Sustainability study of the Integrated system for managing communal waste in Georgia

Variants of the energy waste utilization pursuant to the waste management plan

Sorting plant in Georgia - concept / 2022

TEAM

Project manager:

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Much of the investment units are still launched without proper analysis, which is methodically processed in the feasibility study. Just such a study protects us from failure after starting investment unit. Our company is particularly interested in building a “turnkey”, which can not do without proper study. The concept of building a “turnkey” for us means completely comprehensive assessment of all aspects of investment. Try out our years of experience.

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The company IVP CZ a.s. builds on a long tradition and experience in the production of technologies for waste management and waste treatment.

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INTRODUCTION

The purpose of the study is to prepare a proposal of a possible system for managing mixed communal waste (MCW), including large-volume waste (LVW), produced in towns and cities in Georgia, the manner of its collection, moving, transport and final usage, particularly considering the construction of the facility for energy utilization of the RDF waste in the HEIDELBERG CEMENT Kaspi cement plant. We perceive partial sorting with a further use in bigger cities, such as Batumi, Zugdidi and Achalciche, and possibly others, as intermediate stages. For an effective collection and transport, we recommend using a network of pressing transfer stations with a high efficiency, while saving transport cost. We marked some of them on the map. When preparing the study, we use the information collected from individual regions, which needs to be continuously updated. The study proposes two project stages with minimizing the possible risks. RDF sale is ensured in Kaspi, and the production volume can increase by building another processing plant in Kutajsi.

1

INPUT INFORMATION

1.1 MCW and LVW balance

The basis for preparing the balance of the produced waste is the EVI waste record keeping system. We can use the available annual data since 2019.
The total communal waste production shows, more or less, constant values with a slight linear growth with an annual deviance of up to 10 %. The long-term average amounts to 429,700 tons of CW per calendar year.
The most significant share of the communal waste production is represented by mixed communal waste, volume of which has been practically constant and amounts to approximately 340,000 tons per year, with a slight gradual growing trend.
A more significant growth can be seen when it comes to high-volume waste. Organizations are some of the entities they have a share in this trend.
The values of the production of a separate collection of paper, plastic and glass have been obtained from systems operated by towns, i.e., without the participation of any organizations.

In 2020, the total waste volume grew by approximately 20,000 tons when compared with the previous year. The changes were not recorded for the MCW or LVW. They are mostly due to soil and stones or biologically degradable waste.
From the perspective of the Study, the total volume of the communal waste production is used as the calculation volume. This value is approximately 330,000 tons of CW per year.

Recycled plastics are recycled forms of plastics or residues from municipal, industrial, commercial and consumer waste. The growing environmental impact of plastic disposal is a key growth factor for the recycled plastics industry.
Plastic products are non-biodegradable and they are often disposed of directly in landfills. The problems associated with its method of disposal are environmentally harmful in the long run, because its decomposition takes a long time.
Based on the type, recycled plastics are divided into polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polystyrene (PS) and others. Other recycled plastics include polycarbonate (PC), polyamide (PA).

Table 1: Overall communal waste production, including the production of MCW, LVW, paper, glass and plastic in 2017–2021

Catalogue number	Waste type name	2017	2018	2019	2020	2021	Total
15 01 01	Paper and cardboard packages						
15 01 02	Plastic packages						
15 01 07	Glass packages						
20 01 01	Paper and cardboard						
20 01 02	Glass						
20 01 39	Plastic						
20 03 01	Mixed communal waste						
20 03 07	Large-volume waste						
TOTAL CW							

1.2 Analyses of the communal waste samples in selected localities and built-up areas

The basic used methodology for monitoring communal waste composition and characteristics is the standard sieve analysis.

Analyzed fraction granularity:

- fractions larger than 40 mm
- fractions smaller than 40 mm

Fractions that are larger than 40 mm are subjected ti a complete substance analysis (9 substance groups). Fractions that are smaller than 40 mm are neither sorted, nor examined.

We have conducted a total of 5 one-time analyses of the composition of the communal waste samples in three seasons in five locations:

Table 2: Overall results of the communal waste analyses

Entire year		Weight (kg) Cities	Weight (kg) Housing projects	Weight (kg) Countryside	Weight (kg) **Everything**	Volume (m^3) Cities	Volume (m^3) Housing projects	Volume (m^3) Countryside	Volume (m^3) **Everything**
Fraction	Substance group	% of the whole	% of the whole	% of the whole	**% of the whole**	% of the whole	% of the whole	% of the whole	**% of the whole**
larger than 40 mm	Biowaste	29.2	38.4	21.8	**28.8**	14.5	20.9	13.1	**15.6**
	Incinerable waste	15.9	8.9	11.8	**13.0**	11.2	8.9	10.2	**10.3**
	Plastic	10.1	9.2	9.7	**9.8**	37.4	34.8	40.1	**37.7**
	Paper/cardboard	11.3	8.5	7.0	**9.2**	19.8	18.5	12.4	**17.2**
	Glass	5.1	4.2	5.6	**5.1**	2.1	1.6	2.6	**2.1**
	Textile	4.6	2.7	3.5	**3.8**	4.1	2.4	3.6	**3.6**
	Mineral waste	2.5	3.5	4.6	**3.4**	0.6	0.8	1.2	**0.8**
	Metals	3.1	3.8	2.4	**3.1**	2.4	3.1	2.4	**2.6**
	Beverage carton	1.0	1.1	0.8	**0.9**	1.9	2.2	1.7	**1.9**
	Shoes	0.9	0.5	0.7	**0.8**	0.6	0.4	2.8	**1.2**
	Electro	0.3	0.1	0.7	**0.4**	0.2	0.1	0.3	**0.2**
	Hazardous waste	0.3	0.3	0.4	**0.3**	0.1	0.2	0.2	**0.2**
Total		**84.4**	**81.1**	**69.1**	**78.6**	**94.9**	**94.1**	**90.6**	**93.4**
For energy utilization		**73.1**	**69.1**	**55.4**	**66.4**	**89.6**	**88.3**	**84.0**	**87.5**
Separation increase		**27.4**	**22.9**	**23.1**	**25.0**	**61.3**	**57.2**	**56.8**	**58.9**

1.3 Waste market analysis

1.3.1 Waste originators

Pursuant to the Waste Act. communal waste originators are towns. (Communal waste pursuant to the Waste catalogue) also includes mixed waste produced by organizations with a share of approximately 30%.

Table 3: Town categorization pursuant to the status

Town category/status	**Number in Georgia**
Town	
Township	
City	
Statutory city	
Total	

1.3.2 Localities suitable for founding the centers

From the perspective of the size of individual towns and their locations throughout the region, as well as the layout of the waste landfills with the necessary support facilities, we can consider 3-4 locations

1.3.3 Expected balance of the waste flow to the processing centers

A. AFPF KASPI
60 000 t/year – first stage.
Waste that can not be used for energy purposes will be deposited to local landfills

B. MBT Batumi
Direct transport of the waste without reloading to MBT Batumi. Transport distance up to 30 km. Transport of the waste to a landfill could also cover the southern part of Georgia. Large-volume waste from the collection locations can also be considered for processing.
Total: 350,000 – 500,000 tons of MCW + LVW/year

1.4 Waste management legislature

1.4.1 Legal regulations related to waste management in Georgia

Legislative frame
Document number: 2994
Document issuer: Parliament of Georgia
Publishing date: 26. 12. 2014
Document type: Georgian law
Publication source, website date: 1. 1. 2015
Registration code: 360160000.05.001.017608
Waste management codex, Chapter I General stipulations Article 1.
Purpose and objective of the codex

1. The purpose of this codex is to create a legal base in the area of waste management for the implementation of measures that support prevention of the waste creation, enhancement of its repeated use, waste management by environment-friendly means (including recycling and separation of secondary materials, using energy from waste, safe waste disposal).

2. The objective of this codex is to protect the environment and human health:
a) by preventing the creation of waste or limiting its volume and its negative impact
b) by creating effective waste management mechanisms
c) by reducing damages caused by consuming resources and by more efficient utilization of resources.

1. The waste management policies in Georgia and the Georgian legal regulations in the area of waste management are based on the following waste management hierarchy:
a) prevention
b) preparation for a repeated use
c) recycling
d) other utilization, including energy utilization
e) placement.

When defining particular obligations in relation to the waste management hierarchy specified in a part of this article, the following things need to be considered:
a) benefits for the environment
b) technical feasibility utilizing available technologies of the corresponding quality
c) economic feasibility.

In compliance with this codex, the ministry has been developing a national waste management strategy, which defines the waste management policies in Georgia and their objectives for the next 15 years. The ministry has been developing a strategy for managing biologically degradable communal waste. It defines the objectives for reducing the volume of biologically degradable waste deposited at landfills and the measures that need to be implemented.
The Waste Act represents the basic national legislative frame in the area of waste management. Despite of that, it is not a complex legal regulation for this area.

Waste management plan of the Republic of Georgia
The binding part of the Waste management plan determines the quantitative and qualitative goals for waste management. It forms a binding basis for preparing waste management plans of individual districts and for deciding and other activities of the corresponding administration authorities, districts and towns in the area of waste management.

1.4.2 Expected development of waste management in Georgia

The expected development of waste management is particularly based on the following basic assumptions:
- Reducing the volume of biologically degradable waste deposited at communal waste landfills and determining other ways and technologies of how to manage it.
- Gradual reduction of the communal waste depositions as an “unsupported” way of the waste management and implementation of other waste management ways.
- Expanding the use (utilization) of communal waste as a whole - supporting technologies used by communal waste in an economical, environmental and socially sustainable and efficient manner.

