

Veolia's experience in geothermal district heating under the French incentive scheme

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*The future of geothermal projects in Sofia
and in the country*
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SUMMARY

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Geothermal DHN





District Heating Networks in Veolia

District Heating in Veolia

Key Figures 2022

Veolia is a global leader of District Heating with
Turnover of €5.3 bn in 2022

Network

593

district heating

9 725 km

network length

Production

18.6 GW

Thermal Capacity

26 %

Green energy

Sales

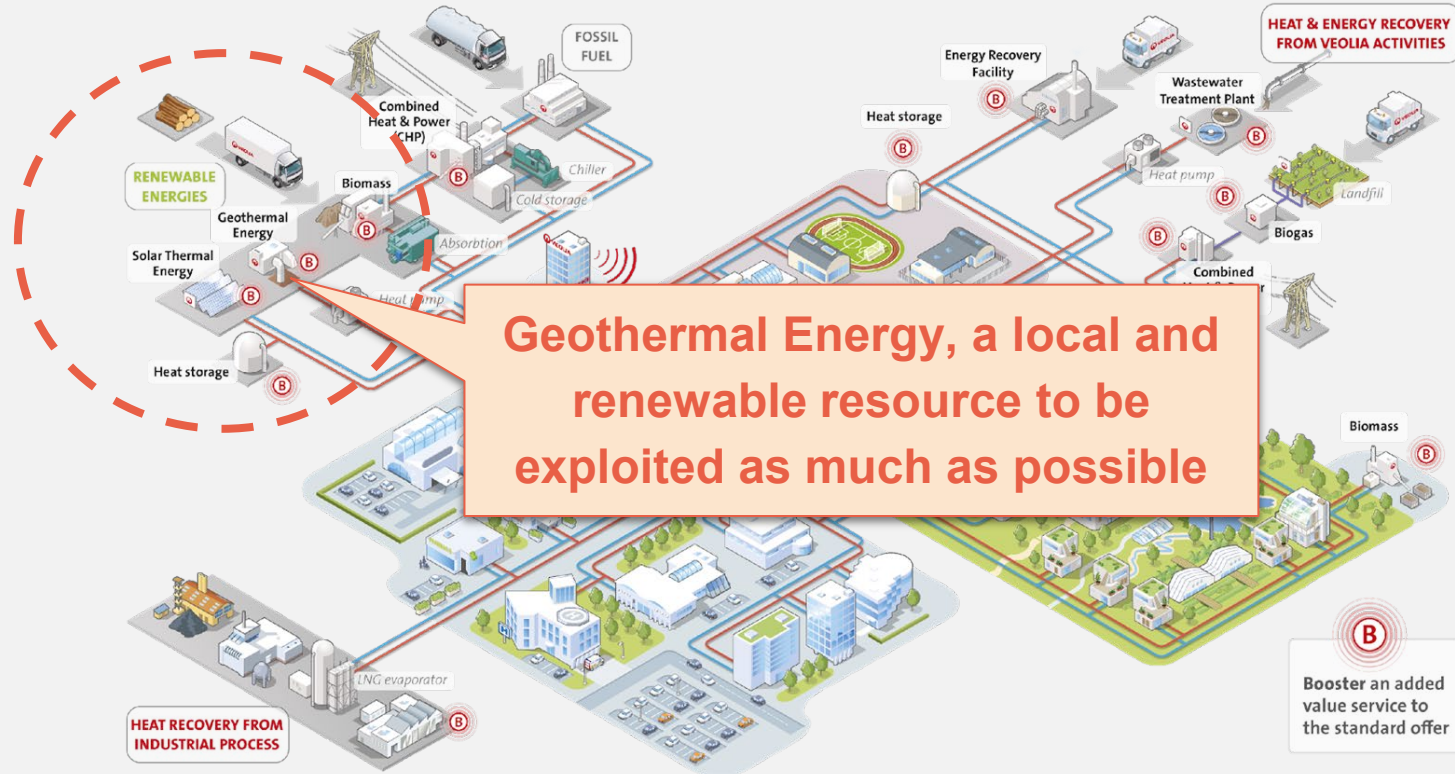
