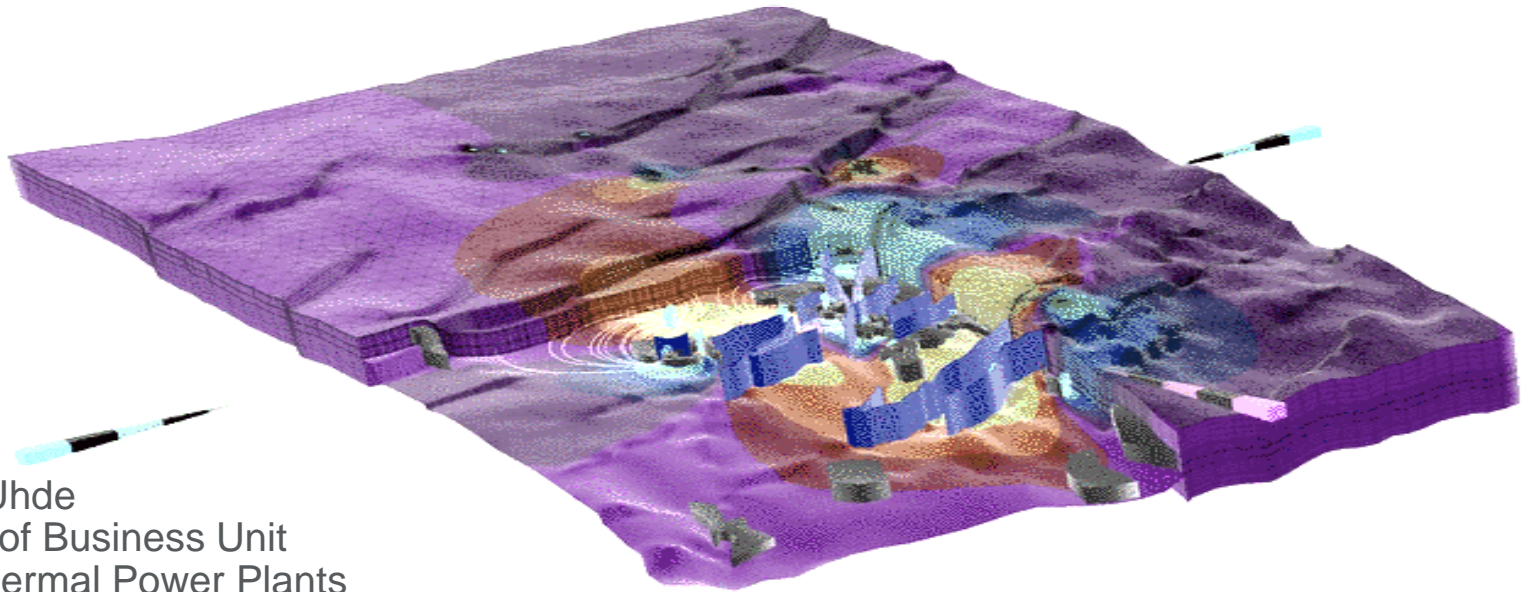


# SCCER-SOE Annual Conference 2014

## Successes and failures in the development of deep geothermal projects in the Bavarian Molasse basin

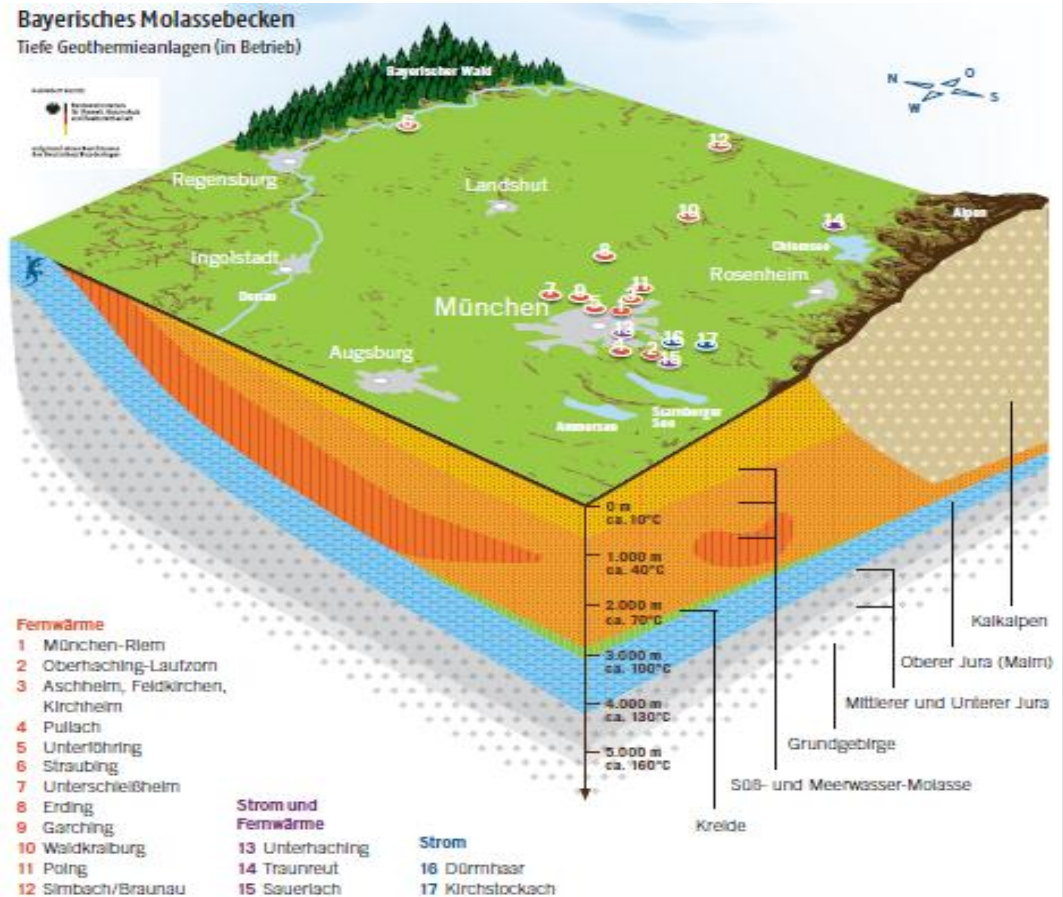


Jörg Uhde  
Head of Business Unit  
Geothermal Power Plants

- **Overview of the Molasse Basin**
- **Update on the Taufkirchen Project**
