



G E O F I T[®]
SMART GEOTHERMAL

Introducing GEOFIT

Cost-effective enhanced geothermal systems for energy efficient building retrofitting



Thomas B. Messervey
R2M Solution
GEOFIT Project Coordinator



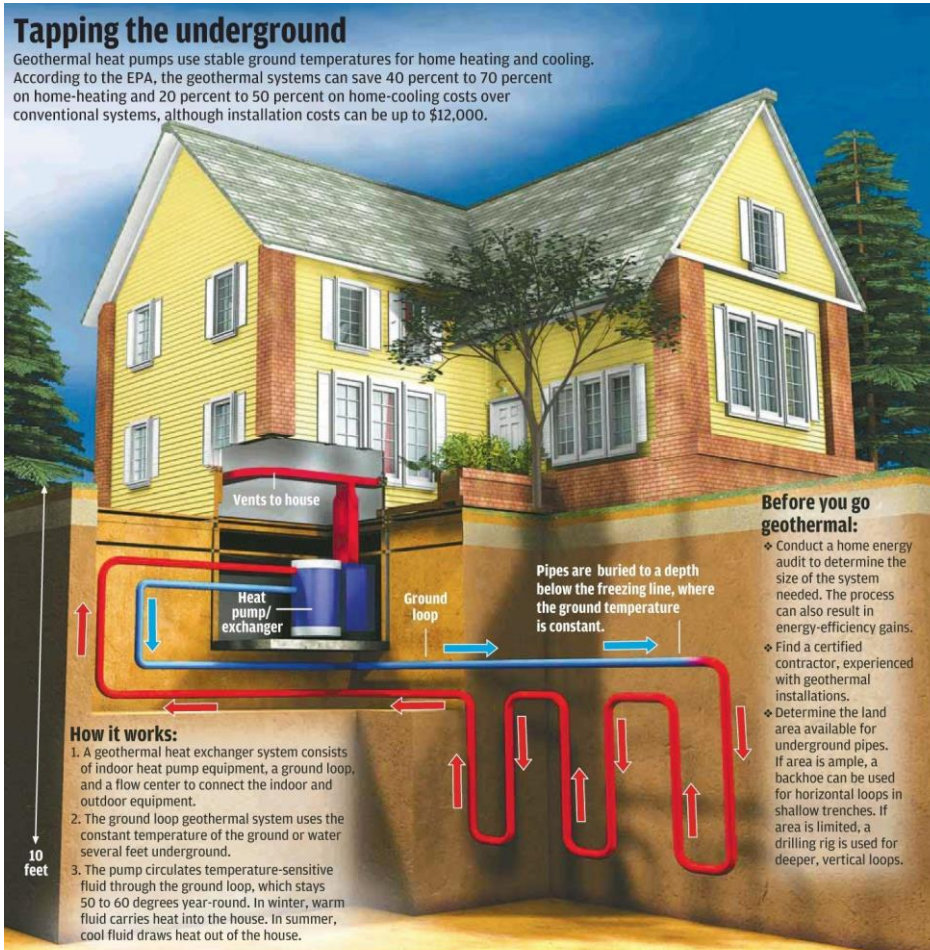
This project has received funding from the H2020 programme under Grant Agreement No. 792210



OPPORTUNITY

Tapping the underground

Geothermal heat pumps use stable ground temperatures for home heating and cooling. According to the EPA, the geothermal systems can save 40 percent to 70 percent on home-heating and 20 percent to 50 percent on home-cooling costs over conventional systems, although installation costs can be up to \$12,000.



Sources: Delta-Montrose Electric Association, About.com

JONATHAN MORENO/THE PHOTOGRAPHY COMPANY

Source: Delta-Montrose Electric Association

Geothermal Opportunities “Tapping the Underground”

- **Renewable:** Ground energy is available endlessly, 24 hours a day for heating and cooling.
- **Environmentally friendly:** Any usage of ground energy reduces the emissions of greenhouse gas.
- **Safe and controllable:** Ground energy is technically mature and has been used for heating and cooling for more than 50 years.
- **High performance:** a response to all energy demands such as heating, cooling, hot water and energy storage.
- **Versatile:** applicable in combination with other energy sources.
- **Economically sustainable:** regionally usable, independent of external suppliers and changes in currency exchange rates.

40-70% savings on home heating
20-50% savings on home cooling

Source: EPA



CHALLENGES

The Challenge: The cost and efficiency of existing geothermal systems, mostly based on vertical wells, to provide heating and cooling in buildings being retrofitted or renovated are not very competitive in particular when digging is difficult.

