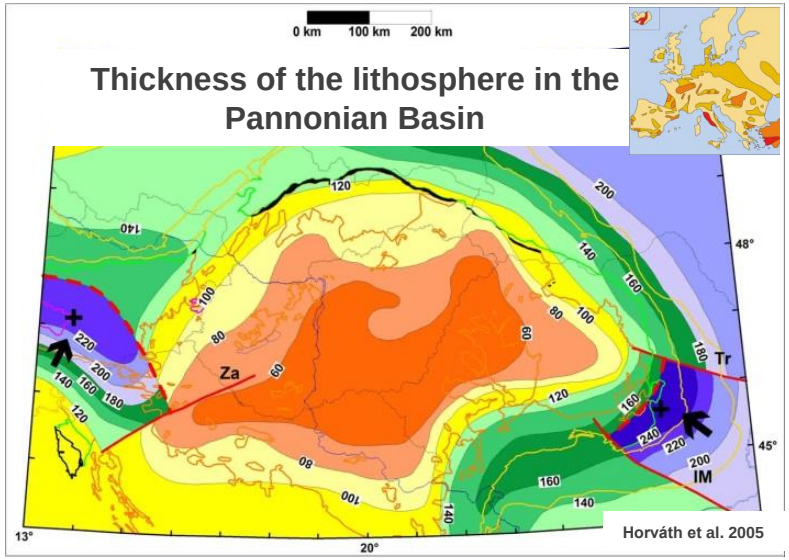
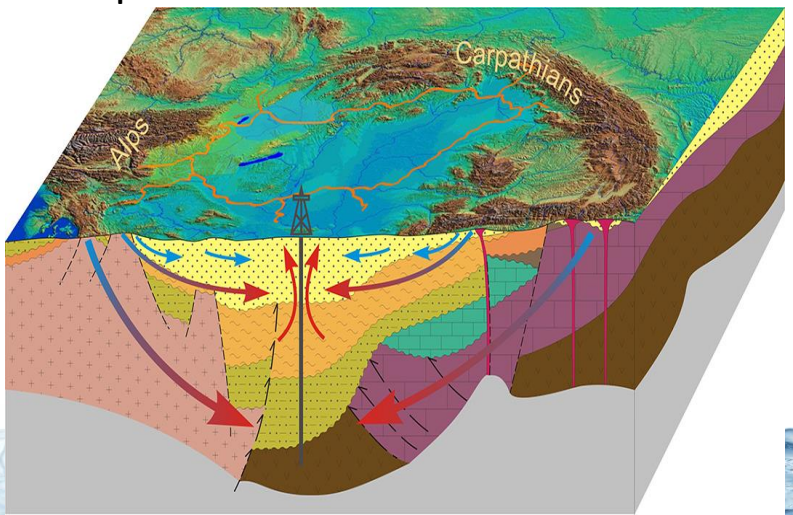
DARLING-E - TRANSNATIONAL PROJECT FOR SUSTAINABLE USAGE OF SHARED THERMAL WATER RESOURCES

DARLINGe- Transboundary geothermal project in the Pannonian BASIN



Pannonian Basin is one of the largest hot sedimentary basin in Europe



Danube Region Leading Geothermal Energy

DARLINGe project
Danube Region Leading Geothermal Energy

Project objective:

Danube Region Leading Geothermal Energy

To contribute to energy security and energy efficiency in the Danube Region by enhancing the efficient use of deep and still untapped geothermal resources in the S-ern part of the Pannonian Basin

