

Smarter Stoves

Partnership

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Stove change-out waste analysis

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Prologue

“Even though we have a new stove in the new house, I still bake bread in this one, as I have done for 50 years now, and that bread is always good”

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DEFINITIONS USED IN THE DOCUMENT

- Smederevac – a common name used for all stoves or furnaces burning wood or coal in general, while the real one bearing that renown name is produced by the factory in Smederevo, Serbia
- Heating devices/heating and cooking devices/wooden stoves/ - all the names for the solid fuel stove that is in the focus of this analysis
- Chamotte—also known as 'grog', 'firesand' or “fireclay” — is calcined clay containing a high proportion of alumina (its composition is usually characterized by a proportion of 40% minimum alumina, 30% minimum silica, 4% maximum iron (III) oxide, up to 2% calcium oxide and magnesium oxide combined). It is produced by firing selected fire clays in a rotary kiln to temperatures between 1,400°C and 1,600°C, before grinding and screening to specific particle sizes. Among many other uses, it is also used to create fire-resistant chamotte type bricks and mortar for construction of fireplaces, old-style stoves and industrial furnaces, and as component of high temperature application sealants and adhesives.
- Circular Economy - Circular economy stands for a renewable industrial economy that offers a changed concept of production and consumption in terms of design, use of resources and approach to waste generation. In a circular economy, there is no waste as a concept: there are only raw materials that can be recycled for identical or different production processes. ZERO WASTE is a kind of circular economy philosophy. In support of this, the circular economy concept means prioritizing renewable energy sources, efficient use of energy, and encourages innovative technologies, green public procurement and replacement of hazardous chemicals with the less hazardous ones. In this way, the habits of consumers are also inevitably changing.
- EPR (Extended producer responsibility) – a policy approach under which producers are given a significant financial and/or organizational responsibility for the treatment or disposal of post-consumer packaging or specific waste streams
- Waste collection means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment plant;
- Waste collector means a natural person or a legal entity that collects waste in Serbia; in WB6 three kinds of waste collectors operate on the markets: C&I Waste Collectors (private entities collecting different waste streams), Utility Companies (public or private entities responsible for

household collection of waste), and last, but not the least at all, the informal sector (IWC-informal waste collectors) - mainly Roma nationality natural persons or business entities.

- Waste collection centre means a place designated by the decision of a municipality, city, or the City of Belgrade (hereinafter: the local self-government unit), to which the citizens take waste and bulky waste (furniture and household appliances, including disused household heating stoves, garden waste, recyclable waste, including hazardous household waste);
- Waste disposal site means a site for the final depositing of waste on or below the surface of the land (i.e. underground), including internal disposal sites (a landfill where a producer of waste disposes its own waste at the place of production), permanent sites (over one year) that are used for the temporary storage of waste, excluding storages where waste is unloaded to be prepared for further transportation to the location for treatment, i.e. recovery, or disposal on other locations, and storage of waste prior to treatment, i.e. recovery, up to three years, or storage of waste prior to disposal up to one year);
- Illegal waste disposal site means a location, public surface, which contains different types of waste disposed in an uncontrolled manner, which do not meet the conditions determined with the regulation governing waste disposal on waste disposal sites;
- Permit/license means an authorisation given by a competent authority to a legal entity or entrepreneur to have the waste collected, transported, imported, exported, or transited, stored, treated or recovered or disposed, determining conditions for waste to be handled in a manner that ensured the least possible risk to human health and the environment;
- Waste holder means a waste producer, natural person or legal entity in possession of waste;
- Characterization of waste means a testing procedure which shall be applied to determine physical-chemical, chemical and biological properties and composition of waste, i.e., to determine if waste contains one or more hazardous characteristics;
- Classification of waste means a procedure which shall be applied to classify waste to one or more waste lists, as prescribed by a specific regulation, according to origins of waste, its composition and further use;
- Municipal waste means household waste, as well as other waste which is, in its nature or composition, similar to household waste;

- Waste disposal means any operation other than waste recovery, even when a substance or energy is produced as a secondary effect of such an operation (D list is a non-exhaustive list of disposal operations);
- Organized waste market means a functional framework that enables efficient, sustainable and transparent trade in waste and secondary raw materials;
- Waste means any substance or object which the holder discards, intends to or is required to discard;
- Special waste streams mean movements of waste (used batteries and accumulators, waste oil, waste tires, electric and electronic waste, old vehicles and other waste) from its source, via collection, transport and treatment, to landfilling
- Waste producer means any entity whose activities produce waste (source waste producer) or any entity that carries out pre-processing, mixing or other operations resulting in a change in the composition or nature of waste;
- Product producer/manufacturer means a legal entity or entrepreneur who, within their business activity, makes, produces, or sells a product, regardless of the sale method, including distance selling, or imports a product in the WB6, and places a product on the WB6 market;
- Waste management region means a spatial area which includes several adjacent local self-government units which, in accordance with the agreement entered into between those local self-government units, jointly manage waste in order to establish a sustainable waste management system;
- Recycling means any recovery operation by which waste is reprocessed into a product, materials or substances, whether for the original or other purposes, including re-production of organic materials, except for the recovery for energy purposes and reprocessing into materials that are to be used as fuel or for backfilling operations;
- Secondary raw material means waste which may be used for recycling to obtain raw materials for the production of the same or other product (paper, cardboard, metal, glass, plastic, etc.);
- Storing of waste means temporary maintenance of waste at the location of a waste producer or owner and/or other holder, as well as operator's activity in a facility equipped and registered for temporary waste storage

- Transport of waste means transport of waste outside the facility, which includes loading, transport (as well as re-loading) and unloading of waste;
- Waste treatment means recovery or disposal operations, including preparation prior to recovery or disposal;
- Waste management means the implementation of measures prescribed for the handling of waste as part of the collection, transport, storage, treatment or recovery and disposal of waste, including the supervision of such activities and after-care of waste management facilities upon their closure and activities undertaken by dealer and broker;
- Waste owner means a waste producer, an entity participating in waste circulation as a direct or indirect waste holder, or a legal entity, entrepreneur, or natural person in possession of waste.

I INTRODUCTION

1. The context and the scope of the analysis

This paper analyses the number of households that are replacing their disused household heating stoves each year with new ones, regardless whether they are purchasing new stove of the identical type, or a new, better stove in terms of the emissions harmful for the environment and human health in general. Main lead is to calculate the potential households capable and willing of taking the future envisaged incentive and changing out from old solid fuel stoves to newer ones, with better performance and less effect on the air we breathe, and to understand the potential tonnage of waste produced in the process on yearly basis and ways of treating it. Managing the waste generated in the course of the project in a responsible manner with the least possible effects on the environment and the greatest efficiency in closing the loop, are the parts of the analysis.

The research started out from the packaging unwrapped from the new installed stove, over sorting the disused household heating stove at home and taking out the heavy part of chamotte from them, to the transport to a sorting / collection / recycling facility, and selling the stove to the scrap dealers in charge of taking-over certificates for the users. The analysis also includes the final administration management of the overall process waste collected and probably recycled in time.

Stove replacement and general air pollution improvement and environment protection areas represent some of the major challenges worldwide, particularly for the developing countries such as WB6. Even though WB6 are in the gradual process of slow improvement in some of the environment protection aspects, the whole approach to building the strong protected system requires significant movements towards changes. The proof for this lies in the state the whole system and waste collection generally is in the region and the prevailing method of waste disposal to sanitary and /or illegal dumpsites.

The analysis shall provide look at the waste in the framework of a circular economy concept in which 6r principle is implemented, and there shall be seen that the 6r concept starts with the concept and message number 1, called the RETHINK principle. As far as it is known, people are the only species in the world today that is capable of reasoning in the first place. Therefore, it seems that the sustainability of our world starts with humans. It is only humans who are responsible for their future, there can be no one else.

The *Smarter Stove Partnership* project as a whole (including the ideal imaginary environment in which there is a completed change-out phase with its maximum effect accomplishment, i.e., all 3 million households have new, efficient and more environmentally friendly heating devices installed), also starts with people. And, there is no people without you getting involved! You are wanted for the change-out!

