WORKING PAPER

Mobilising investment for NDC implementation in Peru's waste sector

By Yasomie Ranasinghe and Susannah Fitzherbert-Brockholes

December 2020

About this working paper

International and domestic private investment will be essential for developing countries to deliver on Nationally Determined Contribution (NDC) commitments made under the Paris Agreement. The mobilising investment for NDC implementation project explored approaches to encourage and facilitate private sector investment into NDCs in seven developing countries: Peru, the Dominican Republic, Bangladesh, Vietnam, the Philippines, Kenya and Ethiopia.

This working paper shares the experiences and insights from this work in Peru, which focussed on waste management. This sector was selected because of the lack of private sector involvement in the waste sector in the country, and an urgent need to address unsustainable waste management practices, with thousands of tonnes of solid waste being generated across the country every day.

The mobilising investment project is an initiative of the Climate and Development Knowledge Network (CDKN) and Low Emission Development Strategies Global Partnership (LEDS GP), managed by SouthSouthNorth (SSN). It is funded by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Delivery partners for the project include the National Renewable Energy Laboratory (NREL), Overseas Development Institute (ODI) and PriceWaterhouseCoopers UK (PwC).

About the authors

Yasomie Ranasinghe is a climate finance specialist within PwC's Sustainability and Climate Change Team. She was the project manager for the Peru and Bangladesh country work streams of the Mobilising Investment for NDC Implementation project. Yasomie works with public and private sector actors to scale financial flows into sustainable development.

Susannah Fitzherbert-Brockholes is a climate change policy expert within PwC's Sustainability and Climate Change Team. Susannah was CDKN's Head of Country Support for Latin America and the Caribbean and oversaw PwC's work on the Mobilising Investment for NDC Implementation project.

Acknowledgments

The following reviewers kindly provided feedback on this paper: With thanks to Guillermo Guerrero, Carlos Salazar and Luis Salcedo from PwC Peru, Lisa McNamara, Samson Mbewe and John Thorne from SouthSouthNorth, Mairi Dupar from ODI, and Sandra Isola and María José Pacha from Fundación Futuro Latinoamericano.

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Informal waste 'separators' at El Milagro who make a living from retrieving and reusing waste materials

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Executive summary

Countries will need to mobilise significant levels of private sector investment to implement Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC). As much as $23 trillion in climate-smart investment opportunities have been identified in emerging economies.[1] Attracting the scale of private sector investment at the speed needed to meet NDC goals requires appropriate incentives and financial instruments to support project development, the expansion of market demand and business investment. Unlocking this kind of private capital requires a progressive and iterative process of stakeholder identification in priority investment subsectors, market analysis, and design and implementation of financing measures.

The waste management sector in Peru is at an early stage of development and faces a number of urgent challenges related to waste management services, such as insufficient sanitary landfill infrastructure and inadequate provisions for the management of landfill gas emissions. At the same time, there has traditionally been a lack of collaboration and coordination between private and public actors involved in the sector. This situation presents an opportunity to develop innovative solutions that can, in turn, generate broad economic, societal and environmental benefits. The pressing need for a large and rapid scale-up of final waste disposal infrastructure sets the stage for successful models to be tested and replicated across the country. It also presents a key opportunity to engage the private sector to support the Government of Peru to meet its NDC commitments.

The mobilising investment for NDC implementation in Peru project provided technical assistance to the Ministry of Environment (MINAM) of Peru from 2018-2020 in order to address some of the challenges and opportunities facing the waste management sector. This included: an analysis of different landfill gas emissions reductions technologies; the development of investment cases for sustainable infrastructure solutions for two landfill projects; and the identification of barriers to mobilising investment in the waste management sector, along with recommended measures to address those barriers. The MI Peru country team (made up of individuals from PwC UK and PwC Peru) worked with MINAM to identify opportunities to mobilise private sector investment for projects delivering landfills that provide both adequate facilities for the final disposal of waste as well as emissions reductions. This paper presents a number of learnings from this work in Peru that may be useful for both public sector and private sector actors involved in the provision of waste management services in countries facing similar challenges and opportunities.

1. Introducing the waste sector in Peru

Peru, with a rapidly growing population of currently over 32.8 million,[2] was generating over 23,000 tonnes of solid waste per day as of 2018.[3] Municipalities are responsible for the country's waste management activities. However, there are not enough waste disposal sites, many municipalities do not have ways of reducing landfill gas emissions, nor do they have systems to collect and treat leachate – the often toxic liquid which filters through the waste. With only 35 operational landfills in the country, around 50% of the waste generated is sent to uncontrolled, unlined, open-air dumpsites, resulting in serious contamination and health-related problems. It is estimated that of the 1,585 open-air landfills in the country, only 27 have the potential to be transformed into formal waste disposal sites.[4]

The full waste management life cycle includes collection, transportation, separation and valorisation (the recycling and separation of organic and inorganic waste), any other forms of processing, and final disposal of waste. Final waste disposal may take the form of sanitary landfills, as well as the technologies for landfill gas emissions reductions and leachate management, which are discussed in this paper.

