

Implementation Plan for the construction of an organic waste treatment plant in the city of Viña del Mar, Chile - Summary

INTRODUCTION

The Climate and Clean Air Coalition (CCAC) is a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations committed to improving air quality and protecting the climate through actions to reduce short-lived climate pollutants. Within CCAC, the Municipal Solid Waste Initiative addresses methane, black carbon, and other air pollutants emissions across the municipal solid waste sector by working with cities and national governments.

The goal of CCAC is that cities, with the support of their regional and national governments, manage their waste in a coordinated and coherent manner to mitigate methane and black carbon emissions. It is in this line that the CCAC has been collaborating with the Municipality of Viña del Mar (hereinafter, the Municipality) to define its municipal solid waste management plan and evaluate technical and economic alternatives for managing its organic waste in a beneficial way. This support has focused on evaluating management schemes where a separation of the organic waste (OW) from the rest of the city waste is carried out and its treatment is managed according to its characteristics and the technical, financial, environmental, territorial and social possibilities, with the intention of identifying municipal organic waste management models that can be replicated in the rest of the country in the near future.

The latest stage of this technical assistance has involved a comprehensive evaluation of the technical and economic alternatives for managing Viña del Mar municipal organic waste. In this context, the city has selected as its highest technological priority, a biogas plant with combined energy production of heat, electric power and natural gas substitute (NGS), which could be used as fuel for clean combustion vehicles.

This document summarizes the implementation plan that has been jointly designed with the city authorities and whose objective is to make available to the municipality a road map allowing the construction of the chosen alternative to be carried out as soon as possible.

1 ALTERNATIVES OF PUBLIC-PRIVATE FINANCING

Public-private partnerships (PPP) have been installed in the public sphere as an attractive scheme to encourage the public and private sectors to work together to solve problems of public interest. From solving specific problems such as infrastructure, to facing the poverty of a region or country, or simply to join forces to solve problems of collective interest, public-private partnerships have come across as a feasible and attractive alternative to complement public efforts to improve the quality of life of our communities while opening investment, employment and productive development options for the private sector.

In the case of solid waste management, we can find joint working models between municipalities and private entities where normally the public entity contracts the services of one or several private entities to carry out the necessary services for an adequate management. A PPP model, on the other hand, distributes more equitably the associated risks and the responsibilities regarding the success or failure of projects. Furthermore, for cases such as the one analyzed in this work, where the investment amounts are high, as is the level of technical complexity for the design, construction and operation, a PPP model represents a very attractive alternative for municipalities since it reduces the financial burden and makes possible these capital-intensive projects, given that municipalities in most cases do not have such a high investment capacity. On the other hand, the private sector has greater technical expertise for developing and operating this type of project, which makes easier to access financing and better guarantees the operational success of projects in the long run. As such, these new project implementation schemes can result in environments suitable to stimulate, create and / or generate innovation in public management and to provide the community, from the social, environmental and economic perspective, new and more sustainable ways to carry out the waste management.

That said, it is relevant to investigate and analyze financing alternatives that bring together the public and private worlds in the great challenge that is implementing a biogas plant for treating the organic waste of Viña del Mar.

1.1 Types of Public-Private funding and administration available for the case of Viña del Mar

1.1.1 Shared Urban Financing (FUC, by its Spanish acronym)

The Shared Urban Financing (FUC) is a funding mechanism through which the Municipality may enter into participation contracts with third parties, aimed at acquiring goods or executing, operating and maintaining urban works, in exchange for a compensation, which may consist of granting rights over movable or immovable assets, or the exploitation of one or more properties or works.

The contract to be entered into states the service that the third-party contractor will provide to the Municipality, as appropriate, receiving in return, a compensation in accordance with the combination and equivalence established in the bidding rules and in the bidder's offer. The service consists of the set of works, actions, goods or money determined in the bidding rules, in accordance with the provisions of article 6 of the FUC Law¹, which the winner bidder will deliver to the Housing and Urban Service (SERVIU) or Municipality, as applicable, with a view to obtaining the corresponding compensation. The compensation consists of the set of works, actions or goods established in the bidding rules in accordance with Article 7 of the FUC Law, which the Municipality will deliver to the winner in exchange for the committed service. The bidding rules shall establish the minimum service which the bidder is willing to accept in exchange for the compensation offered or the maximum compensation it is willing to deliver in exchange for the service requested, with the aim of having a due balance between what the parties shall receive.

1.1.1.1 Services and compensations

According to the regulation and in accordance with article 6 of the FUC Law, the Municipality may receive from the participant one or more of the following **services**, as established in the bidding rules:

- a) The execution, operation or total/partial maintenance of a work for a determined period;
- b) The ownership granting over one or more immovable asset;
- c) The ownership granting of one or more movable assets intended for the purposes of the participation contract;
- d) The use or enjoyment, for a given period, of one or more immovable assets;
- e) The use or enjoyment, for a given period, of one or more movable assets intended for the purposes of the participation contract, and
- f) An amount of money, in addition to one or more of the above.

Pursuant to article 7 of the FUC Law, the Municipality may give to the participant one or more of the following **compensations**, as established in the bidding rules:

- a) The total or partial exploitation of one or more goods or works for a determined period, being able to receive the benefits of such exploitation;
- b) The right to use or enjoy one or more movable or immovable assets for a given period, and
- c) The ownership granting of one or more movable or immovable assets.

1.1.1.2 "Presentations" classification

Presentations, depending on the type of service and compensation and depending on the amount of the budgeted investment, are classified as follows:

¹ <https://www.leychile.cl/Navegar?idNorma=208927>

Projects type 1: Projects that only consider the ownership granting of movable or immovable assets, rights or money as service and the ownership granting over movable or immovable assets, or rights in compensation.

Projects type 2: Projects that consider either the execution, operation or total/partial maintenance of a work for a given period, or the total/partial exploitation of one or more movable or immovable assets, or works for a determined period, according to the following categories:

Category A: Projects that have an estimated investment of up to 20,000 UF ²

Category B: Projects with an estimated investment of more than 20,000 UF and up to 100,000 UF

Category C: Projects with an estimated investment of more than 100,000 UF and up to 300,000 UF

Category D: Projects with an estimated investment of more than 300,000 UF and up to 800,000 UF

Category E: Projects that have an estimated investment of more than 800,000 UF

1.1.1.3 Shared Urban Financing Process

Any natural or legal person may propose to the corresponding SERVIU or Municipality projects related to the works and actions regulated by the FUC Law. This proposal is processed according to the established procedure and comprises two stages. In the first, hereinafter the "Presentation", the applicant submits the project so that the SERVIU or Municipality, as appropriate, assesses whether it is in the public interest. In the event that the submitted projects is of public interest, in principle, a second stage begins, hereinafter the "Proposition", in which the proponent accompanies the studies considered necessary by the SERVIU or the Municipality, as appropriate, to evaluate the idea behind the private initiative.

Studies

According to the Regulation, the studies needed to develop the "Proposition" will be stated in the official response containing the "Public Interest" notice. This document informs the applicant that there is, in principle, a public interest behind the idea presented and will contain, at least, the following:

a) Minimum studies to be submitted at the Proposition stage, its form and specifications;

² UF is an inflation-indexed unit of account used in Chile equivalent to 43 USD approximately as of December 2017

b) Deadlines for the delivery of the studies reports. The deadline for the delivery of the final report may not exceed 180 days,

c) Designation of the Professional who will be the technical counterpart of the project and who will represent the SERVIU or the Municipality, as appropriate, before the applicant, at this stage.

In the case of type 2 projects, categories C, D and E, the favorable ruling of the Ministry of Social Development (MIDESO) must indicate the background documents deemed necessary to request to the interested party.

According to what has been discussed with the Municipality, some studies to be carried out for this particular project are: Architecture Project, Specialties Project, Health Authorizations and Sector Specific Permits, Soil Studies, Road Studies, Rate Studies, Environmental Impact Study, Mitigation Plans, logistics Raw Material, Tax regime, Budget, Economic assessment, among others.

It is important to indicate that a letter of the environmental relevance of the project must be submitted to the Environmental Impact Assessment System in order to obtain an official pronouncement from the authority regarding the need to present an Environmental Impact Study or Assessment.

Some cases in which the FUC model has been used are:

- Construction of parking lots and underground commercial premises. Plaza 19 April- Nuñoa
- 2582-109-LP09 - Contract of Participation and Concession of the Underground Parking Project 'Plaza de la Justicia' in Santiago
- 2735-188-LR16 'Plaza Santa' Underground Parking Project. Participation contract and concession of the underground parking project Plaza Santa Rosa in Lo Barnechea
- 5482-31-LQ17 Parking concession, Nuñoa

1.1.2 Municipal concession

A municipal concession is a kind of administrative contract, through which a municipality provides a service, establishment or property to a third party - natural or legal person – to exploit it or use it under the conditions established by the municipality.