2. Methodological approach

With the support of other consultants in the project and using the data they collected, this analysis relied on self-desk-research, mainly direct communication with main stakeholders in the field, e-mail communication with distant ones, (e.g., the US state of Idaho, whose Environmental Agency personnel was kind enough to share insights from their stoves replacement project), and the data available in the English language and local languages. This all including but not limited to:

- EU Environmental Agency reports and statistics
- SEPA - Serbian Environmental Agency reports and statistics
- KOMDEL – Public Utility Companies Association collection costs methodology
- IEA reports and statistics
- World Bank statistics
- EUROSTAT
- Survey on Income and Living Conditions (SILC)
- Household Budgetary Survey (HBS)
- National Census
- Interviews with key stakeholders in the field
- Other project consultants' reports

II REVIEW OF THE CURRENT WASTE MANAGEMENT SYSTEM FOR HEATING DEVICES IN WESTERN BALKANS

1. Overview of legislation in the area of end of life for heating devices

European Union

In June 2018, the European Union published four amending Directives that constitute the European Circular Economy Package (CEP). The European CEP's intent is to ensure the European Union's transition to a circular economy. In order to achieve that, the CEP imposes several ambitious targets:

- ✓ 55% of municipal waste must be prepared for re-use and recycling by 2025, 60% by 2030, and 65% by 2035.
- ✓ The amount of municipal waste landfilled must be reduced to 10% or less of the total amount of municipal waste generated by 2035.
- ✓ As of 2030, all waste suitable for recycling or other recovery, in particular in municipal waste, must not be accepted in a landfill, except for waste for which landfilling delivers the best environmental outcome.
- ✓ The total amount of recycled packaging waste must be at 65% by 2025 and 70% by 2030.
- ✓ Specific minimum targets for recycling some materials contained in packaging waste (plastic, wood, ferrous metals, aluminium, glass, paper, and cardboard) are imposed.

When it comes to the legislation in the area of solid fuel stoves as early as of 1st January next year, the new standard for efficiency and emissions of individual space heaters are kicking-in in the European Union as provisions of the Eco-design directive governing this particular area are coming into effect. From the perspective of this directive, the vast majority of some three million devices used in the Western Balkans will become obsolete.

New EU Eco-design rules are already applied to solid fuel boilers and stoves that produce up to 500 kW heat (enough for a large home or business), since 1 January 2020, and will start to apply to solid fuel stoves that produce up to 50 kW heat from 1 January 2022. Almost 80% of the energy used in EU households is for heating and hot water. Cutting emissions from household heating improves the quality of the air we breathe, benefits our health and the environment and saves money.

In addition to standards on heating efficiency, the EU also has strict caps on emissions of particulate matter, nitrogen oxide and carbon monoxide. The rules include requirements for additional information on using and repairing boilers safely, and on suitable fuels and their emissions.

Although emissions from residential heating in the EU are on the decrease, they still represent a major source of air pollution, the EU Commission report states. More action is needed to encourage the switch to cleaner fuels and more efficient heating, even though a lot has already been done. This is due to the fact that particulate matter, benzo[a]pyrene and volatile organic compounds from burning wood and coal actually harm human health, and the EU Commission report states that as much as 400.000 and more premature deaths in the EU every year are linked to the air pollution.

WB6

The region as a whole is working hard on harmonizing the legislative practices with those of the European Union in all fields. Waste management is no exception to the rule. Thus, nearly all documents covering circular economy, environment protection and general waste represent less or more successful transpositions of EU Directives in relevant fields.

The regulatory status of general waste streams is covered through different documents. The most significant ones among them in each of the WB6 markets are the laws that govern environmental protection and integrated waste management, paving the way for the obligation to manage waste in the manner that has the lowest possible risk on the environment and the most effective manner when it comes to the costs.

The Serbian Law on Waste Management, for example, stipulates the following:

"Waste management shall be performed in a manner which shall ensure the lowest risk in terms of endangerment of human life and health and environment, by controlling and implementing measures to reduce: 1) Pollution of water, air and soil; 2) Dangers to plants and animals; 3) Risk of accidents, explosions or fire; 4) Negative effects to landscape and natural resources of special value; 5) Level of noise and odours.

Brief analysis of this, Article 3, states it all – in order to deal with the waste arising from the replacement of disused household heating stoves with new more efficient ones in a responsible manner, it must be ensured that disused household heating stoves do not have a prolonged use, that they do not appear on the secondary market after collection and that they

are replaced swiftly with no room left for the end-users to do whatever they used to do with wood stoves in the past... And, unfortunately, in the present.

2. Principles and rules of waste management

One of the principles that has to be taken into account when thinking of the waste from the disused household heating stoves is the principle of proximity and regional approach to waste management, as the principle imposed by the waste management legislation in the Western Balkans. Waste shall be treated or disposed of as near as possible to its place of origin, and/or in the region in which it was generated, in order to avoid unwanted environmental impacts of its transportation. The selection of a location for a plant for waste treatment and/or recovery and/or disposal shall depend on local conditions and circumstances, type of waste, its volume, manner of transportation and disposal, economic viability, as well as possible environmental impact. Regional waste management shall be ensured through the development and application of regional strategic plans based on the European legislation and national policy.

Another principle that has to be looked into is the principle of waste management hierarchy, which implies following the order of priorities in the waste management practice. The waste management hierarchy shall be applied as a priority order in waste prevention and management, as well as in regulations and policies for:

- Prevention;
- Preparing for re-use;
- Recycling;
- Other recovery operations (recovery for energy production, etc.);
- Disposal.

Obviously, the disposal is the least wanted management manner for to-be-replaced stoves while among those listed above, recycling is the most convenient.

In terms of these laws, the type of waste that stoves belong to is **municipal waste (or household waste / HH)** and should, therefore, be managed by Public Utility Waste management companies or private waste management companies. In addition to these waste collection practices, there are also informal sector collectors of scrap materials from the households, which are explained in detail in the chapters that follow. For this project, a somewhat different approach is proposed, depending on the users themselves and the objectives of the change-out project set by the authorities.

In the WB6, reading from the support consultants in WB6 brief overviews, there are no special fees imposed for the stove producers that resemble those existing for some other waste streams such as tires, electric and electronic waste, batteries. For these specific waste streams, the state-imposed producers' taxes – a financial instrument largely used in order to create greater awareness of the EPR for the producers and, thus, make them an active part of the final solution for the subject waste after the end of life of their products. In other words, a producer of one particular product that becomes a specific waste stream after the product is used, is no longer responsible only for the safety of its product during the use, but also for the safety of such product once it is used and becomes waste. The producer can choose to set up a scheme for the collection, sorting and recycling of such waste dependent on the tax or the type of the financial instrument imposed.

In Albania, there are quite general rules applied, without any specific details vis-à-vis stoves becoming waste:

"Criteria, based on which it is determined when iron and steel scrap ceases to be scrap iron and steel scrap where, with the transfer from the manufacturer to another holder, all the following conditions are met: a) the waste used as input for the recovery operation complies with the criteria set out in section 2 of Annex I, attached to this decision,

b) the waste used as input for the recovery operation is treated in accordance with the criteria set out in section 2 of Annex I, attached to this decision;

c) scrap iron and steel resulting from the recovery operation are in accordance with the criteria set out in section 1 of Annex I, attached to this decision;

d) the manufacturer has met the requirements in points 5 and 6 of chapter V of this decision."

The same rule applies to the aluminium, but no tin metal. And this is precisely the case in all WB6 markets.

3. Informal waste industry

Having in mind that for the disused household heating stoves there is no specific regulation in place, it is necessary to become more creative in finding the ways to circumvent the final disposal to legal or illegal dumpsites, disposal to sanitary landfills, or simple leaving the disused household heating stove to rot and die in the nature.

The whole area is having troubles with illegal dumpsites uncontrolled by authorities in charge. In Kosovo*, based on the field verification process in the 33 municipalities that reported

to Kosovo* Environmental Protection Agency, in June 2019, the total number of illegal dumpsites in these municipalities was 2246. Other regions have more or less successful control over disposing of waste, but this illegal manner of treating waste is, unfortunately, a very common approach of the citizens in the region, also due to the fact that the coverage of inhabitants by the communal waste collection (bins, containers) is nowhere greater than 70-75%, and even though Kosovo* illegal dumpsites are mentioned, there is no huge difference among the markets in the region.

What is necessary is to boost the collection of disused household heating stoves and their recycling and, accordingly, the production of new tin metal plates used for possible new stoves or any other product line from tin metal, to close the loop, so to speak and support the circular economy package to the maximum extent as a side environmental effect of the change-out.

Additionally, one also has to take into account the informal sector, mainly consisting of Roma people, who, in most parts of the Western Balkans, represent the largest collection and, thus, recycling group, even bigger than the public utility companies or private collectors when it comes to valuable waste collection. These, so called, "cherry pickers", come from the poor and vulnerable groups of people all over this region, and their way to earn a living is to cruise around communal waste containers on their bicycles and other, often very creative means of transport and select recyclable materials, regardless of whether the communal waste bins are set up for general or recyclable communal waste.