1.4.3 Facility for energy utilization of communal waste (EWUF) - RDF at the HEIDELBERG CEMENT cement plant in the city of KASPI

Co-incineration at the cement plant:
The cement furnace aggregate for clinker firing represents (in its most common alternative) an almost ideal facility for the use of many alternative and waste fuels with various compositions and volumes of additives. The cement furnace can incinerate waste and alternative fuels within a wide composition range. The process is characterized by a high filtration ability of the particles that move with the current and against it and that contain $CaCO_3$ as well as free CaO. Since they come into an intense contact with smoke gases, the particles are able to catch all acidly reacting components from the combustion products, such as SO_2, Cl^-, F^-. Apart from that, they are used as condensation cores in the stabilizer and electrostatic separator. They can also effectively catch heavy metal compounds, such as Hg and Tl.
Current cement plants use a wide range of other secondary fuels for firing clinker when producing cement. Due to the price levels of the basic cement fuels, certified solid fuels based on selected industrial and communal waste are also being considered as a defined mixture of individual components with a specified granulometric structure, making sure the created fuel mixture has the defined and controllable fuel parameters and known minimized volume of cement and environmental pollutants.
The currently used definition of this fuel says that a solid alternative (mixed) fuel is a material formed by separation and subsequent modification of waste materials based on plastic, paper, textile, rubber and other combustible materials. The use of solid mixed fuels is simultaneously limited by the requirements for not exceeding the volume of the generally known cement pollutants, thus not further affecting emissions. It is RDF, i.e., fuels produced from CW components using, for example, the MBT technology, which are used for energy waste utilization in the cement plants. Due to the waste characteristics, the waste cannot be processed directly in the cement furnaces. Using the MBT technology, the waste physical, chemical or biological waste characteristics are changed in a way, that the waste can be fully utilized in the cement plants.

1.4.4 Energy use of the waste

Energy use of the waste, sometimes presented as thermic processing of waste (WTE), is considered a renewable energy source. The creation and utilization of waste heat from the devices for energy utilization of waste can be perceived as a measure that assists in the solution of the current environmental problems.
"The main purpose of the energy utilization of communal waste is:
- Reduction of the waste volume
- Utilization of the caloric content of the waste (the calorific value of communal waste is between 4 and 11 MJ/kg)
- Prevention of the penetration of pollutants into the environment (from underground water, elimination of pathogenic germs etc.)
- The cleanest energy source is obtained by a thermic and oxidation process
- Elimination of the greenhouse gases. From the perspective of the environment, energy utilization of waste is mostly neutral in relation to carbon dioxide, which is formed by oxidation of organic carbon
- Waste utilization in a real time and location
- Significantly contributes to energy self-sufficiency

Reasons for energy utilization of waste:
• Waste is an ideal substitute of natural, non-renewable resources - mixed communal waste has identical calorific value as brown coal
• The states have not been, for a long time, complying with the required EU limits related to limiting the volumes of biologically degradable waste deposited in landfills
• Georgia has been significantly lagging behind the developed European states when it comes to waste utilization as an energy source
• Energy utilization of combustible waste that cannot be materially used corresponds to the versatile demands related to the protection of the environment
• Energy use of the waste results in a reduced import dependency on the primary energy sources (natural gas, crude oil). **WASTE IS ENERGY**

Intention to build a Facility for mechanical processing of mixed communal waste

The subject of the proposal is a facility for processing mixed communal waste using the MBT technology with a capacity of 70,000 tons/year. It is expected that the waste will be initially pre-ground in an input grinder, upon which a magnetic separation of ferrous metals and a sieving technology will be applied, making sure that the energy-valuable fraction is separated from the undersize particles with a prevailing part of biologically degradable materials.
The oversize particles will be certified as a fuel that is usable in, for example, fluid combustion boilers. The undersize particles will be biologically stabilized and deposited in landfills.
The technological line can be expanded by another block with a capacity if 70,000 tons/year.

This project, together with the primary intention AFPF and EWUF in Kaspi, will allow for creating an integrated communal waste management system in Georgia and for fulfilling the main WMP objectives after 2021.

2

ASSESSMENT OF THE ECOLOGICAL AND ECONOMIC IMPACTS OF THE PROPOSED SOLUTION AND SELECTION OF AN OPTIMAL ALTERNATIVE

2.1 Assessment of the ecological and economic impacts of the proposed solution

The assessment of the ecological and economic impacts of the communal waste management system solution in Georgia has been prepared for various alternatives. The following aspects are assessed for each of the assessed alternatives:
- system functions, functional elements and equipment
- ecological impacts on the main components of the environment (air, water, waste);
- investment cost of building the system;
- net processing (removal) cost of 1 ton of waste in the key facilities included in the system;
- estimate of the average processing (removal) cost of 1 ton of communal waste in the Pilsen Region;
- technical and organizational risks and legal enforcement options

When calculating the waste processing cost, we have considered the expected legislative changes (Waste Act) and the expected development of the charge policies.

2.2 Possible solution alternatives of the communal waste management

2.2.1 A. Zero alternative

No technology for processing and energy use of mixed waste will be implemented. Instead, waste sorting at the source (citizens) will be preferred and the remaining communal waste will still be deposited in landfills.

The principle of the so-called "zero alternative" is based on the assumption that the share of residual waste will be significantly reduced. This share of the waste will then be deposited in landfills, as it is now.
Another type of waste collected at the recycling centers is biowaste. The condition for the system to be functional is building of a sufficient network of compost plants, while securing a market for the produced compost
The share of the communal waste that will not be sorted and directly used (mixed and large-volume communal waste) will still form at least 60–80%.
The zero alternative considers an expansion of the landfill capacities, making sure it would be possible to deposit 170-190 thousand tons of mixed and large-volume waste a year.
The zero alternative does not allow for meeting the WMP objectives from the perspective of the share of materially used communal waste in the amount of at least 50% and reducing the waste deposited in landfills in 2021-2025

Ecological impacts on the main components of the environment

Impacts on the waste management

Depositing waste in landfills preferred in the "zero alternative" is the least suitable to undesirable method in the waste management hierarchy. Raw materials, which could be otherwise sorted from the waste and used, are permanently lost.

Investment cost of building the system
From the investment cost perspective, the zero alternative includes expenses related to the construction of subsequent waste landfill stages. In this case, it will be necessary to deposit up to 190,000 tons of large-volume and mixed waste in the landfills. It roughly translates to 12.00 € per 1 m3 of space and 4.00 € for landfill recultivation upon the expiry of its lifespan per every deposited ton of waste.
The overall cost investment cost would thus be 3.5 mil. € per every calendar year, which represents the amount of 105 mil. € in 30 years.

Processing (removal) cost per 1 ton of waste
The price for depositing 1 ton of waste in a landfill includes expenses related to building the given deposition area, operational cost, monitoring cost, and the fee for depositing the waste into the environment.

Technical and organizational risks and legal enforcement options
It is possible that a complete ban on depositing unprocessed communal waste in landfills will be implemented similarly to other EU countries.

2.2.2 B. Passive zero alternative

Waste will be transported to waste utilization facilities, built in another district. Waste sorting will be supported at the waste source and the remaining share will be deposited in landfills.

It is expected that a network of communal waste reloading stations for transporting the waste to facilities located outside of the given district will be built. In this case, approximately 230,000 tons of mixed and large-volume communal waste will be transported for further use or disposal during the first stage.
The remaining produced MCW and LVW will be deposited in the landfills in the region

Investment cost of building the system
The passive alternative includes expenses related to the construction of additional waste landfill stages for the disposal of communal waste with a volume of about 160,000 tons/year.
The necessary capacity represents a deposition space of approximately 72,000 m3 with the expected building cost of 1.1 mil. € per calendar year, which translates to 33 mil. € over 30 years.
Additional investment is represented by the construction of reloading stations with a capacity of up to 130,000 tons of waste per year. The cost of building 1 reloading station amounts to 240 thousand €. The total amount is thus 7.2 mil. €.
Total cost of building the system: 35.5 mil. € for 30 years of operation.

Processing cost per 1 ton of waste
The price for depositing the waste in a landfill was determined to be 100.00 € per 1 ton.
The average reloading station operation cost corresponds to 8.00 € per one ton of waste.
The price for transporting waste for 1 km is 1.5 €. When we consider a transport distance of 200 km x 2, it translates to 28.00 € per one ton of waste.
The price for accepting the waste by a facility will depend on the particular consumer. For comparison purposes, we considered the usual market price for waste processing abroad, which amounts to 120 €/ton.
The total reloading, transport and processing cost of 1 ton of MCW would then amount to about 156.00 €.
The average price for processing (removal) of 1 ton of mixed or large-volume communal waste includes 70% of the expenses with a tariff of 156.00 € /ton and 30% of the expenses with a tariff of 100.00 €, i.e., **which means 256.00 €/ton.**

Technical and organizational risks and legal enforcement options
The passive alternative is particularly exposed to organizational risks. The probability that it will be possible to negotiate the corresponding capacity for the collection of up to 130,000 tons of communal waste is minimal.
A possible option for this alternative to be implemented is that multiple districts would make a joint investment. However, for now we need to consider the fact that no such investment is being prepared.

2.2.3 C. Waste processing and utilization technology using the MBT method

The system of multiple MBT lines in large waste centers, connection to the utilization of the output products - capacity that ensures the fulfillment of the WMP objectives of the district.
The total needed processing capacity of the MBT lines in the districts is 130–135 thousand tons per year. A total of 3 processing lines are proposed in the first stage:

MBT Batumi	capacity: 60,000 tons/year
MBT Zugdidi	capacity: 45,000 tons/year
MBT Achalciche	capacity: 30,000 tons/year
Total:	**135,000 tons/year**

The remaining share of unprocessed waste amounts to about 55-60 thousand tons. This volume will be deposited in landfills. Furthermore, a share of the processed waste from the MBT lines will also be deposited in the landfills after biological stabilization. The landfill volume after MBT processing represents 44,360 tons/year. It means that the total volume of communal waste deposited in landfills will amount to approximately 100,000 tons.

Ecological impacts on the main components of the environment
Impacts on the waste management
Mechanical and biological processing represents a technology that allows for sorting out the usable components of communal waste, particularly metals and energy-usable components. The ballast components are sorted out and deposited in landfills. The use of the fermented component as an energy compost is also considered.
From the waste management perspective, the method is highly effective. It represents one of the best available technologies that leads to the material use of communal waste.

The European Union determined the emission limit of the PCDD/PCDF substances in combustion products to be 0.1 nanograms in m3.
It is a very small number – nanogram is 0.000000001=10-9 of a gram. Despite of that, EWUF complies with this limit with a big reserve.

For comparison purposes, the so-called displaced emissions are stated for individual countries. These are the emissions that would normally escape to the air if the same amount of energy is delivered from a classic source as the energy produced in EWUF.

Investment cost of building the system
The additional equipment for the recycling centers will be addressed by the project itself as a part of the integrated system. The necessary capacity for the mechanical and biological treatment of the waste in the districts will consist of three lines built near the large waste centers - landfills.

