



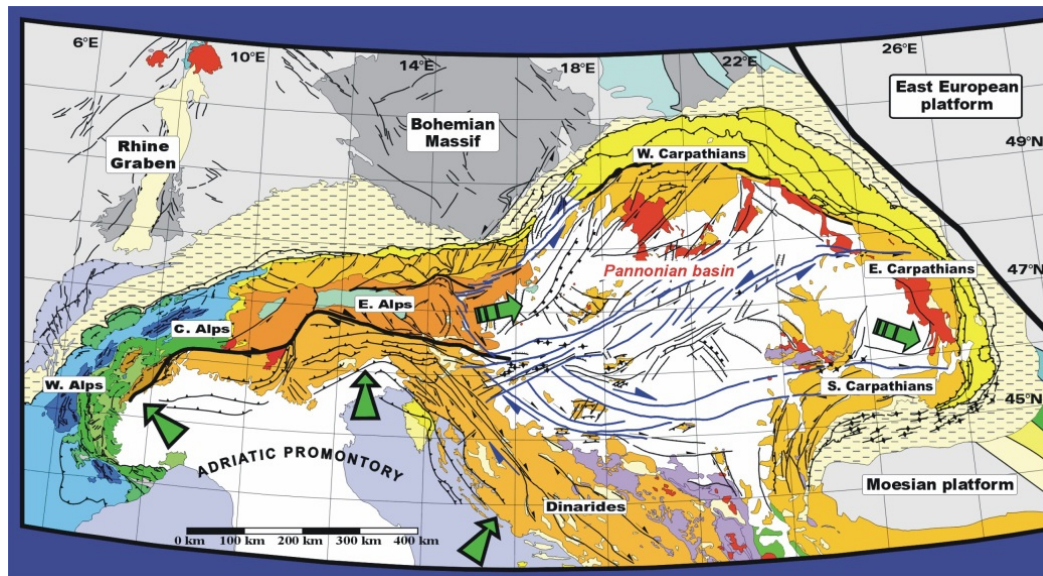
Towards a more efficient and sustainable use of deep geothermal energy resources in the S-ern part of the Pannonian Basin, Central Europe – the DARINGe project perspective

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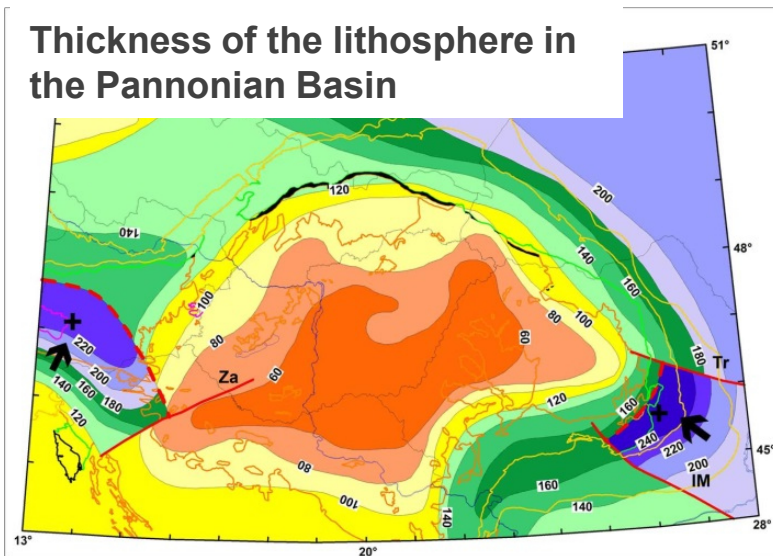
IAH 44th Congress, 25-29 September, 2017, Dubrovnik, Croatia

