Heathighway Report

15. Juli 2024

Allplan GmbH
Schwindgasse 10
A-1040 Wien
T +43 1 505 37 07
F +43 1 505 37 07-27
wien@allplan.at
allplan.at
Sitz Wien - Firmenbuch Nr. 94000k
UID-Nr. ATU 37146209 - allplan.at/datenschutz

INHALTSVERZEICHNIS

1 GENERAL - OBJECTIVE DEFINITION

1.1. BACKGROUND OF THE STUDY

Work Package 7.3 aims to identify and analyze the waste heat potentials in the regions of Southern Vienna and St. Pölten-Krems. Waste heat is a byproduct in energy-intensive companies and can represent a significant resource for sustainable energy supply. In this context, waste heat refers to the unused heat generated during industrial processes or other activities, which has so far been released into the environment without being utilized.

1.2. AIM OF THE STUDY

The aim of this study is to comprehensively quantify the waste heat potentials in the mentioned regions and simultaneously identify local heat sinks. Special attention should be paid to industrial companies that employ energy-intensive processes as potential sources of waste heat. Data collection will take place directly in contact with the companies to obtain accurate information about the type and amount of waste heat produced as well as potential uses. Direct contact with companies ensures accurate information collection, providing detailed insights and a solid basis for future waste heat utilization decisions in these regions.

2. METHODOLOGY

2.1. LITERATUR RESEARCH

A comprehensive literature review was conducted to deepen the theoretical understanding of the generation and utilization of waste heat. This review aimed at developing a uniform definition and understanding of waste heat across various industrial sectors.

Selection of industry sectors:

- Steel production: Considerable amounts of waste heat are generated in steel manufacturing, especially during the blast furnace process and steel processing.
- Aluminium production: The electrolysis in aluminium production generates significant amounts of waste heat.
- Chemical industry: Processes in the chemical industry that involve exothermic reactions often don't utilize waste heat. Examples include the synthesis of plastics and the production of fertilizers.
- Paper and pulp industry: The processing of wood into paper or pulp generates heat as a byproduct.
- Glass production: High temperatures required for melting glass generate significant amounts of waste heat.
- Refineries: Oil refineries produce heat during the refining process.
- Iron and non-ferrous metal processing: Metal processing facilities that handle iron, copper, nickel, and other metals generate waste heat.
- Textile industry: Some processes in textile manufacturing generate waste heat, for example during the dyeing or drying of fabrics.
- Power generation: Power plants, regardless of the energy source (coal, gas, nuclear, renewable energies), often generate waste heat during the power generation process.
- Food and beverage industry: Processes such as cooking, pasteurizing, or sterilizing can generate waste heat.
- Cement production: Considerable amounts of waste heat are generated in cement production, especially during the sintering process.
- .

2.2. INDUSTRIAL MAP OF LOWER AUSTRIA

The industrial map of Lower Austria was used to identify industrial enterprises that potentially generate waste heat. This map provides a detailed overview of company locations, allowing for the targeted selection of companies for in-depth analysis. Figures 1 and 2 depict the design of the industrial map of Lower Austria. This map was created by the state of Lower Austria and illustrates various circles of different sizes. These circles represent the aggregation of multiple company locations, with the size of the circle depending on the number of companies located at that site. For example, a larger circle indicates that there are more than 20 industrial companies at that location.

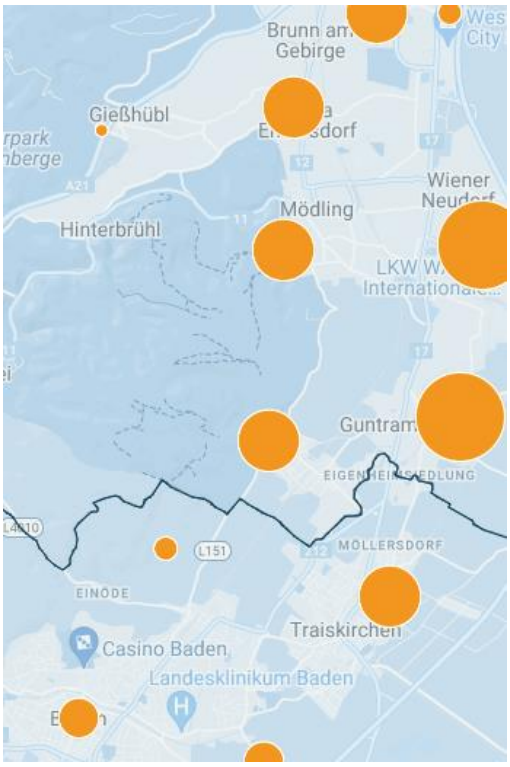

Figure 1: Industrial map Southern Vienna[1]