MBT Batumi	6 mil. €
MBT Zugdidi	6 mil. €
MBT Achalciche	6 mil. €
Total:	**18 mil. €**

Depositing waste to a landfill with an investment price of 12.00 € per 1 m3 of the deposition space and 4.00 €/ton for the landfill recultivation, the project would need 119,160 m3 of space, which translates to 1.8 mil. € per year, i.e., 54 mil. € for 30 years.

Processing (removal) cost per 1 ton of waste
Pursuant to the economic analysis prepared based on the expected investment and operation cost, cost of energies, wage expenses and prices of the output products after the waste is processed, the following collection prices for 1 ton of waste at the facility were determined:

MBT	90.00 €/ton
MBT	95.00 €/ton
MBT	100.00 € /ton
Average price considering the capacity:	**95.00 €/ton**

Average price of the waste deposition in a landfill:: 100.00 €/ton

The average price per 1 ton of waste includes the ratio of the capacities to the overall waste volume, MBT 71% and landfills 29%. The final price for processing or removing 1 ton of waste amounts to 98.00 €

Technical and organizational risks and legal enforcement options
The mechanical and biological communal waste processing technology is used in several European countries, most of all in Austria, Germany, Italy and Spain. Some of the technical risks include the requirements for the quality of the residual waste deposited in landfills from the perspective of its calorific value (it must not exceed 8 MJ/kg) and of the volume of biological materials
The most important risks for MBT are organizational risks. The conceptual solution assumes that it will be possible to put the final product - fuel from the waste - on the market with a positive value of 70% of the brown coal price.
Securing customers for the so-called “energy compost” can be similarly problematic. Selling the produced volume of this product on the market is also unrealistic, particularly for the envisioned price of 2.00 € /ton. In the case of this product, there is a real risk that it would be necessary to deposit the product in landfills with a negative value of 100.00 €/ton, which would significantly affected the economy of the entire process in a negative way.

2.2.4 D. Combination of the waste energy utilization (RDF) and the MBT technology

A combination of these facilities would ensure maximal utilization of the energy valuable share of communal waste in the overall amount of up to 140,000 tons/year. The residual waste would be deposited in landfills.

AFPF KASPI
The capacity of this facility is proposed to be 150,000 tons of mixed communal waste per year. The thermal capacity of the waste would substitute about 70,000 tons of brown coal, which would have to otherwise be incinerated in the Kaspi cement plant in order to ensure the necessary thermal capacity of the cement plant.

MBT Batumi
The proposed capacity amounts to 140-145 tons of mixed and large-volume waste per year. Apart from the mixed communal waste from the southern and southeastern part of the district, the line would also process modified shares of the large-volume waste with a high energy
value. The fuel produced from the waste will be used as a substitute of primary fuels at energy facilities.
When considering the basic waste management balance related to large-volume and communal waste, we need to expect 30,000 tons/year of unprocessed MCW or LVW deposited in landfills and a share of the unusable waste after MBT processing amounting to 14,700 tons/year.
The total maximal capacity of the landfills in the region for this alternative amounts to 165,000 tons.

Ecological impacts on the main components of the environment
Impacts on the air
EWUF KASPI – it is an incineration facility for sorted and dried waste. The emission level corresponds to the BAT levels. Te emission background in the area will not be significantly affected.
MBT Batumi – described in the previous alternative
Waste landfills – impact of the share of the waste deposited in landfills on the air quality corresponds to the previous alternatives.

Impacts on the water management
EWUF KASPI – will not, during standard operation, affect the surface water
MBT Batumi – The MBT technology does not handle water as a part of its mechanical treatment operation.
Waste landfills – impacts of the landfills on the water management are identical to the previous alternatives.

Impacts on the waste management
EWUF KASPI – by an energy utilization of 95,000 tons of MCW per year, the volume of BRKO deposited in landfills will be reduced by 47,000 tons, which represents a fundamental step in the direction of fulfilling the key WMP objectives. Secondary waste is created when incinerating waste. Production of 20,155 tons of slag is expected. The slag will not have hazardous characteristics and will be offered for use in, for example, the construction industry or for recultivation mixtures.
MBT Batumi, Zugdidi, Achalciche – The ballast components will be sorted out and deposited in landfills. The share with a biologically active component is subjected to aerobic fermentation.

Investment cost of building the system
Construction cost of AFPF KASPI - stage 1
The construction price amounts to **14 mil. EUR.**

Construction cost of AFPF Kutajsi - stage 2
The construction price amounts to **14 mil. EUR.**

Construction cost of the MBT line inBatumi
The cost related to the construction of the mechanical and biological processing complex on the premises of the landfill amounts to **6 mil. EUR.**

Construction cost of the MBT line in other cities, Zugdidi and Achalciche
The cost related to the construction of the mechanical and biological processing complexes on the premises of the given landfills amounts to **12 mil. EUR.**

Cost of the equipment of the reloading stations with pressing
The cost of a single station with a press and two collection containers amounts to **240 thousand EUR.** The total investment cost of the proposed 30 lines can reach up to **7.2 mil. EUR.**

Processing cost per 1 ton of waste
AFPF KASPI – the price for one ton of processed waste has been calculated at 98.00 €. This price also includes the cost of the reloading stations, their operation and waste transport from the reloading stations to RDF.
MBT Batumi – the price for one ton of processed waste has been calculated at 55.00 €
Waste landfill – average price of the waste deposition in a landfill: 100.00 € /ton.

Estimate of the average processing (removal) cost of 1 ton of communal waste
The cost includes expenses related to the operation of AFPF, MBT line in Batumi and the actual waste landfills, where the waste, which is not suitable for being used at EWUF or the MBT line, will be deposited. The average price per 1 ton of waste includes the ratio of the capacities to the overall waste volume, i.e., EWUF 60%, MBT 23.6% and landfills 16.4%.
The final price for processing or removing 1 ton of waste amounts to 95.00 €.

Technical and organizational risks and legal enforcement options
Risks can be divided into three basic groups:
ZVAP KASPI – technical risks are expected to be minimal. It is a commonly known technology, which is time-proven and which complies with the conditions for its implementation in Georgia, fully in compliance with the legislature of the European Union and Georgia, particularly from the perspective of the air protection demands.
Legal enforcement of the intention is made possible by a Waste Act amendment, which specifies the conditions for energy utilization of waste.
MBT Batumi – the risks stated for the previous alternative apply.
Waste landfills – the risks stated for the previous alternatives apply.

2.2.4 Assessment of the alternatives in the form of a multicriterial analysis

The points assessment has been prepared for a range of 1 to 5 (the more points, the more positive assessment). A weight value of between 0.1 and 1.0 was assigned to each criterion. The weight values represent the importance of individual criteria from the perspective of achieving the objective. The weight values of the criteria represent their importance from the perspective of feasibility, optimal waste management in compliance with the requirements of the legislature and fulfilment of the WMP objectives under economically acceptable conditions.

Criterion	Criterion weight	Alternative A		Alternative B		Alternative C		Alternative D	
	0.1 – 1.0	points	sum	points	sum	points	sum	points	sum
Impacts on the environment	1.0	1	**1.0**	2	**2.0**	4	**4.0**	4	**4.0**
Fulfilling the WMP objectives	0.8	1	**0.8**	3	**2.4**	5	**4.0**	5	**4.0**
Waste utilization level	0.5	1	**0.5**	2	**1.0**	5	**2.5**	5	**2.5**
Support of energy self-sufficiency	0.4	1	**0.4**	1	**0.4**	3	**1.2**	4	**1.6**
Price per 1 ton of MCW	0.8	2	**1.6**	1	**0.8**	3	**2.4**	5	**4.0**
Technical risks	0.2	5	**1.0**	4	**0.8**	3	**0.6**	4	**0.8**
Organizational risks	0.9	5	**4.5**	1	**0.9**	2	**1.8**	4	**3.6**
Legal enforcement	0.7	1	**0.7**	4	**2.8**	4	**2.8**	4	**2.8**
Total			**10.5**		**11.1**		**19.3**		**23.3**

2.3 Proposal of an optimal alternative

Upon comparing individual alternatives using the point assessment of all considered aspects, the most

most suitable alternative is alternative D,

i.e., a combination of the construction of **AFPF KASPI** and the **MBT** line at the landfills in **Batumi and other cities**, while also depositing unusable residues of the communal waste in landfills, making sure the WMP objectives of individual areas and towns from the perspective of communal waste management are fulfilled.

Conclusion:
The implementation of the system will ensure a rational utilization of communal waste, primarily sorted and subsequently processed, as well as utilization of the energy contained in the residual mixed waste for ensuring the share of the necessary thermal capacity for Georgia, adequate to the consumption of approximately 70,000 tons of brown coal (**AFPF KASPI** facility).

The proposed alternative is recommended for implementation.

3
ELABORATION OF THE OPTIMAL SOLUTION ALTERNATIVE

3.1 Technical solution
3.1.1 Description of the proposed facilities

A – AFPF KASPI within the frame of stage one
AFPF Kaspi will utilize mixed communal waste and other waste of a communal waste character, unsorted but also presorted from the cities with mechanical waste sorting machines.
Waste will be transported in Kuka-vehicles and large-volume trucks and containers. Large-volume waste will be ground to the necessary size.
Waste will be stored in semi-enclosed, vacuumed bunker.
Its thermic modification takes place in the cement plant furnace at its hot end, simultaneously with feeding brown powder coal. The released thermal energy will be used in the cement production technological process.

B – Mechanical and biological waste processing at Batumi
It is a construction of a technological character, which will be built for the purpose of processing and modifying another part of the production of the solid communal waste (SCW) at Adjara.
The input volume to this technological process is proposed at 95.000 tons/year.

The construction will be formed by two, relatively independent structures:
a.) Covered, partially sheathed production hall for the technological line of the mechanical SCW processing (grinding, sorting, separation),
b.) Compost plant formed by a group of aerobic fermenters for processing biologically degradable waste (BDW) for **energy utilization**.