What we need: **Easy to install and efficient** underground coupling systems for **retrofitting existing types of buildings, including historical buildings**, to make geothermal energy a **standard source of heat and cold** in building renovation. Such systems would take into account the **difficulties in drilling in built environments**. There is also the **need for improved and more cost-efficient heat pumps** to optimize the use of the energy generated by geothermal systems.

If we succeed: The action will **increase the commercial attractiveness** of geothermal energy for heating and cooling and therefore **increase the penetration** of this renewable source.

LCE-17-2017: Easier to install and more efficient geothermal systems for retrofitting buildings

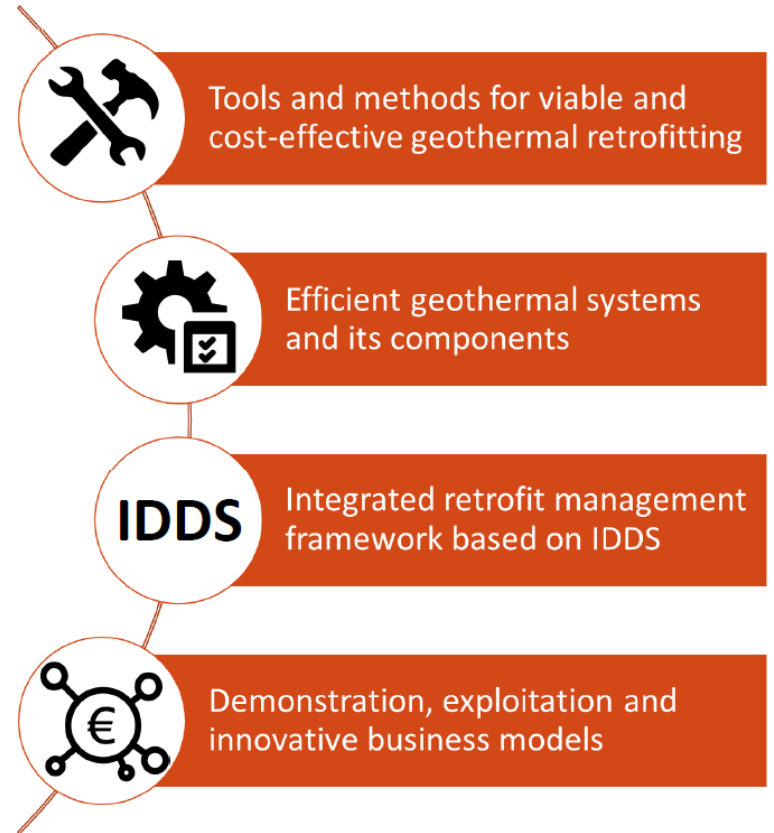
INEA currently oversees 17 Geothermal projects with a total funding of €125 million (May 18)



OUR RESPONSE

GEOFIT: *Cost-effective enhanced geothermal systems for energy efficient building retrofitting*

- 4 year H2020 project (May 2018-April 2022)
- 24 Partners
- Innovation Action supporting the H2020 Societal Challenge of Secure, Clean and Efficiency Energy
- Part of INEA's Energy Portfolio (Low Carbon Economy (LCE), Renewable Energy Technologies (RET))
- € 9.7 million cost / € 7.9 million funding





OBJECTIVES

STO1 Tools & Methods: Develop a complete set of geothermal retrofitting project management tool-chains in the different areas:

1. Retrofitting operations and integrated management framework (IDDS)
2. ICT Tools for ground research and worksite monitoring
3. BIM enabled methods and tools for geothermal based retrofitting

STO2 Technologies: Develop technology components and techniques for easy to install and cost-effective enhanced geothermal systems:

1. Improved and Innovative Drilling Technologies
2. Use of Novel Ground Heat Exchangers (GHEX)
3. Hybrid Ground Source Heat Pump Systems
4. Innovative Heating and Cooling solutions

STO 3 Demand Response and Energy Management: Enable the full utilization of the enhanced geothermal system (EGS) in retrofitted buildings by unlocking flexibility services via the implementation of ICT based control systems and Building energy management systems (BEMS):



OBJECTIVES

STO 4 Demonstration: To demonstrate the GEOFIT's EGS, technologies and tools, and deploy GEOFIT's IDDS framework into the retrofitting operations in 5 Pilot buildings, 4 different climate zones, 5 building uses and 3 different retrofitting scenarios

