



Joint News Release

April 17, 2024

BASF, SABIC, and Linde celebrate the start-up of the world's first large-scale electrically heated steam cracking furnace

- **Demonstration plant with 6 megawatts input of renewable electrical energy to test material behavior and process on an industrial scale**
- **Joint development and construction of electric steam cracking furnaces at BASF's Verbund site in Ludwigshafen**
- **Technology with the potential to reduce CO₂ emissions by at least 90% compared to conventional steam crackers**

April 17, 2024 – Today, BASF, SABIC, and Linde have inaugurated the world's first demonstration plant for large-scale electrically heated steam cracking furnaces. Following three years of development, engineering, and construction work, the regular operation of the demonstration plant is now ready to start at BASF's Verbund site in Ludwigshafen, Germany. In March 2021, the three companies signed a joint agreement to develop and demonstrate solutions for electrically heated steam cracking furnaces.

Steam crackers play a central role in the production of basic chemicals and require a significant amount of energy to break down hydrocarbons into olefins and aromatics. Typically, the reaction is conducted in furnaces at temperatures of about 850 degrees Celsius. Up to now, these temperatures have been reached by using conventional fuels. The demonstration plant aims to show that continuous olefin production is possible using electricity as a heat source. By using electricity from renewable sources, the new technology has the potential to reduce CO₂ emissions of one of the most energy-intensive production processes in the chemical industry by at least 90% compared to technologies commonly used today.

The demonstration plant, which produces olefins, such as ethylene, propylene, and possibly also higher olefins from saturated hydrocarbon feedstock, is fully integrated into the existing steam crackers in Ludwigshafen. The upcoming operation serves the goal of gathering data and experiences about material behavior and processes under commercial

operating conditions for the final development of this innovative technology to industrial market maturity. In two separate demonstration furnaces, two different heating concepts will be tested. While in one furnace, direct heating applies an electric current directly to the cracking coils, in the second furnace, indirect heating uses radiative heat of heating elements placed around the coils. The two electrically heated furnaces together process around 4 tons of hydrocarbon feedstock per hour and consume 6 megawatts of renewable energy.

To support the development of the novel furnace technology, the project was granted €14.8 million by the German Federal Ministry for Economic Affairs and Climate Action under its “Decarbonization in Industry” funding program. The program is supporting energy-intensive industries in Germany in their efforts to achieve carbon neutrality.

“With the development of electrically operated steam cracking furnaces, we are getting our hands on a key technology that will help to significantly reduce greenhouse gas emissions in the chemical industry. It fills me with pride and joy that we have achieved this success together with our partners SABIC and Linde. The demonstration plant here in Ludwigshafen will provide us with valuable experience on the final step towards the industrial application of this technology”, said Dr. Martin Bruder Müller, Chairman of the Board of Executive Directors of BASF SE.

Abdulrahman Al-Fageeh, CEO of SABIC stated: “The e-furnace’s technology holds huge potential for the sustainability of the global petrochemical industry. It can demonstrate the role that renewable electricity can play in higher efficiency and low-emission chemical processing. Through close collaboration, teamwork, intellectual property development, and advancing the best technical solutions holistically, the teams at SABIC, BASF and Linde have brought this project to this key stage. We are proud to be here together today to celebrate the power of collective action on our journey toward a circular carbon economy.”

“It is our common goal to demonstrate that it is possible to electrify the petrochemical industry and to operate a steam cracker with sustainably generated electricity. This outstanding joint project is a significant proof of how together we can develop groundbreaking technologies that will advance us on the journey towards net-zero CO₂ emissions and climate-neutral industry,” said Jürgen Nowicki, CEO of Linde Engineering.

“The STARBRIDGE™ technology brings the vision of an emission-free petrochemical industry a step closer.”

Based on the combined knowledge and intellectual property of the three parties collaborating to develop the new technologies, the demonstration unit in Ludwigshafen will be operated by BASF. Linde was responsible for the engineering, procurement, and construction of the plant. Linde will in the future commercialize the developed technologies under the new trademark STARBRIDGE™, enabling the petrochemical industry to decarbonize by replacing conventional fired technologies.

About BASF

At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. Around 112,000 employees in the BASF Group contribute to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio comprises six segments: Chemicals, Materials, Industrial Solutions, Surface Technologies, Nutrition & Care, and Agricultural Solutions. BASF generated sales of €68.9 billion in 2023. BASF shares are traded on the stock exchange in Frankfurt (BAS) and as American Depositary Receipts (BASFY) in the United States. Further information at www.basf.com.

About SABIC

SABIC is a global diversified chemicals company, headquartered in Riyadh, Saudi Arabia. It manufactures on a global scale in the Americas, Europe, Middle East and Asia Pacific, making distinctly different kinds of products: chemicals, commodity and high-performance plastics, agri-nutrients and metals. SABIC supports its customers by identifying and developing opportunities in key end-use applications such as construction, medical devices, packaging, agri-nutrients, electrical and electronics, transportation and clean energy. The company has more than 32,000 employees worldwide and operates in around 50 countries. Fostering innovation and a spirit of ingenuity, SABIC has 11,070 patents and pending applications, and has significant research resources with innovation hubs in five key geographies – USA, Europe, Middle East, South Asia and North Asia. Visit www.sabic.com for more information.

About Linde

Linde is a leading global industrial gases and engineering company with 2023 sales of \$33 billion. We live our mission of making our world more productive every day by providing high-quality solutions, technologies and services which are making our customers more successful and helping to sustain, decarbonize and protect our planet. The company serves a variety of end markets such as chemicals & energy, food & beverage, electronics, healthcare, manufacturing, metals and mining. Linde's industrial gases and technologies are used in countless applications including production of clean hydrogen and carbon capture systems critical to the energy transition, life-saving medical oxygen and high-purity & specialty gases for electronics. Linde also delivers state-of-the-art gas processing solutions to support customer expansion,

efficiency improvements and emissions reductions. For more information about the company and its products and services, please visit www.linde.com.

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