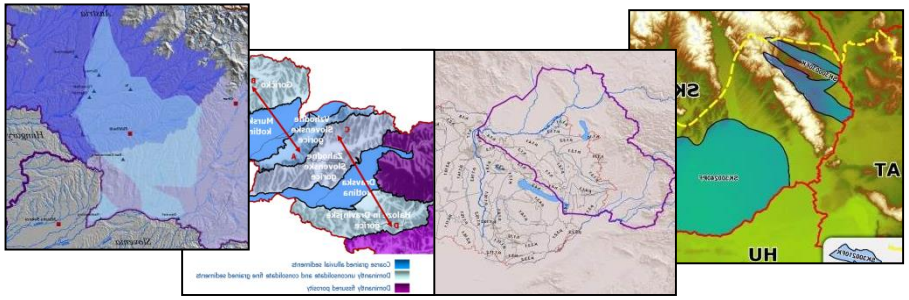
utilization of geothermal energy ≈ thermal groundwater / fluid abstraction

Governance of transboundary aquifers and resources is needed !

Project area: 95 000 km² (HU, SLO, HR, BH, SRB, RO)
15 partners

Integrated resource management of hydro-geothermal systems — two main policy aspects

- **Water policy (2000/60/EC)**



- Groundwater within aquifer and groundwater body

Environmental objectives:

- Constant level / no intrusions protection of thermal water

- Energy policy (2009/28/EC)

- Geothermal energy stored beneath the surface

Energy objectives:

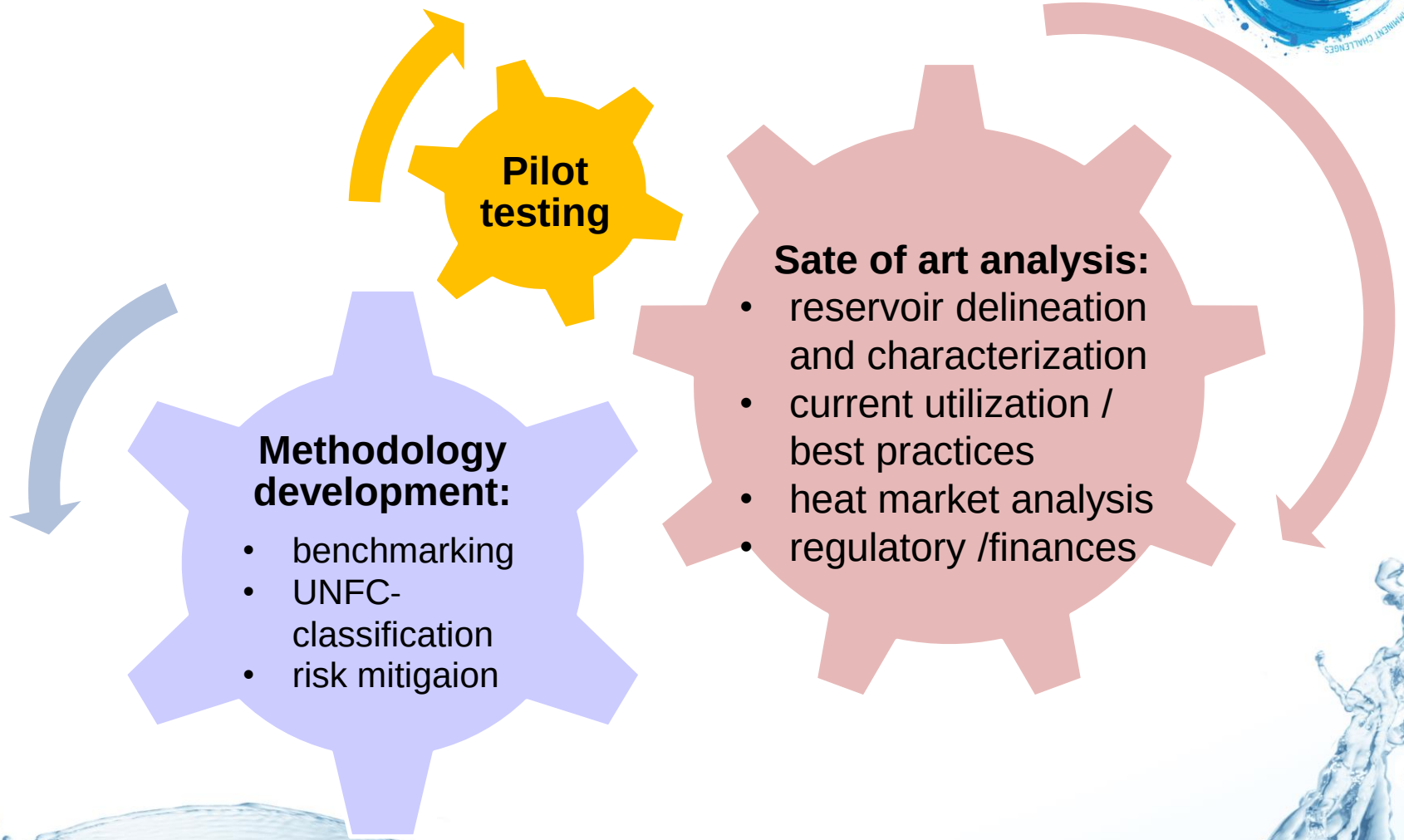
- Significant specific increments increased utilization of thermal water

