

GeoDH Training

Date
Location



Co-funded by the Intelligent Energy Europe
Programme of the European Union



Promote Geothermal District Heating Systems in Europe

GeoDH

Section A – Geothermal

Part 3:

Geothermal project's phases and concepts

elaborated by

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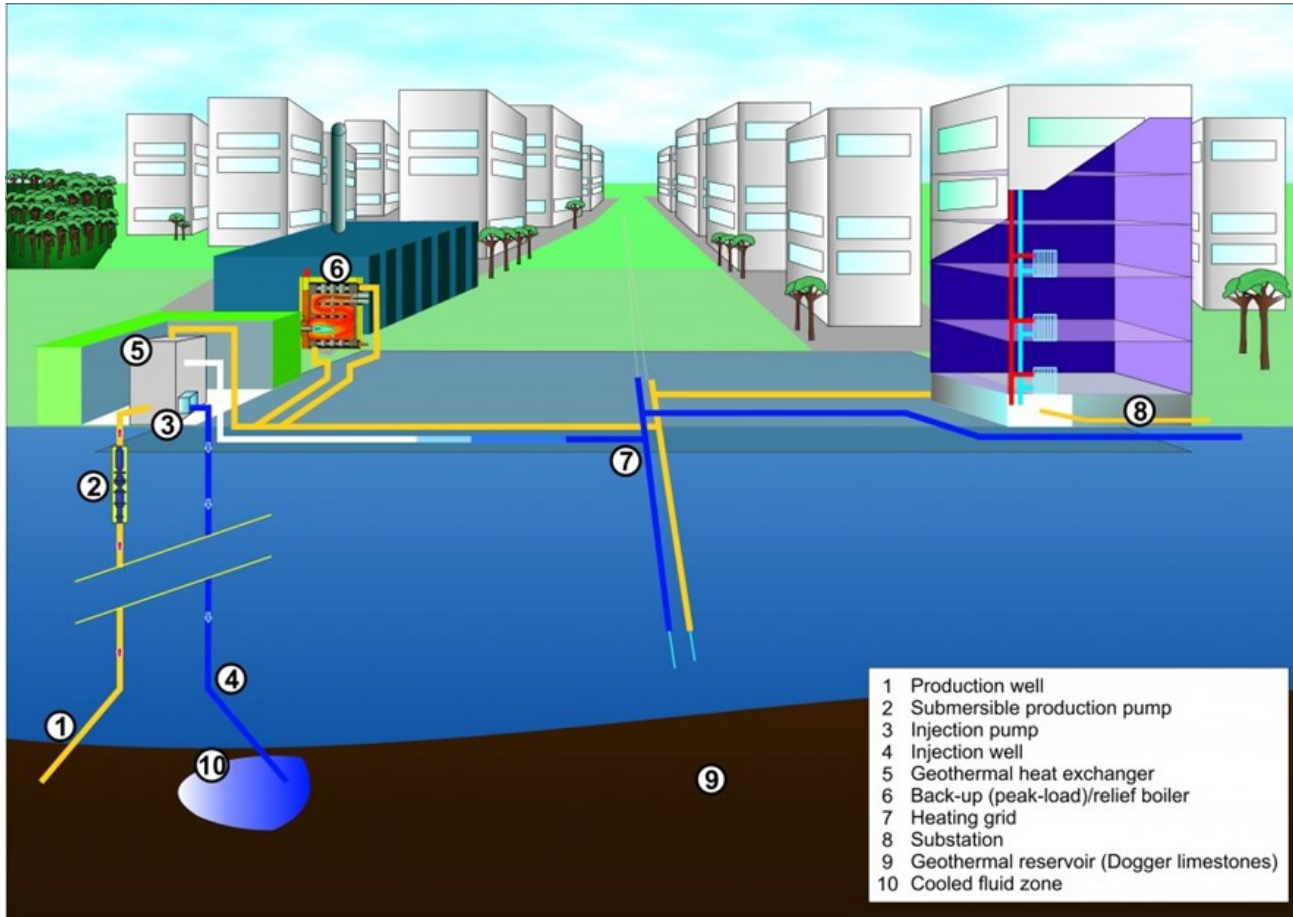


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Concepts and project phases



What are the main components of a geothermal district heating?



A five step analysis is needed to assist an initial evaluation before launching the construction of a geothermal district heating

- **Analyse Geothermal Heat Production.**

Information on the characteristics of an identified resource to estimate the heat production from deep geothermal resources.

- **Identify District heating Market Areas.**

To provide procedures for identifying potential market areas for district heating service. Heating demands in the service area are estimated and several criteria such as the density of thermal loads and distance from production fields are provided as guides in selecting market areas. If the DH already exists, this step will be limited to evaluate the adaptation of the heating loop.

