CRCLR HOUSE

USES
Housing, work, laboratory and workshop spaces, repair café, cafeteria, event venue, greenhouse with a communal roof terrace, common rooms, playground

SIZE
6,100 m²

USERS
CRCLR Living eG and Impact Hub Berlin

DEVELOPER
TRNSFRM eG

LEASEHOLD LANDLORD
Terra Libra Immobilien GmbH, a subsidiary of the Edith Maryon Foundation

DESIGN
Die Zusammenarbeiter – Gesellschaft von Architekten mbH (Berlin) with baubüro in situ AG (Basel)

INTERIOR ARCHITECTURE
LXSY Architekten

MATERIAL PASSPORTS AND INVENTORY
Concular

STRUCTURAL ENGINEERING
ZRS Ingenieure GmbH

STRAW-BALE WALLS AND INTERIOR CONSTRUCTION
Kollektive Baustelle / Heap59 GmbH

BEGINNING OF CONSTRUCTION
2019 (planning started in 2015)

LOCATION
Berlin

FIG. 1
Axonometric drawing of the CRCLR House as seen from the northwest, with the commercial House East on the left and the residential House West on the right

FIG. 2
View of the CRCLR House's southern facade in the Rollbergkiez neighborhood, which is part of Berlin's Neukölln district

The construction industry is the economy's most resource-depleting sector, accounting for roughly half of all raw materials used. It needs to be reevaluated in a circular way.[1] Contrary to the logic of a linear construction economy (extraction of raw materials—production—consumption/use—disposal/accumulation of trash), building according to the principles of a circular economy (cradle-to-cradle) considers the life cycle of resources and raw materials differently. Materials, instead of ending as waste, are preserved with the least loss of quality possible and reused as part of a closed technical cycle, or completely degraded and reintroduced into the biological cycle. To preserve gray energy and prevent construction and demolition waste—which amount to over half of today's total waste accumulation in Germany—maintaining the existing building stock must be prioritized over demolition and new construction.

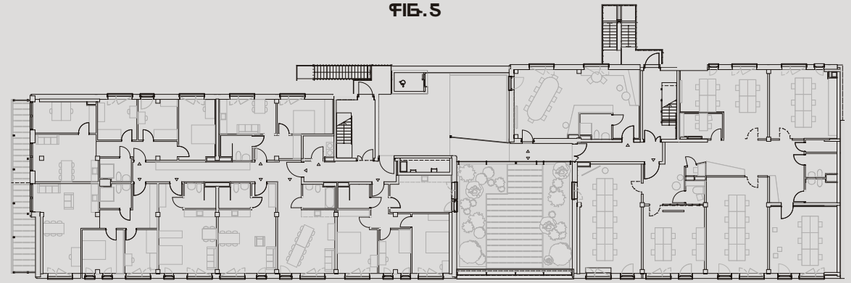
The CRCLR House, which has been under development since 2015 on the grounds of the former Kindl brewery in the Rollberg neighborhood of Berlin's Neukölln district, is a model of circular construction based on three central principles: maintaining and converting existing buildings, reusing entire building sections and pre-used materials, and making (new) construction ecological and disassemblable. For the cooperative TRNSFRM eG as developer, the architecture studio Die Zusammenarbeiter planned a new hub combining work, housing, and community-oriented life in close consultation with the Basel-based baubüro in situ and interior architecture studio LXSY Architekten. Construction on the 6,100 square meter site is carried out by Kollektive Baustelle / Heap59.

The plot on which the CRCLR House is being built lay vacant for several years until it was acquired in 2015 as part of the 20,000 square meter Vollgut site by Terra Libra Immobilien GmbH, the German subsidiary of the Edith Maryon Foundation. Established in 1990, the Swiss non-profit aims to save land and property from real estate speculation in order to enable permanent ecologically and

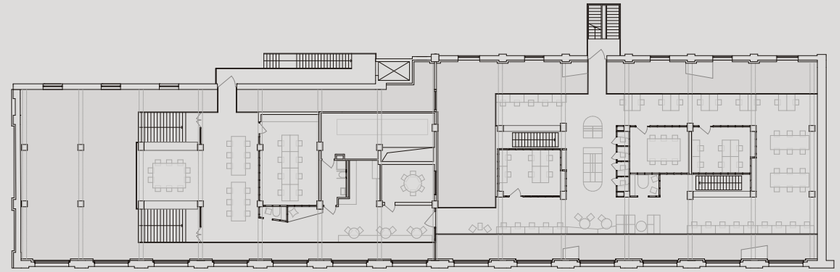
FIG. 3
New residential spaces in the House West were created by adding stories to the existing structure. The stories' height was determined by the size of the reused wood and aluminum windows. All other materials are biobased.

