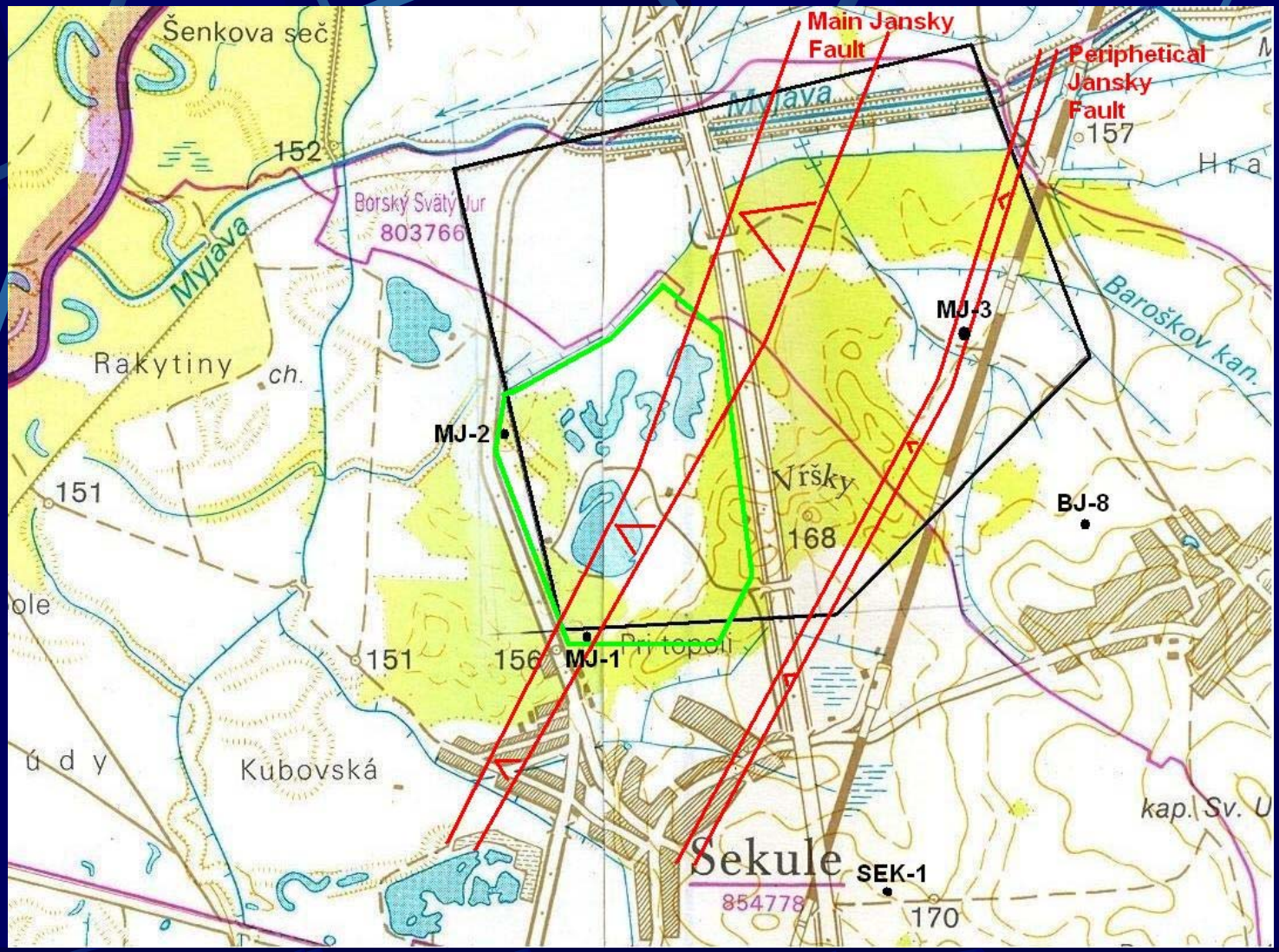
HYDROGELOGICAL INTRODUCTION

- The whole area is situated in Vienna Basin – sedimentary basin of Paleogene rocks
- Vienna basin is the oil and gas prospective area explored by a lot of geophysic measurements and oil-gas boreholes
- The basin is divided by faults into the smaller structures
- The best gas collector is Labsky sands member of the Middle Badenian age (about 50 m of sands)
- The area is not explored by deep hydrogeological wells, but from gas practice we consider Labsky sands member as the best aquifer in the area

