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WP4: Database of selected geothermal district heating system

User4GeoEnergy

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INTRODUCTION

- Development of mathematical model for simulating generation, transmission and supply of heat to end users after applying solutions proposed in the project (WP5) is one of the core activities of U4GE Project

- For that purpose it was necessary to collect a wide range of data as an input for the model

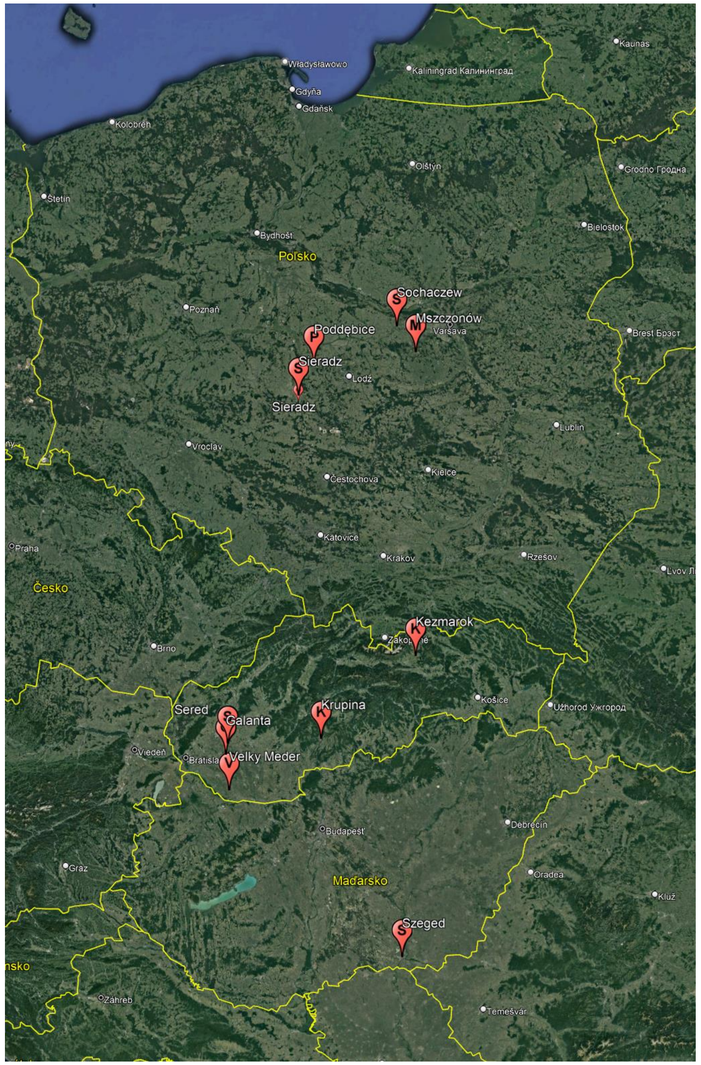
- WP4 was fully dedicated to creating a database containing comprehensive characteristics of geothermal resources, district heating systems (DHS) and heat end users

- Data from altogether 28 DHS from 3 countries were collected and processed

- Responsible partner for WP4: SLOVGEOTERM a.s.
- Contribution: All Project Partners

LOCALITIES OF INTEREST

- Poland – 4 localities
  - Mszczonów (geothermal energy is utilized by heat pumps)
  - Sochaczew (geothermal well is drilled, not connected to DHS yet)
  - Poddębice (using geothermal energy already)
  - Sieradz (geothermal well is drilled but not utilized yet)
- Slovakia – 5 localities with 7 DHS
  - Galanta (using geothermal energy already)
  - Sered (using geothermal energy already)
  - Velky Meder (using geothermal energy already)
  - Kezmarok (geothermal well is drilled, connection to DHS is being prepared)
  - Krupina (under investigation for geothermal energy utilization possibilities)
- Hungary – 1 locality with 23 DHS
  - Szeged (2 DHS already utilizing geothermal energy, 13 are being transformed to geothermal)



CONTENTS OF THE DATABASE

- Part 1 – short overview and general information
- Part 2 – information about geothermal production wells
- Part 3 – analogous to part 2, but referring to geothermal reinjection wells where applicable
- Part 4 – characteristics of the heat source
- Part 5 – characteristics of heat consumers
- Part 6 – general economic indicators
- Annex I – data for typical meteorological year
- Annex II – well construction schemes
- Annex III – principal scheme of the heat source
- Annex IV – data from the DH system operator control system (SCADA)
- Annex V – distribution network situation plan

PART 1

Short overview and general information

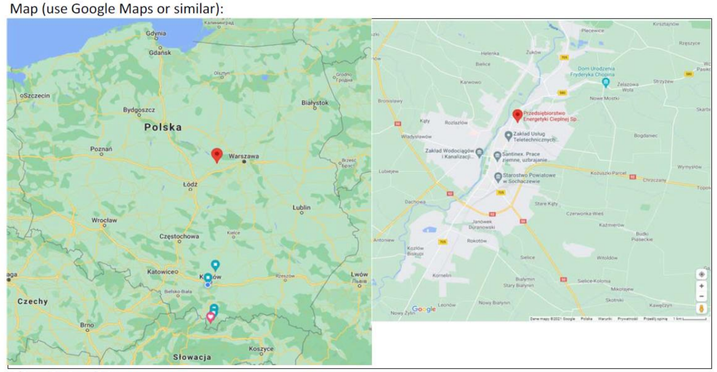
- Location
- Design climatic conditions
- Geological background
- Geothermal conditions

Database **Dataset for particular project/locality** **Part 1** **Locality ID.:** **PL 2**

Location

Country:	Poland	Coordinates (UTM):	52.246050699447956
Town/City of:	Sochaczew		20.25587425650787

Map (use Google Maps or similar):



Climatic Conditions

Design ambient temperature:	-20 °C	Design humidity:	nta %
Design wind speed:	nta m/s	Design solar radiation:	nta W/m2

Typical climatic conditions (Typical meteorological year for period 2007 - 2016): See Annex I

Typical climatic conditions used from: https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html#TM

(nta - is not taken into account)

Geothermal Conditions

Brief description of geological conditions:

The geothermal well Sochaczew GT-1 opens for exploitation the Lower Cretaceous reservoir in the depth interval of 1355-1485.5 m below the surface. The artesian free outflow conditions ocours, with the well head overpressure of waters, in natural and steady conditions, 2.24 bar. The water level in natural conditions is 103.4 m above sea level. During the operating conditions with outflow of 180 m3/h, the water level droped to the elevation 85.4 m above sea level and its temperature at the well head was 44.3°C. Water mineralization 0.962 g/dm3, with a possible slight increase in operating conditions. The Sochaczew GT-1 opening provides access to the bed with a filter with a diameter of 6 5/8 inches.