The Ministry of Environment (MINAM) of Peru has identified waste management, specifically the final disposal of waste, as a priority environmental and social issue to address. The waste sector was responsible for 6%, or 9,679.7 greenhouse gas emissions in carbon dioxide equivalent (Gg CO2-eq), of total emissions in Peru in 2014.[5] Focusing on ways of reducing these emissions in the waste disposal process, therefore, offers a key opportunity to contribute to achieving Peru's NDC. The UNFCCC requires countries to reduce national emissions to 20% below business-as-usual (BAU) by 2030 (or to 30% below BAU with additional international funding).[6] In 2017, a new Law on Solid Waste Management (Ley Nº 27314, Ley General de Residuos Sólidos in Spanish) was passed that places more emphasis not only on the treatment, recovery and recycling of waste, so that it may be seen as a resource rather than a burden, but also on how waste disposal processes must consider the protection of the environment and human health.[7] To meet the requirements of this new law, MINAM has developed plans for constructing 31 landfills.

In order to reach its NDC goals, Peru needs to mobilise significant levels of private sector investment. However, when it comes to the waste sector, to date there has been very limited private investment. Moreover, there has been a low level of involvement from private sector companies in the operation of waste management facilities. This is largely because the financial returns are not attractive enough without sufficient and well-structured government incentives. Commercial banks, and by extension "second tier" institutional investors that require the participation of commercial banks to invest in such projects, have also typically shown little interest in investing in the construction and operation of landfills. This is due to a number of actual and perceived risks, as well as the length of time required to generate returns.

There is, nonetheless, a significant opportunity to mobilise private finance into the waste sector by demonstrating a viable business model for revenue generation from the productive use of landfill gas. There are a number of emissions reductions technologies that capture landfill gas (for example methane, which has a significantly higher climate change impact than carbon dioxide). Such gas may be used for electricity generation or as fuel for operations at landfill sites.[8] At this stage, although there are 31 additional landfills currently under planning or construction in Peru, not all of these have considered or secured financing for the construction of landfill emissions reductions technologies, and none have secured private sector investment.

2. The cases of Trujillo and San Juan Bautista

During the first phase of the project in Peru, MINAM chose two landfills as potential sites for emissions reduction technologies – one in Trujillo, the third largest city in Peru located in La Libertad region, and a second, San Juan Bautista in the Amazonian Loreto region.

Box 1: Landfill gas capture and energy generation

From a circular economy standpoint, sending waste to landfill is not the preferred method for final disposal. A circular economy approach to waste management would involve reducing the waste we produce, using resources for as long as possible to extract the maximum value from them before disposing of them, and then recycling and regenerating products where possible, as opposed to sending them to landfill. However, landfills are still a necessary part of waste management strategies across the world and will continue to be used for wastes that cannot be reused, recycled, or recovered.

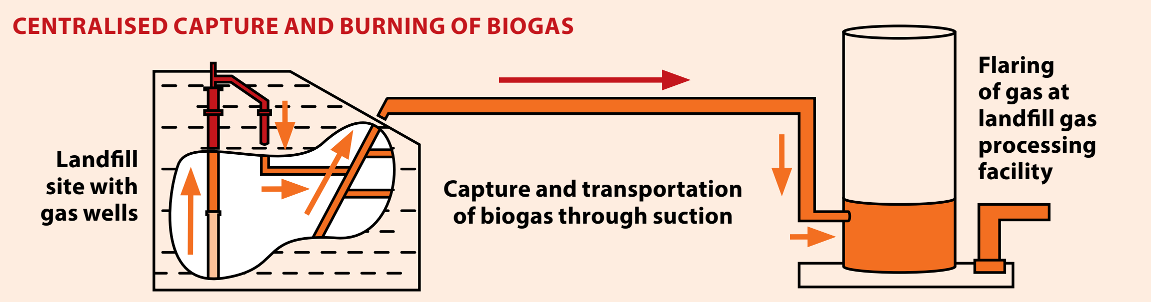
This is further complicated by the fact that the natural decomposition of organic materials in landfills produces gas, which is composed of around 50% methane and 50% carbon dioxide, depending on the content of the waste. Although a short-lived climate pollutant of less than 10 years, methane is nonetheless a highly potent one, with a global warming potential of around 30 times higher than that of carbon dioxide. Methane gas from landfills accounts for a large portion of human related methane emissions.[9]

One innovative method for reducing the negative impacts of landfill methane on the environment is to capture the methane rather than letting it escape into the atmosphere. The methane can then be flared in a controlled manner to convert it into carbon dioxide and water vapour, which has a lower global warming potential.[10] In addition, technologies exist to enable the generation of electricity from the flaring of landfill gas, which can reduce emissions indirectly and be sold on to end users, thereby saving on electricity generated from non-renewable sources.

