



**VULCAN ENERGY  
ENGINEERING**

# **GEOHERMAL ENERGY PROJECTS IN GERMANY**

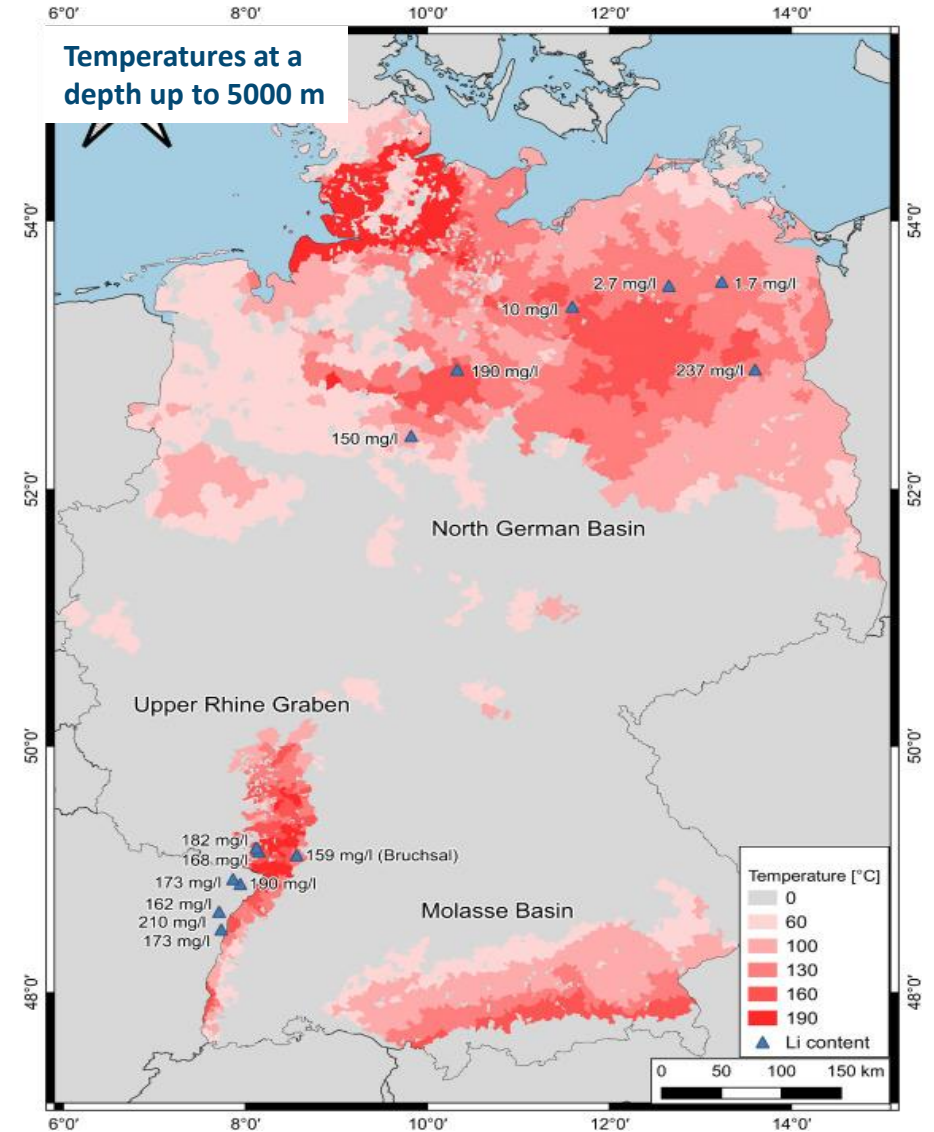
December 12, 2023 | Ferid Seyidov  
Vulcan Energy Engineering GmbH

# POTENTIAL

## Geothermal energy Germany

- Hydrothermal deep geothermal energy has the potential to cover up to 25% of Germany's heat needs (over 300 TWh/a)
  - Depending on the study between 25 – 54%
- Plannable delivery of electricity, heat and cold
- Geothermal energy is increasingly becoming the focus of companies, especially as a heat source
- Lithium production as a further pillar of deep geothermal energy

## Potential of geothermal energy in Germany



**Image Source:** Low-carbon lithium extraction makes deep geothermal plants cost-competitive in future energy systems

# STATUS AND ACTIVITIES

## Focus on Molasse and Upper Rhine Graben

### Little expansion in the period from 2021-2023

- Kirchweidach, larger ORC system completed
- Taufkirchen will be equipped with a new ORC system

### Drilling activities for power projects

- Graben-Neudorf (URG)
- Insheim (beginning of Q2/Q3 2023) (URG)

All relevant license areas in the URG for electricity production have been allocated - a similar situation to the 2010s