Picture 1 and 2. Vehicles for waste collection

In many cases, "cherry pickers" visit packaging waste bins set up in many towns right before the truck for separate collections come their way, and they cherry-pick all the valuable packaging. Sad fact is that, eventually, the packaging waste mainly finds its way to the communal waste company, but this time it has to pay for the recyclables they provided the bins and transport for. It is a certain paradox that was successfully arranged only in the city of Niš in the South of Serbia, where the PUC general manager arranged a sort of a contract with individual

natural person, the leader of Roma community that happen to have his and their residence area right next to the gate of the PUC, and this Roma community practically worked for the PUC on packaging waste instead of engaging PUC's legal employees.

For one example, the Kosovo* situation that was reported by Kosovo* supporting NGO to the *Smarter Stoves Partnership* project is the following:

"Kosovo* has a significant informal waste industry spanning across the country. The majority of actors engaged in this industry are individual "informal waste collectors" (IWCs), composed almost exclusively of members of the most vulnerable communities. These individuals work in harsh and hazardous conditions for poor compensation; they collect waste deemed valuable from various sites, and transport it to local private companies to sell it. These typically small-to-medium sized companies, who are usually – but not always - licensed by MESP to engage in waste management operations, usually sell these recyclable materials to larger companies abroad. This in fact constitutes a huge part of the export market of Kosovo*. There is no central public recycling system in Kosovo*; the country is reliant on private companies, civil society organizations and, most crucially, IWCs to fill this gap".

For another example, Albanian situation is somewhat similar, if not the same:

"In Albania, Roma people play an important informal role in collecting plastic, scrap, and other types of waste and they sell it. Meanwhile we try to separate waste but this scheme is not successful, as the people throw the waste in the same bins, they do not separate it in their households. We have, as well companies that works with municipalities to collect and transport the waste. As for example in Tirana, there is operating http://www.eco-tirana.al/?page_id=5618&lang=sq Eco Tirana, as a sole recycler, a private company".

Even though one may believe that, when it comes to waste in WB6, it is possible to rely on this system for the collection, transport and probable recycling of disused heating stoves for this project purposes. Many operators in the legal market rely on this "system" (informal sector in which Roma and poor people are mainly operating), even if it is in the so-called grey zone of operations and the fact it operates in parallel with the formal system largely supported by the public utility companies and private waste collectors, However, recommendation is to follow the formal system waste collection and recycling streams.

Another proposal is to go even further and consider establishing an alternative system as a one-time system for this project solely, simply because too many loose ends exist in the current

waste collection for heating devices and it might be impossible to close the loop and treat the disused heating stove waste in a responsible manner respecting the circular economy principles.

III REVIEW OF THE CURRENT WASTE STATUS FROM HEATING DEVICES MANAGEMENT SYSTEM

1. Waste disposal

Before entering into this part of the analysis, it is surely a place to state that when this topic was discussed with numerous scrap metal dealers, one thing they mentioned that they hold in common is the following: "Smederevac? Oh, yes, we do get one, every now and then!" What can be concluded is that old solid fuel stoves are becoming scrap metal only when all other usage forms are out of question and there is no other creative way for its prolonged and repeated use. In Šumadija area in central Serbia, as well as in many rural parts of all six Western Balkan markets researched, the solid fuel disused household heating stoves are used for many purposes, other than those they were originally meant for – to heat and to prepare food.



Picture 3. Scrap metal collection centre (there is one visible solid fuel stove in the whole yard)

Many of interviewed dwellers used their stove for more than 3, 4 or even 5 and 6 decades, and once they purchased a new one, the old one found its prolonged use in the detached households objects – pigsties – to keep the pigs warm during harsh winters, chicken coops – obviously for the same purpose, sheep pens, sheds by the houses used for the wood/pellet

stocking, or wood sheds in the woods and in the plains where the farmers keep their stock during the winter, and similar. Many of them, who built their new households and placed new stoves in new houses, kept the old household heating stove in the old house they usually never tear down for some reason. They keep them instead, for “Ne daj Bože” (God forbid) purpose and use them occasionally when preparing preserves “Zimnica” or when they distil rakija (the plum and other fruits brandy; when it becomes a transformed disused household heating stove, though, to serve this purpose).

Therefore, there shall either be a very strong incentive for the change-out in place, or a strong “old for new” rule with no exceptions in installation of new ones and collection of old ones, or, far better - both.

The old man says: This Smederevac was bought a long time ago, back in 1968 in a local store in Krupanj. We bake bread in it, and cook. And such (good) bread cannot come out from any other stove similar to Smederevac. Each year we burn around 50m3 of wood in it and the stove still works properly”.

Dobrila claims: “Even though we have a new stove in the new house, I still bake bread in this one, as I have done for 50 years now, and that bread is always good” - in this brief reminiscence, this waste expert believes, lies the whole philosophy of future potential replacement of stoves.



Picture 4 and 5. Dobrila and her husband in the old house (besides the newly built) still use a 53 years old stove for baking food

Current practise in the Western Balkans that has been noticed from contacts in all WB6 markets suggests that there is no operating system in place when it comes to waste disposal of disused household heating stoves. This device is dealt with in accordance with laws governing general municipal waste. The reason for this is mainly the fact that there are no fees covering this particular product, as, for example, there exists the fee for refrigerators, computers, car batteries, tyres and similar. Main manner of disposing of this kind of waste in all WB6 is highly

dependent on the scrap metal dealers in the region and their area coverage when collecting the general scrap metal from the household appliances such as toasters, dishwashers, stoves.

The other collection manner is through public utility companies that usually once per month collect municipal bulky waste. The way it is done is by placing the bulky waste near the communal waste bins in the neighbourhood on the designated day of the month for the waste collecting vehicle to collect them and landfill or sell along with other scrap metal. However, this type of collection leaves us with no information on the number of households that dispose of their stove and who gets them eventually. This is due to the fact that in major cities and bigger rural places, when a “valuable product” is disposed of in the municipal waste, there comes a bunch of waste scavengers who each have their previously agreed upon exploitation region and they search the municipal waste bins and collect whatever falls into their exploitation field – scrap paper and cardboard, plastic, cans, electronic equipment, bulky waste, old furniture and similar.

Scrap metal is one of the most appreciated waste among the listed ones, and many scrap metal companies, as well as public utility companies have pushed for the change in the waste legislation in order for natural persons to be allowed to collect and sell waste. At present, in all of the WB6 natural persons are allowed to collect waste from the households with no regularly issued state nor local permits attached to the operation (therefore, this represents a grey commercial zone of operation to the large extent, allowed by states, due to Roma community in charge of the process of collection). And this is precisely what is happening with old solid fuels stoves mentioned here.

Because of this fact, the basic assumption should perhaps be that once the change-out scheme is being prepared, the think-tank behind the organization of carrying out the scheme should search for another collection scheme (other than the one depending on the current waste collection practice). Another collection scheme should be carried out as a one-time collection and transportation for the disused household heating stoves to designated collection centres created for the project purposes alone.

In this manner only it will be possible for the organizers to responsibly collect and transport to the recyclers all project stoves with provable certificates.

However, when it is known that operating costs often constitute 60–85% of total waste management costs, it is necessary to create mechanisms to cover operating costs from the change-out phase since only that will ensure that stove replacement waste management services are sustainable and justified. This practically means that the financing of the change-out could

be done through incentives for purchasing new efficient stoves, but also through covering transportation costs of disused household heating stoves to a collection centre, baling and preparation costs for the transportation to a recycling centre and issuing a proof certificate that subject waste has been recycled by licensed recyclers in the country of interest or abroad. Either way, there must be a paper or electronic proof validating the process containing the place of origin with collector's details, the amount and weight of disused household heating stoves, and the name of the facility taking over the disused household heating stove for further treatment.

Since in none of the WB6 markets has regulation covering the exact moment when the disused household heating stove ceases to be a stove and becomes waste, the manner of transporting stoves to the treatment facility could either be by:

- 1. The household looking for the incentive for new stoves purchase itself, or***
- 2. The company installing the new incentivized stove, or***
- 3. The independent transporter created through the project (even some post express service providers could carry the disused household heating stove for a previously agreed transport price having in mind the number of stoves that shall enter the picture after the incentives are in place).***

2. Waste transport

Taking the aspects of optimized costs and environmental protection into consideration, the company installing the new stove being in charge of transporting the disused household heating stove to a collection centre is without further detailed calculations the most efficient way of treating the disused household heating stoves collection. This is due to the fact the transport costs are halved, i.e., minimized – new stove is transported to the incentive user; old stove is transported to the licensed operator for treatment. Whereas, in any other operation of collection, the transport costs are getting more and more significant because of the need to visit the same place more than once.

According to the methodology of collection costs calculation brought by the KOMDEL association of public utility companies in Serbia, that can be used for the entire region due to the similar geographical, as well as structural characteristics, and the fact that the costs that are taken into calculation are the costs of an average transportation truck for collection and transportation, as the cost bearer. In this way, these costs are comparable to the other public utility companies' costs, as well as to the private companies' costs because they depend on the price and working performance in the field of collected and transported waste.

