

Invisible & (ever)-present.

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Geothermal Energy and District Heating. Lessons Learnt.

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Things that could be deep and beautiful



Thoughts written by L. Wittgenstein. Love. The colour at the bottom of the ocean. Symbolism in literature. Song Lyrics on the Eurovision Song Contest.

Geothermal energy.

And (in)visible district heating.

Drilling cutter
height: approx. 45 cm
cross-section dimension: approx. 27 cm

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Content – story of geothermal district heating in 3 steps



Step 1

Location

Development of prices of alternative energy sources

Step 2

Unterhaching – drilling,
insurance policy, Kalina-
process



District Heating system
Challenges

Step 3

Specific features – DH and geothermal energy
Conclusions



Drilling
Exploration
risk

Where ?

(to drill)

Not weather dependent...



HOW to make geothermal energy competitive (against fossil fuels) ?

Fact.
Significant
investments
(drilling)

consequence

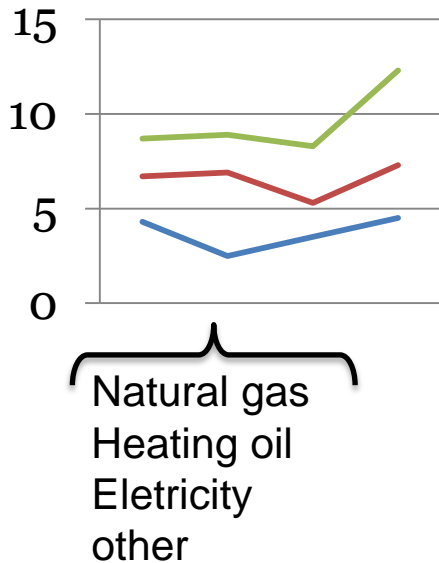
economical only with
installations within
MW-range (MWth)

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HOW to make geothermal energy competitive (against fossil fuels) ?



