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SYNERGYS – Systems for Energy Synergies: Concept and Current Status

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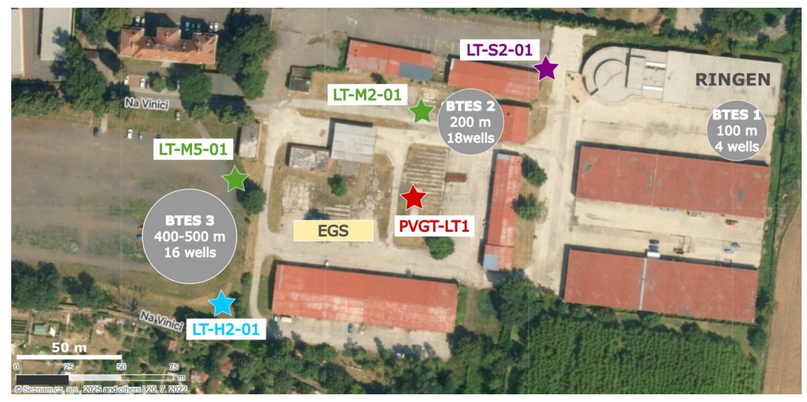


INTRODUCTION

SYNERGYS is a pioneering project aimed at advancing energy transition through integrated renewable technologies. Located in Litoměřice, Czechia—a region historically reliant on fossil fuels—the project seeks to establish synergies between between various renewables including geothermal (Figure 1A).

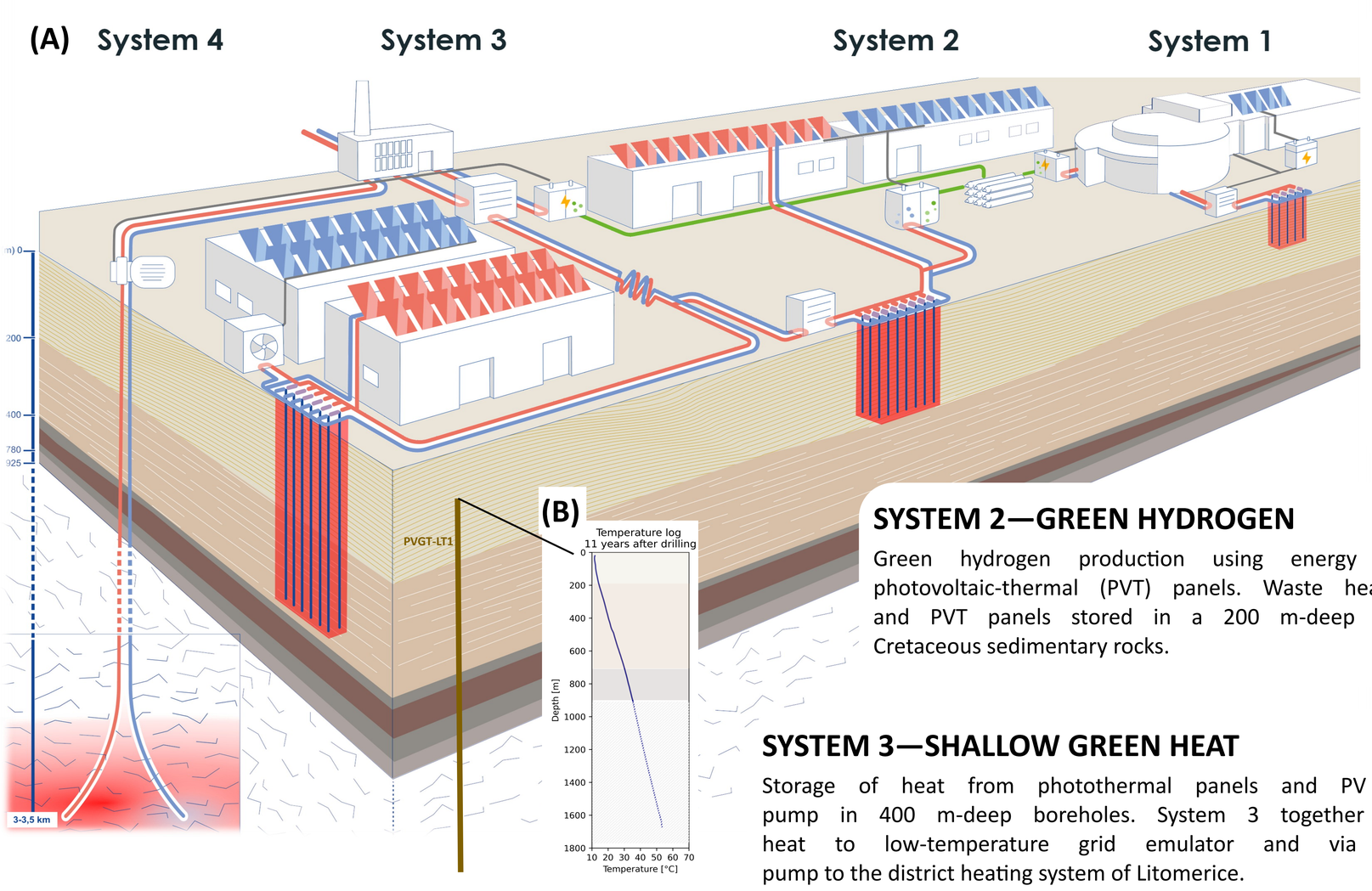
In 2007, well PVGT-LT1 was drilled to 2,111 m, cutting through 700 m of sedimentary deposits, a rhyolite ignimbrite and schist basement. Two monitoring wells drilled in 2025 through the Cretaceous, Permian and Carboniferous deposits (Figure 2) are collecting temperature and groundwater flow data to inform the design of BTES fields. A narrow damage zone possibly linked to the Litoměřice Fault was observed in the crystalline basement, with seismic surveys in late 2024 aiming to clarify fault geometry and basin structure. Downhole stress measurements and well log analyses will assess fault influence on the proposed EGS. Temperature logs indicate a temperature of approximately 60°C at 2 km depth, with geothermal gradient of 22-26°C/km in the crystalline basement. The project targets creating an EGS reservoir at 3–3.5 km depth for sustainable geothermal heating solutions.

