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2022
Executive Summary
Industrial Waste Mapping in Pilot Areas
Absheron-Khizi and Baku Economic Regions
Azerbaijan

Action implemented by:

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Foreword

Waste mapping is a common method used to quantify and demonstrate the distribution and management of waste within a geographic area. The overall objective of industrial waste mapping is to identify, assess, and map the waste streams of manufacturing enterprises in order to develop options for improved resource efficiency. This includes the analysis of the collection, transport, treatment and disposal of waste, together with the monitoring and regulation of the waste management process and waste-related laws, technologies, and economic mechanisms. An efficient waste management system creates increased business value for any manufacturing enterprise. This contributes to the sustainability of industries and the promotion of economic opportunities.

The initiative on Industrial Waste Mapping in Pilot Areas was developed under the regional programme funded by the European Union, the EU4Environment Action. It is the result of a collaboration between team members from the United Nations Industrial Development Organization (UNIDO), an international expert team from SWECO AB consultancy, and ACE Group Consultants LLC in its role as a National Implementing Partner of UNIDO in Azerbaijan. The full report on industrial waste mapping in Azerbaijan consists of 10 chapters, which provide an in-depth analysis on the handling of industrial waste in the selected Absheron-Khizi and Baku Economic Regions.

About the study

Industrial waste mapping (IWM) in Azerbaijan was carried out in Absheron-Khizi Economic Region (AER) and Baku Economic Region (BER). The pilot regions were chosen based on Azerbaijan's regional division,[1] the nature of their respective industrial bases and their potential waste generation. Potential data availability, existing waste management services, and the circular economy potential of waste streams were also taken into consideration during the selection process. Throughout the process, consultations were conducted with the Ministry of Ecology and Natural Resources (MENR), the Small and Medium Businesses Development Agency (SMBDA), industries, academia and other key stakeholders from Azerbaijan.

The report outlines the legislative and strategic background to waste management in the country, provides information on the characteristics of the pilot areas, and identifies key stakeholders in the management of waste. It also describes waste type selection, extrapolation and mapping activities, and identifies dedicated datasets and data collection methods. Finally, it provides recommendations for more circular waste management and highlights lessons learned for future waste mapping exercises.

IWM methodology

To define the scope of the exercise and develop concrete results, the study was delimited to two geographical pilot regions, and focused on sectors with an industrial profile and waste types that have a high potential for circularity. Background research on solid waste management in the pilot regions and focus industries also helped provide a context for IWM. A long list of industrial enterprises within the focus sectors was developed through desk-based research. The enterprises were contacted and data on waste management were obtained through telephone calls and onsite visits from the interested enterprises.

The mapping of wastes focused on their waste journey (including quantities, transport, destination, key stakeholders, collection costs and post-treatment market value). Solutions were proposed, along with estimated material and financial implications. The data primarily focused on the samples from the selected businesses, but extrapolations were made to suggest further impacts and trends for possible replication across the whole pilot area.

[1] As per Presidential Decree dated on 7 July 2021

Legislative, regulatory, and strategic context

Enacted in 1998 and amended in 2020, the Law on Industrial and Household Waste outlines the legal and regulatory framework for waste management in Azerbaijan. This framework law establishes the concept of industrial waste, defines the state policy for protecting the environment from industrial and municipal waste, establishes the responsibilities of state organizations, and sets reporting requirements. It also spells out the responsibility of waste generators and fixes requirements concerning waste reuse and recycling, transportation, treatment, and disposal. Among the important aspects defined by the law is the recognition of the producer as an owner of waste and as responsible for ensuring the treatment, recycling (as secondary raw material), and elimination of hazardous waste, in line with the legal requirements.

The Ministry of Ecology and Natural Resources (MENR) is responsible for both the implementation of and compliance with environmental protection laws, norms, and standards. The Ministries of Emergency Situations, Health, Agriculture and Economy have responsibilities linked to industrial waste management. The need to collect information on industrial and hazardous waste is defined in Resolution No. 41 of the Cabinet of Ministers, dated 31 March 2003, on the “passportization” of hazardous waste and in Resolution No. 13 of the Cabinet of Ministers, dated 25 January 2008, on Rules for the Inventory of Industrial Waste. While passportization requires the preparation of one-time audits on the generation of hazardous waste (to identify key waste streams), the inventory focuses on the introduction of a new classification system for industrial waste and a regular reporting of the quantities of the generated hazardous waste. These two resolutions seek to ensure that waste passports are prepared in a uniform way and generate information on waste. Azerbaijan has not yet adopted any legal framework for Extended Producer Responsibility (EPR). However, the country has adopted a number of strategies and national action plans that promote sustainable development through the efficient use of resources and the application of clean technologies.