16.5 TWh

heat delivered

7 millions

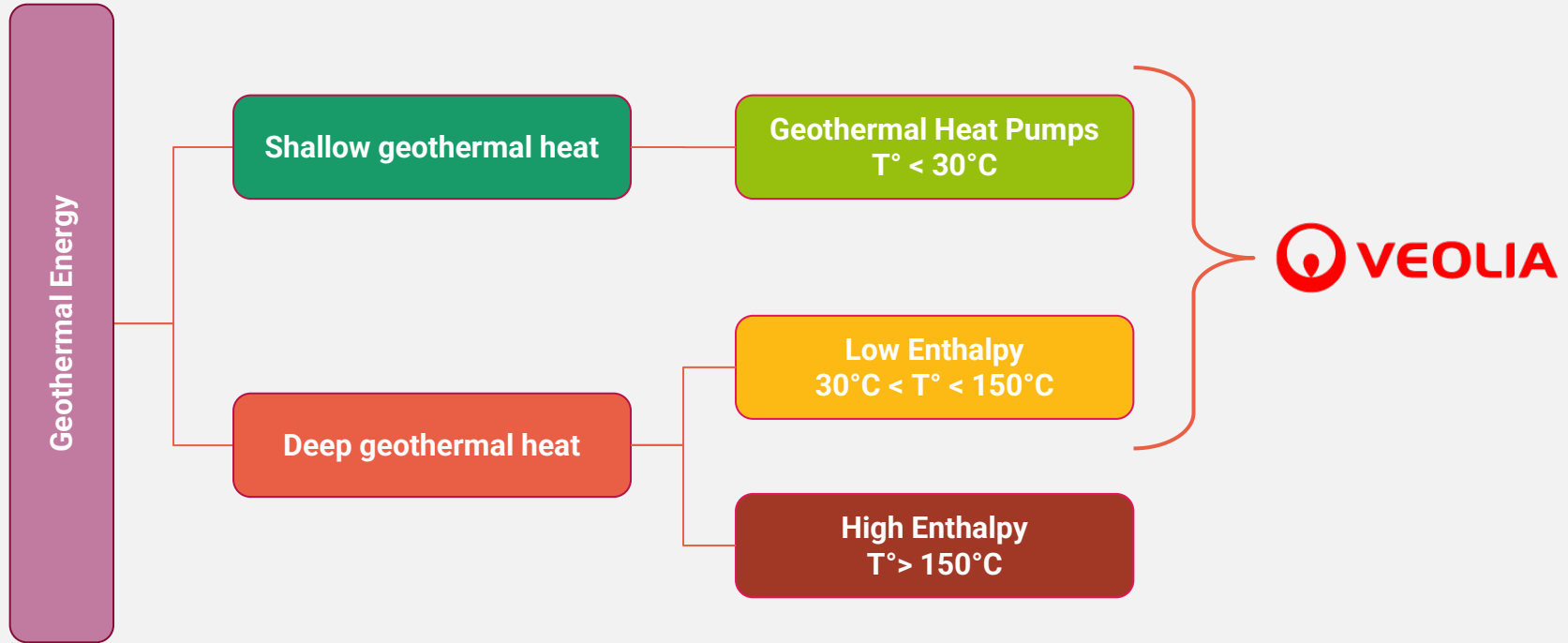
inhabitants supplied

District Heating in Veolia Decarbonization roadmap



District Heating in Veolia

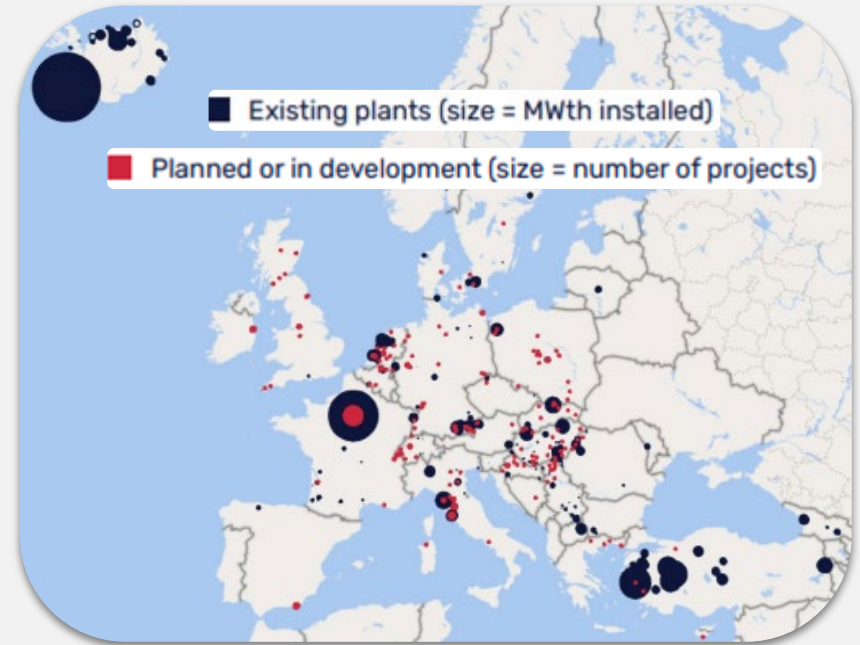
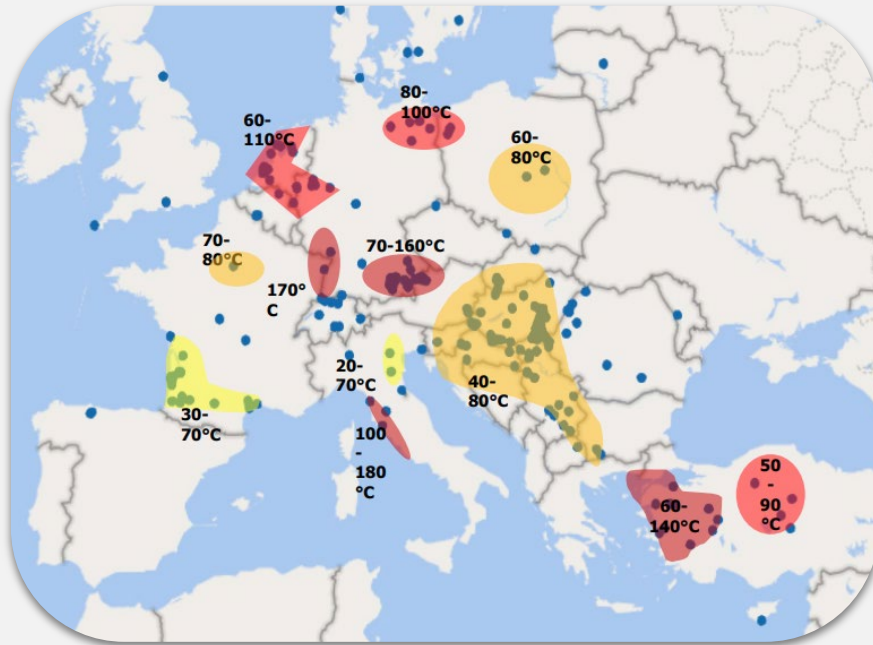
Geothermal as decarbonized heat source