Projekt	Region	Leistung elektrisch	Leistung thermisch	Maximale Temperatur	Teufe	Inbetriebnahme
Bruchsal	ORG	0,5 MW	-	131°C	2.450m	2009
Insheim	ORG	4,8 MW	k.A.	165°C	3.600m	2012
Landau	ORG	1,8 MW	5 MW	159°C	3.291m	2014
Grünwald	Bay. Mol.	4,3 MW	40 MW	135°C	3.755m	2011/2014
Taufkirchen**	Bay. Mol.	4,3 MW	40 MW	136°C	3.696m	2014
Sauerlach	Bay. Mol.	5 MW	4 MW	141°C	4.480m	2014
Dürrnhaar	Bay. Mol.	5,5 MW	-	141°C	3.241m	2013
Kirchstockach	Bay. Mol.	5,5 MW	-	141°C	3.649m	2013/2021
Kirchweidach*	Bay. Mol.	0,68 MW	30,6 MW	127°C	3.500m	2013
Holzkirchen*	Bay. Mol.	3,6 MW	24 MW	157°C	5.078m	2018/2019
Garching (I+II)	Bay. Mol.	3,5 MW	6,2 MW	125°C	3.837m	2021
Traunreut	Bay. Mol.	5,5 MW	12 MW	120°C	4.560m	2014/2016

# OUTLOOK

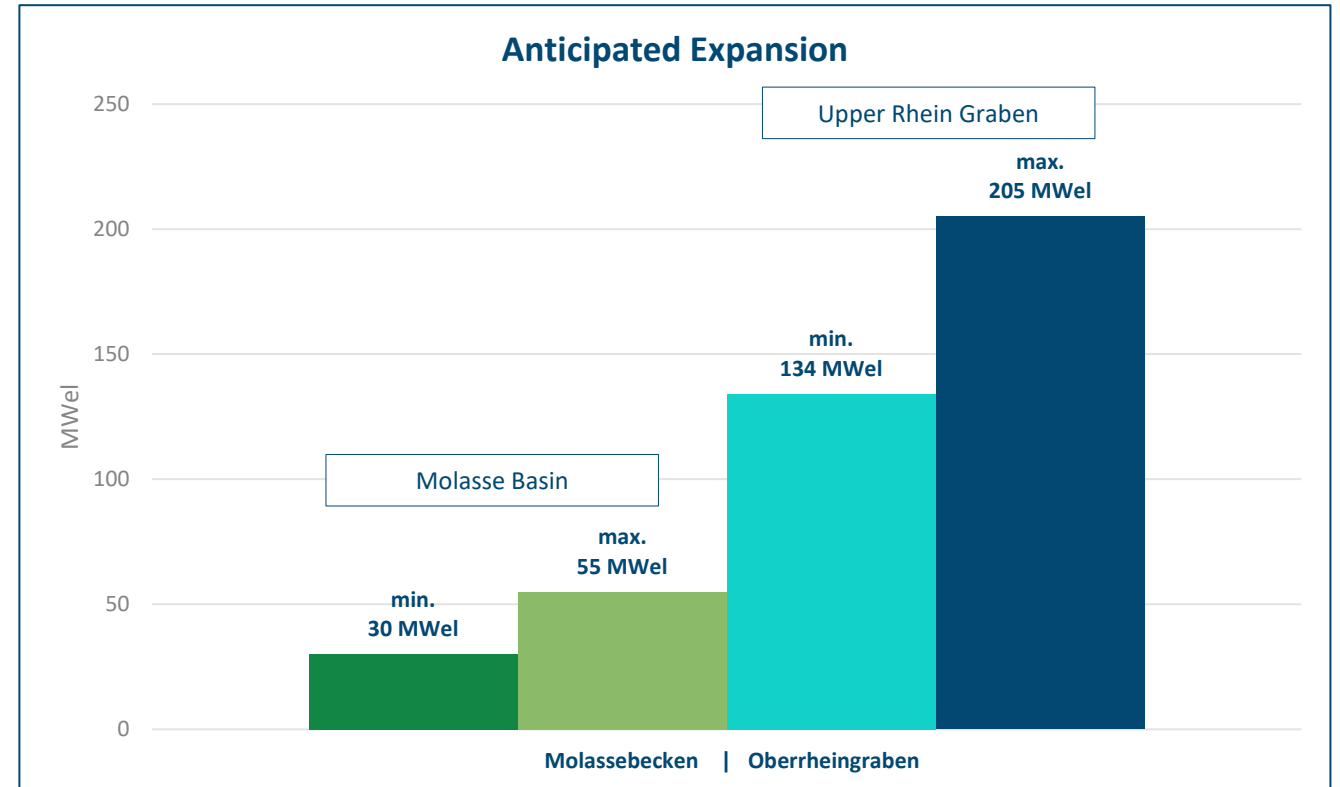
## Focus on the Upper Rhine Graben

Upper Rhine Graben is increasingly the focus of geothermal development - electricity

- Higher temperatures (= better conditions for electricity generation)
- Potential for lithium production