Mechanical SCW processing technology
is proposed in a way that ensures sorting and separation of the waste inert components (aggregate, bricks, plasters, etc.), which will still be deposited at landfills; moreover, the biologically degradable matter will be separated, and so will be the flammable parts of the communal waste (wood, paper, textile, etc.) and ferrous and nonferrous metals.
The biologically degradable part of the waste will be processed by aerobic fermentation to an energy-usable compost.
Technological arrangements are proposed in the form of an automatic production line and machine control in compliance with the work principles applicable to automatic lines.
Backups in the line and mechanical and biological SCW processing technology are not expected.
SCW will be entering the line from a free acceptance handling area upon initial visual sorting of unsuitable parts of the waste. The first technological operation along the line is the initial SCW disintegration (grinding). At the output of the grinder, the ground material will have a granularity of 0–150 mm (up to 250 mm in one direction). Ground SCW falls down and is dispersed on a belt conveyor, above which a magnetic separator for removing ferritic metals is suspended. Next, the material is size-sorted into two granularity groups. Oversize – with a granularity of 50–150 mm (up to 250 mm in one direction), and undersize – with a granularity of 0–50 mm (up to 80 mm in one direction). The oversize particles mostly include light components (plastic, paper, textile, wood), while the undersize particles are mostly heavy (biocomponents, inert materials and small parts of the light components).
The partial oversize processing line from the sorting sieve ensures further processing of the larger and lighter fraction, i.e., another separation of the heavier items and nonferrous metals, as well as grinding to a granularity that is suitable for energy use and for pressing into shipment packages.
The partial line for processing undersize waste particles from the sorting sieve ensures a further separation of heavier items and grinding to a granularity that is suitable for aerobic fermentation in fermenters. The heavy component from the air sorting machine will be transported outside of the building and deposited in a communal waste landfill.
The transport connection among individual technological devices is implemented using belt converters with a smooth or ribbed belt (based on the given slope).
Aerobic fermentation technology (composting)
The proposal suggest the use of a technological concept of a controlled aerobic thermophile fermentation of the degradable communal waste and possibly other waste biomass from the communal and entrepreneurial spheres with the possibility of final drying of the fermented mixture.
The proposed technological equipment includes an EWA fermenter, designed for processing biologically degradable waste and possibly also sludge from wastewater treatment plants and other biowaste from aerobic thermophile fermentation. Considering the processed volume, the so-called group setup, i.e., six fermentation units arranged in a parallel way, will be used.

4
SOCIAL ASPECT

The most important thing from the perspective of the impact on the citizens is to make sure that an unambiguous decision of which alternative will be used for solving the waste management issue is adopted as soon as possible. The implementation of the given measure will take some time and any delay or implementation after the ban on deposition of untreated waste in landfills will result is a more expensive way of the mixed communal waste management process. This price increase would also result in an increase of the fee paid by the citizens. From this perspective, the most risky alternative seems to be the alternative with the MBT technology.
From the comfort perspective, all the alternatives are equal for the citizens.
We can also see how individual alternatives would affect the number of created jobs. The stated job positions are only applicable directly to EWUF. It can be expected that other jobs will be created at, for example, the reloading stations, in relation to transport, etc.

List of the used abbreviations

HW	Household waste
CW	Communal waste
RDF	Refuse Derived Fuel – solid alternative fuel
LVW	Large-volume waste
WMP	Waste management plan
MCW	Mixed communal waste
SAF	Solid alternative fuel
AFPF	Alternative fuel production facility
EWUF	Energy waste utilization facility
MBT	Mechanical-biological treatment

PHASE 1
EKOPARK KASPI

Introduction:
Based on the agreement, we prepared the first phase of the project in the line "waste collection – refuse collection – production of RDF – end user (cement plant)".
We will supply AFPF Kaspi with waste from six cities and produce fuel in the agreed amount of 60,000 tons per year. We will trade the surplus in the prepared mode. In case of lack of input waste, we can relieve the nearby capital city and replenish the waste. The plant is designed in one shift with the possibility of increasing the production of additional waste form neighboring regions.
For the next stages of cooperation, we are preparing the use of plastics for further and other uses in Georgia's industry. EKOPARK expects the maximum use of all knowledge for efficient waste disposal with minimum impact on the environment.

ECONOMY

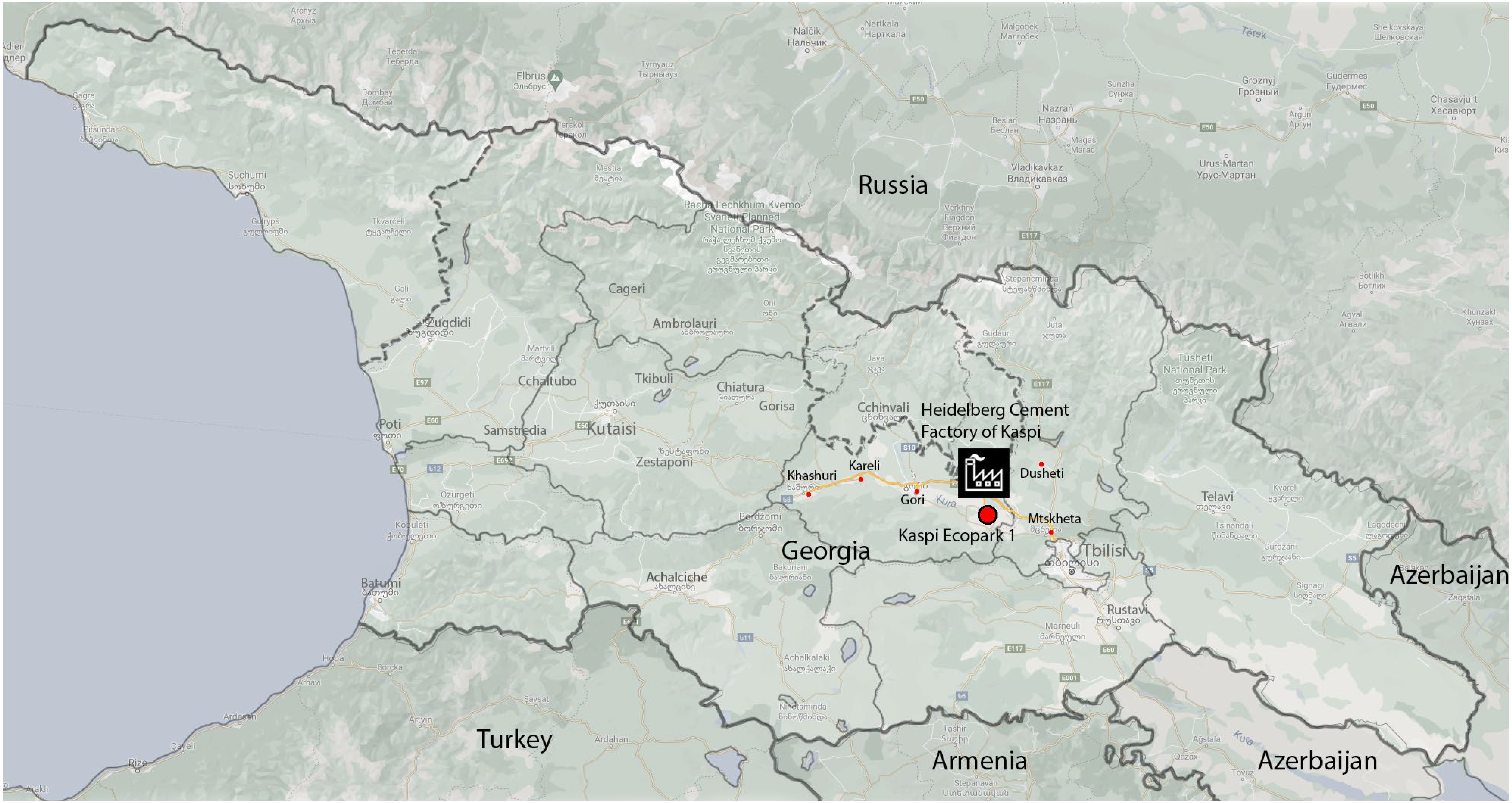
Table and project comment:
The project is designed using of own and external (banking) resources: from the total value of the investment, 4 million own resources and 16 million external resources are calculated. The external resources in a form of bank loan are calculated with a maturity of 10 years and an interest rate of 5%. The loan is not repaid during the loan period, only the relevant interest is paid.
After three years and one month, the negative C-F changes to positive one, which is also the payback period without the use of a discount. Within the growth of prices, due to the length of the period, a total gradual growth of 10-20% is expected, depending on the nature of the input.
Depreciation is currently calculated according to the parameters for Czech tax depreciation and the beginning of depreciation is set from the beginning of the investment operation, it is calculated with an even depreciation plan.
The first year in which the company will be subject of taxation, repeated according to the Czech tax burden, is the year 2028.
The company's insurance is calculated from the beginning of operation in the amount of 200,000 CZK/year, i.e. the amount corresponds to 1% of the total investment.
The provision for unplanned expenses is also calculated, which gradually increases with the age of the investment.
Given the overall profitability of the project 21,32% (net profit + depreciation/sales), it is possible to spend additional funds on project marketing, which would increase the potential for further growth of both this investment and other environmentally oriented projects.

