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**Municipal waste  
management in context  
of sustainable urban  
development**

# ***Basic premises of the sustainable development of cities***

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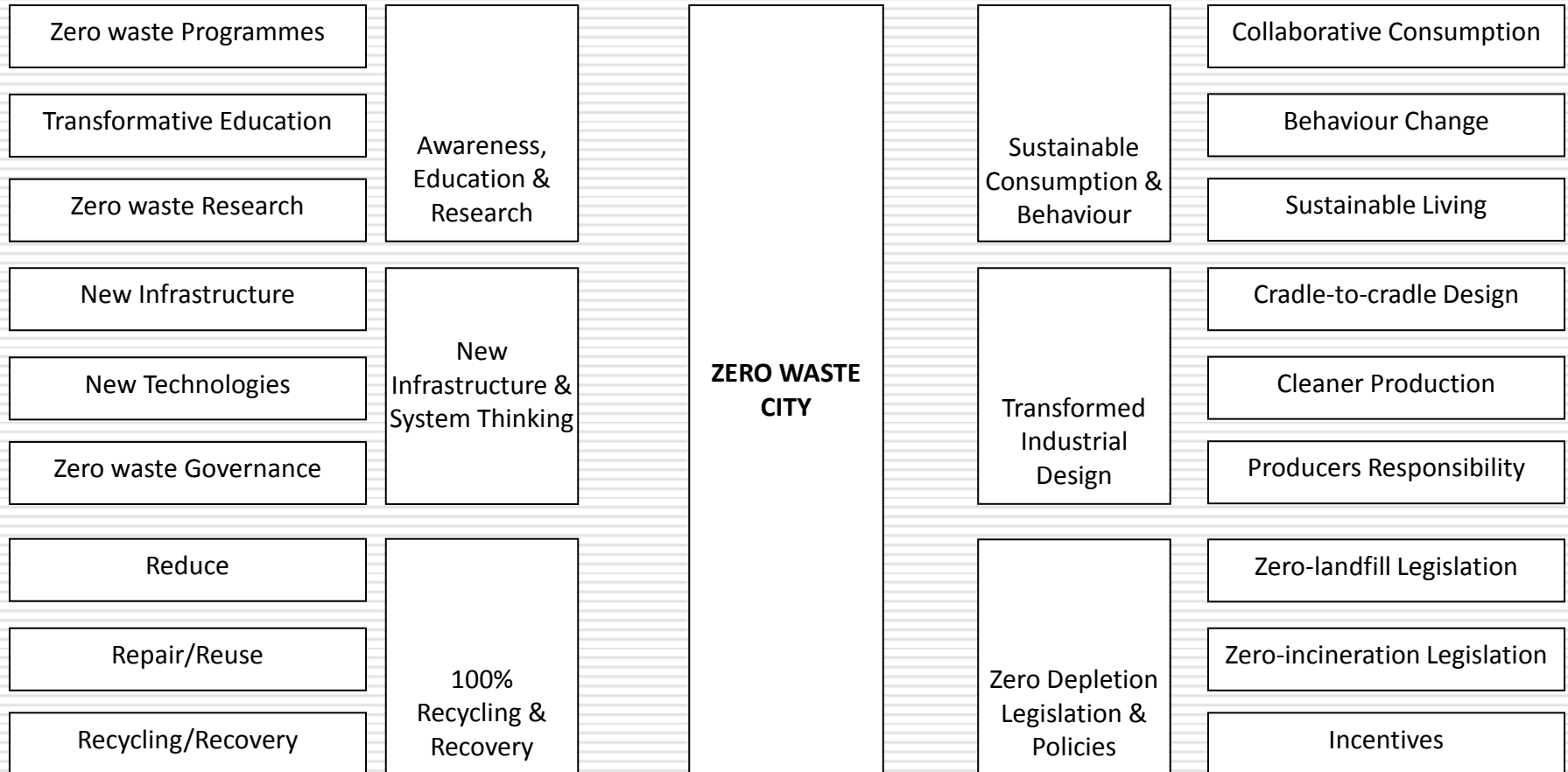
## Basic aspects of sustainable urbanism

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|---------------|--|
| Environmental | An urban form enables its inhabitants to adopt a more ecologically aware, lower carbon lifestyle.  |
| Social        | Sustainable urbanism involves an appropriate mix of dwellings of different tenures, sizes and types, and a variety of spaces and buildings for recreational and community activities, as well as for service providers and commercial enterprises. |
| Economics     | Sustainable developments contain business activities and opportunities capable of providing jobs for many of their inhabitants across the social and economic spectra.   |
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# ***Municipal waste management as an element of the sustainable development of cities***

## ***Drivers for transforming current cities into zero waste cities***



# ***Municipal waste management as an element of the sustainable development of cities***

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- *Municipal Waste*  $\equiv f$  (*Economic Level, City Expenditure, Population*).
  - The variables are: per capita economic level (calculated based on manufacturing, agriculture and trading output of the city), per capita city expenditures on municipal waste management (calculated from the city accounts), and per capita volume of municipal solid waste generated in the city.
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# ***Municipal waste management as an element of the sustainable development of cities***

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The analysis led to the following conclusions:

- economic level of the city can be explained for higher generation of municipal waste over the time periods,
  - municipal waste generation can be explained by the city expenditure for waste management over the time periods.
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## ***The problem of municipal waste on the example of selected Polish cities***

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In order to build an effective waste management system, it is necessary to understand the scale of the municipal waste problem.

The article analyzes the basic measures characterizing waste management in Polish cities in the years 2004 and 2012.

