InvestChile Insights - eBook Series

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INVESTMENT EBOOKS

REPORT

Recycling Infrastructure for Plastic Packaging

Outlook and Opportunities for Investment in Chile

JUNE 2021

InvestChile

CIRCULA EL PLÁSTICO

InvestChile - Foreign Investment Promotion Agency

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I. OVERVIEW OF THE COUNTRY

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01. About Chile

Chile has a population of 19 million citizens, around 70% of whom live in the capital, Santiago, and the surrounding area. More than 87% of its population live in urban cities. (INE, 2020). In 2019, Chile's GDP was above US$280 billion. At more than US$25,000 (adjusted for PPP), the country's per capital GDP is one of the highest in Latin America. (World Bank, 2020)

Key Facts

GDP 2019	US $ 282.3 billion
Exports	US$71.7 billion
Imports	US$65.5 billion
Population	19 million
GDP per capita	US$22,975 (Highest in LatAm)
Reference interest rate	0.5%
Inflation	3%
VAT	19%

Source: (World Bank, 2020)

02. Robust Foreign Direct Investment (FDI) Regime

The following principles govern Chile's FDI regime:

1. **Non-discrimination:** foreign companies based in Chile have the same rights and responsibilities as Chilean companies (national treatment).
2. **Free flow of capital and profit:** Chilean legislation allows the import and repatriation of capital without cost or restrictions other than legal procedures.
3. **Business-friendly environment:** the country has a simple tax structure, including an easy process for setting up a business (which can be accomplished in as little as one day).
4. **Government committed to encouraging investment:** there is a notable pro-investment agenda that is supportive of entrepreneurship.

This is Chile...

N°1 in LatAm. A Global Player

The World Economic Forum (WEF) has ranked Chile the most competitive nation in Latin America since 1998 and one of the most attractive markets for FDI.

#1
GLOBAL COMPETITIVENESS INDEX (WEF)

#1
RANKING BUSINESS ENVIRONMENT

#1
BEST COUNTRIES TO DO BUSINESS IN

#1
ECONOMIC FREEDOM

#2
GDP PER CAPITA (PPP)

1ST
SOUTH AMERICAN ECONOMY IN THE

OECD

(The Organisation for Economic Cooperation and Development)

II. WHY CHILE?

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01. Advantages and Attributes

On-Going Leadership

Since 1998, Chile has been ranked the most competitive country in Latin America by the World Economic Forum. The country was also the first South American economy to join the OECD.

Sophisticated Talent

Chile is a talent-rich economy with a global outlook, competitive costs, and professionals trained to meet the challenges of the new economy.

Chile is a Latin American leader in education and its market attracts international talent:

- **30 universities** among the **150 best in the region** (THE 2020).
- **+1,100,000 higher education students** and **+240,000 new graduates** annually (Higher Education Undersecretary's Office - Ministry of Education 2020)
- For the period **2010-2020**, **there was a 22% increase in the average number of temporary work visas granted each year**, while employer-sponsored work visa applications rose by an average 85% per year (Department of Immigration and Migration, DEM, 2020)
- **Chile encourages the entry of foreign IT professionals** and **specialist technicians** for its global services sector through the **VisaTech Talent Attraction Program**. Between 2017 and 2020, InvestChile processed more than 240 VisaTech applications.

Entrepreneurial Dynamism

Chile has a vibrant entrepreneurial ecosystem that is recognized around the globe. N°1 in Latin America in the Global Entrepreneurship Index (GEDI) in 2019, and 19th worldwide. Chile is the region's digital economy leader (DPE Index - GEDI 2020).

A Latin American Hub

The country is connected to the world and committed to globalization. It has one of the highest number of trade agreements of any country worldwide, which has enabled foreign companies to use Chile as a launchpad for global projection. Chile is also a gateway to the Pacific Alliance trade bloc.

- Free trade agreements (FTAs) with 65 countries & treaties to avoid double taxation with 33 economies.
- FTAs provide access to 88% of global GDP under favorable rate conditions: 4.9 billion potential consumers.

Trendsetter/ Tech & Sustainable Leader

Chile is a natural laboratory for testing new technologies and sustainable business ideas, and has created the ideal environment for clean energies, positioning itself as a leader in the fight against Climate Change in the region. The country has earned recognition for its quality of life and regional leadership on the Global Connectivity Index- GCI 2020 (Huawei).

REGIONAL PLATFORM

Chile is the **largest investor** in the region

(mining, retail, forestry, construction)

FTAs and **preferential rates** with

88%

of **global GDP**

Logistics Performance Index 2018

#1 LatAm
#34 worldwide

Access to

4,3

billion consumers

17

Airports

7 International 10 Domestic

17

Ports

02. Environmental Context

In 2010, Chile's environmental regulatory framework was updated and revised with the enactment of Law 20.417. This set up the following new environmental institutions: the Ministry of the Environment (MMA in Spanish), which is in charge of formulating environmental policy and issuing supporting regulations; the Environmental Assessment Service (SEA in Spanish), responsible for administering the Environmental Impact Assessment System; and the Environment Superintendency (SMA in Spanish), which is responsible for enforcement and monitoring of environmental management instruments, and applying sanctions where applicable. (Ministry of the Environment, 2019).

A robust institutional framework is crucial for the transition to sustainable development and for protecting the country's natural capital. A range of legislative bills seek to strengthen that institutional structure.

The following graphic shows the core institutions and the priority policies currently being implemented, along with a summary of Chile's environmental management instruments.

MINISTRY OF THE ENVIRONMENT (MMA)

Policy and regulation

MINISTERIAL COUNCIL FOR SUSTAINABILITY

Proposes sustainability criteria for public policies.