Geothermal District Heating Deep-Aquifers resources

Geothermal District Heating

Mapping of geothermal DHN vs resource in Europe



Source : EGEC Geothermal Market Report 2020

Geothermal District Heating

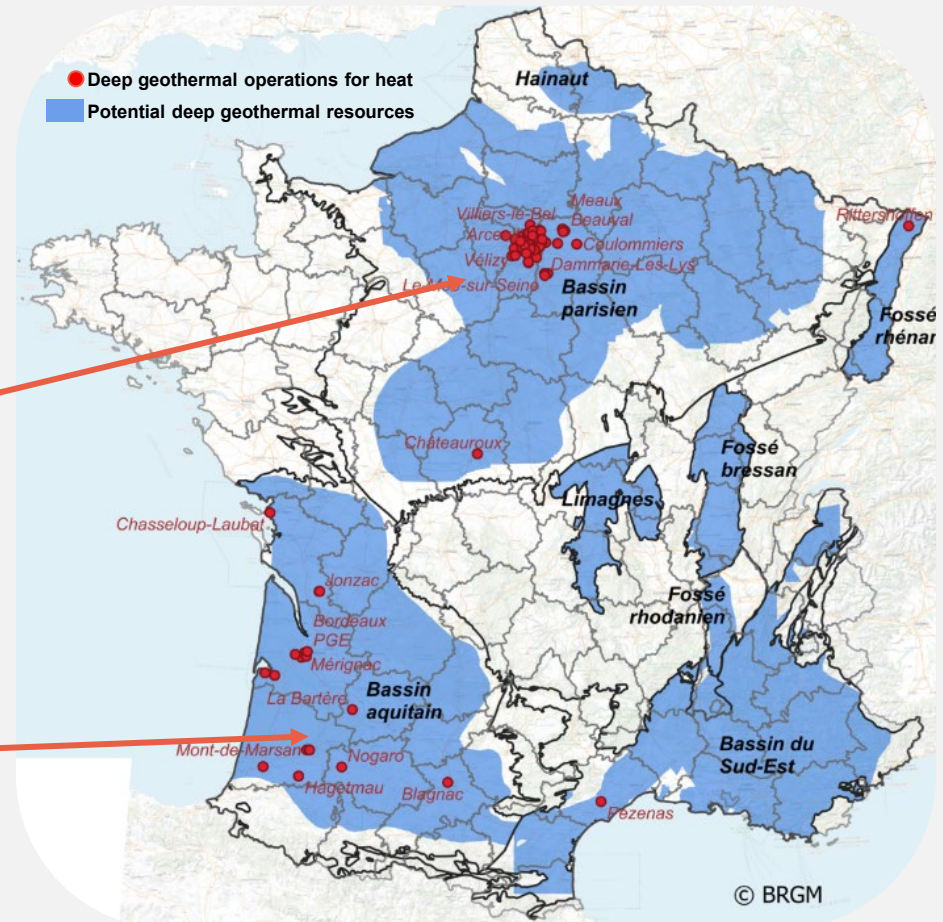
Map of resources in France

Parisian Basin:

- 54 geothermal district heating
 - 36 direct use of heat
 - 13 with heat pump
- Temperatures from 30°C to 85°C
- Drillings between 700 to 2,300 m
- 2,100 GWh/year

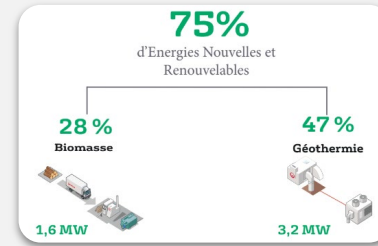
Aquitain Basin:

- 17 geothermal district heating
- Temperatures from 30°C to 70°C
- 160 GWh/year

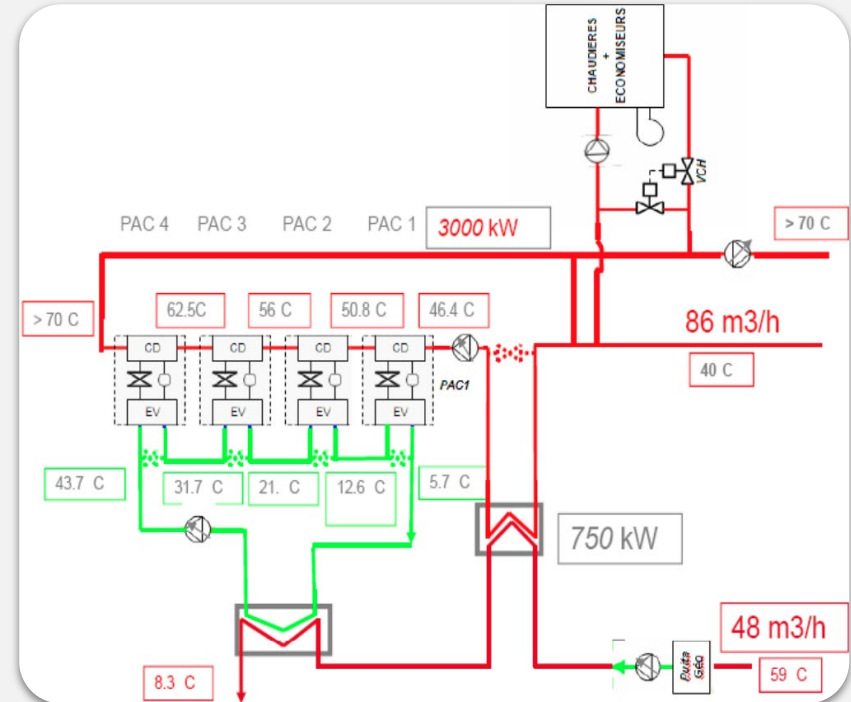


Aquitain Basin

Toulouse-Blagnac DHN

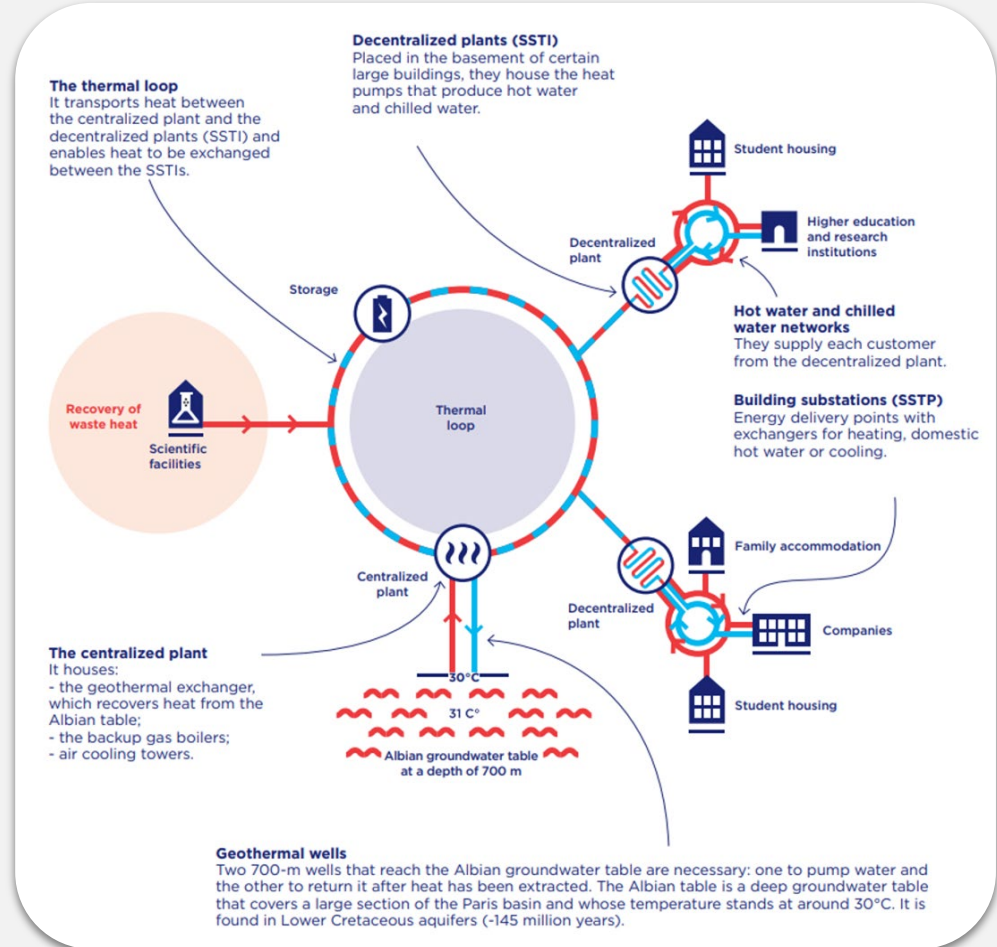


- Geothermal heat from Ritouret well since 1976:
 - depth : 1 640 m, without reinjection well
 - water flow : 48 m³/h, limitation 50 m³/h
 - temperature : 59°C max
 - rejected temperature to the river < 10°C
 - well refurbishment in 2018 due to clogging issues
- 4 Heat Pumps => 3.2 MW in total
- 1 biomass boiler of 1.6 MW
- 2 gas/ light fuel oil boilers => 13 MW in total
- 2 200 housing equivalents / 42 building heat substations
