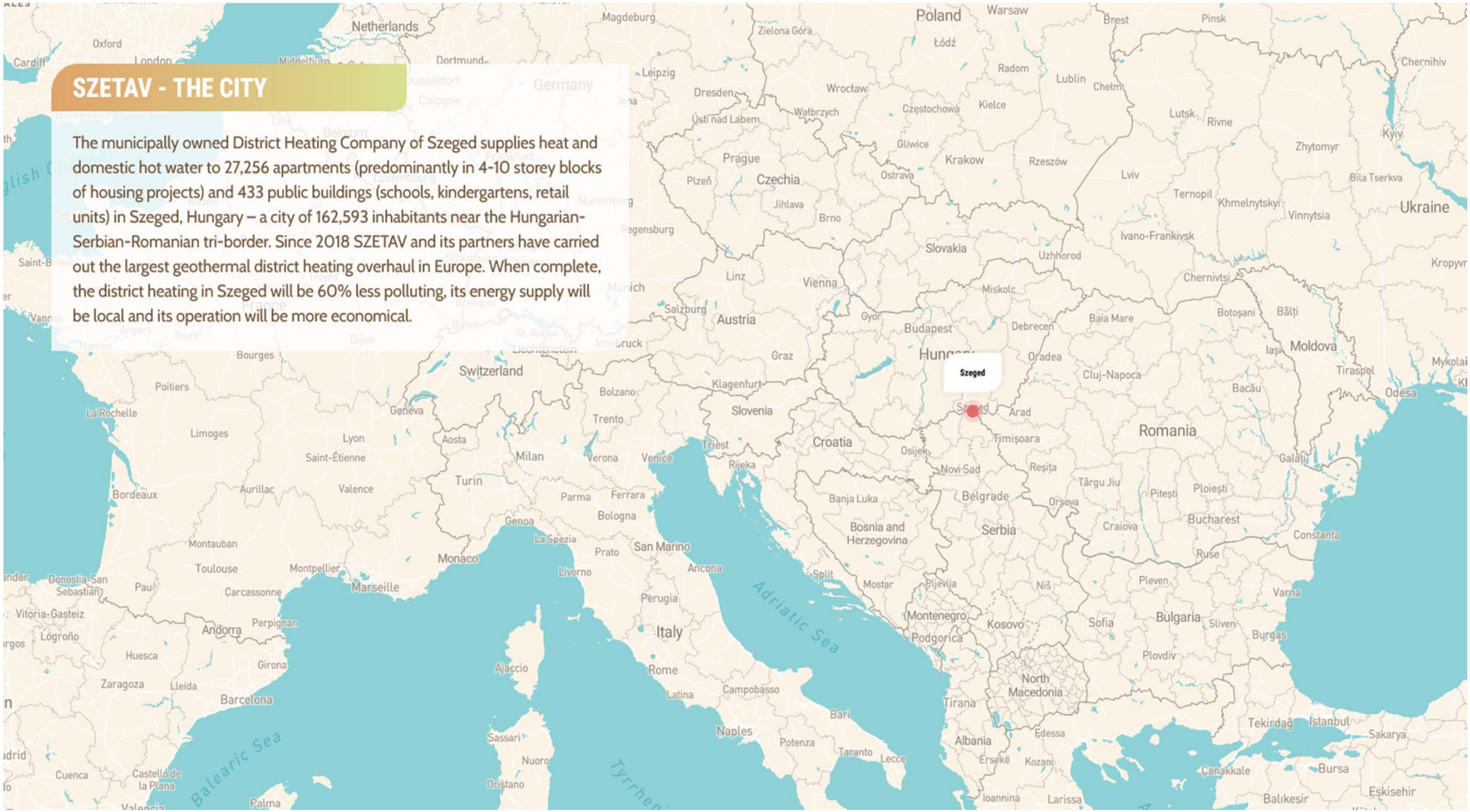
SWITCHING A GAS-BASED URBAN HEATING SYSTEM TO DEEP GEOTHERMAL IN SZEGED (HU)