Basic assumptions for the calculation of transport costs are taken from the public utility companies' method of costs of waste transportation calculation, as this is the method needed for the disused household stoves collection, even though they shall not be treated as waste legislation-wise.

The assumptions are the following:

- There shall be needed special trucks working on the collection and transport activity, where their construction already determines the effects
- Vehicles have predictable routine tasks that are repeated periodically throughout the project phase of change-out
- Data on the total amount of waste is easily obtained as it is calculated on the basis of calculation of stoves weight per truck
- The type of waste disposal bins is not inclusive since it DOES NOT AFFECT the calculation, and the dynamics of emptying is contained in the distance travelled and the number of turns
- The input data required is the data on vehicles and their effects (number of vehicles at work, average number of transported tours, mileage per tour; economic indicators such as the price of diesel fuel, net earnings of drivers and workers, purchase price of vehicles; data needed for conversion into different units of measure (number of inhabitants, number of households, average apartment size).

3. Waste value

This calculation is not identical for any waste collector, for instance, for hazardous and municipal waste, and private waste collectors. It is largely accepted as the general cost of waste transportation, as it is calculated per tonne of transported material or per person/household, not inclusive of the costs for any kind of pre-treatment, landfilling, or landfilling on sanitary landfills. The difference is that Public Utility companies calculate costs per household and square meter of the residential area, while private collectors calculate the costs per weight of transported material. The prices differ to the large extent and they are set out below.

The price range given in Table 1 should be only considered as an approximate waste transportation price and can be calculated in details, once the figures related to the regions where the change-out shall be performed and predictions regarding which households and what number of households shall participate in the change-out are known, because the transportation costs mainly depend on the distance of the routes in the change-out.

The basic assumptions for the calculation of total transportation costs for the disused stoves is the following:

1. Each stove is used per one household
2. The total weight of the stoves in the change-out phase Scenario 1 is taken as the waste stove weight.
3. The transport costs are taken as the cost per tonne of transport, even though the stoves weight on average is around 78kg and it is unknown at what pace the incentivized stoves will be sold and old ones replaced accordingly, nor it is known what will be the geographical dispersion of the program and which areas in WB6 countries will become the part of it – much needed information for the transportation costs. Therefore, the costs given in the estimation are general costs for the transportation of waste calculated per tonne and can only give the reader a notion of what is the minimum cost of transport in this kind of project.

General waste collection and transport costs (EUR) <small>(No landfilling, pre-treatment and landfilling on sanitary landfills included in the cost)</small>	Total number of waste tonnes, number of newly purchased stoves (EUR)	Waste collection and transport operational costs for disused stoves (EUR)
Per tonne of waste	10-15	10,360
Per household	1.73	131,555

Table 1. Costs of covering the collection and transport of disused household heating stoves in WB6

However, the willingness of producers and installers of new stoves for the change-out project comes under question since the whole operation shall impose greater operating and transportation costs for the producers and new time management that should be considered and covered by the project, or the scrap metal dealers that shall become project partners.

In addition, current practice with companies producing stoves when it comes to their waste warehouses is such that they usually have a waste warehouse for the waste produced during the production process itself – so called industrial waste. This waste can legitimately be stored in this facility of theirs as long as their permits allow them, while the space area of the warehouse is usually limited to what the needs of the producers per annum are. Due to the savings in property taxes, none of the producers possess larger warehouse facilities for the purpose of storing the waste. Therefore, engaging producers in this operation of transporting the old stoves to their own facilities is out of question, and their transport should be directed to another licensed location, unless producers themselves are willing to consider storing this waste on their facilities' sites for this project purposes.

From the interviews made during the analysis preparation phase it became clear that scrap metal collectors shall take no disused household heating stove to a collection centre for the real market price per kilogram of waste tin metal, unless such stove is cleared from chamotte – refractory clay bricks for keeping the high temperatures in the stoves, furnaces and other devices used for cooking and heating. When the stove owner is not aware of this fact, he/she shall receive a compensation of 4-5 euros (this amount depends on the region where the stove user lives) for the stove – a far lesser compensation than the average of about 18 euro per stove when calculated per kilogram.

Calculating the weight of disused household heating stoves with and without chamotte, suggested that, on average, chamotte constitutes for about 20% of the total net stove weight. The bigger and more expensive the stove, the lesser the weight of chamotte. This is partly due to the efficiency of newer stoves because of the development of new technologies in chamotte and general stove production.

Due to previously explained market rule adopted by the scrap metal dealers (and waste collectors in general), it is highly advised that any communication campaign towards future users of the incentives for the change-out phase of the project, should inevitably contain the message to clear the stove from the chamotte before surrendering the device to the collectors for the disposal/replacement, regardless of who the collector is. It is not only lighter to carry and, thus, cheaper to transport to a collection centre, but it is also easier to arrange baling and selling the tin metal with potential recyclers.

Furthermore, chamotte itself is a natural product made of refractory clay and it therefore represents no hazard to the environment if disposed of. It can also be further used by the household for the construction works, building roads, filling up holes in the road and similar. Of course, another way of collection can be arranged depending on the collector with whom it is possible to agree on somewhat different approach.

Produce r stove type	Tin metal		Chamotte		Glass		Iron (liv)		Net product weight		
	Weigh t (kg)	Materia l share	Total (kg)	Without chamott e (kg)	Averag e weight						
Type 1	68.90	96%	15.50	18%	0.70	1%	1.90	3%	87.00	71.50	
Type 2	74.80	87%	24.00	22%	1.40	2%	9.80	11%	110.0 0	86.00	78.75

Table 2. Average weight and subsequent material share in majority of solid fuel heating stoves

In the table below there lies a reason why scrap metal collectors and metal recyclers make no objection when taking over the disused household heating stove for further treatment, even though it has other materials present in it, such as chamotte, or glass and iron. The tin metal material parts on average constitutes around 91.5% of the total net product weight.

IV ENVIRONMENTAL AND ECONOMIC EFFICIENCY: HEATING DEVICES ESTIMATED VOLUME AND WASTE MANAGEMENT COSTS

In order to answer the questions such as what direction to take waste-wise when it comes to change-out of heating devices in the Western Balkans, one must firstly turn to the general concept which treats the waste as valuable material. The concept that gathers and comprises all, so far described, largely discussed and finally adopted and partly implemented environmental models in the world is the concept called “Circular economy”. In addition, the Circular economy concept is part of the larger framework of 2030 Sustainable Development Goals, developed and adopted by the United Nations.

When it comes to Western Balkans Circular Economy, this process is aiming to gather, promote and connect the identified stakeholders whose knowledge, innovation and creativity can contribute to a faster transition to circular economy. The goal of this concept strategy locally is to encourage manufacturing with the use of circular business models, to motivate the industry to create new jobs, and to improve doing business by finding innovative and sustainable solutions for the market. The EU has adopted a set of documents that provide guidelines to member states on how to transition from linear to circular economy. The most recent documents are the Green Deal and the Circular Economy Action Plan. Given that the region in this analysis is mostly in the accession process to the EU, all WB6 will be harmonizing their roadmaps with the EU recommendations. Therefore, the Smarter Stoves Partnership project, too, must look into the circular waste concept principle, so it could be applied in waste management during the change-out phase of the project.



The 6R process of circular economy picture

The basic assumptions for the below set out estimations are the following:

- The total number of newly purchased solid fuel stoves in WB6 in the year 2020 is taken as the estimated number of stoves that will ideally become disused household heating stoves in the year 1 of the implementation project (obviously this is the number of households/persons that are willing to buy new stove for different reasons, and they should become the target group of the incentives / subsidies communication campaign in the change-out)

