Financing water loss reduction

Piloting a performance-based partnership in Indonesia

Water.org shares its experience with a public water utility and a private engineering firm that together are taking on the task of reducing water losses in Bekasi, Indonesia. Under a performance-based model, both partners will see the benefits as they save a projected 28 million cubic meters of water from being lost in the coming five years. They expect that some 14,000 households[1] will share in this success as the recovered water flows to new and under-served customers. Thanks to financial support from Reckitt and Amazon Web Services (AWS), as well as intervention co-design and ideation from Will Hewes, Global Lead for Water Sustainability at AWS, this unique model has the potential to overcome utilities' financial and technical barriers on the path to stemming water losses, expanding access and improving community resilience in the face of climate change.

[1] These projections are based on feasibility studies that indicate the potential impact to be reached through two phases covering four subsystems. This case study focuses on the subsystems Cikarang Selatan and Cibarusah.

The missing water of Bekasi

Indonesia, like many low- and middle-income countries, can be a challenging place for a water utility. The publicly owned utilities known as PDAMs strive to provide water access to everyone, but nationwide, one-third of all water they send out into their networks disappears – through physical losses, metering and billing errors, unauthorized use, and other causes. The loss of their precious resource also drains the utilities of their capacity to maintain, improve and expand services, to prepare and recover from short-term shocks like floods, and to adapt to long-term stresses like droughts. Therefore, action on water loss management is climate action – and it needs to happen much faster.

PDAM Bekasi, in West Java, sources water from a treatment plant run by the private operator Grenex. In recent years, Grenex noticed that the utility was not billing for nearly as much water as it was taking in, and its revenue would not sustain the plant for long. Like many utilities, PDAM Bekasi suspected leaks but did not have the technical capacity to make substantial repairs or a way to raise capital outside of limited public sources. Grenex itself had limited water loss management experience.

Left: Hunting for leaks, a technician collects pressure data in the middle of the Kali Malang Bridge in Bekasi, Indonesia

Project scope: What is water loss reduction?

<table>
<tr><td rowspan="11">Water input</td><td>Water exported</td><td colspan="3">Billed water exported</td><td rowspan="2">Revenue water</td></tr>
<tr><td rowspan="10">Water supplied</td><td rowspan="2">Authorized consumption</td><td rowspan="2">Billed authorized consumption</td><td>Billed metered consumption</td></tr>
<tr><td>Billed unmetered consumption</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption</td><td>Unbilled unmetered consumption</td><td rowspan="9">Non-revenue water</td></tr>
<tr><td>Unbilled metered consumption</td></tr>
<tr><td rowspan="7">Water losses</td><td rowspan="3">Apparent losses</td><td>Customer metering inaccuracies</td></tr>
<tr><td>Unauthorized consumption</td></tr>
<tr><td>Systematic data handling errors</td></tr>
<tr><td rowspan="4">Real losses</td><td>Leakage on transmission and distribution mains</td></tr>
<tr><td>Leakage and overflows at utility’s storage tanks</td></tr>
<tr><td>Leakage on service connections up to the point of customer metering</td></tr>
</table>

Source: AWWA Water Balance

PDAM Bekasi began partnering with Water.org in 2019 to extend microcredit and installment on-bill financing programs to households for new water connections. In 2021, Water.org approached PDAM Bekasi about reducing their water losses. Water.org became a technical advisor and focused on building the capacity of Grenex. The goal was to launch a pilot overhauling two loss-prone Bekasi subsystems as phase 1, followed by another two subsystems in phase 2. The high rate of water loss needed to come down rapidly, dramatically and sustainably to serve existing and new users. This would require a partnership based on proven feasibility and a novel financing model.

Defining the feasible

Grenex and Water.org began by conducting a pre-feasibility study to inform the full study design including selecting a methodology, identifying priority subsystems, and documenting requirements for the full study. While Grenex was already providing some valuable repairs for PDAM Bekasi, the feasibility study would take a more systematic and in-depth approach. With help from a technical consultant, this included inspecting the network's condition, calculating the rates of water loss in each subsystem, conducting a risk assessment including social and environmental impact, and developing a financial model.

The phase 1 feasibility study found that water loss rates in the two subsystems stood at 49% and 42%[2], together accounting for more than 9 million m3 of lost water a year. Field observations found vulnerable distribution pipes, including some exposed by eroding riverbanks. The fieldwork also employed hydrophones and listening bars to pinpoint leaks.

