



MASTER PLAN

NEW BALANCE TROSTIANETS

with kind support of:

Mr. Hannes Horvath
Mr. Peter Blaschke
Mr. Madis Maddison

19 April, 2023

Modul5

ces
CLEAN ENERGY
SOLUTIONS

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tbw
RESEARCH

NEW BALANCE TROSTIANETS

Disclaimer

The Master Plan “New Balance Trostianets” has been prepared for the Trostianets city council (Sumy region, Ukraine) by CES clean energy solutions GesmbH (Austria), iC consulenten LLC (Ukraine), tbw research (Austria) and Modul5 (Austria) with in-kind contributions by independent experts: Mr. Peter Blaschke, Mr. Hannes Horvath, Mr. Madis Maddison.

This work is the result of volunteer effort from these companies and independent experts which emerged after start of Russia’s war against Ukraine in February 2022. The Master Plan was developed between June 2022 and February 2023, with the consecutive public presentation introduced on April 19th, 2023.

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NEW BALANCE TROSTIANETS

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Transport & Waste
Valeriy Vyshniakov

POOL OF LOCAL EXPERTS

POOL OF INTERNATIONAL EXPERTS

NEW BALANCE TROSTIANETS

WE BELIEVE



in the positive economic, social and sustainable development of Ukraine



in the requirement of strengthening smaller Cities in their initiatives to respond to a new reality and their future needs



in the need to strengthen the border regions to Russia by creating prosperity, welfare and an attractive living environment



that investments will come soon and that smaller Cities have to be ready to attract them.... every cent invested is for the future of Europe



that now is the time for change, for re-thinking and the start-up for building the future urban environment

NEW BALANCE TROSTIANETS

THEREFORE

1

we moved at a time when no one was ready to think about it

2

we want to set first acupunctural stitches as a best practice example for other urban developments in Ukraine

3

we want to strengthen rural areas and eastern regions of Ukraine having the highest needs for development support

4

we chose Trostianets because the city matches perfectly with our vision, is close to border regions to Russia and is motivated to focus their developments towards a sustainable future



BASE LINE

Supported
by GIZ

**MUNICIPAL DEVELOPMENT
STRATEGY 2030 (AS OF
2019)**



Food production and food processing



Forestry, Wood processing



Development of small and medium enterprises



Tourism, Cultural Events, Sport events



Agriculture

Supported
by GoM

**SUSTAINABLE ENVIRONMENTAL ACTION
PLAN (AS OF 2021)**

**TOPICS: ENERGY, TRANSPORT,
WATER/WASTE WATER, WASTE, ETC.**

RESULTS

VISION... AS DEVELOPED IN 2019

Trostianets city amalgamated community is the leader of chocolate and biscuit production in Europe, with a developed **export-oriented cluster of food, woodworking and agriculture.**

Safe, environmentally friendly, energy-efficient community with **comfortable living conditions, recovery and rest.**

Tourist, ecological and youth centre of innovative cultural, educational and sports spaces with developed infrastructure.

Gender-oriented community of friendly governance and active responsible citizens.

INTERVIEWING - FIRST RESULTS:

Is it comfortable to live in Trostianets?

- 99% of responders answered „yes“

What is your favourite place for spending time in the city:

- 80% responded City Central Park

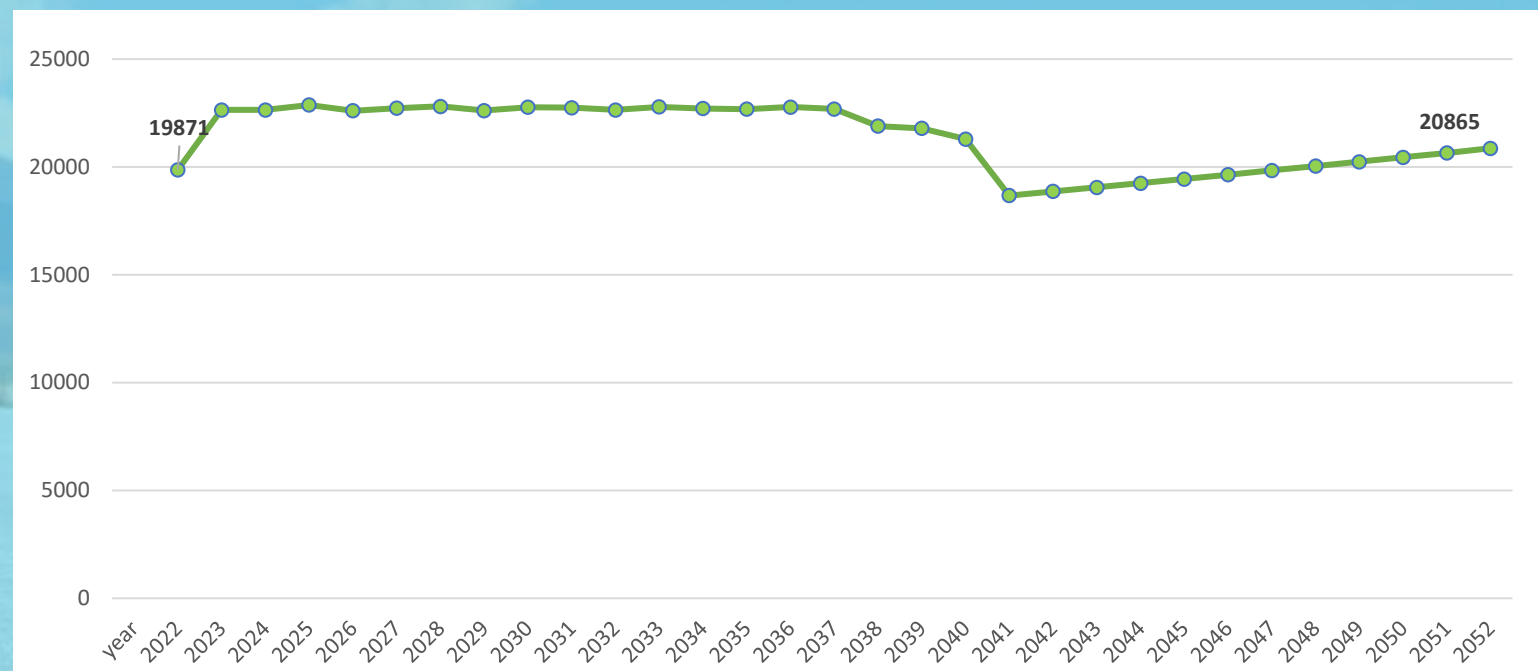
What would be your ideas for international investors to improve the city? What do you miss?

- Sport centres
- Shopping and entertaining centre
- Water pool
- Skate park
- Infrastructure for handicapped people
- Coffee Shops and cafe
- Waste Treatment Plant
- Co-working areas
- Colleges with modern specialities

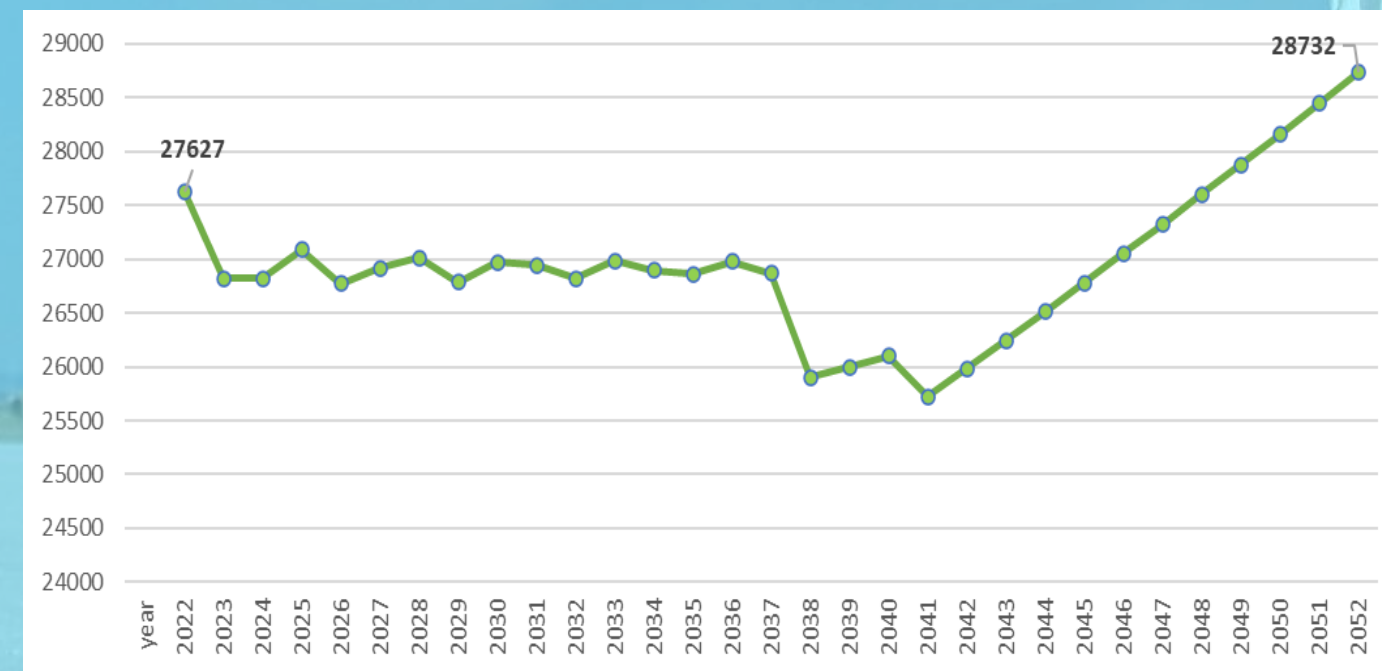


PEOPLE CREATING FUTURE – PROGRESSIVE DEVELOPMENT

- An increase in-migration (coming back and internal displaced people) with the end of the war in the coming year,
- Stronger movement of the working-age population to Trostianets due to its active development
- The population of UTC is expected to grow by up to 4% in the coming 30 years
- The scenario considers the “average age of UTC citizen” (41 years) and the average life expectancy in Ukraine.



City



UTC

NEW BALANCE TROSTIANETS

WHAT TO STRENGTHEN?

- ◆ Future of the children
- ◆ Culture
- ◆ Attractive areas for socialising
- ◆ Economic prosperity
- ◆ Social infrastructure
- ◆ Leisure / Fun / Culinary
- ◆ Daily needs and retail
- ◆ Transport & mobility



- ◆ Quality of Life
- ◆ Sustainability
- ◆ Energy
- ◆ Water / Waste water
- ◆ Future of Young / Education
- ◆ Waste

NEW BALANCE TROSTIANETS

BRANDING - FIRST IDEAS

Basis of various positive developments and connections

No negative association, esp. with the present situation

UNIQUE

Positive image and impressions – today and in the future

Easy to remember

SWEET

“Trostianets, the sweetest town in Ukraine”

Start-up

- Connect existing and future Trostianets key features (tourism, festivals, music, culture, etc.) to the branding
- Sweets are served (as a must) at every meeting concerning Trostianets
- Identify and Create the typical Trostianets Sweet through a competition
- Introduce people to the production of sweets via video from the best sweet-makers in the world
- Create an educational program for young Chocolatiers and Confectioners
- Open a branch of a famous European pastry shop/café
- Support production/work – private, small up to great factories



CITY PLANING

NEW BALANCE TROSTIANETS

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Mr. Josef Lueger

Modul5



GOALS - PREAMBLE

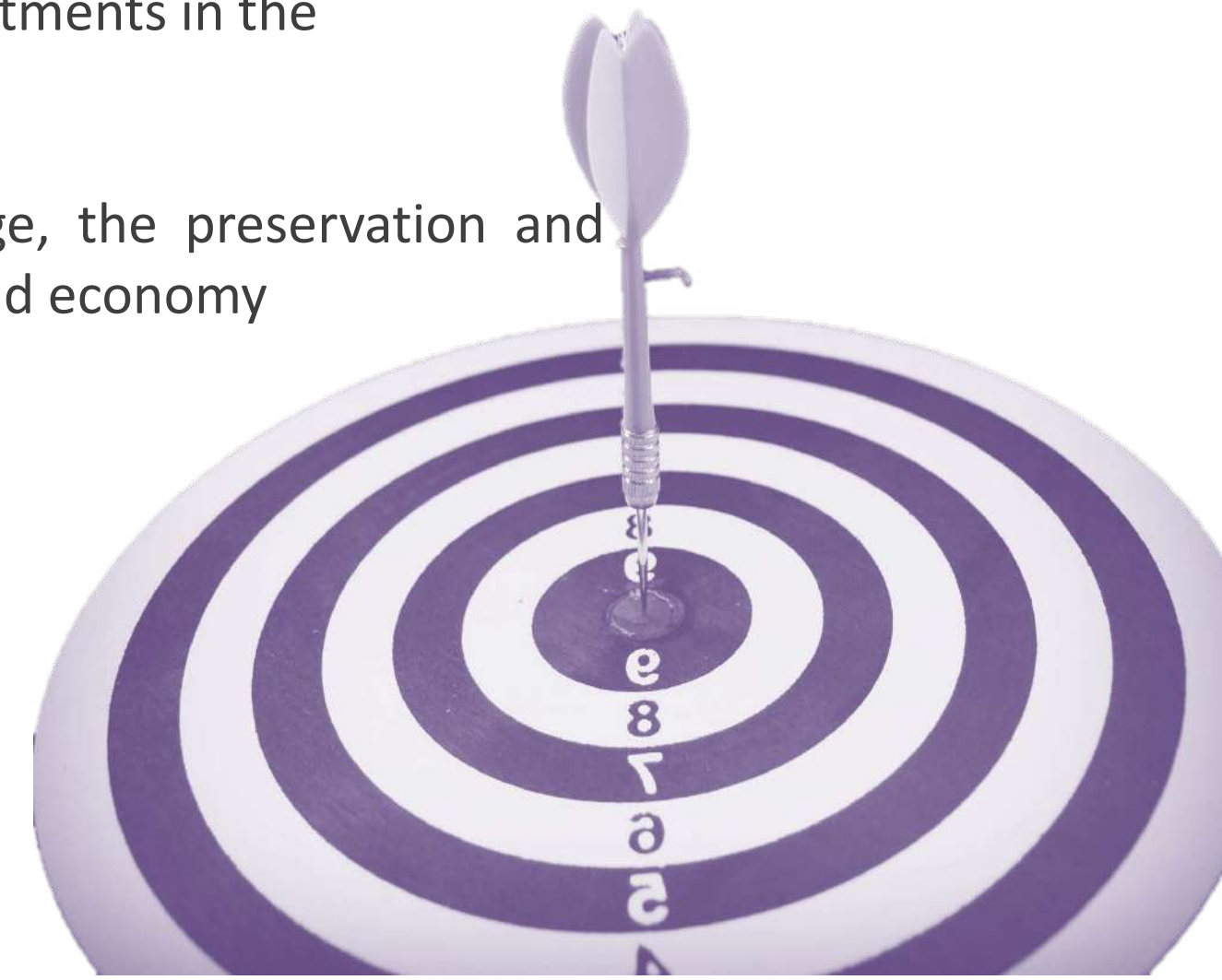
Although we are many kilometres away, the city has given us an overall picture of the different neighbourhoods of the city through feedback, data and videos on city walks.

The destruction and incisions of the war force us to look into the future and make adjustments in the city structures.

The important issues for modern cities today are the adaptation to climate change, the preservation and promotion of the diversity of functions in the centres, the mobility of the inhabitants and economy and the return of production to the city.

All our considerations take into account the specific pressures and challenges.

The master plan is based on the guiding idea of a resilient and self-determined city.



GOALS



Guiding goals targeted by the master plan (what is the spatial vision oriented to?)

- The city will grow through sustainably operating lead businesses and as a liveable full-service provider (health, education, commerce).
- Trostianets spatial development favours "inside" over "outside".
- The concept of "equal opportunity mobility" connects neighbourhoods to their downtown.
- The master plan values the existing and develops it into a vibrant centre through bold interventions.

Objectives of the document (what should be triggered by the master plan?)

- The City Centre Master Plan provides guidance and supports the city in development, promotion and attracting investments.
- A master plan identifies the spatial vision and the next steps for its realization.
- The interventions become concrete in a cost estimate.



CORE STRATEGY - VISION

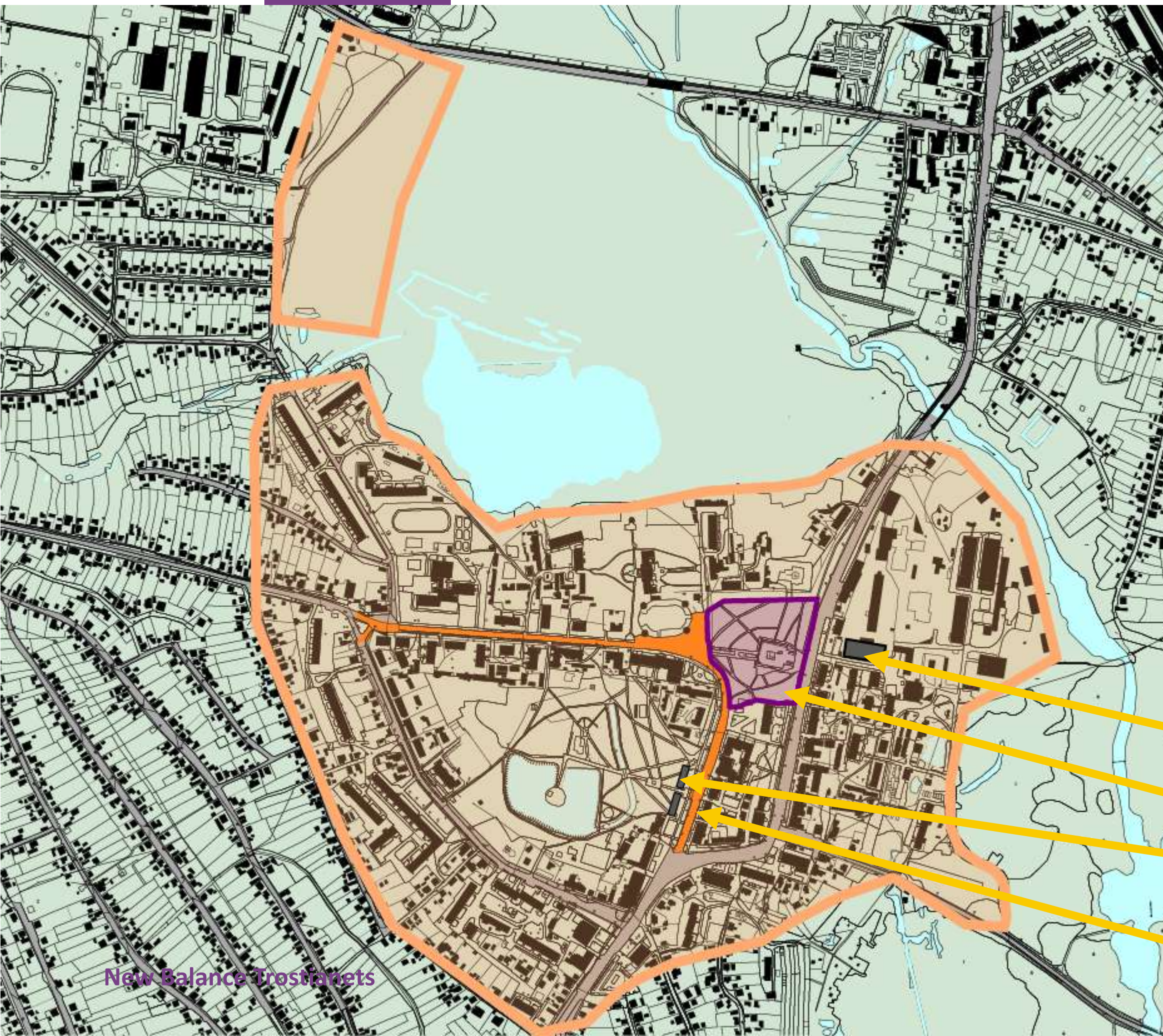
The city centre of Trostianets is a lively and multifunctional centre for the city and the city region. In it the functions of commerce, administration, culture, education and leisure are concentrated. Life in the streets, new squares and buildings does not stop.

The city centre is the heart of Trostianets with a radius of around 600 meters.

The Master Plan describes its veins to the organs of resilient and self-determined Trostianets' and the functional spaces in the heart itself:

- The Commercial Heart
- The Playground Central Trostianets
- The Cultural Heart
- The Heart of Education
- The Sport and Entertainment Heart





CORE STRATEGY SPATIAL ZONING

Develop an urban platform through higher usage density.

- Higher buildings with urban gardening
- Conversion of industrial zones into mixed-use quarters
- Concentration of public uses
- Integration of sports, festivals and events
- Diversify usage of green zone

Urban Factory for Creative Ideas (Co-working / Hub)

TOWN PLAZA

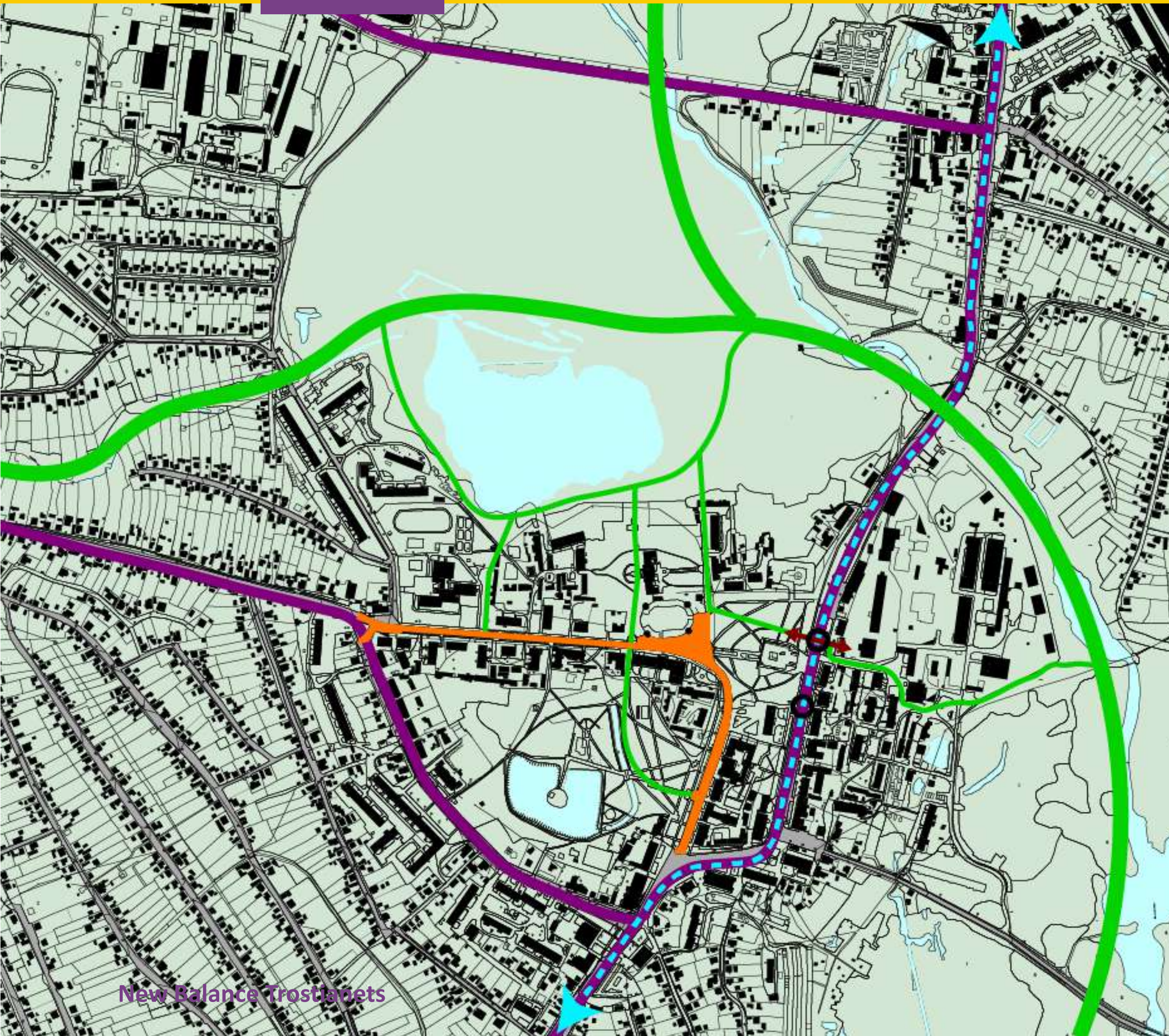
City Market ("Naschmarkt" style) / Farmers or handmade products market

Encounter zone for mixed traffic (car, bike and pedestrian)



GREEN ZONES

- Stable framework of green zones (respond to climate change)
 - city cooling
 - city ventilation
 - urban ecology
 - veins for sports, leisure and tourism
- Create buildable ground
- Encounter zone



MOBILITY

Create stroke veins for:

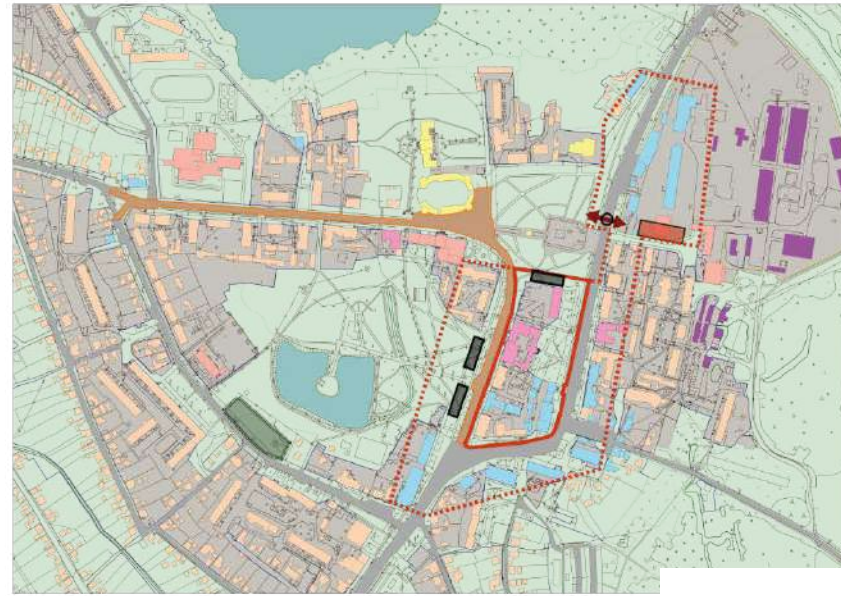
- Motorized traffic
- Pedestrian traffic
- Bicycle highway
- Public transport