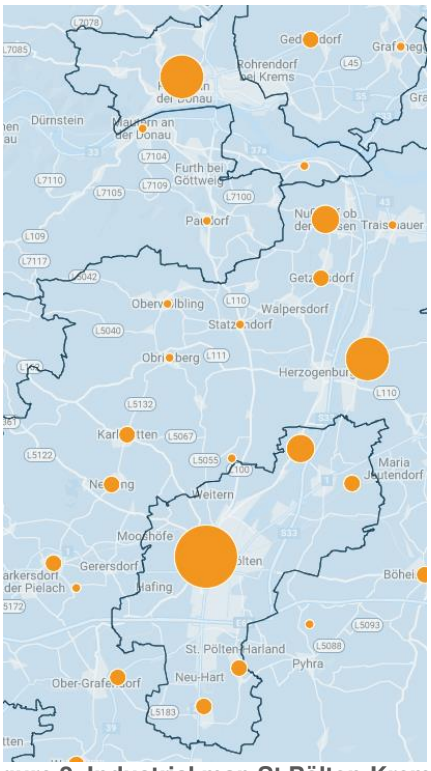

Figure 2: Industrial map St.Pölten-Krems[2]

2.3. COMPANY ANALYSIS

Each identified company was thoroughly examined to understand its specific industry and waste heat potential. This included evaluating the address, existing buildings, and whether the company's size and activities might produce waste heat. Companies were selected based on previously mentioned industry criteria. This detailed analysis enabled the precise selection of relevant companies for further steps in waste heat utilization.

2.4. CONTACT INITIATION

After selecting companies, contact details for each were obtained. Efforts were made via telephone to identify a responsible contact person. If details were not disclosed or a preference was given to use a general office email, a customized email was sent. This email included a brief introduction to the project and a request for information about existing waste heat potential. The goal was to gather data directly from the companies to determine usable waste heat potentials. A questionnaire to assess waste heat potential was also included in these emails.

To achieve a high response rate, the questionnaire was designed to be simple, capturing essential information for assessing waste heat potential. It was created in Excel with two sheets: one for general information and the other for waste heat potential.

[1], [2] Industrial map Lower Austria, https://iv-noe.emerge.at/

The first sheet collects general company information, such as address, distance to the nearest district heating feed-in point, and production details. It includes aspects like manufactured products, production hours and shifts, and a detailed production process description. Additionally, it gathers information on potential waste heat sources, sinks, downtimes, and energy requirements.

The second sheet is intended to capture specific information about waste heat potential. It records details such as the medium (e.g., composition, mass flow, or volume flow), temperature, operating hours, complexity of heat extraction, location of heat occurrence, and any planned heat integration measures.

Due to a lack of responses from the companies, as detailed in the results chapter, additional methods were employed to estimate waste heat potentials in the defined regions.

2.5. ALTERNATIVE RESEARCH: AUSTRIAN HEAT MAP

In 2015, the Vienna University of Technology (TU Wien), in collaboration with the companies “E-think energy research” and Ecofys, conducted a study titled "Assessment of the Potential for the Use of Highly Efficient CHP and Efficient District Heating and Cooling Supply." As part of this project, the Austrian Heatmap was created, which is now accessible at www.austrian-heatmap.gv.at.

The Heatmap provides a comprehensive overview of Austria, displaying a multitude of information, including power plants, district heating networks and industrial sites. This detailed representation allows for the specific examination n of regions of interest. In this case, only industrial sites were selected as potential waste heat points.
For the Austrian Heatmap, waste heat potentials were derived from publicly available data using bottom-up or top-down analyses, without direct coordination with the relevant companies. Therefore, the accuracy of the data depends on publicly available information, with 2019 as the reference year.

2.6. RESEARCH ON HEAT SINKS

A further investigation was conducted regarding potential heat sinks, focusing on large consumers in the two regions. Large consumers are facilities with significant energy needs due to their size and operational activities, making them potential candidates for waste heat utilization. The targeted large consumers include:

- Commercial Buildings: This category comprises large office complexes, shopping centers, hotels, and hospitals.
- Institutions: This includes educational facilities such as universities and schools.
- Large-scale Facilities: Examples are sports stadiums, concert halls, and convention centers.

Consumers of different types were identified their energy consumption estimated based on sqare footage and usage, although many buildings did not have available square footage data. The governmental mapping service atlas.noe.gv.at was used to trace the approximate square meters. Organization of data and calculations were made in Excel.

2.6.1. CALCULATION OF HEAT SINKS

For assessing a building's energy demand, the heating energy performance indicator (Heiz-Energiekennzahl) is crucial as it serves as a fundamental basis for calculating the necessary heating energy requirements. To make a more precise estimation of heating performance, specific heating energy performance indicators were utilized. Tables 1 and 2 list these indicators for public buildings and service-providing buildings. The underlying data for these indicators come from publications such as "Energy Characteristics in Service Buildings," issued by the Energy Institute of the Economy GmbH, and the energy report for the buildings of Lower Austria.

For the calculations, an average value was derived from the data in the first table, which included the minimum and maximum values of the heating energy performance indicators. In analysing the data from the second table, the energy requirement for hot water was also considered, as it was not included in the values for space heating requirements.

