



CIRCULAR CITIES PROGRAM POLAND

Executive Summary

Gdansk • Lublin • Krakow

APRIL, 2021

CATALYZING THE TRANSITION TO A CIRCULAR ECONOMY IN GDANSK, LUBLIN & KRAKOW

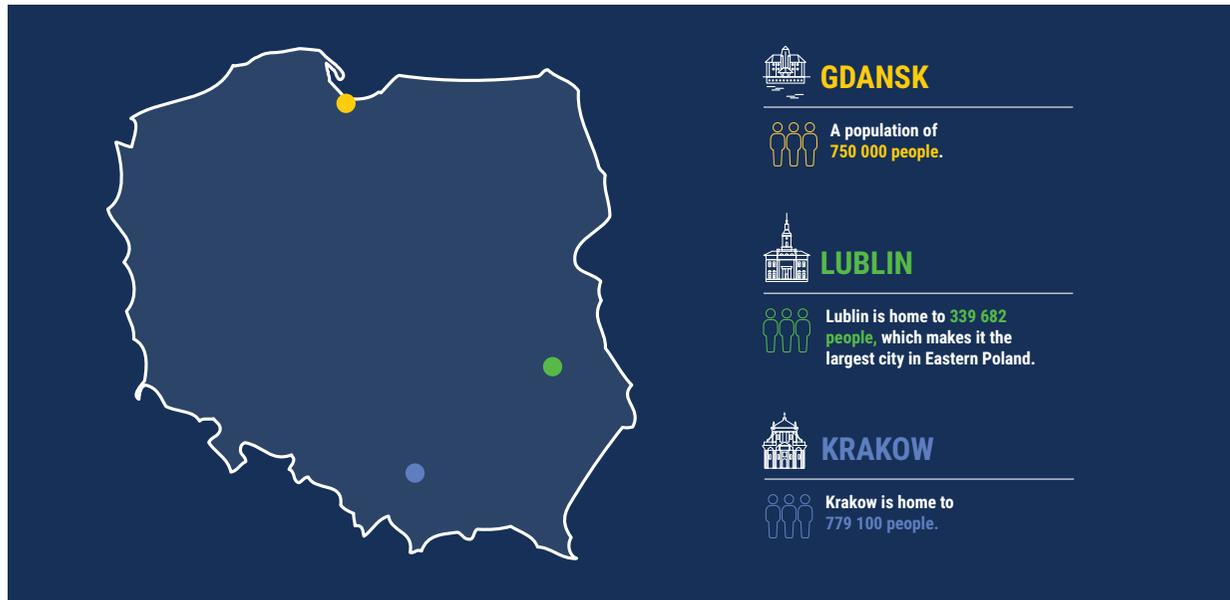


Figure 1: Key stats.

Over the last three decades, Poland's economy has been one of the fastest-growing economies in Europe. However, the country's economy remains carbon-intensive. The acceptance of the circular economy (CE) roadmap at the national level in 2018 as well as city development strategies such as Krakow's 2030 strategy suggests that Poland is ready to transition towards a circular economy. This transition could help tackle some of the country's greatest social and environmental challenges. It could move the current economy into a fundamentally sustainable state by becoming

resource-efficient, and bring long-lasting impact towards a healthy environment for all inhabitants.

All cities can play a leading role in accelerating a sustainable economy by leveraging their unique characteristics to propagate effective strategies, financial opportunities, policy changes, and infrastructure solutions. These Polish cities have the opportunity to drive early implementation, as well as catalyze change both nationally and within Europe by inspiring other cities in the region.

A transition towards a circular economy starting with cities

In a 1.5 year-long program, generously funded by the MAVA foundation, Metabolic Institute worked with our Polish partner Innowo and groups of stakeholders in the cities of Gdansk, Krakow and Lublin to kickstart the transition to a circular economy. Every city is different, some cities might be further along the circular transition, might have already integrated sustainability policies into the agenda, and every city will differ in the level of granularity of available data. For each city, we:

- Uncovered actionable insights and leverage points through an extensive context analysis and sector-based analysis (Waste, energy, water, agrifood and construction) in each of the three cities
- Brought together stakeholders from the public and private sector, community organizations, and academia to build awareness and local networks and formulate a vision with concrete goals and measurable KPIs,
- Translated the citywide analysis to the more granular neighborhood scale to provide insight on the different roles different neighborhoods can play in achieving the city-wide vision and goals,
- Developed a tailored toolkit of immediate circular strategies and examples that can help build the innovation ecosystem needed to land the circular economy and catalyze cross-sector collaboration,
- Built a knowledge network between the cities.