Molasse basins are increasingly the focus of geothermal development - heat

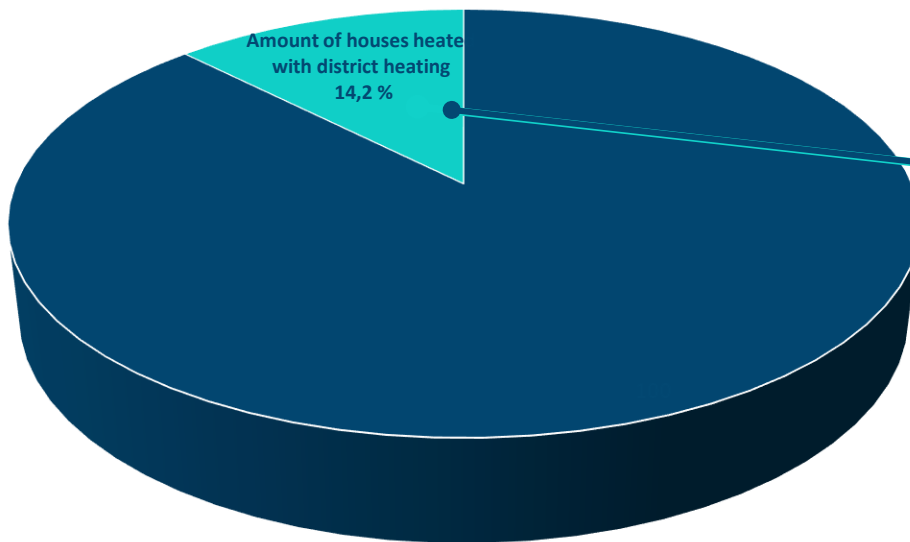
- Simpler geology
- Lower risk of discovery



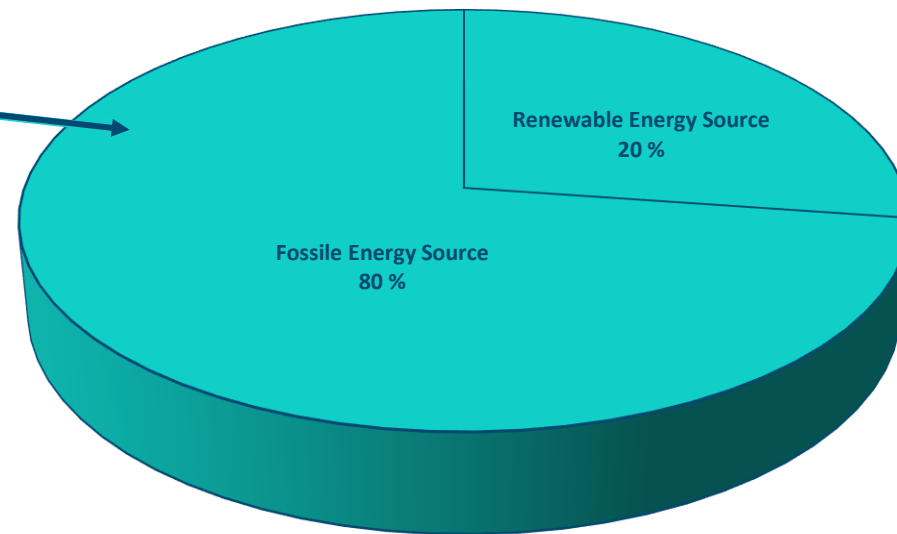
# STATUS OF EXPANSION OF DISTRICT HEATING

## Share of apartments heated with district heating (2022)

Status of the District Heating 2022



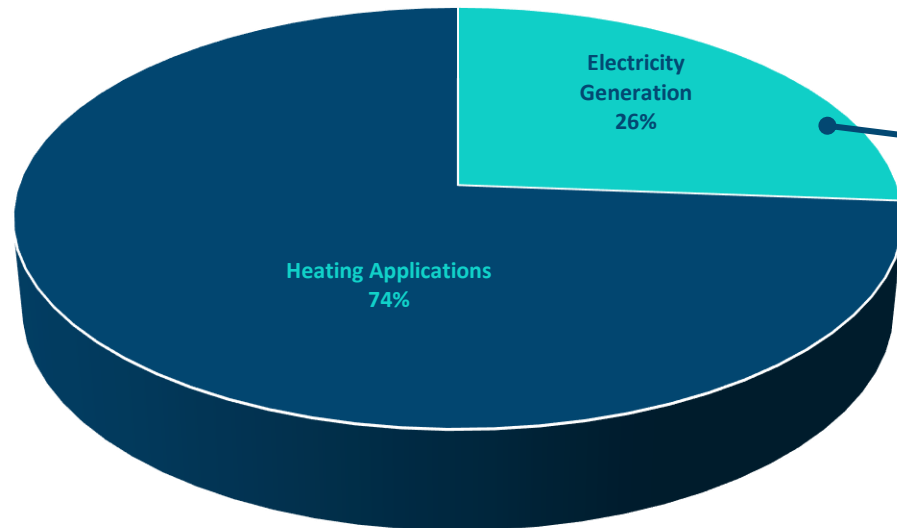
District Heating Energy Sources



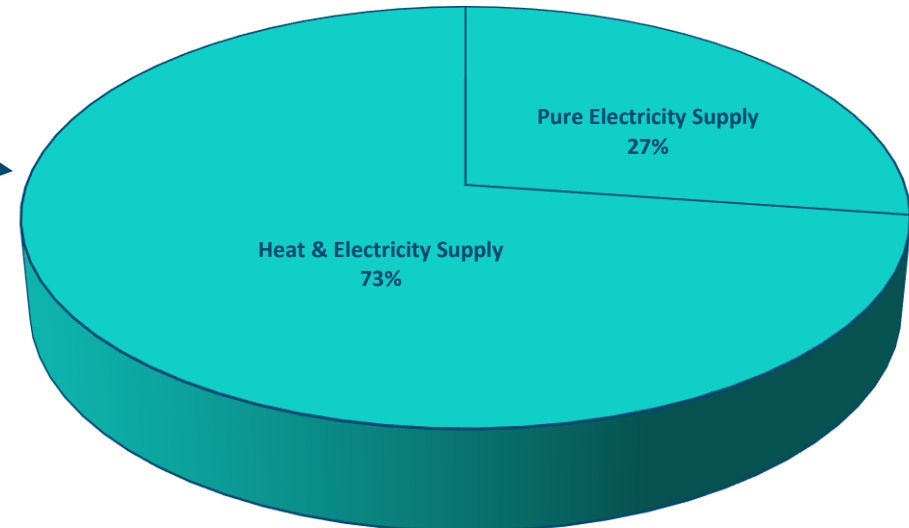
# STATUS OF EXPANSION OF GEOTHERMAL ENERGY