Tamas Medgyes – District Heating Company of Szeged

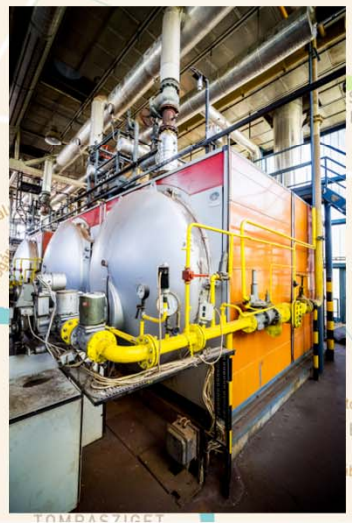
SZETAV - THE CITY

The municipally owned District Heating Company of Szeged supplies heat and domestic hot water to 27,256 apartments (predominantly in 4-10 storey blocks of housing projects) and 433 public buildings (schools, kindergartens, retail units) in Szeged, Hungary – a city of 162,593 inhabitants near the Hungarian-Serbian-Romanian tri-border. Since 2018 SZETAV and its partners have carried out the largest geothermal district heating overhaul in Europe. When complete, the district heating in Szeged will be 60% less polluting, its energy supply will be local and its operation will be more economical.



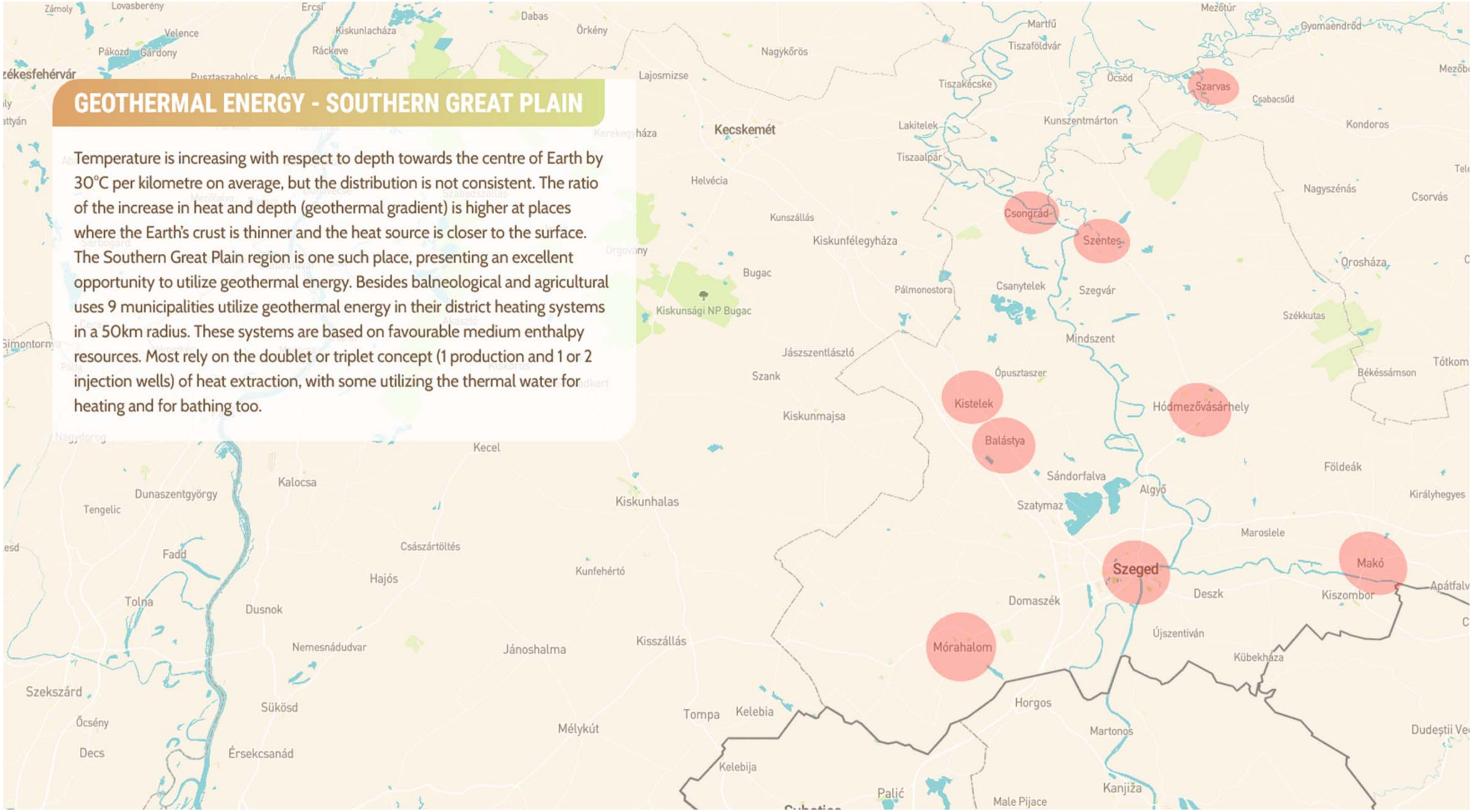
SZETAV - THE COMPANY

SZETAV has 3 departments (operations, finance and energy) and 154 employees. The district heating system of Szeged has 23 heating circuits powered by 1-12 mW boilers with 235.8 MW installed capacity, providing an 843,700 GJ/year total energy output to the end-users via 239 heating substations and 215 km's of subsurface pipelines. Even though the city and its vicinity have exceptional hydrogeological features, and geothermal based bathing, heating and DHW production are all well-established in the region, until very recently 100% imported natural gas has been the sole energy source of the 224 mW DH system, making the company the single largest local emitter of CO_2.



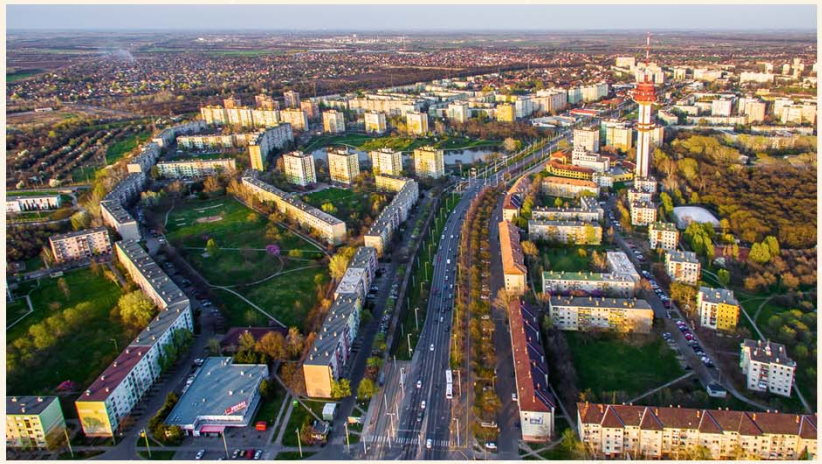
GEOTHERMAL ENERGY - SOUTHERN GREAT PLAIN

Temperature is increasing with respect to depth towards the centre of Earth by 30°C per kilometre on average, but the distribution is not consistent. The ratio of the increase in heat and depth (geothermal gradient) is higher at places where the Earth's crust is thinner and the heat source is closer to the surface. The