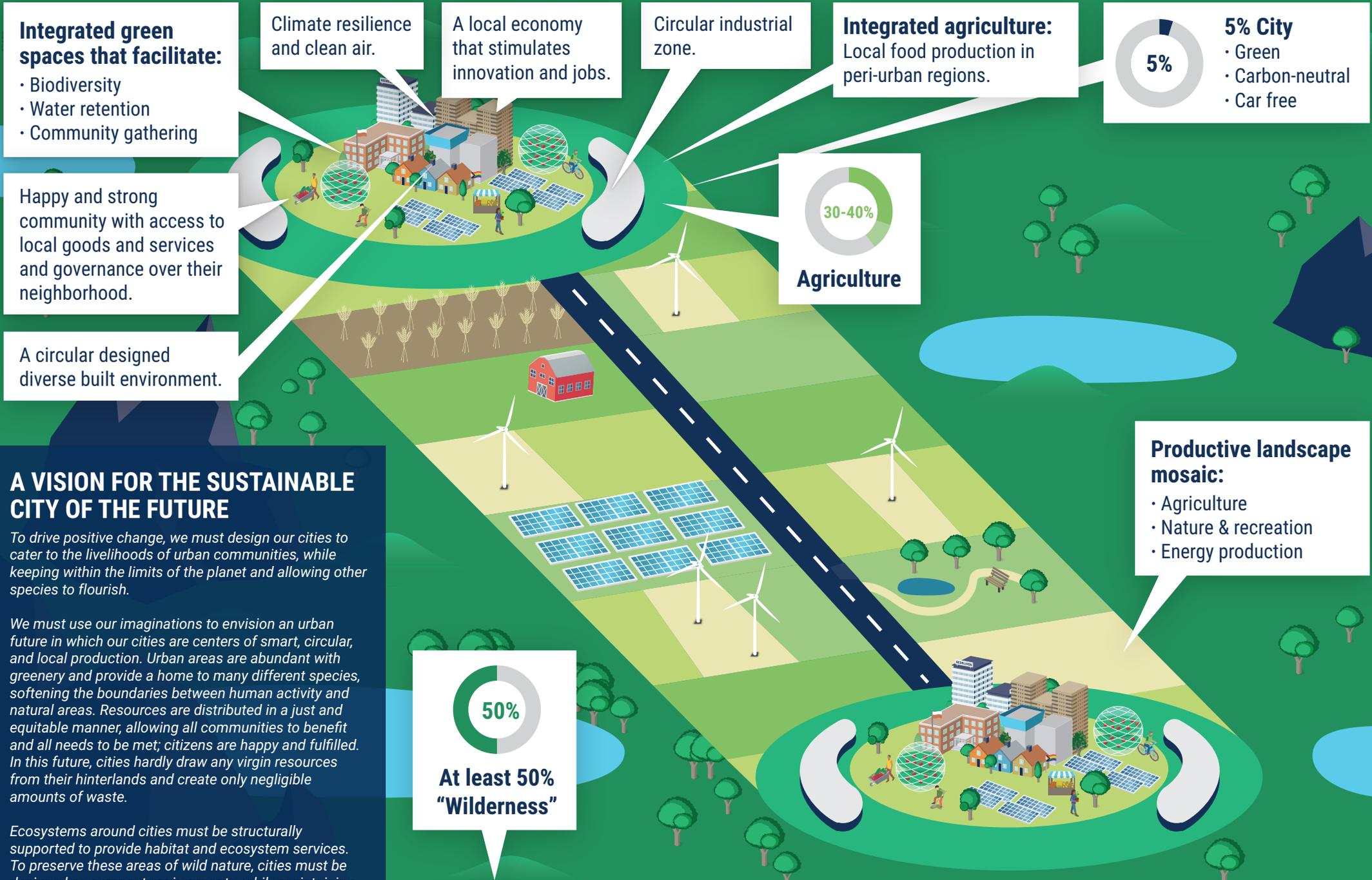
STEPPING STONES FOR THE CITY OF THE FUTURE

In each case, we aimed to connect current and potential projects and build towards a vision of a sustainable city. If we take high-level ideas about what a sustainable city should look like and apply circular economy principles to the city, we can imagine some of the changes that might have to take place.

