



SECONDARY MATERIALS AND WASTE RECYCLING COMMERCIALIZATION

-in-

SERBIA

2009-2010



PART I

ASSESSMENT

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REDUCE: Use less, waste less, and buy products that contain less packaging through:

- **Source Reduction:** Reduce waste before buying it and purchase products that are not wasteful in their packaging or use.
- **Conservation:** Reduce waste through wise use of natural resources.
- **Precycling:** Purchase products in recyclable packaging.

REUSE: Reuse materials in their original form instead of throwing them away or give them to others who could use them.

RECYCLE: Separate reusable materials and bring them to recycling centers so they can be remade into the same product or new products. Recycling consumes less energy and resources than producing from new materials.

COMPOST: Compost organic and food waste to produce a useful by-product and to conserve landfill space.

Acronyms & Definitions

AFR: Alternative Fuels & Raw Materials, a term used in cement and incineration industries.

CIM: Center for International Migration

Collector: As used in this report, an individual or public or private company that collects recyclables, and who may provide further processing such as sorting, washing and/or producing an intermediate such as granulated or shredded plastic.

CRDA: Community Revitalization through Democratic Action, a \$200 million USAID project implemented throughout Serbia by five partners working in five geographic regions from 2001-2007.

CRT: Cathode Ray Tube (video monitors before LCD).

DOO: Društvo s Ogranicenom Odgovornošću, or LLC (Limited Liability Company).

EC: European Commission, now the Delegation of the European Union to the Republic of Serbia.

EBRD: European Bank for Reconstruction and Development.

EPS: Elektroprivreda Srbije, Serbian public enterprise for electricity supply.

GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit, the German international cooperation and development enterprise.

HW: Hazardous Waste.

IFC: International Finance Corporation, a member of the World Bank Group. IFC provides investments and advisory services to build the private sector in developing countries.

IPA: Instrument for Pre-Accession, the sole EU funding instrument for beneficiary and candidate countries.

IPPC: Integrated Pollution Prevention & Control, a directive on industrial emissions,

ISWA: International Solid Waste Association.

JKP: Javno Komunalno Preduzeće (Public Communal Enterprise); public or publicly-funded enterprise in Serbia working at the municipal or regional level responsible for city and municipal maintenance, including waste collection.

LED: Local Economic Development, a development strategy that facilitates public, private and civil society partners working together to improve economic conditions.

LEDIB (Danish): Local Economic Development in the Balkans, a five-year Danish-funded project supporting LED, SME development and employment creation.

LLC: Limited Liability Company.

MEGA: Municipal Economic Growth Activity, a \$24 million USAID LED project implemented in targeted Serbian municipalities from 2005-2010.

MESP: Serbian Ministry of Environment & Spatial Planning.

MoU: Memorandum of Understanding.

MSME Development: Micro, Small and Medium Enterprise Development, a set of development strategies that seek to strengthen existing and startup enterprises so they operate more efficiently and are better able to grow.

MSW: Municipal Solid Waste.

NGO: Non-Government Organization.

OEM: Original Equipment Manufacturer (warranty).

PMU: Program Management Unit of MESP.

PPI: Producer Price Index; measures average change over time in the selling prices received by domestic producers for their output; in the US PPIs are collected and reported by the US Bureau of Labor Statistics; PPIs are aggregated and reported for virtually all industrial materials and sectors, including all recyclables.

PPP: Public-Private Partnership; in the context of this report to indicate partnership arrangements between municipalities and a private strategic waste management partner.

PRO-Europe: Packaging Recovery Organization Europe.

PWW: Porr – Werner & Weber, a strategic waste management partner with waste management contracts in Jagodina and Leskovac.

REAP: Recycling & Employment Alternatives Program; program implemented by Mercy Corps in southern Serbia under the USAID CRDA project; program invested in 23 municipal and private-sector collectors and recyclers in 2007.

Recycler: As used in this report, a company that is producing a consumer product from recycled materials.

RSD: Republic of Serbia dinar, at the time of this writing: €1.00 = \$1.44 = 96.3 RSD.

SDC: Swiss Development Cooperation.

SEPA: Serbia Environmental Protection Agency.

SIDA: Swedish International Development Agency.

SIEPA: Serbia Import-Export Promotion Agency.

SRF: Solid Recovery Fuels, a term used in cement and incineration industries.

SZR: Samostalna zanatska radnja, a business registration for a type of sole proprietorship “workshop” business.

TA: Technical Assistance.

TAM-BAS: Turn-Around Management and Business Advisory Services program implemented through EBRD, EAR and Netherlands funding. TAM targets consulting services to medium to large enterprises, while BAS targets micro to medium enterprises.

TSR: Thermal Substitution Rate, a term denoting the caloric value of a material relative to the conventional fuel used. A TSR of 5% means that 5% of the conventional fuel was substituted by some volume of alternative fuel.

UNDP: United Nations Development Program.

USAID: United States Agency for International Development, US Government agency providing economic and humanitarian assistance worldwide.

Plastic Acronyms

ABS: Acrylonitrile-Butadiene-Styrene; a resilient, low density, rigid, impervious plastic used for pipes, car bumpers, golf club heads and enclosures; when recycled, and the history of the material is unknown it is considered utility material and the original specifications may no longer apply; the three components of ABS are considered probable human carcinogens.

HDPE: High Density Polyethylene; a hard, opaque form of PE with a higher melting temperature; commonly used for beverage cases; also used for cell liners in sanitary landfills; recycling symbol number “2.”

LDPE: Low Density Polyethylene; commonly used for plastic bags and six-pack soda can rings; recycling symbol number “4.”

LLDPE: Linear Low Density Polyethylene, a linear-molecular form of PE that is advantageous because of it allows lower thicknesses; commonly used for stretch wrap and thin plastic bags.

PE: Polyethylene; most widely used plastic, with annual production of 80 million tons; primarily used for packaging materials, including shopping bags; see descriptions for specific types of PE;

PET: Polyethylene terephthalate; a rugged, lightweight plastic that serves as excellent liquid and gas barrier; commonly used for beverage containers; Mylar is a thin-film PET; recycling symbol number “1.”

PP: Polypropylene; a rugged plastic, unusually resistant to most chemicals; commonly used for beverage and food container caps (such as PET bottles), as well as most “living hinges” (such as on Tic-Tac containers) due to its fatigue-resistance; recycling symbol number “5.”

PS: Polystyrene; commonly used for disposable cutlery and CD cases; foamed polystyrene (Styrofoam) is common material used for coffee cups, insulation and packing peanuts; recycling symbol number “6.”

PVC: Polyvinyl chloride; third most widely used thermoplastic polymer after PE and PP; commonly used in construction applications as building materials that are cheap, durable and easy to assemble; typically not recycled due to prohibitive processing costs.

Introduction

Assessment Overview

Overview: This assessment was initiated and financed by the USAID Serbia Competitiveness Project. It is intended to present an overview of the waste management and recycling sector in Serbia from all relevant perspectives: Serbian Government and other national actors and initiatives; municipal governments and public utility companies (JKPs); private-sector actors working with eleven different materials and/or roles in the sector; and relevant development programs and donors. The aims of this study are to:

- assess and present the Serbian recycling situation and actors, particularly those in the private sector;
- examine supply chain trends for different secondary materials from both industrial and communal sources;
- identify opportunities for Serbian companies to engage in public-private partnerships;
- provide a policy overview in Serbia and the EU; and
- identify leverage points for the USAID Serbia Competitiveness Project to support and develop the private sector.

Assessment Volumes: This report is the first of three volumes generated as part of this assessment:

Part 1: Secondary Materials & Waste Recycling Commercialization in Serbia: Assessment (this volume)

Part 2: Serbia Recycling Actors & Company Profiles

Part 3: Activity Programming Recommendations for the USAID Serbia Competitiveness Project

USAID Serbia Competitiveness Project: The USAID Serbia Competitiveness Project is a four-year, USAID-funded project aimed at generating rapid, sustained, and broad-based economic growth in Serbia targeting specific, high-potential economic sectors. The project aims to generate economic growth and development of targeted sectors; increase private sector capacity; improve the business climate and enabling environment; increase domestic, regional and international trade and investment; and increase employment opportunities.

Methodology: This assessment was compiled from interviews and meetings with 77 recycling actors all over Serbia (see Annex 1 for complete list). Interviews and information gained from the independently-conducted *Treehouse Recycling Assessment for South-Central Serbia* (2009) are also included. Interviews were made on-site, at the interviewer's facility or office, and included a tour of facilities. Interviews were structured to provide a profile of the actor; supply and collection; markets and demand; finances; sector challenges and opportunities; and macro issues such as legislation and donor assistance. The table below lists the actors interviewed; each actor is profiled in detail in the order shown below in Part 2 of this assessment: Serbia Recycling Actors & Company Profiles.

Assessment Summary Actors Interviewed	
Sector/Actors	Number
Serbian Government	5
National Private Sector	5
Donor Initiatives	10
JKPs & Municipalities	15
Strategic Waste Management Partners (PPP)	2
Collectors	8
Plastic	11
Paper	5
Glass	2
Metal	2
Electronic Waste & Batteries	2
Wood	4
Construction Waste	2
Cement Industry & Tires	3
Waste Oil	1
Total	77

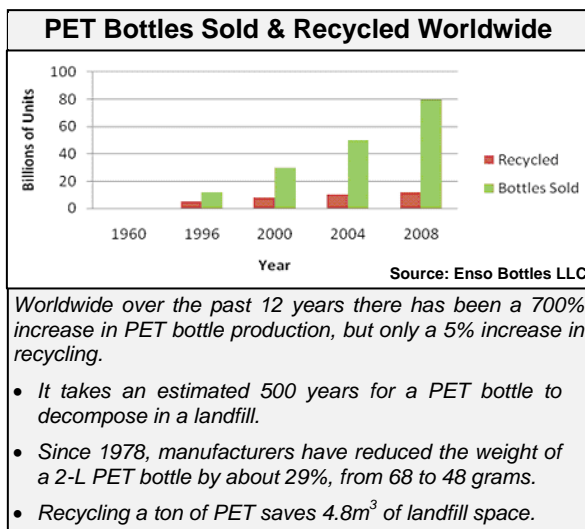
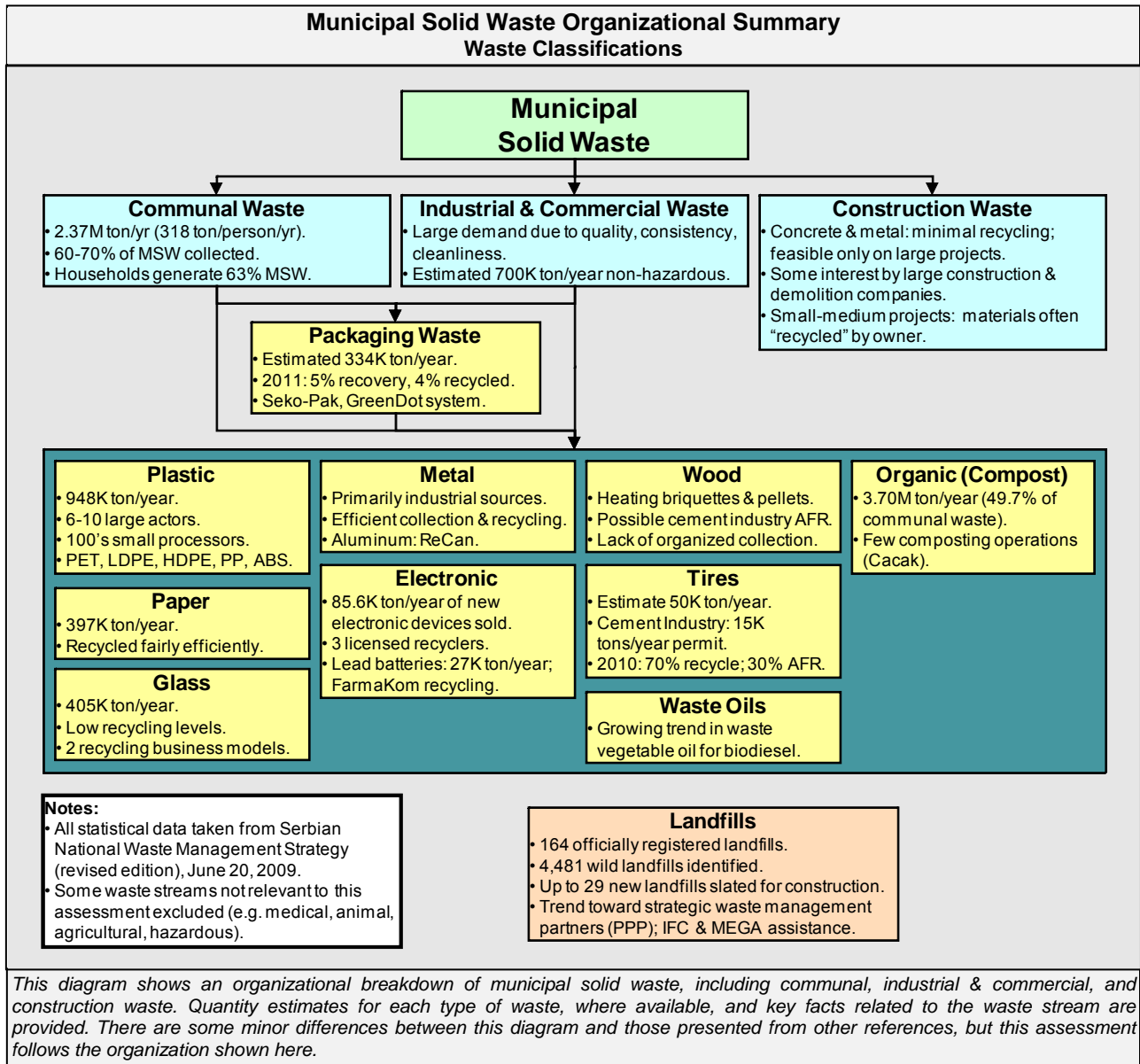
Recycling Databases: At the start of the assessment recycling actors were identified through a number of sources and databases: IFC Recycling Linkages, US Community Connections Waste Management Study Tour, MESP database, Ekapija Business News Service, Serbia Yellow Pages, Ambalaza i Pakovanje, and a number of private contacts throughout Serbia.

Municipal Solid Waste Overview

Municipal Solid Waste: The diagram below presents a summary of municipal solid waste streams, breaking the overall waste stream into three major classifications: communal waste, industrial & commercial waste, and construction waste.

Communal Waste: Communal waste constitutes an estimated 63% of all waste; it is generally uneconomical to collect and recycle. At present most communal waste collection is managed by municipalities and JKPs, and a number of municipalities already manage recycling programs. There is a recent trend in Serbian municipalities and regions to contract landfill and waste collection services to independent international operators in 25-year public-private partnership (PPP) agreements.

Industrial & Commercial Waste: Industrial and commercial waste (i.e. factories, supermarkets, public facilities such as hospitals, and warehouses) is the most desired and demanded waste on the market. It can probably be said that without industrial or commercial waste, a private-sector operator cannot survive; all of the private collectors and recyclers interviewed in this assessment rely to some extent (in some cases exclusively) on industrial or commercial waste.



Packaging Waste: There are an estimated 334,000 tons of packaging waste generated in Serbia per year. Packaging waste is covered under the Law on Packaging & Packaging Waste and has recovery targets established for coming years, beginning with 5% recovered and 4% recycled in 2010, increasing to 30% recovery and 25% recycling in 2012. PRO-Europe (Packaging Recovery Organization Europe) is the umbrella organization for European packaging and packaging waste recovery and recycling schemes; Seko-Pak is the sole PRO-Europe operator in Serbia. National PRO-Europe organizations like Seko-Pak essentially relieve industrial companies and commercial enterprises of their individual obligation to take back used packaging through the operation of a scheme that fulfils these obligations on a national basis on behalf of their member companies. The aim is to ensure the recovery and recycling of packaging waste in the most

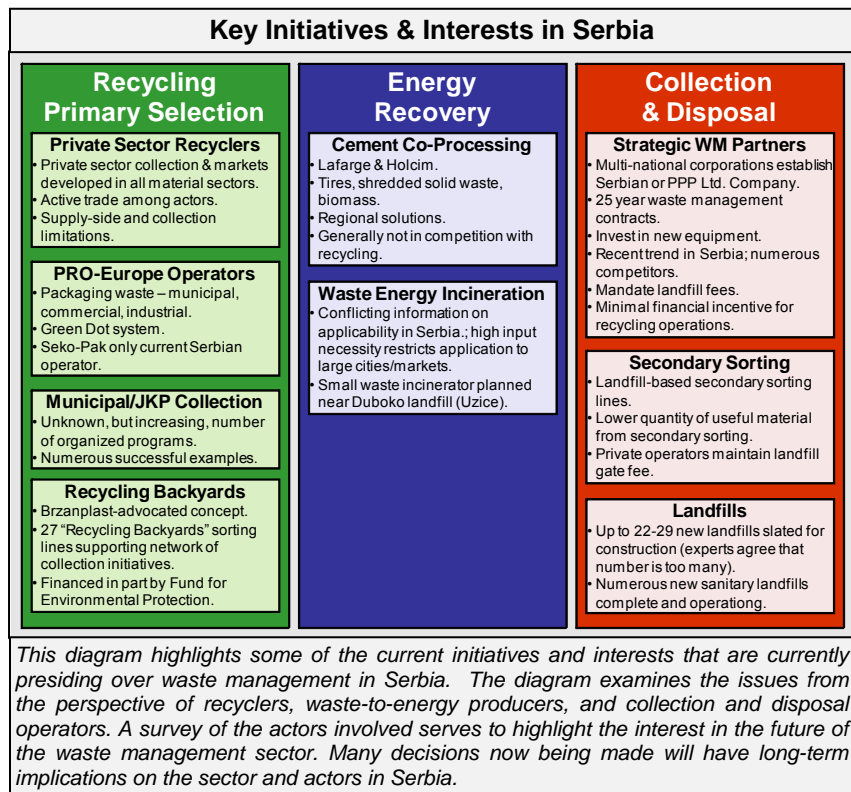
economically efficient manner. The Green Dot trademark is a financing symbol that indicates companies have signed a license agreement with a packaging recovery organization.

Construction Waste: Recycling of construction waste falls into two categories: i) construction material salvaging; and ii) concrete (and other materials) recycling. Salvaging (undamaged and reusable materials) is typically handled by the owner; if left to the construction contractor, materials are typically disposed of in the landfill. The recycling of concrete waste, including reinforcement metal, bricks and stones, is typically not an economical process except on very large demolitions. In this case, the materials are pulverized, often together; the metal is removed; and the chunks are sorted by size and used as aggregate base gravel. Typically, the chunks cannot be added to new concrete mixes.

Serbia Initiatives & Interests

Interests & Initiatives: Now is a crucial and interesting time in Serbia with respect to waste management and recycling. There are large, and sometimes competing, forces at work that are likely to have profound and long-lasting implications in how waste is managed in Serbia in the coming years and decades. Key legislation has been and is being drafted and approved that will bring Serbia's laws into compliance with EU standards. Some of the key factors faced in Serbia today are outlined here and shown in the diagram.

- **Waste Management Plans:** Municipalities have until May 23, 2010 to develop municipal waste management plans, form themselves into regions, and develop regional plans. Many of the regions, perhaps a majority, will choose a private strategic waste management partner, one of a number of international companies currently promoting and competing for 25-year waste management contracts for landfill and/or waste collection services.