- 6 km of heating networks (70°C/40°C)
- Production of 22 GWh (heating and domestic hot water)



Parisian Basin Paris-Saclay DHCN

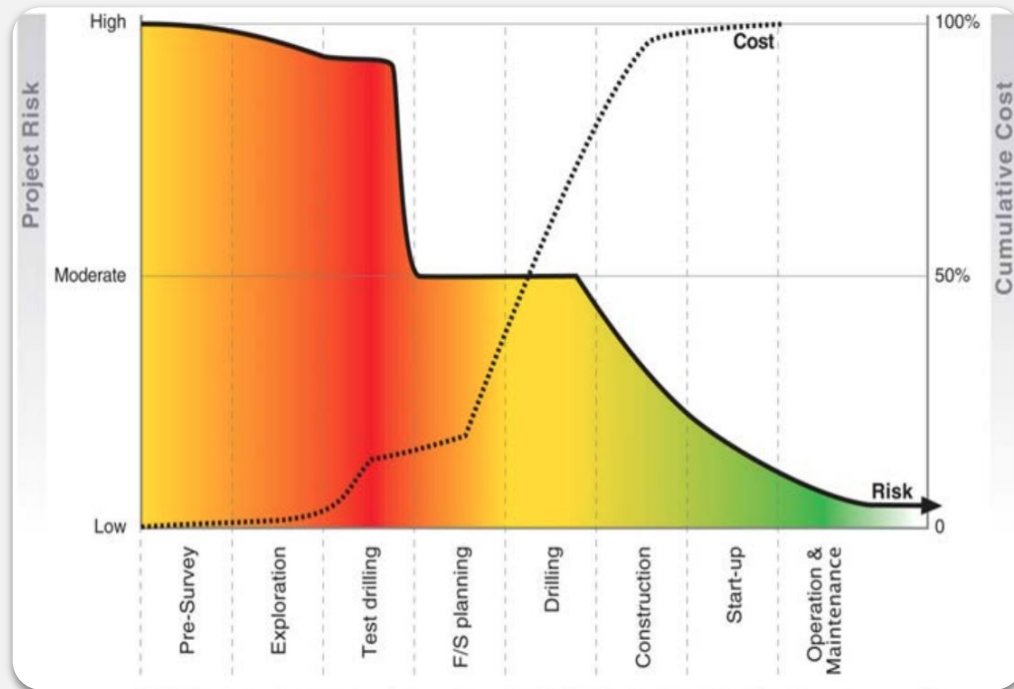
- 2 geothermal wells Albian aquifer since 2019 :
 - depth : 700 m, with reinjection wells
 - water flow : 130 m³/h each
 - temperature : 31°C max
- 7 SSTI Heat Pumps : 48 MW_{heat} + 35 MW_{cold}
- 44 SSTP : 36 MW_{heat} + 17 MW_{cold}
- 2 Centralized Plant : gas boilers of 34 MW + cooling towers of 25 MW
- Networks:
 - Ambient loop (30°C / 10°C) : 7.6 km
 - Heating network (61°C/48°C) : 13.5 km
 - Cooling network (6°C/11°C) : 7.6 km
- 47 GWh of heat + 13 GWh of cold sold