ENVIRONMENTAL COURTS

HIGH PRIORITY POLICIES

ENVIRONMENT SUPERINTENDENCY

Enforcement and sanctions

ENVIRONMENTAL ASSESSMENT SERVICE

Administration of the Environmental Impact Assessment System (SEIA)

CLIMATE CHANGE

Climate Change Legislative Bill. Thermoelectric plant closure plan.

INSTITUTIONAL STRENGTHENING

Legislative bill in process to create the Biodiversity and Protected Areas Service (SBAP).

BIODIVERSITY AND PROTECTED AREAS

22% of Chile's land area and 43.7% of its marine area are Protected Areas. New Urban Wetland Protection Law.

CIRCULAR ECONOMY

Implementation of the Recycling Promotion Law (EPR Law).

AIR QUALITY

21 Air Pollution Control Plans in place Promotion of electromobility.

ENVIRONMENTAL MANAGEMENT INSTRUMENTS

PARTICIPATION

$1 billion from the Environmental Protection Fund issued to civil society organizations in 2019.

EDUCATION

2,065 educational establishments have subscribed to the Environmental Certification System.

ASSESSMENT

300 projects representing US$9 billion in investments approved by the SEIA in 2019.

ENFORCEMENT

274 fines levied by the SMA in 2019.

Source: Chilean Ministry of the Environment, 2019.

03. Plastic in Chile

In recent years, Chile has made substantial reforms to its environmental policies, developing a sophisticated institutional framework, expanding marine protected areas, and implementing environmental taxes.

At the same time, concern is growing about how waste, particularly plastic, is managed, given the growing evidence of plastic contamination of the environment and micro plastic contamination of marine species.

According to recent estimates, total demand for products manufactured from or transformed into plastic (also called apparent consumption) in Chile in 2019 amounted to approximately one million tons, around 56 kg per person. (ASIPLA, 2020).

Internal demand for manufactured plastics includes domestic production (710,549 tons) plus imported manufactured plastics (375,155 tons), minus exports of manufactured plastics (81,273 tons). (ASIPLA, 2020).

The economic sectors in Chile that generate the most demand for plastic are mining, construction, agriculture and fisheries, which together accounted for some 37% of total demand in 2019. However, most of the demand is spread across a wide range of industries associated with final consumers and retail demand for bottles and packaging, which account for 8% and 48% of demand, respectively; the remaining 7% corresponds to a series of smaller categories (ASIPLA, 2020). See Table 1.

In regard to plastic waste, Chile generates more than 1.2 million tons every year. This includes one million tons of manufactured or transformed plastic products and 251,223 tons of plastic waste consisting of plastic packaging and wrapping from the net trade balance (imports minus exports) of products with plastic packaging. (CENEM, 2020).

Today, 89% of all plastic packaging waste in Chile is collected and disposed of in landfills, 4% ends up directly in ecosystems, and just 7% is recycled. Of all recycled plastic, 17% comes from domestic waste and 83% from non-domestic waste. (ASIPLA, 2020)

The installed capacity for plastic recycling in the country is focused on Polyethylene (PE), Polypropylene (PP), and Polyethylene terephthalate (PET), which is in line with global trends. (CodexVerde, 2019).

The current annual installed capacity for recycling is just over 80,000 tons for washing processes, close to 150,000 tons for crushing and shredding, and nearly 110,000 tons for pelletizing recovered material (ASIPLA, 2020).

Just 48% of the installed crushing capacity and 57% of pelletizing capacity are currently in use. It should be noted, however, that recycling rates are still low and should increase substantially with the enactment of the Extended Producer Responsibility Law (EPR) (ASIPLA, 2020)

It should also be highlighted that approximately 80% of all the available infrastructure for the treatment and valorization of plastic is situated in the Metropolitan Region. (ASIPLA, 2020)

If industry were able to use its entire installed capacity for crushing and pelletizing, the volume of recycled plastics could be increased by at least 65,000 tons (ASIPLA, 2020) annually. Therefore, one of the top objectives for increasing the circularity of plastic is to ensure it is received, treated, and recovered.

Table 1: Demand for plastic in Chile by sector and type of resin (2019)

Industry	2019 (tons)	2019 (%)
Packaging	482,126	48%
Mining	80,354	8%
Construction	210,930	21%
Agriculture and Fisheries	80,354	8%
Retail*	80,354	8%
Others	70,310	7%
Total	1,004,431	100%

* * Includes household, sports, and recreation.

Type of resin	2019 (tons)	2019 (%)
PET	97,348	14%
PE (high and low density)	335,196	47%
PVC	91,846	13%
PP	88,553	13%
PS	23,556	3%
Others**	74,050	10%
Total	710,549	100%

** Includes PU, engineering and other resins.

Source: (ASIPLA, 2020).

The total demand for plastic by sector and by resin are different because resin type is related to the demand for plastic material, and therefore only includes domestic production, while total demand for plastic refers to plastic manufactured items (PM), which also includes the imports (minus exports) of plastic manufactured items.

In summary:

Demand by Sector:

Apparent Consumption = PM consumption + Manufactured Goods imports - Manufactured Goods exports, where
PM consumption = PM imports + Local PM production for domestic consumption - PM exports
(Direct Manufactured Goods Imports and Exports; this formula does not include indirect plastics)

Demand by type of resin:
PM consumption = PM Imports + Local PM production for domestic consumption - PM exports

04. Initiatives underway in Chile

The Government of Chile has been working to improve plastic waste management through three main instruments. First, a broad political strategy linked to the circular economy through the 2020-2040 Circular Economy Roadmap – CER 20-40 (Ministry of the Environment, 2020) (through the innovative policy instrument Extended Producer Responsibility (Responsabilidad Extendida del Productor, REP) that forms part of the Recycling Law 20.920. And third, a wide range of regulations associated primarily with waste management.