TOTAL WB6 SCRAP METAL PURCHASE VALUE FOR OLD STOVES EXCL. CHAMOTTE IN JULY 2021 IN EUR - SCENARIO 1															
	SERBIA		KOSOVO*		BIH		NORTH MACEDONIA		MONTENEGRO		ALBANIA		Total EUR per manufacturer		
Solid fuel stoves, cookers, and boilers manufacturer	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum prices EUR/kg	Current stock value EUR/kg	Minimum retail value EUR/kg	Current stock value EUR/kg	
Alfa plam Serbia	262.500,00	675.000	70.312,50	180.803,57	506.250	506.250	46.875	120.536	28.125	72.321	23.438	60.268	937.500	1.615.179	
MBS Serbia	234.375,00	602.679	56.250,00	144.642,86	144.643	144.643	8.438	21.696	12.188	31.339	7.988	20.539	463.880	965.539	
Megal Serbia	1.406,25	3.616	-	-	-	-	-	-	-	-	-	-	1.406	3.616	
Blist Serbia	6.093,75	15.670	-	-	-	-	3.750	9.643	-	-	-	-	9.844	25.313	
Plamen Croatia	3.750,00	9.643	4.687,50	12.053,57	40.982	40.982	9.375	24.107	7.500	19.286	6.225	16.007	72.520	122.079	
Radijator Serbia	2.343,75	6.027	-	-	-	-	-	-	-	-	-	-	2.344	6.027	
Timsistem Serbia	4.687,50	12.054	-	-	-	-	-	-	2.813	7.232	-	-	7.500	19.286	
Trgoprodust Serbia	-	-	-	-	-	-	9.375	24.107	-	-	-	-	9.375	24.107	
HOŠEVEN Turkey	-	-	5.625,00	14.464,29	-	-	-	-	2.813	7.232	7.922	20.371	16.359	42.067	
PRYT Bulgaria	-	-	3.750,00	9.642,86	-	-	9.375	24.107	-	-	15.000	38.571	28.125	72.321	
Rekor Turkey	-	-	-	-	-	-	-	-	-	-	4.688	12.054	4.688	12.054	
Jakšan Turkey	-	-	3.281,25	8.437,50	-	-	-	-	-	-	28.481	73.238	31.763	81.675	
Luks Energi Bulgaria	-	-	-	-	-	-	-	-	-	-	7.641	19.647	7.641	19.647	
Bella ThaliaTrgoprodukt, Serbia	-	-	-	-	-	-	-	-	2.813	7.232	-	-	2.813	7.232	
Skladova tehnika Bulgaria	-	-	-	-	-	-	6.563	16.875	-	-	-	-	6.563	16.875	
Centrometal - etaz Croatia	-	-	-	-	-	-	469	1.205	-	-	-	-	469	1.205	
Hrovat Slovenia	-	-	-	-	-	-	5.625	14.464	-	-	-	-	5.625	14.464	
Other manufacturers	14.062,50	36.161	-	-	-	24.107	11.250	28.929	-	-	13.041	33.533	38.353	122.729	
Total EUR per country	529.219	1.360.848	143.906	370.045	691.875	715.982	111.094	109.688	56.250	144.643	114.422	294.228	1.646.766	3.171.415	

Figure 1. Total Western Balkan scrap metal purchase value for old stoves excluding chamotte in EUR in July 2021 - Scenario 1

- The number received from other consultants of pellet stoves, cookers and boilers, nor the inverter air-conditioning or gas boilers were not taken into the calculation, as they constitute largely acceptable devices from the environmental aspect.
- The weight of the disused household heating stoves is taken as the average weight of market leader products produced by the Serbian producers as they constitute more than 84% of the total WB6 market and thus represent relevant weight for stoves present in the market

TOTAL NEWLY PURCHASED STOVE WEIGHT INCL. CHAMOTTE IN 2020 in kg							
solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total weight (kg) per manufacturer
Alfa plam Serbia	2.758.000	738.750	2.068.500	492.500	295.500	246.250	6.599.500
MBS Serbia	2.462.500	591.000	591.000	88.650	128.050	83.922	3.945.122
Megal Serbia	14.775						14.775
Blist Serbia	64.025			39.400			103.425
Plamen Croatia	39.400	49.250	167.450	98.500	78.800	65.404	498.804
Radijator Serbia	24.625						24.625
Timsistem Serbia	49.250				29.550		78.800
Trgoproduct Serbia				98.500			98.500
HOŠEVEN Turkey		59.100			29.550	83.233	171.883
PRYTI Bulgaria		39.400		98.500		157.600	295.500
Rekor Turkey						49.250	49.250
Jakšan Turkey		34.475				299.243	333.718
Luks Energiy Bulgaria						80.278	80.278
Bella ThaliaTrgoprodukt, Serbia					29.550		29.550
Skladova tehnika Bulgaria				68.950			68.950
Centrometal - etaz Croatia				4.925			4.925
Hrovat Slovenia				59.100			59.100
Other manufacturers	147.750		98.500	118.200		137.014	501.464
Total per country (kg)	5.560.325	1.511.975	2.925.450	1.167.225	591.000	1.202.193	12.958.168
Total (t)	5.560	1.512	2.925	1.167	591	1.202	12.958

Figure 2. Total newly purchased stove weight in kg including chamotte in 2020

- The weight of the disused household heating stoves is taken as the average weight without chamotte (the natural calcined clay containing a high proportion of alumina, used to create fire-resistant chamotte type bricks and mortar for construction of fireplaces, old-style and industrial stoves)

TOTAL NEWLY PURCHASED STOVE WEIGHT EXCL. CHAMOTTE IN 2020 in kg							
solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total weight per manufacturer
Alfa plam Serbia	2.205.000	590.625	1.653.750	393.750	236.250	196.875	5.276.250
MBS Serbia	1.968.750	472.500	472.500	70.875	102.375	67.095	3.154.095
Megal Serbia	11.813						11.813
Blist Serbia	51.188			31.500			82.688
Plamen Croatia	31.500	39.375	133.875	78.750	63.000	52.290	398.790
Radijator Serbia	19.688						19.688
Timsistem Serbia	39.375				23.625		63.000
Trgoproduct Serbia				78.750			78.750
HOŠEVEN Turkey		47.250			23.625	66.544	137.419
PRYTI Bulgaria		31.500		78.750		126.000	236.250
Rekor Turkey						39.375	39.375
Jakšan Turkey		27.563				239.243	266.805
Luks Energij Bulgaria						64.181	64.181
Bella ThaliaTrgoprodukt, Serbia					23.625		23.625
Skladova tehnika Bulgaria				55.125			55.125
Centrometal - etaz Croatia				3.938			3.938
Hrovat Slovenia				47.250			47.250
Other manufacturers	118.125		78.750	94.500		109.541	400.916
Total per country (kg)	4.445.438	1.208.813	2.338.875	933.188	472.500	961.144	10.359.956
Total (t)	4.445	1.209	2.339	933	473	961	10.360

Figure 3. Total newly purchased stove weight in kg, excluding chamotte, in 2020

- The market placement of the weight from the disused household heating stoves is taken using the number of newly purchased stoves in WB6 in the year 2020 per the country
- The value of waste from the disused household heating stoves is calculated from the values that scrap metal dealers offer in the market in July 2021 for the waste tin metal for the stove cleared from chamotte (only metals remain)
- The prices different public utility companies and scrap metal dealers offer differ largely, therefore, the calculation shows the average minimum price offered by utility companies and the average price offered by scrap metal dealers
- The maximum value of the waste is calculated from the values that tin scrap metal reached in July 2021 at the London Metal Exchange (LME) for the GB Pounds Sterling per tonne of scrap tin metal

- The Euro counter value is calculated from the waste tin metal LME GB Pounds Sterling settlement exchange rate for Euro
- For the prices offered in local currencies in the WB6, the euro exchange rate used in this analysis is the 117.6 EUR per RSD, or the euro value shared by the project supporting NGOs and companies in respective countries
- The two additional scenarios (Scenario 2 and Scenario 3) are calculated from estimating a 20% lower percentage of newly purchased stoves, as well as 20% higher compared to the basic figures given in Scenario 1, so that different percentages may be applied once the predictions regarding the numbers for change-out are known

TOTAL NEWLY PURCHASED STOVE WEIGHT EXCL. CHAMOTTE IN 2020 in kg							
solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total weight per manufacturer
Alfa plam Serbia	2.205.000	590.625	1.653.750	393.750	236.250	196.875	5.276.250
MBS Serbia	1.968.750	472.500	472.500	70.875	102.375	67.095	3.154.095
Megal Serbia	11.813						11.813
Blist Serbia	51.188			31.500			82.688
Plamen Croatia	31.500	39.375	133.875	78.750	63.000	52.290	398.790
Radijator Serbia	19.688						19.688
Timsistem Serbia	39.375				23.625		63.000
Trgoprodukt Serbia				78.750			78.750
HOŠEVEN Turkey		47.250			23.625	66.544	137.419
PRYTI Bulgaria		31.500		78.750		126.000	236.250
Rekor Turkey						39.375	39.375
Jakšan Turkey		27.563				239.243	266.805
Luks Energiy Bulgaria						64.181	64.181
Bella ThaliaTrgoprodukt, Serbia					23.625		23.625
Skladova tehnika Bulgaria				55.125			55.125
Centrometal - etaz Croatia				3.938			3.938
Hrovat Slovenia				47.250			47.250
Other manufacturers	118.125		78.750	94.500		109.541	400.916
Total per country (kg)	4.445.438	1.208.813	2.338.875	933.188	472.500	961.144	10.359.956
Total (t)	4.445	1.209	2.339	933	473	961	10.360
Total (t) - 20%							8.288
Total (t) + 20%							12.432