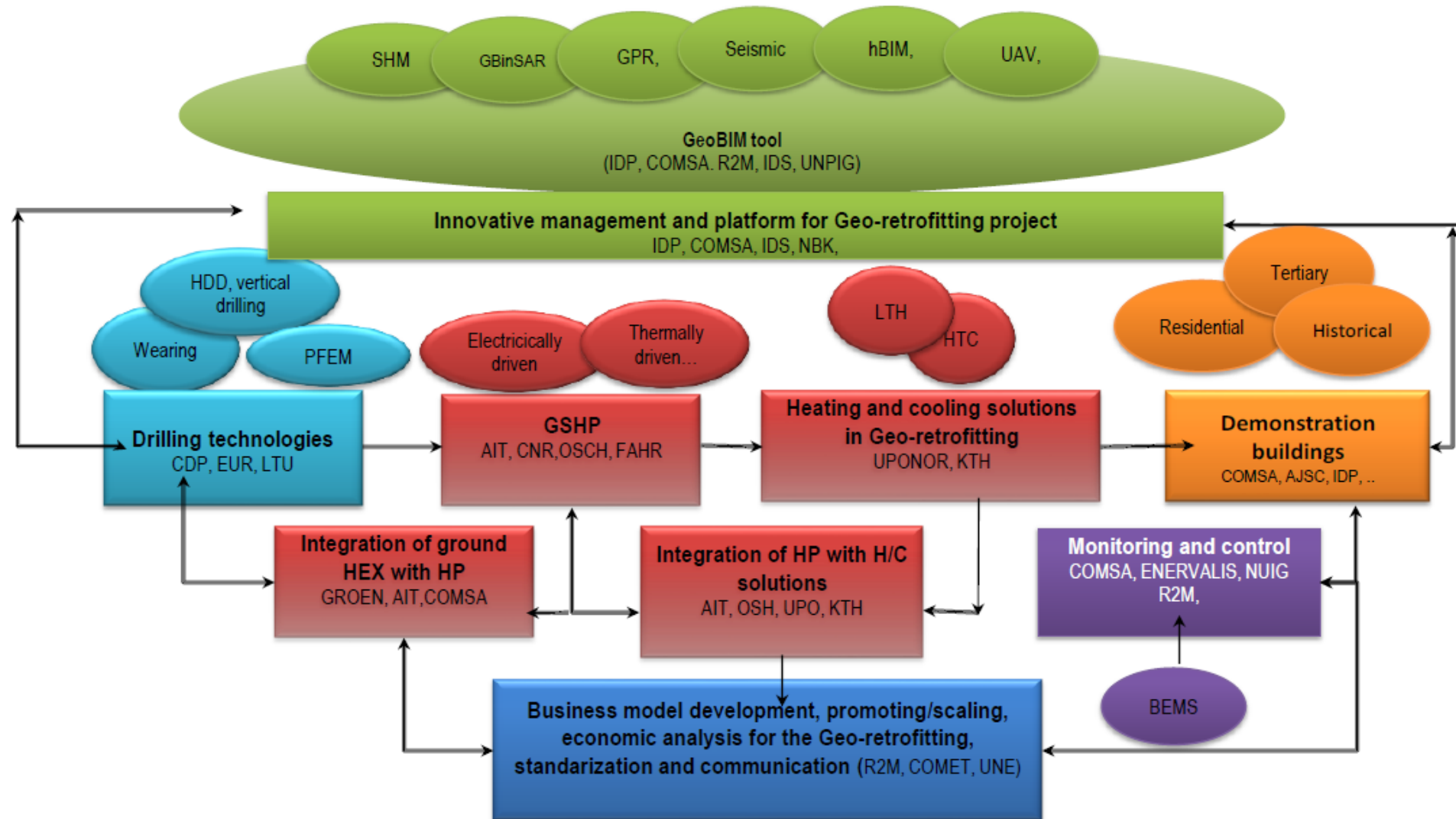
1. Urban retrofitting
2. Retrofitting with rock drilling scenario
3. Seismic retrofitting in historical buildings

STO5 Scalability and Replication: To use project activities as a vehicle to attain the maximum post-project uptake of the GEOFIT project foreground and its impact on the widest possible audience of EU workers and contractors, construction professionals and the general public.

The GEOFIT pilots are OPEN to practice oriented education, training and knowledge exchange



CONCEPT





AMBITION / EXCELLENT SCIENCE

Efficient geothermal systems and its components.

- Non-standard- cost effective HEX compact configuration for geothermal based retrofitting. From TRL6 to TRL7
- Hybrid heat pump system with a small GHEX (From TRL5 to TRL7)
- Electrically driven heat pump system with a large GHEX - From TRL5 to TRL7
- Advanced heating and cooling solutions for geothermal based retrofitting- From TRL5 to TRL7
- ICT systems for cost-effective – energy efficient GSHP – HVAC operation. From TRL6 to TRL7