MAP OF THE AREA



DATA OF ADJACENT BOREHOLES

Drill	MJ-2 Moravsky Jan 2	MJ - 3 Moravsky Jan 3	SEK-1 Sekule 1	BJ-8 Borsky Jur
Realisation	1948	1961	1996	1967
GEOLOGY	Depth (m)			
Pannonian marly clays	0 - 915	0 - 835	0 - 605	0 - 475
Sarmatian clays, sands	915 - 1130	835 - 1080	605 - 1200	475 - 900
Badenian				
Upper Badenian sands	1130 - 2432	1080 - 1710	1200 - 1930	900 - 1691
Middle Badenian clays, Labsky sands		1710 - 2020	1930 - 2240	1691 - 1930
Lower Badenian pelits		2020 - 2290	2240 - 2600	1930 - 2190
Karpathian calcareous clays		2290 - 2500	2600 - 4247	2190 - 3620
Mesozoic quartzite, dolomites limestones			4247 - 4600	3620 - 4000
Utilisation	decommissioned	decommissioned	conserved	fresh water source

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TECTONIC CONDITIONS

- The seismic measurements were done in the area
- From the tectonic viewpoint the Sekule park area is located in the Jansky fault zone of NE-SW direction
- Borehole MJ-3 was intersected by both of Jansky faults (the main and peripheral ones)
- The Jansky fault system divides the site into:
  - Kuty depression – W part – Labsky sands member is located deeper position (about 2 950 – 3 500 m) - *clayey development of lower porosity*
  - Heaved Jansky Block – E part - Labsky sands member – is located in higher position (about 1 690 – 2 240 m, thickness about 250 – 300 m) – *sandy development of higher porosity and permeability* (SEK-1, BJ-8)

