INTEGRATION OF SGE SYSTEMS IN CITIES
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Cities can be subdivided in different zones and the zones have different potential for SGE.

In the context of REGECITIES project a classification of city zones is used for the analysis of the potential use of the ground.

The aim with the zones is to find out about special aspects and conditions for consideration in the implementation of SGE systems, analysing both barriers and possibilities.

POSITIVE ASPECTS FOR SGE SYSTEMS IN CITIES

- Small visual footprint (neither chimneys nor fan-coolers).
- In general more important for an area with special attention to be preserved, like an “old town”, than it is in a new commercial centre.
- Low outdoor noise level and elimination of risk for legionella (from evaporative coolers).
- In denser areas, large SGE seasonal storage systems are more competitive or even necessary to grant everyone access to underground heat/cold.
- In sparse urban settlement there is enough space between individual systems for thermal recovery.

BARRIERS FOR SGE

- Older settlements
  - Low visual impact, no operating noise compared to some competing technologies.
  - Heating and cooling with only one system.
  - If district heating solutions are already used, the implementation of large scale SGE applications can use the distribution preexisting network.
  - In certain cases, “open” technology applications (ATES) can be implemented by drilling in building’s basement.

- Areas with special attention to preservation.
  - Low visual impact, no sound impact compared to other technologies.
  - There is almost no visual evidence of installations above ground at all, at the very most a manhole or two.
  - No outdoor fan coolers (for chillers/air-condition) or chimneys.
  - Heating and cooling with only one system.
  - No delivery of fuel by truck.

- Dense urban settlements
  - Higher density favour use of large area efficient SGE-systems (ATES / BITES), one system for several buildings instead of individual systems alternatively common ground water distribution with individual heat pumps connected.
  - Low visual impact, no sound impact compared to other technologies.
  - No outdoor fan coolers (for chillers/air-condition) or chimneys.
  - Elimination of health problems related to legionella from evaporative condensers/coding towers.

- Sizable urban settlements
  - Higher availability of space for wells/boreholes
  - Enough space between SGE systems for recovery w/o balance source.
  - Ease of access for equipment and installation.
  - SGE collector options generally less restricted.
  - Large buildings as shopping malls with high thermal loads; both heating and cooling.

- Commercial operation areas
  - Buildings (individual or neighborhoods) can be designed for SGE from scratch. This approach covers both heating and cooling needs from the very beginning.
  - Investment in SGE instead of other infrastructure (i.e. gas network) and heat generators (boiler) and cooling system.
  - Low visual impact, no sound impact compared to other technologies.
  - No outdoor fan coolers (for chillers/air-condition) or chimneys.
  - Possibilities to plan large district heating systems with SGE as heat source in early masterplan.
  - Possibility to decontaminate soil and underground water in industrial areas by implementing SGE / ATES systems.
  - Possibility of planning small district heating scheme at very low temperature.

- Industrial areas
  - Buildings can be designed for SGE from scratch
  - Significant reductions of the energy costs associated to thermal energy.
  - Free cooling with COP up to 20 is possible in that kind of building.

- Areas for the technical sustainability of the city
  - Heating and cooling recovery from industrial processes that can be used in HVAC / GSHP solution.

- Park areas
  - Large areas of open space are suitable for SGE collector deployment. If buildings are located in the vicinity.
  - No buildings to supply with thermal energy in the park area.

- Water areas with waterways
  - Water is a very good balancing source for heating as well as cooling of ATES/BTES.
  - SGE can be used directly in water bodies or in the underground beneath the water.

- Main roads and railroad tracks
  - SGE could be used to melt/ice roadtrack (only parts of them, especially ramp or slope areas of the road, in winter or when it is needed) by placing collector loops under the road.

RegioCITIES LAND AREA CLASSIFICATION

<table>
<thead>
<tr>
<th>NAME</th>
<th>IN FAVOUR FOR SGE</th>
<th>BARRIERS FOR SGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Older settlements</td>
<td>Heating and cooling infrastructure already in place. Older settlements may have infrastructure not plotted on drawings, making drilling risky.</td>
</tr>
<tr>
<td>B</td>
<td>Areas with special attention to preservation.</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>C</td>
<td>Dense urban settlements</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>D</td>
<td>Sizable urban settlements</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>E</td>
<td>Commercial operation areas</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>F</td>
<td>Industrial areas</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>G</td>
<td>Areas for the technical sustainability of the city</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>H</td>
<td>Park areas</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>I</td>
<td>Water areas with waterways</td>
<td>Buildings may be extra sensitive to vibrations from drilling. Restoration of courtyards and other exterior areas after installation can be costly. However, restoration might be needed after any form of refurbishment.</td>
</tr>
<tr>
<td>J</td>
<td>Main roads and railroad tracks</td>
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Land area classification scheme