We distilled the vision for each city, structured around four integral thematic areas and building on strategic directions formulated on existing strategies as well as input from stakeholders and the municipality. Rather than a binding image, these vision lines are meant as a source of inspiration to work towards a healthy city for humans (and other species). Each vision line is accompanied by a set of proposed Key Performance Indicators that can help monitor progress.



Figure 3: Vision directions Krakow.



A VISION FOR THE SUSTAINABLE CITY OF THE FUTURE

To drive positive change, we must design our cities to cater to the livelihoods of urban communities, while keeping within the limits of the planet and allowing other species to flourish.

We must use our imaginations to envision an urban future in which our cities are centers of smart, circular, and local production. Urban areas are abundant with greenery and provide a home to many different species, softening the boundaries between human activity and natural areas. Resources are distributed in a just and equitable manner, allowing all communities to benefit and all needs to be met; citizens are happy and fulfilled. In this future, cities hardly draw any virgin resources from their hinterlands and create only negligible amounts of waste.

Ecosystems around cities must be structurally supported to provide habitat and ecosystem services. To preserve these areas of wild nature, cities must be designed as compact environments, while maintaining a human scale that stimulates engagement, social interaction and a sense of personal belonging.

Figure 2: A vision for the city of the future.

CREATING THE ENABLING CONDITIONS TO ACHIEVE THE VISION

Throughout our research and discussions with local stakeholders in Gdansk, Krakow and Lublin, we have come across some key barriers to the implementation of the circular economy. Overcoming these barriers with the following instruments is key to achieving long-lasting impact.

1 Creating cross-departmental collaboration

Achieving the vision involves the waste department, but also energy and construction, amongst others. It also requires integrating the actions and goals with already-existing agendas.

2 Communicating the vision and actions

Publicly communicating about the circular economy can be a strong tool to create awareness of the circular economy and the action agenda for Krakow and others. It can also play a crucial role in creating a coalition around key strategic directions.

3 An active municipality

Governments can utilize their purchasing power through circular procurement strategies, as well as taking an active stance by providing tenders that can showcase new building technologies, creating subsidies for green roofs, and hosting participation meetings for selected driving groups.

4 The Circular economy is a joint venture

Collaboration across sectors and with existing initiatives will fast track the transition. This does require good insights into existing NGOs and local initiatives and an active role from the local government to create cross-sectoral driving groups.

5 Create insight into resource flows

To underpin the other actions presented in this roadmap, It is essential to develop a data collection and monitoring program that details how the city is progressing on improved resource management and inclusive economic development.

6 Policy and legislation

Changing municipal policy can be challenging and time-consuming since it is often informed by national or EU legislation. Creating temporary experimental zones can help provide the space needed for innovation.

7 Identifying funding to incentivize the private sector, academia, and community organization

Understanding the funding landscape's potential at various scales (regional, national, EU) will help to mobilize budget and enable entrepreneurs to finance their solutions.

From insight to action

Insights from the current state analysis and sectoral analyses were translated into an action-oriented toolkit to spark circular action in each city. Building upon local momentum, participating stakeholders and local needs and challenges, a locally relevant scope was adopted for each individual city.

CITY DEEP DIVE: GDANSK

Gdansk has a strong international and regional character. The city has been one of the most successful Polish cities in securing EU funding. In addition, the strong regional character of the Tricity area provides opportunity to stimulate a circular economy across municipal borders.

The city has a thriving yet fossil fuel intensive local economy, with strong coastal infrastructure and a relatively young and skilled workforce. However, situated in a river delta and coastal region, the city is prone to flooding and requires a climate resilient urban system that protects ecological infrastructure in and around the city.

Highlighted insight:

The construction sector is booming, causing extensive material consumption and (embedded) CO₂ impact. There is limited monitoring on the processing of construction waste on site. Through adopting circular design principles and adopting circular construction methods, the city can serve as an urban mine that supports high quality material reuse for new buildings.

The municipality strives to have a minimum:



70%
recycling rate for
**construction and
demolition (C&D)**
waste.

An unknown fraction of C&D waste is generated and processed on site. This makes it difficult to say whether the municipality is reaching its target.

