Urban waste for biomethane grid injection and transport in urban areas

Project No: IEE/10/251

Municipal waste management in Gdynia/Poland

WP3 – Task 3.4 / D 3.3

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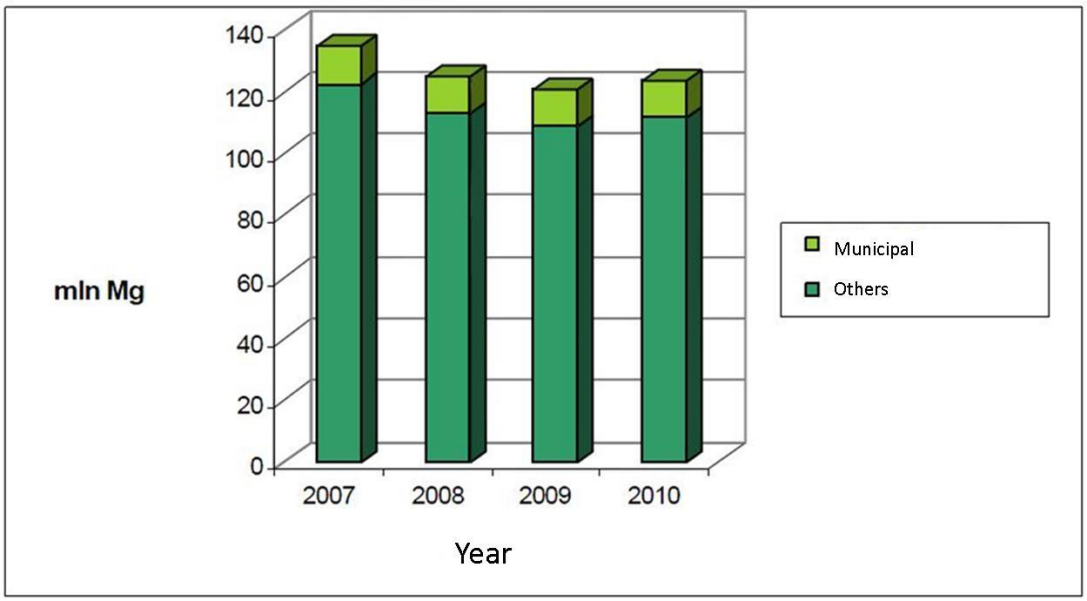
Contents

1 Introduction

The main source of figures on municipal waste market are documents of the Central Statistical Office, and documents such as plans and reports Ministry of Environment. In particular it is the National Waste Management Plan drawn up for a period of four years and report on its implementation. Main Data Statistical Office for the area in question are presented primarily two cyclical industry publications: Environmental Protection and Infrastructure Municipal. For international comparisons used data from Eurostat.

2 Overview of municipal waste management

2.1 Municipal waste generation in Poland



Pic. 1 Amount of total waste generated in Poland

As the chart above shows the amount of waste generated in 2007 amounted to 134 million tonnes (Mg) and decreased in the following years, reaching 120 million tonnes, followed in 2010 increased to 124 million tonnes. During this period, the amount of municipal waste accounted for approximately 9-10% of the total waste, amounting to just over 12 million tonnes. Comparing the year 2007 by 2010, decrease in the amount of municipal waste generated was less than 1.8%.

It must be remembered that not all municipal waste generated was collected.

According to estimates, nearly 10% of the generated municipal waste in Poland goes to unreported environmentally sound manner.

In 2010 Poland produced 11.8 million Mg (tons) of municipal waste, including:

- 10.4 million Mg unsorted municipal waste,
- 243 thousand. Mg of municipal waste collected selectively,
- 440 thousand. Mg of waste from gardens, parks and from markets,
- 251 thousand. Mg of waste from cleaning of streets and squares,

• 451 thousand. Mg large dimensions waste.

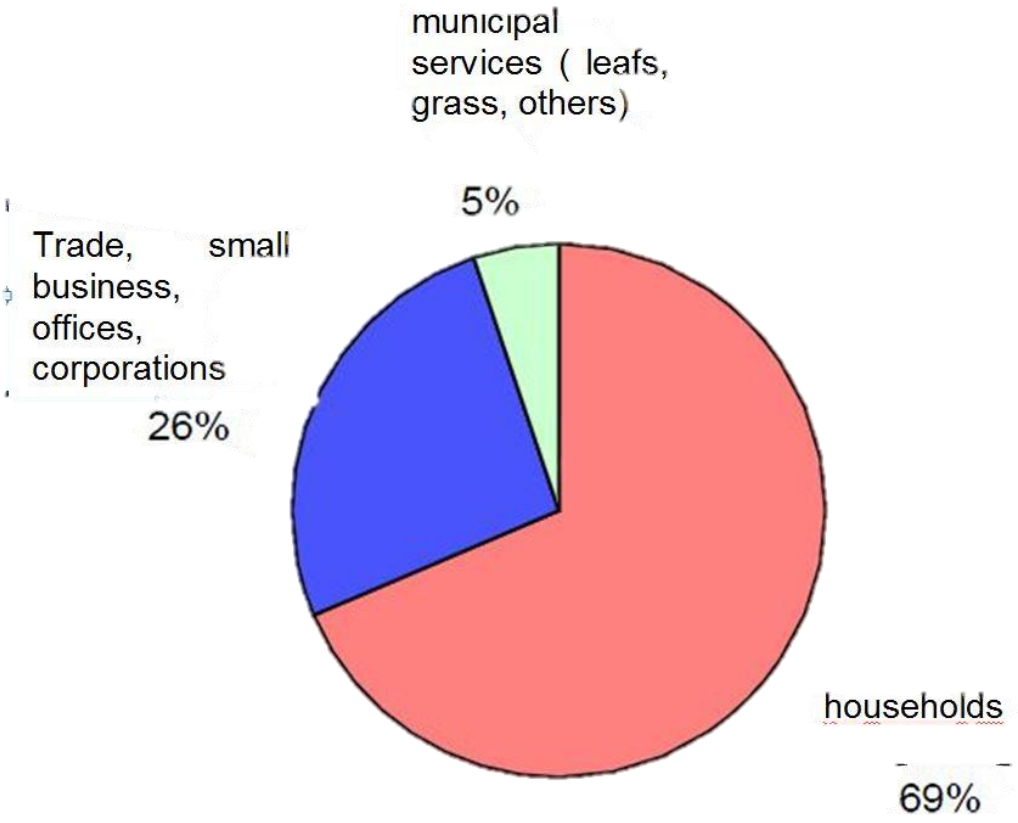
The largest amount of waste produced in the southern Polish region in Śląskie (41.9% of the total flow), Lower Silesia (26.9%) and Lesser Poland (7.3%). The smallest amount of waste created in the Lubuskie (0.5%), Warmia-Mazury (0.5%) and Podlaskie (0.7%).

