



© shutterstock/Gorlov KV

Kehl-Strasbourg heating alliance

A transnational showcase project for the municipal heating transition is being developed in the Strasbourg-Kehl region on the French-German border. Thousands of households on both sides of the Rhine will soon be supplied with waste heat from the local steel plant.

The project is facing exceptional challenges due to its transnational character. Nevertheless, a high level of commitment from partners, active support from governmental institutions in both countries and funding have made the project possible.

From the idea to implementation

On the German side of the Rhine, on a peninsula between its confluence with the Kinzig, the Badische Stahlwerke (BSW) are processing steel scrap into steel bars and wire rods. To do this, the company operates two electric arc furnaces, in which electrical energy is used to melt the scrap down into liquid steel. This results in the release of considerable quantities of waste heat in the form of waste gas, with temperatures reaching as much as 1,300 °C. Currently, the waste heat escapes into the atmosphere unused via water-cooled waste gas lines and the water recooling in the cooling towers.

The Badische Stahlwerke have been looking for a way to utilise this waste heat for quite some time. In the nearby industrial port area, and three kilometres away in the city of Kehl, there are large quantities of heat of this kind, but no long-term buyers. However, on the other side of the Rhine is Strasbourg – a city which already has a large district heating network, and which is looking to further develop it in line with climate policy targets. By 2050 at the latest, Strasbourg's heating networks should be completely operated using renewable energy and otherwise unused waste heat.

In 2014, the possibility of using waste heat from the steel works on the other side of the Rhine was investigated for the first time. However, the idea wasn't successfully realised back then. Four years later, the project was relaunched on

the initiative of the Baden-Württemberg state government amidst improved funding conditions. Since then, the Eurométropole de Strasbourg, the Badische Stahlwerke and the City of Kehl have been working with a group of other stakeholders to implement the collaborative Franco-German project. In July 2018, the Baden-Württemberg Ministry of the Environment commissioned a study that confirmed the project's technical and economic feasibility. This was followed by further investigations on the waste heat potential, the heating needs of Strasbourg and Kehl, and possible routing of the heat pipeline. A final technical implementation concept for the extraction, transportation and usage of waste heat has been available since late 2020.

Facts and figures

Project implementers:	Badische Stahlwerke GmbH, Calorie Kehl-Strasbourg S.A.
Length of the heat pipeline:	4.5 km
Start of operation:	expected 2027
Energy savings:	min. 70,000 MWh/a
Households supplied:	min. 7,000
CO₂-savings:	up to 20,000 t/a
Investment volume:	approx. € 35.5 million
Funding amount:	approx. € 20 million

Extraction of industrial waste heat

The primary waste heat source of the Badische Stahlwerke is waste air from the two electric arc furnaces, in which the scrap is melted down. There are other waste heat sources as well, including the pusher furnaces, in which the cast billets can be reheated for further processing. In the first stage, the waste heat from the electric arc furnaces should be harnessed. However, other potential waste heat sources could also be exploited.



The primary cooling level should be used for the extraction of waste heat from the furnaces. The waste gas, which may have a temperature of up to 1,300 °C, passes through a heat exchanger cooled by water, where preliminary cooling to 600 °C is carried out. The cooling water in the heat exchangers is conducted in a closed circuit and has a flow temperature of approximately 70 °C and a return temperature of up to 90 °C. Water temperatures fluctuate greatly due to the process. There are also brief production interruptions in summer, and operations shut down for three weeks in winter. On average, a heat flow on 20 megawatts is discharged in both furnaces. Based on production data from the steel works, a total of 135 gigawatt hours of waste heat is available each year.