Name of geological locality:	Warsaw Through				
Geological type/Lithology:	Lower Cretaceous				
Aquifer rock:	sandstone				
Type of permeability:					porous aquifer
Depth of aquifer top approx.:	1 355 m				
Depth of aquifer bottom approx.:	1 487 m				
Temperatue in aquifer:	43,4 °C		at depth of:	1307 m	
Pressure in aquifer:	130,6 bar		at depth of:	1307 m	
Existing production wells?	Yes	Number of production wells:		1	
Existing reinjection wells?	No				

Description of geothermal system operation and control:

The geothermal system will ultimately consist of two holes forming a geothermal doublet. Due to the low temperature, the use of heat pumps is planned. The use of absorption heat pumps is envisaged.

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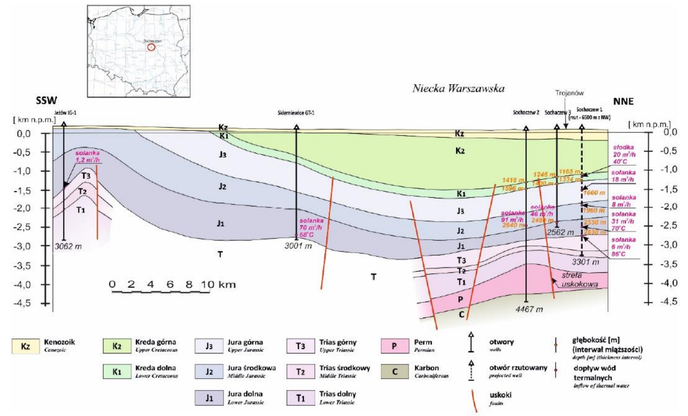

PART 2

Information about geothermal production wells

- Depth
- Casing design
- Wellhead temperature and pressure at the maximum flow rate
- Mineralisation (TDS) of water
- Pumping power required

Database Dataset for particular project/locality **Part 2** **Locality ID.:** **SK 1**

Production Well 1

Well name:	FGG-2		Maximal flow rate:	13,7 l/s
Well depth:	2 100 m		Maximal well head temperature:	81 °C
Production casing 1 diameter:	9 5/8 in		Well head pressure at maximal flow:	0,4 MPa
Production casing 2 diameter:	- in		Water level at static cond. (below surface):	12 m
Production liner diameter:	7 in		Water level at max. flow rate (below surface):	45 m
Outflow conditions:	Pumping		Mineralisation of geothermal water (TDS):	5,3 g/l
Depth of the pump:	100 m		Corrosive properties?	Yes
Electrical input of the pump:	30 kW		Scaling properties?	No
Well construction:	See Annex II		Dosing of inhibitor?	Yes

Water level depression resp. geothermal water temperature vs. flow rate dependence (if available): See Annex IV

Lithostratigraphic profile of the well:

Depth from - to [m]			Lithology/Stratigraphy	Rock type	Aquifer ?	Therm. conduct. [W/(K.m)]	Thermal capacity [J/(kg.K)]
0	-	150	Quaternary, Romanian	gravel, sand, clay	No		
150	-	880	Dacian	sand, clay	No	Clays 2,45±0,49;	
880	-	1500	Pontian	sand, clay	No	Sands 1,97±0,47;	
1500	-	2100	Pannonian	sands, sandstones, clays, claystones	Yes	sandstones 2,66±0,63;	996 - 1033
	-						
	-						
	-						
	-						
	-						
	-						

Production Well 2 (if aplicable)

Well name:	FGG-3		Maximal flow rate:	13,5 l/s
Well depth:	2 100 m		Maximal well head temperature:	77 °C
Production casing 1 diameter:	9 5/8 in		Well head pressure at maximal flow:	0,4 MPa
Production casing 2 diameter:	- in		Water level at static cond. (below surface):	m
Production liner diameter:	7 in		Water level at max. flow rate (below surface):	58 m
Outflow conditions:	Pumping		Mineralisation of geothermal water (TDS):	5,3 g/l
Depth of the pump:	100 m		Corrosive properties?	Yes
Electrical input of the pump:	30 kW		Scaling properties?	Yes
Well construction:	See Annex II		Dosing of inhibitor?	Yes

Water level depression vs. flow rate dependence (output of control system, if available): See Annex IV

Lithostratigraphic profile of the well:

Depth from - to [m]			Lithology/Stratigraphy	Rock type	Aquifer ?	Therm. conduct. [W/(K.m)]	Thermal capacity [J/K]
0	-	150	Quaternary, Romanian	gravel, sand, clay	No		
150	-	900	Dacian	sand, clay	No	Clays 2,45±0,49;	
900	-	1500	Pontian	sand, clay	No	Sands 1,97±0,47;	
1500	-	2100	Pannonian	sands, sandstones, clays, claystones	Yes	sandstones 2,66±0,63;	996 - 1033

PART 3

Information about geothermal production wells

- Depth
- Casing design
- Reinjection pressure
- Reinjection power required

Database **Dataset for particular project/locality** **Part 3** **Locality ID.:** **HU 1**

Reinjection Well 1	(if aplicable)				
Well name:	Od-VS1		Maximal reinjection flow rate:	80	l/s
Well depth:	1 860	m	Maximal reinjection well head temperature:	55	°C
Production casing 1 diameter:	13 3/8	in	Maximal reinjection well head pressure:	0,84	MPa
Production casing 2 diameter:	9 5/8	in	Minimal reinjection well head temperature:	30	°C
Production liner diameter:	5,5	in	Minimal reinjection well head pressure:	0	MPa
Reinjection pump electric input:	2x37	kW	Well construction:	See Annex II	
Reinjection pressure resp. water temperature vs. flow rate dependence (if available):				See Annex IV	

Reinjection Well 2	(if aplicable)				
Well name:	Od-VS2		Maximal reinjection flow rate:	80	l/s
Well depth:	1 900	m	Maximal reinjection well head temperature:	55	°C
Production casing 1 diameter:	13 3/8	in	Maximal reinjection well head pressure:	0,84	MPa
Production casing 2 diameter:	9 5/8	in	Minimal reinjection well head temperature:	30	°C
Production liner diameter:	5,5	in	Minimal reinjection well head pressure:	0	MPa
Reinjection pump electric input:	2x37	kW	Well construction:	See Annex II	
Reinjection pressure resp. water temperature vs. flow rate dependence (if available):				See Annex IV	

