Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Industrial waste mapping pilots in Azerbaijan, Georgia, and Ukraine

Ally Carruth, Henrik Toremark, Emma Danielsson

Sweco AB

September 2022

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

EU4Environment
Green Economy in Eastern Partner Countries

The Teams

UNIDO
UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SWECO

ACE GROUP CONSULTANTS

REC CAUCASUS

EEC·ЭЭС

RESOURCE EFFICIENT AND CLEANER PRODUCTION CENTRE

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Introduction

"Unutilised industrial materials"

Wastes

By-products

Broader view, actions, structured approach, clear benefits, a way ahead

Define baseline
Alternatives
Whole system

Quantities
Classifications
Waste journeys

Financial impacts
Environmental impacts
Key players

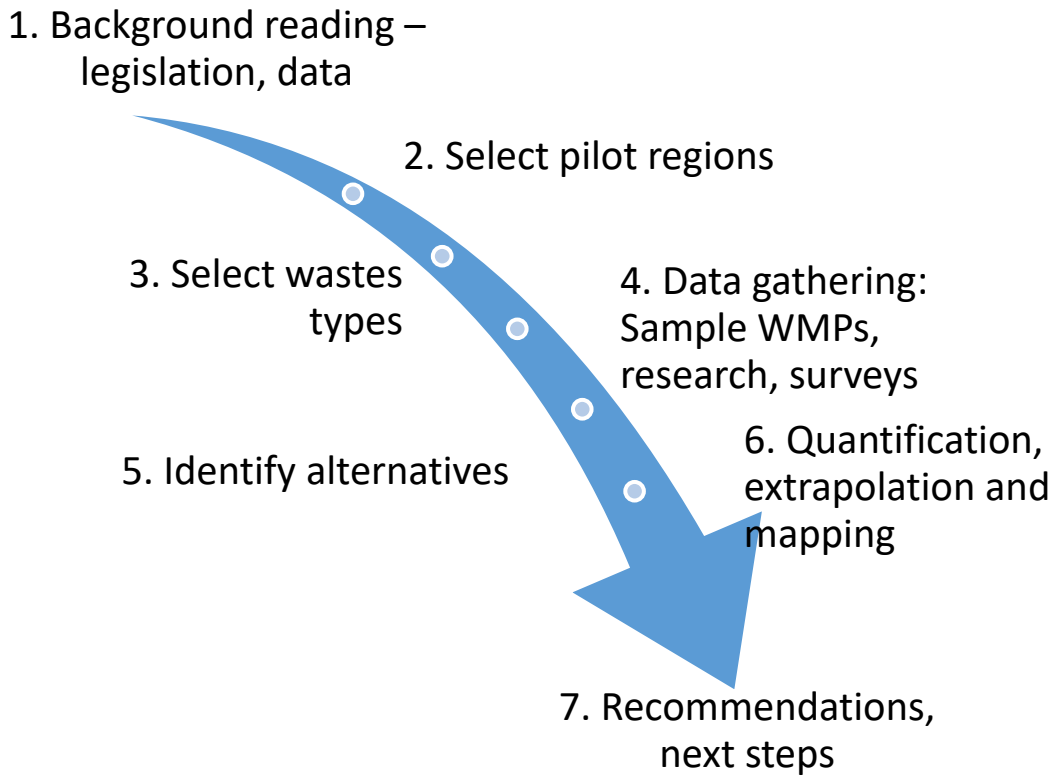
Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

The process



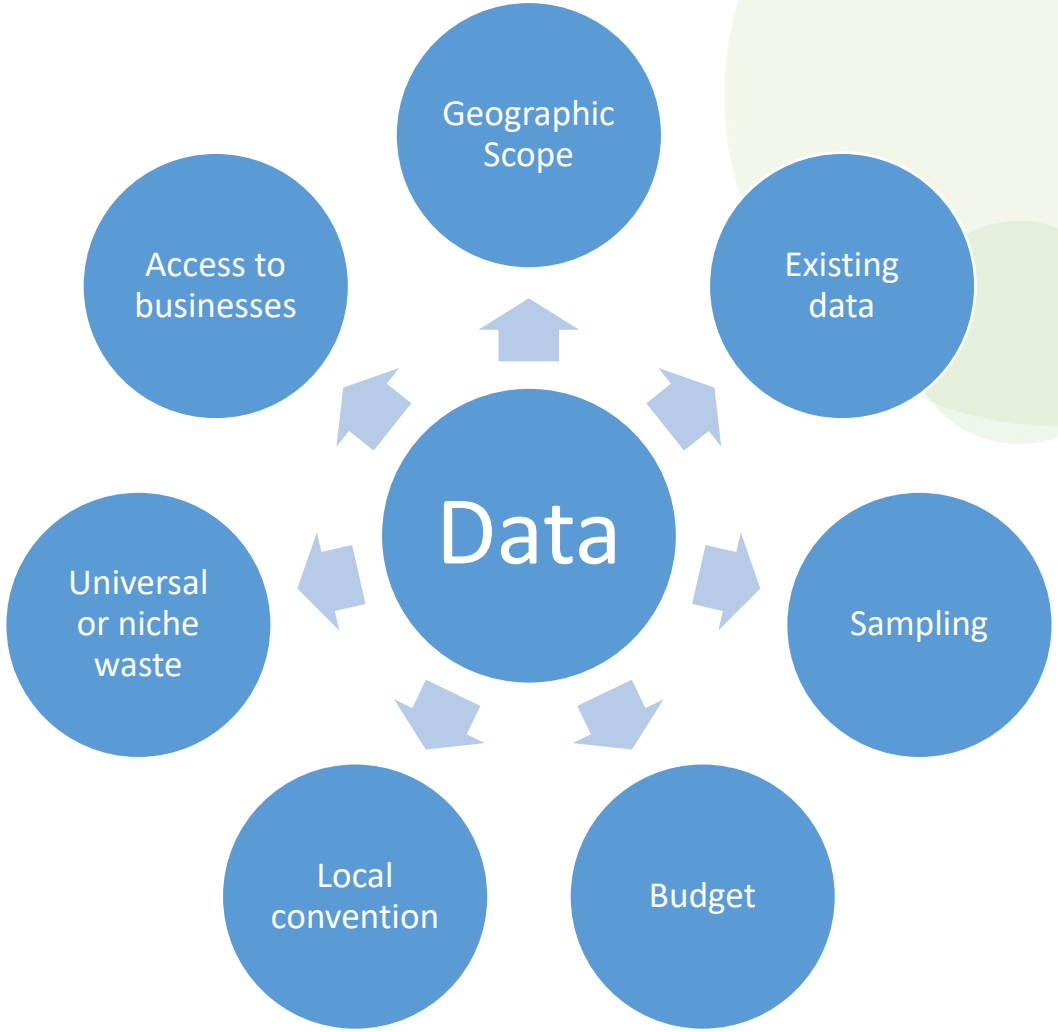
Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Data gathering



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Possible data sets and strategy

Characterizing the industrial base

- NACE lists of businesses
- Data on turnover
- Data on employment
- External sources for benchmarking.