Every municipality is legally authorized to grant the following **concessions**:

- **The provision of certain municipal services** - It refers to the ability of a municipality to commission, to a third party, the execution of a certain service within the scope of its territory, although it could provide it directly since by law it is a matter under its exclusive attribution. This is the case, for example, with the community cleaning and ornament services.
- **The administration of establishments** - The Comptroller General of the Republic has ruled that the concession of establishments involves the delivery in administration of a legal universality,

that is, a set of movable and immovable goods that constitute a harmonious whole, different from the constituent parts of which it is composed, in which an activity is developed with respect to which the municipality has competence. Thus, the comptroller has been able to rule, for example, that it is possible for municipalities to grant a concession to an educational establishment, provided that this does not mean the transfer of municipal functions or powers to individuals; that they may grant concessions for the administration of establishments that go some specific title, such as a community center; and that it is also possible to place in concession the places for deposit of vehicles withdrawn from circulation when the law stipulates such a measure.

- **Municipal or national assets for public use, including the subsoil.** Municipal assets are all those owned by the municipality. National assets for public use or public assets are those whose domain belongs to the whole nation and whose use is available to all inhabitants, such as streets, squares, bridges and roads, the adjacent sea and its beaches. These last assets, by law, are administered by the municipality, unless by their nature or purpose, and in accordance with the law, they are administered by another body of the State Administration.

As described above, the project is legally authorized to be granted as a concession under the concept of "provision of municipal services".

1.1.2.1 Granting, renewal and termination of concessions

The granting of concessions must be made through public bidding if the total rights or benefits that the concessionaire must pay are greater than one hundred monthly tributary units (UTM)³. If the total is less than this amount, they can be granted via private tender. The latter procedure can be undertaken, also, when there are urgent contingencies or other circumstances duly deemed as such by the council, in a session specially convened for this purpose and with the favorable vote of the majority of the councilors in office. The mayor must inform the council about the awarding of concessions in the first ordinary session held after the award.

The granting, renewal and termination of concessions requires the agreement of the council. In all cases, renewals can only be agreed within the six months prior to expiration of the concession, even when the concession in question is regulated in special laws. Concessions may be terminated at any time, when there is a serious impairment or detriment to common use or when other reasons of public interest occur. The concessionaire, in case of early termination of the concession, will be entitled to compensation, unless termination occurred due to a breach of the concessionary obligations.

The law establishes that prior to the start of works, the concessionaire must submit the project to the environmental impact assessment system and obtain all sector-specific approvals and permits necessary for the project's implementation.

³ 1 UTM is around 77 USD

1.1.2.2 Legal responsibilities

It is the function of the mayor to present concessions and their rights opportunely and in a well-founded manner for the approval by the council, since the initiative can be executed only with prior agreement of the municipal council, as is the case for renewal or termination.

One of the characteristics of the Municipal Council is that it is an organ of a normative, resolution and supervisory nature insofar as, at the request of the mayor, it must give its agreement for the dictation of municipal ordinances and for the regulations established by the municipality's internal organization. It is also normative since there is a series of municipal powers that depend on its approval for implementation. These include: approving the communal development plan, the municipal budget and those of the health and education departments, investment programs, the municipal regulatory plan and policies relating to human resources, provision of municipal services and **concessions**, permits and tenders. Concessions are among the administrative instruments that the Municipalities have for the fulfillment of their functions, and because they are administrative contracts, the Municipalities Act is responsible for making a special reference to them in the law.

1.1.2.3 Concerning rights

According to the Organic Law of Municipalities, the ability to establish rights for the concessions that they grant is one of their essential attributions. These rights being considered a form of goods and resources that makes up the municipalities' assets.

Case example:

- Tender ID: 3929-43-LP09 Concession, construction and exploitation of underground parking in Plaza Sucre

1.1.3 National Fund for Regional Development (FNDR)

This is the main financial instrument through which the Central Government transfers fiscal resources to each of the regions, for the realization of projects and development works with regional, provincial or local impact. Administration of the fund corresponds mainly to the Regional Governments and to the Undersecretary of Regional and Administrative Development (SUBDERE).

For the management of financial resources destined for solid waste projects, the SUBDERE has drafted a "National Program of Solid Waste", which establishes the types of Public Financing available for the management and administration of waste by municipalities and associations of municipalities.

The Program indicates that, within the requirements for applicants, minimization projects must have a final value considering transfer, minimization and final disposal per ton not greater than 1 UF per average ton. However, if there is a project that does not comply with these provisions, due to geographical conditions such as population, etc. it will be analyzed and discussed with the relevant authorities to consider its financing.

The financing route for development of a project and the requirements for its application are established according to the stage of development the project has reached:

1.1.3.1 Pre-feasibility stage

This stage will be financed through Concurrent Actions (AACC, by its Spanish acronym) and the activities to be funded include:

- a) Diagnosis.
- b) Studies (site location, topographic, climate, hydrological, hydro geological, geological, and archaeological studies, soil mechanics and/or wind, geotechnical investigations, regional management plans and others).
- c) Technical assistance (hiring professionals to support municipalities' management in solid waste management projects, in the processes of preparation, application, bidding, contracting and development of studies and/or works, municipal associativity, legal advice, etc.).
- d) Acquisition of land (this activity is financed once all studies have been carried out to determine that the land is suitable for the project's purpose and in those cases where the land has a value of less than 5,000 UTM).
- e) Normalization of landfills, minor works and emergencies works, which are specified and recommended by the inspection body of these facilities.
- f) Closure plan studies and environmental impact statements when appropriate.
- g) Management models, rate studies, minimum cost, technology evaluation and sustainability analysis (environmental, technical and economic) of the project.
- h) Studies of minimum cost solution to 20 years,
- i) Diagnosis of the current situation: Supply and demand study.
- j) Calculation of the deficit in the current situation.
- k) Demand forecasting.
- l) Optimal size (optimal capacity).
- m) Definition of micro location alternatives.
- n) Definition of technical alternatives to solve the problem.
- o) Cost estimation for each alternative (item: works, equipment, machines, vehicles, additional works (closings, access roads, others.)

1.1.3.2 Design stage

This stage is financed through the National Regional Development Fund (FNDR, by its Spanish acronym) or AACC; activities to be funded include:

- a) Detail engineering designs of the works to be executed and of the mitigation works. (The land can be bought at this stage if the value is greater than 5,000 UTM).
- b) Environmental Impact Studies.
- c) Compensation or Repair Plans when appropriate

- d) Business Plans and Rate Models.
- e) Other studies supporting the project's execution stage.

1.1.3.3 Execution Stage

Works allowed to apply to the execution stage will be those considering the construction of the biogas plant (minimization, transfer station or final disposal), including administrative expenses and consultancies, technical inspection, acquisition of machinery and vehicles for its operation, construction of access roads within the landfill field, purchase of transport trucks and, eventually, acquisition of household waste collection trucks. The minimum background documents to apply can be found in the program's operational guide.

1.1.4 Summary of Financing and Administration Alternatives

The table below summarizes the characteristics of each alternative previously described.

Table 1 Financing alternatives characteristics

	FUC	Concessions	FNDR
Administrator	Municipality	Municipality	MIDESO
Application period	All year round	All year round	All year round
Who can apply?	Natural or legal persons	Natural or legal persons	Municipality – Municipalities Association
Regulations and related methodology	FUC law and its regulations	- Organic Law of Municipalities N° 18,695 - Law N° 19,886, Bases of Administrative Contracts - Local ordinance of municipal rights for services, concessions and permits	Methodology for appraising SMW - Design stage - Execution stage
Awarding format	Public tender	Public tender	Public tender
Stage of the project			
Documentation and prior approval (1)	1. Presentation of the project to the Municipality (Article 10, FUC regulation) 2. 'Public Interest' notice		1. Fund request presentation for the "Design" stage - Project formulation - Technical ToR Design - Budget 2. Approval 3. Tender (Preparation of administrative and technical rules, and contracts)