By multiplying the gross floor area (GFA) of a building by the respective heating energy performance indicator, an approximate value for the heating demand can be determined. This calculation provides a well-founded estimate of the heat required for a building, considering its specific properties and usage. This methodology is essential for efficiently planning heating systems, especially when integrating waste heat recovery systems, where accurate demand projections are critical.

Table 1: Heating energy characteristic numbers of state buildings [3]

Categories	Minimum kWh/m² GFA a	Maximum kWh/m² GFA a
District Administrations	35	140
Administrative Buildings	60	95
Vocational Schools	35	180
Agricultural technical Schools	70	160
Care Facilities (PBZ)	80	140
Youth Facilities (SBZ,PFZ)	90	220
Clinics	100	400
Road Administration	60	190

[3] Ing. Reinhold Kunze, (2021). *Energiebericht für NÖ Landesgebäude*

Table 2: Heating energy characteristic numbers of service buildings [4]

Categories	Space Heating kWh/m²	Warm Water kWh/m²
Food Retail	109	
Gastronomy	145	28
Hotel Industry	103	21
Non-Food Retail	142	8

[4] Energieinstitut der Wirtschaft GmbH, (2012). *Kennzahlen zum Energieverbrauch, die relevantesten Einsparpotenziale und Hauptverbraucher in ausgewählten Branchen – Bürobetriebe • Einzelhandel Non Food • Lebensmitteleinzelhandel • Gastronomie • Hotellerie (3- und 4-Stern) – im Rahmen des Projektes EV-DLB – Energieverbrauch im Dienstleistungssektor*

3. RESULTS

3.1. CONTACT INITIATION

Upon contacting companies by phone, it became evident that staff at general telephone switchboards often hesitated to provide the contact details of responsible personnel. They typically requested a brief project description to be sent to the office email address. In rare cases, direct contact with a responsible person was established, enabling the exchange of contact details and transmission of informational material and distribution of the questionnaire.

Despite these efforts, both direct telephone acquisition and email outreach resulted in an insufficient response rate regarding waste heat potential information. Only a limited number of companies responded with follow-up questions or completed questionnaires.

Possible reasons for the low response rate include company distrust towards consulting firms. A well-known neutral research institution might be seen as a more trustworthy contact for companies. Besides issues related to contact persons, the limited time resources within companies are also considered possible reasons for rejection.

3.1.1. CONTACT RESULTS SOUTHERN VIENNA REGION

The attached diagram (Figure 3) for the Southern Vienna region shows the percentages of companies that declined, responded, or did not respond, and those that stated they had no waste heat potential. The majority, 69%, did not respond, while 7% declined. On the other hand, 21% responded and indicated that their company had no waste heat potential. Only 3% responded and returned the completed questionnaire.

The reasons for declining were varied and are illustrated by the following examples:

- No apparent benefit or significant potential for the proposed project
- Companies are implementing internal projects to use their waste heat
- Companies only have ventilation or heating waste heat at a low temperature range, which is not relevant for this project
- A company initially interested stated after a few weeks that they were already planning to implement heat extraction into a local network in Gumpoldskirchen with EVN. Therefore, they considered the survey for an atlas no longer relevant as their priority was on their own implementation.

One company, where relevant waste heat streams were suspected, indicated that waste heat streams at the relevant temperature level for the project had not yet been identified and would only be worked on at a later date. It was agreed to have regular updates on the status quo. However, no results were achieved within the project period.

The companies which stated that they had no usable waste heat potential, as shown in the diagram below at 21%, did so due to various circumstances. Some of the buildings considered are used exclusively as storage spaces, while others are primarily used for sales activities with no production processes taking place. In these cases, no significant waste heat is generated

during production activities. Although no usable waste heat potential could be identified in these buildings, they could still be considered as potential heat sinks.