- **Geothermal projects in the Molasse Basin**
- **Thoughts on how the market will develop**

# Overview of the Bavarian Molasse Basin

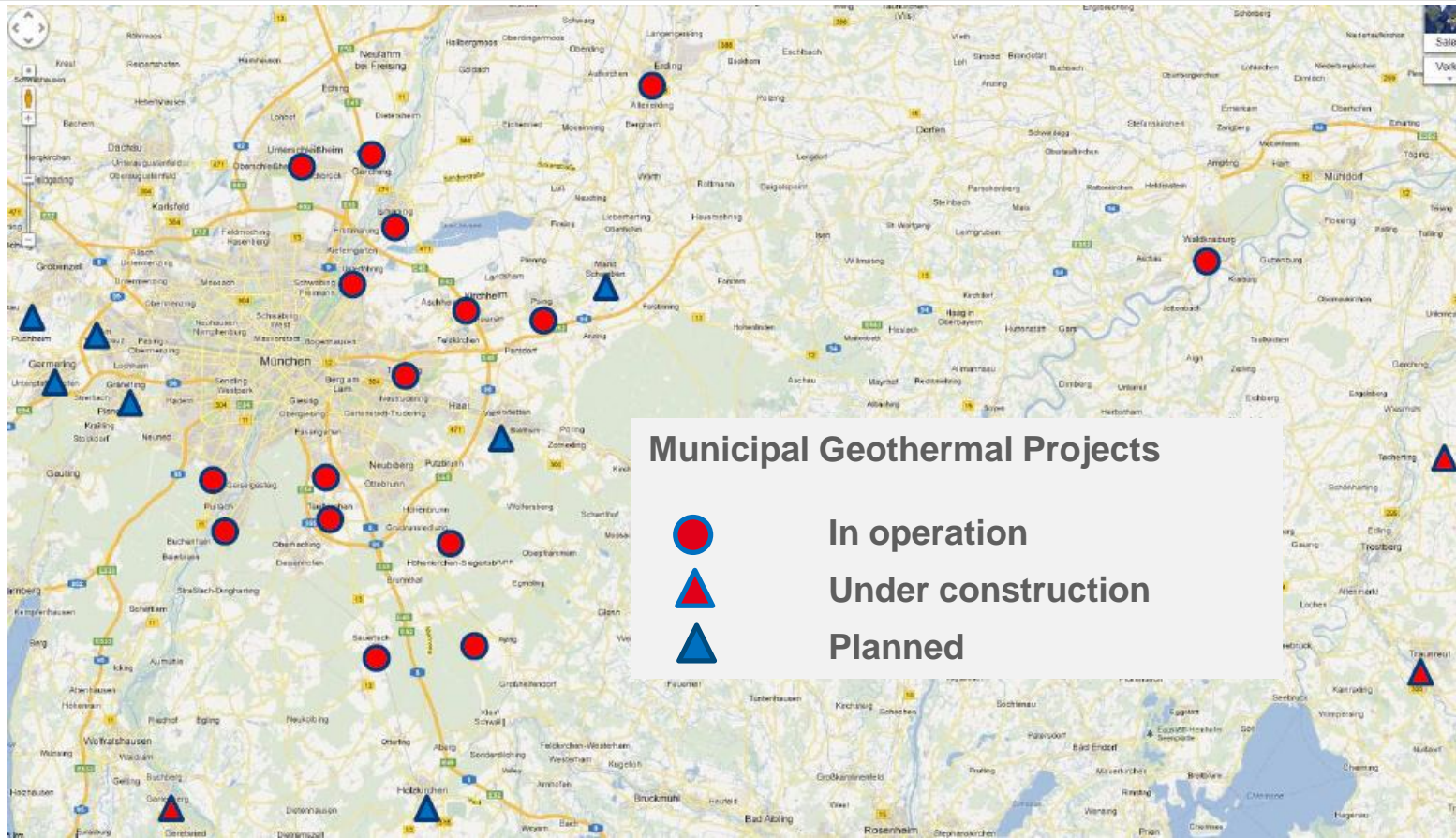
More than 25 geothermal projects for district heating and combined power and heat are in operation or under construction in the Bavarian Molasse basin.