CER 20-40

CER 20-40 is based on the experiences of other countries in applying the principles of circular economy in relation to waste. It proposes "a circular, regenerative economy that fosters a more sustainable, fair, and democratic Chile that puts people's wellbeing first" for 2040.

CER 20-40 is coordinated by an Executive Board composed of representatives of the Ministry of the Environment, Ministry of Economy, the Chilean Economic Development Agency (CORFO), and the Agency of Sustainability and Climate Change (ASCC). Fundación Eurochile and the Consensus Building Institute also participate as consulting NGOs.

Law 20.920 on Extended Producer Responsibility (REP in Spanish, EPR in English) and its regulatory framework.

Law 20.920 sets out a broad framework for recycling that includes principles, definitions, overall targets, and an institutional structure with the Ministry of the Environment as the main regulatory body. As such, the Law sets out a EPR framework for waste recovery and valorization by requiring producers not only to reduce their waste products through a mandatory recovery-valorization target, but also to adhere to waste management systems to efficiently recover plastic material and process their waste products through reuse and/or recycling. The objective is set out in a decree of the Ministry of the Environment and adheres to current environmental legislation. (Ministry of the Environment, 2017)

The decree sets out three key elements that will play a central role in the valorization and recycling of plastic in Chile. These are: (1) a register of producers; (2) the recovery objective under the EPR scheme, and (3) obligations linked to collective waste management associations.

Table 2 presents the annual targets for collecting and recycling packaging that are set out in the Law.

Table 2: Plastic collection and recycling targets set out in the EPR Law

Year	Target (%)	Target (tons/year)
1	3%	9,713
2	6%	19,427
3	8%	25,902
4	11%	35,615
5	14%	45,329
6	17%	55,042
7	20%	64,755
8	23%	74,468
9	27%	87,420
10	30%	97,133
11	37%	119,797
12	45%	145,699

Source: (Triciclos, 2021)

Regulations

Regulation on plastics as material

The Ministry of Health does not define plastic as a hazardous material, unless it is mixed with other substances (SD 148/2003, MINSAL). This is important, as it exempts plastics from the hazardous waste regulatory framework, which is stricter. Another relevant standard is SD 197/1987, which does require all plastic products to be labeled according to a specific classification system based on the type of processing, materials, and other pertinent information to assist recycling efforts.

Regulation on waste

In Chile today, most plastic waste is subject to a wide variety of regulations. Health Ministry Decree 189/2008 sets out regulations for landfills, defining the conditions under which landfills can receive non-hazardous domestic waste. As plastics are not considered hazardous in Chile, this regulation is applicable to plastic waste.

Health Ministry Decree 594/2000 defines the regulation of industrial waste, including rules for the collection, treatment, and disposal of industrial waste within industrial facilities.

Regulation on waste management and treatment

Most regulations applicable to waste management and treatment facilities come from the Ministry of Health and municipal bylaws. Article 79 of the Ministry of Health´s Sanitary Code states that the construction, repair, or renovation of any waste facility requires the Ministry of Health´s authorization.

Article 80 of the Code affirms that any facility or area used for the collection, classification, industrialization, sale, and/or final treatment of waste requires the Ministry of Health´s authorization. Lastly, vehicles that transport waste materials that could be deemed hazardous or affect the population must also be reported to the Ministry.

Another relevant piece of legislation is the Environment Law (Law 19.300), which requires an environmental impact assessment for any project considered as waste treatment, including household and industrial waste.

Law 19.175 on Local Government and Administration provides that the government is required to develop a regional land use plan (PROT in Spanish) that sets out the conditions required for the siting of waste treatment facilities.

Other applicable legal instruments include Resolution 5081 (1994) issued by the Metropolitan Environmental Health Service (SESMA, now replaced by the Metropolitan Regional Ministerial Health Secretary), which makes it a requirement that industrial facilities submit a report on their solid waste. A declaration must be filed for all industrial solid waste, reporting on it from the time it leaves the facility that generated it until it reaches its destination.

This requirement is reiterated in the Ministry of the Environment´s Supreme Decree 1 (SD 1/2014 MMA), under the regulation on pollutant release and transfer registry, the "RETC"[2], which sets out reporting requirements. Any facility that generates more than 12 tons of waste, municipalities that treat waste, and waste collection centers that are not required to report under another sector's requirements, must report under the RETC system.

It is evident that in Chile there is real concern for the environment, with a regulatory framework that is enabling changes that seek to reduce plastic pollution.

It is worth noting that there are other bills and municipal bylaws[3], that are designed to reduce plastic and microplastic contamination, some of which are still in the approval process.

[2]RETC: Catalogs the release and transfer of chemical pollutants, with emphasis on those considered hazardous, including information on their potential health and environmental risks.
[3]Municipal bylaws are legal instruments available to local governments to implement their local environmental management policies.

III. CHILEAN PLASTICS PACT

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Chile was the first country in Latin America to approve and launch its own Plastics Pact, the third under the Global Plastics Pact network, founded in the United Kingdom in 2018 by the Ellen MacArthur Foundation.

The Chilean Plastics Pact (Pacto Chileno de los Plásticos or PCP in Spanish) is led by Fundación Chile and The Ministry of the Environment and is aimed at rethinking the future of plastics by promoting a model that keeps this material in use and prevents it from ending up in the environment.