Tools and techniques for viable and cost effective geothermal retrofitting

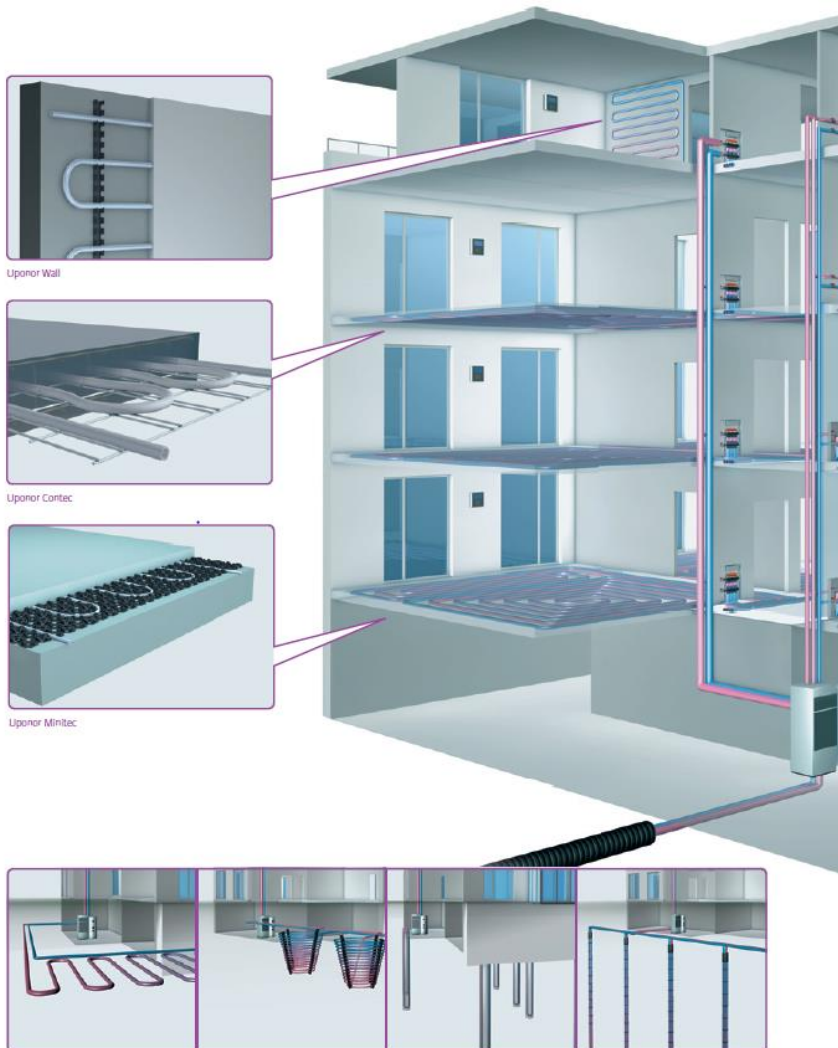
- Advanced methods to improve drilling parameters
- Horizontal Directional Drilling for installation of horizontal loops heat exchangers in urban environments
- GEOBIM platform for geothermal based retrofitting
- Compact ground penetrating radar (GRP) array and integration into GEOBIM system. From TRL5 to TRL7
- Ground Based Interferometric Synthetic Aperture Radar for stability monitoring- From TRL6 to TRL7
- Energy Demand Calculation Engine (EDCE) - From TRL5 to TRL7
- Structural Building Monitoring during drilling. From TRL6 to TRL7

Management processes, methods and tools enabling geothermal based retrofitting

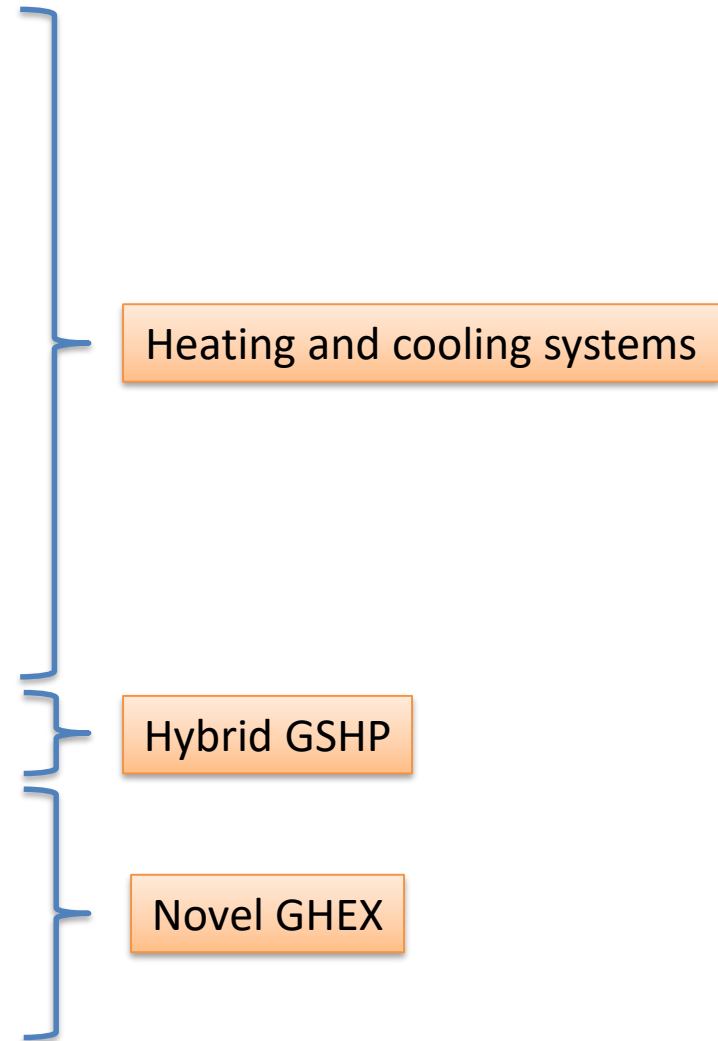
- Self-inspection tools and quality-checks enabling IDDS framework- Direct Transfer for Built2Spec
- Unmanned Aerial Vehicles technology
- Geothermal based retrofitting in historic building
- Seismic retrofit strategies- Seismic protection and structural design