			80 days (approval) + 30 days (bidding rules preparation) + 30 days (design awarding) 140 days
Preliminary studies and permits	In charge of the proponent (if the project is approved and awarded, the costs of the studies are reimbursed)	1 st option: Part of the concession's objective (design-execution-operation-maintenance) 2 nd option: Developed by the municipality or third party	Developed by the company winning the design
Engineering			
	365 days	270 days	365 days
Documentation and prior approval (2)	1. Proposition approval 2. Tender (Preparation of administrative and technical rules, and contracts) 30 days (Approval) 180 days (bidding rules) 180 days (awarding) ⁴	1. Tender (Preparation of administrative and technical rules, and contracts) 180 days (bidding rules and Technical ToR) 180 days (awarding)	1. Fund request presentation for the "Execution" stage - Technical ToR development - Budget - Project formulation 2. Approval 3. Tender (Preparation of administrative and technical rules, and contracts) 80 days (RS) 180 days (bidding rules preparation) 180 days (awarding) 440 days
	270 days	360 days	
Construction (fixed assets – installation) and operation	Private capital	Private capital	State capital

Table 2 Advantages and Disadvantages of Public-Private Financing Alternative

¹ See details in the Implementation Plan Schedule

	FUC	Concession
Advantages	<ul style="list-style-type: none"> • Deadlines for each stage of the project established according to the FUC law and regulations. • Development of the project by a private party for the Municipality. 	<ul style="list-style-type: none"> • Deadlines determined by the bidding rules, customized accordingly to the project. • The same company that designs the project builds it. • The business know-how is safeguarded.
Disadvantages	<ul style="list-style-type: none"> • Transfer of business know-how, which may be inconvenient for the proponent. • There is a risk that the proponent (the one who develops the preliminary studies) would not be the one building the plant. Given the specificity of the technology and its implementation, this does not ensure the correct construction and operation of the plant, nor the determination of responsibilities. • There is no certainty regarding coverage and amounts of reimbursements for previous studies. • If the project is not declared of public interest, if it is not approved by the council or if the call for bids is void, the proponent will not have the right to request a reimbursement for the expenses incurred in the relevant studies. 	<ul style="list-style-type: none"> • Making bidders' evaluation guidelines within the bidding rules is a difficult task. • There is a risk of committing the arrival to the plant of a certain amount of waste, which eventually may not be met.

1.2 Determining factors for implementation

1.2.1 Definition of organic waste generating sources

To estimate the amount of potential organic waste to be separated from the flow of household waste generated in the community and managed in a beneficial manner, several sources were identified, as detailed below.

Viña del Mar Municipality

Public sources: Household and/or household-like waste managed by the municipality⁵, where customers - citizens, organizations and public institutions - do not pay for the service performed by the Municipality. The public sources that generate organic waste in the community are described below:

⁵ In some sectors of the city, this service is outsourced to a private company.

- Street markets/fairs (14)
- Households
- Buildings/condos
- Educational Establishments

Private sources: Household and/or household-like waste managed by the municipality through Special Services, where customers - citizens, organizations and public and private institutions - pay for the service performed by the Municipality. Private sources that generate organic waste in the community are described below:

- Street markets/fairs (1)
- Municipal market
- Hotels/Restaurants
- Malls
- Supermarkets
- Educational establishments
- Health establishments
- Industries
- Households
- Buildings/condos

As a result of gathering information from the registry and statistics of the Municipality, and also considering estimates regarding the composition percentages of organic waste from public and private sources, a list detailing each generating source has been prepared. The table below shows a summary, configured according to the type of collection service carried out in the municipality of Viña del Mar.

Table 3 Generation organic waste by generating source in Viña del Mar

Private sources:	Tons/year	Tons/month	Tons/day
Special collection service (involving municipal fees)			
Gastronomic hotels	8,495.4	708.0	23.3
Buildings-Condos	1,086.0	90.5	3.8
Educational establishments	181.0	15.1	0.6
Supermarkets	1.3	0.1	0.0
Street markets/fairs	1,835.6	152.9	5.1
Sub Total	11,599.3	966.6	32.8
Public sources:			
Traditional collection service (without municipal fee)			
Households	59,044.2	4,920.4	205.0
Sub Total	59,044.2	4,920.4	205.0
Total	70,643.5	5,887.0	237.8

It is estimated that at least 237 tons per day of organic waste are generated between public and private sources.

1.2.2 Final product

According to the technical and economic analysis of the technological alternatives for treating the organic waste for the Municipality of Viña del Mar, the execution of the project can generate the following recoverable products:

Electric power and thermal energy

According to previous analyzes executed by this technical assistance, the project has the potential to produce 1.3 MW of electric power in the first year of operations (2020). It must be taken into account that the 1.3 MW cogeneration unit will also produce thermal energy. Between 1.4 and 2.1 MW of equivalent thermal energy are estimated, depending on the type of technology for efficient cogeneration facilities (gas turbine, alternative internal combustion engine, etc.) and the use of thermal energy (process steam, hot water, absorption cooler, low pressure and high-pressure steam, space heating, etc.).

However, it is also observed that approximately 50% of the thermal energy is typically used for the process (pretreatment of the substrate, if necessary and/or to maintain the digester at the required temperature) and to provide hot water and/or for the installation, if necessary. In any case, excess thermal energy can be used by neighboring users (greenhouses, small industries, etc.)

Based on the calculations and on the estimated organic waste availability per year, the annual energy potential during the Project's shelf life is tabulated below.

Table 4 Project's potential energy generation

Year	Availability of organic waste (tons per day)	Potential energy (MW)	Potential to supply the electricity grid (kWh / day)
2020	139	1.3	25,216
2021	142	1.3	25,896
2022	146	1.4	26,591
2023	150	1.4	27,301
2024	154	1.4	28,026
2025	158	1.5	28,767
2026	258	2.4	46,892
2027	265	2.5	48,180
2028	272	2.5	49,497

2029	279	2.6	50,843
2030	287	2.7	52,217
2031	367	3.4	66,866
2032	378	3.5	68,723
2033	388	3.6	70,623
2034	399	3.7	72,569
2035	410	3.8	74,561
2036	421	3.9	76,600
2037	432	4.0	78,687
2038	444	4.2	80,824
2039	456	4.3	83,010
2040	468	4.4	85,248

Source: Technical Economic Analysis of the Technological Alternatives for treating Organic Waste for the Municipality of Viña del Mar

The table above indicates that it could be a good option to consider modular increases in the acquisition of cogeneration capacity: 1.5 MW in 2020, at the beginning of the project, and the addition of two plants of 1.5 MW each, in 2026 and 2031, respectively.

Biogas, injection to the natural gas grid

Raw and untreated biogas in the digester is mainly composed of CH₄ and CO₂. However, it is also saturated with moisture and contains other pollutants, including H₂S, particulate matter and in some cases drops of oil and siloxane, all of which are detrimental to the processing equipment, especially when the biogas is to be used as Substitute Natural Gas (SNG). The CO₂ must also be eliminated from the biogas, so that the CH₄ content exceeds 90% -95% (when used to inject it in the natural gas network or as vehicular fuel). Therefore, biogas needs to be treated and processed to "clean" all pollutants. The key parameters when evaluating the economic and environmental performance of the technologies are: the amount of energy needed to convert the raw biogas into biomethane and the level of methane losses associated with the upgrading process. The methane lost during the process not only represents loss of income, but also has negative impacts on the environment.

The municipality is open to receive proposals that include this alternative depending on the economic feasibility and potential direct benefits to the city.

The following table shows the potential Compressed Natural Gas (CNG) equivalent for the project's duration.

Table 5 CNG output estimation

Year	Available organic waste (Tons per day)	Net CNG equivalent available (liters/day)
2020	139	5,815
2021	142	5,972
2022	146	6,132
2023	150	6,296
2024	154	6,463
2025	158	6,634
2026	258	10,814
2027	265	11,112
2028	272	11,415
2029	279	11,725
2030	287	12,042
2031	367	15,421
2032	378	15,849
2033	388	16,287
2034	399	16,736
2035	410	17,196
2036	421	17,666
2037	432	18,147
2038	444	18,640
2039	456	19,144
2040	468	19,660

Source: Technical Economic Analysis of the Technological Alternatives for treating Organic Waste for the Municipality of Viña del Mar

- Digestate, as byproduct from the process

Digestate is a stabilized liquid or solid waste that is obtained from an anaerobic digester after the production of biogas. This residue, when mixed with pruning remains chips produced in the Municipality's chip plant, may produce a high-quality fertilizer. It is assumed however, that digestate will not have an economic value for the project since there is no stable market price for it in Chile at the moment.

1.2.3 Services and compensations

Based on the benefits of the project⁶ and the key resources, and to offer a sustainable environmental, technical and financial solution for the city's solid waste management, the following services and compensations should be considered in the development of bidding rules and that are part of the concession contract.