Taking a collaborative approach, the PCP works in a collective, coordinated way, focusing on all plastic packaging put into circulation on the Chilean market. This approach leads to collaboration and innovation in envisioning new forms of manufacturing, use, reuse, and recycling of plastic.

To ensure the success of this initiative, all those in the value chain are invited to participate, along with other pertinent stakeholders in Chile's plastic ecosystem. The aim is to achieve the active participation of plastic producers, packaging producers, retail outlets, brands, civil society (through consumer associations), environmental NGOs, municipalities, waste management companies, plastic valorization firms, government entities, industry and trade associations, and academia.

The PCP also seeks to meet four concrete commitments by 2025, through which stakeholders will build mutually beneficial long-term agreements. The four objectives proposed for 2025 are:

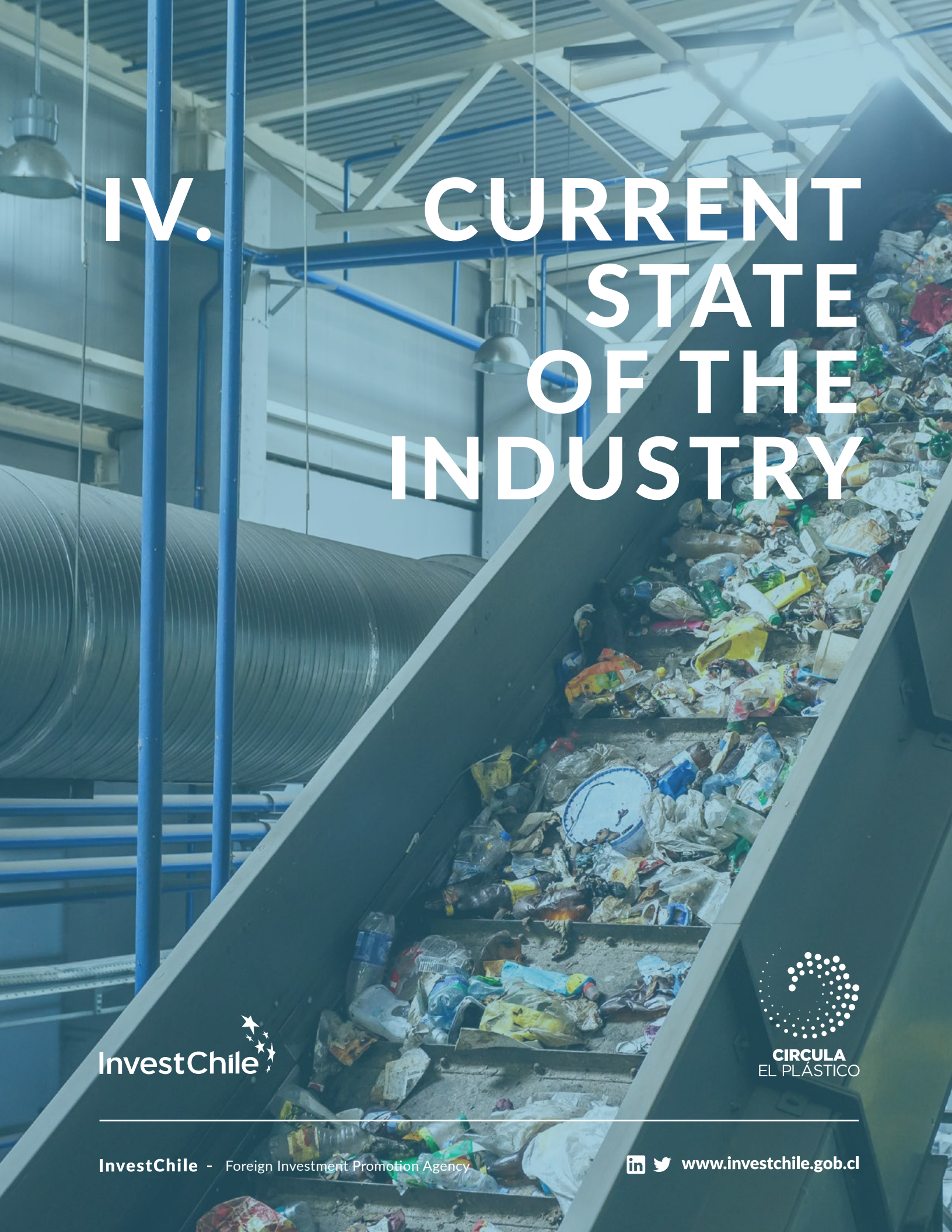
1. Take action to eliminate unnecessary, problematic single-use plastic packaging and utensils by redesigning and innovating.
2. 100% of plastic packaging must be designed to be reusable, recyclable, or compostable.
3. 1/3 of domestic and non-domestic plastic packaging must be effectively reused, recycled, or composted.
4. Plastic packaging must have, in their different formats, an average of 25% recycled material.

In 2020, the PCP entered its implementation stage, with a governance structure based on six Working Groups-- Culture, Circular Design, Open Innovation, Dialogue, Reuse, and Infrastructure-and three committees-Strategic, Technical, and Communications. These groups all seek to scale up initiatives among the Pact's members to achieve the targets in a shorter timeframe.

To date, more than 40 organizations have joined the Pact to work together to address this challenge.

One of the most difficult elements of this challenge, according to a group of leading recycling industry stakeholders with extensive knowledge and experience in the sector, is the need to invest in plants for the classification and/or valorization of plastic material.

