Increasing Water Supply to Customers through a Performance-Based Contract for NRW Reduction

Case Study: Ho Chi Minh City, Vietnam

Summary

In 2005, Ho Chi Minh City (HCMC) did not have enough water supply to meet demand from its 6 million inhabitants. Less than half the city was connected to the network. More than 40 percent of water produced was lost as leakage. Supply was intermittent.

To increase supply to customers, a contractor was competitively procured to enter a performance-based contract (PBC) for non-revenue water (NRW) reduction, with a focus on leakage reduction. By the end of the contract 122MLD (million liters per day) of water had been saved, improving reliability of supply and allowing new customers to be connected.

Background

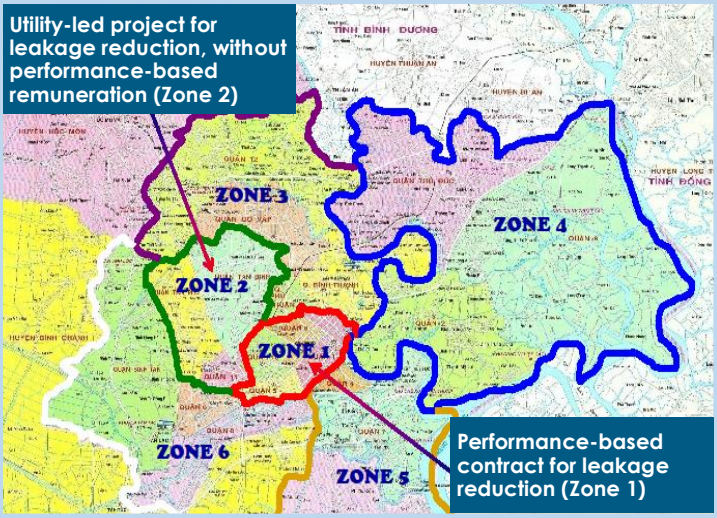
HCMC, Vietnam's most populous city, was home to about 6 million people in 2005, the year the NRW-PBC was conceived.

The Saigon Water Corporation (SAWACO) was the state-owned water utility operating in HCMC. In 2005, SAWACO produced over 1,000MLD of water, of which about 415MLD was not billed for, mostly due to leakage. SAWACO served about 2.5 million people; the others relied on alternative sources that were more expensive and less safe for consumption.

To increase water supply to customers, SAWACO implemented leakage reduction in two of its six hydraulic zones (see map on the right). In Zone 1, SAWACO hired a contractor under a PBC, with remuneration based on volume of leakage reduction. In Zone 2, SAWACO implemented a leakage reduction project with similar objectives, using a traditional input-based approach.

SAWACO chose to implement NRW reduction in both zones at the same time to learn the strengths and weaknesses of each approach.

Map of SAWACO's Hydraulic Zones

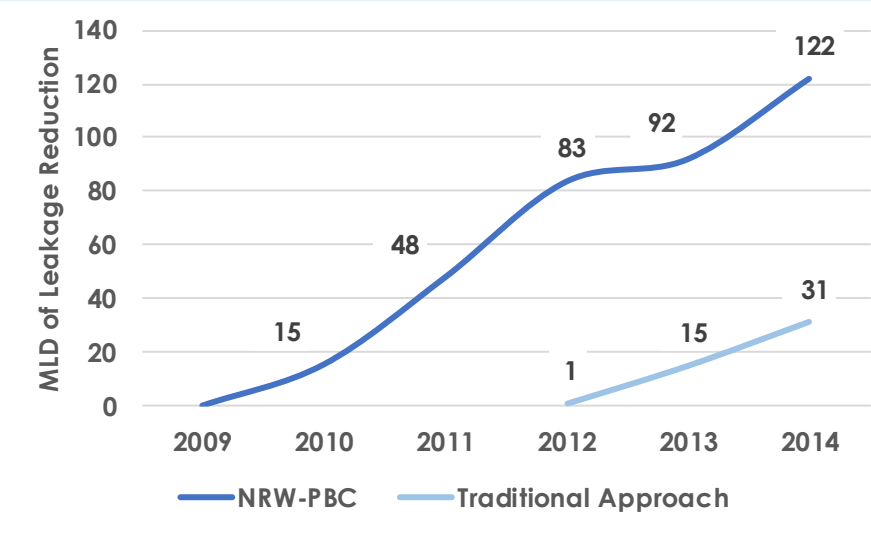


Achievements of the NRW-PBC

The NRW-PBC in Zone 1 achieved better results and was quicker to implement than the utility-led project in Zone 2.

