Re_fashion

What does the future hold for the SRF sector in France?

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Contents

I. Introduction on solid recovered fuel (SRF)

A. Definition, composition, preparation and use

According to article R541-8-1 of the French Environment code, *"solid recovered fuel is non-hazardous solid waste, composed of waste that has been sorted in such a way as to extract the fraction that can be recovered in the form of material under the current technical and economic conditions and prepared in order to be used as fuel [...]"*.

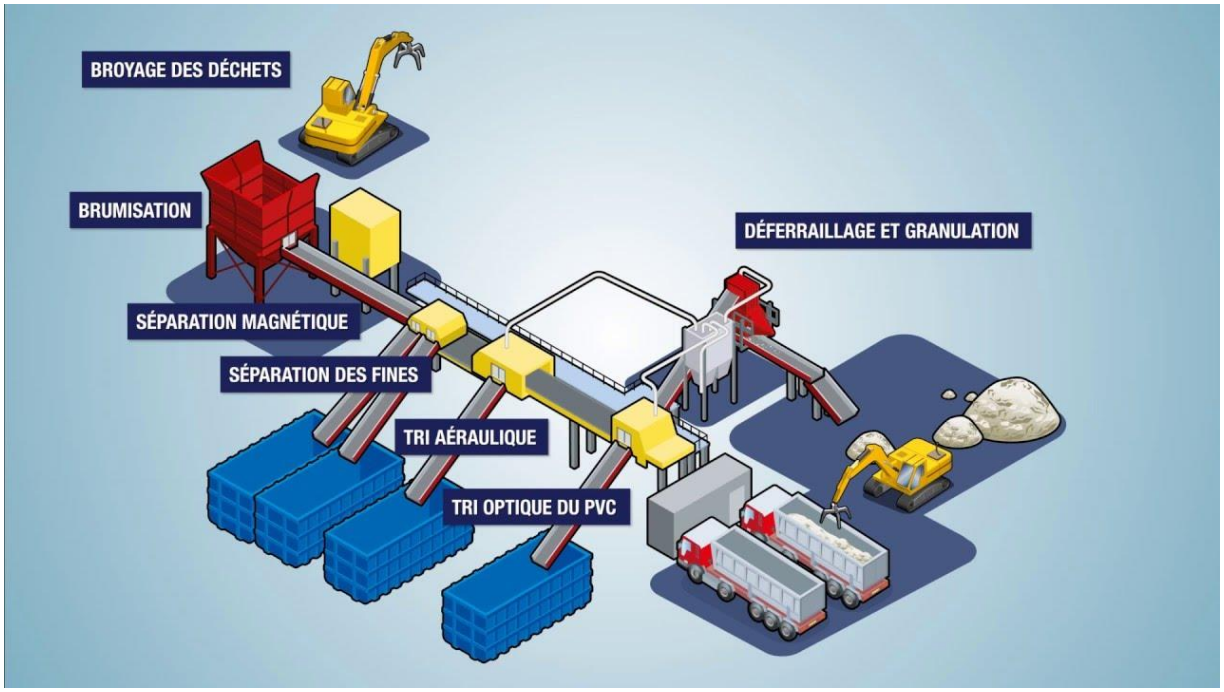
From this definition, several important points can be highlighted:

- SRF **has a waste status**;
- It is comprised of **non-hazardous waste that cannot be reused or recycled;**
- **Waste sorting and preparation stages** are necessary to obtain SRF.

Consequently, waste streams eligible for preparation as solid recovered fuel (SRF) include residual waste from economic activities waste (EAW) sorting[1], residues from residual household waste (rMSW) sorting and certain industrial waste streams. Therefore, SRF is mainly a mix of **paper, plastics, wood, rubber and textiles**[2]

This report's cover page has been illustrated using a photograph of SRF pellets. The scale on the bottom right enables the size of the pellets to be appreciated.

In regards to the **preparation of SRF**, several processes exist depending on the facilities available and the complexity of the waste treated. See below an example of an SRF preparation process taken from a video published by PAPREC[3]:



[1] EAW (Economic activity waste): waste produced by entities other than households.
[2] https://www.ecologie.gouv.fr/traitement-des-dechets
[3] Video explaining the SRF preparation process on YouTube, by PAPREC : https://youtu.be/5XxzXBOWsV4

The preparation stages cited in the video are:

1. Waste shredding;
2. Misting: water is misted to control the dust produced;
3. Magnetic separation: thanks to an overband magnet[4] items made from ferrous metals are separated from the stream;
4. Fines separation: using a vibrating screen fines under 20mm are removed;
5. Aeraulic sorting: light waste is separated from heavy waste by a pressure or suction system;
6. Optical sorting of PVC: PVC is extracted via a laser beam to prevent any alteration to the fuel produced;
7. Ferrous metal removal and granulation: any ferrous metals still present are removed. Waste is then shredded to an average size of 28mm;
8. Loading for shipment to a cement kiln for example.

In regards to the **use of SRF**, it is burned to produced heat and/or electricity via turbines. This is therefore **energy recovery**[5], in the same way as methanisation, pyrolysis and gasification. Therefore in order to respect the order of waste treatment methods[6], waste can only be recovered as SRF when reuse and material recovery (in particular recycling) are not possible. However, recovery as SRF is preferred over disposal.

Furthermore, even if recovery as SRF and incineration with heat recovery both constitute waste-to-energy recovery methods, the two must not be confused. Indeed, these two treatment methods do not have the same objectives: the main purpose of incineration is to treat waste, with energy production being second. **In regards to SRF, its primary purpose is energy production.** So, to achieve good energy efficiency, extensive preparation of the waste to be used in SRF is necessary. This is not the case for waste sent for incineration.

Lastly, the SRF's quality will determine **where it is used**[7]:

- **High quality SRF** (or "cement kiln quality"), mainly used in **cement kilns** in France, has an LCV[8] >18MJ/kg and a chlorine content of <0.5%.
- **Good quality SRF**, intended for use by **heat/electricity producing facilities**, has an LCV of between 12 and 18 MJ/kg and a chlorine content of <1.5 %.

