

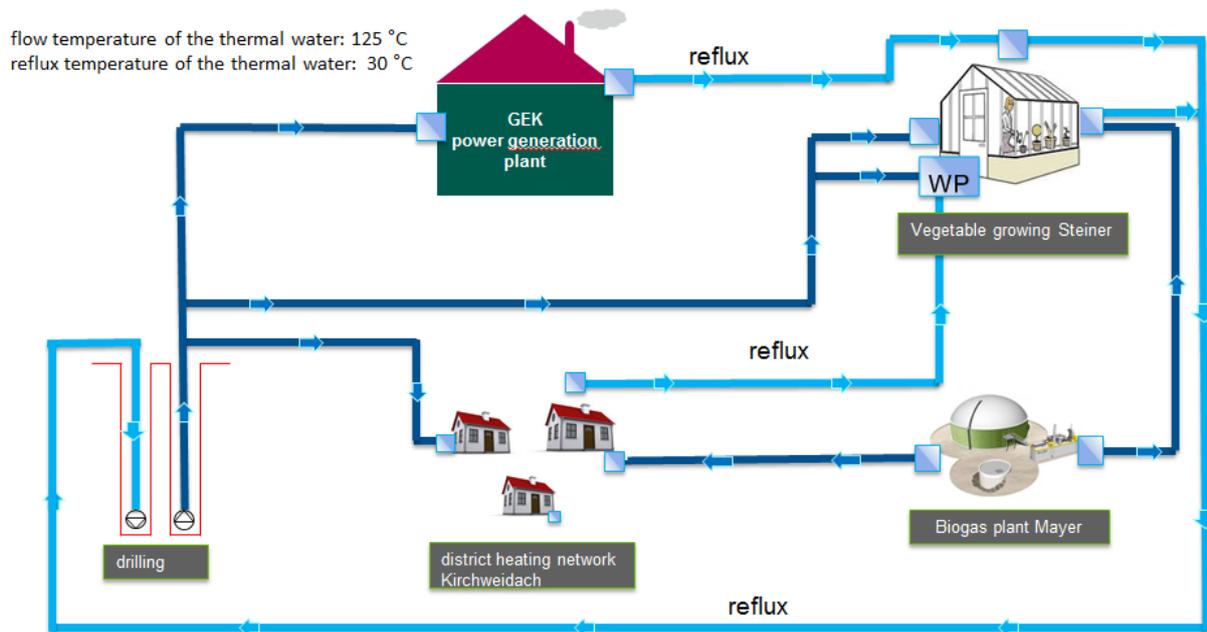
Deep geothermal energy Kirchweidach

	Project description
	<p>In the municipality of Kirchweidach in Germany, since 2013 vegetables are being produced sustainably and residents are supplied with renewable heat and electricity based on deep geothermal energy.</p> <p>The biggest customer of the geothermal heat is a vegetable growing company using a 12 hectare large green house, cultivating regional peppers and tomatoes.</p>
<p>client</p>	<p>This project is a unique flagship in terms of sustainability and environmental heat utilization strengthening the regional economy and location of the municipality in many ways. The vegetable production is completely CO₂ free. Compared to “conventionally produced” tomatoes from Spain or the Netherlands, the company saves approximately 6.5 million liters of fuel oil and 21.5 million kilogram of CO₂. The establishment of the greenhouse enabled the creation of 150 jobs. In addition, a power generation plant is still under construction. The complete project will enable the connection of further 300 households to the local district heating network.</p>
<p>Kirchweidacher Energie GmbH</p>	
<p>country</p>	
<p>Germany, Bavaria</p>	
<p>period</p>	
<p>04/2011-</p>	
<p>Type of project</p>	
<p>Deep geothermal energy</p>	
	<p>The positive response of the citizens and the high acceptance of the district heating network, comprising very low connecting and operating costs, give benefit to each household in the community. If there is a default, the supply is ensured by two fuel oil fired hot water boilers and a reserve heat storage with more than 3,400 m³. The thermal water passes the process twice, what results in an efficient and inexpensive system. In addition, a neighboring biogas plant is connected to supply even bio – heat in combination with the geothermal network.</p>

1. Introduction

Based on successful geothermal drillings, the municipality of Kirchweidach is building a district heating network for its citizens, who currently heat their homes with fuel oil, LPG or pellets. Furthermore a vegetable growing greenhouse is supplied and from the same resource green power is generated by an ORC power plant. Furthermore, even energy from PV and biogas has been integrated into the complete supply concept.