The work carried out by the Infrastructure working group and indeed by the Pact as a whole makes this network an outstanding ally for investors interested in financing plastic classification and/or valorization plants in Chile. The group, which brings together experts in different stages of the plastics value chain to work collectively on achieving the Pact's four commitments, is ready to provide a whole range of necessary tools and support.



IV. CURRENT STATE OF THE INDUSTRY

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01. Installed capacity for recycling

The current unutilized installed capacity means Chile can manage recycling at the present level without any problems (see 3). However, in light of the target recovery rates set out in the EPR Law, processing capacity will need to increase considerably to meet long-term recycling targets. For the same reason, a shortfall is anticipated with regard to investment in infrastructure for classification and/or valorization plants.

Today, the capital goods market associated with the plastic industry has an estimated value of US$67 million. That average was affected by the significant drop in the value of imported goods in 2019, which amounted to just US$56 million. However, the expected rise in recycling rates suggests that there will be a reactivation in the capital goods market associated with the industry (ASIPLA, 2019).

Table 3: Installed capacity for plastic recycling in Chile, by process and resin (2018)

	Type of resin (tons)					
Type of process	PE/PP	PET	PVC	PS	Others	Total
Washing	56,100	26,350		2,550		**85,000**
Crushing	104,582	26,514	4,419	4,419	7,3649	**147,298**
Pelletizing	96,048		4,269	2,134	4,269	**106,720**
Production/capacity	54%	55%	37%	32%	30%	**52%**

Source: (ASIPLA, 2019)

The national register of facilities that receive and store waste and those that valorize it in Chile, prepared by Huaiquilaf consultants in collaboration with the Ministry of the Environment, suggests that collection and separation facilities are limited, and concentrated in the Metropolitan Region. An estimated 64% of Chile's recycling capacity is situated in this region. (ASIPLA, 2019). Furthermore, 2.530 plastic waste collection points called puntos verdes (green points) and 98 puntos limpios (clean points), which accept all waste materials, were identified in 2018, along with recycling collection and classification centers with an estimated capacity for processing 535 tons of plastic waste per month (approximately 6,500 tons per year nationwide), including all waste materials (Huaiquilaf, 2018).

Storage capacity for recycled materials is estimated to be 41,209 tons per month, or 494,508 tons annually, including plastic and other waste materials. The same study estimated the valorization capacity packaging at 7,230 tons monthly, with estimated recycling production in 2017 of 2,719 tons (see Table 4). These figures refer to recycling of household plastic waste, or to post-consumer recycling, and are comparable to household recycling levels, estimated at 14,281 tons annually (ASIPLA, 2019).

Table 4: Estimated valorization capacity in Chile (2017)

	PET	PEAD	PVC	PEBD	PP	Others	Total
Received for valorization (tons per month)	1,032	678	0	408	297	304	2,719
Valorization capacity (tons per month)	2,389	1,572	0	565	394	2,310	7,230
Received/capacity	43%	43%	0	72%	75%	3%	37%

Source: (Huaiquilaf, 2018)

To summarize, although these figures refer to different years and sources and are thus not comparable, they reveal that while Chile's installed recycling capacity is adequate in the short term, there is a bottleneck that is preventing an increase in recycling. This bottleneck occurs in the collection and classification, particularly of packaging associated with household waste, which are central elements of post-consumer recycling.

02. Principal stakeholders in plastic recovery

Over time, a series of stakeholders have emerged in Chile associated with the recovery and valorization of plastic material. The following are among the leading recovery entities recognized by ASIPLA: Cambiaso Hnos, Ferroplast, Greenplast, Inproplas, Integrity, Recipet, Rplast, and Comberplast. (Oceana, 2020)

- **Cambiaso Hnos:** purchases polyethylene waste from industrial processes in industries like agriculture, fisheries, and mining, recycles it in its plants, then uses it as raw material for its products.
- **Ferroplast:** recycles and crushes PVC and manufactures components from it. The company also provides recycling services to third parties for post-industrial polyethylene and polypropylene.
- **Greenplast:** provides solutions to businesses for managing plastic waste. It primarily recycles articles made with polypropylene and polyethylene (all densities). Greenplast also verifies the quality of material for later sale.
- **Inproplas:** a group of companies that recycles polyethylene and polypropylene from industrial scrap.
- **Integrity:** recycles single-use beverage bottles (PET) and transforms them into a raw material for manufacturing clamshell packaging.

- **Recipet:** receives PET beverage bottles, including those used for juice and mineral water. They do not take bottles that have contained oil (they are difficult to clean) or any kind of chemical or hazardous substance.
- **Rplast:** recycles plastics made of polypropylene and high density polyethylene.
- **Comberplast:** develops plastic injection and recycling projects in Chile. The company recycles PP, HDPE, LDPE, ABS, PC, PA, POM, PS, PAI, PBT, and PPO.

In summary, two companies focus on PET, five on high and low density polyethylene and polypropylene, and only one is a multimaterial recycler. The majority of these companies recycle industrial material. In Chile, therefore, PET, LDPE, HDPE, and PP are recycled.

76% of the recovered material is used for domestic production and 24% is exported. (Oceana, 2020)

V. OPPORTUNITIES FOR DEVELOPMENT AND BUSINESS

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01. Opportunities arising from the EPR Law

With the enactment of the EPR Law, recycling plastic has shifted from a voluntary challenge to an obligation. This means that companies with certain products on the market, whether locally made or imported, must take responsibility for the waste these products generate at the end-of-life, including financing their storage, transport, and treatment.

This new measure seeks to promote the circular economy, so that when plastic products are manufactured, their producers think not only of their point of origin, but also the end-of-life, as each product will have to be reusable, recyclable, compostable after use.