Georgia - ecological waste disposal

			0	1	2	3	4	5	6	7	8	9	10	11	12
			3.Q/2022	4.Q/2022	1.Q/2023	2.Q/2023	3.Q/2023	4.Q/2023	1.Q/2024	2.Q /2024	3.Q/2024	4.Q/2024	1.Q/2025	2.Q/2025	3.Q/2025
INITIAL PROJECT COSTS															
INVESTMENT COSTS			-	-	-	-	-	-	-	-	-	-	-	-	-
Building		EUR	3 000 000	3 000 000	2 000 000										
Production line, including assembly and transport		EUR	-	2 000 000	2 000 000	2 000 000	1 500 000	1 000 000	-	-	-	-	-	-	-
Reloading station - number of 5 stations, including transport		EUR	-	-	450 000	450 000	350 000	350 000	-	-	-	-	-	-	-
Recovery, running of technologies		EUR	-	-	-	-	600 000	600 000	-	-	-	-	-	-	-
TOTAL INVESTMENT COSTS		**EUR**	**3 000 000**	**5 000 000**	**2 450 000**	**2 450 000**	**2 450 000**	**1 950 000**	-	-	-	-	-	-	-
INITIAL OPERATING COSTS															
Spare parts warehouse		EUR	-	-	-	-	-	200 000	-	-	-	-	-	-	-
		EUR	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INITIAL OPERATING COSTS		**EUR**	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INITIAL PROJECT COSTS		**EUR**	**3 000 000**	**5 000 000**	**2 450 000**	**2 450 000**	**2 450 000**	**2 150 000**	-	-	-	-	-	-	-
Operation and maintenance costs															
Salaries of employees		EUR	-	-	-	-	-	-	14 925	14 925	14 925	14 925	14 925	14 925	14 925
Staff levies		EUR	-	-	-	-	-	-	5 075	5 075	5 075	5 075	5 075	5 075	5 075
Rising input prices	1,0	koef.	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
#ODKAZ!		EUR	-	-	-	-	-	-	18 750	37 500	37 500	37 500	37 500	37 500	75 000
Heat		EUR	-	-	-	-	-	-	300	300	300	300	300	300	300
Maintenance costs		EUR	-	-	-	-	-	-	6 324	6 324	6 324	6 324	6 324	6 324	6 324
Water + waste		EUR	-	-	-	-	-	-	300	300	300	300	300	300	300
Fuel + other car material		EUR	300	300	300	300	300	300	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Other material - replenishment of spare parts warehouse		EUR	-	-	-	-	-	-	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Land rental		EUR	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353
Other operating expenses		EUR	-	-	-	-	-	-	281 250	337 500	337 500	337 500	337 500	450 000	675 000
Marketing		EUR	2 000	2 000	2 000	2 000	2 000	2 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000
Company insurance		EUR	10 000	10 000	10 000	10 000	10 000	10 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000
Contingency reserve		EUR		-	-	-	-	-	5 000	5 000	5 000	5 000	5 000	5 000	5 000
Interest for the period		EUR	200 000	200 000	200 000	200 000	200 000	200 000	198 710	194 814	190 870	186 874	182 830	178 735	174 587
Depreciation		EUR		-	-	-	-	-	175 775	175 775	175 775	175 775	337 025	337 025	337 025
Total material costs and services			19 653	19 653	19 653	19 653	19 653	19 653	376 276	451 276	451 276	451 276	451 276	563 776	826 276
Total operating costs		EUR	**239 006**	**239 006**	**239 006**	**239 006**	**239 006**	**239 006**	**1 099 364**	**1 226 718**	**1 222 774**	**1 218 778**	**1 375 984**	**1 596 889**	**2 080 241**
Revenues															
Revenues from sales		EUR	-	-	-	-	-	-	937 500	1 125 000	1 125 000	1 125 000	1 125 000	1 500 000	2 250 000
Price increase coefficient	1	koef.		0,00	0,00	0,00	0,00	0,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Total revenues		**EUR**	-	-	-	-	-	-	**937 501**	**1 125 001**	**1 125 001**	**1 125 001**	**1 125 001**	**1 500 001**	**2 250 001**
Profit before tax		EUR	-	(239 006)	(239 006)	(239 006)	(239 006)	(239 006)	(161 863)	(101 717)	(97 773)	(93 777)	(250 983)	(96 888)	169 760
Profit before tax cumulatively		EUR	-	(239 006)	(478 011)	(717 017)	(956 022)	(1 195 028)	(1 356 891)	(1 458 608)	(1 556 381)	(1 650 158)	(1 901 141)	(1 998 029)	(1 828 269)
Profit tax	**19%**	EUR	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit after tax		EUR	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit after tax + depreciation		EUR	-	-	-	-	-	-	**175 775**	**175 775**	**175 775**	**175 775**	**337 025**	**337 025**	**337 025**
Cash flow		EUR	**(3 000 000)**	**(5 239 006)**	**(239 006)**	**(239 006)**	**(239 006)**	**(239 006)**	**(161 863)**	**(101 717)**	**(97 773)**	**(93 777)**	**(250 983)**	**(96 888)**	**169 760**
Cash flow cumulatively		EUR	(3 000 000)	(8 239 006)	(8 478 011)	(8 717 017)	(8 956 022)	(9 195 028)	(9 356 891)	(9 458 608)	(9 556 381)	(9 650 158)	(9 901 141)	(9 998 029)	(9 828 269)
Project financing															
Own resources	4 000 000	EUR	4 000 000	-	-	-	-	-	-	-	-	-	-	-	-
Loan															
Interest	5,00%	Ročně													
Loan funds		EUR	16 000 000		-	-	-	-	-	-	-	-	-	-	-
Total loan at the beginning of the period		EUR	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	15 689 595	15 375 294	15 057 049	14 734 809	14 408 524	14 078 144
Total loan at the end of the period		EUR	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	15 689 595	15 375 294	15 057 049	14 734 809	14 408 524	14 078 144	13 743 616
Interest of the period		EUR	200 000	200 000	200 000	200 000	200 000	200 000	198 710	194 814	190 870	186 874	182 830	178 735	174 587
Repayment of the loan		EUR	-	-	-	-	-	-	310 405	314 301	318 245	322 240	326 285	330 380	334 528
Interest repayment		EUR	200 000	200 000	200 000	200 000	200 000	200 000	198 710	194 814	190 870	186 874	182 830	178 735	174 587
Total repayment (loan + interest)		CZK	200 000	200 000	200 000	200 000	200 000	200 000	509 115	509 115	509 115	509 114	509 115	509 115	509 115
Balance of total repayments		EUR	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	16 000 000	15 689 595	15 375 294	15 057 049	14 734 809	14 408 524	14 078 144	13 743 616
Cash flows including loan		EUR	16 800 000	(5 439 006)	(439 006)	(439 006)	(439 006)	(439 006)	(670 978)	(610 832)	(606 888)	(602 891)	(760 098)	(606 003)	(339 355)
Cash flow including loan cumulatively		**EUR**	**16 800 000**	**11 360 995**	**10 921 989**	**10 482 984**	**10 043 978**	**9 604 973**	**8 933 995**	**8 323 163**	**7 716 275**	**7 113 384**	**6 353 286**	**5 747 283**	**5 407 928**
Project efficiency															
Net cash flow (adjusted), thous. EUR			(3 000 000)	(5 239 006)	(239 006)	(232 566)	(229 412)	(226 300)	(151 180)	(93 715)	(88 859)	(84 072)	(221 956)	(84 520)	146 082
Inflation rate, % per year	-														
Discount coefficient, % per year	5,50														
Payback period (direct), years	and 1 month														

	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	4.Q/2025	1.Q/2026	2.Q/2026	3.Q/2026	4.Q/2026	1.Q/2027	2.Q/2027	3.Q/2027	4.Q/2027	1.Q/2028	2.Q/2028	3.Q/2028	4.Q/2028	1.Q/2029	2.Q/2029	3.Q/2029
INITIAL PROJECT COSTS																
INVESTMENT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Building																
Production line, including assembly and transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reloading station - number of 5 stations, including transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Recovery, running of technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INVESTMENT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INITIAL OPERATING COSTS																
Spare parts warehouse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INITIAL OPERATING COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL INITIAL PROJECT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and maintenance costs																
Salaries of employees	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925
Staff levies	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075
Rising input prices	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
#ODKAZ!	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000
Heat	300	315	315	315	315	315	315	315	315	331	331	331	331	331	331	331
Maintenance costs	6 324	6 956	6 956	6 956	6 956	6 956	6 956	6 956	6 956	7 651	7 651	7 651	7 651	7 651	7 651	7 651
Water + waste	300	315	315	315	315	315	315	315	315	331	331	331	331	331	331	331
Fuel + other car material	1 000	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 210	1 210	1 210	1 210	1 210	1 210	1 210
Other material - replenishment of spare parts warehouse	1 000	1 100	1 100	1 100	1 100	1 500	1 500	1 500	1 500	2 500	2 500	2 500	2 500	5 000	5 000	5 000
Land rental	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353
Other operating expenses	667 500	675 000	667 500	675 000	675 000	691 875	691 875	691 875	691 875	691 875	691 875	691 875	691 875	709 172	709 172	709 172
Marketing	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000
Company insurance	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000
Contingency reserve	5 000	5 000	5 000	5 000	5 000	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500
Interest for the period	170 388	166 136	161 831	157 472	153 057	148 588	144 064	139 481	134 841	130 144	125 386	120 570	115 693	110 755	105 754	100 691
Depreciation	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025
Total material costs and services	818 776	827 139	819 639	827 139	827 139	846 914	846 914	846 914	846 914	848 751	848 751	848 751	848 751	868 548	868 548	868 548
Total operating costs	**2 061 042**	**2 072 652**	**2 053 347**	**2 063 988**	**2 059 573**	**2 094 254**	**2 089 730**	**2 085 147**	**2 080 507**	**2 077 647**	**2 072 889**	**2 068 073**	**2 063 196**	**2 095 352**	**2 090 351**	**2 085 288**
Revenues																
Revenues from sales	2 225 000	2 250 000	2 225 000	2 250 000	2 250 000	2 306 250	2 306 250	2 306 250	2 306 250	2 306 250	2 306 250	2 306 250	2 306 250	2 363 906	2 363 906	2 363 906
Price increase coefficient	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Total revenues	**2 225 001**	**2 250 001**	**2 225 001**	**2 250 001**	**2 250 001**	**2 306 251**	**2 306 251**	**2 306 251**	**2 306 251**	**2 306 251**	**2 306 251**	**2 306 251**	**2 306 251**	**2 363 907**	**2 363 907**	**2 363 907**
Profit before tax	163 959	177 349	171 654	186 013	190 428	211 997	216 521	221 104	225 744	228 604	233 362	238 178	243 055	268 555	273 556	278 619
Profit before tax cumulatively	(1 664 310)	(1 486 961)	(1 315 307)	(1 129 295)	(938 867)	(726 870)	(510 350)	(289 246)	(63 502)	165 101	398 463	636 640	879 695	1 148 250	1 421 806	1 700 425
Profit tax	-	-	-	-	-	-	-	-	-	**43 435**	**44 339**	**45 254**	**46 180**	**51 025**	**51 976**	**52 938**
Profit after tax	-	-	-	-	-	-	-	-	-	**185 169**	**189 023**	**192 924**	**196 874**	**217 530**	**221 580**	**225 681**
Profit after tax + depreciation	**337 025**	**337 025**	**337 025**	**337 025**	**337 025**	**337 025**	**337 025**	**337 025**	**337 025**	**522 194**	**526 048**	**529 949**	**533 899**	**554 555**	**558 605**	**562 706**
Cash flow	**163 959**	**177 349**	**171 654**	**186 013**	**190 428**	**211 997**	**216 521**	**221 104**	**225 744**	**185 169**	**189 023**	**192 924**	**196 874**	**217 530**	**221 580**	**225 681**
Cash flow cumulatively	(9 664 310)	(9 486 961)	(9 315 307)	(9 129 295)	(8 938 867)	(8 726 870)	(8 510 350)	(8 289 246)	(8 063 502)	(7 878 333)	(7 689 311)	(7 496 387)	(7 299 513)	(7 081 983)	(6 860 403)	(6 634 721)
Project financing																
Own resources	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loan																
Interest																
Loan funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total loan at the beginning of the period	13 743 616	13 404 889	13 061 911	12 714 627	12 362 984	12 006 928	11 646 402	11 281 351	10 911 717	10 537 444	10 158 473	9 774 745	9 386 200	8 992 779	8 594 419	8 191 058
Total loan at the end of the period	13 404 889	13 061 911	12 714 627	12 362 984	12 006 928	11 646 402	11 281 351	10 911 717	10 537 444	10 158 473	9 774 745	9 386 200	8 992 779	8 594 419	8 191 058	7 782 635
Interest of the period	170 388	166 136	161 831	157 472	153 057	148 588	144 064	139 481	134 841	130 144	125 386	120 570	115 693	110 755	105 754	100 691
Repayment of the loan	338 727	342 978	347 284	351 643	356 056	360 526	365 051	369 634	374 273	378 971	383 728	388 545	393 421	398 360	403 361	408 423
Interest repayment	170 388	166 136	161 831	157 472	153 057	148 588	144 064	139 481	134 841	130 144	125 386	120 570	115 693	110 755	105 754	100 691
Total repayment (loan + interest)	509 115	509 114	509 115	509 115	509 113	509 114	509 115	509 115	509 114	509 115	509 114	509 115	509 114	509 115	509 115	509 114
Balance of total repayments	13 404 889	13 061 911	12 714 627	12 362 984	12 006 928	11 646 402	11 281 351	10 911 717	10 537 444	10 158 473	9 774 745	9 386 200	8 992 779	8 594 419	8 191 058	7 782 635
Cash flows including loan	(345 156)	(331 765)	(337 461)	(323 102)	(318 685)	(297 117)	(292 594)	(288 011)	(283 370)	(323 946)	(320 091)	(316 191)	(312 240)	(291 585)	(287 535)	(283 433)
Cash flow including loan cumulatively	**5 062 772**	**4 731 006**	**4 393 545**	**4 070 442**	**3 751 757**	**3 454 640**	**3 162 045**	**2 874 034**	**2 590 664**	**2 266 718**	**1 946 626**	**1 630 435**	**1 318 195**	**1 026 610**	**739 075**	**455 643**
Project efficiency																
Net cash flow (adjusted), thous. EUR	139 176	148 500	141 782	151 558	153 051	168 075	169 334	170 573	171 790	139 002	139 970	140 921	141 856	154 613	155 356	156 085
Inflation rate, % per year																
Discount coefficient, % per year																
Payback period (direct), years																