The quality of waste is only statistically known however this numbers cannot be used for biogas production planning.

From statistical numbers there is also signal that amount of separately collected waste growing. That shows the awareness of society growing.

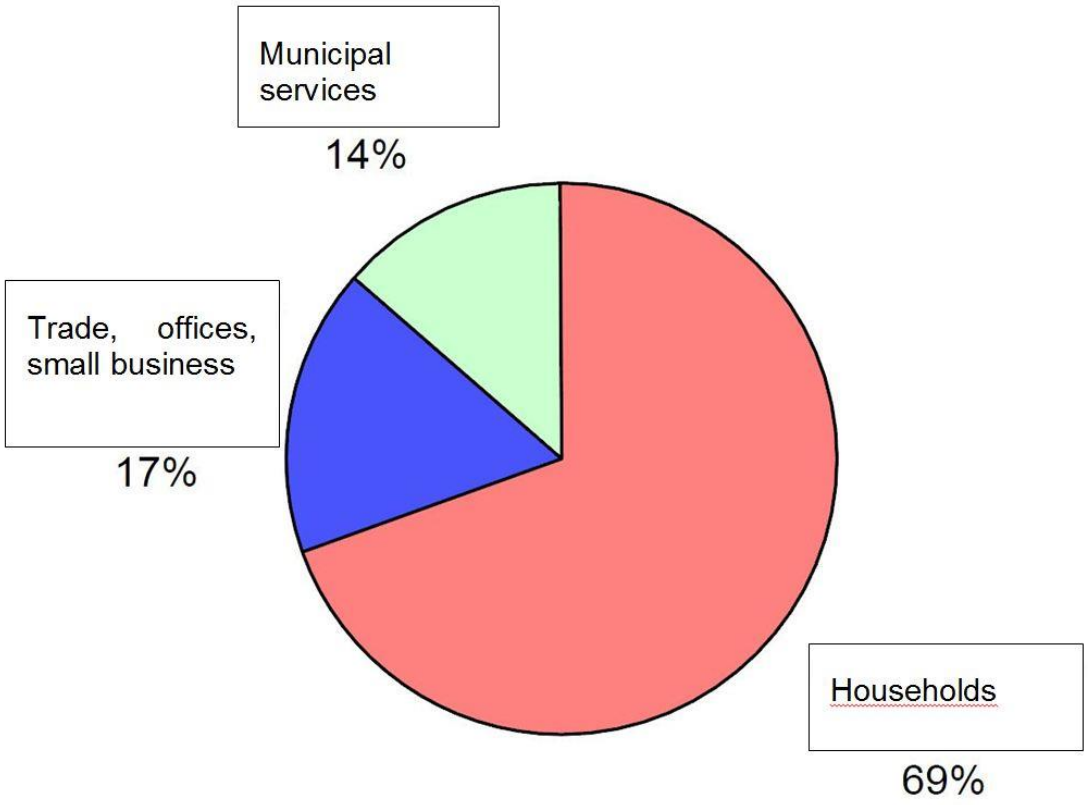
Territory	**Mixed municipal waste is waste collected within one year without waste collected separately and segregated from the dry fraction.**				
	2008	**2009**	**2010**	**2011**	**2012**
	t	**t**	**t**	**t**	**t**
Poland - mixed	9353923,21	9264627,49	9180194,28	8843480,26	no stat. data
POMORSKIE (voivodeship with Gdynia) mixed	645164,14	656806,98	637515,75	622173,19	no stat. data
POMORSKIE – percentage mixed	94,8%	94%	93,3%	92,1%	No stat. data
POMORSKIE – percentage collected separately	5,2%	6,0%	6,7%	7,9%	No stat. data

2.2 Municipal waste management system in Poland



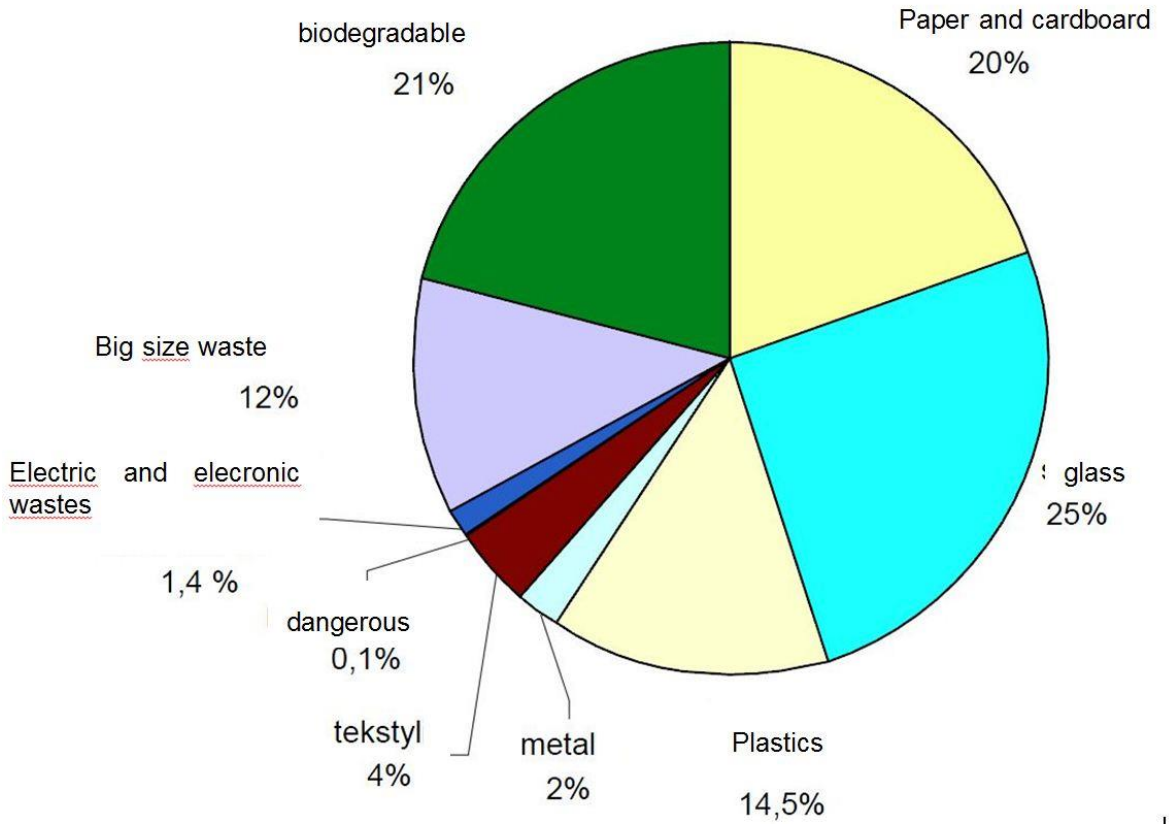
Pic. 2 The structure of **mixed** municipal waste collected by location and methods of collecting in 2011