Geothermal conditions of the Pannonian Basin

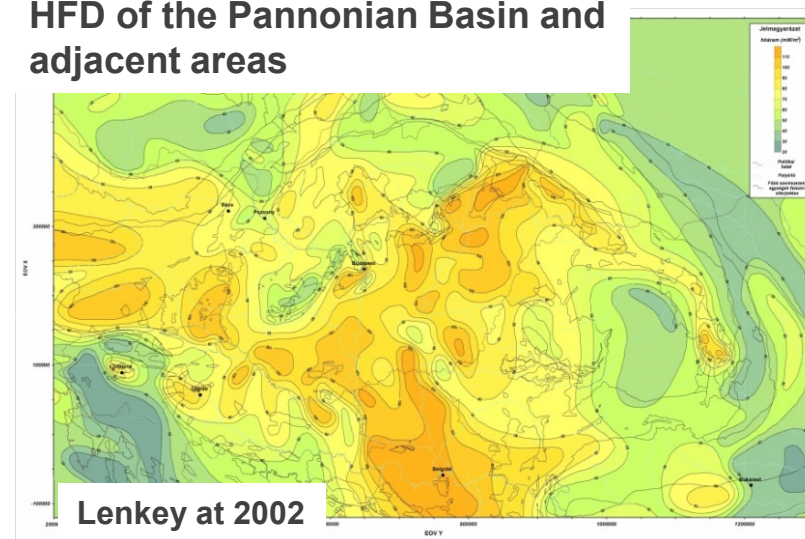


Bada et al. 2002

Thickness of the lithosphere in the Pannonian Basin



HFD of the Pannonian Basin and adjacent areas



Lenkey at 2002

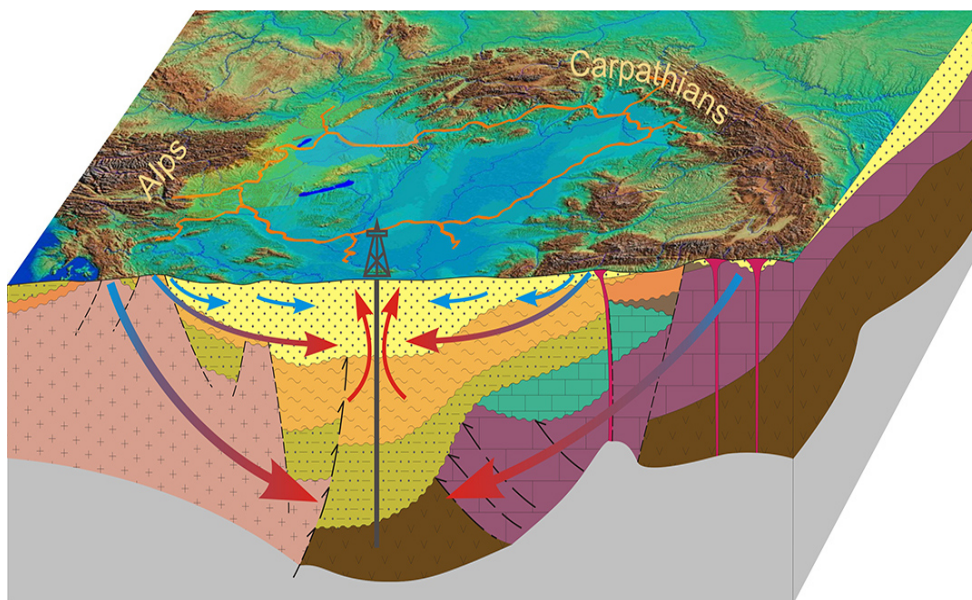
Pannoninan Basin: Hot sedimentary aquifer – the „water perspective”