FIG. 4
View of Impact Hub Berlin's reception area on the first floor of the former keg loading hall with the newly constructed gallery. The structural and fastening elements are left visible to facilitate their retrofitting and disassembly in the future.

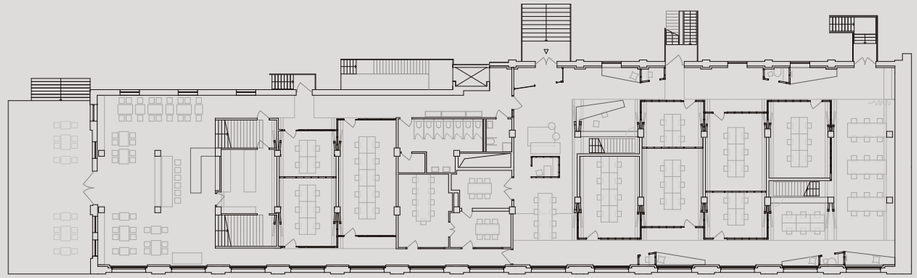
FIG. 5



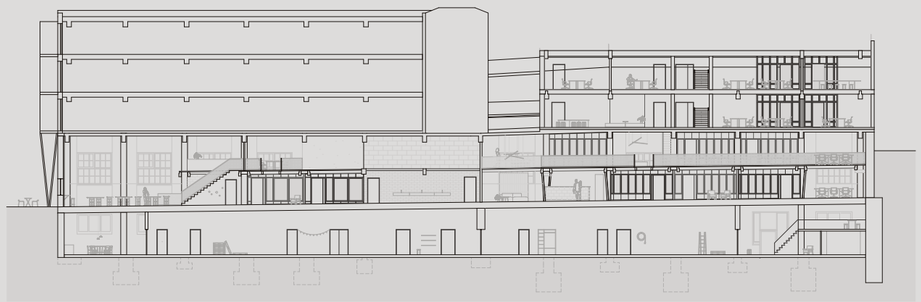
FIRST FLOOR



GALLERY



GROUND FLOOR



LONGITUDINAL SECTION

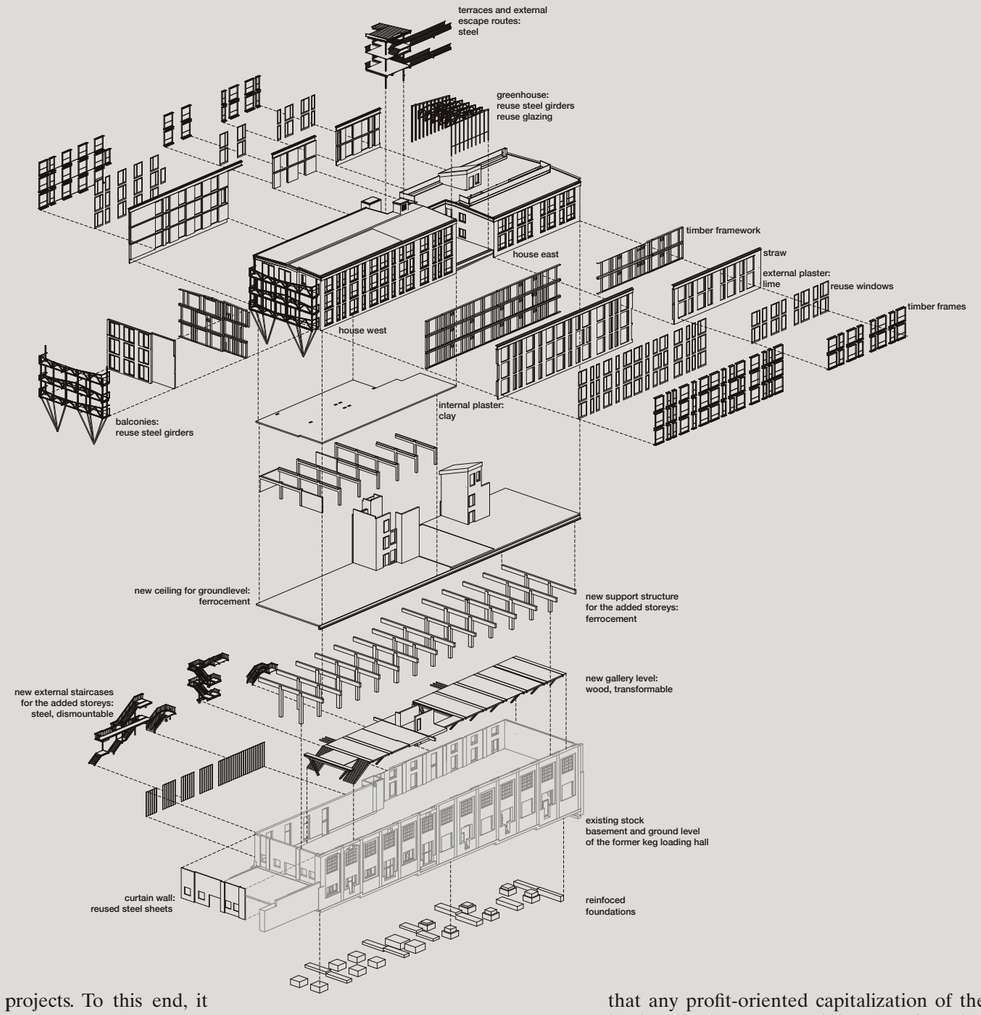


FIG.6
Exploded axonometric drawing of the load-bearing structure and the structural elements reused in the conversion of the existing building, as well as the newly added upper floors

socially responsible projects. To this end, it assigns land to developers and users under leasehold agreements. This method was already implemented in 2008 in cooperation with Mietshäuser Syndikat [apartment buildings syndicate] to secure the continued use of Rigaer Strasse 78, one of the first buildings to be squatted after the fall of the Berlin Wall; likewise, the tenants of Schokoladen, an alternative residential and cultural building squatted in the early 1990s in Berlin's Brunnenviertel neighborhood, were saved from eviction by the transfer of property from private ownership to that of the foundation in 2012. In 2017, the Edith Maryon Foundation assigned the Kindl brewery's land and existing buildings to the construction cooperative TRNSFRM eG through a leasehold agreement with a maximum duration of 99 years. The agreement stated that any profit-oriented capitalization of the land must be prevented by ensuring that user fees and rental income are not pegged to possible increases in the value of the land. Moreover, the programmatic terms set out in the agreement mandate the establishment of structurally, ecologically, and socially circular processes between users, residents, and the neighborhood, ensuring the creation of spaces for new forms of work and affordable yet varied housing for people with special needs or in situations of particular hardship.