Reinjection Well 3	(if aplicable)				
Well name:			Maximal reinjection flow rate:		l/s
Well depth:		m	Maximal reinjection well head temperature:		°C
Production casing 1 diameter:		in	Maximal reinjection well head pressure:		MPa
Production casing 2 diameter:		in	Minimal reinjection well head temperature:		°C
Production liner diameter:		in	Minimal reinjection well head pressure:		MPa
Reinjection pump electric input:		kW	Well construction:	See Annex II	
Reinjection pressure resp. water temperature vs. flow rate dependence (if available):				See Annex IV	

Reinjection Well 4	(if aplicable)				
Well name:			Maximal reinjection flow rate:		l/s
Well depth:		m	Maximal reinjection well head temperature:		°C
Production casing 1 diameter:		in	Maximal reinjection well head pressure:		MPa
Production casing 2 diameter:		in	Minimal reinjection well head temperature:		°C
Production liner diameter:		in	Minimal reinjection well head pressure:		MPa
Reinjection pump electric input:		kW	Well construction:	See Annex II	
Reinjection pressure resp. water temperature vs. flow rate dependence (if available):				See Annex IV	

PART 4

Characteristics of the heat source

- Energy carriers used
- Installed capacity vs energy carrier
- Annual heat production
- Efficiency of use
- Emissions of pollutants
- Characteristics of heat distribution loops:
  - design parameters
  - length
  - heat losses
  - pipe materials
  - Insulation
  - pressure drop
  - circulation pumps power
  - age
  - control system
  - etc.

Database — Dataset for particular project/locality — **Part 4** — **Locality ID.: SK 1**

District Heating System - Heat source

Operator of the heat source: GALANTATERM spol. s r.o.

Description of the system:

Two geothermal production wells are used for heating of large dwelling with approx. 1600 apartments, hospital and other objects. Geothermal energy represents main (base load) heat source with more than 95% share at total heat production. Natural gas boilers are used as a peak and back up heat source. Domestic hot water for dwelling is being prepared in central heat source.

Fee for geothermal water extraction?	Yes	Value:	0,0266 €/m3
Fee for geothermal water utilisation?	No		
Amount of extracted geothermal water per year:	430 306	m3/year	
Amount of utilized geothermal water per year:	430 306	m3/year	
Geothermal heat exchangers installed?	Yes		
Geothermal heat pumps installed?	No		
Geothermal storage tanks installed?	No		
Year of evaluation:	2020		

Heat source	Type	Inst. output [kW]	Annual heat production [MWh/year]	Percentage of total heat production [%]	Annual consumption of fuel/energy carrier		Efficiency of use [%]
Geothermal	Baseload	10,46	16 698,61	99,42%	430 306	m3/y	-
Heat pumps						MWh/y	
Natural gas	Peak and backup	13,10	98,06	0,58%	18 457	m3/y	54,62
Biomass						ton/y	
Hard coal						ton/y	
Heating oil						m3/y	
Electricity					427,375	MWh/y	
TOTAL:		23,56	16 796,67				

Principal scheme of heat source: see Annex III — Data from control system (if available): see Annex IV

Annual emissions based on measurements or calculation:

Heat source	B(a)P [kg/y]	PM [ton/y]	PM10 [kg/y]	PM2,5 [kg/y]	CO2 [ton/y]	CO [kg/y]	SOx [kg/y]	TOC [ton/y]	NOx [ton/y]
Geothermal	-	-	-	-	10,89	-	-	-	-
Natural gas	N/A	0,0014	N/A	N/A	37,785	0,0103	0,0002	0,0013	0,0309
Biomass									
Hard coal									
Heating oil									
Electricity									
TOTAL:	0	0,0014	0	0	48,675	0,0103	0,0002	0,0013	0,0309

District Heating System - Distribution Network

The same operator as of heat source? Yes

Description of the distribution network:

There are three heating/distribution loops: 1. Hospital 90/70 °C; 2. Dwelling Sever (North) 77/52 °C, 3. Hospital ceiling heating 52/42 °C. Distribution pipelines are placed under ground, in channels (except of distribtion loop 2. which is completelly reconstructed - preinsulated pipes are used). Two pipe system is used for loop 1 and 3, four pipe system is used for loop 2 (with central domestic hot water preparation).

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Number of heat distribution loops: 3 — Distribution network situation plan: see Annex V

Heat distribution loop no.: 1 — Type of network: Double pipe

Design temperature gradient: 90 / 70 °C — Design heat capacity: 3 060 kW

Inner diameter of main pipe: 200 mm — Total length of heat distribution loop: 640 m

Heat losses in heat distribution loop: 9,8 % of distributed heat

If heat losses unknown:

Pipe insde diameter [mm]:	200			
Leng of particular pipeline [m]:	640			
Distribution pipe material:	Steel			
Thermal insulation material:	Mineral wool			
Insulation thickness [mm]:	50?			
Protecting cover material:	Gypsum			
Preinsulated?	No			
Thermal conductivity [W/(m.K)]:	N/A			
Dominant placement of pipeline:	In channel			
Age of the network [years]:	25			

Pressure drop in distribution loop: 150 kPa — Dependence on flow rate available? No

Circulation pump input: 11 kW — Dependence on flow rate available? No

Considered modernization of heat distribution loop: No — If yes, description of planned activities:

Expected reduction of heat loss: % of distributed heat — Estimated costs: €

Control system — Type of control system: Qualitative only

Outdoor air temperature measurement? Yes — Supply temperature dep.:

Wind speed measurement? No

Solar radiation measurement? No

Other parameters measurement? No

Pump constant pressure difference control: Yes

	Out. temp. [°C]	Supply temp. [°C]
1	-11	90
2	-5	79
3	0	72
4	10	48
5	20	20

Heat distribution loop no.: 2 — Type of network: Four pipe

Design temperature gradient: 72 / 52 °C — Design heat capacity: 6 500 kW

Inner diameter of main pipe: 250 mm — Total length of heat distribution loop: 1 885 m

Heat losses in heat distribution loop: 5,25 % of distributed heat

If heat losses unknown:

Pipe insde diameter [mm]:	250	200	150	125
Leng of particular pipeline [m]:	720	387	190	50
Distribution pipe material:	Steel	Steel	Steel	Steel
Thermal insulation material:	PU	PU	PU	PU
Insulation thickness [mm]:	60	45	35	40
Protecting cover material:	HDPE	HDPE	HDPE	HDPE
Preinsulated?	Yes	Yes	Yes	Yes
Thermal conductivity [W/(m.K)]:	0,434	0,452	0,4122	0,3428
Dominant placement of pipeline:	In ground	In ground	In ground	In ground
Age of the network [years]:	4	4	4	4

Pressure drop in distribution loop: 150 kPa — Dependence on flow rate available? No

PART 5

Characteristics of heat consumers

- Number of users
- Total ordered heat power
- Annual heat consumption
- Average floor space
- Type of heating system with design supply and return temperature
- etc.
- Similar data are gathered for hot tap water too.