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***Rates of relative growth based on a fixed value(2004 = 100%) for municipal waste collected from public and private sectors in 2012 [%]***

Specification	Grand total	Cities
Collected municipal waste (in thous. tones)	98.17	83.69
Number of controlled landfill sites in operation	50.24	58.18
Area of controlled landfill sites in operation (in ha)	64.92	74.22
Area of controlled landfill sites in operation reclaimed during the year ( in ha)	305.21	223.08
Number of closed controlled landfill sites	69.32	52.94
Area of closed controlled landfill sites (in ha)	76.62	38.43
Area of closed controlled landfill sites reclaimed during the year (in ha)	144.50	27.59

## ***Rates of relative growth based on a fixed value (2004 = 100%) for mixed municipal waste collected in selected cities***

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- The quantity of waste collected in trade, small business, offices and institutions increased the most in Bydgoszcz – by as much as 172.73%. An increase was also observed in Gliwice and Legnica (50%), Lublin (38.89%), Krakow (8.11%). The quantity of collected mixed municipal waste produced by trade, small business, offices and institutions in Rzeszów remained unchanged. The other cities observed a decrease of this type of waste with reference to small business, offices and institutions – with the biggest drop in Białystok (60%) and Warszawa (58.07%).
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## ***Rates of relative growth based on a fixed value (2004 = 100%) for mixed municipal waste collected in selected cities***

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- In the case of municipal services, the highest increase of the quantity of waste was evident in Lublin and Olsztyn - 600% and 400% respectively. Other cities with an increase were Poznań (75%), Katowice (40%) and Gdańsk (30%). The same quantities of municipal waste as in the year 2004 were collected in Bydgoszcz and Legnica in 2012. The other cities recorded a decrease in the quantity of municipal waste from municipal services with the steepest drops in Sosnowiec (87.5%) and Gliwice (85.71%).
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## ***Rates of relative growth based on a fixed value (2004 = 100%) for mixed municipal waste collected in selected cities***

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- Various trends were also observed in the quantitative changes of municipal waste collected in households. Here, the dominant tendency was the decrease of municipal waste in 2012 in comparison to the year 2004. The biggest decrease was observed in Poznań (49.81%) and in Białystok (41.11%), and the smallest in Gdańsk (8.70%). The quantity of collected municipal waste from households increased in Wrocław, Lublin, Toruń, Gdynia, Sosnowiec and Rzeszów, with the biggest increase in Sosnowiec (46.67%). The amount of waste in Gliwice did not change in the analyzed years.
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***Rates of relative growth based on a fixed value (2004 = 100%) for mixed municipal waste collected in selected health resorts [%]***

Health resorts	Collected municipal waste	
	total	from households
Sopot	141.08	94.83
Inowrocław	78.84	91.66
Kołobrzeg	94.93	89.57
Świnoujście	121.04	84.56
Augustów	74.01	93.11
Ustroń	105.53	87.84
Konstancin Jeziorna	72.28	62.87
Ustka	101.50	85.66
Busko-Zdrój	86.00	54.19
Ciechocinek	117.66	184.64
Kudowa Zdrój	52.96	37.92
Jedlina Zdrój	210.25	144.76
Krynica Zdrój	53.14	59.34
Duszniki-Zdrój	82.06	137.93
Gołdap	83.01	85.05
Polanica Zdrój	51.80	50.25
Szczawno Zdrój	90.66	90.81
Rabka Zdrój	84.12	44.23

## ***Share of collected municipal waste from households in municipal waste collected in total [%]***

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- ❑ First point In most analyzed cities the share of collected municipal waste collected from households in municipal waste collected in total in 2012 was smaller than in 2004. In Rabka and Busko-Zdrój the difference exceeds the level of 30%. It can be caused by either a considerable reduction of this type of waste or a steep increase in the quantity of municipal waste from other sources.
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## ***Share of collected municipal waste from households in municipal waste collected in total [%]***

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- ❑ In the majority of the cities the share of the municipal waste collected from households was bigger than 50% in both years. There were exceptions though: Ustroń, Kudowa-Zdrój, Krynica Zdrój i Rabka Zdrój in the year 2012 and Ustroń, Ciechocinek, Krynica Zdrój i Duszniki-Zdrój in the year 2004. Therefore, the municipal waste collected from households is the dominant group of waste.
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## ***Share of collected municipal waste from households in municipal waste collected in total [%]***

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- ❑ The highest share of municipal waste collected from households was observed in Szczawno (92.15%), Inowrocław (91.15%) and Augustów in the year 2012 and in Jedlina Zdrój (92.06%), Szczawno (92.00%), Busko-Zdrój (91.54%), Sopot (90.72%) and Ustka (98.78%) in the year 2004.
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## ***Conclusions***

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- ❑ The quantity of waste produced per capita during a year serves as an index which can be used in the assessment of the level of sustainable development in terms of environmental governance. Polish share in the total quantity of municipal waste in the EU in 2012 was 4.9%. That, with the amount of 314 kg of waste per capita in 2012, ranked Poland 24th out of 27 EU countries. Only the Czech Republic, Latvia and Estonia had a smaller quantity of municipal waste per capita.
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## ***Conclusions***

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- ❑ The quantity of municipal waste collected in cities in 2012 was smaller than in 2004 by 16.31%. Also the number and the area of landfill sites in cities shrank. Data show that the decrease of the waste collected in total and per capita in individual cities is a dominant trend. Municipal waste is a more complicated problem in spa cities though. The average annual quantity of waste collected per capita tends to be overestimated by the large tourist traffic connected with the resort functions of these cities.
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## ***Conclusions***

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- ❑ Generation of municipal waste is inherent in the functioning of urban communities. Yet it is possible to minimize its negative environmental impact through proper waste management systems which, apart from ecological effects, can also bring economic and social perks. That is why municipal waste management is a significant element of the sustainable development of cities.
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