In the short term, one of the main practices that will be increasing is recycling, mainly because of the ambitious targets defined for plastic collection. (Ministry of the Environment, 2020)

In the beginning, 10% of households in the country will have access to curbside pickup of recyclable products. However, this rate will be increased gradually until coverage reaches 80% of all households in Chile.

Additionally, the Law calls for the mandatory installation of “puntos limpios” or collection points to service 75% of Chile’s municipal districts.

Thus, in a four-year period, 350 new puntos limpios will be opened and will operate under the recycling management system in compliance with high quality standards. (Ministry of the Environment, 2020)

The decree establishes a 24-month deadline for companies to begin meeting their targets, with 2023 being year 1.

Table 5: EPR Law requirements for facilities to receive and store recyclable waste

Implementation year	Number of municipal districts covered	N° of facilities required
Año 2023	29	96
Año 2024	64	90
Año 2025	97	97
Año 2026	71	71
Total	261	354

Fuente: Elaboración Propia

With the implementation of this regulation, it is estimated that for the 2022-2033 period, 7.7 million tons of packaging waste will be collected and thus made available for valorization, which will ensure they do not end up in a landfill, authorized dump, or unauthorized trash heap.

02. Important information: flows, costs, and other indicators for the installation of classification and/or valorization plants in Chile

In order to identify barriers and opportunities for increasing recycling capacity in Chile, the Plastics Pact requested consulting firm Triciclos to conduct a study to identify the technological gaps and opportunities that exist in Chile in regard to collection, separation, pre-treatment, and valorization.

The study included a review of literature and field work to gather and cross-reference information. Relevant sections of this study, specifically the economic analysis of plastic waste classification and valorization, are presented below.

Installed capacity for classification

The material entering this stage corresponds to waste collected in selective household pickup (where the material collected comes mixed together and contaminated), at “puntos verdes” (where the materials are separated by those who drop them off, but still are very contaminated), and by informal recyclers (recicladores de base, RRBB in Spanish) – at Collection Centers (Centros de Acopio, CA in Spanish).

Chile currently has no automated classification centers that meet the standards for a materials recovery facility (MRF)[4], instead, there are a series of private stakeholders that carry out this work, but with a low installed operating capacity.

The CAs (collection centers) across Chile do the work of receiving (purchasing post-consumer material) and separating material by type. These CAs send the material to official classification companies, and in some cases directly to valorization plants. The total installed capacity for plastics collection by Collection Centers (CAs) is 490,000 tons/year. (Huaiquilaf, 2018) Of this, more than 335,000 tons/year correspond to CAs between the regions of Valparaíso and Maule.

In terms of classification, the outlook is that 80%-90% of post-consumer plastic collected in relation to the collection targets should be processed at this stage. This corresponds to waste from selective household collection (CSD) and "punto verde" (PV) collection point, which owing to the level of mixing and contamination of the waste, must be processed through the classification infrastructure, unlike waste that comes from "punto limpio" collection point, which is transported directly to valorization plants.

Private classification entities separate and bundle the waste, and in some cases shred it for sale to valorization entities. Private installed capacity ranges from 31,000 to 38,500 tons/year. However, it should be noted that these private installed capacities mainly process post-industrial material, as the input material is of a higher quality.

Reference costs

Treatment costs for recovery plants and collection centers were obtained. These costs represent investment and operating costs per ton for treated material, without differentiating between the different types of material (Rojas, 2018).

[4]Materials Recovery Facility: in Spanish, Instalaciones de Recuperación de Material.

Table 6: Capacities and costs associated with classification

Type of treatment	Total capacity (tons/year)	Treatment cost (USD/ton)
Collection Center	160,000	13.4
MRF KDM[5]	110,000	17.7
Collection Center	100,000	10.7
Collection Center	40,000	18.7
Collection Center	20,000	17.4

Sources: (Rojas, 2018).

It should be noted that treatment costs at collection centers are for the preclassification of material, while the KDM classification center cost refers to the cost of classifying material before it is sent to be valorized.

To complement this, based on the concepts of economies of scale and information about what is happening in Europe, the authors found that the sum of an MRF's marginal cost of investment and operation decreases as its capacity for collection and classification, and its operating technology, increase. Plastic material is deemed to account for 40%-50% of all waste recovered (Cimpan, 2015). See Table 7.

Table 7: Costs of MRFs, by capacity

Type of MRF	Capacity (tons/year)	Material recovered (5)	(%) Capital and operating cost (USD/ton)	Number of workers
Basic	25,000	50	120	>30
Medium	50,000	50	90	>40
Medium +	75,000	60	75	>60
Advanced	100,000	70	65	>50

Source: (Cimpan, 2015),

[5]KDM: leading group in environmental and waste management solutions.

An advanced MRF is a plant in which most processes are automated, operating capacity is high, with the process designed to handle the quantity of material arriving, separation processes are automated, and quality control of the final product is both automated and manual. In contrast, a basic plant has low capacity, typical classification processes (separation for sifting and aeration), and relies to a great extent on manual classification (Cimpan, 2015).

To determine the investment needed for pre-treatment plants in different parts of Chile, economic feasibility studies were carried out to identify CAPEX and OPEX values, according to the capacity of an MRF with a useful life of 20 years. (SUBDERE, 2019)(Subdere , 2019). Estimating a recovery efficiency of 70%, it was demonstrated that MRFs are economically feasible when their capacity exceeds 20,000 tons/year. it is also worth considering that 52% of the material arriving is plastic (Subdere , 2019).