The concrete used in Gdansk's construction sector is responsible for a large amount of emissions:



Moving forward

As a result of the program local stakeholders convened a cross-disciplinary driving group, The CEC Tricity Chapter, and laid the foundation of a regional

circular economy network that can kickstart the local transition. The strong bottom-up network that can potentially draw sustainable development funds to the region.

CITY DEEP DIVE: GDANSK

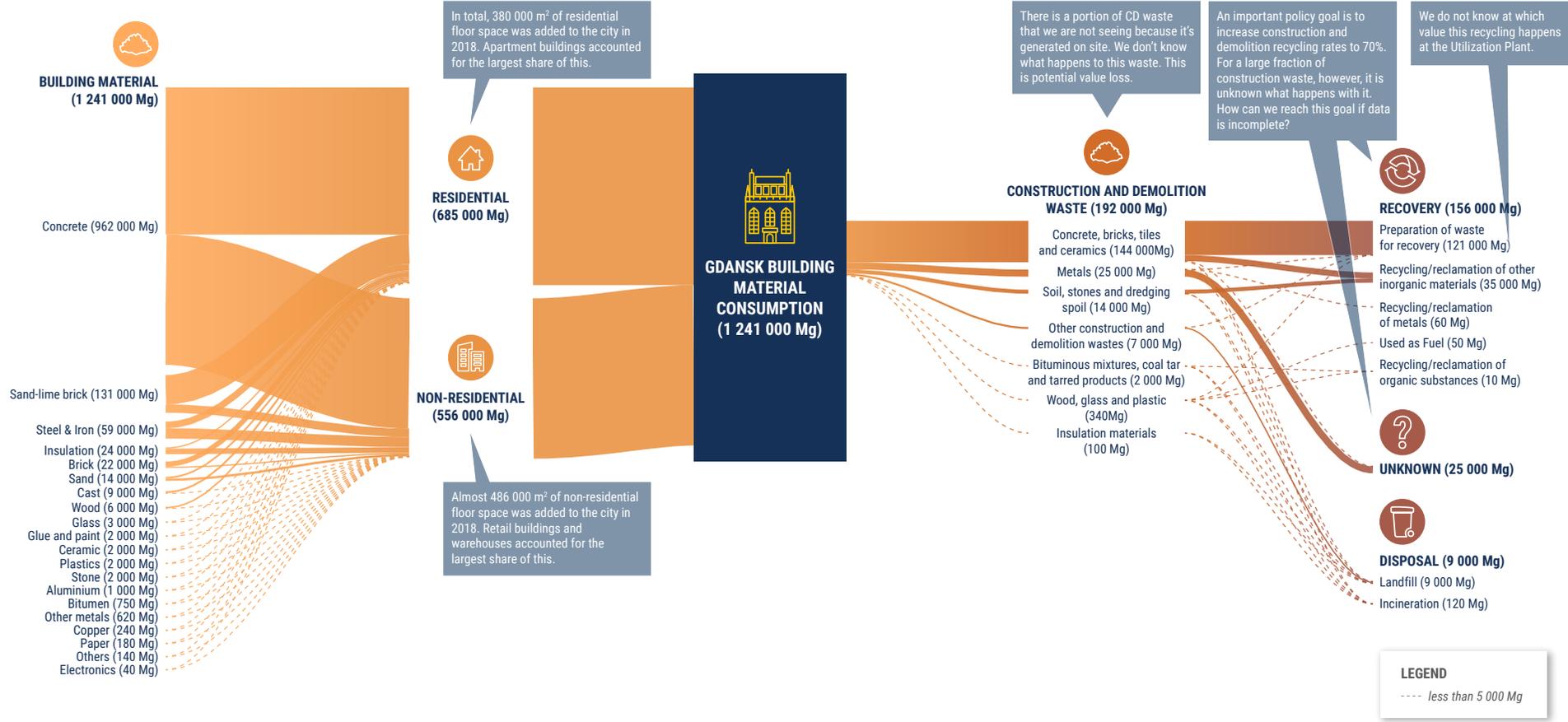


Figure 4: A material flow analysis of Gdansk's construction sector.

CITY DEEP DIVE: LUBLIN

Lublin is the largest city in the east of Poland, and the administrative, economic and cultural center of the Lublin province. The city promotes a high quality of life with monumental architecture and natural landscapes, but is experiencing a declining and ageing population as young employees seek job opportunities elsewhere. Its active municipal government focuses on developing democratic capital and participatory governance, and is working towards a new Strategy of Lublin 2030.