The above changes to the regulatory framework represent progress in providing the necessary guidance to improve information systems to monitor and control industrial waste generation. However, mechanisms must be strengthened to enforce regulations, maintain data collection, and ensure reliable information to help decision-making for both the public and private sectors.

Pilot areas: industrial base, main sectors, and waste management system

As part of the process to select two pilot regions, the study used the designated economic regions as an initial geographical reference, each of which is distinguished according to its economic specialization.

Absheron-Khizi Economic Region (AER)

322 industrial enterprises

4,376 metric tonnes of waste in 2020

Baku Economic Region (BER)

1,671 industrial enterprises

275,697 metric tonnes of waste in 2020

Absheron-Khizi Economic Region (AER) is dominated by the city of Sumgait, which is the second-largest industrial centre in the country. It has 322 active industrial enterprises, which in 2020 generated a total of 4,376 tonnes of waste. Major industries operating in the municipal area include metal smelting and processing, plastic and chemical construction materials, glass and porcelain production, and textiles.

Baku Economic Region (BER) is dominated by the capital, which is the scientific, cultural, and industrial centre of Azerbaijan. It has a total of 1,671 industrial enterprises, which together generated 275,697 tonnes of waste in 2020. The most common industries are the production of non-ferrous and ferrous metals, construction materials, furniture and glass, porcelain, and textiles.

As AER and BER have similar characteristics (geography and industry types), are bordering and partly overlapping each other, and are relatively compact, the two pilot regions were analysed as one (focusing on the generation, collection, and treatment of waste).

The pilot regions have a large and varied industrial base, and hence, the focus sectors were selected based on the industrial presence and theoretical potential for circularity. Due to incomplete databases and limited official records on industrial enterprises, the team used its experience and knowledge in the field of waste management, research data, and data collected, through discussions with MENR to identify key waste producers in the pilot regions. Based on the findings, it was decided to prioritize the following focus industrial sectors:

- Construction materials and components
- Metal smelting and processing
- Textile products and garment components
- Alcoholic and non-alcoholic beverages

There are at least 51 relevant medium-sized and large industrial enterprises in BER operating in the selected focus sectors, and 13 active enterprises in AER. Industrial waste collection from industries is carried out by licensed companies. Some non-hazardous waste is collected by Tamiz Shahar JSC and informal individual waste pickers.

Tamiz Shahar also carries out the treatment of industrial waste, along with at least 32 different waste treatment and processing facilities in AER, and 25 in BER. These range from industries specialized in regular reuse to small-scale recycling facilities, energy recovery in one incineration plant and cement factory, to specialized treatment facilities for hazardous waste. It is estimated that 46 per cent of the total waste produced is put in the landfill, 39 per cent incinerated, 13 per cent recycled or reused, and 2 per cent subject to other treatment, such as oil refining.

The infrastructure for landfilling, energy recovery, recycling and the sorting facility is concentrated in the Balakhany Industrial Park in BER. The incineration plant in Balakhany, which also produces electricity, has the capacity to handle 500,000 tonnes of household and industrial waste per year, and 10,000 tonnes of medical waste per year. The situation in the pilot regions is likely to significantly differ from other parts of the country where a higher share of waste is landfilled, based on the experience of the National Implementing Partner in Azerbaijan. The World Bank[2] estimates that 50 per cent of the collected waste is dumped informally and does not reach the treatment and disposal facilities.

Datasets

Using onsite visits and telephone conversations, data were collected from the waste generators at 16 key sample industrial enterprises. The datasets were to include data per type of waste and information about the generator, its sector and location, amount of waste, collection, and treatment methods. However, a hesitancy to share data and information due to corporate confidentiality and lack of explicit incentives led to difficulty in attaining full datasets.

