Bund für
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Naturschutz
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BUND
FRIENDS OF THE EARTH GERMANY

Study Summary „Blackbox Chemical Industry"

About the study

The study "Blackbox Chemical Industry" by BUND e.V. is the first study by an environmental organisation to comprehensively examine both the products and the energy and resource consumption within the German chemical industry. It sheds light on the specific companies responsible for producing various products and their respective quantities across different regions in Germany. For the very first time, this study allocates energy and resource consumption data to individual chemical products.In addition to the report, the study contains extensive tables on manufacturers and production capacities by location. The study is based on data from the year 2020.

The German chemical industry and its products

Around 750 chemical companies operate in Germany. The domestic chemical industry primarily produces plastics, especially for packaging, the automotive industry, textiles, the construction sector, and electrical appliances. In addition, the production of fertilizers is of great importance.
Specialty chemicals, such as vitamins used as food supplements and pharmaceuticals, are also produced. The study provides an overview of the most important German chemical companies and their products. In addition to well-known and lesser-known companies that produce bulk chemicals such as plastics (BASF, Baskem, BP, Borealis, Dow, Indorama Ventures Public Company Limited, Ineos, LyondellBasell, OMF, Sabic Europe, etc.), the study also identifies manufacturers of critical substances, such as per- and polyfluorinated alkyl substances (PFASs), known as "forever chemicals" (3M/Dyneon, Allessa/WeylChem, Archroma, Solvay, Daikin Refrigerants, F-Select, Fluoron, Lanxess, Pharmpur and W. L. Gore). Of the chemicals produced in Germany, the study shows which quantities are consumed within the country and how many are imported as well as exported. Chemicals produced in large quantities (i.e. over 2,000 kilotons) are in particular feedstocks for plastics production (for example ethylene, propylene and chlorine gas for plastics such as polyethylene, polypropylene and polyvinyl chloride) and for fertilizers (ammonia and urea).

The sectors substantial energy and resource demands

The direct energy demand of the chemical industry is immense. It uses fossil fuels not only as energy (natural gas, for example), but to an even greater extent as raw material for the products themselves (primarily crude oil). In 2020, the chemical industry consumed 383 billion kilowatt hours (1379 petajoules), excluding upstream processing steps such as petroleum refineries and energy losses that occur with externally sourced energy. This consumption represents more than half of the electricity and heat consumed by all private households in Germany. When excluding raw materials and focussing solely on the ultimate energy consumption, the chemical industry becomes the largest industrial energy consumer,

accounting for approximately one-quarter of the total industrial ultimate energy consumption. Its demand even exceeds that of the cement, iron and steel industries combined (second and third largest consumers). In 2020, the chemical industry had an ultimate energy consumption of 159 billion kilowatt hours (574 petajoules). The amount of natural gas used is also noteworthy. Direct natural gas consumption by the chemical industry alone is 95 billion kilowatt hours (341 petajoules). This could meet the natural gas needs of approximately 38 percent of all households in Germany.
The chemical industry also relies significantly on the production of diesel and gasoline because the raw materials for its production are co-produced alongside fuels in oil refineries. Only up to 30 percent of the crude oil can be utilized for chemical products. As a result, a ban on vehicles with combustion engines poses challenges for the chemical industry.

(Inter)national linkages and trading partners

German chemical facilities are closely linked through pipeline systems (for oil, gas, ethylene, etc.), including connections with foreign nations. The study provides information about the locations, infrastructure connections between these sites and foreign countries, distribution density, regional features, and the products associated with the roughly 2,000 registered chemical and petrochemical plants in Germany. Petroleum refineries and steam crackers are also analyzed. Overall, Germany exports more chemicals than it imports, and its primary trading partners are the Netherlands and Belgium. While many chemical products are imported from these two countries, they also rank among the most significant customers for German chemical exports. Even within a single product category, such as polypropylene, substantial quantities are simultaneously imported and exported. This is because Germany produces and exports high-quality products with unique properties, while cheaper products tend to be imported. However, the German chemical industry is not only a net exporter, but also produces important precursors for other export goods (e.g. automobiles).