Waste data

- European Waste Catalogue codes
- Sources of the waste
- Onward destinations of wastes, including sorted and segregated fractions
- By-products that are not listed as wastes
- Classification (non-hazardous, hazardous or inert)
- Treatment capacities
- Waste composition analyses
- Process diagrams and/or photos

Financial

- Collection costs for mixed household waste and sorted fractions
- Post-treatment market value
- Taxation rates levied
- Gate fees at facilities
- Storage fees

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Stakeholder input

Stakeholder	Input
Municipality	Waste data, overview of the local area, contacts
Regional/central Government	Waste data, policy direction
Data agencies	Official statistics (industrial, waste, demographic)
Business clubs	Networking, contacts, sectoral data, symbioses, opinion
Businesses	Primary data, opinion on challenges and opportunities
Waste contractors	Primary data on waste journeys
Regulators	Waste data, qualitative information
Academia/other	Industrial process mapping, research

Action implemented by:

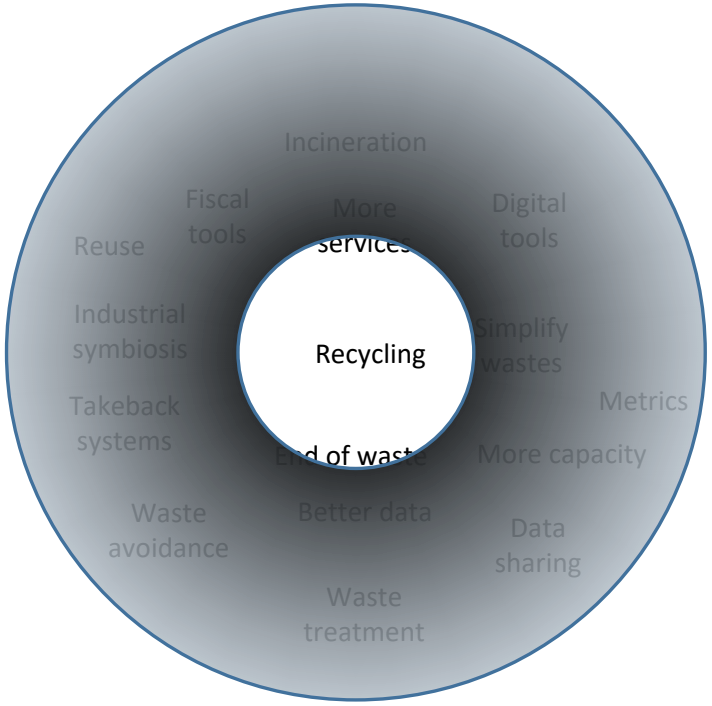
OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

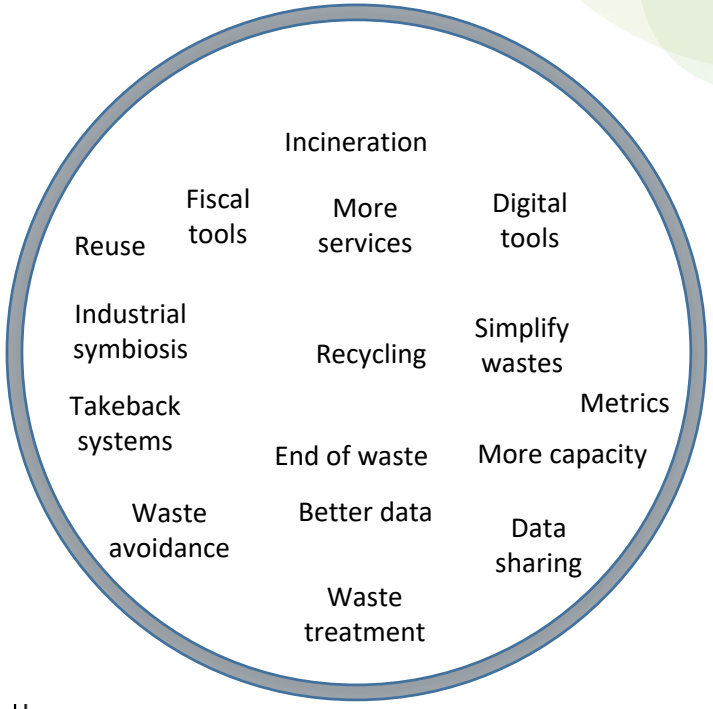
Seeing the whole picture

Narrow individual approach



OR

Broader regional waste mapping



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by
the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Azerbaijan

Action implemented by:

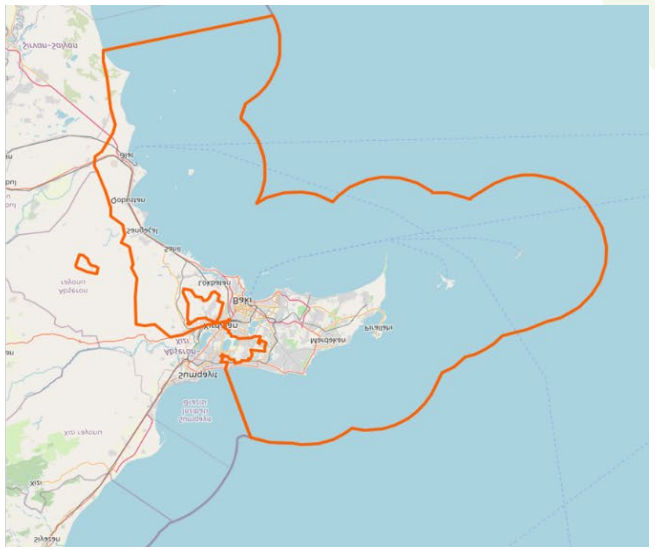
OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Selected regions

Baku



Absheron-Khizi

≈250,000 tonnes per year of industrial waste and
≈944,000 tonnes per year of household waste generated

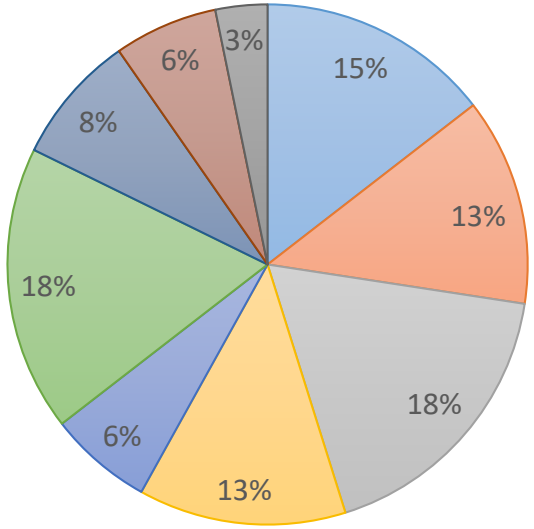
Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Industrial sectors in the pilot regions