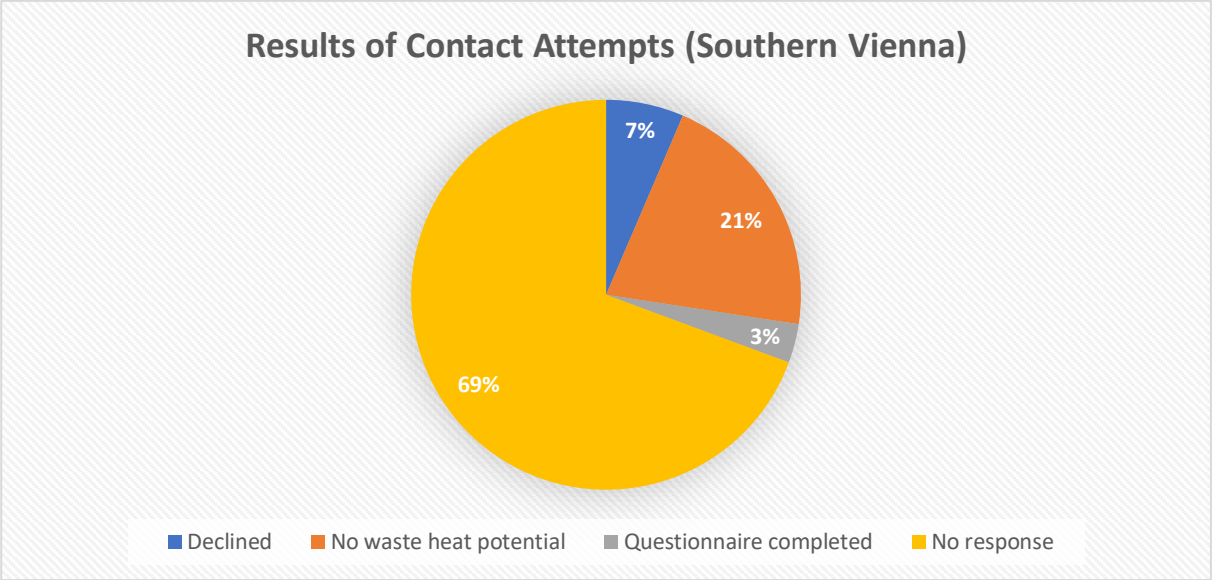

Figure 3: Results of Contact Attempts (Southern Vienna)

3.1.2. CONTACT RESULTS ST-PÖLTEN – KREMS REGION

The attached diagram (Figure 4) for the St. Pölten – Krems region shows the percentages of companies that declined, responded, did not respond, and those that stated they had no waste heat potential. The majority, 73%, did not respond, while 16% declined. On the other hand, 7% responded and indicated that their company had no waste heat potential. Only 4% responded and returned the completed questionnaire.

The reasons for declining were varied and are illustrated by the following examples:

No survey desired: The exact reason for the refusal remains unclear, but the company clearly states that they do not currently wish to participate in surveys.
The companies have already taken internal measures for heat recovery, but their focus is on internal use and not on feeding into district heating.
The companies have already implemented heat recovery measures and use them for space heating and the production process. There is still untapped potential that will only be investigated in the future.
The companies have shown interest in the project, but currently have limited capacity for active participation.
No free time resources were reported.

In the St. Pölten - Krems region, a company was also identified whose waste heat potential varies between 50-60°C. However, the amount of waste heat generated is inconsistent and fluctuates depending on the respective production process. An internal examination regarding the implementation of heat pumps was conducted but concluded that such an investment would not be financially worthwhile. Nevertheless, it was indicated that the company would proactively

make contact if interest arose. However, no concrete solution or cooperation could be realized within the project period.

As shown in the diagram below, 7% of the companies we contacted stated that they had no usable waste heat potential. This situation is due to various circumstances. Some of the buildings considered are used exclusively as storage spaces, while others are primarily used for sales activities with no production processes taking place. In some cases, no significant waste heat is generated during production activities. Although no usable waste heat potential could be identified in these cases, these buildings could still be considered as potential heat sinks.

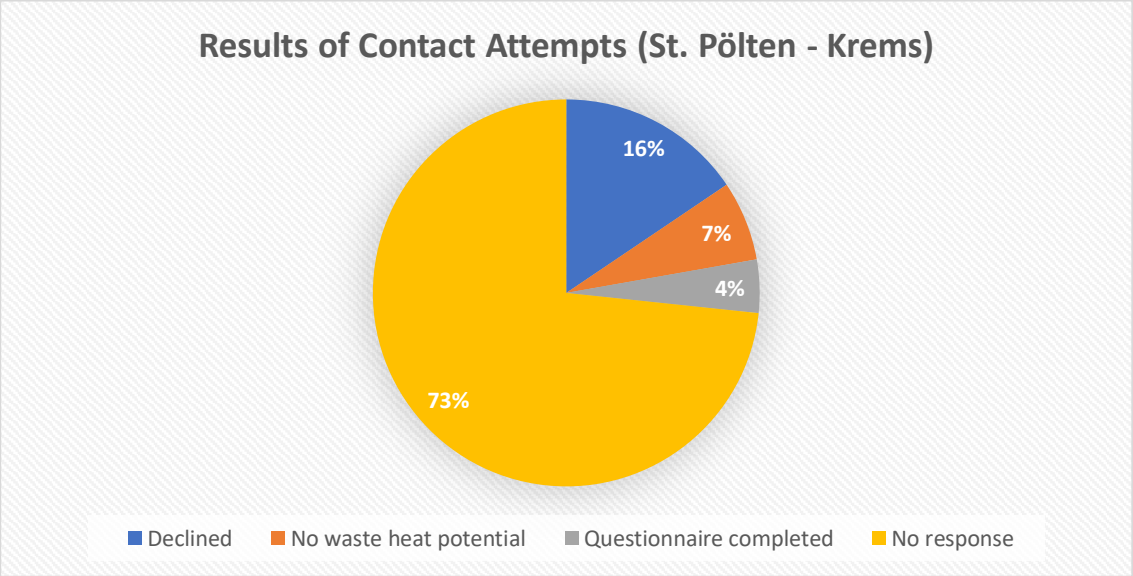

Figure 4: Results of Contact Attempts (St. Pölten - Krems)

3.2. WASTE HEAT POTENTIALS

Due to insufficient direct data collection, waste heat potentials were evaluated using heat map research.