	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44			
	4.Q/2029	1.Q/2030	2.Q/2030	3.Q/2030	4.Q/2030	1.Q/2031	2.Q/2031	3.Q/2031	4.Q/2031	1.Q/2032	2.Q/2032	3.Q/2032	4.Q/2032	1.Q/2033	2.Q/2033	3.Q/2033	4.Q/2033		Total
INITIAL PROJECT COSTS																			
INVESTMENT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-
Building																			**8 000 000**
Production line, including assembly and transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**8 500 000**
Reloading station - number of 5 stations, including transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**1 600 000**
Recovery, running of technologies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**1 200 000**
TOTAL INVESTMENT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**19 300 000**
INITIAL OPERATING COSTS																			
Spare parts warehouse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**200 000**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-
TOTAL INITIAL OPERATING COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-
TOTAL INITIAL PROJECT COSTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			**19 500 000**
Operation and maintenance costs																			
Salaries of employees	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925	14 925		**597 000**
Staff levies	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075	5 075		**202 980**
Rising input prices	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00		
#ODKAZ!	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000	75 000		**2 756 250**
Heat	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331		**12 858**
Maintenance costs	7 651	7 651	7 651	7 651	7 651	8 417	8 417	8 417	8 417	8 417	8 417	8 417	8 417	8 417	8 417	8 417	8 417		**299 051**
Water + waste	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331		**12 858**
Fuel + other car material	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210	1 210		**47 040**
Other material - replenishment of spare parts warehouse	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000		**128 400**
Land rental	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353	7 353		**330 874**
Other operating expenses	709 172	709 172	709 172	709 172	709 172	726 901	726 901	726 901	726 901	726 901	726 901	726 901	726 901	726 901	726 901	726 901	726 901		**25 320 538**
Marketing	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000		**207 000**
Company insurance	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000		**2 010 000**
Contingency reserve	7 500	7 500	7 500	7 500	7 500	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000		**290 000**
Interest for the period	95 565	90 374	85 117	79 795	74 406	68 950	63 426	57 831	52 167	46 431	40 623	34 743	28 788	22 759	16 653	16 653	16 653		**5 566 552**
Depreciation	337 025	337 028	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025	337 025		**12 836 003**
Total material costs and services	868 548	868 548	868 548	868 548	868 548	889 542	889 542	889 542	889 542	889 542	889 542	889 542	889 542	889 542	889 542	889 542	889 542		**31 285 875**
Total operating costs	**2 080 162**	**2 074 974**	**2 069 714**	**2 064 392**	**2 059 003**	**2 094 771**	**2 089 247**	**2 083 652**	**2 077 988**	**2 072 252**	**2 066 444**	**2 060 564**	**2 054 609**	**2 048 580**	**2 042 474**	**2 042 474**	**2 042 474**		**79 113 585**
Revenues																			
Revenues from sales	2 363 906	2 363 906	2 363 906	2 363 906	2 363 906	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004	2 423 004		**86 824 797**
Price increase coefficient	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00		
Total revenues	**2 363 907**	**2 363 907**	**2 363 907**	**2 363 907**	**2 363 907**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**	**2 423 005**		**86 824 797**
Profit before tax	283 745	288 933	294 193	299 515	304 904	328 234	333 758	339 353	345 017	350 753	356 561	362 441	368 396	374 425	380 531	380 531	380 531		**7 472 246**
Profit before tax cumulatively	1 984 170	2 273 103	2 567 296	2 866 811	3 171 715	3 499 949	3 833 707	4 173 060	4 518 077	4 868 830	5 225 391	5 587 832	5 956 228	6 330 653	6 711 184	7 091 715	7 472 246		
Profit tax	**53 912**	**54 897**	**55 897**	**56 908**	**57 932**	**62 364**	**63 414**	**64 477**	**65 553**	**66 643**	**67 747**	**68 864**	**69 995**	**71 141**	**72 301**	**72 301**	**72 301**		**1 431 792**
Profit after tax	**229 834**	**234 036**	**238 296**	**242 607**	**246 972**	**265 870**	**270 344**	**274 876**	**279 464**	**284 110**	**288 814**	**293 577**	**298 401**	**303 284**	**308 230**	**308 230**	**308 230**		**6 103 956**
Profit after tax + depreciation	**566 859**	**571 064**	**575 321**	**579 632**	**583 997**	**602 895**	**607 369**	**611 901**	**616 489**	**621 135**	**625 839**	**630 602**	**635 426**	**640 309**	**645 255**	**645 255**	**645 255**		**18 939 959**
Cash flow	**229 834**	**234 036**	**238 296**	**242 607**	**246 972**	**265 870**	**270 344**	**274 876**	**279 464**	**284 110**	**288 814**	**293 577**	**298 401**	**303 284**	**308 230**	**308 230**	**308 230**		**(1 959 546)**
Cash flow cumulatively	(6 404 888)	(6 170 852)	(5 932 555)	(5 689 948)	(5 442 976)	(5 177 106)	(4 906 762)	(4 631 886)	(4 352 423)	(4 068 313)	(3 779 498)	(3 485 921)	(3 187 520)	(2 884 236)	(2 576 006)	(2 267 776)	(1 959 546)		
Project financing																			-
																			-
Own resources	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		20,00%	**4 000 000**
																			-
Loan																			-
Interest																			-
Loan funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		80,00%	**16 000 000**
Total loan at the beginning of the period	7 782 635	7 369 085	6 950 344	6 526 347	6 097 028	5 662 320	5 222 156	4 776 467	4 325 183	3 868 235	3 405 550	2 937 059	2 462 686	1 982 360	1 496 004	1 003 543	504 901		-
Total loan at the end of the period	7 369 085	6 950 344	6 526 347	6 097 028	5 662 320	5 222 156	4 776 467	4 325 183	3 868 235	3 405 550	2 937 059	2 462 686	1 982 360	1 496 004	1 003 543	504 901	6 259		-
Interest of the period	95 565	90 374	85 117	79 795	74 406	68 950	63 426	57 831	52 167	46 431	40 623	34 743	28 788	22 759	16 653	10 472	10 472		**5 549 899**
Repayment of the loan	413 550	418 741	423 997	429 319	434 708	440 164	445 689	451 284	456 948	462 685	468 491	474 373	480 326	486 356	492 461	498 642	498 642		**14 996 457**
Interest repayment	95 565	90 374	85 117	79 795	74 406	68 950	63 426	57 831	52 167	46 431	40 623	34 743	28 788	22 759	16 653	10 472	10 472		**5 549 899**
Total repayment (loan + interest)	509 115	509 115	509 114	509 114	509 114	509 114	509 115	509 115	509 115	509 116	509 114	509 116	509 114	509 115	509 114	509 114	509 114		**20 546 356**
Balance of total repayments	7 369 085	6 950 344	6 526 347	6 097 028	5 662 320	5 222 156	4 776 467	4 325 183	3 868 235	3 405 550	2 937 059	2 462 686	1 982 360	1 496 004	1 003 543	504 901	6 259		-
																			-
Cash flows including loan	(279 281)	(275 079)	(270 818)	(266 507)	(262 142)	(243 244)	(238 771)	(234 239)	(229 651)	(225 006)	(220 300)	(215 539)	(210 713)	(205 831)	(200 884)	(200 884)	(200 884)		**(3 323 246)**
Cash flow including loan cumulatively	**176 361**	**(98 718)**	**(369 535)**	**(636 042)**	**(898 184)**	**(1 141 428)**	**(1 380 199)**	**(1 614 438)**	**(1 844 090)**	**(2 069 096)**	**(2 289 395)**	**(2 504 934)**	**(2 715 647)**	**(2 921 478)**	**(3 122 362)**	**(3 323 246)**	**(3 524 130)**		
Project efficiency																			
Net cash flow (adjusted), thous. EUR	156 801	157 502	158 195	158 872	159 537	169 414	169 929	170 434	170 928	171 413	171 888	172 353	172 809	173 254	173 692	171 336	169 012		**(4 624 509)**
Inflation rate, % per year																			
Discount coefficient, % per year																			
Payback period (direct), years																			