TECHNOLOGIES



Concept image courtesy of partner Uponor

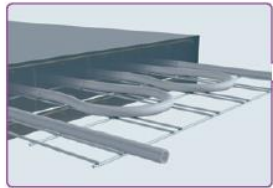




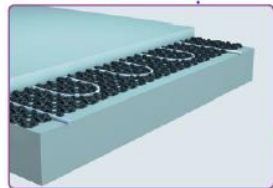
TECHNOLOGY COUPLINGS & SYSTEM INTEGRATION



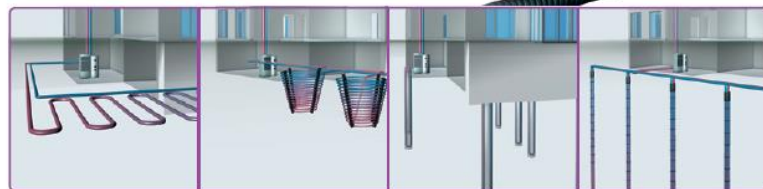
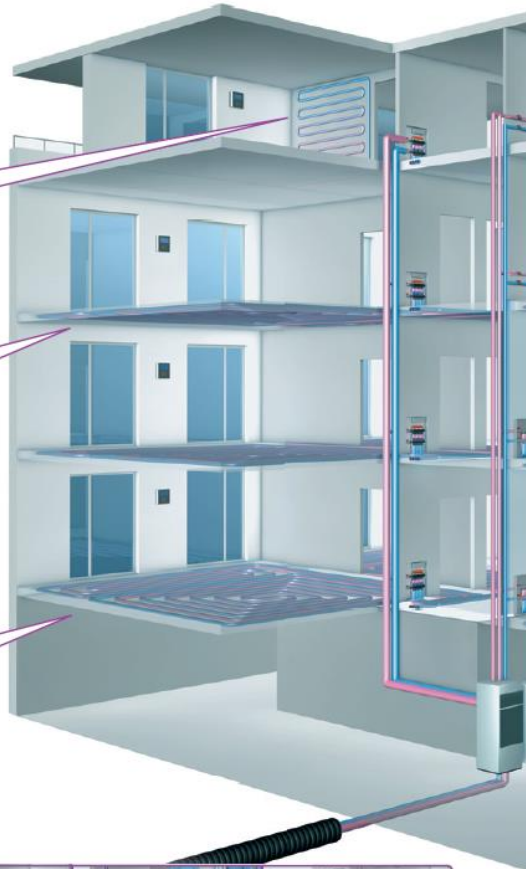
Uponor Wall