The cooperation between the production company, the power plant operator and the community has created an intelligent and highly innovative supply project, being already a model type for further projects to come in its vicinity.



picture 1: functional diagram

1.1 The municipality Kirchweidach

The municipality is located in the administrative region of Upper Bavaria and it is a small city in the southern district of Altötting. With the surrounding member communities Kirchweidach currently has around 5,400 inhabitants. With 2,500 inhabitants Kirchweidach itself is the largest city in the district of Altötting. The surface of the municipality comprises approximately 2,016 hectares.

Looking for potential oil or gas reservoirs in former times, thermal water was found in a depth of 3,000-4,000 meters. This was the start pulse for the current deep geothermal project of GeoEnergie Kirchweidach GmbH (GEK) (see description below) and marked the beginning to providing the community with sustainable, environmentally friendly baseload heat in the future.

1.2 Kirchweidacher Energy GmbH (KiwE)

The KiwE was founded by the municipality Kirchweidach specifically for the construction and operation of the district heating network. The company is responsible for the planning,

construction and secured operation of the district heating network in Kirchweidach. The heat is extracted from hot thermal water by GEK using a geothermal doublet. The key challenge for KiwE is to ensure the project's success and by doing so act as a sustainable and economically successful supplier of heat.

1.3 GeoEnergie Kirchweidach GmbH (GEK)

GEK is the owner of the drilling site and the boreholes. The objective of GEK is to gradually construct a power plant. The generated electricity will be compensated for according to the Renewable Energy Act ¹. In addition to that, extracting useful heat also increases the regional value-added chain. The required heat is sold to KiwE while any heat generated from the recirculation of the power plant is delivered free of charge.

1.4 Bioenergy Mayer GbR

The above mentioned biogas plant with a thermal output of 530 kilowatt (kW) and 8,000 estimated full-load hours per year feeds approximately 4,240 megawatt hours (MWh_{th}) of heat into the district heating system annually. The heat is supplied to the industrial and private customers as well as to the greenhouse operator "Gemüsebaubetrieb Steiner GmbH & Co. KG" (in the following "Steiner"). For seven years the heat is supplied to KiwE free of charge. In return the owner of the biogas plant has the opportunity of receiving a CHP bonus from the EEG by supplying heat into the distribution network. After this seven year period the owner of the biogas plant will supply heat to KiwE on similar terms as those agreed upon with GEK.

1.5 Project Phases

The project consists of several phases listed and described below.

May 2011	1 st deep drilling with 3,800 m depth and 4,900 length, temperature about 125 °C
December 2011	Injection well at 3,850 m depth and 5,130 m length
01. August 2013	Start of the first project phase
07. November 2013	Open council with the idea of planning a district heating system
21. December 2013	Start of implementing the haulage plant and supply of the greenhouse
17. February 2014	Beginning of planting 5,6 ha of peppers and 6 ha of tomatoes
May 2014	Implementation of the additional heat supply from waste heat from the neighboring biogas plant
18 th . August 2014	Start of the construction of the first district heating network section

¹ EEG: The German Renewable Energy Act regulates the preferred supply of electricity from renewable sources into the grid and guarantees fixed feed-in tariffs. The Act came into force in the year 2000 and was the initial spark of a huge boost of renewable energies in Germany.

Spring 2015	Planned start of the implementation of the first expansion level
Spring 2015	Planned start of the construction of the second section
Summer 2015	Planned start of the implementation of the second expansion level

1.5.1 drilling

The first well was completed in May 2011 with a depth of 3,800 meters and a length of 4,900 meters. It was deviated over a distance of 1,200 meters horizontally in the Malm². The temperature of the thermal water is about 130 °C. The second drilling, which is used as an injection hole, was drilled on the same drilling site. In the end of 2011, a total depth of 3,800 meters was reached, however it turned out as not suitable. Therefore, a sidetrack was carried out at about 3,000 meters from the borehole. This resulted in the desired success at a depth of 3,850 meters. After an overall drilling distance of 5,130 meters, which up to that point represented the longest geothermal drilling, thermal water was found with a flow rate of 130 l/s. The plant can provide an thermal capacity up to 40 megawatt. The heat extraction is at the moment around 13,000 megawatt hours per year.

1.5.2 Preliminary phase

The preliminary phase started in 2013 and will be concluded after the construction of the power plant has been completed.