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User4GeoEnergy Project Number: 2018-1-0502

Database Dataset for particular project/locality **Part 5** **Locality ID.: SK 1**

Energy Users (Consumers)

Distribution loop no.: 1 Brief description of energy users:

Hospital with polyclinic areal is supplied by heat. Also other building on the way are connected (Retirement home, social housing, apartment house).

Number of users/end points:	8		Typical unitary heat demand:	N/A	W/m2
Total ordered heat input:	507,86	kW	Typical unitary heat consumption:	N/A	MWh/(m2.year)
Annual heat consumption:	2 691,7	MWh/y	Typical/average floor space:	N/A	m2
Price of heat (energy + distribution):	50,78	€/MWh			

Central air conditioning (cooling) system? No

Number of users/end points: Supply cooling water temperature: °C

Total ordered cooling input: kW Return cooling water temperature: °C

Annual cold consumption: MWh/y

Type of heating system:	Radiators	Floor heating	Ceiling heating	Fan coil
Approx. share in heat sales [%]:	100	0	0	0
Supply heating water temperature [°C]:	90			
Return heating water temperature [°C]:	70			
Share of users requiring retrofitting [%]:	0			

Suggested and possile retrofitting actions:	Share of users:		Estimated costs:	
Walls insulation:		%		€
Replacement of woodwork (windows, doors):		%		€
Increasing the area of radiators:		%		€
Insulation of roofs:		%		€
Insulation of floors on the ground floor:		%		€
Mechanical ventilation without recuperation:		%		€
Mechanical ventilation with recuperation:		%		€
Increasing the surface of radiators:		%		€

Actual Tin: °C Actual Tout: °C

Planned Tin: °C Planned Tout: °C

Other possible interference with the heating installations used: % €

Actual Tin: °C Actual Tout: °C

Planned Tin: °C Planned Tout: °C

Cascade connection of users: % €

Centralized hot tap water preparation? No

Number of users/end points: Hot tap water supply temperature: °C

Total ordered heat input for HTW: kW Hot tap water circulation temp.: °C

Annual heat for HTW consumption: MWh/y Cold water temperature: °C

Additional users/consumers planned to be connected? No

Number of planned new users: Type of control system: Quantitative only

Planned heat input/demand: kW Flow rate dependence: Out. temp. [°C] Flow rate [l/s]

Planned annual heat consumption: MWh/y

1	-15	
2	-7,5	
3	0	
4	10	
5	20	

Type of heating system:

Design temperature gradient: / °C

Cascade connection (on return pipe of the district heating)? No

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Planned hot tap water supply? Hot tap water supply temperature: °C

Planned heat input for HTW: kW Hot tap water circulation temp.: °C

Planned heat for HTW consumption: MWh/y Cold water temperature: °C

Distribution loop no.: 2 Brief description of energy users:

Apartment buildings in dwelling Sever (North), mostly prefabricated apartment houses, 8 above ground floors. Also new apartment building are connected and subsequently being built. Four other object are connected (kindergarten, elementary school, pension and retirement home Patria).

Number of users/end points:	1607		Typical unitary heat demand:	13,35	W/m2
Total ordered heat input:	1330,2	kW	Typical unitary heat consumption:	0,0708	MWh/(m2.year)
Annual heat consumption:	7 050	MWh/y	Typical/average floor space:	62	m2
Price of heat (energy + distribution):	50,78	€/MWh			

Central air conditioning (cooling) system? No

Number of users/end points: Supply cooling water temperature: °C

Total ordered coolin input: kW Return cooling water temperature: °C

Annual cold consumption: MWh/y

Type of heating system:	Radiators	Floor heating	Ceiling heating	Fan coil
Approx. share in heat sales [%]:	100			
Supply heating water temperature [°C]:	77			
Return cooling water temperature [°C]:	52			
Share of users requiring retrofitting [%]:	5			

Suggested and possile retrofitting actions:	Share of users:		Estimated costs:	
Walls insulation:	5	%	90 000	€
Replacement of woodwork (windows, doors):	5	%	480 000	€
Increasing the area of radiators:	0	%		€
Insulation of roofs:	5	%	25 000	€
Insulation of floors on the ground floor:	0	%		€
Mechanical ventilation without recuperation:	0	%		€
Mechanical ventilation with recuperation:	0	%		€
Increasing the surface of radiators:	0	%		€

Actual Tin: °C Actual Tout: °C

Planned Tin: °C Planned Tout: °C

Other possible interference with the heating installations used: % €

Actual Tin: °C Actual Tout: °C

Planned Tin: °C Planned Tout: °C

Cascade connection of users: 0 % €

Centralized hot tap water preparation? Yes

Number of users/end points: 1604 Hot tap water supply temperature: 47 - 53 °C

Total ordered heat input for HTW: 1026,5 kW Hot tap water circulation temp.: 36 - 47 °C

Annual heat for HTW consumption: 3 904 MWh/y Cold water temperature: 12 - 15 °C

Additional users/consumers planned to be connected? Yes

Number of planned new users: 120 Type of control system: Qualitative only

Planned heat input/demand: 120 kW Flow rate dependence: Out. temp. [°C] Flow rate [l/s]

Planned annual heat consumption: 320 MWh/y

1	-11	72
2	-5	64
3	0	57

Type of heating system:

Design temperature gradient: 72 / 52 °C

PART 6

General economic indicators

- Calorific values of burned heat carriers
- Emission factors
- Unit price of heat carriers
- Net unit costs of retrofitting actions
- Net costs of preinsulated pipelines
- Net cost of pipeline laying and assembling

Database Dataset for particular project/locality **Part 6 Locality ID.: PL 1**

General Information

Primary energy carriers information:

Primary energy carrier:	Lower calorific value		Upper calorific value		Unit price of energy carrier		
Natural gas	36,37	MJ/m3	40,46	MJ/m3	0,0258	€/kWh	net value, relate
Heating oil	42,6	MJ/kg	44,73	MJ/kg	718,81	€/m3	
Industrial gases	-	kWh/m3	-	kWh/m3	-	€/kWh	only if utilised
Biomass	17	MJ/kg	19	MJ/kg	248,79	€/t	
Electricity	-		-		0,095	€/kWh	net value