Expansion focus on heat production (2022)

Utilization of Geothermal Energy



Electricity Generation

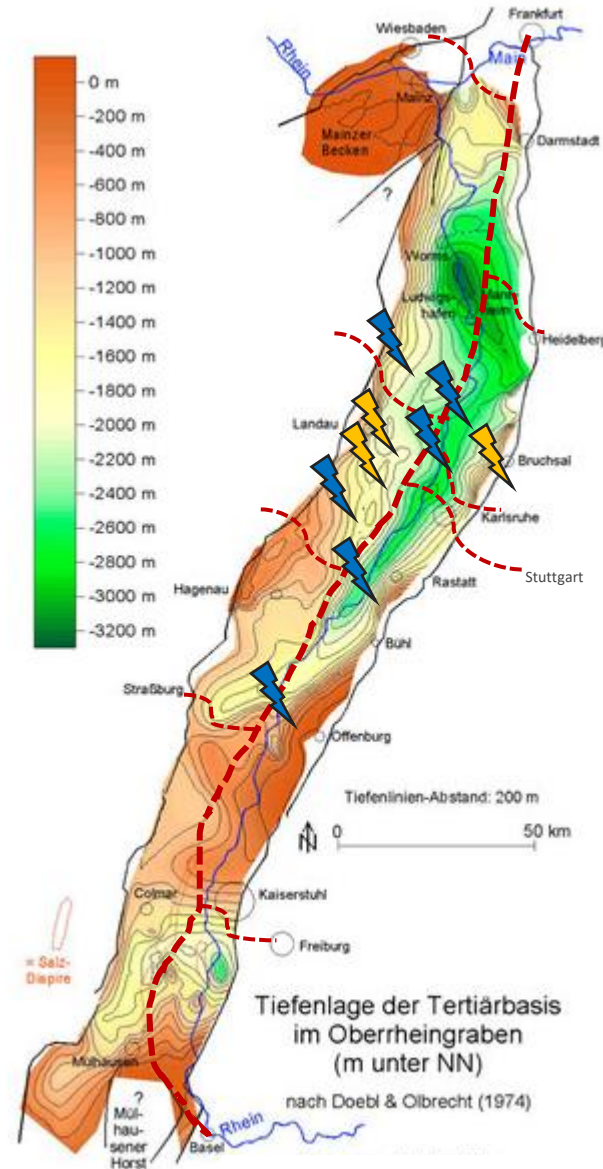


# OUTLOOK

## Upper Rhine Graben heat rail

### Great potential for geothermal energy

- Geological conditions optimal
- Lots of seismic data available
- High Temperature
- Complete supply of the Upper Rhine Graben with renewable energy heat
- Potential for 8-10 large geothermal power plants
- High temperature district heating network (>120°C)
- Use for combined heat and power and cooling