The city is the largest academic center in Eastern Poland, and recognized across the country for its scientific and academic research. The majority of the working population (53.4%) is active in the knowledge economy. Major industries include food processing, printing, metal manufacturing, production of building materials and leather production. Lublin intends to steer its economic development towards biotechnology, pharmaceuticals and food processing.

Highlighted insight:

Waste flows per capita are lower in Lublin than in other major European cities. Yet, close to 40% of industrial waste is landfilled or incinerated. The large flows of homogeneous industrial waste provide opportunities for circular economic activity. Compost derived from the city's organic waste could replace all the fertilizer applied in the Lublin region. Organic waste can be reused at a high value relatively easily on a local scale. It is worth experimenting with new collection methods starting with restaurants and their food waste in the city center.

Moving forward

Lublin's municipality is in the process of collecting insights from local residents to finalize the Lublin 2030 Strategy. Based on our current state analysis, we developed strategic directions that the municipality can take to transition towards a circular economy. Besides using these findings as input for the long-term Lublin 2030 strategy, Lublin's municipal

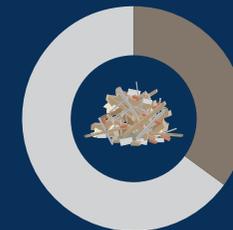
government has immediately started organizing around some of the proposed actions. For example, the city is initiating a program with local stakeholders to make local academic institutions more circular. In addition, the program strengthened cross-departmental collaboration within the municipality by convening different programs around the topic of the circular economy.

All agricultural waste would produce enough compost to replace all fertilizer needed in the Lublin region.



The inhabitants of Lublin generate, on average, 27% less waste than other EU citizens.

35% of industrial waste goes to landfills.



25 STRATEGIC PROJECTS TO KICKSTART THE CIRCULAR ECONOMY IN LUBLIN

A city where resources cycle at their highest value

- **P1** Pilot zero waste schools and public institutions
- **P2** Develop procurement criteria for municipal government purchasing
- **P3** City-wide reuse system for to-go waste
- **P4** Pilot neighbourhood repair and reuse hub
- **P5** Cross-sectoral accelerator program for circular product development from organic waste streams
- **P6** Implement a 'pay as you throw' structure in industry and enterprises

The smart, fossil-free, connected gateway to the east

- **P7** Energy efficiency standards in tendering guidelines for all new construction
- **P8** Create a covenant with local businesses on the production and use of local renewable energy
- **P9** Create Lublin Smart City Dashboard (energy, resources, water, transport)
- **P10** Pilot neighbourhood repair and reuse hub
- **P11** Establish car-free zones across the city

A city of resilient communities and sustainable urban development

- **P12** Pilot bio-based construction of public buildings
- **P13** Material passports for new development
- **P14** Require all new buildings to be built according to circular standards
- **P15** Build out integrated green network along Bystrzyca river
- **P16** Include requirements for (public) green space in development guidelines
- **P17** Further build out Citizen Participation Budget around greening the city

A city with a culture of academia and innovation

- **P18** Building an inter-university MOOC platform for circular innovation
- **P19** Improve primary and secondary school curriculum on sustainability and circular economy
- **P20** Circular economy training for city officials
- **P21** Lublin Universities establish 'green building lab'
- **P22** Lublin Circular Food Hub
- **P23** Create a "Circular Special Economic Zones" steering group of city officials, area management, and current businesses in the zone
- **P24** Set circular criteria for new businesses in the SEZ
- **P25** Establish R&D program between university, agrifood sector & food processing industries

Figure 5: Strategy directions and programs for Lublin

CITY DEEP DIVE: KRAKOW

Krakow is Poland's second most populated city, with a rich history and beautiful architecture that reflect the city's historical and cultural roots. Residents perceive Krakow as a city with a high quality of life, due to its abundant green areas, strong culture and leisure facilities. There is a rich academic scene that contributes to a permanent influx of young talent and innovation.

The city has a thriving knowledge-based economy and a prominent tourist sector, led by a relatively active municipal government. However, urban expansion, excessive tourism and an extractive economic model is putting pressure on Krakow's natural environment at the outskirts of the city, as well as in the city itself. This particularly concerns air pollution, which is among the highest in Europe. The municipality is taking action to alleviate this.