Uponor Cortec



Uponor Minitec



Concept image courtesy of partner Uponor

Integration

Heating and cooling systems

Coupling

Hybrid GSHP

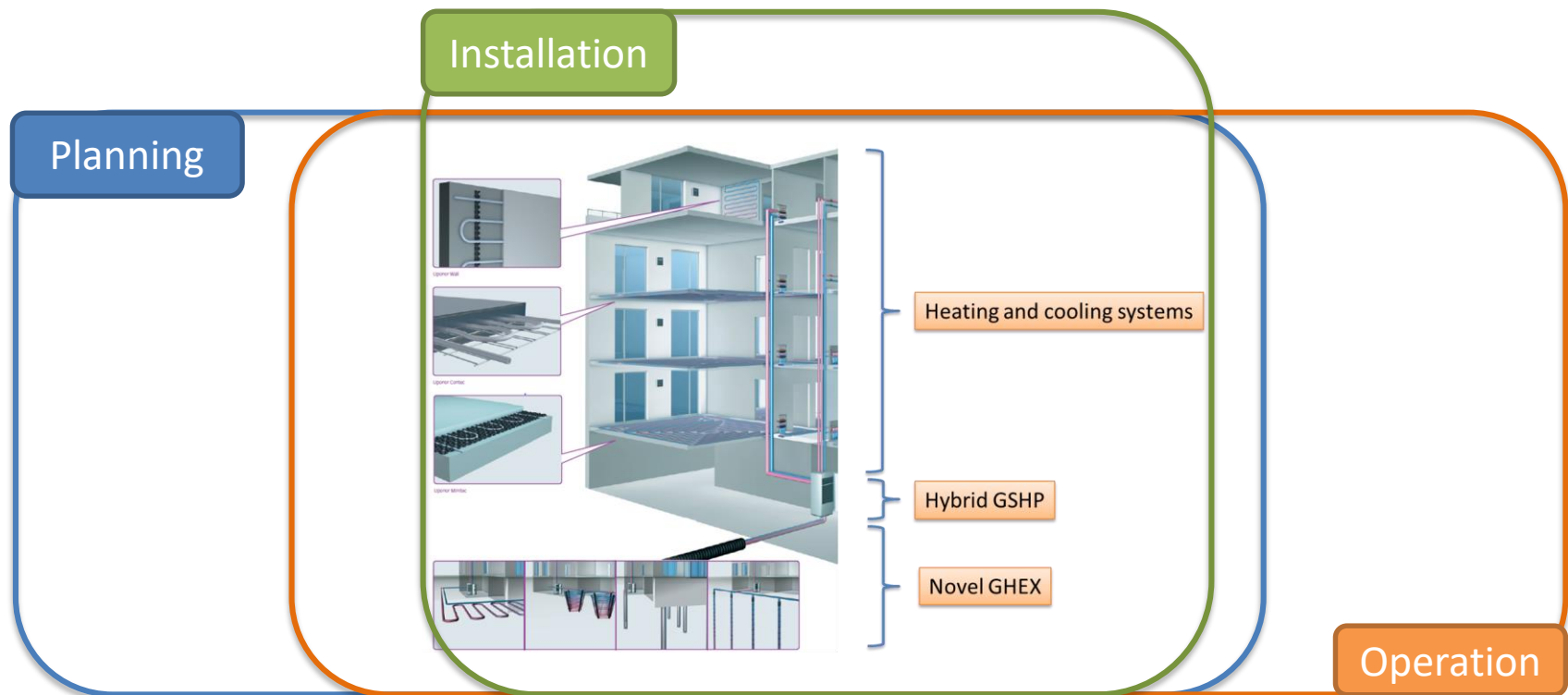
Coupling

Novel GHEX



PROCESSES: PLANNING, INSTALLATION, OPERATION

Technology toolsets to support the building processes around the technology couplings



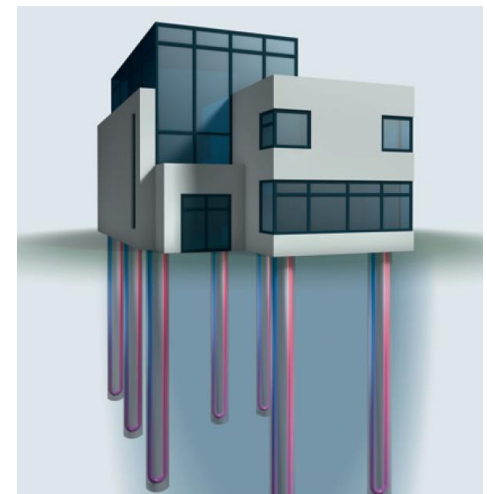
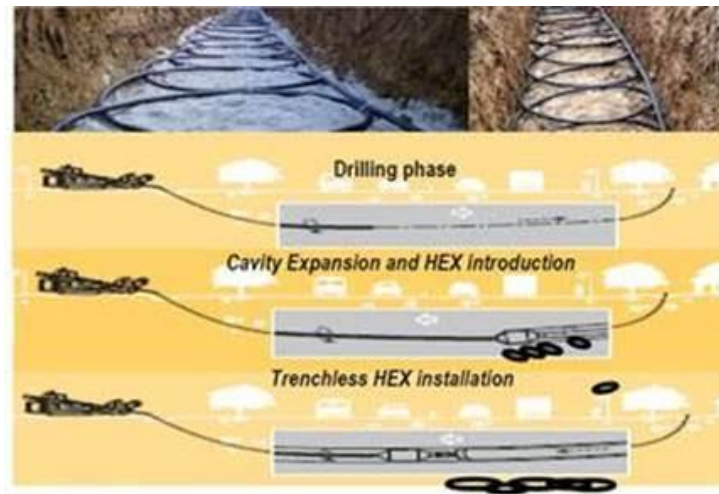
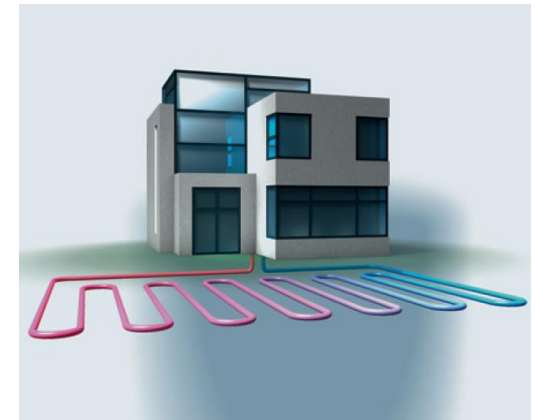
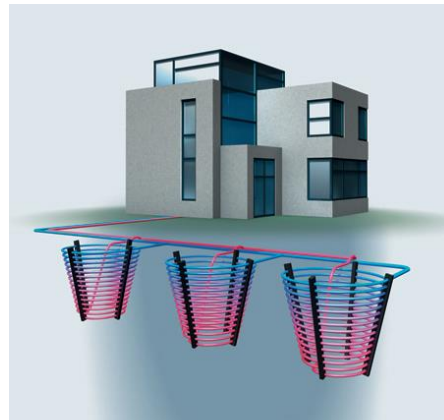
BIM / Survey