General emission factors:

Heat source	B(a)P	PM	PM10	PM2,5	CO2	CO	SOx
	[kg/GJ]	[kg/GJ]	[kg/GJ]	[kg/GJ]	[kg/GJ]	[kg/GJ]	[kg/GJ]
Natural gas	8E-10	5E-04	0,0005	5E-04	57,65	0,03	4E-04
Biomass	1E-05	0,09	0,086	0,081	101,1	0,4	0,025
Hard coal	1E-05	0,08	0,071	0,055	97,8	0,2	0,418
Heating oil	1E-07	0,002	0,002	0,002	72,48	0,03	0,08
Electricity	-	0,009	-	-	210,6	0,068	0,15

Net unit cost of retrofitting action:

Retrofitting action	Unit	Unit cost [€/unit]
Walls insulation	m2	28,89
Replacement of woodwork (windows, doors)	m2	37,36
Increasing the area of radiators	m2	19,78
Insulation of roofs	m2	22,22
Insulation of floors on the ground	m2	26,52
Mechanical ventilation without recuperation	m3/h	10,00
Mechanical ventilation with recuperation	m3/h	15,00
Increasing the surface of radiators	m2	23,07
Other possible interference with the heating installations used		
Cascade connection of users, share of users in cascade system		

Net cost of preinsulated pipelines:

Nominal diameter:	Cost of pipe [€/m]:	Cost of pipe laying and assembling [€/m]:	d [mm]
DN 50	59,80	73,27	50
DN 65	80,69	77,08	65
DN 80	101,58	81,90	80
DN 100	129,44	89,89	100
DN 125	164,26	102,37	125
DN 150	199,08	117,65	150
DN 200	268,73	156,56	200
DN 250	338,37	206,62	250
DN 300	408,02	267,83	300
DN 350	477,66	340,18	350
DN 400	547,31	423,68	400
DN 450	616,95	518,33	450
DN 500	686,60	624,13	500

ANNEX I

Data for typical meteorological year

- Data taken from Photovoltaic Geographical Information System
- Typical meteorological year for period 2007 - 2016)
- 8760 records (one value for each hour) during a year

Annex I - Typical Climatic Conditions **Locality ID.:** **SK 1**

Country: **Slovakia** **Town/city of:** **Galanta**

Latitude (decimal degrees): 48.191
Longitude (decimal degrees): 17.718
Elevation (m): 117.0

month	year
1	2013
2	2011
3	2007
4	2008
5	2008
6	2014
7	201
8	2008
9	2008
10	201
11	2009
12	2011

time(UTC)	T2m	RH	G(h)	Gb(n)	Gd(h)	IR(h)	WS10m	WD10m	SP
20130101:0000	0,8	84,55	0	0	0	267,33	3,66	156	100632
20130101:0100	0,48	82,27	0	0	0	259,17	3,94	158	100563
20130101:0200	0,17	80	0	0	0	251,01	4,22	159	100494
20130101:0300	-0,15	77,72	0	0	0	242,84	4,5	154	100442
20130101:0400	-0,47	75,44	0	0	0	234,68	4,78	150	100389
20130101:0500	-0,79	73,16	0	0	0	226,52	5,06	146	100337
20130101:0600	-1,11	70,88	0	0	0	218,36	5,34	144	100320
20130101:0700	-1,43	68,6	17	17,64	16	210,2	5,61	143	100304
20130101:0800	0,55	71,02	93	96,8	76	226,6	5,97	141	100287
20130101:0900	1,43	69,87	183	243,58	119	227,37	6,23	142	100228
20130101:1000	2,32	68,73	187	118,55	150	228,13	6,5	144	100169
20130101:1100	3,2	67,58	201	143,6	155	228,9	6,76	145	100110
20130101:1200	2,2	71,93	131	31,37	122	229,73	6,27	144	100153
20130101:1300	1,19	76,28	111	79,43	94	230,57	5,78	142	100195
20130101:1400	0,19	80,63	44	46,85	39	231,4	5,3	141	100238
20130101:1500	-0,54	82,8	0	0	0	232,22	5,09	136	100245
20130101:1600	-1,26	84,98	0	0	0	233,03	4,88	132	100251
20130101:1700	-1,99	87,15	0	0	0	233,85	4,68	127	100258
20130101:1800	-2,62	88	0	0	0	235,03	4,49	122	100261
20130101:1900	-3,24	88,84	0	0	0	236,22	4,31	118	100264
20130101:2000	-3,87	89,69	0	0	0	237,4	4,12	113	100268
20130101:2100	-4,26	90,08	0	0	0	237,87	3,8	112	100271
20130101:2200	-4,65	90,47	0	0	0	238,33	3,48	112	100274
20130101:2300	-5,04	90,86	0	0	0	238,8	3,16	112	100277
20130102:0000	-4,73	88,22	0	0	0	240,62	2,69	102	100366
20130102:0100	-4,42	85,58	0	0	0	242,43	2,23	93	100455
20130102:0200	-4,1	82,94	0	0	0	244,25	1,77	83	100544
20130102:0300	-3,94	82,43	0	0	0	243,05	1,7	87	100560
20130102:0400	-3,78	81,91	0	0	0	241,85	1,64	90	100577
20130102:0500	-3,61	81,4	0	0	0	240,65	1,57	93	100593
20130102:0600	-2,85	81,18	0	0	0	244,68	1,3	95	100665