ed Groundwater Bodies in the DRBD
tance

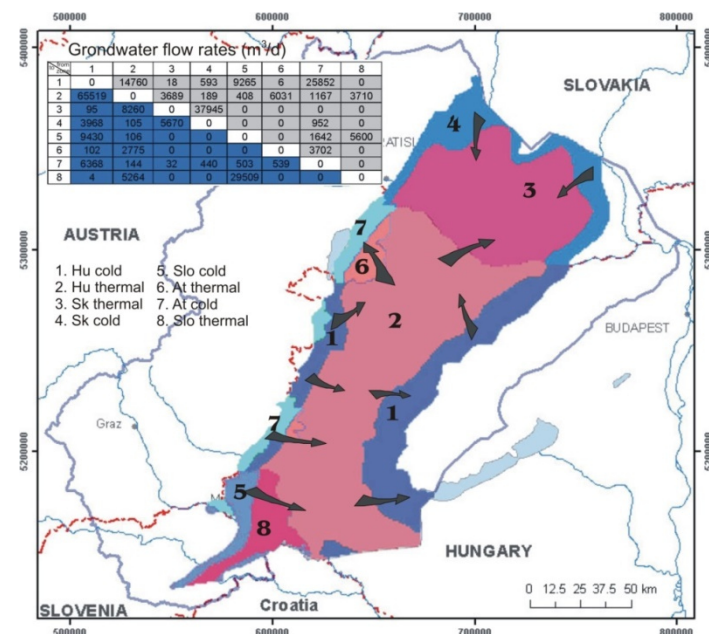
MAP 4

Working map
status on 21 April 2009



**utilization of geothermal energy
≈ thermal groundwater / fluid abstraction**

**Governance of transboundary aquifers
and resources is needed !**



Water policy (2000/60/EC)

Groundwater within aquifer and groundwater body

Environmental objectives:

Good quality and quantity

status: protection of (thermal) (ground)water

RBMPs: GWB delineation, status assessment , monitoring

2009 – 2015 – 2021 – 2017

Energy policy (2009/28/EC)

RES / Geothermal energy: energy stored beneath the surface

Energy objectives:

Increased utilization of RES/ geothermal energy

NREAPs: Compulsory targets to be reached, programmes of actions and incentives (regulatory, financial)

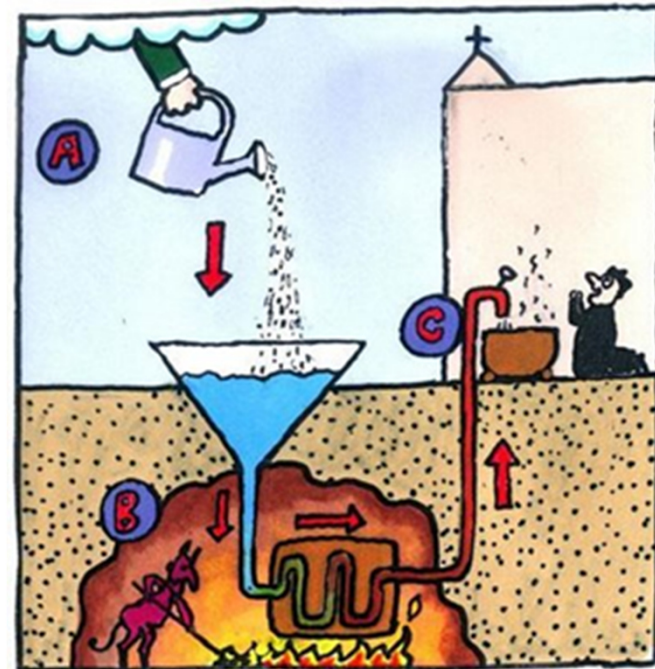
2010 – 2020 – 2030

Is it possible to match „energy” and „environmental” goals ?

Can the abstraction of thermal water be increased without threatening the quality and quantity status of the geothermal aquifers?

If yes, what are the boundary conditions / levels for sustainable production?

What are the „best practices” to increase utilization of geothermal energy without increasing water abstraction? (re injection, cascade use, increasing energy/thermal efficiency, etc.)



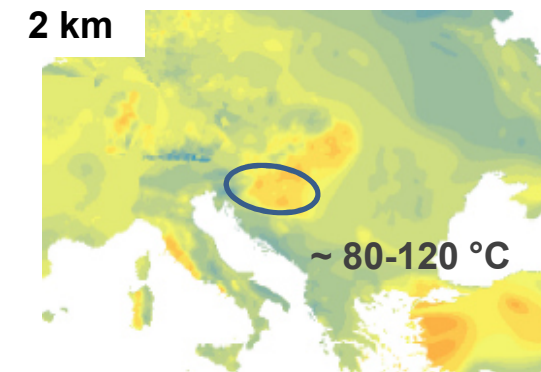
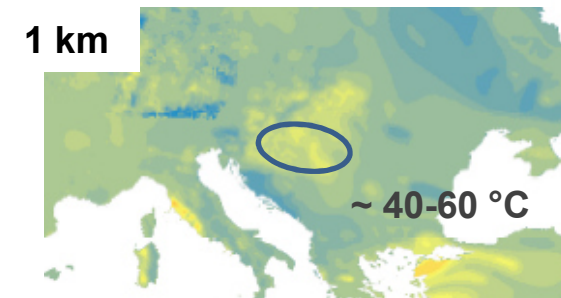
DARLINGe (Danube Region Leading Geothermal Energy) – S-ern part of the Pannonian Basin

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



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 heating sector

Subsurface temperature.