B. Some references in French legislation

Decree n° 2016-630 of 19 May 2016:

- Added **article R541-8-1** following article R541-8 of the French Environment Code. Article R541-8 defines hazardous waste, non-hazardous waste, inert waste, household waste, etc. Article R541-8-1 adds a definition for SRF.
- Created the **ICPE[9] 2971 heading**. This targets facilities producing heat/electricity using SRF, regardless of whether or not it is associated with others fuels. These facilities were previously cited under the heading ICPE 2771 of facilities treating non-hazardous waste thermally and

[4]Explanation of the principle at http://www.blsmagnet.com/fr/secteur-activites/traitement-des-dechets-et-recyclage
[5] https://expertises.ademe.fr/economie-circulaire/dechets/passer-a-laction/valorisation-energetique
[6] https://www.ecologie.gouv.fr/traitement-des-dechets
[7]Normandy Waste, Resources and Circular Economy Observatory. "Solid recovered fuels". (June 2021)
[8] LCV (lower calorific value or net value): total quantity of heat released by combustion. For example, the combustion of 1 litre of fuel or 1 cubic meter of natural gas globally releases 10 kWh. Source: enoptea.fr
[9] ICPE (installation classée pour la protection de l'environnement = facility for environmental protection): a facility which may be dangerous or cause nuisances for local residents , health, la safety, public health, agriculture, protection of nature and the environment, the conservation of sites and monuments. Source: Wikipédia.

which did not allow the specificities in regards to the end purpose of their energy production to be taken into account.

French Order of 23 May 2016:

- It provides a framework for preparing SRF with a view to its use in facilities under heading 2971: SRF meets the technical specifications of a client; it is prepared from non-hazardous waste; has undergone sorting in the best technical-economic conditions available; the characteristics of an SRF batch are stable over time; the LCV is higher than 12MJ/kg; contents in mercury, chlorine, bromide and halogens do not exceed authorised thresholds.
- It provides a framework relating to heading ICPE 2917: facilities producing heat/electricity from SRF, regardless of whether or not it is associated with others fuels.

NB: This Order was first modified by the **Order of 24 of August 2017** on emissions in water and the monitoring of aqueous discharges and secondly by the **Order of 2 October 2020** which relaxed the analyses of the SRF produced and widened the number of facilities that could produce SRF.

European standard NF EN ISO 21640 published in August 2021, superseding European standard **NF-EN-15359**[10] of December 2011 focuses on other properties which characterise SFR: particle size, humidity, ash content and pollutant content (halogens, heavy metals, etc.). These specificities enable SRF to be classified into 5 distinct categories. It is usual to consider categories 1, 2 and 3 of this standard as SRF. If not, the product is considered as refuse derived fuel and the ways in which it can be used are more difficult.

C. A word on the side about foreign terminology and criteria

In a report by RECORD in 2018[11], the term **solid recovered fuel (SRF)** is in theory reserved for fuel meeting the requirements in European standard EN 15359, superseded since August 2021 by European standard NF EN ISO 21640.

The terminology "**Refuse Derived Fuel" (RDF)** signifies non-specific waste obtained after the basic treatment of household, industrial and commercial waste with the aim of increasing the calorific value of waste. The level of preparation of this waste is not therefore as extensive as it is for SRF and RDF meets neither European nor French SRF standards.

Warning: In France, the term **SRF** usually makes reference to compliance with specific quality requirements that are not enforced overseas, i.e., those described in the Order of 23 May 2016 for SRF to be used by ICPE 2971 classified facilities. In this case, the term **standardised SRF** is used for SRF that meets the European standard without, however, meeting the French standard.

[10] https://expertises.ademe.fr/economie-circulaire/dechets/passer-a-laction/valorisation-energetique/dossier/combustibles-solides-recuperation/caracterisation-combustibles-solides-recuperation#:~:text=Le%20code%20de%20classe%20d,%2C%20Cl%202%2C%20Hg%202.

[11] **RECORD.** "The use of SRF and RDF in Europe. Literature review and administrative situations encountered in the field". 393 p, n°16-0250/1A. (2018)

D. Economic model of SRF stakeholders

For several reasons **examining the SRF sector's economic model is complex:**

- The purchase/sale prices between industrials are confidential;
- The diversity of waste, its treatment methods, the types of SRF and type of uses of SRF are technical factors that affect the economic model;
- The economic context (financial support, price of fossil fuels, taxes, etc.) and geopolitical contexts (for example wars) also need to be considered.

However, **keeping it simple**, **the economic model** can be described as follows:

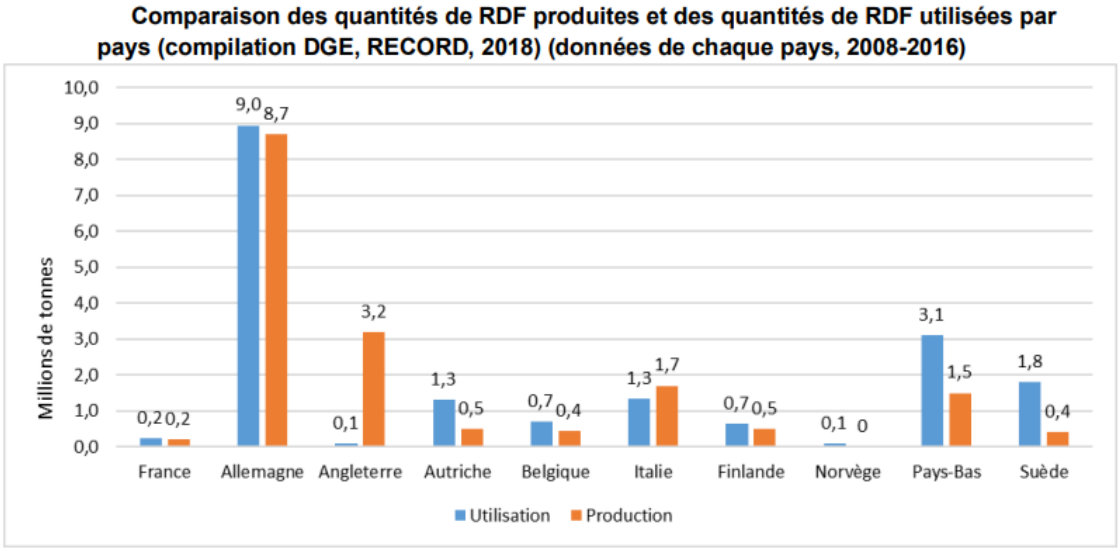
1. Those holding waste pay SRF producers to surrender the waste to these producers. The price depends on the type of waste.
2. The SRF producer bears the costs for preparing SRF. To this is added the costs of managing refused materials, i.e. the fee paid to landfills and incineration plants to recover the waste that cannot be recycled of recovered as SRF. Inversely, waste that can be recycled is sold and, in most cases, brings in extra revenue. Entities preparing SRF also bear transport costs between their preparation units and the industrial sites that will be using the SRF. Lastly, the entity preparing the SRF pays a "gate fee" to the SRF's user.
   NB: As the "gate fee" depends on the quality of the SRF prepared by the entity, this may be negative for higher quality SRF. In this case, the entity preparing it is *paid by* the user. However, generally, the gate fee is positive in order to help the user to amortize the investment in its SRF combustion facilities.
3. The user consumes SRF to produce energy (heat, electricity) that it uses in-situ or sells.