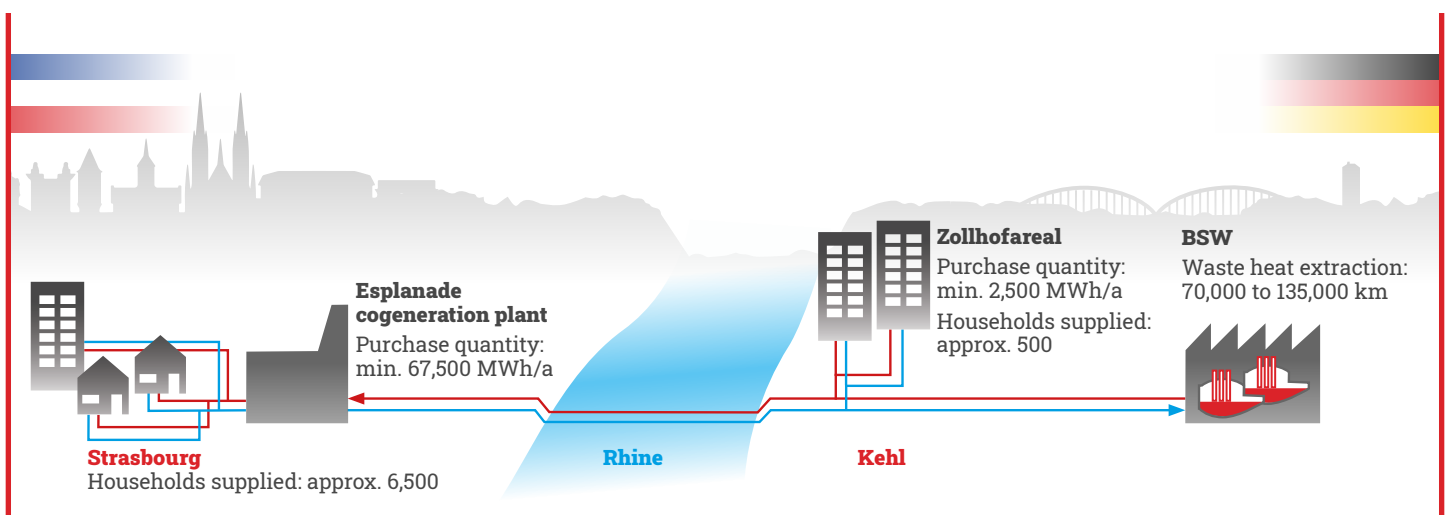
As Strasbourg already has a developed existing district heating network, flow temperatures of over 140 °C are needed in some network areas and during periods of very cold outside temperatures. For the BSW, this means that the temperature level in the heat exchangers must be increased to 160 °C, which significantly raises the operating pressure. The necessary safety requirements can no longer be met with the existing plants, so the entire primary cooling circuit must be rebuilt. This also involves replacing the heat exchangers to the secondary cooling tower circuit, which provide heat discharge in periods of decreased district heating demand. The new heat exchanger to connect external consumers must also

satisfy the safety requirements. Investments in an eight-figure range are therefore necessary for the extraction of waste heat.

Purchase and transportation of waste heat

Strasbourg's district heating system consists of two interconnected district heating networks – Esplanade and Elsau. Two heating plants driven by natural gas function as heating systems and are used to cover peak load. The base load is generated using a biomass cogeneration plant and the municipal waste incineration plant. This means that around 60% of district heating is produced from renewable or CO₂-neutral energy sources. Since there is still a multi-annual purchase requirement for the biomass cogeneration plant, the waste heat from the Badische Stahlwerke will initially only be able to replace a large part of the gas firing in the winter months. Due to the planned connection of additional district heating consumers and supply areas, as well as the increase in district heating sales from the current 260-gigawatt hours to 400 gigawatt hours by 2030, however, more and more waste heat from the steel works can be fed in, especially in the transitional months of the heating period.

In addition, a new quarter will be built in Kehl on the southern bank of the Rhine close to the central train station over the coming years,



which should also be supplied using waste heat from the BSW. Accordingly, at least 70 gigawatt hours of the in total 135-gigawatt hours of available waste heat can be used annually in the district heating networks of Strasbourg and Kehl. As such, more than 7,000 four-person households can be continually supplied with carbon-neutral space heating and hot water, which would save up to 20,000 tonnes of carbon dioxide each year. No further purchasers have been identified as yet for the remaining waste heat in summer. Discussions with neighbouring industrial companies of the Badische Stahlwerke have been held, but they do not yet consider it worthwhile to become involved in the project.