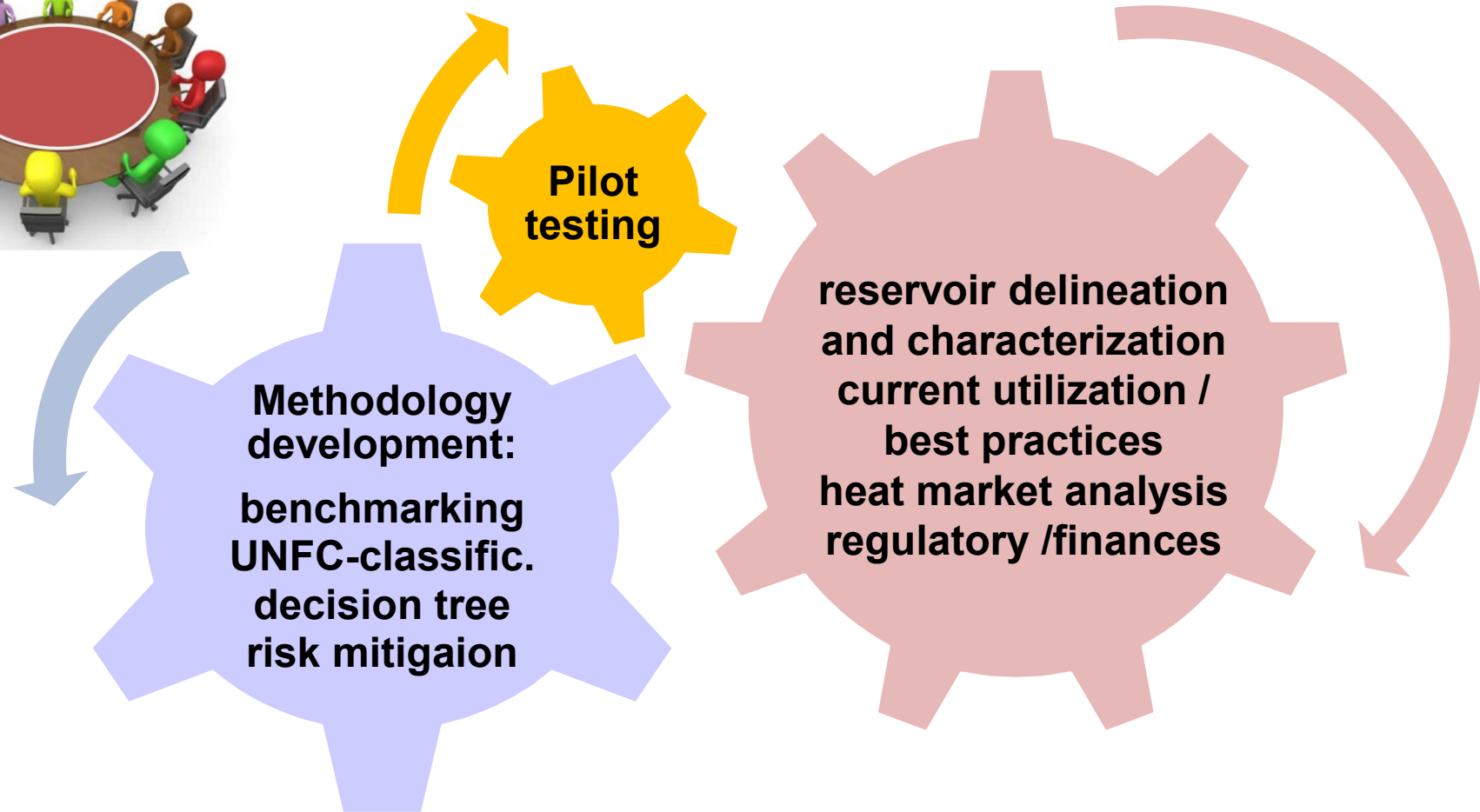
Although some deeper, higher temperature systems suitable for CHP are known, **the low-hanging fruit is direct use**