Thereby, the sector's economic challenge is to ensure that the SRF used must be competitive vis-a-vis to incineration and landfilling and that the energy produced from the combustion of SRF must be profitable vis-a-vis to fossil fuels.

NB: Appendix 1 shows the order of magnitude of the prices in play and resources are suggested in order to examine the SFR sector's economic model more closely.

II. The SRF sector in France

A. France versus Europe: SRF production and consumption



According to the study by RECORD dating from 2018[12], **Germany and England are the primary producers of RDF.** However**, Austria** produces as much RDF from rMSW per inhabitant as Germany. No information is available on Austrian RDF produced from industrial waste. Italy produces around 1.7 Mt of standardised RDF mainly from rMSW and a part is exported to Eastern European countries. England and the Netherlands produce low quality RDF mainly for export.

Germany, the Netherlands and Sweden are the primary consumers of RDF. Sweden and the Netherlands import a large quantity from Norway and England.

For both SRF production and use, **France** is very much lagging behind other member countries.

More figures from the report written by RECORD in 2018 are available in Appendix2.

B. Production and consumption in France

1. SRF production in France

In 2022, **36 SRF production facilities**[13] were identified with an uneven distribution in France (see Appendix 3). This corresponds to **400kt**[14] **of SRF per year in 2022.** This figure is far below theoretical production capacities, estimated at 980kt in 2020[15]. This can be explained by the lack of diversity in SRF outlets: in 2020, 75% of SRF was recovered in cement kilns[15].

2. SRF consumption in France

In France, SRF is mainly recovered by **cement manufacturers**, replacing fossil fuels. This monopoly can be explained by the significant heat requirements of cement manufacturers, the possibility of

[12]**RECORD.** "The use of SRF and RDF in Europe. Literature review and administrative situations encountered in the field". 393 p, n°16-0250/1A. (2018)
[13]**AMORCE.** National state of play of unit preparing Solid Recovered Fuel". (May 2021)
[14] CETIM / IFTH / IPC. "Guide to Recycling and the Ecodesign of Composites, GREC booklet. ". (2022)
[15] FEDEREC. "The 2020 recycling market, considering waste as a resource of tomorrow". (2020)

recovering combustion ash in cement, as well as the small amount of toxic fly ash released thanks to the very high temperatures in the kilns.

However, other industries are likely to absorb a growing portion of SRF in the future:

- Lime kilns, in which limestone is transformed into lime. Lime is used in the steel industry and the construction industry to make plasters and mortars. This industry used to very present in the Pays de la Loire area[16] but has essentially been replaced by the cement manufacturing industry.
- The **steel industry** that manufactures iron and ferrous alloys such as cast iron and steel. This sub-area of metallurgy is still very present in France, especially in the east of the country (see map in Appendix 4).
- The **paper industry** which is present all over France except in the north-west (see map in Appendix 5).
- The **chemical industry**, especially the 'Plastics Valley" in the Ain and Jura counties. We can also consider Novacarb, Solvay, Alsachimie or BASF.

In addition to heavy industries, the French public authorities would like to develop a network of **purpose-built facilities for producing heat and/or electricity using SRF.** It is with this in mind that the ICPE 2971 heading was created. From 2015 to 2020 about twenty facilities were concerned by request for proposals, but only two are in operation (see the map in Appendix 6).

C. Why develop an SRF sector in France?

The energy (heat and/or electricity) from the combustion of SRF has numerous advantages:

1. **Local energy** participating in LIE[17] and France's sovereignty in energy.
2. **Low carbon energy,** because 50% of this energy is renewable thanks to the biogenic[18] content of SRF;
3. An **energy that enables waste to be sent elsewhere other than to landfill or for incineration.**

This last point is even more advantageous because two French laws restrict waste disposal:

- **LTECV[19]**: 4 LTECV objectives are related to waste management and energy[20], amongst which the reduction by 50% of the quantities of waste being landfilled in 2025 compared to 2010;
- The **AGEC law**: requiring energy recovery of at least 70% of waste that cannot be recovered as materials by 2025.

This is why the 2014-2025 waste plan targets a national production capacity of **2.5Mt/year by 2025.** Out of the 2.5 Mt, **1 Mt is intended for cement manufacturers.** The ADEME's objective is to develop **facilities under the ICPE 2917 heading capable of consuming 1.5 Mt** of SRF per year, for a thermal output of 100 MW[20]. As a reminder, SRF production in France was 400 kt in 2022.

[16] https://fr.wikipedia.org/wiki/Liste_des_fours_%C3%A0_chaux_en_France?tableofcontents=1
[17] LIE: local and industrial ecology
18 SRF contains a portion of biomass, which is a renewable resource.
19 LTECV: law on the energy transition for green growth, published on 17 August 2015.
[20] French Ministry of the Environment, Energy and the Sea, ADEME, French Circular Economy Fund. "SRF Energy" request for proposals (2020)

D. The obstacles to developing the SRF sector in France

No legal definition for SRF exists nor do any specific regulations at an EU level. Only a standard exists (which in terms of regulations imposes nothing whatsoever). At a European level, SRF is therefore governed by the Waste Framework Directive[21]. The freedom of choice by member states thereby leads to **distortions in competition between countries**. Here are a few examples of factors causing this **distortion between France and other EU countries**:

- **Waste management policy**: for example, waste eligible for SRF is available at competitive prices in Germany thanks to prohibitions or severe taxes imposed on incineration or landfilling. This is (or nearly) not the case in France.
- **ICPE 2971 facility status**: "co-incineration" classification implies being subject to CO2 quotas (the case in France) whereas for "incineration" this is not the case (the case in Germany).
- **ICPE 2971 facility regulations:** it requires that operations are continuous, that other fuels can be used to avoid slowing down recycling processes, that preferably an industrial or urban heat network be supplied [22], etc.
- **Requirements on SRF quality**: these requirements are defined by the Order of 23 May 2016 in France whereas in a majority of other member countries, the quality to be achieved is only specified in the technical specifications between the producer and the user.
- **Co-generation with SRF:** it does not appear that France encourages co-generation (i.e. the co-production of heat and electricity) using SRF[23] unlike Europe.