From the above chart shows that about 69% of mixed municipal waste collected is received by households. In this structure can also be distinguished companies and institutions (26%) and utilities (street cleaning, emptying bins in parks and on the streets), which provided for the development of 5% of the collected waste municipal.



Pic. 3 The structure of municipal waste **collected selectively** by location and methods of collecting in 2011**.**

From last two charts we can conclude that people care less for selective collecting in place of work, and municipal services cares more for selective collecting. Admirations of public use buildings, office buildings should take care more about selective collection in buildings.

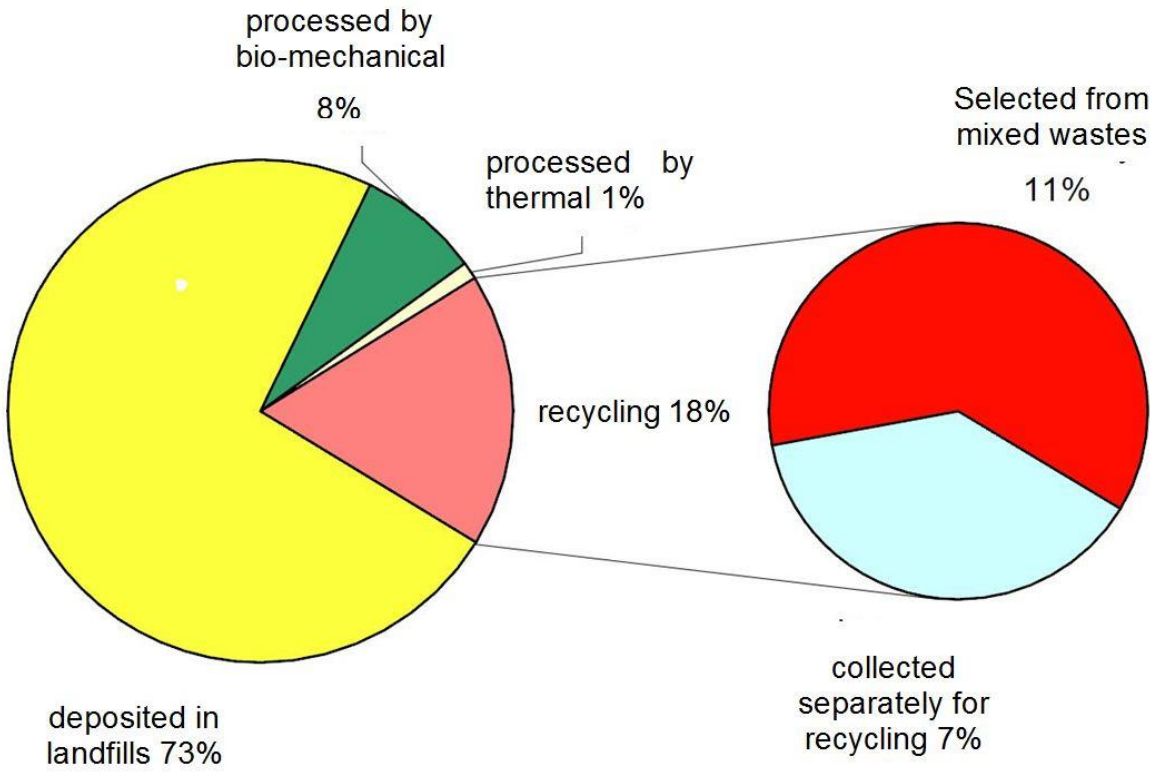


Pic. 4 The share of each category of waste by weight of municipal waste collected separately in 2010

As can be seen from the above chart, segregated municipal waste, otherwise known as selectively collected are: glass (25%), biodegradable waste (21%), paper and cardboard (20%), plastics (14.5%). From point of view of project Urban Biogas most interesting is biodegradable part. However it's only randomly tested for dangerous substances but not for using in biogas plants.

Disposal methods of municipal waste collected

As mentioned earlier in this chapter, the same waste collection eg. municipal reception from the locals is just the initial step in the process management of municipal waste. After that, there always comes a time to development through disposal (landfill or deposit processing) or recycling. The share of individual management methods municipal waste presented in the following graph



Pic. 5 Structure (in percent). Collected waste management method municipal by the number of tonnes in 2011

Specific issues governed by the law of waste management:

Act dated 13 September 1996 on maintaining cleanliness and order in the communities

Act dated 20 January 2005 on recycling of end-of-life

Act dated 24 April 2009 on batteries and accumulators

Act dated 29 July 2005 on waste electrical and electronic equipment

Act dated June 1997 on the prohibition of the use of products containing asbestos

Act dated 11 May 2001 on packaging and packaging waste

Act dated 11 May 2001 on the obligations in the field of management of certain waste and the product fee and deposit fee