Kaspi - sorting plant location

- Heidelberg Cement Factory of Kaspi

Mccheta - waste transfer stations locations

Phase 1 of sorting waste in Georgia

project/ Sorting plant concept in Georgia

Kaspi - sorting plant location

- Heidelberg Cement Factory of Kaspi

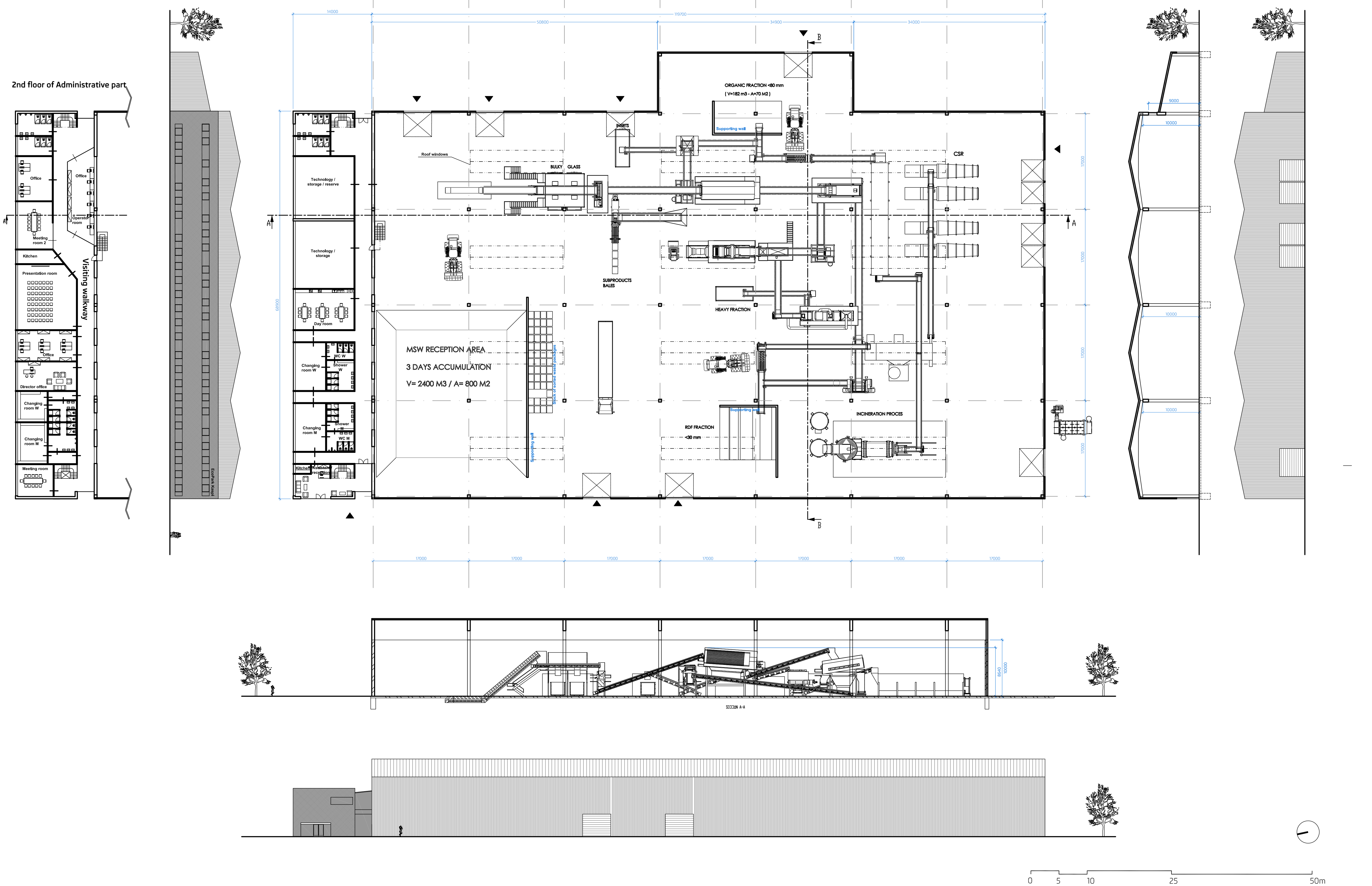
Mccheta - waste transfer stations locations

Phase 1 of sorting waste in Georgia - detail

project/ Sorting plant concept in Georgia

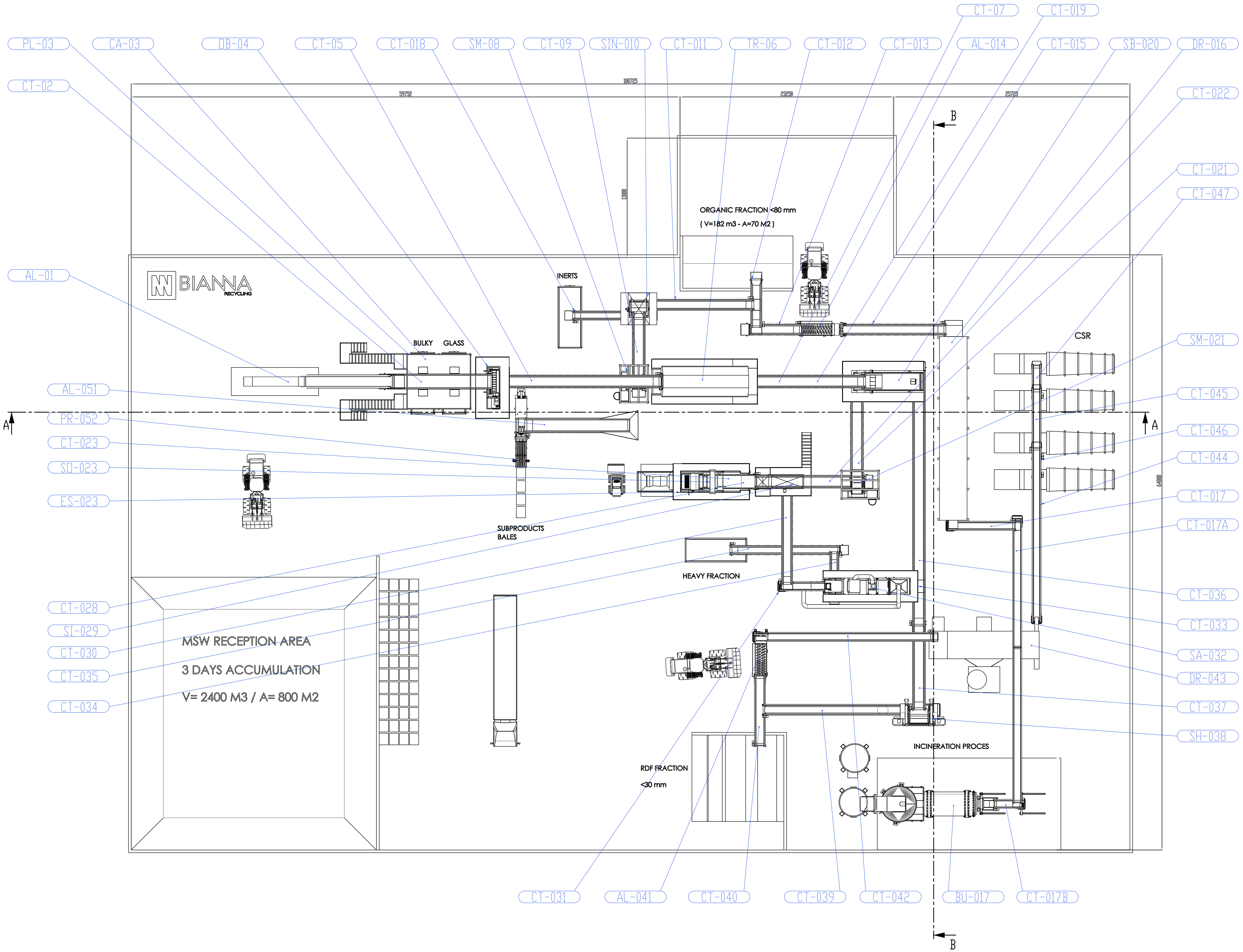
Sorting plant in Kaspi - building site

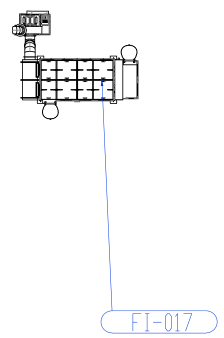
project/ Sorting plant concept in Georgia