Highlighted insight:

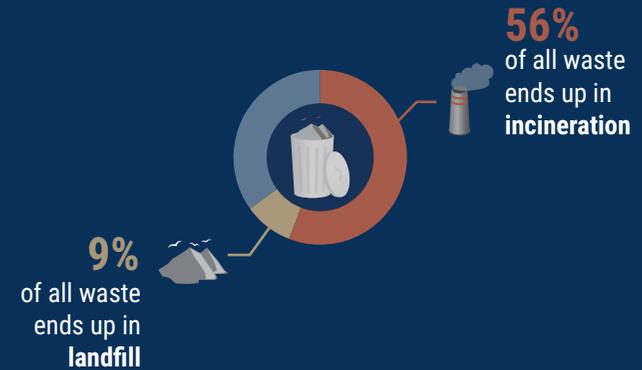
There is limited infrastructure available to residents of Krakow for high value processing of materials and products. Krakow municipality has appointed eight revitalization areas, to improve the built environment while preserving cultural heritage. These projects provide an opportunity for the integration of sustainable development measures in the built environment by developing centers of circular

The PSZOK point in Krakow collects construction and demolition waste. Yearly, this amounts to:



3 961

Mg/y of concrete, brick, tiles and ceramics



innovation. As in many cities, the built environment is responsible for an extensive amount of the city's material consumption and carbon emissions. Existing material collection facilities (PSZOKS) could play a role in collecting material from demolition. Post-industrial centers such as Nowa Huta could provide the necessary infrastructure for circular entrepreneurship.

Moving forward

In collaboration with the municipality of Krakow, we identified a set of 24 actions to kick-start

a circular economy. Building upon the existing sustainability ambitions in the city and the active role of the municipality in the process, these are oriented towards spearheading systemic change in the coming years. The actions require a strong network of collaboration between the private sector, academia and civil society, driven by strong leadership from the local government. A map of neighborhood typologies provides insight into the role different neighborhoods can play in accelerating the circular economy in the city.

SETTING THE RIGHT EXAMPLE: ZERO WASTE PUBLIC INSTITUTIONS AND SCHOOLS

Key Actions

A2a Zero-waste public institutions and schools

Public institutions can set the right example and create awareness by committing to zero waste. Local schools and public institutions commit to becoming zero-waste facilities by diverting all of their waste streams from landfill and engage in recycling, reuse or composting. A program with schools can be piloted with 2-3 schools and if successful can be scaled up.

- **Impacts:** Reducing waste, setting awareness for zero waste.
- **Who is needed?** Municipal governments, local schools, public institutions.
- **Key building blocks:** Internal capacity.

A2b Develop procurement criteria for municipal government purchasing

Circular public procurement refers to an approach by which public authorities purchase goods and services that contribute to the implementation of a circular economy by closing material loops, energy loops or reduced life-cycle impacts. Krakow can pilot a circular purchasing strategy in one of their public bodies.

- **Impacts:** Supporting circular markets.
- **Who is needed?** Municipal governments, public institutions.
- **Key building blocks:** Internal capacity.

Where to look for inspiration?

Going zero waste: Schools in Palo Alto pledge to eliminate all waste from their systems (going further than reducing, reusing and recycling) by designing products to eliminate waste and building community collaboration.

Responsible Purchasing Promotion Scheme: In Nantes, France, as part of the city's plan for public purchasing, Nantes has set 11 clear actions and targets that also include guidelines for circular procurement.

More information:
[EU Brochure on Circular Procurement](#)

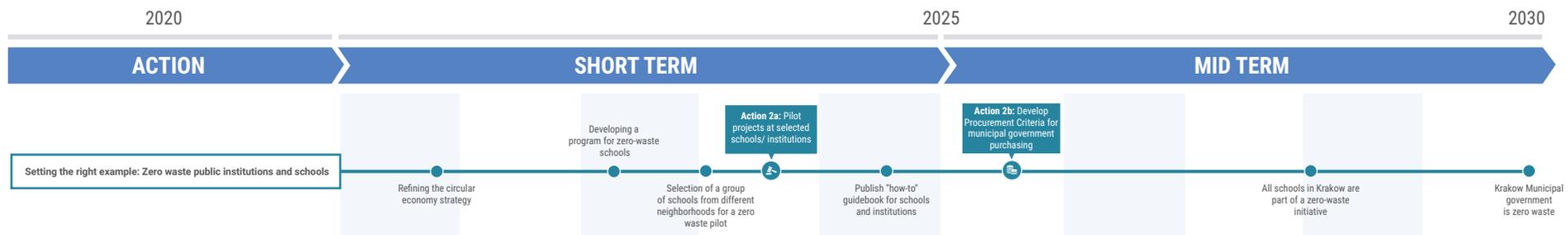


Figure 6: A page from Krakow's Action Toolkit.