Table 6 Scope and reach of the project's benefits

Benefits	Scope	Reach			
		Global	Local		
			City and its inhabitants	Municipality	Plant operator
Reduce greenhouse gas emissions from the current management of MSW	<i>Environmental</i>	x	x		
Improve inhabitants' quality of life by improving air quality in the city			x		
Educate and raise awareness among the population regarding the importance of separation at source, availability of resources and care for the environment of the planet and its city	<i>Social</i>		x		
Job creation during the plant's construction and operation	<i>Social</i>		x		
Valuing the Organic Waste generated in the commune by treating them and turning it into products: Gas, electric power, thermal energy and organic fertilizer	<i>Economic</i>			x	x
Reduce operation and maintenance costs of current MSW management	<i>Economic</i>			x	
Achieving a sustainable MSW Management Model, since income generation is expected: participation in the business's profits and/or concession rent fee and/or reduction of the electricity bill paid by the Municipality by injecting electric power into the network	<i>Economic</i>			x	
Co- benefits					
Construction of an ecological park 'Ecoparque'	<i>Environmental, social, economic</i>	x	x	x	
Comprehensive Waste Management Center	<i>Environmental, social, economic</i>	x	x	x	
Environmental Classroom	<i>Environmental, social</i>		x		

⁶ The benefits and co-benefits correspond to the project's value proposal included in the business model section

Key resources for the implementation of the project have been identified and these are shown in the table below. Because of the public-private nature of the project the different responsibilities and resources contributions will be share between different stakeholders according to the expertise and capacities of each party.

Table 7 Project key resources

		Financial resources
Physical resources	Site	Municipality/Canada's government /Subdere
	Facilities, machines and equipment for the treatment of organic waste	Private company
	Machines and equipment for differentiated collection	Subdere's Solid Waste National program: Official Notice 33
	Access roads paving	Municipality/Canada's government / Participatory Paving Program of the Ministry for Housing and Urbanization (MINVU)
Knowledge resources	Biogas plant design	Private company
	Customer Recruitment and Follow-up Program	Municipality
	Broadcast and communication program	Municipality
	Education Program for organic waste management	Municipality
	Collection logistics program	Municipality
Human resources	Execution of the project's outreach program	SUBDERE's Solid Waste National program: outreach program/ Municipality
	Execution of the Customer Acquisition and Follow-up Program	Municipality
	Execution of the Education Program for SW management	SUBDERE's Solid Waste National program: Waste minimization pilot program
	Construction, operation and maintenance of the biogas plant	Private company
	Execution of the waste collection logistics program	Municipality
	Project's general management	Municipality

Compensations

The compensations refer to the benefits that the Municipality will have, through a Public-Private Partnership (PPP), in the development of the Project. These are an important part of the negotiation and financial feasibility of the project.

The compensations linked to the project are:

- Concessional income from the PPP;
- Profit sharing;
- Reduced electricity bill as a result of the injection of electricity into the grid;
- Delivery of digestate for municipal production of compost for the maintenance and construction of new green areas in the community;
- Design and construction of the Comprehensive Management Center and Environmental Classroom;
- Design of the Lajarrilla ecological park;
- Design and construction of green areas; and
- General project management.

Services

The Services correspond to the resources that the municipality provides or contributes for the execution of the project, through a legitimized PPP by means of a municipal concession.

Such services or resources are:

- Grant a long-term concession over a municipal piece of land for the construction of the plant and its operation (20 years).
- Guarantee the delivery of a minimum volume of organic solid waste that would enter the plant daily during the project's shelf life.
- Guarantee a minimum 2% annual increase in organic waste delivery to the plant resulting from the execution of municipal programs: Customer capture and follow-up; outreach and communication; and education for adequate organic waste management.
- Capital contributions for initial investment and operation, but not limited to in-kind contribution from the city during the plant's construction phase. For example, use of heavy machinery to improve roads, excavations, etc.
- Possibility to use leftover gas from the existing Lajarrilla landfill site, which could be recovered to complement the plant's biogas production.

1.2.4 Criteria for selecting financing alternatives

1.2.4.1 *Public and private interests (services and compensations)*

This criterion is of great relevance when deciding on the financing alternative, since it considers a prior agreement of the interests of the municipality and of the company that is selected for the execution, operation and maintenance of the plant. This point is considered when evaluating FUC alternatives and concessions, since in the case of the FNDR, the company that wins the project must assume the conditions established by the Municipality.

1.2.4.2 *Resources needed for studies and relevant parties*

Due to the size of the project and its specificity, studies can be of very costly, and depending on the type of alternative a decision is made as to the relevant players for its execution:

FUC Alternative: The cost of the studies must be disbursed by the proponent, which could eventually be the company that is awarded the project at the execution and operation stage, or it could be the Canadian consultant that will continue supporting the implementation of this project once CCAC technical assistance has ended.

Concessions Alternative: The Municipality may concession the project from the design stage, in which case the bidder will be responsible for the design, construction, operation and throughput of the plant, since the municipality does not have the technical or financial capacity to perform the design.

FNDR Alternative: Prior to the evaluation and approval of the Project presentation given when seeking funds, the Government, through the Ministry of Social Development, finances all the studies necessary for the execution of the biogas plant. For the development of the studies, the award procedure must be carried out through public bidding.

1.2.4.3 *Time between the project application and execution*

This is the most relevant criterion, since it requires efficiency and speed in the execution of the stages to allow the execution of the project in the shortest possible time.

1.2.4.4 *Due execution of the Design*

This criterion is of great relevance because the type of technology to be used determines the design and construction of the plant. In Chile there are few companies that have experience in the design, construction and operation of biogas plants. Therefore, it is crucial that a single company carries out the project from its initial stage. This gives complete clarity in the determination of responsibilities in case the plant does not operate correctly.

1.2.5 Selected financing alternative

Based on the criteria described in the previous point, and after intense and detailed discussions with the municipal stakeholders, the financing alternative selected is that of a Concession, since it is the one that presents the greatest feasibility in execution because:

- The deadlines for the development of the project are determined by the Municipality and are established in the bidding rules and the execution times are shorter than any other alternative;
- In relation to the financing the studies and construction: the design, construction and operation of the plant are carried out by a single proponent, safeguarding the company's know-how and ensuring the correct execution of the project;
- Establishment of rights and obligations by the municipality and the bidding company for the correct execution of the project, established in the bidding rules and award contract.

With this, of vital importance for the definition of the next steps is the development of a business model and an implementation plan that allow for a consensus between the public and private interests of the project, together with the definition of a clear plan of action to advance in the implementation.

2 VIÑA DEL MAR BIOGAS PLANT BUSINESS MODEL

A business model describes the way an organization produces, distributes and captures value. The Canvas model was used for the analysis of this case since it is a powerful tool but at the same time very simple and easy to understand by key stakeholders. The main results are outlined below.

2.1 Customer segments

The population benefiting from the project comprises the 323,530 inhabitants of the Viña del Mar community. Since the project plans to incorporate organic waste coming from neighboring municipalities such as Concon and eventually Valparaíso, the benefited population could increase considerably if the right collaboration schemes are put in place.

It is impossible to address all customers with the same strategy, which is why we have grouped them according to the types of source of organic waste.

Table 8 Customer Segments-by Organic Waste source

Public customers	Private customers
Street markets/fairs	Hotels/Restaurants
Buildings /Condos	Shopping centers
Households	Supermarkets
Educational Establishments	Buildings /Condos
	Educational Establishments
	Health Establishments
	Industries
	Municipal market
	Street markets/fairs

2.2 Value proposal

The benefits that the project will provide to the inhabitants of the community, the city and the municipality are:

- Reduce greenhouse gas emissions from the current management of MSW;
- Improve inhabitants' quality of life by improving air quality in the city;
- Educate and raise awareness among the population regarding the importance of separation at source, availability and use of resources and the positive effects of caring for the environment;
- Create job posts during the plant's construction and operation;
- Value the organic waste generated in the commune by treating them and turning it into products: Gas, electric power, thermal energy and organic fertilizer;
- Reduce operation and maintenance costs of current MSW management;

- Achieve a sustainable MSW management model, where income generation is expected from participation in the business's profits and/or concession rent fee and/or reduction of the electricity bill paid by the Municipality by injecting electric power into the national grid;
- Selective collection service that allows valuing and treating MSW in the community.

Additionally, the development of the Biogas Plant has made the Municipality to be interested in building an ecologic park (EcoParque) in the same site with additional elements that enhance the project and generate associated co-benefits. The establishment of an ecologic park corresponds to the vision of an innovative commune, leader in the implementation of technologies for the integral management of urban solid waste, generating tangible benefits such as the development of a park with green areas fertilized and improved thanks to the compost produced from the organic waste recycling. EcoParque is expected to develop its elements and projects around the following concepts: Green Areas, Environmental Education, Water Management, Waste Management, Energy Management, Urban Agriculture and Communication and Information Technologies.

