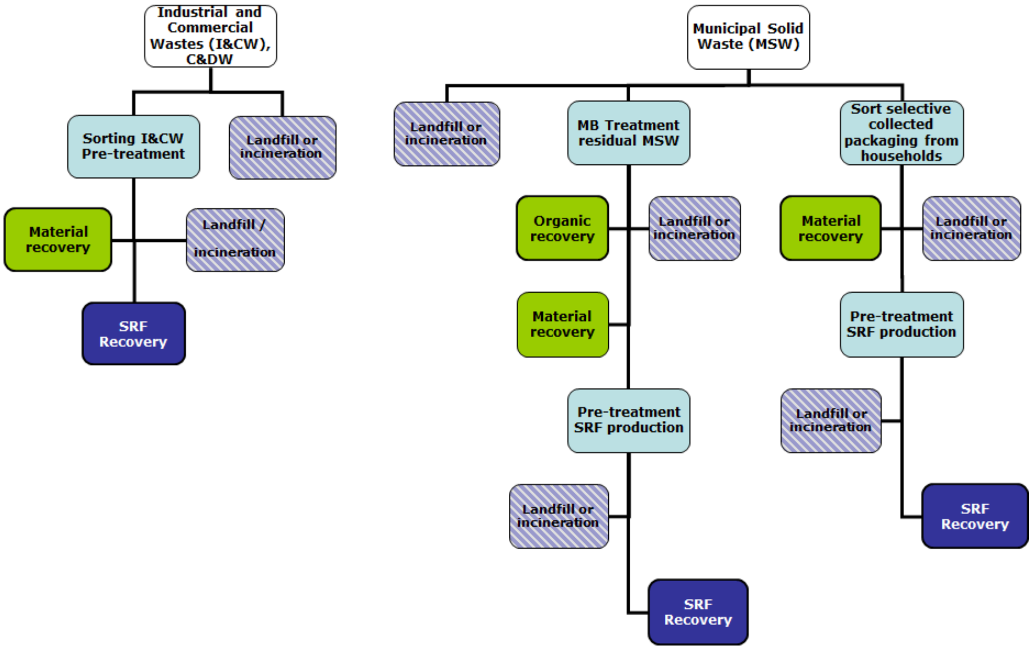
The role of SRF in a Circular Economy

Summary
Solid Recovered Fuel (SRF) is a less known, yet crucial element in waste management, often overseen by policy makers. SRF is produced from non-hazardous waste which usually has undergone a prior sorting process. SRF production therefore, does not compete with recycling but is integral part of it. LCA studies proof the sustainable aspects of the SRF concept. Whereas SRF is used in cement kilns, CHP plants and in other high efficiency applications, there is less need for huge investments in mass burn incineration. Whereas SRF can be traded, the energy content of waste can be used at the spot where there is a true heat demand. First estimates show that there is a good balance between the potential volumes of SRF that can be produced and the heat demand in industry.

What is SRF?
SRF, Solid Recovered Fuel, is a fuel produced from non-hazardous waste in accordance with EU standards for SRF, especially EN15359. It is typically produced from municipal solid waste (MSW), industrial and commercial waste or Construction & Demolition Waste (C&DW). It must be sharply distinguished from RDF. RDF is a non-defined term and refers to waste that has not undergone proper processing. RDF is not standardised and it's features (composition, contaminants, calorific value) are undetermined. SRF is sampled and tested according to EU standards. It's features are well specified and following that SRF is classified. SRF is produced under the regime of a quality assurance scheme of the producer.

Production of SRF



Schematic process of the production of SRF

Position of SRF as waste management tool
Processing of waste into SRF is a relatively new waste management option. Actually it is not an option on its own. Production of SRF always goes hand in hand with recycling. Only those materials that can not be recovered for recycling are fit to be used for SRF production. Production of SRF is complementary to recycling. This automatically means that optimisation of recycling will leave less materials for the production of SRF. However, full recycling of such wastes as MSW, I&CW and C&DW is not possible. Optimised sorting facilities can recover up to 75% of input material, leaving space for SRF production.

The above illustrates the flexible role that SRF takes in waste management. It does not require huge investment as MSW incineration does. SRF production, as it does not stand on its own, will never compete with recycling.

Unlike SRF production, the generation of RDF does not contribute to recycling. RDF is generated by low profile treatment of waste, often with the mere aim of obtaining a fraction that is allowed for transboundary shipment to incineration plants.