Utilization of geothermal energy in the DARINGe countries

	Geothermal DH plants		Geothermal heat in agriculture and industry		Geothermal heat in balneology		Geothermal heat for individual buildings and other	
	Capacity (MW _{th})	Production (GWh _{th} /yr)	Capacity (MW _{th})	Production (GWh _{th} /yr)	Capacity (MW _{th})	Production (GWh _{th} /yr)	Capacity (MW _{th})	Production (GWh _{th} /yr)
BH					12,5	29,3	10,4	53,3
HR	45,8	83,5			22,2	47,8		
HU	157,2	353,7	325,6	732,6	241,6	724,8	28,0	63,0
RO	158,0	300,0	8,0	50,0	10,0	12,0		
SRB	45,9	161,0	11,6	62,4	36,7	186,3	16,8	78,0
SLO	3,6	6,1	14,4	34,5	17,9	34,5	29,8	61,9

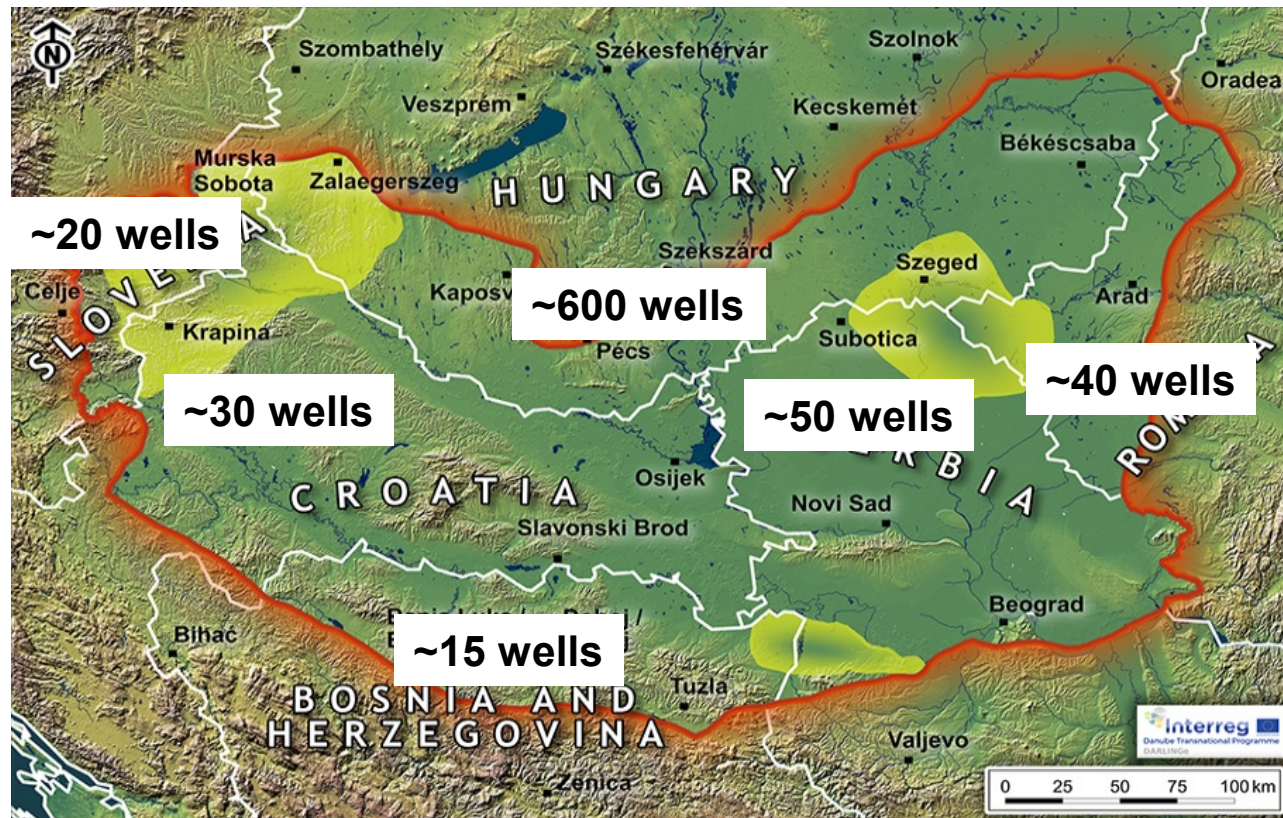
- GeoDH is significant in HU, RO, also in SRB and HR
- Geothermal in agriculture is outstanding in HU, to less extent in RO, SRB, SLO
- Balneology important in all countries
- Individual space heating is subordinate