The total sample waste generation from the industrial enterprises participating in the waste mapping exercise was estimated at 12,120 tonnes per year. The most common waste types were organic (10,373 tonnes/year), plastic (874 tonnes/year), wood (279 tonnes/year), dust (245 tonnes/year), metal (227.2 tonnes/year) and paper (59.4 tonnes/year). The waste generated in the sample amounts to an estimated 4.3 per cent of the total estimated industrial waste in the selected region.

However, the lack of official records on industrial enterprises and waste generation in Azerbaijan casts doubt on the estimates of the sampled waste and illustrates the need for structured monitoring of waste generation.

The gathered sample was used to extrapolate and replicate results, estimating the total number of enterprises in each of the focus sectors within the two pilot regions. Smaller enterprises were difficult to map and thus assumed to generate negligible quantities of waste, which is often disposed of as household waste. The total industrial waste generation for the two pilot regions is estimated in the range of 18,800 tonnes to 25,500 tonnes per year for the four focus sectors, which represents approximately 8 per cent of the total industrial waste generated in the two economic regions.

Waste type selection

Five to six waste streams per pilot region were selected to ensure that lessons could be drawn from a variety of different situations. Particular streams were chosen based on the quantity and industrial nature of the wastes, the kind of waste journeys best suited to the pilot regions, and the potential for greater circularity.

Since it is a pilot project, the selected waste types are characterized as having low or medium levels of resource efficiency. Based on the above criteria, waste oils, wood, metals, paper, glass, and textile wastes were selected from the focus industries.

[2] World Bank Group, 2021. Project Performance Assessment Report Azerbaijan.

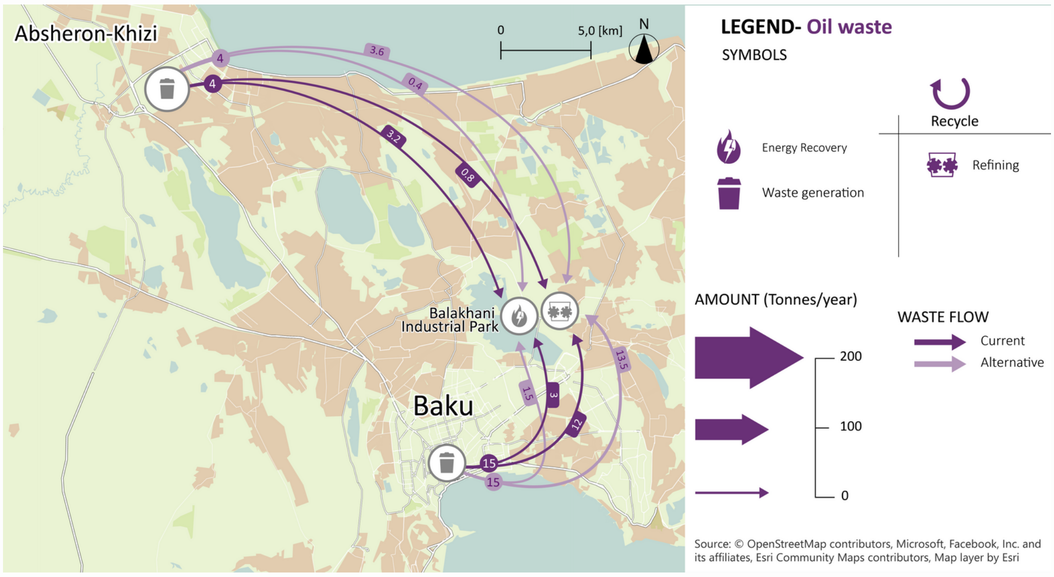
Results

The results are presented in order of priority for each selected waste type, based on the waste management hierarchy framework (prevent, reduce, reuse, recycle, recover, dispose of). The potential financial savings are derived from the specific amounts presented by the enterprises in the sample, which provide the basis for later extrapolation. Most of the cost-saving calculations for the enterprise samples reflect the limited incentive to implement more circular options due to the relatively small collection and treatment costs for most of the wastes.

Oil waste

Generation of 19 tonnes per year of lubricants and hydraulic oils waste from cement and beer production, including 1.3 tonnes per year of rags contaminated with oil. he waste is collected separately by specialized contractors. It is estimated that 20 per cent of the oils are refined and reused, and 80 per cent are incinerated.