Southern Great Plain region is one such place, presenting an excellent opportunity to utilize geothermal energy. Besides balneological and agricultural uses 9 municipalities utilize geothermal energy in their district heating systems in a 50km radius. These systems are based on favourable medium enthalpy resources. Most rely on the doublet or triplet concept (1 production and 1 or 2 injection wells) of heat extraction, with some utilizing the thermal water for heating and for bathing too.



GEOTHERMAL ENERGY - SZEGED

Installing geothermal DH systems in areas of high urban density improves project economics, as both resources and demand need to be geographically matched for an economically sound system. For this reason, Szeged is an excellent site for deep geothermal utilization: the city has good geothermal potential, vast heat demand, an existing DH infrastructure, a supporting municipality and a critical mass of grey matter capable of managing and running such projects.



GEOTHERMAL DH IN SZEGED - EXTRACTION

Within the framework of the Szeged project 1,700 - 2,000 m deep thermal wells are drilled in the Upper Town, in Odessa housing estate, in the northern part of the city, in Tarján, in Rókus, and in the city centre, to produce 70 m^3/h thermal water at 90°C. Altogether 27 new wells are being drilled in the city, 2 drilling rigs are working night and day. 9 of the boreholes being dug will be used as extraction wells.

GEOTHERMAL DH IN SZEGED - TRANSPORTATION

Extracted water is transported to 9 heating plants via 30 km's of newly laid pre-insulated pipeline connecting each point of utilisation, ensuring that the heat loss between the stations is minimal. In most cases the pipes run below the surface, deep enough for the ground to have a fairly consistent year-round temperature, which further helps in reducing heat loss.