Once the measures have been completed in 2026, the waste heat will flow through a four and a half-kilometre heat pipeline as water at 150 °C. The first 2,000-metre pipeline is expected to run along the banks of the Kinzig as well as to the south of the Badische Stahlwerke site. Due to currently contaminated brownfield sites, railways, roads and water pipes, an underground micro-tunnel is planned for the remaining 2,500 metres, which will also pass under the Rhine. The costs of the planned heat line and waste heat integration amount to around €25 million, of which approximately two thirds will be incurred on the German side and one third on French territory.

A unique collaboration

The implementation of district heating projects with industrial waste heat is complex and expensive. The project's transnational nature comes with additional challenges. The effort involved in coordinating the project is very high due to the numerous stakeholders involved from both countries. A large number of organisational and legal questions also arose in regard to practical implementation, including a suitable binational organisational structure, financing models and funding opportunities. Suitable solutions were developed thanks to the close and intense cooperation between all participants.

In early 2022, a municipal public company was founded under French law for the construction and operation of the heat pipeline from the steel works to the new Zollhofareal neighbourhood and the Strasbourg district heating network. Local authorities from other countries may also hold interests in the company. The Eurométropole de Strasbourg holds the largest share in Calorie Kehl-Strasbourg' Société d'économie mixte locale (SEML CKS) at 47%. The City of Kehl (12.75%), the Grand Est region (12.75%), the State of Baden-Württemberg (12.75%) and the French Banque des Territoires (15%) are also involved with smaller shares. The Badische Stahlwerke (BSW) also hold one share in the company and are integrated included as an observer. Baden-Württemberg's involvement with the French company constitutes a precedent. Calorie Kehl-Strasbourg is the first foreign company in which the German federal state holds a financial interest. The new heating supply company will purchase waste heat from the Badische Stahlwerke and sell this to the Strasbourg district heating network's operating company and the Kehl heating company.

Milestones

2018

May / June 2018

Franco-German discussions on resumption of the project

2019

February 2019

Feasibility study confirms the technical and economic implementability

May 2019

Signing of a joint declaration of intent

November 2019

Basic engineering for the heat extraction is developed

2020

June 2020

Funding commitment from Interreg for pre-project costs

November 2020

Implementation concept is presented

2021

December 2020 – June 2021

Official decisions on corporate participation are made

December 2021

The articles of association and shareholder agreement are signed

2022

August 2022

Formal establishment of the Calorie Kehl-Strasbourg heating supply company (CKS)

Application for funds, conclusion of the contracts, project planning and request for government approval