DARLINGe concept

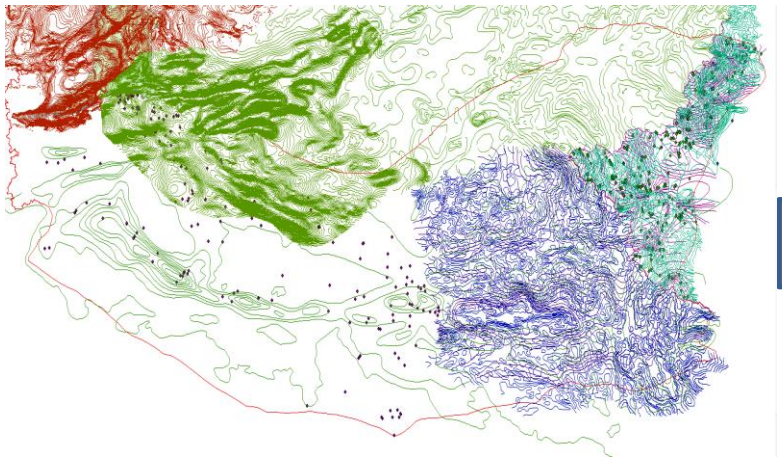
Danube Region Geothermal Strategy and Action Plans

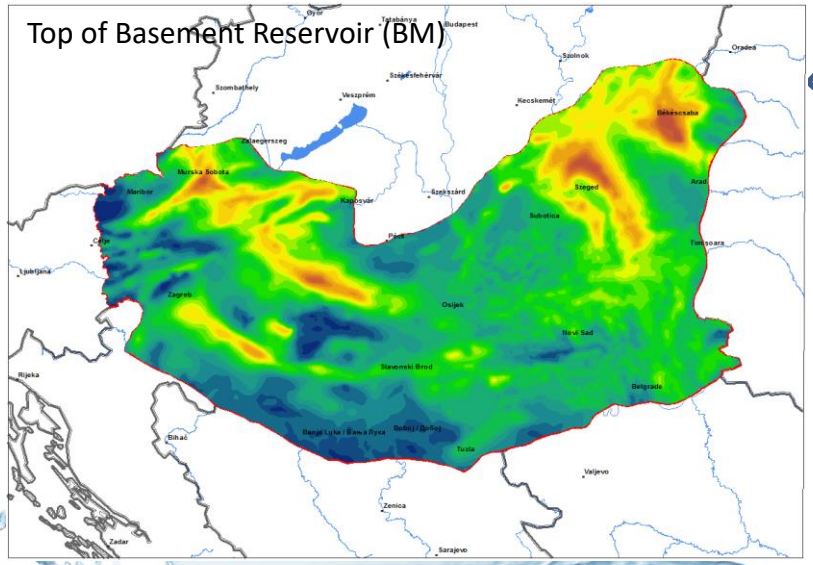
Danune Region Geothermal Information Platform (DRGIP) – interactive web-portal