BAKTÓI KISKERTEK
BAKTÓ
ÚJPETŐFITELEP
MAKKOSHÁZ
NAGYSZILLÉRI DOMB
FELSŐVÁROS
PETŐFITELEP
IPARVÁROS
Belvárosi temető
Bajai út
Kálvária sugárút
Szeged MJV Önkormányzatának Kórháza
MÓRAVÁROS
Vármegye Étterem
Gróf-palota
BELVÁROS
Szeged Zoo
Votive Church of Szeged
Déli Klinikai Tömb
ODESSZA
ÚJSZEGED
VADASPARK LAKÓPARK
Szabadkai út
KECSKÉS ISTVÁN-TELEP
Szegedi ferences szerzetesek
ALSÓVÁROS
SZTE JGYPK Hattyas sori Sportkomplexum
Füvészkert
Tisza
Szőregi út
HÁRSFA LAKÓPARK
KÁLLAYLIG
TÖMÖRKÉNY-ÜDÜLŐTELEP
Maros utca
Petőfi Sándor sugárút
Mórávárosi körút
Temesvári körút
Horgosi utca
FNX Élelmiszerdiszkont

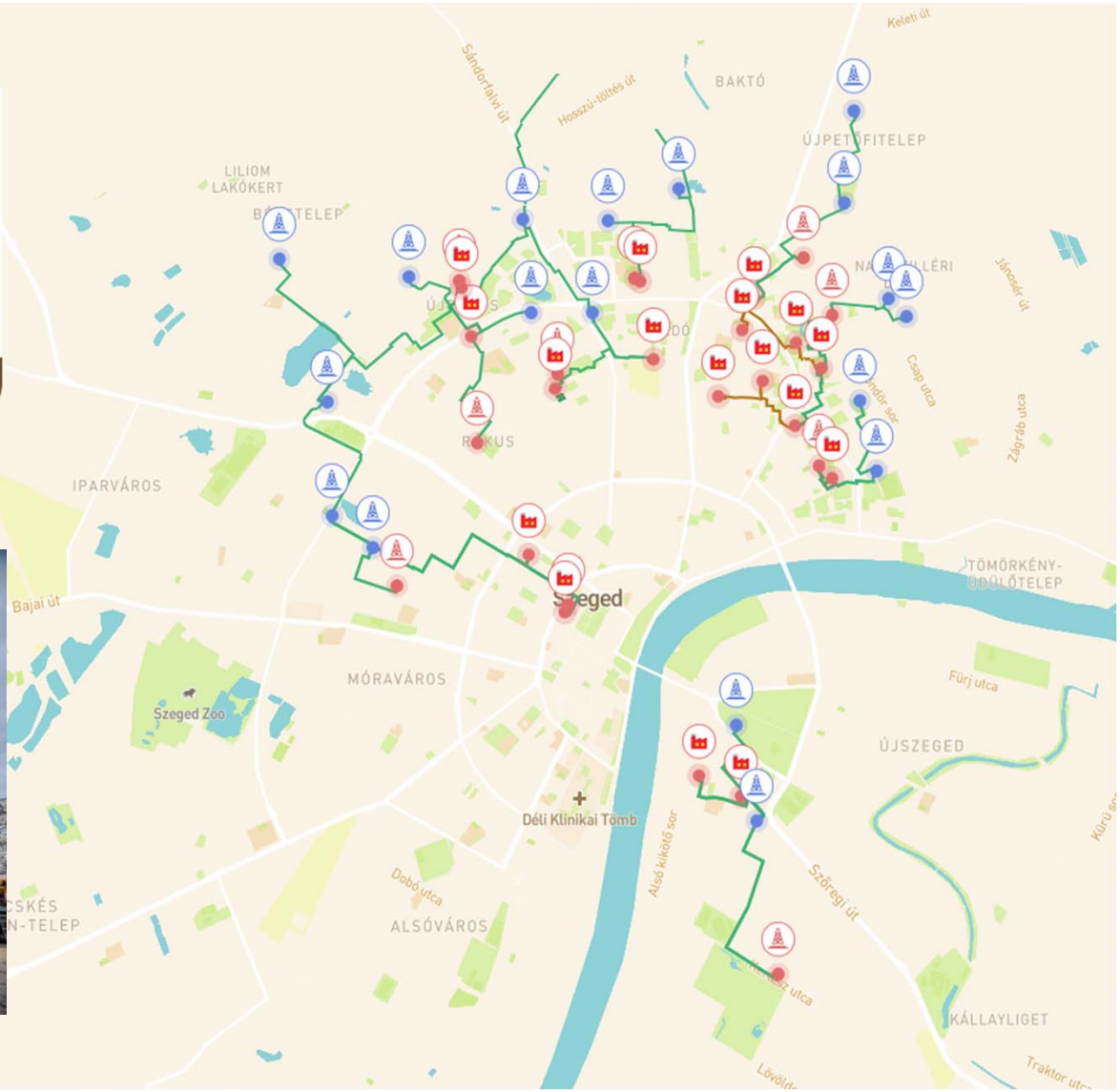
GEOTHERMAL DH IN SZEGED - UTILIZATION

Once the water is in the heating plant, its heat energy is utilized via heat exchangers. Geothermal water serves as a heating