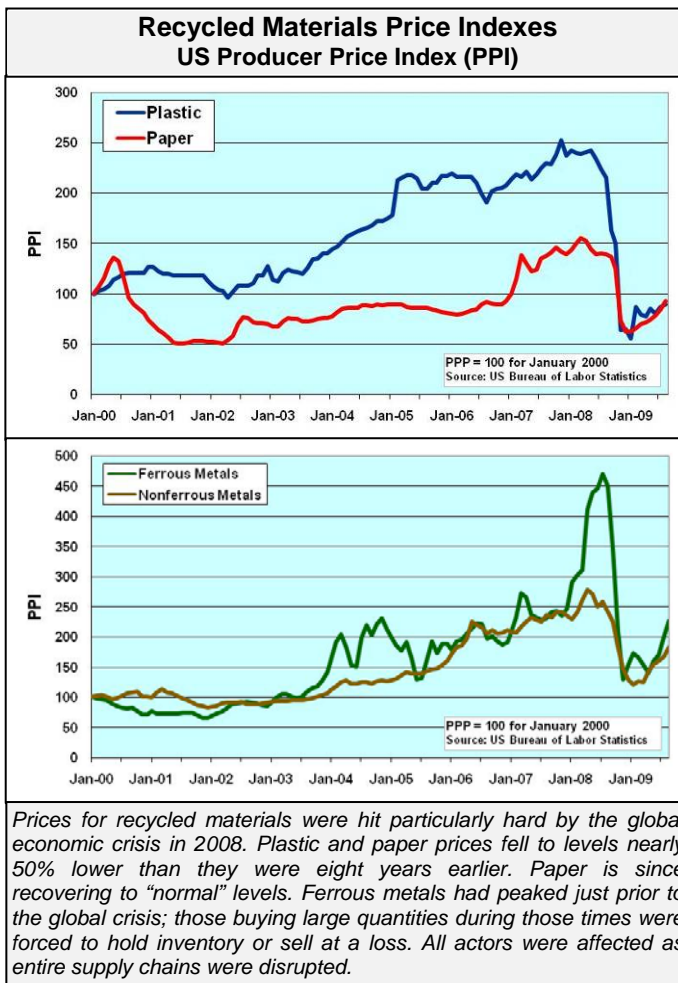


- **Eco-Tax:** A "Producer Pays" Eco-Tax will be applied to goods marketed and sold in Serbia and used to finance an Eco-Fund that will reinvest revenues into collection, transport, consolidation, treatment and disposal actors.
- **PRO-Europe Operator:** The Serbia PRO-Europe operator Seko-Pak will compete for waste management agreements with generators, collectors and treatment operators.
- **Recycler Registration:** Companies working in the recycling field have until May 23, 2010 to register under the new law. Waste movement manifests will track movements and allow MESP to record quantities of waste managed by all registered recyclers; this data will help determine where Eco-Fund investments are needed.
- **Recycling Backyards:** The "Recycling Backyards" concept is being considered for support by the Eco-Fund; the project could dramatically increase municipal recycling program outreach and construct a network of collection and sorting centers in larger cities across Serbia; the project could impact the dynamics of various interests.
- **IPA Funding:** IPA funding for Serbia under Components 1 and 2 will increase to €198.7 million in 2010. Serbia is expected to be eligible for Component 3 (Regional Development) funding beginning in 2011 (€202.7 million total projected funding).

Secondary Materials

Overview: Serbia has a fairly vibrant level of activity in the recycling sector, with actors working with virtually all materials (see diagram above). Collectors and recyclers share a number of challenges, including lack of State subsidies and investments as in EU countries; deflated prices brought on by the global economic crisis; undersupply brought on by

lack of organized collection, deflated prices and other factors; and complex, cumbersome and expensive administrative procedures, sometimes more complex than those in the EU.



Historical Prices: The accompanying graphs show the Producer Price Index (US) for recycled plastics, wastepaper and ferrous and nonferrous metals since January 2000 (PPI=100). These data represent a composite of relevant materials and markets. Prices for all materials climbed steadily from 2002-2008; ferrous metals nearly doubled in a seven-month period from December '07 and July 2008, when it reached levels 4.7 times higher than in January 2000. In autumn 2008, with the onset of the global economic crisis, the price of secondary materials fell dramatically, disrupting supply chains and sharply reducing collection. Individual collectors stopped or focused on other materials. Paper collection, which had been quite efficient, suffered as Roma collectors were not willing to collect for the low prices. Large quantities of materials were stockpiled to prevent selling at a loss, which many consolidators were forced to do in the end. Demand was driven down throughout the supply chain, forcing some actors to make desperate transactions; some did not survive.

Recovery: Price recovery is underway for most materials. Actors agree that ferrous metals were selling for unsustainable prices, and collection efforts have resumed to normal levels; similarly for nonferrous metals. Roma have not yet fully resumed communal cardboard collection; collectors can be seen, but quantities remain uncollected and buyers still cite lower recovery levels. Plastics are recovering more slowly, but the large actors in Serbia all

survived the crisis and there have recently been several important investments.

Collectors vs. Recyclers: For the purposes of this assessment, a distinction is made between the terms collector and recycler. The term "collector" is used to describe a company or individual that is limited to collecting, sorting and low levels of treatment such as washing or grinding. "Recycler" is used to describe a company that is producing a final product (e.g. hose, folio, fruit trays) or a high level intermediary such as granulate or fiber. The distinction can be subtle and at times a judgment was made regarding their classification.

Social Consciousness: An interesting observation during this assessment is a level of social consciousness of the private-sector actors. Nearly all practice some form of corporate responsibility (e.g. cleanups, education, campaigns, advocacy) and express a degree of insight and perspective on environmental issues and their role in the community.

Currency Conversion: The relevant currency exchange rates used in this report are €1.00 = \$1.44 = 96.3 RSD.

Republic Government

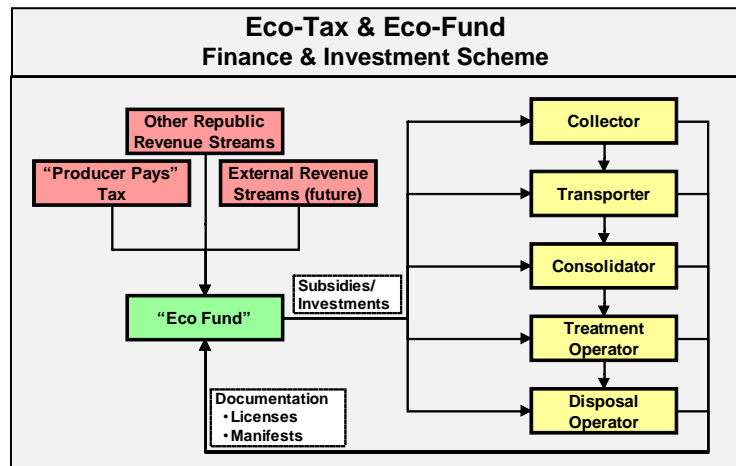
Summary: This section provides an overview of key actors in the Serbian Government. All actors are profiled in detail in Part II of this assessment: "Serbia Recycling Actors & Company Profiles."

Republic of Serbia Environmental Protection Fund (Eco-Fund)

Profile: The Environmental Protection Fund (Eco-Fund) is responsible for financing priority environmental projects on the Republic level through the collection of fees and taxes. In 2009 the Eco-Fund budget was about €15 million and is expected to take in more than €30 million in 2010 (the Croatia Fund takes in more than €150 million per year). So far, direct investments in private-sector recyclers have been limited, though the Eco-Fund has financed a number of waste

management initiatives. The Eco-Fund revenue structure consists of four sources, to which will be added a tax on goods marketed and sold in Serbia under the “Producer Pays” principle.

1. NOx, SOx, and particulate air emissions, plus disposed waste fees; based on emission data;
2. Motor vehicle registrations; based on engine displacement;
3. Ozone-depleting compound use; based on quantity used;
4. Wild flora and fauna use & marketing; based on collection permits;
5. “Producer Pays” tax; applied to goods marketed and sold in Serbia. Under this principle, the producer bears the cost of its activities, so waste treatment and disposal is included in the price of a product. The tax is paid when the producer places a locally produced or imported product on the market. (Products manufactured in Serbia but exported are not subject to the Serbia Eco-Tax).



This diagram shows how the Eco-Tax and Eco-Fund should function. Producers pay an Eco-Tax when products are placed on the market; this, plus other revenue streams (see text) are deposited into the Eco-Fund. Meanwhile, registered recyclers are licensed and begin to manifest all waste movement and transfer. Based on the quantities of various materials managed, and their role in the supply chain, the fund management will be able to assess where investments should be placed, and whether in the form of subsidy or investment. Registered recyclers will be able to apply for assistance through Calls for Proposals. MEST is targeting strong collectors and consolidators to build and maintain collection networks and provide quality secondary materials with good value to buyers and markets.

The intention is that the tax be used to help manage the waste at the end of the product’s life. It is not clear as to how and whether the Eco-Tax will apply to packaging; various sources say that this has not yet been resolved, but it appears that producers will be responsible for recycling their own packaging waste, or alternatively financing Seko-Pak or other PRO-Europe operator to recycle target quantities in their name.

Line of Credit Environmental Protection Fund
2009 Loan Capital: 50 M RSD (decreased from planned 300 M)
2010 Loan Capital: 100 M RSD anticipated
Maximum Loan Size: 10 M RSD
Interest Rate: 3% per year
Duration: 3-5years
Grace Period: 6-12 months
Application: Available on website www.sepf.gov.rs
<i>The Eco-Fund, in cooperation with the Republic Development Fund, established a line of credit to finance investments for environmental companies in three segments: solid waste, air emissions, and renewable energy. Two loans have been approved: one for a company producing wood heating briquettes, and the second for a company producing biodegradable plastic bags; both loans were roughly 7.5 million RSD. A third loan for a company making heating pellets is on standby.</i>

Fund for projects. There have apparently been some issues over which fund should be used for certain projects (e.g. Ambrosia and sewage problems).

Serbia Environmental Protection Agency (SEPA)

Overview: SEPA is mandated to collect, analyze, tabulate and report all data and information related to the environment, pollution and polluters in Serbia. SEPA has a large collection of publications and resource materials on all types of waste, waste collection and municipal and national statistics, plus a host of EU reports and documentation. They manage all of the data on noise, air, water and soil quality and pollution, including 50 air quality stations throughout Serbia, one of which is at their Belgrade office. One of their main publications is the annual State of the Environment Report in Serbia, a well-organized and presented resource covering all sectors of the environment. Most of the former staff members of the Agency for Recycling (see below) now work at SEPA.

Permitting & Registration: Under the new Law on Waste Management, companies working in waste management have until May 23, 2010 to register their company and apply for an operating permit. The application process will be

used to construct the new database of recyclers. Companies may apply for a permit in one of five classifications: i) collection; ii) transport; iii) consolidation; iv) treatment; or v) disposal. Companies working in more than one of the areas will be covered by a single permit. (The situation is not clear for companies who are producing a finished product from a recycled material; according to several such companies, they were not required in the past to be registered as a recycler.) There are 16 different secondary materials classifications to be covered by permit. Under the new law, beginning with the generator, all waste handlers will be required to complete manifests that document all movement and transfers; data will be used by SEPA for statistical purposes. At the time of the interview (Dec. '09), no companies had registered under the new law; it is expected that most will wait until the deadline. The database will be published on the SEPA website (www.sepa.gov.rs) once compiled.

Information Management System: In September 2009 SEPA installed an information management system that will soon be placed online. Currently most of the data is submitted from the field on handwritten tables, and then tabulated for analysis on simple spreadsheets.

MESP Program Management Unit (PMU)

Overview: The mandate of the MESP PMU is to prepare projects and designs for current and future IPA, NIP, Eco-Fund and international donors. The PMU is currently preparing projects for IPA Component 3 (see inset) in the areas of waste, water and air; the total value of the current project portfolio is €100 million. Some of the projects include Kalinic landfill (an open lignite mine near Obrenovac); Halovo landfill serving Zajecar, Bor and other municipalities; and the Nova Varos landfill. The PMU attends donor coordination meetings, organized twice per year; USAID is a participant.

Projects: The PMU provided an overview of their current project portfolio and initiatives for various waste streams including old vehicles, lead, aluminum, tires, used oils, paper, plastic and communal waste.

MESP PMU versus Eco-Fund: Though some of the projects described by the Eco-Fund and the MESP PMU are similar, the two are different in several ways: i) the PMU only designs projects, while the Fund both designs and implements projects; ii) the PMU is financed from the State budget and has significantly less financial resources than the Eco-Fund; iii) the PMU focuses on external funding sources, primarily IPA.

EU Instrument for Pre-Accession (IPA) IPA Components
Component 1: Transition Assistance & Institution Building
Component 2: Cross-Border Cooperation
Component 3: Regional Development
Component 4: Human Resources Development
Component 5: Rural Development
<i>IPA, or Instrument for EU Pre-Accession Assistance, is now the sole EU pre-accession instrument for the period of 2007-2013. IPA replaces four previous funding instruments: Phare, ISPA, SAPARD and CARDS. Funding under Components 1 and 2 concern all beneficiary countries (including Serbia). The remaining three components are aimed at candidate countries only; Serbia is expected to be eligible for Component 3 funding beginning in 2011. MESP PMU is currently preparing projects with a total value of €100 million in three areas of IPA 3: waste, water and air.</i>

Serbia Chamber of Commerce

Overview: The Serbia Chamber of Commerce has Board for Environmental Protection with 25 members representing chemical, petroleum, paper, wood processing and other sectors; they also cooperate with MESP and international donors and organizations. The interest of the Chamber is to help the business sector to develop capacities to implement and adopt environmental laws. Activities related to recycling have been limited since their scope of activities is broader than recycling and waste management; they do, however, recognize the potential for developing recycling businesses. In the area of waste management, they organized a study tour to Slovenia in spring 2009; cooperated with GTZ to develop an on-line secondary material trading site where buyers and sellers could locate materials and make trades; (according to GTZ, it was developed in cooperation between the Chamber and the Agency for Recycling, but a conflict over ownership prevented it from becoming operational); and cooperated with the IFC Recycling Linkages project.

Integrated Pollution Prevention & Control: At present the Chamber is working with companies on Integrated Pollution Prevention & Control (IPPC), a directive on industrial emissions, and were in the process of organizing an event for the board in Valjevo at the time of our visit (Dec. '09). The Gorenje factory in Valjevo is the first company in Serbia to be issued an IPPC compliance permit.

MESP Advisor to Minister, former Agency for Recycling

Overview: The Serbian Agency for Recycling, formerly an agency within MESP, was abolished under the new Law on Waste Management and ceased working on May 23, 2009. The agency's former responsibilities were assigned to new entities within MESP. The part of the Agency related to recycling and tasked to maintain the database of Serbian recyclers was transferred to SEPA. Ms. Gordana Perovic remains as an Advisor to the Minister and provided an

informative review of current policy and legislation, which is used throughout this report. A summary of the permitting process and waste movement requirements are summarized in the following paragraphs.

National Private Sector Actors

Seko-Pak (PRO-Europe)

Pro-Europe System: PRO-Europe (Packaging Recovery Organization Europe), founded in 1995, is the umbrella organization for European packaging and packaging waste recovery and recycling schemes that use the "Green Dot" trademark as a financing symbol. It acts as the common policy platform representing the interests of all packaging recovery and recycling organizations founded and run by or on behalf of industry. These national organizations essentially relieve industrial companies and commercial enterprises of their individual obligation to take back used packaging through the operation of a scheme which fulfils these obligations on a national basis on behalf of their member companies. The aim is to ensure the recovery and recycling of packaging waste in the most economically efficient and ecologically sound manner. Apart from requiring the coordination and alignment of individual members, they safeguard common interests and project a coherent, unified policy and image to the outside world. PRO-Europe is a limited liability company registered in Belgium.

Seko-Pak: Seko-Pak is currently the sole national recovery organization in Serbia (most countries have multiple providers; Austria, with whom Seko-Pak seems to be working most closely, has only one). As Seko-Pak is just beginning operations (Jan. '10), many of the details related to their operations in Serbia have not been defined and released. There are currently nine industry stakeholders in Seko-Pak (e.g. Coca-Cola, Ball Metal, Tetrapak, Calsburg), though Seko-Pak is not limited to the beverage sector and will represent any company, offering solutions for all packaging waste. Seko-Pak is intended to be non-profitable with all income used to subsidize and facilitate collection (less an administrative fee); potential surpluses will be used for further reinvestment or to lower founder/client fees. It should be noted that Seko-Pak is a limited liability company; and that they will not be *owners* of waste.

Recycling Investments: Revenues are collected through a price per ton of waste paid by founders and clients (specific details are still not defined). Subscribing to Seko-Pak's services is voluntary and may be through ownership shares in the DOO company (founders) or as a client. Seko-Pak is currently planning to enter 7-10 municipalities, helping them to establish primary collection programs. According to Seko-Pak, their short-term goal is to stabilize collection through subsidies and investments targeting collection. Preparing citizens through education campaigns is seen as a constraint, since communal waste accounts for a high percentage of packaging waste, but it is not clear if Seko-Pak intends to finance public education campaigns.

Policy Influence: Seko-Pak provided input into the Law on Waste Management and By-Law on Packaging & Packaging Waste, which essentially put the obligation on the generator to treat their waste. Seko-Pak opposed a deposit system on the basis that only 5-12% of waste is accounted for by beverage containers, and they believe that consumers are hurt by deposit systems. Seko-Pak also opposed individual targets for different materials (the by-law specifies 5% recovered, 4% recycled for 2010) since some materials will be more difficult, and they can therefore focus on the difficult targets in the short term while being relieved of increasing collection of materials that are currently recycled at high levels. They are using these early years to construct a plan to meet more ambitious 2012 targets: 30% recovery, 25% recycling.

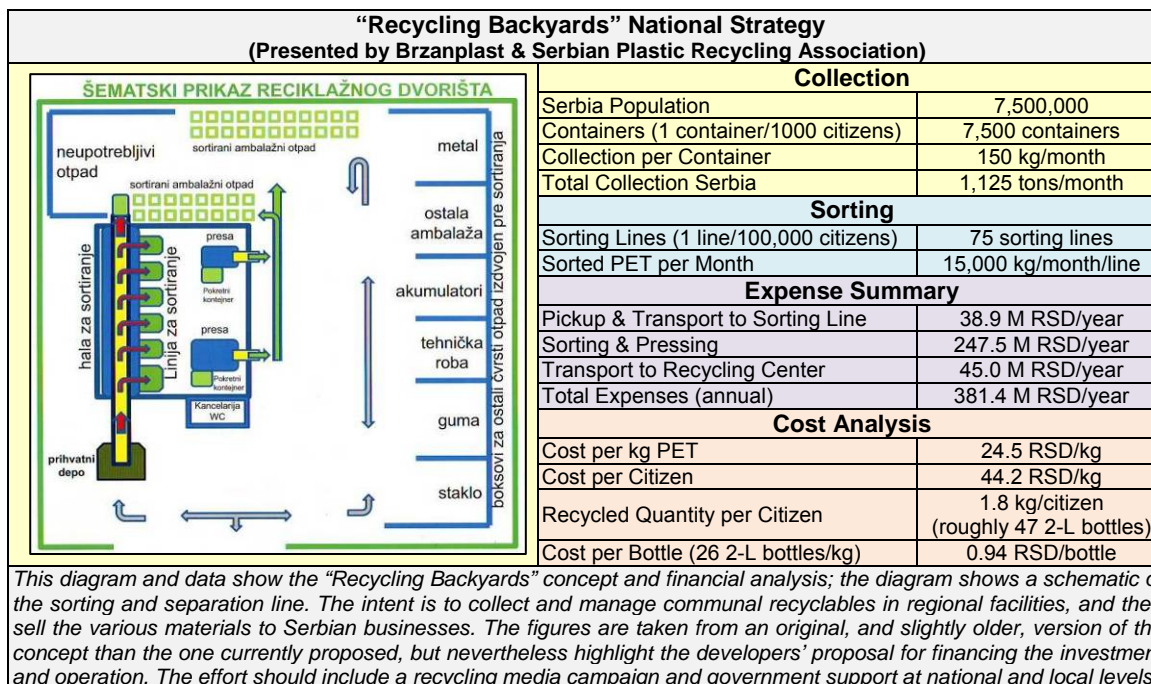
Serbia Plastic Recycling Association

Overview: The Serbia Plastic Recycling Association, founded in 2006, is a citizens association aimed at promoting and undertaking recycling initiatives in cooperation with the private sector, Government and donors. The goals of the association are to i) organize recyclers so they can better cooperate and have opportunities to work toward common goals, and ii) provide non-profit opportunities through access to public and international resources. The main founder of the association is Brzanplast and the association is supported financially by the company (rent and other expenses). Mr. Rade Simic, Director of Brzanplast, is the President of the association; Mr. Milan Ilic is the President of the Board and manages the association's office in Belgrade. The association employs five to ten employees who work voluntarily. There is no membership fee, and it has around 50 members. The association is a member of the European Association for Recycling and has received technical assistance and advice on collection methods and planning.