Implementation of the project



Harmonization of existing data





Objects

boreholes

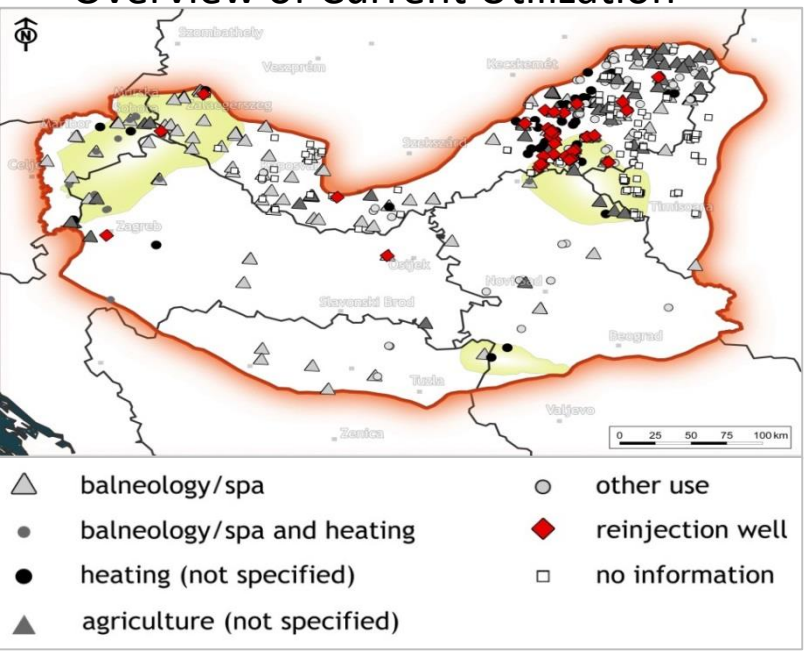
wells

springs

Parameter groups	Parameters - content
General	• borehole identification, localization, purpose, ownership, etc.
Utilization	• thermal power, thermal groundwater usage/monitoring, waste water data, etc.
Technical	• borehole dimensions and construction, drilled profile, casings, screened intervals, geophysical surveys (inclination and dip), etc.
Geology	• lithology and stratigraphy (age) of rocks, facies, formations, fault traces
Hydrogeological	• hydraulic tests, hydraulic parameters, aquifer hydraulic properties, groundwater level monitoring, etc.
Geothermal	• thermal properties of rock and fluid, temperature profiles and monitoring, thermal gradients, etc.
Geophysics	•geophysical borehole logs
Basic chemistry	•Water analyses or monitoring of respective macrocomponents (Ca, Na, Cl, ...)
Trace elements	•water analyses or monitoring of respective microcomponents (Se, B, I, ...)
Isotops and noble gases	•water/gas analyses or monitoring of respective Isotopes (^{14}C, δ^{18}...) and Noble gases (He, Ne, Ar, ...)
Organic compound	•water analyses or monitoring of respective components (PAH, VOC, AOX, ...)