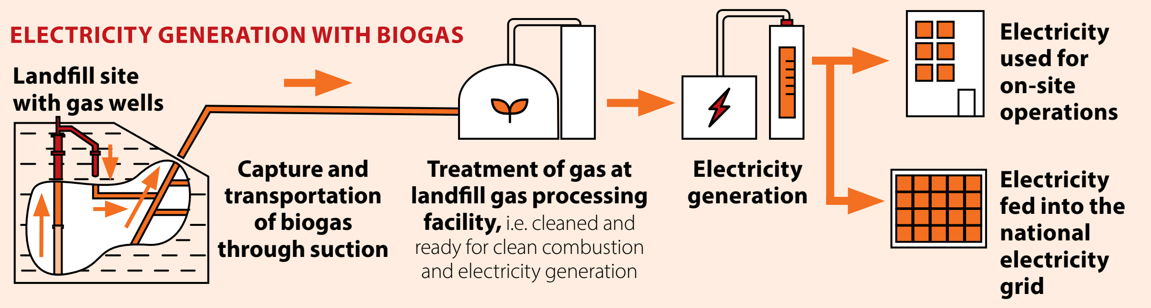
These sites were chosen because there were immediate opportunities for integrating these technologies, as well as the different geographic and demographic characteristics of the two locations. The project team evaluated different emissions reductions technologies against a number of selection criteria in order to determine the most appropriate for each landfill site. The selection criteria were: cost optimisation; risk level (construction); risk level (operation); suitability; flexibility; emissions reduction; environmental and social impact; and replicability.

Table 1. Summary of different emissions reduction and leachate management technologies evaluated in the concept notes

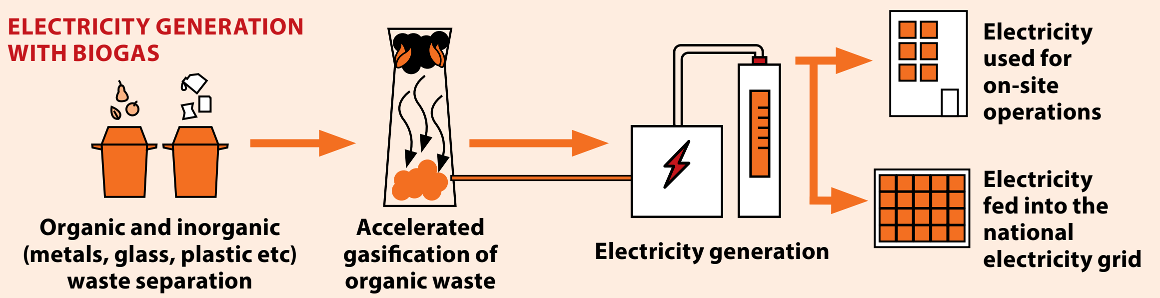
Technology	Description
1. Landfill gas capture and centralised flare	This technology involves the construction of landfill gas wells in the platforms of the landfill in order to capture landfill gas, which is then transported to a landfill gas processing and flaring facility through an active suction system. The methane is burned centrally, to become less potent carbon dioxide and water vapour. The disadvantage of this method compared to option 2 and 3 below is that emissions are still created and the energy from the gases is not captured for productive use (such as electricity generation).



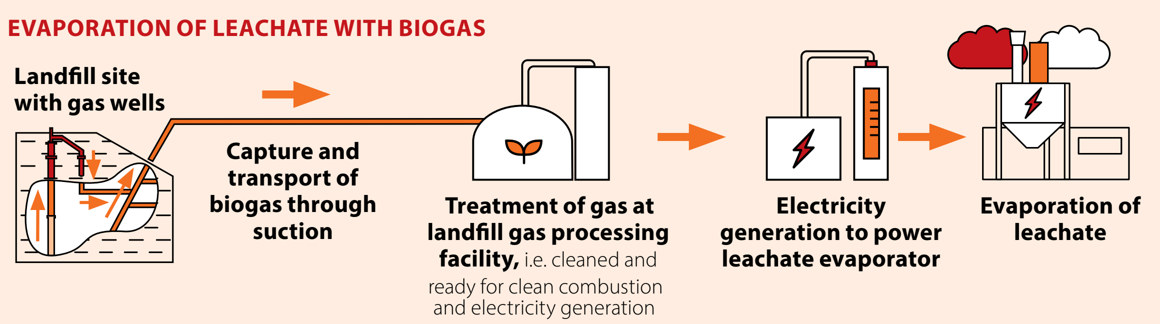
Technology	Description
2. Landfill gas capture, centralised flare and electricity generation	As with option 1 above, this technology involves the construction of landfill gas wells in the platforms of the landfill in order to capture landfill gas, which is then transported to be cleaned and compressed. The treated gas is converted by high-efficiency combustion engines into electricity. The electricity can then be sold to the national electricity grid and/or be used for operations at the landfill site, such as lighting of facilities, aircon of office buildings, powering a leachate evaporator, etc. This reduces the cost that would otherwise be incurred for the purchase of electricity (which would be generated with diesel). This option also integrates centralised flaring as a safety measure should the combustion engines need to stop for maintenance. Since 2010 the Peruvian state has held periodic renewable energy auctions, and electricity generated from biomass is considered an eligible renewable energy.[11] Energy sales contracts with a guaranteed rate for up to 20 years backed by the Peruvian state can be established at these auctions. The electricity generated at a landfill site using this technology could be fed into the grid at a fixed tariff, if an energy sales contract is agreed for this project at the renewable energy auction.



