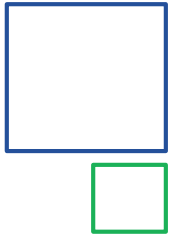


# DESCRAMBLE Project



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## Executive Summary



### Project description:

The “Drilling in dEep, Super-Critical AMBient of continental Europe” (DESCRAMBLE) project proposes to drill in continental-crust, super-critical geothermal conditions, and to test and demonstrate novel drilling techniques to control gas emissions, the aggressive environment and the high temperature/pressure expected from the deep fluids. The project will improve knowledge of deep chemical-physical conditions for predicting and controlling critical drilling conditions. An existing well in Larderello (Tuscany, Italy), Venelle\_2, will be deepened from its present depth of 2.2 km down to 3-3.5 km. The DESCRAMBLE project will be partly supported by EU H2020 funds. The final purpose of the project is the chemical and thermo-physical characterization of the steam reservoir. The Venelle\_2 well will not be converted in a production well.



# Executive Summary

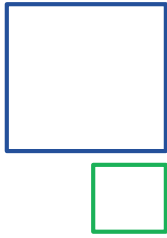


Future Developments of the Project

**The DESCRAMBLE PROJECT is the first part of an innovation path in three phases:**

- **PHASE I – R&D:** the activity partly financed by H2020 of deepening the Venelle\_2 well, for testing new material and procedure for drilling and fluid handling in supercritical conditions (450°C and 250 bar);
- **PHASE II - PILOT:** in case of success of PHASE I, a Pilot Plant, with possibility of grants from EU (as follow up of DESCRAMBLE), MIUR and Tuscan Region;
- **PHASE III - Deployment:** after the R&D and Pilot phases, the supercritical plant could be replied in different locations in Italy and abroad, with a substantial cost reduction due to a learning curve effect.





## Project description



### A. Objective:

- Demonstrate safe drilling of a deep super-critical geothermal well, and extending the Venelle\_2 well into a very high temperature formation.
- Reduce the technical and financial risks of drilling and exploiting deep geothermal wells by improving knowledge of the physical and chemical conditions in deep geothermal formations.
- Reduce pre-drill uncertainty in the exploration of deep geothermal wells by applying the latest seismic processing, imaging and interpretation technology for exploring the super-critical reservoir prior to drilling. T.
- Investigate the economic potential of exploiting chemicals and minerals by analysing fluid samples for valuable materials.

### B. Background:

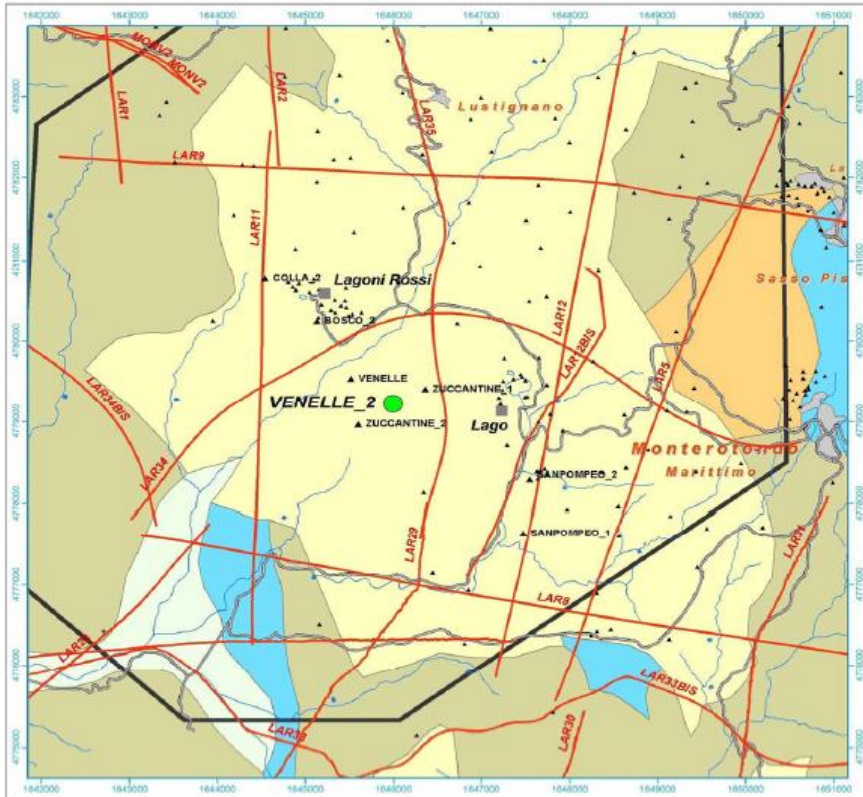
In the EU H2020 call, “Work Programm 2014-2015” “Low Carbon Energy”, ILCE-2-2014/2015: “Developing the next generation technologies of renewable electricity and heating/cooling”, the geothermal activity for development of new drilling technologies and concepts for geothermal energy will be financed; new drilling technologies and concepts are necessary to increase the number of economically viable geothermal resources, including in hard rock and high temperature/pressure conditions, and have a demonstrably smaller environmental footprint by comparison to existing drilling methodologies. Cross-fertilisation with hydrothermal oil and gas technologies and operations shall be explored. Our DESCRAMBEL project fits completely into the topics of this call, and it has been considered as **EXCELLENT (score 15/15)** from the EU evaluators.