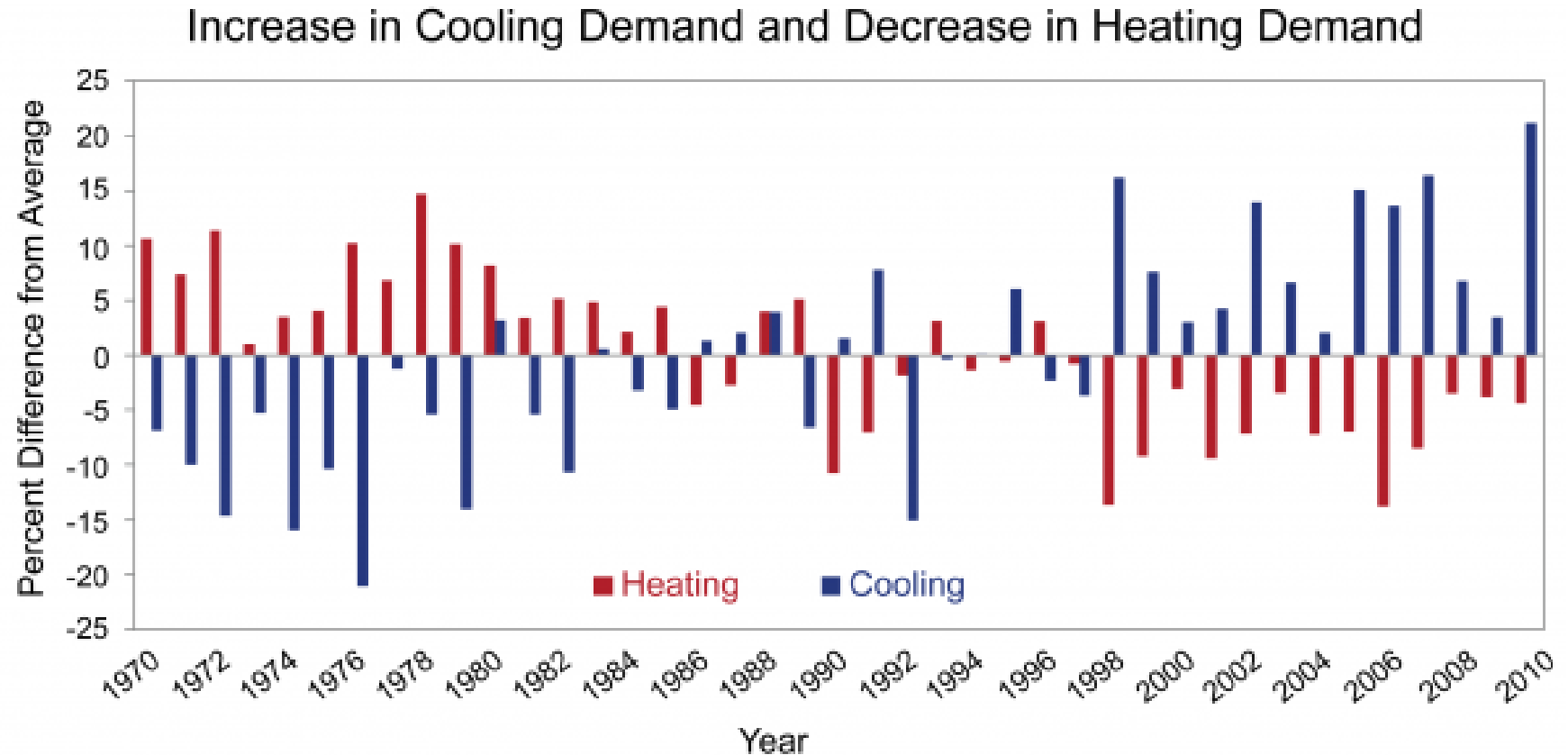


# OUTLOOK

## Upper Rhine Graben heat rail - cooling generation

Great potential for geothermal cooling

- Geological conditions optimal for cooling
- Temperatures => 100°C
- In the future, the energy requirement for cooling will continue to increase

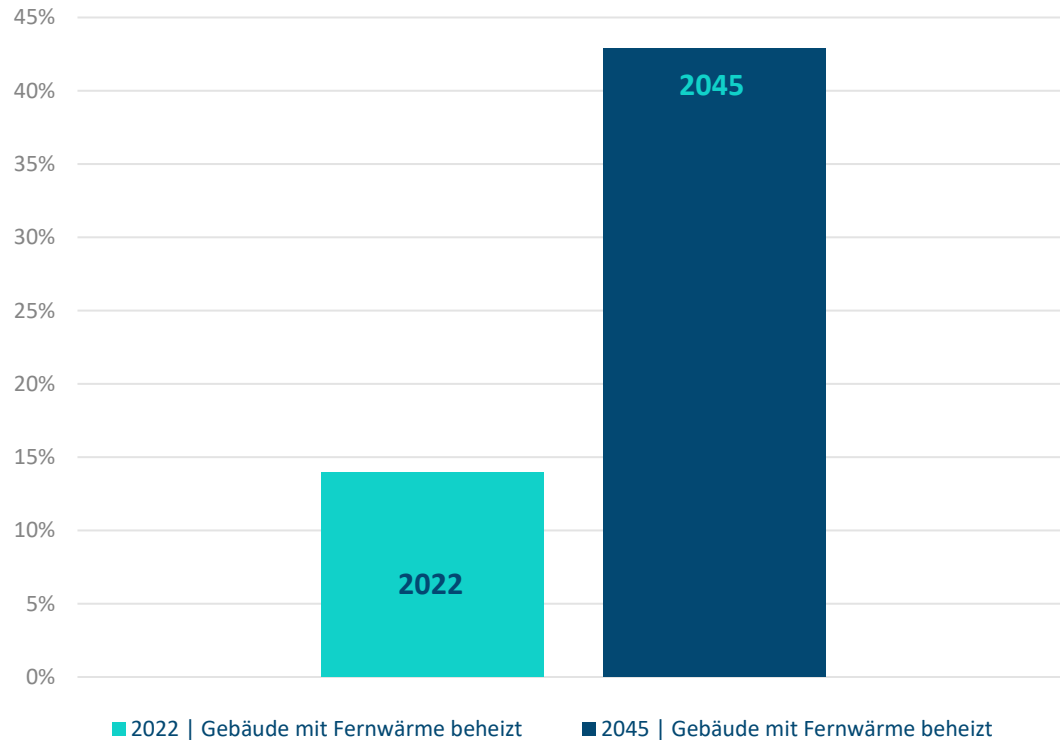


Source: <https://www.globalchange.gov/browse/multimedia/increase-cooling-demand-and-decrease-heating-demand>, Data from NOAA NCDC 2012



# STATUS OF EXPANSION OF DISTRICT HEATING

## Proportion of buildings heated with district heating by 2045



*“With a significantly accelerated expansion of the heating networks, by 2045, the number of buildings connected to heating networks is expected to roughly triple compared to today, meaning that at least 100,000 new buildings will be added each year in the medium term. Heating networks are connected.”*