Technology	Description
3. Electrcity generation through gasification	This technology involves the installation of a large, solid waste processing centre at the landfill in order to remove metals, glass and other waste items that are ineligible for gasification. The process separates solid waste suitable for gasification, which is then transported to designated units to be transformed into syngas fuel (containing methane and carbon monoxide). Once this has been done, the fuel is taken to an electricity generation plant, converted into electricity, and fed into the national electricity grid. The main difference between this option and the previous two is that it does not involve disposing of waste in a landfill and leaving it to produce gas naturally, but instead separating the waste materials and processing the organic waste in order to accelerate the production of gas. As with the previous option 2, the intention would be to sell the electricity to the grid at a fixed tariff guaranteed by the Peruvian government, if an energy sales contract is agreed at the renewable energy auction.



Technology	Description
4. Landfill leachate treatment through evaporation	This technology involves the installation of the landfill gas capture and transportation to a 50kW combustion engine. The engine will feed directly into the leachate evaporation technology to be combusted to fuel the treatment of leachate generated by the landfill. There is no electricity generation as part of this option. This alternative involves the installation of a leachate evaporation plant on site to treat leachate produced by the landfill that would have otherwise have been taken to a wastewater treatment plant, or allowed to remain and risk contaminating surrounding surface water. The leachate evaporator, powered by landfill gas captured from the landfill, would heat the leachate to produce water vapour that is stripped away leaving a concentrated leachate, which can be safely disposed of more easily.



Trujillo landfill

Since 1989, all of the municipal waste of Trujillo, which is the third-largest city in Peru, has been sent to a dumpsite called "el Milagro". El Milagro covers 43 hectares and receives over 1,000 tonnes of waste daily from seven different provinces.[12] It is an open-air, unlined dump with basic compaction and burning of solid waste resulting in the generation of methane emissions, toxic vapours and odours. Located close to the site is El Milagro Village Centre where about 1,000 families live, mainly subsisting on income from informal work related to the segregation and commercialisation of recyclable solid waste that they collect from the dump. In 2019, MINAM declared that el Milagro was in a state of environmental emergency, which required the termination of the use of the dumpsite and a recovery plan to reduce further environmental impact.[13]

The Provincial Municipality of Trujillo has been working towards solving the challenges associated with final disposal of waste. It has secured an agreement with the regional government for the donation of 67 hectares of government-owned land for the construction of a landfill that will meet the requirements for proper final disposal of municipal solid waste. At the time of analysis, no plans had been made to integrate emissions reductions technologies into the landfill construction, or to mobilise private investment to support the financing of the landfill.

In order to provide an efficient and sustainable solution to the municipal waste management issues experienced in Trujillo – namely the uncontained release of landfill gas emissions – three landfill gas emissions reductions technology options were evaluated for the new landfill. The project team worked with MINAM to identify appropriate technologies, analyse the baseline scenario of waste and landfill gas generation of the landfill, develop selection criteria, and jointly evaluate the options. The technologies were chosen based on the characteristics of the planned landfill, and the advantages and disadvantages of each are summarised in Table 2.

The project team used the selection criteria in combination with a weighting as follows: cost optimisation (with a weight of 20%); construction risk (5%); operational risk (5%); suitability to the characteristics and requirements of the site (10%); flexibility of to adapt to future demands (10%); emissions reduction potential (20%); broader environmental and social impact (15%); and replicability (15%). A workshop was held with representatives from MINAM and the project team where each technology was assigned a score of 1 to 3, with 1 being the lowest score and 3 highest, for each criterion. The scores for each technology were then weighted and summed and the final scores can be seen in Table 2.

The evaluation identified option 2 in table 1 – the landfill gas capture, centralised flare and electricity generation technology – as the most appropriate for the Trujillo site. Given the large quantity of landfill gas emissions the landfill will produce over its lifetime, this option would provide the opportunity to enhance the potential emissions reduction through the generation of renewable energy. It would also provide returns to private investors through the sale of this renewable electricity to the grid. Over the life of the landfill, it was estimated that this technology would result in a reduction of over three million tonnes of Gg CO2-eq compared to a scenario with no emissions reductions technology installed. The level of investment required for this technology was more reasonable and realistic than option 3 – the generation of electricity through gasification. The technology in option 2 had also been implemented previously in Peru, which was the deciding factor over option 3.

