Geothermal Communities

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FP7 Concerto - 239515

First Periodic Report – Final Version

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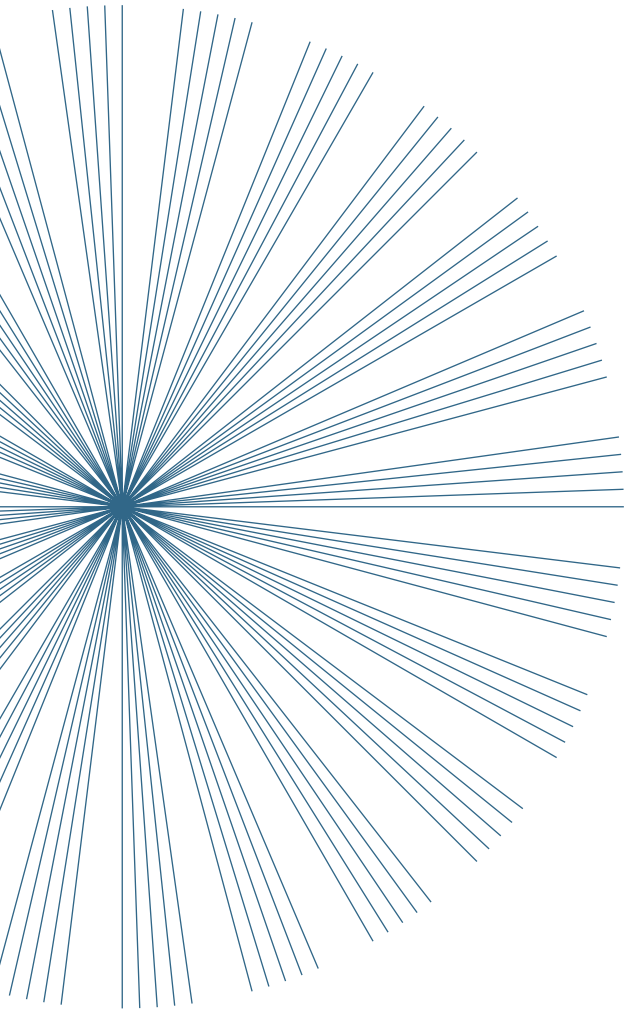
Coordinator: Geonardo Environmental Technologies Ltd.