Act dated June 2007 on the international shipment of waste

Act dated 16 March 1995 on the Prevention of Pollution from Ships

Act dated February 4, 1994 - Geological and Mining Law

Act dated 10 July 2008 on mining waste

Act dated 29 November 2000 Nuclear Law

The targets are specified in Polish Parliament resolution of 22 May 2009 on the adoption of the "National Environmental Policy for 2009-2012 with perspectives till Year 2016"

At the central level has been adopted National Waste Management Plan. Plans adopted at lower levels should take into account the findings of higher-level plans. The waste management plans shall be updated at least every four years. For this moment valid

document is The Council of Ministers Resolution No. 233 of 29 December 2006 on the "National Waste Management Plan 2010"

Plans for municipal waste management in Poland

Waste Management Plan for the Pomeranian to 2018 -Department of Environment and Agriculture Office for Environmental Policy

Now updated National Waste Management Plan provides for the construction of a network of regional Polish waste management facilities (170) for achieving the required levels of recovery and waste: biodegradable large-scale construction and renovation, hazardous (composting, sorting, fermentation equipment, dismantling stations bulky waste and construction and repairs).

There will also be construction of 10 objects of thermal utilization of municipal waste. There is one planned in Gdynia area. The planed facility is more than 50 km from Gdynia.

2.3 Municipal waste management system in Gdynia

According to art. 3 of the Act on waste, municipal waste is the waste generated by households and waste containing hazardous waste from other waste producers, which, because of its nature or composition, is similar to waste from households.

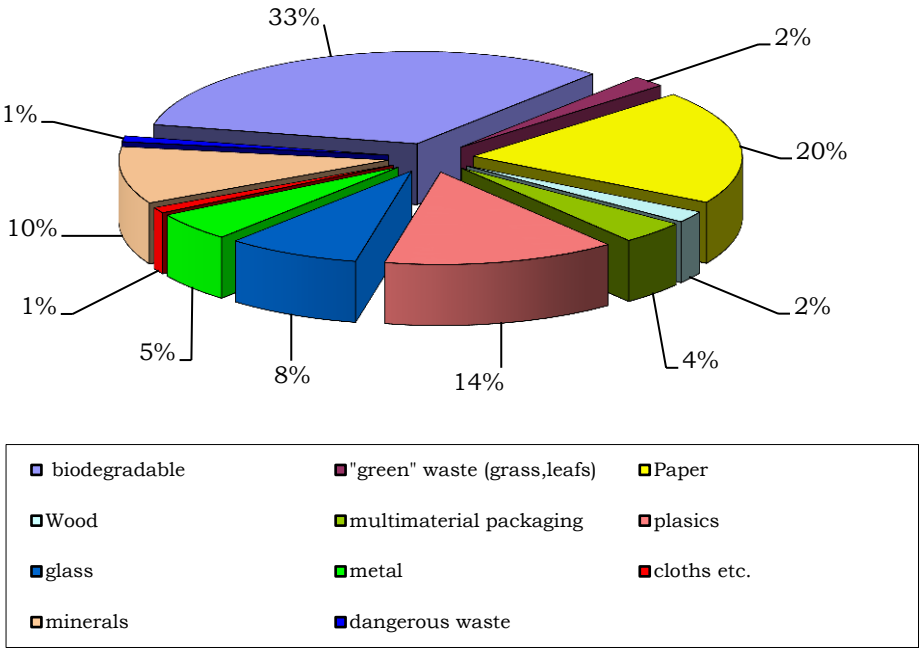
The sources of municipal waste are:

- Households,

- Infrastructure facilities such as trade, services and crafts, education, industry in the "social", tourist facilities, markets, and more.

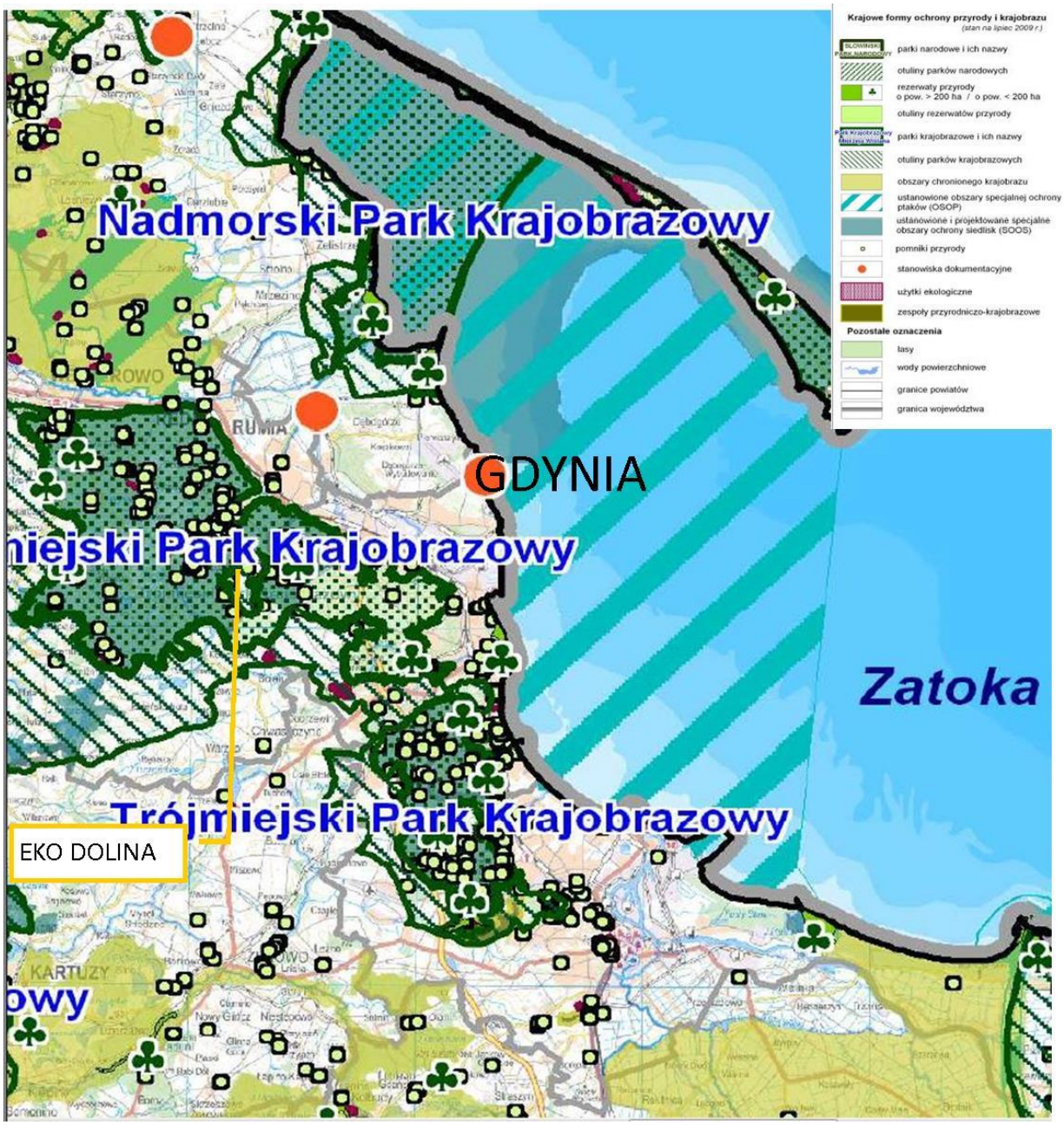
Gdynia district	Mixed municipal waste is waste collected within one year without waste collected separately and segregated from the dry fraction					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
	t	**t**	**t**	**t**	**t**	**t**
Total mixed	98 953,50	94 254,58	98 138,40	88 897,14	88 703,12	No data:
Households mixed	53 581,89	59 941,59	56 193,45	53 092,27	52 250,06	No data:

Pic. 6 Structure of mixed waste in Gdynia district based on national stat. data 2011-last available year



The important thing for Gdynia is that the amount of waste during summer holidays drastically growing. Building bio-waste utilization facility must be included for example highest weekly value of resources.

Gdynia have a plan of waste management for years 2008 - 2014. The plan is on implementation. There is also Waste Management Plan for the Pomeranian to 2018 - Department of Environment and Agriculture Office for Environmental Policy accepted in June 2012. The Plan for Pomeranian voivodeship is parent document for municipality plan. The main utilisation company is Eko Dolina.



Pic. 7 The map with Eko dolina and City Gdynia

On the map above we can find Eko Dolina – utilization company surrounded by protected landscape area “Trójmiejski Park Krajobrazowy”. The good point of this location is that there is no large population centres- eventual information campaign in area will bring positive effect easier.

3 Technical requirements for biowaste management system implementation

3.1 Biowaste collection systems / approaches

At this moment a waste collection is a subject of contracting between municipality of Gdynia represented by the President of City Gdynia and company which will give best offer fulfilling

terms of reference (SIWZ). The terms contains percentage values of recycled wastes. Fractions to obligatory recycle: paper, metal, plastic materials and glass. For each year percentage value of recycled growing starting 2013 -12%, 2014 – 14% and 2015 – 16%. Quantity of recycled waste must be confirmed after every quarter of each year. A report about quantity of wastes must be reported every month. The winner of the contest have to deliver waste to utilisation facility or recycle separate collected fractions by their own or by licenced companies. The company Region Eko Dolina is a the regional plant for processing waste (MBP, management of green waste storage MBP residues and municipal waste sorting). The total number of population serviced by EKO Dolina was 460 527 people (GUS 2010)

Name of community	District	Number of people
Gdynia	**City Gdynia**	**247 324**
2. Sopot	City Sopot	38 141
3. Kosakowo	pucki	9 710
4. Luzino	wejherowski	14 116
5. Reda		20 959
6. Rumia		46 107
7. Szemud		14 722
8. Wejherowo (City Area)		47 794
9. Wejherowo (Rural Area)		21 654

3.2 Biowaste proceeding (treatment) technologies / solutions.

Today physical chain of waste is: people – transport company – utilisation and recycling companies.

Main treatment company is Eko Dolina (Eco Valley). Surface area of the plant is 39,74 ha.

During the year, the plant gets about 185 thousand Mg of waste, including about 140 thousand. Mg of municipal waste.

In the period 1998-2005 carried out the first stage of construction of the plant, while in 2008-2010, the project "Waste Management for Dolina Redy and Chylonki" completed the second phase of expansion of the plant. As a result of the modernization of the plant in Łężycach has become one of the most modern waste management in Poland. Eco Valley through the use of modern technologies for the recovery and disposal of waste meets the environment standards of EU and national.

Equipment the plant:

1 Sorting of mixed-100 000 Mg / year - 2 shift work - 150 000 Mg/rok- 3 shift work;

2 Composting of green waste-6 000 Mg / year;

3 Composting Hard-30 000 Mg / year;

4 Segment accepting waste from individual suppliers;

5 Temporary storage of hazardous waste collection;

6 Segment dismantling bulky waste-15 000 Mg / year;

7 Segment dismantling refrigeration and equipment RTV/AGD- 550 Mg / year;

8 Box for sorted waste storage 100 000 m^3;

9 Box storage of construction waste-70 000 m^3;

10. Segment crushing of construction waste;

11. **Segment utilization of landfill biogas-power about 2 MW_e;**

12. Screening and treatment of leachate-117 m^3/day;

13. Boxes for recyclable materials;

14. Covered boxes for temporary storage of recyclable materials;

15. Flat non-hazardous waste and inert (B2) - 1 020 thousand m^3;

16. Weighbridge for trucks;

17. Cleaner for wheels and car chassis;

18. Operating heavy equipment to the repository;

19. Administrative and social facilities, workshop facilities.

Estimates show that in the region of Eco Valley in 2010 produced 172 159 Mg mixed municipal waste, of which over 56% of biodegradable waste - 96 858 Mg. In 1995, the region has produced 63 493 Mg of biodegradable. In accordance with the requirements of the EU in 1995 is the base year for determining the limits landfill of biodegradable waste.

The capacities of regional plant for municipal waste treatment, functioning in the region - RIPOK Eco Valley. Mechanical parts processing capacity MBP is 150 000 Mg/year, and biofraction processing capacity of the area - 30 000 Mg/year

The ability of management of separately collected green waste and other bio-waste is 6 000 Mg / year.