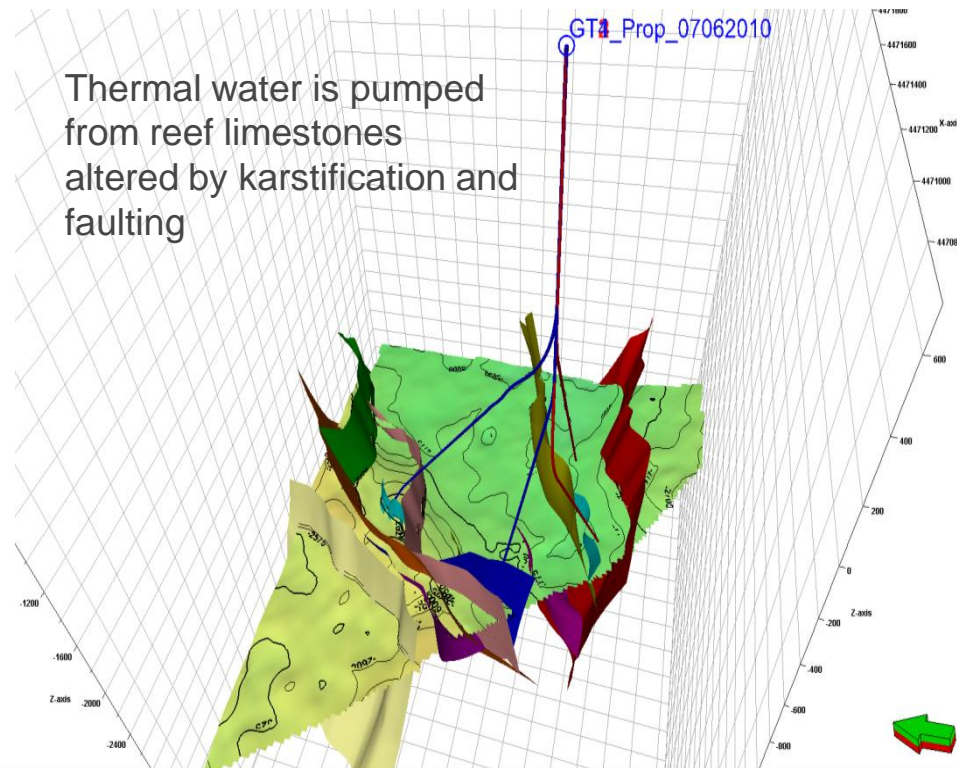
# Municipal Geothermal combined power and heat projects in the Bavarian Molasse Basin