CONCERTO
An FP7 CONCERTO Project

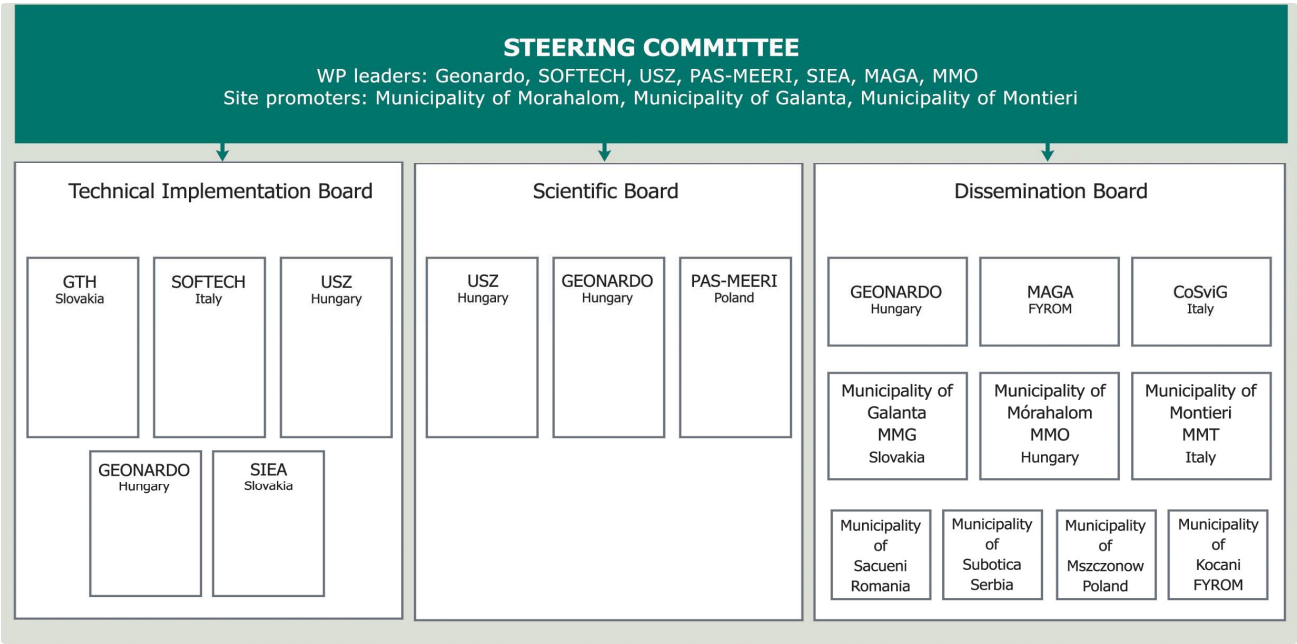
SEVENTH FRAMEWORK PROGRAMME

3.1 Publishable summary (max. 4 pages)

3.1.1. A summary description of project context and objectives

The project **Geothermal Communities - demonstrating the cascading use of geothermal energy for district heating with small scale RES integration and retrofitting measures** is a CONCERTO Phase III action, accepted and negotiated in 2009 and has started in January 2010.

The project is lead by Geonardo Environmental Technologies Ltd, a Budapest based engineering and consultancy SME with relevant experiences in EC project management and in geothermal emery applications. The project consortium consists of 16 partners altogether – including the Coordinator -, representing the relevant municipalities and technological companies/organisations, research partners and associated cities:



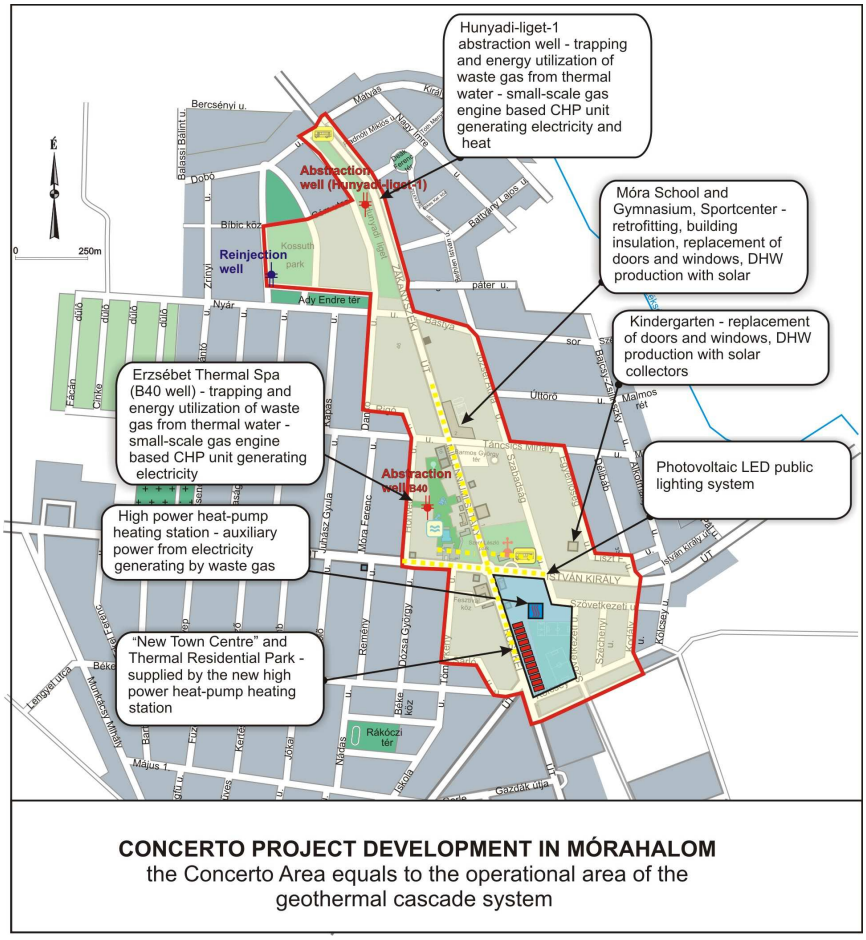
The project's overall and main objective is to promote the usage of geothermal energy and resources as a reliable renewable energy resource through demonstration actions in 3 cities involved in the project as Concerto Areas. Geothermal energy is the least known and least expanded RES in Europe, though its relevance and importance should deserve much more attention. **By using of the practically unlimited internal heat of earth, geothermal energy has one of the highest potential of all RES.** When compared with other RES – like solar or wind – it's main advantage is the practically constant energy and heat output it can provide. Besides the well known geothermal regions like Iceland or region of Tuscany (Larderello) in Italy, **Central-Eastern European countries have exceptional geothermal resources. These resources are either unexploited due to the lack of technological know-how or their utilisation is carried out in an unsustainable way; geothermal district heating projects lack the energy efficiency component and the used thermal water is generally not re-injected but instead released to surface waters.**