Individual boilers



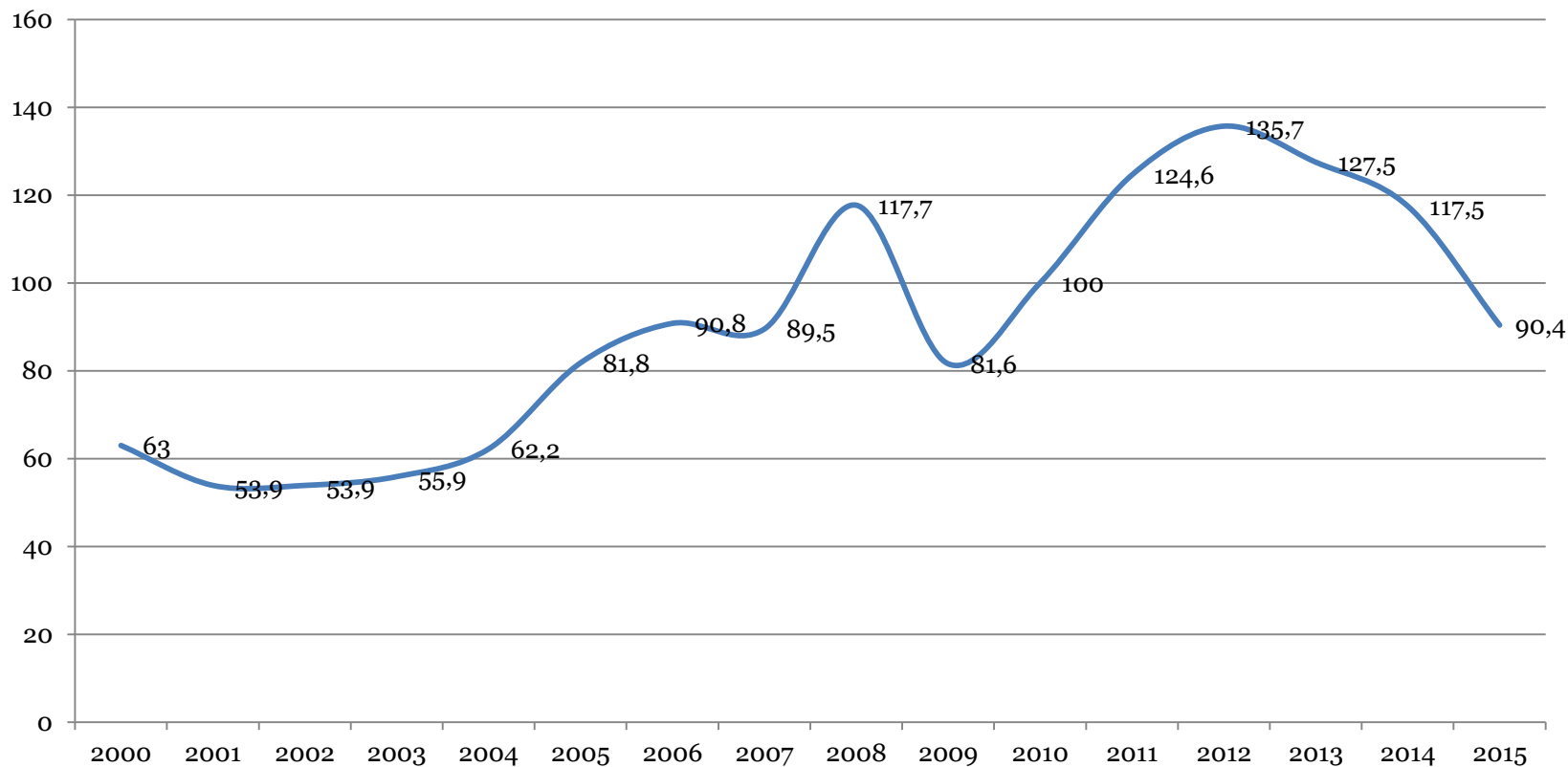
Heat Demand

District Heating



PRICE DEVELOPMENT

Light heating oil. Consumer Price Index.



Consumer price index. 2010 = 100

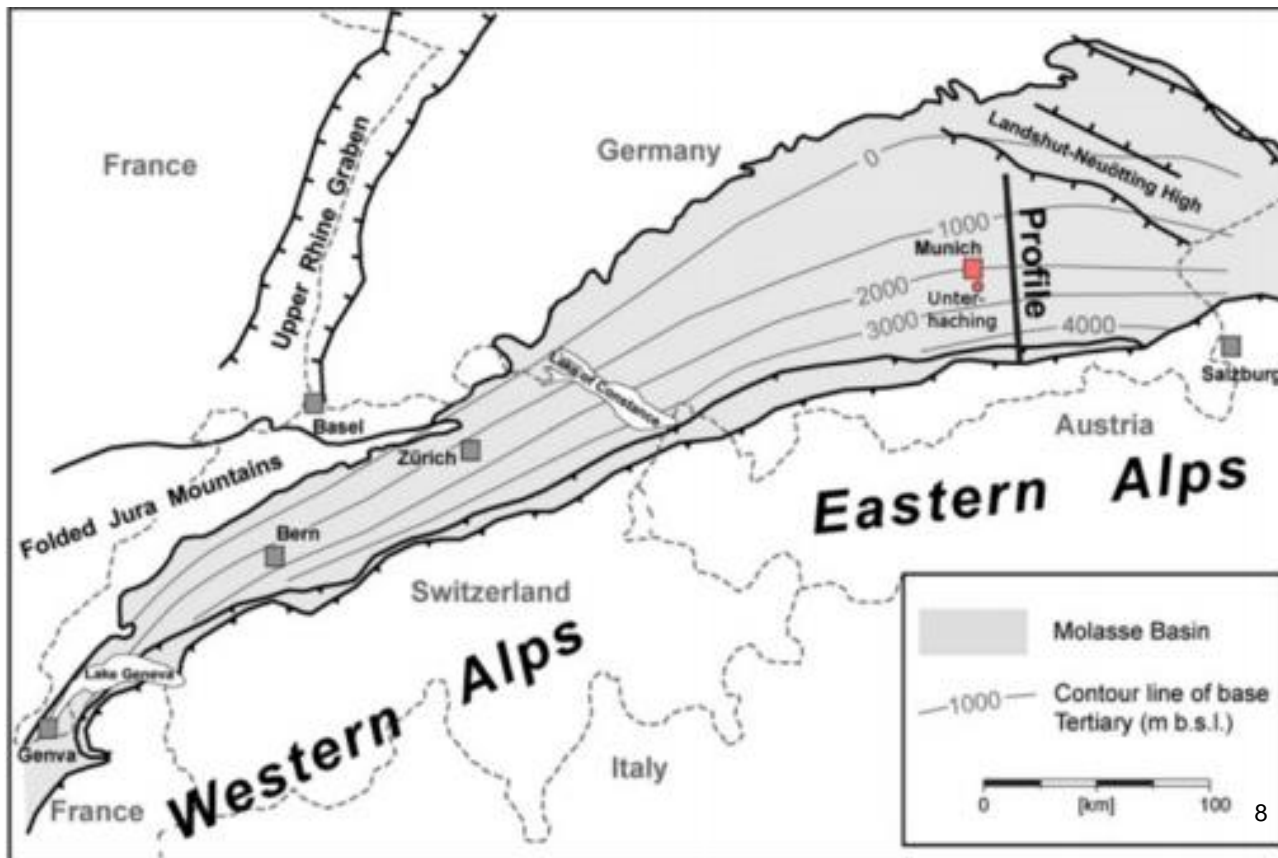
Source: AGFW. Data based on: Federal Statistical Office, Price Data on energy price trends, Long-time series from January 2000 to April 2016, Statistisches Bundesamt, Wiesbaden 2016