medium, so it does not enter the district heating network, nor is it used as domestic hot water. According to the plans, with the help of deep geothermal energy a total of nearly 20 million m^3 of natural gas would be replaced with 600,000 GJ of geothermal energy per annum, reducing the greenhouse gas load of the city of Szeged by 35,000 tons/year, improving air quality and security of supply.

GEOTHERMAL DH IN SZEGED - INJECTION

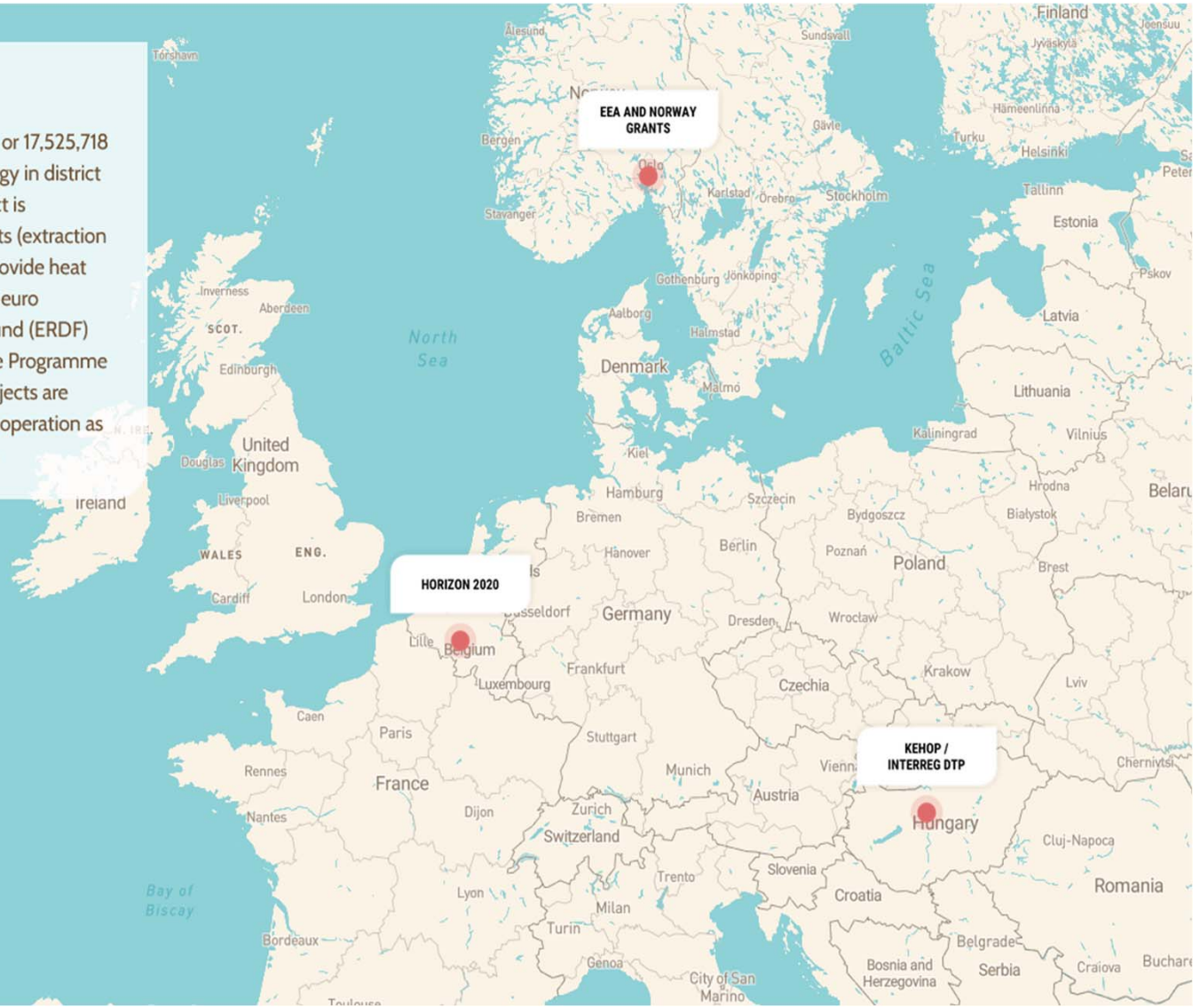
With its energy content utilized in the heating plants, the fluid is injected back into the reservoir. After being pumped down, the fluid enters the natural water cycle and gets heated up again by the Earth's heat and may be extracted again. Without injection, geothermal energy would not be a sustainable resource in the long run.