Table 2. Results of the evaluation of technologies for the Trujillo landfill

	Option 1: Landfill gas capture and centralised flare	Option 2: Landfill gas capture, centralised flare and electricity generation	Option 3: Electricity generation through gasification
Advantages	• Lowest cost • Lowest emissions reduction potential • Most adaptable to deviations/changes • Two existing national examples	• Medium costs • Medium emissions reduction potential • Proven, tried and tested technology • Four existing national examples	• Waste recovery and waste to energy results in destruction of almost all solid waste • Highest emissions reduction potential • Job creation • High energy generation
Disadvantages	• Low labour requirements	• Gradual implementation of infrastructure over the useful life of the landfill	• Highest cost • New technology and no experience in Peru
Weighted score	**2.05**	**2.5**	**1.7**

Note: More details of the evaluation can be found in the Trujillo concept note[14]

San Juan Bautista landfill

The landfill at San Juan Bautista, which was already under construction at the time of analysis, is significantly smaller than the envisaged landfill in Trujillo. It will serve an Amazonian population from four districts: Iquitos, San Juan Bautista, Punchana, and Belen. The decision to construct the new landfill in San Juan Bautista was taken partly in response to the negative environmental, biodiversity and health impacts caused by the existing "el Treinta" landfill, which is located in the buffer zone of the Allpahuayo-Mishana National Reserve. This area is subject to year-round high humidity and rainfall because it is located in the Peruvian Amazon jungle. Inadequate leachate management in any new landfill located here would result in significant environmental damage to the nearby Amazonian ecosystem.

The new landfill at San Juan Bautista, which is funded by an initiative between the Japan International Cooperation Agency (JICA) and the Inter-American Development Bank (IDB),[15] will provide additional much-needed public waste infrastructure. However, the current plans do not have onsite provisions for the control of landfill gas emissions or the leachate resulting from its operation. Rather, the San Juan Bautista municipality had proposed that final disposal would involve treating the leachate by draining the liquid from the landfill and later transferring it to the wastewater treatment plant located at the nearby town of Iquitos.[16] This form of leachate treatment, however, poses the risk of contamination during the extraction and transportation process. It also results in additional costs associated with the transport and treatment of the leachate, which is more complex than the treatment of the wastewater for which the wastewater treatment plant was designed.

Box 2: Leachate evaporation using landfill gas

Landfill leachate is the liquid that percolates through landfills and contains soluble or suspended solids coming from the material it has passed through. It is generated by the natural decomposition of organic material as well as from other liquids and chemicals that have been disposed. Leachate also results when rainfall enters a landfill and mixes with the waste, and is many times stronger and more toxic than conventional sewage.

If a landfill is not properly lined and leachate is not managed appropriately it can mix with, and pollute, ground and surface water near the landfill site, resulting in negative impacts on humans and the environment.[17] This risk is particularly acute in regions with high levels of rainfall, an abundance of surface water, and areas of high biodiversity value.

Innovative technologies have been developed to address both issues of landfill gas emissions and leachate through the use of captured landfill gas to power a leachate evaporation system. This technology heats up the leachate so that around 90% of the water and organic content of the leachate evaporates, and the hazardous elements, such as heavy metals, are left as residue that can then be transferred for hazardous chemical disposal.[18]

MINAM was concerned that the plans for the San Juan Bautista landfill did not contain provisions for emissions reductions or leachate management. The San Juan Bautista analysis, therefore, considered both the greenhouse gas emissions reductions potential of various technology options and the potential to reduce other negative impacts to the environment through leachate management. The three technologies considered were: landfill gas capture and centralised flare; landfill gas capture, centralised flare and electricity generation; and landfill leachate treatment through forced evaporation (option 1, 2 and 4 in table 1 above). Based on data on the composition of waste in the region, and precipitation and humidity, the team developed projections of the amount of landfill gas, carbon dioxide equivalent emissions and leachate generated from the solid waste over the life of the landfill.

Using the same evaluation criteria and scoring as the Trujillo site, MINAM and the project team determined that landfill leachate treatment through evaporation was the most appropriate (option 4 in table 1 above). Given the smaller size of the San Juan Bautista landfill, it would not produce enough landfill gas to generate electricity to sell to the grid at scale. It would, however, generate enough landfill gas to directly power a leachate evaporator, along with additional fuel. This approach also has the benefit of reducing the risks and costs associated with sending the leachate to the wastewater treatment plant. It was estimated that the productive use of the landfill gas would result in an emissions reduction of 95,437 tonnes of carbon dioxide equivalent over the 10-year life of the landfill. A summary of the evaluation can be seen in the table below:

Note: More details of the evaluation can be found in the San Juan Bautista concept note[19]

Table 3. Results of the evaluation of technologies for the San Juan Bautista landfill

	Option 1: Landfill gas capture and centralised flare	Option 2: Landfill gas capture, centralised flare and electricity generation	Option 3: Landfill leachate treatment through evaporation
Advantages	• Lowest cost • Lowest emissions reduction potential • Most adaptable to deviations/changes • Two existing national examples	• Medium costs • Joint highest emissions reduction potential • Proven, tried and tested technology • Four existing national examples	• Lower costs compared to leachate treatment at a WTP • Joint highest emissions reduction potential • Greatest potential reduction in negative environmental impact
Disadvantages	• Low labour requirements	• Gradual implementation of infrastructure over the useful life of the landfill • Can be applied on a small scale	• New technology and no local experience
Weighted score	**1.95**	**2.1**	**2.6**

3. Developing investment cases

Following technology selection, detailed investment cases were developed for the chosen technologies at each site (these investment cases are available in Spanish on the CDKN website).[20, 21] The investment cases contain in-depth analysis of financial and economic feasibility. This is based on:

- cash flow modelling of the costs of the integration of the technologies;
- the construction of the landfill in the case of Trujillo; and
- the on-going operational costs and potential revenues from the management of the landfills.