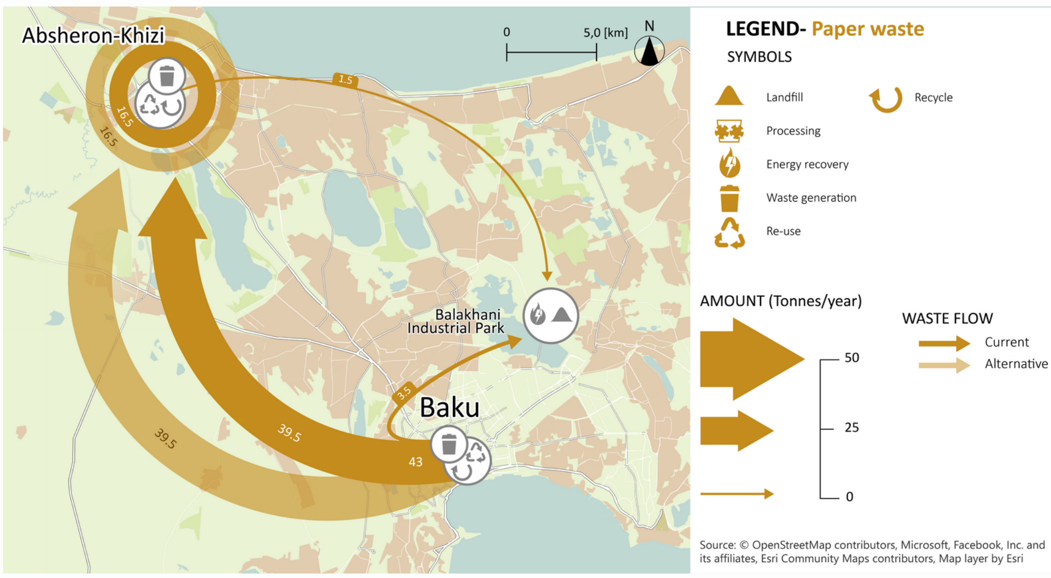
The key alternatives to increase circularity are: 1) reduction of oil waste: minimum quantity lubrication is a growing trend in industries using dosage equipment; 2) reduction in oil consumption, lower costs and higher productivity of the machines: investing in dosage equipment could provide significant savings on the consumption of lubricant; 3) washing textiles with oils: rags contaminated with oils could be cleaned in designated treatment facilities, usually located at hazardous waste treatment plants; 4) separation of oil waste at production sites: proper sorting of all oils and lubricant waste at the enterprises would ensure its value and allow it to be sold for recycling, and; 5) promotion of the use of bio-oils: some bio hydraulic oils (e.g. Hydraulic Oil Environmental Triglyceride (HETG) from vegetable fats) are more conducive to recycling and could be promoted.



The potential financial savings would be limited, however, and are estimated at approximately €513 per year for the sample enterprises (due to the small collection and treatment costs).

Paper waste

Generation of 61 tonnes per year from the production of cement and other construction materials, textiles, and beverages. Paper waste stems mainly from used packaging materials. Approximately 92 per cent of the waste is recycled with the remainder incinerated or disposed of in a landfill. Some of the sampled paper wastes in landfill originated from a smaller cement production facility, where the paper bags used for cement filling are destroyed because of incompatibility or low quality.