And liveable space for citizens to meet and live together

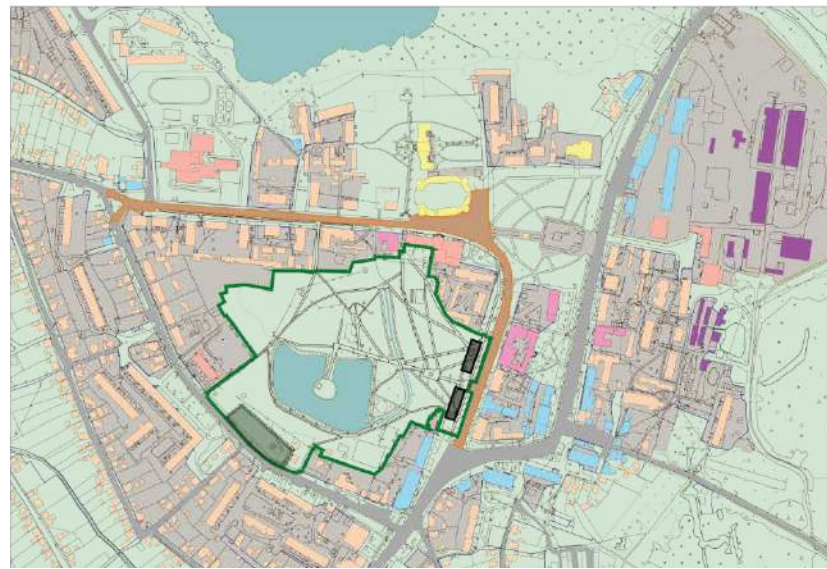
Legend:

- Main road
- Pedestrian and bicycle highway
- Encounter zone
- Public transport station
- Strong vein for sports and leisure time

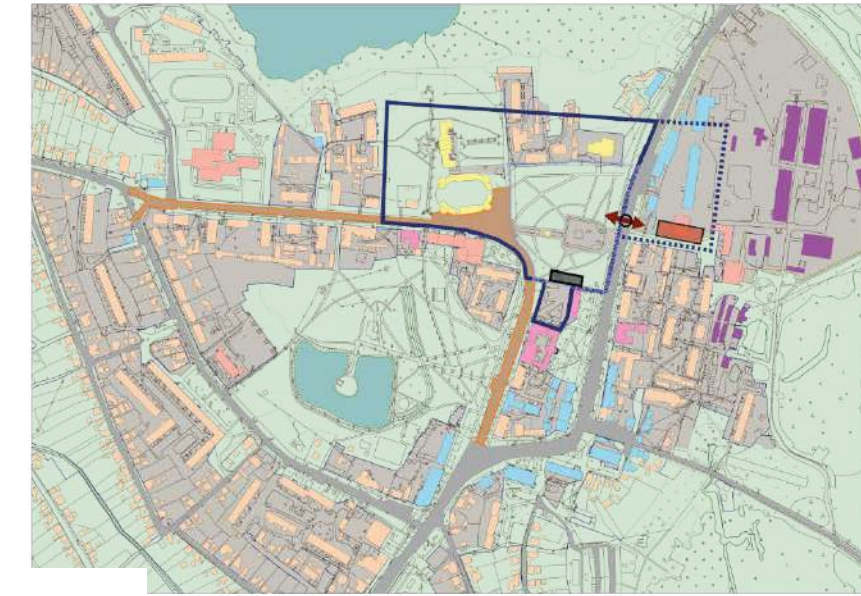
1. The Commercial Heart of Trostianets



2. The Playground in Central Trostianets

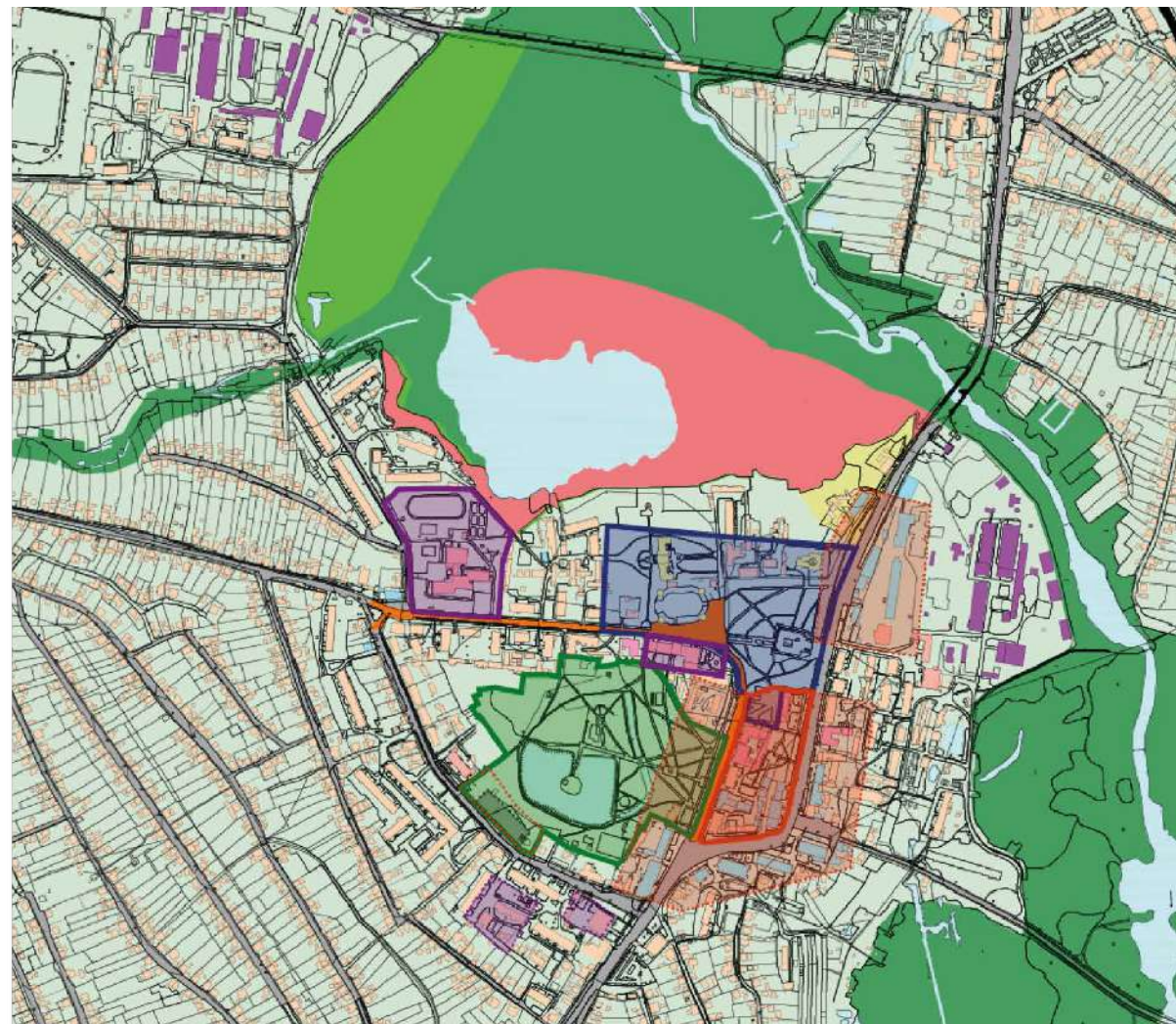


3. The Cultural Heart of Trostianets

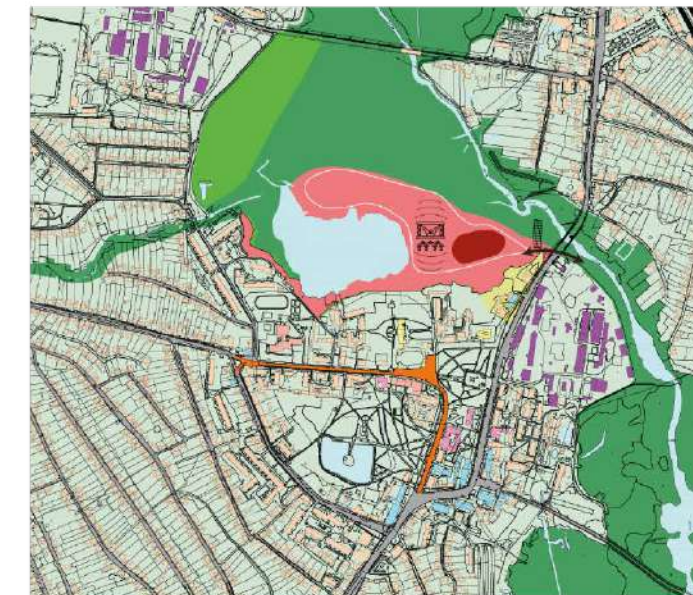


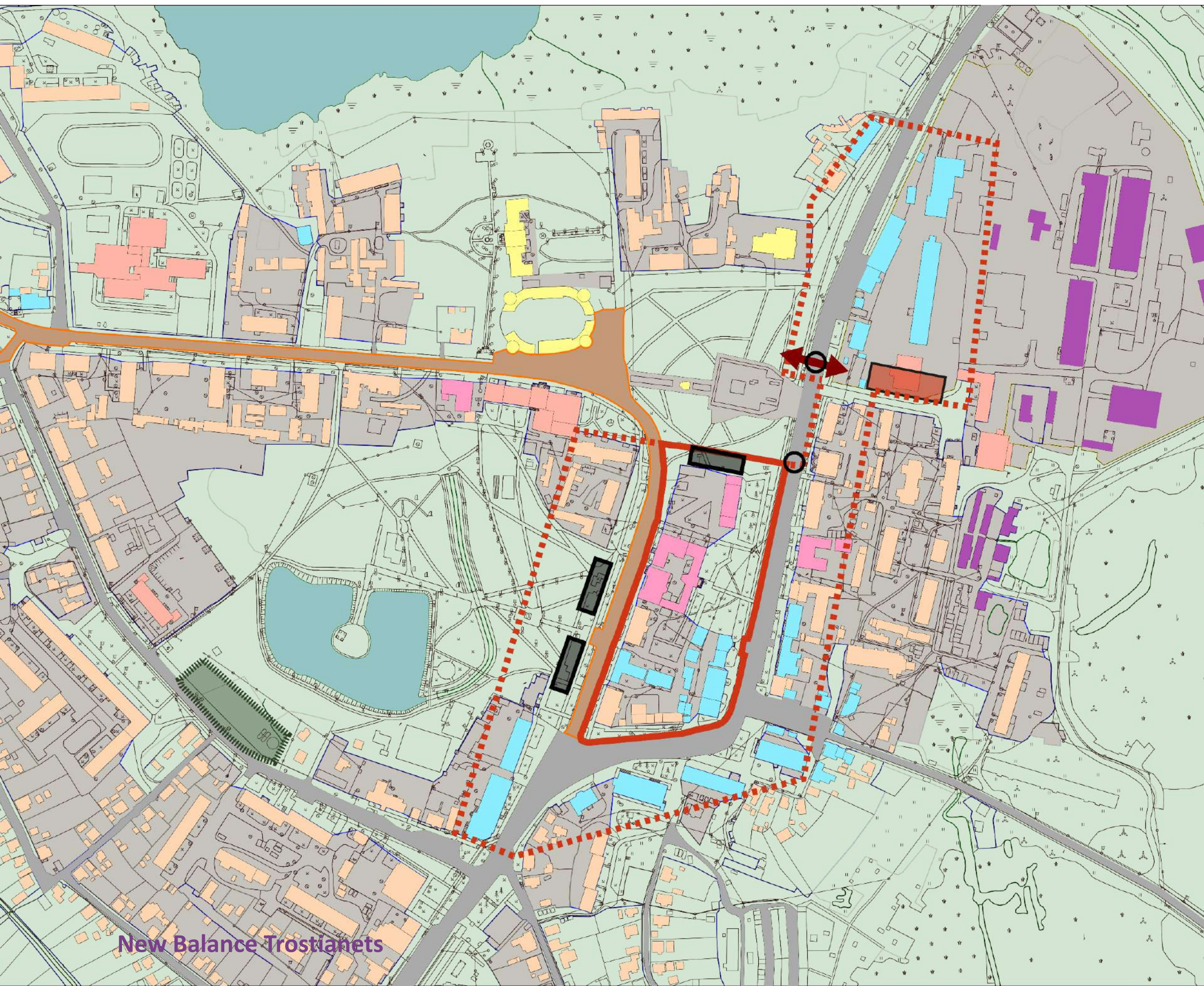
COMBINATION OF THE HEARTS

4. The Educational Heart of Trostianets



5. The Sports and Entertainment Heart of Trostianets





THE COMMERCIAL HEART

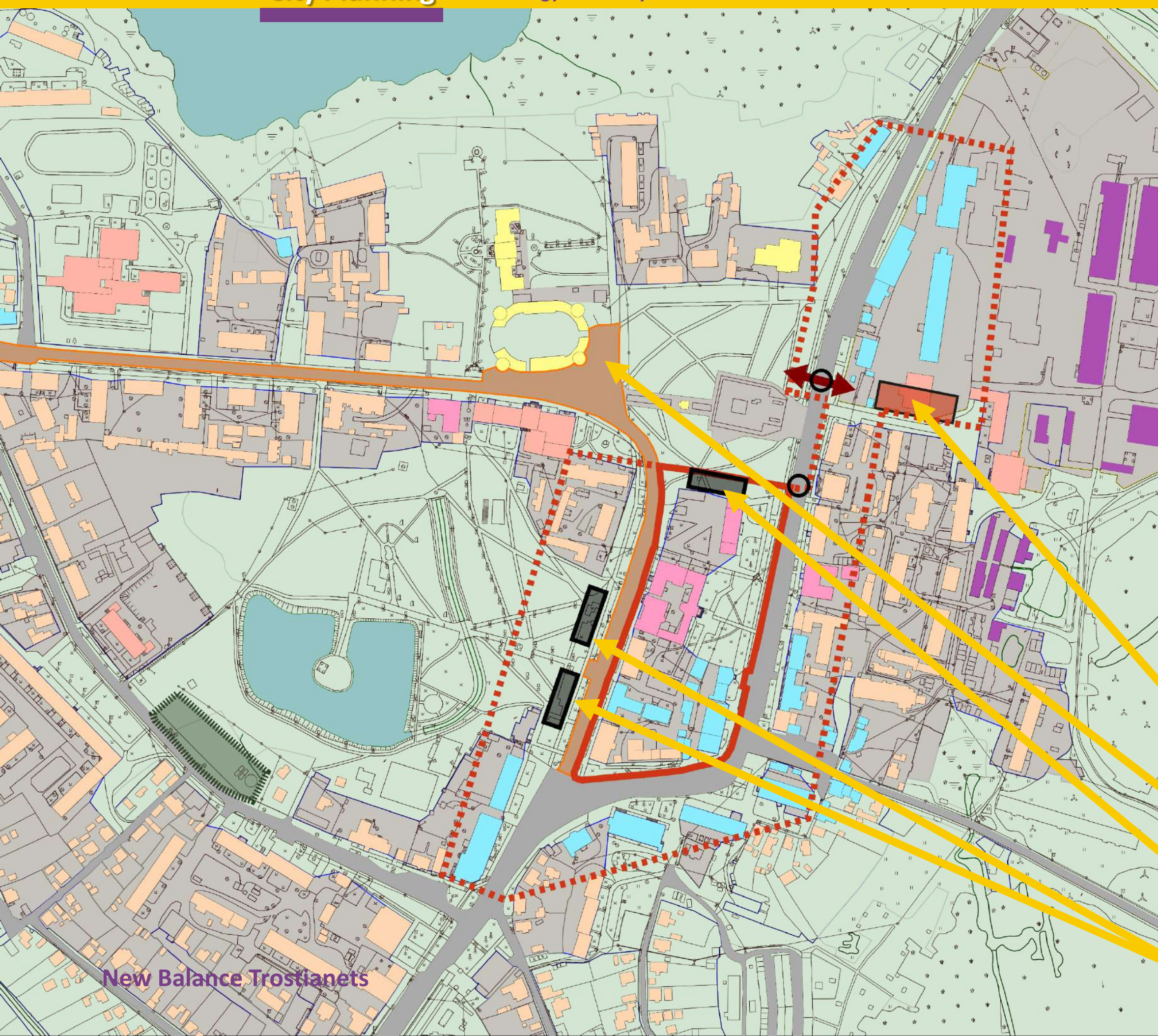
1st Step:

Cooperative planning process for the detailisation of the urban concept, including the spatial transitions to the Playground, Cultural Heart and Urban Factory for Creative Ideas (Co-working / Hub).

The dominant uses are **administration, retail and gastronomy.**

We recommend the complete reorganization of the central quarter for the development of a **shopping mall** that opens up to a **market square** and a **town square.**

The marketplace is bounded on the west by two signal buildings. These mark the entrance to the Playground. A **Farmers or handmade products market** uses the street, a **encounter zone**, and offers the products of farmers and self-suppliers.



THE COMMERCIAL HEART

A car-free city square will be marked by the city administration and a multifunctional new building, the “House of the future”.

The **public transport station** is moved to the House of the future, where an **overpass** optimizes the connection across the main traffic axis to the eastern part of the city.

The interventions **City Farm** with kitchen and store, the **training confectionery**, as well as the House of the Future are explained in the further section.

Urban Factory for Creative Ideas (Co-working / Hub)

Encounter Zone. Accessible by car only for residents and suppliers / Pedestrian area “Alley of peace”

“House of the future”

City Market (Naschmarkt style) / Farmers or handmade products market

THE COMMERCIAL HEART OF TROSTIANETS

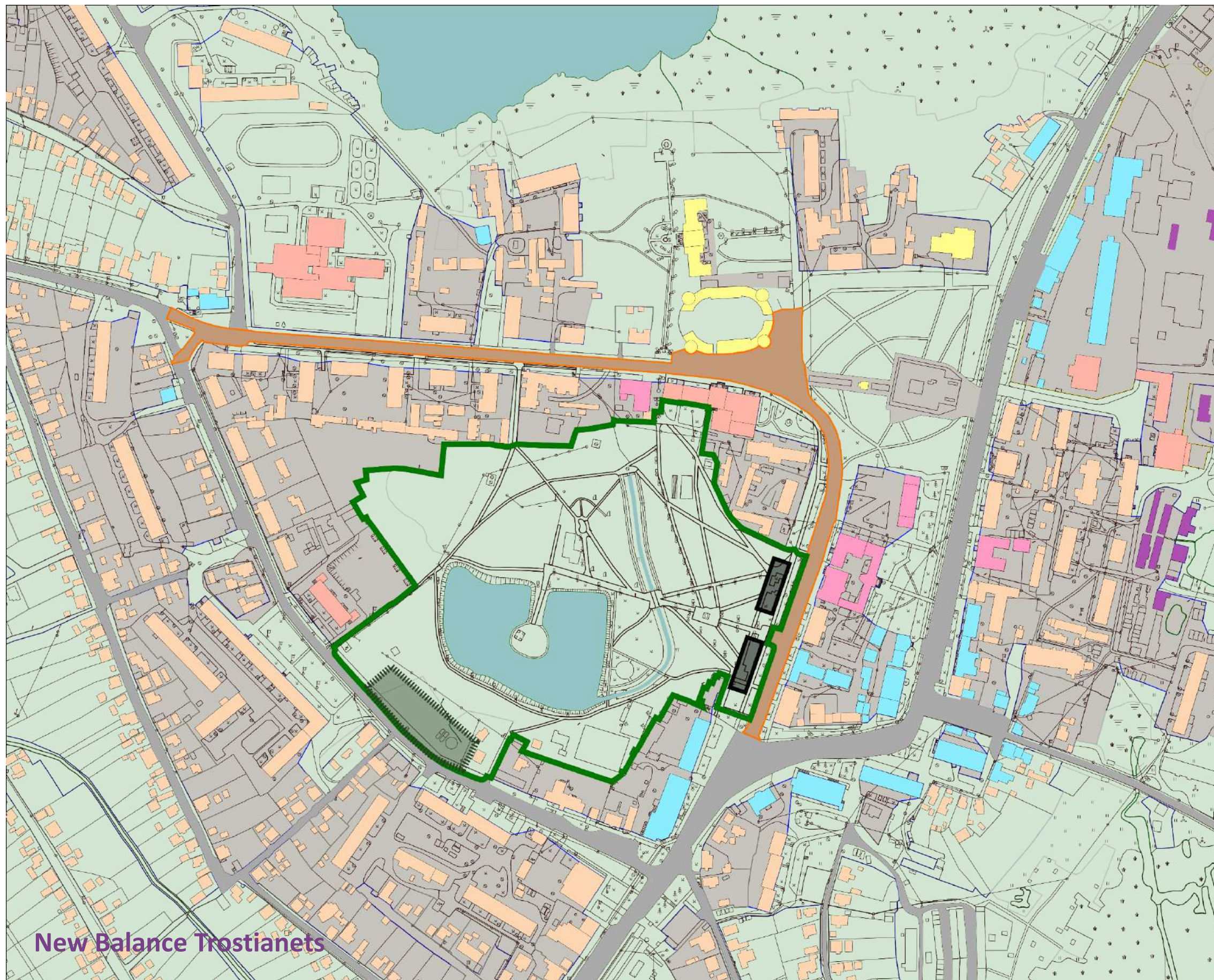
The current status of the master plan provides a direction of development for the commercial centre. For sustainable spatial solutions that are sufficiently linked to the other areas of the centre, we recommend that the city undertake more concrete spatial and utilization studies with an interdisciplinary planning team.

In a **cooperative process**, the following criteria should be worked through:

- Urban density
- Maximum heights
- Development options
- Uses and quantity structure

In the following step, **competitions** can and should be held for sections and construction projects.

THE PLAYGROUND IN CENTRAL TROSTIANETS



1st Step:

Design competition for the open space "Playground in Central Trostianets" incl. interface to the new buildings City farm and training confectionery.

Dominant uses are play and fun areas for children from 0 to 15 years.

We recommend an **overall concept** that proposes selective improvements in furniture, equipment and routing and, above all, specifies the access from the Commercial Heart.

The signal buildings the **Farmers or handmade products market** with kitchen and store as well as the **training confectionery** with pastry store mark the access and on the other side the market place.

The design of the new buildings should be light and transparent. Reference images are greenhouses made of steel and glass. They open to both sides.

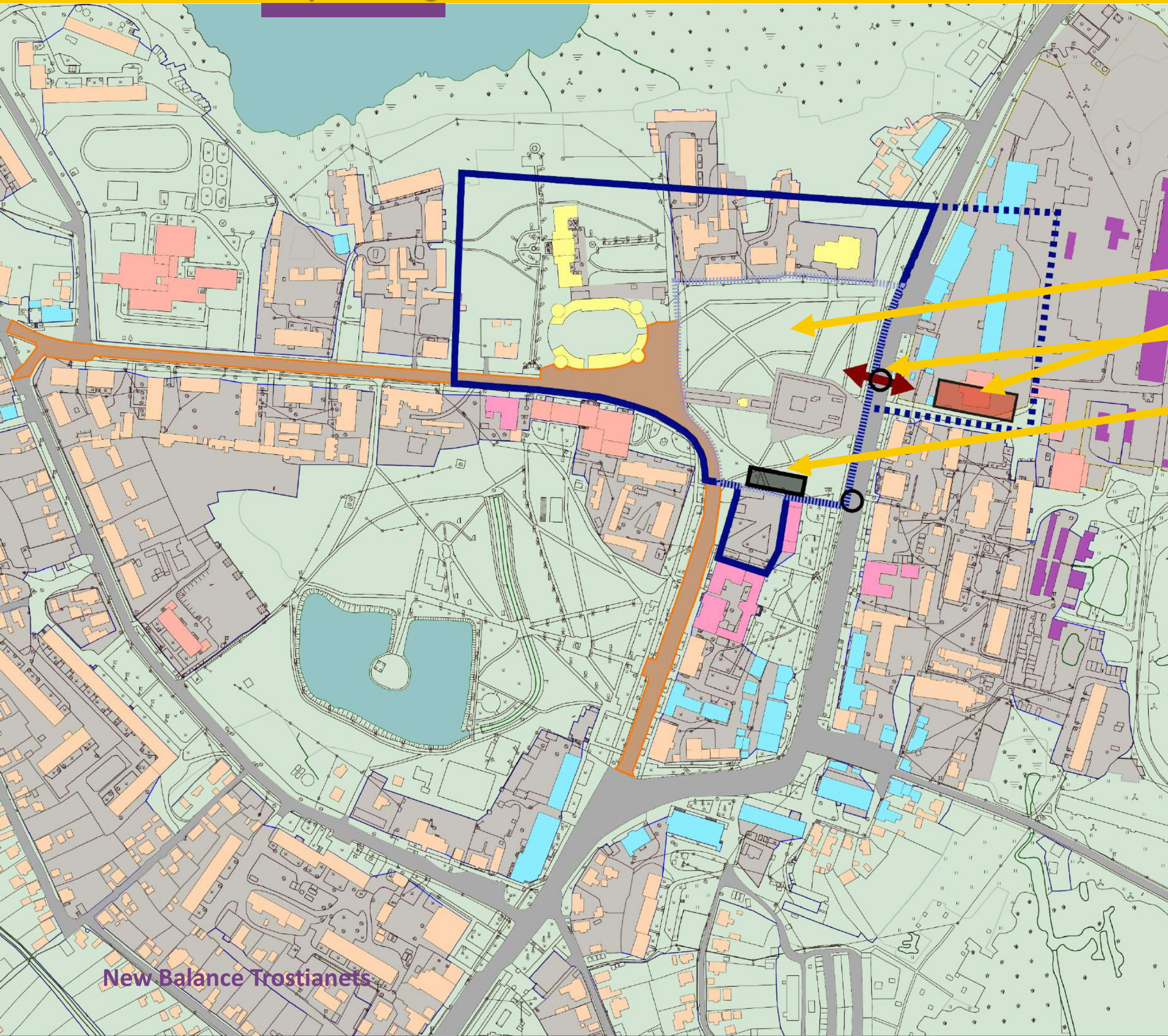
ENTRANCE TO THE PLAYGROUND IN CENTRAL TROSTIANETS, REFERENCES



© <https://www.rollingpin.at/konzepte-openings/inspirati@http://www.rollingpin.at>



© <http://www.glashaus-cafe.at>



THE CULTURAL HEART

Town Plaza

Urban Factory for Creative Ideas (Hub)

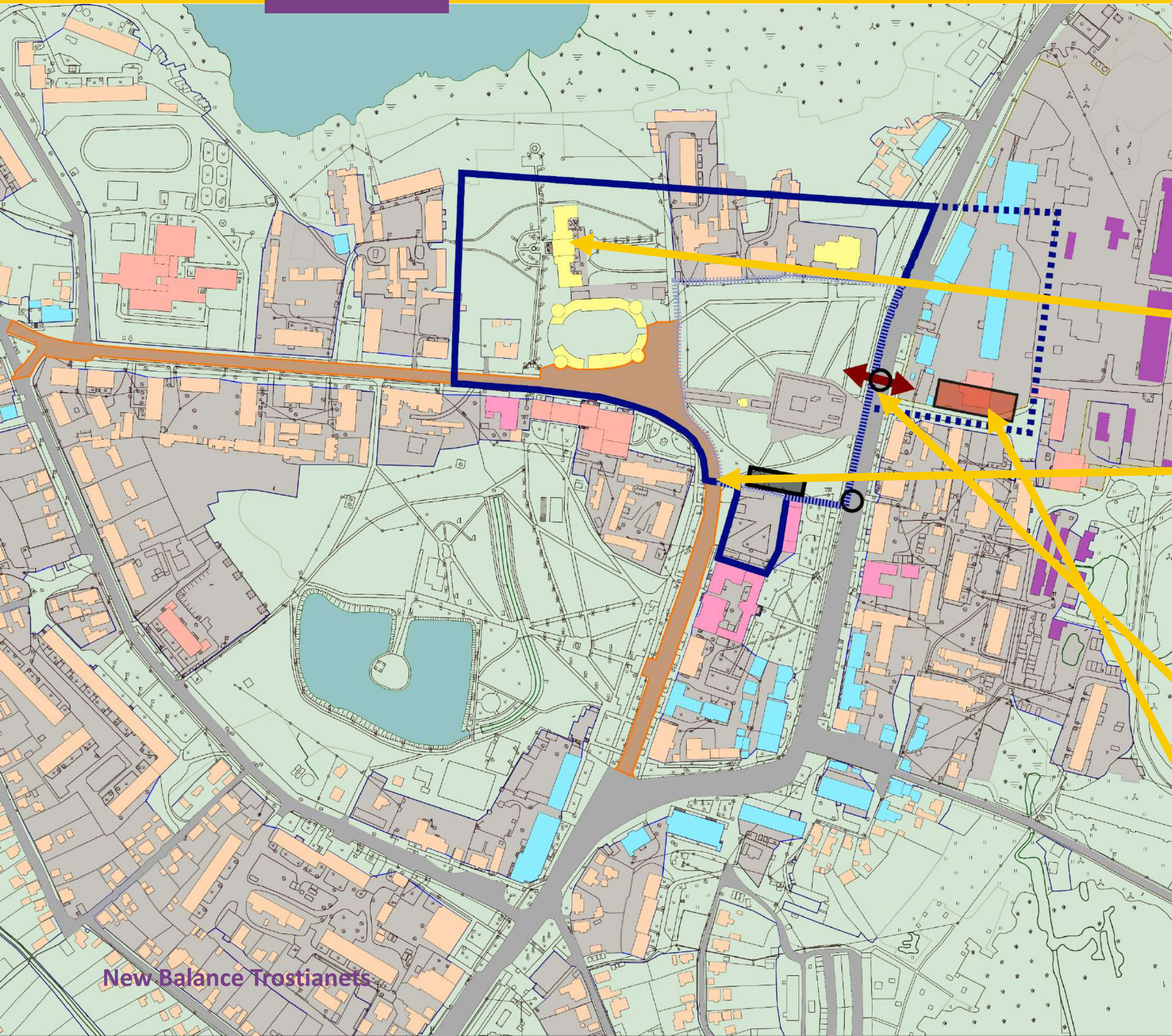
Public transport transition

House of the Future

Trostianets cultural heart is open on all sides with a core for inspiration and high quality of stay.