Projects: The recycling association is a partner in the *Clean up Serbia!* campaign, a 4 M RSD project financing a public campaign and recycling equipment. They cooperated with the IFC Recycling Linkages project and together completed a business plan of recyclers and a feasibility study for one member, "Eva" in Kladovo. ACIDI/VOCA, through the USAID CRDA project, procured some containers and milling and baling equipment from the association or Brzanplast;

municipal/JKP clients contributed a matching contribution in recyclable materials equal to 30% of the project value. The association also provided input into the Law on Waste Management and had some contact with UN and World Bank.

Recycling Backyards: The “Recycling Backyards” concept aims to cover the territory of Serbia with recycling containers and strategically-located sorting lines for separating recyclable waste, relying on existing Serbian companies as markets for the collected materials. The concept’s developers are promoting it to the Eco-Fund and advocating MESP to procure 7,500-11,000 containers, presses for each municipality (150); and around 27 sorting lines in major Serbian municipalities (see inset). According to Brzanplast, financing the concept would cost €2 million and would be sufficient to collect 20,000 tons/year of baled, recycled plastic, reaching a target of 20-30% recycled plastic, plus other materials. The current concept and earlier versions are presented in a series of short publications prepared by Brzanplast.



Challenges: Lack of Government assistance, lack of a defined national strategy, and competing interests in waste and recycling were identified as the main obstacles; at present, the association says that the majority of problems are currently being solved piece-meal by the private sector. With respect to the association itself, some members don’t fully understand, and perhaps expect too much, from the association in terms of donations and assistance; the association should increase its profile and visibility; and members are unwilling to contribute.

KOMDEL, Association of JKPs

Overview: KOMDEL, founded in 1998, is the national association of JKPs; membership is voluntary and includes 94, or roughly half, of JKPs. Its interests are not limited to waste management but also include cemeteries, water and heating companies, plus 24 industry members. The association receives no public funding; there is a small “token” annual membership fee. According to KOMDEL, less than 20% of Serbian municipalities have some form of communal recycling program, though there are some good examples and citizens are becoming increasingly aware of the need.

KOMDEL and TTI Group: Since KOMDEL is essentially not financially sustainable, the association is affiliated with a private consulting group, TTI Group; the management of KOMDEL and the consultants of TTI Group are the same individuals. KOMDEL and TTI Group together provide consulting services for communal infrastructure and waste management; they share information and resources, including the website: <http://ttigroup.co.rs>. KOMDEL/TTI has produced a number of documents and resources addressing waste management issues and advocating at the national level for planning and implementation of a waste management strategy.

Donor Initiatives

Summary: A number of donors and internationally-funded development initiatives related to recycling and waste management were interviewed. In the interests of brevity and to eliminate any potential misrepresentations of their programs and initiatives, only brief summaries of some relevant programs are provided; full profiles are presented in Part 2 of this assessment, “Serbia Recycling Actors & Company Profile.”

Recycling Linkages, International Finance Corporation: The goal of Recycling Linkages was to improve the performance of the recycling industry in the region by creating strong economic, social and environmental impact, resulting in significant increase of the volume of collected and recycled scrap across the region. The project supported SMEs, national and local government structures, individual collectors (mainly Roma) and business associations. Activities focused on improving the regulatory framework, strengthening operational capacities and access to finance of private sector recycling actors, and increasing public awareness on the benefits of recycling. The project worked in all sectors of recycling and was implemented from Jan. '06 through Dec. '08.

Integrated Solid Waste Management Project, International Finance Corporation: The Integrated Solid Waste Management project began in 2009 following Recycling Linkages. The project was originally designed to help implement Serbia's waste management strategy through public private partnerships in waste management in some of the 27 designated geographic regions. The project has since evolved to a broader focus, and now deals not only with waste management but with the more general topic of municipal infrastructure. Specifically the project helps municipalities prepare and organize tenders for private partners in municipal services (including but not limited to waste management). The municipalities of Subotica and Smederevo are currently participating in the project.

Municipal Economic Growth Activity (MEGA), USAID: MEGA is providing waste management consulting services to municipalities and JKPs, helping them to prepare solid waste projects in accordance with the national law and EU directives. Their services include technical assistance on landfill design and site selection; facilitating municipal and regional waste management plans; and facilitating the planning and procurement process for engaging strategic waste management partners through PPP agreements (similar to the current IFC Integrated Solid Waste Management project). MEGA organized four workshops in 2009 on these topics, plus sessions on project financing, public-private partnerships, and recycling. MEGA officially works in 32 municipalities but covers all regions and municipalities with their consulting services; with respect to waste management they are currently focusing on Nis, Valjevo and Timocka Krajina.

Socially Responsible Waste Management, Netherlands: The aim of Fair Waste Practices is to improve the capacity of all stakeholders to assure the sustainability, effectiveness and fairness of local waste management and recycling practices and national waste policies and legislation in Serbia. The 30-month project, started in late-2009, is targeting the municipalities of Prokuplje and Pirot; it is being implemented by a host of local and Dutch organizations.

Plastic Recycling Project, USAID Macedonia: The aim of the USAID Plastic Recycling Project was to establish an efficient and economically viable plastic recycling program in Macedonia. The \$1.3 million project, implemented from Sept. '05 through Dec. '09, was comprised of six components: i) develop and certify collection and recycling companies; ii) implement PET collection programs in municipalities; iii) conduct public awareness campaigns on national and local levels; iv) strengthen municipal capacities in waste management, including applying for IPA funds; v) establish Plastic Recycling Association PETRA; and vi) assist the Ministry of Environment and Physical Planning to develop and implement a Law on Packaging Waste to institutionalize the recycling industry.

Strengthening of Local Self Government & Modernization of Communal Services, GTZ: GTZ is a good technical resource on issues related to waste management, landfills and the Serbian Waste Management Strategy. They are working to apply successful German experiences and successes in Serbia. They believe that Serbia should focus on expanding recycling initiatives and that the number of landfills planned (27) is too high a figure. They argue that landfill costs are high, European landfills are closing and consolidating while Serbia is planning to build an excess, and that the PPP model for waste management may ultimately prove not to be cost-effective. GTZ is interested in strengthening cooperation between international and national actors, and believes the Standing Committee for Towns & Municipalities should be involved more in donor coordination. In a previous project, GTZ worked with the Agency for Recycling and Serbia Chamber of Commerce to develop an online trading system for recyclables in Serbia. The system was completed before a conflict developed over ownership of the system and data; as a result the system was never made operational; GTZ may try to reintroduce the system. Conclusions from a Waste Management Working Group in June 2009 are presented in Part 2: Serbia Recycling Actors & Company Profiles.

JKPs & Municipalities

Collection Programs

Municipal Collection Programs: Thirteen JKPs and municipalities were interviewed in this assessment (including those in the *Treehouse Recycling Assessment for South-Central Serbia*); of those, nine had received a USAID donation to start or expand a recycling program. Of the nine, five currently manage a recycling program; two started and discontinued their efforts (Ivanjica, Priboj); and two never utilized their donations (Nova Varos, Tutin). Municipalities

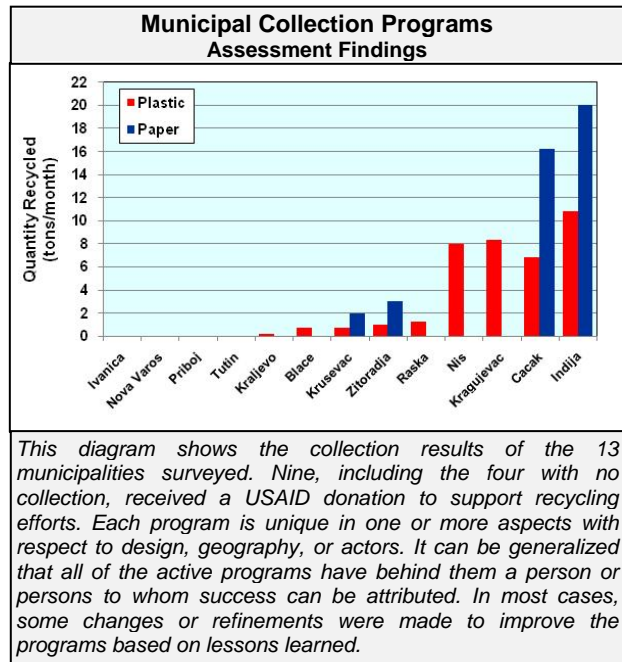
typically focus on plastic (PET) collection, to a lesser extent on paper and cardboard, and a few on all kinds of materials; few collect glass. The accompanying chart shows the average monthly collection of plastic and paper among the 13 municipalities surveyed. Annex 2 presents a basic overview of each municipality surveyed, including a summary of materials, collection methods, sorting & separation, and markets. The reader is also referred to Part 2 of this assessment for a detailed profile on each program.

Types of Collection Programs: Of the municipalities who manage a collection program, each program is unique in some way, but in general three types of programs, or some combination, emerge: i) container collection, ii) bag (household) collection, and iii) wet-dry model.

Container Collection: Traditional container collection, with containers designated for specific materials, was the most common approach, implemented solely or with other initiatives in eight of the nine collecting municipalities (Cacak uses the wet-dry model). Most commonly, municipalities designated plastic containers, and to a lesser extent paper; in a few cases containers for other materials are also placed. In Indjija, all businesses are required to purchase two 140 L containers for plastic and paper.

Bag (Household) Collection: Indjija and Cacak manage collection programs where they distribute recycling bags to households in targeted areas. In houses, the bags are placed in front of the house on pickup day; in apartment buildings, the bags are picked up door-to-door. In both programs full bags are replaced with new bags at pickup. While these two programs do rank among the highest in terms of quantities collected (though not necessarily per capita) they are also the most management-intensive and probably costly to manage as well.

Wet-Dry Model: Of the municipalities surveyed, only Cacak relies on the “wet-dry” model for recyclable collection. In this system, wet waste is placed in one bag or container, and dry waste is placed in a separate one (of different color). Wet waste is disposed of at the landfill (Cacak JKP Javna Zelenila also operates a pilot composting facility where a small amount of the wet waste is sent); dry waste is sent for sorting (in the case of Cacak, to a privately-managed line at the municipal waste management complex). Seko-Pak seems to endorse the wet-dry model.



Indjija has an effective collection system with high participation rates. Businesses are required to purchase containers for plastic and paper; homes and apartments in both the city and 11 villages receive bags. In the photo, JKP placed an empty blue bag (for paper) on the lawn of this user after picking up a full bag. Later in the day, JKP will pick up the yellow bag (plastic) and provide a replacement.



Raska solved the problem of adapting containers to their trucks by placing large liners inside the containers. The containers are opened, the liner is lifted out and emptied, then replaced in the container. The containers in Raska showed excellent separation and seem to be placed efficiently around the city.

JKP Kragujevac hires temporary workers through a Republic-funded social employment program to sort, press and bale the plastic. As JKPs routinely note, recycling PET is not profitable without some sort of subsidized collection or labor, unless done so at higher economies of scale.



Advantages & Disadvantages: It cannot be generalized which of the three models is best; largely it depends on the human and material resources that the JKP, municipality and other actors are willing to contribute. It should be noted that none of the programs surveyed are covering their expenses.

- For a municipality that wants to get started, or one that lacks the resources, containers are probably the best solution: it is relatively simple, inexpensive, easy-to-manage, and can easily be increased by adding containers.
- Bag collection results in better separation since citizens are collecting in their households; citizens dispose of the wet waste themselves while the dry bags are picked up at their door, typically weekly, so that they are diligent in placing only *dry* waste in the bags. Bag collection is inherently more labor-intensive since bags are picked up at the household (or flat) level.
- The wet-dry model is designed to be the most simple for the citizen; it also allows the highest degree of sorting and maximizes the number of materials that can be sorted. On the other hand, it requires the most investment and labor on the part of the municipality or other actor. First, there must be a sorting line and facility to separate, press and store the materials. Second, the waste on the line must be sorted manually, requiring a number of workers depending on the capacity. Finally, the entire system must be managed, an operation that requires a degree of hands-on supervision.

Local Public-Private Partnerships: Given the high number of private collectors and recyclers throughout Serbia and the number of JKPs starting or managing a recycling program, there is minimal cooperation between the public and private sectors. Many private collectors and recyclers cite repeated and failed attempts at gaining approval or agreement to manage a collection initiative or scheme targeting specific materials or areas. At the same time, many municipalities are entering into 25-year contracts for an international company to manage their waste collection and/or landfill. In terms of this, Cacak is an excellent example of a strong and effective *local* public-private partnership that could be considered by more municipalities.

Financial Performance: None of the municipalities/JKPs surveyed are able to cover their expenses by recycling, but they state that reduced landfill demand is a benefit. Brdja in Trstenik is a company that in part serves the role of JKP through communal collection, but does so profitably with no local government subsidy or assistance. Brdja succeeds by collecting recyclable materials in public containers in addition to purchasing commercial and industrial waste. Brdja also attributes their profitability to better separation by their workers than by public employees, as well as to general private sector efficiencies not achievable in the public sector.

Material Theft: Several interviewees face the problem of theft of materials from containers, generally in the case of paper and cardboard. While most JKPs view this as a problem, others such as Zitoradja view it positively as the materials are being recycled regardless, as well as providing income for unemployed Roma. Blace JKP sells the small amount of paper and cardboard it collects to a Roma firm in Prokuplje, one example of a positive local partnership.

Success Factors


General Success: Despite the collection model used, interviewees commonly repeated that many citizens *want* to recycle, and will participate if given a relatively convenient opportunity. That said it can also take only a few citizens to disrupt a program by not sorting properly. Some of the key success factors identified include:

- **Geography:** Remote municipalities face more difficulties in identifying buyers, transportation and recycling economics. Expanding around existing “hubs” or clusters of recycling programs, and establishing and supporting regional sorting lines, may help to overcome this challenge.
- **Will & Initiative:** The will and initiative of municipalities and JKPs ultimately determines the success of a public recycling program. The actors must be diligent in introducing and promoting the initiative to the public, persistent in their efforts despite potential early setbacks, and committed to achieving their goal and targets.
- **Citizen Behavior:** Citizen behavior can be influenced by an effective media campaign to introduce recycling, encourage citizens to recycle, engage the private sector, and provide ongoing information about the program to the public. Media coverage can also help eliminate wrong impressions and opinions among the public; for example, that JKPs are not recycling collected waste but rather sending it to the landfill along with the rest.
- **Politics:** The relations and cooperation between the municipalities and JKPs vary between municipalities. It might be generalized that smaller municipalities have better cooperation than larger ones; larger municipalities may have an opposition party in charge of the JKP, further complicating the issue. Regardless, the politics of the relation play a key role in success, as recycling impacts waste management contracts and agreements.

Source Separation: Related to source selection, a number of other best practices are noted:

- Separation of plastic is better in smaller cities and even villages than in many urban centers. This runs counter to what might be expected, though some interviewees explained that it may be because waste disposal problems are more evident in villages due to the high number of visible illegal landfills.

- Wire containers (those whose contents can be viewed from outside) have far better separation than closed (solid) varieties. There appears to be a clear psychological effect in citizens' ability to view the contents of the container.
- Recycling containers should be accompanied by general waste containers nearby. Recycling containers by themselves attract general waste, as citizens simply dispose of their waste in the most convenient container. Interestingly, many plastic recycling containers in the small towns and villages had excellent separation despite not being placed near general trash containers.
- Recycling containers should be efficiently placed to maximize collection and minimize effort. Containers should be placed on an easily-traversed route; in quantities to meet the population and demands of citizens (so that they fill at roughly the same rate); placed to allow citizens the *opportunity* to recycle with minimal effort; and placed in public areas of high visibility, residential populations, foot traffic, and drink consumption.

Profile: Cacak Municipality	
Municipal Organizational Philosophy	
Social Philosophy: Cacak is one of the more advanced Serbia municipalities, yet one which still has 8000 unemployed persons, for whom the municipality provides some social protection. If the municipality can provide jobs for a number of people of the lowest social status, those individuals can then work for income that the municipality would otherwise pay out in social protection; so instead of paying subventions they are creating jobs. These individuals can be employed at a low cost through recycling and waste management activities, whereas if these activities are organized by a strategic waste management partner they would be more expensive. The municipality argues that the best solution is for the JKP to retain the high cost, high labor collection,	
Public-Private Partnerships: Cacak views waste as a resource and is reluctant to give away the resource to an international operator when existing local companies can more effectively manage it and profit from it. In this way, local companies provide the market and services and receive the benefit, thereby retaining companies and jobs in the municipality. Cacak's contract with Pima is a good example. Cacak advocates the involvement of multiple local partners, with each actor having clearly defined obligations. Their recycling facility is a kind of "business incubator" since the municipality provides the buildings and space to the private companies for their recycling activities. The entire scheme is part of a wider business-friendly strategy of the municipality.	
Public Partner Obligations: Cacak advocates that waste collection (and other unprofitable activities) should remain the responsibility of the municipality and JKP, employing unskilled workers on sorting lines and other activities, and using the municipal budget to pay their salaries that would otherwise be spent on social protections. Since these activities are labor-intensive and unprofitable, then there should be no profit in them. For this reason, private operators should not provide collection services since they demand a profit on their activities; collection should be done at the lowest possible costs with the least tax burden on citizens.	
<i>Cacak manages a business startup fund to support innovative ideas, providing up to 60 grants per year. In addition to startup capital they assist the company in management for its first 2-3 years. In this photo Mr. Velimir Mitrovic shows a decorative construction tile made from unrecyclable glass and other secondary materials. A small group of engineering students produce these and other composite products from secondary materials.</i>	

Strategic Waste Management Partners (PPP)

Municipal & Regional Plans

Municipal & Regional Waste Management Strategies: The 2003 National Strategy of Waste Management stipulated the closure and rehabilitation of existing dumpsites and the construction of 29 regional sanitary landfills, with waste transfer stations and centers for secondary separation of recyclable waste. The Law on Waste Management directed that each municipality develop a municipal waste management plan; subsequently, municipalities must then organize themselves into regions (which can be different than the 2003 Strategy regions) and prepare regional waste management plans based on the local plans. The goal is to allow municipalities to plan how they will manage their waste in compliance with the law. Municipalities are allowed a number of options including retaining existing structures, outsourcing to a strategic waste management partner, establishing local public-private partnerships, or any combination of options. The deadline for the regional plans is May 23, 2010. According to the 2009 Strategy 25 regions have been organized (see Annex 3); the remaining municipalities had not yet reached an agreement at the time the strategy was released (June '09).

Landfills: European experts argue that the number of landfills planned for Serbia is too high and that the resources would be better utilized by investing in collection and recycling initiatives. They argue that landfills are the most costly form of treatment, require large capital investments, are opposed by local citizens, and are long-term obligations. In many European countries, they note, landfills are being closed and consolidated while Serbia is on a course to over-construct which will lead to high municipal, citizen and business financial obligations. Some believe that ultimately the

number will be lower, perhaps around ten. According to SEPA only six landfills in Serbia have scales (Nov. '09), resulting in large amounts of "estimated" data; there are 3200 wild dumps in Serbia. According to MEGA the current landfill fees charged by two private operators are ASA (Lapovo) €16/ton; and Porr-Werner & Weber €21/ton. The municipalities where the landfill is situated receive a €1/ton discount.