Drilling, Monitoring & Integration

Geothermal as a smart asset



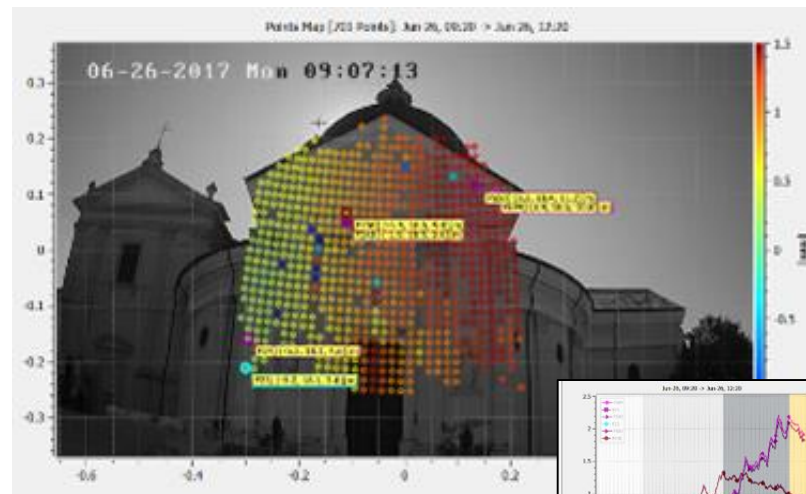
SHALLOW-EARTH HEAT EXCHANGER CONCEPTS COUPLED TO INNOVATIVE DRILLING TECHNIQUES



Images from partner Uponor and partner Catalana De Perforacions



GROUND PENETRATING RADAR, UAV SURVEYS, AND MONITORING TO REDUCE RISK



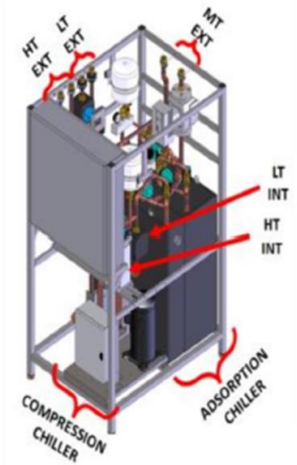
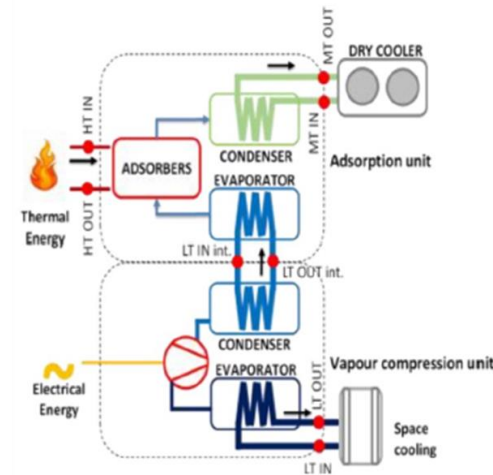
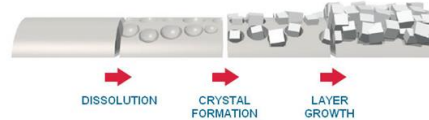
Images from partner IDS Georadar & R2M Solution



