

Thermal water complex and direct use in Agriculture in Hungary

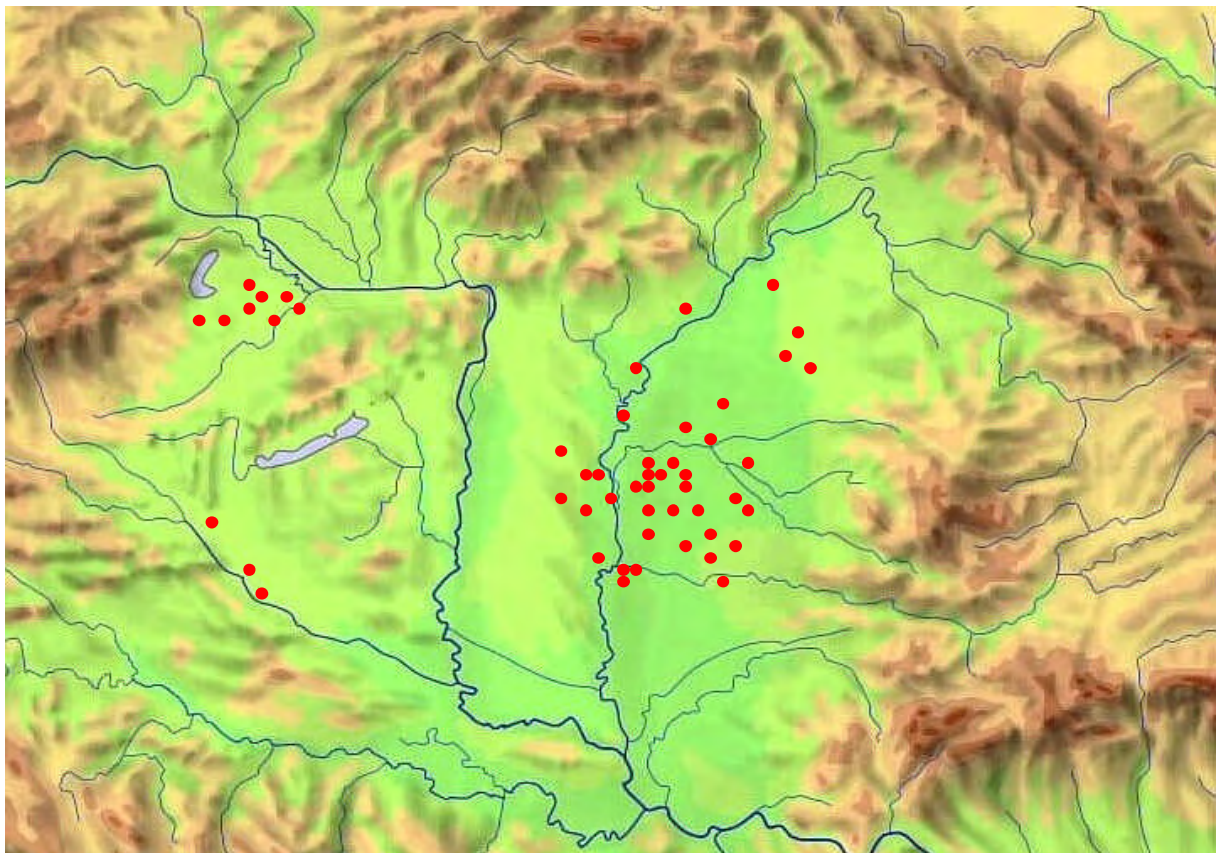
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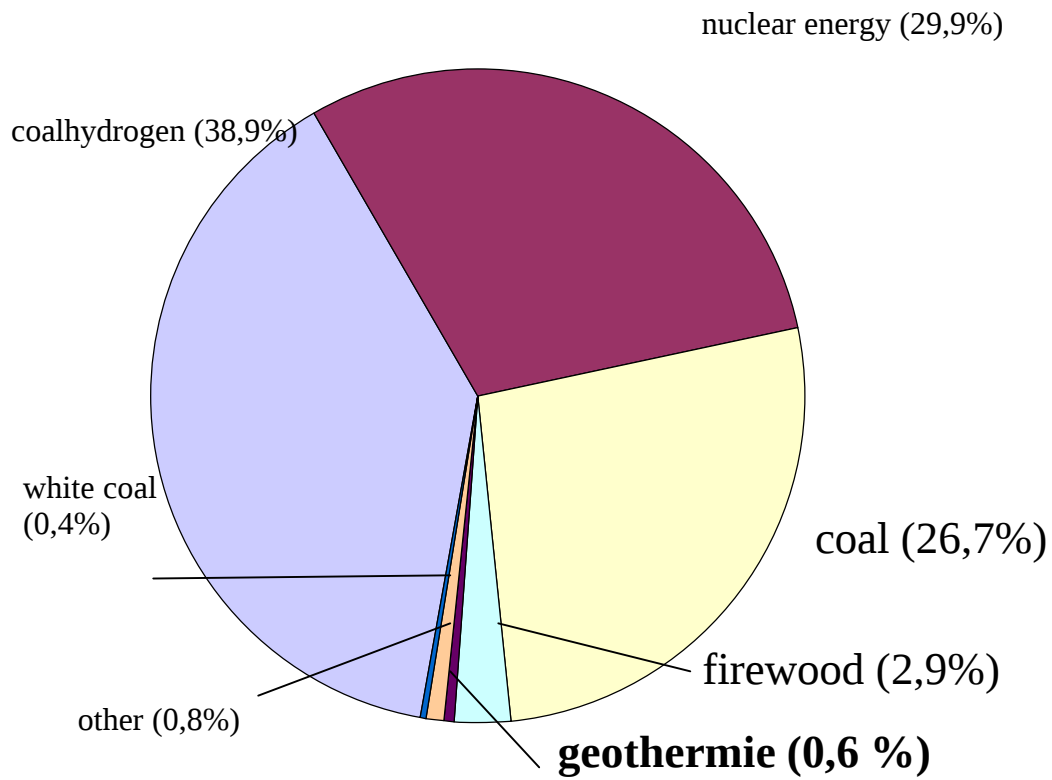
Our greenhouse operation and our poultry farming based on thermal water are internationally well-known. We operate one of the largest only thermal water heated complexes in the world. 20 thermal wells provide the energy needed by 30 ha glasshouses and 30 hectares of plastic tunnels. We heat the our social buildings, our corn dryer, turkey-equerry and our chicken incubator with thermal water. We are complex geothermal energy user.