Partnership Agreements (PPP)

Strategic Waste Management Partnerships: As seen in the table of waste management regions, many municipalities in Serbia are or will be entering into long-term public-private partnership (PPP) agreements with a strategic waste management partner (typically an international company). Both IFC and USAID programs provide technical support to municipalities wishing to engage a strategic partner.

Type of Agreements: In general, there are two types of these agreements: i) waste collection and disposal, and ii) landfill construction and management. The first one generally establishes a joint company between the municipality and a private operator; typically 20% municipality and 80% private. The municipality's 20% is invested in the form of assets: buildings, vehicles, containers and infrastructure, all of which is turned over to the new company to provide collection services. The private partner provides the remaining 80% in new equipment and assets. Most of the existing JKP workers are hired by the new company. To date, the second type, landfill management, is wholly owned by the international partner (excluding some cases where an international company was hired only for construction).

Advantages of PPP: There are numerous advantages for municipalities to engage a strategic waste management partner:

- Local government is relieved of costs and responsibility in communal waste management, leaving the responsibility to large companies with experience and financial resources.
- Assigns waste management responsibilities to the private sector, which is arguably more efficient and cost-effective than overstuffed public JKPs.
- Provides stability in management and operations by eliminating leadership changes of JKPs following political changes.
- Waste management fees are calculated based on household member, not living area, making the system more compliant with the "polluter pays" philosophy and EU directives.

<p>A Joint-Stock Company for Waste Recycling</p> <p style="font-size: small;">Sources: Danas Tandem Financial Serbia Daily Report</p>
<p><i>The mayors of Novi Pazar and Kraljevo, Meho Mahmutovic and Ljubisa Simonovic have signed a protocol with German corporation Medsorga on the construction of a waste recycling factory in Kraljevo, and on sanitary waste disposal cells on the territories of both cities.</i></p> <p><i>Novi Pazar, Kraljevo, and Medsorga founded a joint-stock company, in which the two towns will have a 51% stake and a majority in the Management Board. Activities included in the protocol on cooperation are estimated at €300 million. Medsorga assessed that they can get 12-15 MW of energy from the waste in the territories of Novi Pazar and Kraljevo.</i></p>

Disadvantages of PPP: Despite these attractive advantages, they can be offset by a number of other issues that municipalities should consider before ultimately deciding and signing an agreement:

- Agreements are typically signed for 25 years, a long period of contractual obligation, during which time many things can change; operators are likely counting on this and have a good idea of what to expect based on their experience and access to data and information.
- The operators are private, limited-liability partners; their operations will inherently earn a profit for their stakeholders. Their income is derived from collection and/or landfill revenues, meaning that businesses and citizens will pay the costs plus profits. There are clauses in some contracts that municipalities guarantee certain revenues. Because of this, Cacak municipality argues that collection should remain a public service.
- There are financial disincentives for recycling, especially primary (source) selection. Experts agree that recycling programs need to incorporate primary selection to reduce sorting costs and to collect cleaner materials with higher reusable content. According to PPP operators, however, their recycling operations operate at a financial loss (no different than the JKPs interviewed). As a result, they have little financial incentive to establish recycling programs. Of the two operators interviewed, both currently manage recycling programs with very limited outreach; many municipalities operate more advanced and effective collection schemes.
- Landfill operators are paid a gate fee; primary selection will reduce the gate fee by capturing recyclables before they reach the landfill. For this reason, some private operators favor secondary sorting facilities at the landfill so that the gate fee is retained. Most of the agreements include a secondary sorting line to be constructed at the landfill at some point in the future, though there appears to be little incentive by the private partners to expedite the activity. In addition, gate fees belong 100% to the operator, while recycling income is shared with the municipality. Source separation will be required by law so there should be some diligence on the part of municipalities and observers to watch how this plays out.

Competition for Industrial Waste: At least some waste management operators are counting on municipalities to force companies to turn their industrial waste over to the strategic partner, whose position is that by virtue of their contract, they own all non-hazardous waste generated in the municipality. This could be a controversial point as many companies already have agreements with local collectors to buy their waste. Industrial waste has a higher value than communal waste as it is more uniform in composition, in higher quantities, and cleaner and easier to sort. Operators admit that it is a form of monopoly and so far have not interfered with these contracts, but that will likely change in the future. Operators argue that all buyers will still have access to the materials, albeit from the operator. They see the only conflict as one between operators and collectors, who they admit will be hurt by the agreement. If operators can leverage secondary materials from industrial and commercial sources, they may effectively limit access to the materials not only from collectors but also from end users and other buyers and consolidators.

Operators

Porr – Werner & Weber: PWW, one of two operators interviewed in this assessment, is an Austrian waste management consortium and one of the competing operators in Serbia. PWW is registered in Serbia, based in Nis and has two contracts in Serbia for landfill and waste management services in Jagodina and Leskovac; in both cases PWW is in partnership for collection and transport of communal and industrial waste; rehabilitation of the existing landfill; and construction of a recycling center, transfer station and new regional sanitary landfill. They are planning to compete for agreements in Nis for a sorting facility and for similar contracts in Smederevo and other regions.

PWW Recycling: At present PWW is only doing a small simulation of recycling on 8-10 streets in Leskovac, and have adapted a small hall for sorting LDPE, PET, aluminum, paper and glass. In May-June 2010, PWW expects to have a completed sorting facility. As is the case with JKPs, PWW loses money on recycling; for PET they estimate losses of €100/ton, but they expect Seko-Pak to cover the loss through a subsidy in the same amount. A similar situation exists for glass and paper. PWW has no recyclable collection in villages; in the future PWW plans to have two types of recycling containers in villages: organic and inorganic. PWW admits at present there is little incentive for recycling; they operate at a loss on their current scale, and are paid per ton of waste landfilled. As their scale increases, hopefully accompanied by a recovery in the prices for secondary materials, they hope to achieve a profitable economy of scale.

ASA International Environmental Services: The ASA companies are part of the Austria FCC Group, 30 companies involved in construction, cement, energy and environmental services. ASA Group provides waste management services in nine countries in Europe, and two regions in Serbia – Lapovo and Kikinda. ASA waste management services include collection, transport, treatment, landfill, communal services, site remediation, landfill gasification, bio-fuel production and consulting. In Serbia, there are three ASA companies: ASA Eko (parent company), ASA Kikinda and ASA Vrbak (PPP joint companies). Both landfills are built and management contracts signed for 25 years; ASA manages only communal, non-hazardous solid waste from citizens and companies and has invested in new trucks and modern equipment.

ASA Recycling: Secondary materials are collected for recycling only in the town limits of Lapovo, Batocina and Despotovac: PET 1 ton/month and paper 4-5 tons/month. None are collected in villages but there is a plan to do so in the future. In the next 2-3 years there is a plan for secondary separation at the landfill. At present, only tires are separated at the landfill. Brzanplast buys the PET and paper is sold to one of two local companies. ASA's recycling operations operate at a loss.

Collectors

Collector Profiles

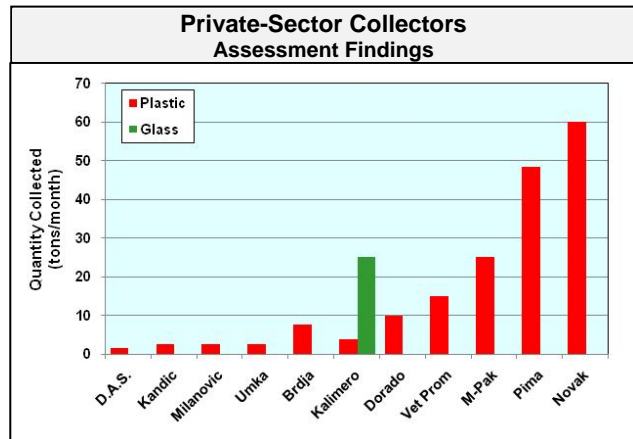
Collectors: Secondary material collection is a function that virtually all companies in the recycling sector do to some extent, even large value-adding processing factories. Collection can be categorized in a number of ways based on material, quantities, sources, business form, or industrial versus communal waste. In this section, and in Part 2 (Actors & Profiles) the term “collector” is used to refer to companies whose sole purpose is to collect and consolidate materials, and who provide no or limited value-added processing beyond pressing and baling.

Quantities: The graph shows the relative quantities of plastic (and glass) collected by companies who fall under the “collector” classification used in this report. The chart presents the scale of collection activities that one can find in Serbia (notwithstanding notes explained under graph). It should be noted that Indjija was the JKP surveyed with the highest plastic collection, with 10.8 tons/month.

Collection Opportunists: Though most collectors specialize in one or several materials or groups, they tend to be opportunistic and will sometimes buy, trade or broker deals in materials outside of their particular specialty. They may do this on a one-time basis, for example if they locate a large supply of a particular waste; or they may change their focus as prices of materials change, adjusting their collection to meet demand. Some collectors will buy almost any material if they have a potential buyer, though will generally stay limited to a range of materials due to their established networks and sector knowledge.

Non-Monetary Trade: Private sector collection and recycling is characterized by a high level of material trade between the actors. Such trade has allowed these actors to develop a kind of functional network amongst themselves that in many cases allow them to:

- trade raw material for finished plastic goods or other materials;
- plan their production so as not to compete with each other by producing similar products;
- combine commodities and shipments to jointly fill larger orders; and
- broker deals where one company “sells” a commodity to a user without actually having to handling it directly.



This diagram shows a relative comparison of the collectors surveyed based on quantity of plastic collected. This data is a reference only and should not be used as a true comparison because it represents only plastic (and glass) and some companies specialize in other materials. At least two of the companies also granulate, putting them outside of the “collection” definition in this section. It also does not take into account types of plastic, rather considers all plastics together.

Financial Analysis

Operating Margins: The table shown here provides a rough estimate of the operating margins of individual recyclers and consolidators for some commonly collected materials. The data was obtained from assessment interviews and include private and individual collectors, JKPs, and ultimate end users or processors. Multiplying these figures by the tons of material per month provides a rough approximate of the level of financial activity of collectors and recyclers. In general, consolidators sell materials for about twice what they pay, but also press and bale the materials.


Collector Operating Margins (prices converted to €/ton)					
Material	Individual		Consolidator		Notes (explanation of “N/A” entries)
	Buy	Sell	Buy	Sell	
Paper	0	10-20	10-20	40-50	
LDPE	N/A	40-50	40-50	100	Most collected from industrial sources.
HDPE	0	35-50	35-50	N/A	Sold to plastic processors.
PP	N/A	120-150	120-150	N/A	PET caps or specialized collection. Sold to plastic processors.
PET	N/A	80-150	80-150	N/A	Communal collection; sale to processors.

This table provides rough operating margins for secondary material collectors in Serbia for paper and different plastics. A “0” in the price column indicates that the material is collected by individuals (usually removed from containers). “N/A” indicates that collection or trade is not commonly conducted at that level (see Notes). For materials collected from commercial sources (i.e. factories, supermarkets, distributors) purchasing prices and arrangements vary considerably. Prices are increasing as the global economy recovers.

Commercial Collection: One common trait that characterizes nearly all collectors is that they rely on some commercial or industrial waste, in many cases almost exclusively. As mentioned, commercial and industrial waste are the most desired waste streams due to their quality, consistency and cleanliness; as such, collectors compete for the supply. Collectors visited on this assessment have agreements with factories of every kind of production, supermarkets, distributors, warehouses and all other major waste generators. The most common materials collected are paper (cardboard) and LDPE, and of course metal and other high value materials; though some have agreements that specify they take all waste. In all cases interviewed (except electronics), the collector pays the supplier for right to collect, or for the quantity of material.

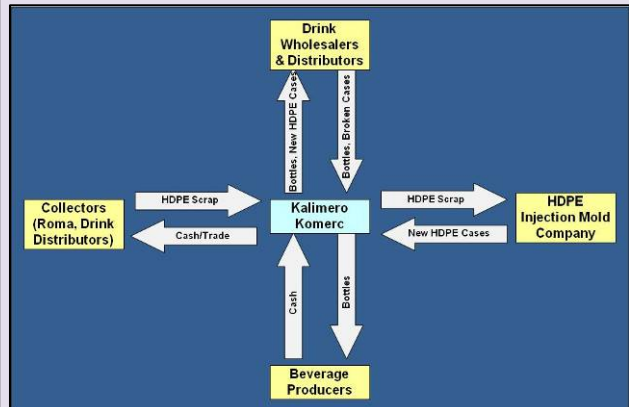
Public vs. Private Sector Profitability: When comparing public and private sector recycling efforts, one might ask why JKPs lose money on recycling activities while private collectors doing similar work can be profitable. There are several reasons, but it is probably due most to the issue of commercial and industrial waste mentioned above; it is difficult or impossible to operate profitably solely on communal waste. (Strategic waste management partners also don’t cover recycling costs.) Other factors include public-sector inefficiencies, private sector’s ability to target specific waste and exclude other waste, and better diligence on the part of the private sector in ensuring that recyclables are properly sorted, cleaned and packed for buyers. This issue itself should lead more municipalities to seek *local* public-private partnerships that will help reduce their costs and strengthen local companies in their territories.


Minorities/Roma: As one would expect the collection of communal recyclables still relies to a large extent on the Roma population; where there are few Roma living, the job is sometimes taken up by other disadvantaged individuals. In some cases, collection is managed almost entirely by Roma. Paper and cardboard waste is often done by the Roma, and in some cases consolidators are also Roma. With regard to plastics, Roma collection is generally limited to HDPE (LDPE is often collected from commercial and industrial sources).



Brdza operates in part like a JKP (though without a formal agreement) by collecting communal waste in containers around Trstenik. Their sorting facility is typical for small consolidators with a few presses, granulators and other equipment.

This diagram exhibits the role of trade in transactions for companies like Kalimero Komerc in Krusevac. Kalimero buys and collects unbroken glass bottles and jars and HDPE beverage cases. In collaboration with a network of similar companies, they supply users and recyclers with the collected materials. Oftentimes, the companies work together to fill larger orders and meet regional demand.





Pima, a partner of Cacak municipality, operates in a municipal owned, rent-free facility on the Cacak recycling compound along with the JKP and other private partners. Cacak manages a "wet-dry" communal collection program. In the photo, Pima workers sort the "dry" waste, which is transported to the facility by the JKP, where it becomes the property of Pima.

Challenges: Waste collectors and recyclers face numerous challenges, including:

- materials offer low operating margins; large economies of scale (and therefore capital investment) are required to succeed;
- private companies are at an inherent disadvantage compared to JKPs, which receive public subsidies for their efforts, and have shown little interest in developing local public-private partnerships;
- the work itself is dirty and difficult;
- the sorting process is labor intensive (it is typically done manually by means of a conveyor with a number of individuals separating materials by type and color);
- few people have an interest in working with waste and if they're not employed directly, they are often unreliable;
- laborers and collectors are generally unskilled and often uneducated;
- those who do work in the sector are often disadvantaged and face their own challenges;
- delayed and late payments from buyers, while they are forced to pay individual collectors on the spot.

LDPE Collection Financial Analysis Secondary Collection at Landfill		
Description	Result	Basis
Collector Income	160 RSD/day	40 kg/person/day 4 RSD/kg
Monthly Collection	4,400 kg	5 collectors 22 working days
Time to Collect Full Shipment	2.73 months	12 ton shipment capacity
Material Cost for Full Shipment	48,000 RSD (€498)	4 RSD/kg LDPE 96.3 RSD/€
Revenue for Full Shipment	120,000 RSD (€1,246)	10 RSD/kg LDPE 96.3 RSD/€
Margin (1 shipment, 2.7 months)	72,000 RSD (€750)	No expenses included

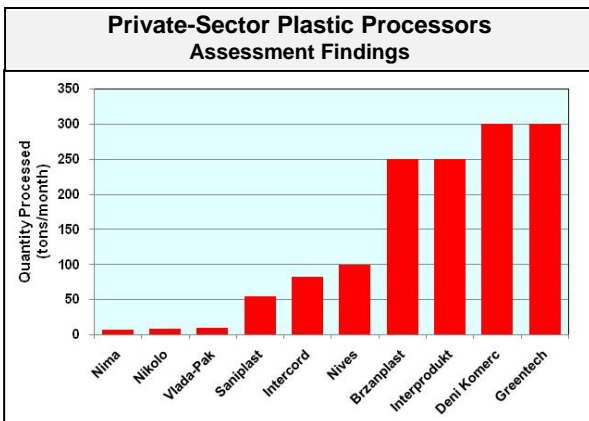
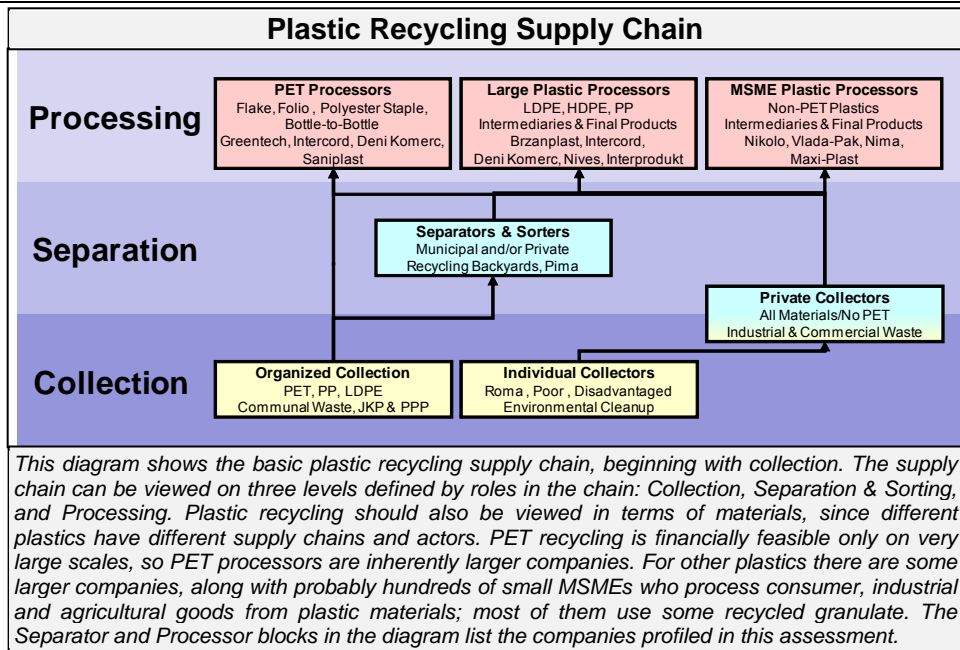
This table provides a financial analysis for secondary collection of LDPE from a landfill, and illustrates why it is not economical: a collector would earn only 160 RSD/day; it would take 5 collectors 2.7 months to collect enough LDPE to fill a 12-ton shipping container; and the consolidator who organizes the shipment (over 2.7 months) would earn only €750 after buying the LDPE, a figure that does not include any storage, transport, handling or organizational expenses. In addition, permission would need to be organized for landfill access, the materials collected would be dirty and contaminated, plus a host of other inconveniences.

Opportunities: Despite these challenges, there are ways for collectors to operate profitably. In fact, some say that it is because of these challenges that they are able to succeed. For example, the undesirable nature of waste management means that few entrepreneurs have the interest, thereby allowing opportunities in the market for those who are willing. Nikolo, a plastic recycler in Krusevac, says that one of the keys to being successful is minimizing and maintaining low monthly fixed expenses. He added that unless a company can afford expensive, automatic sorting equipment they are going to require a large workforce.