- **Metal smelting, metal processing**
- Paint and other construction materials
- **Construction Materials**
- Chemicals
- Plastic products
- **Furniture**
- **Glass and porcelain-faience**
- **Textiles**
- Other

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Summary of industrial wastes

- 16 sample businesses as a starting point
- 16 waste type groups
- 12,120 tonnes/year, of which organic waste is 10,373 tonnes/year

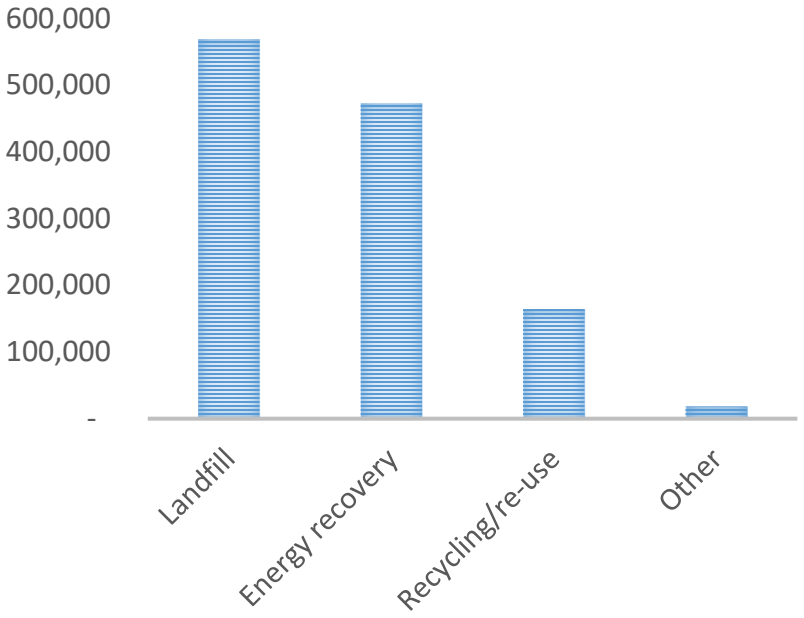
Action implemented by:

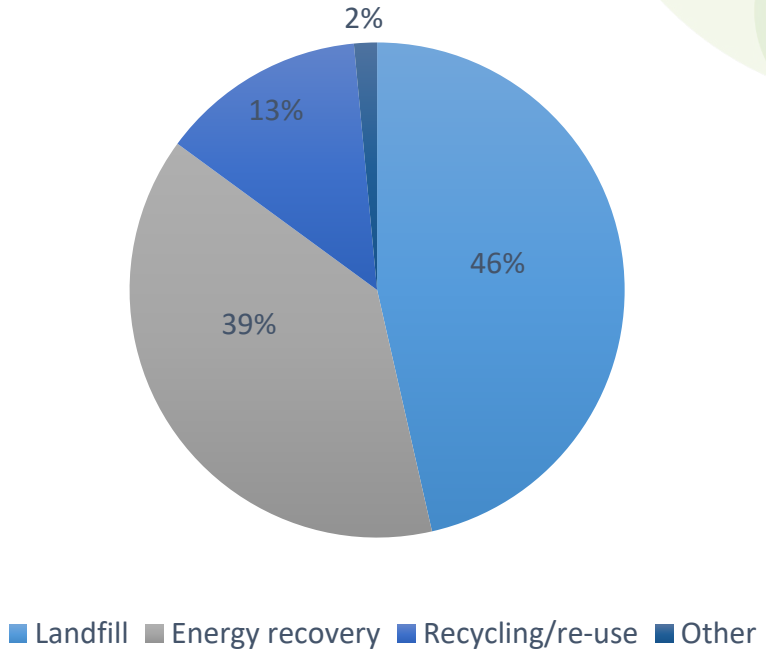
OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Waste destinations in pilot regions





Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Finalised waste shortlist

- Waste oils
- Wood
- Metals
- Paper
- Glass
- Textile waste

Based on:

- Amount of waste generated
- Industrial nature and current resource efficiency
- Likely waste journeys
- Potential for greater circularity
- Potential for an informative pilot

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Overview of results – selected wastes

Waste type	Quantity	Alternatives
Waste oils from cement and beer production 80% currently incinerated, 20% refined	19 tonnes/year	Reduce oil consumption Reduce oil waste Sorting Bio-oils
Wood waste from furniture, cement and beer production Mainly incinerated in various ways	279 tonnes/year	Repair/reuse of pallet Better sorting Recycling to particle boards
Metal waste from beverage, smelting and furniture. 89% recycled	245 tonnes/year	Better sorting