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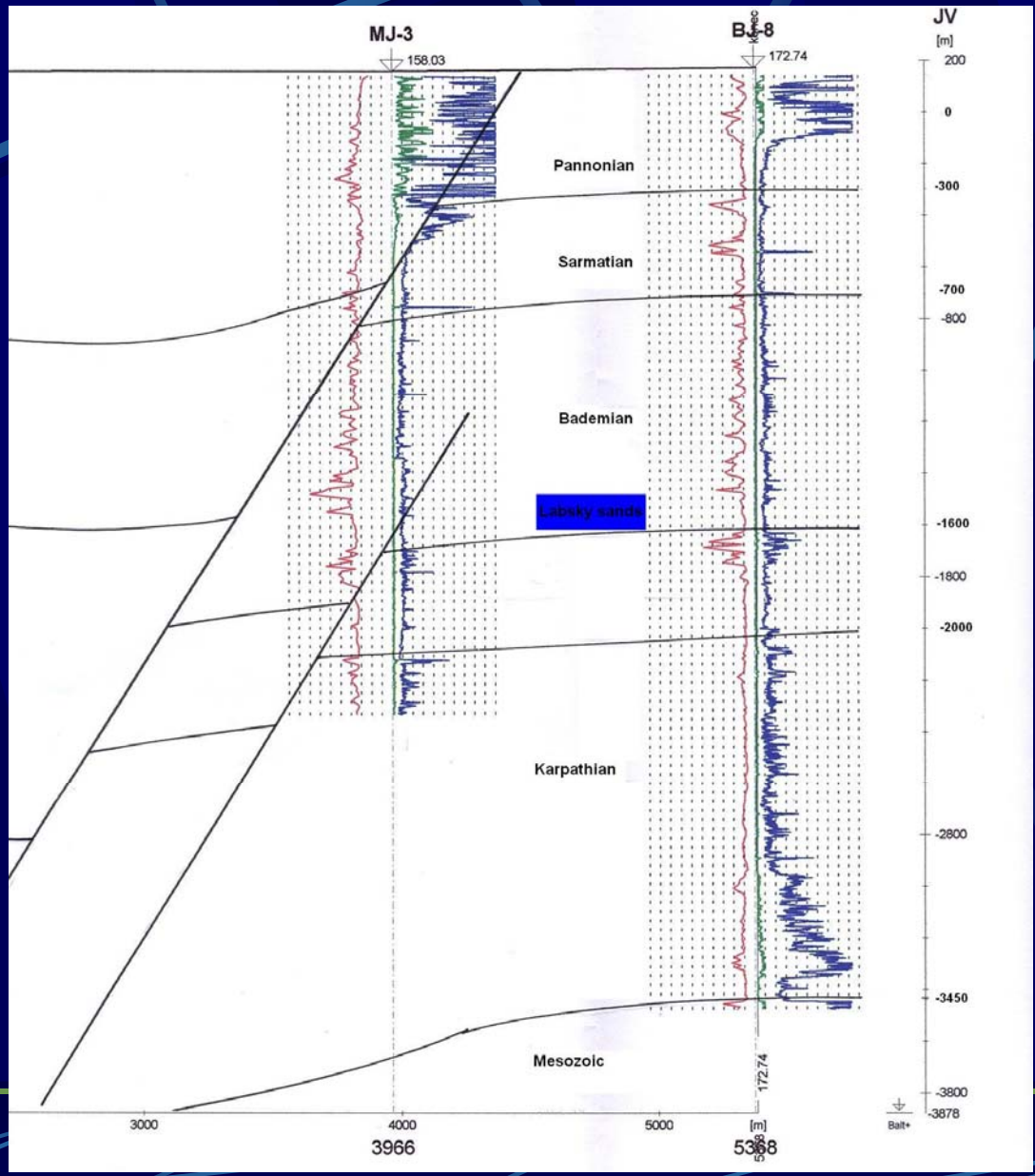
CROSS-SECTION



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GEOTHERMIC CONDITIONS

- **Most reliable information is the thermic measurements in the SEK-1 borehole**

Depth (m)	SEK-1 (°C)	MJ - 3
500	14	
1 000	26	
1 500	39	
2 000	53	1710 - 2020 m
2 500	65	Labsky sands
3 000	79,5	

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HYDROGEOLOGICAL CONDITIONS

- **Indirect information have been obtained from:**
  - **the logging measurements done in gas boreholes (SP, AR) – appoints the sandy layers and higher permeable zones**
  - **the testers performed during the drilling**

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HYDROGEOCHEMICAL CONDITIONS

- the hydrogeochemical information is gained from the water analyses done in neighboring boreholes
- there are salty waters of NaCl(HCO3) type
- according the previous analyses we can expect the gas in the well with 60 - 90% of methane

Stratigraphic member	TDS (mg/l, ppm)
Pannonian	3 000 - 8 000
Sarmatian	8 000 - 14 000
Badenian	8 000 - 20 000
Karpatian	14 000 - 19 000

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OUR PROPOSAL

- Drill the geothermal well in the neighborhood of the former borehole MJ-3 up to 2 300 m
- The Labsky sands member is expected in the depth 1 700 – 2 050 m
- The expected temperature in the depth 2 000 m is 53°C, in the depth 2 300 m is 60°C
- Expected flowrate is 5 – 20 l/s
- TDS 8 000 – 20 000 mg/l of NaCl(HCO3) chemical type