Secondary Materials

Plastic

Supply Chain: A simplified plastic recycling supply chain is shown in the diagram to the right. Readers interested in plastic recycling are referred to Part 2 of this assessment (Profiles & Actors) for more detailed descriptions of the activities and actors. This section will present the supply chain and a comparison of the large processors who generally serve as the ultimate buyers of the materials. The supply chain can be said to consist of three basic levels: collection, separation & sorting, and processing.



This diagram shows a relative comparison of plastic processors based on total quantity processed. As before, this data is only a rough reference and should not be used as a true comparison because of the different types of materials and processing technologies involved. Figures used were the most recent available, so may be somewhat deflated due to the impact of the global economic crisis.

Separation & Sorting: At present in Serbia there are few examples of strictly sorting operations. A number of actors manage sorting lines (Pima, Brzanplast) but they do so as part of a larger operation. In fact, virtually all of the processors, both large and small, also manage sorting operations. The Recycling Backyards concept, if implemented, would be an example.

Processing: There are numerous types of plastic processors in Serbia that specialize or utilize recycled plastic. First are the PET processors, larger companies processing from 50 to several hundred tons per month. Next are the large non-PET processors, producing LDPE folio

Collection: There are generally three types of collectors in the plastic sector: individual, organized and private.

- Individual collectors include Roma and other small collectors, and individuals operating on a larger scale organizing collection, often including commercial and industrial waste (Kandic, Kraljevo). Individual collectors can also include citizens or groups that collect waste for an environmental goal.
- Organized collectors include communal waste collectors: JKPs, strategic waste management partners in PPPs, and in a few cases private operators (Brdja, Trstenik).
- Private collectors, such as those described in the previous section, often serve as both collectors and sorters. These actors are registered businesses and serve to collect, separate and consolidate waste for the ultimate processors or end users.

International & Serbia Plastic Prices			
International Prices: January 2010			
Plastic Material	Global Price (€/ton)	Serbia	
		Collector	Consolidator
PET	€940	---	€830-€1560
HDPE	€980	€360-€520	---
LDPE	€1,160	€420-€520	€1040
LLDPE	€1,070	€420-€520	€1040
PS	€1,140	---	---
PP	€1,224	€1240-€1560	---

This table shows average prices for various plastics on the international market (January 2010) along with the prices in Serbia reported by interviewees. PET is generally among the lowest-price plastics; other plastics have higher values and are recycled locally in Serbia. A non-entry indicates that a supply chain link is not common at that level.

Global Price Source: IDES – The Plastic Web

(Brzanplast), hose and piping (Nives), or granulate. Finally are the hundreds of small plastic processors scattered around Serbia producing folio and injection-molded products, most of whom process recycled material to a greater or lesser degree (Nikolo, Vlada-Pak, Interprodukt, Nima).

		<p><i>Intercord produces high-quality granulate from PE, PP and PET in their three processing lines. Materials can be jointly shredded and subsequently separated. The company also recycles its wastewater, using the filtered waste as an additive in roof sealant.</i></p>
<p><i>Brzanplast is one of the largest plastic recyclers in Serbia, buying, sorting (above) and processing all types of plastic, into granulates and folio; PET is baled and sold. Brzanplast, along with the Serbian Plastic Recyclers Association, is the author of the Recycling Backyards concept.</i></p>	<p><i>Nives is a large distributor of plastic materials and operates three extrusion lines for hose and piping, along with two LDPE folio production lines.</i></p>	
	<p><i>Deni Komerc recently invested in a state-of-the-art PET recycling line. In addition, the company produces biodegradable and self-oxidizing LDPE folio products.</i></p>	

Supply & Demand: There is an under-supply of secondary plastic materials on the market, evidenced by surplus capacity in most buyers and processors, and competition for materials, including PET. Greentech, Saniplast, Intercord and Deni Komerc all process PET and all have additional capacity and demand. Greentech notes this as a positive, as it creates demand and helps cover times of crisis, such as when during the peak of the economic crisis Greentech was the processor buying PET. To illustrate the scale, Greentech collects 300 tons/month of PET in Serbia; in their two Romanian plants (producing mainly Polyester Staple Fiber) they process 5000 tons/month. Development efforts should focus on increasing collection by expanding existing operations and facilitating the startup of new initiatives.

Plastic Processor Summary: Most, perhaps all, of the largest plastic processors, including all major PET processors, were interviewed in this assessment. Annex 4 provides a summary of each processor interviewed, including materials and quantities, collection methods and outreach, and the company's production. The reader is also referred to Part 2 of this assessment for a detailed description of each.

	<p><i>Interprodukt recycles hard plastics into industrial products such as bus seats and fruit trays. Most of the collection is organized from final users, for example beer cases from drink distributors or other industrial plastic users; the company does not rely on individual collectors.</i></p>
<p><i>Vlada-Pak is a true "recycler." The company sorts all varieties of plastic, processes and sells intermediates, and produces a number of molded products. The company's biggest product is LDPE plastic bags and folio, mostly for agriculture supply and fruit packaging.</i></p>	

Paper

Supply Chain: Paper, especially cardboard, is recycled fairly efficiently in Serbia. It has value and is collected in varying levels of in probably every city, small town and many villages in Serbia. The paper recycling supply chain is presented in the diagram, with key actors interviewed noted in the boxes. Each actor is profiled in detail in Part 2 of this assessment. The supply chain consists of collection, consolidation, and processing.

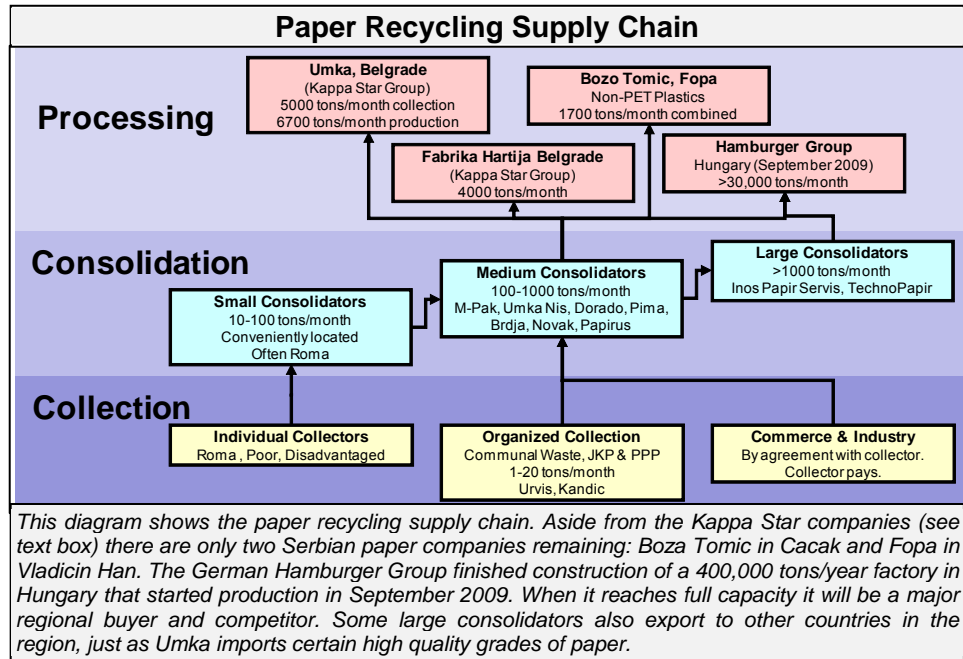
Collection: Paper is collected in three ways:

- Individual collectors (Roma and others) collecting cardboard directly from containers and small retail shops.
- Organized collectors (JKPs and strategic waste management partners) and some slightly larger private operators like Kandic and Urvis.

- Commercial and industrial sources of waste paper (cardboard packaging and print shop waste) sell their waste to consolidators who pick up the waste from the source. These arrangements are typically structured so that a single operator is required to take all of the waste, and pays the source for the waste, either by a fee or by weight (presumably they do not take communal waste generated by workers). In the case of supermarkets, the consolidator typically owns the containers. Pickups are usually arranged on demand.

Consolidation: Consolidators can be placed into three categories based on size:

- Small consolidators, who purchase primarily or solely from individual collectors; in urban centers, these actors are often Roma. Most small towns and villages in Serbia also typically have a buyer of paper, metal and other materials; such consolidators might buy from 10-100 tons/month. Small consolidators serve medium consolidators, almost never selling directly to the processors.



- Medium consolidators collect from 100-1000 tons/month; several were interviewed and profiled in this assessment.

These consolidators are also usually the buyers of JKP-collected cardboard and hold agreements with commercial and industrial waste sources.

Paper Buying Prices & Operating Margins (prices converted to €/ton)		
Paper Source	Price Paid	
	Cardboard	White Paper
Individual Collector (loose)	10-20 €/ton	40-50 €/ton
Industrial & Commercial (containers & pickup)	10-15 €/ton	
Collected (pressed, baled)	20-40 €/ton	
Large Consolidation	40-42 €/ton	
Umka Factory	50 €/ton	90 €/ton

This table shows the prices for collected paper (cardboard and white paper) as the materials proceed through the supply chain. Margins can be calculated for any actor by multiplying the price by the tons of material collected.


- Large consolidators, of which there are only a handful in Serbia (Inos and TechnoPaper, neither of which was interviewed) collect more than 1000 tons/month. Medium consolidators will sometimes sell their paper to large consolidators and achieve a better price because of the higher quantities. In these cases, the large consolidator generally does not handle the paper, but simply organizes supplies from different sources and holds the agreement with the buyer. It seems, and is logical, that the large consolidators serve export markets.

Processing: Most of the paper and cardboard production in Serbia is handled by companies in the Kappa Star group (see inset). Together they account for over 9000 tons/month of paper and cardboard production. Besides those companies, there are two remaining paper factories in Serbia: Bozo Tomic in Cacak, and Fopa in Vladicin Han, producing about 1700 tons/month combined. In September 2009, the German Hamburger Group opened a large factory in Hungary with a capacity in excess of 30,000 tons/month. The factory is not yet operating at full capacity but will become a major regional buyer and competitor for waste paper. There is already some waste paper export from Serbia (to Croatia). Meanwhile, Umka imports high quality white paper from other countries in the region.

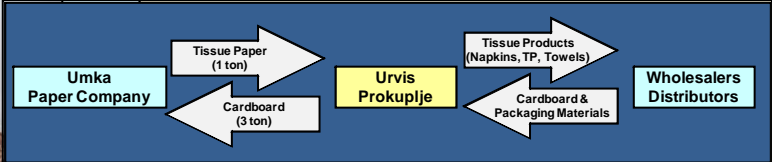
Kappastar Group www.kappastar.com
<ul style="list-style-type: none"> Umka, Belgrade: cardboard Avala Ada, Belgrade: packaging materials Jaffa, Crvenka: biscuit & cakes Pitkyaranta (Russia): cellulose Fabrika Hartije, Belgrade: paper Geomasina, Belgrade: mechanical elements

Policy & Support: Umka and paper consolidators have not received any financial support for recycling from the government, as opposed to EU countries which received subsidies during the economic crisis that provided value to collected paper. A project proposed to the Government to subsidize Roma collection for those who legally registered was not supported. According to Umka, Croatia subsidizes paper collection at €30/ton; Umka supports investing in collection and efficiency improvements and hopes that the new laws will result in effective instruments of support to the

Serbian recycling sector. Umka, like most other actors, believes that the current national targets (5% recovery, 4% recycled) are too low, partly due to lobbying efforts by Seko-Pak. They are discussing a future arrangement with Seko-Pak to support investments in JKPs and private collectors to meet national targets. Umka supports the philosophy that the green economy will create jobs.



Umka is the largest paper mill in Serbia and the region. By weight they are the largest recycler in Serbia, recycling 60,000 tons/year cardboard. Umka has 6000 employees, and operates 35 trucks and 20 baling presses out of their plant near Belgrade. Umka is 100% privately owned. They export over 70% of their production to the EU, Ukraine and Russia, with less than 30% is consumed locally. Even considering imports, Umka production exceeds overall Serbia demand. Umka Nis (shown here) rents a collection facility in Nis.

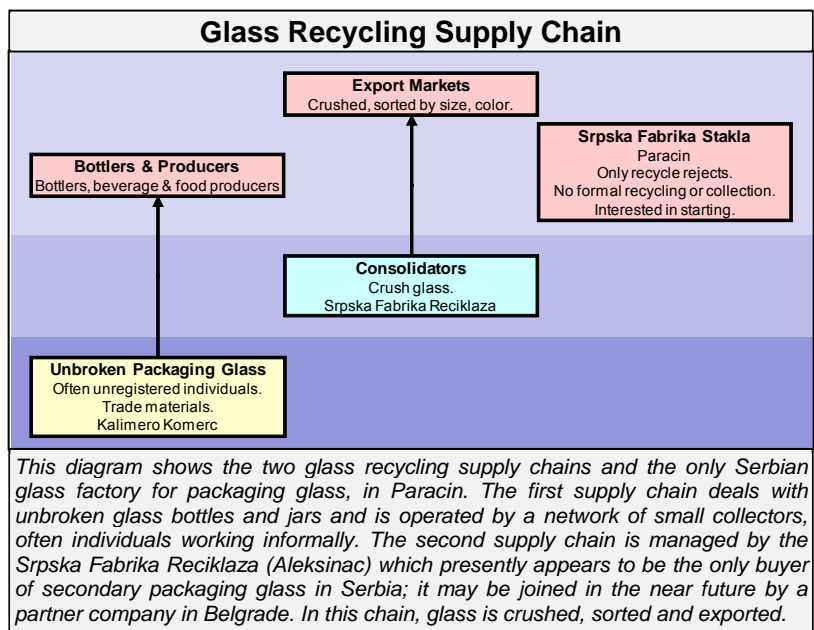


Urvis, a small company employing mostly handicapped people, is an interesting case that demonstrates the trading nature of secondary materials among Serbian collectors and recyclers. The company collects cardboard, trades the cardboard to Umka Nis in exchange for large rolls of tissue paper, and then produces products from tissue paper. On the distribution side, they trade their products to local wholesalers and in return have the collection rights for all of the packaging waste from the wholesalers. The company is located in the Business Incubator Center, Prokuplje, founded in cooperation with USAID.

Glass

Supply Chain: At the outset it should be noted that glass recycling in Serbia is fairly uncommon: demand and prices are low, it is heavy (transport costs are high), and there are few collectors willing to work for the low margins. That said, there are two supply chains of glass recycling in Serbia (see diagram and Part 2 of assessment). Many, probably most, cities in Serbia do not a buyer for glass in either supply chain.

Unbroken Packaging Glass: The first supply chain deals only with unbroken glass bottles and jars of all types and sizes. There is a small network of collectors, often individuals working informally, who buy virtually any unbroken glass container, organize and consolidate types and sizes by trading with one another, and sell or trade the bottles and jars to their network of bottlers and food producers. Kalimero Komerc in Krusevac is the only example of this type of collector interviewed for this assessment, though several others (mostly individuals) were identified in other cities. The average price for a standard glass jar or bottle is 3-5 RSD. Mr. Popovic, the owner of Kalimero Komerc, says that 90% of his sales are to individuals, not companies.



All Packaging Glass: The second supply chain deals with any packaging glass, broken or unbroken. Currently, Srpska Fabrika Reciklaza (SFR) near Aleksinac appears to be the only buyer in Serbia, though a partner collector, Glass Rec, may soon begin working in Belgrade. SFR, a privatized operation employing 13 workers, crushes the glass and sorts it by size, and sometimes by color; they have a capacity of 30,000 tons/year; all of the crushed glass is exported. Collection details were vague but include some containers in Aleksinac owned by SFR, individual collectors, bottlers, and a number of JKPs and collectors of commercial and industrial waste who are required to collect glass along with other materials (Pima). One JKP informed that SFR pays 0.75 RSD/kg for glass.

Serbian Glass Factory: Srpska Fabrika Stakla (SFS) is the only Serbian producer of glass packaging; SFS is owned by Serbia Gas (63%), Bulgaria Glass Factory Plevan (25%), and company ownership (balance). At this time, SFS only recycles broken glass from its own factory (rejects), clients (damaged), and limited private collectors (clean). From the private collectors, the company is paying 2.0 RSD/kg for white, 1.5 RSD/kg for sorted color, and 1.0 RSD/kg for mixed. They are, however, interested in beginning glass recycling on a larger scale.

Recycling Capacity: After privatization, the company had 10,000 tons of broken glass in storage, plus additional quantities waiting return from clients. In addition, they routinely have quantities of internal glass that gets recycled (broken, reject, surplus). So for some time, the factory has been trying to reduce its inventory of broken glass and now appears ready to undertake more serious collection and recycling. In addition to reducing inventory they have also been making some changes to their process to decrease the amount of rejected and damaged production.

Recycling Economics: SFS stated that they have two interests to begin recycling: firstly because of ecological responsibility, and secondly economics. Simply put, glass is cheaper to melt than quartz so recycling saves energy and reduces the cost of production. Energy is the biggest expense in glass production; for every 10% of recycled glass, a savings of 3% can be realized in energy.

Glass Recycling Allowances Maximum Recycled Glass (%)	
Clear Glass	Glass: 30% maximum Quartz: 70%
Brown Glass	Glass: 50% maximum Quartz: 50%
Green Glass	Glass: 90% Quartz: 10%
<i>Glass production allows varying levels of recycling, depending on color. Looking at the above figures, and accounting for production levels of various colors, the glass factory states that on average 50% of their production could be filled by recycled glass; of that amount, roughly half would be filled through internal means, leaving 25-30% of total production that could be met through external collection. The biggest demand is for clear glass since it can be used to produce any color.</i>	

Recycling Requirements: The glass factory is interested in collecting and recycling glass of all colors. In order to be recycled, however, the glass must be totally pure with no inorganic contamination. Some levels of organic dirt and dust are tolerable, but any ceramic, metal, stone or other inorganic substances can damage the furnaces; the factory already has magnetic separators for ferrous metals. Therefore the glass should be cleaned and sorted prior to recycling; this could be done either by the collectors, an intermediary, or the factory itself. An automated cleaning and sorting line requires an investment of approximately €3 million; credit or other financing scheme would also be necessary. There is no existing collection network on which to rely; transport is also an issue as shipping broken glass must be done in different containers than normal shipments.

Glass Demand & Trends: The annual demand for glass in Serbia is between 130-150K tons/year, of which approximately 30% is produced by SFS; the remainder is imported. Despite the global trend toward plastic containers, SFS stated that demand for glass is increasing, particularly for small, non-transparent bottles such as those used for small bottled wines. The company hopes to increase its production to 100K tons/year by 2011 by increasing its share of the Serbian market.

Collection: The glass factory does not have a developed strategy for recycled glass collection, though they do accept returns from some companies (e.g. Knjaz Milos). All glass currently accepted for return is clean and doesn't pose a contamination hazard. They have had no other contact with collectors and would require a period and/or assistance to develop a collection network.

Metal

Supply Chain: Metals, both ferrous and nonferrous, are recycled quite efficiently in Serbia through a vast network of collectors and buyers covering virtually every city, town and village. Individual collectors, mainly Roma, collect metal from containers and door-to-door; many citizens facilitate the process by placing metal waste alongside, rather than inside, of containers. Industrial and commercial metal waste is recycled even more efficiently. It is likely that every producer of metal scrap has a buyer established, either under a long-term agreement or periodic negotiated sales.