Table 8: Outlook for a pretreatment plant for household and similar solid waste RSDyA[6]

Type	Capacity (tons/year)	Capex (USD)	OPEX (USD/year)	Treatment cost (USD/ton)
Small	20,000	3.641.080	741,207.6	54.6
Medium	50,000	6.891.290	1,308,070,4	39.2
Large	90,000	10.935.036	1,896,757,8	33.6

Source: (Subdere , 2019).

For an MRF, the costs of separation and classification of material represent 30%-50% of the total cost of the system (Cimpan, 2015). Additionally, secondary sources consulted provided market prices for the sale of classified waste material:

[6]Household and similar solid waste (Residuos sólidos domiciliarios y asimilables, RSDyA): solid waste, garbage, scrap generated in industrial processes or other activities and not deemed hazardous waste under current health regulations, which, for its quantity, composition, and physical, chemical, or bacteriological properties, can be disposed of in a landfill without interfering with the facility's normal operation. (Subdere, 2018)

Table 9: Sales price, by type of classified resin in Chile

$USD/ton	Material Sales Prices		
	Minimum price	Maximum price	Average price
HDPE	203.01	232.28	220.04
LDPE	116.42	220.75	169.08
PET	178.20	257.14	266.84
PP	220.16	220.16	220.16

Fuente: (Triciclos, 2021).

These sales prices offer a point of reference for the revenue that these facilities could generate through the sale of separated and properly classified plastic material alone.

Installed capacity for valorization

Once waste undergoes a classification process, in which it is separated, cleaned, compacted, and shredded, among other actions, it is ready to enter the valorization stage, the aim of which is to recover a residue, one or several materials that comprise the material, and/or its caloric value, and prepare it for reuse, recycling, or energy valorization.

In Chile, the total installed capacity for valorization of plastic waste amounts to 86,760 tons/year. (Huaiquilaf, 2018) The valorization firms in Chile tend to be located in the country's central macrozone, making it logistically challenging to bring materials from the further reaches of the country. This translates into low reprocessing at the national level.

Table 10: Capacity for valorization of plastic waste in Chile

Macrozone	Region	Generation of household and similar solid waste plastics (tons/year)	Valorization (tons/year)	Regional coverage
Central Chile	Valparaíso	79,888,6	12,000	15.02%
Central Chile	Metropolitan	329,018,4	73,560	22.37%
Southern Chile	Biobío	53,071,5	600	1.13%
Southern Chile	Araucanía	26,974,6	600	2.22%
Southern Chile	Los Lagos	36,638,9	720	1.97%

Source: (Triciclos, 2021).

Note: total installed capacity refers to post-consumer and post-industrial plastic. No additional installed capacity for plastic valorization has been identified in other regions of Chile.

Reference costs

In general, the report on plastics separation and recycling prepared in Germany (Plastikviden, 2019) yielded standard investment values, by type of resin to be recycled. Figures on capital expenditure, investment in capital goods (CAPEX) were obtained, as well as on annual capacities and the efficiency of each process:

Table 11: CAPEX and plant capacity for different types of plastic

LDPE Films				
	CAPEX (USD)		Ton/año	
Washing line	3,600,000	6,000,000	2,592	3,240
Extrusion	1,200,000	1,800,000	1,944	2,376
Efficiency	75%-80%			
Rigid HDPE/PP				
	CAPEX (USD)		Ton/año	
Washing line	4,800,000	7,200,000	4,320	5,400
Extrusion	3,000,000	3,600,000	2,592	3,240
Efficiency	80%-90%			
PS/PET bottles				
	CAPEX (USD)		Ton/año	
Washing line	4,800,000	7,200,000	4,320	5,400
Extrusion	3,000,000	3,600,000	2,376	2,808
Efficiency	90%-95%			

Source: (Plastikviden, 2019).

For the operations listed above, the required floor space has been defined as approximately 500 m^2 for the operations area (handling), 1,200 m^2 for the washing line, and 300 m^2 for the extrusion area (Plastikviden, 2019).

Costs for recycling plant equipment were obtained from other sources. The table below lays out the main features of three projects in Latin America:

Table 12: Investments made in Latin American projects

	1.Perú (2017)	2.Chile (2013)	3.Colombia (2014)
Type of plastic	PET flakes	LDPE Pellet	PET (33%), HDPE (20%), LDPE (20%), PP (13%), Others
Plant capacity (tons/year)	1,100	749	936
Assets associated with investment	Tangible assets (renovations, machinery, fixtures), intangible assets (certificates, licenses), and working capital	Includes infrastructure (67%), machinery (20%) and minor facilities	Includes machinery and equipment, installation and fixtures, vehicles and intangibles (legal expenses and certificates)
Investment (USD)	$141,593	$1,680,000	$336,000

Source: (Aguilar, 2017). (Leiva, 2013). (Restrepo, 2014).

The different values derive mainly from differing investments in infrastructure and machinery. The projects above have low capacity, as they were designed for geographic areas with low population density.

To reach the targets set under the EPR Law, with the current rate of 17% post-consumer plastic valorization maintained, the alternatives are to build more infrastructure to expand the installed capacity, or increase the capacity of existing valorization plants. To offset investment and operating costs, revenues come from the sale of recycled resin to final markets. The sales prices for different types of resin are presented below, based on different sources and interviews with stakeholders.

Table 13: Sales price of resin to final markets

Type of resin	Sale of valorized resin (Market price in USD/ton)		
	Minimum price	Maximum price	Average price
HDPE	688.8	820	754.4
LDPE	676.5	780	728.3
Botella PET	568.9	795.3	1037.1
PP	446.9	474.2	921.1

Source: (Triciclos, 2021).