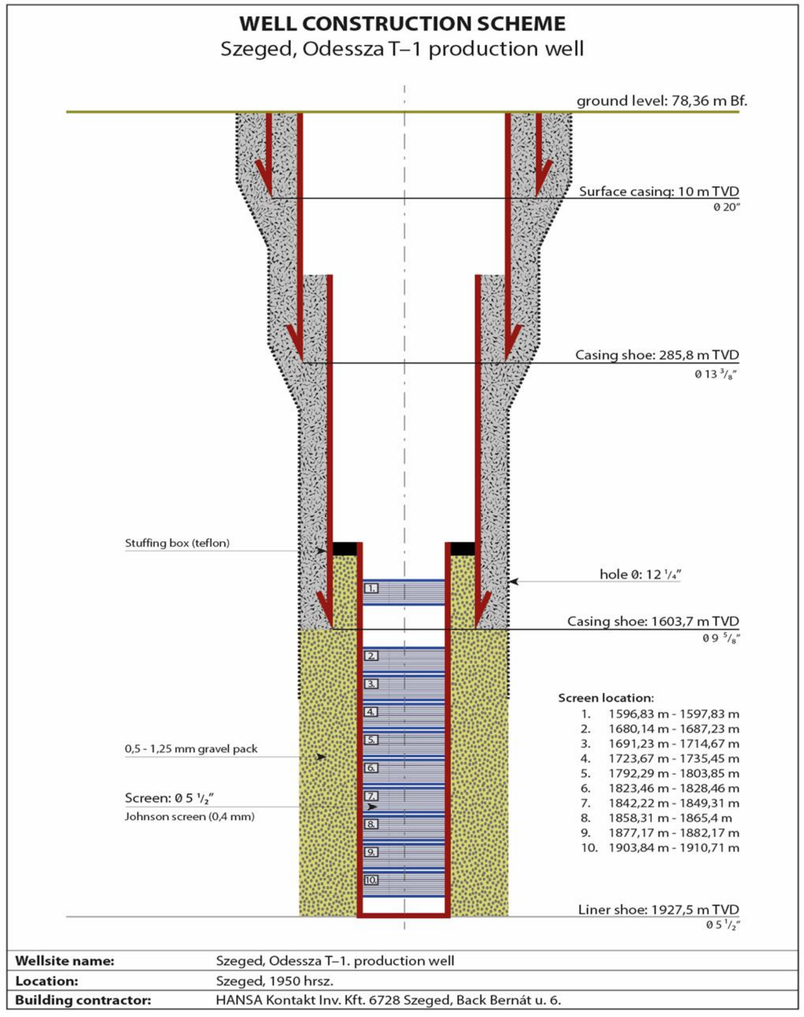
ANNEX II

Well construction schemes

Annex II - Well construction schemes **Locality ID.: HU 1**

Country: Hungary **Town/city of: Szeged**

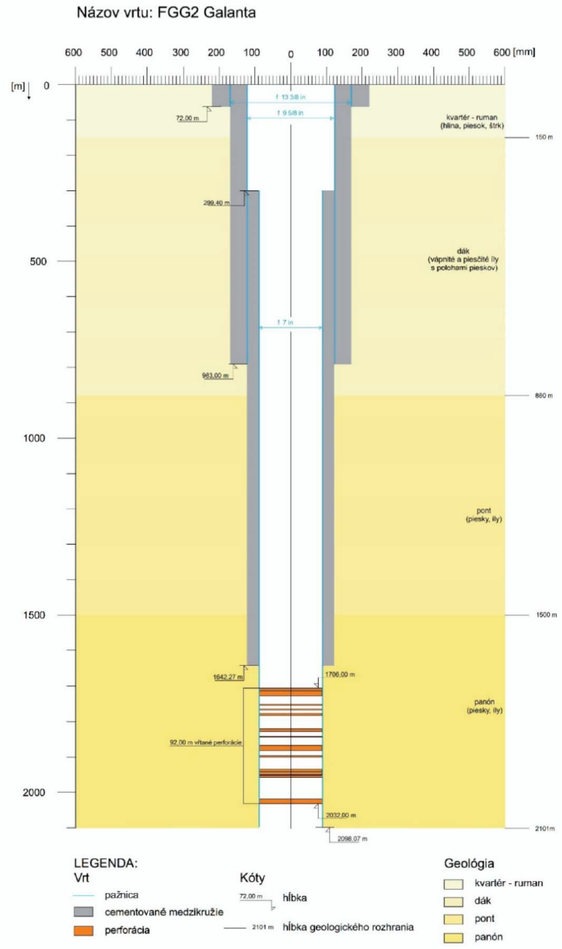
Production well 1 construction **Well name: Od-T1**



Annex II - Well construction schemes **Locality ID.: SK 1**

Country: Slovakia **Town/city of: Galanta**

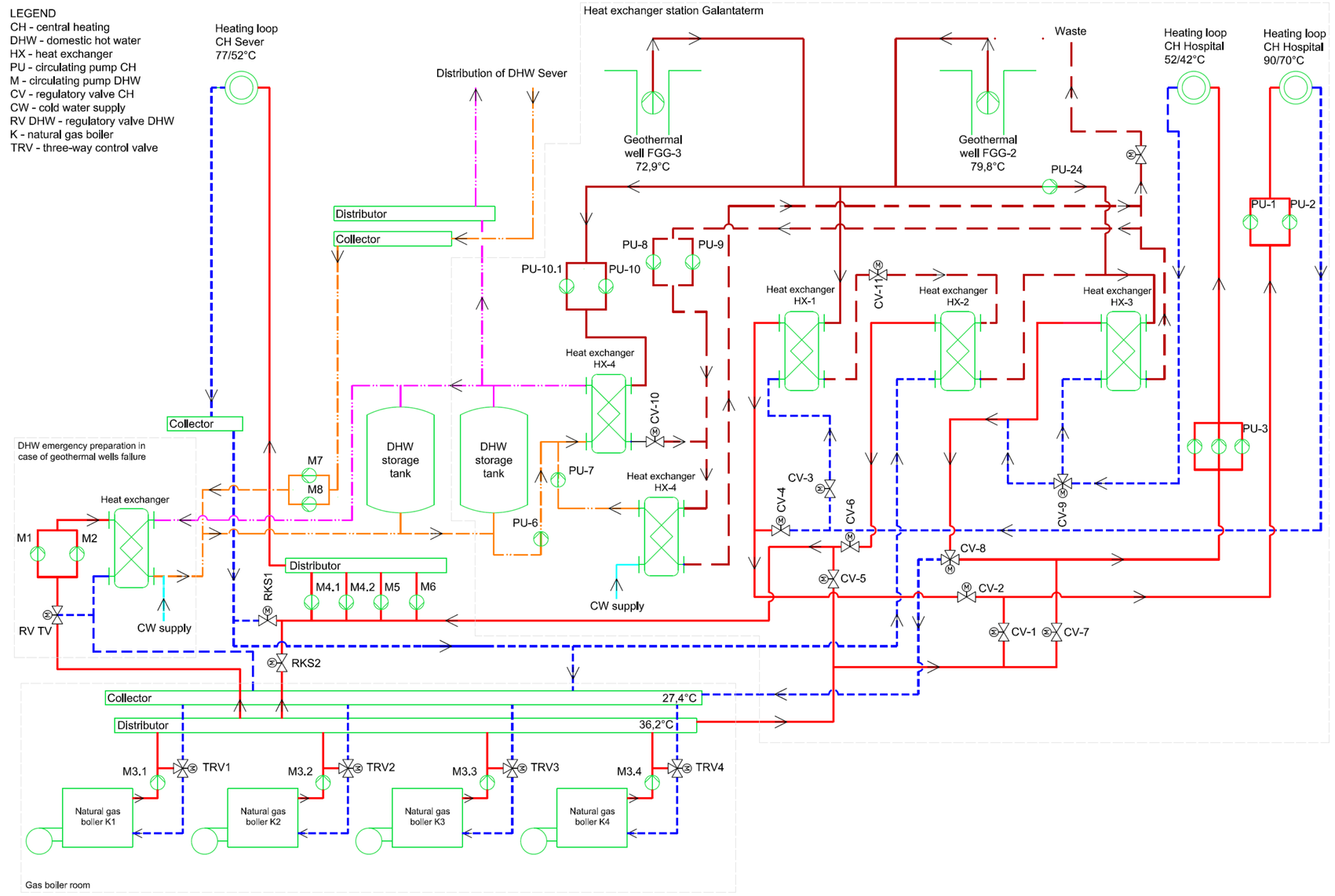
Production well 1 construction **Well name: FGG-2**