Flexible and efficient use of the calorific value of waste
A main advantage of SRF is that it provides for flexible use of the calorific value in waste. SRF is stored and shipped as fluff or pellets. It is used in those places where there is an actual need for a fuel and where there is an actual demand of heat.

SRF is used in combustion processes that are designed to generate heat and/or power. The efficiency of such processes is high. On the other hand, energy is needed to transform waste into SRF. The overall balance however is still positive.

Production and use of SRF

Data on the current production and use of SRF are difficult to obtain. This is due to the fact that the concept of standardisation is not yet well applied by stakeholders. Whereas many companies produce a secondary fuel, they are not yet aware of the benefits of standardising their materials. The production of “almost SRF” still exceeds the production of true SRF. In practice the “almost SRF” is usually still referred to as RDF, yet it is used for proper applications such as in cement kilns. Data for SRF and such “almost SRF” at the moment can only be obtained as a whole.

ERFO and Cembureau estimate the following:

Current use of SRF and RDF	13.5 million ton	Replacing 5,000 million ton of Russian gas
Of which in cement kilns	5 million ton	
Potential production capacity (conservative)	53 million ton	Replacing 20,000 million ton of Russian gas
Potential demand industry (conservative)	63 million ton SRF	

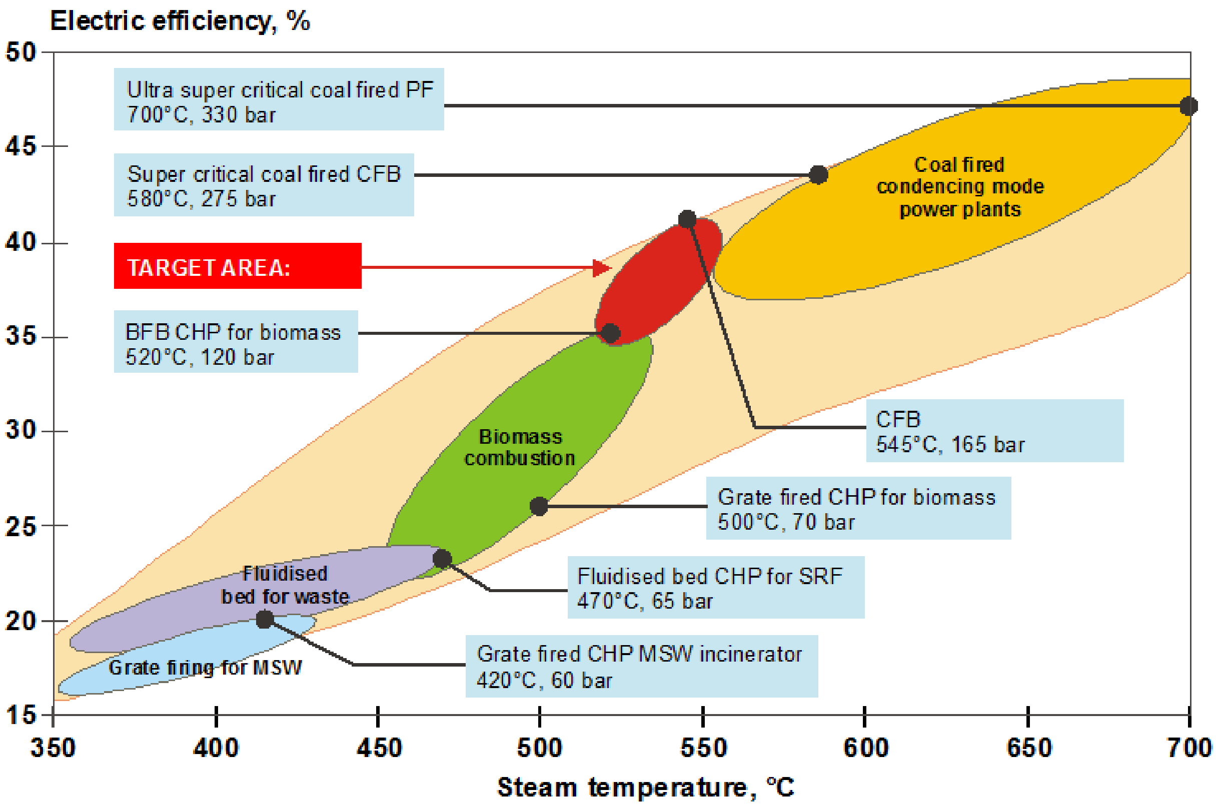
Practice example: Tallin, Estonia

In and around the city of Tallin in Estonia 220,000 ton/y of MSW is produced. Instead of landfilling the waste, the city is looking into more sustainable solutions. Two main options are the incineration in a waste to energy plant and production of SRF to be used in the Kunda cement plant of HeidelbergCement. The latter option turns out to be more sustainable and more interesting from an economic point of view.