Thermal wells in Hungary

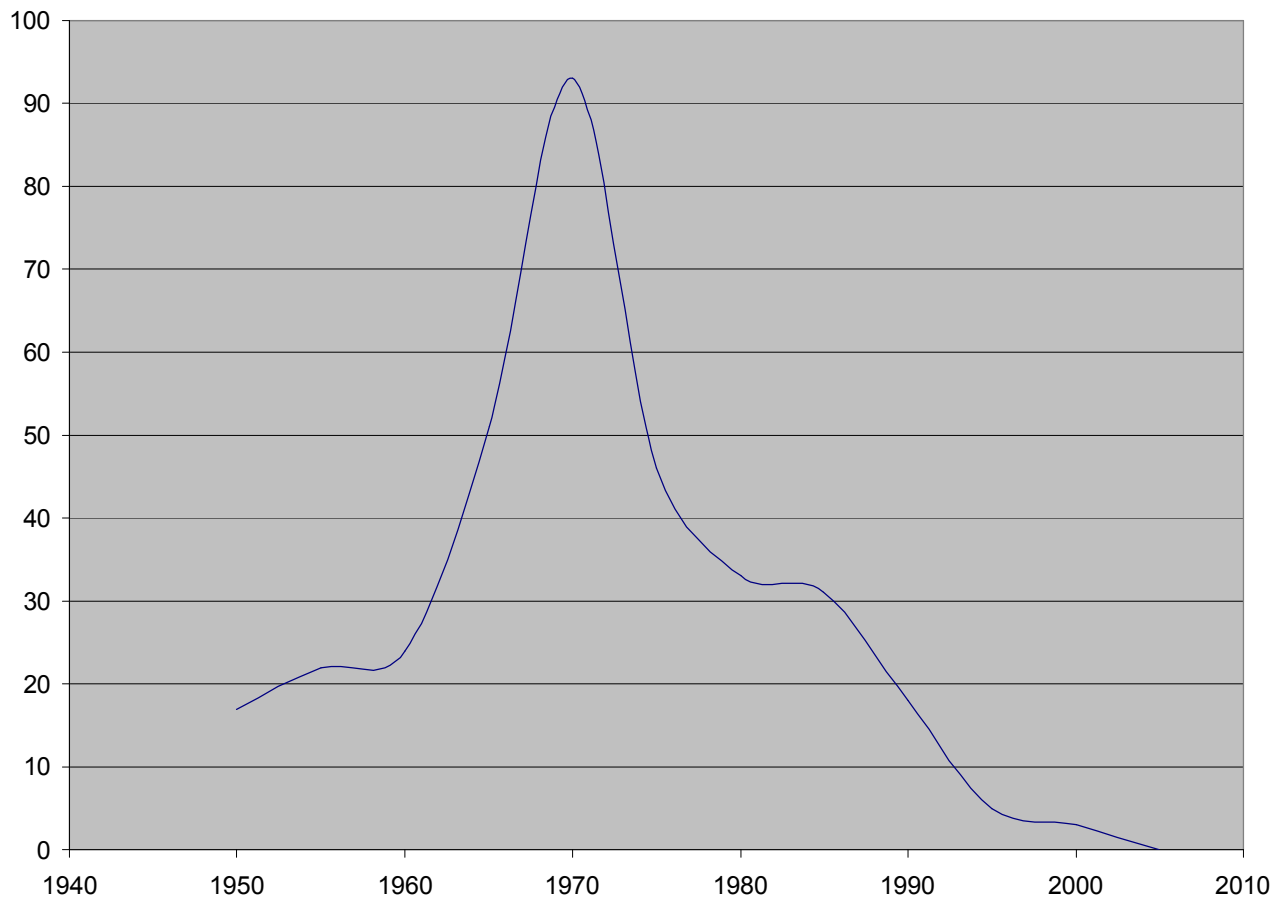


Hungary is a „hot spot” in centre of one of biggest sedimentary basin in the World, the Carpathian basin. The geothermal reserves of Hungary have been identified, by geological exploration. By wells drilled for thermal and drinking water supply (over 85% of the drinking water of the country is supplied from deep wells and wells drilled for hydrocarbon resources. Over 1200 geothermal and 3000 abandonen oil wells provided reliable information about the existence of geothermal resources. According to the survey carried the dynamic thermal water resources of Hungary were 380 million m³/year and the geothermal energy contained in these resources exceeds 60 PJ/year.