The investment cases also propose business models and financial structures that could incentivise private sector investment in these projects. In order to conduct this analysis, the team met with multiple actors from MINAM, the municipal governments, financial institutions and private sector operators to gain insights and information.

Trujillo investment case

The Trujillo investment case analysis calculated the costs associated with the construction of a landfill with technology option 2 in table 1 above of gas capture, flaring and the generation of electricity sold to the grid. The investment case assumed a useful life of 28 years, along with the revenues associated with the operation of the landfill and the sale of electricity to the grid. This required an initial investment of $5.4 million for the first cell and the gas capture technology. This would be followed by investments totalling $24.7 million to carry out extensions to the landfill for additional cells and the construction of the electricity generation plant, including the equipment, plus additional annual operating costs of $1.3 million. The cash flows from the operation of the landfill were based on assumed tariffs of around $5-7 per tonne of waste disposed paid by the municipal government for waste management services and around $120 per MWh of electricity sold to the grid. The cost of the land for the landfill would be zero in both scenarios, as this has been donated by the government for waste management uses.

Two financial structuring scenarios were mapped out (see table 4): Scenario 1: a private sector waste operator would finance all of the investments required for the project with 80% debt (assuming an interest rate of 7-8.6% paid on the debt) and 20% equity (assuming a 20% return on equity to the investors); Scenario 2: the government would make the initial $5.4 million investment and the private sector waste operator would provide the subsequent investments.

In the first scenario, the municipality would have to pay a higher tariff to the waste operator during the first years of the life of the landfill and the payback period would be longer for the waste operator. When using the upper range of the tariff per tonne of waste disposed, scenario one would lead to a net present value of $3.3 million with a payback period of seven years and an average operating margin of 27%. For scenario two, with a lower tariff charged by the waste operator for waste disposed (closer to $5 per tonne of waste for the first five years), the project would have a net present value of $2.2 million with a payback period of one year and an average operating margin of 30%.

As a result, the team recommended that the second scenario would be preferable for both the municipality and the private sector, as it was more likely to incentivise private sector investment. However, even with the effective subsidy from the public sector in the second scenario, our consultations with private waste operators led us to understand that it may still not be significantly attractive to the private sector. This is partly due to a number of perceived and actual risks associated with investing in public infrastructure in Peru. These include municipalities defaulting in payments for services or changes in political priorities affecting the support and continuity of projects. All of this is exacerbated by a lack of successful examples of public-private collaboration in this sector.

Box 3: Work for Taxes (Obras por Impuestos - OxI) scheme: A potential solution to further incentivise private sector investment in waste management

The Work for Taxes (Obras por Impuestos) scheme has been designed to incentivise private companies to collaborate with local and regional governments in Peru to execute high priority public infrastructure projects. Under this scheme, private companies can use the value of expenses they incur through the financing or execution of the projects as a credit to pay up to 50% of their income tax.[22]

Municipal governments are awarded an annual budget from the central government to be used for Work for Taxes credits, which they can then allocate to different projects as they see fit.

A private company is able to approach a municipality with a Letter of Intention that proposes a project they wish to execute under the scheme, and the municipality may approve or reject this. Once the construction project has been completed, it is presented to the relevant public entity, which will often take over the operation of the infrastructure, and the Ministry of Economy and Finance will issue a credit note. The private company will deduct the value of the note from their taxes and the value of the note will also be deducted from the municipality's Work for Taxes credits.

To date over 401 projects have been completed under this scheme, mobilising $1,454.34 million of investment.[23] However, this scheme has only been used twice for two small waste management projects, and these were projects that covered the full waste management life cycle and not just the construction of final disposal infrastructure.

Table 4. Key information for different financing scenarios for the Trujillo landfill

	Scenario 1: Private sector financing	Scenario 2: Public-private financing
Investment	• Land is donated by public sector • Private waste operator invests $31,1 million	• Land is donated by public sector • Public sector invests $5.4 million • Private waste operator invests $24.7 million
Tariff paid	• $6.5-7 per tonne of waste received	• $5-7 per tonne of waste received ($5 for the first 5 years and $6.5-7 after)
Pay-back period	**7**	**1**
Net present value	**$3.3 million**	**$2.2 million**
Average operating margin	**27%**	**30%**

San Juan Bautista investment case

The San Juan Bautista investment case differs from Trujillo in that it provides further analysis on integrating the leachate evaporator technology into the landfill (option 4 in table 1), but not the construction of the landfill itself, as this had already been funded and executed through the IDB/JICA initiative. Given the issues identified in the concept notes relating to the environmental risks and costs associated with the existing plans to send leachate to a wastewater treatment plant, identifying a feasible model for a suitable alternative was crucial. Leachate management in landfills is a widespread issue in the Amazonian and Andean regions of Peru where there are similar climatic characteristics, and therefore a successful model will have a wide scope for replication.

To estimate the volume of leachate that would be generated, the team used the Hydrogeological Evaluation of Landfill Performance Model developed by the US Environmental Protection Agency[24], along with waste generation projections for San Juan Bautista. The analysis estimated that the costs of sending this quantity of leachate to a wastewater treatment plant over the 10-year life of the landfill would be over $12 million. This is based on an average tariff of $69 per cubic meter of leachate transported to and treated at the plant.