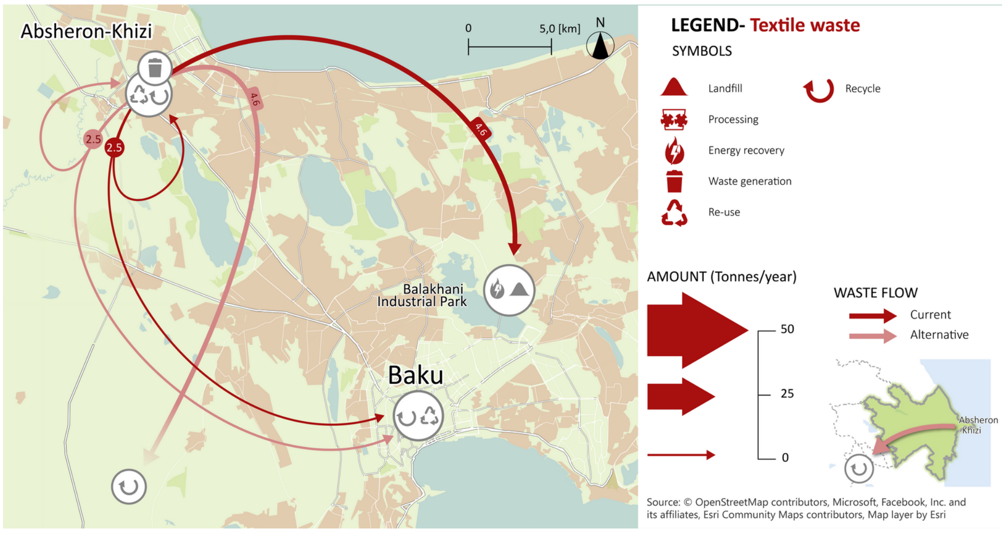


The key alternative for increased circularity is the proper sorting of paper waste, which is currently not done at the source by some enterprises. Sorting at source would ensure its value and allow it to be sold for recycling. At cement production facilities, one option would be to reuse paper sacks to decrease the generation of paper waste. The use of reusable sacks for the cement industry could be investigated, supported by deposit-return systems whereby a deposit for each sack is paid, and then repaid when the sack is returned. This is a common system for many industrial materials and would virtually eliminate this waste stream altogether and its associated waste management costs. However, according to sample results, the potential financial savings would be small at an estimated €769 per year.

Textile waste

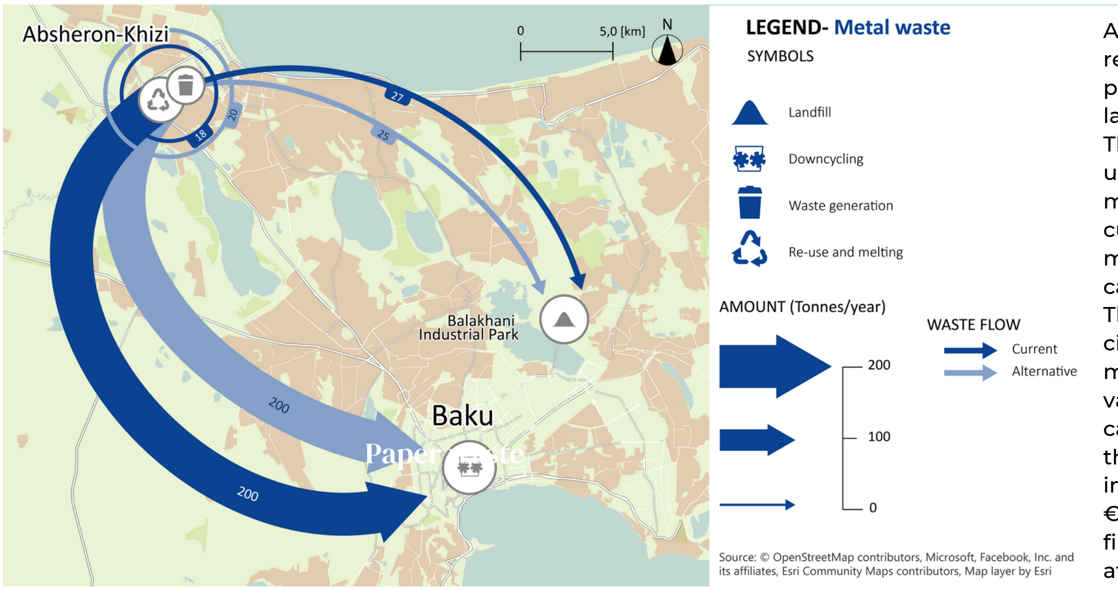
Generation of 7 tonnes per year from the production of furniture and clothes. Although the amount is small, the most common textiles, such as cotton, are resource-intensive to produce and therefore recycling the waste could have a significant environmental impact. Currently, around 65 per cent of textile waste is incinerated or landfilled and 35 per cent is treated in small-scale reuse facilities or is reused in the production of basic furniture and interior furnishings, including wallpapers.

The key alternatives for increased circularity are 1) replacement of raw materials in production: raw textile materials can, to some extent, be replaced by second-hand textiles and/or non-blended fabrics and have a significant impact on the final product's environmental impact and recyclability; 2) innovative re-use schemes for the use of clothes (take-back or rental). This would improve the conditions for the reuse of textiles, as many textile producers create take-back or rental schemes for their own (and other) textiles; 3) and proper sorting of the textile waste: proper sorting of dry and clean textile waste at the enterprise level would ensure its value and provide preconditions for designated textile recycling companies to enter the market or for the waste to be sold internationally. The potential financial savings would be small relative to the enterprises' sample, at approximately €600 per year.