3.2.1. WASTE HEAT POTENTIAL IN THE SOUTHERN VIENNA REGION

Heat map research identified several companies with waste heat potential, categorized into three levels: below 50°C, between 50°C and 100°C, and aboce 100°C.

The following waste heat potentials were determined according to the research:

- Waste heat potential < 50°C: 111 GWh/a
- Waste heat potential 50°C – 100°C: 10 GWh/a
- Waste heat potential > 100°C: 5.5 GWh/a

The diagram below provides an overview of the total potential across the different temperature levels.

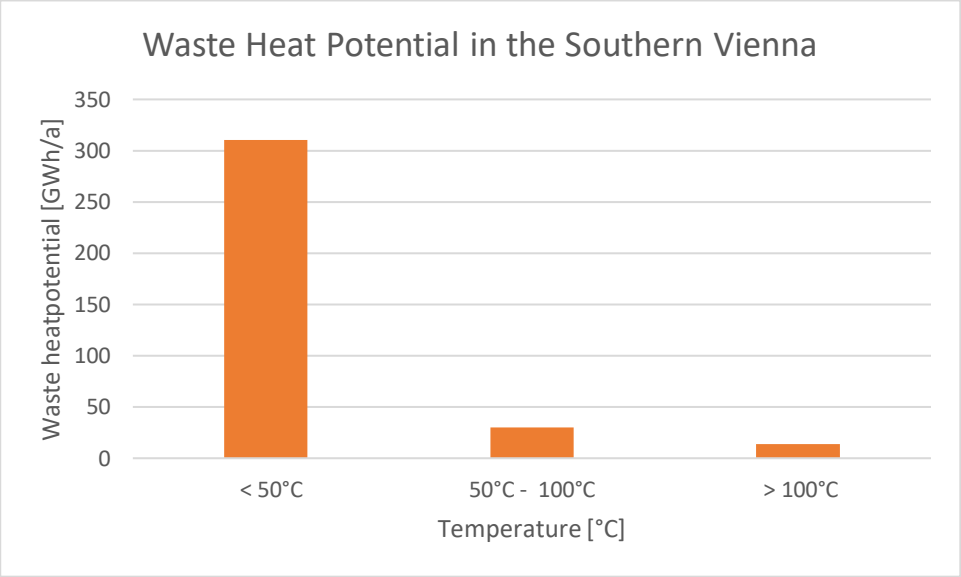

Figure 5: Waste Heat Potential in the Southern Vienna

In Figure 6, the exact locations of the waste heat potentials and their temperature levels are shown. The blue columns represent the waste heat potential at temperatures below 50°C. The height of the columns represents the respective waste heat potential at each location, with particularly tall columns indicating higher waste heat potential and particularly short columns indicating lower waste heat quantities. The yellow columns represent the waste heat potential at temperatures between 50°C and 100°C. The red columns represent the waste heat potential at temperatures above 100°C. This map was created using Power Map in Excel.