- **Preliminary design of the district network for selected zones inside the town.**

To consider engineering design options available for the geothermal district heating system, which is dependent on resource temperature, flow rate, geothermal water quality and depth.

- **Analyse the economic aspects.**

To provide a procedure to estimate capital expenditures, and annual operation and maintenance costs which could be translated into costs per unit of energy for both district heating and conventional systems.

- **Evaluate district heating feasibility.**

To explain how district heating and conventional costs are compared.

Evaluation criteria are suggested to determine whether district heating is appropriate.



The 4 key phases to built a geoH system

Phase/Quarter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1a-Geothermal resources and DH prefeasibility study	█	█														
1b-Exploration permits			█	█	█											
1C-Detailed study on surface and subsurface equipments			█	█												
1d-Heat purchase agreement			█	█	█											
1e-Economics and financial			█	█	█											
2a-Risk insurance						█										
2b-Drilling first well							█									
2c-Drilling second well								█								
2d-Long term testing								█								
3a-Heating station									█	█						
3b-Network construction									█	█	█	█				
3c-Commissioning													█			
4a-Exploitation phase														█	█	█

Equity risk

Maximum risk zone if no insurance coverage

Debt risk



GO / NOGO road of a geothermal district heating plant construction

- **Pre-feasibility study:**

- ✓ Pre-Sales: Project pre-design, MOU for heat purchase agreement with customers and financing research
- ✓ Preliminary survey
- ✓ Prefeasibility study (surface and sub-surface)

GO / NOGO



Geothermal expected potential confirmed and existing customers ready to buy heat at a fixed cost for a long duration which has to exceed the loan period

- ✓ **Exploration and feasibility study:**

- ✓ Detailed studies, including geophysics if possible and permitting to obtain the right to drill a doublet
- ✓ Negotiation to get a coverage for the first and second well + geothermal loop testing
- ✓ Project economical review and financing strategy

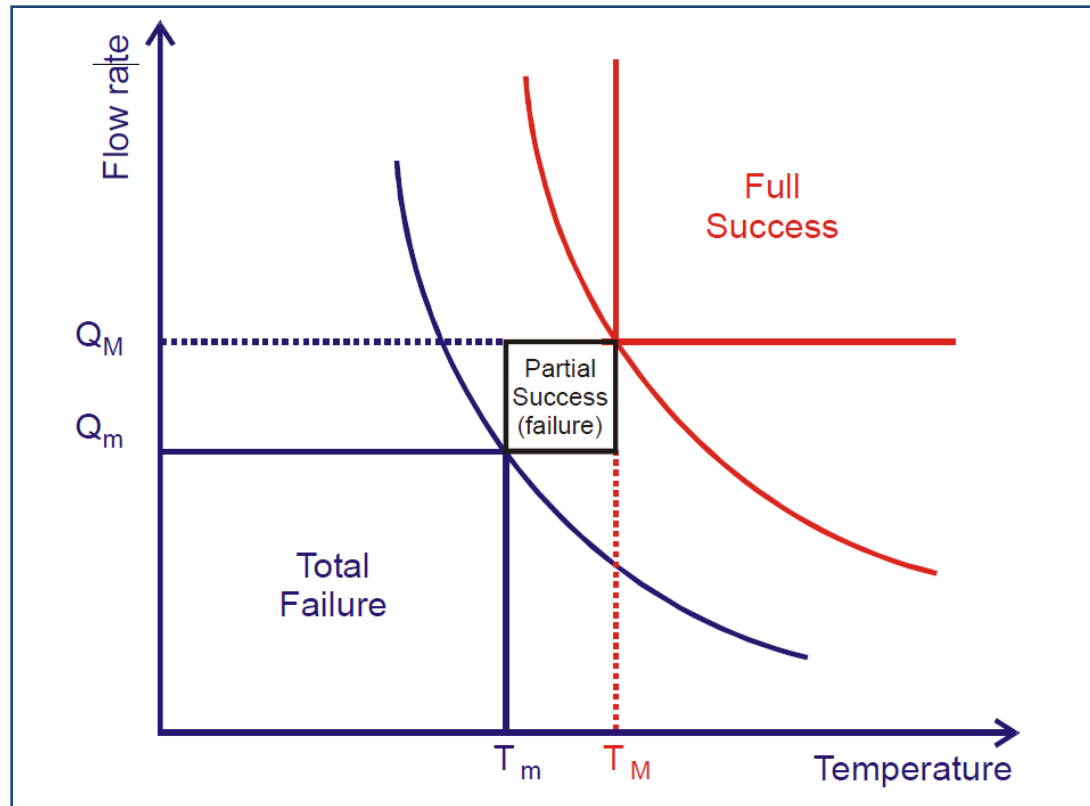
GO / NOGO



Confirmation of geothermal potential (depth, temperature, flow-rate), insurance coverage secured and financial details arranged



