RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

ADEME AGENCE DE LA TRANSITION ÉCOLOGIQUE

Sectoral Transition Plans

ALUMINIUM

Finance ClimAct

What is a Sectoral Transition Plan?

The "Sectoral Transition Plans", led by ADEME, constitute one of the actions of the LIFE Finance ClimAct project.

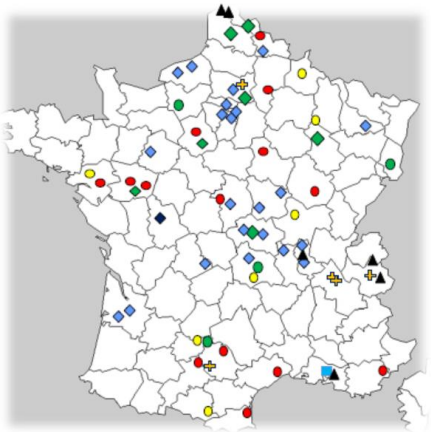
Objective:
Promote investment in the transition of the French energy-intensive industry to aim for its decarbonisation by 2050, taking into account the specificities of each sector

The Sector Transition Plan (STP) is a work in progress drawing up tools to support forward-looking dialogue in 9 industrial sectors, in cooperation with sector players (manufacturers and federations). Carried out over a period of 12 to 18 months, an STP builds decarbonisation scenarios aimed at achieving France's energy-climate objectives by 2050 (-81% of emissions compared to 2015 for industry), quantifies the impacts on production costs, assesses climate investment needs and analyses job changes. Finally, the Sectoral Transition Plan offers public and private actions that allow to create the socio-economic conditions necessary for the decarbonisation of the sector.

360° vision to inform the transition of the sector towards carbon neutrality.

This document is the first deliverable of STP Aluminum. Its objective is to present the key issues of the sector's decarbonisation to a wide audience in order to initiate dialog pertaining to the action plan. It was carried according to a bibliographic research and to the first discussions with industry key players. These results and proposals will be further developed during the next stages of the project.

Key Figures - ALUMINUM



Source: Aluminum France

Primary and secondary aluminum production sites which meet in first transformation

- Aluminum production of **0.9 Mt,** of which **55% is recycled**
- **2 primary aluminum production sites ("smelters"):** Aluminum Dunkirk and TRIMET Saint-Jean-de-Maurienne
- **Recycling 6 direct recycling plants and 10 refining plants**
- A few dozen first processing plants combining virgin and recycled material

French demand driven by three sectors

- Aluminum production is mainly driven by construction, transport and packaging
- French demand for aluminum metal and semi-aluminum products (bars, sheet metal, yarn ...) doubled between 1978 and 2000, the pace of growth has slowed since then.

Emissions mainly of process

- ~1.5% of industry GHG emissions but 5% of power consumption for primary aluminum manufacturing.
- 0.5% of the industry's thermal energy for the manufacture of recycled aluminum

Sources: ETS EU, SNBC, TURPE, CEREN, INSEE, IREP

An industry with low margins and high debt

- 2018 turnover of **5Bd EUR**
- A **4%** rate of return*
- A debt ratio of **192 %***

	Industry
	1000 Mds
	8%
	55%

INSEE data NAF 24.4, average on 2013-2017, Aluminum France

**Values for NAF code 24.4. - Production of precious and other non-ferrous metals*

First transformation, source of jobs

- **~10,700 direct jobs**

Of which 2/3 in first processing
15% in aluminum production
primary <5% for recycling