Figure 4. Scenario 2 - 20% less change-out than in Scenario 1

TOTAL NEWLY PURCHASED STOVE WEIGHT INCL. CHAMOTTE IN 2020 in kg							
solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total weight (kg) per manufacturer
Alfa plam Serbia	2.758.000	738.750	2.068.500	492.500	295.500	246.250	6.599.500
MBS Serbia	2.462.500	591.000	591.000	88.650	128.050	83.922	3.945.122
Megal Serbia	14.775						14.775
Blist Serbia	64.025			39.400			103.425
Plamen Croatia	39.400	49.250	167.450	98.500	78.800	65.404	498.804
Radijator Serbia	24.625						24.625
Timsistem Serbia	49.250				29.550		78.800
Trgoproduct Serbia				98.500			98.500
HOŠEVEN Turkey		59.100			29.550	83.233	171.883
PRYTI Bulgaria		39.400		98.500		157.600	295.500
Rekor Turkey						49.250	49.250
Jakšan Turkey		34.475				299.243	333.718
Luks Energij Bulgaria						80.278	80.278
Bella ThaliaTrgoprodukt, Serbia					29.550		29.550
Skladova tehnika Bulgaria				68.950			68.950
Centrometal - etaz Croatia				4.925			4.925
Hrovat Slovenia				59.100			59.100
Other manufacturers	147.750		98.500	118.200		137.014	501.464
Total per country (kg)	5.560.325	1.511.975	2.925.450	1.167.225	591.000	1.202.193	12.958.168
Total (t)	5.560	1.512	2.925	1.167	591	1.202	12.958

Figure 5. Scenario 3 - 20% more change-out than in Scenario 2

1. Estimation of generated quantities per annum

Dependant on the data collected by other consultants in the *Smarter Stoves Partnership* project, below is the analysis estimating the potential number of households that shall participate in the change-out phase of the project, accordingly generated quantities of disused household heating stoves per year, the value of the waste metal generated by the project, as well as two additional scenarios heading towards the number of households and relevant material. The two additional scenarios are made considering the fact that is still not know for sure how many households shall be participating in the project and the calculation allows the user to change the percentage of participation, that is, the number of new incentivized stove purchase and accordingly the tonnage of disused stove replaced and brought to the collection/recycling centre, the value of the waste tin metal potential, etc.

Table 4 is showing the origin country for the stoves present in WB6, where the Serbian producers of solid fuel stoves accounted for the majority of sold new solid fuel stoves in all of the WB6 markets researched. Among those 84% are the two biggest producers – *Alfa plam* in Vranje, in the south of Serbia and *Milan Blagojević* in Smederevo, situated in Central Serbia.

Accordingly, the weight of products needed for the waste weight calculation is also taken from the market leader products from these two factories and the average from their weight is in the calculation. Their weight calculation is laid out previously in Chapter 2 above in the analysis and it is repeated here in Table 3.

Produce r stove type	Net product weight		
	Total (kg)	Without chamott e (kg)	Average weight without chamott e
Type 1	87.00	71.50	
Type 2	110.0 0	86.00	78.75

Table 3. Average weight of stove market leaders

Market share per manufacturer country of origin	Percent
Serbian manufacturers	84.07%
Croatian manufacturers	3.89%
Bulgarian manufacturers	3.43%
Turkish manufacturers	4.28%
Slovenian manufacturers	0.46%
Other manufacturers	3.87%

Table 4. Market share per manufacturer country of origin

The number of newly purchased stoves per country is the number taken as the potential number of stoves for the replacement in the change-out project phase.

NUMBER OF NEWLY PURCHASED SOLID FUEL STOVES, COOKERS AND BOILERS IN 2020 IN WB6							
Solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total per manufacturer
Alfa plam Serbia	28,000	7,500	21,000	5,000	3,000	2,500	67,000
MBS Serbia	25,000	6,000	6,000	900	1,300	852	40,052
Megal Serbia	150						150
Blist Serbia	650			400			1,050
Plamen Croatia	400	500	1,700	1,000	800	664	5,064
Radijator Serbia	250						250
Timsistem Serbia	500				300		800
Trgoproduct Serbia				1,000			1,000
HOŠEVEN Turkey		600			300	845	1,745
PRYTI Bulgaria		400		1000		1,600	3,000
Rekor Turkey						500	500
Jakšan Turkey		350				3,038	3,388
Luks Energiy Bulgaria						815	815
Bella Thalia Trgoprodukt, Serbia					300		300
Skladova tehnika Bulgaria				700			700
Centrometal - etaz Croatia				50			50
Hrovat Slovenia				600			600
Other manufacturers	1,500		1,000	1,200		1,391	5,091
Total	56,450	15,350	29,700	11,850	6,000	12,205	131,555

Table 5. Total number of purchased solid fuel stoves, cookers and boilers in WB6 in 2020 per country and manufacturer

In table 5, the number of newly purchased stoves, cookers and boilers in all WB6 markets is calculated, as well as the total number per manufacturer. It provided the basis for the

assumption that 131,555 new devices are purchased annually, and this number was used for further calculation for the potential number of change-out of stoves. This is Scenario 1 of the analysis.

inverter air conditioning, manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total per manufacturer
BEKO	25.000	2.000			1.000		3.000
LG		500					25.500
MIDEA		1.500					1.500
NONAMA		1.000					1.000
Mitsubishi and Fujitsu		5.000					5.000
origin of goods mainly from China			20.000				20.000
Hisense				40.000	1.000		41.000
Azuri					300		300
Bergen					200		200
Gree					3.000		3.000
LG					1.000		1.000
Samsung					500		500
Toshiba					800		800
Fujitsu					500		500
Vivax					2.000		2.000
							-
Panasonic, Daikin,							-

Samsung, Hisense,							-
Gree, Tesla, Haier,							-
Mitsubishi, Vivax,							-
Toshiba							-
Total	25.000	10.000	20.000	40.000	10.300	-	105.300

Figure 1. Total number of sold inverter air conditioning in the Western Balkan

2. Role of the manufacturer in waste management

The country producing the greatest number of stoves in the market of WB6 is Serbia with more than 84% of market share.

The fact the greatest manufacturer share is on Serbian manufacturers is creating negotiation potential for the project once the implementation preparation starts since it will be interesting to find out whether Serbian manufacturers will be willing to arrange return schemes for old stoves, as this analysis shows this is the most efficient way of taking back the disused household heating devices.

The greatest share of responsibility, thus, lies on the Serbian manufacturers in this project, and it may be reasonable to analyse the potential introduction of a producer tax for the heating devices production per piece of device that would serve as the incentive for the producers to arrange the safe take-back of disused stoves themselves, once they or their distributors install the new stoves or to transfer the obligation onto another business entity already operating on the market or solely established for this purpose in the future. Either way, the collection and safe putting away old stoves from the possible secondary market must be put also on the producers.

As one of the interviewed environmental service project leaders for the United States of America, Larry Brockman, told me in his interview: “The retail store (consultants’ adding: or the producer), that is selling the new appliance is required to take the old stove from the home – the homeowner MUST give up the old stove. (This is part of an agreement that is made before the Wood Stove Change-out Program is started).”

NUMBER OF NEWLY PURCHASED SOLID FUEL STOVES IN 2020								
solid fuel stoves, cookers, and boilers manufacturer	SER	KOS*	BiH	NMA	MNE	ALB	Total per manufacturer	Market share per manufacturer
Alfa plam Serbia	28.000	7.500	21.000	5.000	3.000	2.500	67.000	50,93%
MBS Serbia	25.000	6.000	6.000	900	1.300	852	40.052	30,45%
Megal Serbia	150						150	0,11%
Blist Serbia	650			400			1.050	0,80%
Plamen Croatia	400	500	1.700	1.000	800	664	5.064	3,85%
Radijator Serbia	250						250	0,19%
Timsistem Serbia	500				300		800	0,61%
Trgoproduct Serbia				1.000			1.000	0,76%
HOŠEVEN Turkey		600			300	845	1.745	1,33%
PRYTI Bulgaria		400		1.000		1.600	3.000	2,28%
Rekor Turkey						500	500	0,38%
Jakšan Turkey		350				3.038	3.388	2,58%
Luks Energiy Bulgaria						815	815	0,62%
Bella ThaliaTrgoprodukt, Serbia					300		300	0,23%
Skladova tehnika Bulgaria				700			700	0,53%
Centrometal - etaz Croatia				50			50	0,04%
Hrovat Slovenia				600			600	0,46%
Other manufacturers	1.500		1.000	1.200		1.391	5.091	3,87%
Total	56.450	15.350	29.700	11.850	6.000	12.205	131.555	100,00%