DARLINGe concept



Danube Region Geothermal Strategy and Action Plans

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

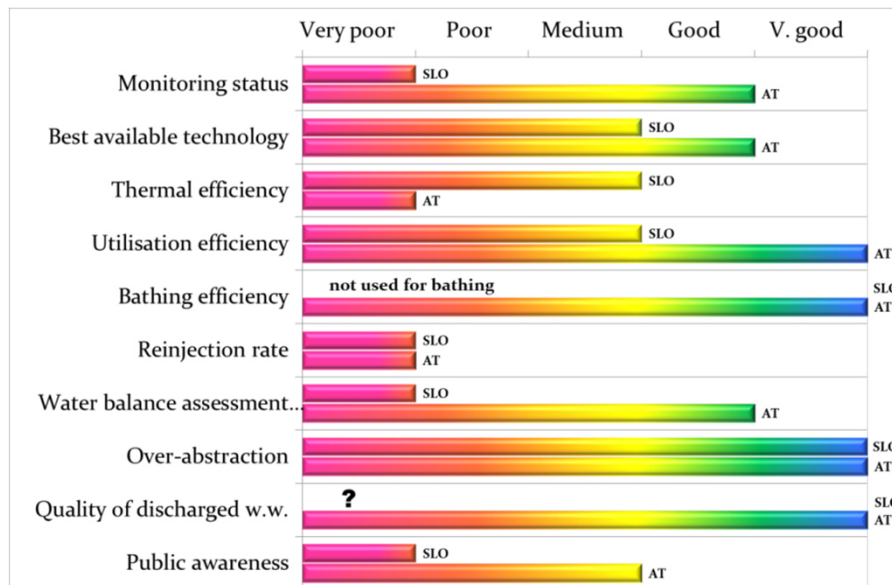


Compilation of a comprehensive database:

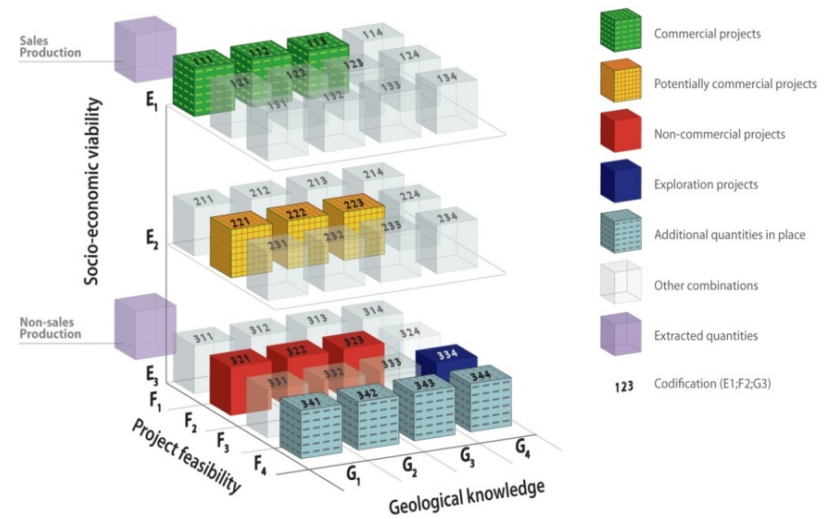
- basic well data,
- utilization data (type of utilization, users),
- hydrogeological and hydrogeochemical data,
- geothermal data,
- production data,
- monitoring data (observation wells, production wells, discharged water)