NB 1: Be aware that French legislation is not always an obstacle. For example, before the creation of the heading ICPE 2971, facilities were governed by heading ICPE 2771, which is less suitable and more demanding.

NB 2: The issue of co-generation is flawed: on the one hand because its interest for the SRF sector is controversial, and on the other because the position of the French public authorities on this issue is not clear.

Apart from this distortion in competition between member countries due to the different legislative and strategic choices that have been made, the SRF sector in France must overcome **the obstacles related to the nature of the activity itself:**

- **Low social acceptability** of projects by the general public and local elected officials[24].
- The SRF sector's **fragile economic model**:
  - competition with fossil fuels the price of which is unstable and has been low for a long time;
  - the difficulty of engaging consumers to use SRF or energy coming form SRF for 15-20 years;
  - reluctance of private investors (What do we do with an SRF boiler if the industrial heat consumer goes out of business?).
- **Little use of coal in France,** but:
  - coal-fired boilers are possible outlets for SRF;
  - adapting a coal-fired boiler requires less investment than building a facility;
  - savings made in CO2 quotas are higher when SRF is used as a substitute to coal rather than natural gas.
- **Technical difficulties related to fly ash management and pollutant releases.**

[21]BIO Intelligence Service S.A.S and Inddigo S.A.S. "State of the art in the production and use of SRF " (August 2012)
[22] https://expertises.ademe.fr/economie-circulaire/dechets/passer-a-laction/valorisation-energetique/dossier/combustibles-solides-recuperation/utilisation-combustibles-solides-recuperation
[23]For example, see the conditions in the ADEME's "SRF Energy" request for proposals.
[24] Example of the Blue Paper in Strasbourg: https://www.dna.fr/edition-de-strasbourg/2018/06/22/blue-paper-et-greenwashing

Lastly, **difficulties related to a recent worldwide context exist**:

- **An increase in the price of raw materials** including construction materials and therefore an increase in the initial investment;
- **An increase in the price of energy and reagents** and therefore the operating costs of facilities;
- **The RePowerEU project and the EU's green taxonomy** exclude low carbon recovered energies such as SFR and thereby discourage private investors even further.

E. Can the SRF sector still be developed in France?

Despite the obstacles described in the previous paragraph, **numerous factors could well push for the development of the SRF sector in France**, i.e.:

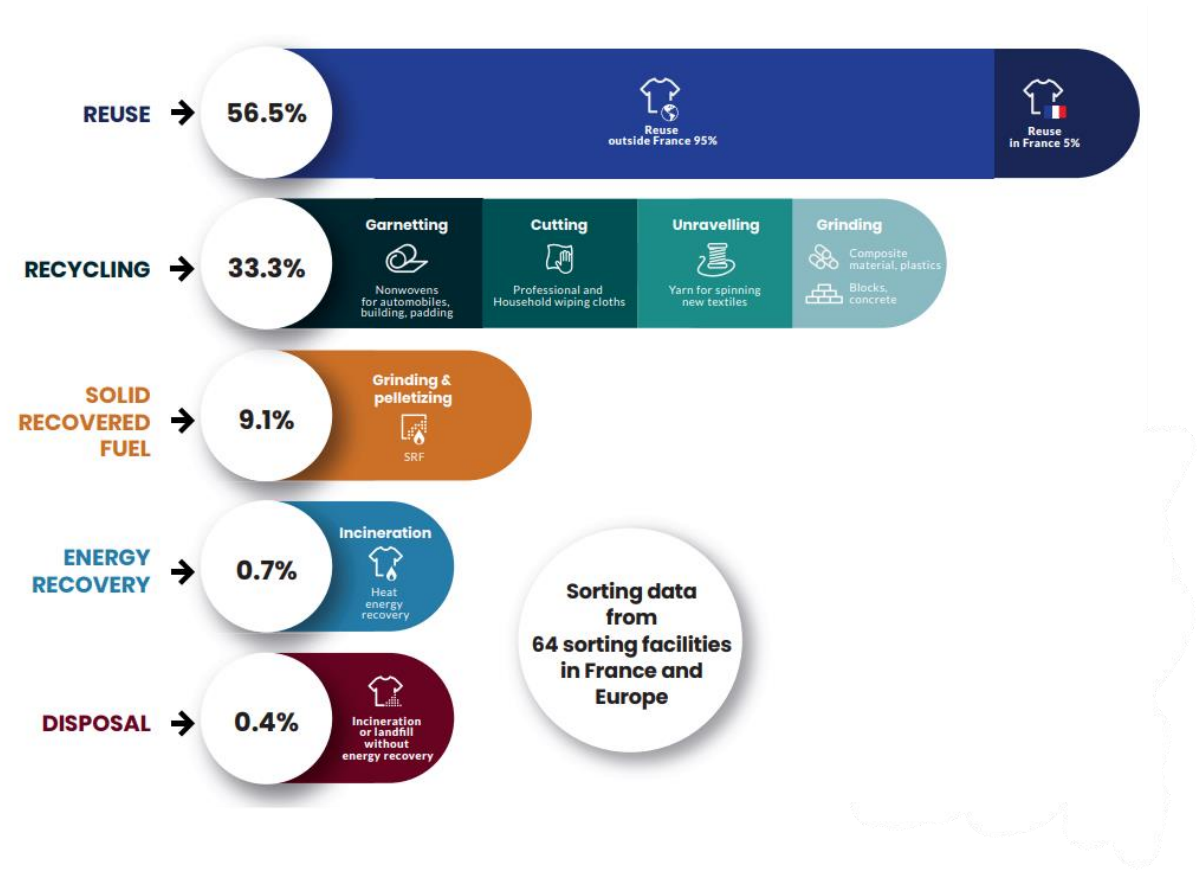
- **The war in the Ukraine and the international context**: a willingness to move away from a dependency on certain countries in order to have better control of prices and energy supplies. Energy from SRF is local and its price is relatively constant. Furthermore, energy from SRF has become competitive compared to fossil fuels.
- **The saturation of landfills and incinerators and the export of waste to other countries is threatened:** a willingness by the public authorities to develop an SRF sector with the implementation of laws and aid via RFPs, the increase of the TGAP[25] as from 2025 for facilities disposing of waste whereas the heading ICPE 2971 is not subject to this, etc.
- Energy from SRF is of more interest that the fossil fuels in terms of CO2 quotas because the energy from the SRF is in part renewable and thereby partly exempt from quotas. This will be all the more the case as the review of the European carbon market is heading towards removing free quotas allocated to sectors such as cement kilns.