Figure 1. Planned layout of the wellsite including current monitoring wells.



SYNERGYS SYSTEM

Figure 1. Concept of integration of SYNERGYS components (A) and the monitoring well PGVT-LT1 with inset temperature profile versus lithology (B).



SYSTEM 1—GREEN BUILDING

This system powers the RINGEN research centre building. Shallow (100 m) BTES field serves for seasonal heat storage and heating the building in colder months. Photovoltaic panels provide electricity during summer months, supplemented by a hydrogen fuel cell (provided by SYSTEM 2) during winter.

SYSTEM 2—GREEN HYDROGEN

Green hydrogen production using energy from photovoltaic and photovoltaic-thermal (PVT) panels. Waste heat from the electrolyser and PVT panels stored in a 200 m-deep borehole field in clastic Cretaceous sedimentary rocks.

SYSTEM 3—SHALLOW GREEN HEAT

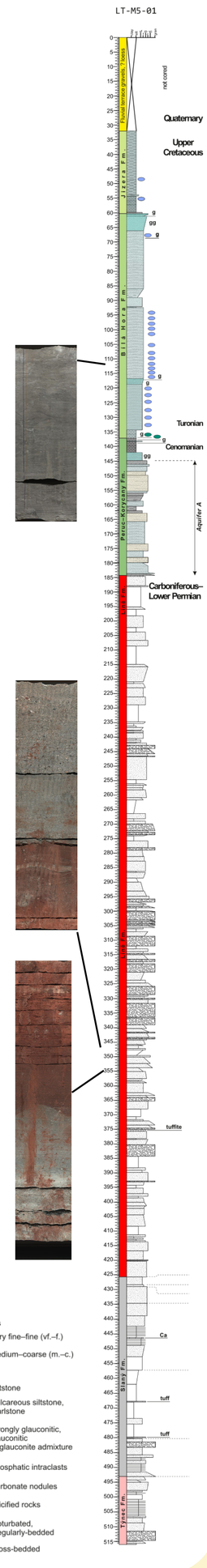
Storage of heat from photothermal panels and PV driven air source heat pump in 400 m-deep boreholes. System 3 together with System 2 supplies heat to low-temperature grid emulator and via high temperature heat pump to the district heating system of Litomerice.