Another survey inspected customer meters and found that hundreds were damaged, and thousands were past their functional lifespan.

Left: A distribution pipe on an eroding riverbank was in need of immediate corrective action.

Crucially for the project's financial prospects, the study found that a performance-based contract would produce a benefit-cost ratio of 1.98 and an annual rate of return of 6.4% for Grenex in phase 1. The $5.4 million investment by Grenex could save 18 million m3 of water over five years, enough to supply 32,000 more people (see Table 1). It could also prevent 5,000 tons of carbon emissions from going to waste – which is what happens when such large quantities of water are treated, pumped, and then lost.

[2] All percentages expressed as non-revenue water, however the project only focused on water losses.

Table 1. Projected impacts of the Bekasi project's two phases

	Subsystems	Capital mobilized	Water saved	Equivalent water usage	Prevented waste of CO_2 emissions
Phase 1	Cikarang Selatan Cibarusah	$5 million	18 million m^3	8,000 households / 32,000 people	5,000 tons
Phase 2	Cikarang Utara Tarumajaya	$5 million	10 million m^3	6,000 households / 24,000 people	5,000 tons
Total		**$10 million**	**28 million m^3**	**14,000 households / 56,000 people**	**10,000 tons**

A performance-based answer

The study gave the partners data to develop an equitable performance-based contract. Grenex would pay for the labor and materials to reduce water losses throughout the subsystems. The partners would share the economic return: 37% to PDAM Bekasi and 63% to Grenex, calculated by the water volume saved multiplied by the utility's tariff rate. In the five years of the contract, this would result in $4.1 million in potential profit for PDAM Bekasi and $1.7 million for Grenex (see Table 2).

Table 2. Financial projection for the Bekasi project's first phase

	Investment	Revenue	Revenue share	Profit	Profit share
PDAM Bekasi	-	$4.1 million*	37%	$4.1 million	71%
Grenex	$5.3 million	$7 million	63%	$1.7 million	29%
Total	**$5.3 million**	**$11.1 million**		**$5.8 million**	

*Projected revenue based on selling saved water to existing or new customers

The contract hinges on the baseline evidenced in the feasibility study. Revenue is shared depending on the amount of improvement measured each month, and how this compares to the baseline loss rate of 46.48% for phase 1. Grenex receives more revenue as water loss falls further below this baseline, but the firm will receive no payment if it rises to the baseline or higher. The arrangement allows and encourages Grenex to take risks, try different approaches, and think about the whole system from input to output.

Agreeing on the baseline took a high degree of trust, impartial data and negotiation. Here, Water.org came to the fore in its role as an independent third party whose sole interest is to see more households get more water.

There was also a six-month-long step to take before securing the contract: a public procurement process compliant with Indonesia's anti-corruption legislation. PDAM Bekasi published a request for proposals as a solicited process. This was open to all bidders but granted a right-to-match advantage to Grenex, due to their role in developing the feasibility study, and they made the successful bid.

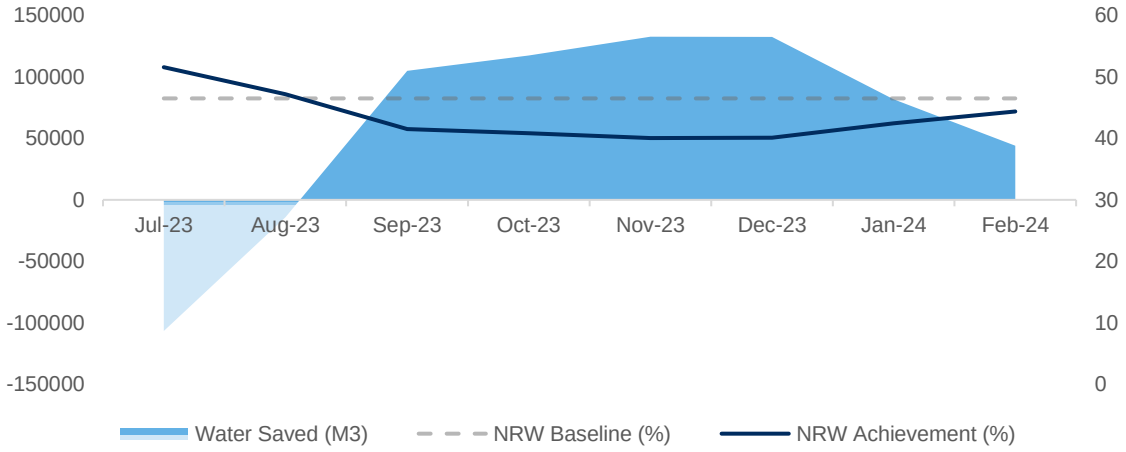
New pipes, new meters, new possibilities