The project Geothermal Communities is to **demonstrate best available technologies** in the use of geothermal energy combined with innovative **energy-efficiency measures** and integration of other

renewable energy sources in three different pilot sites (Morahalom in Hungary, Galanta in Slovakia and Montieri in Italy). Furthermore the project will integrate a large number of cities as project partners (from Serbia, Romania, Poland and Italy) that either already have ongoing geothermal systems that needs the **adoption of new technologies** (e.g. Oras Sacueni, Romania) or they would like to **implement new systems** from scratch with the help of the project partners (e.g. Subotica, Serbia).

There are 3 demonstration areas in the project, where the project will implement the following measures:

1. **Mórahalom, Hungary:**
   a. **The Geothermal Cascade System of Mórahalom** (the core works were financed by the Hungarian Structural Fund *(„KEOP-4.1.0-2007-0006: Geothermal Cascade System of Morahalom (2008-) – EURO 2,147,000”*). According the plans the proportion of renewable energy within the energy utilization of public institutions will grow from 0% up to more than 80% - resulting in saving 14,441 GJ of fossil energy sources per year. 2620 kW heat capacity will be built in the geothermal heat supply system. Annual amount of 481,907 m^3 of combusted natural gas will be replaced; the annual emission of pollutants from energy utilization will be reduced by 866 t of CO_2, 318 kg of N_xO_x and 605 kg of CO.



   b. **High power heat-pump station:** The auxiliary power demand of 60 kW of the heat-pump heating station will be met by the trapping of methane production of the new abstraction well of the cascade system, while the electric power produced by trapping of the methane production of the B40 well at the spa will be used at the Thermal Spa. Currently this methane is directly emitted into the air (with a twenty-one times higher greenhouse effect than CO_2). Complex, so called combined energy utilization gas engine based CHP units are planned for the waste gases (CH_4: 65-

98%) of the abstracted thermal water, which generates electric power, and supplies auxiliary power to the system. An average water amount of 30m^3/h with a temperature of 30 C° arrives to the area of the "New Town Centre" (after cooling down in the cascade system), which is able to produce a thermal power of 450 kW in a heat-pump system with an average efficiency of 5 COP. This helps the full utilisation of the complete energy of the thermal water (including its gas content) abstracted for the supply of the cascade system at a temperature of 65-70Cº to a temperature down to 5-6 C° before reinjection. Currently there is no thermal water and heat pump combined system with similar efficiency either in Hungary or elsewhere in Central-Eastern Europe.