[25]TGAP: French general tax on polluting activities

III. SRF, an outlet for non-reusable and non-recyclable CHF

Today, SRF is one of the possible end-of-service life solutions for non-reusable and non-recovered CHF[26]. For example, the purpose of the Thermicuir project started by the CTC Group is the thermal recovery of leather residues in shoes that are at the end of their service life[27]. Generally, much non-reusable and non-recycled CHF can be recovered as SRF. However, **the hard points and footwear can cause problems**, either during the preparation phase (metallic items may create sparks) or during combustion (release of harmful emissions in the case of footwear in PVC). Thereby, all or part of CHF sources may be refused by entities preparing SRF depending upon their facility and their know-how. However, for the most experienced SRF preparing entities, **their SRF may contain up to 40% CHF.**

Overall, **9.1% in 2020**[28] **and 8.7% in 2021**[29] of CHF was recovered as SRF according to the latest Refashion activity reports. This represents **about 16,000 tonnes of CHF.** The figure below shows the figures for the second lease of life of sorted CHF in 2021.



[26] **CHF:** Clothing, Household linen, Footwear
[27] https://conseilnationalducuir.org/newsletter/newsletter-n24-la-durabilite-en-actions
[28] https://extranet.refashion.fr/rapport-activite/2020/
[29] https://refashion.fr/rapport-activite/2021/

IV. Conclusion: advice for developing the SRF sector in France

On the basis of the studies examined in order to write this report, here are the lesson and advice learnt:

Review the French national waste management policies: prohibit and/or heavily tax landfilling and incineration in order to make energy recovery of waste as SRF more attractive.

Work on making facilities socially acceptable: provide information and communicate on SRF in order to end the confusion with waste incineration.

Give visibility to the sector: put into practice projects selected by the ADEME during the previous RFPs; maintain the issuing of RFP and adapt them to the SRF consumption objectives set for 2025 (2.5Mt) in regards to current consumption (400kt).

Stabilise the economic model, a few ideas: encourage co-generation enabling adjustment to seasonal needs in heat requirements; implement a system to ensure there is a compensatory system in place in the event that the price of heat from gas is lower than that of SRF; allocate free CO2 quotas for SRF boilers; reduce the TGAP for waste from SRF preparation that cannot be recycled.

One question remains: **What is the environmental impact by the SRF sector?**

The ADEME published a study[30] on the environmental impacts of different energy recovery scenarios from non-hazardous waste from industrial activity. The best scenario for the environment consists in recycling what can be recycled and recovering waste in the form of SRF as a substitute for coal.

However, this point has not been sufficiently addressed in the other studies mentioned in this report. More particularly, for the CHF industry it would be of interest to compare the environmental impact of the energy recovery of CHF to its recycling in Asia.

[30]ADEME, RDC Environment. "Environmental impacts of different energy recovery scenarios from non-hazardous waste from industrial activity". (May 2019)

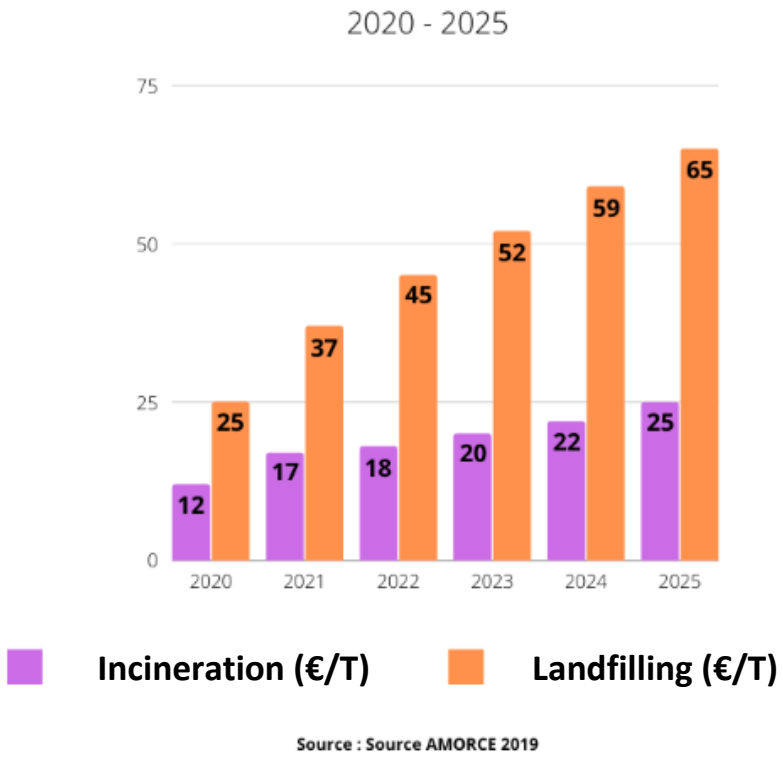
V. APPENDICES:

A. Appendix 1: The SRF sector's economic model in France

According to a study by AMORCE in 2021[31], the cost of preparing SRF is on average 100€/tonne of SRF. Some materials that can be recycled are sold at varying prices but often at a positive price. The entities preparing SRF are paid an average of 101€/t for handling the refused materials (waste that cannot enter the SRF preparation process and that cannot be recovered). They also bear the transport costs, which are 26€/t. Lastly, the fee for an SRF user is on average 21€/t of SRF.

It should be noted that prices vary enormously from one type of waste or SRF from another and depending on the economic and geopolitical contexts. Furthermore, the study was conducted on a sample with a very limited number of sector stakeholders. Lastly, the gradual increase in incineration or landfilling costs must be considered, in particular the increase due to the TGAP. This impacts the fee paid for handling waste from the SRF preparation entities but makes the SRF sector more competitive compared to landfilling and incineration.