	Waste-to-Energy plant	**SRF production and use in cement kiln**
Production	Electric: 138 GWh/y Heat: 320-400 GWh/y	120,000 ton SRF, 15 GJ/ton
Investment	Eur 100M	Eur 36M
Recovery of energy	83%	90%
Subsidy	Eur 4.4/year, 12 years	No

Practice Example: Recombio – combined use of biomass and SRF

Within the framework of a EU funded project the successful combined use of biomass and SRF in CHP plants has been demonstrated. SRF adds important value to the combustion process due to its different characteristics from biomass. It increases the flexibility of the process and improves combustion behaviour. Using a combination of biomass and SRF, the highest recovery of energy can be achieved, as is demonstrated in the following picture.



LCA studies by JRC Ispra show that compared to using primary resources production of energy with SRF scores better on all 15 environmental categories.

The only safe secondary fuel

The generation of secondary fuels from non-hazardous waste has been an issue for a long time. Clients and authorities have always felt uncomfortable about the application of such fuels, as the composition and thus potential environmental and technical impacts were unknown. Appropriate methods for sampling and testing were lacking, until CEN/TC343 started working on it. Nowadays there is a full set of standards, based on which the characteristics of fuel can be declared reliably. EN15359 is the overarching standard, prescribing rules for specification, classification and quality assurance. Only fuels produced in accordance with EN15359 may be referred to as “SRF”.

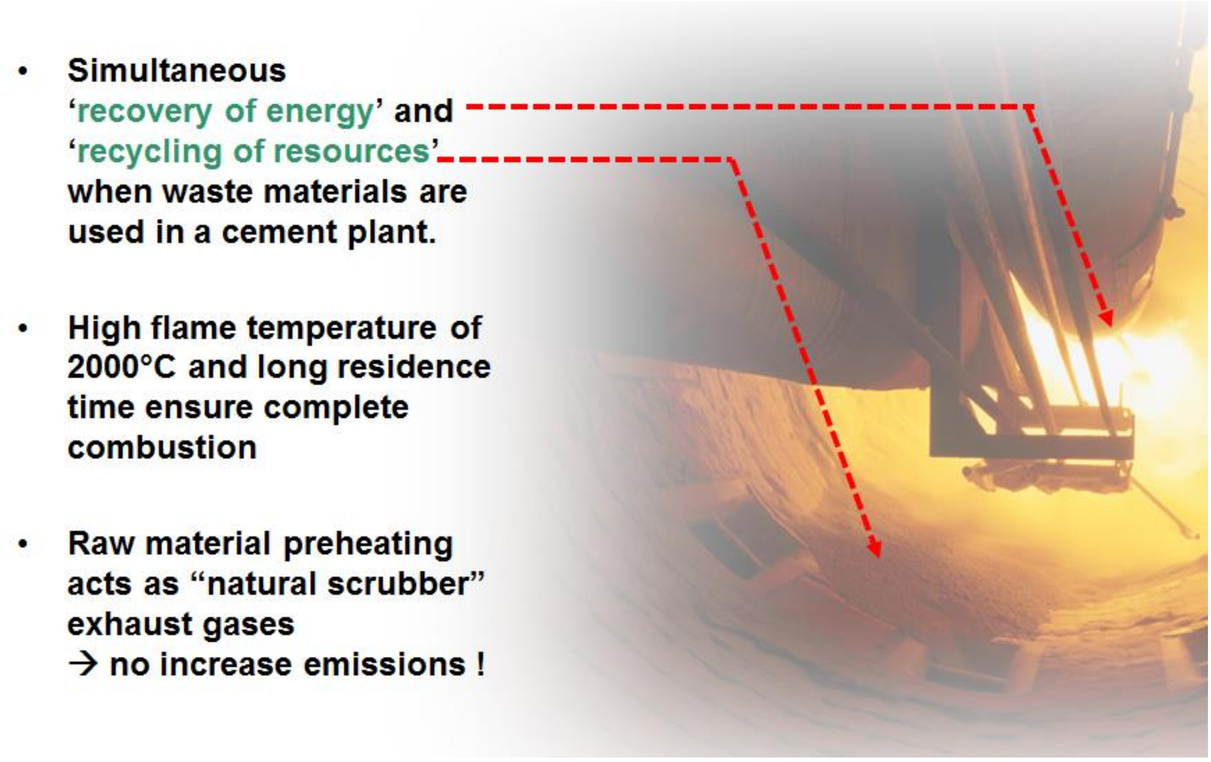
The system of classification is well used nowadays, also outside Europe. It provides for an easy and quick way of communication. The nature of SRF is summarized in three parameters: mercury (indicating environmental impact), chlorine (indicating technical behaviour) and nett calorific value (indicating the performance). Any SRF can be described using the system of classification. The set of standards assures that all stakeholders know exactly the nature of the SRF applied.