Metal waste

Generation of 245 tonnes per year from the beverages sector, metal smelting, and furniture production sector. Metal waste comprises various types and materials, including slag by-products, mud from anode cuttings, aluminium, and metal solid wire waste.



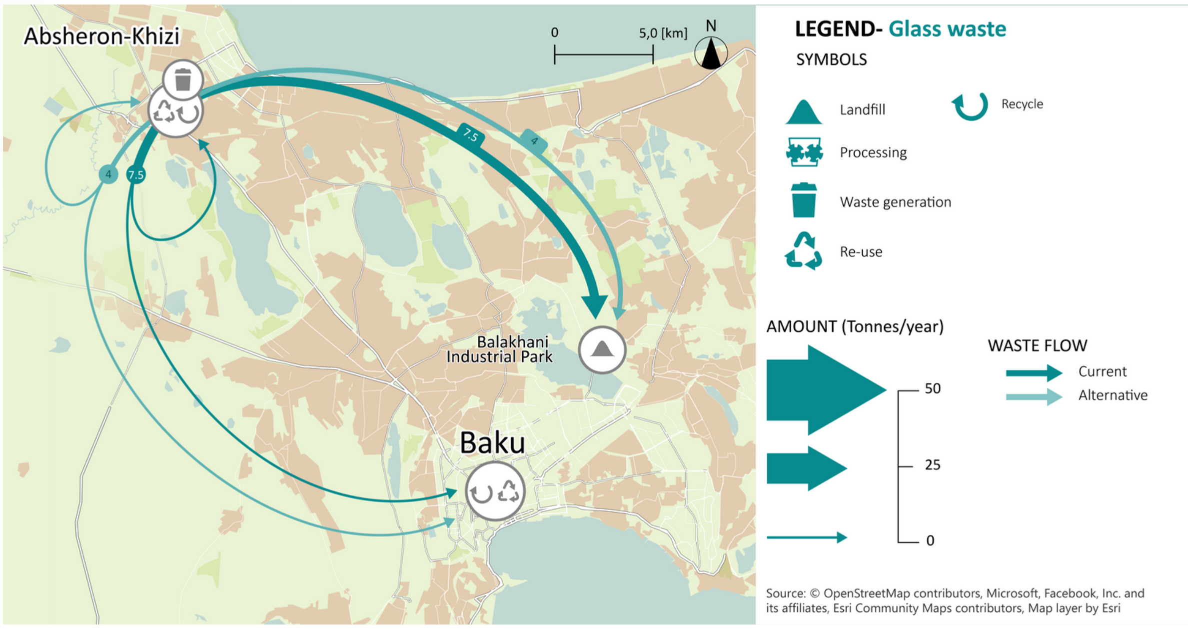
Around 89 per cent of the waste is recycled or used as an input for production, and 11 per cent is landfilled or otherwise disposed of. The landfilled metal waste is made up largely of complex waste materials, such as mud from anode cutting (which includes valuable metals such as gold and copper that cannot be processed in Azerbaijan). The key alternative for increased circularity is proper sorting of the metal waste to ensure that all valuable metals are separated and can be sold for recycling. Based on the sample enterprises, this could increase material value to at least €4,256 per year, although potential financial savings would be negligible at approximately €369 per year.

In addition, a regulatory initiative to allow recycling abroad could be introduced to open new business opportunities, although, because of the difficulty in assessing the amount of the complex material waste produced, the financial implications of such a measure could not be estimated.