State of the art analysis

Overview of Current Utilization



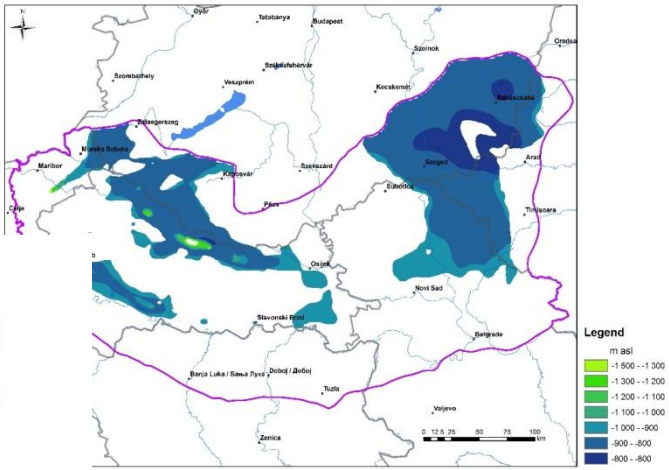
Best Practices

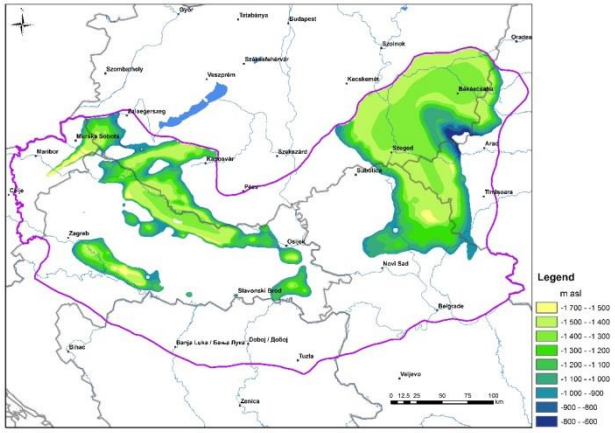
Financial Support Study

Heat Market Analysis

Legislation Overview

Outlining of geothermal reservoirs (as 3D bodies) and resource assessment

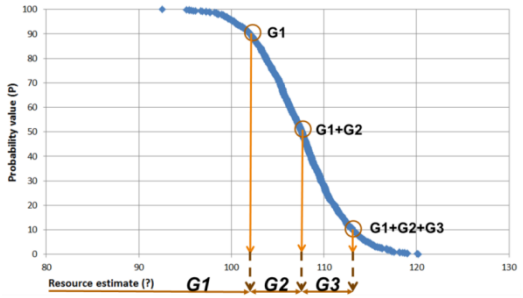




G1: Quantities associated with a high level of confidenece (low estimate – P90)

G2: Quantities associated with a moderate level of confidenece (best estimate – P50)

G3: Quantities associated with a low level of confidenece (high estimate – P10)



	Input parameters					Calculated parameters			
	A	B	C	D	E	F	G	H	I
	Reservoir area (km^2)	Reservoir thickness (km)	Porosity (V/V)	Reservoir temp. (˚C)	Recovery factor	**Total volume (km^3)**	**Pore volume (km^3)**	**Porosity heat content (PJ)**	**Recove-rable heat (PJ)**
Calculation formula						A*B	C*F	4.187*G*(D-30)	**(H*E)**
MIN									
MAX									

Applying new methods – Benchmark (independent indicators)

What is local weakness (bad) and what is strength (good)?

Very bad	Bad	Medium	Good	Very good

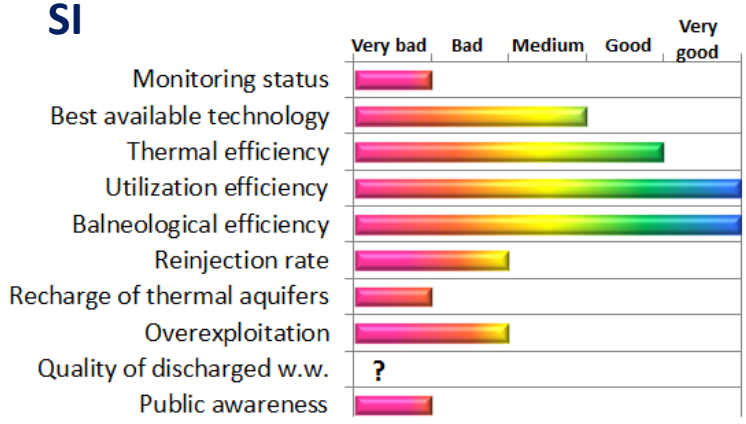
I_{MON}	Monitoring	
	Descriptive	Points [%]
> 8	Very good	Cont meas. Yearly report Reg. meas. Temp. sampl.
6 - 8	Good	
4 - 6	Medium	
2 - 4	Bad	
< 2	Very bad	