2.3 Distribution and communication channels

According to the identification and description of the project's customer segments including large OW sources, we visualize the way in which the Municipality classifies each segment chosen to deliver the value proposal and make it part of the project and its benefits.

2.3.1 Distribution channels

To make possible a source collection service, the following collection systems differentiated by customer segment are identified:

- House to house collection with bags (high grammage recycled paper -plastic) and garbage bins 70-90 [L], open top crane truck;
- Collection from large producers by means of big containers 2400-3200 [L] (with key), open top crane truck;
- Collection by means of medium-size containers 240 [L] and collection with container lifting, non-compacting truck (multi-container lifting).
- Bulk collection, ampirrol truck with 6-8 [m3] containers

The following table shows the types of distribution channels according to each customer segment and sub-segment

Table 9 Distribution channels by customer segment

Distribution channels	Households	- Buildings/ condos - Educational establishments	- Hotels/ Restaurants - Supermarkets - Industries - Others	Street markets/fairs
House to house collection with bags (high grammage recycled paper -plastic) and garbage bins 70-90 [L], open top truck;	x			
Collection from large producers by means of big containers 2400-3200 [L] (with key), open top crane truck		x	x	
Collection by means of medium-size containers 240 [L] and collection with container lifting, non-compacting truck			x	
Bulk collection, ampliroll truck with 6-8m3 containers				x

2.3.2 Communication channels

For the private sector, these customers are currently contacted directly, through visits and by telephone. And this communication strategy will be maintained during the project's development and execution.

In the case of public customers, two outreach and communication channels will be used. Street markets/fairs, the municipal market, educational establishments and buildings will be contacted directly, through visits and by telephone. On the other hand, private households, coordination is done through neighborhood meetings through neighborhood coordinators, raising their requirements and generating press points for the dissemination of activities of local benefit. For the development and execution of the project these communication strategies will be maintained together with others to be defined in later stages in the Project Implementation Plan.

As part of a global strategy to establish a dynamic communication with our clients, a section will be developed on the website of the municipality where any person interested in knowing the project can access it. A registration form will be displayed through which participants acquire the commitment to separate its organic waste at the source. In addition, information will be available on sectors that

participate in the project, education materials for the community to understand what type of waste the plant receives and how this should be separated, collection frequencies by sector, training program for schools, among others.

2.4 Relationship with customers

It represents the type of relationship that the Municipality establishes with the different customer segments. It is about how to reach each particular group, maintain its attention and achieve the expected participation.

A relationship based on personal assistance and collective creation is proposed, based on human interaction where citizens, organizations or companies of the community collaborate and create value in the project and the city. They participate actively in the initial process of organic waste separation at the source, having received training to do so, to later visualize the treatment process in the MSW Comprehensive Management Center and Environmental Classroom, besides seeing the direct benefits in the EcoParque and other parks of the community and in the city in general.

That is why the proposal is to recognize the participation of each customer segment, with the design and execution of a Green Certification Program and a Green Bonus Program, for private and public clients respectively. These programs are further described in the Project Implementation Plan.

2.5 Sources of income

This section identifies the main ways in which the Municipality would generate the needed income to sustain the whole project and generate a circular economy around the MSW management in the city. The sources of income are displayed in the form of savings and income in the municipal coffers.

Savings

- MSW transport and final disposal costs. These represent a monthly value saved from reducing operation (fuel) and maintenance (supplies and spare parts) costs due to the fact that Biogas Plant (former Lajarilla dump site) is closer than the current Sanitary Landfill (Camino la Pólvora).
- Purchase of fertilizer for the construction and maintenance of parks and gardens in the community, since one of the products achieved by treating waste at the plant would be an organic fertilizer (digestate)
- Reduced electricity bill as a result of injecting electric power into the general grid from the biogas plant.
- Design and/or construction of a Comprehensive Waste Management Center and Environmental Classroom
- Lajarilla EcoPark Design
- Design and construction of green areas
- Project General Management

Income

- Concessional income fee from the PPP
- Profit sharing
- Recruitment of new clients for the waste collection service (special service)

2.6 Key resources

These cover the strategic assets that the Municipality must have to create and offer the value proposal, reach and establish relationships with customers (citizens, organizations and companies) and allow the sustainability of the project. The resources foreseen for the project, detailed below, are physical, economic, knowledge, human and financial.

Physical resources

- Land
- Infrastructure
- Machines and equipment for treating OW at the Biogas Plant
- Machines and equipment for waste selective collection
- Access roads paving

Knowledge Resources

- Design and Strategy – Outreach and Communication Program
- Design and Strategy - Education Program for OW Management
- Design and Strategy - Transport Logistics Program
- Customer Recruitment and Follow-up Program
- Design of the General Management Program
- Design of the Biogas Plant

Human Resources

- Execution of the Outreach and Communication Program
- Execution of the OW Management Education Program
- Execution of the Customer Recruitment and Follow-up Program
- Construction, operation and maintenance of the biogas plant
- Execution of the Waste Collection Logistics Program
- Project's General Management

Financial resources

- Subdere's Solid Waste National program:
 - o Official Notice 33-FNDR
 - o Waste Minimization Pilot Program
 - o Outreach Program

- Government of Canada
- Private company
- Municipality

The following table shows the key resources for the project's value proposal; the distribution and communication channels; and the sources of income.

Table 10 Key resources of the Viña del Mar Biogas Plant Project

		Financial resources
Physical resources	Piece of land	Municipality/Canada's government /Subdere
	Facilities, machines and equipment for the treatment of organic waste	Private company
	Machines and equipment for differentiated collection	Subdere's Solid Waste National program: Official Notice 33
	Access roads paving	Municipality/Canada's government / Participatory Paving Program of the Ministry for Housing and Urbanization (MINVU)
Intellectual resources	Biogas plant design	Private company
	Customer Recruitment and Follow-up Program	Municipality
	Broadcast and communication program	Municipality
	Education Program for organic waste management	Municipality
	Collection logistics program	Municipality
Human resources	Execution of the project's outreach program	Subdere's Solid Waste National program: outreach program/ Municipality
	Execution of the Customer Acquisition and Follow-up Program	Municipality
	Execution of the Education Program for SW management	Subdere's Solid Waste National program: Waste minimization pilot program
	Construction, operation and maintenance of the biogas plant	Private company
	Execution of the waste collection logistics program	Municipality
	Project's general management	Municipality

2.7 Key activities

These are the essential strategic activities that the Municipality must carry out to create and offer the value proposal, reach and establish a relationship with the customers (citizens, organizations and companies) and allow the sustainability of the project. To execute the Biogas Plant project, the activities to be carried out in the first 2.5 years have been grouped by programs according to the strategic guidelines of the Implementation Plan, as shown in Table 11.

2.8 Key partners

This element identifies the network of suppliers and partners needed to carry out the business model. The project can never be thought of as a self-sufficient initiative, but rather immersed in a large network of contacts that allow making it possible, optimizing returns and being successful, this is investors, strategic suppliers, control bodies, commercial alliances, etc.

Key partners of the project are:

- Work group, Viña del Mar Municipality
- Chile's Ministry of the Environment
- Private Company with experience in biogas projects
- Chile's Ministry of Health
- Chile's Ministry of Housing and Urbanism
- Undersecretariat of Regional and Administrative Development (Subdere)
- Municipality of Concon
- Private Company with Experience in Environmental Education Workshops
- CCAC
- CCAP
- Government of Canada

Below are the positions and people who compose the work group, classified according to the Municipality's organization chart

- Urban advice department
- New Businesses Unit, Concessions Directorate
- Community Investment Projects Department
- Cleaning Unit, Environmental Services Department
- Legal Advice Department - Concessions Directorate
- Tourism Office
- Municipal administration
- City Hall
- Dideco
- IT department
- Directorate of extension

Table 11 Key activities carried out by key partners

Strategic Lines	Plans of Action	Key activities	Key partners
A. Construction of the Biogas Plant	A.1 Municipal concession of the biogas plant	Environmental and technical feasibility of the land	Urban Advice Department, Viña del Mar Municipality. Municipal Management Health Regional Secretariat. Municipality of Concon.
		Technical Reference Terms and Bidding rules	New Businesses Unit – Concessions Directorate , Viña del Mar Municipality
		Tender and contracts	Legal Advice Department – Concessions Directorate/ Viña del Mar Municipality
	A.2 Design	Specialty projects Environmental Impact Statement Sector Permits Waste management plan in the facility	Private Company with experience in biogas projects
	A.3 Construction	Minor works Works execution Machine and equipment setting up	Private Company with experience in biogas projects
	A.4 Operation	Implementation plan for waste management at the plant	Private Company with experience in biogas projects
	A.5 Access roads paving	Development and execution of paving access roads	Department of communal investments projects/ Viña del Mar Municipality CCAC/ Canada's government
B. Selective collection of the organic waste	B.1 Customer acquisition and follow up	Agreements with customers (Private-1 st Stage)	Cleaning services unit - Environmental Services Department / Viña del Mar Municipality
		Segregated collection ordinance	Legal advice - Environmental Services Department / Viña del Mar Municipality