## Project Description

- Taufkirchen, SE of Munich
- Project Developer: Exorka GmbH as general contractor
- Axpo's share: 35%
- Two boreholes completed
- Productivity 120 l/s @135°C
- Expected power production 20 MW<sub>th</sub>, 4.3 MW<sub>el</sub>
- Connected to two district heating grids
- 3<sup>rd</sup> Kalina Project in Germany
- Start of electricity production: 2014/2015



# Update on the Taufkirchen Project



One major economically interesting aspect of the project is the revenue that will be generated from feeding power into the grid - the German Renewable Energy Law prescribes that electricity from geothermal energy may be fed into existing power grids and must be paid for by the power suppliers at specified rates of 25 euro cents/kWh<sub>el</sub>.





# Update on the Taufkirchen Project



## Construction permit

- After the project had been three years in preparation and despite the fact that the wells were successfully drilled the local authority of Taufkirchen refused to give the construction permission.
- With active support from the state government of Bavaria, it was finally possible to complete all approval processes for the geothermal power plant in August 2013, but 410 days later than originally planned.





# Update on the Taufkirchen Project

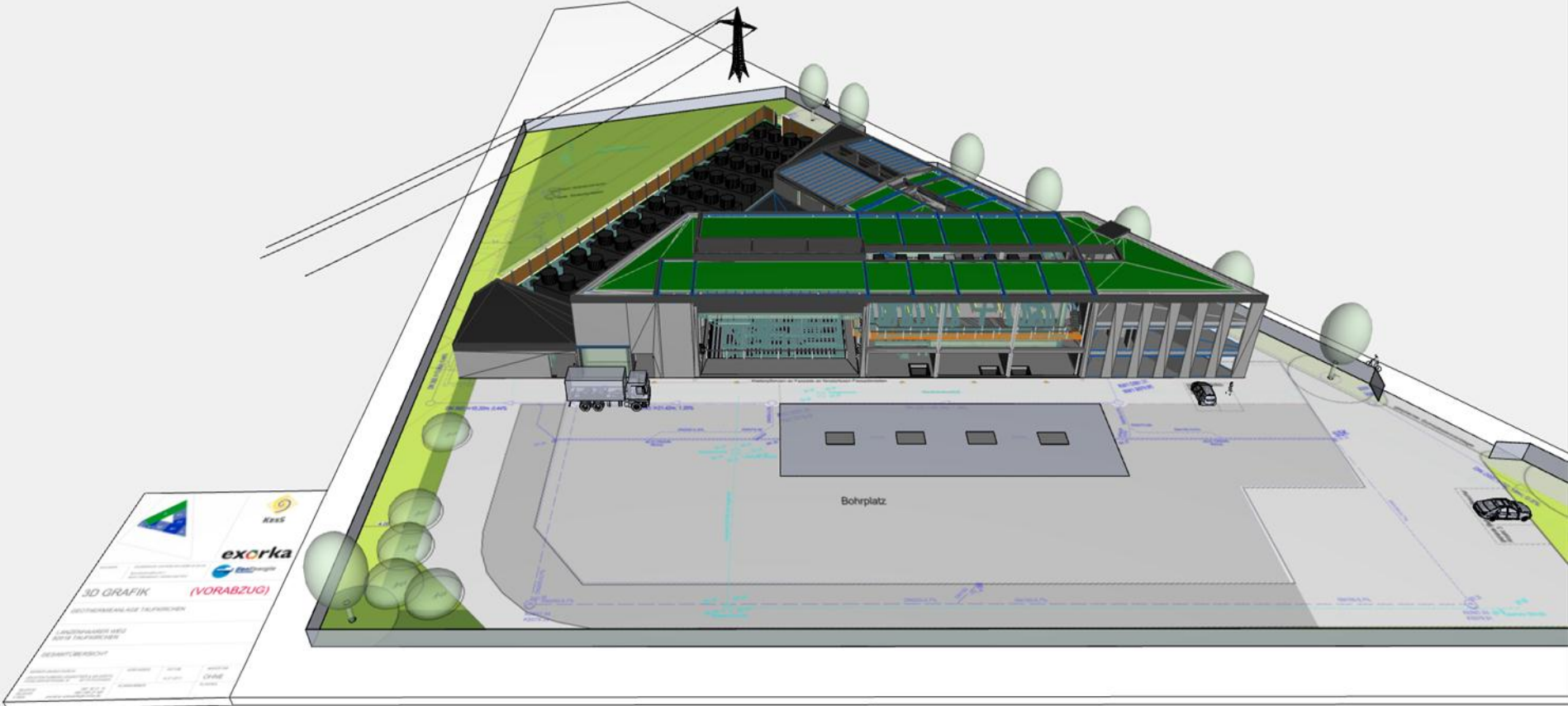


## Construction phase

- A provisional district heating supply has started in November 2013.
- Construction work began in December 2013 and will not impact provisional district heating supply.
- Power generation is due to commence in December 2014.