Key levers to support geothermal DHN in France

Key levers to support geothermal DHN development in France

Risk mitigation by improving underground knowledge



The **geological risk** is linked to the fact that the exploitable geothermal energy resource can only be precisely known after the drilling of boreholes – a costly operation which may result in failure.

In the Paris area, the exploitation of the Dogger aquifer (between 1,600 and 1,800 meters deep) has been favored by the knowledge acquired during oil exploration in the Paris basin (1960s-1980s).

Key levers to support geothermal DHN development in France

Deep aquifer geothermal guarantee fund

The development of deep geothermal operations with heating networks is supported in France by the **geothermal guarantee fund for deep aquifers** (17.2 M€ in public grants since 1981). This fund offers a double guarantee:

- **Short Term Guarantee Fund** to cover the geological risk linked to the search for geothermal resources, i.e. the risk of not finding an exploitable resource (insufficient flow, too low temperature, unsuitable geothermal fluid composition)
- **Long Term Guarantee Fund** to cover the risk of changes in water resources during operation over a period of 25 years

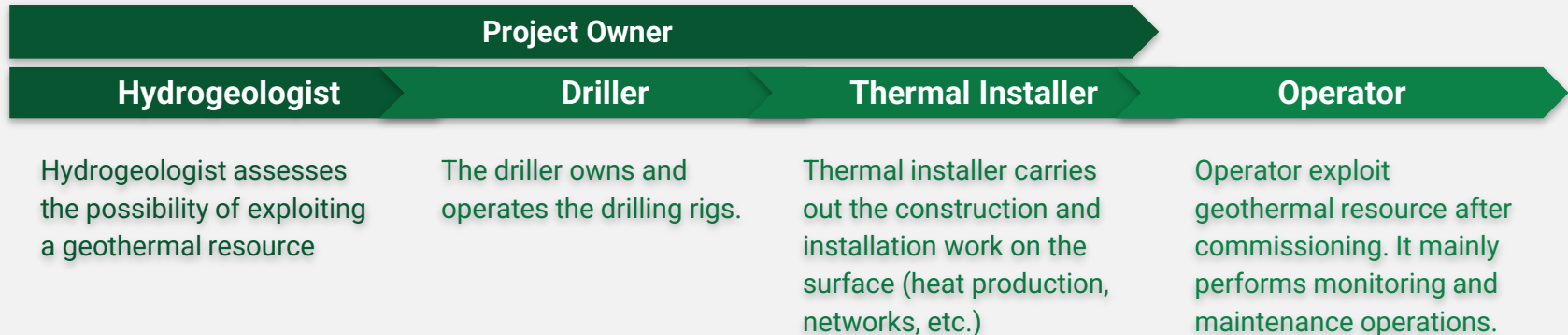
An extension of this guarantee fund was pre-notified in December 2021 to the European Commission for an amount of 45 M€ in public aid.

Key levers to support geothermal DHN development in France

Support key players in the value chain

A specific **certification framework** guarantees the **skills and know-how** of the key players in geothermal energy. The AFPG, French Association of Geothermal Professionals has more than 100 members representing the various geothermal energy professions in France.