Novel methods

Benchmark (independent indicators)

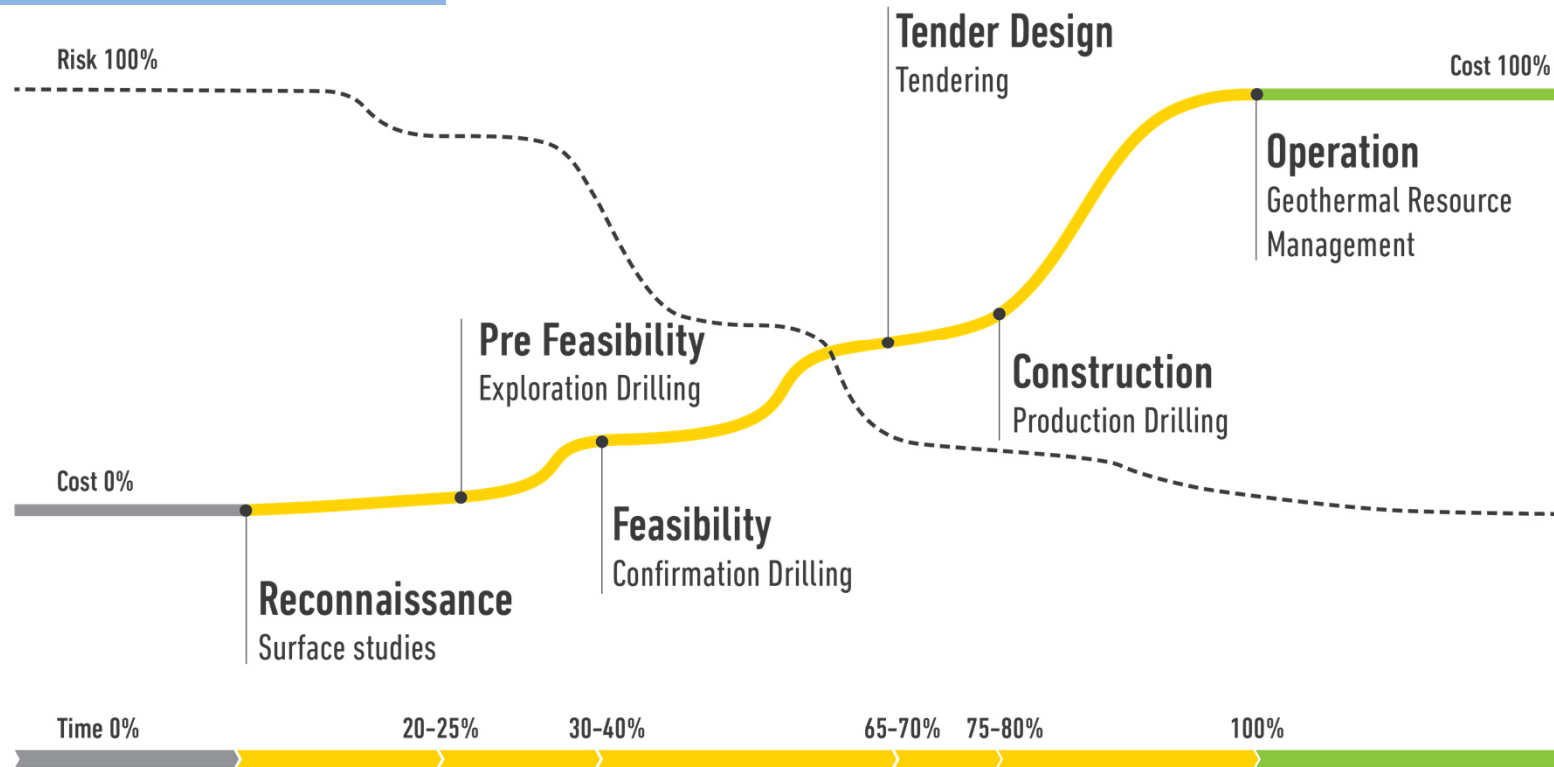


Application of the UNFC-2009 classification (testing of the geothermal specifications elaborated in 2016)