	B.2 Waste collection logistics	Georeferencing of associated customers (Public and Private) and organic waste quantification	Cleaning services unit - Environmental Services Department / Viña del Mar Municipality
		Definition of zones, routes, frequency and type of collection by groups of customers	Cleaning services unit - Environmental Services Department / Viña del Mar Municipality
		Equipment project formulation (trucks, containers and garbage bins)	Investment projects department - Environmental Services Department / Viña del Mar Municipality
		Equipment purchase (trucks, containers and garbage bins)	Legal advice - Environmental Services Department / Viña del Mar Municipality
C. Outreach and education for organic waste management	C.1 Outreach and communication	Corporate identity	Environmental Services Department / Viña del Mar Municipality
		Design and execution of the outreach strategy and web site	City Council Consultancy
		Design and execution of the communication strategy (Green certificates and bonds program)	
		Development of graphic material	
	C.2 Education for Organic Waste Management	Customer selection (Public: Neighborhood residents' committees -1 st stage)	Dideco - Environmental Services Department / Viña del Mar Municipality
		Formulation and approval of the minimization pilot program (organic waste)	Investment projects department - Environmental Services Department / Viña del Mar Municipality
		Execution of the minimization pilot program (organic waste)	Private Company with Experience in Environmental Education Workshops

D. Project's general management	D.1 Management, Control and Follow up	Organic waste statistics, programs follow up, web site section	Environmental Services Department/ Viña del Mar Municipality
	D.2 Strategic alliances	Collaboration agreement with Municipality with experience in organic waste treatment with biogas plants	Environmental Services Department/ Viña del Mar Municipality CCAC

2.9 Cost structure

This structure comprises all costs that the Municipality will have to assume to operate the Biogas Plant. This last step stems from the previous sections: key activities, key partners and key resources. The following table indicates the overall costs related to each program, considering the key activities and resources.

Table 12 Cost structure

Strategic lines	Programs	Costs \$Millions of Chilean pesos
A Biogas Plant Construction	A.2 Design	180
	A.3 Construction	6,500
	A.5 Access roads paving	350
B. OW selective collection	B.1 Customer recruitment and follow up	30
	B.2 Waste collection logistics	1,200
C. Outreach and education on OW management	C.1 Outreach and communication	65
	C.2 OW management education	65
D. Project's general management	D.1 Management, Control and Follow Up	360
	D.2 Strategic alliances	30
Total		8,780

3 IMPLEMENTATION PLAN FOR VIÑA DEL MAR BIOGAS PLANT

The implementation plan of the Biogas Plant for Viña del Mar seeks to deliver a vision and strategic lines, presenting different plans of action allowing showcasing objectives and indicators for the Municipality of Viña del Mar, regarding the management of organic waste in the city.

In this sense, this initiative is aligned with the national legal framework of the Ministry of the Environment, from the Extended Producer Responsibility Law N°20,920/16 and the waste hierarchy by means of energy valorization through organic waste recycling; the strategic guidelines of Viña’s current development plan (Pladeco); and will also be an important part of the Sustainability Chapter of the New Community Development Plan, which is under development.

The Implementation Plan of the Biogas Plant establishes four strategic lines, for which a description and vision of the situation that is expected in the long term is presented, after having reached the relevant objective. Within each strategic line, action plans describe the activities that must be fulfilled to achieve the main objective. Each of them presents a description, the actions needed to carry out the activities, the players involved, and the key indicators to monitor the progress of compliance with these proposed activities.

The strategic lines of this plan point to the different stages of organic waste management, as indicated below:

Construction of the Biogas Plant:	Strategic Line A
Selective Collection of the organic waste:	Strategic Line B
Outreach and Education for Organic Waste Management:	Strategic Line C
General Project Management:	Strategic Line D

The Strategic lines and associated plans of action and activities are outlined in the following table:

Table 13 Key activities according to the Plan of Action and Strategic Lines

Strategic Lines	Plans of Action	Key activities and programs
A. Construction of the Biogas Plant	A.1 Municipal concession of the biogas plant	Environmental and technical feasibility of the land
		Bidding rules
		Tender and contracts

	A.2 Design	Specialty projects Environmental Impact Statement Sector Permits Waste management plan in the facility			
	A.3 Construction	Minor works Works execution Machine and equipment setting up			
	A.4 Operation	Implementation plan for waste management at the plant			
	A.5 Access roads paving	Development and execution of paving access roads			
B. Selective collection of the organic waste	B.1 Customer acquisition and follow up	Agreements with customers (Private-1 st Stage) Segregated collection ordinance			
	B.2 Waste collection logistics	Georeferencing of associated customers (Public and Private) and organic waste quantification Definition of zones, routes, frequency and type of collection by groups of customers Equipment project formulation (trucks, containers and garbage bins) Equipment purchase (trucks, containers and garbage bins)			
C. Outreach and education for organic waste management	C.1 Outreach and communication	Corporate identity Design and execution of the outreach strategy and web site Design and execution of the communication strategy (Green certificates and bonds program) Development of graphic material			
		C.2 Education for Organic Waste Management	Customer selection (Public: Neighborhood residents committees -1 st stage) Formulation and approval of the minimization pilot program (organic waste) Execution of the minimization pilot program (organic waste)		
			D. Project's general management	D.1 Management, Control and Follow up	Organic waste statistics, recycled CO2 tons Action plans follow up, web site
				D.2 Strategic alliances	Collaboration agreement with Municipality with experience in organic waste treatment with biogas plants

Source: Compiled by the author

To ensure compliance with the action plans, a continuous monitoring of each of them is necessary during the development of the Implementation Plan. This follow-up is detailed in the strategic line D: Project General Management, whose main objective is to verify that each of the proposed activities and the review of indicators are fulfilled.

Within each Action Plan a detail of the following is provided:

- Description and future vision
- Necessary actions
- Financing
- Players involved
- Indicators
- Deadlines

3.1 Strategic Line: Construction of the Biogas Plant

One of the fundamental pillars of the development and execution of the project correspond to several activities associated with the construction of the Biogas Plant. As defined previously, this type of Organic Waste treatment involves a high investment cost and expertise in its design, execution and operation. For this reason, a Private Public Partnership is proposed, whose management will be carried out through a Municipal Concession.

The vision that the municipality of Viña del Mar has defined for the project is to become a pioneer city in efficiently treat organic waste through the construction and operation of a biogas plant that allows for clean energy generation, long term sustainability, promotion of circular economy and the reduction of short-lived climate pollutants in the atmosphere to help tackle climate change and reduce health impacts on the community.

3.1.1 Action Plan: Municipal Concession of the Biogas Plant

3.1.1.1 Environmental and Technical Feasibility of Lajarilla site

The organic waste treatment project is located in the Fundo Lajarilla, owned by the Municipality of Viña del Mar. It corresponds to a 40-hectare piece of land, located in the community of Concon and which was the landfill for disposal of the domestic waste of the city until 2003. The property, at present, is in the process of stabilization and is not used in its great majority except for some areas to temporary keep street dogs, which as a whole occupy less than one (1) hectare. Additionally, at the south-western end of the property there is the Municipal Parking Lot where vehicles that have been removed from public roads or are under judicial proceedings are stored (around 700 vehicles).

In relation to the use of the land, the territorial planning instruments in force state certain uses that are indicated below:

- The current Concon Zoning Plan (resulting from the former Zoning Plan of Viña del Mar, as amended by the divisions of Lomas de Montemar in 2003 and the Coastal Border Sector in 2006) establishes the urban area as an area distant about 5km from Fundo Lajarilla, so this is legally a rural area.
- The city is currently taking the measures to update the Zoning Plan, in accordance with the provisions of articles 43 of the General Law of Urban Planning and Construction and 2.1.11 of the

General Urban Planning and Construction Ordinance, at the date in the process of public consultation of the preliminary draft. The areas proposed to be included in the new Concon Zoning Plan also fail to regulate the sector where Fundo Lajarilla is located.

The following territorial scale, the Metropolitan Zoning Plan of Valparaiso (PREMVAL) that was published in the Official Gazette on April 2, 2014, regulates an intercommunity scale of the Valparaiso Region and includes the city of Concón. The area where Fundo Lajarilla is located, the zoning is stated as "Green Area of Intercommunity Level (AV)", comprises the area of the farm in its entirety, as shown in Figure 1.