Consolidation: There is a large network of metal buyers across Serbia. In the former MESP recycling database, metal recyclers were by far the most prevalent, with 55 registered metal recyclers; the IFC Recycling Linkages project had 65 in their database. A typical consolidator, Vet Prom in Krusevac, was interviewed in this assessment; Vet Prom collects 150-200 tons/month of metal, mostly from larger firms

Scholz AG Group Scrap Metal Recycler
<i>Scholz Group consists of more than 80 companies that together are the leading recycler of scrap iron and metal in Europe, buying and collecting more than 6 million tons of metal per year; they are represented in every European and Balkan country. In the scrap metal supply chain, individual quantities are separated at the various collection points and then grouped together into enormous quantities of separated metals; they are then industrially processed and sold to industrial companies. Since 1990 Scholz companies have invested more than €200 million in metal collection and processing. Scholz was not visited in this assessment.</i>

and factories in and around Krusevac; they have a one-year contract with most generators. Vet Prom accepts all metal, including machines, motors, vehicles, processing equipment and scrap. The equipment is disassembled, sorted and baled on the Vet Prom lot, where it is then sold to various buyers who reprocess the metal or melt it into ingots. Vet Prom also collects LDPE and PP from the same commercial and industrial sources. In the city of Krusevac (city pop. 75,000), there are around five such collectors.

Markets: Most of the steel collected in Serbia is either sold to the US Steel factory in Smederevo or exported, along with other metals. Recan (below) manages a Serbian program collecting aluminum cans. Some other metals are also processed locally: lead by the Farma Kom battery factor in Sombor, copper by Jugo Impex in Nis, and others.

Recan: Recan, a wholly-owned subsidiary of Ball Packaging Europe, operates recycling centers in Serbia where used aluminum cans are sorted, compressed and returned for recycling. The recycling centers cooperate with waste management operators, scrap metal dealers, supermarkets, shopping centers, petrol stations and other businesses, providing a network of collection points to ensure that consumers have a convenient and problem-free facility to return used beverage cans. Recan also provides consulting services related to logistics and quality, quality checks, analyses and documentation, and payment handling. Recan offers attractive prices for used beverage cans that meet Ball's quality specifications.



Jugo Impex, Nis collects more than 5000 tons of metal per year, including over 2000 tons each of copper and steel. They are the largest metal recycler in southern Serbia and the only ISO-certified recycler in Serbia. Jugo Impex has four facilities in Nis: administrative offices and showroom; metal and cable collection; copper melting plant; and a newly-acquired 10,000m² industrial facility for future use. They produce metal granulate and sheeting, pipe and ingots; they employ 40 workers.

Electronic Waste & Batteries

Supply Chains: There are three licensed electronics recyclers in Serbia: Bozic i Sinovi in Pancevo (visited), Eko Metal in Vrdnik and CE Trade in Belgrade. There is only one licensed lead battery recycler in Serbia: Farma Kom (Galenit Cluster, visited), the automotive battery manufacturer in Zajeca near Sombor. Due to the specialized nature (in the case of electronics recycling) and the sole source (in the case of battery recycling) the discussions below are based on information provided in the two interviews (condensed from the profiles in Part 2 of this assessment). Related to electronics recycling it is likely that the three recyclers operate considerably different from one another, so the explanation below applies only to Bozic i Sinovi.

BiS manages separate storage units for circuit boards, power supplies, CRTs, magnetic tape, metal, plastic and other waste streams. Metal and milled plastic are sold locally to Serbian companies. Circuit boards and CRTs will likely ultimately be exported. All inventories are tracked on an inventory control system. A customs-controlled vault is sealed with a waxed seal, accessible by customs officials.

Technicians dismantle electronic equipment on the lower floor, and an elevator transports the sorted materials to compartments at ground level. BiS currently has 46 tons of sorted electronic components prepared for shipment. All inventories are tracked on an inventory control system.

BiS refurbishes machines and donates them to non-profit and public institutions and schools, sells them at reduced prices, and offers spare parts for their clients. BiS is a Microsoft authorized refurbisher, so they donate ready computers. (Windows XP and Office 2003 licenses are purchased for \$6.) For this effort they were awarded the 2008 Corporate Responsibility Award.

BiS Profile: BiS (Bozic i Sinovi) has two core businesses: IT recycling and software development. They recycle all electronic and electrical equipment and waste, plus magnetic tape and fluorescent bulbs in a 2-floor, 3000 m² facility in Omoljica, approximately 10 km outside Pancevo. Gowi, the IT/software company, was recently separated from BiS; in 2009 Gowi won an award in 2009 from SIEPA for the largest increase in export business. BiS also serves the Ministry of Trade & Services by destroying pirated CDs and DVDs, recycling all of the plastic from the discs and cases; they provide a similar service for Microsoft. They have also begun providing a service to wipe hard disk data from clients with sensitive data, such as banks.

Collection: BiS collected 330 tons of electronic waste in 2009, a “very low” figure according to the company. Most of the collection (97%) is done directly with businesses (B2B) and government offices; both BiS and companies reach out to one another and BiS cooperates with NGOs. Telenor, Price-Waterhouse-Coopers, and banks in Serbia are key clients. Without organized collection it is difficult to reach citizens and household electronic waste; initiatives, containers and collection infrastructure are necessary. The company has had communications with the strategic waste management providers Brantner and PWW. BiS is currently limited on the supply-side and wants to develop collection and transport services to begin developing citizen collection services all over Serbia.

Galenit Cluster Profile: The Galenit Cluster is comprised of the Serbian battery factory Farma Kom and includes members from battery distributors and retailers, auto services, collectors, two citizens associations, Institute Kirilo Savic and Nis Faculty of Electronics. The cluster manages eight battery storage centers and 150 collection sites (typically retail stores and services). Farma Kom is the founder of the cluster. The Galenit Cluster accepts all batteries: lead-automotive, industrial and general purpose. Lead batteries are recycled in the Zajeca plant and other batteries are currently being accumulated and stored for future processing or export. Galenit is responsible for collecting and recycling 15,000 tons of batteries per year.

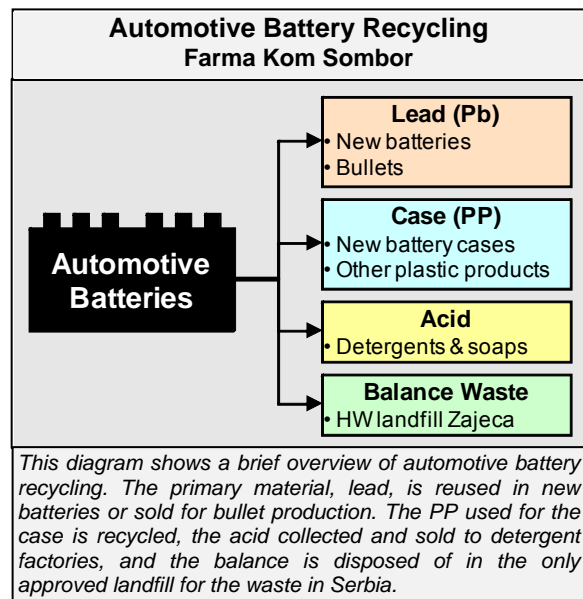
Collection: Galenit is confident that they collect 95% of all automotive batteries in Serbia, with only 5% staying somewhere outside the system. They have 3000 special, licensed containers in Serbia: each service has two, with the remainder in public, private, military and transport sites. In August 2009 they were granted approval to begin importing waste batteries; they imported a relatively low volume of 5000-6000 tons but expect the volume to increase since Croatia, Montenegro and Macedonia have no recycling facilities. Farma Kom pays 30 RSD/kg for automotive batteries, a portion of which is used to support the Galenit Cluster. They accept the used mobile phone batteries from the Telenor initiative. They are also storing CRTs for future processing or export since they also contain lead; this is a strategic move as they are preparing for large volumes of CRTs as consumers trade in their old televisions and monitors for LED and plasma screens.

Projects: Galenit is registered as a fund (association of businesses) and implements recycling development projects. In a recently-approved ISC-financed project Galenit and project partners will help register small collection businesses (mainly Roma) and provide training and initiatives to transition Roma into the formal sector through banking, registration and health services. Cluster development was supported by the Ministry of Economy and Netherlands Government. They also were awarded an EC cross-border project with Romania, and regularly conduct battery collection campaigns through NGOs and schools. They noted that all battery recycling project proposals should have their participation and consent since they are the only recycler.

Wood

Supply Chain: There are different wood and waste wood supply chains in Serbia based on origin and type of wood, products and materials produced, and form of waste wood. In this assessment, three woodworking businesses and one wood waste collector were interviewed. Woodworking businesses typically use a portion of their waste to operate drying ovens for their incoming supply; despite that, they have a surplus of bark and trimmings, cut waste, chip and dust. The three woodworking businesses are all located in south-central Serbia and all had received donations (50-50 cost share) of sawdust briquette machines.

Wood Waste Disposal: There are many saw mills and wood processors in the region and many of them simply throw their waste into rivers. Some companies report that there are transporters who deliver wood to processors and take



some of the waste when they are able, presumably for briquette or pellet production. Some mills were observed on the road with large canvas bags of waste placed along the road apparently waiting to be picked up.

Marinkovic Mill, Raska: Marinkovic is a third-generation family business and produces a range of wood products including prefabricated wooden houses, furniture, custom kitchens, doors and windows, and other wood products. Marinkovic processes raw timber and has substantial quantities of bark and trimmings from rough cutting (2.5 tons/day); they also do a lot of shaping, which generates a large quantity of chip and dust (10m³ of sawdust per day), creating a disposal problem. At times, they have a buyer who will accept up to five tons every two days, but it is intermittent; the wood is sold for a minimal fee but it solves a short-term disposal problem. The company would like to invest €10-€30,000 in new drying equipment and a new briquette machine, but is not currently positioned for capital investments due to decreased production and outstanding credit obligations. Due to the economic crisis, the company's production has decreased from 11,000m³ in 2007 to less than 3000m³ in 2009.



Grozd, Ivanjica The main production of Grozd concerns gluing together small boards and strips into larger boards for further processing by himself and others. In addition to edgewise gluing, he also has the latest technology for end-to-end gluing. The company has modern, computerized equipment and is a very clean operation. Grozd uses a portion of their wood waste for fuel for drying, and produces briquettes from the remainder, selling them for €120/ton, including some export. The current briquette machine (donated in part by USAID) is undersized for Grozd, at 140 kg/hr; Grozd requires 250 kg/hr to process all of their waste, requiring an investment of €40-45,000.

Brest Parket, Ivanjica: Brest originally began producing wood windows and doors, and subsequently moved into parquet which is now their main product. Brest processes 40-50 m³ of wood per month and manages a shop located near the factory. The company employs ten workers and wishes to remain roughly the same size. In 2009 the company was processing only 50% of its 2008 levels due to the global economic crisis. Brest received a co-financed donation of an 80 kg/hr briquette machine from USAID but is not currently using it because of complaints from neighbors about dust when preparing the waste for briquettes. The company hopes to move to another location in 2010, where they hope to be free from what appears to be frequent complaints from neighbors. Once they move they plan to process 100% of their waste. At present they use a small amount of their waste for their dryer and give the remainder to an unspecified individual who recently began producing pellets. The company has 2 tons/month of surplus waste that can be processed into briquettes or pellets. If they move to their new location, they may be interested in taking waste from others but not on a large scale.

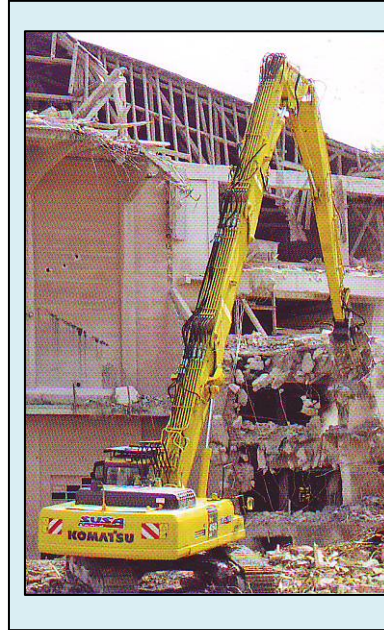
Dorado, Kragujevac: Dorado company has two main activities: i) producing sawdust heating briquettes from wood waste (50 ton/month); and ii) collecting and baling paper (150 ton/month, mostly cardboard) and LDPE (10 ton/month). The owner, Mr. Dejan Radovanovic is a young, energetic entrepreneur who enjoys the collection business. Dorado started in collection, then moved into wood waste about a year later after receiving an offer from Forma Ideal, located several hundred meters from his facility. At the time Forma Ideal was disposing of their sawdust in the landfill so he saw an opportunity to use the waste to produce briquettes. He originally was allowed to take the sawdust for free but then the Holcim cement factory offered to buy the wood waste so he was then forced to begin buying. He currently pays about €10/ton for waste and sells briquettes for €80-90/ton.

Construction Waste

Construction Waste Interviews: Two companies were interviewed with respect to construction waste: Susa, a large company specializing in demolition, site clearance and remediation, landfill closure and remediation, hydro-technical works, and oversized and heavy equipment transportation. Susa demolished a Lafarge cement production plant (see inset), the Hotel Yugoslavia, and numerous other large structures. Most of the demolition work is done with modern mechanized demolition equipment, though some particular structures, such as the chimneys of the Lafarge plant, were demolished with explosives. Stevanovic Invest is one of the largest construction companies in southern Serbia, and they have projects throughout Serbia. Stevanovic Invest employs 230 workers.

Construction Material Salvaging: According to Mr. Stevanovic, few materials are salvaged from demolished buildings, homes and other structures by construction companies. Many construction materials are reused but it appears to be the responsibility of the owner to do so. In actuality, if nothing else workers would probably organize salvaging rather than simply sending to the landfill. The company's involvement is limited to selling metal to collectors, and at times reusing a "very small percentage" of roof tiles. There is rumor of some stores dealing with second-hand construction materials imported from Germany, but none were identified.

Concrete Recycling: Construction waste is the second-largest waste stream behind municipal solid waste; according to estimates concrete and by-product waste consumes 17% of worldwide landfill space. Most countries do not have a concerted solution for its management and disposal, in part due to efforts on the part of construction companies to prevent mandatory recycling. Concrete recycling is, however, gradually becoming more common due to improved environmental awareness, governmental laws, and economic benefits. Concrete is recycled by separating the softer materials and then passing it through a crushing machine, often along with asphalt, bricks, and rocks. Rebar and metallic reinforcements are removed with magnets and recycled through traditional metal recycling supply chains. The remaining aggregate chunks are sorted by size, with larger chunks sometimes being reprocessed. The resulting pieces are reused as aggregate base gravel, with fresh concrete or asphalt placed over it. Crushed recycled concrete can sometimes be used as the dry aggregate for new concrete if it is free of contaminants, though this affects the strength and properties of the concrete and is therefore prohibited in many jurisdictions.



Susa utilizes modern mechanized demolition equipment with variable reach capacity and hydraulic equipment designed for demolition. Hydraulic hammers and processors of variable size and strength break and crush even the hardest reinforced concrete. Recycling construction waste in this manner is generally only economical on very large demolition projects or for companies routinely managing high volumes of construction waste.

Susa Demolition: In the case of the Lafarge factory, Susa recycled or disposed of 30,000 m³ of waste in a process similar to that just described. The resulting chunks of concrete were either used as aggregate on Susa construction sites or sold as a gravel substitute. Steel was sold to metal recyclers. The crushed concrete and bricks are sold for a price up to 50% less than that for standard gravel:

- 0-30 mm: €9/m²
- 31-60 mm: €8/m²
- 61-80 mm: €7.5/m²
- >80 mm: €7/m².

Initiatives: Susa recently purchased a 2 ha site where they wish to build a recycling yard. The company recognizes the need for recycling on large-scale demolition projects, both for the economic benefit and for reducing unnecessary demands on landfill and other disposal methods. Susa wants to position itself as a leader in demolition and construction waste recycling. Stevanovic Invest is interested in two segments of construction waste recycling. The first is traditional crushing and pulverizing of demolished concrete; the separated metal is sold to US Steel and the concrete is crushed to 30mm and used as a gravel substitute. The second is concerned with recycling excess concrete and wash water from concrete mixing and equipment/vehicle washing; the system collects the water, cement and aggregate in pools and reuses it in the production of new concrete. The necessary investments are €250,000 and €100,000, respectively. The motivation for the investments is to be positioned to more successfully compete on large demolition projects.

Cement Industry & Tires

Cement Production in Serbia: There are three cement plants in Serbia with a total production of around 2.7 million tons of clinker per year. (Clinker is the solid material produced by the cement kiln stage that has sintered into lumps of diameter 3-25 mm. Clinker is ground, usually with addition of gypsum, to become Portland cement. It may also be combined with other active ingredients or chemical admixtures to produce other cements.) The three cement plants, their capacity, and alternative fuels permitted and applied are summarized in the table.

Co-Processing Advantages: Co-processing waste in cement kilns has a number of advantages. With regard to cement quality, studies have shown that the bottom ash produced by the waste incineration is trapped in the cement, and no

further leaching taking place in the cement and concrete. Gas emissions are also unaffected due to the high treatment temperatures. In comparing with traditional waste incineration, the cement industry burns the waste at 2000°C at a retention time of 15 minutes, versus incineration which operate at 1000°C with a retention time of 15 seconds. Advantages of co-processing waste in cement kilns include:

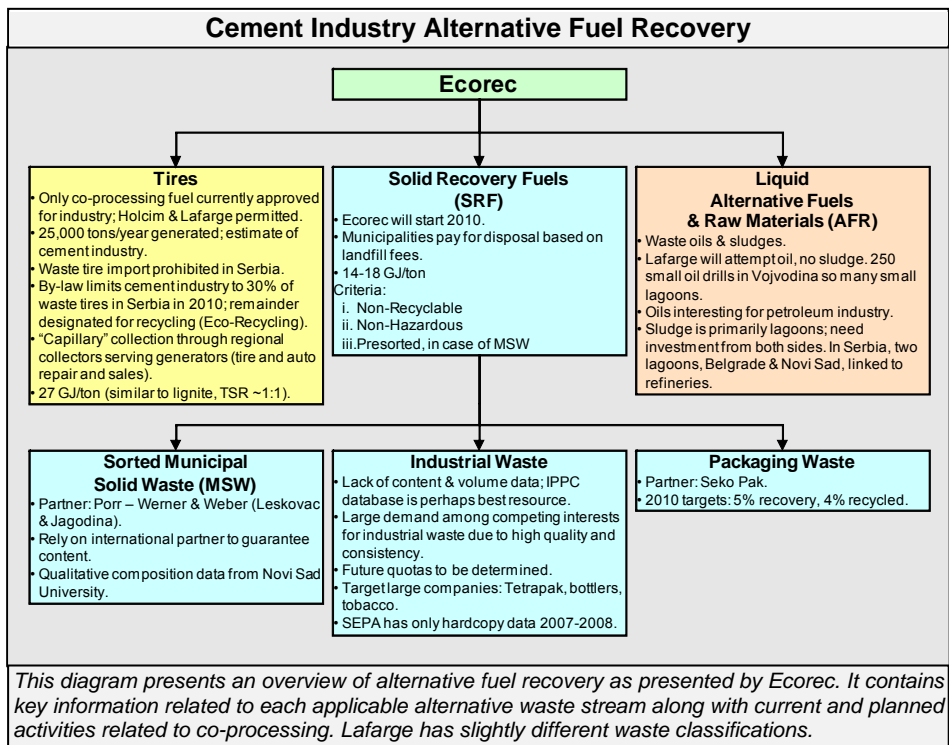
1. substitute fossil fuels with alternative fuels, thereby conserving fossil fuels;
2. reduce fuel costs;
3. decrease CO₂ emissions;
4. does not affect or produce other waste or ash (as is the case with incineration);
5. fast and clean treatment of waste;
6. supports the country's waste management and principle of "zero waste."

Cement Industry in Serbia				
Plant	Majority Owner	Clinker Capacity	Alternative Fuels Permitted	Alternative Fuels Applied
Beocin (Novi Sad)	Lafarge	1.2 M tons	Tires	Used Oils Shredded Solid Waste Meat & Bone Meal
Novi Popovac (Nis)	Holcim	0.9 M tons	Tires Shredded Solid Waste	Meat & Bone Meal Biomass
Kostjeric (Uzice)	Titan	0.6 M tons	None	None

There are three cement factories in Serbia, all with international majority owners. The two largest, Lafarge and Holcim are permitted to burn alternative fuels, and have applied for other approvals. Lafarge is currently preparing the preliminary designs for shredded solid waste and meat/bone meal which form the basis for the permits. They plan to begin a testing phase in March 2010, will full permits obtained by the end of 2010.