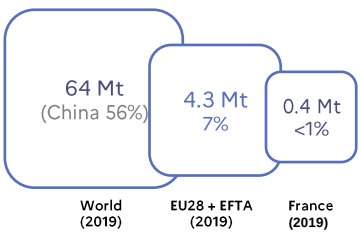
- **~50,000 indirect jobs**

Source: Aluminum France

Industry
1 Mn direct jobs
3 Mn indirect jobs

Production dependent on imports of raw materials and processed

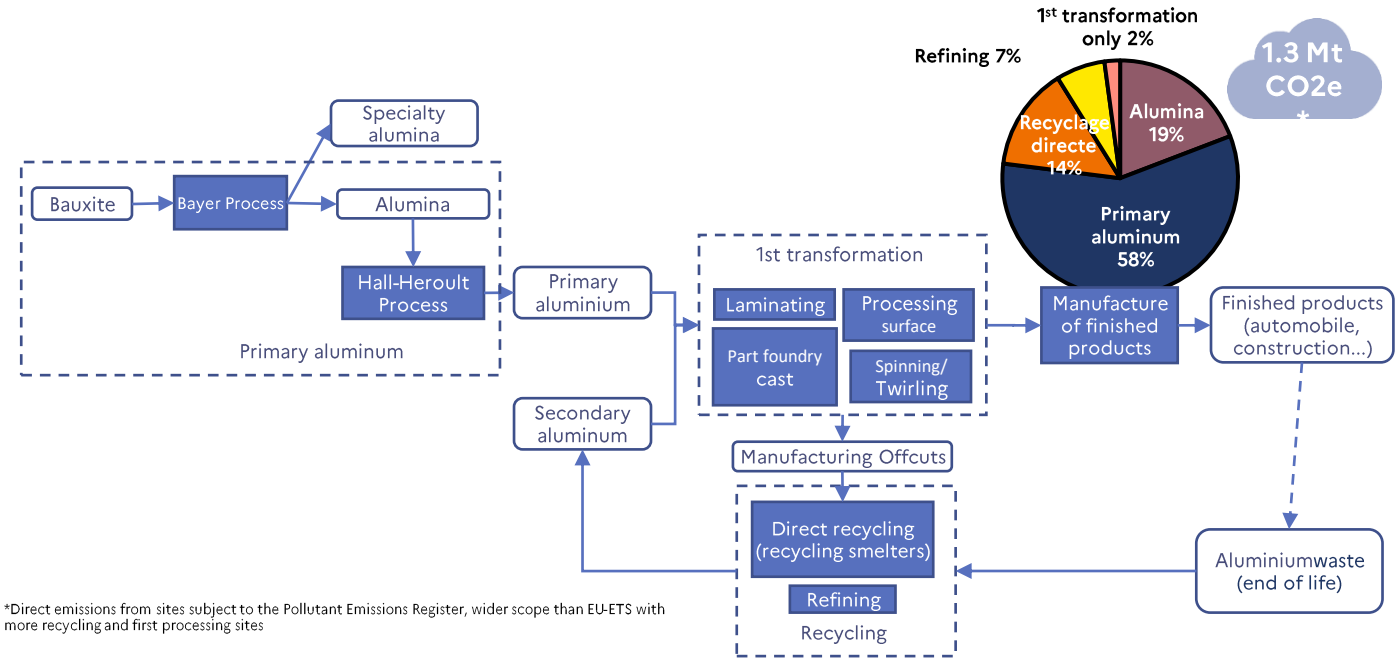
- Aluminum is a commodity traded on world markets. The aluminum market has been growing exponentially for 20 years in China.
- France is the 4th European producer (behind Norway, Iceland and Germany) but **¼ of the national demand for metal is based on net imports.**
- **France imports the raw materials needed to manufacture primary aluminium and exports aluminium waste**



Primary aluminum production

Source: Aluminum France

Decarbonisation Issues
Aluminum production and recycling



❖ Primary aluminium is highly demanding in terms of electricity and resources

Primary aluminum is produced by electrolysis from alumina, an aluminum oxide of formula Al_2O_3. 1 ton of primary aluminum requires between 13 and 14 GWh of electricity and 2 tons of alumina (obtained from 4 tons of bauxite). Alumina and electricity account for between half and 2/3 of primary aluminum production costs.

Due to the electric mix, primary aluminum produced in France has a carbon footprint (scope 1 and 2) about 6 times lower than primary aluminum produced in China. Indirect emissions (scope 2) related to electricity consumption of the entire aluminum industry in France are around 0.3 $MtCO_2e$, which is still significant in terms of direct emissions (1.3 MtCO2e).