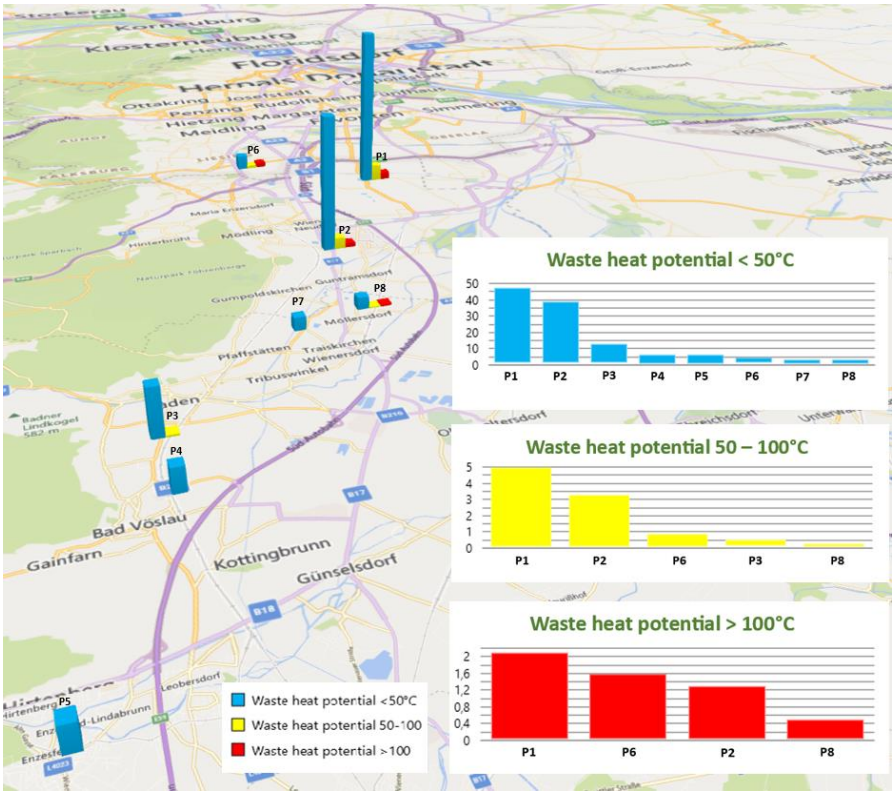

Figure 6: Waste Heat Potential Map for the Southern Vienna Region

3.2.2. WASTE HEAT POTENTIAL ST.PÖLTEN – KREMS REGION

Heat map research identified companies with waste heat potential in the St. Pölten – Krems region, categorized into three temperature levels.

The following waste heat potentials were determined according to the research:

- Waste heat potential < 50°C: 310 GWh/a
- Waste heat potential 50°C – 100°C: 30 GWh/a
- Waste heat potential > 100°C: 14 GWh/a

The attached diagram provides a comprehensive overview of the total potential at each of these defined temperature levels.

The present diagram illustrates that waste heat potential at temperatures below 50°C is significantly greater compared to higher temperature levels in the St. Pölten – Krems region as well.

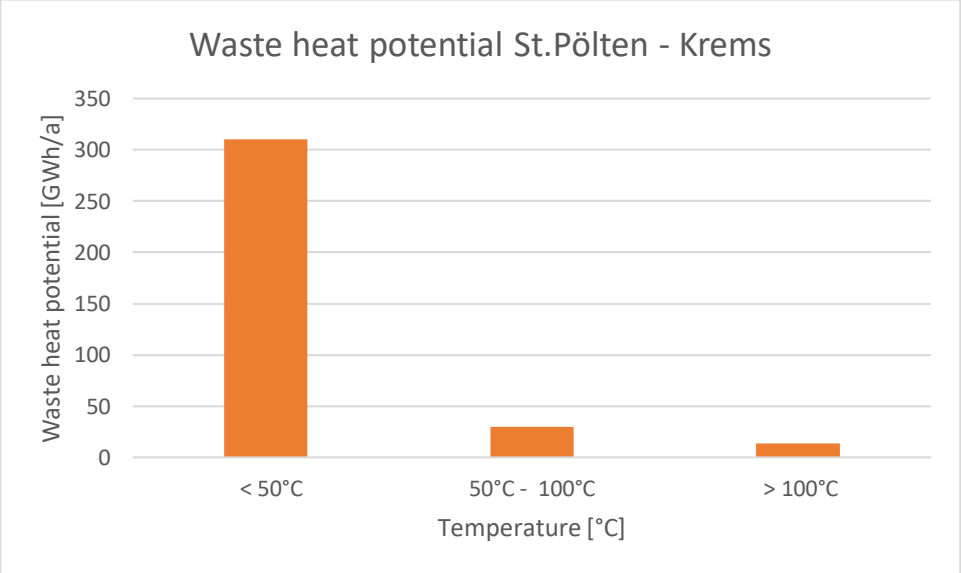

Figure 7: Waste heat potential St.Pölten – Krems

In Figure 8, the exact locations of the waste heat potentials and their temperature levels are shown. Compared to the Southern Vienna region, this region has fewer locations with waste heat potential. Another difference compared to Figure 3 is that in this region, all locations exhibit waste heat potential at all three temperature levels.