c. **Retrofitting and RES integration:** The area concerned in the development of the Mora Cultural Centre, School and Gymnasium (built in 1935 and 1972) is 1430 + 560 =1990 m2, and uses an annual amount of 130-140,000 m^3 natural gas for heating. By the GEOCOMN measures, gas amount of approx. 122,000 m3/ year will be replaced by geothermal energy.). Retrofitting measures of these buildings will be accompanied by a solar collector system of 175 m^2 of vertical plate collectors and the related engineering are planned, which is able to produce a hot water amount of 17,500 l/day. An intelligent control unit will optimise the use of solar-thermal and geothermal in the building taking into consideration the peak demands and the usual school cycle (45 minutes class/15 minutes break) for ventilation control. It needs to be mentioned that façade insulation and refurbishment measures will take into account the fact that the old building is part of the local cultural heritage and is under local protection. Windows will be custom made (triple glass with argon fills) made of wooden frames in a style that matches the building that was built in 1936.

2. **Galanta, Slovakia:**

City of Galanta has been operating a geothermal district heating system since the early '80s. The Concerto activities will be focused on the further utilization of the geothermal energy by retrofitting measures, connection of new areas to the district heating system and last, but not least by developing the possible reinjection techniques. The municipality's effort is to use this green energy widespread in the city and assure this energy for the next generations.

a. **Retrofitting of three old, concrete-panel based multi-level dwellings and of the elementary school and RES integration by photovoltaic system and comprehensive renewal of the lighting system and RES integration also by photovoltaic system:**
The refurbished buildings and the elementary school need less geothermal energy, which can be used for longer DHW producing on the other main part of the Concerto area. The retrofitting of the selected dwellings will include:
- Facade insulation,
- Roof insulation,
- Change of the doors and windows at the common spaces,
- Reconstruction of the rising pipes

- Using of thermostats.

Insulating will include change of windows and doors, which are in disrepair and in addition to poor thermal insulation attributes, are dangerous when handling them. The construction of windows is disrupted with cracks in the wooden frame. From the energy savings point of view, taking into account the current technical condition, the windows are the structure, which has the greatest impact on the wasteful heating of the building.

Photovoltaic panels will provide enough electricity for the lighting of the common areas of multi-storey buildings included in the project. Photovoltaics and a comprehensive renewal of the lighting system will significantly decrease the electricity consumption of the retrofitted elementary school heated from the geothermal source.

b. **Reinjection borehole research and projectworks**, including full documentation, studies, permits and assessments To secure the geothermal capacity for the next generation recent system needs a reinjection well, which is injecting the non-used or waste geothermal water back to the reservoir. Now this "waste water" is pumped into river Váh in amount more than 500 000 m^3 a year. The implementation of a reinjection borehole needs a feasibility study, research and a comprehensive project documentation to set the technical specification of the well.
c. **Connection of the natural gas heating plant to the geothermal energy.**
d. **Connection of newly developed urban areas to the geothermal district heating system**

3. **Montieri, Italy:**

Montieri is a small medieval village situated in the heart of the Tuscany Geothermal Region of Larderello, with 3 main Concerto activities:

a) Implementing a highly **innovative geothermal district heating system** by using high-enthalpy fluid. This will serve as a new, ambitious example for Central-Eastern European countries, where higher temperature fluids (medium/high enthalpy) may also be recovered (although at significantly higher investment costs). With the help of the innovative technological solutions the feasibility of tapping into medium enthalpy resources will be demonstrated. In the project to be implemented the number of dwellings served by the district heating is 425, with a total heated volume of 110,000 m3, the value of energy required and **produced by the geothermal system is estimated in 5,500 kW (20,000 GJ).**

b) **Retrofitting of selected dwellings** by using integrated approaches and techniques. Montieri also represents a challenging site for defining and testing a qualitative architectural integration of renewable energy technologies and retrofitting measures because in such an architectural heritage, the potential for intervention at the

building envelope level is quite limited. Only natural materials and methods are acceptable that are in conformity with the medieval city structure. **20% of the total dwellings in Montieri will be retrofitted during the project!**

c) An **Energy Retrofit Strategy** will be implemented over the 425 residential dwellings, part of the geothermal district-heating plan. This strategy aims at reducing energy needs, in conjunction with a building renovation. In addition these buildings will make use of geothermal heating to get a 100% free fossil fuel. The retrofitting demonstration will take care of the town high cultural and artistic value.

d) **RES Integration** – on one hand 8,5kW of photovoltaic panels system will be implemented to serve as the main electricity producer of the renewed public lighting system of Montieri. On the other hand a total of 42,5 m2 solar thermal collectors will be set up to serve as primary heating and DHW source for those (mainly distant) dwellings not connected to the district heating system.