Figure 1 Location of the Project and Zoning Plan of the City of Concon



Source: Technical and Economic Analysis of technological Alternatives for the treatment of organic waste for the Municipality of Viña del Mar

Efforts were made with the Ministry of Housing and Urban Development for a favorable ruling on the interpretation of the articles described above. However, the reconsideration on the feasibility of implementing the project on this site was rejected as it corresponds to an AV Zone. However, the health authority has determined that the site must be stabilized before it is considered with an AV designation, which implies that all the gas that is still generated in the area must be extracted first. The implementation strategy will then be to build a gas recovery system from the old landfill that will complement the gas production of the plant. In this way, the health authorization will be correct for the execution of the works

of the major project. In any case, the project should be included into the environmental impact assessment system where the implementation conditions by the authority will be defined in detail.

Actions needed

- Submit application for Change of Use of the Land of Fundo Lajarilla
- Design and implementation of insertion plan to former landfill Lajarilla (extraction of gas, closing and sealing)

Financing

Regarding the implementation of the insertion plan from the former landfill Lajarilla, this will be financed with resources from Subdere or through a private company in charge of using the biogas extraction holes and to recondition the land for future development of an Ecopark.

Key Players

- Municipality of Concon – Municipality of Viña del Mar (Urban Planner Consultants)- MINVU
- Municipality of Viña del Mar – Health Regional Ministerial Secretary – Private Company
- Municipality of Viña de Mar - Subdere

Indicators

- Documentation describing the Application for a Change of Use of the Soil to the MINVU
- Documentation describing that the Project applied for Funds from Subdere - APP Lajarilla Insertion Plan
- Documentation describing that the Project applied for Funds from Subdere

3.1.1.2 Terms of reference and bidding requirements

According to what was described and discussed above, the Project is implemented through a PPP for Municipal Concession, which comprises the Design, Construction, Operation and Exploitation of the Municipal Land.

Actions needed

- Formulation of the Technical Terms of Reference (ToR) for the Tender process
- Formulation of Administrative Requirements for the Tender

Financing

- No financing is required, only man hours provided by the Municipality of Viña del Mar

Key Players

- Municipality of Viña del Mar: Department of Concessions - New Businesses Unit

Indicators

- Terms of reference approved by the Department of Concessions

Deadline

- February 2018

3.1.1.3 Tender and Contracts

Actions needed

- Publishing tender in the public tendering platform
- Bidders assessment and awarding
- Contract signing

Financing

- No funding is required, only man-hours for the development of the above-mentioned documents.

Key players

- Viña del Mar Municipality: Concessions Department- Legal Advice Department

Indicators

- Tender publication in the public tendering platform
- Contract signed

Deadline

- June 2018

3.1.2 Action Plan: Design

Once the concession contract is signed, the development of the Biogas Plant Design begins. This stage includes: Conceptual Engineering, Basic Engineering and Detail Engineering; defining the pillars of the project, location, machines, equipment, materials, basic services; in short, all the elements that allow to ensure the success of the initiative.

This stage provides the minimum and necessary engineering background to perform the environmental impact assessment of the project.

With the basic engineering developed and considering eventual modifications to the project given its passage through the Environmental Impact Assessment System (SEIA) it is the turn of the detail engineering process in which the functional and technical precisions of the project are carried out. Here the technical specifications, architecture planimetry and civil works, calculation records and final cost analysis are performed.

In sum, the studies to be carried out are:

- Soil studies
- Architectural design and general specialties
- Electric power specialties project
- Gas specialties project
- Cogeneration specialties project

- Access and transit study
- Tariff study
- Economic evaluation
- Environmental Impact Statement
- Tax regime

Actions needed

- Development of specialties projects
- Formulation and presentation of the Environmental Impact Statement
- Obtaining sector-specific permits
- Plant's Waste Management Plan

Financing

The financing for this stage of the project will be provided by the awarded company in the concession tender;

Players

- Awarded company
- Environmental Assessment Service
- Regional ministries (MINVU-MINSAL)
- Electricity and fuels regulator (SEC)
- Municipalities (Viña del Mar and Concón)

Indicators

- Favorable Environmental Rating Resolution
- Sector-specific approved permits
- SEC approval of projects

Deadline

- December 2018

3.1.3 Action Plan: Construction

Once the technical specifications, architecture planimetry and civil works, calculation reports and definitive cost analysis have been developed, and their approval by the relevant public bodies has been secured, the construction process begins.

Actions needed

- Execution of minor works
- Execution of works

- Installation of machinery and equipment

Financing

Financing for this stage of the project will be obtained by the awarded company in the concession bidding process.

Key players

- Awarded company
- Electricity and fuels regulator (SEC)
- Municipalities (Viña del Mar and Concón)

Indicators

- Approval of electricity and gas installations (SEC)

Deadline

- December 2019

3.1.4 Action Plan: Start-up and Operation

After the construction of the Plant, its start-up and operation begins. This action plan is coordinated with the selective collection start-up, which is part of the B.2 Logistics collection action plan.

Actions needed

- Registration of the Biogas Plant before the SEC
- Test and Calibration of machines and equipment
- Implementation of the Plant Waste Management Plan

Financing

The financing of this stage of the project will be obtained by the awarded company at the concession bidding process;

Key players

- Awarded company
- Electricity and fuels regulator (SEC)
- Municipalities (Viña del Mar and Concón)

Indicators

- Registration Document of the Biogas Plant (SEC)

Deadline

- December 2019

3.1.5 Action Plan: Paving access roads

For the correct operation of the plant, the organic waste must easily reach the plant, so it is critical to improve the standard of the roads accessing the site. The municipality has expressed its commitment to start the process for obtaining regional funding to carry on the works.

Actions needed

- Formulation of Public Investment Projects
- Execution of works

Financing

Financing for this stage of the project will come from the Ministry of Housing and Urbanism funds, through the Participatory Paving program.

Key players

- Municipalities (Viña del Mar and Concón)
- MINVU

Indicators

- Application documents for public funds
- Paved access roads

Deadlines

- June 2019

3.2 Strategic Line: Selective collection of the organic waste

One of the fundamental pillars of the development and execution of the project correspond to various activities associated with the Selective Collection of Organic Waste. With this, two action plans are carried out, one related to customer acquisition and follow-up and another related to the collection logistics.

The municipalities' vision is to install for the city an efficient and effective organic waste selective collection through the optimization of routes. GPS systems and intelligent sensors will allow the automation of the process, reduction and optimization of resources, finally achieving a quality service for the city's inhabitants and visitors.

3.2.1 Action Plan: Customer acquisition and follow-up

This refers to managing the municipality customers (private-public), from which organic waste will be collected. This process is key to the success of the project. In addition, since there are no similar initiatives in Chile until now, some risks will need to be addressed in order to ensure the success of the plan.

Actions needed

- Update of active customers (public-private)
- Detection of potential customers
- Selection of public customers
- Definition of total customers in the first stage of the project
- Agreements / commitments regarding the delivery method and associated rate (private clients)
- Creation of a Segregated Collection Ordinance

Financing

Funding will come from the own funds of the Municipality of Viña del Mar

Key players

- Public and private customers
- Department of Environment Services at Viña del Mar Municipality
- Legal advice department at Viña del Mar Municipality

Indicators

- Documentation of current and future customers
- Documentation regarding selected public customers to work under a pilot program
- Documentation related to the agreement/commitment to participate in selective collection
- Selective Collection Ordinance in the Official Gazette

Deadline

- May 2019

3.2.2 Action plan: Collection logistics

Once the total number of customers in the 1st Stage of the project has been defined, it is necessary to define the logistics of the Selective Collection and associated technological applications.

Actions needed

- Georeferencing of associated customers
- Quantification of the organic waste
- Definition of collection and routing zones according to groups of customers and associated equipment
- Formulation of the equipment project for selective collection
- Purchase of equipment for selective collection
- Start-up of the selective collection

Financing

Financing will be obtained from funds of the Regional Government, through the Official Notice 33.

Players

- Cleaning Unit of the Environment Services Department, Viña del Mar Municipality
- Legal advice department, Viña del Mar Municipality
- Department of environment services and Department of Investment Projects, Viña del Mar Municipality

Indicators

- Documentation related to the project's application to the Regional Government
- GIS maps of current and potential customers - waste generation - collection areas
- Equipment purchased
- Start of the organic waste selective collection system

Deadline

- December 2019

3.3 Strategic Line: Outreach and Education for Organic Waste Management

According to the international experience on the matter, outreach and education is a very relevant strategic line of work since it is necessary to guarantee sufficient organic waste separated at the source by the customers (inhabitants, visitors, institutions, and public and private organizations) in order to comply with the delivery commitments with the biogas plant. For this reason, this program groups together two important issues. The first one is related to the dissemination and communication of the project and its identity: how is it linked to the environment? Which is its relationship with the customer (user)? How is its value proposal and benefits known by the public? Which is the vision and talent? These are some questions that should be envisaged with the development of this action plan. On the other hand, the education issue is addressed by the action plan of Education for the Management of Organic Waste, whose focus is on the training of public and private clients on the separation of waste at the source, their management and the benefits associated to the correct separation and treatment of organic waste.