With the contract signed, it was time for a detailed engineering design to map out district metered areas (DMAs). This work divided the subsystems into DMAs of around 1,000 households, each sharing a distribution pipe where a strategically placed district meter could determine where water was disappearing from the larger system.

In July 2023, Grenex got to work on the streets of Bekasi. They first targeted pipe maintenance, fixing the largest leaks. In just the first month this brought water loss in the subsystems down from 46.48% to under 39%. From July-August 2023 Grenex repaired the main distribution pipes, completed pipe network mapping and leakage detection, and identified unbilled water flow to different subsystems. In September-October 2023 a water meter was installed to measure water flow to other subsystems, along with a pressure-reducing valve to manage effective water pressure in the main distribution pipes. The next step will be replacing old and broken household meters. Grenex has a list of customers needing new meters, and this should also show immediate results by bringing more accuracy to billing.

Since July, an average of 61,000 m3 of water per month has been saved, totaling nearly 500,000 m3. The average monthly water loss rate of 44% marks a significant achievement, especially considering the baseline water loss rate of 46.48%. Additionally, during this period, more than 1,000 new customers have been added, showcasing steady growth and expansion of PDAM Bekasi's customer base (see Figure 1).

Figure 1. Results to date



Enhancing water services, today and in the future

This is only the beginning of a five-year commitment, and only the start of the benefits. PDAM Bekasi is initially directing the saved water to existing customers who do not receive all the water they need. After that, finding more households ready to connect will be easy. In fact, the utility currently serves just 20% of households in its mandated area, so service can expand rapidly as more water stays in the system.

Water.org has subsequently partnered with the Indonesian association of utilities, PERPAMSI, to share the process in online and in-person workshops, reaching 125 utilities across the country. These also included representatives from the Ministry of Public Works, the World Bank and USAID's IUWASH program. The workshops explored ways to scale up this work, and were a key step to begin replicating the success with more PDAMs in the near future. As a result of these efforts, Water.org has recently started a similar project with a PDAM in the District of Sleman to reduce water losses and improve the energy efficiency of its water systems.

Impact Story: Improved PDAM Water Service Transforms Yasinta's Life

Yasinta, a former kindergarten teacher, lives with her husband Aris and their three children in Babelan Indah community in Bekasi. Since moving into their house in 1988, they struggled with poor water quality from a hand pump, which impacted their health and daily life. After Aris's accident 15 years ago, Yasinta became the primary breadwinner, running a small stall selling drinks and snacks. In the mid-1990s, they learned about PDAM Bekasi District's piped water service from their neighborhood head and applied for a connection, paying a fee of IDR 1 million (USD 62). However, they faced issues with low water pressure and limited service hours.

Since Water.org's recent projects with PDAM Bekasi, the water quality and quantity have improved significantly. Yasinta's family now enjoys reliable 24-hour water service with good pressure, paying an average monthly water bill of IDR 200,000 (USD 12). This convenient and reliable water source has transformed their lives, allowing her children to focus on their education and enabling Yasinta to contribute to the family's income when possible. The improved water access has enhanced their health, safety, and overall quality of life.

A blueprint for water loss reduction projects

Water.org, PDAM Bekasi and Grenex took the following steps to create this project. Similar steps may be useful to consider in other countries and contexts.

1. **Pre-feasibility study** which includes collecting technical information about the utility, developing an agreed-upon methodology, identifying the most suitable subsystems and planning for the implementation of the full feasibility study.
2. **Feasibility study** which includes detailed information on the subsystems, field survey results, legal and regulatory considerations, social and environment impact assessment, financial analysis, and more.
3. **Public procurement process** which will vary based on county regulations and utility operating procedures.
4. **Performance-based contract** signed between the utility and the engineering firm, incorporating a baseline performance rate informed by the feasibility study.
5. **Detailed engineering design** including mapping and creation of new DMAs. The DMAs help identify where water losses are occurring and allow the utility to more efficiently manage its network.
6. **Implementation phase** with revenue sharing based on monthly measures of water savings. In the Bekasi project, this will last five years.