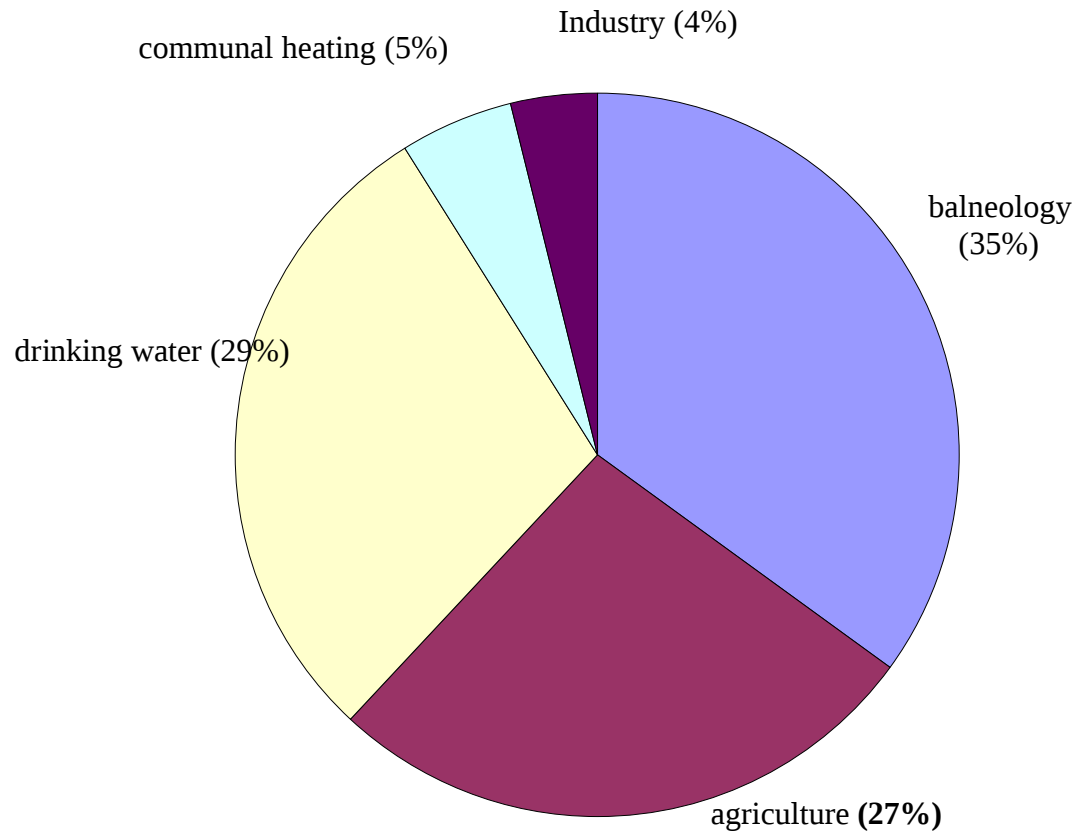
Energy production in Hungary



New thermal wells in Hungary 1950-2005



Thermal water using in Hungary



Wells data

Number	Denomination	Well number	Construction year	Q max. l/min	Depth m	Filter m	Temperature °C
1.	I.kút	K-498	1964	1800	1995	1800-1975	85
2.	II.kút	K-562	1970	1800	1800	1640-1793	82
3.	III.kút	K-563	1970	1800	1992	1678-1936	78
4.	IV.kút	K-586	1972	2200	2303	2060-2235	96
5.	V/1.kút	K-640	1979	1420	2240	2040-2210	94
6.	V/2.kút	K-641	1979	1340	2000	1785-1993	84