The plaza is to be developed into a 3rd Place, in that a multi-use plaza with urban furniture and spatial enclosure will encourage active use. People will meet, read, listen to and make music here in the future. The design respects the existing buildings and embraces the central axis. A competition will decide on the framing of the plaza.

Additional pathways connect the plaza to the Promenade and Urban Factory (Hub).



THE CULTURAL HEART

The **museum** will be further developed into the **House of Memories** by incorporating the events and fates of the war.

The other end of the quarter is marked by the **House of the Future**. Joy and liveliness are promoted here, traumatic memories are transformed into confidence. Low-threshold art of styling oneself, expressing oneself and form and music can unfold in a house open to use.

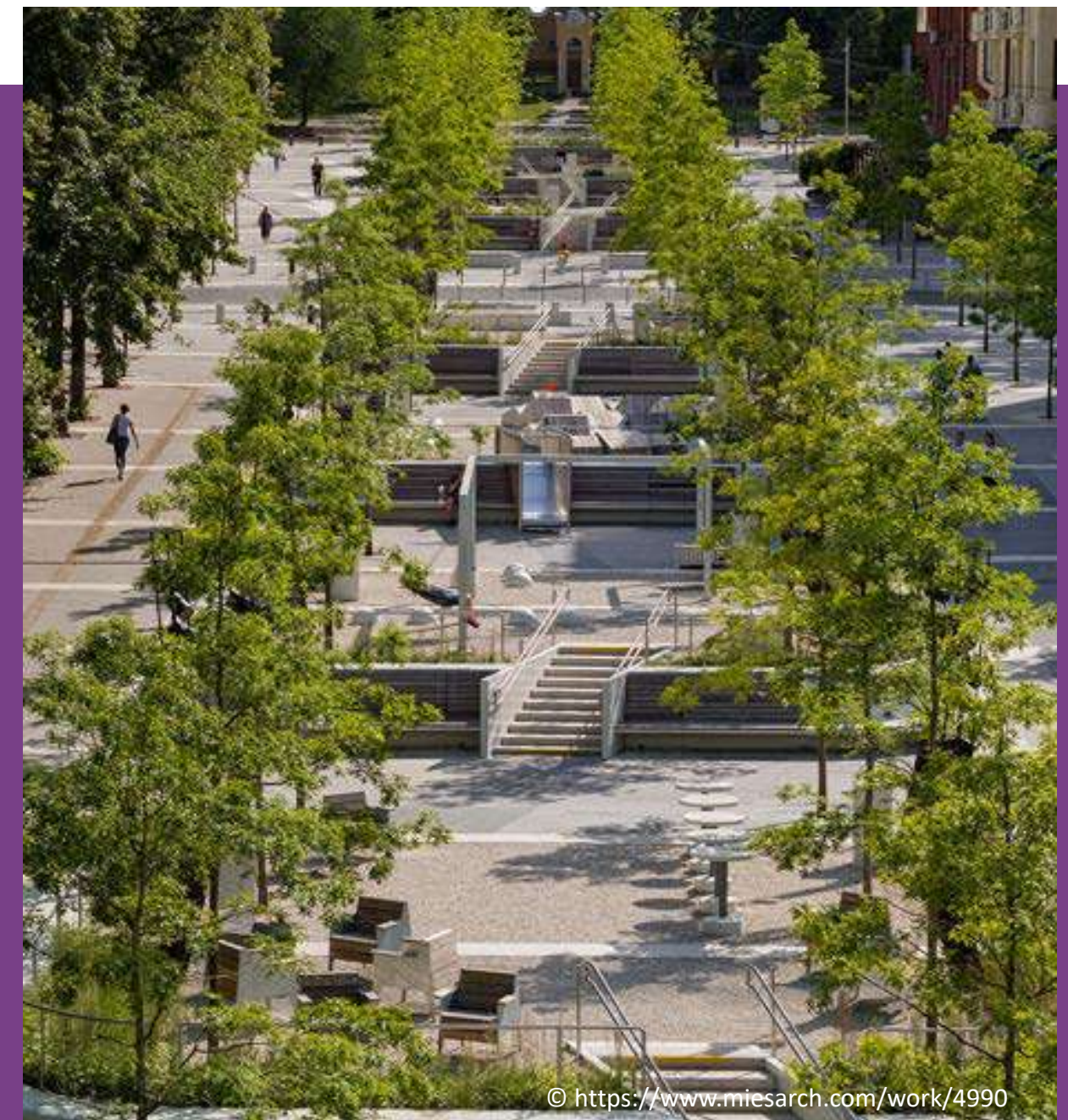
The **public transport station** with an **overpass** strengthen the connection with the city.

The **Urban Factory** is an anchor use adjacent to the industrial park. Economic opportunities are created in the workshops for craft techniques.

THE CULTURAL HEART OF TROSTIANETS REFERENCES FOR THE PLAZA, FRAMING



© <https://landezine.com/wp-content/uploads/2016/03/Cultural-Plaza-Park-13.jpg>



© <https://www.miesarch.com/work/4990>

THE CULTURAL HEART OF TROSTIANETS REFERENCES FOR THE HOUSE OF THE FUTURE

Modal units for different uses

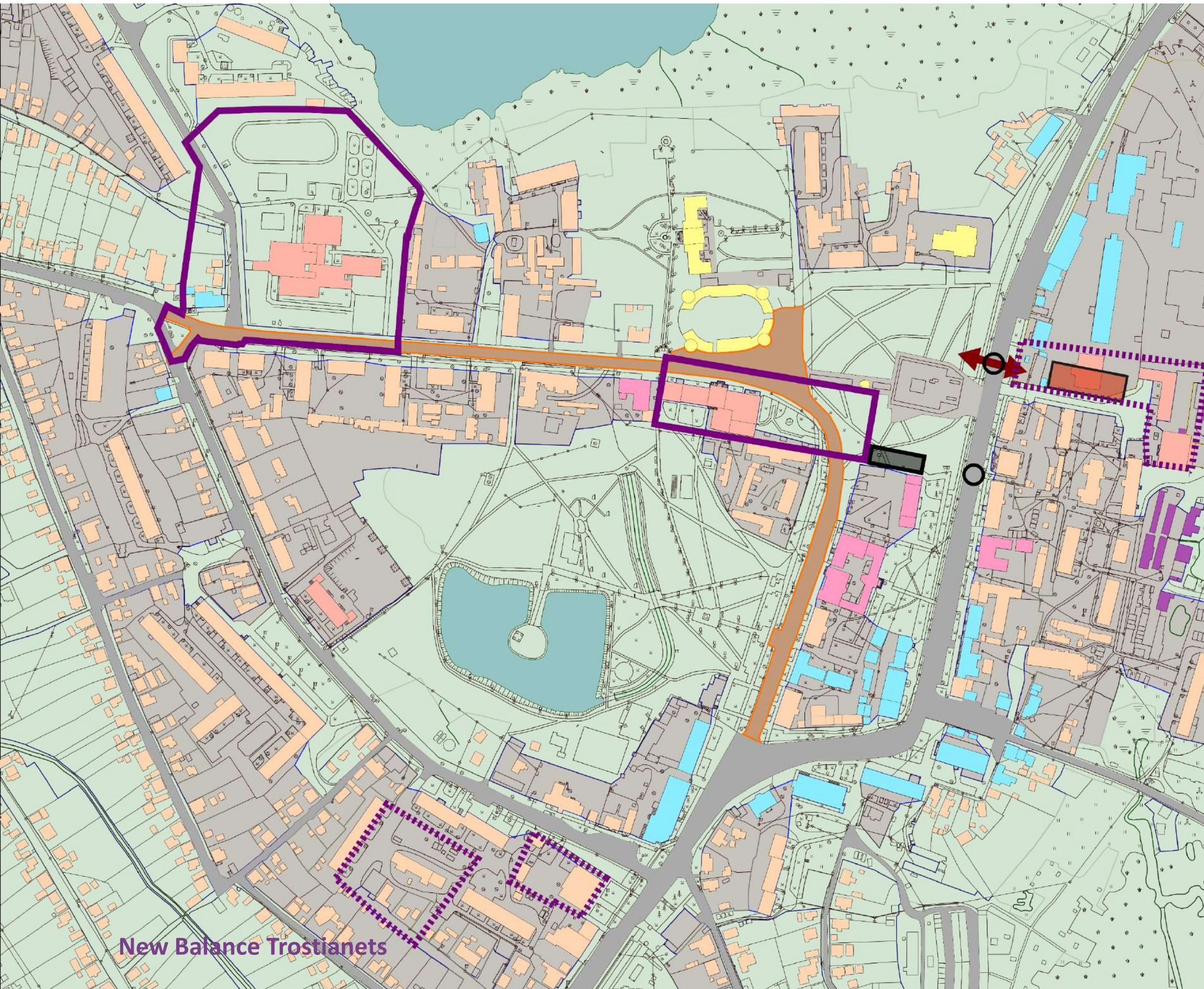


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New Balance Trostianets

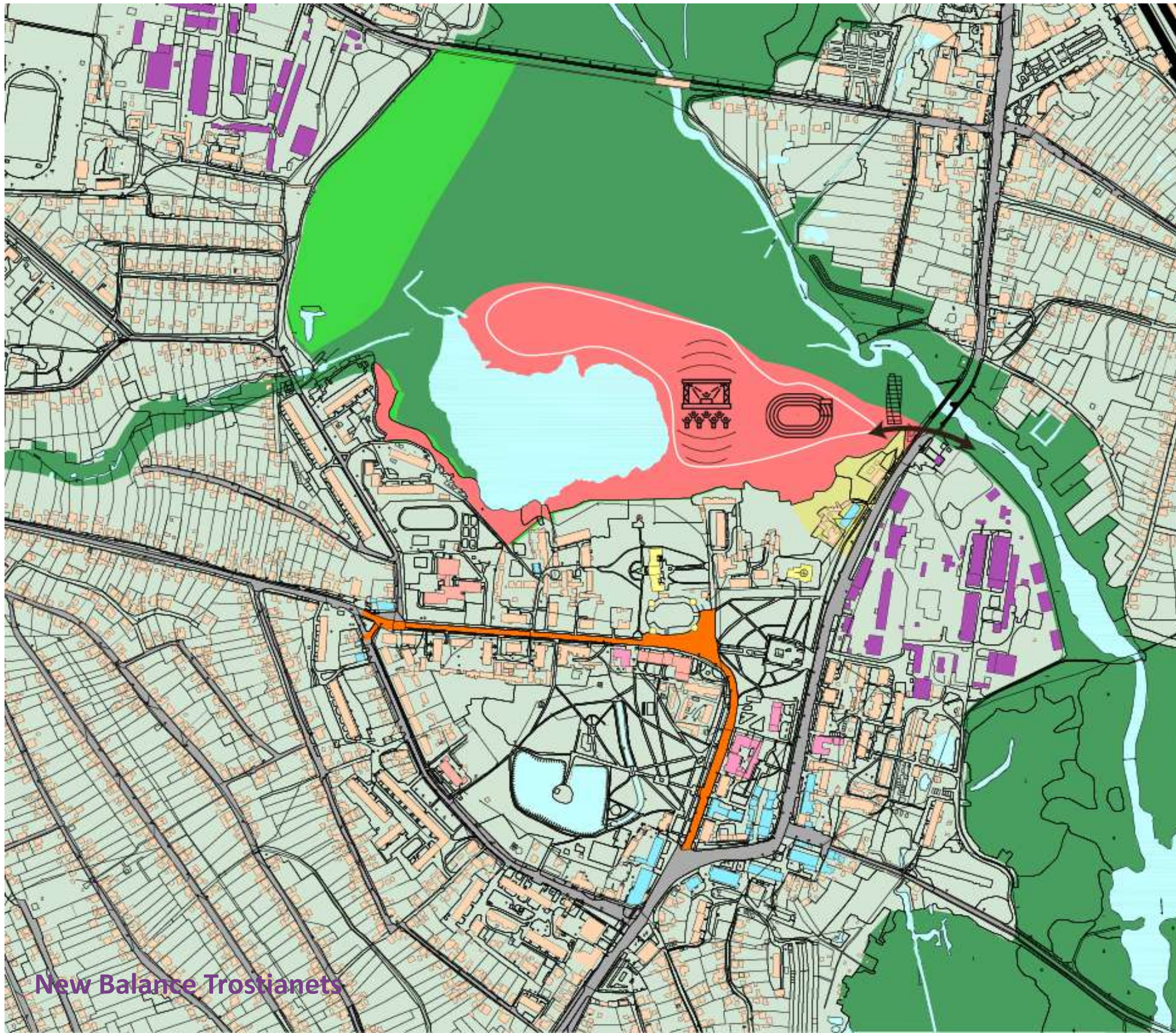


THE EDUCATIONAL HEART

The educational institutions in the centre are connected by an encounter zone. The school route leads to the new station public transport and revitalizes the adjacent city quarters.

In the future, the educational facilities are to be forced and if possible be expanded.

THE SPORTS AND ENTERTAINMENT HEART



New Balance Trostianets

1st Step:

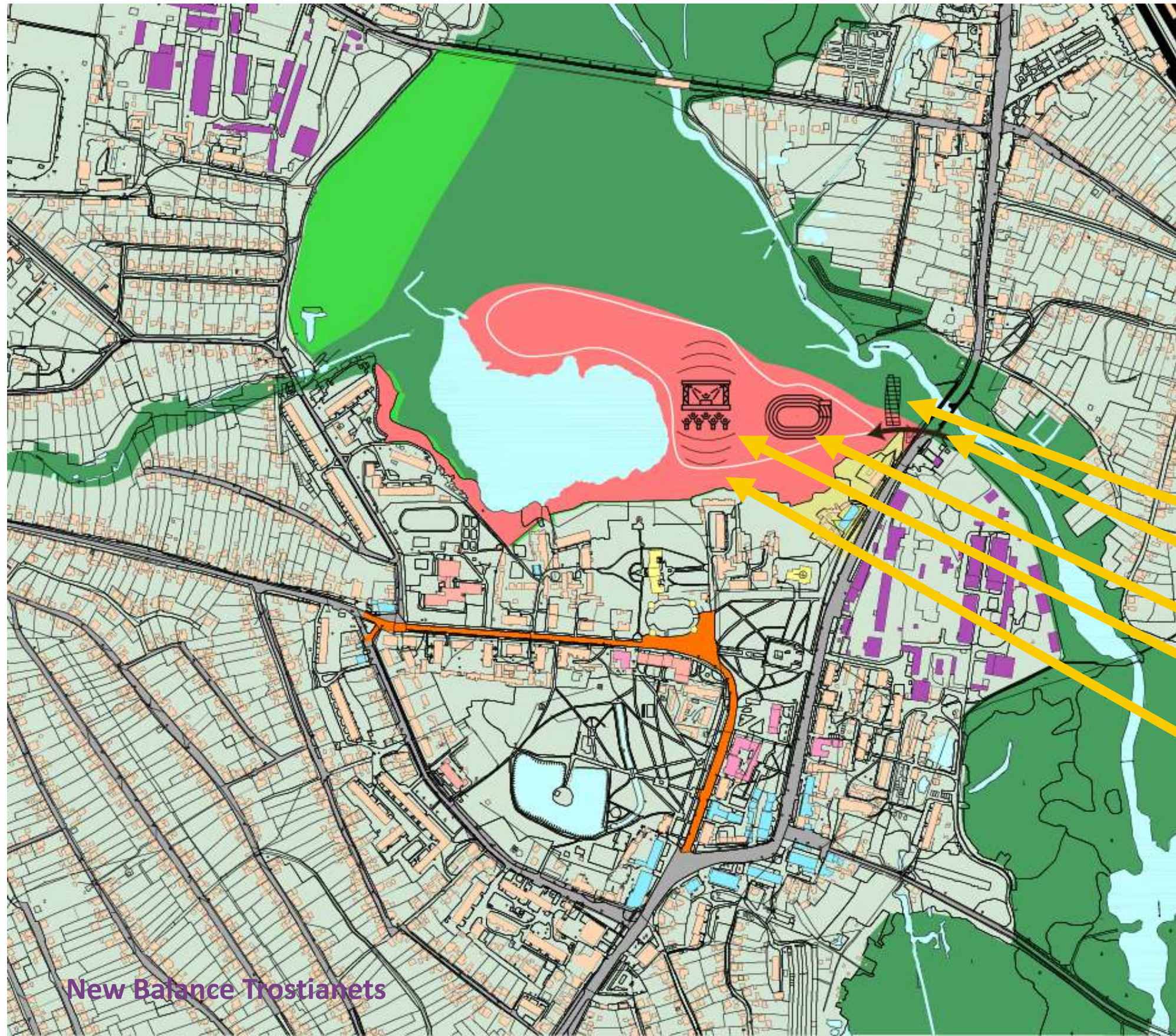
Creation of a detailed concept for the year-round use of a multifunctional arena. (for concerts and sports)

Four heart functions of the city is located on the city terrace. To the north, the site slopes down to a central green space. This is the site of a nationally significant **entertainment and sports arena**.

Standing and seating terraces are oriented towards **the stage**. Towards the city, medium-sized events with 5-10,000 visitors can be held here. Concerts with up to 50,000 visitors and more can be staged to the north.

Infrastructures for sports and hotels can be built along the main road in the future.

THE SPORTS AND ENTERTAINMENT HEART



The entrance to the stadium leads across the street via a **wooden construction**. In summer, this construction can be used for cyclists and pedestrians to change sides without danger. Optionally, a **wooden city tower** could become a landmark for the city.

- Wooden city tower
- Entrance to the stadium
- Sports stadium
- Festival area
- Seating terrace

SPORTS AND ENTERTAINMENT HEART OF TROSTIANETS



MAKE THE CITY ATTRACTIVE TO LOST RESIDENTS AND POTENTIAL MIGRANTS

House of Future / Future Garden

Releasing the trauma of children, women and men. By appreciating people, by being able to express yourself. A low-threshold house and a garden/space for

- hair styling and nail design
- music, painting, dance and artistic experiments
- celebrating, barbecuing, cooking and baking together

With

- a multifunctional stage inside and outside and

Embedded in a house that transforms and can change with the needs. For housing and offices, for services and community spaces – like Future Garden.

House of Memories

Collect memories of the people who had to leave the city during the war, of the people who are moving to the city now and in the future. Document the demolitions, changes, and items needed to rebuild the destroyed museum.



INVESTMENT ACTIVITIES

Commercial Heart

- Shopping Mall
- Marketplace
- Town Square
- Pedestrian zone
- Public transport station
- Overpass
- House of the Future /Future Garden
- Cooperative planning procedure Commercial Heart

Playground Heart

- Additional equipment for playgrounds and fun
- Farmers or handmade products market
- Learning Café
- Overall detailed planning Playground Ground Heart

Cultural Heart

- Plaza usability and furniture
- Plaza enclosure (competition and implementation)
- House of Memories
- Future Garden
- Urban Factory for Creative Ideas (HUB)
- Overall detailed planning Cultural Heart

Sports- and Entertainment Heart

- Arena (Seating terraces)
- Arena (Two-sided stage, double stage)
- Hotel and sports infrastructure
- Wooden structure city tower, crossing
- Promenade
- Overall detailed planning Cultural Heart

Development strategy 2024 - 2050

URBAN PLANNING

PROGRAM / INVESTMENT ITEMS	2024 (€)	2025 (€)	2026 (€)	2027 (€)	2028 (€)	2029 (€)	2030 (€)	TOTAL Investment till 2030 (€)	2030-2040 (€)	2040-2050 (€)
URBAN PLANNING										
Commercial Heart										
TA: Overall planning Commercial Heart / Competition, Tendering, Supervision										
Shopping Mall										
Market Place										
Town Square										
Pedestrian Zone ("The Walk of Peace")										
Public transport station										
Overpass										
House of the Future / Future Garden										
Playground Heart										
TA: Overall planning Playground Heart / Competition, Tendering, Supervision										
Equipment playgrounds and fun										
Farmers or handmade products market										
Learning Café										
Cultural Heart										
TA: Overall planning Cultural Heart / Competition, Tendering, Supervision										
Plaza usability and furniture										
Plaza enclosure (competition and implementation)										
House of Memories										
Future Garden										
Urban Factory for Creative Ideas (HUB)										
Sports- and Entertainment Heart										
TA: Overall planning Sports- and Entertainment Heart / Competition, Tendering, Supervision										
Arena (Seating terraces)										
Arena (Two sided stage, double stage)										
Hotel and sports infrastructure										
Wooden structure city tower, crossing										
Promenade										

Development strategy
Urban Planning



INFRASTRUCTURE & BUILDINGS

NEW BALANCE TROSTIANETS

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THE VISION



The EU Energy Efficiency directive is the baseline for future developments



All existing buildings receive energetic rehabilitation with a target of 40% energy savings



Phasing out from gas



All new developments have to achieve a Zero Energy or Plus Energy label



Modern Street lighting is developed in all City/UTC areas to increase safety and to create an attractive living environment



Industrial developments are bound to highest EE standards – EU Best Practice shall apply

ENERGY EFFICIENCY POTENTIAL FOR DIFFERENT TYPES OF BUILDINGS

Energy saving potential for residential buildings



Energy saving potential for hospitals



Energy saving potential for kindergartens



Energy saving potential for schools



The energy efficient renovation of UTC building stock is one step towards saving and proper use of resources. Information materials are taken from the site:

[Building typology for Ukraine – \(BTU\) \(building-typology.com.ua\)](http://building-typology.com.ua)

ENERGY MODELLING

Multi family house

Scenarios	Heat load [kW]	Cooling load [kW]	Final energy, heating, [kWh]	Final energy, cooling, [kWh]	Final energy lighting, [kWh]	Final energy equipment [kWh]	Final energy DHW, [kWh]	District heating, [kWh]	Electricity, [kWh]	Energy generation, [kWh]	Primary energy consumption [kWh]	CAPEX [EUR]
Existing, DH, nat vent	62,9	61,1	113.068,2	2.248,2	9.904,6	9.904,6	10.117,6	123.185,9	22.057,5	0,0	210.873,8	0,0
Better U-values 20%, ERV, DH, PV	21,9	51,6	16.615,6	4.535,5	9.904,6	9.904,6	10.117,6	26.733,3	24.344,7	13.708,0	59.217,7	172.789,8
Better U-values 20%, ERV, ASHP	21,9	51,6	5.112,5	4.535,5	9.904,6	9.904,6	10.117,6	0,0	39.574,9	0,0	91.022,2	185.789,8
Better U-values 20%, ERV, ASHP, PV	21,9	51,6	5.112,5	4.535,5	9.904,6	9.904,6	10.117,6	0,0	39.574,9	13.708,0	59.493,7	202.789,8

BUILDING REHABILITATION PROGRAM

Multi family house

Standard building parameters:

Heated area: approx. 825 m²

Number of Floors: 2

Total Number of buildings: 112

Investment Strategy:

Till 2030: Energy Efficiency + Ventilation + DH + PV: 64 buildings

Till 2040: Energy Efficiency + Ventilation + Heat Pump + PV: 48 buildings

Scenarios	Heat load [kW]	Cooling load [kW]	Final energy, heating, [kWh]	Final energy, cooling, [kWh]	Final energy lighting, [kWh]	Final energy equipment [kWh]	Final energy DHW, [kWh]	District heating, [kWh]	Electricity, [kWh]	Energy generation [kWh]	Primary energy consumption [kWh]	CAPEX [EUR]
Existing, DH, nat. vent	62,9	61,1	113.068,2	2.248,2	9.904,6	9.904,6	10.117,6	123.185,9	22.057,5	0,0	210.873,8	0,0
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Better U-values 20%, ERV, ASHP	21,9	51,6	5.112,5	4.535,5	9.904,6	9.904,6	10.117,6	0,0	39.574,9	0,0	91.022,2	186.000
Better U-values 20%, ERV, ASHP, PV	21,9	51,6	5.112,5	4.535,5	9.904,6	9.904,6	10.117,6	0,0	39.574,9	13.708,0	59.493,7	203.000

BUILDINGS

Standard building parameters:

Schools & Kindergartens & Sport:

Average heated area: 1530 m²

Number of buildings: 15

Health Institutions:

Average heated area: 400 m²
(does not include main hospital)

Number of buildings: 8

Administration buildings:

Average heated area: 500 m²

Number of buildings: 5

Culture and Tourism:

Average heated area: 1300 m²

Number of buildings: 11

Total Number of buildings: 39

Investment Strategy::

EE + Ventilation + DH Connection: EUR 321 000 per building

4 school buildings with PV installation: EUR 76 000 per building

EE + Ventilation + DH Connection: EUR 84 000 per building

EE + Ventilation + DH Connection: EUR 105 000 per building

EE + Ventilation + DH Connection: EUR 273 000 per building

STREET LIGHTING

Baseline

	Energy saving
Light type	
Length of electric lighting network [km]	160
Number of lighting points [pcs]	3.763
Energy saving [%]	100
Estimated energy use, [kWh]	486.847
Estimated energy use, [kWh]	531.995
Power, [W]	37
Operational hours per year	3.854
With sodium lamps 70 W	268
With sodium lamps 250 W	6
LED 30 W	165
with LED lamps 20 W	170
with fluorescent lamps 30 W	939
Total	1.548
Number of missing fixtures [pcs]	1200-1800
Annual energy consumption, [kWh/a]	430.376

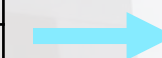
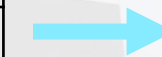
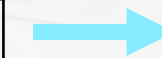
Proposal

Number of lighting fixtures (incl. missing lighting fixtures) [pcs]	5.563
Baseline energy consumption (incl. missing lighting fixtures) [kWh/a]	786.471
Proposed energy consumption (incl. missing lighting fixtures) - fixtures replacement LED without dimming [kWh/a]	524.737
Proposed energy consumption (incl. missing lighting fixtures) - fixtures replacement LED + dimming [kWh/a]	415.824
Dimming 70%, [hours]	1.000
Dimming 50%, [hours]	1.000
Replacement/modernization of electrical cabinets [pcs]	45
Dispatching system installation [pc]	1
Replacement of lighting fixtures (including works) [pcs]	5.563
Cable (missing), [km]	80
Lighting poles replacement, [pcs]	20

STREET LIGHTING TROSTIANETS CITY

Full modernisation of street lighting system

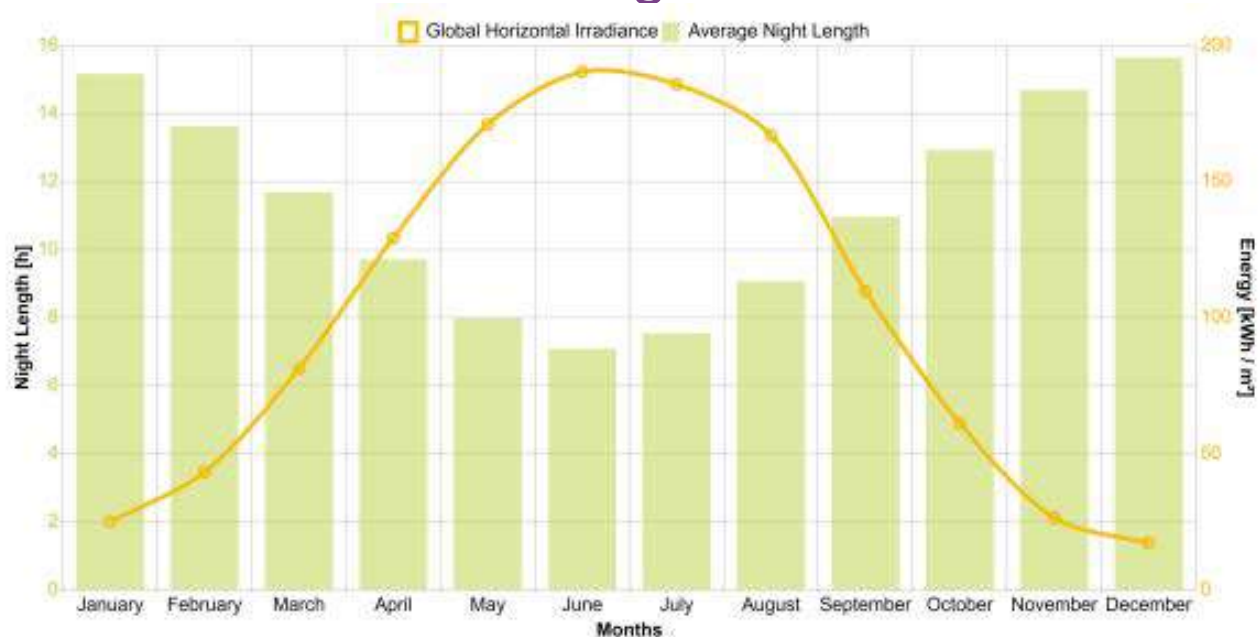
Replacement/modernization of electrical cabinets [pcs]	45
Dispatching system installation [pc]	1
Replacement of lighting fixtures (including works) [pcs]	5.563
Cable (missing), [km]	80
Lighting poles replacement, [pcs]	20



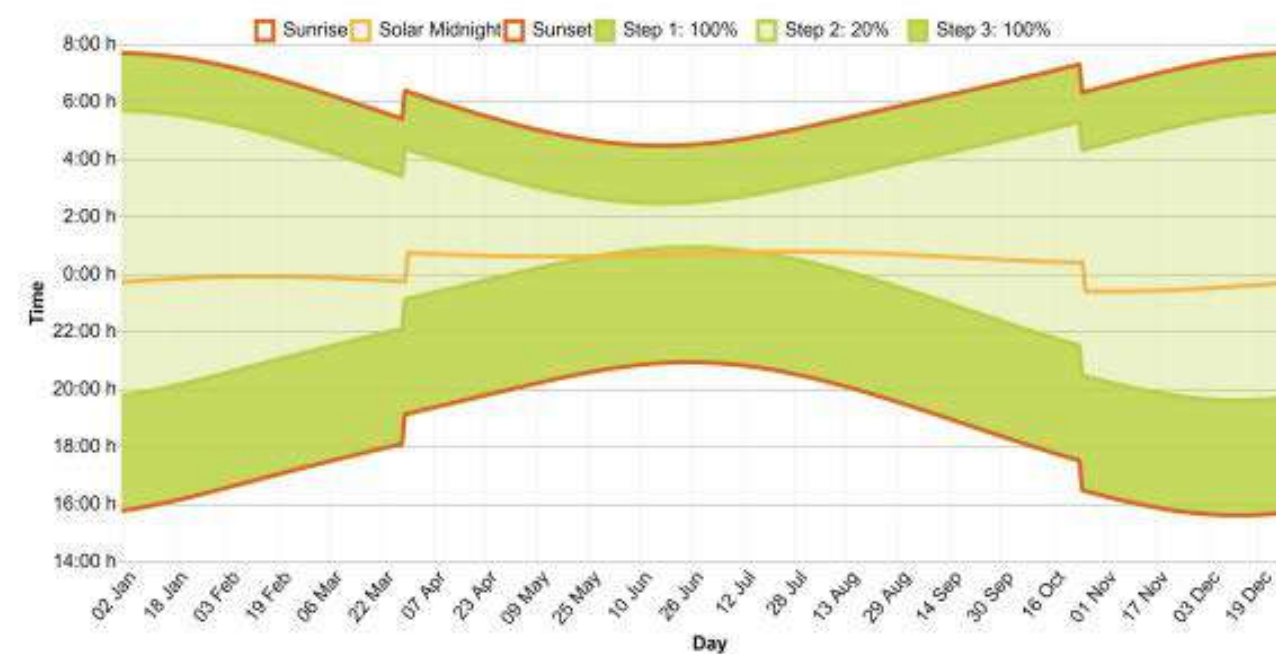
Cost, [EUR/pcs]	Total value, EUR
500	22.500
2.500	2.500
500	2.781.500
1.350	108.000
400	8.000
Total, EUR	2.922.500

CASE STUDY: SOLAR STREET LIGHTING FOR THE CITY

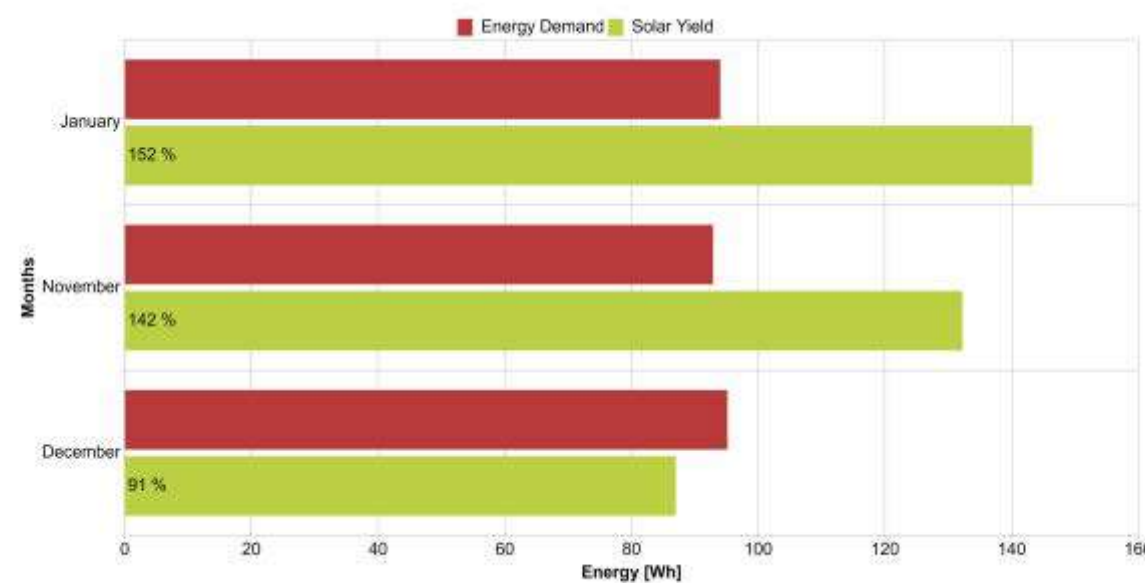
Global Horizontal Irradiance and Average Night Length



Dimming profile for Trostianets

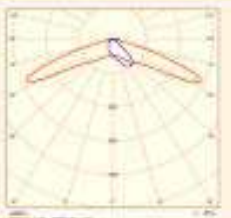


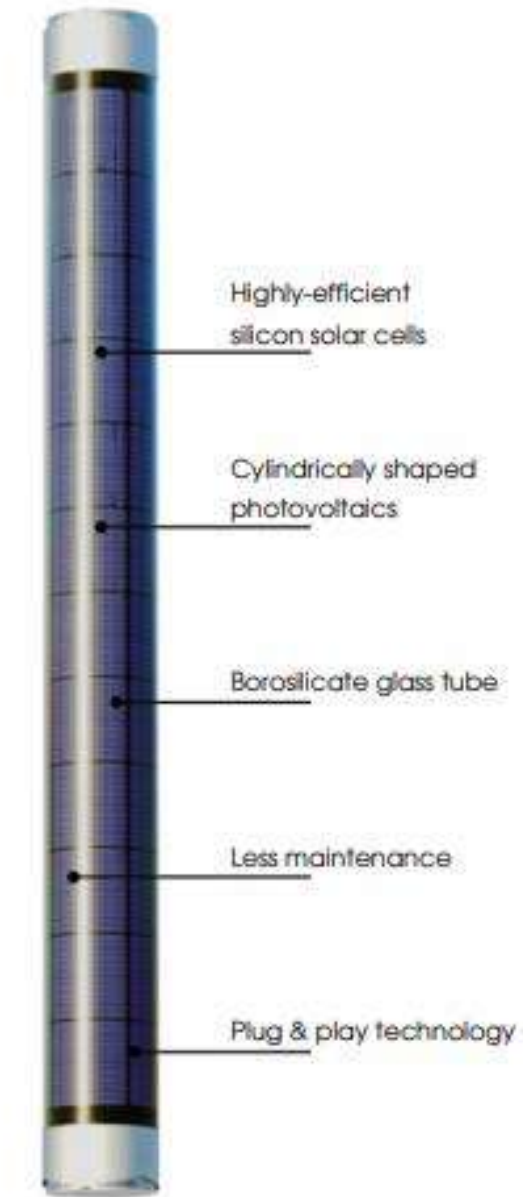
Dimming profile for Trostianets



CASE STUDY: SOLAR STREET LIGHTING FOR THE CITY

EXAMPLE PRODUCT: ANTARES 4000 P200-215

Luminaire	
Operating power	12 W
Luminous flux	2010 lm
CCT	4000 K
Optics	C70, Asymmetric street
Light distribution	
Photovoltaics (Power Tube P200-215)	
Number of units	1
Series	P200-215
Cell type	High-efficiency mono crystalline silicon solar cells
Nominal power of solar cells	267 Wp
Dimensions	L2,019 mm x D220 mm
Battery	
Type	LiFePO4
System voltage	12 V
Battery set-up	460.8 Wh (3 x 12 Ah / 12.8 V)
Installation	In pole
4.8 days actual autonomy in the most critical month of the year, including dimming profile.	
Pole	
Height	5 m
Foundation	Flange plate
Bracket length	1 m



CASE STUDY: SOLAR STREET LIGHTING

ADVANTAGES



Solar powered.
Environmental friendly.



Highly efficient LED-technology.
High-end optical lenses.



360 degree light
collection.



No CO2 emissions.



No cabling.
No electricity
grid required.



Superb light distribution.
Increased pole distance.



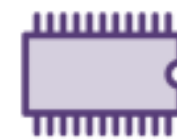
Maintenance free.
No sand, snow or
dust accumulation.



Simple installation.
Plug & play.



No trenching.



Smart lighting control.
Self-learning.
Reliable.



Aestetical design.
Forward-looking design.



Minimal installation costs.
No electricity costs.



No PV panel.
Slim design.
Low wind load.




ENERGY GENERATION AND DISTRIBUTION

NEW BALANCE TROSTIANETS

Modul5



THE VISION THE VISION THE VISION

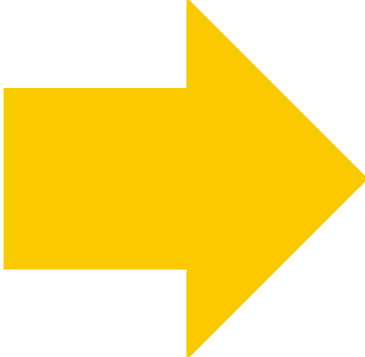


EU renewable energy directive
(2030) is the base line to be
considered

A Zero Gas strategy shall be applied
and reached by 2050



BASE LINE - ENERGY SUPPLY

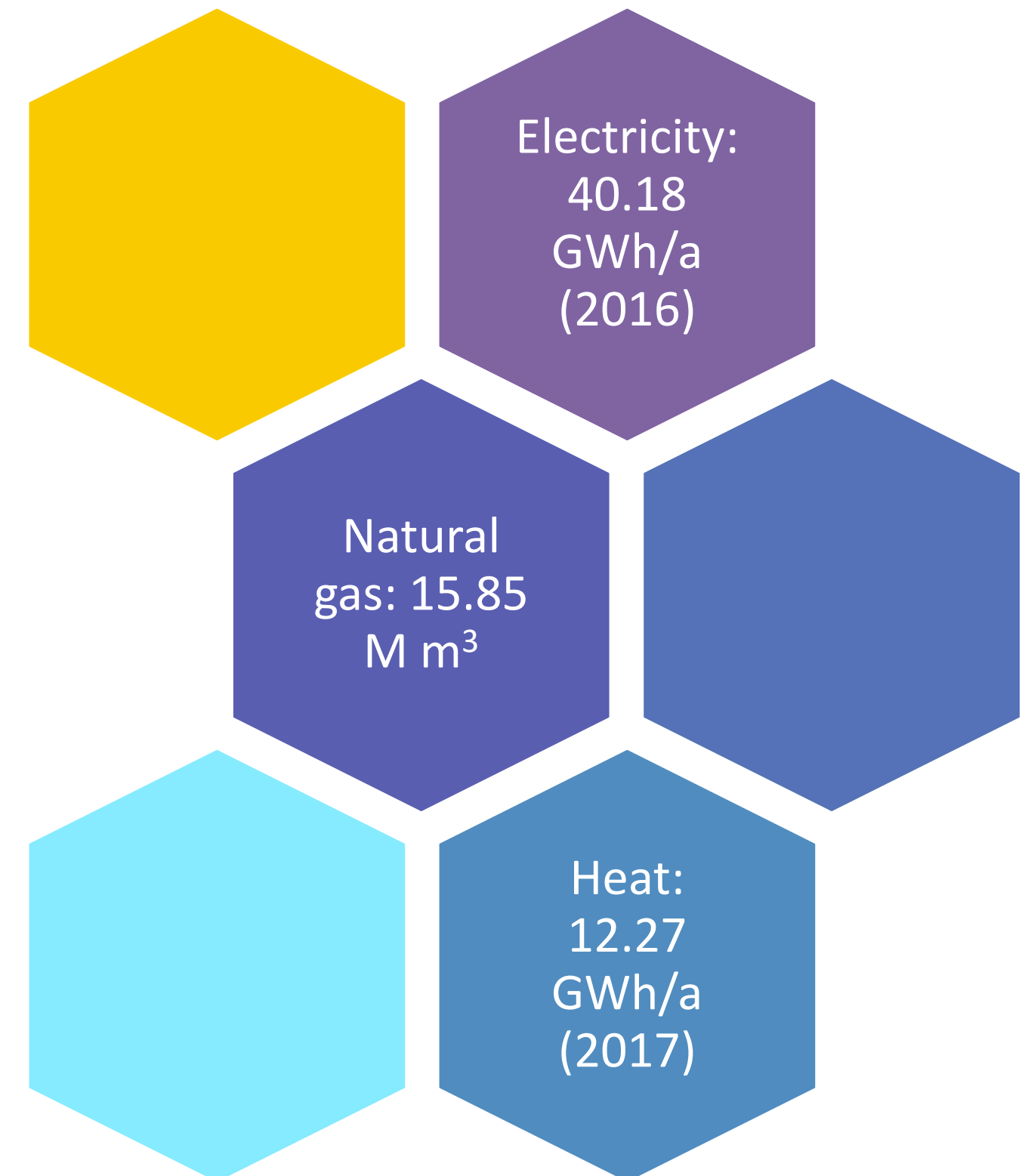


The industry, municipal and residential buildings of the united territorial community are mainly provided with electricity and partially with natural gas.

Key Features

1. Low use of renewable energy sources:
 - one PV systems already exists;
 - minor using biomass (firewood) as fuel for heating.
2. Since 2005 district heating (DH) supply only to municipal buildings (e.g. schools, hospitals).
 - Gas and biomass are fuel for municipal buildings;
 - Individual gas heaters and boilers are the main equipment for heating apartment buildings.
3. During the Russian occupation in 2022, DH pipes were damaged due to freezing.
4. The energy industry requires upgrades and implementation of energy savings and environmental protection measures.

Energy consumption



BASE LINE - ELECTRICITY

Key equipment:

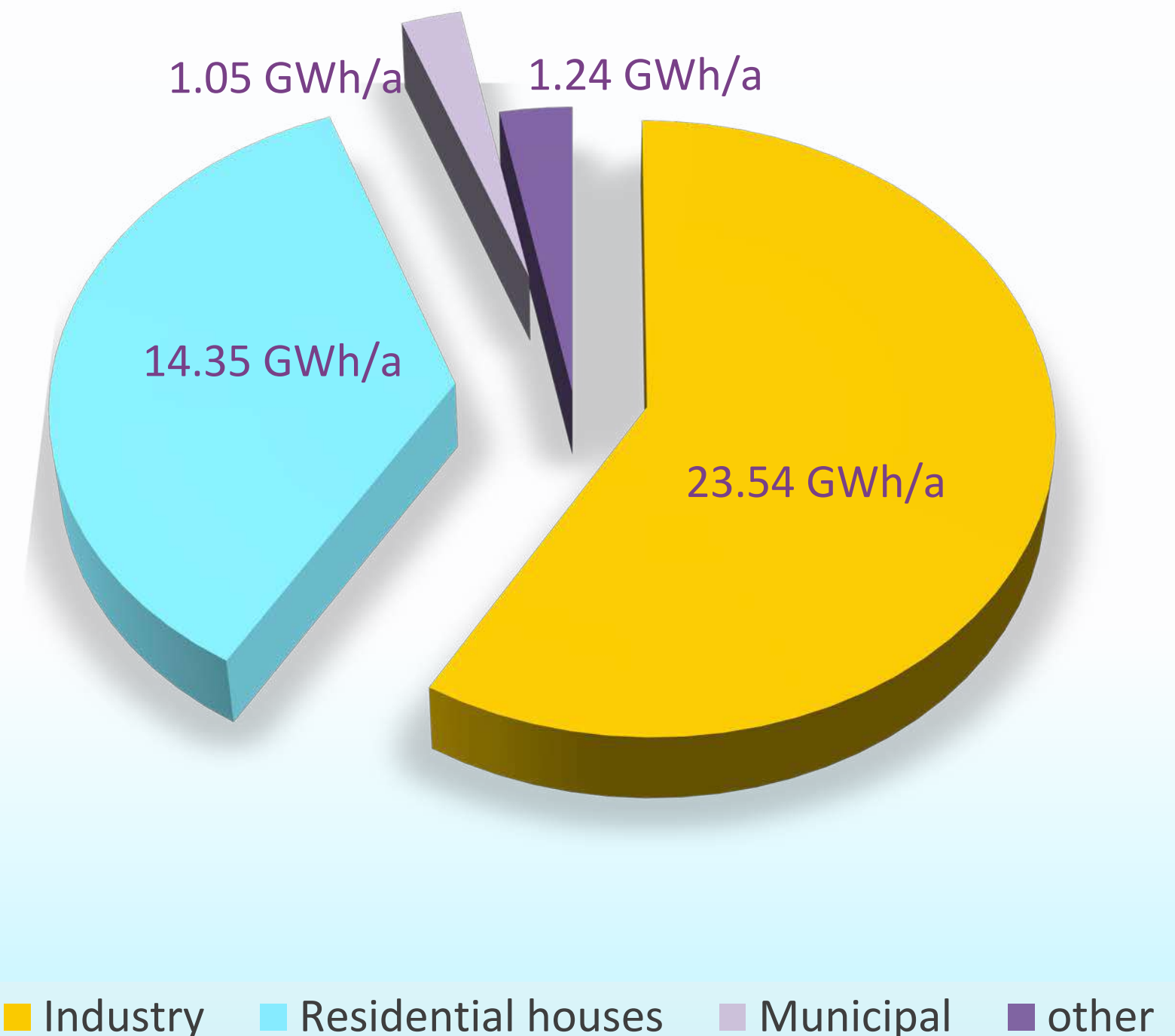
- Electrical substation with transformers 110/35/10 kV – 1 pc.
- Electrical substation with transformers 35/10 kV – 1 pc.
- Distribution electrical substation – 64 pc.

Networks length:

- Overhead power line – 7,4 km;
- Underground power line – 167,5 km

Main supplier – AT “Sumyoblenergo”

Consumption by categories



BASE LINE - NATURAL GAS

Key features:

West part of united territorial community is well supplied with gas, and eastern part – is weakly supplied;

Main supplier – AT “Sumygas”

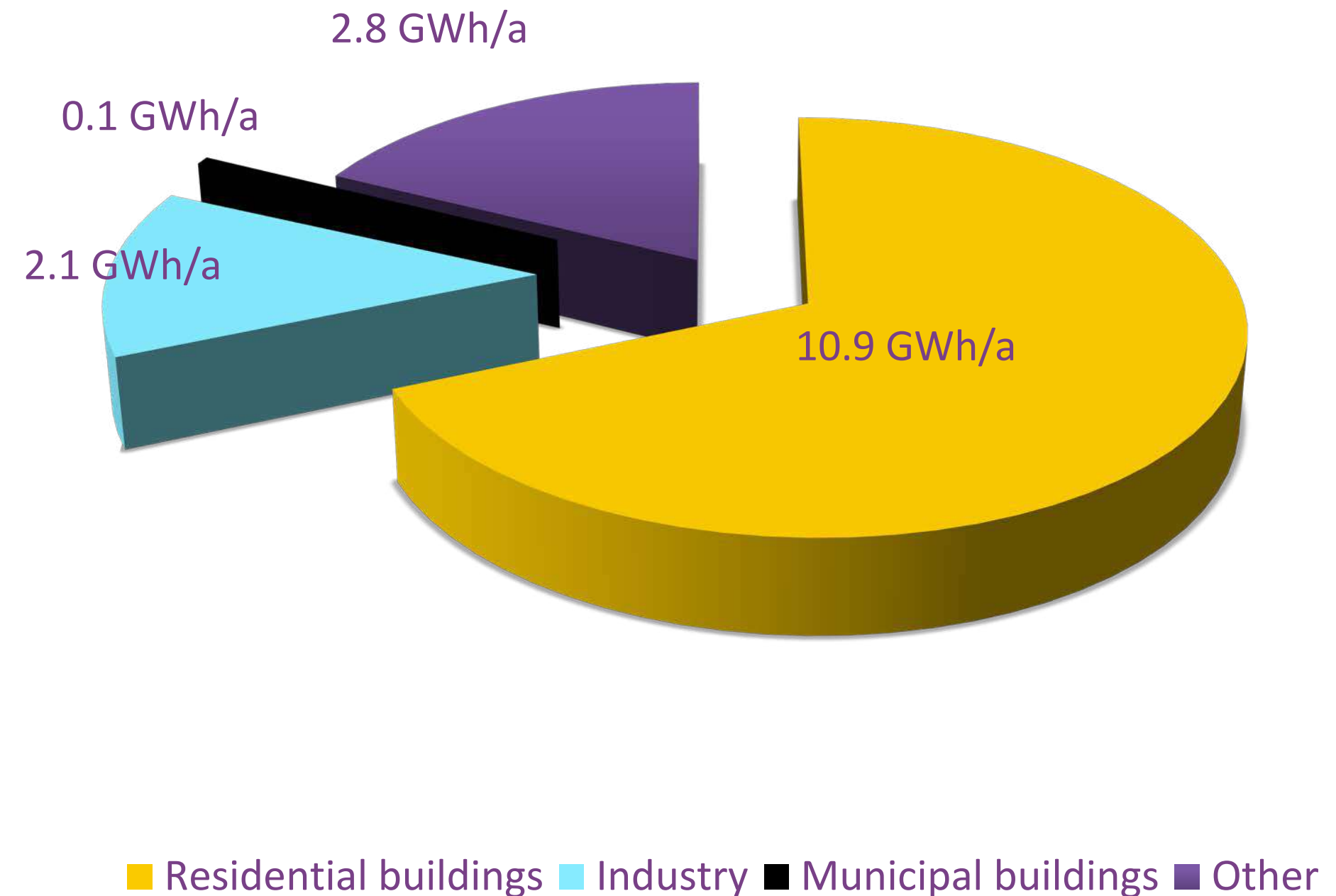
Trostianets city has a broad gas pipe network and equipment

- High pressure (HP) pipelines (0.3 - 0.6 MPa) – slightly;
- Middle pressure (MP) pipelines (0.005 - 0.3 MPa);
- Low-pressure (LP) pipelines (up to 0.005) – mainly distribution network for household consumers;
- Gas regulation station (HP to MP) – 1 pc.
- Gas regulation-distribution station (MP to MP/to LP) – approx 40 pc.