Change in the cost of the TGAP according to the treatment method (landfilling or incineration) in €/T



Source : Source AMORCE 2019

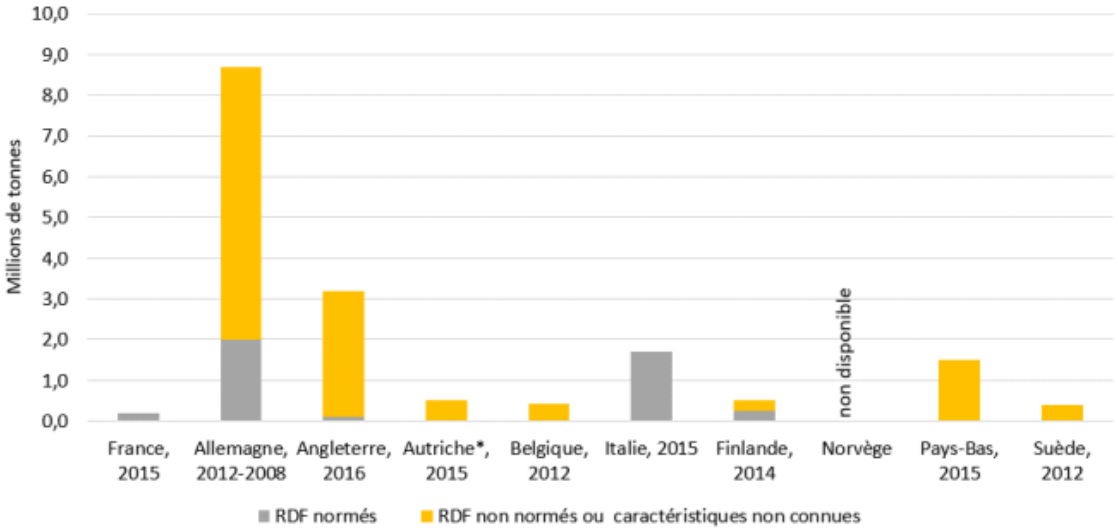
For more information on the SFR sector's economic model, see the studies carried out by SN2E in 2015[32] and by ANCRE in 2018[33].

[31] AMORCE. National overview of units preparing Solid Recovered Fuel". (May 2021)
[32] SN2E/FNADE. "Establishment of an overall economic model for the production and recovery of SRF". (Oct. 2015)

B. Appendix 2: Figures taken from the 2018 RECORD study[34]

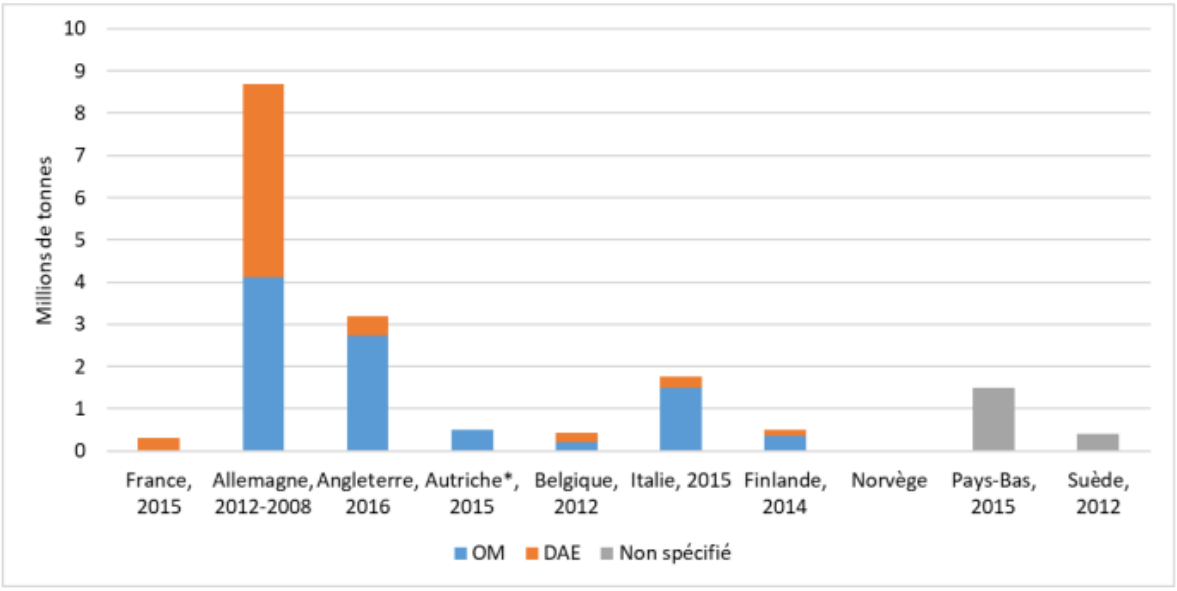
Figure 19, terminology reminder: the terms "standardised SRF" makes reference to solid fuels, prepared from non-hazardous waste complying to the European standard or an equivalent national standard. SRF is therefore standardised RDF but not all standardised RDF is SRF.

Figure 19: Non-standardised RDF (yellow) and standardised RDF (grey) production (DGE, RECORD, 2018)



***Excluding waste from EAW**

Figure 20: RDF production from EAW (orange) and Household Waste (blue) (DGE, RECORD, 2018)



[33] CVT ANCRE. "Solid recovered fuel (SRF): The technical, regulatory, economic and social barriers of the sector in France". (June 2018)

[34] RECORD. "The use of SRF and RDF in Europe. Literature review and administrative situations encountered in the field". 393 p, n°16-0250/1A. (2018)

Figure 21: Quantities of SRF used (DGE, RECORD, 2018)