SYSTEM 4—DEEP GREEN HEAT

EGS developed in the crystalline basement at 3-3.5 km: a doublet of wells with horizontal sections from 3 km depth and multi-stage stimulation applied to create the reservoir. This system should supplement System 3 with supplying district heating of the town of Litomerice.

GEOLOGY

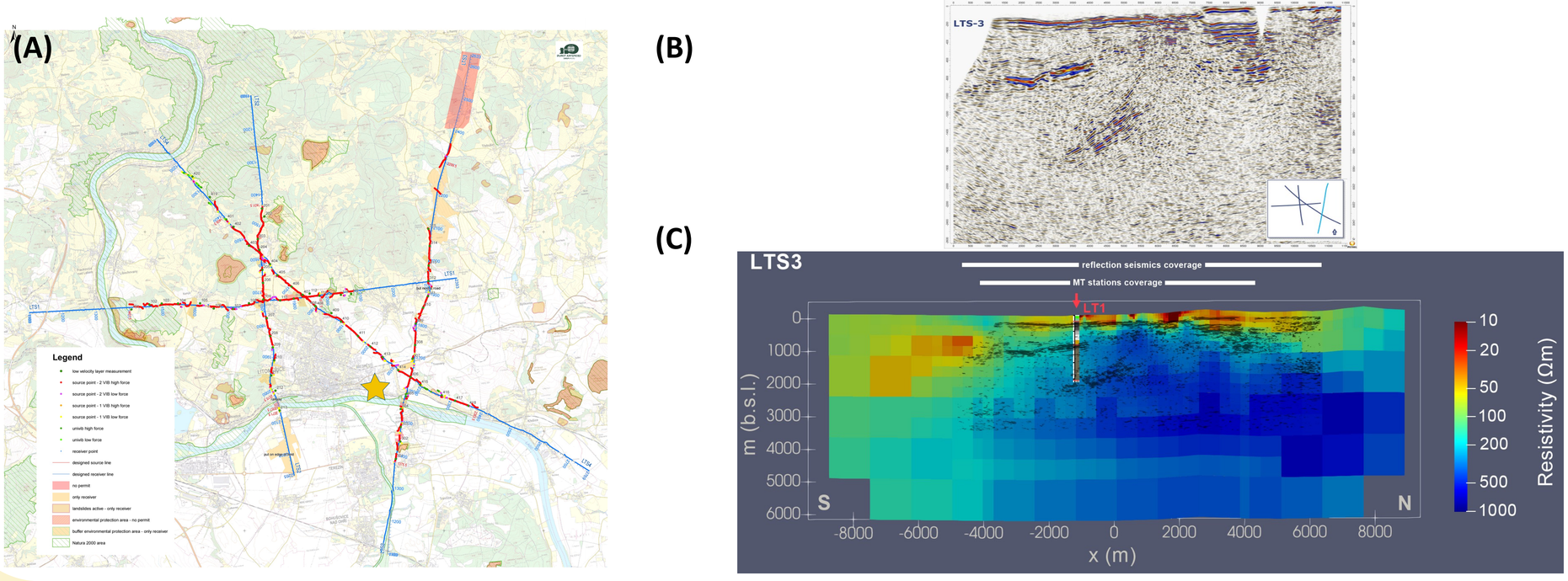
Figure 2. lithological profile of PUSH-IT exploration boreholes. Siliciclastic Cretaceous and Carboniferous sediments have been documented down to 516 m and are known to continue to ~700 m.
LT-M5-01 was cored (example of scanned core in inset) and used for petrophysical measurements.



EXPLORATION AND RESULTS

SYNERGYS benefits from 20 years of research in the area, including well logs down to 2 km depth from 2007 and multidisciplinary geophysical survey from 2006. Additional measurements have been applied during the course of the project, including 2D seismics and VSP in 2024 and MT in early 2025. Findings from these survey are used for designing and stimulating the deep EGS wells (drilling in 2026/2027). The system will be launched in 2028.

Figure 3. Layout of seismic lines with RINGEN site marked with a star (A), example of a 2D seismic section in two-way travel time (B) and magnetotelluric resistivity profile along LTS3 line to 6 km depth (C).



Acknowledgements

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PUSH IT

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