Figure 2.Number of newly purchased solid fuel stoves in 2020

Market share per manufacturer	Percent %
Alfa plam Serbia	50,93%
MBS Serbia	30,45%
Megal Serbia	0,11%
Blist Serbia	0,80%
Plamen Croatia	3,85%
Radijator Serbia	0,19%
Timsistem Serbia	0,61%
Trgoproduct Serbia	0,76%
HOŠEVEN Turkey	1,33%
PRYTI Bulgaria	2,28%
Rekor Turkey	0,38%
Jakšan Turkey	2,58%
Luks Energiy Bulgaria	0,62%
Bella ThaliaTrgoprodukt, Serbia	0,23%

Skladova tehnika Bulgaria	0,53%
Centrometal - etaz Croatia	0,04%
Hrovat Slovenia	0,46%
Other manufacturers	3,87%
Total	100,00%

Figure 3. Market share per manufacturer

Market share per manufacturer origin	Percent
Serbian manufacturers	84,07%
Croatian manufacturers	3,89%
Bulgarian manufacturers	3,43%
Turkish manufacturers	4,28%
Slovenian manufacturers	0,46%
Other manufacturers	3,87%
	100,00%

Figure 4. Market share per manufacturer origin

Number of sold stoves per country	Percent %
SER	42.91%
KOS*	11.67%
BiH	22.58%
NMA	9.01%
MNE	4.56%
ALB	9.28%

Table 6. Share of sold solid fuel stoves per country in 2020

Table 6 presents the share of solid fuel stoves per market. The calculation shows that around 42.91% of solid fuel stoves are sold in Serbian market, 22.58% in Bosnia and Herzegovina and 11.67% in Kosovo*.

The manual for main producers' product usage states that the new product packaging is 100% recyclable, and that the same is true for the device itself. However, no instruction is provided regarding the material components, nor the ways of treating them at the end of product life cycle. Below is the part of the manual explanation for one of the stove types stating the packaging material of the new stove is 100% recyclable.

3. Tin metal prices estimation and value of the waste material collected

The prices for the tin metal and other metals present in the old solid fuel stoves have changed greatly throughout the past years. High demand for consumer electronics and difficulties shipping metal out of Asia have created a shortage of tin, pushing prices for the metal close to records for the first time in a decade.

Below is the graph showing the value of tin metal change throughout the past years, reaching the cash value of around 33.000 USD per tonne.

LME TIN HISTORICAL PRICE GRAPH



Graph 1. London Metal Exchange historical price graph for the tonne of tin metal since November 2019

According to BMI Research tin prices are expected to trend higher over the coming years due to a widening supply deficit as global demand growth outpaces production between 2017 and 2021.

Table 7 presents the different minimum and maximum purchase prices (where available) for different waste metal solid fuels stoves are made from, including the packaging materials used for their packaging, as well as for the whole stove with and without chamotte. The prices differ greatly, and this notion gives enough reason to adopt an approach that can optimize the whole process, as previously explained.

While the packaging waste from new stoves can easily be managed in some WB6 markets where operators for packaging waste are well established, in some there is no proper packaging

collection in place. This means that different packaging waste collection approaches should be applied from market to market.

Approximate net market prices for the scrap materials found in solid fuel stoves	Minimum scrap dealers' purchase price		Maximum scrap dealers' purchase price	
Material type	RSD/kg	EUR/kg	RSD/kg	EUR/kg
Aluminium	85.00	0.72		
Messing	225.00	1.91		
Copper	380.00	3.23		
Lead	80.00	0.68		
Stainless steel	70.00	0.60	90.00	0.77
Waste tin metal	14.00	0.12	36.00	0.31
Waste wires and construction wires	8.00	0.07		0.00
Whole electronic waste when collected jointly (toasters, blenders, laundry machines, stoves)	12.00	0.10	25.00	0.21
Paper/ Cardboard	2.00	0.02	8.00	0.07
Broken glass	2.00	0.02		
Old stove per piece	500.00	4.25	650.00	5.53
Old stove per weight excl. chamotte	1102.50	9.38	2835.00	24.11

Table 7. Different prices for different materials present in the solid fuel stoves

As previously explained, in practice, scrap metal dealers offer very small compensations to stove owners who stop using them unless they are cleared from chamotte and cleaned, when they offer a price of around 0.31 euro per kilogram, or around 24 euros for the average weight stove.

Since in some of the countries, primarily in the USA, where change-out projects run for many years now, the cash was paid by retailers to the users who drop-off their stoves in order to get subsidies for purchasing new efficient stoves, it is worth of consideration to implement such pre-arranged approach in this project, as well.

Furthermore, in the state of Montana, for instance, many years ago when the price of steel was quite high (and the stoves that were being replaced were mainly made of steel), the agency implementing program was able to sell the steel and put that money back into the program to help additional homeowners purchase new stoves. This kind of approach may also be the case when prices offered for the stoves at present in the market are taken from this analysis.

One last remark: the entire Western Balkan region has a well-developed scrap metal market, and there is practically not one town or even a small place in the region without a local scrap metal collector, big or small.

There is so much more to be said and calculated; however, this analysis, besides the basic calculations related to the numbers, weight and prices of the material, as well as on the best potential ways of collecting disused household heating stoves, is perhaps just the beginning. As the project enters the phase in which more information is available on the exact numbers of replaceable stoves and timeframe for their replacement, findings can be adjusted accordingly.

V RECOMMENDATIONS FOR THE WAY FORWARD

Recommendations laid out in this analysis can best be used in another project phase, communicating and arranging conditions with listed stakeholders directly under the project continuation framework. Once the aims of the waste collection and treatment from the change-out phase are clearly set and established, the recommendations may serve as the path towards material recovery and circular economy package accomplishment.

- ✓ Financial instruments such as fees for stove producers when placing the new stove on the market are not imposed in any WB market. However, this fee could become the incentive for producers to start treating their products in a more responsible manner after their end of life, they can help set up a scheme for managing the waste from disused household heating stoves in the first phase and they can also be time limited, as the change-out process has its limitations in stoves replacement numbers and years to implement the potential replacement phase
- ✓ Having in mind there is no separate collection of waste and packaging waste at source developed in rural areas (in some countries such as Albania, even the urban separation at source is under big question), it may be considered to propose setting the obligation and/or education for stoves producers to take-back the packaging after the installation of new stoves and manage it accordingly in a responsible manner. The aim is to have 0 waste in the process of the stoves replacement and closing the loop.
- ✓ Obligation and/or education for stoves producers to manage such taken-back packaging in a lawful manner – to be recycled/recovered with licensed operators. The process should bear the proof of recycled material from licensed recyclers whether in the country or abroad if exported

- ✓ Create a list of pre-approved partners per region (collection centres / public utility companies / scrap metal collectors / metal recyclers) and inform the potential/targeted users
- ✓ Introduce a certificate (a kind of a document on the waste movement) from the user to the designated facility as the subsidy precondition
- ✓ Impose such handover manner that a certificate for the potential subsidy for purchasing new stove is issued only to those users who properly dispose of their disused household heating stove by bringing disused household heating stoves to a collection centre/ public utility company centre/ local scrap metal dealer / local recycler or
- ✓ When applying for the subsidy, the condition is that installation personnel of the new stove take back the old one to their own facility or transport it to the closest pre-approved partner
- ✓ Covering the costs through user transport charges alone when bringing the stoves for the replacement may in many contexts result in user charges or transport requests that are not affordable for the majority of the population. Therefore, the full range of economic instruments should be considered, including user charges / incentives, landfill fees or taxes for this particular product, product taxes and similar, as well as economic incentives for improved solid waste management like subsidies and tax exemptions.
- ✓ Some of these measures must be imposed on the national level, for instance product taxes, while some may be established locally; therefore, it must be put on the agenda by those local regions depending heavily on this way of heating its population.
- ✓ In order to avoid fraud, it may be considered having a government authorized financial body in charge of the process of applying for the change-out, paying the subsidies to the users, collecting the certificates from the pre-approved partners for disused household heating stoves, monitoring the stoves take-over, issuing recycling certificates, etc.

VI APPENDIX

ANNEX 1: LIST OF STAKEHOLDERS

Citizens/households with wood stoves

Producers of wood stoves and wood stoves components and the retailers

Ministry of the Environment Protection

Cities and Municipalities

Public Utility Companies

Scrap material collectors

Scrap material recyclers – domestic and international

Customers

ANNEX 2: LIST OF INTERVIEWEES

Dan B. Smith – Regional Air shed Coordinator, Idaho Department of Environmental Quality

Larry Brockman, the US Environmental Protection Agency (EPA)

Velimir Mitrović, former Čačak Municipality Manager – responsible also for implementing first PUC waste sorting facility in the wider region

Goran Đokić – chief of scrap metal collection and recycling yard in Gornji Milanovac

Igor Tatić- Elixir Group hazardous waste collector

Ivan Iazić, JKP Gornji Milanovac

Dragan Dramićanin – JKP Komunalac – Čačak

ANNEX 3: EXAMPLES FROM OTHER WORLD REGIONS - IDAHO

Idaho has two primary programs. 1. State-Wide Tax Deduction program and 2. Community-based targeted Wood stove change out programs.