### C. Rationale:

- Strategic:** drilling in very high temperature and pressure conditions represent a new frontier for the geothermal development, increasing the resource development of Larderello area.
- Technical:** drilling deep wells into supercritical conditions would require a specific technical approach, with synergies from Oil&Gas
- Economical:** in case of success the power density per well is one order of magnitude higher than standard ones, so it would be possible to achieve a substantial saving in drilling costs for a geothermal project

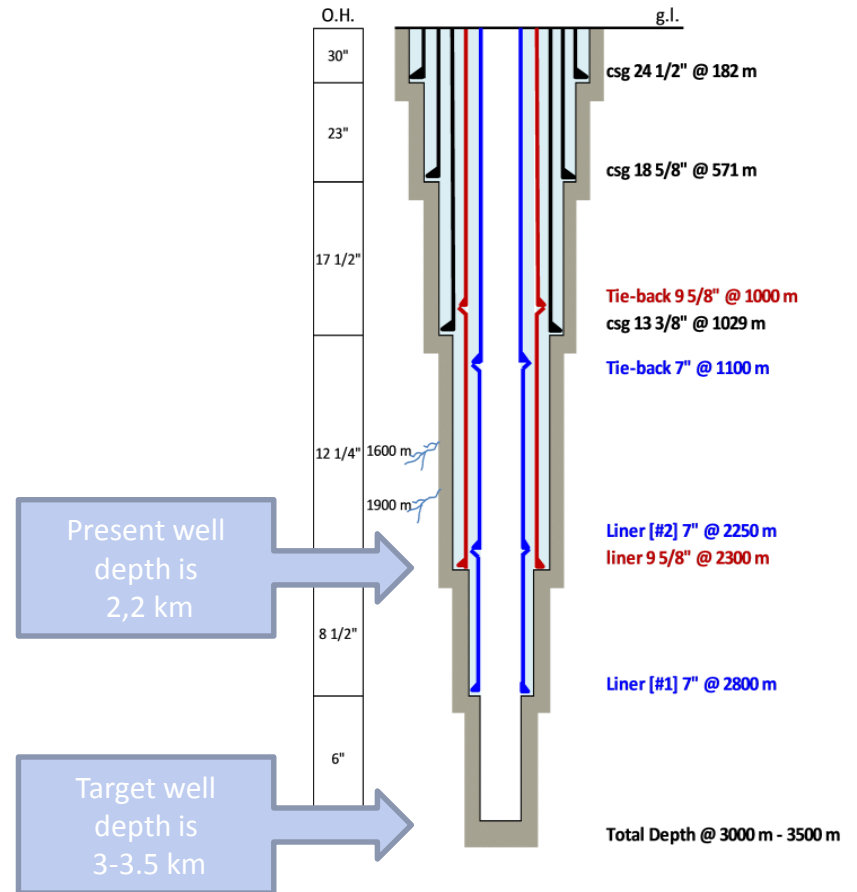


# Location and main characteristic



Location of the Venelle\_2 well, Larderello, Tuscany, Italy

## VENELLE 2 [HORIZON 2020]

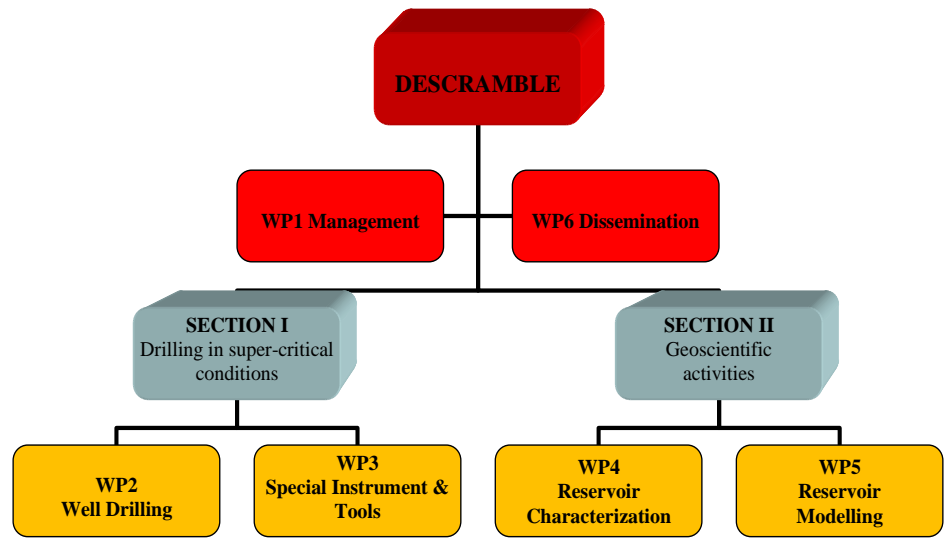
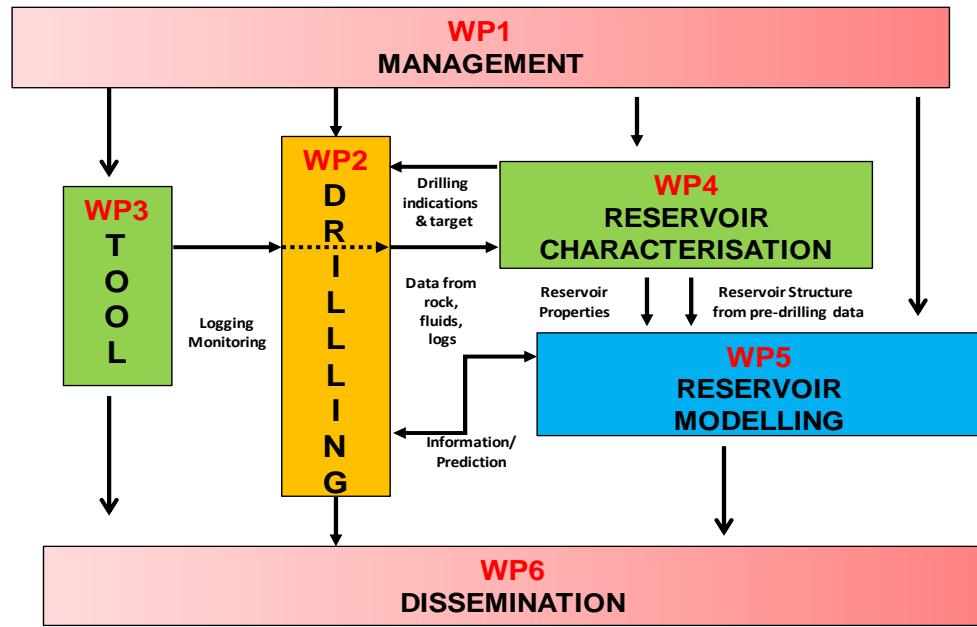