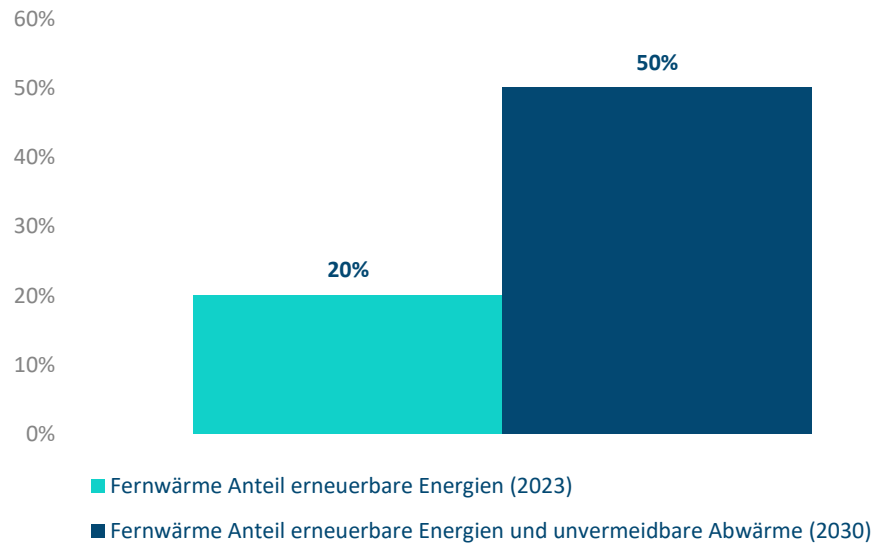
Source: BMWK/BMWSB, Joint Statement Alliance for “More speed in the transformation of heat supply, converting and expanding heating networks in a climate-neutral manner” from June 12, 2023; last accessed online on June 20, 2023;

[https://www.bmwk.de/Redaktion/DE/Downloads/Energie/0612-erklaerung-fernwaeme-gipfel.pdf?\\_\\_blob=publicationFile&v=10](https://www.bmwk.de/Redaktion/DE/Downloads/Energie/0612-erklaerung-fernwaeme-gipfel.pdf?__blob=publicationFile&v=10)

# SHARE OF RENEWABLE ENERGIES IN DISTRICT HEATING

## Share 2023 vs. 2045

The share of renewable energies and unavoidable waste heat must therefore grow by 4.3% annually.



Source: BMWK/BMWSB, Joint Statement Alliance for "More speed in the transformation of heat supply, converting and expanding heating networks in a climate-neutral manner" from June 12, 2023; last accessed online on June 20, 2023;

[https://www.bmwk.de/Redaktion/DE/Downloads/Energie/0612-erklaerung-fernwaeme-gipfel.pdf?\\_\\_blob=publicationFile&v=10](https://www.bmwk.de/Redaktion/DE/Downloads/Energie/0612-erklaerung-fernwaeme-gipfel.pdf?__blob=publicationFile&v=10)

# EXPANSION OF GEOTHERMAL ENERGY

## Barriers

- Difficult development, especially in metropolitan areas, due to unsuitable regulatory framework conditions
- Lack of instruments to minimize discovery risk (risk mitigation funds and insurance)
- Market maturity is not being advanced (lack of investment in key technologies and innovation)
- Lack of skilled personnel along the entire value chain & lack of training and further education
- Germany is insufficiently explored geothermally