The first program allows a person who has replaced an old inefficient stove with a more modern EPA Certified stove a way to deduct the cost of the new stove from their State Taxes. The person must follow these rules:

- They must deliver their disused household heating stoves to a State-Approved Wood Stove Recycler.
- Must have the new stove professionally installed.

After these requirements are met, they may submit a deduction based on the cost of the new stove. They may deduct 40% of the new stove cost in the first year, and 20% the next two years. Taken together this can pay 80% of the cost of the new stove.

The second program is aimed at areas that have more local Air pollution issues. For those areas the Agency – the Idaho Department of Environmental Quality (DEQ) – will often pay for the full replacement of the stove, chimney, with professional installation. They have a capped cost, but any costs over that amount is the responsibility of the Homeowner. Capped costs vary depending on the local area, grants they apply for, etc. The requirements to recycle the disused household heating stove through one of Idaho State-approved recyclers is still in place.

Idaho DEQ sends out requests for proposals to the various metal recycling businesses across the state. They then work out an agreement for them to document the recycling and destruction of the disused household heating stove as they do not want these stoves to be re-sold or reused - they must be destroyed. The businesses we work with work in other scrap metals as well - old vehicles, wire, etc. The only compensation these businesses receive is from the sale of the scrap iron, and metal in general in the disused household heating stoves.

THE US EXPERIENCE

Below is the mail received from Mr. Larry Brockman, whom I contacted through e-mail after finding out about the programs they have in the US. It is full of valuable information and I am, therefore, leaving the whole e mail in this appendix for future reference, as well as the documents sent attached:

Rebeka,

I will try to address your questions as best I can based on my many years of working with our state, local and non-profit organizations here in the USA. I am sure your situation is very different in many ways, but also similar.

Dealing with Packaging waste: here in the US many towns and cities (both large and small) have recycling programs where either the local government comes around with "Recycling trucks" to homes and businesses and picks up materials that can be recycled (cardboard, paper and some plastics). In some cases, the local government provides "drop off" locations where people can bring materials that can be recycled or reused. The remaining non-recyclable materials is typically then picked up by "garbage" trucks run by the local government again sometimes there is a central drop off area where homeowners bring their garbage and dispose of it often for free but other times they need to pay for dropping off their trash. Some people in rural or poorer areas end up burning waste in their backyards or in "burn" barrels – this is of course what we don't want, but it does happen sometimes.

Taking over the old stoves and transporting them to the recycling facility:

Here in the US the typical approach with old stoves is the following:

The retail store that is selling the new appliance is required to take the old stove from the home – the homeowner MUST give up the old stove. (This is part of an agreement that is made before the Wood Stove Change-out Program is started). Before taking the old stove, the retailer takes a photo(s) of the old stove still installed at the home – to ensure the stove is being used.

*The retail store typically then installs the new appliance and takes a photo(s) of that too. (We strongly recommend that the stove be installed by a trained professional and NOT by the homeowner – too risky and too many opportunities to make a mistake) *.*

The retailer hauls the stove back their store where they "render the stove inoperable" e.g., take the doors off, smash the door hinges, other parts and/or drills a hole into the stove).

They take a photo of the stove rendered inoperable.

The retailers will often wait until they have 10-12 stoves and then haul them to a recycling facility or disposal facility. In most cases there is enough value in the steel that a steel recycling center will take the stove and, in a few cases, will pay the retailer for the steel. The retailer typically will keep the money to offset their transportation and handling costs as it is an extra burden that they would not otherwise have. The recycling facility will then sell the steel to a steel company.

I did find one case in the state of Montana many years ago when the price of steel was quite high, the agency implementing program was able to sell the steel and put that money back into the program to help additional homeowners purchase new stoves.

**As mentioned above the retail store also installs the new appliance. Most Change-out Programs here require that the installer be “certified professional” for example, certified by the National Fireplace Institute or the Chimney Safety Institute of America. An installation mistake could end up in a house fire or improper venting which will cause pollution indoors and the appliance may not operate correctly and will emit excess pollution. However, in all our wood stove change-out programs the homeowner, MUST turn over the old appliance.*

In terms of incentive levels, most Programs here include a two-tiered incentive or voucher program. One for the very poor, where a voucher amount that is for full or very near full replacement cost are offered and then a general voucher for people who were better off financially.

Also, under the general voucher program I STRONGLY recommend that you provide a higher amount of incentive for the cleaner technologies (e.g., moving to gas or electric appliances or even pellet stoves). We don’t see nearly the emission reductions when going from an old wood stove to a new wood stove – improper operation of the new appliance is typically the issue (wet wood is the #1 problem).

It will likely depend on various issues, but a general voucher that represented about 1/3 of the total cost of the appliance and installation seemed to be the right amount to get people to want to participate who were upgrading to a new wood appliance. So, if the total cost of installation of the new appliance was \$3000 then providing a \$1000 general voucher seems to be enough to get people interested – again this may be different there, but people who had a decent income could be persuaded if they understood the benefits (burns less wood, saves me money and time, is safer b/c of less risk of a chimney fire and my family’s health and air quality will be better).

One other related Program that is implemented in a couple places in the US that has been successful is called a “Wood Stove Bounty Program” or Wood Stove Recycling Program where a homeowner in a given geographic area delivers and turns over their old wood

burning devices directly to the recycling facility. The owner of the old stove goes to the location where they are met the recycler representative on the date advertised, and the program sponsor (state or local government) provides the documentation and voucher for a cash reimbursement to the participating homeowner turning in the old stove. The homeowners get money for their old appliance and may or may not purchase a new stove, but it gets the old high polluting less efficient stoves out of use. This Program helps get used, non-compliant devices out of the secondary market for resale on (e.g., Facebook marketplace).

I am including various example forms used by many programs here in the US that maybe helpful to you and your program. I hope some of what I have shared is helpful. Please say hello to and send my best to Aleksandar Macura.

If you/your colleagues would like to discuss any of my comments I'd be happy to have a Zoom call and go over this material and provide greater detail.

Cheers,

Larry

ANNEX 4: LIST OF LICENSED SCRAP DEALERS AND METAL RECYCLERS

Due to the great number of licensed operators for waste collection, waste treatment and waste recycling of more than 2.000 companies in Serbia, the list with relevant filter reflecting index numbers of the wastes analysed for this project's purposes is attached in tables above.

The list of the biggest scrap metal dealers in other WB6 market is below:

Kosovo*:

- <https://reckos.net/>, RECKOS shpk, rr. Pajazit Islami nr. 186, Fushe Kosove, +383 38 721 294, info@reckos.net,
- Green Recycling Kosova, https://greenKosovo*.com/businesses_list/green-recycling-kosova/, Industriale Zone: Prishtina – Fushe Kosovo*, p.n., 10 000, Prishtina, Kosovo*, +383 (0) 44 111 107, info@greenrecycling-ks.com, www.greenrecycling-ks.com
- Natyra SHPK - Podujevo, natyra.shpk@hotmail.com

Albania

- Albanian Aluminium Recycling Factory <https://amarecycling.al/>

Main index numbers that are relevant for the project are as follows:

- metal packaging	15 01 04
- ferrous metal	16 01 17
- metals containing iron	19 12 02
- coloured metals	19 12 03
- metals	20 01 40
- mixed metals	17 04 07

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[Manual for Smederevac product usage - Serbian](#)

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Sat, 26/11/2011 - 09:20 ok. Vidi se kvalitet sporeta

#6

Aleksandar80



ok.

Vidi se kvalitet sporeta kad pre prvog lozenja moram da ga krpim 😊
Nisam imao vise para za centralno,pa sam za ovu zimu uzeo smederevac,a kad se uradi centralno,naci ce on sebi svrhu u pomocnom objektu.

Offline

Registrovan dana:
06/11/2011



Receive up to **\$550** when replacing your old wood stove



\$550 to replace your
non-EPA certified
wood stove with a
heatpump

\$550 to replace your
non-EPA certified wood stove
with a gas, propane or
electric stove

\$400 to replace your non-
EPA certified wood stove
with a new EPA-Certified
wood stove

PRE-APPROVAL REQUIRED

The **qathet Regional District** is working to replace old smoky wood stoves that contribute particulate matter into the air with cleaner burning, more efficient models.

Please contact **Let's Talk Trash** to find out more information about program requirements. Call **604.485.2260**, email info@letstalktrash.ca or visit **qathet.ca** to learn more.

Additional rebates can be applied for through Efficiency BC.



qathet
REGIONAL DISTRICT

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WHAT IS WASTE?