CITY DEEP DIVE: KRAKOW

Neighborhood typologies

Each neighborhood can play an essential role in achieving a sustainable future based on its unique characteristics. We can design outer city neighborhoods to produce excess renewable energy serving the entire city as production centers by building on their post-industrial nature, proximity to natural resources, and existing infrastructure. By contrast, neighborhoods in the city-center might consume more, due to their higher densities and older building stock. However, their inner city location might continue to provide many of the cultural and commercial functions that are essential to any city.

Throughout the Circular Cities Program, the Metabolic Institute developed the neighborhood typology approach. By combining material flow analysis with spatial analysis, we can identify a set of neighborhood typologies that help us understand the role that each neighborhood can play in the transition to a circular city.

Four prevalent typologies in the city of Krakow are described below:



Residential hubs:

These housing districts focus on developing a safe, affordable, providing and pleasant environment for Krakow's communities to flourish. Accentuating current networks and initiatives either in the neighborhood or nearby can facilitate the transition to a circular economy.



Loop closers:

These peripheral neighborhoods require less energy per square meter due to the lower population density and can become energy-positive, thus providing energy surplus for the city. Large industrial roofs and existing logistical networks make this a perfect neighborhood to close loops. Existing industrial spaces can provide a platform for innovation and experimentation and small scale manufacturing.



Consumption centers:

Dense districts can benefit from innovations in waste separation systems to improve the separation and collection of waste. With limited potential for local energy generation and extensive manufacturing, these centers should facilitate retailers and could create a "product bank" that remarkets the refurbished products of the city's entrepreneurs.



Green oases:

These neighborhoods offer plenty of green space and serve as ecologically rich retreats for the urban residents. The ecosystems and biodiversity in these areas should be supported and protected as the population grows and the ecological richness in these areas should be made easily accessible for educational as well as recreational purposes.

CITY DEEP DIVE: KRAKOW



Typologies in Krakow

Typologies

- Organic producer
- Consumption center
- Green oasis
- Residential hub
- Concrete jungle
- Productive center
- Loop closer
- Mixed use



--- City boundary

* Data from 2018
 ** Data from 2014-2015
 *** Data from 2015

Figure 7: Granular insights for different neighbourhoods.

GREEN OASIS - ZWIERZYNIEC (VII)

Population density PLN/m² ** 7 472 Green space Industrial waste Energy consumption

Unemployment : 3,6 % ***
 Strength: Greenest neighborhood with community agriculture
 Challenge: Limiting sprawl
 Highlight: Revitalization area
 Budget 2018: 2 467 565 PLN
 Existing infrastructure: waste water treatment plant

1910

CONCRETE JUNGLE - KROWDZRA (V)

Population density 6 680 Green space Industrial waste Energy consumption

Unemployment : 4,2% ***
 Strength: Trust in community
 Challenge: Not very mixed
 Budget 2018: 2 092 579 PLN
 Highlighted: implementation of pocketparks planned

1970s

ORGANIC PRODUCER - WZGORZA KRESLAWICKIE (XVII)

Population density 4 510 Green space Industrial waste Energy consumption

Unemployment : 5,3% ***
 Strength: Food producer
 Challenge: Construction boom
 Budget 2018: 2 115 351 PLN
 Existing infrastructure: Water purification

1950s

CONSUMPTION CENTER - STARE MIASTO (I)

Population density 8 329 PLN, Cost m²** Green space Industrial waste Energy consumption

Unemployment : 4,7 % ***
 Strength: Unesco / High concentration of universities
 Challenge: Tourism & air pollution
 Highlight: Revitalization area
 Budget 2018: 2 630 803 PLN
 Existing infrastructure: Data center
 Highlighted initiatives:
 - Foodsharing Krakow: www.foodsharing-krakow.blogspot.com
 - Creating small localised parks in the historic centre
 Association of Municipalities Polish Network "ENERGIE CITES"

1250s

PRODUCTIVE CENTER - CZYZYNY (XIV)