**Important for the further expansion and reduction of electricity production costs:**

- Implementation of projects
- Economy of scale



# FEDERAL FUNDING FOR EFFICIENT HEATING NETWORKS (BEW)

## Geothermal energy

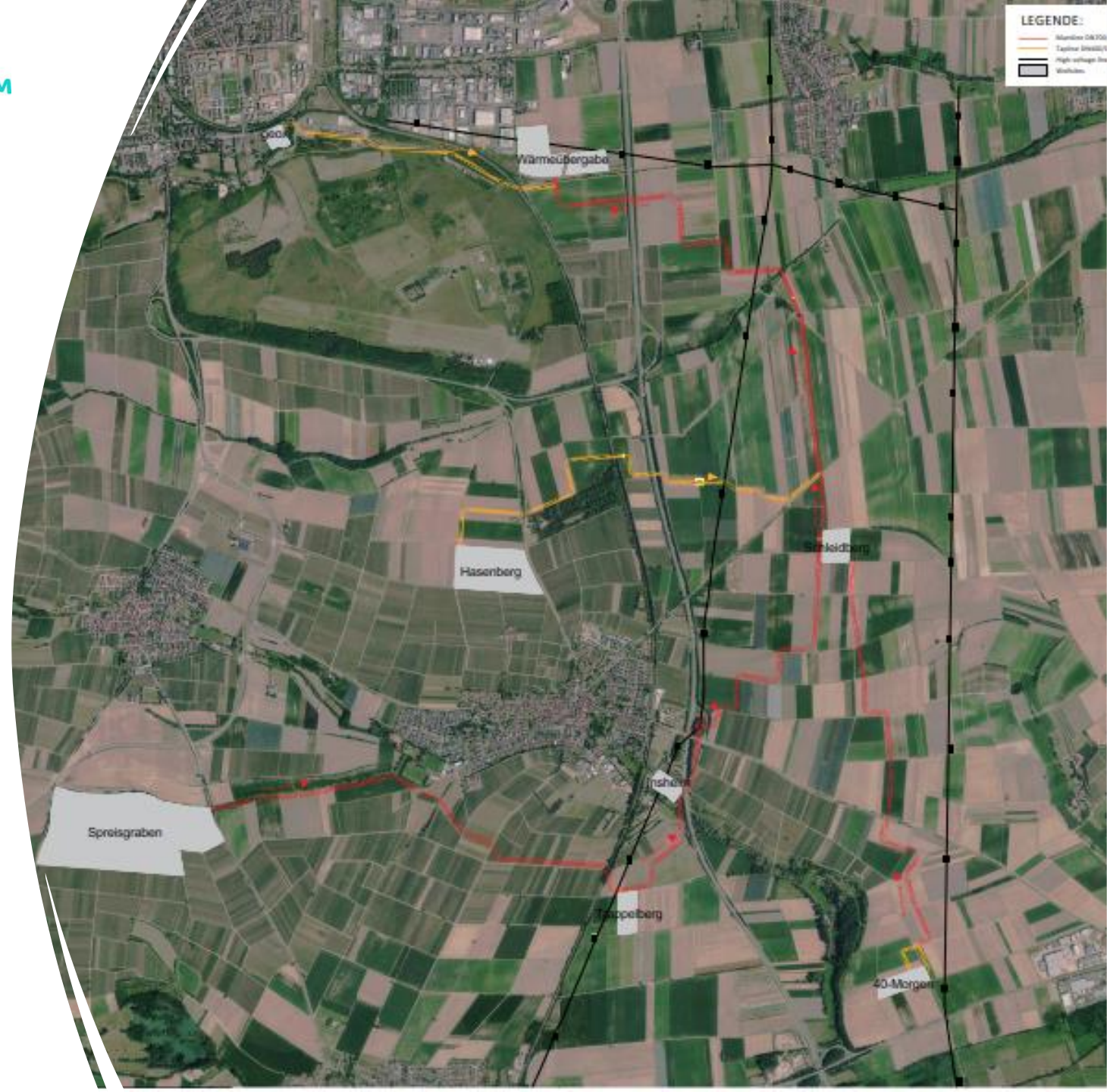
- High funding volumes, up to €100 million
- Funding rate up to 40%
- Complete discovery insurance is missing
- Disadvantage of geothermal energy compared to solar thermal energy and heat pumps when it comes to operating cost subsidies
- Number of eligible boreholes too low
- Funding is limited to the economic gap
- BAFA statement from September 30, 2022: ... “However, only those systems that exclusively generate heat are eligible for funding. Regardless of any waiver of EEG funding, electricity-generating deep geothermal energy systems are not eligible for funding under the BEW.”



# PHASE ONE

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- Production of geothermal fluids from 7 Sites
- Providing District Heating to
  - Insheim
  - Landau
- Extraction of Lithium
- Reinjection of Brine





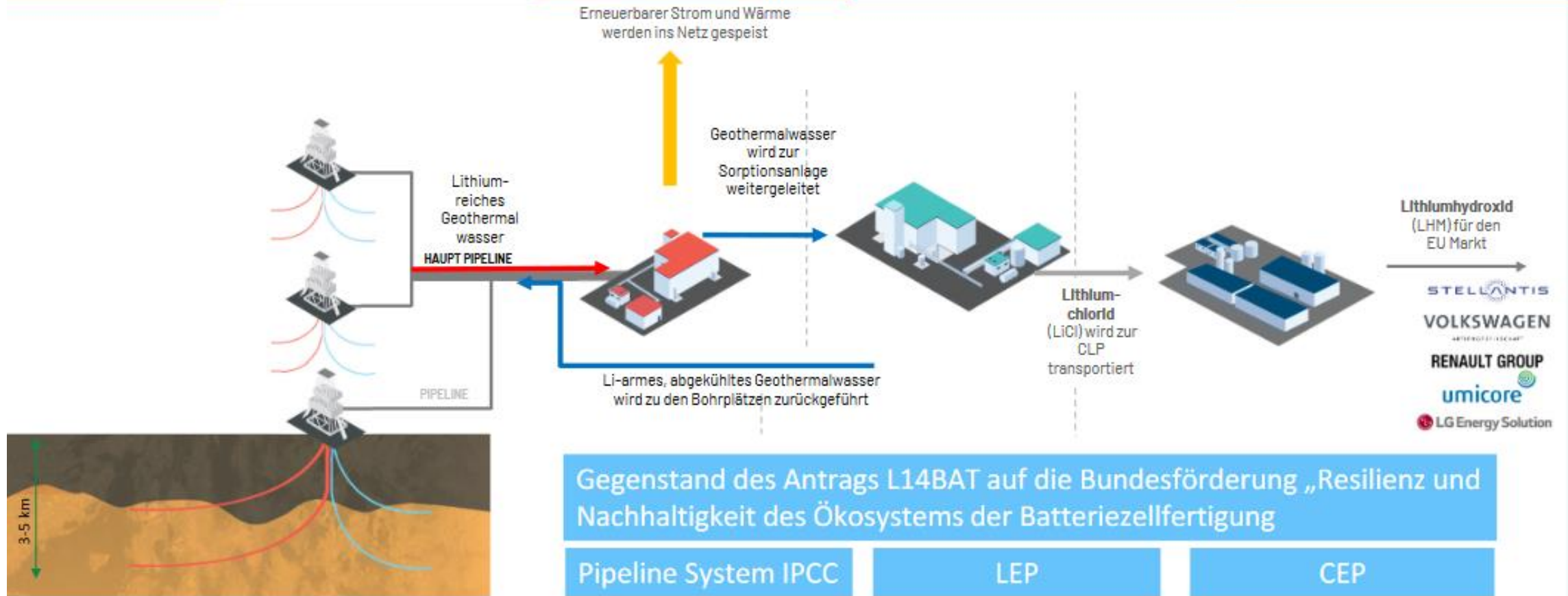
1. Ressource:  
Lithiumhaltiges  
Geothermalwasser