Glass waste

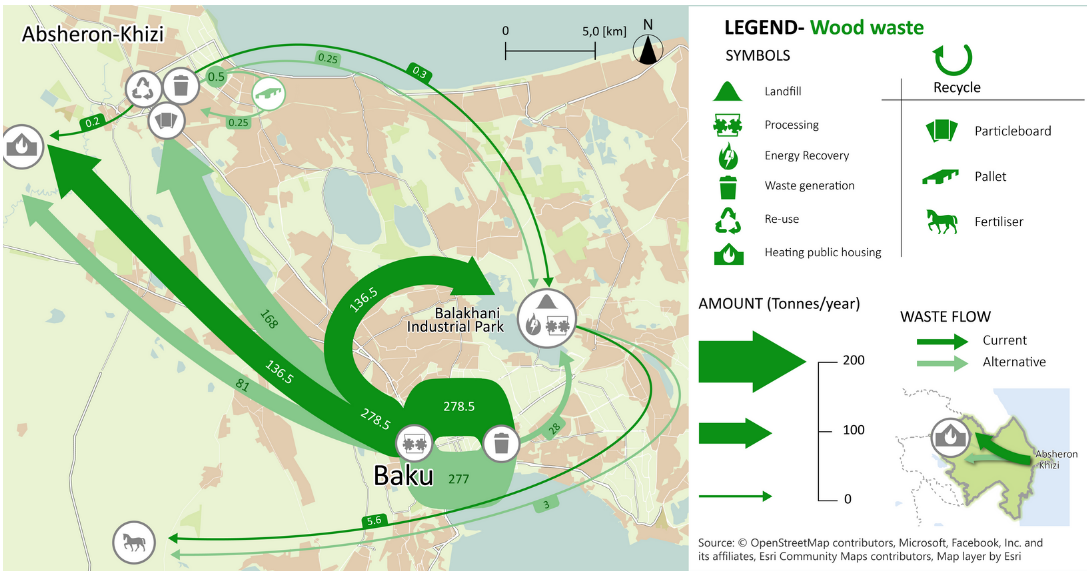
Glass waste is generated from the production of glass bottles used by producers in the beverage sectors and is made up mostly of coloured broken glass. The bottles are not produced in-house by drinks manufacturers and there is currently little or no cooperation between producers on coordinating waste treatment and/or standardization. At present, only white glass, which comprises roughly half of the glass produced, is recycled by three glass recyclers. The remaining half, comprising mainly coloured glass, is landfilled. The key alternatives for increased circularity are: 1) reuse systems: introduction of a deposit-based take-back system for glass bottles similar to the ones that exist in countries such as Turkey and Sweden; and 2) shift from glass to PET bottles: beverage producers would work towards replacing glass packaging with standardized plastic PET bottles.

PET is less energy-intensive to produce, lighter to transport and relatively easy to recycle. The financial implications of the proposed solutions could not be assessed within the scope of the IWM as they involve full business model development in the beverage industry, targeting system-wide and legislative changes which require more information.



Wood waste

Generation of 279 tonnes per year of waste, comprising mainly of solid wood and pallets from the production of furniture, cement, and beverages. Approximately 2 per cent of wood waste is reused in agriculture, 49 per cent is deployed to heat buildings and 49 per cent goes to direct incineration or landfill.



The key alternatives to increase circularity are: 1) repair shop for broken pallets: the reuse of the broken pallets could be easily managed by installing a repair shop for pallets at industrial facilities of sufficient scale; 2) proper sorting of the wood waste: proper sorting of all unpolluted wood waste at the enterprises would ensure its value and allow it to be sold for recycling; 3) recycling to other products with material value (as most wooden waste that is currently not directly incinerated is "recycled" into fuels for energy recovery, such as pellets).

It would be preferable to recycle wood waste into other products with a material value, such as particle boards, fibreboards, or activated carbon. This could create potential financial revenue of over €1 million per year but would require further market development to bring in new producers.

Recommendations for more circular waste management

In order to promote circular practices, a more holistic approach is needed to strengthen the use of the waste hierarchy framework in the governance of waste management, and to ensure its inclusion in Azerbaijan's legislative and regulatory practices. The Government of Azerbaijan has taken some measures to improve both waste management and the overall resource efficiency in the country, for example, through the establishment of the Balakhany Industrial Park, but further action is required to establish a more effective waste management system.

On the regulatory side, a waste hierarchy perspective should be more heavily embedded in waste strategy and in the development of relevant law. For example, the Law on Industrial and Household Waste promotes the separation of waste at source and recycling, which is needed as Azerbaijan develops its waste management systems, but arguably fails to place sufficient focus on waste avoidance. An EPR framework would provide a structure to move toward prevention. In addition, to shift the perspective towards the necessary frameworks rather than technology, it is suggested that future national initiatives regarding waste management are evaluated according to the anticipated effect on the organization, monitoring, legislation, compliance, financing, and public awareness of Azerbaijani industries. These frameworks need to be in place before advanced technology can be deployed that could make further improvements in the waste management system.