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ENERGY PART

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GEOTHERMAL WATER PARAMETERS

- Flow rate of 5 – 20 l/s
- Temperature 50°C
- TDS 8 – 20 g/l

Temperature [°C]	50	50	50
Flow rate [l/s]	5	10	20
Heat potencial [MW_t]	**0,73**	**1,47**	**2,93**

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HEAT DEMAND

- Space heating: 10,6 MW_t
- Spa: 0,8 MW_t
- **TOTAL HEAT DEMAND: 11,4 MW_t**

Majetkovy Holding A.S / Slovak Landinvest Sro

Site Plan KPGCD, October 16, 2006 adjusted November 14, 2006

Utility Definition Sekule, Slovakia			Electricity				Heating		Total
Area I, Golf Development		m2 / number	KW	Installed KVA	KW	Simul-taneuos KVA	m2 or m3	KW/m2	KW
Golf Course	Clubhouse	1.200	0,10	120,00	0,05	60,00	1.200	0,05	60
	Proshop	200	0,10	20,00	0,05	10,00	200	0,05	10
	Driving Range, Caddie house	500	0,10	50,00	0,05	25,00	500	0,05	25
	Maintenance building	500	0,10	50,00	0,05	25,00	500	0,05	25
Total Area I				240,00		120,00	2.400		120
Area II, Residential Development									
Residential Lots	130 medium lots / +1.200 m2	130	7,00	910,00	1,50	195,00	97.500	0,02	1.950
Residential Lots	80 Large Lots / + 2.000 m2	80	7,00	560,00	1,50	120,00	80.000	0,02	1.600
Residential Lots	33 Super Lots + 3.000 m2	33	7,00	231,00	1,50	49,50	49.500	0,02	990
Apartements	300 Units	300	7,00	2100,00	1,50	450,00	172.800	0,02	3.456
Roads & Open space									
Total Area II				3801,00		814,50	399.800		7.996
Area III, Hotel Development									
Hotel	150 kamers	150	2,00	300,00	1,00	150,00	10.000	0,05	500
Spa	500 m2	500	0,20	100,00	0,10	50,00	500	0,05	25
Total Area III				400,00		200,00	10.500		525
Area IV, Commercial Services & Retail Areas									
Retail	4.000 m2	4.000	0,10	400,00	0,06	240,00	4.000	0,05	200
Commercial Services	30.000 m2	30.000	0,10	3000,00	0,06	1800,00	30.000	0,05	1.500
Total Area IV				3400,00		2040,00	34.000		1.700
Total Project Area I -V				7841,00		3174,50	446.700		10.341