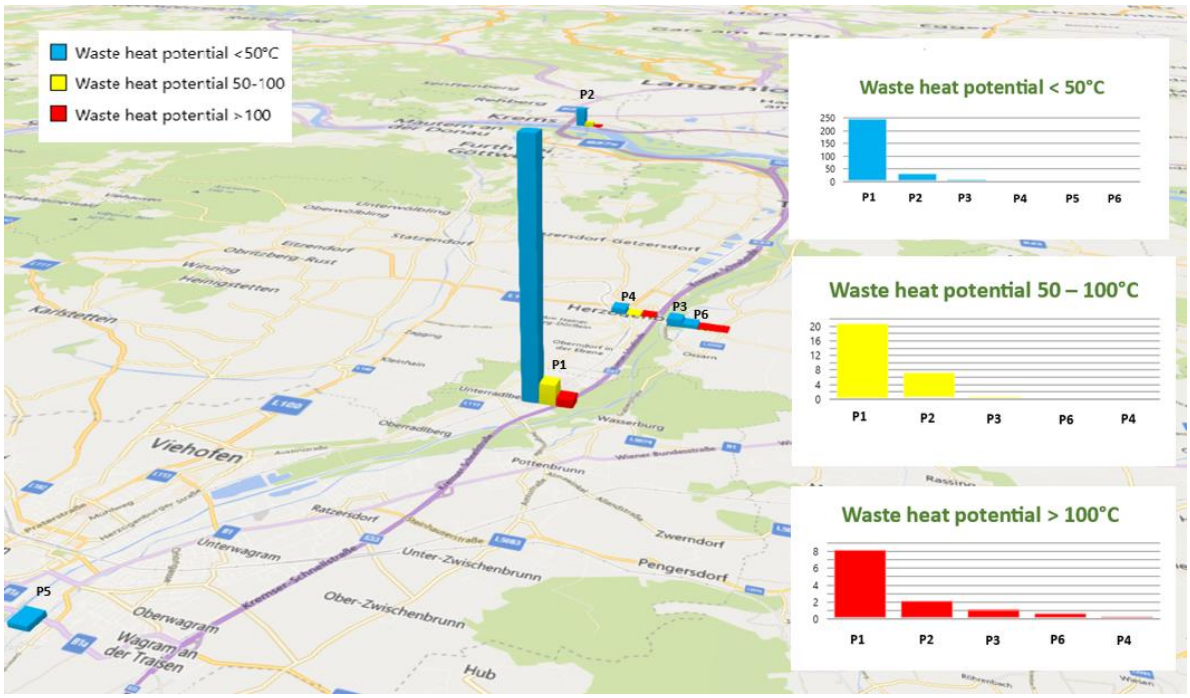

Figure 8: Waste Heat Potential Map for St.Pölten-Krems Region

3.3. HEAT SINKS RESEARCH

Local heat sinks were identified in the studied regions, focusing on their potential size and function as significant energy consumers. This process aimed to develop a detailed understanding of the distribution and potential of heat sinks in the respective areas to explore efficient solutions for utilizing or minimizing energy demand.

The visualization of these heat sinks and waste heat potentials was carried out using a specially created map. Blue circles represent companies that declined or have no waste heat potential, while orange circles mark companies identified as potential heat sinks.