The 3 Concerto cities in the project represent completely different climatical and technological setting, populations (Montieri: 1.200, Morahalom: 6.000, Galanta: 20.000), altered retrofitting techniques will be used and the nature of the geothermal systems are very dissimilar. This gives the project a unique added value where communities with different background will demonstrate the importance of geothermal energy.

In addition to the demonstration component through the **parallel implementation of three ambitious development works** there is also a strong complementary component of research focusing on making geothermal projects more cost efficient and technologically sound. Research work will include:

- **Integration of the geothermal energy with other RES** to outline ways of more efficient and more sustainable green-energy production (e.g. solar energy, biomass, wind) in Europe – with special focus on CH4 and other combustible gas trapping and energy production .
- **Transboundary issues** of the utilisation of geothermal energy (4D modelling of geothermal reservoirs along the Hungarian/Serbian border)
- **Socio-economic modelling** of geothermal investments, with special focus on the public perception and understanding of RES/RUE measures

Results of the project activities will be actively disseminated via straightforward dissemination actions combined with tradition and electronic training programmes and workshops organised for municipal-level decision makers. Besides the dedicated dissemination work-package, the demonstration activities will have solid impact on the environmentally-focused thinking (i.e. involving educational institution buildings into retrofitting and system integration helps the students studying there to meet with the RES/RUE measures and understand its importance). Finally, the unique **Mayors' Geothermal Club** will be set up and will continue operating even after the EC-funded period as a permanent network of city mayors and municipal-level decision makers who are interested in the sustainable utilisation of geothermal energy. It is expected that with the help of such **high-visibility pilot actions** combined with the research and dissemination efforts investment into geothermal systems can be boosted in Europe and **these investments** will be **implemented in a sensible, environmentally aware and economically sound way**.

3.1.2 A description of the work performed since the beginning of the project and the main results achieved so far

The planned duration of the project is 60 months, expanding from 01/2010 to 12/2014. During the first 12 months of the project mainly administrative, management and preparatory works have been performed, however, the retrofitting measures in Galanta at the 3 multi-level dwellings were also implemented quite ahead of schedule.

The project's kick-off meeting was held on 27-29 January 2010 at Budapest, with site visits to the Morahalom and Galanta demo sites. All partners and the EC project officer Mr. Santiago Gonzalez-Herriaz were present at this meeting, where all administrative, technical and financial issues of the project were discussed in details.

Due to the geographical makings an interim project meeting was held in June 2010 at Montieri, Italy, with most of the partners being present as well. Besides discussing the project progress in of the first 6 months a site visit at the Larderello Geothermal Area and at Montieri was held.

There were also several bilateral meetings between the coordinator and the demo sites representatives in order to keep the project on track and to help the preparatory works of the measures.

In Galanta, we decided to bring the retrofitting measures forward by a year thus we started and actually completed the retrofitting measures of the 3 multi-level dwellings in the primary Concerto area. This makes the project being quite ahead of its original schedule. The description of these measures and their results are described in Chapter 3.

The preparatory works, energy audits, planning and public procurement procedures are also in the pipeline at the other Concerto cities. The actual retrofitting and construction works will be started in 2011, as planned.

The research works in WP5 are also partially completed. A detailed study on the possible RES integration with Geothermal Energy and on the transboundary issues of geothermal energy utilisations are attached as a draft version deliverable to this report.

Technology showcase on retrofitting measures in Montieri – due to its special building structure – was also performed by the responsible partner and attached as a deliverable to the report.

The project website is available at www.geothermal-communities.eu. This website is frequently updated and all relevant information and results are available on it.

The publishable summary should be updated for each periodic report.