Using the alternative solution of leachate evaporation powered by centralised capture and burning of landfill gas would require an initial investment amount of $2 million plus $260,000 for extensions over the 10-year useful life of the landfill and additional annual operating costs of $1.3 million. The investment case assumed that the private sector waste operator would finance all of the investments required for the project with 80% debt (assuming an interest rate of 8% paid on the debt) and 20% equity (assuming a 18% return on equity to the investors) and charge a tariff of $40 per cubic metre of leachate managed. This would represent a significant saving of at least $4.1 million to the San Juan Bautista Municipality compared to the wastewater treatment plant option. It would result in a net present value of around $1.6 million and a payback period of six years.

As such, the case for integration of a leachate evaporator into the landfill is very strong from the perspective of the municipality, the environment and the local population. However, the benefits for the private sector to invest are not as clear, given the small scale of revenues and the long payback period. A further challenge is that the funds for the leachate tariff would need to originate from municipal tax collection for waste management services. However, the national average tax delinquency rate for waste services is estimated at 60-70%, and is thought to be as high as 90% in San Juan Bautista[25]. This is a significant risk, and if there are no guarantees or mechanisms in place to ensure that the tariff payments are made to the waste operator, it is unlikely that a company would be willing to invest. As a result, this type of intervention should be classified as a desirable public good, and it should therefore receive a greater level of public investment.

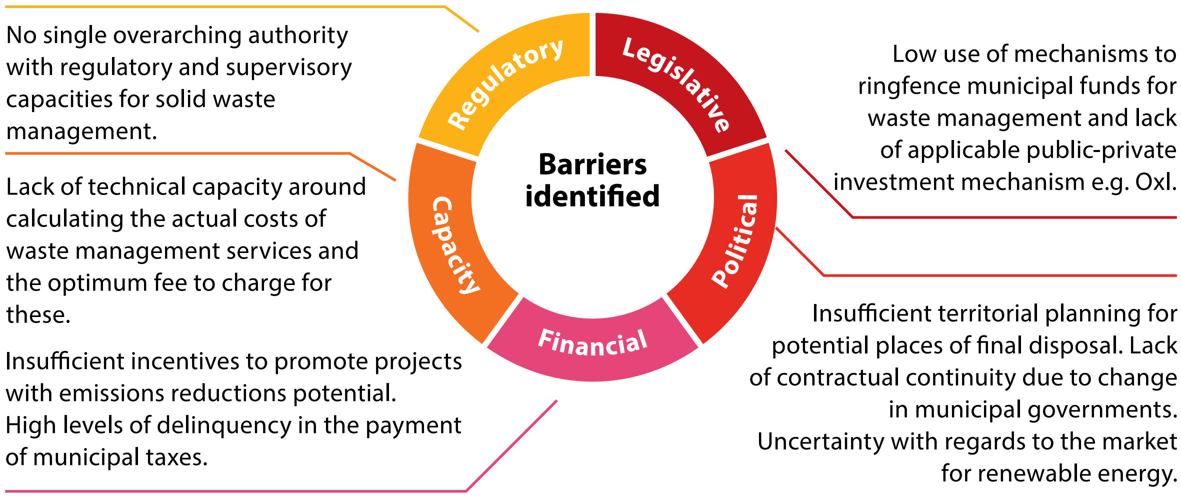
4. The environment for investment: barriers and enabling conditions

Through the analysis of the two very different landfill projects and engagement with various public and private actors operating in the waste sector, a number of key barriers were identified to mobilising investment for NDC implementation in this sector. Although the scope of the analysis in the former phases of work was limited to the final disposal of waste, many of the barriers identified also relate to the broader waste management process. Figure 1 on page 11 below highlights some of the regulatory, legislative, financial, political and capacity barriers that were identified.

Opportunities to enable private investment in Peru’s waste sector

The project team developed a long list of potential measures and enabling conditions to address these barriers. Through consultation with MINAM, measures were prioritised based on the potential impact, the feasibility of implementing them, and the perceived demand from the actors consulted over the course of the project. The national plan of solid waste management was referred to in both the development and prioritisation of the measures. The three prioritised measures considered the barriers around the collection of municipal taxes, the availability of funds to provide cash flows to private sector waste operators, and the need for mechanisms to incentivise private investment in waste infrastructure. An implementation roadmap was developed for each measure to guide MINAM in taking them forward.[26]

Figure 1. Barriers to mobilising investment in the waste sector in Peru



Opportunity 1: Increase the collection of taxes that can be used for public cleaning and waste management through payments made by residents for public services (e.g. water, electricity)

The first measure responds to the lack of sustainable flows of funding needed to attract private sector involvement and investment in projects related to the final disposal of waste. It proposes that municipal taxes for all public cleaning services, including waste management, should be combined with the payments made for public services such as water, gas or electricity. This is because customers feel the consequences for delinquency more directly and therefore they have higher collection rates. This method has been successful in increasing tax collection rates in a number of different countries in Latin America,[27] and it has been implemented successfully in Peru between the municipality of Chancay and the Municipal Company of Potable Water and Sewerage. The team concluded that in Peru including the payment in electricity bills would be most effective given the high coverage of household electricity across the country.