Although both contracts were conceived at the same time, leakage reduction activities in Zone 1 started in 2009 whereas leakage reduction activities in Zone 2 did not begin until 2012. By 2014, the NRW-PBC had saved 91MLD more water than the traditional approach (see figure to the right).

The NRW-PBC achieved leakage reduction faster than the traditional approach



From 2008 to 2014, the NRW-PBC:

- Saved 122MLD of water, improving reliability of supply and allowing new customers to be connected
- Reduced operating costs (energy and chemical costs) per unit of water sold because a higher percentage of water produced was sold
- Saved about US$100 million of capital expenditure on alternative water supply sources (using typical benchmark costs, a new supply of 122MLD could have cost around US$120 million, compared to the NRW-PBC cost of US$15 million)
- Established 119 district metered areas (DMAs)
- Repaired more than 15,000 leaks.

The following sections of the case describe the procurement and design of the NRW-PBC, both of which were done with the support of the World Bank. The case highlights how strong incentives helped the NRW-PBC realize the achievements described above.

Procurement of the NRW-PBC

The NRW-PBC in Zone 1 was competitively procured. Four bidders submitted proposals. The Manila Water Company was awarded the contract because it met all technical criteria and offered the lowest price (US$15 million).

Structure of the NRW-PBC

The scope of work under the NRW-PBC comprised the following four activities:

- **DMA establishment works**—Establishing 119 DMAs based on the preliminary design and time schedule provided in the contract
- **Leakage reduction and management services**—Conducting leak detection surveys, conducting pressure management, repairing leaks on mains and service connections, and detecting illegal connections
- **System expansion works**—Connecting new customers to the network
- **Emergency and unforeseen works**—Repairing leaks outside of Zone 1, or implementing other plumbing, repair, installation or maintenance works upon SAWACO's request.

For each activity, Table 1 on the following page describes how the contractor was remunerated, the targets the contractor had to meet, and the penalties if targets were not met. For instance, more than 70 percent of remuneration for leakage reduction and management services was performance-based, with the contractor earning US$75 per m^3/day of leakage reduction achieved, and paying US$50 per m^3/day if leakage reduction targets were not met.

DMA establishment works

A preliminary design and time schedule for establishing 119 DMAs had been developed before procurement. Once hired, the contractor was required to check the accurateness of the design and finalize it.

Then, the contractor was responsible for conducting all the civil and installation works required to establish the DMAs. The contractor was paid US$18,500 per DMA established, a price based on the contractor's technical proposal. Unplanned costs, such as construction of additional inflow chambers, were reimbursed.

If the contractor did not establish the DMAs per the time schedule, a financial penalty would apply. For each month of delay, the penalty equaled 10 percent of the amount that would have been due to the contractor, had the DMAs been established on schedule.

Table 1: Scope of Work of the NRW-PBC

Activity	Remuneration Structure	Target	Penalty for not Meeting Targets
DMA Establishment Works	▪ US$18,500 per DMA established, plus reimbursement for unplanned additions (e.g. additional inflow chambers).	▪ Establish 119 DMAs based on a preliminary design and time schedule provided in the contract.	▪ For each month of delay, 10% of the amount that would have been due to the contractor, had the DMAs been established on schedule.
Leakage Reduction and Management Services	▪ At least 70% performance-based fee, calculated as follows: – US$75 per m^3/day saved – US$38 per illegal connection detected. ▪ Less than 30% fixed fee, of US$85,000 paid quarterly.	▪ Achieve targets for total leakage reduction (TLR), which apply every fourth quarter (Q) as follows: – TLR_{Q4}: 2,000 m^3/day – TLR_{Q8}: 10,000 m^3/day – TLR_{Q12}: 20,000 m^3/day – TLR_{Q16}: 37,500 m^3/day.	▪ US$50 per m^3/day of leakage reduction below the target for TLR.
		▪ Maintain Target Night Flow Level (TNFL) for one year, set by the contractor (in m^3/hour) for each DMA, after completing all leakage reduction activities in that DMA.	▪ US$2.20 per m^3/hour, if the minimum night flow exceeds the TNFL by 5 liters/connection/hour.
System Expansion Works	▪ Reimbursement based on unit prices provided in the BoQ from the technical proposal.	▪ No target.	N/A.
Emergency and Unforeseen Works	▪ Reimbursement based on unit prices provided in the BoQ from the technical proposal.	▪ No target.	N/A.