Waste Co-Processing:

Cement factories are limited in co-processing quantities, either by regulations and permits, or ideally by the cement kiln and process. Holcim and Lafarge are currently only permitted to co-process tires; in 2009 the quantity was unlimited but beginning in 2010 the cement industry will be limited to only 30% of the total waste tire supply in Serbia. Ecorec is in the application process to begin co-processing Solid Recovery Fuels (SRF); Lafarge has applied to process used oils, shredded solid waste, and animal meat and bone meal. The data and notes related to co-processing and alternative fuels are summarized in the accompanying diagram.



Serbia Waste & Co-Processing Volumes: The co-processing limit of Holcim and Lafarge together in Serbia, all things considered, is 120,000-150,000 tons/year. This compares to 2.2-2.5 million tons/year of total waste generated in Serbia (according to Novi Sad University estimates). Co-processing in Serbia is currently limited by law and the vintage of the kilns; Ecorec would be satisfied for the cement industry to achieve 35-40% TSR by 2013.

Regional Solutions: With respect to municipal and industrial waste (solid shredded waste) the cement industry offers regional, rather than national, solutions. Given the relatively low caloric value of the waste and high costs for transporting the waste long distances, the cement industry is only interested in co-processing the waste on a regional basis with a specific transport radius. Some special industrial wastes with higher caloric value and more uniform composition may be cost effective for national or longer-distance collection.

Wood Pellets & Waste: Given the USAID Serbia Competitiveness Project's current work with wood pellets, the question was raised as to whether the cement industry would be interested in using wood pellets as an alternative fuel. With wood pellets producing a caloric value of 18 GJ/ton and a cost of €150/ton, the cement industry would not be interested in substituting them as a fuel given that they can pay roughly half this price for coal with double the caloric value. They are,

however, looking for sources of “treated” wood waste, such as furniture or saw dust contaminated with oil, or other sources of wood waste which can be collected at a much lower cost to the factory.

Incineration: According to Eco-rec, cement is just part of the solution for MSW; incineration is also necessary for large cities (e.g. Belgrade, Novi Sad). Incineration faces obstacles, including €500-600 million investment for a medium-size facility, difficult permitting process, and potential opposition from local communities. EPS has had a business plan for incineration for five years but Eco-rec is not optimistic that they will obtain the €1.0-1.2 billion necessary for construction. A small incinerator is planned in Uzice near the Duboko landfill, and is expected to be operational in 3-5 years.

Alternative Fuels Caloric Value & Serbian Supply				
Alternative Fuel	Sources	Caloric Value	Estimated Serbia Supply	Potential Industry Usage
Tires	---	27 MJ/kg	30,000 tons	109%
Biomass	Wood Agricultural Waste Sunflower Shells Straw Animal By-Products	16-19 MJ/kg	22,000 tons (animal waste only)	150%
Shredded Solid Waste	Municipal Waste Industrial Waste	19-24 MJ/kg	2.81 M tons	24% theoretical 7% cost-realistic 50% regional
Waste Oils & Solvents	Vegetable Oils Industrial Oils Motor Oils Solvents	35-42 MJ/kg	25,000 tons (current collection low)	91%

Data for the four main alternative fuel groups are presented in the table. The cement industry sometimes co-processes or categorizes other wastes, including sewage, wastewater, meat and bone meal, and other liquids. The final two columns show the estimated supply of the waste in Serbia, and the percentage of the waste that could potentially be co-processed by the cement industry, given certain assumptions. All available tires currently available in Serbia (10,000 tons/year, or 400,000 tires) are now burned in cement kilns, though according to the new law, only 30% of collected tires will be intended for the cement industry, with a target of 70% recycling into other products. Used tires cannot be imported into Serbia.

Tire Recycling & Co-Processing In Serbia Recycling & Cement Industry Notes
<ul style="list-style-type: none"> • Import of waste tires into Serbia presently prohibited. • With new tire recycling plant (Eco-Recycling, Sirig/Novi Sad), demand for waste tires far exceeds supply. • According to by-law (Dec. 24, 2009) waste tire co-processing limited to 30% of total tires, with 70% designated for recycling. • Conflicting and lacking data regarding quantities makes estimating 70-30% difficult. • No Serbia competition for Eco-Recycling. • Eco-Recycling produces granulated rubber for use in playgrounds and limited road applications. • Tigar Tires announced will take EBRD loan for tire recycling; if so, demand will be further increased unless import restriction lifted. • Caloric Value: 27 GJ/ton (similar to lignite, less than petcoke).

Waste Tire Collection: One certified collector and registered tire recycler, Auto Mirko in Prokuplje, was interviewed. Auto Mirko is the contracted supplier for Eco-rec (Holcim) covering southern Serbia. Auto Mirko collects 5-12 tons of used tires per week from “vulkanizers” and auto repair shops; from this collection he uses some tires to produce retreads (his main business) and transports the remainder to Holcim. He typically organizes one shipment per week, traveling to one city or region and picking up all of the tires available. Mirko picks up tires free of charge; in the past, tire companies paid €30/tire for disposal, but when the cement companies obtained permits to co-process tires the tire and auto shops could then transfer the tires to the cement factories and not pay a collector. Mirko transports the tires to Holcim, who covers his fuel cost. In exchange, he is also able to sort through the tires at Holcim and take some for retreads.

Waste Oil

Supply Chains: One waste oil collector was interviewed for this assessment, Bio King in Popovac, near Nis. Bio King is reportedly the only licensed waste cooking oil collector for biodiesel in southern Serbia. The company presently operates under two agreements – one for collection and one for distribution.

Collection: Bio King has an agreement with Bio Oil Austria to supply used cooking oil from southern Serbia; Bio Oil buys the oil for €0.30/L and also loaned Bio King a small collection truck and some startup assistance. Bio King plans to expand collection to cover roughly the southern third or half of the country. The main suppliers are student centers, hospitals, catering companies and big bakeries. He also collects from OMV, and



Bio King collects used oil in the small containers shown in the left photo, then filters it into the square intermediate bulk container (IBC). The temperature must be sufficiently high to pump the oil so filtration is done indoors. The filtered oil is then pumped into the outside storage tanks for pickup; at the time of the interview Mr. Nestic had 16 tons in the tanks awaiting pickup. He has already provided 4000 L of used oil to his buyers. In Belgium, Mr. Nestic visited a company of only four employees that collects 6000-8000 ton/year.

smaller amounts from restaurants and hotels. According to Mr. Mikan Nestic, Serbian law requires generators to give used oil to licensed collectors free-of-charge; therefore, Bio King does not pay for the used oil. Most generators simply dispose of the oil, but there are some unregistered collectors with home-based processes who will pay for the oil (12-15RSD/L), creating illegal competition for Bio King. Oil is collected in 30 and 60L containers provided by Bio King; they are collected on demand. Bio King filters the oil before sending to Austria.

Distribution: Bio King had originally bought some waste oil processing equipment, but subsequently transferred it to an unspecified company in Subotica, who operates the equipment, along with their own, and returns a portion of the biodiesel to Bioking for distribution. Bio King is working with the municipality of Nis to supply biodiesel at a level of 2 tons/month for JKP Nis vehicles to use on a trial basis; the biodiesel will be blended with regular diesel; the partners are seeking financial assistance to install a 3-4 ton tank and pump. The total demand for city vehicles is 4 ton/month. There are also some discussions with Nis municipality to provide collection space for Bio King in return for biodiesel.

Regulatory Environment: According to Mr. Nestic under EU law, countries must add biodiesel to all diesel sold on the market (10%); Serbia does not have this requirement, providing little incentive for biodiesel. Mr. Nestic is optimistic that Minister Dulic will improve the situation, both in terms of supporting production and administrative processes.

Organic (Compost)

Overview: Composting offers a low-cost, economically sustainable treatment for a large volume of communal waste. Composting is simple and fast, with easily-implementable solutions. In addition, the process produces a high quality product with an established market. This section provides a brief overview of composting solutions, based on the presentation, "Composting Strategies for Serbia," made at the 2009 ISWA Beacon Conference in Novi Sad.

Morphological Waste Composition: According to studies of waste composition in Serbia, 50% of the communal waste currently disposed of in Serbia is organic and bio-decomposable; if we remove certain non-compostable components, we are still left with a waste stream that consists of 30-40% of waste that could readily be treated by composting; sewage waste can also be used in composting operations.

Solutions: Composting solutions for cities and populations require three strategies based on the point of generation: urban, rural and home.

Urban: Urban composting solutions require a collection system. Door-to-door collection is the most labor intensive but produces a purity of 97-99%. Roadside collection is much less costly but produces a product of lower purity, on the order of 85-96%. For Serbia, the author of the presentation at the ISWA conference recommends door-to-door collection with small biodegradable bags and small collection vehicles. Urban solutions also require capital investments in composting plants, some of which (€10-12/ton) can be financed through the Clean Development Mechanism (CDM) of the Kyoto Protocol (see inset). Gate fees cost €20-25/ton, which are competitive in comparison with landfill fees.

Clean Development Mechanism (CDM) Kyoto Protocol Arrangement

The Clean Development Mechanism (CDM) is an arrangement under the Kyoto Protocol allowing industrialized countries with a greenhouse gas reduction commitment (Annex 1 countries) to invest in ventures that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

Rural: Rural composting solutions require minimal investment and are decentralized, relying on responsible local citizens to manage. In general, a village operation is managed by one or more local citizens who oversee collection and management of the composting operations, encouraging citizen participation. An example of a 2000 ton/year operation in Austria required 5000 m² plot and building and an investment of €150,000.

Home: While home composting is not suitable for many population groups, such as those residing in cities, in cases where it is possible, it is the most cost-effective solution. Home composting requires zero investment and no transport and collection systems and costs. Typical home or backyard composting operations can treat 0.6-1.0 tons of waste per year. An example presented was done with 2,000 families and was spearheaded by the local mayor who managed his own backyard compost operation. The community ultimately showed a large commitment and unity, and also participated in a very successful source separation recycling program. Implementing home composting programs require considerable effort on education, monitoring and awareness-raising, and need to develop alternative solutions for households that are not interested in composting.

Legal Framework for Waste Management

Summary: The overview of national and EU policy below is summarized from the Serbia National Waste Management Strategy 2009-2018 (Reviewed Version of June 20, 2009) and discussions with MESP staff. For more detailed information the reader is referred to the Strategy and its appendices, which outline the entire waste management legal framework. Key legislation aimed at harmonizing Serbia with the EU in the areas of waste management and packaging waste were adopted on May 23, 2009; the adoption of these laws is driving the municipal waste management strategic planning process. The Law on Waste Management, in addition to other requirements, establishes a deadline for municipalities to complete both municipal and regional plans for waste management, and leading many municipalities to opt for international strategic waste management partners as previously discussed.

Republic Legislation

Summary: Waste management is regulated by laws enacted by the Republic of Serbia, and including some enacted previously by the Federation of Serbia & Montenegro. A summary of key regulations governing waste management in Serbia are outlined below, beginning with the Laws on Waste Management and Packaging, passed on May 23, 2009. These two laws are the ones primarily driving the current situation of waste management in Serbia, and to which municipalities, waste management operators, and recyclers are now responding.

Law on Waste Management: Establishes classification of waste; waste management planning; stakeholders; obligations and liabilities; permitting procedures; trans-boundary waste movement; and reporting, financing, supervision and other aspects of waste management (Official Gazette, RS, No. 36/09). Until specific by-laws are developed, a host of previous regulations not mentioned here remain valid (these are outlined in the Strategy). The law prescribes deadlines for harmonization of operations, specifically:

- i) Companies working in the area of recycling shall register their information with SEPA by May 23, 2009; this information will be used to issue the necessary permits.
- ii) Waste generators in existing facilities that are required to obtain permits in accordance with the law, shall, by May 23, 2010, develop a facility waste management plan and action plan for harmonizing operations in accordance with the law by Dec. 31, 2015. If the facility served as temporary waste storage, the generator shall remove the stored waste within three years from the date of the law.
- iii) Operators of existing waste management facilities shall, by Nov. 23, 2009, report their operations to the permitting authority and develop an action plan to harmonize the facility by Dec. 31, 2012.
- iv) Local governments shall: conduct an inventory of undeveloped landfills that do not adhere to stipulated provisions within one year of the date of the law; develop a sanitation and re-cultivation program for illegal landfills within two years; and designate a location for constructing a waste storage, treatment or disposal facility in collaboration with one or more surrounding municipalities by May 23, 2010.
- v) Producers and importers of electrical and electronic goods shall align their electrical and electronic waste management with the law by Dec. 31, 2012.
- vi) Disposal, decontamination and removal of PCBs from PCB-containing devices shall be conducted no later than 2015, with other obligations shall be prescribed by a specific by-law.

Law on Waste Management By-Laws: Over the past several months and during the time of this assessment, a number of by-laws (20 in total) are in various phases of preparation and adoption. All are expected to be drafted and passed in 2010. Generally speaking, there will be a separate by-law for each type of waste, as well as by-laws related to reporting, monitoring, polluter cadastres, recycler registration, and other administrative areas. With respect to specific waste streams, by-laws have been adopted or are being prepared for tires, batteries, PCB, electronic, fluorescent, used oils and other types of wastes.

Law on Packaging & Packaging Waste: Establishes packaging requirements for allowed sale of products, packaging waste management, reporting, economic instruments, and other issues related to packaging and packaging waste (Official Gazette, RS, No. 36/09). The law regulates imported packaging; packaging waste generated in Serbia, regardless of its origin or purpose; and used packaging material. The law prescribes deadlines of 12-18 months for the period of harmonization:

- i) Producers, importers, packaging/bottling plants and delivery companies in terms of organizing packaging waste and providing of space for collection, sorting and temporary storage; concluding an agreement with the municipal and non-municipal waste operator, or obtaining of permit to independently manage packaging waste;

establishing packaging waste management; labeling marketed packaging with information on the possibility to leave packaging waste immediately at the point of purchase or return it later free-of-charge.

- ii) End users who import or purchase packaging or raw materials for production of packaging for the purpose of their own businesses, including those who do not cooperate with a supplier; these must provide adequate management of non-municipal packaging waste by way of concluding an agreement with an operator or relying on their own resources to re-use, recycle or dispose of packaging waste.
- iii) Postponement of law enforcement is stipulated for: producers and importers of packaging who align their operations with respect to labeling of packaging within twelve months from the date of the law; and packaging which was produced prior to the day the law came into force, is not compliant with basic prerequisites for marketing, and which may be on the market no longer than two years from the day the law came into force.

Law on Environmental Protection, 2004, 2009: Broad law establishing the Environmental Protection Agency and the system of environmental protection (Official Gazette of the Republic of Serbia”, no. 135/04 and 36/09). The law outlines conditions and instruments for sustainable management and preservation of natural resources; biological diversity and quality of environment; prevention, control, reduction and sanitation of all forms of pollution; promotion and utilization of products, processes, technologies and practices that have less harmful effects on environment; codes of conduct in waste management from generation to disposal (prevention, reduction, reuse, separation and recycling, and waste-to-energy); waste import, export and transit; action planning; and awareness-raising, access to information and public participation in decision-making processes. Several by-laws have been passed, with separate by-laws planned for individual categories of waste; those passed include:

- i) By-Law for Entities Specialized in Waste Examination (Official Gazette, Republic of Serbia, No. 53/06);
- ii) By-Law on Waste Oil Management (Official Gazette, Republic of Serbia, No. 60/08);
- iii) By-Law on Methods & Procedures of Asbestos-Containing Waste (Official Gazette, Republic of Serbia, No. 60/08).

Law on Integrated Pollution Prevention & Control: Establishes procedures for issuing integrated operating permits for plants and activities that may have a negative impact on human health, environment, resources or other relevant aspect of the environment (Official Gazette, RS, No. 135/04, 108/08). No integrated permit has yet been issued in Serbia; application periods for specific industries are as follows:

- i) Mineral Industry: 12/2009-9/2010;
- ii) Food, Animal Waste, Waste Management Facilities, Swine & Poultry, Wood & Paper, Leather Industries: 10/2010-9/2011. Specifically, related to waste management includes operators in charge of animal carcasses and other animal waste disposal in a recycling facility with capacity greater than 10 ton/day (10/2010-3/2011).
- iii) Metal Industry: 10/2011-3/2010.
- iv) Chemical Industry: 4/2012-12/2012.
- v) Waste Management, Energy: 1/2013-12/2013. Specifically, related to waste management, includes operators in charge of waste management, disposal or reuse of hazardous waste in a facility with capacity greater than 10 ton/day, municipal waste incineration facilities with capacity greater than 3 ton/day, non-hazardous waste storing facilities with capacity greater than 50 ton/day and landfills storing more than 10 ton/day or with an overall capacity exceeding 25,000 tons (excluding inert waste landfills).
- vi) Mineral Industry, Asbestos Products: 1/2014-3/2014.

Law on Strategic Environmental Impact Assessment, 2004: Sets forth relations between environmental protection policy and other policies (Official Gazette, RS, No. 135/04). Law outlines planning and programming in physical and urban planning, land utilization, agriculture, industry, water, waste, tourism, natural habitat, and a framework for adopting development projects. Furthermore, it regulates procedures for environmental impact assessments, reporting and verification and public engagement. The law conforms to the corresponding EU Directive.

Law on Environmental Impact Assessment, 2004, 2009: Establishes procedures for assessing environmental impacts of certain projects carried out by public and/or private enterprises, permit procedures for developing or reconstructing buildings, technology changes, discontinuation of projects with adverse environmental impact, and public participation (Official Gazette, RS, No. 135/04, 36/09).

Law on Conformity with Basel Convention on Trans-boundary Movement and Disposal of Hazardous Waste, 1999: Internationally aligns mechanisms and instruments for the control of trans-boundary movement of hazardous waste (Official Gazette of the Federal Republic of Yugoslavia, International Conventions, No. 2/99).

EU Waste Management Policy & Legislation

Strategy & Policy: This Thematic EU Strategy on Waste aims to prevent waste generation and reuse waste as resource for new materials and energy. The strategy instructs that markets must facilitate recycling, high standards must be set, regulatory frameworks must be modernized, life-cycle analysis in management policy must be conducted, and waste legislation must be simplified and clarified. Governing principles require that all activities are planned and implemented so as to cause the least impact on the environment, human health, spatial overload, and raw material and energy consumption in all production, construction, distribution, and consumption processes.

Waste Management Principles: Several relevant waste management principles are common to all EU directives:

- **Prevention:** Preserve nature and natural resources by reducing waste.
- **Precaution:** Reduce impact of waste on environment and human health; reduce use of hazardous materials.
- **Polluter Pays:** Require waste generators and environmental polluters to bear the costs and responsibilities for their actions.
- **Vicinity:** Provide infrastructure for waste collection, treatment and disposal based on the vicinity and responsibility for one's own waste.

Regulatory, Planning Goals & Measures: Source reduction, reuse and recycling are key goals of EU regulations and planning. Between EU countries, however, there is a significant difference in results: waste recycling ranges from 10-65%, landfill disposal ranges from 10-90%. The EU Policy on Waste outlines measures including: cleaner production & technology; public awareness campaigns; waste treatment; content reduction of hazardous materials in products; economic instruments; product life-cycle analysis; and eco-labeling schemes.