2027

Commissioning and start

2024

Implementation works start

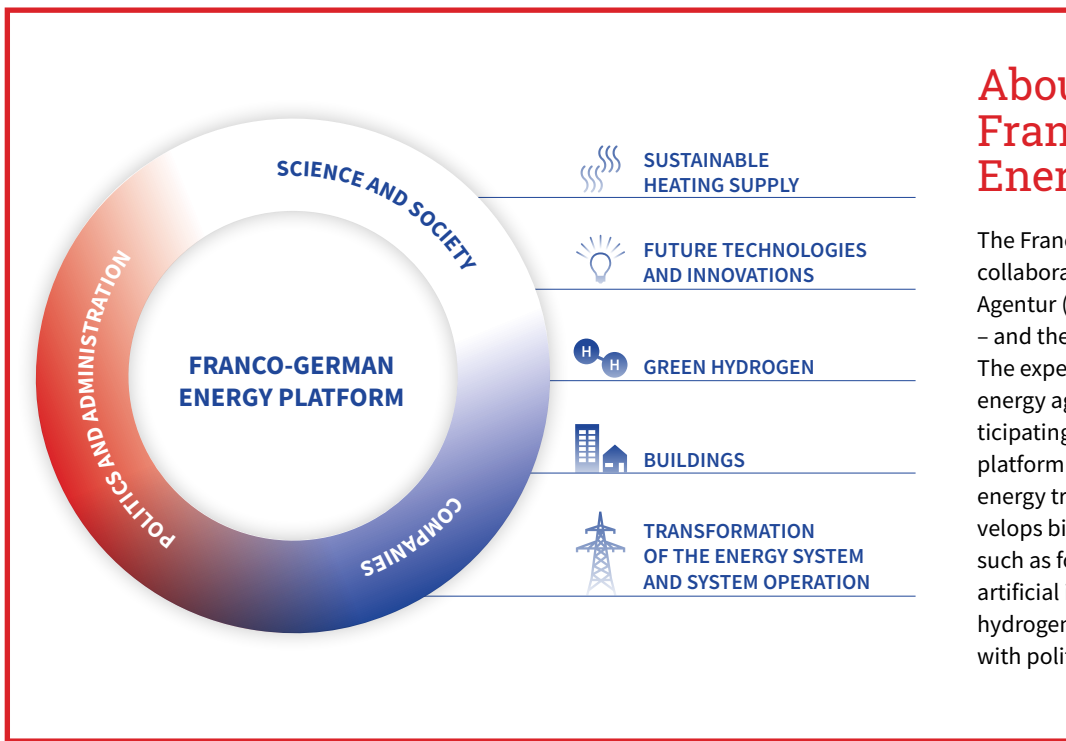
The design and preparation phase of the transnational project was linked to high costs and time investment. The project received the necessary seed funding based on a feasibility study financed by the Baden-Württemberg Ministry for the Environment and the European regional programme Interreg Oberrhein. There are currently no suitable funding instruments at EU level would accommodate the significant investments needed for waste heat extraction and the construction of the heat pipeline, and so national funding will be primarily used. Investments from Calorie Kehl-Strasbourg on German soil and those of the Badische Stahlwerke will receive subsidies of up to 40% using the federal funding programme for energy and resource efficiency in industry. Alongside funds from ADEME's Fonds Chaleur and, if necessary, other funds from Interreg Oberrhein, it is expected that around 60% of the implementation costs for the heat pipeline will be funded. The subsidies enable the economic implementation of the project on both sides: for the Badische Stahlwerke as the heat supplier and for Calorie Kehl-Strasbourg as developer of the heat pipe.



© shutterstock.com/alexklich

A strong network

The project was implemented thanks to a strong network. Local, regional and national partners overcame hurdles together and showed how collaboration between France and Germany can advance the heating transition in the border region.



About the Franco-German Energy Platform:

The Franco-German Energy Platform is a collaboration between Deutsche Energie-Agentur (dena) – the German Energy Agency – and the French energy agency ADEME. The expertise and networks of the national energy agencies, as well as those of the participating stakeholders, are combined in the platform to overcome the challenges of the energy transition together. The platform develops bilateral energy transition projects, such as for energy efficiency, smart grids, artificial intelligence, the heating transition, hydrogen and innovations, in cooperation with politics, business, science and society.

Federal Ministry for Economic Affairs and Climate Action

This publication is issued on behalf of the Federal Ministry for Economic Affairs and Climate Action. The German Energy Agency (dena) assists the Federal Government in various projects to implement the energy and climate targets in the context of the energy transition.

CONTACT:

Franca Pompey
Team Leader, European Cooperation
 E-Mail: Franca.pompey@dena.de
 Tel.: +49 (0)30 66 777-770

Véronique Tetu
International Policy Officer
 E-Mail: Veronique.Tetu@ademe.fr
 Tel.: +33 (0) 2 41 20 41 08

Further information on the projects of the Franco-German Energy Platform:
www.d-f-plattform.de
 E-Mail: d-f-plattform@dena.de
 www.d-f-plattform.de
 Last updated: 11/2022