The analysis of the data provided in the tables above show that the production capacity RIPOK[1] Eco Valley may not be sufficient in 2013 to utilize both separately collected green waste and other bio-waste and biodegradable waste produced in the process of MBP. In the region

This should be carried out detailed monitoring of the actual amount of biodegradable waste and consider the possible need for the expansion or construction of a new plant processing the biodegradable fraction originating from the municipal waste stream. This is real opportunity for biogas plant. This solution is also considered in voivodeship waste management plan.

It is estimated that in 2020 in the region of Eco Valley weight of biodegradable municipal waste degradation will require development was 72 926.0 Mg.

[1] RIPOK regionalna instalacja przetwarzania odpadów komunalnych – regional installation for processing communal waste.

It is estimated that in the region of Eco Valley for 15 years to build more than 767 thousand. m^3 waste mechanical processes - biological treatment of mixed municipal waste and residues from the sorting of municipal waste to be landfilled. Capacity of landfill in RIPOK Eco Valley is enough to collect the amount of waste.

The most important point of Eko Dolina development strategy is construction segment for alternative fuel production from waste 60 000 Mg / year. That is “green light” for biogas plant.

The recycling is supported by REKOPOL. Rekopol Recovery Organization was founded by leading Polish and international companies, in order to protect and represent the interests of producers and importers of packaged products, and therefore imposed on companies financial responsibility for the collection and recycling of packaging the products they place on the market. The strategic objective of the organization Rekopol recovery is reliable and effective implementation of the statutory duties imposed on businesses by the Polish law and the European Directive 94/62. To achieve this ambitious objective, Rekopol focused on developing a system of separate collection of packaging waste covering the whole country. Is the only one recovery organization in Poland, a non-profit organization that does not make any profit from operations, and funds given to it by the industry funding are allocated for separate collection system operated in municipalities.

At this moment most part of biofraction is a subject of composting. Mixed part is stored on landfill and landfill gas is used to generate electric energy.

4 Economic and organisational considerations

4.1 current and future costs of disposal

There are estimated calculations waste cost for people in Poland:

UNIT COST OF MUNICIPAL WASTE - per 1 inhabitant specification in 2006 and in 2014	2006 PLN/Person year	2014 PLN/Person year
disposal of biodegradable municipal waste	3.3	19.6
bulky waste disposal	1.2	4.4
construction waste disposal	0.8	5.3
disposal of hazardous waste generated in the group waste	0,9	4,8
other waste disposal	50.9	47.5
Total	57.2	81.6
(Source: Based on data compiled by the IETU).		

The calculations were made before implementation national waste law (art. 9e ust. 1 pkt 1 Act on maintaining cleanliness and order in municipalities). Nowadays, in 2013 cost for people in Gdynia fees for waste are in table below

Fees for people in Gdynia.	monthly for apartment up to 40sqm	apartment up to 80sqm	bigger apartments than 80sqm and houses
Separate collection	19PLN	32PLN	39PLN
Mixed waste	28PLN	48PLN	58PLN

The fees are one of the lowest fees in a country. The city try to find a good way of cost calculation, “fair for all”

Current costs of disposal in Gdynia area are known from EKO Dolina fees guide for waste recovery and utilisation. The charges are calculated for Mg **delivered** wastes. The table contain more than 300 categories of not dangerous wastes. In table below there are few examples important from biogas point of view. Full table available at http://www.ekodolina.pl/text_pages/cennik-na-odpady-inne-niz-niebezpieczne-i-obojetne,80.html

Code of waste	A Kind of waste The last part of waste name sets the utilization way.	Total fee in PLN for utilization inc. environmental fee and VAT tax 8%. per Mg
02 01.03K	Waste from agriculture – waste mass plants cat K. – for composting	35,79
02 01.03B	Waste from agriculture – waste mass plants cat. B – for storage	253,04
02.01.83 Z/K	Waste from agriculture – waste mass from aquaculture cat. Z or K – for composting	34,64
02.01.83 B	Waste from agriculture – waste mass from aquaculture cat. Z or K – for storage	145,75
02.02.01K	Food processing wastes of animal origin – from wash and preparing raw materials – to composting	237,81
02.02.03 Z/K	Food processing wastes of animal origin – raw materials and products not suitable for consumption – to composting	423,68
02.02.03 B	Food processing wastes of animal origin – raw	484,37