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

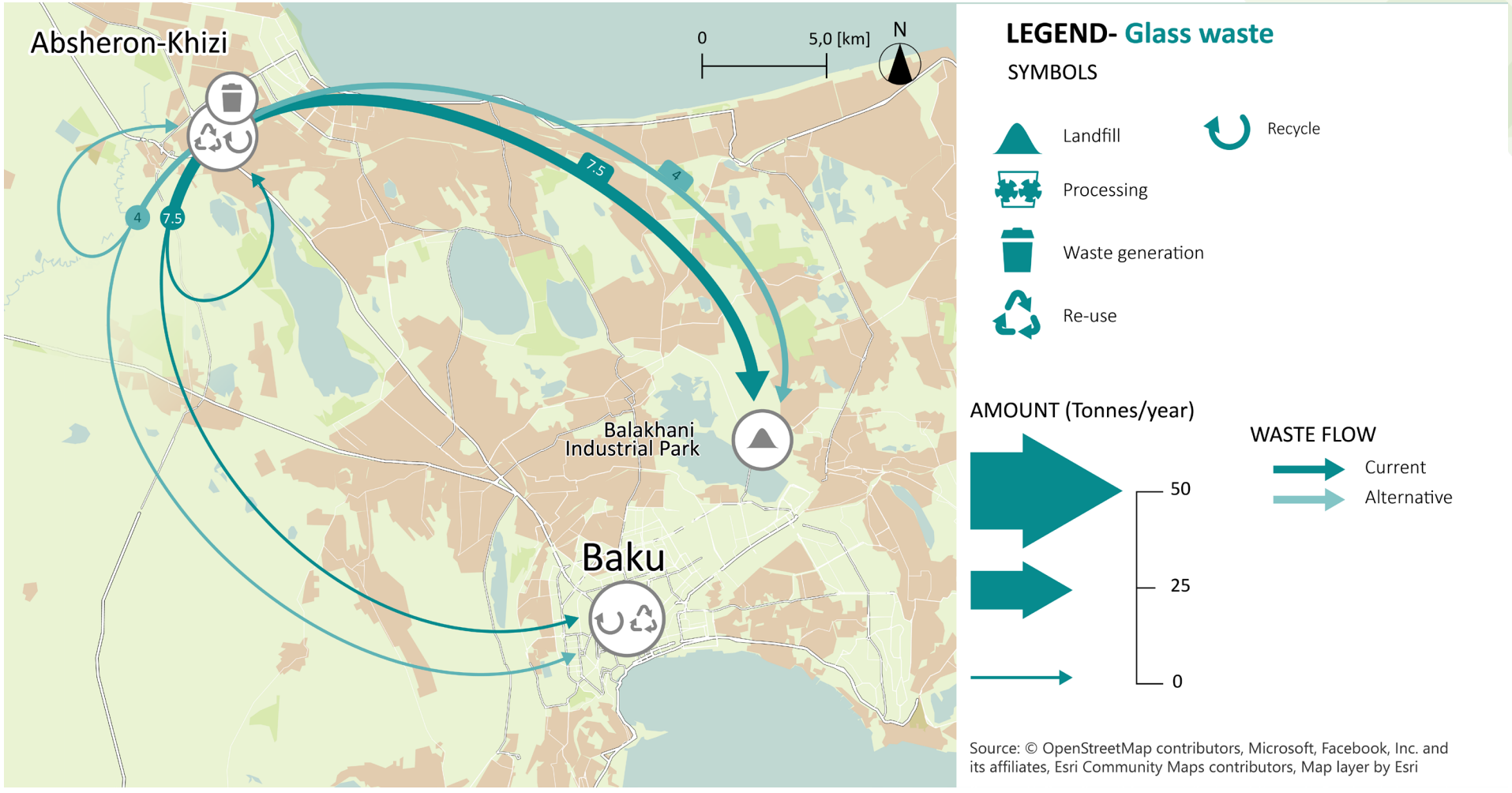
Overview of results

Waste type	Quantity	Alternatives
Paper waste from packaging of cement, textiles and beverages 92% recycled, 8% landfilled or incinerated	61 tonnes/year	Re-use systems and takeback Better sorting
Glass waste from beverage production 50% recycled, 50% landfill	15 tonnes/year	Deposit / takeback scheme Plastic bottles
Textile waste from furniture and clothes production 65% landfilled, 35% recovered	7 tonnes/year	Replacement of raw materials in production Embrace circular models for clothes reuse

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Glass waste



Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Conclusions

- ≈13% of mapped industrial industrial waste recycled or re-used
- Financial implications of alternatives in sample industries – in total 1.1 million EUR /year in reduced collection costs and material value
- Extrapolated to the four focus sectors in the pilot regions:
  - 29-35,000 EUR / year savings in collection costs
  - 5.6-6.8 million EUR in increased material value per year

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by
the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Georgia

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Selection of pilot regions

- All 10 Georgian regions considered
- 4 taken forward
  - Shida Kartli
  - **Kvemo Kartli - Rustavi**
  - Adjara
  - **Imereti – Zestaponi**

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

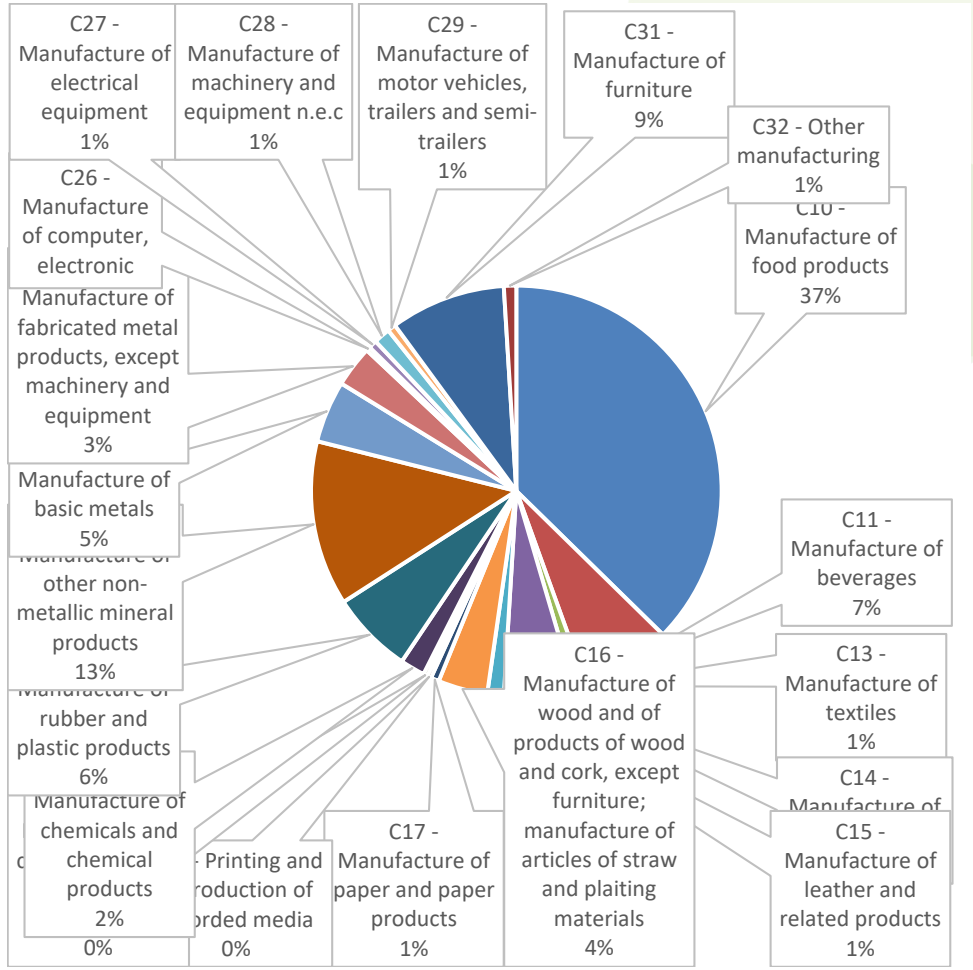
EU4Environment
Green Economy in Eastern Partner Countries

Industrial businesses - Zestaponi

- 14,242 tonnes MSW (all sectors)

NACE codes 10-32:

- 308 manufacturing businesses (10% of total)
- Estimated approx. 2000 employed
- No data on employment, turnover of sub-sectors