The CRCLR House's starting point was the preservation and conversion of the former 19th century brewery's existing keg loading hall. Modernizing the basement and ground floors and adding new stories was predominantly accomplished with used building components and materials sourced through urban

mining on building demolition sites in Berlin and by the partial dismantlement of the existing building, as well as from exhibitions, trade fairs, museums, warehouse inventory stock, and off-cuts from carpentry workshops around the city. The practice of urban mining views the built environment as an anthropogenic material repository enabling the "lossless and value-preserving repeated use and recovery of materials, building components, and substances."[2] The recuperated materials were stockpiled first in the hall on the ground floor, and subsequently in a neighboring building,

FIG.7
View of the new gallery level with the collectively used kitchenette and open seating, lounging, and working areas. Following the principle of "use as is," high-quality old and new materials are incorporated without prior treatment, whereas damaged or rough materials are upcycled to meet the design concept.

before being repurposed in the newly established workshop in the basement: Lacerated drywall panels were lacquered with natural paints and secondhand windows upgraded from double- to triple-glazing to bring them up to highest insulation standards. The stored materials—ranging from commonplace components like tiles, limestone blocks, multiwall sheets, profiled sheeting, perforated sheet metal, metal panels, drywall paneling, and wooden materials to technical elements like acoustic insulation panels, cable ducts, ventilation tubes, step grids, to architectural elements like doors, windows, parapets, dividing walls, steel girders and supports, and roof beams—were cataloged with so-called material passports by TRNSFRM, LXSY Architekten, and Concular. The documentation recorded evaluation criteria such as proper functioning, material properties, source, and storage, as well as data on avoiding waste and on the item's integration into new use cycles to improve the overall process of installation and future reintegration into further cycles of usage. The goal of