Project owner manages the various operations for the study and the realization of geothermal projects until commissioning



Key levers to support geothermal DHN development in France

Heat Fund to support District Heating development

Operating geothermal resources at **temperature between 30°C and 90°C**, can deliver large amount of heat. It is a dynamic sector with already **80 operations in France and a dozen planned in 2023**.

The deep **geothermal heat in France in 2020** represents about **2.5 TWh**, among which **87% is delivered by districts heating networks**.

The objective of the national energy multi-annual program is to reach **6.5 TWh in 2030**, which represents **55 MWth per year** of new capacity.

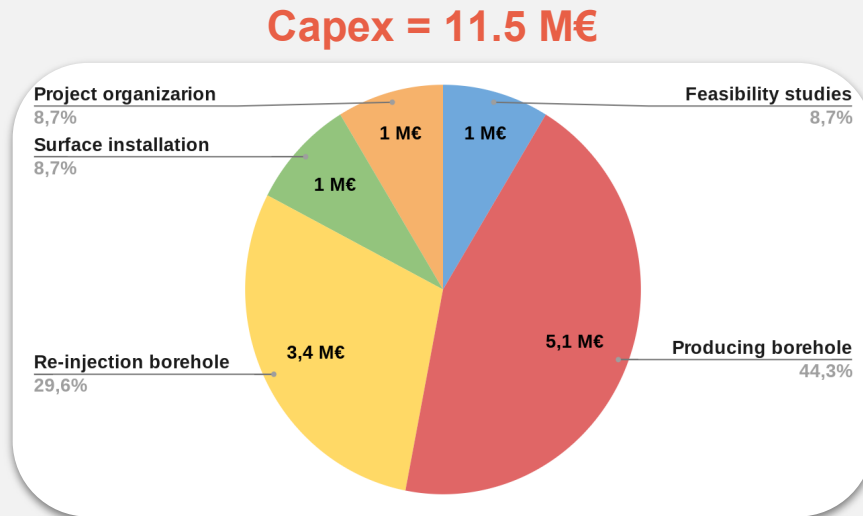
⇒ French State allocates an annual grant to the **Heat Fund to support the development of renewable heat through district heating network**. Heat Fund reaches **520 M€ for the 2023**.

The implementation of a deep geothermal well (from 1,500-2,000m) costs ~ 10 M€. Solution is only economically viable if implemented for many users. We estimate that at least 5,000 dwellings connected are needed to ensure the economic balance of an operation.

Key levers to support geothermal DHN development in France

Affordable and sustainable price of geothermal heat

Example for a 10 MW standard operation based on deep-aquifer geothermal well (2017 value)



Maintenance operations	Frequency	Cost (k€)
Replacement of producing well pump	Every 4 years	150
Servicing (upwelling of old pump and installation of new pump)	Every 4 years	100
Partial replacement of tubing	Every 8 years	50
Replacement of reinjection pump seal	Every 2 years	15
Producing well logging	Every 4 years	25
Reinjection well logging	Every 5 years	20
Speed variator maintenance	Every year	10
Corrosion inhibitors	Every year	50
De-sludging of exchangers	Every 4 years	25
Average yearly cost		152 k€
O&M cost (20 years)		3 M€

Levelized Cost of Heat (LCOH) ~ 25 € / MWh at DHN input

Key levers to support geothermal DHN development in France

To sum up ...

1. Improving **knowledge of the underground** to mitigate the risk of failure of deep geothermal projects
2. Implementing a **geothermal guarantee fund** to cover the geological risk during the search for geothermal resources and the risk of changes in water resources during exploitation phase
3. Increasing the **skills and know-how of key players** (hydrogeologists, drillers, thermal installers, operators) **to support project owners** in the deployment of geothermal solutions
4. Setting up a **grant scheme to develop district heating networks** together with geothermal energy to offer an **affordable and sustainable carbon-free heat**

| **Thank you**