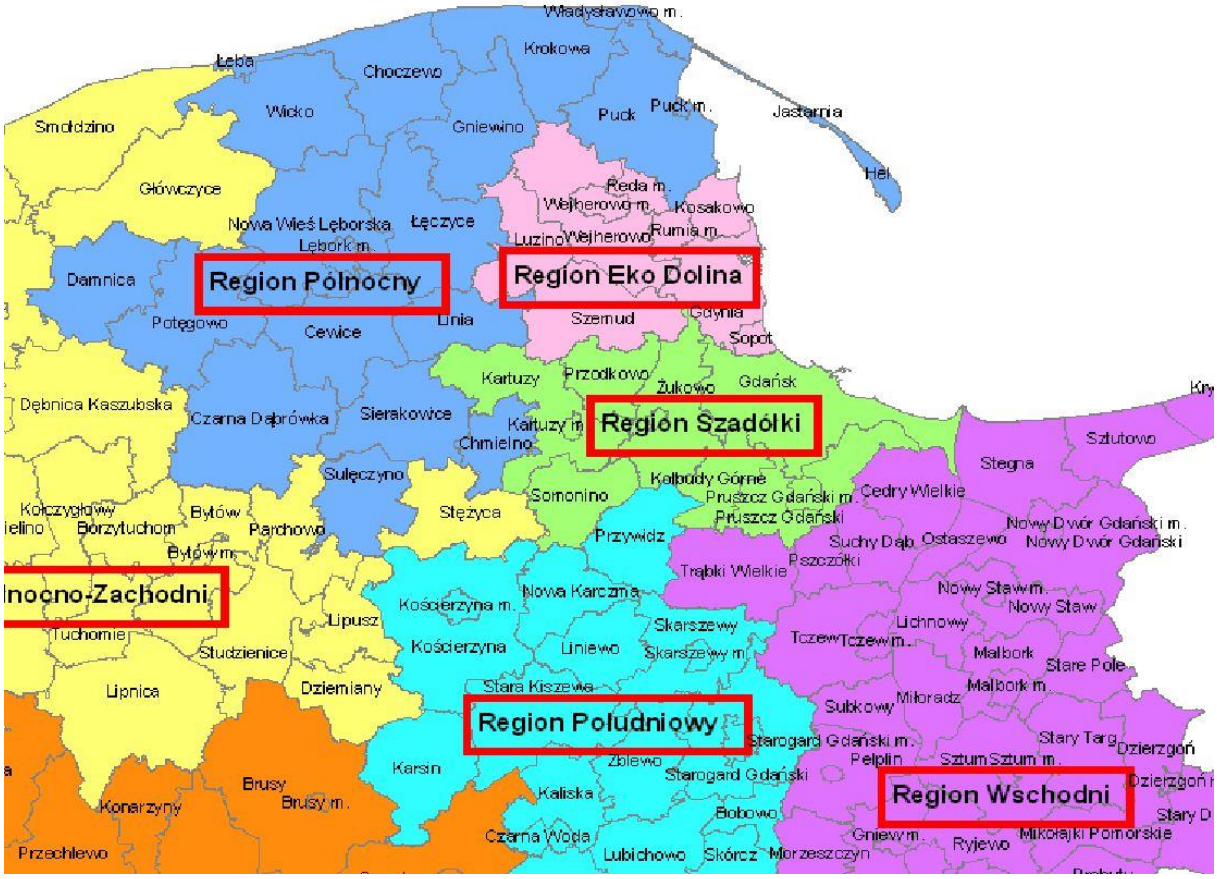
	materials and products not suitable for consumption – to storage	
02.03.01 Z/K	Food processing wastes of plant origin, and from alcohol production – slime from wash and centrifugation and separation raw materials – to composting	505,66
02.03.01 B	Food processing wastes of plant origin, and from alcohol production – slime from wash and centrifugation and separation raw materials – to storage	145,20
02.03.04 K/Z	Food processing wastes of plant origin – raw materials and products not suitable for consumption – to composting	505,66
02.03.04 B	Food processing wastes of plant origin – raw materials and products not suitable for consumption – to storage	508,22
02.03.80 A	**Food processing wastes of plant origin – mill cake, slime, and other waste materials from plant processing - to technological purposes (without 02.03.81)**	66,95
02.03.80 Z/K	Food processing wastes of plant origin – mill cake, slime, and other waste materials from plant processing - to composting (without 02.03.81)	70,42
02.03.81 Z/K	Animal food processing wastes of plant origin - composting	70,42
02.04.80 Z/K	Sugar producing waste – mill cake from sugar beet – to composting	123,52
02.06.80 Z/K	Bakery and confectionery waste – unsuitable fat – to composting	193,94
02.07.04 Z/K	Bakery and confectionery waste – raw materials and products not suitable for consumption – to composting	238,96
02.06.01Z/K	Bakery and confectionery waste – raw materials and products not suitable for consumption – to composting	490,64
16.03.80 Z/K	**All food product after the expiry date**	**495,23**

19.05.02 Z/K	Not composted waste fractions from plant and animal origin – to composting	141,99
19.08.09 Z/K	**Waste from waste water plants -Fats and oils mixtures from water-oil separation containing only eatable oils and fats – to composting**	**245,88**
20.01.25 Z/K	**Municipal waste from selective collecting – eatable fats and oils – to composting**	**208,76**
20.01.08 K	**Municipal waste from selective collecting – biodegradable kitchen waste – to composting**	**49,66**
20.02.01 Z/K	**Municipal waste from gardens and parks biodegradable – to composting**	**208,76**

The table contains only examples of fees for “useful” fractions. Waste classification is fluent. There is possibility to make formal change of classification under few conditions like chemical tests of waste- for dangerous waste. However if there will be biogas plant with pre-treatment facility making available to carry out at least some waste from group above there will be reason to make some changes in fee guide. There will be more groups classified A - to technological purposes with lower fees. That will motivate waste producers and collecting companies to taking care of quality of waste. At the same time Eko dolina (Eco Valley) realizes purchase selectively collected recyclable waste (some fractions).

4.2 contract durations;

The City Gdynia issued a tender for the transfer of garbage to utilization or recycling. At this moment in the most important region, seven districts of Gdynia tender was won by collecting company Sanipor. The contract can be broken if company will not fulfill requirements of agreement. The Eko Dolina is obligatory utilization company for this area of Pomeranian and there is no time limit for this activity.



Pic. 8 Utilization regions of Pomeranian

4.3 Legal requirements / improvements for biowaste management system implementation

On national level main legislation document is Act of 1 July 2011 amending the Act on maintaining cleanliness and order in municipalities and other acts. The requirements of act are spread over time. Art. 9 Section 2 shall enter into force on 9 August 2011, Art. 1, paragraph 17 of Article added. 9x paragraph. 1 point 4 and 5, para. 2 and 3, Art. 9y paragraph. 1 point 4 and 5, para. 2 and 3 and art. 9z paragraph. 1-3 shall enter into force on 1 January 2013, Art. 1, paragraph 17 of Article added. 9z paragraph. 4 shall enter into force on 1 July 2013. This Act in respect of its regulation implementing the following Directives:

1) Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment (OJ. L 135, 30.05.1991,P. 40, as amended. d., Acts. Office. Polish special edition, Chap. 15, v. 2, p 26);

2) of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ. L 182, 16.07.1999, p 1,later. d., Acts. Office. Polish special edition, ch. 15, v.4, page 228);

3) Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives (OJ. L 312, 22.11.2008, p 3-30). "

This national act give many possibilities for biogas plants development. Requirement of separate collecting , level of recycling and decreasing of biofraction stored on landfills makes perfect surround for biogas utilisation plant.

4.4 Business model for the biowaste management

At this moment business model basing on agreements between city and collecting company Sanipor. However the plans for biogas plant in Eko Dolina facility could change existing business model.

5 Involved parties in the biowaste management chain in Gdynia

From the perspective waste management in Gdynia, we can distinguish four groups of stakeholders:

- bodies involved in the organization and management – municipality Gdynia and municipal association of municipalities (association focus municipalities: Gdynia, Reda, Rumia, Wejcherowo, Sopot, and communities Kosakowo, Wejcherowo, Szemud , code name: KZG)
- operators performing tasks – collecting, transporting and recycling companies
- operator that control the course of the implementation and effects of collecting and recycling – President of city Gdynia
- property owners –residents- producers of waste and observers of utilisation system.