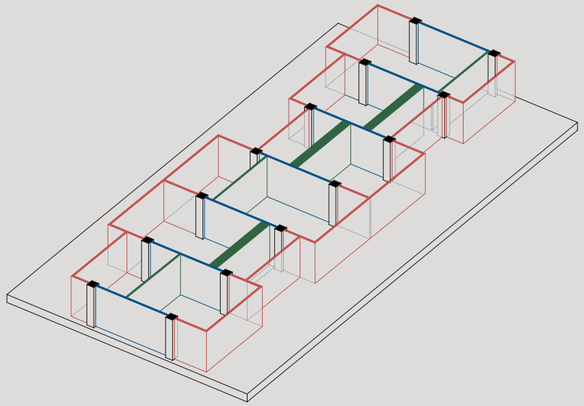
FIG.8
In addition to the open-plan office, secluded booths and meeting rooms enable a variety of work settings.

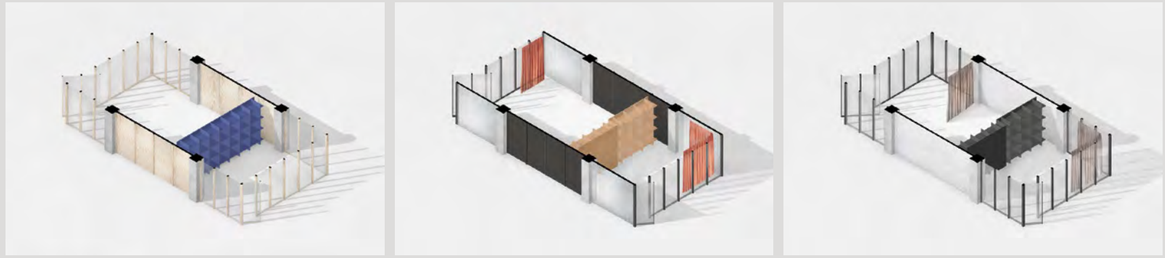
circular construction creates new challenges to the conventional workflow and routines, as planning and construction have to be geared to the principle of "form follows availability," as regards the existing stock of materials. In contrast with the traditional construction and planning phases, where design defines the choice of materials, a circular approach oscillates between (prototype) design and the sourcing of appropriate materials. A broad implementation (i.e., scaling) of digital inventory systems, secondhand materials exchange platforms, and material passports, as well as the related warranty and certification structures would make the arduous process of reusing materials easier in the future. In the case of the CRCLR House, flexibility and improvisation were prioritized both in planning and on the construction site itself. Under the given circumstances, the search for specialist firms proved difficult, which led to the founding of the construction collective named "Kollektive Baustelle" [collective construction site], which in turn gave birth to the construction company Heap59, specialized in circular construction. In close consultation between the construction workers and the architects, specific structural schemes were developed to respond efficiently to inconsistencies and irregularities in the design and implementation. Here, the close interaction with baubüro in situ, which concentrates on circular construction, played a crucial role. To enable the reuse of 600 square meters of large-format wood and aluminum windows salvaged during the planning phase, a special permit was issued to raise the maximum cornice height set in the zoning plan to adapt to the existing windows' size of 2.80 meters.

For the building's interior, LXSY Architekten approached planning by defining desired spatial qualities and allocating different degrees of transparency, translucence, and opacity for the walls, without identifying specific materials in advance. Choosing a smaller standard size of 62.5 centimeters for the wood-frame grid enabled the easy repurposing of usually small-sized offcuts from carpentry workshops. Panes of tempered glass from a dismantled curtain facade of the headquarters of Berlin's public transport agency BVG were reused as interior wall cladding for the existing floors, and old metal grating steps were recycled to function as guardrails. Such potential for reuse is, however, constrained by the legal framework set by building regulations: Stipulations for reuse are not uniform in structure, building components lose their certification if dismantled, and, depending on the case, time-consuming and costly special permits need to be sought.

Where recycled materials were unavailable for construction, the team behind CRCLR House resorted to using sustainable,

FIG. 9
One of LXSY Architekten's strategies for circular construction was to approach interior design by defining desired spatial qualities without designating specific materials. To easily integrate salvaged materials and their respective qualities into the spatial concept later on, three types of walls were defined: partition walls (blue), transparent/translucent elements (red), and flexible bookcase units (green).





regenerative raw materials and components that can each be disposed of separately and reintroduced into the biotic cycle after use: wood as the main load-bearing material, straw-bale outer walls, hemp-based walls with high noise insulation properties for individual work spaces, limestone or clay plaster and straw panels instead of plasterboard. The new roof was realized as a back-ventilated wood-beam ceiling using wood-fiber insulation and a reusable, mechanically fastened (i.e., detachable) plastic film instead of heat-sealed bitumen for waterproofing.