MORE



SYSTEM OPERATION - BASIC DATA

Geothermal in the DH will result in saving 595,887 GJ/year (82%) or 17,525,718 m^3/year (68%) natural gas, provide 536,298 GJ/year thermal energy in district heating and 34,699 t/year (65%) CO2 emission saving. The project is implemented in 9 instalments, that is 9 geothermal heating circuits (extraction – production well triplets) are being constructed, and these will provide heat energy to 15 heating circuits in the DH of Szeged. The 70-million-euro development is funded from European Regional Development Fund (ERDF) sources under the Environmental and Energy Efficiency Operative Programme (KEHOP) scheme and from private investments. Related R&D projects are funded through the EEA and Norway Grants Fund for Regional Cooperation as well as Horizon 2020 and the Danube Transnational Programme.



UPTOWN

Basic data

- Number of apartments served: 3,353
- Number of public institutions served: 26
- Heating plants and heating circuits: Felsőváros II.

Energy balance before switching to geothermal

- Natural gas used: 3,355,000 m^3/year
- Energy output: 93,775 GJ/year
- CO_2 output: 6,755 t

Energy balance with geothermal

- Natural gas saved: 75,781 GJ/year, 2,228,853 m^3/year
- CO_2 emission decreased by: 4,413 t/year
- Geothermal energy output: 68,203 GJ/year

ROKUS

Basic data

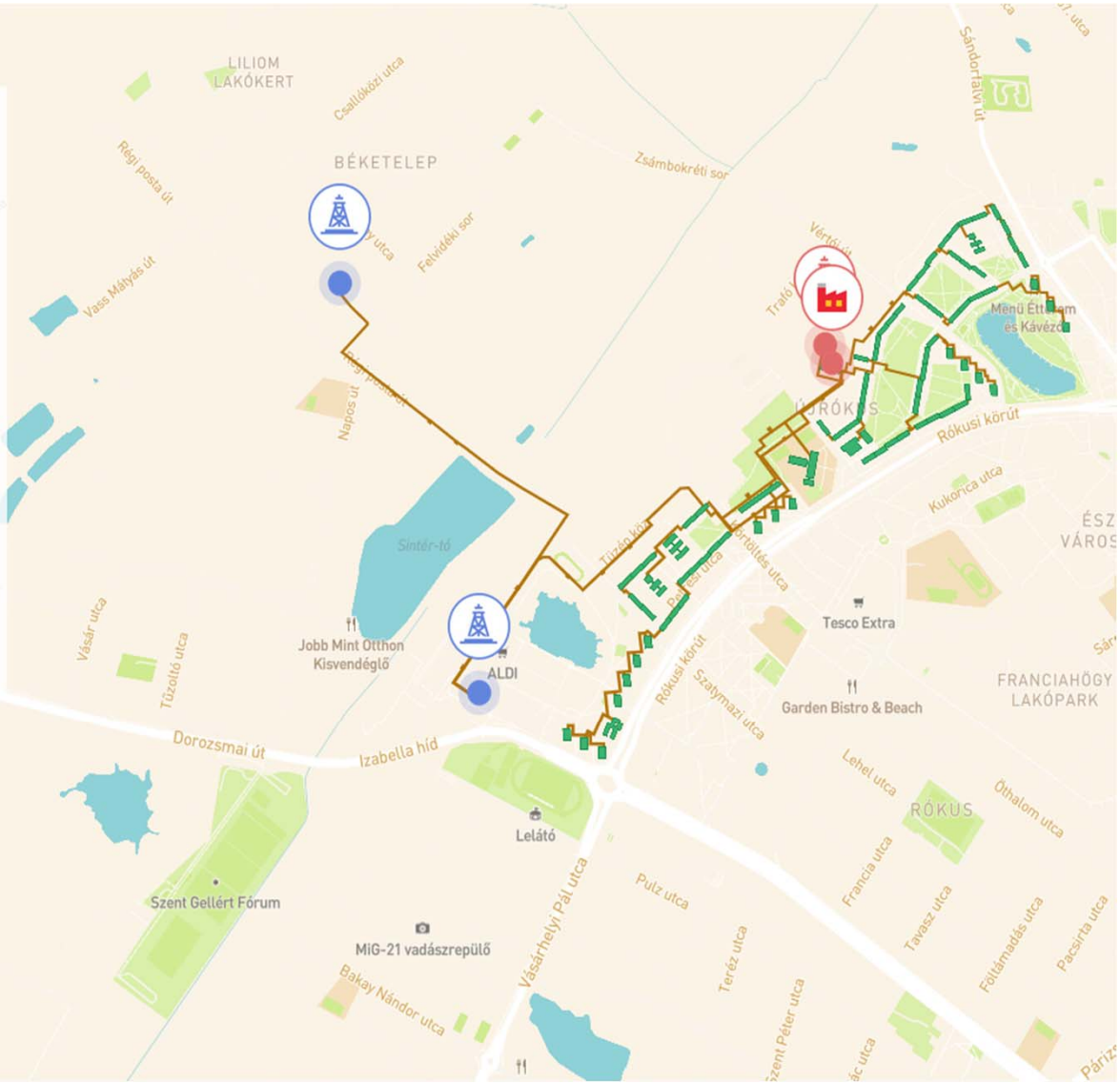
- Number of apartments served: 3,253
- Number of public institutions served: 33
- Heating plants and heating circuits: Rókus

