

Enel Green Power Innovation & Sustainability

DESCRAMBLE

ETP-RHC
15th Geothermal Panel Meeting,
Bruxelles, September 23th 2015



 **Enel**
Green Power



DESCRAMBLE

Executive Summary



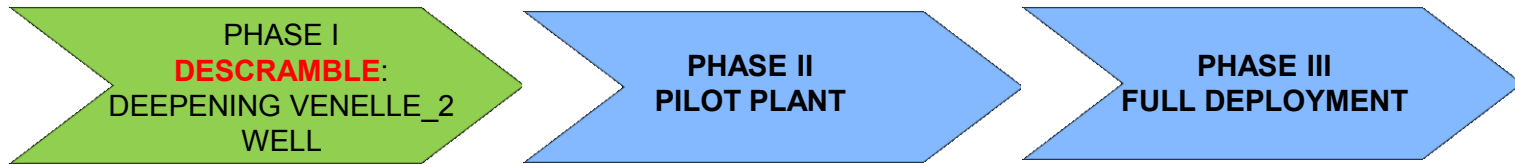
Project description

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 H20202 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.



DESCRAMBLE

Executive Summary



Under evaluation by
Investment Committees

Future Developments of the Project

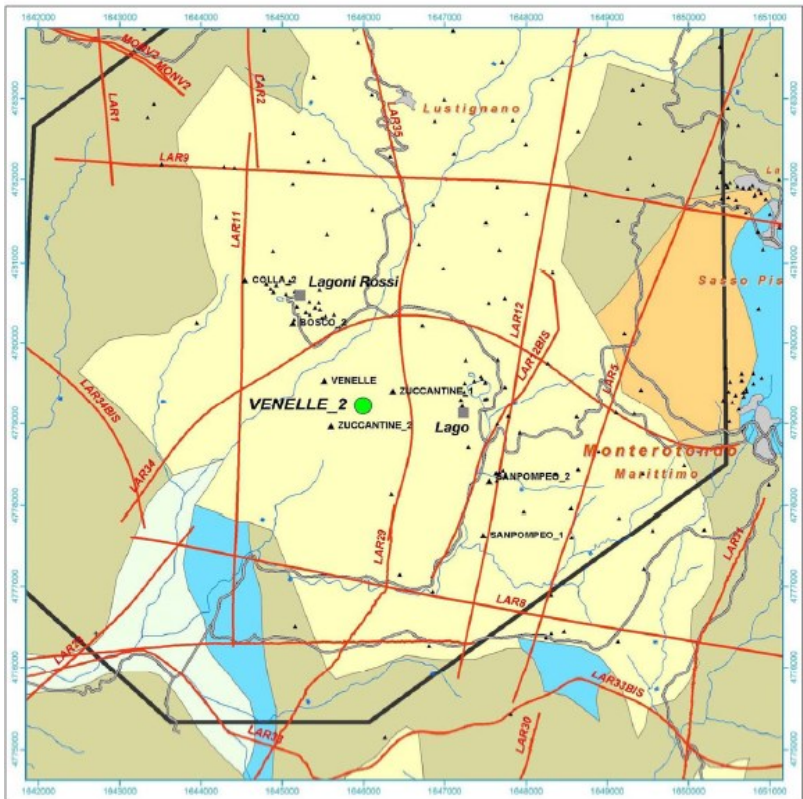
The DEGRAMBLE PROJECT is the first part of an innovation path in three phases:

- **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). The probability of success of this phase is about 30%;
- **PHASE II - PILOT:** in case of success of PHASE I, a Pilot Plant of 40 MW could be realized, fed by a two supercritical wells, with possibility of grants from EU (as follow up of DEGRAMBLE), MIUR and Tuscan Region; the probability of success of this phase is about 80%.
- **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.



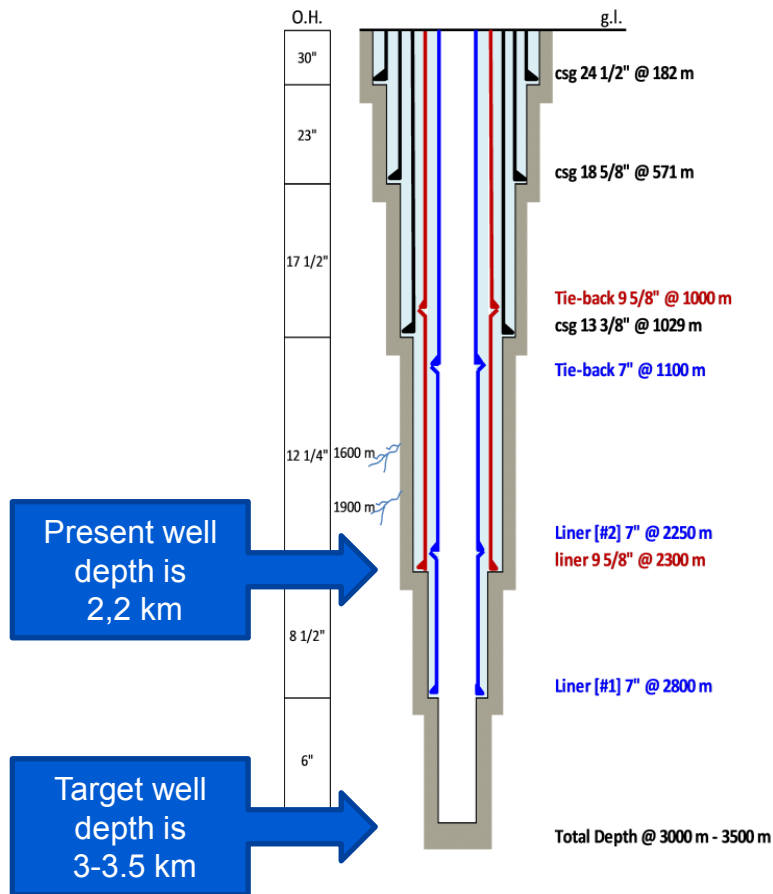
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Location and main characteristic