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Unterhaching - Geological Position

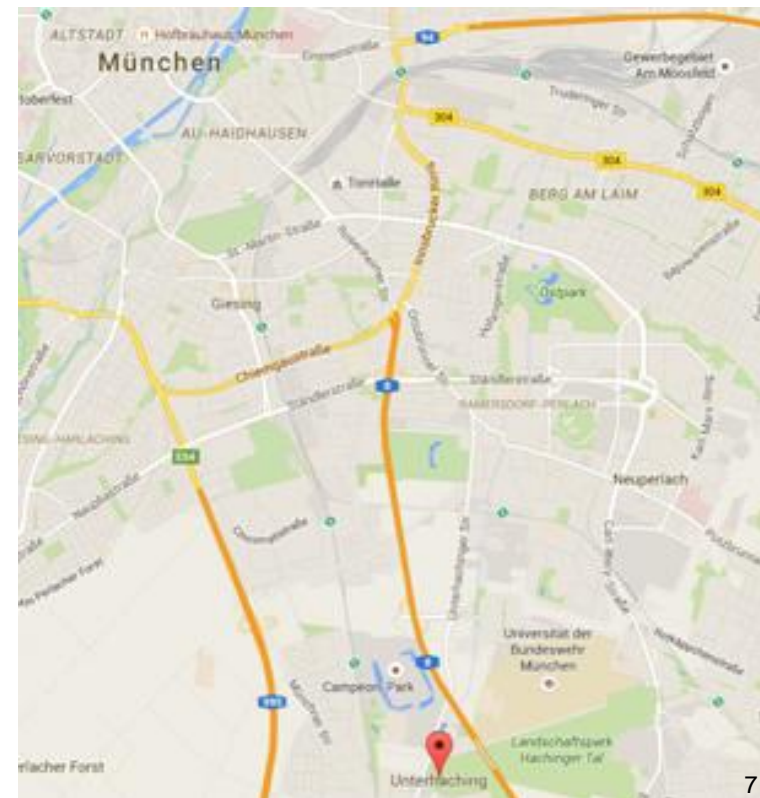


Source.
122 °C water in a limestone layer at a depth of approx. 3,500 m

600-1,000 mg/l of salts + dissolved gases.

Unterhaching - Geographical Location

- A suburb of Munich
- Knowledge basis: test drilling for crude oil reserves in previous decades
- The private insurance sector is engaged in providing market-based insurance policies
- Special drilling contracts - a fixed price based on the amount of drilled meters.



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Characteristic Values

- Subsidies for: geological analyses, testing of a Kalina plant
- The thermal water circuit is pressurised with nitrogen. The thermal water pipes between the wells are made of fibreglass reinforced plastic to avoid any potential corrosion problems.
- The shift from electricity generation to heating during the course of the project – because of the fossil prices' increase

Production well	
Well depth	3,446 m
Temperature	122 °C
Injection well	
Well depth	3,864 m
Temperature	133 °C
Output	up to 150 l/s
Geothermal thermal output	up to 38 MW
Fossil thermal output (peak load, redundancy)	up to 47 MW

District heating network (31.12.08)	28 km length
Connected load	30.4 MW (represents the heating requirement of approx. 3,000 households)
Annual heating load 2008	47,000 MWh
Geothermal electricity generation	3.4 MW (average value)
Electrical output	21.5 Mio. kWh
Annual electricity generation	(represents the annual consumption of approx. 6,000 households)



- A closed loop process. Instead of thermal water: a mixture of ammonia and distilled water
- Heat-led modulating

More information on: <https://www.youtube.com/watch?v=7Z4-8nJQBbU>

+ boilers (2 x 23,5 MW) for peak load and redundant heat supply

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Unterhaching – District heating network