The vision of the municipality is to achieve clients involved in the project and enjoying the benefits of the treatment of urban waste, achieving 80% involvement of the population, within a period of 5 years after starting up.

3.3.1 Action Plan: Outreach and Communication

3.3.1.1 Corporate identity

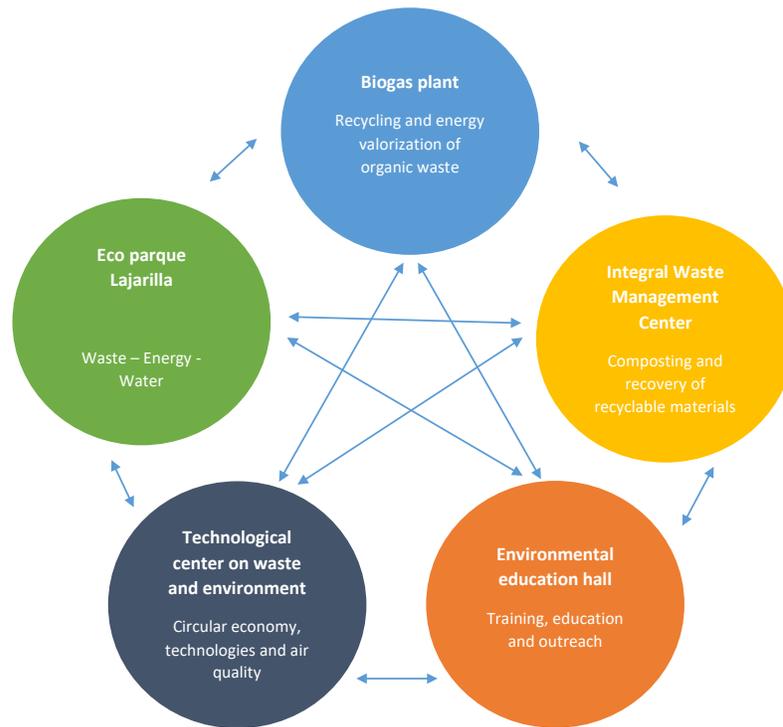
Based on self-recognition by municipal authorities of the vision as an innovating city, which is the leader in the implementation of technologies for the integral management of waste, generating tangible benefits which result from the recycling of organic waste, to define and clarify how this leadership is practiced within the authority client relationship is clear and necessary.

The Identity Model is developed in conjunction with the Communications Strategy and the dissemination and development of the graphic material. It is important to highlight that in this sense, and according to the development in the Business Model and the Concept of “Lajarilla Thematic EcoPark” this Project is linked with other interesting thematic issues in the municipal area, which makes the Biogas Plant to be part of the integral solution generating co-benefits for the city and its inhabitants.

Actions needed

- Development of an Identity Model
- Presentation of the Model and lines of work

Figure 2 Integral Solution of Solid Waste from Municipality of Viña del Mar



Source: Compiled by the author

Financing

Financing will be obtained from own resources of Municipality of Viña del Mar.

Key players

- Department of Environment Services from Municipality of Viña del Mar
- Major's Office
- Unit of New Businesses

Indicators

- Presentation of the model and lines of work

Deadline

- April 2018

3.3.1.2 Dissemination Strategy, Communication Strategy and Graphic Material

The Implementation Plan is an integrated plan that includes social disciplines to achieve greater approach to clients and it considers three major thematic issues which are worked out in conjunction with the definition of the identity:

Outreach strategy

It includes actions such as: press releases, proposals of creative activities, coverage activities, visits to the media, news bulletin, meetings with stakeholders and website. Under this strategy, the development of two programs focused on the recognition of participation of citizens and organizations in the project is proposed.

Green Certification Program, focused on private customers. A seal identifies the institution that complies with the sustainability indicators, and that generates benefit for the city and its inhabitants through participation in the organic waste source separation program.

Green Bonus Program, focused on public customers. It is a bonus delivered to public organizations (neighborhood residents' committees, public educational institutions, family health centers (*cesfam*)) which have actively participated in the project and it is based on the quantity of waste delivered. Based on the green bonuses accumulated, the municipality will give priority and develop local impact projects (parks, squares, and paving, among other things) where such clients are located.

Communication strategy

It corresponds to the definition of the way in which the particular messages associated to the objectives, benefits, driving messages, scope of action will be disseminated, and which will be integrated in the development of the graphic material. Definition of the message through the work with the different concepts that are part of the project to bring the message to life.

Development of the Graphic Material

It corresponds to the development of communication brochures, flyers, iconographies, information graphics, communicational and educational videos.

Actions needed

- Definition of the dissemination strategy
- Definition of the communication strategy
- Development of graphic material
- Implementation of the dissemination strategy
- Implementation of the communication strategy
- Printing and recording of graphic and audiovisual material
- Starting-up of the dissemination and communication program

Financing

Financing will be obtained from own resources from the Municipality of Viña del Mar and the contributions from international cooperation agencies.

Key Players

- Department of Environment Services from the Municipality of Viña del Mar
- Technical Advisor Committee from the Major's Office
- Information Technology Department
- Extension Department

Indicators

- Documentation of dissemination strategy and communications strategy
- Documentation of graphic material
- Web site and mass media under progress

Deadline

- December 2018

3.3.2 Action Plan: Education for Organic Waste Management

The success of a program to generate energy from domestic solid waste mostly depends on the participation of the different social key players. For this, education and training for the correct organic waste management should include, as a fundamental foundation, actions for dissemination and the involvement of the citizens of Viña del Mar.

Actions needed

- Selection of public clients to participate in the program
- Formulation and approval of the Minimization Program
- Design of the Municipal Environmental Education Program
- Design of the Municipal Employees Training Program
- Starting up of the Pilot Minimization Program and the Municipal Environmental Education Program

Financing

Financing will be obtained from own resources from the Municipality of Viña del Mar and public financing through the National Program of Waste from SUBDERE.

Key Players

- Department of the Environment Services from the Municipality of Viña del Mar
- Consultancy Company
- SUBDERE

Indicators

- Documentation for the selection of public clients to participate in the program
- Documentation for the financial approval of the Minimization Program
- Documentation for the Municipal Environmental Education Program
- Implementation of Minimization and Education programs

Deadline

- December 2019

3.4 Strategic Line: General Execution of the Project

This line is intended to evaluate, control and inform the compliance with the indicators set forth, to update the agenda for the project, in line with the objective of the project and its benefits for the city and the inhabitants. In the same way, to generate strategic alliances with different players is searched for to manage to succeed in the implementation of the project and its efficient operation in compliance with the objectives stated.

3.4.1 Action Plan: Management, Control and Follow-Up

It includes all the actions related to the progress of the Implementation Plan and in the future, to the execution indicators of the project.

Actions needed

- Round table meetings according to the strategic lines and action plans.
- Updating and management of the agenda of the Project
- Coordination with strategic partners
- Management of the performance indicators for the Implementation Plan and Model of Organic Waste Management of the commune, and
- Reports and presentations of the status of the Implementation Plan and the Model of Organic Waste of the commune
- Evaluation of Smart City tools for the follow-up of the Indicators of the Management Model in real time

Financing

Financing will be obtained from own resources from the Municipality of Viña del Mar, with contributions from the awarded company.

Key Players

- Department of Environmental Services of the Municipality of Viña del Mar
- Awarded company

Indicators

- Agenda
- Agreements reached at meetings – Record of each participant
- Statistical indicators
- Reports and Presentations
- Documentation of Smart City Analysis for Model of Organic Waste Management

Deadline



- Permanent

3.4.2 Action Plan: Strategic Alliances

It corresponds to the reaching of agreements with strategic partners for the successful execution of the project. It is expected they contribute with talent and recommendations to show their culture and the way they work and where their offer regarding the benefits and value propositions are aligned with those of the project.

Actions needed

- Agreement with Strategic Partners
- Agreement with Municipalities and Universities
- Agreement with Companies

Financing

Financing will be obtained with own resources from the Municipality of Viña del Mar.

Key Players

- Department of Environmental Services from the Municipality of Viña del Mar

Indicators

- Documentation for the Agreements

Deadline

- Permanent