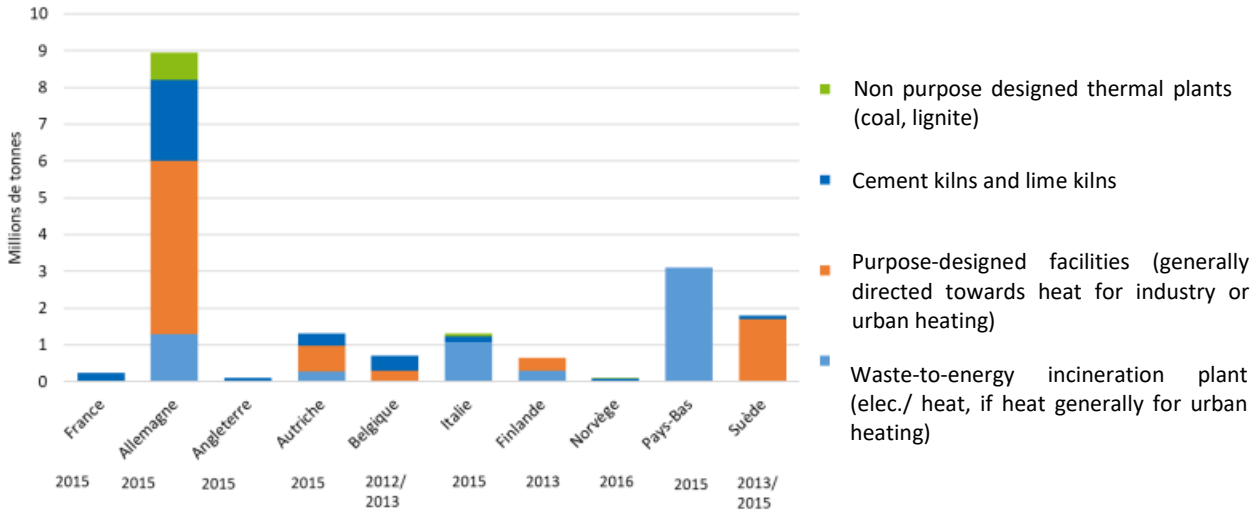


Table 17: Location of identified facilities (RECORD, 2018)

Pays	Nombre d'installations
Autriche	4
Belgique	2
Allemagne	40
Finlande	3
Italie	3
Pays-Bas	3
Suède	3
Royaume-Uni	2
Total	60

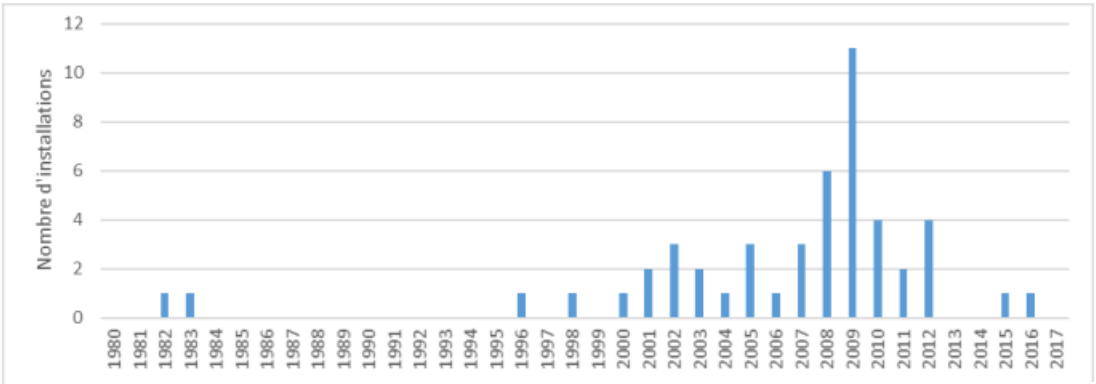


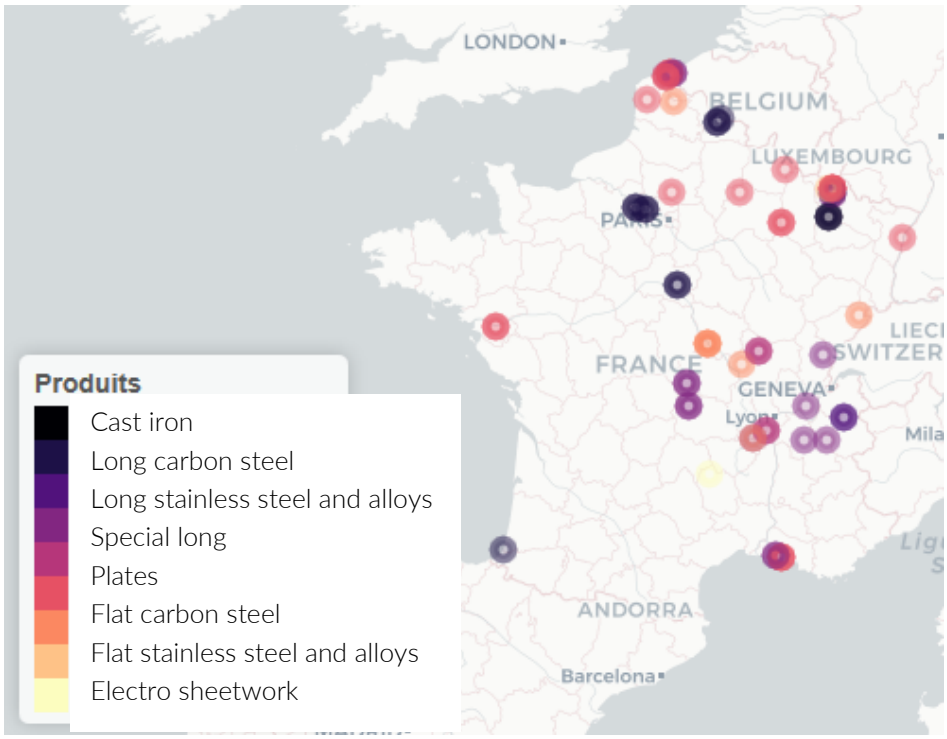
Figure 23: Commissioning date of identified facilities (RECORD ,2018)

C. Appendix 3: Mapping of SRF production facilities in France

Figure 8: Map of SRF production units (2020)