Directive on Waste: The EU General Directive on Waste (2008/98/EC) supersedes and amends General Directive 75/442/EEC, and establishes a system for coordinated waste management in the EU aimed at restricting waste production. Under the Directive member states are obliged to develop a waste management plan; the directive contains the following new requirements and revisions:

- i) New definitions for bio-waste, waste oil, dealer, collection, sorted collection, treatment, best available techniques and other terms.
- ii) Recycling and utilization goals remain unchanged: 50% of total collected municipal waste and 70% of remaining non-hazardous waste by 2020.
- iii) Waste utilization for the purpose of generating energy is included in annex.
- iv) Adherence to the principle of hierarchy in waste management is applied: reduce, reuse, recycle, recover, dispose.
- v) Acceptable disposal methods are stipulated.
- vi) Minimum standards for different methods of waste treatment are specified.

Directive on Landfills: The General Directive on Landfills (99/31/EC) aims to introduce strict technical requirements that reduce negative impact of waste disposal on the environment, especially land, underground and aboveground waterways, and human health. The directive defines different waste categories and landfill classes (hazardous, non-hazardous and inert); mandates treatment before disposal; bans landfill disposal of liquid waste, flammable or highly flammable waste, explosive waste, contagious medical waste, old tires, and other specified waste; prescribes reduction of biodegradable waste disposal; and establishes a system for landfill licensing. The directive aims to set standards for reduction of air, water and land pollution originating from waste incineration or co-incineration, in order to reduce adverse impact to human health. The directive supersedes the Directive on Reduction of Air Pollution from Existing Municipal Waste Incineration Facilities (84/429/EC); Directive on Reduction of Air Pollution from New Municipal Waste Incineration Facilities (89/369/EC); and Directive on Hazardous Waste Incineration (94/67/EC).



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Annex 1: Actors Interviewed

Sector/Actors	Number	Actors Interviewed
Serbian Government	5	<ul style="list-style-type: none"> • MESP Advisor to Minister (former Agency for Recycling) • Serbia Environmental Protection Agency (SEPA) • Republic of Serbia Environmental Protection Fund (Eco-Fund) • MESP Program Management Unit (PMU) • Serbia Chamber of Commerce
National Private Sector	5	<ul style="list-style-type: none"> • Seko-Pak • Recycling Backyards Concept • Serbia Plastic Recycling Association • KOMDEL (Association of JKPs) and consulting group partner TTI • Zoran Cvijanovic
Donor Initiatives	10	<ul style="list-style-type: none"> • IFC Recycling Linkages Project • IFC Integrated Solid Waste Management Project • USAID MEGA Project • USAID Plastic Recycling Project, Macedonia • Swedish International Development Agency (SIDA) • GTZ Strengthening of Local Self-Government Project • GTZ Modernization of Communal Services Project • Swiss Development Cooperation (SDC) • Delegation of the European Union to the Republic of Serbia (formerly EC) • UNDP
JKPs & Municipalities	15	<ul style="list-style-type: none"> • JKP & Municipality Cacak • JKP Kragujevac • JKP Indjija • JKP Krusevac • JKP & Municipality Krusevac • Municipality Nis • JKP Kraljevo • JKP & Municipality Raska • JKP Zitoradja • JKP Blace • Municipality Ivanjica • JKP & Municipality Priboj • JKP Nova Varos • JKP & Municipality Tutin
Strategic Waste Management Partners (PPP)	2	<ul style="list-style-type: none"> • Porr – Werner & Weber • ASA International Environmental Services
Collectors	8	<ul style="list-style-type: none"> • Brdja, Trstenik • Pima, Cacak • Kalimero Komerc, Krusevac • Novak, Prijepolje • Milovanovic, Ivanjica • Kandic, Kraljevo • D.A.S., Pancevo • Eurosparta, Krusevac
Plastic	11	<ul style="list-style-type: none"> • Greentech, Novi Sad • Brzanplast, Batocina • Intercord, Subotica • Deni Komerc, Nis • Saniplast, Gorni Milanovac • Nives, Nis • Nikolo, Krusevac • Vlada-Pak, Blace • Interprodukt, Nova Varos • Nima, Krusevac • Maxi-Plast, Krusevac
Paper	5	<ul style="list-style-type: none"> • Umka, Belgrade • M-Pak, Krusevac • Umka, Nis • Urvis, Prokuplje • Papirus, Krusevac
Glass	2	<ul style="list-style-type: none"> • Serbian Glass Factory, Paracin • Serbian Recycling Factory, Aleksinac
Metal	2	<ul style="list-style-type: none"> • Jugo Impex, Nis • Vet Prom, Krusevac
Electronic Waste & Batteries	2	<ul style="list-style-type: none"> • BiS IT Recycling Center, Pancevo • Galenit Cluster (Farma Kom), Belgrade & Sombor
Wood	4	<ul style="list-style-type: none"> • Dorado, Kragujevac • Marinkovic Mill, Raska • Grozd, Ivanjica • Brest Parket, Ivanjica
Construction Waste	2	<ul style="list-style-type: none"> • Susa Demolition Company, Novi Sad • Stevanovic Invest, Krusevac
Cement Industry & Tires	3	<ul style="list-style-type: none"> • Ecorec (Holcim), Paracin • Lafarge BFC Cement Company, Beocin • Auto Mirko, Prokuplje
Waste Oil	1	<ul style="list-style-type: none"> • Bio King, Nis
Total	77	

Annex 2: Municipal Collection Programs Summary

Municipality	Materials	Collection	Sorting/Separation	Markets/Buyers
Cacak	<ul style="list-style-type: none"> Plastic (all types) Paper (all, including Tetra Pak) Metal Tires Glass Compost 	<ul style="list-style-type: none"> Wet-dry model; dry waste collection bag system. 32 ton/month useful dry collected; detailed records maintained all materials. JKP & municipality manage and finance collection. Participating citizens exempt from future landfill fees. Pilot agreement with Seko-Pak to support non-profitable aspects of collection. 	<ul style="list-style-type: none"> Municipal-owned "Waste Management Incubator" with five-year, rent-free agreements for private partners. Local private partners: Pima (non-metal), Scholz (metal). Pima-managed sorting line. JKP Javna Zelenila manages pilot compost operation. Secondary separation facility planned at Duboko landfill. 	<ul style="list-style-type: none"> Various buyers for different materials; private operators manage all sales and transactions. "Symbolic" fee paid to JKP based on quantities of materials.
Kragujevac	<ul style="list-style-type: none"> Plastic (PET, PP) Paper 	<ul style="list-style-type: none"> 2009: >100 tons plastic. Began with USAID assistance. 200 wire containers; 200 large canvas "bags." Stable management (no political influence). Suburbs served (no villages). Public awareness campaigns. 	<ul style="list-style-type: none"> PP caps separated from PET bottles; PET sorted by color and baled. Temporary workers through a Republic-financed social employment program (subsidy). 	<ul style="list-style-type: none"> PET: Saniplast, 12 RSD/kg clear; 8 colored. PP: Various small plastic producers, 12 RSD/kg
Indjija	<ul style="list-style-type: none"> Plastic (mainly PET, LDPE) Paper Electronic Waste Tires (planned) Glass (none) 	<ul style="list-style-type: none"> 2009: 100 tons PET. Paper: 200-240 tons/year. Bag collection for households. Business obligated to buy two 140L containers. Public containers. Bag collection in 11 villages. Bag system nearly prohibitively expensive. 	<ul style="list-style-type: none"> PET pressed and baled together with PP caps. Sorting facility located 10 km from city. Umka provided press for cardboard. 	<ul style="list-style-type: none"> Paper: Umka. PET: Probably Greentech, but not positive.
Krusevac	<ul style="list-style-type: none"> Plastic (mixed) Paper/Cardboard Glass 	<ul style="list-style-type: none"> 2008: 50 tons total Plastic: 750 kg/month. Started in 2006; USAID supported expansion. JKP management changes with political party. Wire containers with few (early) closed containers. Expanded to several villages. 	<ul style="list-style-type: none"> PET pressed and baled together with PP caps. Five workers collection and processing. "Recycling Center" likely planned for future. 	<ul style="list-style-type: none"> PET: Saniplast, €150/ton, 2008. Paper: Umka, 4.8 RSD/kg, 2008; currently YuKarton in Nis.
Nis	<ul style="list-style-type: none"> PET Metal 	<ul style="list-style-type: none"> PET: 8 tons/month Preparing for PPP. 250 PET containers, plan to add 50. Plan to add 50 metal containers. Municipality buys scrap metal from local industry. Planning recycling yard and "islands." 	<ul style="list-style-type: none"> PP caps separated from PET bottles; PET sorted by color and baled. PET, sorted by color, pressed and baled. 	<ul style="list-style-type: none"> PET & PP: Greentech.
Kraljevo	<ul style="list-style-type: none"> Plastic (mixed) 	<ul style="list-style-type: none"> 3 tons PET since 2008. Began in cooperation with Ministry of Economy & Regional Development, Ministry of Tourism. 50 containers. Concede paper collection to Roma and private collectors. 	<ul style="list-style-type: none"> PP caps separated from PET bottles; PET sorted by color and baled. 55 temporary workers under "Eko Brigad" social employment program. 	<ul style="list-style-type: none"> PET: €85/ton PP caps: €150/ton
Raska	<ul style="list-style-type: none"> PET Paper (started and later stopped) 	<ul style="list-style-type: none"> PET: 1.0-1.5 tons/month. Paper: 15 tons before stopping. Wire containers with canvas liners added later. Began with USAID donation of 60 wire containers & press. Good example of collection efficiency and source separation. 3-4 nearby villages served. 	<ul style="list-style-type: none"> Pressing, baling & accumulating PET. 	<ul style="list-style-type: none"> Until time of interview had only stockpiled material.
Zitoradja	<ul style="list-style-type: none"> PET LDPE Cardboard 	<ul style="list-style-type: none"> PET: 1 tons/month. Cardboard: 3 tons/month. Began with USAID assistance. 120 wire containers (50 from USAID). Villages served. Good source separation. 	<ul style="list-style-type: none"> PET pressed and baled together with PP caps. 	<ul style="list-style-type: none"> PET: Greentech, 16 RSD/kg, 2008. Paper: Umka, 3 RSD/kg, 2008.
Blace	<ul style="list-style-type: none"> Plastic (mixed) Cardboard 	<ul style="list-style-type: none"> Plastic: 750 kg/month. Began with USAID assistance. 70 wire containers (50 from USAID). Media campaign. Good participation and source separation. Villages served. 	<ul style="list-style-type: none"> PET pressed and baled together with PP caps. 	<ul style="list-style-type: none"> Plastic: Greentech.
Ivanjica	<ul style="list-style-type: none"> No current activities. 	<ul style="list-style-type: none"> Received USAID donation, started, then later stopped activity. Closed containers. Private communal collector, wire containers. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A
Priboj	<ul style="list-style-type: none"> No current activities. 	<ul style="list-style-type: none"> Received USAID donation, started, then later stopped activity. 5m³ compartmentalized containers. Collected 20 tons before stopping. Private communal collector, wire containers. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> All collected materials sold to Novak, €1000 total.
Nova Varos	<ul style="list-style-type: none"> No current activities. 	<ul style="list-style-type: none"> Received USAID donation; not utilized at time of interview. 20 5m³ compartmentalized containers. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A
Tutin	<ul style="list-style-type: none"> No current activities. 	<ul style="list-style-type: none"> Received USAID donation of 50 containers and press; not utilized at time of interview. Privatized (contracted) JKP. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A

Annex 3: Regional Waste Management Plans

Regional Waste Management Plans National Waste Management Strategy (June 20, 2009), with input from this assessment			
Municipalities	Regional Plan Summary	Municipalities	Regional Plan Summary
Sombor, Apatin, Kula, Odžaci, Bač	Regional landfill constructed 11 km from Sombor, at location of Rančevo.	Zaječar, Bor, Negotin, Majdanpek, Kladovo, Boljevac, Sokobanja, Knjaževac	Regional landfill in Zaječar, location of Halovo, 11 km east of Zaječar. Area: 15.5 ha. Strategic partner being sought.
Subotica, Bačka Topola, Čoka, Kanjiža, Mali Idoš	Inter-municipal agreement signed. Micro-location decision made, to be adopted at Assembly. IFC assisted process. Regional enterprise for waste management established, "Regionalna Deponija" d.o.o. Subotica.	Užice, Bajina Bašta, Požega, Arilje, Ivanjica, Čajetina, Kosjerić, Čačak, Lučani	Inter-municipal agreement signed. Landfill location of Duboko. Area = 15 ha. Eight transfer stations stipulated. Italian partner. EBRD finance secondary sorting facility.
Kikinda, Ada	Inter-municipal agreement signed. Strategic partner chosen (ASA); construction of first phase of sanitary landfill is finalized. Landfill is not currently considered "regional."	Priboj, Prijepolje, Nova Varoš, Sjenica	Inter-municipal agreement signed. Landfill has been constructed on territory of Nova Varos.
Pančevo, Opovo	Inter-municipal agreement signed in 2008. Landfill located on route to Dolovo, 12 km from Pančevo. Large capacity.	Novi Pazar, Raška, Tutin	New regional landfill to be located between Novi Pazar and Raška; tender for selection of strategic waste management expected to be announced.
Vršac, Bela Crkva, Alibunar, Plandište	Agreement on Joint Performance in Municipal Waste Management signed.	Prokuplje, Žitorađa, Kuršumlija, Blace	Landfill in Utrina, territory of Prokuplje. Sources indicate that this project may have been closed due to public opposition.
Inđija, Irig, Ruma, Sremski Karlovci, Pećinci, Šid, Stara Pazova	Agreement to locate regional landfill on 35 ha in Inđija signed.	Pirot, Dimitrovgrad, Bela Palanka, Babušnica	Construction works initiated in Muntina Padina, northwest of Pirot. Area = 15 ha.
Novi Sad, Bačka Palanka, Bački Petrovac, Beočin, Žabalj, Srbobran, Temerin, Vrbas	Inter-municipal agreement on waste management in procedure of signing.	Leskovac, Lebane, Bojnik, Medveđa, Vlasotince, Crna Trava, Vladičin Han	Agreement with strategic waste management partner signed for construction of landfill, sorting facility, composting center, and five transfer stations. Landfill location in Željkovac, 5-10 km south of Leskovac.
Zrenjanin, Sečanj, Kovačica, Titel	Landfill technical design underway. Location is near old landfill site in Zrenjanin.	Vinča, for 12 Belgrade municipalities	Landfill in Vinča needs rehabilitation and expansion. Selection of strategic waste management partner expected (maybe Brantner).
Sremska Mitrovica, Šabac	Agreement on construction of regional landfill signed. Plan for detailed regulation and main design underway.	Nis region, Doljevac	Initiative begun for establishing waste management region.
Lapovo, Velika Plana, Rača, Batočina, Svilajnac, Despotovac	Strategic waste management partner (ASA). Plan for detailed regulation and environmental impact assessment underway.	Jagodina, Cuprija, Paracin, Novi Becej	Landfill constructed (not yet regional but some municipalities may join). Strategic waste management partner (PWW). Paracin tendering collection.
Vranje, Preševo, Bujanovac, Trgovište and Surdulica	First sanitary landfill in Vranje (not regional). Transfer stations in Presevo & Bujanovac. May become regional after constructing sorting facility and expanding landfill. Landfill is 50% full with remaining life 5-10 years.	Aleksinac	Strategic waste management partner (PWW).
Smederevo, Požarevac, Kovin	Currently selecting strategic waste management partner.	Veliko Gradiste	Strategic waste management partner (Spajder).
Valjevo, Osečina, Lajkovac, Mionica, Ub, Ljig, Vladimirci, Obrenovac, Barajevo, Lazarevac, Koceljeva	Inter-municipal agreement signed. Selected landfill location at Kalenić, between Lajkovac and Ub, Area: 100 ha. Tender for selection of strategic partner under preparation. Expect IPA funding.		

Annex 4: Plastic Processors & Recyclers

Plastic Processors & Recyclers Comparison Summary				
Company, Municipality	Materials	Quantities	Collection	Production
Greentech, Novi Sad	<ul style="list-style-type: none"> PET 	<ul style="list-style-type: none"> Serbia 300 ton/month input; 250 ton/month finished product. Greenfiber Group: 5000 ton/month, 4000-4500 for Polyester Staple Fiber. Possible future investment in PE and PP lines in Serbia. 	<ul style="list-style-type: none"> 70% of all PET in Serbia passes through Greentech. Supply contracts & cooperation with all large operators. 100 containers in New Belgrade. 	<ul style="list-style-type: none"> Serbia: PET flake. Polyester Staple Fiber. Strapping band.
Brzanplast, Batocina	<ul style="list-style-type: none"> All plastic, sorted, cleaned, granulated LDPE folio 	<ul style="list-style-type: none"> 2007: 3000 tons. 2008: 5000 tons. 2009: 3000 tons. 	<ul style="list-style-type: none"> Private-sector collectors, some municipalities. Operate sorting line for all inputs. Four main suppliers 50%: Intercord, Saniplast, Pima, Nives. 	<ul style="list-style-type: none"> LDPE folio. Granulate.
Intercord, Subotica	<ul style="list-style-type: none"> PET PE PP Non-Plastics 	<ul style="list-style-type: none"> 2009: 1000 tons plastic. 	<ul style="list-style-type: none"> Commercial & industrial clients. Subotica JKP. 40% collection ultimately provided by Roma (secondary sorting at landfill). 	<ul style="list-style-type: none"> Granulates: PET, PE, PP
Deni Komerc, Nis	<ul style="list-style-type: none"> PET Biodegradable & recycled LDPE PP 	<ul style="list-style-type: none"> PET: 600 kg/hour, 4000-5000 ton/year minimum. Current demand: 200-400 ton/month. 	<ul style="list-style-type: none"> Municipalities & JKPs. 	<ul style="list-style-type: none"> PET: flake, film, bottle-to-bottle. LDPE folio.
Saniplast, Gorni Milanovac	<ul style="list-style-type: none"> PET 	<ul style="list-style-type: none"> 50-60 ton/month. 	<ul style="list-style-type: none"> Municipalities & JKPs. 40 containers in Belgrade. 	<ul style="list-style-type: none"> Pet flake.
Nives, Nis	<ul style="list-style-type: none"> LDPE, LLDPE, HDPE PP PS 	<ul style="list-style-type: none"> 100 ton/month washing & processing. 1000 ton/month distribution. 	<ul style="list-style-type: none"> Granulators & processors. Collectors. 	<ul style="list-style-type: none"> LDPE folio. Hose & piping.
Nikolo, Krusevac	<ul style="list-style-type: none"> LDPE, HDPE PP 	<ul style="list-style-type: none"> 8 ton/month secondary material inputs. 	<ul style="list-style-type: none"> Commercial & industrial waste. 	<ul style="list-style-type: none"> Granulation & manufacture.
Vlada-Pak Beloljin, Blace	<ul style="list-style-type: none"> LDPE, HDPE PP PS, PVC, PA 	<ul style="list-style-type: none"> 10 ton/month average Recycles 50% into new products & sells 50%. 	<ul style="list-style-type: none"> 60% commercial & industrial waste. 30% individual collection. 10% production excess. 	<ul style="list-style-type: none"> Consumer, industrial & agricultural plastic products.
Nima, Krusevac	<ul style="list-style-type: none"> LDPE 	<ul style="list-style-type: none"> 7-8 tons/year, seasonal. 	<ul style="list-style-type: none"> Agricultural producers. 	<ul style="list-style-type: none"> Folio products for agricultural purposes.
Interprodukt, Nova Varos	<ul style="list-style-type: none"> LDPE, HDPE PP & other plastics 	<ul style="list-style-type: none"> 350 ton/year total plastic. 250 ton/year recycled. 	<ul style="list-style-type: none"> Commercial, industrial and agricultural waste. Individual collectors (small). 	<ul style="list-style-type: none"> Bus seats. Consumer & industrial products.
Maxi-Plast, Pepeljevac	<ul style="list-style-type: none"> HDPE PP (small) 	<ul style="list-style-type: none"> 2007: 47.2 tons. <10% recycled. 	<ul style="list-style-type: none"> Opportunity buying. 	<ul style="list-style-type: none"> Injection-molded containers.