Energy consumption by site and product

For the first time, the study provides a detailed breakdown of the energy consumption within the chemical industry, including a breakdown by product. It shows the final energy consumption (excluding raw materials) of the most important chemical processes in Germany. Additionally, the study lists the top 15 sites with significant combustion facilities, categorized by their fuel consumption: BASF in Ludwigshafen has the largest fuel consumption, followed by BP Gelsenkirchen (with refinery) and Chempark Dormagen. Of the 107 power plants in chemical parks, 51 run on natural gas, 19 on coal, 12 on waste and 11 on petroleum. Finally, the study discloses three quarters of the final energy demand of the chemical industry in Germany, broken down by product. In line with production volumes, the highest consumption is observed for chemicals used in plastics and fertilizers at sites where one of the three particularly energy-intensive processes is used: steam cracking (for the production of ethylene and propylene), chlor-alkali electrolysis (for the production of chlorine and sodium hydroxide) or the Haber-Bosch process (for fertilizers). The study estimates that the primary energy demand, including energy and raw materials, for chemicals utilized in packaging amounts to 77 billion kilowatt hours (277 petajoules). Consequently, the production of packaging alone needs more energy than the entire country of Slovenia consumes in total.

Challenges for the future viability of the sector

In the chemical industry, various concepts for electrifying processes are being explored with the aim of eventually replacing fossil fuels in the future (for example, the use of heat pumps as well as the electric heating of energy-intensive steam crackers). Furthermore, the industry reports a substantial demand for hydrogen, which, however, surpasses the provisions outlined in the German national hydrogen strategy.

All these measures would result in a significant surge in electricity demand. To reduce the consumption of fossil raw materials, investments are being directed toward the chemical recycling of polymers, a process that partly allows for the reuse of carbon atoms derived from fossil sources. However, these processes will also raise the industry's energy requirements. Moreover, endeavors to replace fossil raw materials with renewable alternatives do not provide a sustainable solution. A straightforward substitution of fossil raw materials with renewable ones is not feasible on a quantitative scale, given the limited availability of land for increased biomass production. The industry will only become sustainable if it significantly reduces its energy and resource consumption.

Demands of BUND

The climate crisis, material pollution, exploitation of resources and loss of biodiversity are interconnected. They are the consequences of an economic system that is detrimental to nature and the environment. Along with climate change and species extinction, chemical pollution and resource depletion is the third major ecological crisis of our time and, at the same time, a driver of the other two crises. Continued expansion of the chemical industry's production volumes is not feasible in a sustainable manner. The chemical industry must live up to its social responsibility by transitioning to sustainable chemical production and revising its business models accordingly. Efficiency, consistency, and, most importantly, sufficiency—meaning a reduction in production volumes—are crucial in the production and utilization of chemicals to combat climate change and prevent species extinction.
BUND therefore calls for sustainable chemistry and the consistent implementation of a sustainable resource and substance policy, with particular attention to the precautionary principle.

This means:

- An end to the waste of resources by the chemical industry: This requires a resource protection law that sets ambitious and binding absolute reduction targets for resource consumption. The chemical industry should be held accountable against these resource protection targets, following a clear reduction path.
- Significant reduction in disposable packaging: This can be achieved through consistent national and European packaging legislation with ambitious reusable quotas in all areas, sanctions in the event of non-compliance, and mandatory reuse in the to-go sector.
- Rapid implementation of the EU Chemicals Strategy for Sustainability: This is to serve as a blueprint for the global restructuring of the chemicals industry in line with the UN Sustainable Development Goals and the zero-pollutant target set out in the Green Deal.
This blueprint is intended to guide the worldwide restructuring of the chemicals industry, aligning it with the UN Sustainable Development Goals and the zero pollution targets outlined in the Green Deal.
- Immediate revision of the EU chemicals regulation REACH: This must become the cornerstone of a substances policy based on the principles of precaution and sustainability.
- Enforcement of the REACH principle of "no data, no market", up to and including withdrawal of authorization in the event of serious violations of the registration obligation.
- Development of inherently safe chemicals ("safe and sustainable by design") with low persistence and mobility
- Development of safe and more flexible (i.e. regional and decentralized) production processes with low energy and resource consumption
- Restriction of the entire substance group of per- and polyfluorinated substances: This is a first step to establish group assessment of pollutants (grouping) and thus accelerate the regulation of substances of concern.
- Immediate production and export ban on chemicals restricted and banned in the EU.
- Consistent implementation of the polluter pays principle: This means that industry must pay for the costs of environmental and health damage caused by its products.

- Implementation of the same labor, environmental and consumer protection standards for globally operating companies at all their sites.
- Anchoring chemical intensity as an Issue of Concern in the Strategic Approach to International Chemicals Management (SAICM): This should serve as a starting point for a future framework agreement to address the chemicals policy crisis.

Link to the study

The study Blackbox Chemical Industry can be downloaded here (in German):
https://www.bund.net/service/publikationen/detail/publication/blackbox-chemieindustrie/
Comprehensive data sets of the study can be requested from BUND.

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