ANNEX III

Principal scheme of the heat source

Annex III: Principal Scheme of Heat Source Locality: Galanta Locality ID: SK 1



ANNEX IV

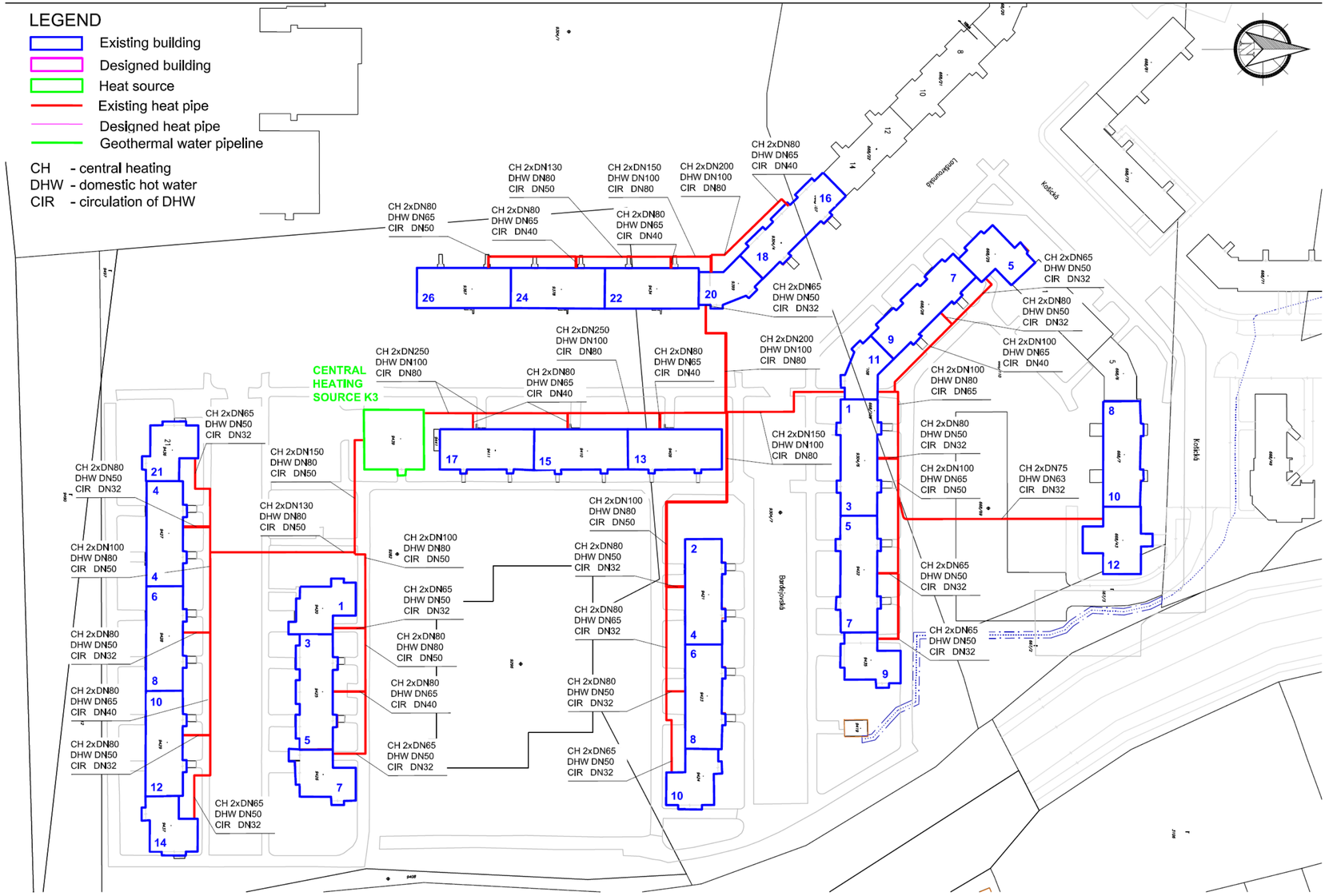
Data from the DH system operator control system (SCADA)