2. Tiefenbohrungen fördern  
heisses Geothermalwasser

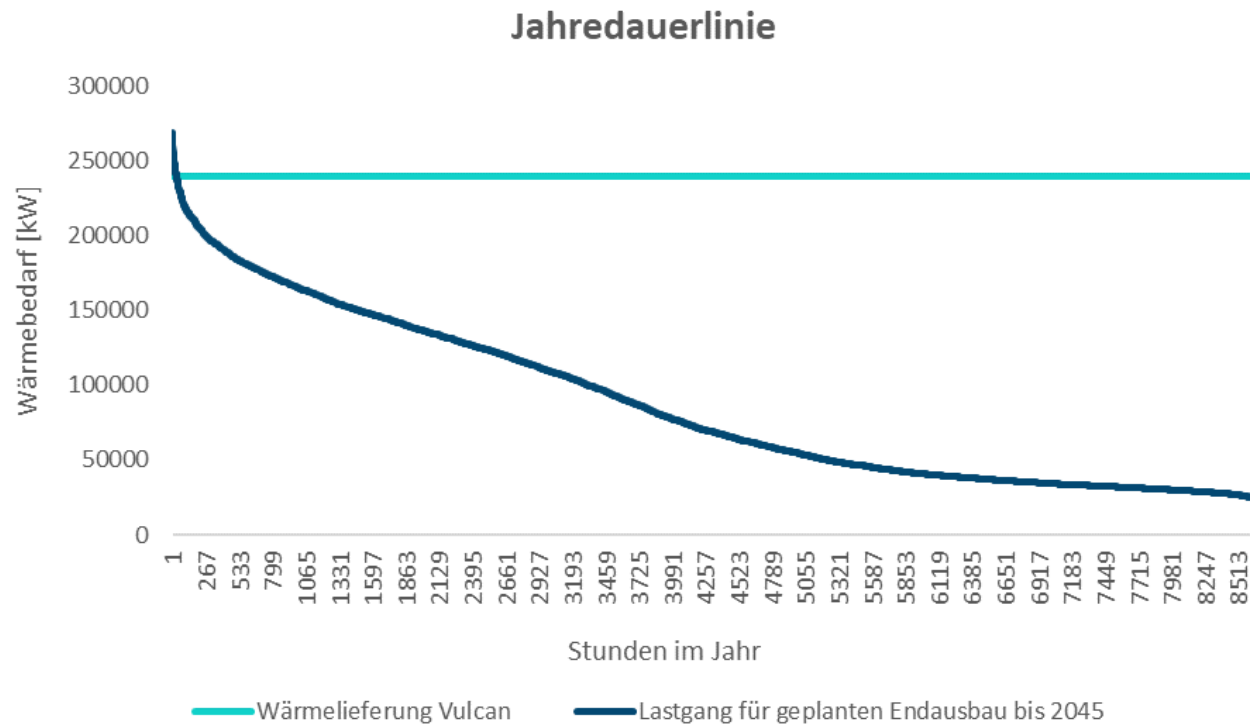
3. Geothermie Kraftwerk  
kühlt Thermalwasser ab

4. Lithium wird aus  
Geothermalwasser extrahiert

5. Veredelung zu Batterierohstoff  
(CLP)



# ENERGY CURVE OF PHASE ONE

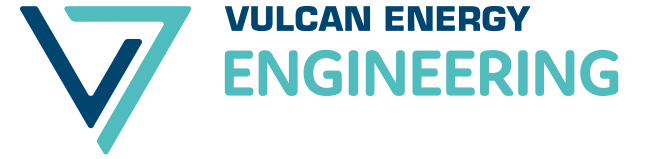


- Landau requires a peak output of around 260 MW (blue line), which should be achieved gradually by 2040.
- Vulcan can continuously provide 250 MW at the transfer point in Landau (heat transfer - turquoise line) from as early as 2028.
- The area under the blue line is the heat demand and the area between the turquoise and blue lines is the electricity generation.



# SCHEDULE OF PHASE ONE DISTRICT HEATING

Trasse (von-nach)	Start	Ende	2024				2025				2026				2027	
			Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Schleiberg-Insheim	Aug. 24	Aug. 25	█	█	█	█										
Schleiberg-Gewerbegebiet D 12	Okt. 24	Dez. 25		█	█	█	█	█								
40 Morgen-Schleiberg	Jul. 25	Apr. 26					█	█	█	█						
Landau-Gewerbegebiet D 12	Jul. 25	Apr. 26					█	█								
Trappelberg-Insheim	Okt. 25	Jun. 26						█	█	█	█					
Hasenberg-Schleiberg	Jan. 26	Jul. 27							█	█	█	█	█	█		
Spreissgraben-Trappelberg	Aug. 26	Nov. 27									█	█	█	█	█	█



**THANK YOU FOR ATTENTION**