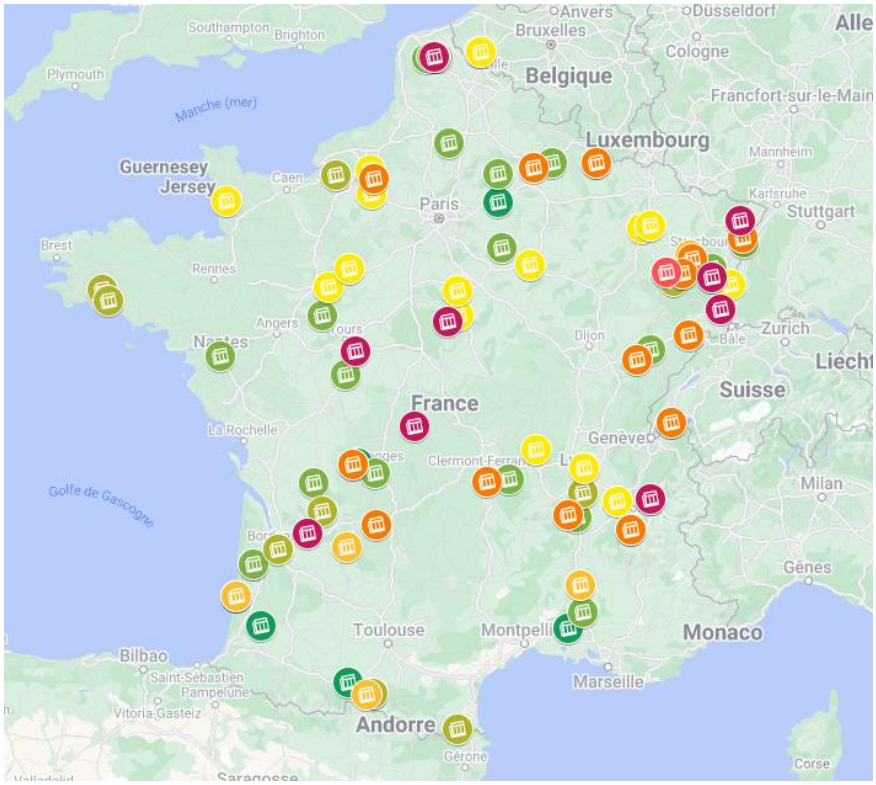
Source: AMORCE. National overview of units preparing Solid Recovered Fuel". (May 2021)

D. Appendix 4: Mapping of the steel industry in France



Source: A3M, which can be found in this report: https://www.senat.fr/rap/r18-649-1/r18-649-12.png

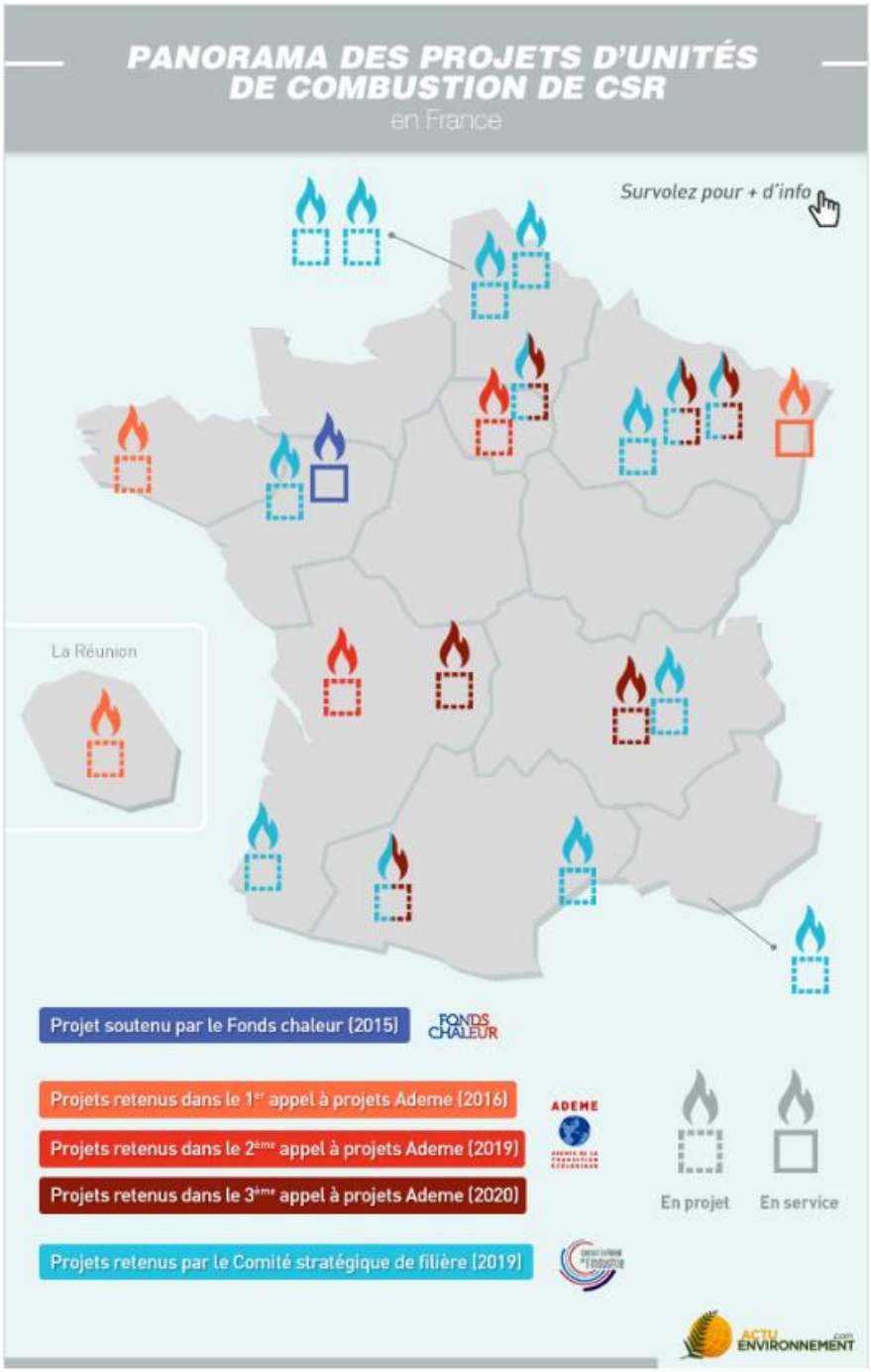
E. Appendix 5: Mapping of paper makers in France



Newspaper
Printing-writing paper
Industrial and special paper
Cellulose pulp
Flat cardboard
Flexible packaging paper
Paper for corrugated cardboard
Sanitary paper

Source: Copacel, https://www.copacel.fr/producteurs/

F. Appendix 6: Mapping of purpose-built facilities supported by the public authorities



Project supported by the "Fonds chaleur(2015)
Projects selected in the ADEME's 1st RFP (2016)
Projects selected in the ADEME's 2nd RFP (2019)
Projects selected in the ADEME's 3rd RFP (2020)
Projects selected by the Sector's Strategy Committee (2019)

Source: https://www.actu-environnement.com/ae/news/ademe-dechets-carte-unites-valorisation-CSR-35894.php4