Classification characteristic	Statistical measure	Unit	Classes				
			1	2	3	4	5
Net calorific value (NCV)	Mean	MJ/kg (ar)	≥ 25	≥ 20	≥ 15	≥ 10	≥ 3

Classification characteristic	Statistical measure	Unit	Classes				
			1	2	3	4	5
Chlorine (Cl)	Mean	% (d)	≤ 0,2	≤ 0,6	≤ 1,0	≤ 1,5	≤ 3

Classification characteristic	Statistical measure	Unit	Classes				
			1	2	3	4	5
Mercury (Hg)	Median 80th percentile	mg/MJ (ar) mg/MJ (ar)	≤ 0,02 ≤ 0,04	≤ 0,03 ≤ 0,06	≤ 0,08 ≤ 0,16	≤ 0,15 ≤ 0,30	≤ 0,50 ≤ 1,00

The concept of co-processing
It is still overseen by many Member States that a main solution for diverting waste from landfills is already in place. Many industry sectors have a major heat or energy demand that can be covered by waste. This waste only needs a transformation into a reliable fuel with known characteristics: SRF. The cement industry has recognised the potential of SRF and currently is the main user of it. The benefits of using SRF in cement kilns are twofold. Whereas the energy is recovered at the highest efficiency, inert materials become a substituent of the cement clinker.



Sorting of waste, production of SRF and co-processing is the ultimate combination for non-hazardous waste. It can be implemented throughout Europe as major investments in expensive waste treatment infrastructure can be prevented.

Utilisation of SRF is not yet common in other industries. This could change rapidly when circumstances are beneficial (such as oil price, real pricing of CO_2, …). Some developments take place in the power industry and in district heating, but main outlets in such industries as steel/iron, pulp/paper, glass and chemical industry are yet unexplored.

Benefits from using SRF
The concept of SRF provides for a flexible waste management solution. It combines with recycling and is actually integral part of it. It allows for the efficient use of energy in waste by the fact that it can be stored and shipped to places where there is a true heat demand. Its combined combustion with biomass provides for the best option for district heating and CHP plants.

The environmental benefits of SRF have been confirmed in several LCA studies. Already in 2001 the European Commission concluded that the route of secondary fuels is to be preferred above integral incineration [GUA, 2001]. This has been confirmed by several studies. As an example, the CO_2 reduction potential of SRF has been studied in a major study by Prognos [Prognos, 2008]. The study clearly confirms results from other sources.

Material Waste Stream	Item	CO_2 emissions	Benefit (+) / Burden (-)
		kg CO_2-equivalent	kg CO_2-equivalent
Solid fuel waste	Co-incineration of SRF/ RDF in a cement kiln	440	1,040
	Substitution of fossil fuels co-incineration cement kiln	1,480	
	Co-incineration of SRF in an optimised MSWI	440	460
	Electricity and heat substitution	900	
	Co-incineration of SRF/ RDF in a coal power plant	450	1,060
	Substitution of fossil fuels co-incineration coal power plant	1,510	

CO_2 reduction potential of SRF. Source: [Prognos, 2008]

Bottlenecks
The development of SRF markets has been growing moderately in the past decade. The full potential has not been used due to several reasons. Main obstacles that prevent optimum recovery of energy in waste are:

- There is an overcapacity of mass burn incineration in north-west Europe. In The Netherlands, as an example, recycling (and thus SRF production) is loosing market share due to competition of cheap incineration. Recently this seems to be turning as waste from the UK is imported. This is waste that has undergone mere shreddering and is referred to as RDF.
- Long term contracts for Municipal Solid Waste incineration
- Low CO_2 prices
- Subsidies for incineration

Literature

[GUA, 2001] Waste to recovered fuel, cost-benefit analysis. GUA Gesellschaft fur umfassende Umweltanalysen, 2001

[Prognos, 2008] Resource savings and CO2 reduction potential in waste management in Europe and the possible contribution to the CO2 reduction target in 2020. Prognos, INFU, IFEU, 2008.