7.	VI/1.kút	K-642	1978	1030	2398	2046-2255	97
8.	VI/2.kút	K-643	1978	1190	1998	1694-1989	86
9.	VII/1.kút	K-644	1979	1090	2257	2053-2205	96
10.	VII/2.kút	K-639	1979	1020	1806	1534-1754	76
11.	VII/3.kút	K-645	1980	1130	1998	1800-1998	80
12.	VIII.kút	K-666	1988	1100	2300	2004-2143	90
13.	AL/1.kút	K-561	1969	1550	2050	1801-2019	85
14.	AL/2.kút	K-578	1971	1700	2401	2135-2401	94

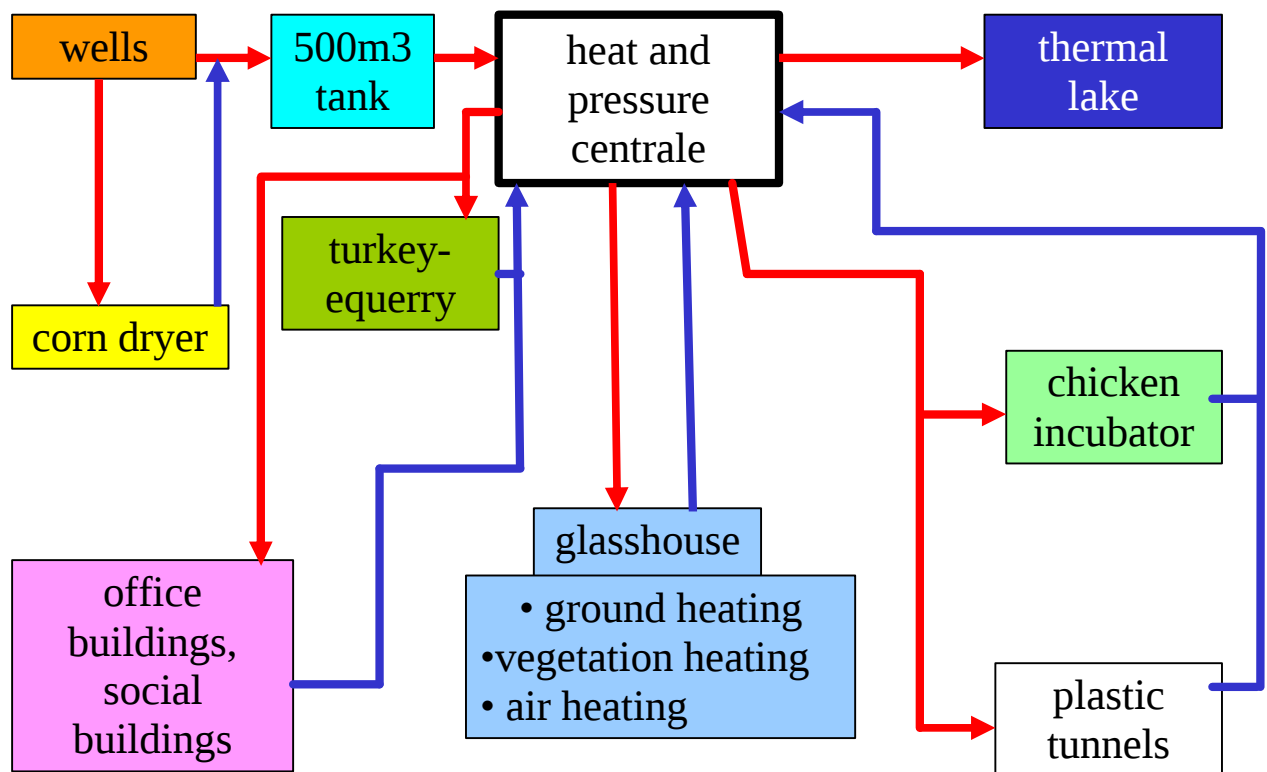
Water and gas analysis for thermal wells from Arpad-Agrar Co.