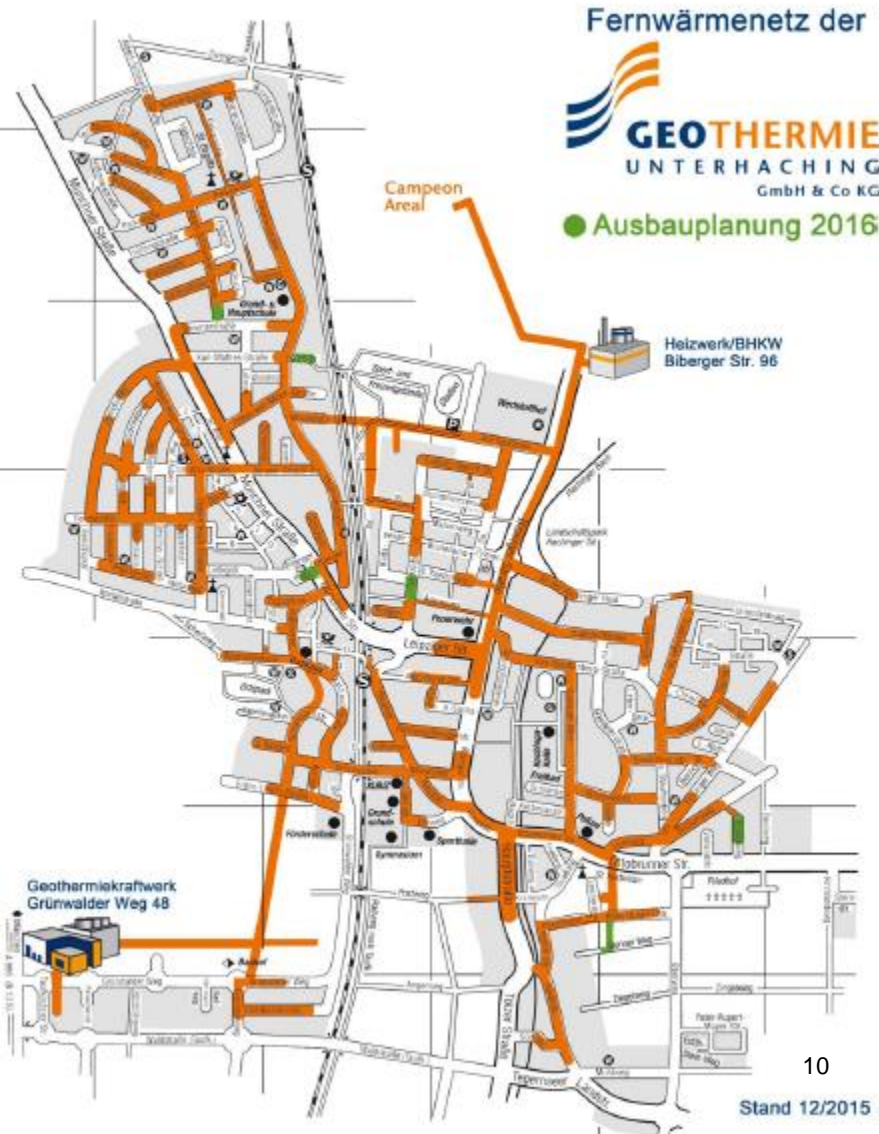
- Inhabitants connected: approx. 6,300 households (50% market share)
- Total investment: 90 mil. Euro
- Type: plastic jacket pipe with a leakage indicator-system installed
- Once-only connection costs: 1578,15 Euro/household, incl. heat exchanger and 5 m of district heating (DH) piping

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District heating in Unterhaching



- DH network: 44,5 km
- Temperature: 80-110 °C
- Return temperature: 50-60 °C
- 20 DN bis 450 DN

- Transparent pricing structure:

- (The price list 2015, in German:

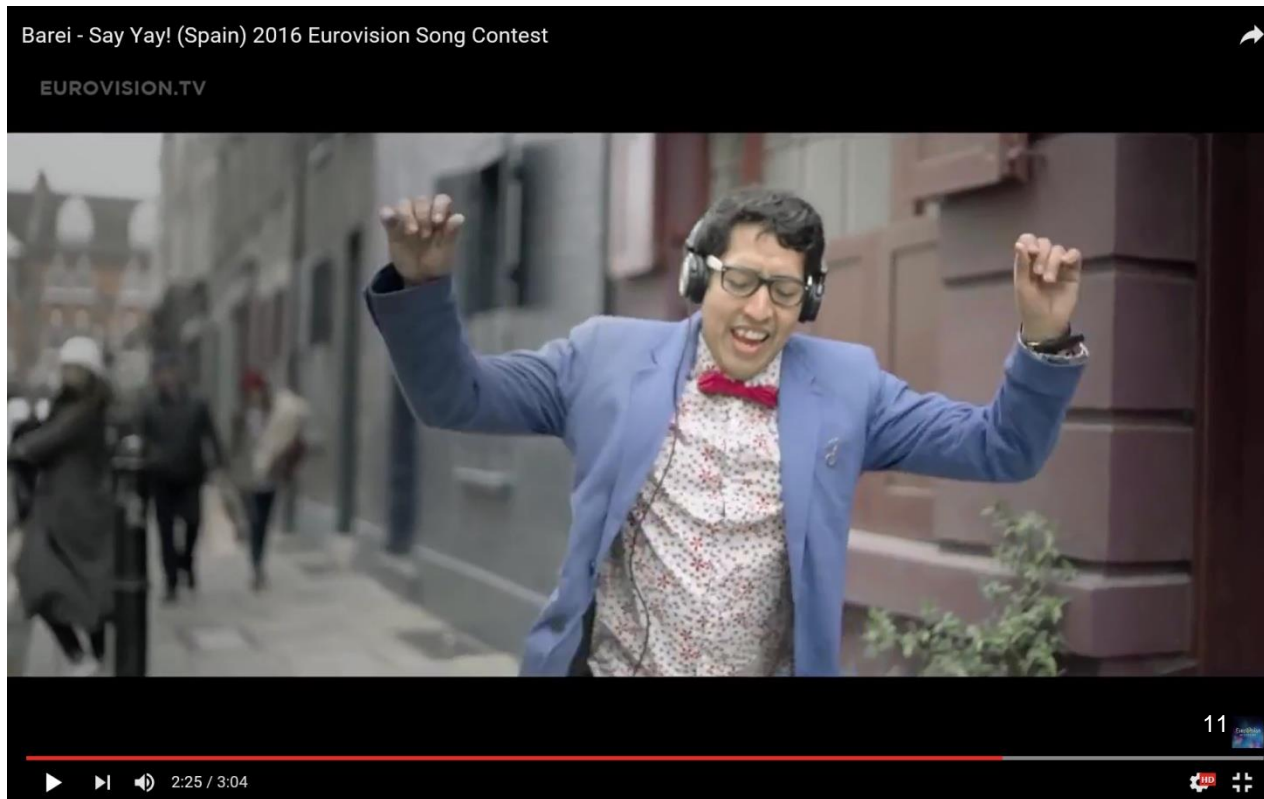
[https://www.geothermie-unterhaching.de/cms/geothermie/web.nsf/gfx/851232621B792E65C1257EC900460140/\\$file/Preisblatt%202015.pdf](https://www.geothermie-unterhaching.de/cms/geothermie/web.nsf/gfx/851232621B792E65C1257EC900460140/$file/Preisblatt%202015.pdf))

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Challenges for Unterhaching



Due to the required output and the high temperatures – a great challenge for the pumps available on the market

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Challenges and barriers for geothermal district heating sector

Geological.

- a] too low productivity or the resource overexploited
- b] no guarantee that the original T and flow rate will not decline

Technical.

- a] corrosion (the high salt content)
- b] scaling
- c] pumps

...and political

Misinformation, the lack of acceptance, the Act on Fracking,

Support schemes should be phased out as the technology reaches full competitiveness.

The EU State Aid regime.

And solutions:

- Enlightenment based on the profound knowledge and the „be the first“-concept
- Support schemes for geothermal heat in the EU: investment grant (Spain), insurance scheme, low interest loan (Germany)

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Specific features: DH and geothermal energy

- DH development costs > drilling costs (30 – 50 %)
- **The role of municipalities.** Who else would achieve the share of own capital at 25%? + being able to make longer term investments
- Ambitious goals for geothermal energy and DH: Munich
- Success factors: DH network already installed
- Prioritisation of energy carriers as the geothermal energy may constrain the existing CHP plant
- Pricing of DH heat and price amendment clause, e.g.

$$AP = AP0 * (0,4 + 0,3 \text{ electricity} / \text{electricity0} + 0,3 \text{ nat.gas} / \text{nat.gas0})$$

Conclusions

*“ We only got today
To learn from our yesterday ”*

- *Be prepared* for the average development time: 5-7 years
- Before the drilling of the first well, *negotiate* a contract to sell the heat to customers
- *Follow* price development of alternative energy sources
- *Be aware of the fact –without subsidies* geothermal electricity production is still not profitable
- If you can, *be the first* with your project.

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Photos

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