Sweden is the leading market for shallow geothermal in Europe, and the largest user of geothermal in terms of final energy use in Europe. Thanks to a successful policy, regulatory and financial framework, coupled with favourable climate and geological conditions, the country is consistently leading the European market in terms of installed stock and sales of shallow geothermal systems. Moreover, strong of an extensive heating and cooling infrastructure, Sweden is investing in novel technologies such as underground thermal energy storage (UTES) to deal with the variability of variable electricity production and seasonal demand peak in heating and cooling. Sweden also has some 44 MWth of deep (or large shallow) geothermal systems for heating and cooling, notably for district heating and cooling.

The Swedish geothermal sector is structured by large industrial actors for the manufacturing and development of shallow geothermal systems, along SMEs developers. Large private developers and local utilities are also involved in the development of larger systems.

### POLICIES AND REGULATIONS

#### Legislative framework

The 2016 Framework Agreement on Energy Policy (Energy Agreement), which was passed into law in April 208, provides the main legislative framework for Sweden renewable energy policies. The agreement does not make any specific reference to geothermal energy or to plans for the development of geothermal technology other than heat pumps.

#### Support schemes

All renewable energy generation technologies, including geothermal, are eligible for a quota system, which obliges electricity suppliers, certain electricity consumers and energy-intensive companies to annually acquire renewable energy certificates in due proportion to their electricity sales and their consumption by a set date.

In addition, electricity produced from geothermal energy in electricity generators with a capacity lower than 50 kW is not taxable and a tax reduction is provided for the excess electricity fed from micro-producers of electricity generated from renewable energy sources.

Concerning heating and cooling, the installation or replacement of a heat pump in both apartments and single-family houses is eligible for the tax allowance covering 30% of the labour costs (up to SEK 50 000 per year).
Key public institutions

- The Ministry of the Environment and Energy (MEE)
- The Swedish Energy Agency (SEA)
- The Swedish Energy Markets Inspectorate
- The National Board of Housing, Building and Planning
- The Swedish Environmental Protection Agency
- The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)
- Vinnova, the Swedish Governmental Agency for Innovation Systems

RESOURCES

Sweden is particularly well suited for shallow geothermal developments, as its geology allows for more cost-effective drilling, and its climate justifies more easily the larger investments required by this heating and cooling technology. Shallow geothermal systems can be deployed throughout the whole country.

For deep geothermal, Sweden has identified resources in the south of the Country that are exploited to some extent.

PERSPECTIVE TO 2030, AND POTENTIAL DEVELOPMENTS

In the medium term, Sweden’s key challenge will be to consolidate its shallow geothermal sector, notably as it enters a cycle of replacement of part of the installed stock. The stability of the framework that allowed this technology uptake is therefore crucial. Regarding the deep geothermal sector, or for large installations, there is a large potential for greater development in Sweden. To allow these developments, robust policy objectives are required. These objectives will also need to be accompanied by a long term planning around heating and cooling infrastructure at the local level, and will require a better knowledge of the resource potential for deep geothermal in Sweden. This is important both for developing ‘conventional’ deep geothermal heating and cooling systems, and for increasing the penetration of UTES, which reduce the cost of the energy transition by allowing the system to deal with the seasonal shifts in energy demand linked to winter heating requirements. Geothermal electricity developments are unlikely in Sweden except for some possible demonstration projects for innovative technologies.

<table>
<thead>
<tr>
<th></th>
<th>Baseline (ongoing projects, commissioned by 2025)</th>
<th>Market slow down</th>
<th>Current trend</th>
<th>Moderate market acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating &amp; Cooling</td>
<td>+55MWh</td>
<td>+78MWh</td>
<td>+111MWh</td>
<td>+215MWh</td>
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<tr>
<td>Electricity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shallow geothermal</td>
<td>+220000 units</td>
<td>+100000 units</td>
<td>+220000 units</td>
<td>+300000 units</td>
</tr>
</tbody>
</table>
KEY RECOMMENDATIONS

- Set ambitious objectives based resources not historical trends;
- Set the regulatory and policy framework fit to attain these objectives, based on best practices that have proven able to deliver at the European level;
- Establish a long-term local planning of heating and cooling investments according to local resources.
- Continue and set financial support tools to increase geothermal development for heating and cooling and CHP, notably by the establishment of a geothermal risk mitigation scheme.
- Introduce measures that encourage users/consumers to use geothermal heat and electricity, reflecting the lower emissions in the market price (e.g. reduction of VAT for geothermal district heat…)
- For shallow geothermal, the policy, financial and regulatory framework should be not be a barrier to market uptake considering the technology’s benefits compared to other technologies (i.e. higher investment, lower operating costs, reduction of winter peaks in electricity consumption…)