pH		8,15	7,75	7,6	7,95	7,85	7,25	8,2	7,4	8,2	7,75
Alkali	p-mval/l	1,8	0,4	0	1,3	0	0	1,3	0	0,8	0
Alkali	m-mval/l	30,6	19	21,7	28,3	24,4	27,2	30,8	25,4	25,2	17,4
Fe 3+	mg/l	0,34	0,45	0,34	0,28	1,39	0,28	0,45	0,28	0,28	0,22
Ca ++	mg/l	6	4	4	5,2	3,6	0,56	6,4	5,6	4	4
Mg ++	mg/l	1,7	1,2	1,45	1,7	1,2	1,45	1,45	1,45	1,45	1,2
Hardness	mk°	1,2	0,84	0,89	1,12	0,84	1,1	1,23	1,12	0,89	0,84
Cl	mg/l	17,7	17,7	17,7	31,9	21,2	17,7	78	17,7	31,9	14,1
NaCl	mg/l	29,2	29,2	29,2	52,6	35	29,2	128,5	29,2	52,6	23,3
Na+	mg/l	725	427,5	480	650	537,5	562,5	775	530	575	460
K+	mg/l	12,1	4,8	5,8	12,6	10,7	9,6	16,4	8,8	11,9	5,2
Conductivity	µs	1455,9	1007,4	1110,9	1414,5	1980,4	1345	1676,7	1228,2	1324,8	945,3
/NH4/ +	mg/l	27	23,6	26,6	29,8	19	17	24	19,8	15	12,8
NaHCO3	mg/l	2268	1528,8	1794,3	2160	2024,4	2251,8	2370	2100	1982,4	1436,4
Na2CO3	mg/l	166,3	26,4	-	114,9	-	-	112,8	-	67,8	-
Solid matter		-	-	-	-	-	-	-	-	-	-
Gasanalysis											
Gas-water relation	Nl/m3	158,6	120,64	185,83	485,85	502,62	422,16	586,8	151,25	314,8	155,68
Composition	tf %										
O2		18,65	13,8	3,55	12,27	13	17,17	4,3	9,38	1,2	17,67
N2		72,91	65,95	68,07	11,77	62,23	77,78	50,76	45,51	22,77	31,12
CH4		2,53	17,13	14,18	46,58	21,67	2,18	9,7	24,96	49,38	38,25
CO2		5,91	3,12	14,2	28,83	3,1	2,87	35,24	19,96	26,07	15,99
C2		-	-	-	0,55	-	-	-	0,19	0,58	-
Metan-water relation	Nl/m3	4,01	20,66	26,35	213,73	108,9	9,2	56,91	19,96	159,01	59,55

The thermal waters in south Hungary have high mineral content and high salinity.



Complex use by Arpad-Agrar Co.



Thermal lake in Szentes



Artificial lake with 140 ha area

	Primary lake	Secondary lake
area	40 ha	100 ha
winter temperature	+2 to +8 °C	-5 to -15 °C
summer temperature	+18 to +25 °C	+18 to +25 °C
utilization	nature reserve lake, ornithology observatory, 176 birds species, fish, frog	aquatic sport and free time lake, wind surf, ice surf, line fishing, fishery

**Thermalwater costs
by 3 million m3 thermalwater for 2005**

- water reserves contribution 372.972 USD
- mining royalty 64.865 USD
- sewage penalty 127.030 USD
- amortization 97.296 USD
- current 172.975 USD
- service cost (parts) 64.875 USD
- hire 36.765 USD

The future

- swimming pool and health centre
- current produce with geothermal energy
- warm water produce with suncollector
- current produce with other renewable energy:
 - photovoltaic
 - wind energy
- hydrogen produce with current for fuel cells, for vehicles and for household

The final goal is achieve the 100 % share of renewables energy in agriculture.

Janos Nagygal

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predoctor, project theme: - renewable energy

- hybrid vehicles
- fuel cells

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