This measure could be implemented through formulating a law that promotes inter-institutional agreements, specifically for public cleaning tax collection between public services providers and municipal governments. The roadmap also recommends that the income from these taxes be directed to an escrow or trust[28] which is designed so that the funds may only be used for the payment and/or guarantee of obligations to private sector waste operators for final disposal services they provide. This would lower the risk of payments defaulting to waste operators and, therefore, improve the risk-return profile of investing in public waste projects.

Opportunity 2: Develop a methodology to calculate municipal taxes for public cleaning and waste services at the national level

Currently, local governments in Peru do not have a standard methodology for accurately calculating the costs of waste management services, which further exacerbates the issue around the collection of taxes to fund these services. The second measure proposes developing a methodological framework for calculating municipal taxes for public cleaning services across the country.

We proposed this methodology is developed with a pilot group of prioritised municipalities that have:

- established a comprehensive public cleaning service (cleaning of public areas, waste collection, transport of water and final disposal of waste in landfills);
- are ideally situated in different regions of the country;
- and, have unique geographical characteristics.

The pilot projects would involve gathering data on operational and maintenance costs of the various elements of public cleaning services under different business models to inform a methodology which could be applied nationally. It would also enable an evaluation of how those costs could be passed onto the taxpayer. The methodology, once developed, should be formalised within a law to enable dissemination and implementation across the country.

Opportunity 3: Apply the Work for Taxes (Obras por Impuestos, OxI) mechanism to final waste disposal services

The third measure applies the Work for Taxes scheme to the construction of sustainable final waste disposal infrastructure. Currently there is no precedent for the scheme being applied for this purpose. Moreover, many of the actors we consulted were unsure if, or how, the scheme could be applied to a distinct element of the waste management cycle. The roadmap proposes that MINAM and the Ministry of Economy and Finance, which is responsible for the scheme, collaborate to establish a blueprint for how it could be applied to the waste sector. MINAM could then develop guidelines for assessing the feasibility of applying the scheme to waste management projects and identify pilot projects to which it could be applied.

The first two opportunties above are strongly related in that they both promote tax flows to municipalities, which are essential for providing funds for the on-going payment for waste management services. The implementation of one of these measures without the other would likely not achieve the goal of mobilising sufficient investment in sustainable waste management. A common factor for all of the measures is that successful implementation would require on-going support and participation of local and central government actors, and specifically that of MINAM in a coordinating capacity.

5. Conclusion

The waste management sector in Peru is at an early stage of development and faces a number of challenges beyond emissions reductions and mobilising investment. However, the waste sector also presents an opportunity to develop innovative solutions that can generate broad economic, societal and environmental benefits. The need for a large and rapid scale up of final waste disposal infrastructure presents an opportunity to test and replicate successful models across the country.

Private actors in the waste sector in Peru have significant technical expertise and resources that can be drawn on to improve waste management services; however, they lack experience in collaborating with public actors on municipal waste management. This is largely due to the limited capacity of the public sector to facilitate and engage in public-private collaboration. At this stage, as well as addressing the actual and perceived barriers and risks associated with private investment and involvement in this area, the government needs to provide additional financial incentives, such as the Work for Taxes scheme. Significant commitment and collaboration are, therefore, required from the public sector to implement the recommended measures and other measures that would serve to improve the conditions for investment in the waste sector.

Further reading

The outputs for the mobilising investment for NDC implementation in Peru project are available on the CDKN and SSN websites here: https://cdkn.org/project/project-mobilising-investment-for-ndc-implementation-in-peru/ https://southsouthnorth.org/portfolio_page/mobilising-investment-for-ndc-implementation/

- **Trujillo Concept Note: Summary Version**
- **San Juan Bautista Concept Note: Summary Version**
- **Trujillo Caso de Inversión (Spanish)**
- **San Juan Bautista Caso de Inversión (Spanish)**
- **Implementation Roadmap: Summary Version**

Endnotes

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About CDKN

The Climate and Development Knowledge Network (CDKN) supports decision-makers in developing countries in designing and delivering climate compatible development. We do this by combining knowledge sharing, research and advisory services in support of locally owned and managed policy processes. CDKN works in partnership with decision-makers in the public, private and non-governmental sectors nationally, regionally and globally.

About PwC

PwC is the world's largest professional services advisory firm, with representation in almost every country in the world. PwC's network of climate change and development professionals and practitioners is working in more than 100 countries, supporting governments, NGOs and the private sector.

About SSN

SouthSouthNorth (SSN) is a South African NGO that supports national and regional responses to climate change in developing countries through policy and knowledge interventions, partnerships and deep collaboration. The mobilising investment in NDC implementation project and the global coordination of CDKN are both led by SSN.

Design and layout: Design for development (www.d4d.co.za)

Supported by:

based on a decision of the German Bundestag

www.cdkn.org cdkn@southsouthnorth.org