It is important to consider that the price paid for recycled resin depends upon several factors, the three most influential being: (1) the demand for recycled resin; (2) the value placed on the purity and cleanliness of the virgin resin; and (3) the price of petroleum – the raw material used for virgin resin (De Tandt, 2020).

Examples

As a case in point, it is worth examining the "Separation and Treatment Plant for the Valorization of Recyclable Waste" proposed by Rembre and currently undergoing environmental assessment. This project proposes the installation of a plant that separates and classifies recyclable materials from household, industrial, and commercial waste, for later valorization in third party recycling plants (SEIA, 2021).

The project consists of the construction and operation of a plant for the separation and treatment of recyclable waste for valorization. The project entails US$10 million in investment.

The facility's main operation consists of two processing lines that are expected to treat a total of 41,000 tons/year of waste for valorization. The lines correspond to:

- **Scrap Tires Processing Line:** Tires from cars and trucks are shredded in three different processes.
- **Packaging Processing Line:** The plant classifies recyclable material from industrial, commercial and similar waste, and packaging from urban solid waste that result from their segregation at origin and selective collection as dictated by Law 20.920.

Table 14: Volume of waste received for valorization (tons/year)

Year	Materials recovery facility (MRF) processing line	Scrap tire production line	Total
1	24,000	17,000	41,000

Source: SEIA, 2021

The bulk of the materials collected in the plant and processed in the MRF packaging processing line are expected to be plastic and paper-cardboard. (See table 15)

Table 15: Average composition of materials on the MRF Packaging processing line

Material	Average composition
Plastic	33.9%
Paper-Cardboard	36.9%
Metal/ Scrap	5.9%
Tetra Pack	0.8%
Wood	5.9%
Textiles	1.3%
Glass	15.2%

Source: SEIA, 2021

03. Benefits of investing in recycling classification and/or valorization infrastructure in Chile

Chile is leading the transformation towards sustainable development, the EPR Law, the Plastics Pact, the regulations associated with the single use plastics, the different public and private stakeholders working in collaboration, the changes in consumer habits, and the increasing importance of recycling education together have created an unprecedented opportunity to drive the economic potential of the recycling industry. For these reasons, it is important to identify and take advantage of the opportunity that currently exists to invest in this industry. Chile's recycling industry is positioning itself as a focal point for economic development and a role model in economics that have a positive impact in social and environmental areas.

It is worth emphasizing that Chile has the most open economy on the globe, with the greatest number of free trade agreements with the world's leading economies. It is also an early adopter of new technologies and market demands, which makes it not only a natural hub in the region, by providing access to key markets under favorable rate conditions, but also an excellent laboratory for testing new trends and products.

Chile also offers other benefits, such as:

- **CORFO's R+D Law.** A 35% tax credit against first category taxes on the amount invested in R+D and the 65% remaining investment can be deemed a necessary expense for producing revenue, regardless of the company's line of business.
- **VAT exemption on imported capital goods** Investors can access a VAT exemption on the importation of certain capital goods used for development, exploration, or extraction for different kinds of projects in Chile, including mining, energy, telecommunications, and technological, scientific, and medical research and development, where such projects involve investments for an amount equal to or greater than US$5 million.
- **Law of Remote Areas** Applicable to the regions of Arica and Parinacota, Los Lagos (Palena Province), and Magallanes. The Law grants three benefits: (1) a tax credit on first category taxes; (2) a wage subsidy; and (3) the DFL 15 – investment promotion fund.
- **Double Taxation Agreements** signed by Chile (33 tax treaties with leading economies).
- **Innovation support programs** offered by the Chilean Economic Development Agency (CORFO).

04. Support for investors: Services, Stages, and Instruments

InvestChile, the Foreign Investment Promotion Agency, promotes the country as a key destination for foreign direct investment and as the Latin American Hub for Global Business. It is the bridge between, the interests of overseas investors and the business opportunities available by providing free, tailor-made services to facilitate and grow investment in Chile.

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Promotion & Advice

- Meeting agenda/e-meetings with public & private players
- Investor delegations & B2B meetings
- Investment roadshows, conferences & workshops
- Detailed information on installation/sector-specific costs
- Investment incentives & special programs (i.e., R+D+i, visas, tax deductions/credits)

LANDING

Guidance & Access

- Dedicated expert-sector managers speaking several languages (i.e.,spanish, chinese, english, german, french, afrikaans, portuguese, italian, japanese)
- Sector-specific and legal advice on starting up
- Contact with key players within the business ecosystem & site visits
- Assistance in applying for financial incentives & government programs
- Public-private portfolios & public tenders
- Incorporation into the Regional Support Network for projects outside the Santiago Metropolitan Region

ESTABLISHED COMPANY

Permanent Support

- Ongoing assistance for landing & expansion/re-investment
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- #InvestChileE-Consuting with immediate -free of charge- assistance to resolve your concerns
- VisaTech Program for fast-tracking work permits for technology sector human capital
- Management of contacts and difficulties with public sector institutions to speed up your investment (i.e., permits, R&D+i, human capital)
- Media management to highlight your company's contribution to the country
- Special advisory on value-added & sustainable development initiatives
- Contact with public and private partners to foster synergies and cooperation

#InvestChileTools to power up your business

As an agency strongly committed to the environment and the promotion of the country's sustainable development, our investment support material is primarily digital.

Especially in these challenging times, the agency is providing solid support to companies to enable them to streamline their online and remote business.

Investor's Guide

*中文

A complete guide to setting up your business operations.
Steps involved in setting up/Incentives for foreign investment/ Intellectual Property/ Chile's tax structure/Environmental legislation/ Visas and foreign visitors/ Personal data protection legislation/Labor laws and social security.

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