Population density 5 647 Green space Industrial waste Energy consumption

Unemployment : 4,3 % ***
 Strength: Affordability attracts young community
 Budget 2018: 2 345 538 PLN
 Existing infrastructure: PSZOK / Organic waste facility / Coal plant / Data center

1941

LOOP CLOSER - NOWA HUTA (XVIII)

Population density 4 555 Green space Industrial waste Energy consumption

Unemployment : 5,7% ***
 Strength: Affordability attracts young community
 Challenge: Heavy industry
 Highlight: URBACT
 Budget 2018: 3 854 072 PLN
 Existing infrastructure: Train station and railway

1949

RESIDENTIAL HUB - PODGORZE (XIII)

Population density 6 845 Green space Industrial waste Energy consumption

Density: 1 437 p/km²
 Unemployment : 4,5 % ***
 Strength: Diverse and attractive neighborhood to live in
 Challenge: Air quality and flood vulnerability
 Highlight: Revitalization area
 Budget 2018: 3 143 450 PLN
 Highlighted initiative NGOs: Stowarzyszenie MAYDAY (not-for-profit providing social assistance to people in Krakow).

1910s

CITY DEEP DIVE: KRAKOW

Landing the Circular Economy in Krakow

Typologies

- Organic producer
- Consumption center
- Green oasis
- Residential hub
- Concrete jungle
- Productive center
- Loop closer
- Mixed use

- ⬢ Hospitality clusters
- City boundary

Figure 8: A proposal for kickstarting the different vision lines.

A CITY WITH A HEALTHY ECOSYSTEM FOR ALL SPECIES

Krakow becomes a bustling city with clean air and water, vast green areas and affordable housing.

- Krakow protects its natural assets
- Increases local food consumption
- Provides equal access to green areas for all citizens.

A19 Piloting the transformation of car parks in green areas

Surface area: ± 50 000 m²
Potential additional green space: 10%

- Green parking area
- Consumption center

A23 Green roofs on post-industrial buildings

30 largest roofs
Surface area: ± 850 000 m²
Catchment area: 571 million m³ water/y
2 284 olympic swimming pools

- Potential green roofs
- Loop closer [Nowa Huta]

A21 Pilot a brownfield redevelopment project

- Brownfield
- Productive center [Czyzyny]

A8 Insights in high-value synergies between industries

Industrial symbioses study of industrial parks like

- Industrial symbiosis
- Productive Center & Loop Closer

A9 Krakow Circular food hub

Available food waste from household and tourism: 22 930 Mg/y

- Possible location for circular food hub
- Consumption Center

A10 Krakow Green Building Lab

In collaboration with i.e. Krakow University of Technology

- ◆ Green construction lab

A CONNECTED CITY WITH AN ECONOMY OF CREATIVITY AND INNOVATION

Krakow builds on its academic environment and untapped business potential to lead in circular innovation.

- Krakow becomes a world leader in circular technologies
- Develops a zero-emission mobility system
- Ensures that circular strategies are leveraged to alleviate social inequality.

A14 A building hub to store and exchange salvaged construction materials

- Construction hub

A SUSTAINABLE, DIVERSE AND INCLUSIVE BUILT ENVIRONMENT THAT FOSTERS RESILIENT COMMUNITIES

Krakow moves towards sustainable and circular urban development, increasing well-being for all of its communities.

- Krakow maximizes energy efficiency
- Increases secondary energy use
- Includes community goals in their development plans

A1 Pilot neighbourhood repair and reuse hub

- Social centre for reuse

A CITY WITH A CIRCULAR METABOLISM

Krakow cycles all resources at high value, minimizes emissions and waste production.

- By 2050 Krakow:
- Eliminates landfill
 - 100% renewable energy
 - Achieves zero waste

A4 Create a first line of products designed from industrial waste streams

- Possible location for food waste processing

MOVING FORWARD

Our work has resulted in extensive insights for each city and an action toolkit with 24 actions to kickstart the circular economy in Krakow, strategic input for Lublin's 2030 strategy, and an inspiration guide for a bottom-up innovation ecosystem in Gdansk. Implementing the circular economy, however, does not happen overnight. It requires dedicated immediate actions engaging various stakeholder groups, building local driving groups, as well as longer-term systemic implementations.

Through this program, we built local capacity and activated knowledge networks in Poland. Organizations such as Innowo's Polish Circular Hotspot and the network of Local Circular Economy Chapters will play a key role activating the outcomes and building a national movement.