There is an acute need for better waste data. Although improvements are ongoing, current data gaps could be filled, inter alia, by: creating protocols for the reporting of waste at the production sites and for its shipment to waste treatment facilities; statistical protocols to avoid double counting; and distinguishing as much as possible between household, commercial, and industrial sources of municipal solid waste.

In addition, as Azerbaijan's waste and resource management systems is less developed than those in the EU, the country is given an opportunity to embrace circular economy policies and thinking that were not available in the EU at the same stage of development. These include the use of more nuanced reporting indicators such as CO2e weightings for waste management, the creation of national databases for recovered materials to encourage reuse, the promotion of green procurement, and taking a broader, collaborative whole-system view where industrial symbioses are enabled.

There are a number of strategic actions that could be taken to stimulate more circular flows of industrial waste, such as fiscal tools and collection pricing that encourage recycling, market stimulation, and support such as procurement strategies that prioritize recovered materials. Regulation could support circular solutions, such as greater use of end-of-waste protocols that clarify how wastes can become products again.

Conclusions

In both pilot regions, there are established reuse or recycling routes in place for many industrial wastes. Nevertheless, only 13 per cent of the total waste generated is reused or recycled. For most waste types, further introduction of sorting at the source of the industrial enterprises would allow for an increased circularity. Other circular solutions of the selected waste types, such as wastes from synthetic hydraulic oils and coloured glass waste recycling, are more dependent on regulatory measures, market stimulation, and supply chain reliability than on technical feasibility factors.

The alternative options put forward in this exercise are likely to retain significant value in the development of current practices. The total financial implications of introducing the proposed alternative actions for increased circularity are estimated at approximately €1.1 million per year for the sample industries. In extrapolation to the four focus sectors, at large, the proposed actions to increase circularity could result in a reduction in waste collection costs for the generator, worth between €29,000-€35,000 per year, and a post-treatment material value of €5.6 million to €6.8 million a year.

Financial implications for introducing circularity options of up €1.1 million per year

Reduction in waste collection costs between €29,000 - €35,000 per year

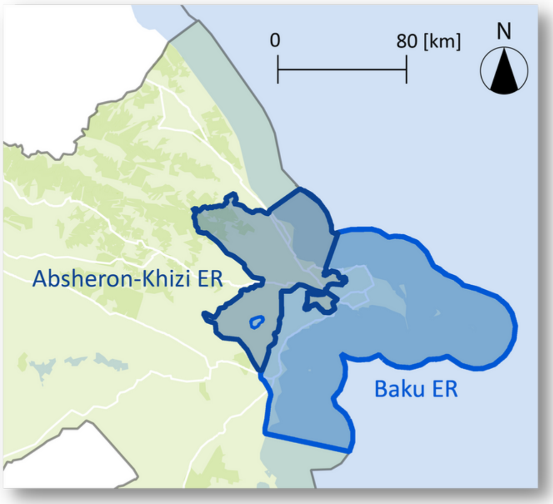
Post-treatment material value between €5.6 - €6.8 million per year

Further suggestions

Establishing a regulatory framework, through measures such as EPR, would create the regulatory and financial basis necessary to foster increased resource efficiency and help develop circular solutions for a number of wastes. There is a shortage of reliable empirical data on industrial waste. Until more data exist on quantities, types, composition, and prices, there will be a lack of confidence on which to base decisions pertaining to the development and improvement of waste management systems.

Lessons learned for industrial waste mapping exercises

- The need to have a clear mandate from relevant public authorities and other management bodies to maximize the availability of data
- The importance of cooperation with industrial enterprises in order to improve data collection, along with the need for incentives to encourage participation
- Allowing sufficient time to gather data
- The need to build impact when it comes to a lack of data on waste quantities and prices
- The importance of undertaking research on the industrial base and the waste management sectors, in particular treatment facilities, before proceeding with tasks
- Acknowledging the vital role financial savings have in making a case for change
- The use of process diagrams to verify the understanding of industrial processes and wastes
- The importance of putting in place a structured data-gathering and documenting process that is also sensitive to local conventions and customs



Read more

Industrial Waste Mapping in Pilot Areas of Georgia

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