NOVEL TECHNOLOGIES AND INTEGRATED SYSTEM CONCEPTS DELIVERING ULTRA-EFFICIENT HEATING AND COOLING SOLUTIONS



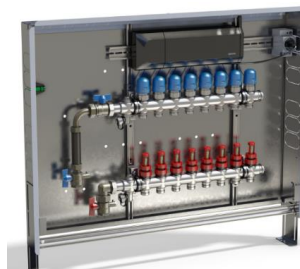
Zeolite Crystallization



Radiant heating and cooling



Thermally active slabs



Manifold stations



Geothermal energy stations



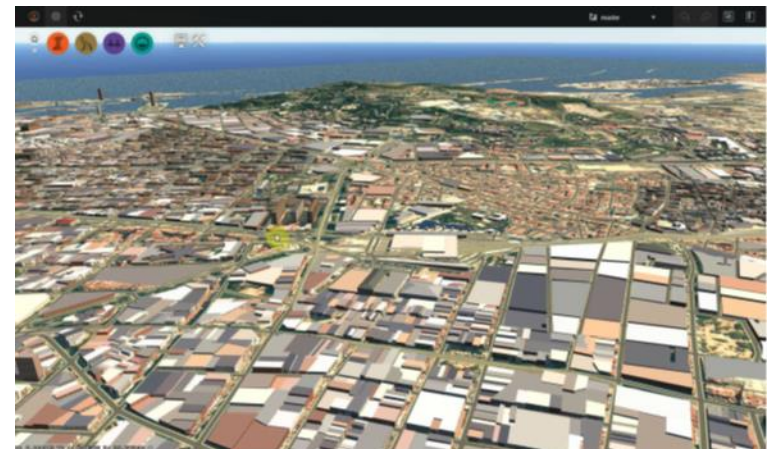
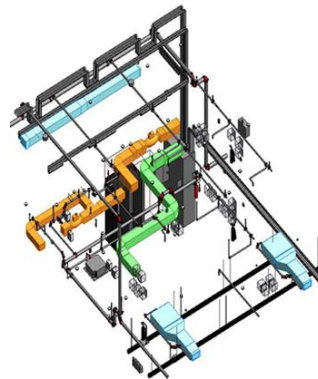
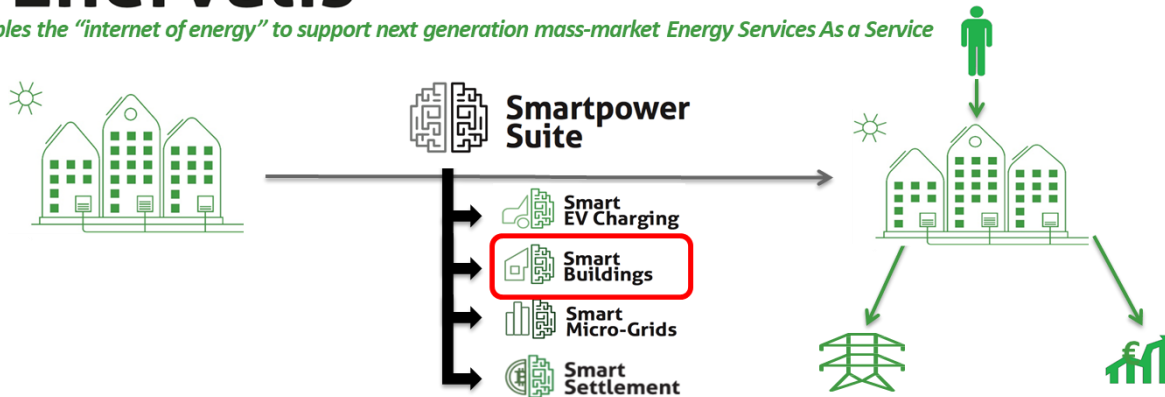
Controls



GEOTHERMAL SYSTEMS AS FLEXIBLE ASSETS, BIM AT THE BUILDING LEVEL AND LINKED INTO BIM AT THE CITY INFORMATION MODELLING LEVEL



enables the "internet of energy" to support next generation mass-market Energy Services As a Service





(OPEN) PILOTS

Sant'Apollinare Demo Site
Historical Building: Conference/Office Center



San Cugat Demo Site
Primary school



Talence Demo Site
Office Space



Galway Demo Site
NUIG Kingfisher Sport Center

4 Countries, 5 Building Types, Different
Soil Conditions, 3 Different Climates



Aran Island (IE)
Residential

Thank you for your attention



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Find out more at www.geofit-project.eu

Write us directly at thomas.messervey@r2msolution.com