To ensure future circularity, the CRCLR House is built for disassembly, meaning it has been devised with further usage and production cycles in mind for the materials and building components, should the building be torn down at some point in the future. The components' properties are recorded in the material passports. The building itself thus becomes a "material reservoir" that "temporarily stores" the building components until they are used again in the possible later context of a new construction. Structurally, this "design for disassembly" prioritizes simple bonds between disparate elements, straightforward requirements for building components, and a decoupling of the functional elements of the load-bearing structure, which means that less plaster was used and thermal bridges were geometrically avoided. The utmost importance is placed on the connections between construction elements, which were rated on repairability, as well as ease of disassembly and separation, which is why screwing, interlocking, or wedging elements together was chosen over gluing or nailing them, preferably with wood being connected to wood. The key principle here was adjusting the complexity of the connections for the duration of each element's use cycle, thus avoiding irreversible bonds between elements that are part of different use cycles, and enabling repair and dismantling without special expertise. All such connections were left unclad and the floor free of electric installations and piping. This facilitates repair and disassembly, conveys the simplicity and sufficiency the design seeks to achieve, and enables users to more easily adapt the built structures in the future.

Alongside the circular construction method, the CRCLR House's expressed goal is to link housing and workplaces in a socially sustainable manner, taking cues from circular processes by closely interlocking the technical, organic, and social material cycles of various

FIG. 10
A partition wall on the gallery level, consisting of a wooden post and beam structure, reused glass, and cross-laminated timber.

FIG. 11
Locally produced hemp walls allow for the separation of individual working zones withing the existing building's commercial use area. As a natural product with acoustic, thermal, and moisture insulating qualities, and acting as a natural carbon sink, hemp represents an environmentally sustainable alternative to conventional walls.

parties across the different stories of the building. Divided into two structures, one for working, the other for housing, two and three stories were respectively added to the existing building, increasing its floor space by 2,800 square meters. A rooftop terrace offering a communal zone for tenants and users connects the two volumes. The three-story residential building, House West, is predominantly organized in so-called apartment clusters, where one to three rooms can be interconnected to form housing units together with shared spaces such as laundry rooms and restrooms, communal kitchens, a bicycle shed, guest rooms, or shared bathrooms that can be assigned respectively to a single cluster or to the entire community. The increased proportion of shared usages and shared spaces in the residential section is aimed not only at nurturing the social aspect, but also at reducing the surface used by each person. After all, improvements in ecological efficiency of construction methods will not reduce humanity's overall ecological footprint over time if the average person continues to use up more and more space each year. The specially established CRCLR Living eG is the organization underpinning the communally oriented housing model in the CRCLR House: It is a tenants' cooperative that seeks to provide affordable housing for groups often disadvantaged on the housing market, such as members of the LGBTQ+ community, Black people, and

FIG. 12
Double-glazed windows are reused as partitions between the hallway and individual meeting rooms.