Column:	1	2	10				11	14		15		16		17	
Description:	Date/time	Outdoor air temperature	Temperature of heating water at output from boilers				Temperature of return heating water at input to boilers	Temperature of heating water at output from boiler room for each loop separately		Temperature of return water at entrace to boiler plat for each heating loop separately		Flow rate of heating water for each loop separately		Actual thermal output for each loop separately	
			K1	K2	K3	K4	K1,K2,K3,K4	UK1	UK2	UK1	UK2	UK1	UK2	UK1	UK2
Unit:		°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	m3/h	m3/h	kW	kW
	1.1.2020 1:06	1,8	71,8	56,3	56,3	65,7	52,6	49,7	49,6	42,6	42,9	88,8	36,9	745	281
	1.1.2020 1:18	1,8	72,8	56,3	56,3	65,7	53,2	49,7	49,5	42,6	42,9	88,8	36,1	729	276
	1.1.2020 1:29	1,6	72,8	56,3	56,3	65,5	53,3	49,7	49,6	42,6	43	88,6	36,7	719	278
	1.1.2020 1:40	1,6	72,2	56,3	56,3	65,5	53,5	49,7	49,6	42,6	43	88,1	37	718	269
	1.1.2020 1:51	1,2	73,1	55,8	55,8	64,8	52,4	50,6	50,5	42,9	43,3	90,5	34,7	796	308
	1.1.2020 2:02	1,2	72,8	55,8	55,8	64,8	52,9	50,6	50,5	42,9	43,2	89,8	36,7	796	308
	1.1.2020 2:13	1,3	72,9	55,8	55,7	64,8	53,3	50,7	50	43	43,3	88,3	34,7	788	267
	1.1.2020 2:25	1,5	72,3	55,8	55,7	64,8	49,9	50,7	50	43	43,3	90,5	33,7	788	286
	1.1.2020 2:36	1,3	74,5	55,3	55,3	64	54,5	50	50,5	43,4	43,7	87,6	36,3	695	246
	1.1.2020 2:47	1,3	74,2	55,3	55,3	64	53,5	50,5	50,1	43,4	43,7	88,1	35,3	726	262
	1.1.2020 2:58	1,2	72,2	55,2	55,2	63,9	53,5	51	50,4	43,4	43,7	88,8	34,6	771	246
	1.1.2020 3:09	1,2	75,3	55,2	55,2	63,9	47	50,3	50,1	43,3	43,6	90,2	36,4	774	246
	1.1.2020 3:20	0,8	72,2	54,8	54,7	63,1	54,3	51,1	51	43,5	43,8	87,4	33,3	690	285
	1.1.2020 3:31	0,8	72,2	54,8	54,7	63,1	53,5	51,1	50,9	43,5	43,8	88,8	33,3	766	271
	1.1.2020 3:43	0,8	71	54,7	54,7	63	53,6	50,7	50,6	43,5	43,9	88,8	35,4	733	274
	1.1.2020 3:54	0,8	64,1	54,5	54,4	63	52,3	50,1	50,6	43,5	43,9	89,3	32,3	700	224
	1.1.2020 4:05	0,3	77,4	78,3	74,6	62,3	57,5	52,3	52,1	43,8	44,1	81,6	36	866	334
	1.1.2020 4:16	0,3	77,4	77	74,6	62,3	57,2	51,6	51,6	43,7	44,1	87,4	35,6	835	304
	1.1.2020 4:27	0,3	77	75,3	74,9	62,2	57,3	51,9	51,6	43,8	44,2	87,1	36,3	810	310
	1.1.2020 4:38	0,3	77,5	76	75,6	62,2	54,9	52,3	52,4	43,8	44,2	85	34	839	315
	1.1.2020 4:50	0,4	71,3	71,8	73,6	61,6	60	51,1	50,9	44,3	44,6	88,3	36,6	700	253
	1.1.2020 5:01	0,4	76,9	73,1	73,6	61,6	59,9	51,3	51,3	44,3	44,6	88,3	36,6	710	283
	1.1.2020 5:12	0,4	77,3	72,8	73,4	61,6	60,6	51,5	51,7	44,3	44,7	87,4	35,6	717	284
	1.1.2020 5:23	0,4	77,7	72,6	73,4	61,6	61,6	51,2	51,8	44,4	44,7	88,6	34,1	687	288
	1.1.2020 5:34	0,3	76,4	73,5	72,3	61,3	60,5	51,8	51,1	44,3	44,5	86,4	35,7	748	261
	1.1.2020 5:45	0,3	76,7	72,9	72,3	61,3	60,5	51,8	51,5	44,3	44,6	87,4	35,7	748	281
	1.1.2020 5:57	0,3	76,9	73,7	72,2	61,3	61,7	51,9	51,1	44,4	44,7	88,8	33,8	754	248
	1.1.2020 6:08	0,4	76,2	73,7	72,2	61,3	62,1	51,9	51,1	44,4	44,8	89,3	33,7	771	248
	1.1.2020 6:19	0,2	78	72,7	71,2	60,9	60,6	51,2	51,8	44,3	44,5	84,7	35,4	688	294
	1.1.2020 6:30	0,2	76,9	72,7	71,2	60,9	61,1	51,7	51,8	44,3	44,5	87,8	35,1	741	294
	1.1.2020 6:41	0,3	76,8	72,5	71	60,9	60,8	51,8	51,4	44,3	44,4	87,4	34,1	745	271
	1.1.2020 6:52	0,3	76,3	72,3	71	60,9	61,6	51,4	51,3	44,4	44,4	86,2	34,1	705	271
	1.1.2020 7:04	-0,2	77,5	73,7	70	60,6	60	52,5	52,1	44,3	44,7	89,3	36	838	302
	1.1.2020 7:15	-0,2	77,5	73	70	60,6	60,6	52,5	52,1	44,3	44,7	89	35,3	838	301
	1.1.2020 7:26	-0,4	77,7	73,7	69,9	60,6	60,6	52,2	52	44,5	44,8	87,4	36	779	298
	1.1.2020 7:37	-0,3	77,7	74	69,9	60,6	60,6	52,2	52	44,5	44,8	89	34	777	301
	1.1.2020 7:48	-0,8	75,4	72,5	69	60,3	59,2	53	52,9	45	45,5	85,7	36,1	830	283
	1.1.2020 7:59	-0,6	76,7	72,5	69	60,3	59,2	52,8	52,7	45	45,5	87,4	36,1	794	298
	1.1.2020 8:10	-0,5	76,9	74	68,9	60,3	59,6	53	52,8	45	45,5	85,4	34,7	792	291
	1.1.2020 8:22	0	77,3	74	68,9	60,3	61,1	52,2	53	45	45,6	87,6	34,7	792	291
	1.1.2020 8:33	-0,8	76,7	72,1	68	59,9	59,3	53	52,1	45,3	45,4	85,2	33,7	680	254
	1.1.2020 8:44	-0,6	76,8	72,1	68	59,9	59,3	53	52,5	45,2	45,4	85,4	33,7	770	277
	1.1.2020 8:55	-0,3	77	72,6	67,9	59,8	58,8	53	52,3	45,1	45,2	86,6	33,3	784	270
	1.1.2020 9:06	-0,3	76,5	72,6	67,9	59,8	58,8	53	52,5	45,3	45,2	86,6	33,4	784	273
	1.1.2020 9:17	1,3	77,5	73,8	67,1	59,5	61,1	50,6	50,6	45	45,7	84,7	32	559	184
	1.1.2020 9:29	1,3	77,3	73,8	67,1	59,5	61,1	50,8	51	45	45,5	84,7	32,5	559	205
	1.1.2020 9:40	1,3	76,2	74,4	67	59,4	61,8	50,3	50,4	44,9	45,4	84,5	31,8	526	182

ANNEX V

Distribution network situation plan

Annex V b: Distribution Network Situation Plan | Locality: Kežmarok | Scale 1:1000 | Project ID: SK 5



CONCLUSIONS

- The WP4 database is probably the most detailed collection of data on the district heating systems in these countries ever created.

- This database is the base input to all activities in WP5.

- The database is being updated (mainly in relation to significant energy carriers price).

Iceland Liechtenstein Norway grants

Norway grants

Thank you!

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