What could be a success curve: the French insurance system



GO / NOGO road of a geothermal district heating plant construction

- **Drilling of wells:**

- ✓ Drilling of first well (preferably vertical)

GO / NOGO



The project is stopped if the result of the first well is under a ratio “temperature/flow-rate “ is under the limits of the success curve built which is annexed in the insurance contract

- **Drilling of the second well and loop test:**

GO / NOGO



The project could be stopped at that time if the capacity of the second well is much lower or do not accept the reinjection of the total production flow rate

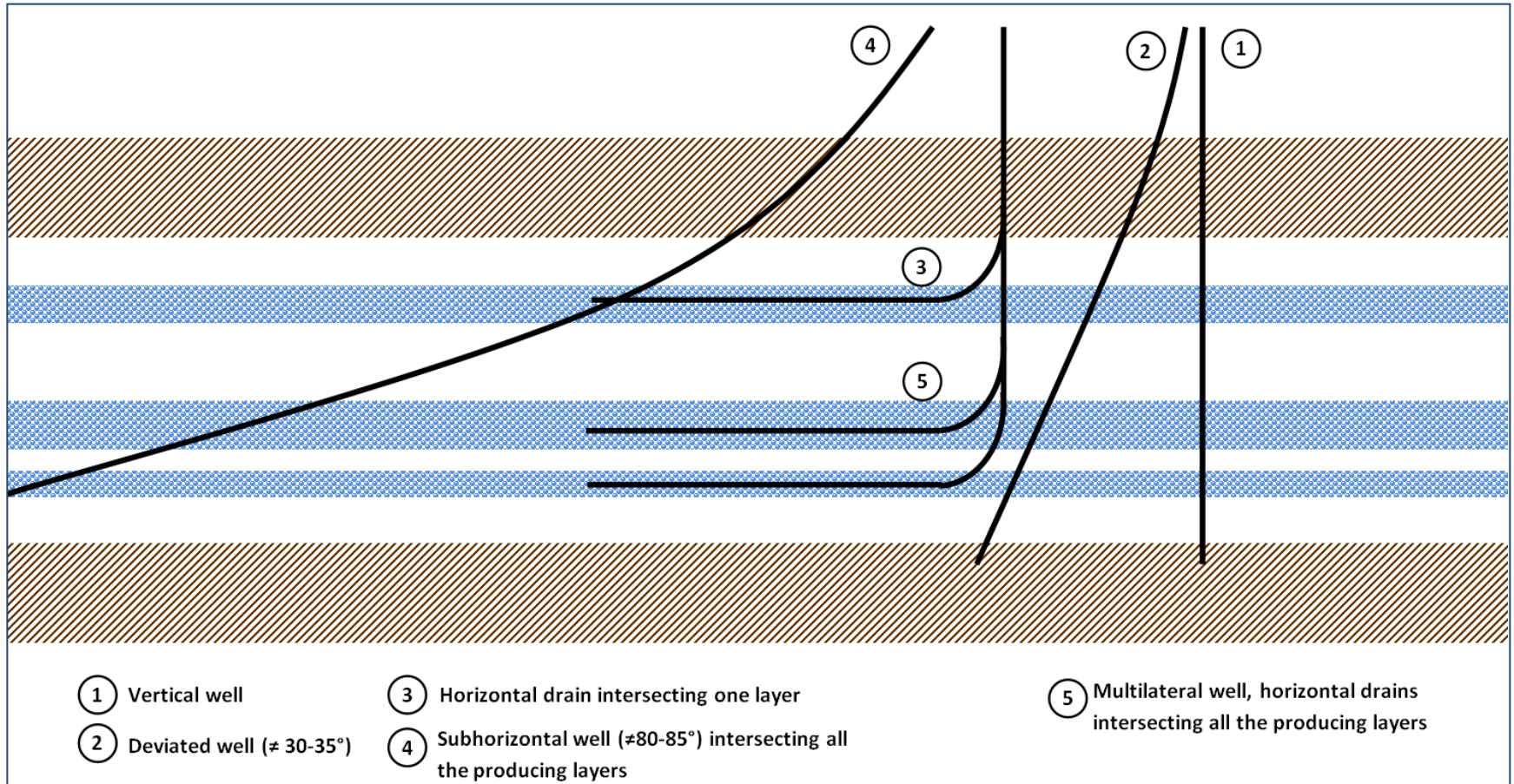


GO / NOGO road of a geothermal district heating plant construction

- **District heating construction:**
 - ✓ Equipment of the geothermal loop (submersible pump, surface injection pumps, speed variators, heat exchanger installation, chemical treatment if any), monitoring of the loop and testing