TE [%]	Thermal efficiency	
	Descriptive	Points [%]
> 70	Very good	Used/available annual heat energy Reinj. 100%
60 - 70	Good	
40 - 60	Medium	
30 - 40	Bad	
< 30	Very bad	

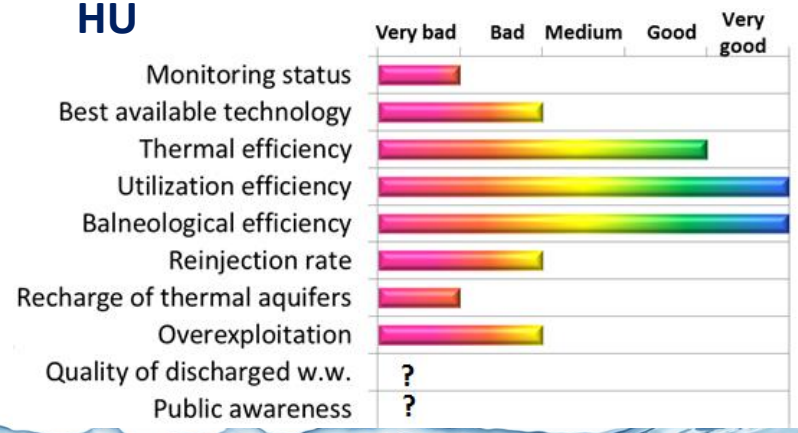
$\bar{I}_{OE}$	Overexploitation	
	Descriptive	Points [%]
0	Very good	Decrease Piezo. Level W. qual./T Gr.w. avail. Ecosys.; Subs
1	Good	
2	Medium	
3	Bad	
> 3	Very bad	