Novel methods

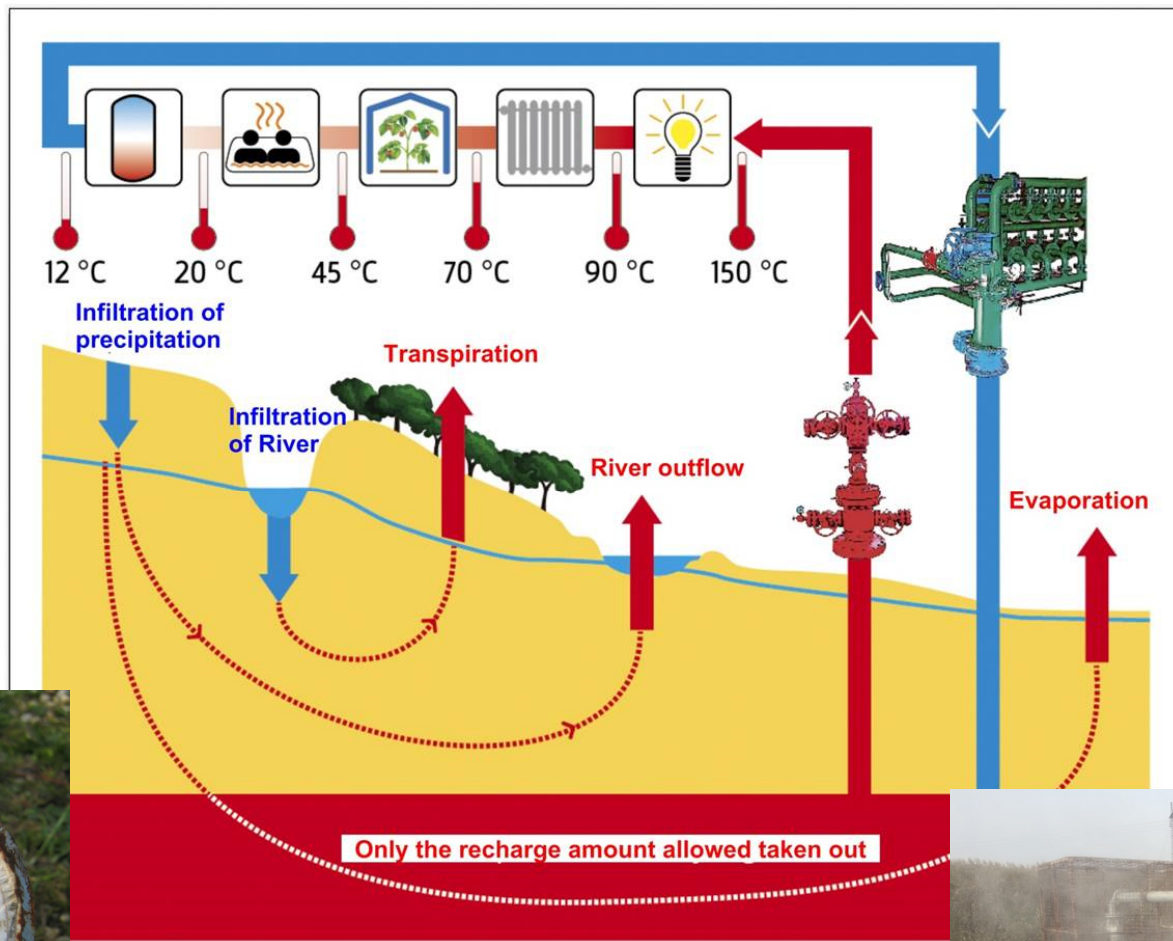
Geological risk mitigation



Source: Geoelec project

Increased geological knowledge – more confident estimation of reservoir parameters (temperature, flow-rate) – to be known only after the first successful drilling

Towards an efficient and sustainable utilization



Thank you for your attention!



BOSNIA AND HERZEGOVINA
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Federal Institute for Geology
Sarajevo

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