 - ✓ Construction of the piping network or adaptation of the existing network
 - ✓ Construction of heating station (the closest possible from the drilling pad) or adaptation of the existing
- **Commissioning of the whole installation:**
 - ✓ First year of operation with detailed measurements on the geothermal loop (water flow rates, levels in the wells, well-head pressure, physics-chemistry of water, pump electrical consumption, etc...)
 - ✓ First year of operation with detailed measurements on the DH network (temperature, flow rate, return temperature to the exchanger, follow up of back up boilers and calculations of energy balance with the coverage of geothermal)
 - ✓ Normal exploitation of the plant including well controls, repairs and heavy maintenance and equipment replacement.

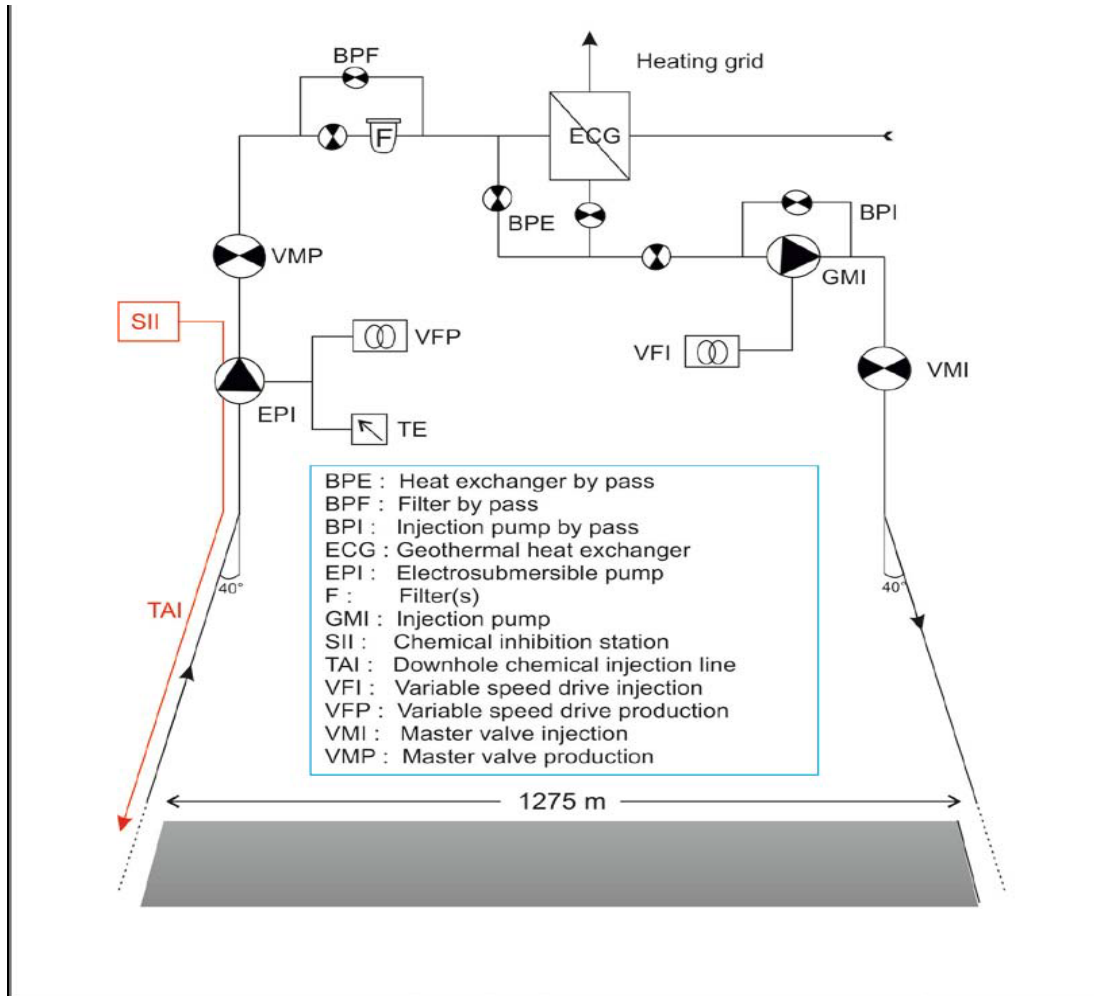


Geometry of the sub-surface system



- Concepts and project phases

Geometry of the sub-surface system



Typical design of the GeoDH system