Sorting plant - layout

project/ Sorting plant concept in Georgia





AL-01	FEEDING CONVEYOR	PK 18/1500
CT-02	SELECTION CONVEYOR	PA 11.5/1400
PL-03	STRUCTURE PLATFORM SELECTION	PL 6/7/4.7
CA-03	SELECTION CABIN	CA 7/6/3,11
OB-04	BAG OPENER (*)	OC250/75
CT-05	CONVEYOR TO SIEVE DRUM	UP 20/1200
TR-06	SIEVE DRUM	TR2.5/6/8
CT-07	CONVEYOR FINE	UP 28.5/1200
SM-08	MAGNET SEPARATOR	R SKM10.12
CT-09	INCLINED CONVEYOR	UP 9/1200
SIN-010	INERT SEPARATOR	HA-1418
CT-011	INCLINED CONVEYOR	UP 14.5/1000
CT-012	REVERSIBLE CONVEYOR	UP 5/1000
CT-013	INCLINED CONVEYOR	UP 6/1000
AL-014	SCREW FEEDER	SF91/3
CT-015	CONVEYOR TO DRYER	UP 13/1000
DR-016	DRYER ORGANIC FRACTION	
FI-017	FILTER	
BU-017	BURNER	
CT-017	INCLINED CONVEYOR	PAE 7/800
CT-017A	INCLINED CONVEYOR	PAE 17.5/800
CT-017B	INCLINED CONVEYOR	PAE 2,5/800
CT-018	INERTS CONVEYOR	UP 9/800
CT-019	REJECTION CONVEYOR SIEVE DRUM	UP 15/1200
SB-020	BALLISTIC SEPARATOR	SB40
CT-021	INCLINED CONVEYOR 3D	UP 12.5/1200
SM-021	MAGNET SEPARATOR	R SKM10.12
CT-022	INCLINED CONVEYOR 3D	UP 12.5/1200
CT-023	ACCELERATE CONVEYOR DOBLE TRACK	PLS 5,5/1500
SO-023	OPTICAL SORTER	NIR 1400
ES-023	STRUCTURE OPTICAL SORTER	
CT-028	REJECTION OPTICAL SORTER	PAE 6/1000
SI-029	INDUCTIVE SEPARATOR	R-SPM 1050
CT-030	REJECTION INDUCTIVE SEPARATOR	UP 12.5/1000
CT-031	CONVEYOR TO WINDSIFTER	PAE 4.5/800
SA-032	WINDSIFTER	MW100
CT-033	LIGHT CONVEYOR WINDSIFTER	PAE 7/1200
CT-034	HEAVY CONVEYOR WINDSIFTER	UP 5/800
CT-035	HEAVY CONVEYOR A CONTENTOR	UP 12.5/800
CT-036	INCLINED CONVEYOR 2D	UP 28/1200
CT-037	INCLINED CONVEYOR 2D	UP 10/1200
SH-038	SECONDARY SHREDDER (*)	KOMET 1100
CT-039	INCLINED CONVEYOR	PAE 19/1000
CT-040	REVERSIBLE CONVEYOR	PAE 7/1000
AL-041	SCREW FEEDER	SF91/3
CT-042	CONVEYOR TO DRYER	PAE 19/800
DR-043	DRYER RDF	BTL 3000-8
CT-044	CONVEYOR TO SCREW FEEDER	PAE 19/800
CT-045	REVERSIBLE CONVEYOR	PAE 7/800
CT-046	REVERSIBLE CONVEYOR	PAE 3/800
CT-047	REVERSIBLE CONVEYOR	PAE 3/800
AL-051	CONVEYOR TO PRESS BALE	UP 12.5/1400
PR-052	PRESS BALE	H-30-1000
COM-053	OPTICAL SORTER COMPRESSOR	BELT 18

Sorting plant - technology

project/ Sorting plant concept in Georgia

Sorting plant - administrative part vizualization

project/ Sorting plant concept in Georgia

Sorting plant - aerial vizualization

project/ Sorting plant concept in Georgia

Sorting plant - main entrance vizualization

project/ Sorting plant concept in Georgia

Sorting line

project/ Sorting plant concept in Georgia


PET bottles


Folies


Hard plastics


Wood


Cans


Bales loaded on trailer

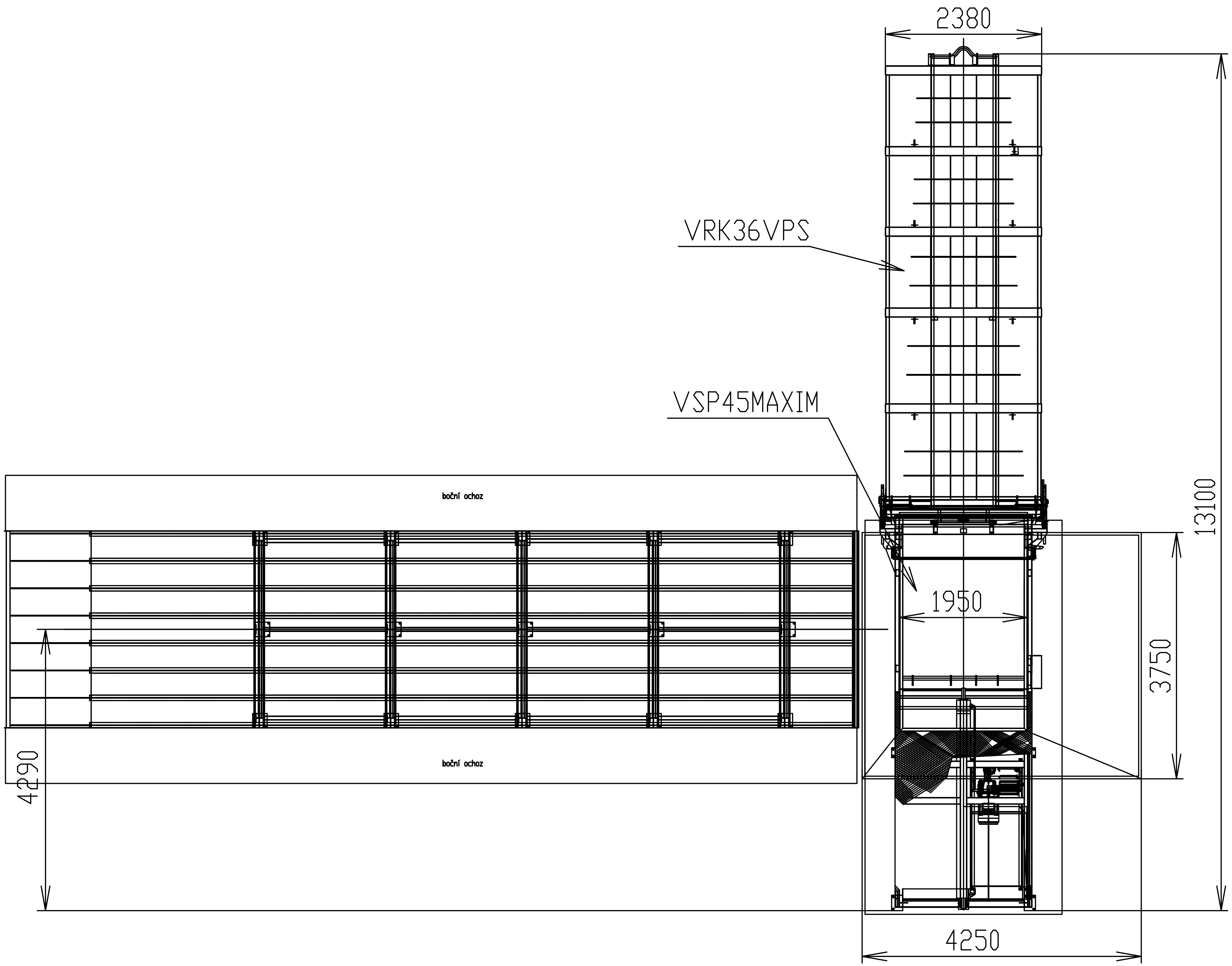
Bales with sorted material

Automatic waste transfer station with pressing units

project/ Sorting plant concept in Georgia

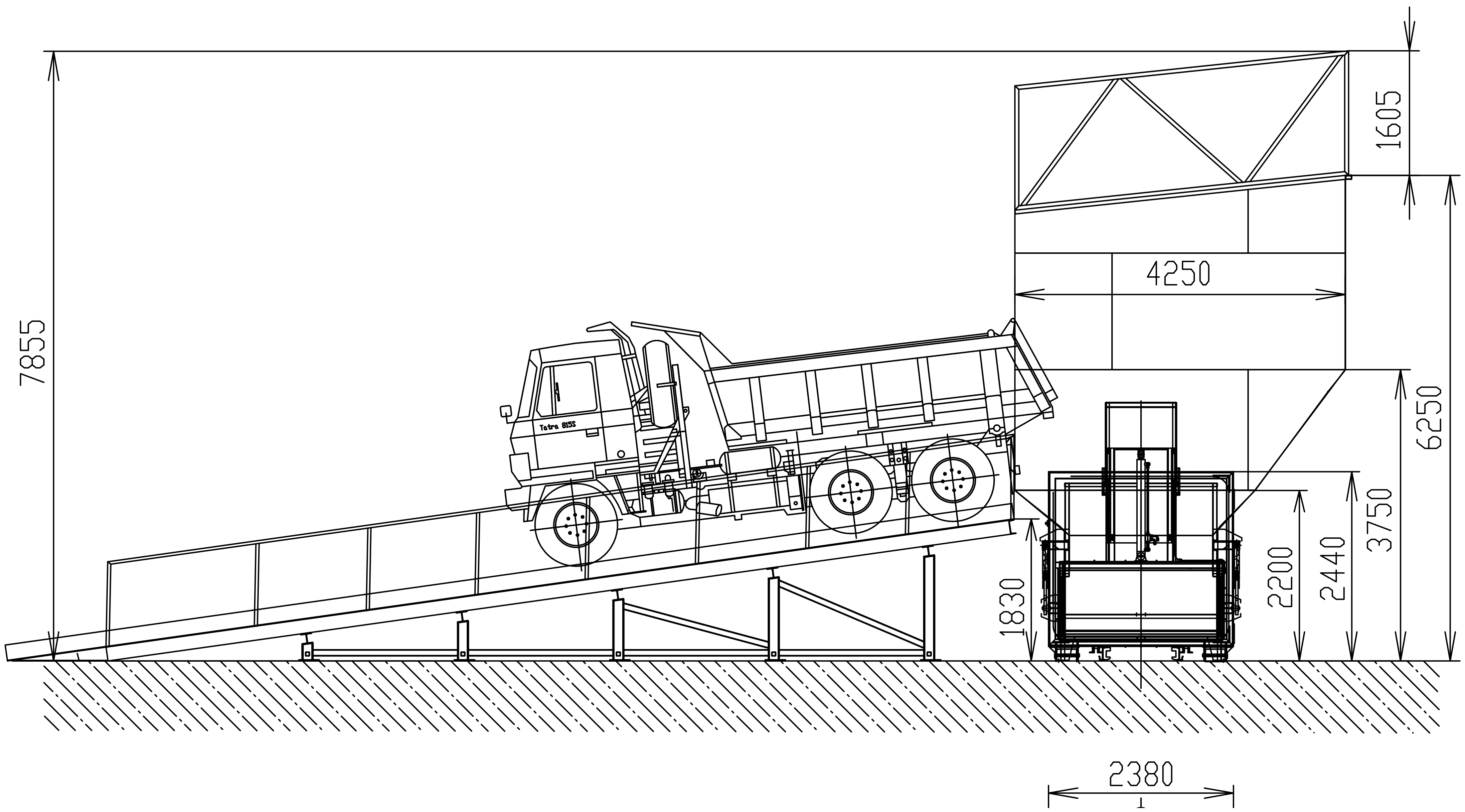
Manual waste transfer station

project/ Sorting plant concept in Georgia



Waste transfer station - floorplan

project/ Sorting plant concept in Georgia



Waste transfer station - elevation

project/ Sorting plant concept in Georgia