Leakage reduction and management services

After establishing each DMA, the contractor was responsible for reducing leakage within that DMA. The scope of work included the following tasks:

- Conducting leak detection surveys
- Pressure management activities
- Repairing leaks on mains
- Replacing leaking service connections
- Detecting illegal connections.

More than seventy percent of remuneration for leakage reduction and management services was performance-based, with the contractor earning US$75 per m^3/day of leakage reduction achieved and US$38 per illegal connection detected. The remainder was paid through a fixed-fee.

Ensuring a minimum amount of leakage reduction

To ensure that the NRW-PBC achieved a satisfactory amount of leakage reduction, minimum contractual amounts for leakage reduction were established. Minimum contractual amounts increased from 2,000 m^3/day at the end of the first year of the contract, to 37,500 m^3/day in the fourth year of the contract. Financial penalties of US$50 per m^3/day would apply if the minimum savings were not achieved. If these minimum savings were exceeded, the contractor received the same performance-based payment (US$75 per m^3/day) for additional amounts saved.

Maintaining leakage reduction

After completing all leakage reduction activities in a DMA, the contractor was required to set a target Night Flow Level (TNFL) in m^3/hour for that DMA. If the minimum night flow later exceeded the TNFL by 5 liters/connection/hour, the contractor would be penalized at a rate of US$2.20 per m^3/hour.

System expansion works

To share the benefits of increased supply with all inhabitants of Zone 1, the contractor was required to connect new customers to the system. The contractor laid necessary main pipes, installed valves inside DMAs, and installed new service connections to mains.

System expansion works were based on work orders. The contractor was reimbursed for the system expansion works based on unit prices included in the BoQ that the contractor submitted as part of its proposal.

Emergency and unforeseen works

Possible emergency or unforeseen works, such as repairing leaks outside of Zone 1, or implementing other plumbing, repair, installation or maintenance works were carried out upon SAWACO's request.

Emergency or unforeseen works were based on work orders. The contractor was reimbursed for emergency and unforeseen works based on unit prices included in the BoQ that the contractor submitted as part of its proposal.

Lessons Learned from the NRW-PBC

The HCMC case shows that NRW-PBCs can be effective and relatively quick approaches to reducing leakage, provided there are well-designed incentive mechanisms. Table 2 summarizes the lessons learned from the NRW-PBC in HCMC.

Table 2: Lessons Learned

Category	Lesson	Evidence from the HCMC NRW-PBC
Effectiveness of NRW-PBCs	NRW-PBCs can work effectively	▪ The NRW-PBC saved 122MLD of water over 6 years.
	NRW-PBCs can be implemented faster than traditional contracts, leading to more water savings sooner	▪ Under the NRW-PBC, leakage reduction started in 2009, whereas under the traditional contract (conceived at the same time) leakage reduction started in 2012. By 2014, the NRW-PBC had saved 91MLD more water than the traditional contract.
Contract Flexibility	Contracts that are too prescriptive could limit the contractor's achievements	▪ The contract included a unit price per DMA established, and a target number of DMAs to establish. This approach may have not encouraged the most effective or efficient outcomes. The contractor could not optimize the network configuration based on new or learned conditions throughout the contract without incurring financial penalties.
Incentives	NRW-PBCs can provide good incentives to contractors to reduce leakage	▪ Payment was linked to water saved (US$/m^3/day). The same price applied to all savings above the minimum contractual amount, which further incentivized the contractor to exceed the minimum contractual amount (38MLD) by three times (122MLD achieved).
	Through incentives, NRW-PBCs can encourage contractors to maintain the amount of leakage reduction achieved	▪ Financial penalties applied if leakage exceeded the target set for each DMA. Further, the final performance-based payment was calculated based on the final amount of leakage reduction achieved.

Takeaways

- ✓ An NRW-PBC brought in a private firm to help HCMC save 122MLD of water. Reliability of supply improved, and new customers were connected to the network.
- ✓ Performance-based incentives are effective, particularly when they are linked to water saved.
- ✓ NRW-PBCs can achieve better and faster results than traditional contracts for leakage reduction.

For more information on NRW-PBCS, and how to implement one at your water utility, visit: https://pppknowledgelab.org/pbcsfornrw

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