During the Russian occupation in 2022, some gas supply pipes were damaged by combat action

New Balance Trostianets

Consumption by categories

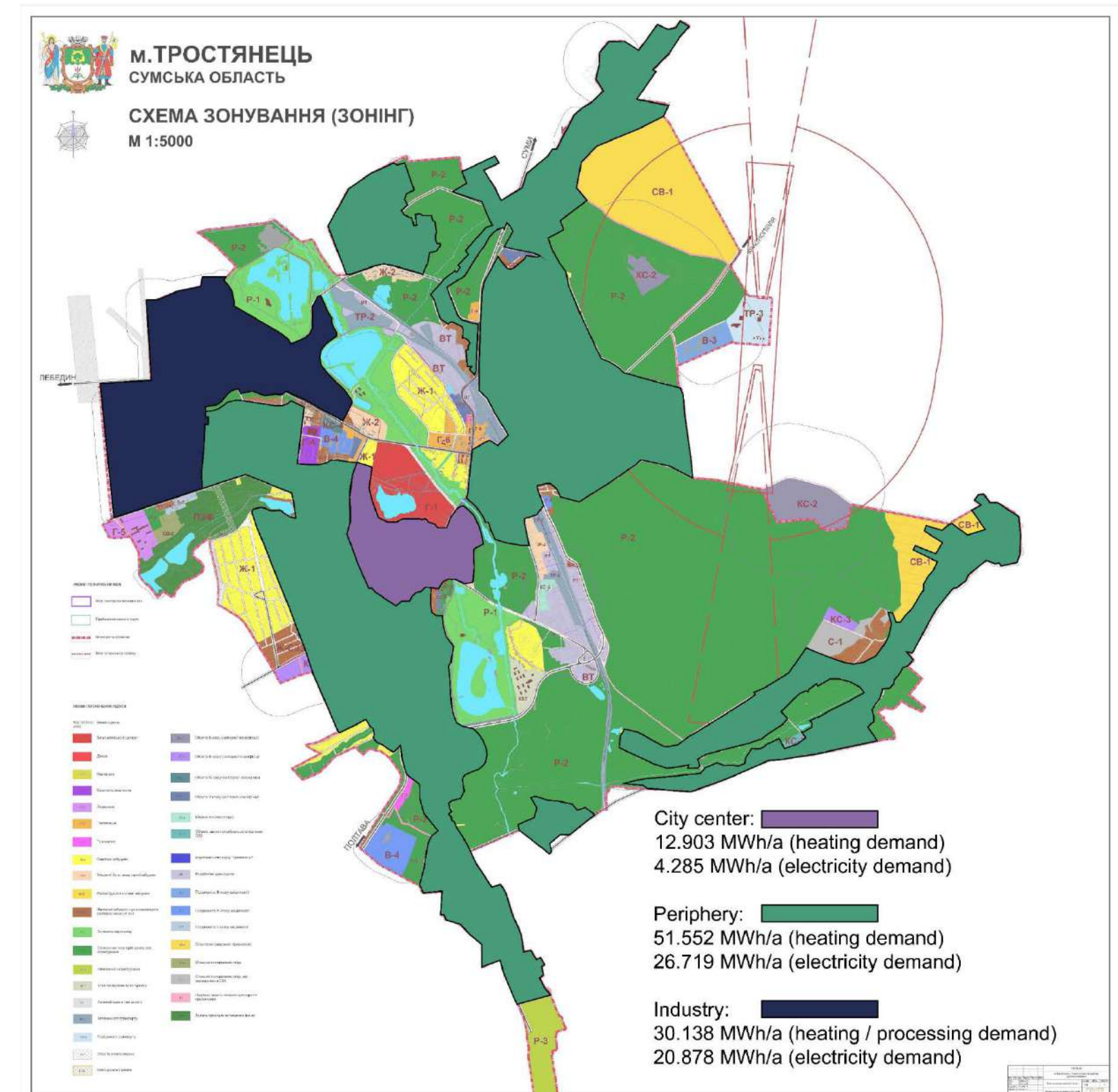


BASE LINE - ANNUAL ENERGY DEMAND

The city was divided into two sections, based on their energy density. For each section different alternatives for energy supply were elaborated.

Current energy demand (Trostianets City excl. UTC)

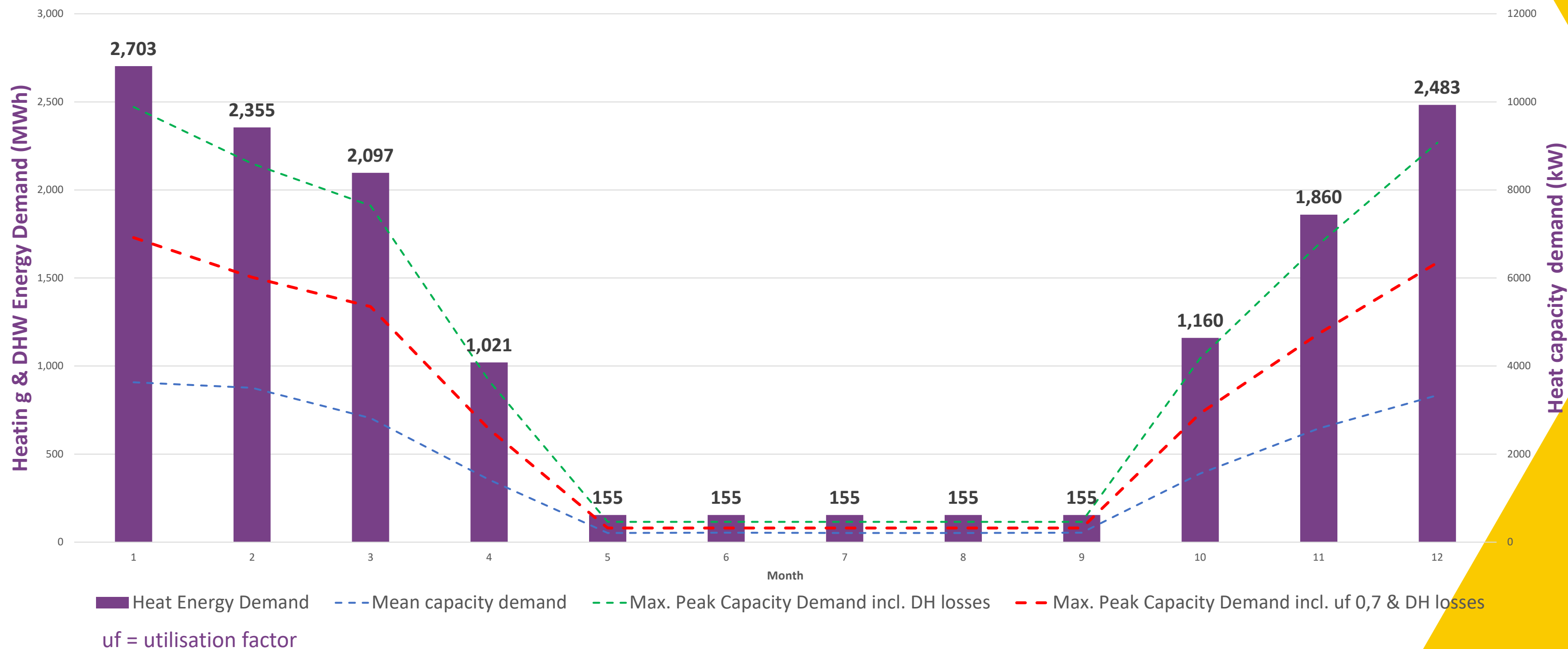
City Centre (purple area)		
Heating incl. DHW (Domestic Heat Water)	12.903 MWh/a	
Electricity	4.285 MWh/a	
Periphery (green area)		
Heating incl. DHW (Domestic Heat Water)	51.552 MWh/a	
Electricity (incl. HP)	26.719 MWh/a	
Industry and processes & street lighting (dark blue area)		
Heating and processing mixed	30.138 MWh/a	
Electricity	20.878 MWh/a	
Total for City		
Heating incl. processing from industry	94.593 MWh/a	
Electricity	51.882 MWh/a	



BASELINE - ENERGY DEMAND CITY CENTER

Heat Energy Demand Profile

Space Heating & DHW Energy Demand - Trostianets incl. uf 0,7 and 12% DH net losses "City Centre"

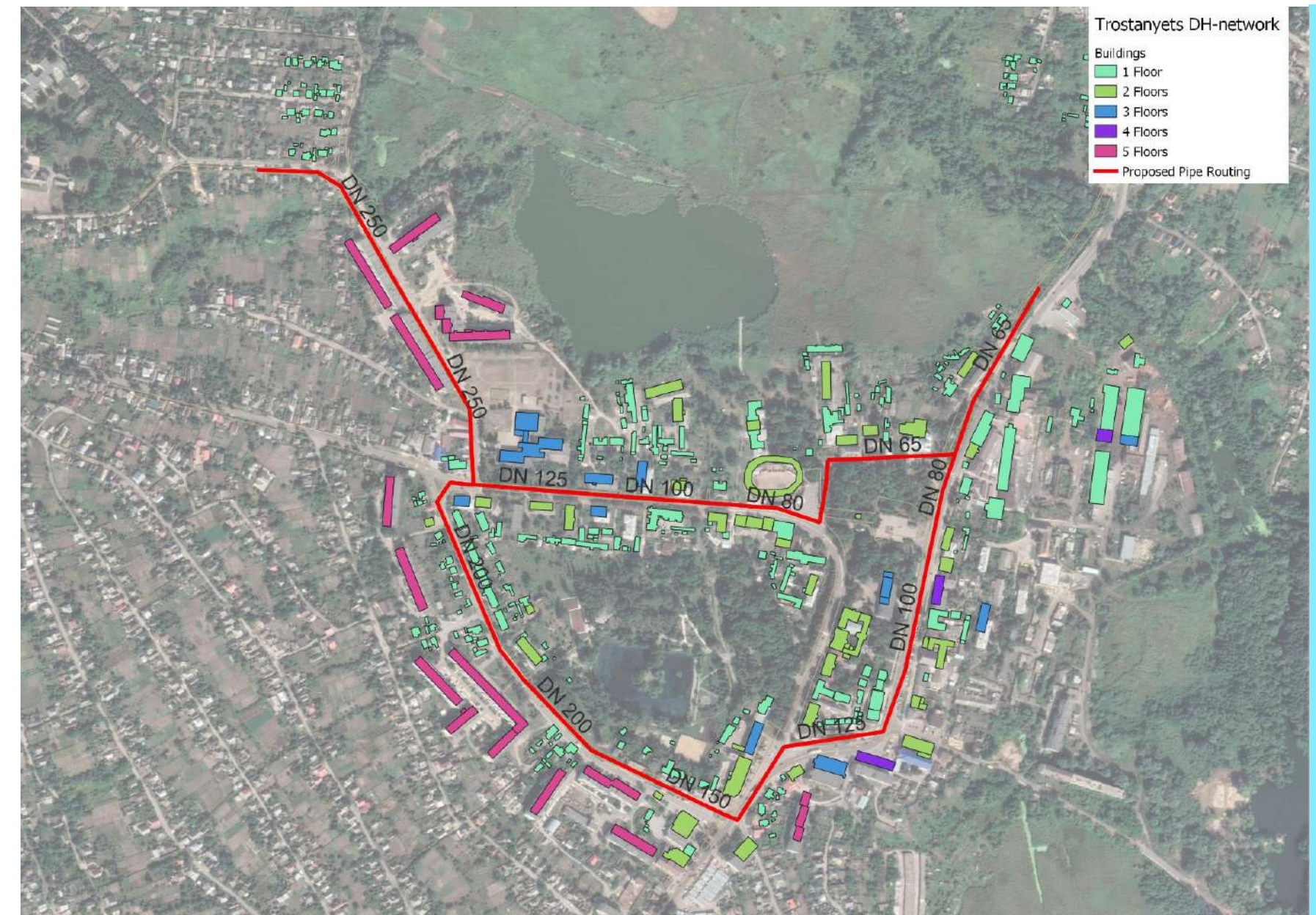


ENERGY DISTRIBUTION – CITY CENTER

District Heating Network

Strategy City Centre: Rehabilitation and Extension

- Connection of all buildings along the network
- Focus on big multi family houses and public buildings
- Covering heat energy and domestic hot water demand
- Preparation for future developments in the city centre (new urban planning concepts)



ENERGY GENERATION

Analysis of alternatives

The following options for production of energy (heat and electricity) are assessed:

- Big Solar plant (long-term heat storage, supplied by solar thermal plant)
- Biogas plant (CHP)
- Biomass plant (HoB) + Solar thermal for summer loads only
- Biomass plant (CHP)
- Heat pumps (Periphery)
- Decentral Photovoltaic PV (Periphery)



ENERGY GENERATION – CITY CENTER

Alternative - Big Thermal Solar Plant – Big Solar with seasonal storage



- Required area (collectors + water pit storage)
- Heat generation by Big Solar
- Volume long-term water pit storage
- Electricity demand big solar
- Capex incl. DH net, contingencies & consulting

7,4 ha

14.451 MWh/a

138.509 m³

1.897 MWh/a

32.822.001 €



ENERGY GENERATION – CITY CENTER

Alternative - Biogas (CHP)



Biogas Plant (CHP)

- Required area (biogas plant)
- Required organic input substrate
- Required volume of digesters
- Provided heat energy
- Provided electrical energy
- Biogas production
- Capex biogas plant incl. DH net, contingencies & consulting

1,3 ha
97.040 t/a
28.000 m³
14.454 MWh/a
10.185 MWh/a
6.618.132 m³/a
23.555.591 €

The input substrate for biogas-production to be clarified (collection, quantity, availability)

ENERGY GENERATION – CITY CENTER

Alternative - Biomass Heat only Boiler (HoB)

Biomass HoB:

- Required area (sustainable forestry for biomass)
- Plant side area required
- Biomass fuel demand
- Heat generation by HoB
- Capex biomass plant incl. DH net, contingencies & consulting

682 ha; 5995 t/a

1,5 ha

5.995 tons/a

14.451 MWh/a

16.102.802 €

Option: Solar thermal system for Domestic Hot Water (DHW) supply in summer

m ² footprint required	ha footprint required	solar fraction	Heat energy generated /month	Heat Energy Demand	Collectorfield gross area m ²	TS Capex
4296	0,430	100%	155 MWh	155 MWh	2024	625.314
3222	0,322	75%	116 MWh	155 MWh	1518	468.985
2148	0,215	50%	77 MWh	155 MWh	1012	320.904
1074	0,107	25%	39 MWh	155 MWh	506	160.452

ENERGY GENERATION – CITY CENTER

Alternative - Biomass Cogeneration (CHP) ⚡ 🔥

Biomass CHP

- Required area (sustainable forestry for biomass)
- Plant side area required
- Biomass fuel demand
- Heat generation by CHP
- Electricity generation (mean)
- Capex biomass plant incl. DH net, contingencies & consulting

791 ha; 6.952 t/a
1,5 ha
6.952 tons/a
14.451 MWh/a
3.814 MWh/a
21.568.971 €

ENERGY GENERATION – ELECTRICITY

Large scale Photovoltaic (PV) - Stage 1

Option 1 (400 W collectors)

- Max. installed capacity
- Used PV collectors
- Mean energy yield over 20 years

Option 2 (300 W collectors)

- Max. installed capacity
- Used PV collectors
- Mean energy yield over 20 years

7,7 MWp
400 W
8.103 MWh/a

5,8 MWp
300 W
6.078 MWh/a

PLANT HAS ALREADY BEEN PUT INTO OPERATION

ENERGY GENERATION – ELECTRICITY

Large scale Photovoltaic (PV) - Stage 2 ⚡

Option 1 (400 W collectors) Recommended state of the art of tech.

- Max. installed capacity
- Used PV collectors
- Mean energy yield over 20 years
- Capex incl. contingencies & consulting

16,6 MWp
400 W
17.362 MWh/a
11.125.245 €

Option 2 (300 W collectors)

- Max. installed capacity
- Used PV collectors
- Mean energy yield over 20 years
- Capex incl. contingencies & consulting

12,4 MWp
300 W
13.021 MWh/a
8.665.773 €

Available land plot

13,5 ha

ENERGY GENERATION – PERIPHERY

Alternative - Individual heat pump (HP)

Single family housing (SFH)

- Number of houses
- Total heated area
- Specific heat energy demand - space heating & DHW
- Total heat energy demand

Multi family housing (MFH)

- Number of houses
- Total heated area
- Specific heat energy demand – space heating & DHW
- Total heat energy demand

Total heat energy demand SFH & MFH

Total Capex SFH & MFH

5.695 buildings
402.098 m²
124 kWh/m²a
49.663 MWh/a

19 buildings
26.712 m²
71 kWh/m²a
1.889 MWh/a

51.552 MWh/a

Estimation provided in the energy efficiency section

ENERGY GENERATION – PERIPHERY

Alternative - Photovoltaic (PV) on roofs



Single family housing

- Number of houses
- Electricity demand per house
- Total annual electricity demand
- Total Capex PV generators

Multi family housing

- Number of houses
- Electricity demand per house
- Total annual electricity demand
- Total Capex PV generators
- **Total electricity demand SFH & MFH**
- **Total PV annual yield**
- **Total Capex SFH & MFH PV generators**

5.695 buildings
4.559 kWh/a
25.967 MWh/a
17.381.226 €

19 buildings
39.575 kWh/a
752 MWh/a
459.511 €

26.719 MWh/a
16.087 MWh/a

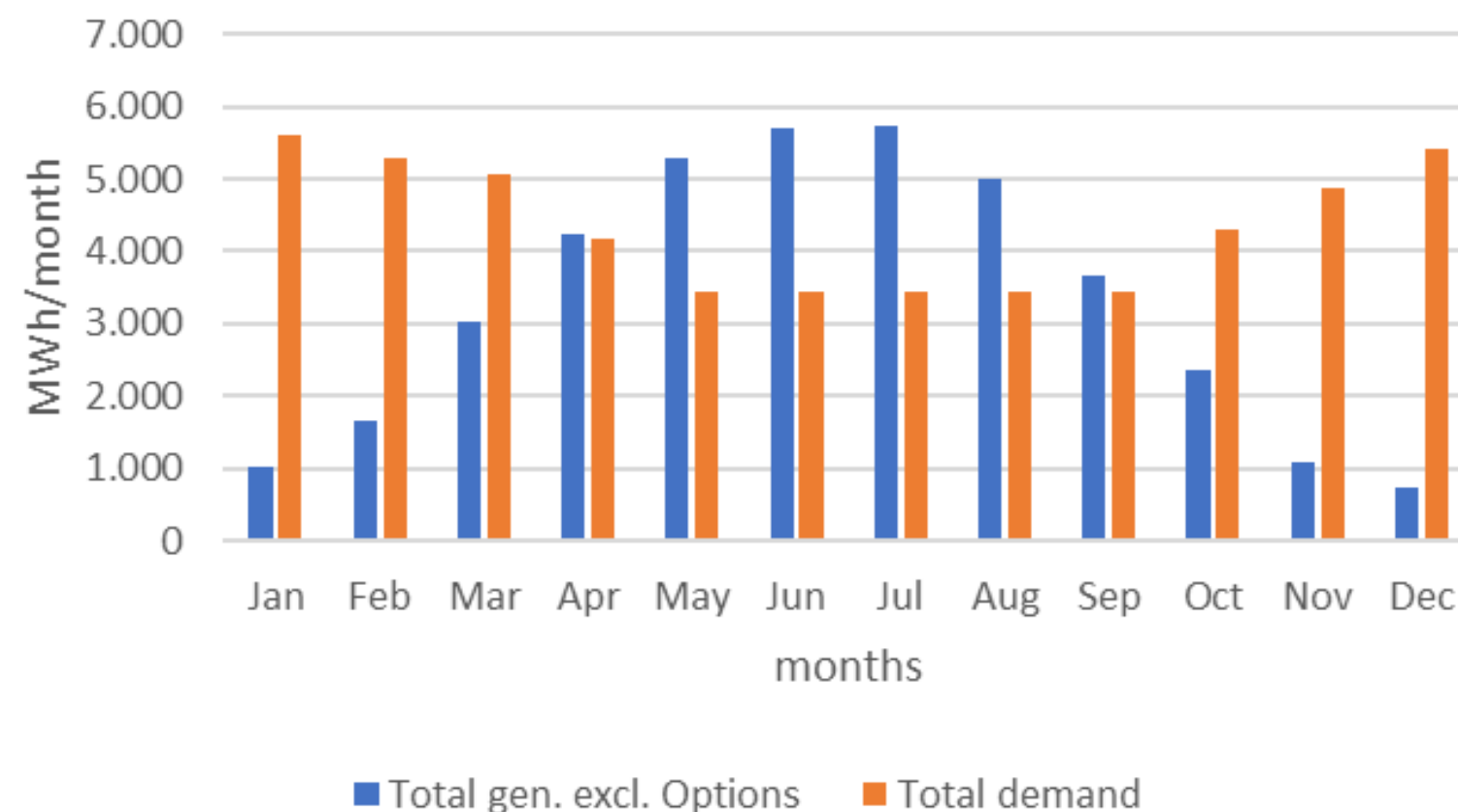
Estimation provided in the energy efficiency section

ENERGY GENERATION – RECOMMENDATION

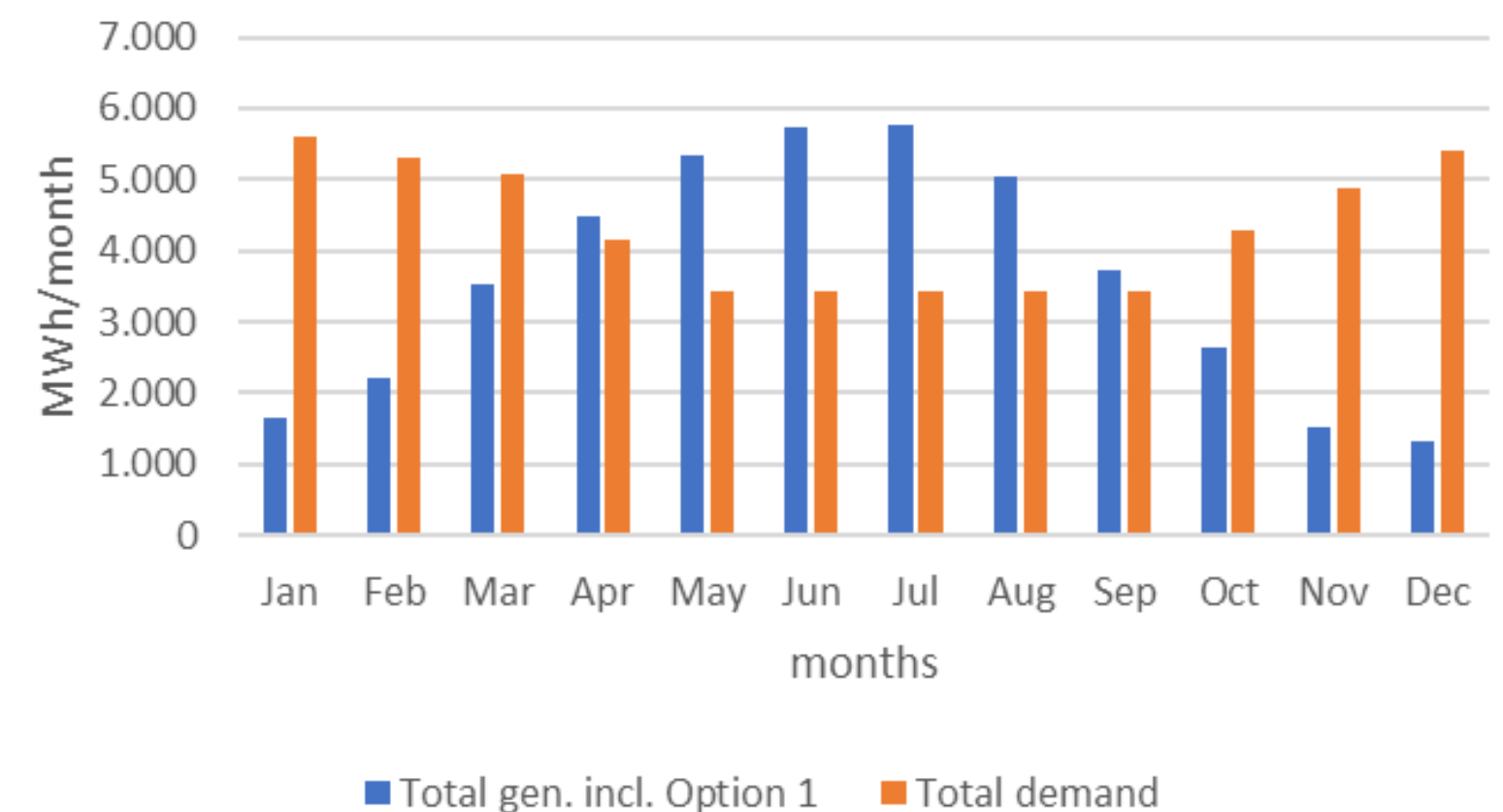
Incl. PV stage 1 & 2, PV peripheries ~76% of annual electricity demand can be covered (80% of PV yield is used for own demand, 20% grid feed in)

Incl. PV stage 1 & 2, PV peripheries, Biomass CHP ~83% of annual electricity demand can be covered (80% of PV yield is used for own demand, 20% grid feed in)

Electricity generation & demand excl. CHP Options



Electricity generation & demand incl. CHP Option 1 (Biomass)



Conclusion:

- CHP provides with 7 % insignificant additional support to the electricity demand of the City
- Electricity supply from the public grid is required to cover the electricity demand in winter

ENERGY ALTERNATIVES – STRENGTHS AND WEAKNESSES

Considering the current situation and fast track development success in the City.