Primary aluminum: ¾ direct emissions are process emissions

Electrolysis requires a carbon anode made from calcined petroleum coke and coal pitch. During the reaction, the anode is consumed by releasing CO_2. Under certain conditions ("anode effect"), the reaction may also produce perfluorocarbons (PFCs) that are potent greenhouse gases.

1.9 tCO_2e/t
Primary aluminum

❖ A well-controlled and virtuous recycling process

Aluminum is a 100% recyclable material. We are talking about:
- **direct recycling:** waste from families of identical alloys, allows to make aluminum of the same composition. Primary aluminum may be added for dilution.
- **refining:** recycling of aluminum waste from different alloys to produce specific alloys without adding primary aluminum.

Recycling aluminum saves **95% of the energy** needed for primary production and does not require bauxite.

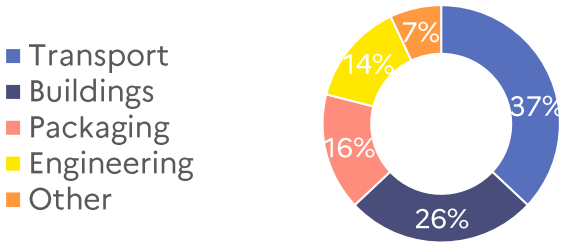
In France, the production of recycled aluminum avoids imports of primary aluminum.

❖ A well developed recycling chain except for packaging

Aluminum from manufacturing offcuts, buildings, transport and engineering is **already well recycled** (~90 - 100%). However, **only 50% of packaging waste is recycled**, due to a lack of equipment in sorting centers. Furthermore, without the ability to distinguish and separate the different aluminium alloys, recycling does not enable production for the same uses.

Decarbonisation Issues

Aluminum, a transition material



❖ Use French aluminum and recover more waste to decarbonise

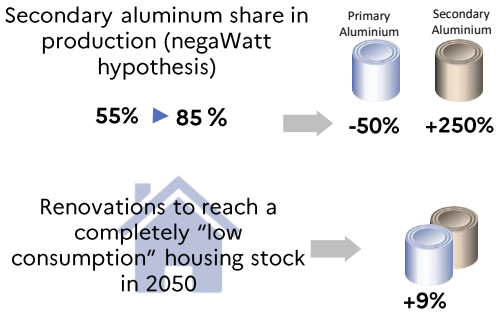
Demand for French aluminum is increasingly driven by imports. Given that primary aluminum production (and all products thereof) is an electro-intensive process and that France possesses one of the most decarbonised electric mixes in the world, it can be considered first-rate that any importation of aluminum has a greater carbon impact than if it were produced in France.

In addition, imports of aluminum metal are **of the same order of magnitude as the volume of waste exported** (≥ 500 kt/year): recyclers depend on the efficiency of the collection, the sorting equipment but also on the price of raw materials.

❖ A heavy industry sector going against the flow, but beware of greenwashing

More durable than PVC, lighter than steel, and already integrated into a circular economy, aluminum tends to be exploited more in the construction and transport sectors.

Trends of aluminum consumption (constant demand, 100% production relocated in France)