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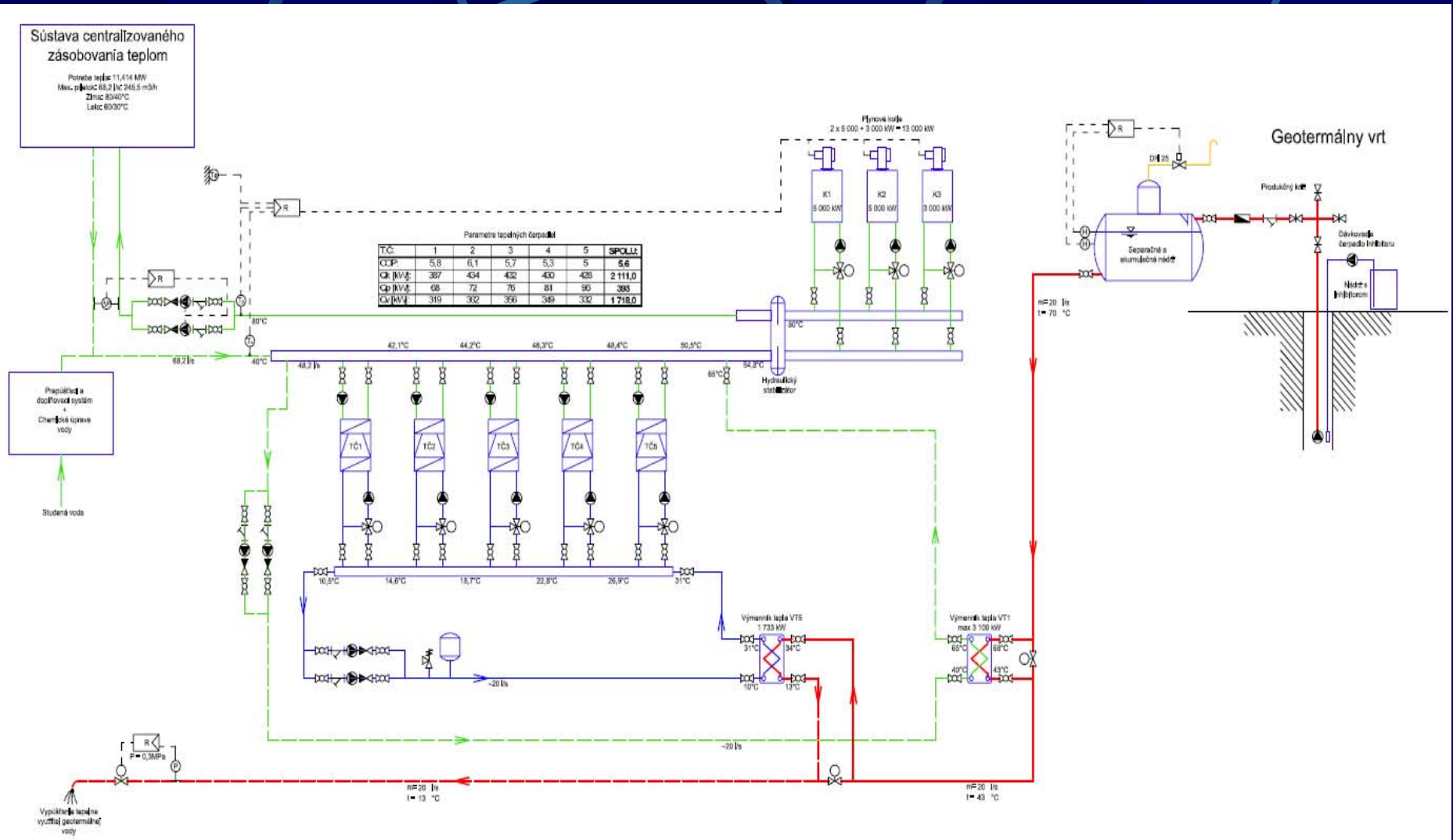
HEATING SYSTEM DESIGN

- District heating system with central heat source
- Temperature gradient 80/40°C
- Gas boilers as peak load and backup heat source
- Low temperature heating systems in buildings
  - Floor heating
  - Large radiators

PROCESS SHCEME



ANNUAL HEAT PRODUCTION

GW flow rate	Maximal heat output	Annual heat production	Ratio
[l/s]	[MW_t]	[GJ]	[%]
20	2,9	65 000	**68**
10	1,5	37 000	**39**
5	0,7	15 000	**16**
TOTAL	11,4	95 000	100