Energy balance before switching to geothermal

- Natural gas used: 353,244 m^3/year
- Energy output: 84,742 GJ/year
- CO_2 output: 6,809 t

Energy balance with geothermal

- Natural gas saved: 75,555 GJ/year, 2,190,016 m^3/year
- CO_2 emission decreased by: 4,224 t/year
- Geothermal energy output: 68,000 GJ/year



CITY CENTRE

Basic data

- Number of apartments served: 312 + 600 in the Cedrus apartment complex
- Number of public institutions served: 32
- Heating plants and heating circuits: Tisza Lajos krt 38, Török u. 3.

Energy balance before switching to geothermal

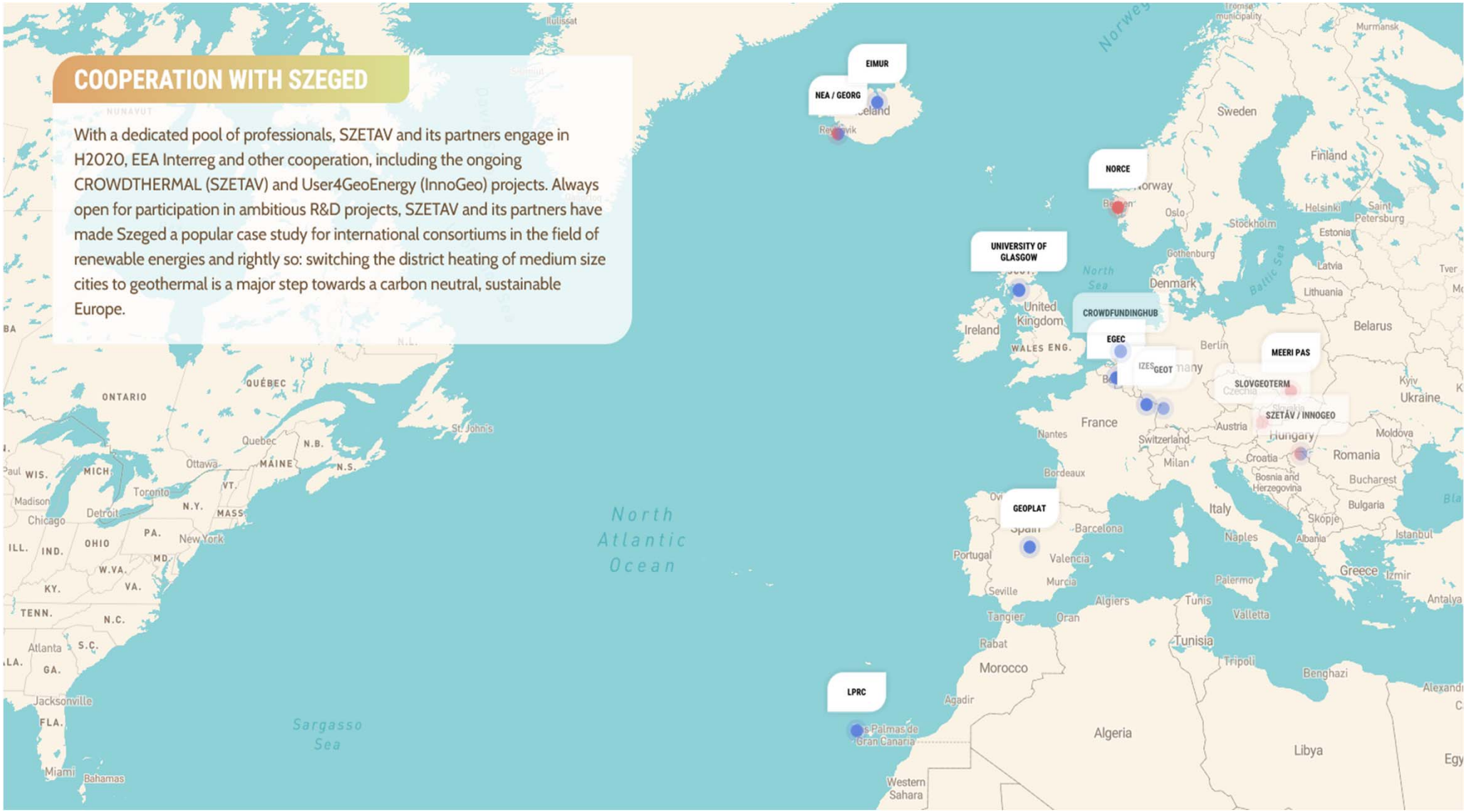
- Natural gas used: 435,894 m^3/year
- Energy output: 13,301 GJ/year
- CO_2 output: 977 t

Energy balance with geothermal

- Natural gas saved: 16,635 GJ/year, 489,264 m^3/year
- CO_2 emission decreased by: 4,575 t/year
- Geothermal energy output: 14,968 GJ/year + 55,692 in the Cedrus apartment complex

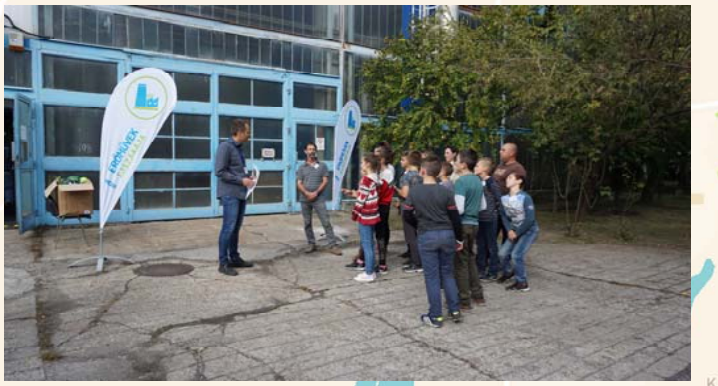
COOPERATION WITH SZEGED

With a dedicated pool of professionals, SZETAV and its partners engage in H2020, EEA Interreg and other cooperation, including the ongoing CROWDTHERMAL (SZETAV) and User4GeoEnergy (InnoGeo) projects. Always open for participation in ambitious R&D projects, SZETAV and its partners have made Szeged a popular case study for international consortiums in the field of renewable energies and rightly so: switching the district heating of medium size cities to geothermal is a major step towards a carbon neutral, sustainable Europe.



GREEN ENERGY IN SZEGED

The robust development in Szeged is a great opportunity for interested municipalities, stakeholders, students and researchers to gain first-hand experience of a large-scale RES integration programme, sustainable reservoir management and environmentally responsible, as well as economically sound operational protocols. The developments in Szeged may serve as easy-to-duplicate blueprints for future DH overhauls in Central and Eastern Europe and beyond.



THANK YOU