Location of the Venelle_2 well, Larderello, Tuscany, Italy

VENELLE 2 [HORIZON 2020]



Present well depth is 2,2 km

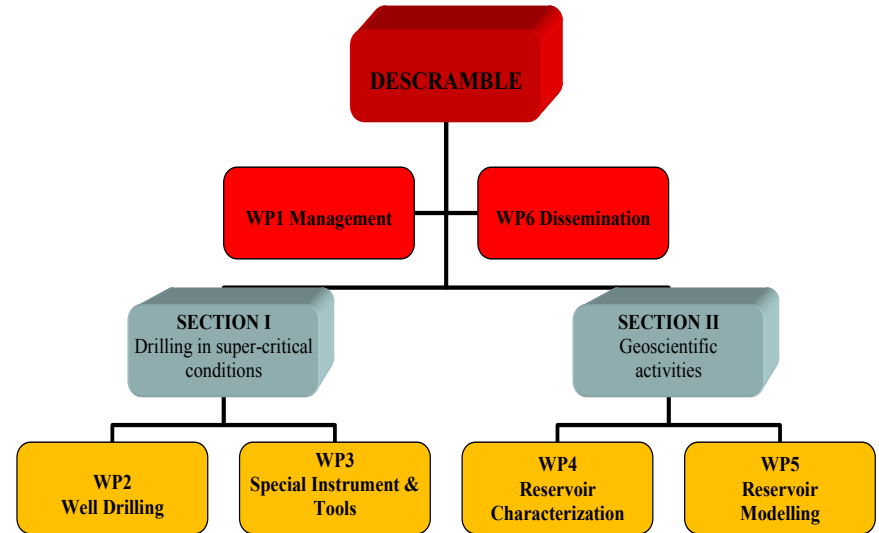
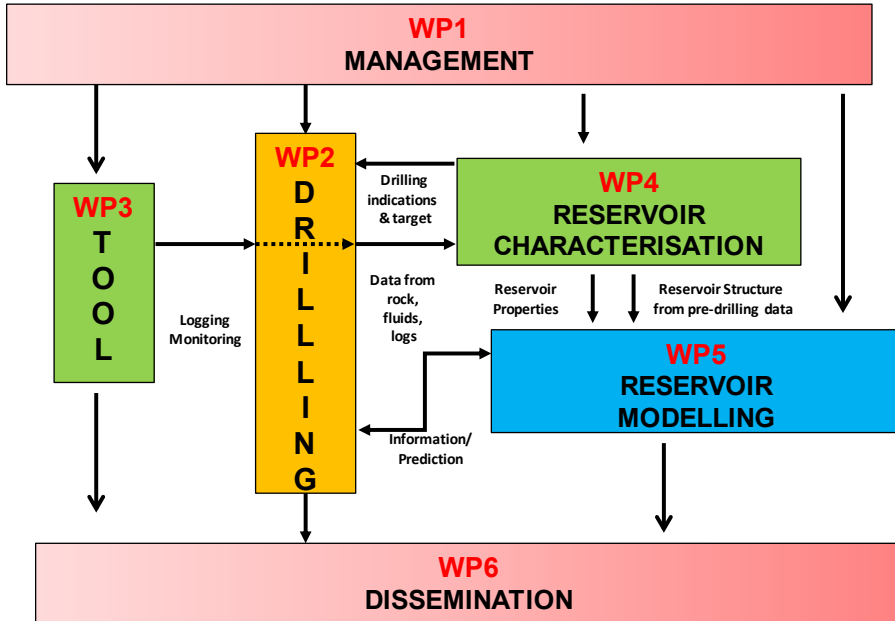
Target well depth is 3-3.5 km

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



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Work Breakdown Structure and Partners



Christian-Albrechts-Universität zu Kiel



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.
- Clearing all the permitting phases.
- 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.

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

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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