 Strength

 Weakness

Biomass (HOB)

Heat only Boiler



- Low investment volume
- Technology available in all sizes
- Future extension possible (also CHP boiler)
- Low area requirement
- Location near city centre (short supply routes)
- No/Low disturbance factors for neighbours



- No electricity generation
- Requirement of biomass (unknown availability)

Biomass (CHP)

Combined heating Plant



- Electricity generation
- Low area requirement
- Location near city centre (short supply routes)
- No/Low disturbance factors for neighbours



- Higher investment volume
- Requirement of biomass (unknown availability)
- Low electricity generation in relation to investment (low impact on overall electricity demand)

Big solar Plant



- High renewable energy source
- No requirement of (bio-) fuels
- Minimal maintenance
- No air pollution
- Storage of summer energy for winter



- High investment volume
- Requirement of an existing DH network / backup energy source
- High area requirement
- Distance to city centre (long supply routes)
- Long-term experience limited

Biogas Plant



- Possibility to use other resources (waste, etc.)
- Higher energy output per ton



- High area requirement (storage etc.)
- Low acceptance in community (unpleasant smell)
- Distance to city centre (long supply routes)
- Waste management & collection system to be developed
- Availability of input substrates all over the year

ENERGY GENERATION – RECOMMENDATION



Heating

- DH city centre
- Biomass HoB
- Peripheries
- Heat pumps integration incl. energy efficiency measures

Electricity generation

- PV plants stage 1 (already installed), PV stage 2 to be further developed
- PV installation on buildings (single family houses) in the peripheries
- Public electricity grid supply specifically in winter periods

ENERGY GENERATION – RECOMMENDATION

Alternative Biomass HoB

- Reasonable Capex (low)
- Installation in the city (no long connection pipes, no smell nuisance)
- No implementation of a completely new foresting management system required
- Empowerment of local forestry industry
- State of the art of technology with long-time experience
- Future extension of DH net easy possible (just add an additional biomass boiler or CHP)
- Reasonable plant site area demand max. 1,5ha (100x150m)
- Future implementation of i.e. big solar possible in case of DH network extension

Electricity generation

- Without PV plant stage 2 only 42% of annual electricity demand can be covered
- With both PV plants installed 77% of annual electricity demand can be covered
- Public electricity grid energy supply in winter at low PV energy generation is required in addition

ENERGY GENERATION – RECOMMENDATION

Additional Option for DHW supply in summer

Domestic hot water (DHW) supply in summer by thermosolar collectors (TS)

- DHW supply by installation of TS collectors at biomass plant area
- Biomass plant area required ~ 1,5ha
- DHW heat energy demand in summer ~ 155MWh/month

Results

- Heat storage buffer ~ 173m³ (2 days supply), part of biomass plant
- Depending on solar fraction footprint area demand 0,43ha (100% coverage) to 0,11ha (25% coverage)

m ² footprint required	ha footprint required	solar fraction	Heat energy generated /month	Heat Energy Demand	Collectorfield gross area m ²	TS Capex
4296	0,430	100%	155 MWh	155 MWh	2024	625.314
3222	0,322	75%	116 MWh	155 MWh	1518	468.985
2148	0,215	50%	77 MWh	155 MWh	1012	320.904
1074	0,107	25%	39 MWh	155 MWh	506	160.452

Development strategy 2024 - 2050

ENERGY GENERATION AND DISTRIBUTION

HEATING AND DOMESTIC HOTWATER SUPPLY

PROGRAM / INVESTMENT ITEMS	TOTAL estimated Investment (€) 2024 - 2050	TOTAL Investment till 2030 (€)	2030-2040 (€)	2040-2050 (€)
ENERGY GENERATION HEATING AND DOMESTIC HOT WATER SUPPLY - RECOMMENDED SCENARIO				
GRAND TOTAL	16,872,000	16,872,000	-	-
TA: Feasibility study / ESIA (Int. / Local)	167,000	167,000		
TA: Survey, Design, Tendering, Supervision	1,280,000	1,280,000		
City Center	15,425,000	15,425,000	-	-
Biomass HoB Alternative (Capex biomass plant incl. DH network)	14,850,000	14,850,000		
Solar Thermal Heating to support Summer Loads	575,000	575,000		
	-			
Periphery: covered within the Building Rehabilitation Program				
ENERGY GENERATION ELECTRICITY - RECOMMENDED SCENARIO				
GRAND TOTAL	11,125,000	11,125,000	-	-
Large Scale PV options - Extension Phase 2 (Private Investment)	11,125,000	11,125,000		
	-			

**Investment
Strategy
Energy Generation**



WATER SECTOR

NEW BALANCE TROSTIANETS

with kind support of:
Mr. Madis Maddison

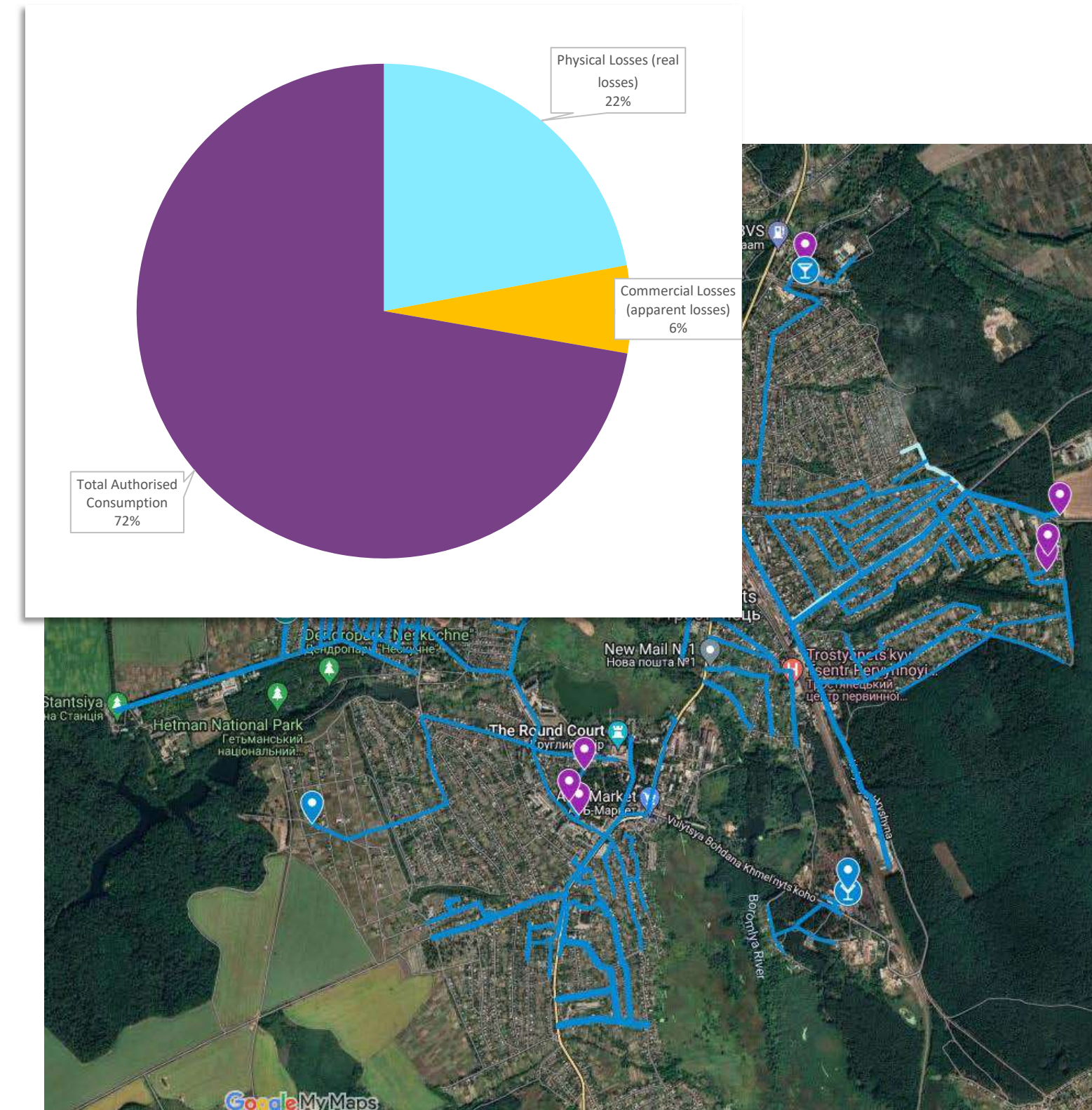
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EXISTING WATER SUPPLY (WS)

New Balance Trostianets

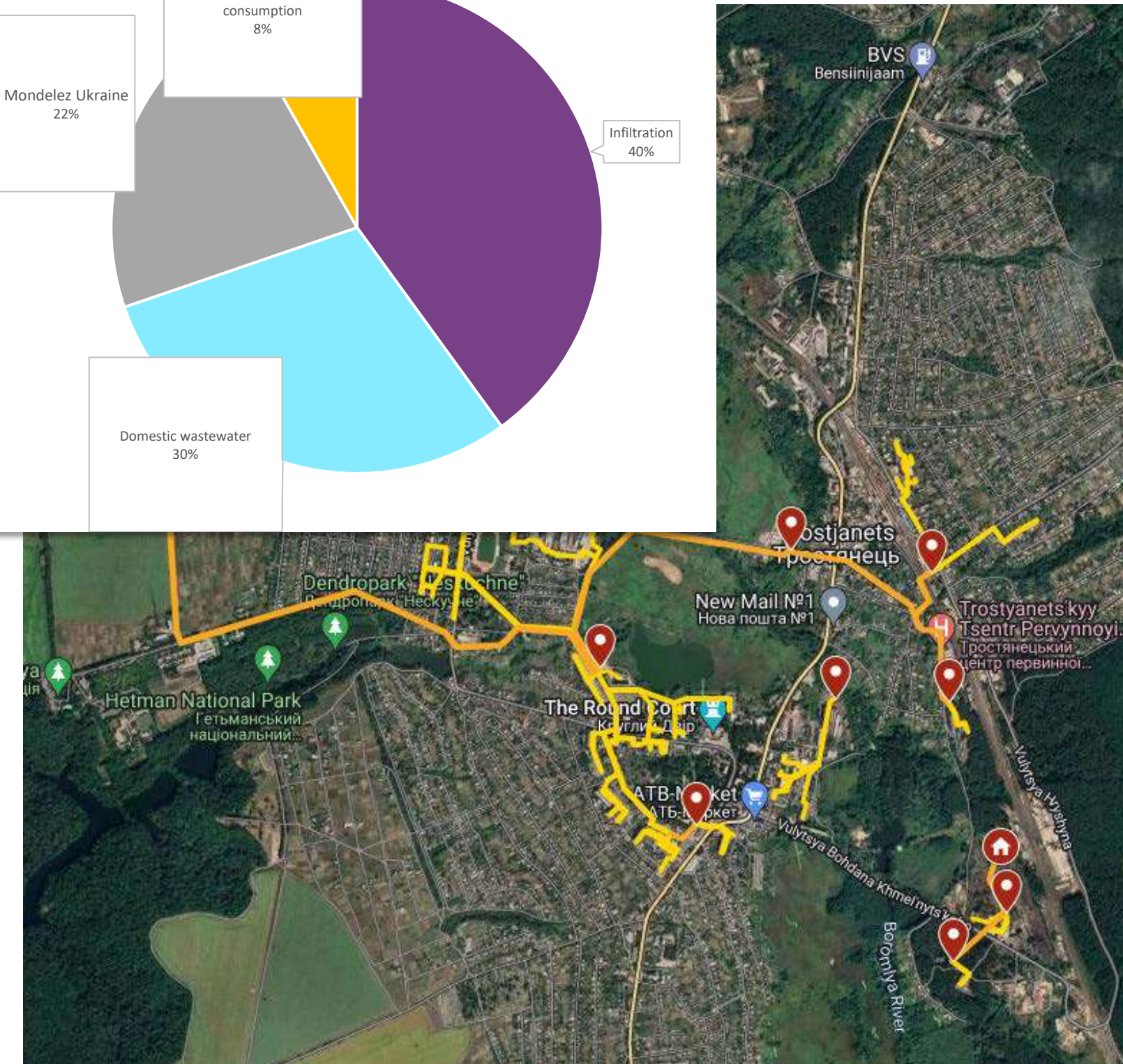
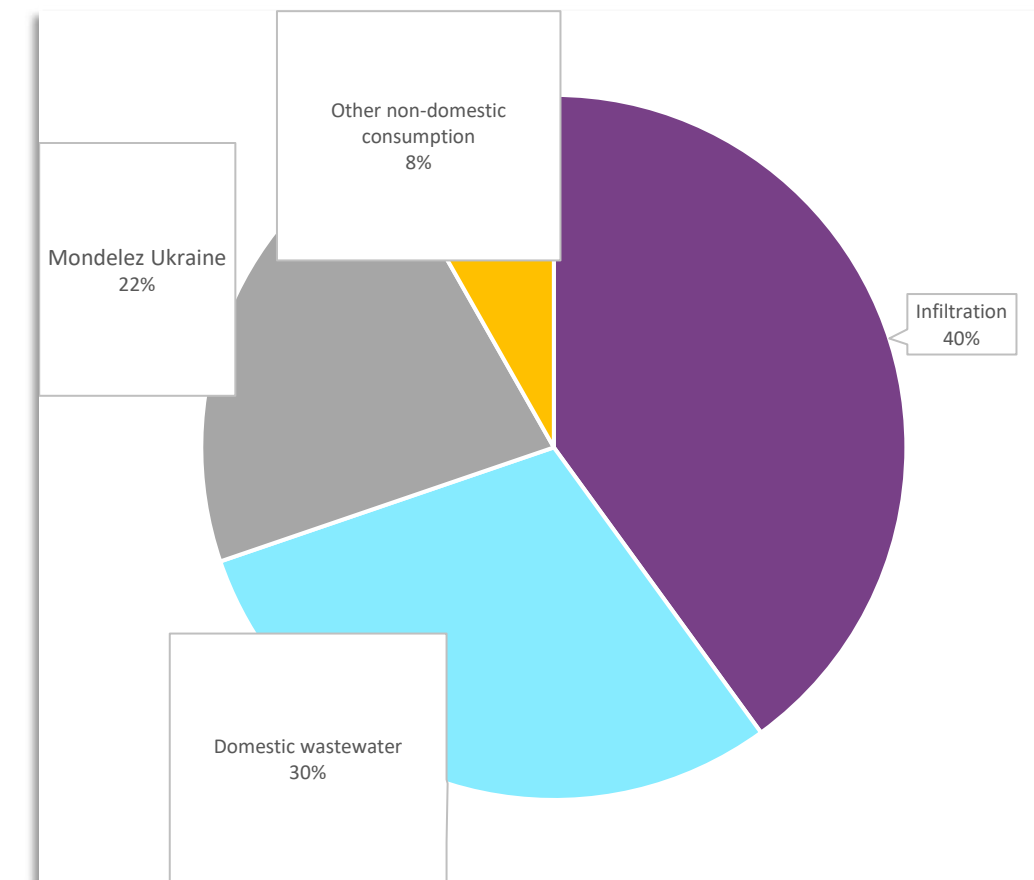
- WS serves in Trostianets city and some settlements;
- WS has 11 water intakes, including 40 artesian wells, 24 are operational. Estimated total capacity 6200 m³/d. No water treatment;
- Service coverage is only 55% of the population;
- City WS comprises several (5) isolated systems. Industrial zone has its own WS system;
- Total length of City water supply distribution network is 47 km with average depreciation about 42%. Average pressure - 22 m;
- In 2021 WS pumped out 313 600 m³ water, authorised consumption was 220 000 m³, the total water loss was 28% (NRW). Per capita consumption is only 40 l/c/d!!!
- 91% of consumers have water meters, no master meters;
- Water quality is meeting Ukrainian requirements, however the problem is high Fe and some bacterial contamination;
- No central hot water system. Widespread electric or gas household boilers;
- Householders without WS use private wells;
- During the Russian occupation in 2022, some elements were damaged. Currently, the water supply of some districts works periodically.



WASTEWATER AND STORM WATER

New Balance Trostianets

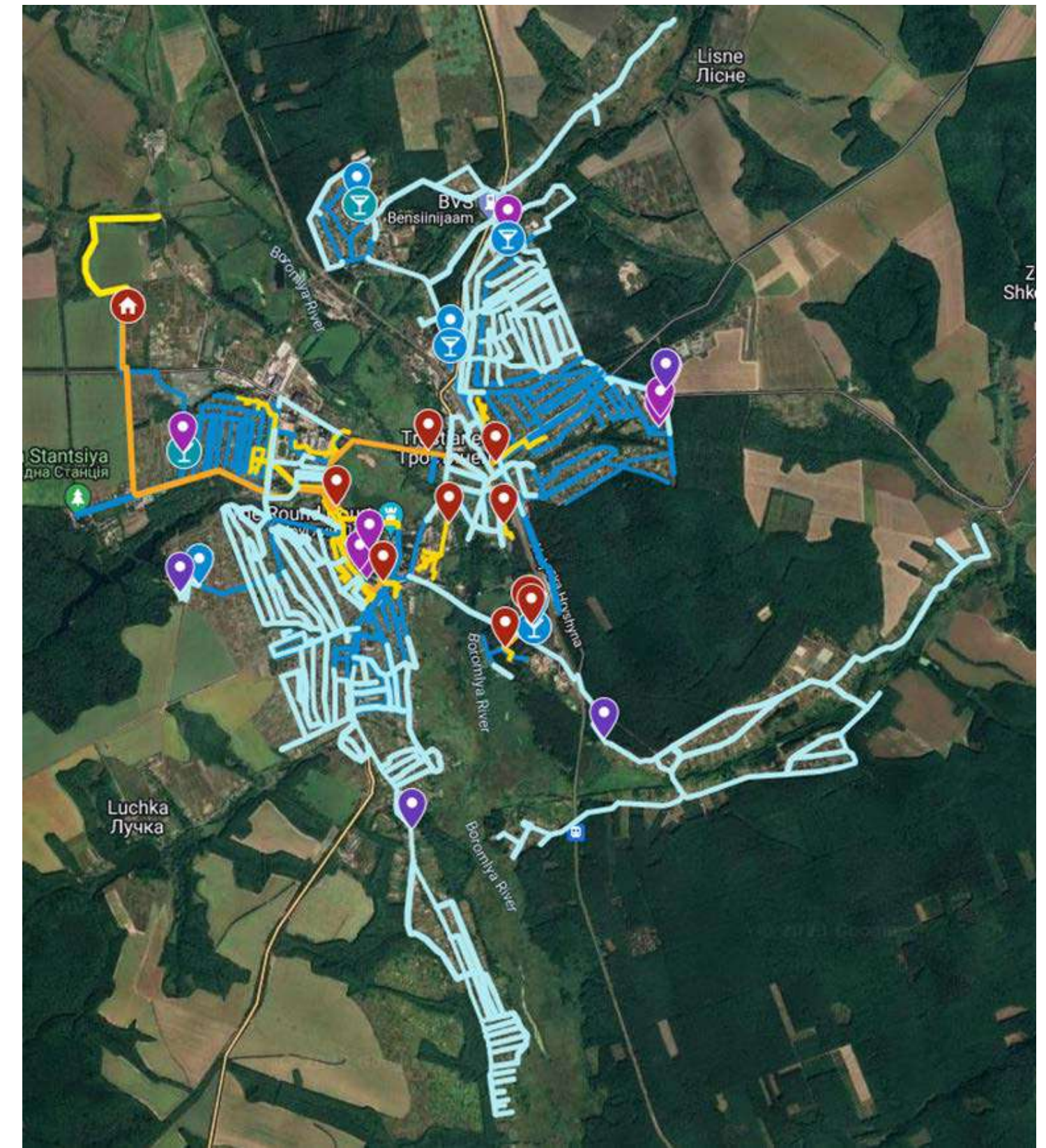
- Sewerage serve central part of the city, districts with multi-story buildings and municipal buildings. Households in settlements and households of individual houses are mainly not connected to sewers, they use cess pits;
- Sewerage includes 6 (six) pumping stations and 2 (two) wastewater treatment plants (municipal and industrial). Total estimated capacity is 4100 m³/d;
- Treatment is not operational after war. Municipal WWTP is located 80 m higher and discharges into river Boromlya above the City;
- Service coverage only 31% of the population;
- The total length of the wastewater collection network is 10 km with an average depreciation of about 52%.
- In 2021, sewerage system processed 186 100 m³ including 92 300 m³ from domestic consumers and 68 300 m³ from Mondelez Ukraine. Infiltration is estimated to 40%;
- Storm-water drain is practically non-existent. (Simple roadside ditches and about 700 m of the underground pipelines);
- During the Russian occupation in 2022, two sewage collectors were damaged. Presently, it is being repaired. Some projects on sewerage development and reconstruction were in work.



MAIN DEVELOPMENT TARGETS

New Balance Trostianets

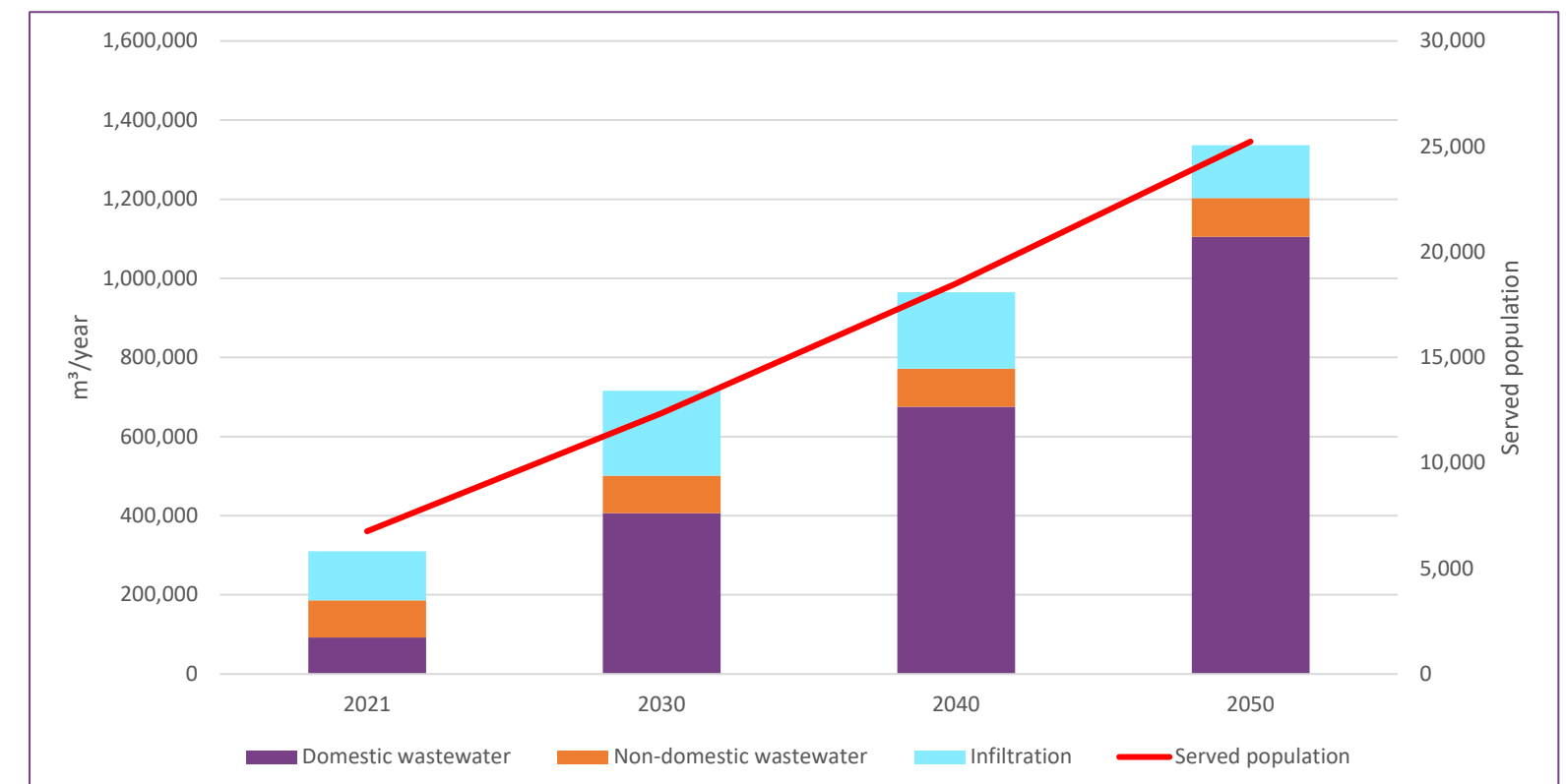
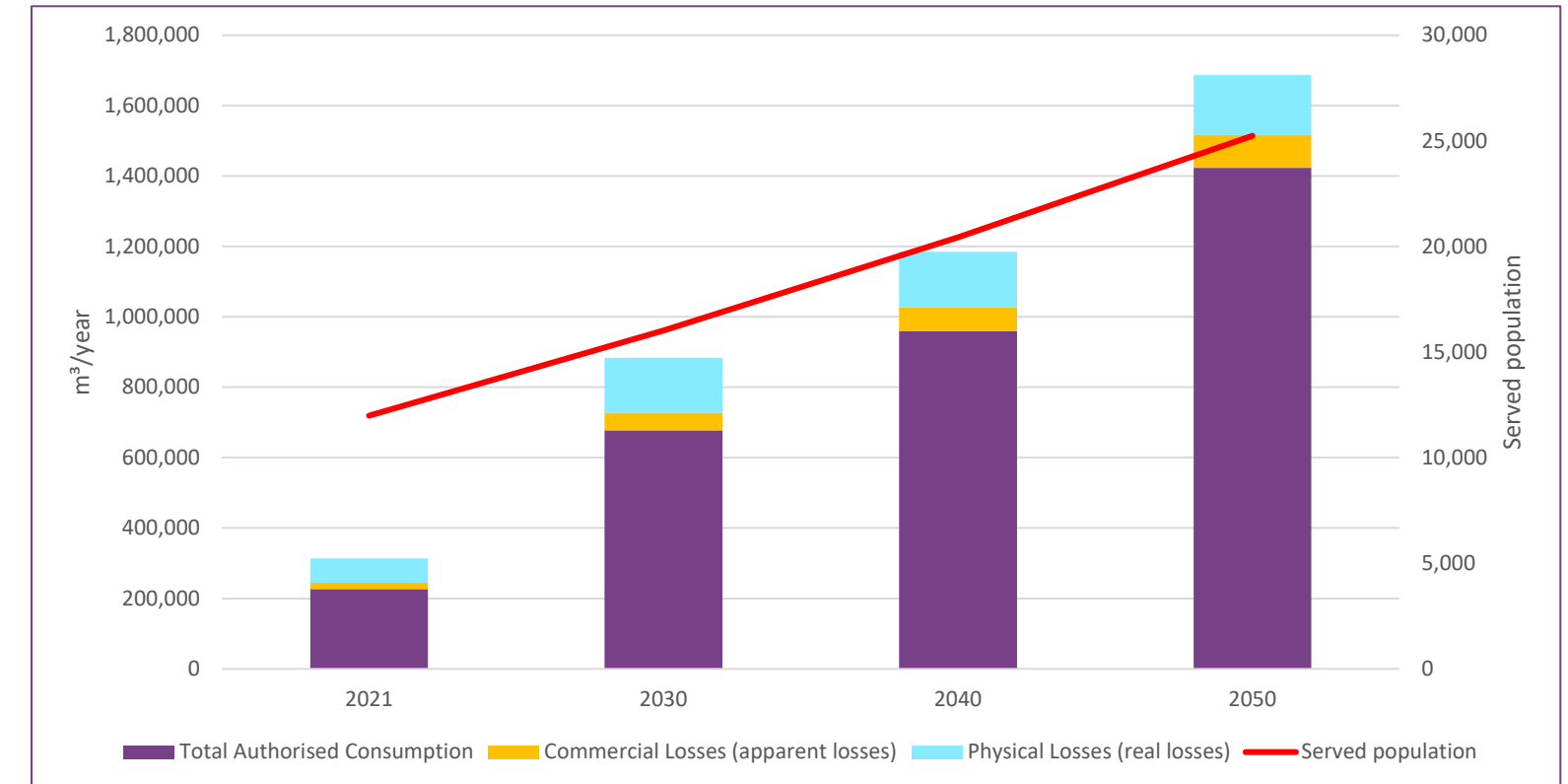
- Meeting EU Directives (potable water quality, WW and sludge treatment etc);
- 100% service coverage for WS and WW;
- Keeping industrial zone WS and WW (including treatment) separately from municipal systems. Private ownership?
- Reconstruction/replacement of existing bore wells; installation of local treatment facilities, interconnection of isolated WS systems;
- Allocation of new WWTP at the site of existing „railway station“ WWTP; reconstruction of „industrial WWTP“;
- Introduction of full third level SCADA (monitoring and automated control);
- 100% of water metering (production, own consumption, invoiced consumption etc). Master meters and one contract for multiapartment buildings. Distant reading;
- Development of separate storm water collection and treatment in co-operation with land use architects (retention ponds, infiltration etc) to respond to climate change challenges.