# Update on the Taufkirchen Project









# The Unterhaching Project



- **Municipal Project developed by the city of Unterhaching**
- **Two boreholes completed:**
  - GT1 3.350 m md, GT2 3.580 m md
- **Productivity up to 150 l/s @122°C**
- **Power production:**
  - 38 MW<sub>th</sub>, 3.36 MW<sub>el</sub>
- **1<sup>st</sup> Kalina Power Plant (Siemens)**
- **Connected to the district heating grids of Unterhaching and Grünwald**
- **Start of electricity production: 2008**





# The Sauerlach Project



- **Municipal Project developed by Stadtwerke München GmbH**
- **Three boreholes completed:**
  - GT1 4.757 m md, GT2 5.060 m md, GT3 5.567 m md
- **Productivity 110 l/s @143°C**
- **Power production: 38 MW<sub>th</sub>, 5 MW<sub>el</sub>**
- **ORC Power Plant (Turboden)**
- **Connected to the district heating grid of Sauerlach**
- **Start of electricity production: 2013**



## The Dürrnhaar Project

- Privately financed projects, developed by the Süddeutsche Geothermie-Projekte Gesellschaft
- Two boreholes completed:  
GT1 3.670 m md, GT2 3.720 m md
- Productivity 135 l/s @ 135°C
- Power production: up to 5.5 MW<sub>el</sub>
- ORC Power Plant (Turboden)
- No connection to district heating grids
- Start of electricity production: 2013



## The Kirchstockach Project

- Privately financed projects, developed by the Süddeutsche Geothermie-Projekte Gesellschaft
- Two boreholes completed:  
GT1 4.214 m md, GT2 4.452 m md
- Productivity 115 l/s @ 138°C
- Power production: 5.5 MW<sub>el</sub>
- ORC Power Plant (Turboden)
- No connection to district heating grids
- Start of electricity production: 2013