GEK was not able to connect its power plant with its own district heating system right away. Therefore KiwE started to supply autonomous the district heating system as well as the vegetable growing company Steiner ahead of schedule. The preliminary phase will end after the construction of the power plant is completed.

By the end of 2013 the supply of the greenhouse was started. Currently 12 hectares of greenhouses are heated with geothermal energy with additional 6 hectares planned in the near future.

In the preliminary phase 40 l/s at 125 °C are pumped to surface by the submersible pump. This is sufficient for the supply of the greenhouse and the local network except for a few hours per year.

2. District heating and power development stages

The following section describes the characteristics of the district heating network and the various expansion steps.

2.1 district heating network

KiwE was founded for the construction and operation of the district heating network, as well as for the distribution of the heat, to all households in the community. Both the planning

² Malm: A layer of rocks from the upper Jura which is located in the "Molassebecken" in southern Germany.

and the operation of the district heating network were tendered throughout Europe. The construction of the network was awarded in August 2014. The construction of the network is divided temporarily and spatially into two phases. Currently up to 300 households and larger commercial customers are connected to the network. According to the latest plans initially approximately 12,8 kilometers of district heating pipes are currently being installed. The heating medium is the prepared hot district heating water which is heated by the energy of the thermal water. Below is a general overview of the project:



In the picture above, the vegetable gardening company Steiner (green), the drilling site (blue) and the biogas plant of Guido Mayer (yellow) are shown. In addition, the development area and the construction phases I and II can be seen.

2.2 expansion level I

The first expansion level successfully started in fall of 2014. In this stage 160 customers will get connected to the district heating system with an output of about 3 MW_{th}.

2.3 expansion level II

The second expansion is expected to begin in spring of 2015 and will be completed in the summertime. In this stage the remaining 140 households will be connected. Furthermore, if applicable, further block heat power plants as well as a heat pump will be integrated into the network. The development time for the plant is extraordinarily short and speaks to the commitment of all local stakeholders.

Hereafter the most important customers are described briefly.

2.3.1 vegetable growing Steiner GmbH & Co. KG

The vegetable growing company Steiner is the largest customer connected to the district heating network. A greenhouse complex of about 12 hectares is heated using solely geothermal energy provided by the district heating system. The heat demand of the entire greenhouse facility amounts from 40 to 60 gigawatt hours per year in the final stage. With this unique project, the regional economy and location of the municipality is strengthened. It is also the flagship project in terms of sustainability and environmental heat utilization.



With the help of geothermal energy the greenhouse complex is completely CO₂-free and due to this a great contribution to the energy transition process. Compared to conventional tomatoes from Spain or the Netherlands, the vegetable growing company Steiner saves approximately 6.5 million liters of fuel oil and 21.5 million kg of CO₂ emissions. Also around 400.000 truck kilometers are saved in one year.



2.3.2 Household customers

In 2015 customers with a total installed capacity of approximately 9 megawatts will be connected to the district heating network. Taking into account the weather and various diversifying factors, the local district heating network has to cover 5,1 MW of thermal power as permanent lower demand level at about 2,060 full load hours. The thermal take out in household customers is approximately up to 10 gigawatt hours.

2.3.3 commercial customers

Included in the sales volumes of the local network are several large customers like the town hall, a gym, a furniture store and a hotel with restaurant.

3. Competitive situation

In order to make the switch to a new heating system as interesting as possible for the residents, the household customers were offered attractive conditions. The district heating will be significantly cheaper, especially in the consumption costs, than other fuels. In the price escalation clauses the inclusion of the cost development for heating with oil and gas was incorporated. Because geothermal energy is available at all times, the base load is covered exclusively by geothermal energy. In case of default the supply is ensured by two fuel oil fired hot water boilers and a reserve heat storage in the premises of the greenhouse.

4. Technical parameters

1 st deep drilling (production well)	3,800 m depth and 4,900 length
2 nd deep drilling (injection well)	3,850 m depth and 5,130 m length,
production temperature	around 125 °C
injection temperature	30 to 60 °C
flow rate	around 130 l/s
heat supplied greenhouse	12 hectares and additional 6 hectares planed (peppers and tomatoes)
heat supplied households	300 with a capacity of approximately 9 megawatts
length of the local district heating network	13 km
CO ₂ emissions saved by the supply of the greenhouse	21.5 million kg (6.5 million liters of fuel oil and around 400.000 truck kilometers)