INVESTMENT STRATEGY

New Balance Trostianets

	2030	2050
Total	52 340 000	52 640 000
Survey, investigations and technical assistance	5 000 000	3 000 000
Water Supply	14 070 000	14 760 000
Reconstruction/replacement of existing bore wells; installation of local treatment facilities	2 780 000	2 780 000
Booster pumping stations	60 000	60 000
Reconstruction of WS distribution network	3 960 000	440 000
Interconnection of WS distribution network	1 000 000	
Extension of WS distribution network	4 920 000	11 480 000
Distant reading water meters	1 350 000	
Wastewater collection and treatment	30 470 000	26 480 000
Reconstruction of WW gravity sewers	1 600 000	200 000
Reconstruction of WW pressure sewers	800 000	
Reconstruction of WWPS	2 000 000	
Extension of WW gravity network	6 840 000	15 960 000
Extension of WW pressure sewers	900 000	2 100 000
Construction of new WWPSs	3 330 000	2 220 000
Construction of new municipal WWTP	10 000 000	6 000 000
Reconstruction of industrial WWTP	5 000 000	
Storm water sewer system	1 800 000	7 400 000
SCADA	1 000 000	1 000 000



WASTE SECTOR

NEW BALANCE TROSTIANETS

with kind support of:
Mr. Peter Blaschke

Modul5



THE STATUS QUO

New Balance Trostianets

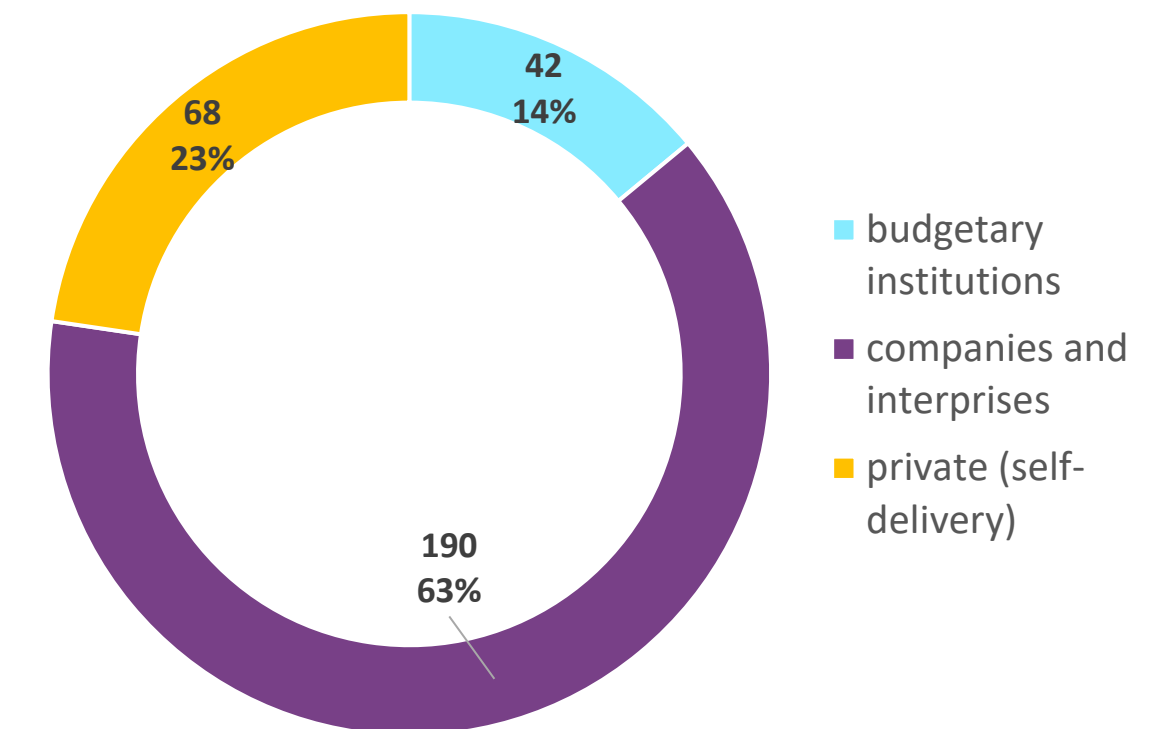
Key Findings - As of February 2022

- Waste disposal is done on the landfill located at the edge of the Trostianets city on Lunina St. Landfill in operation since 1956. Landfill serves for all UTC. All landfill documentation is available.
- The landfill is operated by direct shipment of household and industrial waste to the surface
- Territory of the landfill is 5,6 Hectare which do not correspond to the UTC needs, thus such measures as waste compaction and territory has been provided during recent years
- Responsible for waste collection and transporting as well as landfill operation is Subsidiary Enterprise "Ecoservice" of the municipal enterprise of Trostianets city council "Trostyansetkomunservice". Four (4) employees of SE "Ecoservice" are involved in landfill operation
- Private enterprises are also providing disposal of waste on the landfill
- Waste collection is provided for streets of Trostianets city and villages Kamyanka, Zarichne, Luchka (according to 2016 data). Waste from new UTC villages will be transferred to the landfill as well (according to city information for 2022)
- Illegal dumping is common problem in UTC small villages

According to the Report of SE "Ecoservice" of "Trostyansetkomunservice" on the implementation of the Solid Waste Management Program

In 2016, in terms of consumers collected and disposed of solid waste is

300 enterprises and institutions use the service of garbage collection and disposal



THE STATUS QUO

New Balance Trostianets

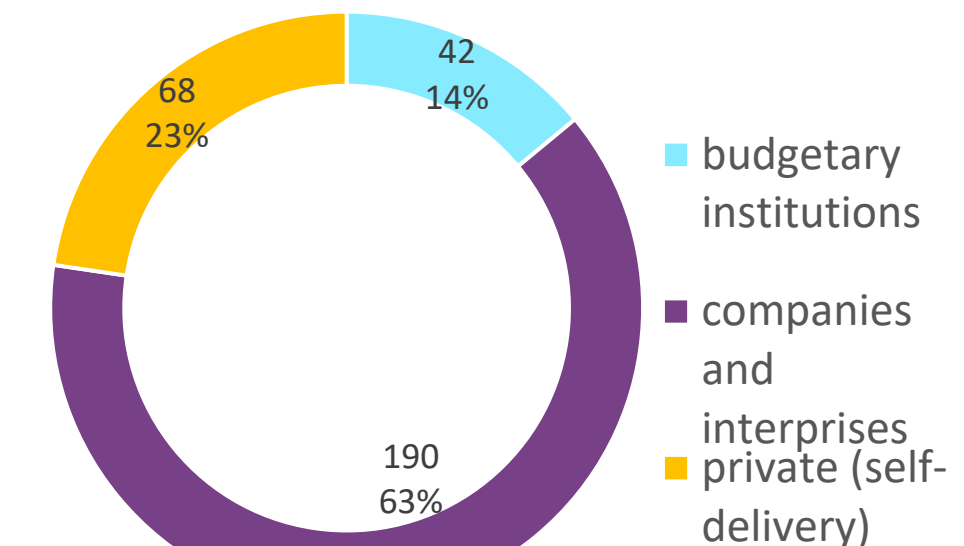
Key Findings - As of June 2022

- Trostianets UTC is continuing recovery from Russian invasion, which includes a number of measures related to waste disposal.
- Volunteering organizations are involved in waste and garbage disposal. However, no proper trainings regarding hazardous waste collection (i.e. asbestos) were provided for volunteers.
- Waste cleaning of damaged buildings leads to an increase in construction waste.
- Destroyed military equipment and machinery are located in the region and require special heavy machinery for removal and transferring.

According to the Report of SE "Ecoservice" of "Trostyanetskomunserwis" on the implementation of the Solid Waste Management Program

In 2016, in terms of consumers collected and disposed of solid waste is

300 enterprises and institutions use the service of garbage collection and disposal



KEY LANDFILL PROBLEMS

New Balance Trostianets



- Absence of waste sorting and recycling system at the landfill
- Absence of disinfection facilities at the territory of the landfill
- Absence of separate landfill territory for hazardous materials
- Absence of proper fencing of landfill territory
- Absence of systems of melt waters collection and systems for water treatment
- Timely transfer of hazardous waste to a specialized enterprise is not provided
- Partial disposal of untreated hazardous waste is done directly to on the territory where the depth of groundwater is less than 2 (two) meters deep. Due to all accumulated waste – actual dumping height is 5 (five) m and more

STRATEGY



Considered

- City's General Plan (2013)
- Present operation and concept (collection and dumping practice)
- Information and clarifications provided based on a Questionnaire (2022)
- "EC-Directive on Waste" (Directive 2008/98/EC)

Not Considered

- **National Hazardous Waste Centre** - due to lack of a National Hazardous Waste Plan, though infrastructural connection of Trostianets (railroad, road) would be advantageous
- **Waste Incineration** - population number too less for economic operation and related energy creation
- **Waste gas collection** - specialized waste analyse is necessary to make a conclusion on possibility and economical expedience of gas collection
- **All three visions** would only be realisable if a time of 10 – 15 years would be given and decisions would be taken on governmental level

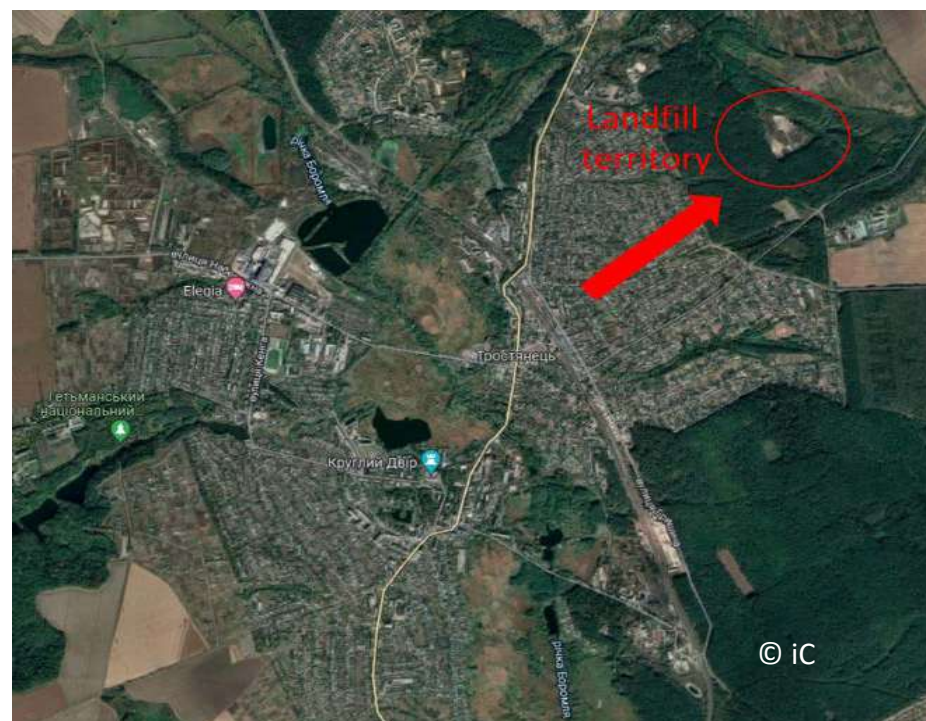
SUMMARY / COMMENTS ON CITY'S GENERAL PLAN / QUESTIONNAIRE

- Subsidiary company "Ekoservice" (The Company) of CP of Trostianets City Council is responsible mainly for:
 - Collection, removal and disposal of solid household waste (incl. operation of the landfill)
 - Municipal road maintenance
- Waste is dominantly generated in Trostianets (~ 93 %), than in UTC (~ 7 %). With addition of the new villages to the UTC indicated % can change.
- Data recording appears to be a good base for further development (see Section Procurement)
- Number of customers over last 10 years more or less is constant (average 12,300); tendency increasing
- Amount of waste over the last 10 years slightly increasing (average 31,400 m³; exception year 2020: 41,100 m³, decreasing to 32,800 m³ in 2021). Increase of waste accumulation in the UTC related to the addition of the new villages to UTC (expected average 40,000 m³ per year).
- Existing landfill (6 ha) reported to be already filled by 90% (operated since 1984)
- Existing landfill is constructed on clay layers
- Waste from the Mondelez factory is partially transferred to the landfill but most of the waste can be taken for re-processing

SUMMARY / COMMENTS ON CITY'S GENERAL PLAN / QUESTIONNAIRE

- Existing landfill has no fencing and no groundwater monitoring system
- Ideas for extension of the existing landfill by another 2 ha exists
- Ideas for opening a new landfill (poultry farm in southeast of Trostianets) existed, however due to legal issues this option is not considered anymore
- Superficial analyse of waste was performed, which concluded that a gas collection (in the course of hulling the existing landfill) isn't sufficient to make it profitable. However, specialized waste analyse is necessary to make a conclusion on possibility and economical expedience of gas collection
- Partial manual sorting of waste (glass, polyethylene bottles, aluminium bottles, cardboard, plastic canisters) is carried out on a small scale in the city of Trostianets (12 tons of plastic and 6 tons of glass were reported to have been sorted in 2021)
- Available waste collection and landfilling equipment/ machinery appears to be partially depreciated respectively not appropriate
- New machinery (waste trucks, bulldozers for landfill operation etc), and equipment is necessary
- Medical waste - hospital collects and hands over independently on its own line

SUMMARY / COMMENTS ON CITY'S GENERAL PLAN / QUESTIONNAIRE (CONTINUATION)



STRATEGY – WASTE SEPERATION



Waste Separation shall be “at source” (already in the households) and not as envisaged solely at a “Waste Sorting Centre” at the (new) landfill site

- Separation of the following waste fractions:
 - Paper/ Cardboard
 - Glass
 - Metal
 - Plastic
 - Biowaste
 - Residue Waste
 - Household “Hazards” (e.g. batteries, electronic waste, paints, chemical fluids, expired drugs)
- Requires 3-4 different collection facilities (e.g. cardboard boxes, bags) in each household
- Beside Residue and Household Non-Hazards, population brings the separated waste to Collection Points (aggregation of containers for the different waste fractions)
- Ideally, Collection Points located as average distance to individual housings < 400 m, in proximity of e.g. bus-stations, shops, etc. (generally points of frequent pedestrian traffic)

STRATEGY – WASTE SEPERATION *(CONTINUATION)*

- All Collection Points do not necessarily to be equipped with Containers for all separated waste fractions
- Separated waste fractions to be collected by the Company
- Collection vehicles are to be procured accordingly

- Residue Waste: as per practice in place, to be collected by the Company
- Due to separated waste, reduction in volume expected -> collection intervals to be reduced
- Household “Hazards”: to be brought by population to either **Collection Centres** (not to be staffed permanently, but at regular weekdays/ times) or **Mobile Units** (available at fixed days per month at fixed locations)

- Opening hours of Centres/ Units to be published by Municipality
- Ideally Collection Centres or **Mobile Units (recommended)**, due to customer friendliness and expected amounts of Household “Hazards”) located as average distance to individual housings < 1,500 m; ideally located at points of frequent pedestrian traffic



STRATEGY – WASTE SEPERATION *(CONTINUATION)*

- Awareness campaign(s) for waste separation required
- Training of Company's staff related to waste fractions required, incl. international site visits
- Procurement of collection containers, to be distributed within Trostianets and UTC
- Identification of locations (ideally on footpaths)
- Potentially construction bases for Collection Points (hard-stands, not covered) and Centres (hard-stands, regular 20 and/ or 40 ft Containers, respectively Mobile Unit)



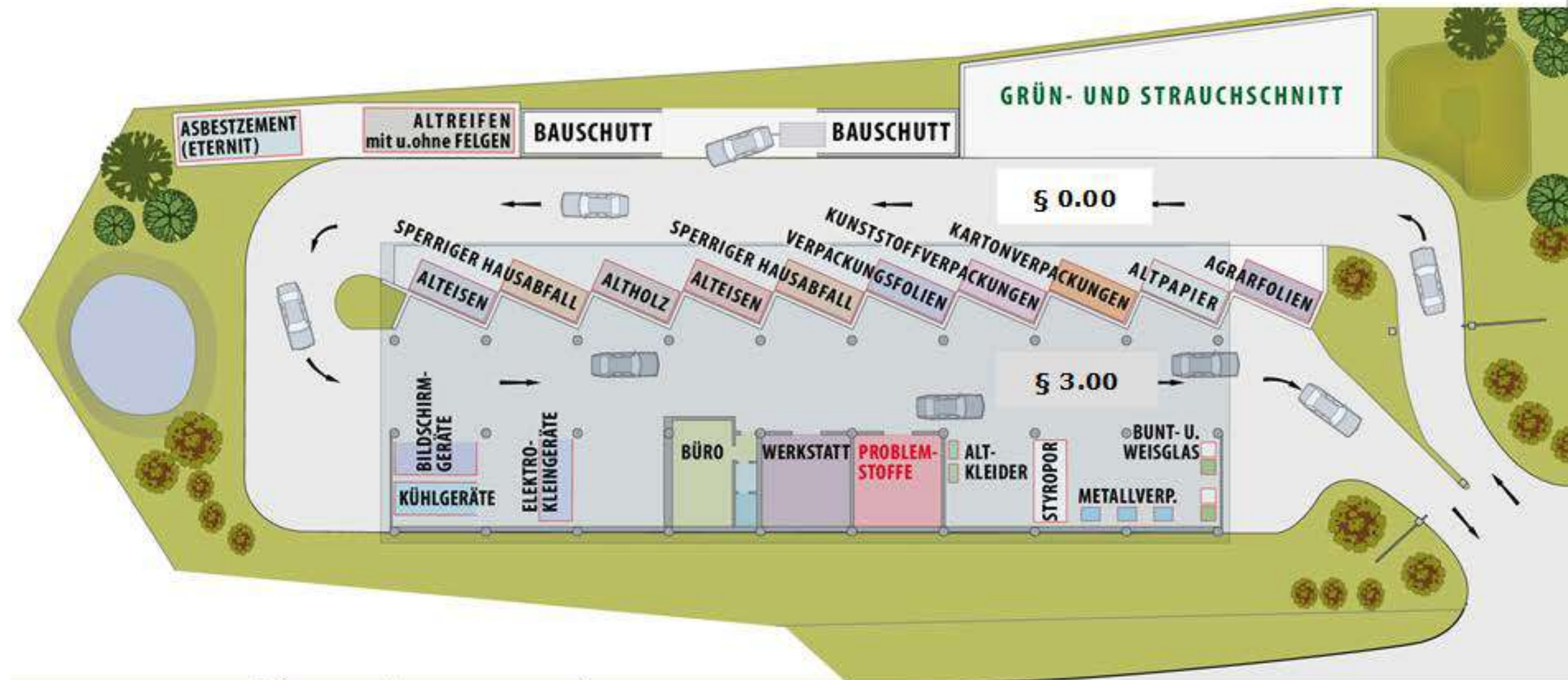
STRATEGY – WASTE SEPERATION *(CONTINUATION)*

- Recycling Centre: at the site of the new landfill, the population shall have the possibility to deposit other waste fractions than already separated at their households, namely (e.g.):
 - Garden Waste
 - Construction/ Demolition Waste - separated into wood; glass; reinforcement; bricks, plaster and concrete; the latter potentially to be used for temporary road-building
 - Bulky Waste (e.g. mattresses, furniture)
 - Electronics (e.g. non functioning computers, screens, TV-Sets, refrigerators)
 - Polystyrene / Packaging remaining
 - Any kind of waste fraction identified to be accumulated as per the results of a local social study
- Separated Waste Fractions potentially to be resorted before selling
- Residue Waste potentially to be resorted before landfilling
- Household “Hazards”: to be stored till reasonable amounts for transport are accrued (to be handed over to Spetszakhist LLC, as per practice in place)
- Recycling Centre – best practice
 - Separated Waste collected in transportable troughs, partially adjusted with hydraulic presses (for e.g. paper/ cardboard)
 - Other Waste Fractions to be compressed by a Telehandler



STRATEGY – WASTE TREATMENT

- Recycling Centre – Best Practice
- Separated Waste Fractions potentially to be resorted before selling
- Household “Hazards”: to be stored till reasonable amounts for transport are accrued



STRATEGY – LANDFILLING OF RESIDUE WASTE

Landfill consisting of

- Landfill and Monitoring Area (LAMO)
- Reception and Operational Area (RESO)

For Extension of existing Landfill -> LAMO only (if new Landfill will not be at location of existing Landfill)

For new Landfill

- LAMO & RESO
- RESO potentially Recycling Centre way before other components

STRATEGY – LANDFILLING OF RESIDUE WASTE *(CONTINUATION)*

LAMO consisting of

- Security fence and gates
- Utilities connections (electricity, water)
- Internal surface water collection ditches
- Perimeter irrigation ditches
- Surface water collection
- Sampling chambers and outfalls
- Engineered Clay Liner (ECL)
- HDPE geo-membrane
- Separation/ protection geotextile
- Basal leachate drainage pipework
- Leachate drainage media
- Leachate pumping and monitoring system
- Lighting for entire site
- Cell access roads and perimeter footways

RESO consisting of

- Recycling Centre
- Weighing office and Guardroom
- Weighbridge
- Car parking
- Administration building
- Staff building
- Garages, Compactor-Shelter
- Workshop, incl. Machines, Tools, Stores System
- Gasoline station
- Vehicle wash site
- Traffic control, incl. signs, barriers, parking, etc.
- WWTP for sewerage from buildings
- All buildings' services (lighting, heating, AC, etc.)

STRATEGY – LANDFILLING OF RESIDUE WASTE *(CONTINUATION)*

Best Practice

iC - Georgia: Rustavi Solid Waste – PIU Support; 2010 - 2013



STRATEGY – LANDFILLING OF RESIDUE WASTE *(CONTINUATION)*

Best Practice *(continuation)*

iC - Georgia: Rustavi Solid Waste – PIU Support; 2010 - 2013



Site View



Administrative Building



Telehandler



Back Hoe Loader



Staff Building



Waste Sorting Building



Telehandler and Back Hoe Loader



Wheeled Loader and Dumper



Weighbridge



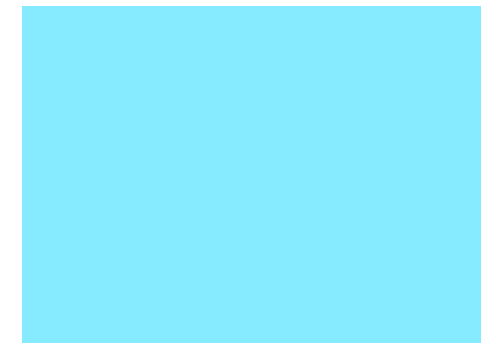
WWTP



Cleaning Facility (brush and water tank not shown)



Compactor (really needed?)