Comparison in the Mura – Zala Sub-basin

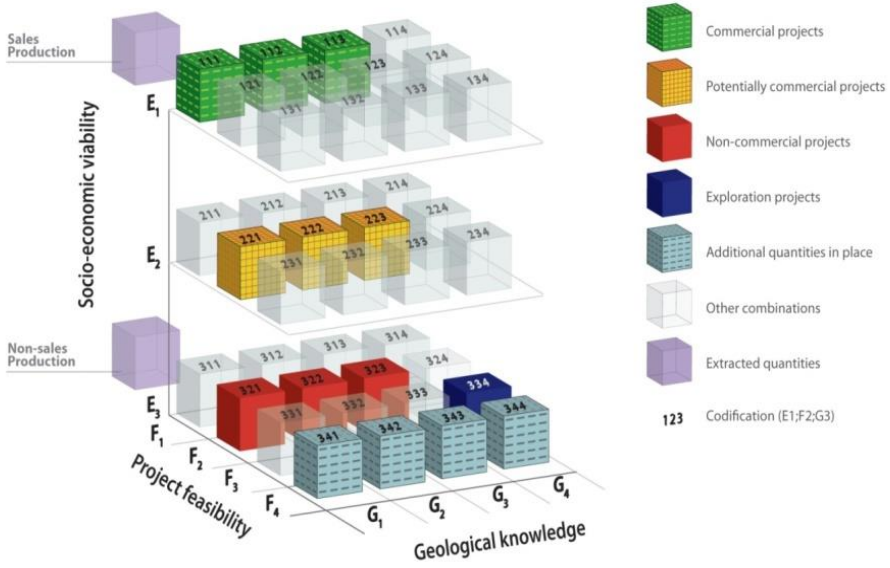
SI



HU

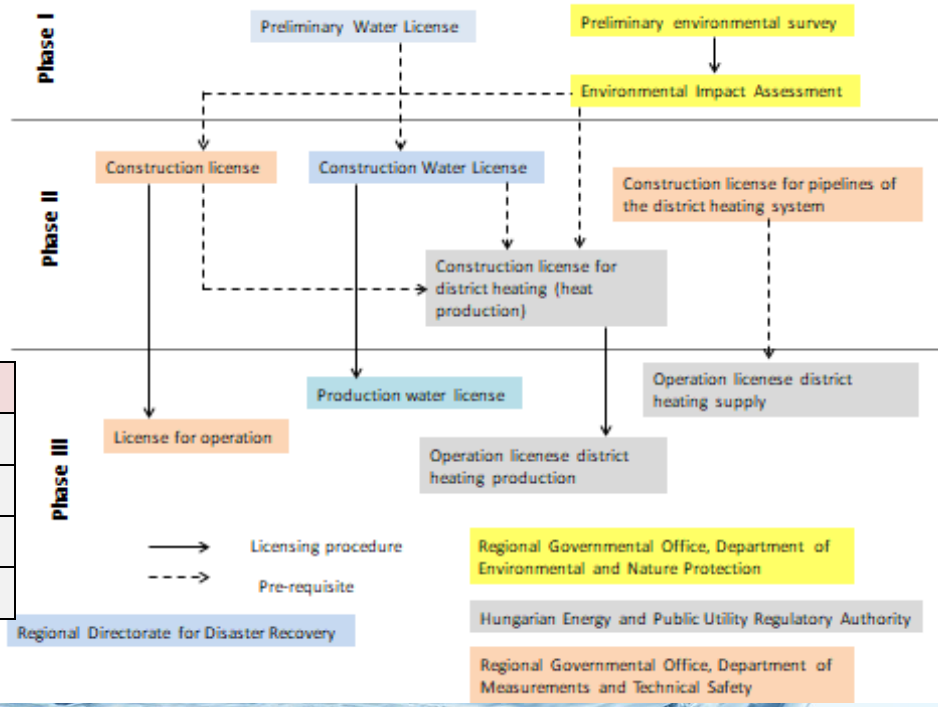


Applying new methods – UNFC categorization

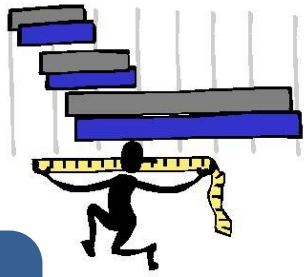


Inputs for E and F categories: comprehensive assessment of „non-technical aspects" (e.g. legislation charts, heat sector analyses, *etc.)*

Region	Heating Energy Consumption	Surface	Inhabitants	Consumption per km²	Consumption per capita
Pomurje	1,246,880,285 kWh	1,337 km²	116,078	932,596 kWh/km²	10.741 MWh
Podravje	1,549,821,553 kWh	2,168 km²	322,513	714,862 kWh/km²	4.805 MWh
Posavje (partly)	494,954,758 kWh	644 km²	53,980	768,563 kWh/km²	9.169 MWh
Savinja (partly)	654,710,491 kWh	756 km²	70,736	866,019 kWh/km²	9.255 MWh



Danube Region Geothermal Strategy and Action Plans



Baseline / SWOT

Ambition setting

Dreams for the future

Vision

Scenarios beyond BAU

Roadmapping

Define priority areas and possible routes to reach the vision

Action Plans

Preliminary results

- Identification, ranking and characterization of potential geothermal reservoirs
- Summary report on the current status of thermal water uses
- Summary report on the evaluation case studies
- Summary Report on Heat Sector Analysis
- Report on financial support mechanisms
- Summary report on the evaluation of national regulatory frameworks
- Manual on the use of the transnational tool-box

Thank you for your attention!

LEA Pomurje
Lokalna energetska agencija za Pomurje
Local Energy Agency Pomurje

MBFSZ

InnoGeo

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