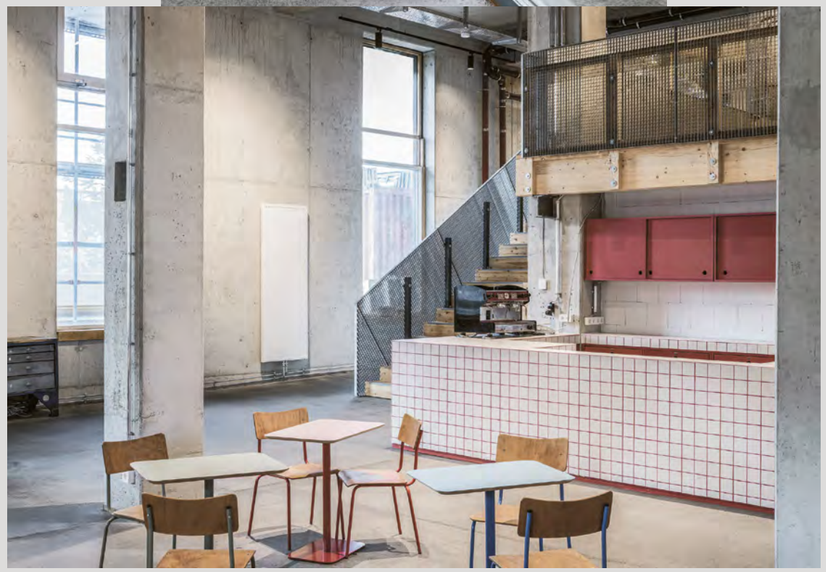


FIG. 13
Impact Hub Berlin's publicly accessible restaurant in the CRCLR House is open to the surrounding neighborhood. Differently colored joint sealants made with discarded paints were used between the tiles, mirroring the experimental and resource-mindful approach down to the most detailed level.

FIG. 14
Scraps of wood in various shapes and colors were reused as wall paneling in the Rollwerk workshop's kitchen.

People of Color. The two-story commercial extension, House East, consists of flexible spaces for different office layouts, with smaller phone booths for privacy and one adjacent optional space per floor available to both residents and commercial users for larger events.

The ground floor of the existing building is enhanced by a gallery level which offers both a cafeteria and office spaces for various companies that join forces in the Impact Hub, a network of young companies and non-profit NGOs working around the topics of circular economy, sustainable nutrition, social innovation, and green technologies. The collective working spaces, which can be appropriated in a variety of ways, have different sizes, shapes, and degrees of privacy, ranging from small booths to a large open-plan office, to an event area that can host up to 190 people. Prototypes and ideas can be tested in specialized workshops and laboratories for crafts manufacturing, research, and educational activities relating to resource-preserving applications located in the basement. Here, Made of Air take agricultural waste to produce carbon-negative components that capture CO_2 from the environment and will find application, among other things, as new building material. Mujō produces biodegradable packaging films for food, cosmetics, and goods, while Proteme manufactures coatings that prolong the shelf life of produce and protects it against pathogens. Moreover, a repair café is on site, integrated into the material and social circuits of the immediate neighborhood as well as charitable organizations such as Reviving Home, a crowdfunding platform for the repair of destroyed cities in crisis-stricken regions, or Hudara, a non-profit NGO focusing on issues of mental health, life under the impact of climate change, and social development through

FIG. 15
In their basement laboratory, Made of Air transform agricultural waste into carbon-negative components that capture carbon dioxide from the environment and could be used, among other things, as new building materials.

FIG. 16
Prototypes of products and ideas developed in the CRCLR House can be implemented and tested in the basement's Rollwerk workshop. The workshop community dedicated to various aspects of sustainable and circular economics offers an openly accessible repair café as well as tools and services for 3D printing and upcycling metal, wood, and glass.

access to renewable energies. To ensure adequate energy provisions for the various usages of the CRCLR House, the building relies on geothermal and heat pumps, solar thermal systems, photovoltaic panels, heat recovery systems, and a seasonal heat accumulator. Excess power is fed into the local heating network.

Across different scales, the CRCLR House offers an example of a circular construction methodology that goes beyond the implementation of durable material cycles and envisions a sustainable and decidedly holistic approach to all resources—from the plot of land to the extreme reduction of primary resources, to the social inclusion of users. The oftentimes very specific decisions made in planning and construction as well as the measures developed on a transdisciplinary basis are not universally reproducible but do reflect trends on how a circular approach changes the assessment of materials, construction methods, structures, and spatial programs in their totality. Learning from and widely disseminating these is a necessary precondition for new construction to be an ecologically viable option to solve the pressing spatial problems we are faced with today. *DK*

FIG. 17
The office of Skyseed, a company using drones and pelleted seeds for reforestation and climate change-resilient forest transformation, was refurbished only to the extent necessary for the long-term preservation of the existing building.

1 According to the European Union, the construction sector is responsible for 40% of CO_2 and other greenhouse gas emissions, 50% of primary energy consumption, as well as 50% of primary raw materials consumption and at least 37% of solid waste volume in Europe. See European Commission, "LEVEL(S): Taking action on the TOTAL impact of the construction sector" (Luxembourg, 2019), 5; see also Eurostat, "Waste statistics," 2023, accessed January 16, 2023, ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/1183.pdf.

2 Dirk Hebel and Felix Heisel, "Introduction," in *Urban Mining und kreislaufgerechtes Bauen: Die Stadt als Rohstofflager*, eds. eid. (Stuttgart: Fraunhofer IRB, 2021), 13.