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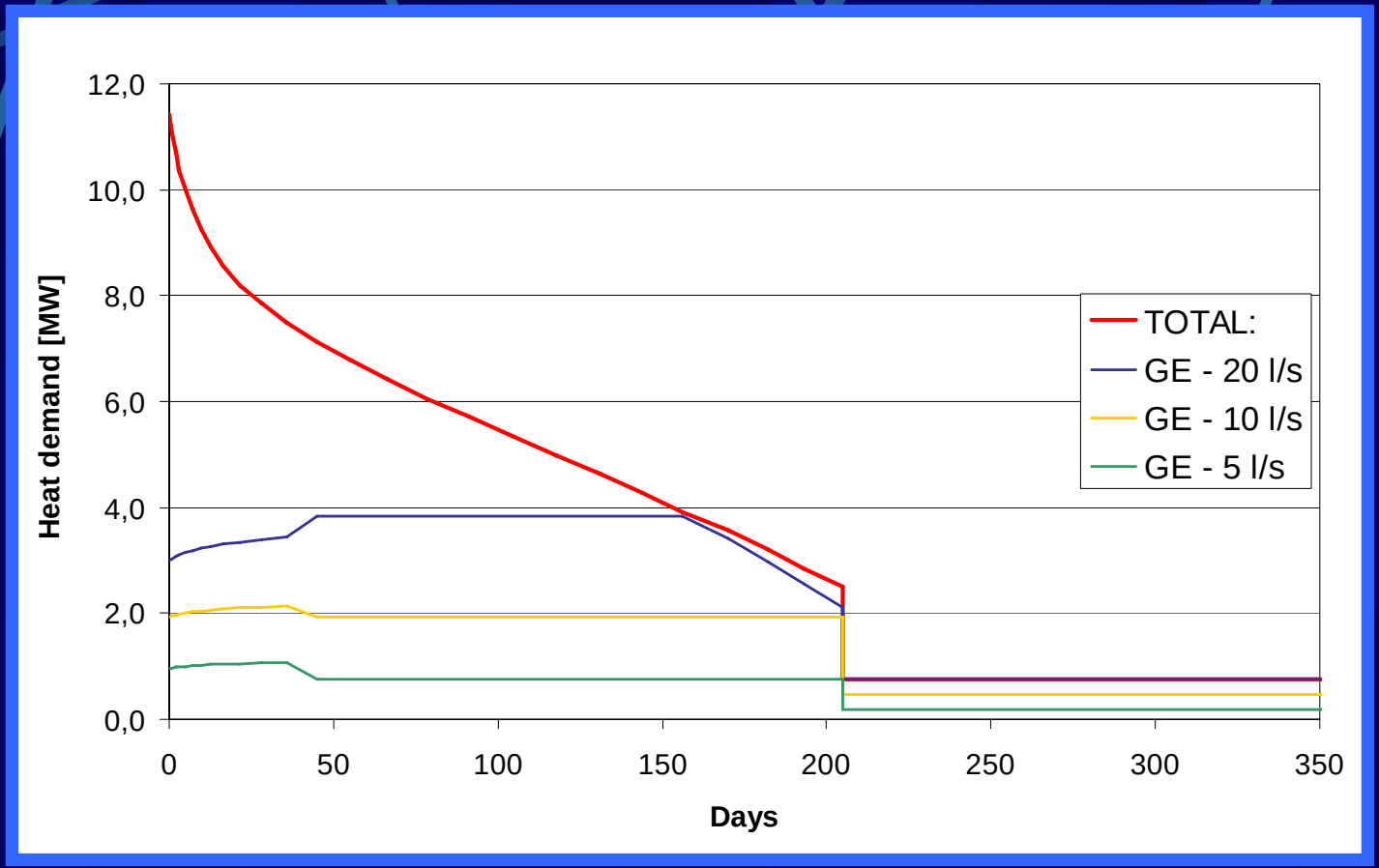
ENERGY DURATION CHART



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NATURAL GAS SAVINGS

GW flow rate	Natural gas consumption	Annual savings	Annual savings
[l/s]	[m^3]	[mil. SK]	[%]
20	935 640	14,5	**41**
10	1 681 420	7,9	**22**
5	2 223 900	3,4	**10**
Only gas boilers	2 935 571	-	-

- **ONLY natural gas consumption and electricity consumption in heat pumps is taken to account!**

INVESTMENT AND OPERATIONAL COSTS

... ARE COMMING SOON...

CONCLUSIONS

- Significant part of annual heat consumption can be covered by geothermal energy (up to 68%)
- Significant natural gas savings can be achieved (up to 14,5 mil. SK)
- Geothermal energy constitutes independent and reliable renewable energy resource

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