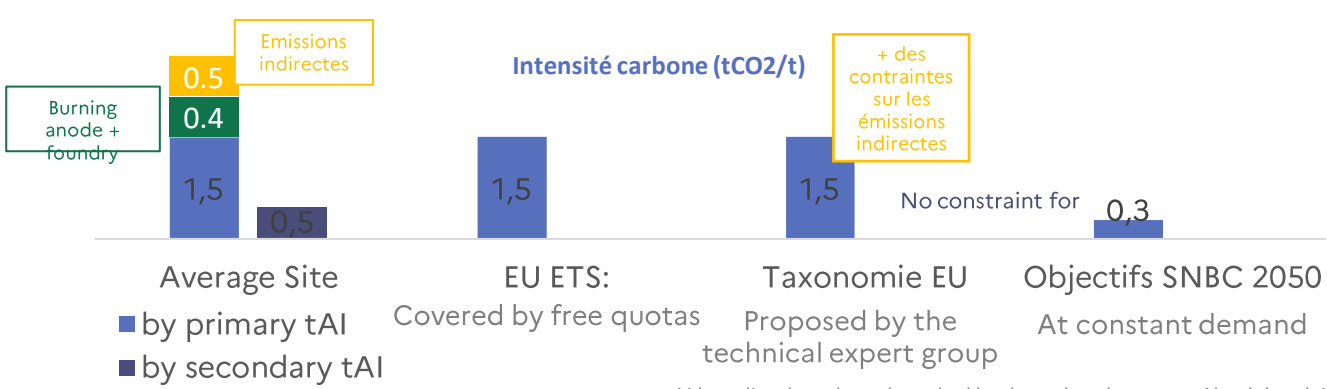


However, demand for recycled aluminum must not lead to the opposite: Create easy-to-recycle waste to increase the share of recycled content.

❖ A good student in the carbon market, regardless of the electricity mix

The EU ETS carbon market only covers process emissions from primary aluminium and direct recycling and the direct carbon intensity of the fleet is currently below regulatory levels. The group of experts involved in the development of European Taxonomy proposes to constrain indirect emissions by means of an energy efficiency threshold or a fuel mix emission factor.

Recycled aluminum is considered virtuous in both devices without particular constraints.

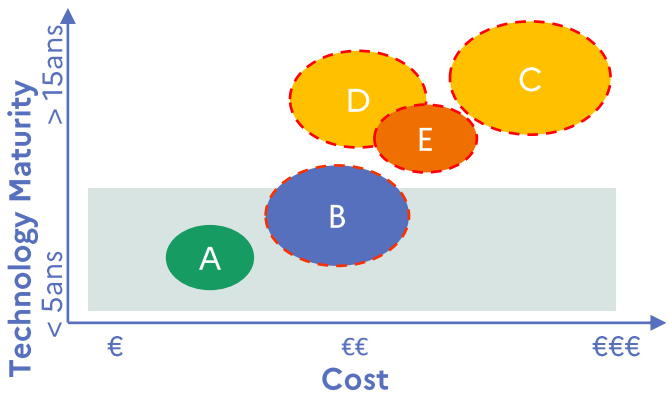


Decarbonisation levers

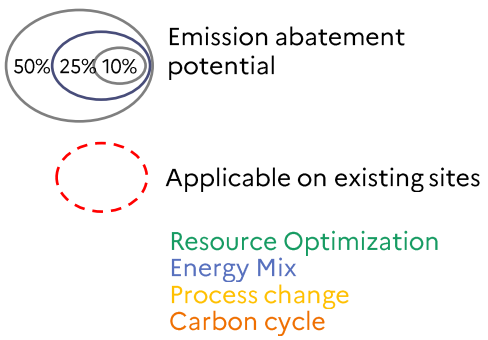
decarbonisation in the aluminum sector will focus on **efforts in the** end-**of-life manufacturing chain** to improve recycling and use of recycled materials. Apart from this aspect, the main decarbonisation levers of the sector are the electrification of thermal processes, the heat from biomass and the development of a breakthrough innovation still under study: inert anode for electrolysis

Key technological levers and their technological and economic trends

		Details/Barriers identified
A	**Improved recycling rate**	*Improved sorting and collection*
B	**Decarbonised heat for alumina production and recycling (biomass + electrification)**	*Availability of alternative biomass resources, electrification of large non-mature ovens.*
C	**Development of the inert anode preventing** the oxidation reaction of the anode carbon	*This technology is in the R&D stage. Uncertainty about the date of industrialization.*
D	**Anode from carbon from biomass**	*Availability of alternative resources, R&D*
E	**Capture carbon (CCS)**	*Capture planned on primary aluminum sites only. About 30% of emissions seem to be well located for geological storage.*



~50% of emissions potentially covered by mature technologies



Examples of actions to create a favorable investment environment

Best practices	Regulation	Financial Support
Dissemination of product eco-design practices to facilitate recycling	Regulation to increase the recovery of aluminium waste in France (e.g. through a fair consignment between materials) and limit exports	Innovation support devices to limit process emissions
Transparency on the carbon footprint of products and on the part of the recycled material incorporated	Carbon tax at borders to boost French aluminum and relocate part of the industry	Financial support to help recovery companies invest in the equipment needed for a better recycling rate

Ref ADEME 011518