# The Kirchstockach Project



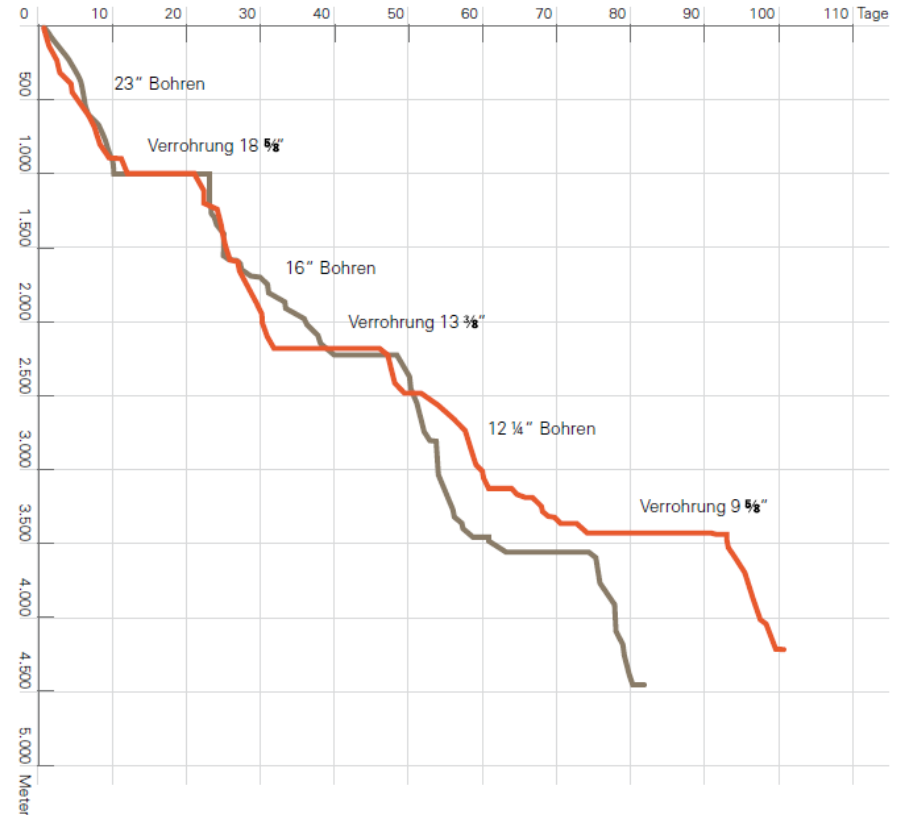
## Time / depth diagram

### Well 1

**Start:** 12.09.2008  
**End:** 21.12.2008  
**Duration:** 101 days  
**MD (Measured Depth):** 4.214 m

### Well 2

**Start:** 10.09.2009  
**End:** 29.11.2009  
**Duration:** 81 days  
**MD (Measured Depth):** 4.452 m  
**Productivity:** 150 l/s @ 140°C





# The Grünwald Project



- Municipal project, developed by the Erdwärme Grünwald GmbH
- Two boreholes completed:  
GT1 4083 m md, GT2 4453 m md
- Productivity 150 l/s @130°C
- Power production: 50 MW<sub>th</sub>, 4 Mw<sub>el</sub>
- Connected to the district heating grids of Grünwald and Unterhaching
- Start of electricity production: 2014



# The Traunreut Project



- Privately financed project, developed by the Geothermische Kraftwerksgesellschaft Traunreut mbH
- Two boreholes completed:  
GT1 5412m md, GT2 5070m md
- Productivity 135 l/s @116°C
- Due to an unexpectedly low temperature the drilling costs of the first well were covered by a productivity risk insurance
- Power production: 38 MW<sub>th</sub>, 4.1 Mw<sub>el</sub>
- Connected to the district heating grid of Traunreut
- Start of electricity production: 2015



## The Kirchwaidach Project



- Privately financed project, developed by the GEOenergie Bayern GmbH
- Two boreholes completed:  
GT1 4937 m md, GT2 5133 m md
- Productivity <math><150\text{ l/s}</math> @130°C
- Due to an unexpectedly low flow rate the the first well was extended by a long sidetrack resulting in a productivity of 200 l/s. The productivity is still limited by the low permeability in the 2<sup>nd</sup> well.
- Power production: 38 MW<sub>th</sub>, 4.1 Mw<sub>el</sub>
- Connected to twelve hectares of greenhouses for geothermal heated vegetable production
- Start of electricity production: 2015



## The Geretsried Project



- Privately financed project, developed by Enex Power Germany GmbH
- First borehole: deepest and longest geothermal well in Europe @ 6036 m md unfortunately turned up dry.
- Therefore drilling costs were covered by a productivity risk insurance.
- The planned sidetrack will not be drilled because the investor cannot obtain an all-risk insurance.
- Two further geothermal projects in this region (Weilheim and Bernried) are put on hold since then.





# The Mauerstetten Project



- Privately financed project, developed by Exorka GmbH
- First borehole @ 4.545 m md unfortunately turned up dry.
- Therefore drilling costs were covered by a productivity risk insurance.
- A state funded R&D project to develop novel hydraulic and chemical stimulation methods for an enhanced productivity is about to commence



## Thoughts on how the market will develop I

- **The strong market development for deep geothermal energy in Germany is primarily attributable to the EEG (German Renewable Energy Act) which, with its scale of feed-in tariffs, created an encouraging economic environment for the operation of geothermal plants.**
- **Electricity generation is still dependent upon assistance from the EEG**
- **Fortunately the amendment that has already been passed for the German Renewable Energy Act (EEG) as from 1 August 2014 will not make provision for a further reduction of the EEG funding for geothermal projects.**

## Thoughts on how the market will develop II

- Due to significant loss occurrences it has become hardly impossible to get productivity risk insurance coverage for new geothermal projects.
- The insurance conditions have worsened for explorations risks and technical drilling risks much beyond what could have been expected.
- Because of this and the still ongoing discussions of the EEG design a long-term planning and investment security is so far missing.
- Public and private investors wait with investment decisions until there is more certainty about market situation in 2014.

# Many thanks for your attention!

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