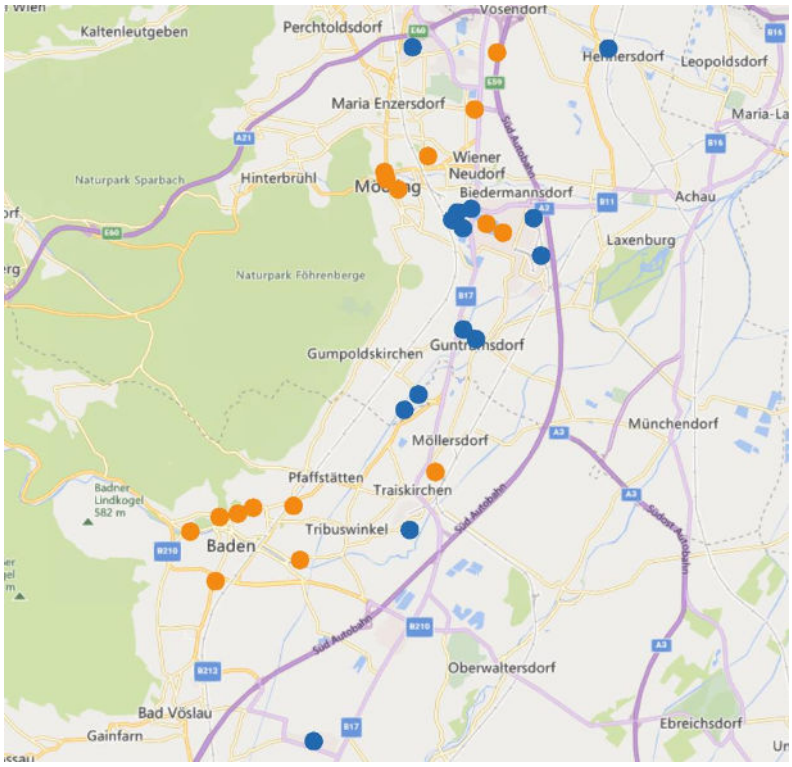

Figure 9: Heat Sinks Map for the Southern Vienna Region

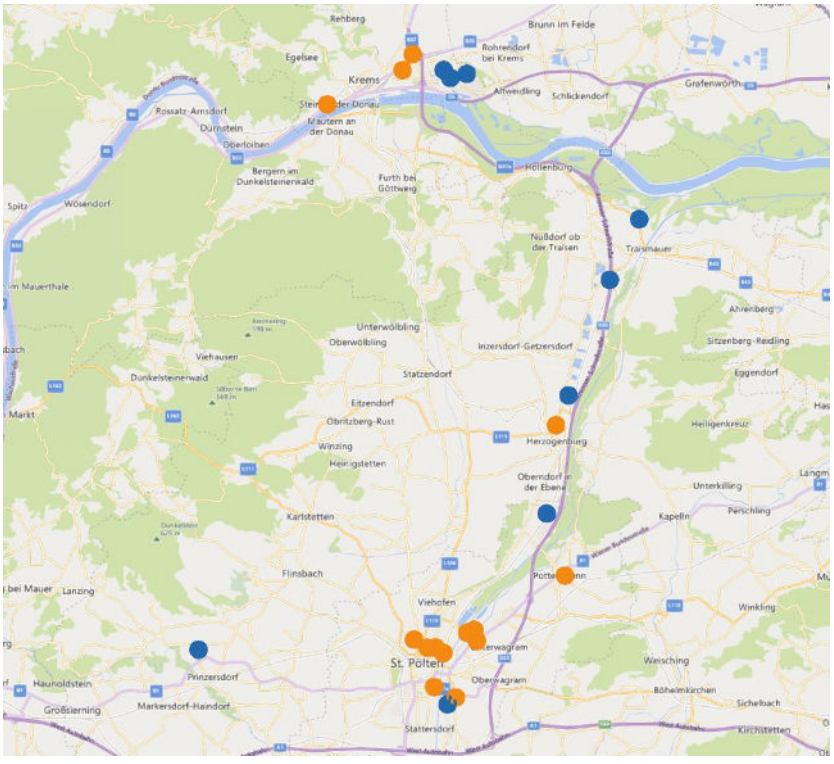

Figure 10: Heat Sinks Map for the St. Pölten – Krems Region

3.4. WASTE HEAT POTENTIALS AND HEAT SINKS

To enable a more precise understanding of the available resources and requirements, a refined map was created to visually represent waste heat potentials and corresponding heat sinks,

facilitating planning and design. This appealing visualization provides a clear view of the potential connections within the so-called “heat highway”, making planning and design much easier. Blue dots indicate the locations of heat sinks, while thermal images highlight areas with waste heat potential below 50°C. The intensity of waste heat is color-coded: stronger red hues signify higher waste heat potential, while lighter shades indicate lower potential.

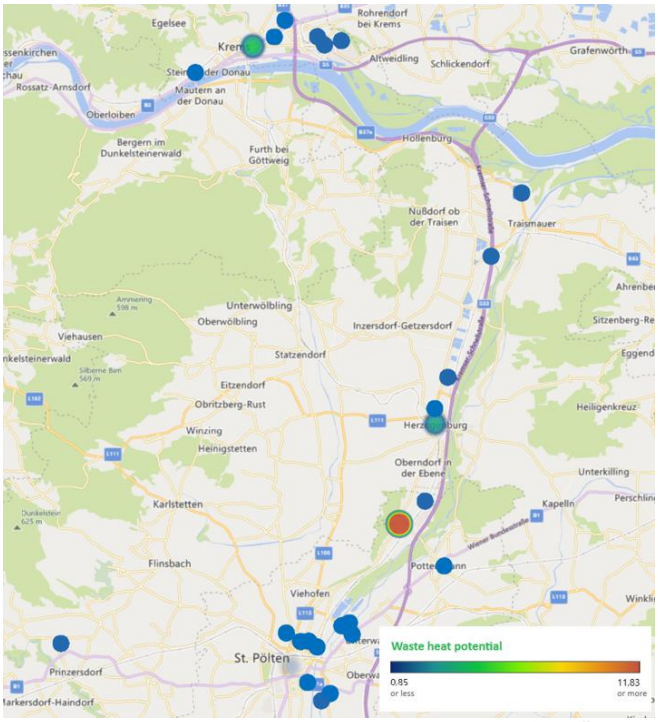

Figure 11: Waste Heat Potentials and Heat Sinks Map for the St. Pölten – Krems Region

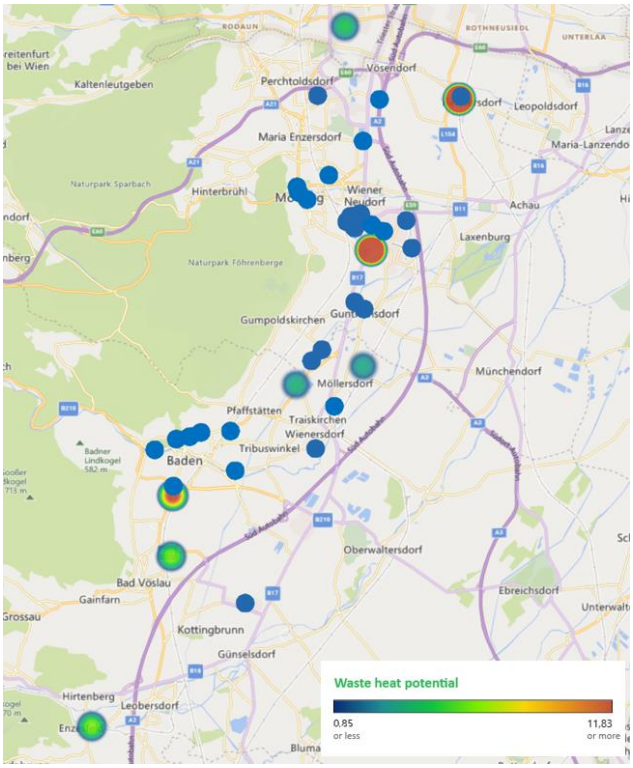

Figure 12: Waste Heat Potentials and Heat Sinks Map for the Southern Vienna Region