6 Strategy proposal for a biowaste use in production of biomethane in Gdynia

Nowadays collection system runs on rules written by Waste Management Plan for the Pomeranian to 2018 and Environmental program, including waste management plan for years 2008-2010 including perspective for 2011-2014 for city Gdynia. It is assumed that center of the weight mixed – selective collection will move to selective site. This will be caused by financial promotion made by Eco Valley for collecting companies. The mechanism is easy more selective – lower fees and for some fractions additional salary. This will translate to promotions for people – discount for waste separation at source. In this environment will be possibility for Eko Dolina to build biogas plant. Having separated bio fraction it is much more effective to make biogas in reactor than making landfill gas. Desulfurized biogas might be used at existing cogeneration unit or can be sold to waste operator as fuel. For example: waste truck based on Mercedes Econic can run on poor biometan (desulfurized). That could make a perfect symbiosis between two key actors of waste market. Using (bio)methane truck will gave additional environmental impact to society for separate collection. Other point of this action is that the large part of Eko Dolina collecting area are protected landscape area that means the diesel fuel trucks are not welcome because of pollution they make.

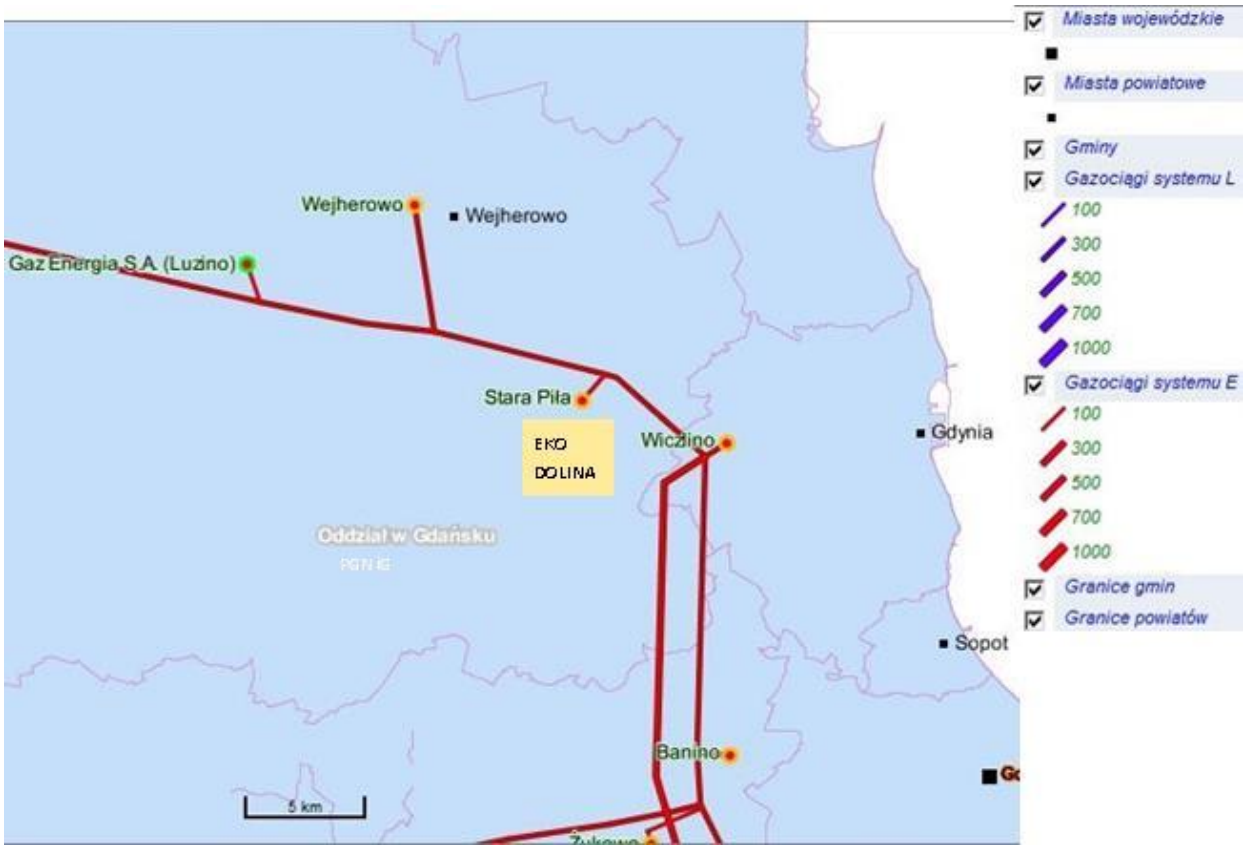
There is no possibility to make biogas plant for bio fraction at wastewater plant. There is a anaerobic digestion unit in waste water plant.

The big threat for profits from selective collecting is waste market penetration by Swedish companies searching cheap sources for thermal utilization – producing energy at their own territory.

The biggest opportunity is financing program GEKON (Generator Koncepcji Ekologicznych – generator of ecologic concepts, http://program-gekon.pl/) in NFOŚiGW where one of the points is “Innovative methods of obtaining fuel, energy and materials from waste and recycling”. Program supports whole cycle from design, testing to full scale start-up. In this case project can contain biogas upgrade facility for production clean biomethane – useful

fuel for all matene (NG)– cars. In Poland scale upgrading is innovative because there is no upgrade in whole country. Additional innovation could be use of GHP heat pump for cooling and heating in “wash” biogas process. GHP is a heat pump running on any methane which could decrease drastically cost of upgrade operation.

Other option for upgraded biomethane is plug in to national natural gas net. The nearest line and junction points are Wiczlino and Stara Pila. On the map below clearly shows that the pipeline could power the main network.



Pic. 9 Natural gas pipeline at Eko Dolina neighbourhood.

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Environmental program, including waste management plan for years 2008-2010 including perspective for 2011-2014 for city Gdynia t. 2 –waste management – act number XXIII/557/08 City Council Gdynia 24th September 2008.