- Existing Casing
- Liner + Tie-back 9 5/8" to be run in hole
- Liner (n° 2) + Tie-back 7" to be run in hole



# DESCRAMBLE

## Work Breakdown Structure and Partners

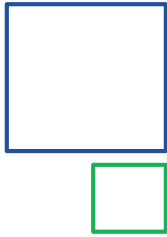


Istituto di Geoscienze e Georisorse  
Consiglio Nazionale delle Ricerche



SINTEF Group





## PROJECT ACTIVITIES

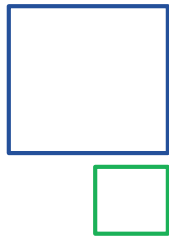
### Section I: Drilling in super-critical conditions.

- Definition of the drilling program: deepening the Venelle 2 well.
- Develop procedures for well monitoring and control in order to secure the safety of the well in terms of health and the environment.
- Selection/development of appropriate equipment and material to withstand the harsh downhole conditions.
- Definition/development of drilling procedures.
- Development and testing of a novel logging tool for measuring temperature and pressure at super-critical conditions. The heat shield and high-temperature electronics will allow for a minimum of 8 hours logging at 450°C.

### Section II: Geo-scientific activities to increase knowledge of super-critical wells.

- Geophysical survey and reinterpretation of all data before drilling for a better identification of the drilling target, with a new seismic data acquisition campaign, with a Vertical Seismic Profile and the accompanying deployment of seismographs in a 10-20 km area around the drill site, sounding the underground for a comprehensive and areal seismic characterization of the target horizon.
- Definition of procedures for supercritical fluid handling and sampling.
- Definition of procedures and equipment for the production test.
- Geophysical logs before and during drilling, to obtain a full dataset of valuable information.
- Measurement of several physical and chemical characteristics from rock cores, cuttings and sampled fluids.
- Evaluation of petrological characteristics of the rock samples.





## Innovative Aspects



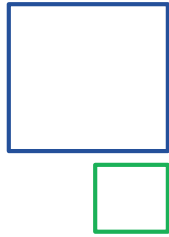
### HIGHLIGHT ON THE MOST INNOVATIVE ASPECTS

#### Applied research/demonstrations of industrial component in an unconventional application:

- **Materials**: Bottom hole assembly components, Cementing process, Drilling fluids, Well materials (casing, well head, and cement)
- **Well design and control**: the research will optimize new procedures, explicitly utilizing synergies with oil and gas industry.
- **Predicting and controlling super-critical conditions**: the research will optimize new procedures, explicitly using synergies with oil and gas industry. Existing simulators will be extended to the super-critical regime.
- **Development of a new logging tool**: suitable for measurement of pressure and temperature at supercritical conditions.
- **Scientific research aspects**: Seismic characterization of the super critical region, Petrophysics and log interpretation, Geochemical monitoring and Petrology







## Benefits



### HIGHLIGHT ON THE MOST IMPORTANT BENEFITS

- Increased power output per well (5-10 fold)
- Production of a higher value steam (higher P-T)
- Extending the resource base and lifetime of existing fields
- Knowledge of reservoir characteristics at greater depths
- Advancing techniques of UGR (Unconventional Geothermal Resources)
- Development of an environmentally benign resource
- Development of high-temp. instruments and drilling technology
- Application to high-temp. geothermal systems world wide
- Educational, industrial and economic spin offs





WE HAVE A DREAM



Thanks for your kind attention

1931: Soffionissimo well

1999: Montieri 1 well