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

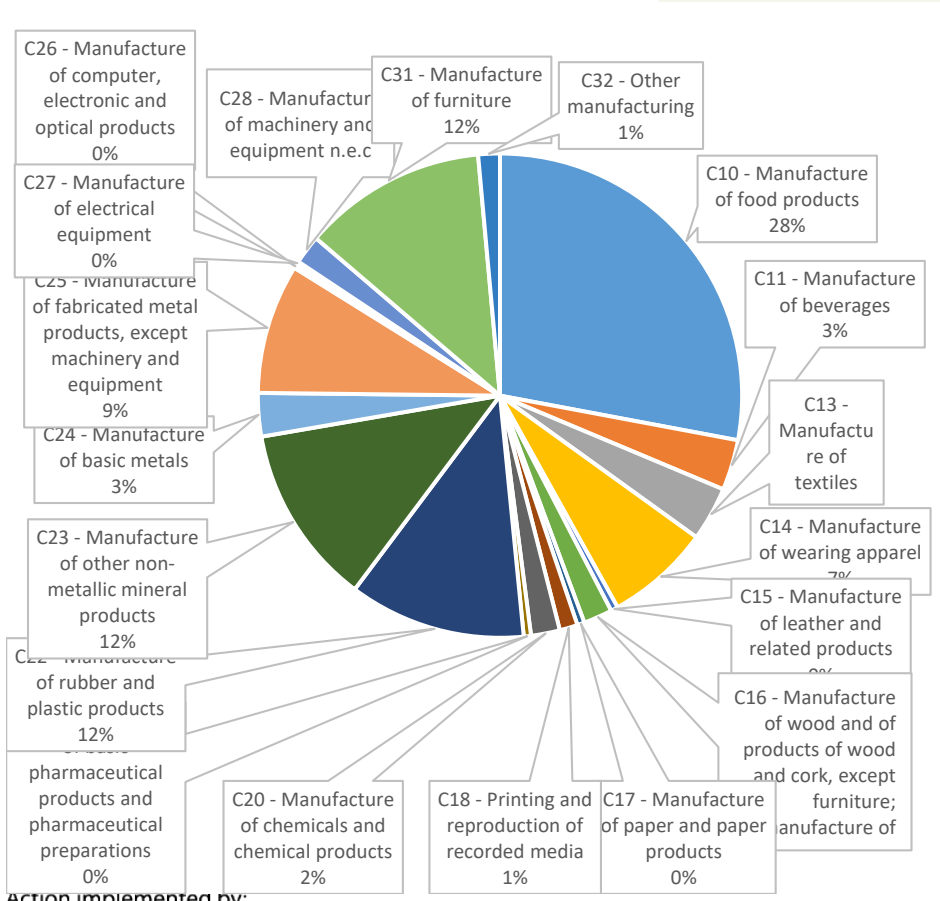
EU4Environment
Green Economy in Eastern Partner Countries

Industrial businesses - Rustavi

- 44,627 tonnes MSW (all sectors)

NACE codes 10-32

- 415 manufacturing businesses (8.4% of total)
- Estimated approx. 4000 employed in manufacturing
- No data on employment, turnover of sub-sectors



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Industrial waste producers

Company Waste Management Plans formed centerpiece of data gathering
Focused on major businesses:

Rustavi

- Rustavi Steel
- Heidelberg Cement
- Vivacement
- Mneshibili

- **105,718 tonnes** per year according to their Waste Management Plans

Zestaponi

- Sakabelli
- Metalline
- GTM Group
- Ecometal
- Metalolami
- **21,801 tonnes** per year according to their Waste Management Plans

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Industrial waste arisings - Zestaponi

- 21,500 tonnes (89%) is from 2 waste types:
  - Unprocessed slag
  - Wastes from the processing of slag
- 300 tonnes from 20 waste types
- **Extrapolated estimate of total industrial waste per year:** 23,700 tonnes - 36,000 tonnes. Very approximate.

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Industrial waste arisings - Rustavi

- **94,000 tonnes** (89%) is from 6 waste types:
  - Unprocessed slag
  - Waste binders
  - Particulates and dust
  - Ferrous metal dust and particles
  - Other linings and refractories from metallurgy
  - Construction and demolition
- The remaining 11,000 tonnes from 55 waste types
- **Extrapolated estimate of total Rustavi industrial waste per year:** 108,000 tonnes - 125,000 tonnes. Very approximate.

Action implemented by:
OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Selected wastes for mapping

Rustavi

- Paper and card
- End of life tyres
- Mixed municipal waste (albeit from an “industrial” setting)

Zestaponi

- Waste from processing of slag and unprocessed slag
- Synthetic hydraulic oils
- End of life tyres
- Mixed municipal waste. (mixed waste from industrial facilities)

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

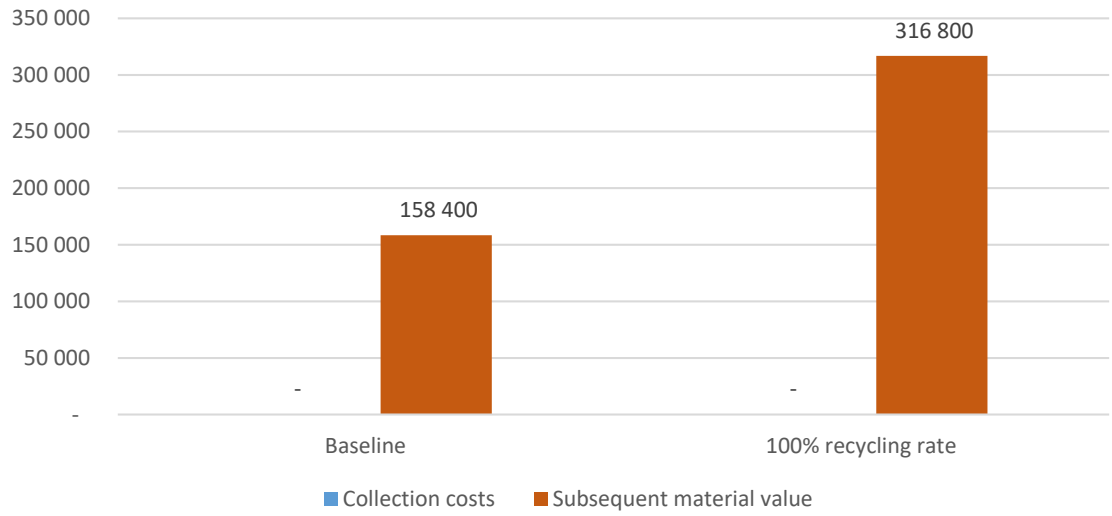
Zestaponi - Waste from processing of slag and unprocessed slag

Baseline:

- 21,500 tonnes per year
- Of which 16,500t are wastes from the processing of slag. 50% crushed and sold, the rest stored in situ…
- …and 5000 tonnes unprocessed slag fed back into the metallurgy process
- Unknown waste transporters
- Collection costs: No direct costs
- Market value of waste: €158,000 per year

Options:

- Clarify status as waste – end of waste protocol
- 100% recycling



OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

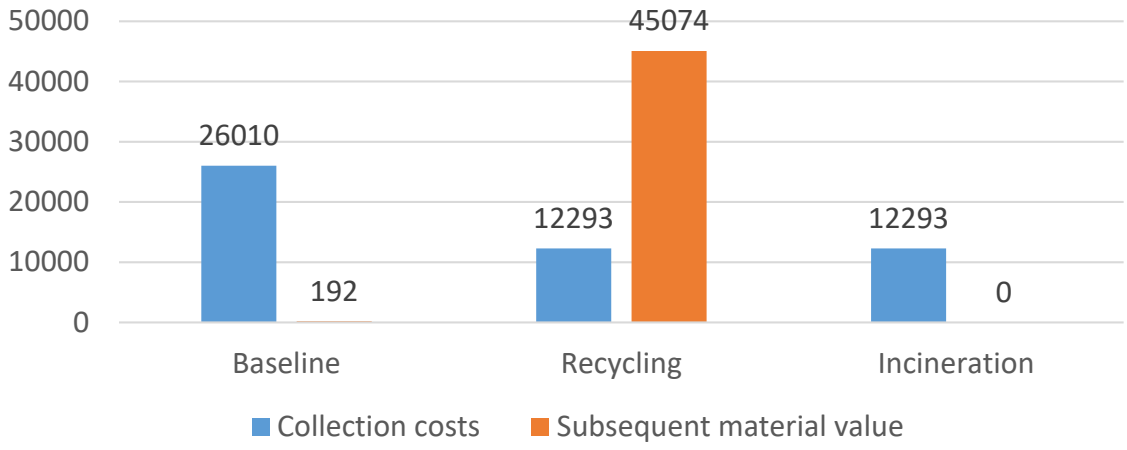
Rustavi - Paper and cardboard

Baseline:

- 1281 tonnes per year
- Of which 1250t are damaged disposal sacks for transport of cement
- Unknown waste transporters, assumed local municipal services
- Destination: landfill, very small amount of separation for recycling at landfill
- Collection costs: €26,000 per year
- Market value of waste: €192 per year

Options:

- Waste avoidance through reusable cement containers
- Recycling
- Incineration in kilns



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Zestaponi - extrapolations

	Collection costs		Material value	
Waste	Upper range	Lower range	Upper range	Lower range
Unprocessed slag and wastes from processing of slag				
Baseline	-	-	254 400	254 400
100% recycling rate	-	-	412 800 (+50%)	412 800 (+50%)
Synthetic hydraulic oils				
Baseline	16 604	2 767	1 038	173
Adoption of eco oils	6 227 (-63%)	1 038 (-63%)	3 798 (+266%)	633 (+266%)
End of life tyres				
Baseline	8 694	1 449	-	-
Granulation and recycling	30 528 (+251%)	5 088 (+251%)	101 760	16 960
Incineration / pyrolysis	40 704 (+368%)	6 784 (+368%)	14 925	2 487
Mixed MSW				
Baseline	9 398	5 639	-	-
50% recycling rate	4 337 (-54%)	2 602 (-54%)	10 844	6 506
Incineration as RDF	8 675 (-8%)	5 205 (-8%)	15 904	9 542

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

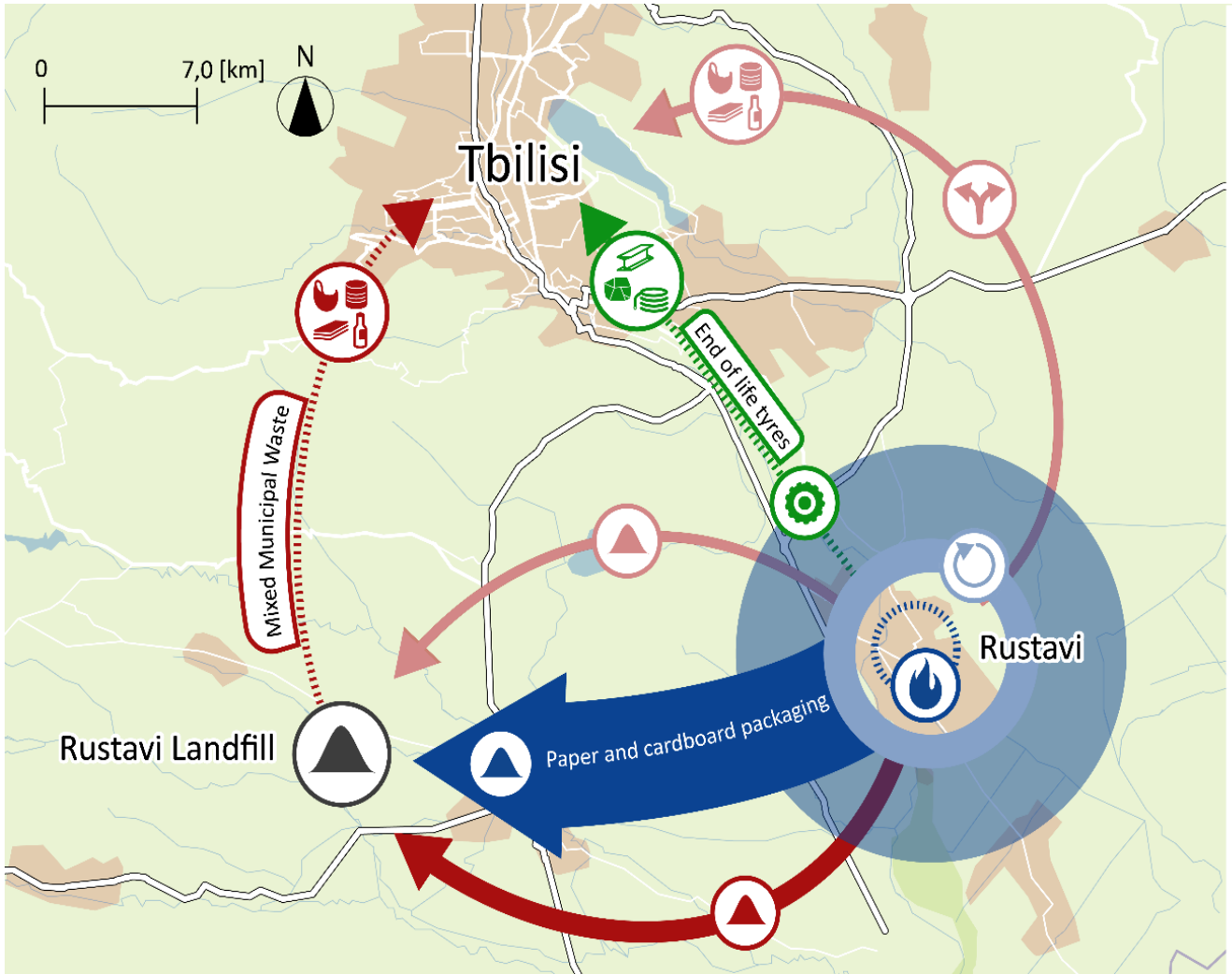
Rustavi - extrapolations

	Collection costs € (+/-%)		Material value € (+/-%)	
Waste	Upper range	Lower range	Upper range	Lower range
Paper and cardboard				
Baseline	**65 026**	**37 158**	**480**	**274**
Recycling	30 732 (-53%)	17 561 (-53%)	112 684 (+23k%)	64 391 (+23k%)
Incineration	30 732 (-53%)	17 561 (-53%)	-	-
End of life tyres				
Baseline	**11 290**	**1 882**	**37 632**	**6 272**
Shredding for incineration	15 053 (+33%)	2 509 (+33%)	2 760 (-85%)	920 (-85%)
Mixed MSW				
Baseline	**29 831**	**17 899**	**4 957**	**2 974**
50% recycling rate	13 768 (-54%)	8 261 (-54%)	68 842 (+1300%)	41 305 (+1300%)
Processing into RDF	27 537 (-7%)	16 522 (-7%)	50 484 (+918%)	30 290 (+918%)