STRATEGY – WASTE SORTING OF HOUSEHOLD WASTE

iC Georgia: Rustavi Solid Waste – PIU Support; 2010 - 2013



Main Feeder



Sorting Cabin



Outlet conveyor



Drum



Shredder



Baler (at a later project stage returned)



Re-construction of WSL



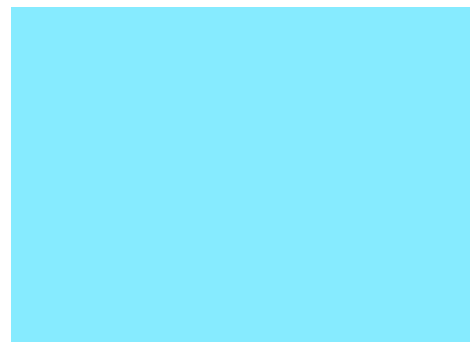
Waste feeder in operation



Dumper loading

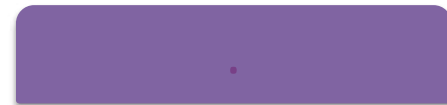


Feeding of Press by Telehandler



STRATEGY – PROCUREMENT

NOTES



- Only main key points/ details/ remarks are listed



- Listing not exhaustive



- Details are only provided if Procurement Title is considered as not self-explanatory



- No indication for recommended timing is given, since no information on financing is available



- Ranking of recommended procurement indicates to some extent the recommended sequence

STRATEGY – PROCUREMENT (*CONTINUATION*)

Procurement details

1. Preparation of Tender Documentation for a Feasibility Study for the Waste Sector in Trostianets and Preparation of Tender Documentation
 - Mainly ToR for Services

2. Preparation of a Feasibility Study for the Waste Sector in Trostianets and Preparation of Tender Documentation
 - Separated Waste Collection and Treatment, including Location Map for Collection Points
 - Feasibility of Extension of the existing Landfill , including EIA
 - Identification of a site for a new Landfill, including Environmental Impact Assessment (EIA)
 - Preparation of Tender Documentation for:
 - WO - Fencing and Installation of a Groundwater Monitoring System
 - SE - Corporate Development/ Awareness Campaign/ Operational Assistance for the Waste Company of Trostianets
 - SE – Design and Supervision of Extension of the existing Landfill and Remediation Measures

STRATEGY – PROCUREMENT *(CONTINUATION)*

3. Fencing and Installation of a Groundwater Monitoring System of the existing Landfill in Trostianets
 - Groundwater Monitoring System already considering potential extension
 - Supervision can potentially be done by Municipality own resources (thus Supervision not listed as individual Contract)

4. Corporate Development/ Awareness Campaign/ Operational Assistance for the Waste Company of Trostianets
 - Assistance also to Project Implementation Unit
 - Preparation/ Review/ Refinement of Company's Business Plans
 - Identifying of markets for selling of separated waste
 - Awareness Campaigns for population to separate waste
 - Reasonability/ Depreciation of Compactor
 - Elaboration of a Landfill Operation Plan
 - Preparation of Tender Documents for:
 - SU - Supply of Waste Containers and Waste Collection Vehicles for separated waste in Trostianets
 - SE - Design and Supervision of Extension of the existing Landfill in Trostianets and Remediation Measures
 - SE - Design and Supervision of a New Landfill for Trostianets - **ONLY** in case the extension of the existing landfill isn't feasible

STRATEGY – PROCUREMENT *(CONTINUATION)*

5. Supply of Waste Containers and Waste Collection Vehicles for separated waste in Trostianets
 - Potentially as two tenders; however waste containers shall fit to the vehicles
 - Vehicles potentially to be 2nd Hand
 - Incl. the recommended Mobile Unit for Household “Hazards”
6. Design and Supervision of Extension of the existing Landfill in Trostianets and Remediation Measures
 - New landfill cell (2 ha) to be designed and its construction to be supervised
 - Remediation Measures:
 - Existing Landfill closure/ cover and renaturation
 - Gas chimneys, no collection
7. Supply of Machinery for Operation and Maintenance of Waste Treatment for Trostianets
 - Compactor (provided reasonability in terms of improved compaction versus landfill life time is given)
 - Telehandler
 - Back Hoe Loader
 - Dumper, Wheeled Loader
 - Cleaning Facility

STRATEGY – PROCUREMENT

#	Title	Contract Type	Value* [EUR]	Implementation Time* [years]
1	Preparation of Tender Documentation for a FS for the Waste Sector in Trostianets and Preparation of TD	SE	50,000	0.5
2	Preparation of a FS for the Waste Sector in Trostianets and Preparation of TD	SE	700,000	1.5
3	Fencing and Installation of a Groundwater Monitoring System of the existing Landfill in Trostianets	WO	250,000	0.5
4	Corporate Development/ Awareness Campaign/ Operational Assistance for the Waste Company of Trostianets	SE	2,300,000	6.0
5	Supply of Waste Containers and Waste Collection Vehicles for separated waste in Trostianets	SU	2,000,000	0.5
6	Design and Supervision of Extension of the existing Landfill in Trostianets and Remediation Measures	SE	500,000	D: 0.75; S: 1.5
7	Works for Extension of the existing Landfill in Trostianets and Remediation Measures	WO	3,500,000	1.5
8	<i>Design and Supervision of a New Landfill for Trostianets (in case Extension of ex. Landfill isn't feasible)</i>	SE	800,000	<i>D: 1.5; S: 2.0</i>
9	Supply of Machinery for Operation and Maintenance of Waste Treatment for Trostianets	SU	2,000,000	6.0
10	Works for a new Landfill in Trostianets	WO	4,200,000	2.0
U	Unforeseen	---	3,300,000	---
Total			19,600,000	

* ... estimated; Contracts can/ shall partially be procured in parallel; Implementation Time does not include time for procurement and in case of Supervision time for DNP

D ... Design; DNP ... Defects Notification Period FS ... Feasibility Study; S ... Supervision; SE ... Service; SU ... Supply; TD ... Tender Documentation; WO ... Works

Note: all Works Contracts are recommended to be FIDICRed, respectively Detailed Design prepared by the Employer

Development strategy 2024 - 2050

WASTE MANAGEMENT / INFRASTRUCTURE

PROGRAM / INVESTMENT ITEMS	TOTAL estimated Investment (€) 2024 - 2050	TOTAL Investment till 2030 (€)	2030-2040 (€)	2040-2050 (€)
WASTE MANAGEMENT / INFRASTRUCTURE				
GRAND TOTAL	19,600,000	13,300,000	6,300,000	-
TA: Corporate Development / Awareness Campaign / Operational Assistance	2,300,000	2,300,000		
TA: Feasibility study / ESIA (Int. / Local)	750,000	750,000		
TA: Survey, Design, Tendering, Supervision	1,300,000	500,000	800,000	
Infrastructure		9,750,000	5,500,000	-
Fencing and Installation of a Groundwater Monitoring System of the existing Landfill	250,000	250,000		
Supply of Waste Containers and Waste Collection Vehicles for separated waste	2,000,000	2,000,000		
Works for Extension of the existing Landfill in Trostianets and Remediation Measures	3,500,000	3,500,000		
Supply of Machinery for Operation and Maintenance of Waste Treatment for Trostianets	2,000,000	2,000,000		
Works for a new Landfill in Trostianets	4,200,000	-	4,200,000	
Contingency	3,300,000	2,000,000	1,300,000	

**Investment
Strategy
Waste**



TRANSPORT & MOBILITY

NEW BALANCE TROSTIANETS

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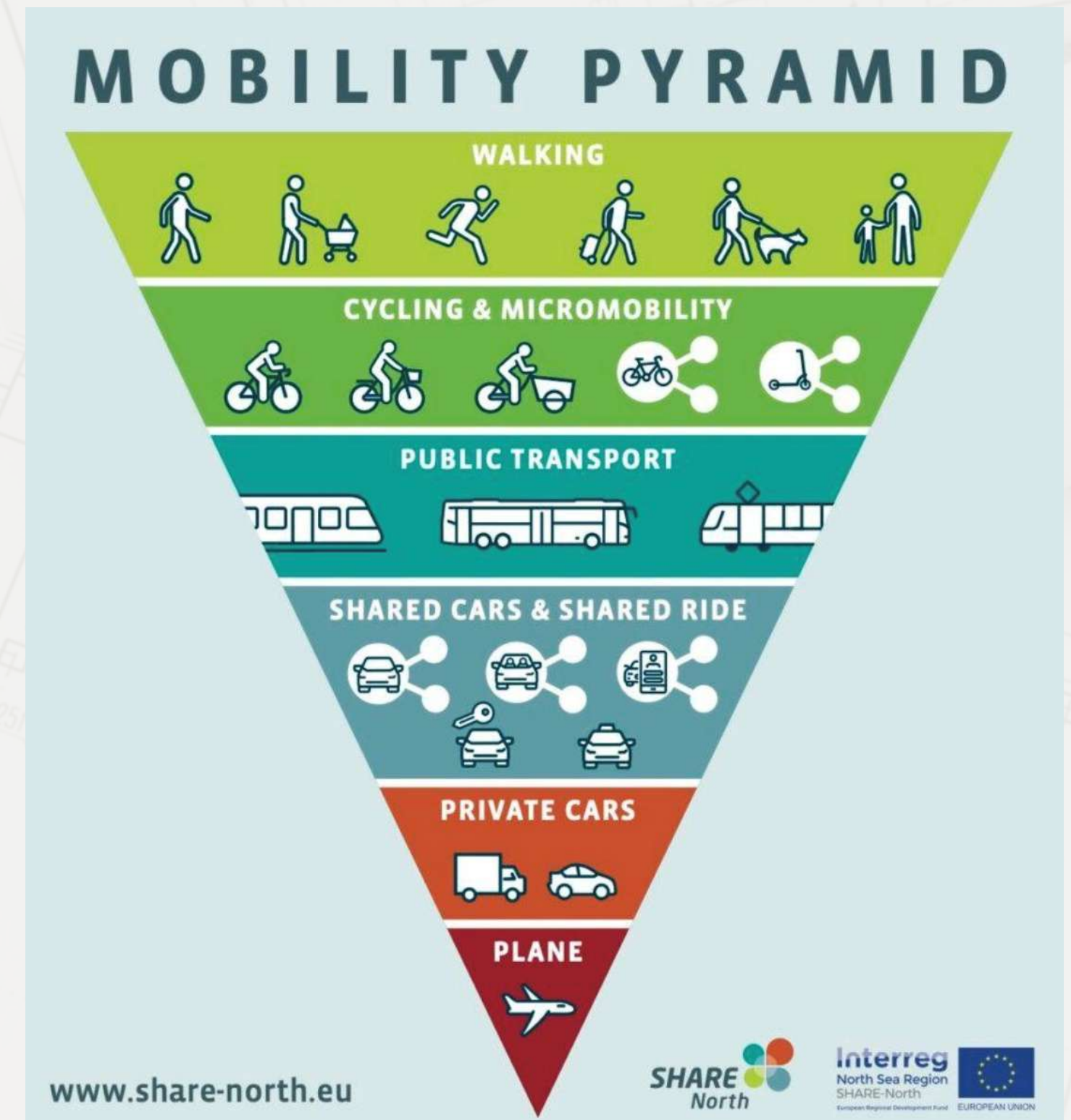
iC

ces
CLEAN ENERGY
SOLUTIONS

tbw
RESEARCH

TROSTIANETS MOBILITY PLAN – FRAMEWORK CONDITIONS

- (Re-)building the transportation system of Trostianets considering relevant framework conditions:
 - Climate Change and related (inter)national mitigation strategies (Paris Agreement, etc.)
 - UN-Sustainable Development Goals (SDGs)
 - Avoidance of western-/middle European misdevelopments in transport planning
- Conceptual orientation towards the Mobility Pyramid as strategic concept for transport planning
- Strategic Urban Mobility Plans (SUMPs) as role model



MAIN STRATEGIC GOALS

Development of a future-proof mobility Concept:

- Assessment of existing **strengths** and **potentials** to safeguard existing mobility behaviour related to **sufficiency** and **sustainability**.
 - *Preservation of existing non-fossil inner-city people transport (esp. walking, cycling).*
Comparable Austrian examples: Eisenstadt, Mattersburg,...
 - *Reduction of mobility demand by improving the supply situation with goods of daily use, following the concept of the **Compact City** (Dantzig & Saaty, 1973; Jacobs, 1961)*
- Overall minimization of car-dependency while at the same time ensuring city-wide mobility services (e.g. public transport) to tackle needs of people and freight transport.
- Ensure **affordability** and tailor made solutions according to the needs of the local population
- Minimization of investments into unsustainable transport solutions in order to **avoid stranded costs/stranded assets**
- Strategies for **agenda-setting for sustainable mobility solutions** in political processes to ensure effective outcomes regarding mode choice etc.

New Balance Trostianets



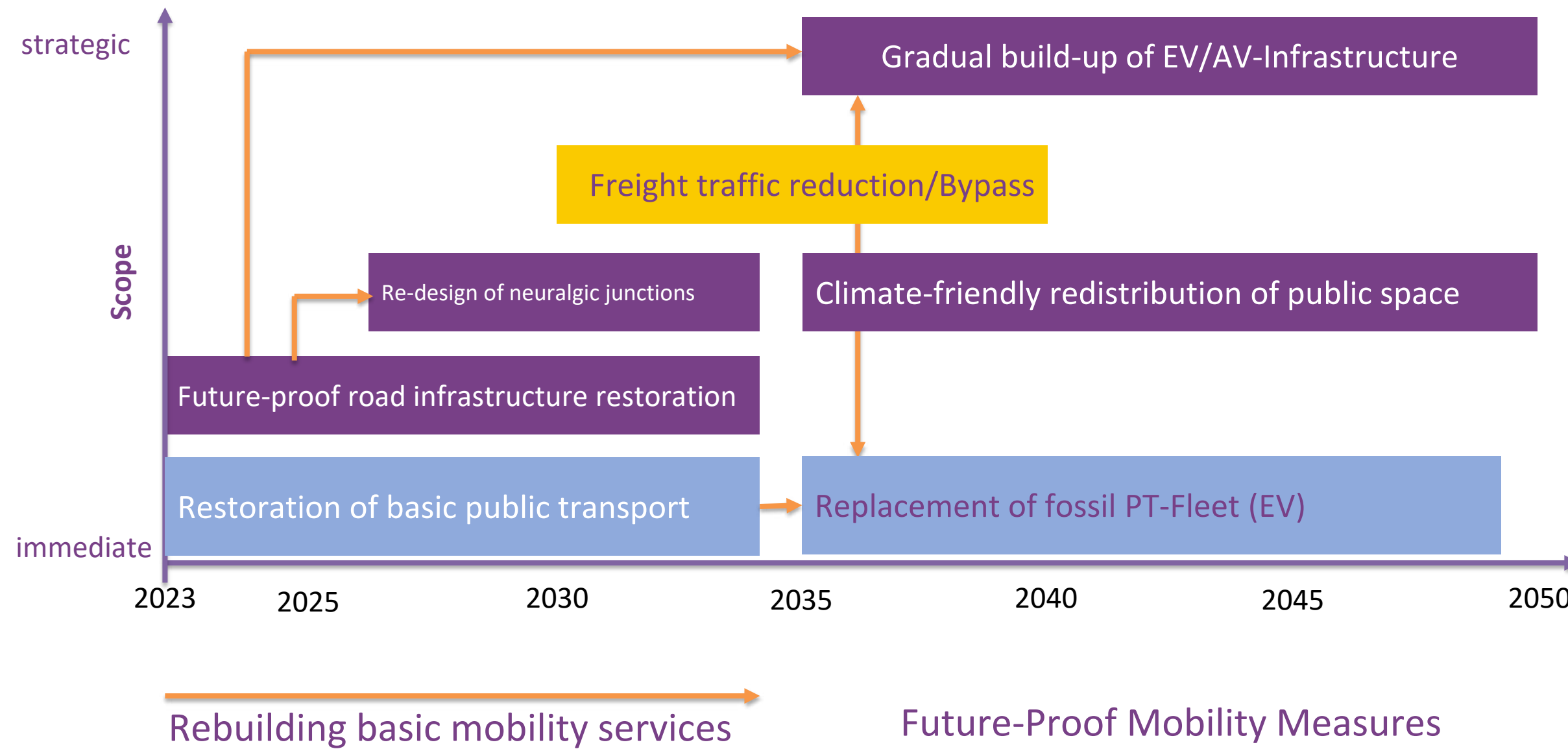
Pedestrian zone Eisenstadt (Google Street View 2023)



Traffic-calmed centre in Mattersburg (Google Street View 2023)

MOBILITY MASTER PLAN HORIZON

New Balance Trostianets



FREIGHT TRAFFIC REDUCTION/BYPASS

New Balance Trostianets

Reduction of freight transit through the city-centre

- Discussion, assessment and planning of a **bypass road** to reduce freight traffic through the city centre.
- Employment of **traffic management regimes** limiting freight traffic; concurrent parking policies in city centre
- Proof of Concept: Austrian City [Laa an der Thaya](#)
- Before bypass road & inner-city truck ban: **6700 vehicles per day**
- After opening of the road: **Reduction of traffic by 40% in the city centre**
- Establishing of inner city logistics concepts by promoting **rail based transportation for industrial zones.**



Traffic policy induced Truck-Ban for city of Laa an der Thaya (Google Street View 2023)



Bypass road of the Austrian City Laa an der Thaya (own cartography, basemap.at, 2023)

RE-DESIGN OF NEURALGIC JUNCTIONS

New Balance Trostianets

- Implementation of roundabout as effective solution of
 - *traffic flow problems*
 - *high risk of accidents*
- Enforcement of lower vehicle velocities by design
- Average Costs of implementation in Austria: 300k €

- Traffic flow analysis
- Planning of infrastructural prerequisites
- Detailed planning of solution for the junction
- Monitoring of congestion/traffic flow

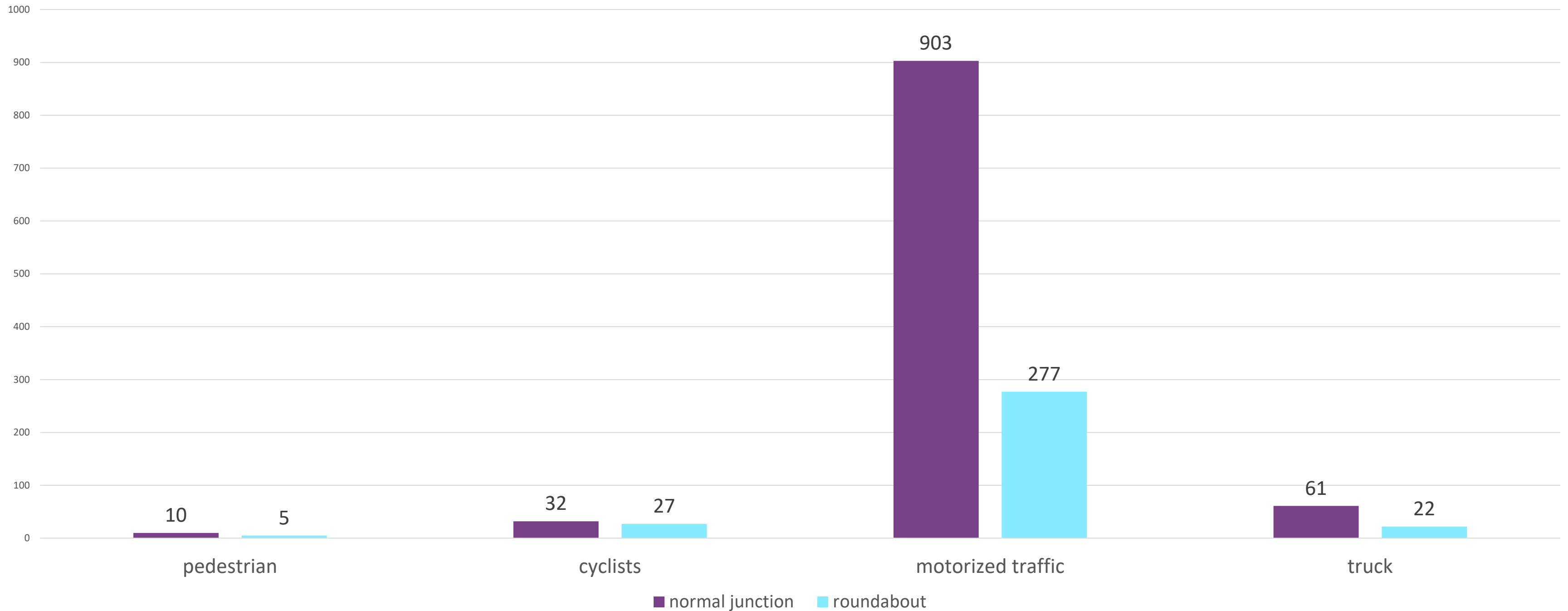


Neuralgic junction in Trostianets (Google Street View, 2015)



Example roundabout (KFV, 2007)

Reduction of accidents induced after roundabout installation



FUTURE-PROOF MOBILITY SYSTEM RESTORATION

■ Immediate measures:

- Basic restoration of roads alongside public transport infrastructure
- Rebuilding inner-city traffic infrastructure to state-of-the-art standards
 - *Ensure future-proof road infrastructure by installing flexible road infrastructure channels (future ev-Infrastructure, post 2050: automated driving)*
- Restoration of basic public transport
- Policy based traffic management regimes

■ Near-future activities

- Replacement of fossil PT-Fleet (Ev - electric vehicles)
- Climate-friendly redistribution of public space: Development of active mobility infrastructure, complementary to existing motorized transport





SUSTAINABILITY

NEW BALANCE TROSTIANETS

Modul5



FOCUS: UNITED NATIONS SUSTAINABILITY GOALS



- The SDG's can help think, plan and act in a systemic manner and allow to identify / manage synergies across different policy areas.
- The city of Trostianets should use the SDG's as an engine / opportunity to further improve and add value to the on-going work off the city.
- Trostianets could become a leader city for SDG's implementation and inspire other cities and regions in Ukraine.

FOCUS: UNITED NATIONS SUSTAINABILITY GOALS

6 CLEAN WATER AND SANITATION

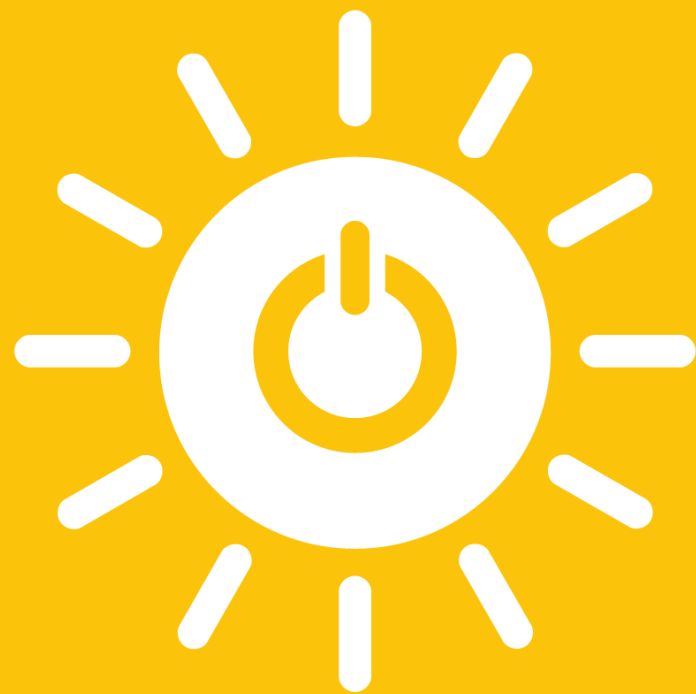


By implementing the Master Plan, it is possible to achieve following targets and indicators set by the United Nations:

- **Target 6.3:** By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- **Indicator 6.3.1:** Proportion of domestic and industrial wastewater flows safely treated
- **Indicator 6.3.2:** Proportion of bodies of water with good ambient water quality
- **Target 6.a:** By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
- **Indicator 6.a.1:** Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan

FOCUS: UNITED NATIONS SUSTAINABILITY GOALS

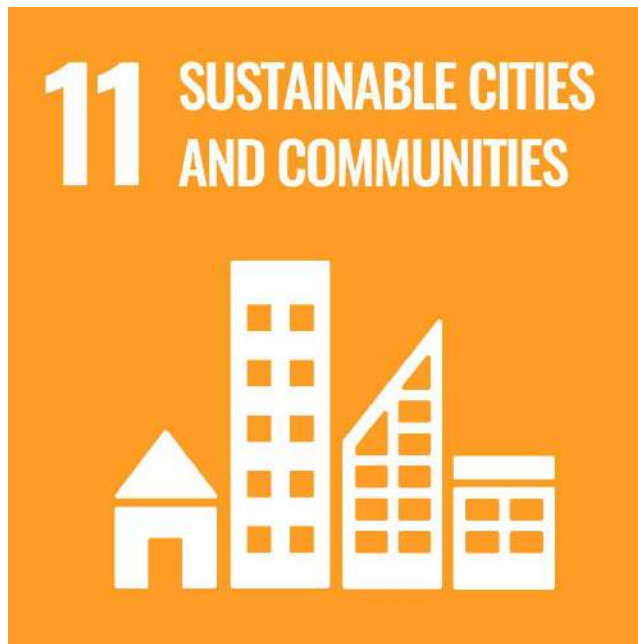
7 AFFORDABLE AND CLEAN ENERGY



By implementing the Master Plan, it is possible to achieve following targets and indicators set by the United Nations:

- **Target 7.2:** By 2030, increase substantially the share of renewable energy in the global energy mix
- Indicator 7.2.1: Renewable energy share in the total final energy consumption
- **Target 7.a:** By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
- **Indicator 7.a.1:** International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems
- **Target 7.b:** By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and land-locked developing countries, in accordance with their respective programmes of support
- **Indicator 7.b.1:** Installed renewable energy-generating capacity in developing countries (in watts per capita)

FOCUS: UNITED NATIONS SUSTAINABILITY GOALS



By implementing the Master Plan, it is possible to achieve following targets and indicators set by the United Nations:

- **Target 11.6:** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
- **Indicator 11.6.1:** Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities
- **Target 11.7:** By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities
- **Indicator 11.7.1:** Average share of built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
- **Target 12.5:** By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
- **Indicator 12.5.1:** National recycling rate, tons of material recycled





TOGETHER FOR FUTURE

NEW BALANCE TROSTIANETS

WITH KIND SUPPORT OF:

MR. HANNES HORVATH
MR. PETER BLASCHKE
MR. MADIS MADISON