Filling the roles

The utility: Three quantities are important for a utility to be part of a financially feasible performance-based contract:

- A large enough volume of water under management
- High water loss in target subsystems, showing scope for significant performance improvements
- A reasonable level of tariff that does not put undue pressure on the utility's financial security.

The service provider: This should be a company with some technical experience in water loss reduction and a desire to build its capacity, as well as to help utility staff build theirs. It should also have an appetite for the risk of uncertain performance-based payments – recognizing that these also represent a large potential return. It needs the capital on hand to fund up-front investments under the contract, or the ability to raise such capital, perhaps with assistance from a third party such as Water.org.

The catalytic third party: There is no one obvious actor to help establish this type of arrangement, but Water.org found that its support, de-risking and relationship building was important to the process in Bekasi. Water.org was a longstanding partner of the utility but also a neutral broker. It participated as a nonprofit advisor and had donors in AWS and Reckitt that were on board with the novel pilot from the start, encouraging Water.org to pursue innovative action for water loss reduction.

Table 3. The partnership in Bekasi

	TIRTA BHAGASASI	GRENEX GRENEX GRENEX	water.org
Situation	• High levels of non-revenue water • Limited knowledge on water loss reduction • Limited ability to raise capital	• Limited knowledge on water loss reduction	• Interest in piloting approaches that reduce water loss and expand access to water
Value Addition	• Leadership foresight to prioritize water loss reduction and scale-up the solution • Prior trusted relationship with Grenex and Water.org	• Prior trusted relationship with PDAM Bekasi and small pilot on water loss reduction • Access to capital	• Third party to help bridge perspectives on sensitive topics • Capacity in engineering, financial modeling, risk assessment, agreement structuring, and regulatory compliance
Support Provided	• Undertook the public procurement process • Staff working alongside and learning from Grenex	• Implementing actions to reduce water loss • Building capacity of PDAM Bekasi, especially through on-the-job training	• Building capacity of Grenex • Financial support to hire a specialist for feasibility study and engineering design • Dissemination of results with other partners and the sector association PERMPAMSI

The global picture

Water loss is a major problem across low- and middle-income countries. According to a recent study from the International Water Association, utilities lose about 126 billion m^3 per year in water distribution systems on the way to consumers, equivalent to approximately $39 billion per year.[1] Utilities are frequently limited in what they can do about water loss, both financially and technically.

Historically, reducing water loss was not a priority when there was plenty of water to go around. The cost of fixing leaks was often not worth the investment – until now, when changes in climate, water scarcity and competing water use have stressed and depleted natural water resources. Cities like Cape Town, South Africa and Chennai, India have sounded the alarm as they have been forced to make every liter of water count. By 2025, half of the global population will be living in water-stressed areas, with low-income communities bearing the greatest brunt of the crisis. [2]

Under these conditions, performance-based agreements might be an answer to the financial barrier for many utilities. If so, the benefits could be far-reaching. Communities will be more resilient to climate change's impacts as households gain access to reliable sources of water through improved water management. And utilities will not have to pump and treat as much water to ultimately deliver the same quantities, reducing greenhouse gas emissions per liter delivered by up to 50%.[3]

1 International Water Association (2018). Quantifying the Global Non-Revenue Water Problem.

2 Water and Wastewater Companies for Climate Mitigation (2018). The Roadmap to a Low-Carbon Urban Water Utility.

3 World Health Organization (2019). Drinking-Water: Key Facts.

Reclaiming the value of water

This pilot operationalizes a simple truth: there is value in water that is being lost, and that value can be leveraged to solve the problem. If the economic benefits can be shared between a utility and a service provider that takes on the cost of action, this will be a breakthrough for infrastructure financing possibilities.

At the same time, the real benefits are in the water itself. For households with insufficient access to clean water, stopping the leaks can make the difference between climate emergency and resilience, or between wasted hours of water collection and water on tap. On a large scale, it can help bring global goals on water access, climate adaptation and mitigation, and sustainable urbanization within reach. Right now, those goals remain distant – so the world needs more innovative financing models to recognize and share the immense value in lost water.