Funded by
the European Union

EU4Environment

Green Economy in Eastern Partner Countries



LEGEND

SYMBOLS

- Landfill
- Separate
- Incineration

Recycle

- Paper
- Plastic
- Metal
- Glass
- Tyre/granulation
- Rubber
- Carbon black
- Steel

AMOUNT (Tonnes/year)

- 100 000
- 5 000
- 0

COLOUR

- Current
- Alternative

Source: Esri, HERE, Garmin, FAO, METI/NASA, USGS

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Conclusions

- Range of alternatives – incineration to new business models
- Collection costs reduced by 40-70%
- Material value created anew or multiplied in value
- Solutions mainly logistical/organisation, rather than technical
- Issues with data availability

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by
the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Ukraine

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Selected regions

Slavuta City Territorial Community
69 sq.km
36,000 people
15 production enterprises

Davydiv Village Territorial Community
23 sq.km
20,000 people
25 production enterprises

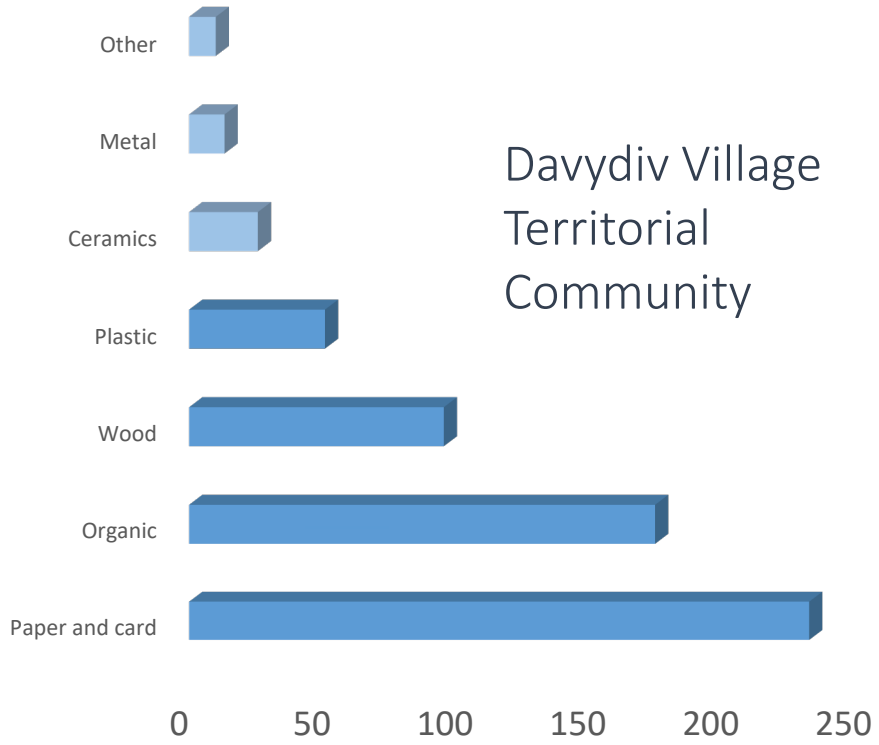
Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

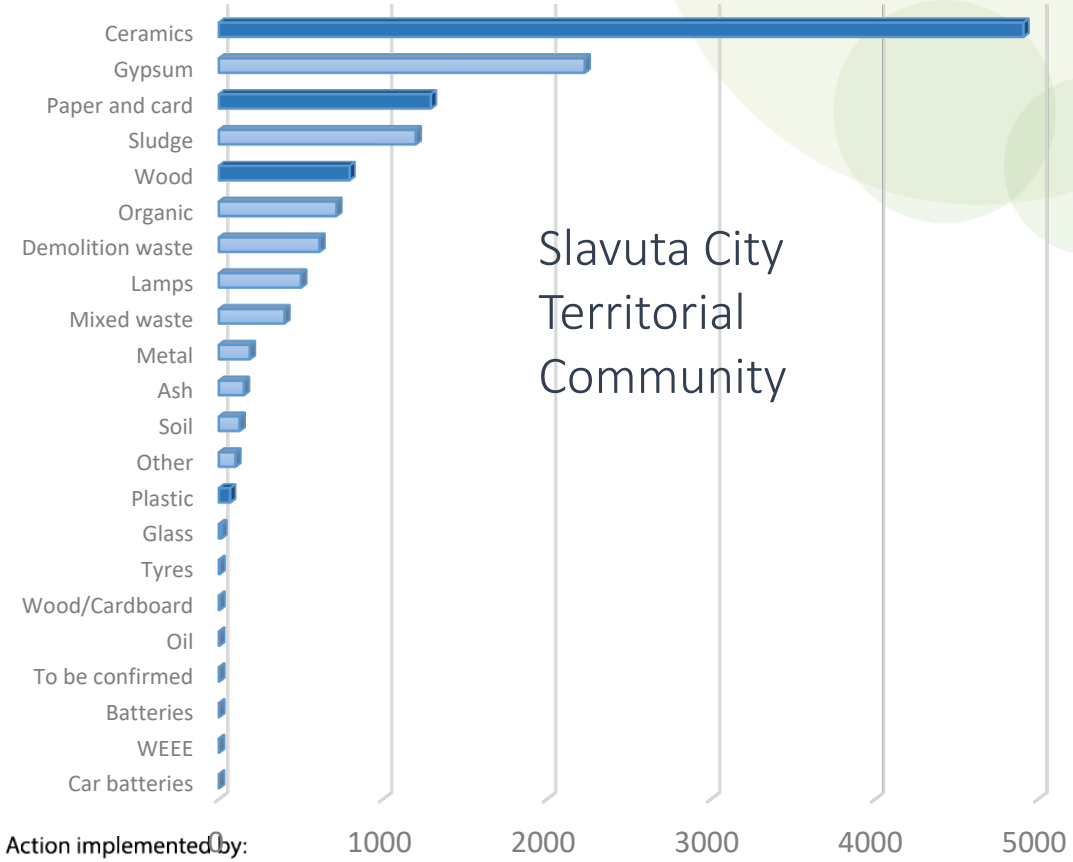
Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Waste types and amounts



Davydiv Village Territorial Community



Slavuta City Territorial Community

Action implemented by:

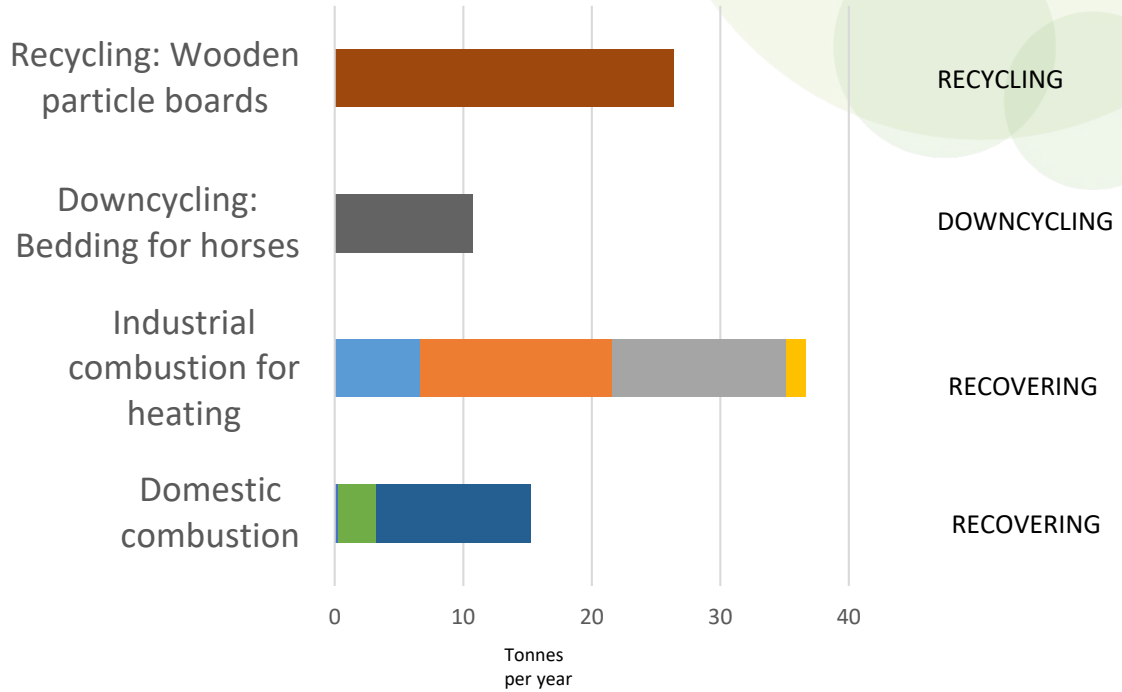
OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Example: Wood Davydiv VTC

Funded by
the European Union

EU4Environment
Green Economy in Eastern Partner Countries

- Cutoffs and sawdust from furniture production, waste pallets
- Kronospan collects and recycles into wooden particle boards
- Kronospan pays producer UAH 600 / cbm



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by
the European Union

LEGEND

SYMBOLS

- Industrial combustion
- Domestic combustion
- Pellets manufacturing
- Downcycling to horse bedding
- Recycling to particleboards

AMOUNT

- 30 ton
- 15 ton
- 0 ton

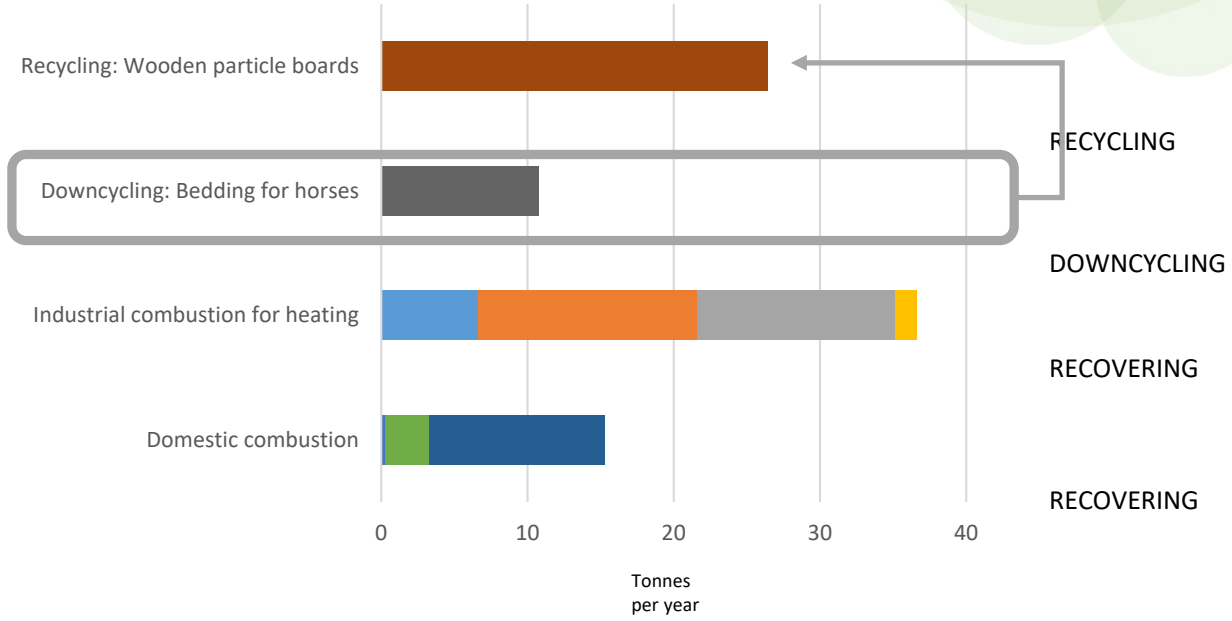
0 2,0 [km] N

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Opportunities: From downcycling to recycling

- Recycle into wooden particle boards
- Approximate increase in income per cbm:
  480 UAH
- Approximate total increase in income for company in waste mapping:
  20 000 UAH



Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Conclusions

- Clear financial benefits evident
- Waste policy could support the waste hierarchy more
- Acute need for more robust and digitalised waste data system
- Regional planning/mapping needed for economies of scale
- Practical support is needed for businesses

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by
the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Summary of pilots

Action implemented by:

OECD BETTER POLICIES FOR BETTER LIVES | UNECE | UN environment programme | UNIDO | THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

Funded by the European Union

EU4Environment
Green Economy in Eastern Partner Countries

Recap and summary

- **Large financial savings possible.** Waste prevention measures yield greatest results
- **Collaboration.** Numerous opportunities between industry. Opportunities to build on business networks
- **Mindset.** Avoid temptation to think of better waste management. Think of **"circular economy systems".**
- **Incomplete data**. This was a challenge throughout. Data strategies should be prioritised
- **Procurement and market stimulation**. Green procurement can help develop markets
- **Fiscal tools.** Landfill is often cheaper than recycling
- **Regulation.** Needs to support reuse and recycling, e.g. end of waste protocols
- **Strategy**. Need greater alignment of policy and goals with waste hierarchy